

**PRELIMINARY HYDROLOGY
CALCULATIONS**

FOR

**8TH STREET AND HAVEN AVENUE
RANCHO CUCAMONGA, CALIFORNIA**

PREPARED FOR

**DUKE REALTY
200 SPECTRUM CENTER DRIVE, SUITE 1600
IRVINE, CALIFORNIA 92618
PHONE: (949) 797-7000
FAX: (949) 797-7080**

**APRIL 16, 2018
REVISED JUNE 15, 2018
REVISED AUGUST 29, 2018
REVISED OCTOBER 19, 2018**

JOB NO. 3320

PREPARED BY

**THIENES ENGINEERING
14349 FIRESTONE BOULEVARD
LA MIRADA, CALIFORNIA 90638
PHONE: (714) 521-4811
FAX: (714) 521-4173**

**PRELIMINARY HYDROLOGY
CALCULATIONS**

FOR

8TH STREET AND HAVEN AVENUE

**PREPARED BY RICKY HWA
UNDER THE SUPERVISION OF**

**REINHARD STENZEL DATE:
R.C.E. 56155
EXP. 12/31/18**

INTRODUCTION

A: PROJECT LOCATION

The project site is located at the southwest corner of 8th Street and Haven Avenue in the City of Rancho Cucamonga, California. Please see next page for vicinity map.

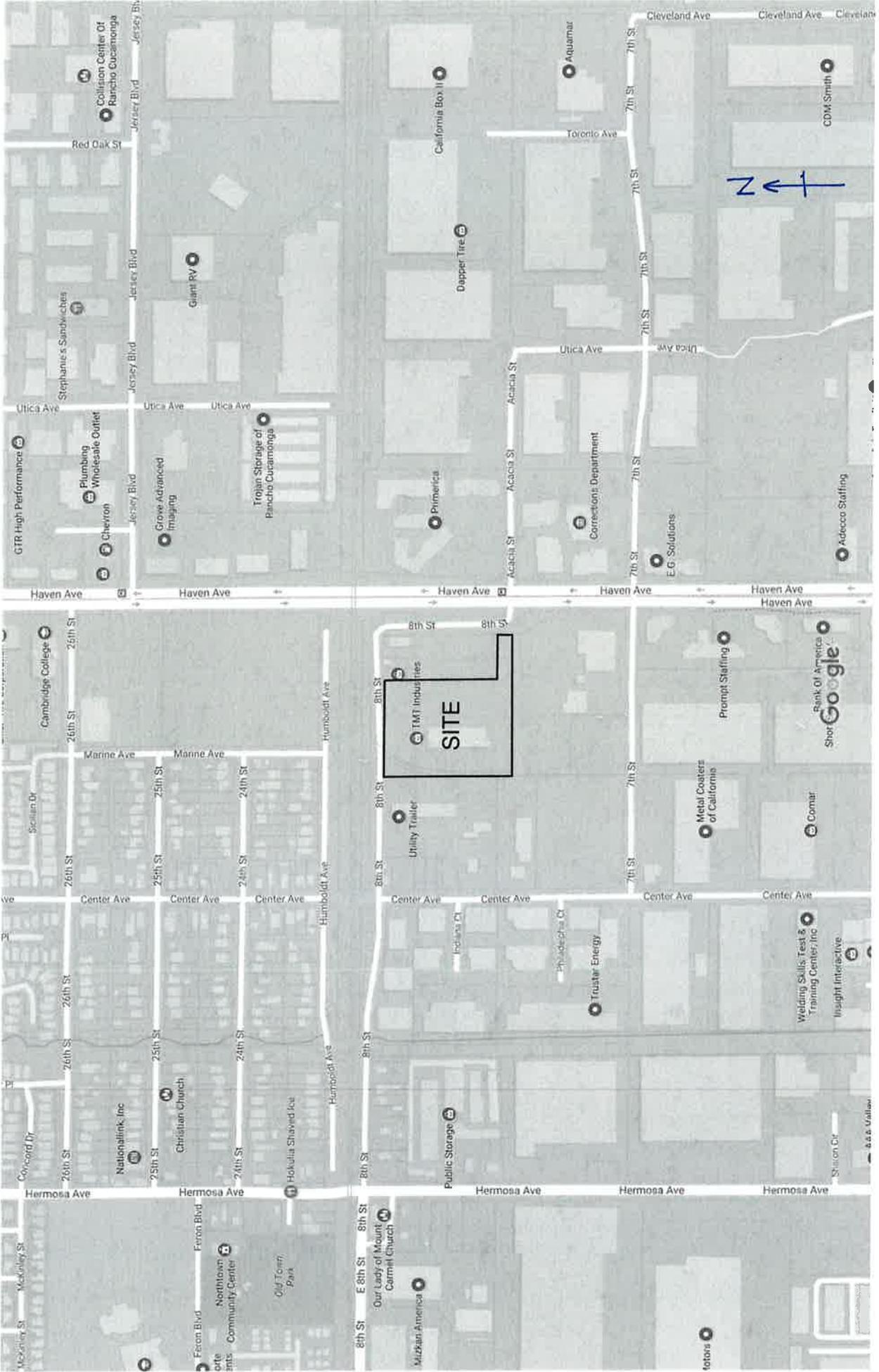
B: STUDY PURPOSE

The purpose of this study is to determine the 100-year existing and proposed condition peak flow rates from the project site.

C: PROJECT STAFF:

Thienes Engineering staff involved in this study include:

Reinhard Stenzel
Brian Weil
Ricky Hwa



VICINITY MAP

DISCUSSION

The project site encompasses approximately 5.50 acres. Proposed improvements to the site include one industrial building of 120,220 square. There will be a truck yard to the building's west, parking lots to the south and east, plus landscape to the north and throughout the site. The existing railroad and dirt area adjacent to the site's westerly property line will remain under proposed condition. A cul-de-sac will be constructed from the southeast corner of the site to 8th Street to provide access to the site. The existing 24-inch storm drain in 8th Street (Line C of the Haven Avenue Storm Drain) will be extended to accept onsite discharge.

Master Plan Hydrology

Per the City of Rancho Cucamonga Comprehensive Storm Drain Plan – Revision No. 1 by L.D. King dated June 1981, the project site is tabled to a public storm drain in Haven Avenue. The existing 42-inch Haven Avenue storm drain (Line “A” per as-built plans by U.R.S. dated July 2008) was designed for 50-year storm events.

Since the project site does not drain to the Haven Avenue storm drain under existing condition, pipe hydraulics for the Haven Avenue storm drain was analyzed with the additional proposed condition site discharge to ensure that there will be no negative impact on the existing storm drain system.

Please see Appendix “A” for the City’s comprehensive storm drain plan, the as-built Haven Avenue storm drain plans and other pertinent reference materials.

Existing Condition

The project site is currently developed with a small warehouse building with a paved parking lot. A railroad traverses through the site near the westerly property line.

Under existing condition, the project site (5.50 acres) surface drains southerly to a neighboring property. A portion of 8th Street north of the project site (0.65 acres) surface drains onto the site and, ultimately, to the southerly neighboring property. The total existing condition 100-year peak flow rate tributary to the southerly neighboring property, from the project site plus the portion of 8th Street tributary to the site, is approximately 23.4 cfs (1.8 cfs over 0.45 acres at Node 101 + 7.8 cfs over 1.95 acres at Node 201 + 13.8 cfs over 3.75 acres at Node 301). The existing condition 100-year peak flow rate from the project site only is approximately 21.0 cfs (1.2 cfs over 0.30 acres at Node 101 + 7.8 cfs over 1.95 acres at Node 201 + 12.0 cfs over 3.25 acres at Node 301).

An open dirt lot and several small commercial lots east of the project site, plus the easterly portion of 8th Street (3.80 acres total), are tributary to a pair of street catch basins in 8th

Street immediately west of Haven Avenue. The street catch basins are tributary to the Haven Avenue storm drain Line "A" via a 24-inch lateral (Line "C"), where the proposed site discharge will also be conveyed. The existing condition 100-year peak flow rate from the above mentioned offsite areas tributary to the 8th Street catch basins is approximately 13.2 cfs.

See Appendix "B" for existing condition hydrology calculations and Appendix "E" for existing condition hydrology map.

Proposed Condition

The portion of the project site west of the existing railroad (0.30 acres, Nodes 100-101) plus a small portion of 8th Street north of the site (0.15 acres) will continue to surface drain south to the neighboring property. The proposed condition 100-year peak flow rate for these areas will remain at 1.8 cfs.

The proposed building, its westerly truck yard and northerly landscape (3.70 acres, Nodes 200-201) drain westerly to catch basins in the truck yard. Runoff is then conveyed southerly, then easterly via a proposed onsite storm drain system to the existing Haven Avenue Storm Drain Line C (24" lateral) and Line A (42" main line). The proposed condition 100-year peak flow rate for this area is approximately 16.9 cfs.

The southerly parking lot (0.85 acres, Nodes 210-211) drains westerly to a proposed catch basin in the parking lot. Similarly, the easterly parking lot (0.65 acres, Nodes 220-221) drains southerly to a proposed catch basin in the parking lot. Runoff from each parking lot is then conveyed easterly via the same onsite storm drain system to the existing Haven Avenue Storm Drain Line C and Line A. The respective proposed condition 100-year peak flow rates for these parking lots are approximately 3.4 cfs (southerly) and 3.0 cfs (easterly).

The total proposed condition 100-year peak flow rate from the project site (5.20 acres) tributary to the Haven Avenue storm drain is approximately 22.7 cfs.

Also tributary to the Haven Avenue Storm Drain are the proposed cul-de-sac (0.40 acres total at Node 300 via an extension of the existing 24" Line C), the northerly portion of 8th Street (0.50 acres tributary to existing street catch basin at Node 321 via proposed 18-inch storm drain in 8th Street), the existing easterly offsite dirt lot and small commercial lots (3.45 acres tributary to the existing street catch basin at Node 331), plus the easterly portion of 8th Street (0.45 acres tributary to the existing street catch basin at Node 321). The proposed condition 100-year offsite discharge tributary to the Haven Avenue Storm Drain Line C and Line A is approximately 15.4 cfs (38.1 cfs total – 22.7 cfs onsite).

See Appendix "B" for proposed condition hydrology calculations and Appendix "E" for proposed condition hydrology map.

Detention Analysis

Onsite detention at Node 201, in the underground storage in the truck yard area, will be utilized to reduce discharge from the site to the Haven Avenue Storm Drain. The underground storage is primarily used for water quality purposes. The underground storage consists of 96" CMP's in a gravel bedding. The storage volume is larger than the required BMP volume for additional storage for detention purposes. In addition, the infiltration rate was modeled in the detention analysis. From the infiltration test, the recommended rate is 11.0 inches/hour. A safety factor of 2 was used for detention calculations. This rate was converted to cfs (0.59 cfs) based only on the bottom surface area of the rock bedding for a conservative rate. A small area hydrograph was established for the tributary area. Basin routing analysis shows that about 3.5 cfs discharges from the underground storage area (approximately 2.9 cfs to the outlet pipe, 0.6 cfs assumed as infiltration).

Overall, the total discharge from the site is approximately 9.3 cfs (2.9 cfs from underground storage + 3.4 cfs from southerly parking lot + 3.0 cfs from easterly parking lot), for a total onsite (9.3 cfs) plus offsite (15.4 cfs) discharge of 24.7 cfs to the Haven Avenue Storm Drain.

See Appendix "D" for detention analysis.

Hydraulics

As previously mentioned, pipe hydraulics for the Haven Avenue Storm Drain would be re-analyzed with the additional proposed condition discharge (24.7 cfs) to ensure that there will be no negative impact on the existing storm drain system. The Haven Avenue storm drain was calculated based on information from the plans. Note that there is a connection for the existing storm drain at Acacia/8th Street. Here the peak flow rate increases by 6.3 cfs. The same model was recalculated with a total of 24.7 cfs at this same lateral (an increase of 18.4 cfs). Comparing the two models, the hydraulic grade line (H.G.L.) is about 0.9' higher at the upstream portions of the storm drain system. However, comparing the recalculated H.G.L. to the existing plans, the H.G.L. appears to be no more than 2 inches (maximum 0.17') than the existing H.G.L. as shown on the as-built plan.

Line C was also re-analyzed with the proposed condition discharge, with the proposed condition energy grade line (E.G.L. = 1099.49) more than 2 feet below the existing street surface (flow line elev. = 1101.60). Therefore, it can be concluded that the proposed site improvements will not impose a negative impact on the existing Haven Avenue Storm Drain.

The proposed onsite storm drain will be sized during the project's final design phase to restrict site discharge such that there will be no negative impact on the existing storm drain system.

See Appendix "C" for hydraulic calculations.

Methodology

Hydrology calculations were computed using San Bernardino County Rational Method program (by AES Software). The soil type is "A" per the San Bernardino County Hydrology Manual. The San Bernardino County Small Area Unit Hydrograph Model (also by AES Software) was used for detention calculations. See Appendix "A" for reference materials.

W.S.P.G. was used for hydraulic calculations. The control H.G.L. for the existing Haven Avenue Storm Drain Line "A" is 1074.40 at Station 36+27.30 per the U.R.S. as-built plan.

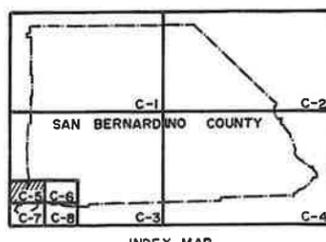
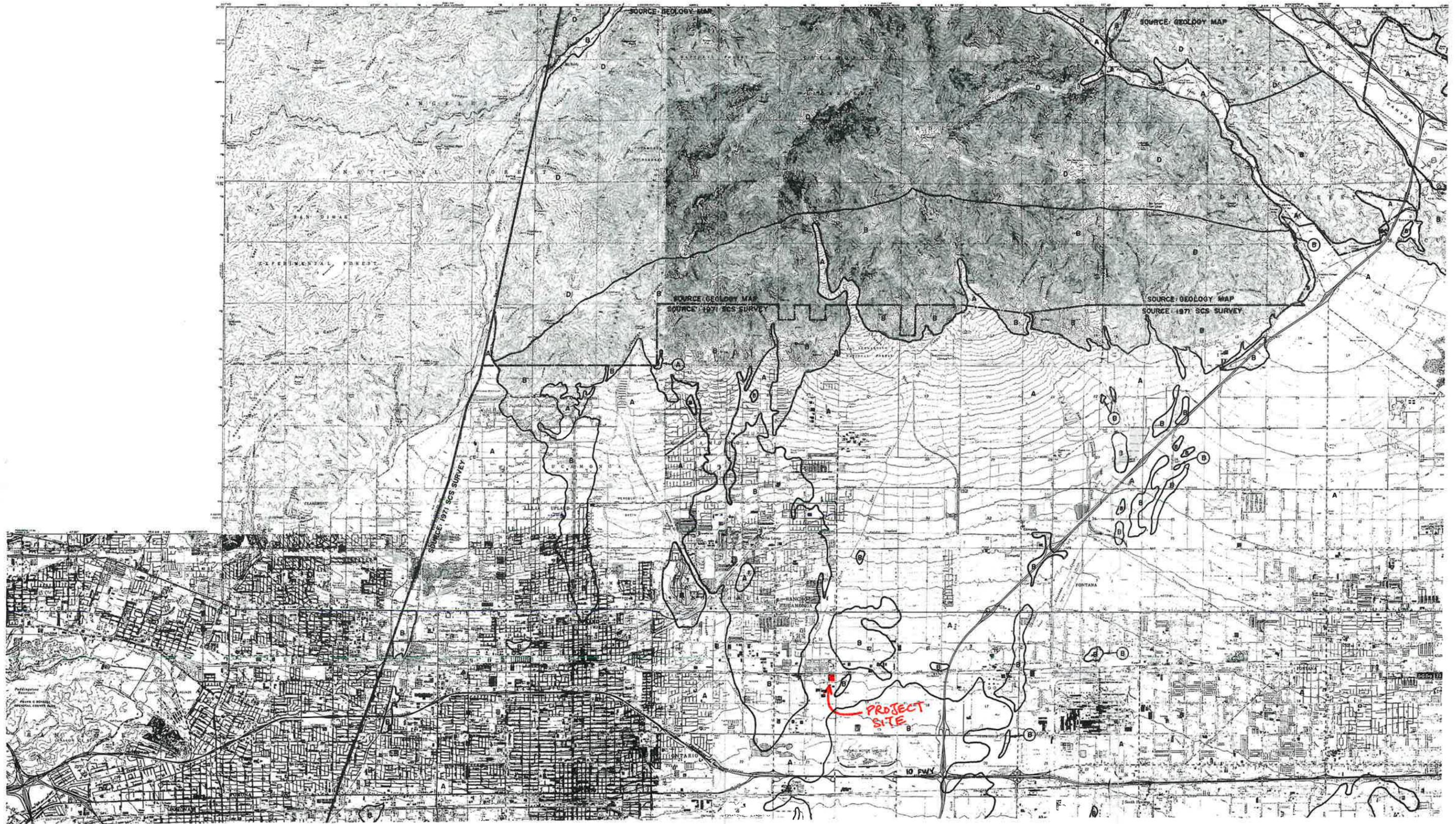
APPENDIX

DESCRIPTION

A	REFERENCE MATERIALS
B	HYDROLOGY CALCULATIONS
C	HYDRAULIC CALCULATIONS
D	DETENTION ANALYSIS
E	HYDROLOGY MAP

APPENDIX A

REFERENCE MATERIALS



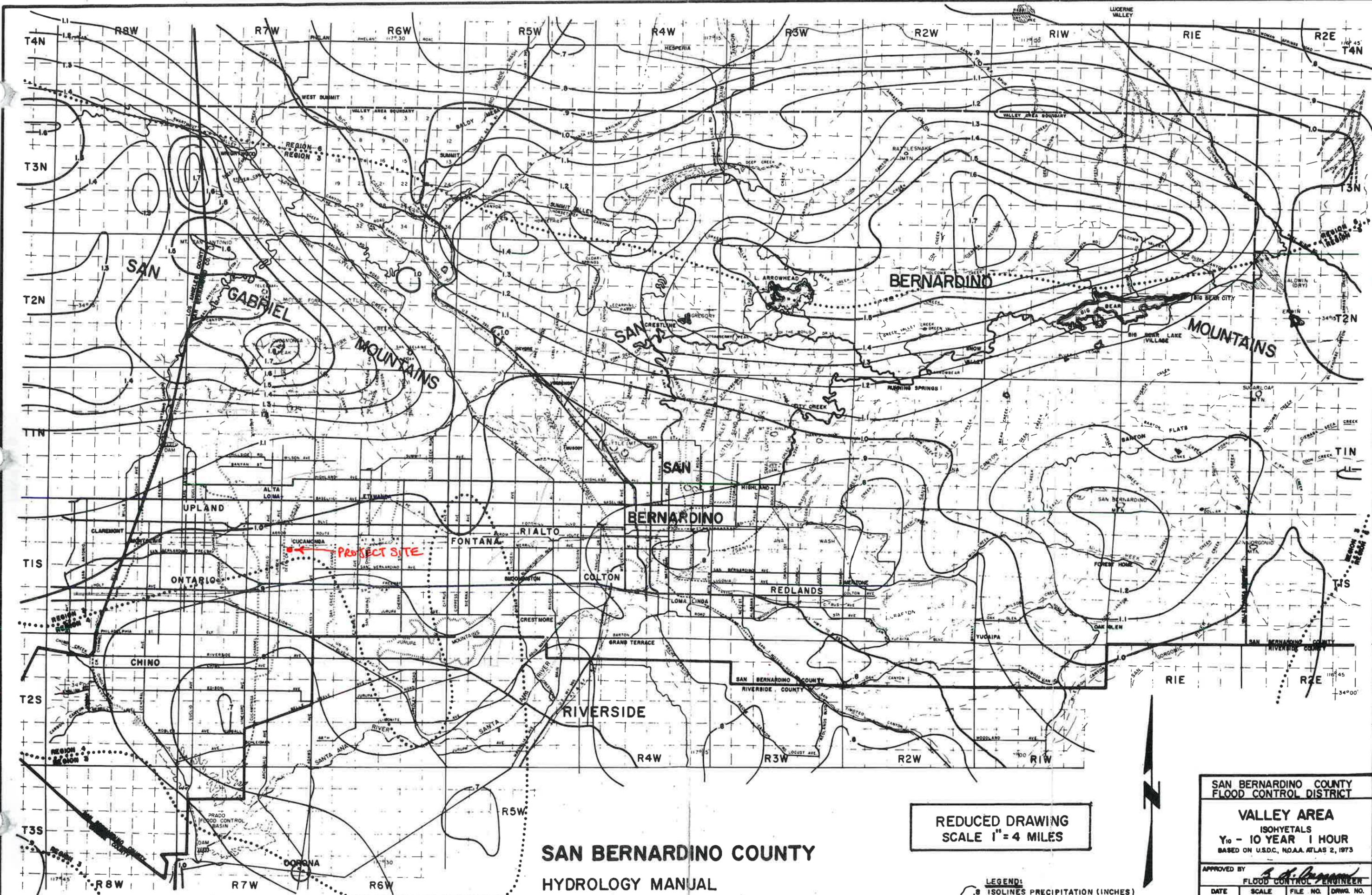
- LEGEND
- SOIL GROUP BOUNDARY
 - A SOIL GROUP DESIGNATION
 - BOUNDARY OF INDICATED SOURCE

SCALE REDUCED BY 1/2

SCALE 1:48,000

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

HYDROLOGIC SOILS GROUP MAP
FOR
SOUTHWEST-A AREA

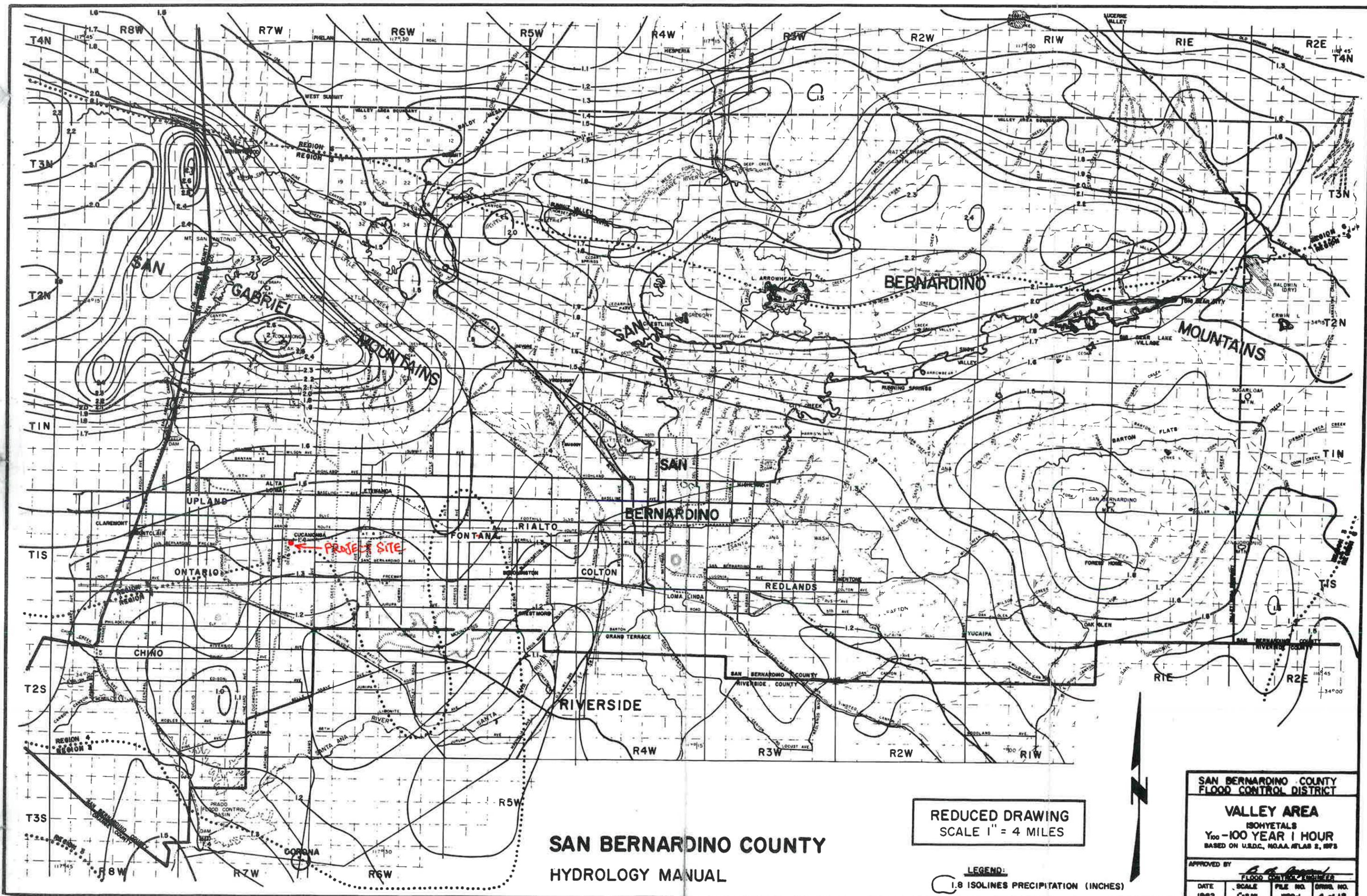


**SAN BERNARDINO COUNTY
HYDROLOGY MANUAL**

**REDUCED DRAWING
SCALE 1" = 4 MILES**

LEGEND:
ISOLINES PRECIPITATION (INCHES)

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT			
VALLEY AREA ISOHYETALS Y ₁₀ - 10 YEAR 1 HOUR BASED ON U.S.C., NOAA ATLAS 2, 1973			
APPROVED BY <i>[Signature]</i> FLOOD CONTROL ENGINEER			
DATE	SCALE	FILE NO.	DWG. NO.
1982	1" = 4 MI.	WRD-1	3 of 12



**SAN BERNARDINO COUNTY
HYDROLOGY MANUAL**

**REDUCED DRAWING
SCALE 1" = 4 MILES**

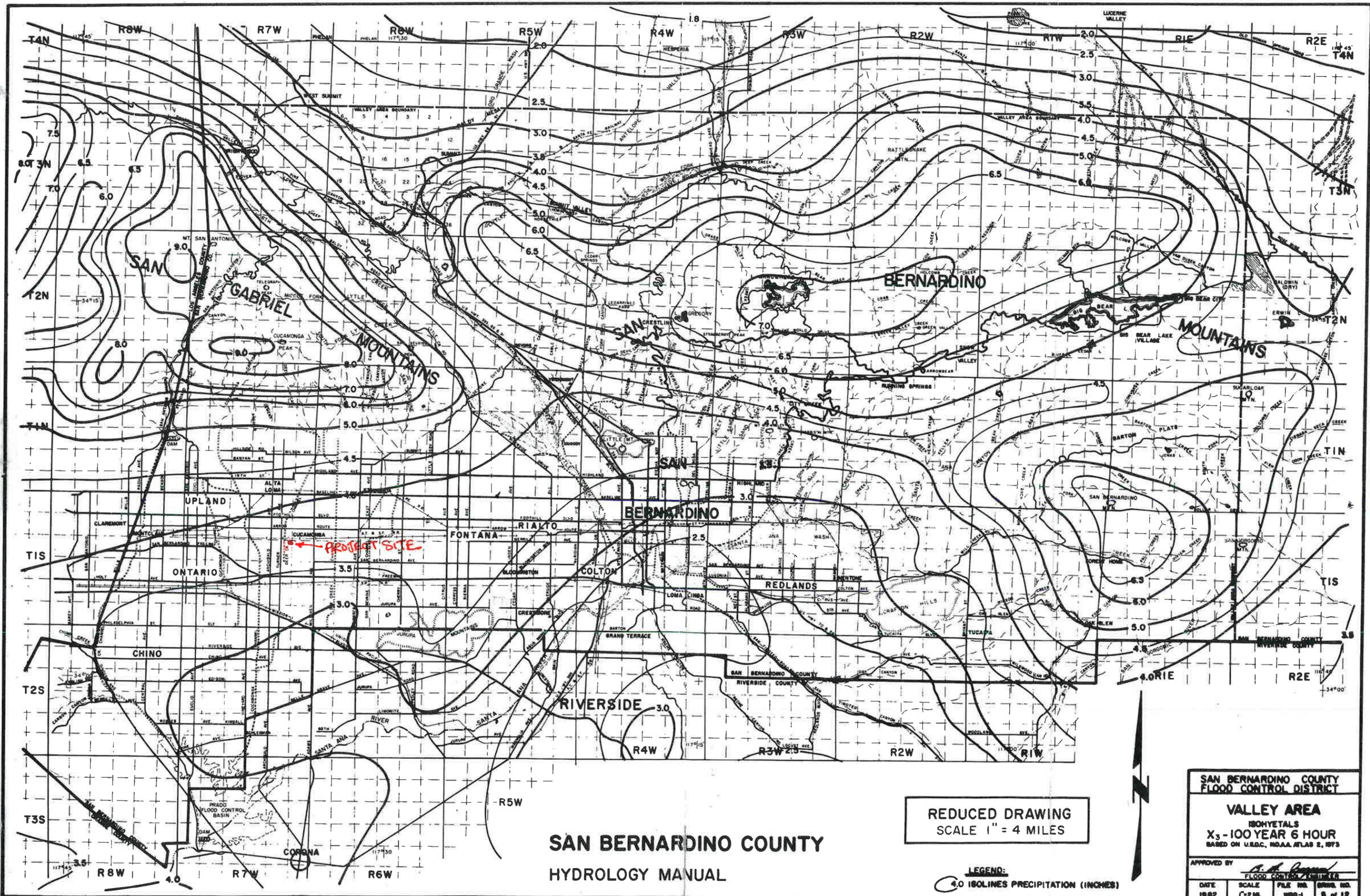
LEGEND:
1.0 ISOLINES PRECIPITATION (INCHES)

**SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT**

**VALLEY AREA
ISOHYETALS
Y₁₀₀ - 100 YEAR 1 HOUR
BASED ON U.S.D.C. NOAA ATLAS 2, 1973**

APPROVED BY: *[Signature]*

DATE	SCALE	FILE NO.	DRAW. NO.
10-82	1"=2 MI.	WRD-1	4 of 12



**SAN BERNARDINO COUNTY
HYDROLOGY MANUAL**

**REDUCED DRAWING
SCALE 1" = 4 MILES**

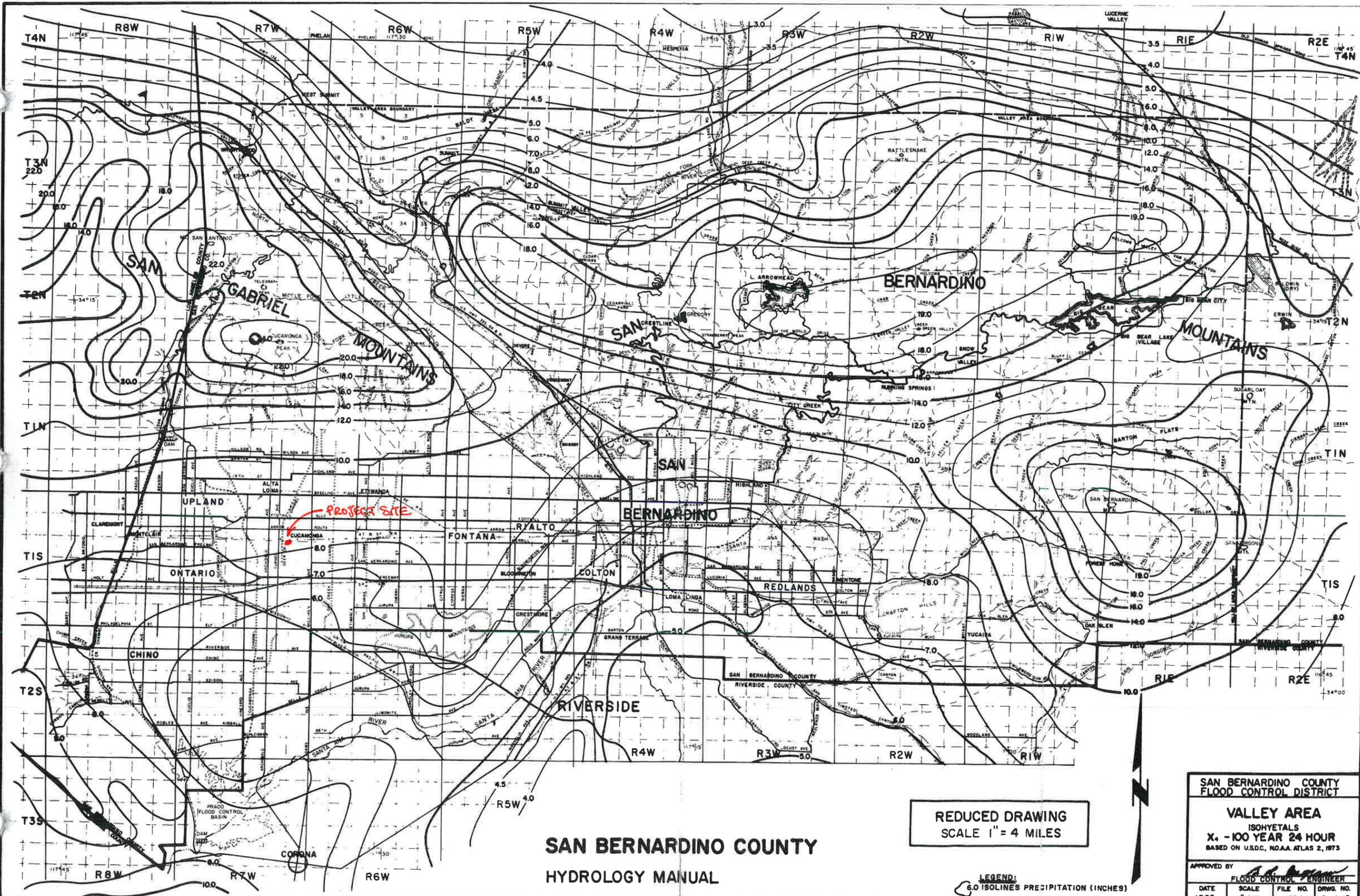
LEGEND:
4.0 ISOLINES PRECIPITATION (INCHES)

**SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT**

VALLEY AREA
ISOHYETALS
X₃-100 YEAR 6 HOUR
BASED ON U.S.D.C. NOAA ATLAS 2, 1973

APPROVED BY: *[Signature]*
FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DRWG. NO.
1982	1"=2 MI.	WB-1	8 of 12



**SAN BERNARDINO COUNTY
HYDROLOGY MANUAL**

**REDUCED DRAWING
SCALE 1" = 4 MILES**

LEGEND:
6.0 ISOLINES PRECIPITATION (INCHES)

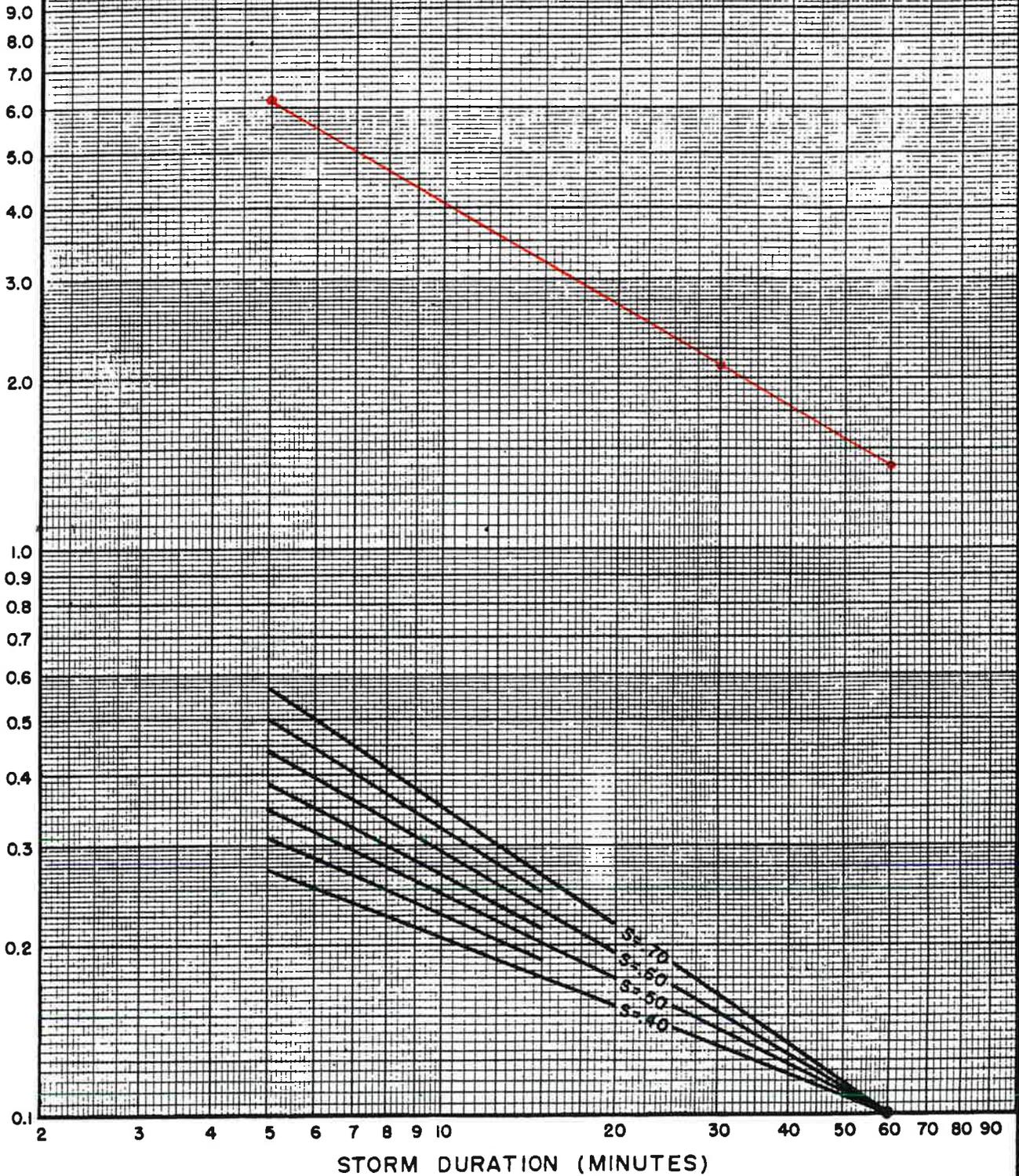
**SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT**

**VALLEY AREA
ISOHYETALS
X₁ - 100 YEAR 24 HOUR
BASED ON U.S.D.C. NOAA ATLAS 2, 1973**

APPROVED BY *[Signature]*
FLOOD CONTROL ENGINEER

DATE	SCALE	FILE NO.	DRWG. NO.
1982	1"=2 MI.	WRD-1	6 of 12

RAINFALL INTENSITY (INCHES / HOUR)



DESIGN STORM FREQUENCY = 100 YEARS
 ONE HOUR POINT RAINFALL = 1.40 INCHES
 LOG-LOG SLOPE = 0.60
 PROJECT LOCATION = 8TH ST. & HAVEN AVE, RANCHO CUCAMONGA

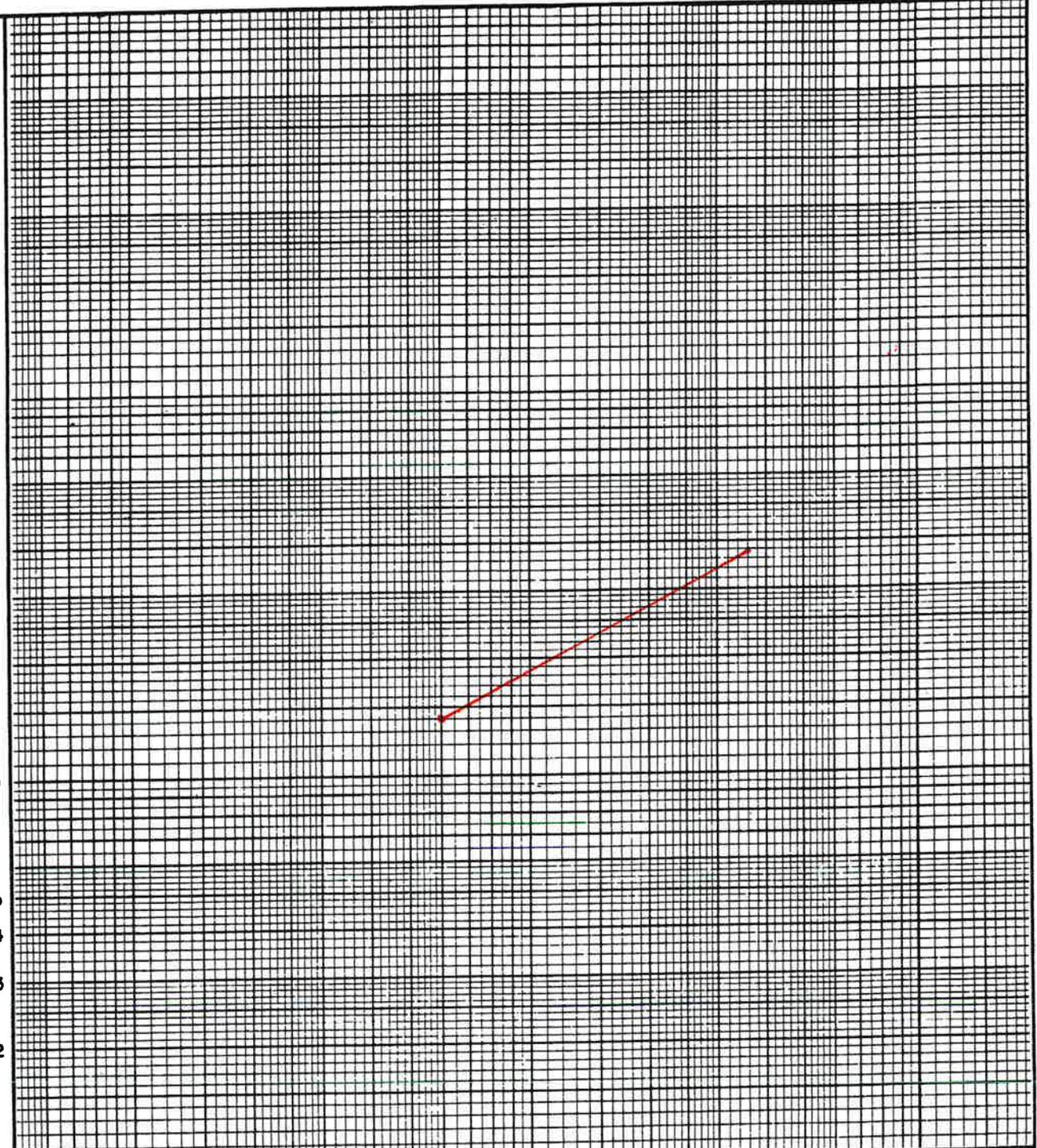
1 HR = 1.40"
 30 min = 2.10" / 2 = 1.05"
 5 min = 6.20" / 12 = 0.52"

SAN BERNARDINO COUNTY
 HYDROLOGY MANUAL

**INTENSITY - DURATION
 CURVES
 CALCULATION SHEET**

POINT RAINFALL - INCHES

50.0
40.0
30.0
20.0
10.0
5.0
4.0
3.0
2.0
1.0
0.5
0.4
0.3
0.2
0.1



5 10 20 30 40 50 100 200 300 400 500 1000
↑ 1HR 1.40"
↑ 3HR 2.55"
↑ 6HR 3.75"
STORM DURATION - MINUTES

PROJECT LOCATION 8TH ST. & HAVEN AVE, RANCHO CUCAMONGA

NOTES _____

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

AREA - AVERAGED
MASS RAINFALL
PLOTING SHEET

Angie Lomeli

From: Diaz, Eduardo <Eduardo.Diaz@cityofrc.us>
Sent: Tuesday, October 10, 2017 3:35 PM
To: Angie Lomeli
Subject: RE: Hydrology for Storm drain plan 2220

Hello Angie,

I'm sorry but I couldn't locate a hydrology report for that segment of Haven Ave. I don't know if this will help, but I did find the full set of Storm Drain Plans from URS and an Environmental Assessment Staff Report presented to city council on Sept. 08, 2004. I'm sending these files through our city clerk's (city.clerk@cityofrc.us) Hightail.com account because they're too large to send through email.

Thank you

Ed Diaz
Assistant Engineer
City of Rancho Cucamonga
909-477-2740 ext. 4027

From: Angie Lomeli [mailto:Angie@thieneseng.com]
Sent: Tuesday, October 10, 2017 8:33 AM
To: Diaz, Eduardo <Eduardo.Diaz@cityofrc.us>
Subject: RE: Hydrology for Storm drain plan 2220

Great, thanks! ☺

From: Diaz, Eduardo [mailto:Eduardo.Diaz@cityofrc.us]
Sent: Tuesday, October 10, 2017 8:32 AM
To: Angie Lomeli <Angie@thieneseng.com>
Subject: RE: Hydrology for Storm drain plan 2220

Hello Angie,

I'll do my best to have something for you by the end of the day. The plans help a lot!

Thank you

Ed Diaz
Assistant Engineer
City of Rancho Cucamonga
909-477-2740 ext. 4027

From: Angie Lomeli [mailto:Angie@thieneseng.com]
Sent: Tuesday, October 10, 2017 8:27 AM
To: Diaz, Eduardo <Eduardo.Diaz@cityofrc.us>
Subject: FW: Hydrology for Storm drain plan 2220

Hi Ed,

Please provide the hydrology report for storm drain plan 2220, prepared by URS and approved August 2008. Not sure if this was City CIP project. Attached are a couple plan sheets for reference.

Thank you!

Angie Maldonado

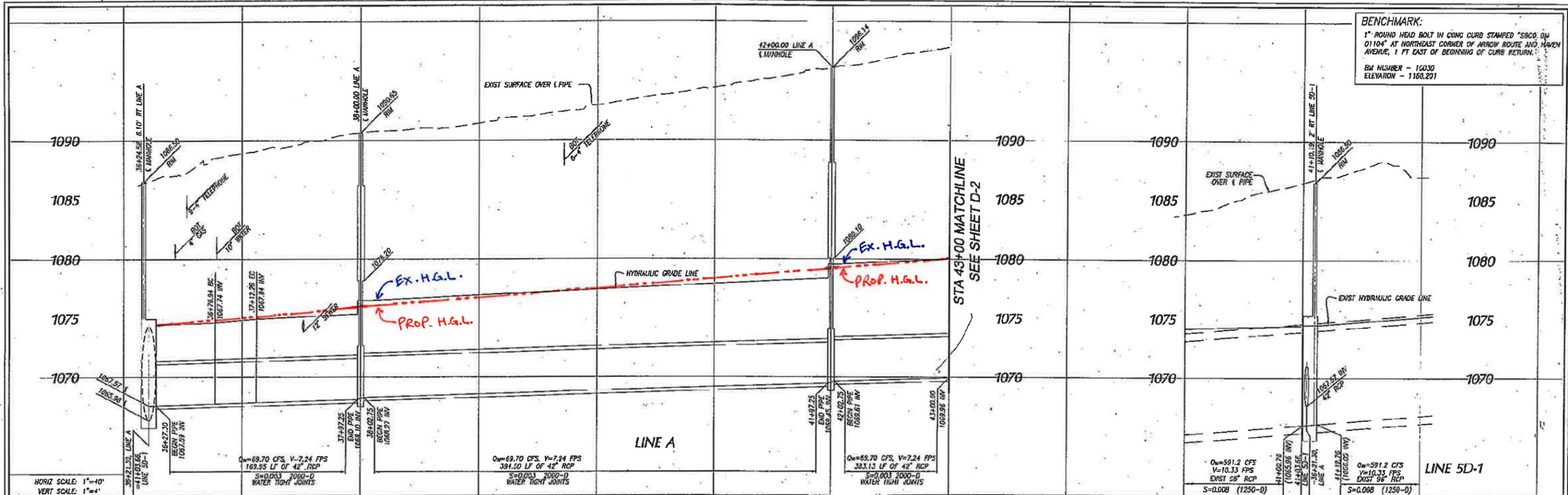
Research Specialist

THIENES ENGINEERING, INC.

14349 Firestone Blvd. La Mirada, CA 90638

Phone: (714) 521-4811 ext: 237 Fax: (714) 521-4173

Angie@ThienesEng.com

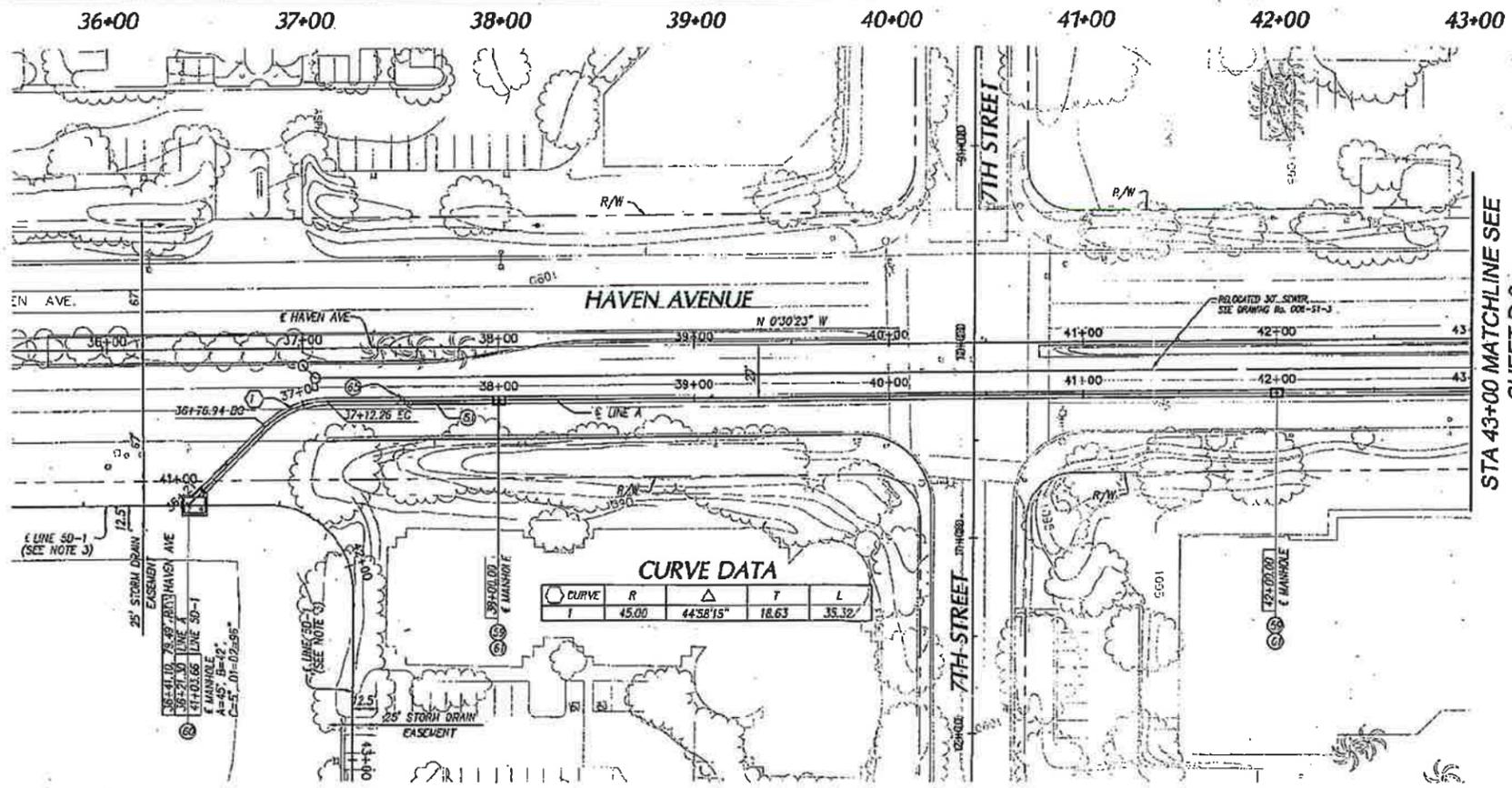


BENCHMARK:
 1" ROUND HEAD BOLT IN CONC CURB STAMPED "SBCO, 04 01104" AT NORTHEAST CORNER OF ARROW ROUTE AND HAVEN AVENUE, 1 FT EAST OF BEGINNING OF CURB RETURN.
 BM NUMBER - 16030
 ELEVATION - 1160.201

HORIZ SCALE: 1"=40'
 VERT SCALE: 1"=4'

STA 43+00 MATCHLINE
 SEE SHEET D-2

STA 43+00 MATCHLINE SEE
 SHEET D-2



CURVE DATA

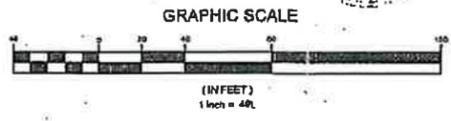
Curve	R	Δ	T	L
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STORM DRAIN CONSTRUCTION NOTES

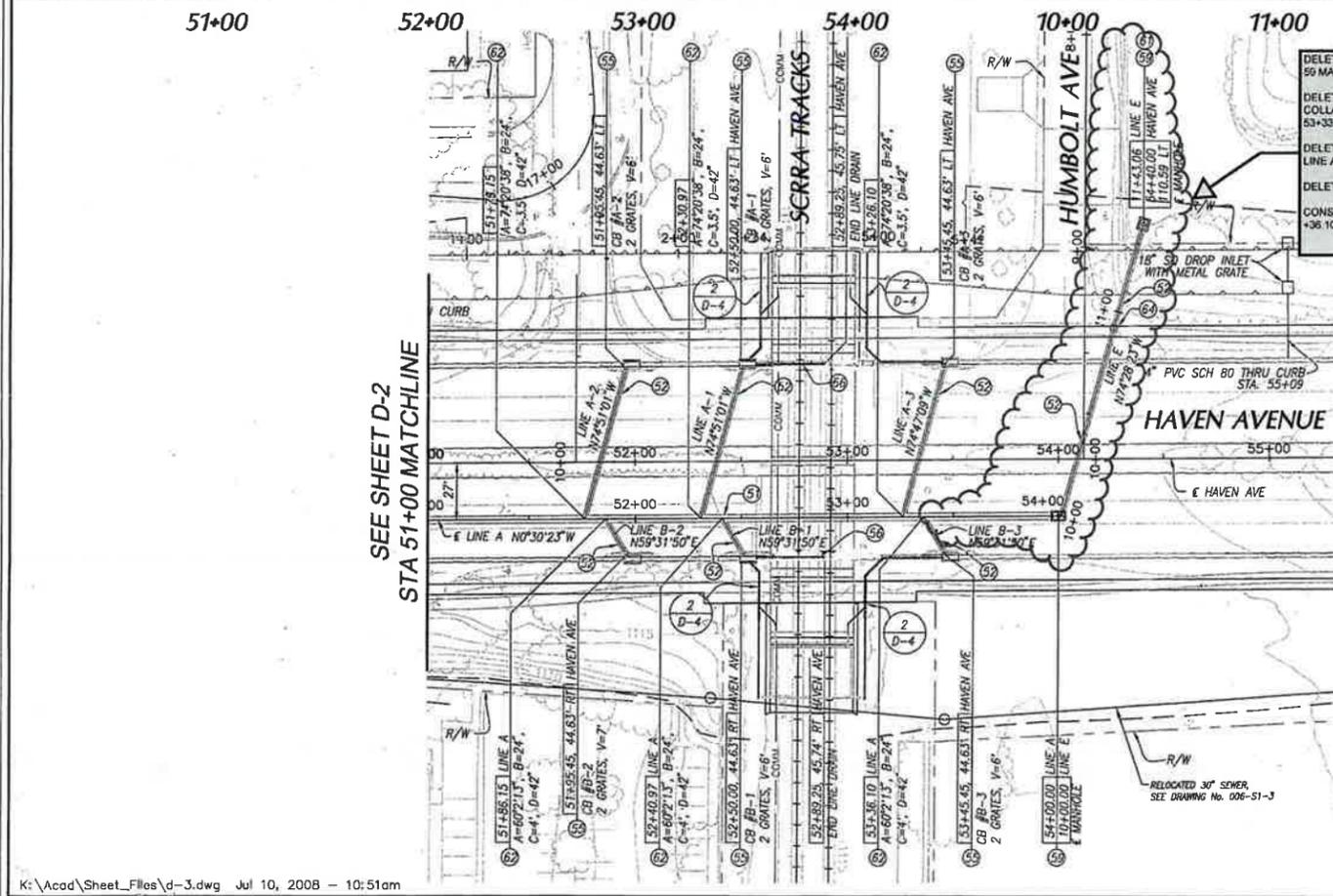
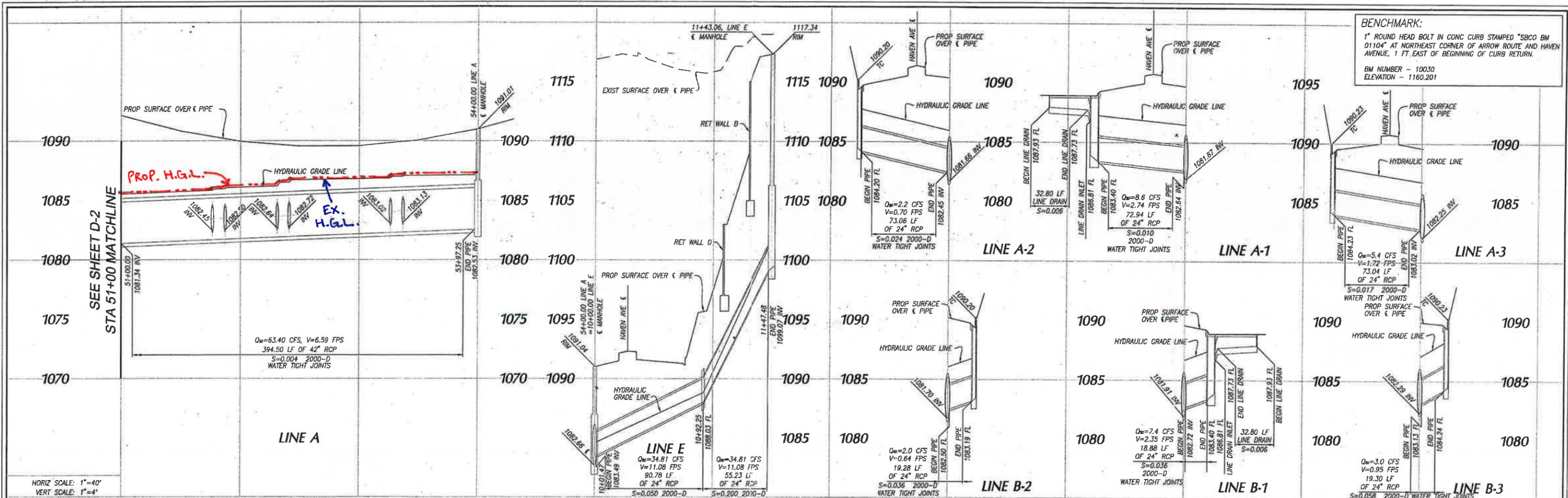
- LOCATIONS OF UTILITY FACILITIES SHOWN ON THESE PLANS ARE APPROXIMATE AND SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.
- SEE UTILITY PLANS (SHEETS U-1 TO U-4) FOR DISPOSITION OF EXISTING UTILITIES.
- FOR EXISTING STORM DRAIN FACILITY, REFER TO CITY OF RANCHO CUCAMONGA DRAWING NO 1049, ASSESSMENT DISTRICT 02-1, APPROVED MARCH 12, 1982.
- FOR PIPE CONNECTIONS AT CATCH BASINS, JUNCTION STRUCTURES, AND TRANSITION STRUCTURES, RCP SHALL BE BEVELED.
- SEE STORM DRAIN PROFILES FOR THE LIMITS OF WATERTIGHT JOINTS.
- IF SHORING OR JACKING METHODS ARE TO BE USED TO INSTALL STORM DRAIN LINE A UNDER THE MWD PIPELINE, CONTRACTOR SHALL PREPARE AND SUBMIT PLANS AND CALCULATIONS FOR THE PROPOSED METHOD TO MWD FOR REVIEW AND WRITTEN APPROVAL AT LEAST 45 DAYS PRIOR TO CONSTRUCTION. PLANS AND CALCULATIONS MUST BE STAMPED AND SIGNED BY A CIVIL ENGINEER OR STRUCTURAL ENGINEER REGISTERED IN CALIFORNIA.
- THE MWD PIPELINE IS ADEQUATE FOR AASHTO H-20 LOADING. IF CONTRACTOR PLANS TO USE ANY EQUIPMENT OVER THE PIPELINE WHICH WILL IMPOSE LOADS GREATER THAN AASHTO H-20, CONTRACTOR SHALL SUBMIT SPECIFICATIONS OF SUCH EQUIPMENT TO MWD FOR REVIEW AND WRITTEN APPROVAL AT LEAST 30 DAYS PRIOR TO ITS USE.

- ⑤ FURNISH AND INSTALL 42" RCP (2000-D)
- ⑥ MANHOLE NO 2
- ⑦ MANHOLE NO 4
- ⑧ MANHOLE SHAFT SAFETY LIDGE
- ⑨ SUPPORT FOR CONDUITS ACROSS TRENCHES

CITY STD 319
 CITY STD 321
 APWA STD 330
 CITY STD 339



DESCRIPTION OF REVISION	DATE	CIF APPROVED
CITY OF RANCHO CUCAMONGA		
PLAN AND PROFILE HAVEN AVENUE STORM DRAIN FROM STA 36+21 TO STA 43+00 HAVEN AVENUE GRADE SEPARATION		
APPROVED BY: CITY ENGINEER	DATE: 8-14-09 RCE: 42166	
DESIGN: BRANSON	PLAN PREPARED BY: [Signature]	RECOMMENDED: [Signature]
DRAWN: BRANSON	URS 2000 EAST FIRST STREET, SUITE 400 SANTA ANA, CA 92705 (714) 835-0900	SHEET: 22 OF 144
CHECKED: [Signature]	R.C.E. NO. 51730	DRAWING NO. D-1

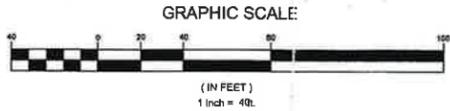


NOTES:

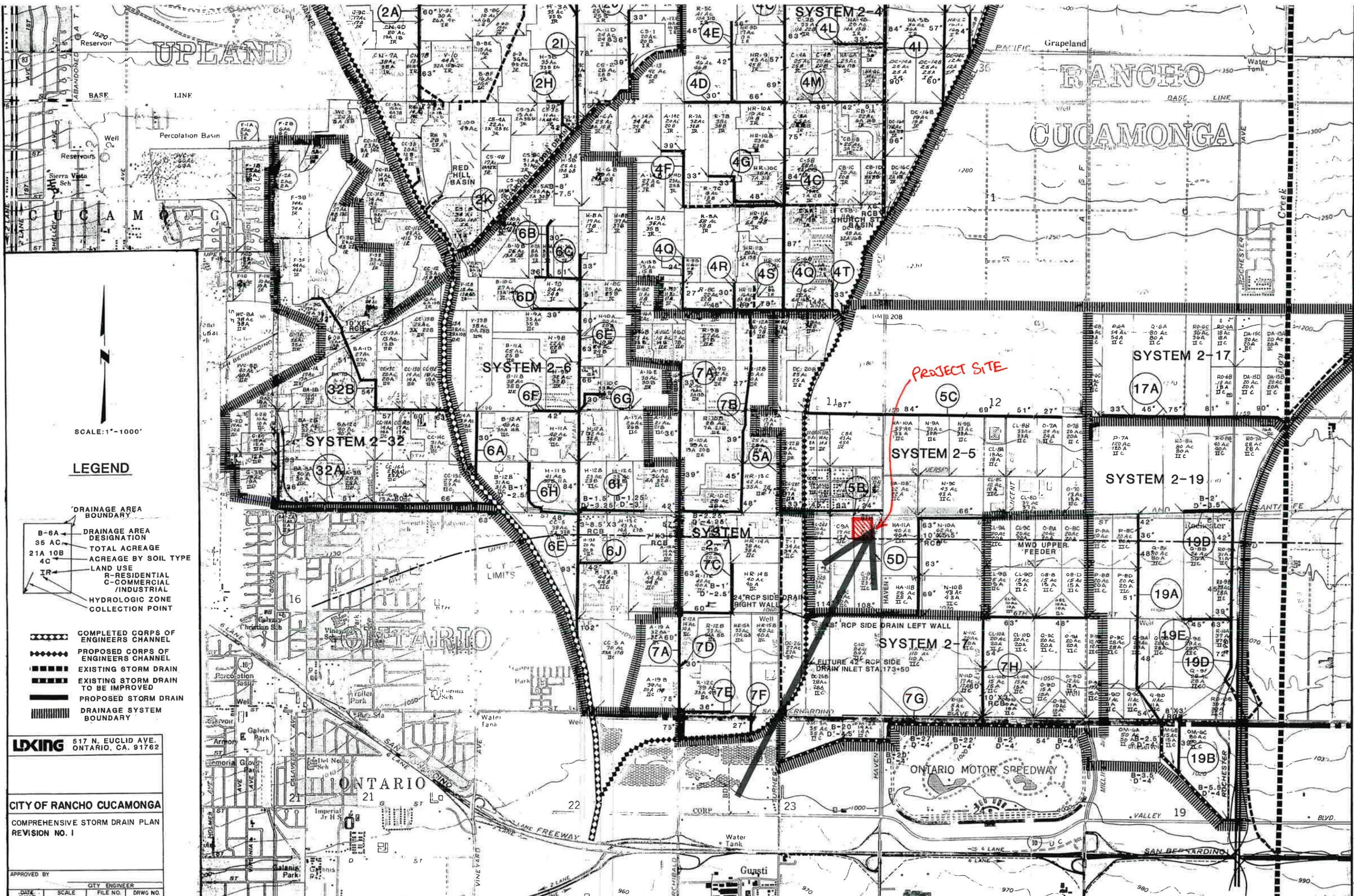
- LOCATIONS OF UTILITY FACILITIES SHOWN ON THESE PLANS ARE APPROXIMATE AND SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION
- SEE UTILITY PLANS (SHEETS U-1 TO U-4) FOR DISPOSITION OF EXISTING UTILITIES.
- FOR EXISTING STORM DRAIN FACILITY, REFER TO CITY OF RANCHO CUCAMONGA DRAWING NO 1049, ASSESSMENT DISTRICT 82-1, APPROVED MARCH 12, 1962.
- FOR PIPE CONNECTIONS AT CATCH BASINS, JUNCTION STRUCTURES, AND TRANSITION STRUCTURES, RCP SHALL BE BEVELED.
- WHERE THE HGL IS ABOVE THE SOFFIT OF THE PIPE, WATER TIGHT JOINTS SHALL BE USED FOR ALL PIPE SEGMENTS.
- IF SHORING OR JACKING METHODS ARE TO BE USED TO INSTALL STORM DRAIN LINE A UNDER THE MWD PIPELINE, CONTRACTOR SHALL PREPARE AND SUBMIT PLANS AND CALCULATIONS FOR THE PROPOSED METHOD TO MWD FOR REVIEW AND WRITTEN APPROVAL AT LEAST 45 DAYS PRIOR TO CONSTRUCTION. PLANS AND CALCULATIONS MUST BE STAMPED AND SIGNED BY A CIVIL ENGINEER OR STRUCTURAL ENGINEER REGISTERED IN CALIFORNIA.
- THE MWD PIPELINE IS ADEQUATE FOR ASHTO H-20 LOADING. IF CONTRACTOR PLANS TO USE ANY EQUIPMENT OVER THE PIPELINE WHICH WILL IMPOSE LOADS GREATER THAN ASHTO H-20, CONTRACTOR SHALL SUBMIT SPECIFICATIONS OF SUCH EQUIPMENT TO MWD FOR REVIEW AND WRITTEN APPROVAL AT LEAST 30 DAYS PRIOR TO ITS USE.

STORM DRAIN CONSTRUCTION NOTES

- 51 FURNISH AND INSTALL 42" RCP (2000-D)
 - 52 FURNISH AND INSTALL 24" RCP (2000-D)
 - 53 CURB OPENING CATCH BASIN WITH GRATING(S)
 - 54 GRATED LINE DRAIN
 - 55 MANHOLE NO 2
 - 56 MANHOLE SHAFT SAFETY LEDGE
 - 57 JUNCTION STRUCTURE NO 2
 - 58 CONC COLLAR
- CITY STD 120 & 341
 CITY STD 120 & 341
 CITY STD 302
 CALTRANS STD PLN D98C
 CITY STD 319
 APWA STD 330-1
 CITY STD 331
 CITY STD 329



DESCRIPTION OF REVISION	DATE	CITY APPROVED:
CITY OF RANCHO CUCAMONGA		
PLAN AND PROFILE		
HAVEN AVENUE STORM DRAIN FROM STA 51+00 TO STA 54+00		
HAVEN AVENUE GRADE SEPARATION		
APPROVED BY: CITY ENGINEER	DATE: 8-14-08 RCE: 42166	
DESIGN: B.SAWSON	PLAN PREPARED BY: URS	RECOMMENDED: [Signature]
DRAWN: B.SAWSON	3030 EAST FIRST STREET, SUITE 400 SANTA ANA, CA 92705 (714) 235-8888	SHEET: 24 OF 144
CHECKED: S.WILLIAMS	DATE: 7-11-08 R.C.E. NO: 54730 FILE NO:	DRAWING NO: D-3



SCALE: 1" = 1000'

LEGEND

- DRAINAGE AREA BOUNDARY
- B-6A 35 AC DRAINAGE AREA DESIGNATION
- 21A 10B 4C TOTAL ACREAGE
- ACREAGE BY SOIL TYPE
- IR LAND USE
- R-RESIDENTIAL
- C-COMMERCIAL
- I-INDUSTRIAL
- Hydrologic Zone Collection Point

- COMPLETED CORPS OF ENGINEERS CHANNEL
- PROPOSED CORPS OF ENGINEERS CHANNEL
- EXISTING STORM DRAIN
- EXISTING STORM DRAIN TO BE IMPROVED
- PROPOSED STORM DRAIN
- DRAINAGE SYSTEM BOUNDARY

LIXING 517 N. EUCLID AVE. ONTARIO, CA. 91762

CITY OF RANCHO CUCAMONGA

COMPREHENSIVE STORM DRAIN PLAN
REVISION NO. 1

APPROVED BY: _____ CITY ENGINEER
DATE: _____ SCALE: _____ FILE NO.: _____ DRWG NO.: _____

APPENDIX B

HYDROLOGY CALCULATIONS

EXISTING CONDITION

 RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
 (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
 (c) Copyright 1983-2016 Advanced Engineering Software (aes)
 Ver. 23.0 Release Date: 07/01/2016 License ID 1435

Analysis prepared by:

THIENES ENGINEERING, INC.
 14349 FIRESTONE BLVD
 LA MIRADA, CA 90638

***** DESCRIPTION OF STUDY *****
 * JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA *
 * EXISTING CONDITION 100-YEAR *
 * PORTION OF SITE WEST OF RAILROAD PLUS NORTHERLY OFFSITE AREA (100-101) *

FILE NAME: W:\3320\EX100A.DAT
 TIME/DATE OF STUDY: 09:43 04/05/2018

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
 USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
 USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.4000

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF-	CROWN TO	STREET-CROSSFALL:			CURB	GUTTER-GEOMETRIES:			MANNING
	WIDTH	CROSSFALL	IN-	/ OUT-	/PARK-	HEIGHT	WIDTH	LIP	HIKE	FACTOR
(FT)	(FT)	(FT)	SIDE	/ SIDE/	WAY	(FT)	(FT)	(FT)	(FT)	(n)
1	30.0	20.0	0.018/0.018/0.020			0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
 1. Relative Flow-Depth = 0.00 FEET
 as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
 2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
 *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
 OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
 *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

 FLOW PROCESS FROM NODE 100.00 TO NODE 101.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 585.00
 ELEVATION DATA: UPSTREAM(FEET) = 1112.20 DOWNSTREAM(FEET) = 1102.10

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.756
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.443
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	0.30	0.74	0.100	52	8.76

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 1.18
 TOTAL AREA(ACRES) = 0.30 PEAK FLOW RATE(CFS) = 1.18

EX100A.RES
FLOW PROCESS FROM NODE 100.00 TO NODE 101.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 8.76
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.443
SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	A	0.15	0.74	0.100	52

SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.15 SUBAREA RUNOFF(CFS) = 0.59
EFFECTIVE AREA(ACRES) = 0.45 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 0.5 PEAK FLOW RATE(CFS) = 1.77

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) =	0.5	TC(MIN.) =	8.76
EFFECTIVE AREA(ACRES) =	0.45	AREA-AVERAGED Fm(INCH/HR) =	0.07
AREA-AVERAGED Fp(INCH/HR) =	0.74	AREA-AVERAGED Ap =	0.100
PEAK FLOW RATE(CFS) =	1.77		

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END OF RATIONAL METHOD ANALYSIS

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Analysis prepared by:

THIENES ENGINEERING, INC.
 14349 FIRESTONE BLVD
 LA MIRADA, CA 90638

***** DESCRIPTION OF STUDY *****
 * JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA *
 * EXISTING CONDITION 100-YEAR *
 * WESTERLY PORTION OF SITE, EAST OF RAILROAD (200-201) *

FILE NAME: W:\3320\EX100B.DAT
 TIME/DATE OF STUDY: 09:44 04/05/2018

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
 USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
 USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.4000

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF-	CROWN TO	STREET-CROSSFALL:			CURB	GUTTER-GEOMETRIES:			MANNING
	WIDTH	CROSSFALL	IN-	/	OUT-/PARK-	HEIGHT	WIDTH	LIP	HIKE		FACTOR
	(FT)	(FT)	SIDE	/	SIDE/ WAY	(FT)	(FT)	(FT)	(FT)	(n)
1	30.0	20.0	0.018	/	0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
 as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
 OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

FLOW PROCESS FROM NODE 200.00 TO NODE 201.00 IS CODE = 21

=====

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 580.00
 ELEVATION DATA: UPSTREAM(FEET) = 1112.80 DOWNSTREAM(FEET) = 1101.60

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$

SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 8.533

* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.512

SUBAREA T_c AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	F_p (INCH/HR)	A_p (DECIMAL)	SCS CN	T_c (MIN.)
COMMERCIAL	A	1.95	0.74	0.100	52	8.53

SUBAREA AVERAGE PERVIOUS LOSS RATE, F_p (INCH/HR) = 0.74

SUBAREA AVERAGE PERVIOUS AREA FRACTION, A_p = 0.100

SUBAREA RUNOFF (CFS) = 7.79

TOTAL AREA (ACRES) = 1.95 PEAK FLOW RATE (CFS) = 7.79

=====

END OF STUDY SUMMARY:

EX100B.RES

TOTAL AREA(ACRES) = 2.0 TC(MIN.) = 8.53
EFFECTIVE AREA(ACRES) = 1.95 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE(CFS) = 7.79

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END OF RATIONAL METHOD ANALYSIS

♀

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Analysis prepared by:

THIENES ENGINEERING, INC.
 14349 FIRESTONE BLVD
 LA MIRADA, CA 90638

***** DESCRIPTION OF STUDY *****
 * JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA *
 * EXISTING CONDITION 100-YEAR *
 * EASTERLY PORTION OF SITE PLUS NORTHERLY OFFSITE AREA (300-301) *

FILE NAME: W:\3320\EX100C.DAT
 TIME/DATE OF STUDY: 09:50 04/05/2018

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

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--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
 USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
 USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.4000

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF-WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / PARK-SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	GEOMETRIES: LIP (FT)	MANNING HIKE (FT)	FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
 1. Relative Flow-Depth = 0.00 FEET
 as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
 2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
 SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.
 *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

 FLOW PROCESS FROM NODE 300.00 TO NODE 301.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 675.00
 ELEVATION DATA: UPSTREAM(FEET) = 1113.20 DOWNSTREAM(FEET) = 1104.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.721
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.173
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	3.25	0.74	0.100	52	9.72

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 11.99
 TOTAL AREA(ACRES) = 3.25 PEAK FLOW RATE(CFS) = 11.99

EX100C.RES
FLOW PROCESS FROM NODE 300.00 TO NODE 301.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 9.72
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.173
SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	A	0.50	0.74	0.100	52

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA AREA(ACRES) = 0.50 SUBAREA RUNOFF(CFS) = 1.84
EFFECTIVE AREA(ACRES) = 3.75 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
TOTAL AREA(ACRES) = 3.8 PEAK FLOW RATE(CFS) = 13.83

=====

END OF STUDY SUMMARY:
TOTAL AREA(ACRES) = 3.8 TC(MIN.) = 9.72
EFFECTIVE AREA(ACRES) = 3.75 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.100
PEAK FLOW RATE(CFS) = 13.83

=====

END OF RATIONAL METHOD ANALYSIS

♀

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Analysis prepared by:

THIENES ENGINEERING, INC.
 14349 FIRESTONE BLVD
 LA MIRADA, CA 90638

***** DESCRIPTION OF STUDY *****
 * JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA *
 * EXISTING CONDITION 100-YEAR *
 * OFFSITE FLOWS TRIBUTARY TO CATCH BASINS IN 8TH ST (400-412) *

FILE NAME: W:\3320\EX100D.DAT
 TIME/DATE OF STUDY: 09:48 04/05/2018

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
 USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE (LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
 USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.4000

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF-WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL IN- / SIDE / OUT-/ PARK / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	GEOMETRIES LIP (FT)	MANNING HIKE FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167 0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
 1. Relative Flow-Depth = 0.00 FEET
 as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
 2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)
 *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
 OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
 *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

 FLOW PROCESS FROM NODE 400.00 TO NODE 412.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 825.00
 ELEVATION DATA: UPSTREAM(FEET) = 1117.20 DOWNSTREAM(FEET) = 1101.70

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.878
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.132
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	1.70	0.74	0.100	52	9.88
NATURAL FAIR COVER "OPEN BRUSH"	A	1.65	0.55	1.000	66	22.94

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.57
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.543
 SUBAREA RUNOFF(CFS) = 11.53
 TOTAL AREA(ACRES) = 3.35 PEAK FLOW RATE(CFS) = 11.53

 FLOW PROCESS FROM NODE 412.00 TO NODE 412.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 9.88
 RAINFALL INTENSITY(INCH/HR) = 4.13
 AREA-AVERAGED Fm(INCH/HR) = 0.31
 AREA-AVERAGED Fp(INCH/HR) = 0.57
 AREA-AVERAGED Ap = 0.54
 EFFECTIVE STREAM AREA(ACRES) = 3.35
 TOTAL STREAM AREA(ACRES) = 3.35
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 11.53

 FLOW PROCESS FROM NODE 410.00 TO NODE 411.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 615.00
 ELEVATION DATA: UPSTREAM(FEET) = 1117.20 DOWNSTREAM(FEET) = 1101.30

$T_c = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM T_c (MIN.) = 8.240
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.608
 SUBAREA T_c AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	0.45	0.74	0.100	52	8.24

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 1.84
 TOTAL AREA(ACRES) = 0.45 PEAK FLOW RATE(CFS) = 1.84

 FLOW PROCESS FROM NODE 411.00 TO NODE 412.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 1097.01 DOWNSTREAM(FEET) = 1096.87
 FLOW LENGTH(FEET) = 44.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 9.2 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 2.83
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 1.84
 PIPE TRAVEL TIME(MIN.) = 0.26 T_c (MIN.) = 8.50
 LONGEST FLOWPATH FROM NODE 410.00 TO NODE 412.00 = 659.00 FEET.

 FLOW PROCESS FROM NODE 412.00 TO NODE 412.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 8.50
 RAINFALL INTENSITY(INCH/HR) = 4.52
 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74
 AREA-AVERAGED Ap = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 0.45
 TOTAL STREAM AREA(ACRES) = 0.45
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.84

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	11.53	9.88	4.132	0.57(0.31)	0.54	3.3	400.00

2 1.84 8.50 4.523 0.74(0.07) 0.10 0.4 410.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	12.77	8.50	4.523	0.57(0.28)	0.48	3.3	410.00
2	13.21	9.88	4.132	0.57(0.28)	0.49	3.8	400.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 13.21 Tc (MIN.) = 9.88
EFFECTIVE AREA (ACRES) = 3.80 AREA-AVERAGED Fm (INCH/HR) = 0.28
AREA-AVERAGED Fp (INCH/HR) = 0.57 AREA-AVERAGED Ap = 0.49
TOTAL AREA (ACRES) = 3.8
LONGEST FLOWPATH FROM NODE 400.00 TO NODE 412.00 = 825.00 FEET.

END OF STUDY SUMMARY:

TOTAL AREA (ACRES) = 3.8 TC (MIN.) = 9.88
EFFECTIVE AREA (ACRES) = 3.80 AREA-AVERAGED Fm (INCH/HR) = 0.28
AREA-AVERAGED Fp (INCH/HR) = 0.57 AREA-AVERAGED Ap = 0.491
PEAK FLOW RATE (CFS) = 13.21

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	12.77	8.50	4.523	0.57(0.28)	0.48	3.3	410.00
2	13.21	9.88	4.132	0.57(0.28)	0.49	3.8	400.00

END OF RATIONAL METHOD ANALYSIS

♀

PROPOSED CONDITION

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Analysis prepared by:

THIENES ENGINEERING, INC.
 14349 FIRESTONE BLVD
 LA MIRADA, CA 90638

***** DESCRIPTION OF STUDY *****
 * JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA *
 * PROPOSED CONDITION 100-YEAR *
 * PORTION OF SITE WEST OF RAILROAD PLUS NORTHERLY OFFSITE AREA (100-101) *

FILE NAME: W:\3320\PR100A.DAT
 TIME/DATE OF STUDY: 09:17 04/06/2018

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
 USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
 USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.4000

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL:			CURB HEIGHT (FT)	GUTTER-GEOMETRIES:			MANNING FACTOR (n)
			IN- SIDE	/ /	OUT-/PARK- SIDE/ WAY		WIDTH	LIP	HIKE	
1	30.0	20.0	0.018	0.018	0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
 as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
 OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

 FLOW PROCESS FROM NODE 100.00 TO NODE 101.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 585.00
 ELEVATION DATA: UPSTREAM(FEET) = 1112.20 DOWNSTREAM(FEET) = 1102.10

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.756

PR100A.RES

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.443
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
 COMMERCIAL A 0.30 0.74 0.100 52 8.76
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 1.18
 TOTAL AREA(ACRES) = 0.30 PEAK FLOW RATE(CFS) = 1.18

 FLOW PROCESS FROM NODE 100.00 TO NODE 101.00 IS CODE = 81

=====
 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
 =====

MAINLINE Tc(MIN.) = 8.76
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.443
 SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 COMMERCIAL A 0.15 0.74 0.100 52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 0.15 SUBAREA RUNOFF(CFS) = 0.59
 EFFECTIVE AREA(ACRES) = 0.45 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 0.5 PEAK FLOW RATE(CFS) = 1.77

=====
 END OF STUDY SUMMARY:
 TOTAL AREA(ACRES) = 0.5 TC(MIN.) = 8.76
 EFFECTIVE AREA(ACRES) = 0.45 AREA-AVERAGED Fm(INCH/HR)= 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.100
 PEAK FLOW RATE(CFS) = 1.77
 =====

=====
 END OF RATIONAL METHOD ANALYSIS
 =====

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RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
 (Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
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Analysis prepared by:

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***** DESCRIPTION OF STUDY *****
 * JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA *
 * PROPOSED CONDITION 100-YEAR *
 * MAJORITY OF PROJECT SITE PLUS EASTERLY OFFSITE AREAS (200-331) *

FILE NAME: W:\3320\PR100B.DAT
 TIME/DATE OF STUDY: 08:41 10/19/2018

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
 SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00
 SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
 USER-DEFINED LOGARITHMIC INTERPOLATION USED FOR RAINFALL

SLOPE OF INTENSITY DURATION CURVE(LOG(I;IN/HR) vs. LOG(Tc;MIN)) = 0.6000
 USER SPECIFIED 1-HOUR INTENSITY(INCH/HOUR) = 1.4000

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF-WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT- / SIDE / SIDE / WAY	CURB HEIGHT (FT)	GUTTER WIDTH (FT)	LIP (FT)	HIKE (FT)	GEOMETRIES: MANNING FACTOR (n)
1	30.0	20.0	0.018/0.018/0.020	0.67	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
 1. Relative Flow-Depth = 0.00 FEET
 as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
 2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.
 *USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

 FLOW PROCESS FROM NODE 200.00 TO NODE 201.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 330.00
 ELEVATION DATA: UPSTREAM(FEET) = 1110.02 DOWNSTREAM(FEET) = 1103.89

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.863
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.142
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
 COMMERCIAL A 3.60 0.74 0.100 52 6.86
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 16.42
 TOTAL AREA(ACRES) = 3.60 PEAK FLOW RATE(CFS) = 16.42

 FLOW PROCESS FROM NODE 201.00 TO NODE 201.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN.) = 6.86
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.142
 SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN

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COMMERCIAL A 0.10 0.74 0.100 52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 0.10 SUBAREA RUNOFF(CFS) = 0.46
 EFFECTIVE AREA(ACRES) = 3.70 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 3.7 PEAK FLOW RATE(CFS) = 16.88

 FLOW PROCESS FROM NODE 201.00 TO NODE 212.00 IS CODE = 31

 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 1100.89 DOWNSTREAM(FEET) = 1099.62
 FLOW LENGTH(FEET) = 152.00 MANNING'S N = 0.012
 DEPTH OF FLOW IN 24.0 INCH PIPE IS 15.8 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 7.67
 ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 16.88
 PIPE TRAVEL TIME(MIN.) = 0.33 Tc(MIN.) = 7.19
 LONGEST FLOWPATH FROM NODE 200.00 TO NODE 212.00 = 482.00 FEET.

 FLOW PROCESS FROM NODE 212.00 TO NODE 212.00 IS CODE = 1

 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 7.19
 RAINFALL INTENSITY(INCH/HR) = 5.00
 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74
 AREA-AVERAGED Ap = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 3.70
 TOTAL STREAM AREA(ACRES) = 3.70
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 16.88

 FLOW PROCESS FROM NODE 210.00 TO NODE 211.00 IS CODE = 21

 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 370.00
 ELEVATION DATA: UPSTREAM(FEET) = 1104.33 DOWNSTREAM(FEET) = 1101.75

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.739
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.448
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	0.85	0.74	0.100	52	8.74

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 3.35
 TOTAL AREA(ACRES) = 0.85 PEAK FLOW RATE(CFS) = 3.35

 FLOW PROCESS FROM NODE 211.00 TO NODE 212.00 IS CODE = 31

 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 1098.75 DOWNSTREAM(FEET) = 1098.62
 FLOW LENGTH(FEET) = 44.00 MANNING'S N = 0.012
 DEPTH OF FLOW IN 15.0 INCH PIPE IS 11.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 3.42
 ESTIMATED PIPE DIAMETER(INCH) = 15.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 3.35
 PIPE TRAVEL TIME(MIN.) = 0.21 Tc(MIN.) = 8.95
 LONGEST FLOWPATH FROM NODE 210.00 TO NODE 212.00 = 414.00 FEET.

 FLOW PROCESS FROM NODE 212.00 TO NODE 212.00 IS CODE = 1

 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:

TIME OF CONCENTRATION(MIN.) = 8.95
 RAINFALL INTENSITY(INCH/HR) = 4.38
 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74
 AREA-AVERAGED Ap = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 0.85
 TOTAL STREAM AREA(ACRES) = 0.85
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.35

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	16.88	7.19	4.999	0.74(0.07)	0.10	3.7	200.00
2	3.35	8.95	4.384	0.74(0.07)	0.10	0.9	210.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	19.95	7.19	4.999	0.74(0.07)	0.10	4.4	200.00
2	18.11	8.95	4.384	0.74(0.07)	0.10	4.5	210.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 19.95 Tc(MIN.) = 7.19
 EFFECTIVE AREA(ACRES) = 4.38 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 4.5
 LONGEST FLOWPATH FROM NODE 200.00 TO NODE 212.00 = 482.00 FEET.

 FLOW PROCESS FROM NODE 212.00 TO NODE 222.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 1098.60 DOWNSTREAM(FEET) = 1097.62
 FLOW LENGTH(FEET) = 326.00 MANNING'S N = 0.012
 DEPTH OF FLOW IN 30.0 INCH PIPE IS 21.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.42
 ESTIMATED PIPE DIAMETER(INCH) = 30.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 19.95
 PIPE TRAVEL TIME(MIN.) = 1.00 Tc(MIN.) = 8.20
 LONGEST FLOWPATH FROM NODE 200.00 TO NODE 222.00 = 808.00 FEET.

 FLOW PROCESS FROM NODE 222.00 TO NODE 222.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

=====

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 8.20
 RAINFALL INTENSITY(INCH/HR) = 4.62
 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74
 AREA-AVERAGED Ap = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 4.38
 TOTAL STREAM AREA(ACRES) = 4.55
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 19.95

 FLOW PROCESS FROM NODE 220.00 TO NODE 221.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 400.00
 ELEVATION DATA: UPSTREAM(FEET) = 1113.37 DOWNSTREAM(FEET) = 1102.30

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.844
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.151
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	0.65	0.74	0.100	52	6.84

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 2.97
 TOTAL AREA(ACRES) = 0.65 PEAK FLOW RATE(CFS) = 2.97

FLOW PROCESS FROM NODE 221.00 TO NODE 222.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 1100.16 DOWNSTREAM(FEET) = 1098.10
 FLOW LENGTH(FEET) = 158.00 MANNING'S N = 0.012
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 7.3 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.90
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 2.97
 PIPE TRAVEL TIME(MIN.) = 0.45 Tc(MIN.) = 7.29
 LONGEST FLOWPATH FROM NODE 220.00 TO NODE 222.00 = 558.00 FEET.

FLOW PROCESS FROM NODE 222.00 TO NODE 222.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 7.29
 RAINFALL INTENSITY(INCH/HR) = 4.96
 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74
 AREA-AVERAGED Ap = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 0.65
 TOTAL STREAM AREA(ACRES) = 0.65
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.97

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	19.95	8.20	4.623	0.74(0.07)	0.10	4.4	200.00
1	18.11	9.97	4.109	0.74(0.07)	0.10	4.5	210.00
2	2.97	7.29	4.959	0.74(0.07)	0.10	0.6	220.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	22.03	7.29	4.959	0.74(0.07)	0.10	4.5	220.00
2	22.71	8.20	4.623	0.74(0.07)	0.10	5.0	200.00
3	20.56	9.97	4.109	0.74(0.07)	0.10	5.2	210.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 22.71 Tc(MIN.) = 8.20
 EFFECTIVE AREA(ACRES) = 5.03 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 5.2
 LONGEST FLOWPATH FROM NODE 200.00 TO NODE 222.00 = 808.00 FEET.

FLOW PROCESS FROM NODE 222.00 TO NODE 300.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 1097.60 DOWNSTREAM(FEET) = 1097.47
 FLOW LENGTH(FEET) = 45.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 33.0 INCH PIPE IS 22.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 5.21
 ESTIMATED PIPE DIAMETER(INCH) = 33.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 22.71
 PIPE TRAVEL TIME(MIN.) = 0.14 Tc(MIN.) = 8.34
 LONGEST FLOWPATH FROM NODE 200.00 TO NODE 300.00 = 853.00 FEET.

FLOW PROCESS FROM NODE 300.00 TO NODE 300.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN.) = 8.34
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.574
 SUBAREA LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SC5 SOIL AREA Fp Ap SC5
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
 COMMERCIAL A 0.20 0.74 0.100 52
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74

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SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 0.20 SUBAREA RUNOFF(CFS) = 0.81
 EFFECTIVE AREA(ACRES) = 5.23 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 5.4 PEAK FLOW RATE(CFS) = 22.71
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

 FLOW PROCESS FROM NODE 300.00 TO NODE 300.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN.) = 8.34
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.574
 SUBAREA LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	A	0.20	0.74	0.100	52

 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA AREA(ACRES) = 0.20 SUBAREA RUNOFF(CFS) = 0.81
 EFFECTIVE AREA(ACRES) = 5.43 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 5.6 PEAK FLOW RATE(CFS) = 22.71
 NOTE: PEAK FLOW RATE DEFAULTED TO UPSTREAM VALUE

 FLOW PROCESS FROM NODE 300.00 TO NODE 331.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 1098.39 DOWNSTREAM(FEET) = 1096.92
 FLOW LENGTH(FEET) = 269.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 30.0 INCH PIPE IS 19.7 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.64
 ESTIMATED PIPE DIAMETER(INCH) = 30.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 22.71
 PIPE TRAVEL TIME(MIN.) = 0.68 Tc(MIN.) = 9.01
 LONGEST FLOWPATH FROM NODE 200.00 TO NODE 331.00 = 1122.00 FEET.

 FLOW PROCESS FROM NODE 331.00 TO NODE 331.00 IS CODE = 10

>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<

 FLOW PROCESS FROM NODE 310.00 TO NODE 311.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 230.00
 ELEVATION DATA: UPSTREAM(FEET) = 1115.30 DOWNSTREAM(FEET) = 1112.59
 $Tc = K * [(LENGTH ** 3.00) / (ELEVATION CHANGE)] ** 0.20$
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.506
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.309
 SUBAREA Tc AND LOSS RATE DATA(AMC III):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	0.50	0.74	0.100	52	6.51

 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 2.36
 TOTAL AREA(ACRES) = 0.50 PEAK FLOW RATE(CFS) = 2.36

 FLOW PROCESS FROM NODE 311.00 TO NODE 321.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 1106.76 DOWNSTREAM(FEET) = 1098.91
 FLOW LENGTH(FEET) = 909.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 12.0 INCH PIPE IS 7.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 4.48
 ESTIMATED PIPE DIAMETER(INCH) = 12.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 2.36
 PIPE TRAVEL TIME(MIN.) = 3.38 Tc(MIN.) = 9.89
 LONGEST FLOWPATH FROM NODE 310.00 TO NODE 321.00 = 1139.00 FEET.

FLOW PROCESS FROM NODE 321.00 TO NODE 321.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 9.89
 RAINFALL INTENSITY(INCH/HR) = 4.13
 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74
 AREA-AVERAGED Ap = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 0.50
 TOTAL STREAM AREA(ACRES) = 0.50
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 2.36

FLOW PROCESS FROM NODE 320.00 TO NODE 321.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 615.00
 ELEVATION DATA: UPSTREAM(FEET) - 1117.70 DOWNSTREAM(FEET) = 1101.35

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.194
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.623
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
 COMMERCIAL A 0.45 0.74 0.100 52 8.19
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.74
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
 SUBAREA RUNOFF(CFS) = 1.84
 TOTAL AREA(ACRES) = 0.45 PEAK FLOW RATE(CFS) = 1.84

FLOW PROCESS FROM NODE 321.00 TO NODE 321.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 8.19
 RAINFALL INTENSITY(INCH/HR) = 4.62
 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74
 AREA-AVERAGED Ap = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 0.45
 TOTAL STREAM AREA(ACRES) = 0.45
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.84

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	2.36	9.89	4.130	0.74(0.07)	0.10	0.5	310.00
2	1.84	8.19	4.623	0.74(0.07)	0.10	0.4	320.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	4.03	8.19	4.623	0.74(0.07)	0.10	0.9	320.00
2	4.00	9.89	4.130	0.74(0.07)	0.10	0.9	310.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 4.03 Tc(MIN.) = 8.19
 EFFECTIVE AREA(ACRES) = 0.86 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 0.9
 LONGEST FLOWPATH FROM NODE 310.00 TO NODE 321.00 = 1139.00 FEET.

FLOW PROCESS FROM NODE 321.00 TO NODE 331.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 1097.01 DOWNSTREAM(FEET) = 1096.87

PR100B.RES
 FLOW LENGTH(FEET) = 44.00 MANNING'S N = 0.013
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 11.1 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 3.53
 ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
 PIPE-FLOW(CFS) = 4.03
 PIPE TRAVEL TIME(MIN.) = 0.21 Tc(MIN.) = 8.40
 LONGEST FLOWPATH FROM NODE 310.00 TO NODE 331.00 = 1183.00 FEET.

 FLOW PROCESS FROM NODE 331.00 TO NODE 331.00 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<

** MAIN STREAM CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	4.03	8.40	4.554	0.74(0.07)	0.10	0.9	320.00
2	4.00	10.10	4.079	0.74(0.07)	0.10	0.9	310.00

LONGEST FLOWPATH FROM NODE 310.00 TO NODE 331.00 = 1183.00 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	22.03	8.14	4.643	0.74(0.07)	0.10	4.9	220.00
2	22.71	9.01	4.366	0.74(0.07)	0.10	5.4	200.00
3	20.56	10.83	3.911	0.74(0.07)	0.10	5.6	210.00

LONGEST FLOWPATH FROM NODE 200.00 TO NODE 331.00 = 1122.00 FEET.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	26.01	8.14	4.643	0.74(0.07)	0.10	5.8	220.00
2	26.26	8.40	4.554	0.74(0.07)	0.10	6.0	320.00
3	26.73	9.01	4.366	0.74(0.07)	0.10	6.3	200.00
4	25.43	10.10	4.079	0.74(0.07)	0.10	6.5	310.00
5	24.40	10.83	3.911	0.74(0.07)	0.10	6.5	210.00

TOTAL AREA(ACRES) = 6.5

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 26.73 Tc(MIN.) = 9.015
 EFFECTIVE AREA(ACRES) = 6.33 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74 AREA-AVERAGED Ap = 0.10
 TOTAL AREA(ACRES) = 6.5
 LONGEST FLOWPATH FROM NODE 310.00 TO NODE 331.00 = 1183.00 FEET.

 FLOW PROCESS FROM NODE 331.00 TO NODE 331.00 IS CODE = 12

>>>>CLEAR MEMORY BANK # 1 <<<<<

 FLOW PROCESS FROM NODE 331.00 TO NODE 331.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
 TIME OF CONCENTRATION(MIN.) = 9.01
 RAINFALL INTENSITY(INCH/HR) = 4.37
 AREA-AVERAGED Fm(INCH/HR) = 0.07
 AREA-AVERAGED Fp(INCH/HR) = 0.74
 AREA-AVERAGED Ap = 0.10
 EFFECTIVE STREAM AREA(ACRES) = 6.33
 TOTAL STREAM AREA(ACRES) = 6.55
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 26.73

 FLOW PROCESS FROM NODE 330.00 TO NODE 331.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH(FEET) = 830.00
 ELEVATION DATA: UPSTREAM(FEET) = 1117.70 DOWNSTREAM(FEET) = 1101.72

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
 SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 9.854
 * 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.139
 SUBAREA Tc AND LOSS RATE DATA(AMC III):
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)

PR100B.RES
 COMMERCIAL A 1.25 0.74 0.100 52 9.85
 NATURAL FAIR COVER
 "OPEN BRUSH" A 1.70 0.55 1.000 66 22.88
 RESIDENTIAL
 "5-7 DWELLINGS/ACRE" A 0.50 0.74 0.500 52 12.61
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.58
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.601
 SUBAREA RUNOFF(CFS) = 11.76
 TOTAL AREA(ACRES) = 3.45 PEAK FLOW RATE(CFS) = 11.76

 FLOW PROCESS FROM NODE 331.00 TO NODE 331.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<

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TOTAL NUMBER OF STREAMS = 2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
 TIME OF CONCENTRATION(MIN.) = 9.85
 RAINFALL INTENSITY(INCH/HR) = 4.14
 AREA-AVERAGED Fm(INCH/HR) = 0.35
 AREA-AVERAGED Fp(INCH/HR) = 0.58
 AREA-AVERAGED Ap = 0.60
 EFFECTIVE STREAM AREA(ACRES) = 3.45
 TOTAL STREAM AREA(ACRES) = 3.45
 PEAK FLOW RATE(CFS) AT CONFLUENCE = 11.76

** CONFLUENCE DATA **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	26.01	8.14	4.643	0.74(0.07)	0.10	5.8	220.00
1	26.26	8.40	4.554	0.74(0.07)	0.10	6.0	320.00
1	26.73	9.01	4.366	0.74(0.07)	0.10	6.3	200.00
1	25.43	10.10	4.079	0.74(0.07)	0.10	6.5	310.00
1	24.40	10.83	3.911	0.74(0.07)	0.10	6.5	210.00
2	11.76	9.85	4.139	0.58(0.35)	0.60	3.5	330.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	37.01	8.14	4.643	0.62(0.17)	0.27	8.6	220.00
2	37.39	8.40	4.554	0.62(0.17)	0.27	8.9	320.00
3	38.14	9.01	4.366	0.62(0.17)	0.27	9.5	200.00
4	37.48	9.85	4.139	0.62(0.17)	0.27	9.9	330.00
5	37.01	10.10	4.079	0.62(0.17)	0.27	9.9	310.00
6	35.45	10.83	3.911	0.62(0.17)	0.27	10.0	210.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) = 38.14 Tc(MIN.) = 9.01
 EFFECTIVE AREA(ACRES) = 9.48 AREA-AVERAGED Fm(INCH/HR) = 0.17
 AREA-AVERAGED Fp(INCH/HR) = 0.62 AREA-AVERAGED Ap = 0.27
 TOTAL AREA(ACRES) = 10.0
 LONGEST FLOWPATH FROM NODE 310.00 TO NODE 331.00 = 1183.00 FEET.

=====

END OF STUDY SUMMARY:
 TOTAL AREA(ACRES) = 10.0 TC(MIN.) = 9.01
 EFFECTIVE AREA(ACRES) = 9.48 AREA-AVERAGED Fm(INCH/HR) = 0.17
 AREA-AVERAGED Fp(INCH/HR) = 0.62 AREA-AVERAGED Ap = 0.267
 PEAK FLOW RATE(CFS) = 38.14

** PEAK FLOW RATE TABLE **

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp(Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	37.01	8.14	4.643	0.62(0.17)	0.27	8.6	220.00
2	37.39	8.40	4.554	0.62(0.17)	0.27	8.9	320.00
3	38.14	9.01	4.366	0.62(0.17)	0.27	9.5	200.00
4	37.48	9.85	4.139	0.62(0.17)	0.27	9.9	330.00
5	37.01	10.10	4.079	0.62(0.17)	0.27	9.9	310.00
6	35.45	10.83	3.911	0.62(0.17)	0.27	10.0	210.00

=====

END OF RATIONAL METHOD ANALYSIS

APPENDIX C

HYDRAULIC CALCULATIONS

DATE: 10/19/2018
 TIME: 9:18

F0515P
 WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)	
CD	24	4			2.00															
CD	30	4			2.50															
CD	36	4			3.00															
CD	42	4			3.50															

F 0 5 1 5 P

PAGE NO 3

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA

HEADING LINE NO 2 IS -

EXIST. COND.

EX. LINE "A" IN HAVEN AVE

HEADING LINE NO 3 IS -

F 0 5 1 5 P

PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	IS	A	SYSTEM OUTLET	STATION	INVERT	SECT	W S ELEV													
1	IS	A	SYSTEM OUTLET	3627.30	1067.59	42	1074.40													
2	IS	A	REACH	3676.94	1067.74	42		N	0.013					0.00	0.00	0.00	0.00			
3	IS	A	REACH	3712.26	1067.84	42		N	0.013					45.00	45.00	0.00	0.00			
4	IS	A	REACH	3797.25	1068.10	42		N	0.013					0.00	0.00	0.00	0.00			
5	IS	A	REACH	3802.75	1068.27	42		N	0.013					0.00	0.00	0.00	0.00			1
6	IS	A	REACH	4197.25	1069.45	42		N	0.013					0.00	0.00	0.00	0.00			0
7	IS	A	REACH	4202.75	1069.61	42		N	0.013					0.00	0.00	0.00	0.00			1
8	IS	A	REACH	4565.00	1070.74	42		N	0.013					0.00	0.00	0.00	0.00			0
9	IS	A	JUNCTION	4565.00	1070.74	42		N	0.013	Q3	6.3	Q4	0.0	1071.49	0.00	90.00	0.00	PHI 3	PHI 4	0.00
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING																				
10	IS	A	REACH	4647.25	1070.98	42		N	0.013					0.00	0.00	0.00	0.00			
11	IS	A	REACH	4652.75	1071.16	42		N	0.013					0.00	0.00	0.00	0.00			
12	IS	A	REACH	4800.00	1080.00	42		N	0.013					0.00	0.00	0.00	0.00			0

F 0 5 1 5 P

PAGE NO 3

WATER SURFACE PROFILE - ELEMENT CARD LISTING

13	IS	A	REACH	4997.25	1080.79	42		N	0.013					0.00	0.00	0.00	0.00			
14	IS	A	REACH	5002.75	1080.95	42		N	0.013					0.00	0.00	0.00	0.00			1
15	IS	A	REACH	5178.15	1081.70	42		N	0.013					0.00	0.00	0.00	0.00			0
16	IS	A	JUNCTION																	

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5178.15 1081.70 42 24 0 0.013 2.2 0.0 1082.45 0.00 75.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 17 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5186.15 1081.75 42 0.013 0.00 0.00 0.00 0

ELEMENT NO 18 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5186.15 1081.75 42 24 0 0.013 2.0 0.0 1082.50 0.00 60.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 19 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5230.97 1081.89 42 0.013 0.00 0.00 0.00 0

ELEMENT NO 20 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5230.97 1081.89 42 24 0 0.013 8.6 0.0 1082.64 0.00 75.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 21 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5240.97 1081.97 42 0.013 0.00 0.00 0.00 0

F 0 5 1 5 P
 PAGE NO 4

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 22 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5240.97 1081.97 42 24 0 0.013 7.4 0.0 1082.72 0.00 60.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 23 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5326.10 1082.27 42 0.013 0.00 0.00 0.00 0

ELEMENT NO 24 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5326.10 1082.97 42 24 0 0.013 5.4 0.0 1083.02 0.00 75.00 0.00

ELEMENT NO 25 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5345.45 1082.38 42 0.013 0.00 0.00 0.00 0

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 26 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5345.45 1082.38 42 24 0 0.013 3.0 0.0 1083.13 0.00 60.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 27 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5397.25 1082.53 42 0.013 0.00 0.00 0.00 0

ELEMENT NO 28 IS A SYSTEM HEADWORKS * * *
 U/S DATA STATION INVERT SECT W S ELEV
 5397.25 1082.53 42 0.00

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING
 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
 LICENSEE: THIENES ENGINEERING
 F0515P
 PAGE 1

WATER SURFACE PROFILE LISTING

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
 EX. LINE "A" IN HAVEN AVE

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.BL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO			SF AVE		HF	NORM DEPTH		ZR					
3627.30	1067.59	6.810	1074.400	69.7	7.24	0.815	1075.215	0.00	2.617	3.50	0.00	0.00	0	0.00
49.64	0.00302					.004799	0.24			3.500		0.00		
3676.94	1067.74	6.898	1074.638	69.7	7.24	0.815	1075.453	0.00	2.617	3.50	0.00	0.00	0	0.00
35.32	0.00283					.004799	0.17			3.500		0.00		
3712.26	1067.84	7.083	1074.923	69.7	7.24	0.815	1075.738	0.00	2.617	3.50	0.00	0.00	0	0.00
84.99	0.00306					.004799	0.41			3.500		0.00		
3797.25	1068.10	7.231	1075.331	69.7	7.24	0.815	1076.146	0.00	2.617	3.50	0.00	0.00	0	0.00
5.50	0.03091					.004799	0.03			1.526		0.00		
3802.75	1068.27	7.128	1075.398	69.7	7.24	0.815	1076.213	0.00	2.617	3.50	0.00	0.00	0	0.00
394.50	0.00299					.004799	1.89			3.500		0.00		
4197.25	1069.45	7.841	1077.291	69.7	7.24	0.815	1078.106	0.00	2.617	3.50	0.00	0.00	0	0.00

5.50	0.02909					.004799	0.03				1.552					0.00
4202.75	1069.61	7.749	1077.359	69.7	7.24	0.815	1078.174	0.00	2.617		3.50	0.00	0.00	0	0.00	
362.25	0.00312					.004799	1.74				3.500					0.00
4565.00	1070.74	8.357	1079.097	69.7	7.24	0.815	1079.912	0.00	2.617		3.50	0.00	0.00	0	0.00	
JUNCT STR	0.00000					.004385	0.00									0.00
4565.00	1070.74	8.638	1079.378	63.4	6.59	0.674	1080.052	0.00	2.496		3.50	0.00	0.00	0	0.00	
82.25	0.00292					.003971	0.33				3.500					0.00
4647.25	1070.98	8.725	1079.705	63.4	6.59	0.674	1080.379	0.00	2.496		3.50	0.00	0.00	0	0.00	
5.50	0.03273					.003971	0.02				1.425					0.00
4652.75	1071.16	8.567	1079.727	63.4	6.59	0.674	1080.401	0.00	2.496		3.50	0.00	0.00	0	0.00	
77.16	0.06003					.003971	0.31				1.210					0.00

LICENSEE: THIENES ENGINEERING

F0515P
 WATER SURFACE PROFILE LISTING
 JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
 EX. LINE "A" IN HAVEN AVE

PAGE 2

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
4729.91	1075.79	4.245	1080.037	63.4	6.59	0.674	1080.711	0.00	2.496	3.50	0.00	0.00	0	0.00
HYDRAULIC JUMP													0.00	
4729.91	1075.79	1.398	1077.190	63.4	17.67	4.851	1082.041	0.00	2.496	3.50	0.00	0.00	0	0.00
0.63	0.06003					.035105	0.02			1.210		0.00		
4730.54	1075.83	1.398	1077.228	63.4	17.66	4.843	1082.071	0.00	2.496	3.50	0.00	0.00	0	0.00
14.36	0.06003					.032918	0.47			1.210		0.00		
4744.90	1076.69	1.449	1078.141	63.4	16.84	4.403	1082.544	0.00	2.496	3.50	0.00	0.00	0	0.00
11.15	0.06003					.028902	0.32			1.210		0.00		
4756.05	1077.36	1.502	1078.864	63.4	16.05	4.002	1082.866	0.00	2.496	3.50	0.00	0.00	0	0.00
8.89	0.06003					.025390	0.23			1.210		0.00		
4764.94	1077.89	1.558	1079.453	63.4	15.31	3.638	1083.091	0.00	2.496	3.50	0.00	0.00	0	0.00
7.24	0.06003					.022318	0.16			1.210		0.00		
4772.18	1078.33	1.616	1079.946	63.4	14.59	3.308	1083.254	0.00	2.496	3.50	0.00	0.00	0	0.00
5.93	0.06003					.019628	0.12			1.210		0.00		
4778.11	1078.69	1.677	1080.363	63.4	13.92	3.007	1083.370	0.00	2.496	3.50	0.00	0.00	0	0.00
4.92	0.06003					.017271	0.08			1.210		0.00		
4783.03	1078.98	1.740	1080.721	63.4	13.27	2.734	1083.455	0.00	2.496	3.50	0.00	0.00	0	0.00
4.05	0.06003					.015207	0.06			1.210		0.00		
4787.08	1079.22	1.807	1081.031	63.4	12.65	2.486	1083.517	0.00	2.496	3.50	0.00	0.00	0	0.00
3.34	0.06003					.013403	0.04			1.210		0.00		
4790.42	1079.42	1.877	1081.302	63.4	12.06	2.259	1083.561	0.00	2.496	3.50	0.00	0.00	0	0.00
2.75	0.06003					.011821	0.03			1.210		0.00		

LICENSEE: THIENES ENGINEERING

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 WATER SURFACE PROFILE LISTING
 JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
 EX. LINE "A" IN HAVEN AVE

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STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR		
4793.17	1079.59	1.950	1081.540	63.4	11.50	2.054	1083.594	0.00	2.496	3.50	0.00	0.00	0	0.00
2.19	0.06003					.010437	0.02			1.210		0.00		
4795.36	1079.72	2.028	1081.749	63.4	10.97	1.868	1083.617	0.00	2.496	3.50	0.00	0.00	0	0.00
1.73	0.06003					.009227	0.02			1.210		0.00		

4797.09	1079.83	2.110	1081.935	63.4	10.46	1.697	1083.632	0.00	2.496		3.50	0.00	0.00	0	0.00
1.30	0.06003					.008168	0.01			1.210			0.00		
4798.39	1079.90	2.197	1082.100	63.4	9.97	1.543	1083.643	0.00	2.496		3.50	0.00	0.00	0	0.00
0.91	0.06003					.007242	0.01			1.210			0.00		
4799.30	1079.96	2.289	1082.247	63.4	9.51	1.403	1083.650	0.00	2.496		3.50	0.00	0.00	0	0.00
0.53	0.06003					.006434	0.00			1.210			0.00		
4799.83	1079.99	2.388	1082.378	63.4	9.06	1.275	1083.653	0.00	2.496		3.50	0.00	0.00	0	0.00
0.17	0.06003					.005729	0.00			1.210			0.00		
4800.00	1080.00	2.496	1082.496	63.4	8.64	1.159	1083.655	0.00	2.496		3.50	0.00	0.00	0	0.00
8.80	0.00400					.005117	0.05			2.854			0.00		
4808.80	1080.04	2.611	1082.646	63.4	8.24	1.053	1083.699	0.00	2.496		3.50	0.00	0.00	0	0.00
51.57	0.00400					.004592	0.24			2.854			0.00		
4860.37	1080.24	2.737	1082.979	63.4	7.85	0.957	1083.936	0.00	2.496		3.50	0.00	0.00	0	0.00
126.25	0.00400					.004222	0.53			2.854			0.00		
4986.62	1080.75	2.821	1083.569	63.4	7.63	0.904	1084.473	0.00	2.496		3.50	0.00	0.00	0	0.00
													0.00		

HYDRAULIC JUMP

4986.62	1080.75	2.211	1082.959	63.4	9.90	1.521	1084.480	0.00	2.496		3.50	0.00	0.00	0	0.00
10.63	0.00400					.007867	0.08			2.854			0.00		

LICENSEE: THIENES ENGINEERING

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WATER SURFACE PROFILE LISTING

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
EX. LINE "A" IN HAVEN AVE

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO	AVBPR	
L/ELEM	SO					SF AVE	HF			NORM DEPTH		ZR			
4997.25	1080.79	2.149	1082.939	63.4	10.23	1.626	1084.565	0.00	2.496		3.50	0.00	0.00	0	0.00
1.64	0.02909					.007937	0.01			1.472			0.00		
4998.89	1080.84	2.197	1083.035	63.4	9.97	1.543	1084.578	0.00	2.496		3.50	0.00	0.00	0	0.00
2.21	0.02909					.007242	0.02			1.472			0.00		
5001.10	1080.90	2.289	1083.191	63.4	9.51	1.403	1084.594	0.00	2.496		3.50	0.00	0.00	0	0.00
1.26	0.02909					.006434	0.01			1.472			0.00		
5002.36	1080.94	2.388	1083.327	63.4	9.06	1.275	1084.602	0.00	2.496		3.50	0.00	0.00	0	0.00
0.39	0.02909					.005729	0.00			1.472			0.00		
5002.75	1080.95	2.496	1083.446	63.4	8.64	1.159	1084.605	0.00	2.496		3.50	0.00	0.00	0	0.00
11.64	0.00428					.005117	0.06			2.760			0.00		
5014.39	1081.00	2.611	1083.611	63.4	8.24	1.053	1084.664	0.00	2.496		3.50	0.00	0.00	0	0.00
95.83	0.00428					.004592	0.44			2.760			0.00		
5110.22	1081.41	2.737	1084.147	63.4	7.85	0.957	1085.104	0.00	2.496		3.50	0.00	0.00	0	0.00
67.93	0.00428					.004331	0.29			2.760			0.00		
5178.15	1081.70	2.749	1084.449	63.4	7.82	0.950	1085.399	0.00	2.496		3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000					.003876	0.00						0.00		
5178.15	1081.70	3.003	1084.703	61.2	6.97	0.753	1085.456	0.00	2.452		3.50	0.00	0.00	0	0.00
8.00	0.00625					.003471	0.03			2.302			0.00		
5186.15	1081.75	2.964	1084.714	61.2	7.04	0.770	1085.484	0.00	2.452		3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000					.003292	0.00						0.00		
5186.15	1081.75	3.114	1084.864	59.2	6.55	0.665	1085.529	0.00	2.411		3.50	0.00	0.00	0	0.00
44.82	0.00312					.003080	0.14			3.071			0.00		

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WATER SURFACE PROFILE LISTING

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
EX. LINE "A" IN HAVEN AVE

STATION	INVERT	DEPTH	W.S.	Q	VEL	VEL	ENERGY	SUPER	CRITICAL	HGT/	BASE/	ZL	NO	AVBPR
---------	--------	-------	------	---	-----	-----	--------	-------	----------	------	-------	----	----	-------

L/ELEM	SO	ELEV	OF FLOW	ELEV	HEAD	GRD.EL.	ELEV	DEPTH	DIA	ID NO.	PIER	ZR		
5230.97	1081.89	3.112	1085.002	59.2	6.55	0.666	1085.668	0.00	2.411	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000				.002771	0.00						0.00		
5230.97	1081.89	3.496	1085.386	50.6	5.26	0.430	1085.816	0.00	2.224	3.50	0.00	0.00	0	0.00
10.00	0.00800				.002367	0.02			1.877			0.00		
5240.97	1081.97	3.437	1085.407	50.6	5.28	0.433	1085.840	0.00	2.224	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000				.002060	0.00						0.00		
5240.97	1081.97	3.645	1085.615	43.2	4.49	0.313	1085.928	0.00	2.048	3.50	0.00	0.00	0	0.00
85.13	0.00352				.001844	0.16			2.205			0.00		
5326.10	1082.27	3.502	1085.772	43.2	4.49	0.313	1086.085	0.00	2.048	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000				.001622	0.00						0.00		
5326.10	1082.97	2.881	1085.851	37.8	4.46	0.309	1086.160	0.00	1.910	3.50	0.00	0.00	0	0.00
3.74	-.03049				.001350	0.01			0.000			0.00		
5329.84	1082.86	3.025	1085.881	37.8	4.28	0.284	1086.165	0.00	1.910	3.50	0.00	0.00	0	0.00
4.12	-.03049				.001267	0.01			0.000			0.00		
5333.96	1082.73	3.176	1085.906	37.8	4.12	0.264	1086.170	0.00	1.910	3.50	0.00	0.00	0	0.00
4.51	-.03049				.001230	0.01			0.000			0.00		
5338.47	1082.59	3.335	1085.928	37.8	4.00	0.248	1086.176	0.00	1.910	3.50	0.00	0.00	0	0.00
4.93	-.03049				.001308	0.01			0.000			0.00		
5343.40	1082.44	3.500	1085.943	37.8	3.93	0.240	1086.183	0.00	1.910	3.50	0.00	0.00	0	0.00
2.05	-.03049				.001401	0.00			0.000			0.00		
5345.45	1082.38	3.565	1085.945	37.8	3.93	0.240	1086.185	0.00	1.910	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000				.001304	0.00						0.00		

LICENSEE: THIENES ENGINEERING

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WATER SURFACE PROFILE LISTING
 JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
 EX. LINE "A" IN HAVEN AVE

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
5345.45	1082.38	3.634	1086.014	34.8	3.62	0.203	1086.217	0.00	1.829	3.50	0.00	0.00	0	0.00
51.80	0.00290				.001196	0.06			2.040			0.00		
5397.25	1082.53	3.546	1086.076	34.8	3.62	0.203	1086.279	0.00	1.829	3.50	0.00	0.00	0	0.00

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
 EX. LINE "A" IN HAVEN AVE

3627.30	I	C	H	W	E									R
3642.96	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3658.63	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3674.29	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3689.95	I	C	H	W	E									R
3705.62	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3721.28	I	C	H	W	E									R
3736.94	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3752.61	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3768.27	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3783.93	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3799.60	I	C	H	W	E									R
3815.26	I	C	H	W	E									R
3830.92	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3846.59	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3862.25	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3877.91	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3893.58	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3909.24	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3924.90	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3940.57	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3956.23	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3971.89	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3987.56	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4003.22	.	.	.	.	.	.	.	.	.	.	.	.	.	.

H = HEIGHT OF CHANNEL
E = ENERGY GRADE LINE
X = CURVES CROSSING OVER
B = BRIDGE ENTRANCE OR EXIT
Y = WALL ENTRANCE OR EXIT
2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY□

DATE: 10/19/2018
 TIME: 10:48

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 WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

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CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)	
CD	24	4			2.00															
CD	30	4			2.50															
CD	36	4			3.00															
CD	42	4			3.50															

F 0 5 1 5 P

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WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA

HEADING LINE NO 2 IS -

EX. LINE "A" IN HAVEN AVE

HAVEN S.D W/SITE ADDED.

HEADING LINE NO 3 IS -

F 0 5 1 5 P

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WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	IS	A	SYSTEM OUTLET	U/S DATA	STATION	INVERT	SECT	W S ELEV	RADIUS	ANGLE	ANG PT	MAN H
1	IS	A	SYSTEM OUTLET	U/S DATA	3627.30	1067.59	42	1074.40				
2	IS	A	REACH	U/S DATA	3676.94	1067.74	42	0.013	0.00	0.00	0.00	0
3	IS	A	REACH	U/S DATA	3712.26	1067.84	42	0.013	45.00	45.00	0.00	0
4	IS	A	REACH	U/S DATA	3797.25	1068.10	42	0.013	0.00	0.00	0.00	0
5	IS	A	REACH	U/S DATA	3802.75	1068.27	42	0.013	0.00	0.00	0.00	1
6	IS	A	REACH	U/S DATA	4197.25	1069.45	42	0.013	0.00	0.00	0.00	0
7	IS	A	REACH	U/S DATA	4202.75	1069.61	42	0.013	0.00	0.00	0.00	1
8	IS	A	REACH	U/S DATA	4565.00	1070.74	42	0.013	0.00	0.00	0.00	0
9	IS	A	JUNCTION	U/S DATA	4565.00	1070.74	42	0.013	24.7	0.0	1071.49	0.00
THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING												
10	IS	A	REACH	U/S DATA	4647.25	1070.98	42	0.013	0.00	0.00	0.00	0
11	IS	A	REACH	U/S DATA	4652.75	1071.16	42	0.013	0.00	0.00	0.00	0
12	IS	A	REACH	U/S DATA	4800.00	1080.00	42	0.013	0.00	0.00	0.00	0

F 0 5 1 5 P

PAGE NO 3

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	IS	A	REACH	U/S DATA	STATION	INVERT	SECT	RADIUS	ANGLE	ANG PT	MAN H	
13	IS	A	REACH	U/S DATA	4997.25	1080.79	42	0.013	0.00	0.00	0.00	0
14	IS	A	REACH	U/S DATA	5002.75	1080.95	42	0.013	0.00	0.00	0.00	1
15	IS	A	REACH	U/S DATA	5178.15	1081.70	42	0.013	0.00	0.00	0.00	0
16	IS	A	JUNCTION									

U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5178.15 1081.70 42 24 0 0.013 2.2 0.0 1082.45 0.00 75.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 17 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5186.15 1081.75 42 0.013 0.00 0.00 0.00 0

ELEMENT NO 18 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5186.15 1081.75 42 24 0 0.013 2.0 0.0 1082.50 0.00 60.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 19 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5230.97 1081.89 42 0.013 0.00 0.00 0.00 0

ELEMENT NO 20 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5230.97 1081.89 42 24 0 0.013 8.6 0.0 1082.64 0.00 75.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 21 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5240.97 1081.97 42 0.013 0.00 0.00 0.00 0

F 0 5 1 5 P PAGE NO 4

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO 22 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5240.97 1081.97 42 24 0 0.013 7.4 0.0 1082.72 0.00 60.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 23 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5326.10 1082.27 42 0.013 0.00 0.00 0.00 0

ELEMENT NO 24 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5326.10 1082.97 42 24 0 0.013 5.4 0.0 1083.02 0.00 75.00 0.00

ELEMENT NO 25 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5345.45 1082.38 42 0.013 0.00 0.00 0.00 0

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 26 IS A JUNCTION * * * * *
 U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
 5345.45 1082.38 42 24 0 0.013 3.0 0.0 1083.13 0.00 60.00 0.00

THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING
 THE ABOVE ELEMENT CONTAINED AN INVERT ELEV WHICH WAS NOT GREATER THAN THE PREVIOUS INVERT ELEV -WARNING

ELEMENT NO 27 IS A REACH * * *
 U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
 5397.25 1082.53 42 0.013 0.00 0.00 0.00 0

ELEMENT NO 28 IS A SYSTEM HEADWORKS * * *
 U/S DATA STATION INVERT SECT W S ELEV
 5397.25 1082.53 42 0.00

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING
 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
 LICENSEE: THIENES ENGINEERING F0515P PAGE 1

WATER SURFACE PROFILE LISTING

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
 EX. LINE "A" IN HAVEN AVE

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
3627.30	1067.59	6.810	1074.400	88.1	9.16	1.302	1075.702	0.00	2.917	3.50	0.00	0.00	0	0.00
49.64	0.00302					.007668	0.38		3.500			0.00		
3676.94	1067.74	7.041	1074.781	88.1	9.16	1.302	1076.083	0.00	2.917	3.50	0.00	0.00	0	0.00
35.32	0.00283					.007668	0.27		3.500			0.00		
3712.26	1067.84	7.396	1075.236	88.1	9.16	1.302	1076.538	0.00	2.917	3.50	0.00	0.00	0	0.00
84.99	0.00306					.007668	0.65		3.500			0.00		
3797.25	1068.10	7.787	1075.887	88.1	9.16	1.302	1077.189	0.00	2.917	3.50	0.00	0.00	0	0.00
5.50	0.03091					.007668	0.04		1.745			0.00		
3802.75	1068.27	7.725	1075.995	88.1	9.16	1.302	1077.297	0.00	2.917	3.50	0.00	0.00	0	0.00
394.50	0.00299					.007668	3.03		3.500			0.00		
4197.25	1069.45	9.570	1079.020	88.1	9.16	1.302	1080.322	0.00	2.917	3.50	0.00	0.00	0	0.00

5.50	0.02909					.007668	0.04				1.777						
4202.75	1069.61	9.517	1079.127	88.1	9.16	1.302	1080.429	0.00	2.917		3.50	0.00	0.00	0	0.00		
362.25	0.00312					.007668	2.78				3.500						
4565.00	1070.74	11.164	1081.904	88.1	9.16	1.302	1083.206	0.00	2.917		3.50	0.00	0.00	0	0.00		
JUNCT STR	0.00000					.005820	0.00										
4565.00	1070.74	12.420	1083.160	63.4	6.59	0.674	1083.834	0.00	2.496		3.50	0.00	0.00	0	0.00		
82.25	0.00292					.003971	0.33				3.500						
4647.25	1070.98	12.507	1083.487	63.4	6.59	0.674	1084.161	0.00	2.496		3.50	0.00	0.00	0	0.00		
5.50	0.03273					.003971	0.02				1.425						
4652.75	1071.16	12.348	1083.508	63.4	6.59	0.674	1084.182	0.00	2.496		3.50	0.00	0.00	0	0.00		
147.25	0.06003					.003971	0.58				1.210						

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F0515P
 WATER SURFACE PROFILE LISTING
 JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
 EX. LINE "A" IN HAVEN AVE

PAGE 2

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
4800.00	1080.00	4.093	1084.093	63.4	6.59	0.674	1084.767	0.00	2.496	3.50	0.00	0.00	0	0.00
197.25	0.00400					.003971	0.78		2.854			0.00		
4997.25	1080.79	4.086	1084.876	63.4	6.59	0.674	1085.550	0.00	2.496	3.50	0.00	0.00	0	0.00
5.50	0.02909					.003971	0.02		1.472			0.00		
5002.75	1080.95	3.982	1084.932	63.4	6.59	0.674	1085.606	0.00	2.496	3.50	0.00	0.00	0	0.00
175.40	0.00428					.003971	0.70		2.760			0.00		
5178.15	1081.70	3.928	1085.628	63.4	6.59	0.674	1086.302	0.00	2.496	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000					.003835	0.00					0.00		
5178.15	1081.70	4.019	1085.719	61.2	6.36	0.628	1086.347	0.00	2.452	3.50	0.00	0.00	0	0.00
8.00	0.00625					.003700	0.03		2.302			0.00		
5186.15	1081.75	3.999	1085.749	61.2	6.36	0.628	1086.377	0.00	2.452	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000					.003581	0.00					0.00		
5186.15	1081.75	4.077	1085.827	59.2	6.15	0.588	1086.415	0.00	2.411	3.50	0.00	0.00	0	0.00
44.82	0.00312					.003462	0.16		3.071			0.00		
5230.97	1081.89	4.093	1085.983	59.2	6.15	0.588	1086.571	0.00	2.411	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000					.002995	0.00					0.00		
5230.97	1081.89	4.390	1086.280	50.6	5.26	0.430	1086.710	0.00	2.224	3.50	0.00	0.00	0	0.00
10.00	0.00800					.002529	0.03		1.877			0.00		
5240.97	1081.97	4.335	1086.305	50.6	5.26	0.430	1086.735	0.00	2.224	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000					.002187	0.00					0.00		
5240.97	1081.97	4.540	1086.510	43.2	4.49	0.313	1086.823	0.00	2.048	3.50	0.00	0.00	0	0.00
85.13	0.00352					.001844	0.16		2.205			0.00		

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F0515P
 WATER SURFACE PROFILE LISTING
 JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
 EX. LINE "A" IN HAVEN AVE

PAGE 3

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
5326.10	1082.27	4.397	1086.667	43.2	4.49	0.313	1086.980	0.00	2.048	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000					.001628	0.00					0.00		
5326.10	1082.97	3.836	1086.806	37.8	3.93	0.240	1087.046	0.00	1.910	3.50	0.00	0.00	0	0.00
19.35	-.03049					.001412	0.03		0.000			0.00		

5345.45	1082.38	4.453	1086.833	37.8	3.93	0.240	1087.073	0.00	1.910	3.50	0.00	0.00	0	0.00
JUNCT STR	0.00000					.001304	0.00							0.00
5345.45	1082.38	4.522	1086.902	34.8	3.62	0.203	1087.105	0.00	1.829	3.50	0.00	0.00	0	0.00
51.80	0.00290					.001196	0.06		2.040					0.00
5397.25	1082.53	4.433	1086.963	34.8	3.62	0.203	1087.166	0.00	1.829	3.50	0.00	0.00	0	

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
EX. LINE "A" IN HAVEN AVE

3627.30	I	C H		W	E									R
3660.70														R
3694.09	I	C H		W	E									R
3727.49	I	C H		W	E									R
3760.88														
3794.28														
3827.67	I	C H		W	E									R
3861.07	I	C H		W	E									R
3894.46														
3927.86														
3961.25														
3994.65														
4028.04														
4061.44														
4094.83														
4128.23														
4161.62														
4195.02														
4228.42	I	C H		W	E									R
4261.81	I	C H		W	E									R
4295.21														
4328.60														
4362.00														
4395.39														
4428.79														
4462.18														
4495.58														
4528.97														
4562.37														
4595.76	I	C H		W	E									JX
4629.16	I	C H		W	E									R
4662.55	I	C H		W	E									R
4695.95	I	C H		W	E									R
4729.34														
4762.74														
4796.13														
4829.53														
4862.93														
4896.32														
4929.72														
4963.11														
4996.51														
5029.90														
5063.30	I	C H W E												R
5096.69	I	C H W E												R
5130.09														
5163.48														
5196.88														
5230.27														
5263.67														
5297.06														
5330.46														
5363.85														
5397.25														
1067.59	1069.55	1071.51	1073.46	1075.42	1077.38	1079.34	1081.29	1083.25	1085.21	1087.17				

NOTES

1. GLOSSARY

- I = INVERT ELEVATION
- C = CRITICAL DEPTH
- W = WATER SURFACE ELEVATION
- H = HEIGHT OF CHANNEL
- E = ENERGY GRADE LINE
- X = CURVES CROSSING OVER
- B = BRIDGE ENTRANCE OR EXIT
- Y = WALL ENTRANCE OR EXIT

2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY

DATE: 10/19/2018
 TIME: 10:53

F0515P
 WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

PAGE 1

CARD CODE	SECT NO	CHN TYPE	NO OF PIERS	AVE WIDTH	PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)	
CD	24	4				2.00															

F 0 5 1 5 P

PAGE NO 3

WATER SURFACE PROFILE - TITLE CARD LISTING

HEADING LINE NO 1 IS -

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA

HEADING LINE NO 2 IS -

EX. LINE "C" IN ACACIA ST

HEADING LINE NO 3 IS -

F 0 5 1 5 P

PAGE NO 2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ELEMENT NO	IS A	U/S DATA	STATION	INVERT	SECT	W S ELEV	RADIUS	ANGLE	ANG PT	MAN H
1	SYSTEM OUTLET		-911.70	1071.49	24	1083.16				
2	REACH		-803.70	1096.62	24		0.00	0.00	0.00	0
3	SYSTEM HEADWORKS		-803.70	1096.62	24	0.00				

NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

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F0515P
 WATER SURFACE PROFILE LISTING

PAGE 1

JOB #3320 8TH ST & HAVEN AVE, RANCHO CUCAMONGA
 EX. LINE "C" IN ACACIA ST

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
-911.70	1071.49	11.670	1083.160	24.7	7.86	0.960	1084.120	0.00	1.754	2.00	0.00	0.00	0	0.00
27.35	0.23269					.011921	0.33		0.650			0.00		
-884.35	1077.86	5.636	1083.491	24.7	7.86	0.960	1084.451	0.00	1.754	2.00	0.00	0.00	0	0.00
HYDRAULIC JUMP													0.00	
-884.35	1077.86	0.675	1078.530	24.7	26.47	10.883	1089.413	0.00	1.754	2.00	0.00	0.00	0	0.00
19.40	0.23269					.185969	3.61		0.650			0.00		
-864.95	1082.37	0.697	1083.065	24.7	25.33	9.965	1093.030	0.00	1.754	2.00	0.00	0.00	0	0.00
12.77	0.23269					.163763	2.09		0.650			0.00		
-852.18	1085.34	0.722	1086.061	24.7	24.14	9.052	1095.113	0.00	1.754	2.00	0.00	0.00	0	0.00
8.94	0.23269					.143596	1.28		0.650			0.00		
-843.24	1087.42	0.748	1088.169	24.7	23.02	8.228	1096.397	0.00	1.754	2.00	0.00	0.00	0	0.00
6.76	0.23269					.125949	0.85		0.650			0.00		
-836.48	1088.99	0.775	1089.767	24.7	21.96	7.485	1097.252	0.00	1.754	2.00	0.00	0.00	0	0.00
5.34	0.23269					.110501	0.59		0.650			0.00		
-831.14	1090.23	0.803	1091.037	24.7	20.93	6.804	1097.841	0.00	1.754	2.00	0.00	0.00	0	0.00
4.34	0.23269					.096970	0.42		0.650			0.00		
-826.80	1091.24	0.832	1092.076	24.7	19.95	6.181	1098.257	0.00	1.754	2.00	0.00	0.00	0	0.00
3.60	0.23269					.085151	0.31		0.650			0.00		
-823.20	1092.08	0.863	1092.945	24.7	19.03	5.623	1098.568	0.00	1.754	2.00	0.00	0.00	0	0.00
3.03	0.23269					.074825	0.23		0.650			0.00		
-820.17	1092.79	0.895	1093.683	24.7	18.14	5.107	1098.790	0.00	1.754	2.00	0.00	0.00	0	0.00
2.59	0.23269					.065761	0.17		0.650			0.00		

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
-817.58	1093.39	0.928	1094.317	24.7	17.30	4.646	1098.963	0.00	1.754	2.00	0.00	0.00	0	0.00
2.21	0.23269					.057828	0.13		0.650			0.00		
-815.37	1093.90	0.963	1094.868	24.7	16.49	4.222	1099.090	0.00	1.754	2.00	0.00	0.00	0	0.00
1.91	0.23269					.050902	0.10		0.650			0.00		
-813.46	1094.35	1.000	1095.349	24.7	15.72	3.838	1099.187	0.00	1.754	2.00	0.00	0.00	0	0.00
1.65	0.23269					.044829	0.07		0.650			0.00		
-811.81	1094.73	1.038	1095.772	24.7	14.99	3.488	1099.260	0.00	1.754	2.00	0.00	0.00	0	0.00
1.44	0.23269					.039501	0.06		0.650			0.00		
-810.37	1095.07	1.078	1096.146	24.7	14.29	3.173	1099.319	0.00	1.754	2.00	0.00	0.00	0	0.00
1.24	0.23269					.034850	0.04		0.650			0.00		
-809.13	1095.36	1.121	1096.477	24.7	13.63	2.885	1099.362	0.00	1.754	2.00	0.00	0.00	0	0.00
1.08	0.23269					.030776	0.03		0.650			0.00		
-808.05	1095.61	1.165	1096.773	24.7	12.99	2.621	1099.394	0.00	1.754	2.00	0.00	0.00	0	0.00
0.93	0.23269					.027211	0.03		0.650			0.00		
-807.12	1095.82	1.213	1097.036	24.7	12.39	2.383	1099.419	0.00	1.754	2.00	0.00	0.00	0	0.00
0.79	0.23269					.024100	0.02		0.650			0.00		
-806.33	1096.01	1.263	1097.272	24.7	11.81	2.167	1099.439	0.00	1.754	2.00	0.00	0.00	0	0.00
0.69	0.23269					.021372	0.01		0.650			0.00		
-805.64	1096.17	1.316	1097.484	24.7	11.26	1.970	1099.454	0.00	1.754	2.00	0.00	0.00	0	0.00
0.57	0.23269					.018992	0.01		0.650			0.00		
-805.07	1096.30	1.373	1097.674	24.7	10.74	1.791	1099.465	0.00	1.754	2.00	0.00	0.00	0	0.00
0.47	0.23269					.016920	0.01		0.650			0.00		

STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD. EL.	SUPER ELEV	CRITICAL DEPTH	HGT/DIA	BASE/ID NO.	ZL	NO PIER	AVBPR
L/ELEM	SO					SF AVE	HF		NORM DEPTH			ZR		
-804.60	1096.41	1.434	1097.844	24.7	10.24	1.628	1099.472	0.00	1.754	2.00	0.00	0.00	0	0.00
0.37	0.23269					.015127	0.01		0.650			0.00		
-804.23	1096.50	1.501	1097.998	24.7	9.76	1.480	1099.478	0.00	1.754	2.00	0.00	0.00	0	0.00
0.28	0.23269					.013586	0.00		0.650			0.00		
-803.95	1096.56	1.574	1098.136	24.7	9.31	1.345	1099.481	0.00	1.754	2.00	0.00	0.00	0	0.00
0.18	0.23269					.012286	0.00		0.650			0.00		
-803.77	1096.60	1.657	1098.261	24.7	8.88	1.223	1099.484	0.00	1.754	2.00	0.00	0.00	0	0.00
0.07	0.23269					.011233	0.00		0.650			0.00		
-803.70	1096.62	1.754	1098.374	24.7	8.46	1.111	1099.485	0.00	1.754	2.00	0.00	0.00	0	0.00

-911.70 I CH W E R
-909.66
-907.62
-905.59
-903.55
-901.51

APPENDIX D

DETENTION ANALYSIS

LOSSRATE.txt

NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS

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Ver. 23.0 Release Date: 07/01/2016 License ID 1435

Analysis prepared by:

THIENES ENGINEERING, INC.
14349 FIRESTONE BLVD
LA MIRADA, CA 90638

Problem Descriptions:
JOB #3320 8TH ST & HAVEN AVE
100-YEAR

*** NON-HOMOGENEOUS WATERSHED AREA-AVERAGED LOSS RATE (Fm)
AND LOW LOSS FRACTION ESTIMATIONS FOR AMC III:

TOTAL 24-HOUR DURATION RAINFALL DEPTH = 8.20 (inches)

SOIL-COVER TYPE	AREA (Acres)	PERCENT OF PERVIOUS AREA	SCS CURVE NUMBER	LOSS RATE Fp(in./hr.)	YIELD
1	5.50	10.00	32.(AMC II)	0.742	0.905

TOTAL AREA (Acres) = 5.50

AREA-AVERAGED LOSS RATE, \bar{F}_m (in./hr.) = 0.074

AREA-AVERAGED LOW LOSS FRACTION, $\bar{Y} = 0.095$

Thienes Engineering, Inc.

CIVIL ENGINEERING • LAND SURVEYING

subject	by	date	job no.	sheet of
---------	----	------	---------	----------

INFILTRATION @ WESTERLY TRUCK YARD

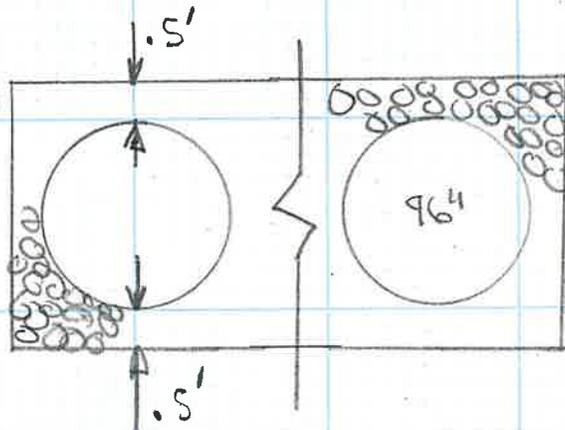
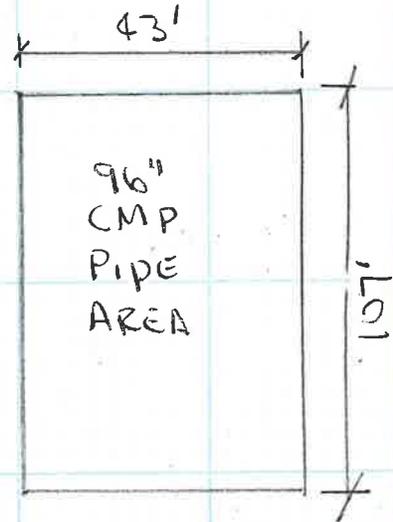
INFILTRATION RATE = 11" / HR

W/ SAFETY FACTOR OF 2 5.5" / HR

CONVERT TO CFS

$$\frac{5.5 \text{ IN}}{\text{HR}} \times \frac{\text{HR}}{60 \text{ MIN}} \times \frac{\text{MIN}}{60 \text{ SEC}} \times \frac{\text{FT}}{12 \text{ IN}}$$

$$\times 43 \text{ FT} \times 107 \text{ FT} = 0.59 \text{ FT}^3 / \text{SEC.}$$



$$\Sigma V = 29,500 \text{ FT}^3 = .68 \text{ AC-FT}$$

$$\Sigma V = 14,750 \text{ FT}^3 = .34 \text{ AC-FT}$$

$$V = 9,200 \text{ FT}^3 = .02 \text{ AC-FT}$$

TOTAL VOLUME = 29,500 FT³ (SEE FOLLOWING PAGE)

DYODS™

Design Your Own Detention System



For design assistance, drawings, and pricing send completed worksheet to: dyods@contech-cpi.com

Project Summary

Date:	10/19/2018
Project Name:	8th St & Haven Ave (DA 1-A & ROW)
City / County:	Rancho Cucamonga, San Bernardino
State:	California
Designed By:	Luis Prado
Company:	Thienes Engineering
Telephone:	(714) 521-4811

Enter Information in Blue Cells

Corrugated Metal Pipe Calculator

Storage Volume Required (cf):	29,100
Limiting Width (ft):	45.00
Invert Depth Below Asphalt (ft):	10.00
Solid or Perforated Pipe:	Perforated
Shape Or Diameter (in):	96
Number Of Headers:	1
Spacing between Barrels (ft):	3.00
Stone Width Around Perimeter of System (ft):	1
Depth A: Porous Stone Above Pipe (in):	6
Depth C: Porous Stone Below Pipe (in):	6
Stone Porosity (0 to 40%):	40
50.27 ft ² Pipe Area	

System Sizing

Pipe Storage:	21,564 cf
Porous Stone Storage:	7,938 cf
Total Storage Provided:	29,502 cf
Number of Barrels:	4 barrels
Length per Barrel:	97.0 ft
Length Per Header:	41.0 ft
Rectangular Footprint (W x L):	43. ft x 107. ft

101.4% Of Required Storage

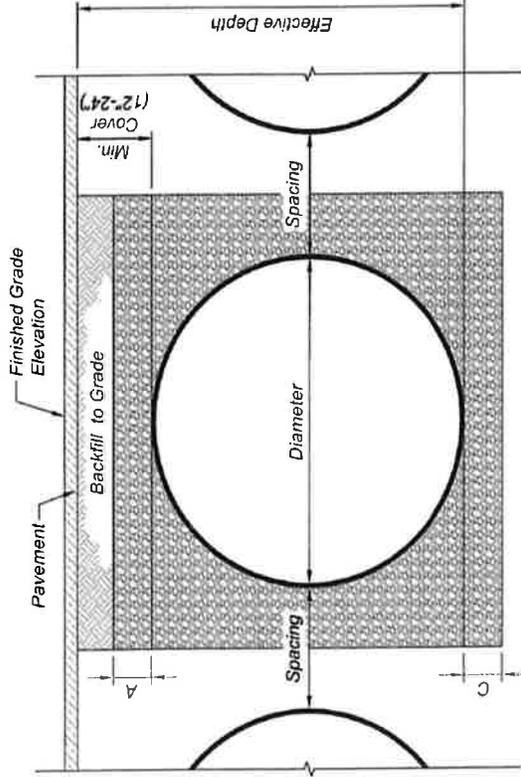
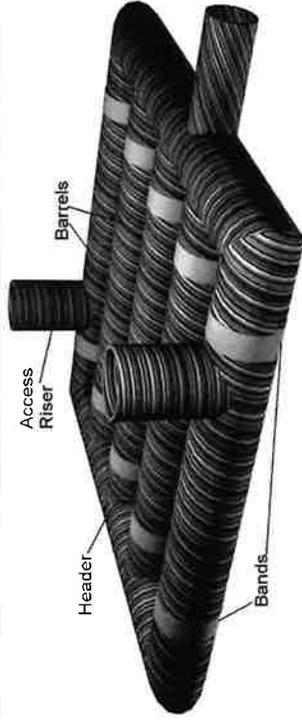
CONTECH Materials

Total CMP Footage:	429 ft
Approximate Total Pieces:	22 pcs
Approximate Coupling Bands:	21 bands
Approximate Truckloads:	11 trucks

Construction Quantities**

Total Excavation:	1705 cy
Porous Stone Backfill For Storage:	735 cy stone
Backfill to Grade Excluding Stone:	171 cy fill

****Construction quantities are approximate and should be verified upon final design**



System Layout

Barrel 12	0
Barrel 11	0
Barrel 10	0
Barrel 9	0
Barrel 8	0
Barrel 7	0
Barrel 6	0
Barrel 5	0
Barrel 4	0
Barrel 3	97
Barrel 2	97
Barrel 1	97

Barrel Footage (w/o headers)

Analysis prepared by:

THIENES ENGINEERING
16800 VALLEY VIEW AVENUE
LA MIRADA CA 90638
PH: (714) 521-4811 FAX: (714) 521-4173

TIME/DATE OF STUDY: 7: 8 10/19/2018
=====

***** DESCRIPTION OF STUDY *****
* CAPACITY OF 18" PIPE *
* FLOWING 1' DEEP *
* *

>>>>PIPEFLOW HYDRAULIC INPUT INFORMATION<<<<

PIPE DIAMETER (FEET) = 1.500
FLOWDEPTH (FEET) = 1.000
PIPE SLOPE (FEET/FEET) = 0.0030
MANNINGS FRICTION FACTOR = 0.012000
>>>> NORMAL DEPTH FLOW (CFS) = 4.89
=====

NORMAL-DEPTH FLOW INFORMATION:

NORMAL DEPTH (FEET) = 1.00
FLOW AREA (SQUARE FEET) = 1.25
FLOW TOP-WIDTH (FEET) = 1.414
FLOW PRESSURE + MOMENTUM (POUNDS) = 71.21
FLOW VELOCITY (FEET/SEC.) = 3.904
FLOW VELOCITY HEAD (FEET) = 0.237
HYDRAULIC DEPTH (FEET) = 0.88
FROUDE NUMBER = 0.731
SPECIFIC ENERGY (FEET) = 1.24
=====

 SMALL AREA UNIT HYDROGRAPH MODEL

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Analysis prepared by:

THIENES ENGINEERING
 16800 VALLEY VIEW AVENUE
 LA MIRADA CA 90638
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RATIONAL METHOD CALIBRATION COEFFICIENT = 0.90
 TOTAL CATCHMENT AREA (ACRES) = 3.70
 SOIL-LOSS RATE, Fm, (INCH/HR) = 0.074
 LOW LOSS FRACTION = 0.095
 TIME OF CONCENTRATION (MIN.) = 6.90
 RATIONAL METHOD PEAK FLOW RATE (DEFINED BY USER)
 IS USED FOR SMALL AREA PEAK Q
 USER SPECIFIED RAINFALL VALUES ARE USED
 RETURN FREQUENCY (YEARS) = 100
 5-MINUTE POINT RAINFALL VALUE (INCHES) = 0.52
 30-MINUTE POINT RAINFALL VALUE (INCHES) = 1.05
 1-HOUR POINT RAINFALL VALUE (INCHES) = 1.40
 3-HOUR POINT RAINFALL VALUE (INCHES) = 2.55
 6-HOUR POINT RAINFALL VALUE (INCHES) = 3.75
 24-HOUR POINT RAINFALL VALUE (INCHES) = 8.20

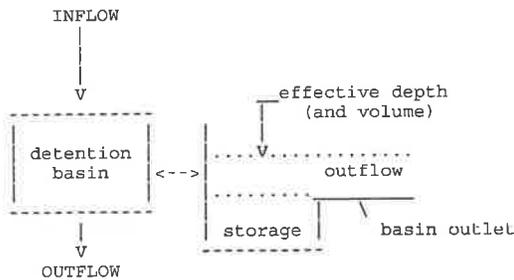
 TOTAL CATCHMENT RUNOFF VOLUME (ACRE-FEET) = 2.06
 TOTAL CATCHMENT SOIL-LOSS VOLUME (ACRE-FEET) = 0.47

TIME (HOURS)	VOLUME (AF)	Q (CFS)	0.	5.0	10.0	15.0	20.0
0.01	0.0000	0.00	Q	.	.	.	.
0.13	0.0028	0.58	.Q	.	.	.	.
0.24	0.0083	0.58	.Q	.	.	.	.
0.36	0.0139	0.59	.Q	.	.	.	.
0.47	0.0194	0.59	.Q	.	.	.	.
0.59	0.0250	0.59	.Q	.	.	.	.
0.70	0.0306	0.59	.Q	.	.	.	.
0.82	0.0363	0.59	.Q	.	.	.	.
0.93	0.0419	0.60	.Q	.	.	.	.
1.05	0.0476	0.60	.Q	.	.	.	.
1.16	0.0532	0.60	.Q	.	.	.	.
1.28	0.0589	0.60	.Q	.	.	.	.
1.39	0.0647	0.60	.Q	.	.	.	.
1.51	0.0704	0.60	.Q	.	.	.	.
1.62	0.0762	0.61	.Q	.	.	.	.
1.74	0.0819	0.61	.Q	.	.	.	.
1.85	0.0877	0.61	.Q	.	.	.	.
1.97	0.0936	0.61	.Q	.	.	.	.
2.08	0.0994	0.62	.Q	.	.	.	.
2.20	0.1053	0.62	.Q	.	.	.	.
2.31	0.1112	0.62	.Q	.	.	.	.
2.43	0.1171	0.62	.Q	.	.	.	.
2.54	0.1230	0.63	.Q	.	.	.	.
2.66	0.1289	0.63	.Q	.	.	.	.
2.77	0.1349	0.63	.Q	.	.	.	.
2.89	0.1409	0.63	.Q	.	.	.	.
3.00	0.1469	0.63	.Q	.	.	.	.
3.12	0.1530	0.64	.Q	.	.	.	.
3.23	0.1590	0.64	.Q	.	.	.	.
3.35	0.1651	0.64	.Q	.	.	.	.
3.46	0.1712	0.64	.Q	.	.	.	.
3.58	0.1773	0.65	.Q	.	.	.	.
3.69	0.1835	0.65	.Q	.	.	.	.
3.81	0.1897	0.65	.Q	.	.	.	.
3.92	0.1959	0.66	.Q	.	.	.	.
4.04	0.2021	0.66	.Q	.	.	.	.
4.15	0.2084	0.66	.Q	.	.	.	.
4.27	0.2147	0.66	.Q	.	.	.	.
4.38	0.2210	0.67	.Q	.	.	.	.
4.50	0.2273	0.67	.Q	.	.	.	.
4.61	0.2337	0.67	.Q	.	.	.	.
4.73	0.2401	0.67	.Q	.	.	.	.
4.84	0.2465	0.68	.Q	.	.	.	.
4.96	0.2530	0.68	.Q	.	.	.	.
5.07	0.2595	0.68	.Q	.	.	.	.
5.19	0.2660	0.69	.Q	.	.	.	.
5.30	0.2725	0.69	.Q	.	.	.	.
5.42	0.2791	0.69	.Q	.	.	.	.
5.54	0.2857	0.70	.Q	.	.	.	.
5.65	0.2923	0.70	.Q	.	.	.	.
5.76	0.2990	0.70	.Q	.	.	.	.
5.88	0.3057	0.71	.Q	.	.	.	.
5.99	0.3124	0.71	.Q	.	.	.	.
6.11	0.3192	0.71	.Q	.	.	.	.
6.22	0.3260	0.72	.Q	.	.	.	.
6.34	0.3328	0.72	.Q	.	.	.	.
6.45	0.3397	0.73	.Q	.	.	.	.
6.57	0.3466	0.73	.Q	.	.	.	.

18.07	1.6897	1.05	.Q	.	.	.	.	.	.
18.18	1.6997	1.04	.Q	.	.	.	.	.	.
18.30	1.7095	1.02	.Q	.	.	.	.	.	.
18.42	1.7191	1.00	.Q	.	.	.	.	.	.
18.53	1.7284	0.98	.Q	.	.	.	.	.	.
18.64	1.7376	0.96	.Q	.	.	.	.	.	.
18.76	1.7466	0.94	.Q	.	.	.	.	.	.
18.88	1.7555	0.92	.Q	.	.	.	.	.	.
18.99	1.7641	0.90	.Q	.	.	.	.	.	.
19.11	1.7727	0.89	.Q	.	.	.	.	.	.
19.22	1.7811	0.88	.Q	.	.	.	.	.	.
19.33	1.7893	0.86	.Q	.	.	.	.	.	.
19.45	1.7974	0.85	.Q	.	.	.	.	.	.
19.57	1.8054	0.84	.Q	.	.	.	.	.	.
19.68	1.8133	0.82	.Q	.	.	.	.	.	.
19.80	1.8211	0.81	.Q	.	.	.	.	.	.
19.91	1.8288	0.80	.Q	.	.	.	.	.	.
20.02	1.8364	0.79	.Q	.	.	.	.	.	.
20.14	1.8439	0.78	.Q	.	.	.	.	.	.
20.26	1.8512	0.77	.Q	.	.	.	.	.	.
20.37	1.8585	0.76	.Q	.	.	.	.	.	.
20.48	1.8658	0.75	.Q	.	.	.	.	.	.
20.60	1.8729	0.75	.Q	.	.	.	.	.	.
20.72	1.8799	0.74	.Q	.	.	.	.	.	.
20.83	1.8869	0.73	.Q	.	.	.	.	.	.
20.94	1.8938	0.72	.Q	.	.	.	.	.	.
21.06	1.9007	0.72	.Q	.	.	.	.	.	.
21.17	1.9074	0.71	.Q	.	.	.	.	.	.
21.29	1.9141	0.70	.Q	.	.	.	.	.	.
21.41	1.9208	0.69	.Q	.	.	.	.	.	.
21.52	1.9273	0.69	.Q	.	.	.	.	.	.
21.64	1.9338	0.68	.Q	.	.	.	.	.	.
21.75	1.9403	0.68	.Q	.	.	.	.	.	.
21.86	1.9467	0.67	.Q	.	.	.	.	.	.
21.98	1.9530	0.66	.Q	.	.	.	.	.	.
22.09	1.9593	0.66	.Q	.	.	.	.	.	.
22.21	1.9656	0.65	.Q	.	.	.	.	.	.
22.33	1.9717	0.65	.Q	.	.	.	.	.	.
22.44	1.9779	0.64	.Q	.	.	.	.	.	.
22.56	1.9840	0.64	.Q	.	.	.	.	.	.
22.67	1.9900	0.63	.Q	.	.	.	.	.	.
22.78	1.9960	0.63	.Q	.	.	.	.	.	.
22.90	2.0019	0.62	.Q	.	.	.	.	.	.
23.02	2.0079	0.62	.Q	.	.	.	.	.	.
23.13	2.0137	0.61	.Q	.	.	.	.	.	.
23.24	2.0195	0.61	.Q	.	.	.	.	.	.
23.36	2.0253	0.61	.Q	.	.	.	.	.	.
23.48	2.0311	0.60	.Q	.	.	.	.	.	.
23.59	2.0368	0.60	.Q	.	.	.	.	.	.
23.70	2.0424	0.59	.Q	.	.	.	.	.	.
23.82	2.0480	0.59	.Q	.	.	.	.	.	.
23.93	2.0536	0.59	.Q	.	.	.	.	.	.
24.05	2.0592	0.58	.Q	.	.	.	.	.	.
24.17	2.0620	0.00	Q	.	.	.	.	.	.

FLOW-THROUGH DETENTION BASIN MODEL

SPECIFIED BASIN CONDITIONS ARE AS FOLLOWS:
 CONSTANT HYDROGRAPH TIME UNIT (MINUTES) = 6.900
 DEAD STORAGE (AF) = 0.00
 SPECIFIED DEAD STORAGE (AF) FILLED = 0.00
 ASSUMED INITIAL DEPTH (FEET) IN STORAGE BASIN = 0.00



DEPTH-VS.-STORAGE AND DEPTH-VS.-DISCHARGE INFORMATION:

TOTAL NUMBER OF BASIN DEPTH INFORMATION ENTRIES = 5

* BASIN-DEPTH	STORAGE	OUTFLOW	** BASIN-DEPTH	STORAGE	OUTFLOW
(FEET)	(ACRE-FEET)	(CFS)	(FEET)	(ACRE-FEET)	(CFS)
* 0.000	0.000	0.000**	0.500	0.020	0.570*
* 4.500	0.340	0.580**	9.000	0.670	0.590*
* 10.000	0.680	5.500**			

BASIN STORAGE, OUTFLOW AND DEPTH ROUTING VALUES:

INTERVAL NUMBER	DEPTH (FEET)	{S-O*DT/2} (ACRE-FEET)	{S+O*DT/2} (ACRE-FEET)
1	0.00	0.00000	0.00000
2	0.50	0.01729	0.02271
3	4.50	0.33724	0.34276
4	9.00	0.66720	0.67280

5 10.00 0.65386 0.70614
 WHERE S=STORAGE(AF);O=OUTFLOW(AF/MIN.);DT=UNIT INTERVAL(MIN.)

 DETENTION BASIN ROUTING RESULTS:

NOTE: COMPUTED BASIN DEPTH, OUTFLOW, AND STORAGE QUANTITIES
 OCCUR AT THE GIVEN TIME. BASIN INFLOW VALUES REPRESENT THE
 AVERAGE INFLOW DURING THE RECENT HYDROGRAPH UNIT INTERVAL.

TIME (HRS)	DEAD-STORAGE FILLED(AF)	INFLOW (CFS)	EFFECTIVE DEPTH(FT)	OUTFLOW (CFS)	EFFECTIVE VOLUME(AF)
0.015	0.000	0.00	0.00	0.00	0.000
0.130	0.000	0.58	0.12	0.07	0.005
0.245	0.000	0.58	0.21	0.19	0.009
0.360	0.000	0.59	0.29	0.29	0.011
0.475	0.000	0.59	0.34	0.36	0.014
0.590	0.000	0.59	0.38	0.41	0.015
0.705	0.000	0.59	0.42	0.45	0.017
0.820	0.000	0.59	0.44	0.49	0.018
0.935	0.000	0.60	0.46	0.51	0.018
1.050	0.000	0.60	0.47	0.53	0.019
1.165	0.000	0.60	0.49	0.55	0.019
1.280	0.000	0.60	0.50	0.56	0.020
1.395	0.000	0.60	0.50	0.57	0.020
1.510	0.000	0.60	0.51	0.57	0.021
1.625	0.000	0.61	0.51	0.57	0.021
1.740	0.000	0.61	0.52	0.57	0.021
1.855	0.000	0.61	0.52	0.57	0.022
1.970	0.000	0.61	0.53	0.57	0.022
2.085	0.000	0.62	0.53	0.57	0.022
2.200	0.000	0.62	0.54	0.57	0.023
2.315	0.000	0.62	0.54	0.57	0.023
2.430	0.000	0.62	0.55	0.57	0.024
2.545	0.000	0.63	0.56	0.57	0.024
2.660	0.000	0.63	0.56	0.57	0.025
2.775	0.000	0.63	0.57	0.57	0.026
2.890	0.000	0.63	0.58	0.57	0.026
3.005	0.000	0.63	0.58	0.57	0.027
3.120	0.000	0.64	0.59	0.57	0.027
3.235	0.000	0.64	0.60	0.57	0.028
3.350	0.000	0.64	0.61	0.57	0.029
3.465	0.000	0.64	0.62	0.57	0.029
3.580	0.000	0.65	0.63	0.57	0.030
3.695	0.000	0.65	0.64	0.57	0.031
3.810	0.000	0.65	0.65	0.57	0.032
3.925	0.000	0.66	0.66	0.57	0.032
4.040	0.000	0.66	0.67	0.57	0.033
4.155	0.000	0.66	0.68	0.57	0.034
4.270	0.000	0.66	0.69	0.57	0.035
4.385	0.000	0.67	0.70	0.57	0.036
4.500	0.000	0.67	0.71	0.57	0.037
4.615	0.000	0.67	0.72	0.57	0.038
4.730	0.000	0.67	0.73	0.57	0.039
4.845	0.000	0.68	0.75	0.57	0.040
4.960	0.000	0.68	0.76	0.57	0.041
5.075	0.000	0.68	0.77	0.57	0.042
5.190	0.000	0.69	0.79	0.57	0.043
5.305	0.000	0.69	0.80	0.57	0.044
5.420	0.000	0.69	0.82	0.57	0.045
5.535	0.000	0.70	0.83	0.57	0.047
5.650	0.000	0.70	0.85	0.57	0.048
5.765	0.000	0.70	0.86	0.57	0.049
5.880	0.000	0.71	0.88	0.57	0.050
5.995	0.000	0.71	0.90	0.57	0.052
6.110	0.000	0.71	0.91	0.57	0.053
6.225	0.000	0.72	0.93	0.57	0.054
6.340	0.000	0.72	0.95	0.57	0.056
6.455	0.000	0.73	0.97	0.57	0.057
6.570	0.000	0.73	0.98	0.57	0.059
6.685	0.000	0.73	1.00	0.57	0.060
6.800	0.000	0.74	1.02	0.57	0.062
6.915	0.000	0.74	1.04	0.57	0.063
7.030	0.000	0.74	1.06	0.57	0.065
7.145	0.000	0.75	1.08	0.57	0.067
7.260	0.000	0.75	1.11	0.57	0.068
7.375	0.000	0.76	1.13	0.57	0.070
7.490	0.000	0.76	1.15	0.57	0.072
7.605	0.000	0.77	1.17	0.57	0.074
7.720	0.000	0.77	1.20	0.57	0.076
7.835	0.000	0.78	1.22	0.57	0.078
7.950	0.000	0.78	1.25	0.57	0.080
8.065	0.000	0.79	1.27	0.57	0.082
8.180	0.000	0.79	1.30	0.57	0.084
8.295	0.000	0.80	1.32	0.57	0.086
8.410	0.000	0.80	1.35	0.57	0.088
8.525	0.000	0.81	1.38	0.57	0.090
8.640	0.000	0.81	1.41	0.57	0.093
8.755	0.000	0.82	1.44	0.57	0.095
8.870	0.000	0.82	1.47	0.57	0.097
8.985	0.000	0.83	1.50	0.57	0.100
9.100	0.000	0.83	1.53	0.57	0.102
9.215	0.000	0.84	1.56	0.57	0.105
9.330	0.000	0.84	1.59	0.57	0.107
9.445	0.000	0.85	1.62	0.57	0.110
9.560	0.000	0.86	1.66	0.57	0.113
9.675	0.000	0.87	1.69	0.57	0.115
9.790	0.000	0.87	1.73	0.57	0.118
9.905	0.000	0.88	1.76	0.57	0.121
10.020	0.000	0.88	1.80	0.57	0.124

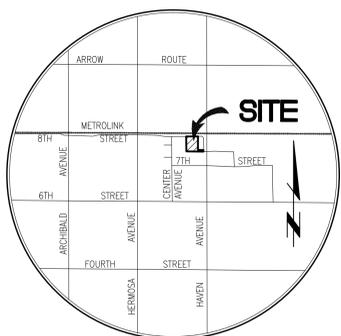
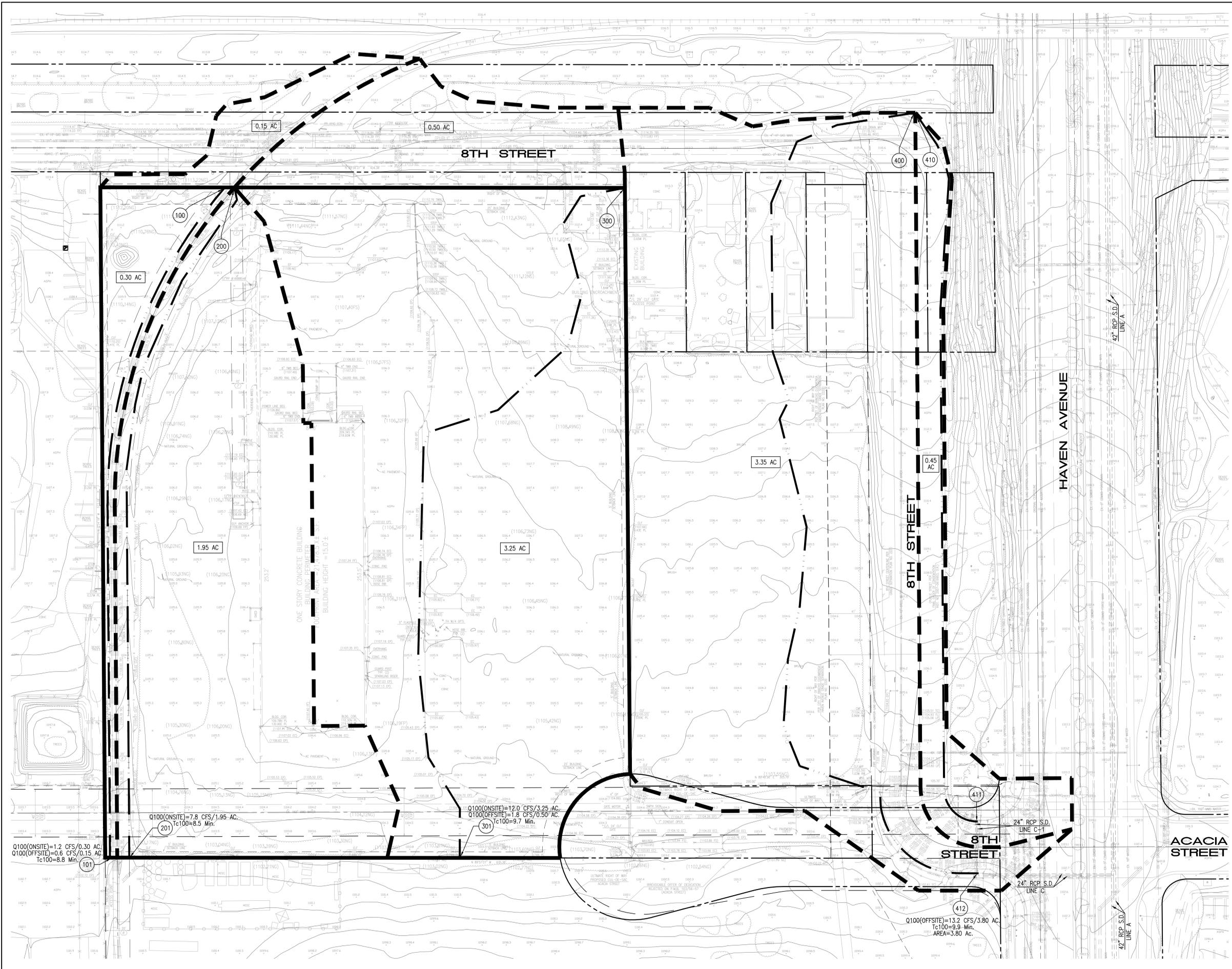
10.135	0.000	0.89	1.84	0.57	0.127
10.250	0.000	0.90	1.88	0.57	0.130
10.365	0.000	0.91	1.92	0.57	0.133
10.480	0.000	0.92	1.96	0.57	0.137
10.595	0.000	0.93	2.00	0.57	0.140
10.710	0.000	0.93	2.04	0.57	0.143
10.825	0.000	0.94	2.09	0.57	0.147
10.940	0.000	0.95	2.13	0.57	0.151
11.055	0.000	0.96	2.18	0.57	0.154
11.170	0.000	0.97	2.23	0.57	0.158
11.285	0.000	0.98	2.27	0.57	0.162
11.400	0.000	0.99	2.32	0.57	0.166
11.515	0.000	1.00	2.37	0.57	0.170
11.630	0.000	1.01	2.43	0.57	0.174
11.745	0.000	1.03	2.48	0.57	0.178
11.860	0.000	1.03	2.53	0.58	0.183
11.975	0.000	1.05	2.59	0.58	0.187
12.090	0.000	1.06	2.65	0.58	0.192
12.205	0.000	1.06	2.71	0.58	0.196
12.320	0.000	1.07	2.77	0.58	0.201
12.435	0.000	1.09	2.83	0.58	0.206
12.550	0.000	1.10	2.89	0.58	0.211
12.665	0.000	1.12	2.95	0.58	0.216
12.780	0.000	1.14	3.02	0.58	0.222
12.895	0.000	1.16	3.09	0.58	0.227
13.010	0.000	1.17	3.16	0.58	0.233
13.125	0.000	1.20	3.23	0.58	0.239
13.240	0.000	1.21	3.31	0.58	0.245
13.355	0.000	1.24	3.39	0.58	0.251
13.470	0.000	1.26	3.47	0.58	0.258
13.585	0.000	1.29	3.56	0.58	0.264
13.700	0.000	1.31	3.64	0.58	0.271
13.815	0.000	1.35	3.73	0.58	0.279
13.930	0.000	1.37	3.83	0.58	0.286
14.045	0.000	1.41	3.93	0.58	0.294
14.160	0.000	1.41	4.03	0.58	0.302
14.275	0.000	1.47	4.13	0.58	0.311
14.390	0.000	1.50	4.24	0.58	0.319
14.505	0.000	1.56	4.36	0.58	0.329
14.620	0.000	1.60	4.48	0.58	0.338
14.735	0.000	1.68	4.62	0.58	0.349
14.850	0.000	1.72	4.77	0.58	0.360
14.965	0.000	1.83	4.93	0.58	0.371
15.080	0.000	1.89	5.10	0.58	0.384
15.195	0.000	2.03	5.28	0.58	0.398
15.310	0.000	2.11	5.48	0.58	0.412
15.425	0.000	1.94	5.66	0.58	0.425
15.540	0.000	1.91	5.83	0.58	0.438
15.655	0.000	2.29	6.05	0.58	0.454
15.770	0.000	2.55	6.31	0.58	0.473
15.885	0.000	3.62	6.70	0.58	0.501
16.000	0.000	5.09	7.28	0.59	0.544
16.115	0.000	16.90	9.88	2.74	0.679
16.230	0.000	2.89	9.31	3.49	0.673
16.345	0.000	2.08	9.30	2.08	0.673
16.460	0.000	2.21	9.34	2.17	0.673
16.575	0.000	1.95	9.25	2.05	0.673
16.690	0.000	1.77	9.24	1.79	0.672
16.805	0.000	1.63	9.20	1.67	0.672
16.920	0.000	1.53	9.19	1.55	0.672
17.035	0.000	1.44	9.17	1.46	0.672
17.150	0.000	1.39	9.16	1.40	0.672
17.265	0.000	1.33	9.15	1.35	0.671
17.380	0.000	1.28	9.14	1.29	0.671
17.495	0.000	1.23	9.13	1.24	0.671
17.610	0.000	1.19	9.12	1.19	0.671
17.725	0.000	1.15	9.11	1.16	0.671
17.840	0.000	1.11	9.10	1.12	0.671
17.955	0.000	1.08	9.10	1.09	0.671
18.070	0.000	1.05	9.09	1.06	0.671
18.185	0.000	1.04	9.09	1.04	0.671
18.300	0.000	1.02	9.09	1.03	0.671
18.415	0.000	1.00	9.08	1.00	0.671
18.530	0.000	0.98	9.08	0.98	0.671
18.645	0.000	0.96	9.07	0.96	0.671
18.760	0.000	0.94	9.07	0.94	0.671
18.875	0.000	0.92	9.07	0.92	0.671
18.990	0.000	0.90	9.06	0.91	0.671
19.105	0.000	0.89	9.06	0.89	0.671
19.220	0.000	0.88	9.06	0.88	0.671
19.335	0.000	0.86	9.05	0.86	0.671
19.450	0.000	0.85	9.05	0.85	0.671
19.565	0.000	0.84	9.05	0.84	0.670
19.680	0.000	0.82	9.05	0.83	0.670
19.795	0.000	0.81	9.04	0.82	0.670
19.910	0.000	0.80	9.04	0.80	0.670
20.025	0.000	0.79	9.04	0.79	0.670
20.140	0.000	0.78	9.04	0.78	0.670
20.255	0.000	0.77	9.04	0.77	0.670
20.370	0.000	0.76	9.03	0.77	0.670
20.485	0.000	0.75	9.03	0.76	0.670
20.600	0.000	0.75	9.03	0.75	0.670
20.715	0.000	0.74	9.03	0.74	0.670
20.830	0.000	0.73	9.03	0.73	0.670
20.945	0.000	0.72	9.03	0.72	0.670
21.060	0.000	0.72	9.03	0.72	0.670
21.175	0.000	0.71	9.02	0.71	0.670
21.290	0.000	0.70	9.02	0.70	0.670
21.405	0.000	0.69	9.02	0.70	0.670

21.520	0.000	0.69	9.02	0.69	0.670
21.635	0.000	0.68	9.02	0.68	0.670
21.750	0.000	0.68	9.02	0.68	0.670
21.865	0.000	0.67	9.02	0.67	0.670
21.980	0.000	0.66	9.01	0.67	0.670
22.095	0.000	0.66	9.01	0.66	0.670
22.210	0.000	0.65	9.01	0.65	0.670
22.325	0.000	0.65	9.01	0.65	0.670
22.440	0.000	0.64	9.01	0.64	0.670
22.555	0.000	0.64	9.01	0.64	0.670
22.670	0.000	0.63	9.01	0.63	0.670
22.785	0.000	0.63	9.01	0.63	0.670
22.900	0.000	0.62	9.01	0.62	0.670
23.015	0.000	0.62	9.01	0.62	0.670
23.130	0.000	0.61	9.00	0.62	0.670
23.245	0.000	0.61	9.00	0.61	0.670
23.360	0.000	0.61	9.00	0.61	0.670
23.475	0.000	0.60	9.00	0.60	0.670
23.590	0.000	0.60	9.00	0.60	0.670
23.705	0.000	0.59	9.00	0.59	0.670
23.820	0.000	0.59	9.00	0.59	0.670
23.935	0.000	0.59	9.00	0.59	0.670
24.050	0.000	0.58	9.00	0.59	0.670
24.165	0.000	0.00	8.92	0.59	0.664

1

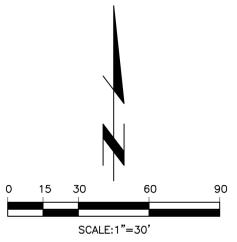
APPENDIX E

HYDROLOGY MAP



VICINITY MAP
N.T.S.

LEGEND	
	PROJECT BOUNDARY
	SUBAREA BOUNDARY
	FLOW PATH
	SUBAREA AREA
	SUBAREA NUMBER



Q100(ONSITE)=1.2 CFS/0.30 AC
Q100(OFFSITE)=0.6 CFS/0.15 AC
Tc100=8.8 Min.

Q100(ONSITE)=7.8 CFS/1.95 AC
Q100(OFFSITE)=1.8 CFS/0.50 AC
Tc100=8.5 Min.

Q100(ONSITE)=12.0 CFS/3.25 AC
Q100(OFFSITE)=1.8 CFS/0.50 AC
Tc100=9.7 Min.

Q100(OFFSITE)=13.2 CFS/3.80 AC
Tc100=9.9 Min.
AREA=3.80 AC.

Last Update: 4/9/18
G:\3300-3399\3320\3320HW-EX.dwg

CITY OF RANCHO CUCAMONGA

PUBLIC WORKS DEPARTMENT

EXISTING CONDITION HYDROLOGY MAP

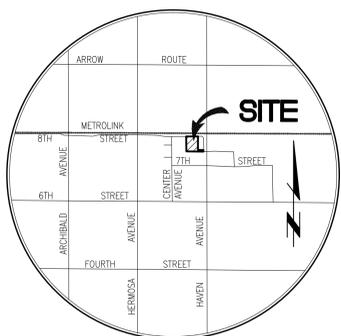
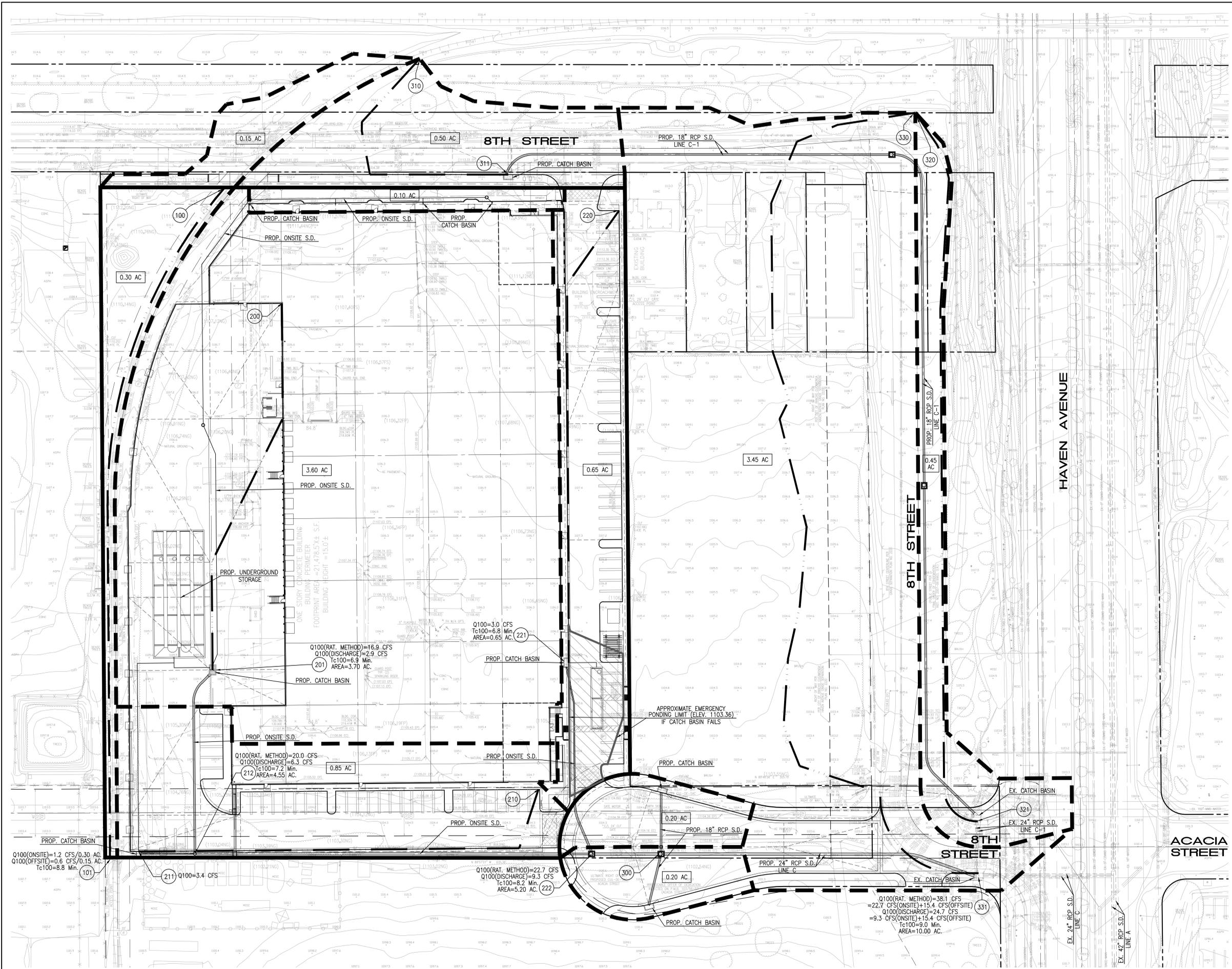
8TH STREET AND HAVEN AVENUE

PREPARED FOR:
DUKE REALTY
200 SPECTRUM CENTER DRIVE, SUITE 1600
IRVINE, CA 92618
PHONE: (949) 797-7000
FAX: (949) 797-7080

Tai Thienes Engineering, Inc.
CIVIL ENGINEERING • LAND SURVEYING
14146 FORESTONE DR. SUITE 100
LA MIRADA, CALIFORNIA 90638
PH: (714) 521-4811 FAX: (714) 521-4133

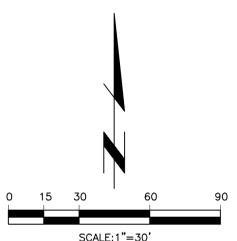
Designed by _____	Approved by _____	Date _____
Checked by _____	Public Works Director _____	R.C.E. XXXXX
Designed by _____		
Date _____		
Checked by _____		
Date _____		
Sheet 1 of 1		Sheets

3320/1 OF 1 SHEET



VICINITY MAP
N.T.S.

LEGEND	
	PROJECT BOUNDARY
	SUBAREA BOUNDARY
	FLOW PATH
	SUBAREA AREA
	SUBAREA NUMBER
	APPROXIMATE EMERGENCY PONDING LIMIT IF CATCH BASIN FAILS



Last Update: 10/19/18
013300-3389\3320\33201RD.dwg

CITY OF RANCHO CUCAMONGA
PUBLIC WORKS DEPARTMENT

**PROPOSED CONDITION
HYDROLOGY MAP**

**8TH STREET AND
HAVEN AVENUE**

Designed by _____	Approved by _____	Date _____
Checked by _____	Public Works Director _____	R.C.E. XXXXX
Designed by _____		
Date _____		
Checked by _____		
Date _____		
Sheet 1 of 1		Sheets

PREPARED FOR:
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3320/1 OF 1 SHEET