ALLARD ENGINEERING
civil engineering land surveying land planning

Highland / Mango Townhome
At the S-W corner of Highland Ave. & Mango Ave., Fontana
APN: 0240-121-22

Preliminary Drainage Report

June 14, 2021

Prepared For:
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Prepared under the supervision of:

_____

Robert K Allard, P.E. RCE 85349 Exp. 06-30-22

Discussion

Introduction

This report is for the proposed Highland/Mango Avenue Townhome development site (6.45 ac, net area) located in the City of Fontana at the southwest corner of Highland Ave. & Mango Ave. This site is currently used undeveloped. The current runoff, which occurs during storm events drains south east through the undeveloped surface and discharge into the cities storm drain masterplan in Mango Avenue.

Purpose

The purpose of this Drainage Report is to assess the existing and future flows that affect the site and provide necessary onsite drainage facilities to safely convey the mitigated peak flow generated from the proposed development into the Foothill Blvd. via surface flow which will ultimately conveys to the existing Etiwanda Channel.

The purpose of this Drainage Report is to quantify the developed condition runoff and show that the proposed drainage system is adequate to drain mitigated onsite water into the Foothill Blvd. which ultimately drains to the Mango Avenue storm drain.

Criteria

The criteria utilized for hydrologic analysis is the San Bernardino County Hydrology Manual. Rational Method Hydrology was used to quantify flow rate utilizing AES software. Also, AES software were used to size the proposed storm drain and swales/valley gutters to carry the flow onsite.

Findings

The proposed development will consist of townhomes (107 units), covered tandem parking, parking lot, private streets, driveways, sidewalks, paved area and landscape/planters. The existing site is undeveloped and considered 100% pervious cover (Open brush-poor condition). The flow generated from existing condition was calculated as 19.1 CFS from the entire site (6.45 acres).

In developed condition we have estimated the proposed development (High density multi-family) will create impervious area which is estimated 80% of the site. The flow generated from the proposed developed condition was calculated as 23.8 CFS from the entire site (6.45 acres).

From a drainage perspective, the onsite runoff will flow into hardscape/landscape areas and conveys into five below surface Stormtech infiltration chamber system (Stormtech Chamber System MC-4500) via onsite storm drain conveyance system for low flow (WQ volume) infiltration. For high flow, up to 100-yr storm event and when the chamber system reaches their capacity, the runoff will bypass the chamber system via proposed weir structure and continuing draining through the onsite SD system and finally discharge to the existing detention basin located across Mango Avenue via the proposed 30" RCP lateral. The existing detention system is the part of the City master drainage system, and its drain out in Mango Ave and follow the existing drainage course to discharge to the Cactus Basin. Therefore, the site will not create any HCOC condition for the proposed development. According to the City Storm Drain Master Plan,

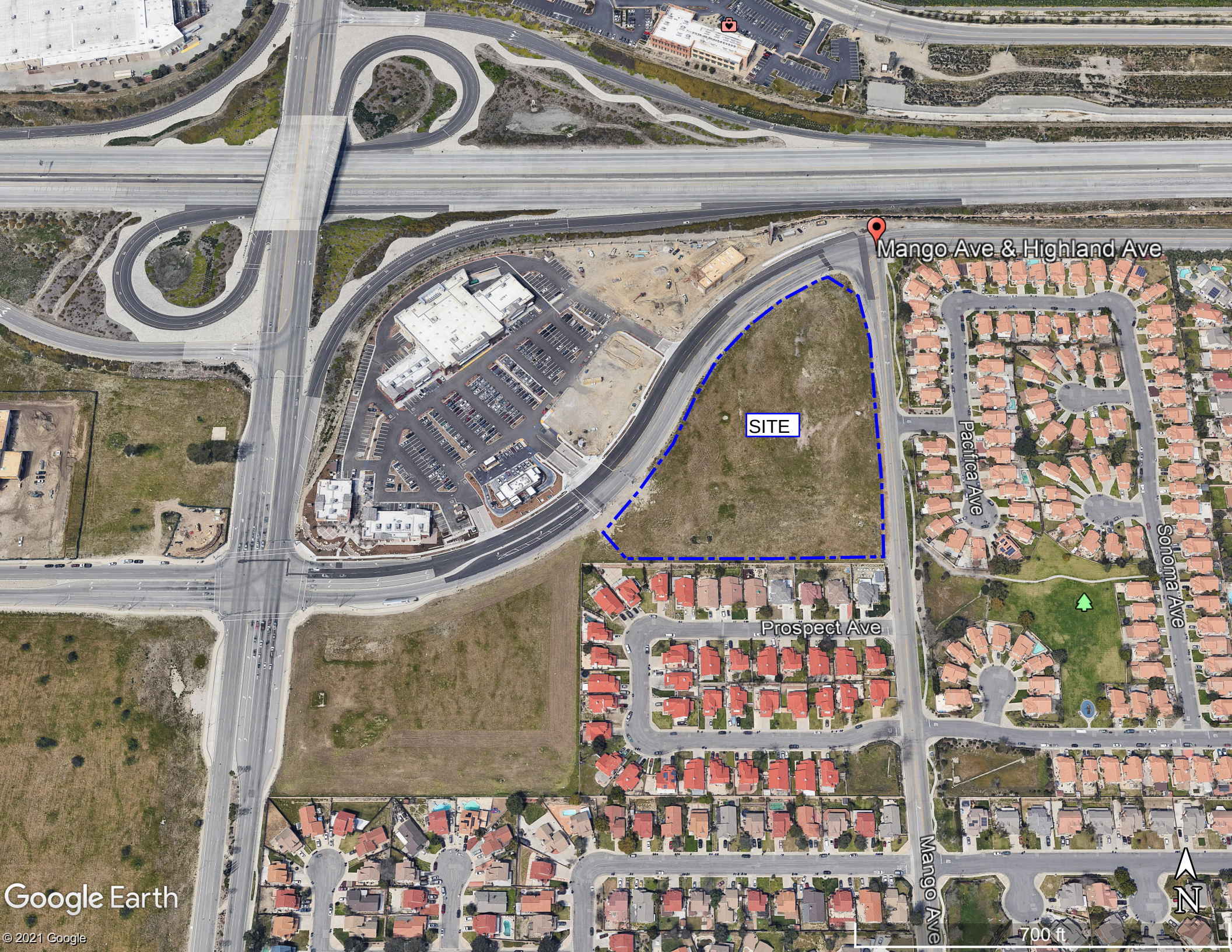
City has an existing 45” storm drain system in Mango Avenue. The basin we are joining outlets to the masterplan storm drain. Therefore no HCOC mitigation required for the high flow.

There are no offsite tributary areas that drains through the property in existing/developed condition.

The proposed developed site is consistent with drainage pattern in the area. It flows on surface to Mango Ave. and ultimately drains to the Cactus Basin.

Calculations and exhibits are attached to support these findings.

Reference Materials


Mango Ave & Highland Ave
SITE
Pacifica Ave
Sonoma Ave
Prospect Ave
Mango Ave
N
700 ft
Google Earth
© 2021 Google

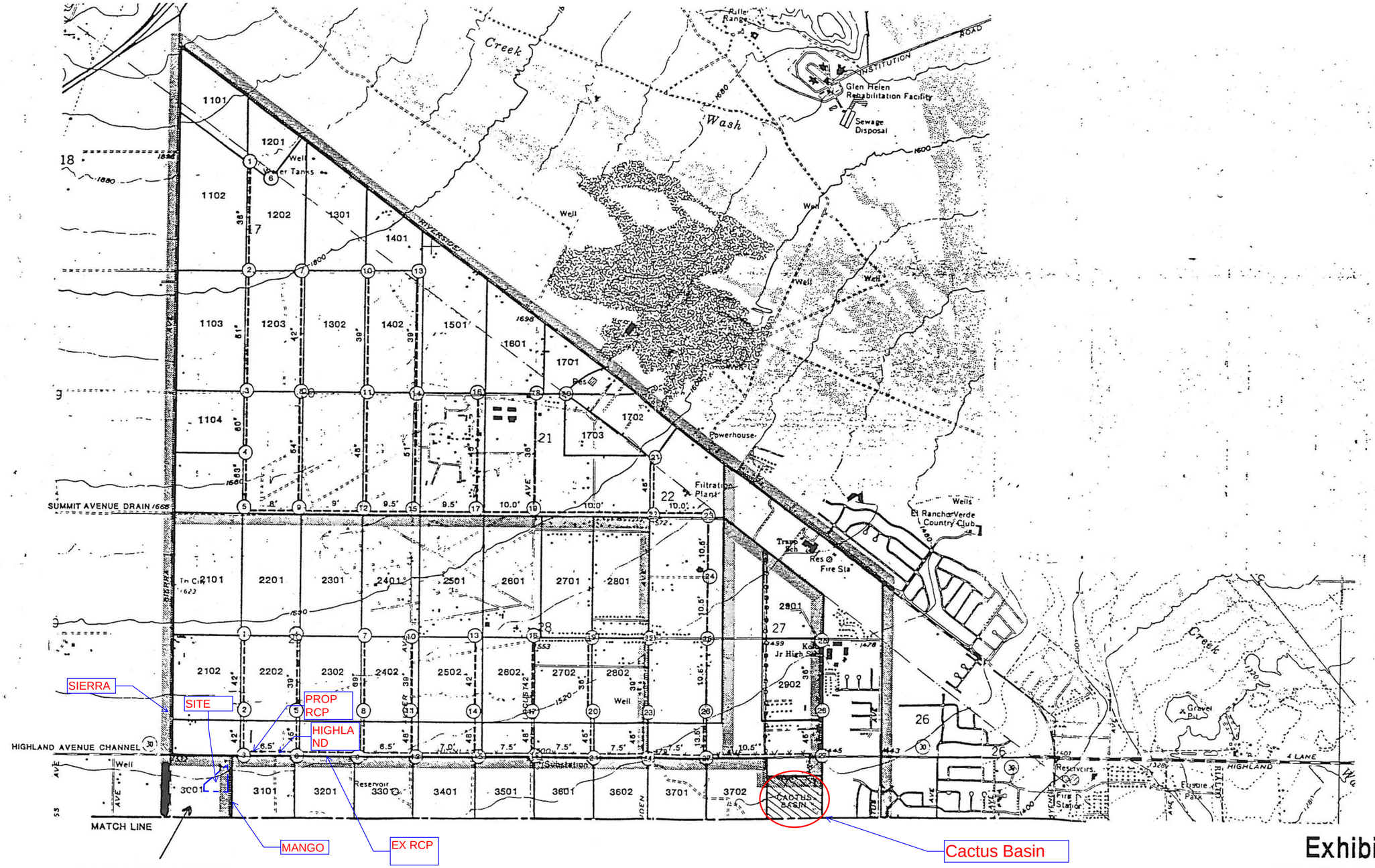


Exhibit 3.1

DRAINAGE SYSTEM LEGEND

PROPOSED REINFORCED CONCRETE PIPE	SUBBASIN BOUNDARY
PROPOSED TRAPEZOIDAL CHANNEL 1 1/2 : 1 SIDES B = 12 FT.	(57) NODE AND NODE NUMBER
EXISTING REINFORCED CONCRETE PIPE	1446 SUBBASIN NUMBER
EXISTING TRAPEZOIDAL CHANNEL	HYDROLOGIC UNIT BOUNDARY

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

COMPREHENSIVE STORM DRAIN PLAN
RIALTO CHANNEL
SUBBASIN AND NODE MAP
FIGURE 12-1

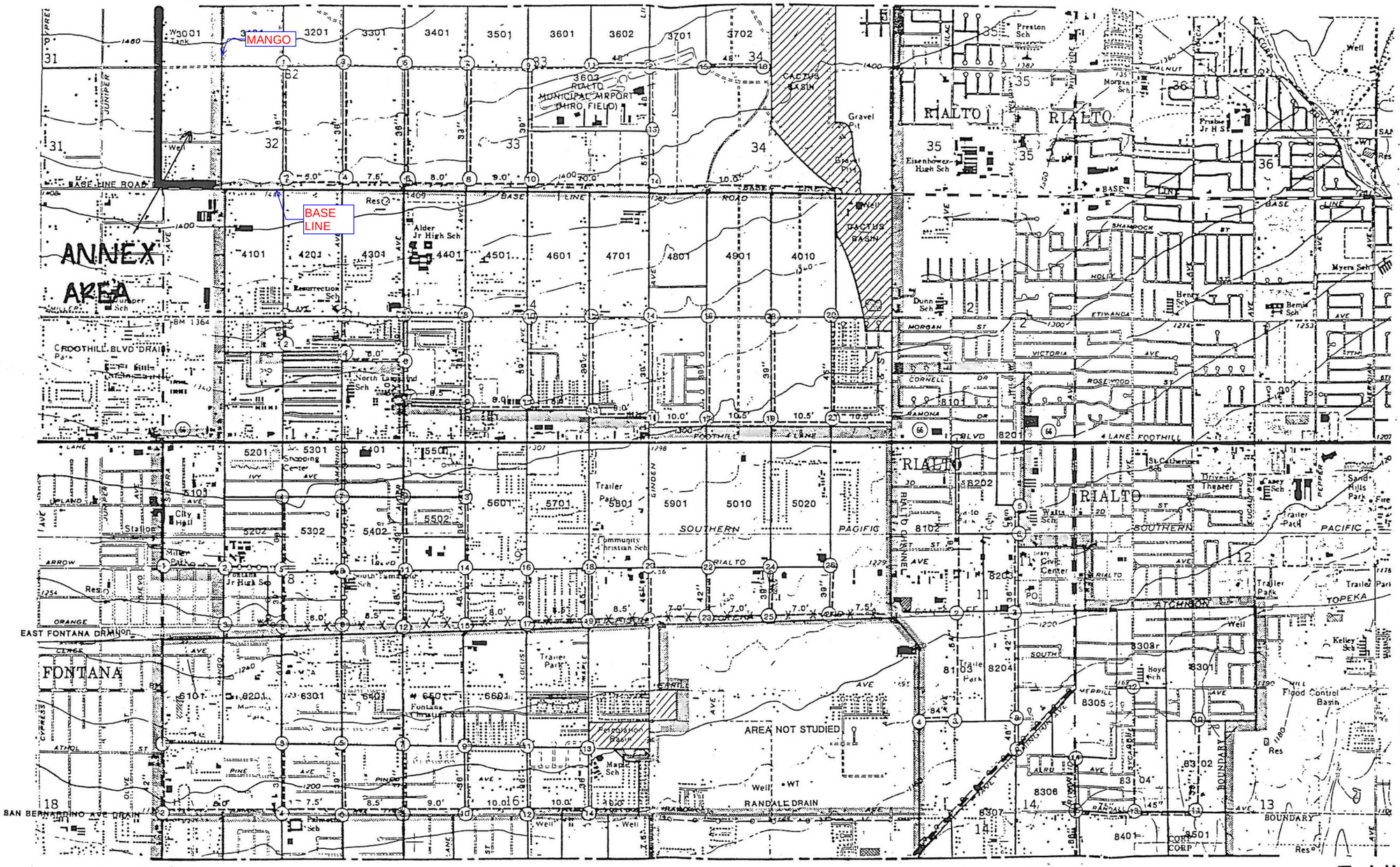
SUBMITTED BY: MILES E WOLLAM R.C.E. 13975 DATE 12-14-86

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.

SCALE 0 1000 2000 FEET

DATE DEC. 1986 SHEET 1 OF 2

MATCH LINE



MATCH LINE

Exhibit 3.1

DRAINAGE SYSTEM LEGEND

-------	PROPOSED REINFORCED CONCRETE PIPE	———	SUBBASIN BOUNDARY
-×-×-×-	PROPOSED TRAPEZOIDAL CHANNEL 1 1/2 : 1 SIDES B=12 FT.	(57)	NODE AND NODE NUMBER
-o-o-o-o-	EXISTING REINFORCED CONCRETE PIPE	1446	SUBBASIN NUMBER
-•-•-•-•-	EXISTING TRAPEZOIDAL CHANNEL		HYDROLOGIC UNIT BOUNDARY

Miles E. Wollam 12-14-86
SUBMITTED BY: MILES E. WOLLAM R.C.E. 13975 DATE

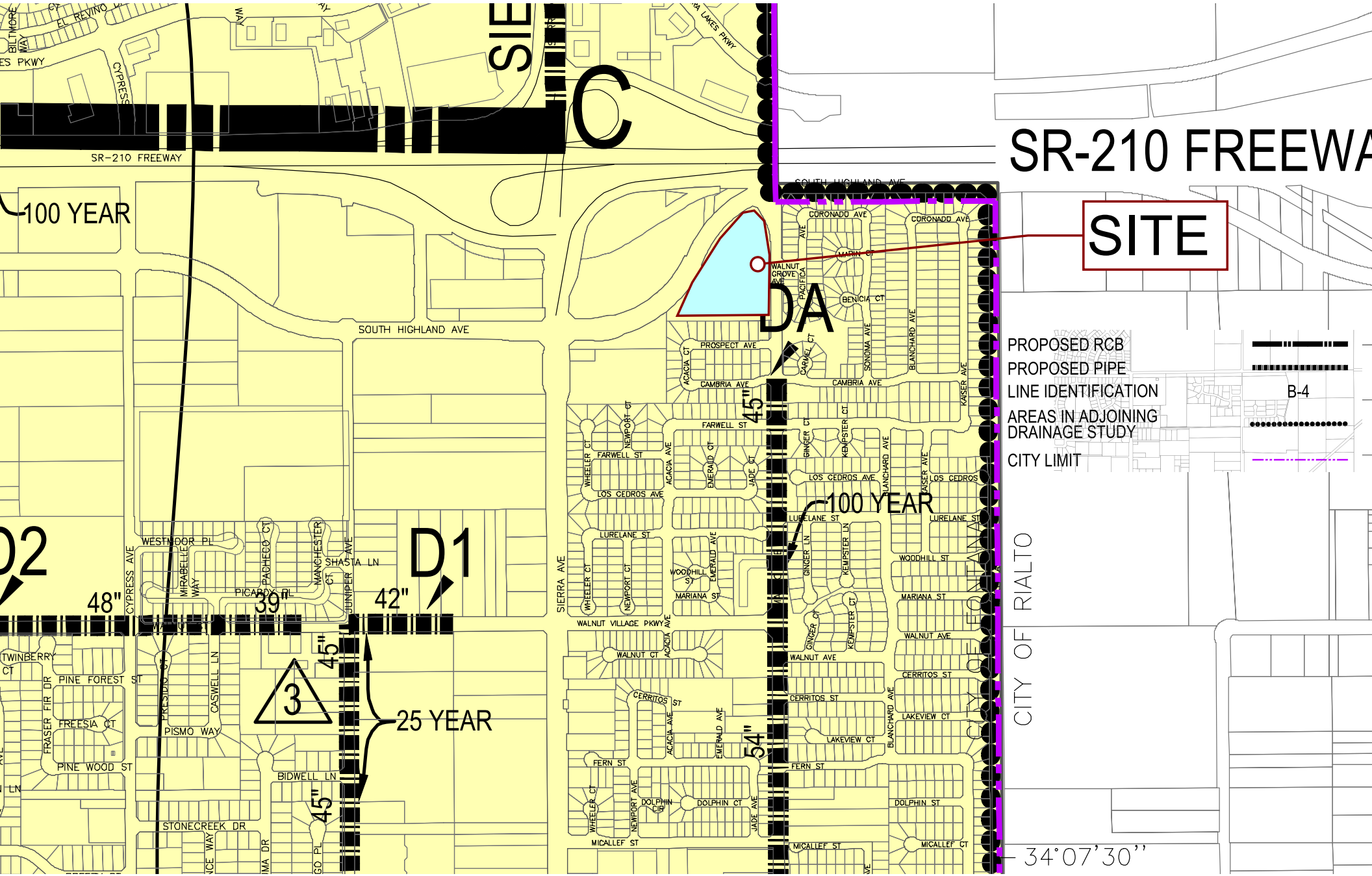
JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.

SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT

COMPREHENSIVE STORM DRAIN PLAN
RIALTO CHANNEL
SUBBASIN AND NODE MAP
FIGURE 12-1

SCALE 0 1000 2000 FEET

DATE DEC. 1986 SHEET 2 OF 2


SR-210 FREEWAY
SR-210 FREEWA
SITE
100 YEAR
SOUTH HIGHLAND AVE
SOUTH HIGHLAND AVE
C
DA
D1
D2
3
48"
39"
42"
45"
45"
45"
54"
25 YEAR
PROPOSED RCB
PROPOSED PIPE
LINE IDENTIFICATION
B-4
AREAS IN ADJOINING DRAINAGE STUDY
CITY LIMIT
CITY OF RIALTO
CITY OF FONTANA
34°07'30''
CORONADO AVE
WALNUT GROVE AVE
PROSPECT AVE
CAMBRIA AVE
FARWELL ST
LOS CEDROS AVE
LURELANE ST
WOODHILL ST
MARIANA ST
WALNUT AVE
CERRITOS ST
LAKEVIEW CT
FERN ST
DOLPHIN ST
MICALLEF ST
WALNUT VILLAGE PKWY
STONECREEK DR
BIDWELL LN
PISMO WAY
PINE FOREST ST
PINE WOOD ST
FREESIA CT
TWINBERRY CT
WESTMOOR PL
SHASTA LN
SIERRA AVE
CYPRESS AVE
MANCHESTER CT
JUNIPER AVE
PACHECO CT
MIRABELLE WAY
CASWELL LN
FRASER FIR DR
BENICIA CT
SONOMA AVE
BLANCHARD AVE
KAISER AVE
ACACIA AVE
EMERALD AVE
JADE CT
GINGER CT
KEMPSTER CT
KEMPSTER LN
NEWPORT CT
WHEELER CT
DOLPHIN CIR
JADE AVE
CARMEL CT
PACIFICA AVE
MARIN CT

NOAA Atlas 14, Volume 6, Version 2
Location name: Fontana, California, USA*
Latitude: 34.1344°, Longitude: -117.4325°
Elevation: 1521.4 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.133** (0.111-0.161)	**0.176** (0.146-0.214)	**0.232** (0.192-0.282)	**0.277** (0.228-0.341)	**0.339** (0.270-0.432)	**0.387** (0.301-0.503)	**0.436** (0.331-0.582)	**0.487** (0.359-0.669)	**0.557** (0.393-0.798)	**0.612** (0.417-0.908)
10-min	**0.190** (0.159-0.231)	**0.252** (0.209-0.306)	**0.332** (0.275-0.405)	**0.397** (0.327-0.488)	**0.486** (0.386-0.619)	**0.555** (0.432-0.722)	**0.626** (0.474-0.834)	**0.699** (0.514-0.958)	**0.799** (0.564-1.14)	**0.878** (0.598-1.30)
15-min	**0.230** (0.192-0.280)	**0.305** (0.253-0.370)	**0.402** (0.333-0.489)	**0.481** (0.395-0.591)	**0.588** (0.467-0.748)	**0.671** (0.522-0.873)	**0.756** (0.573-1.01)	**0.845** (0.622-1.16)	**0.966** (0.682-1.38)	**1.06** (0.723-1.58)
30-min	**0.348** (0.289-0.422)	**0.460** (0.382-0.559)	**0.606** (0.503-0.739)	**0.726** (0.597-0.892)	**0.888** (0.705-1.13)	**1.01** (0.788-1.32)	**1.14** (0.866-1.52)	**1.28** (0.939-1.75)	**1.46** (1.03-2.09)	**1.60** (1.09-2.38)
60-min	**0.529** (0.440-0.642)	**0.699** (0.581-0.850)	**0.922** (0.764-1.12)	**1.10** (0.907-1.36)	**1.35** (1.07-1.72)	**1.54** (1.20-2.00)	**1.74** (1.32-2.32)	**1.94** (1.43-2.66)	**2.22** (1.57-3.18)	**2.44** (1.66-3.62)
2-hr	**0.806** (0.671-0.978)	**1.05** (0.876-1.28)	**1.37** (1.14-1.67)	**1.63** (1.34-2.01)	**1.98** (1.57-2.52)	**2.25** (1.75-2.92)	**2.52** (1.91-3.35)	**2.79** (2.06-3.83)	**3.17** (2.24-4.54)	**3.46** (2.36-5.13)
3-hr	**1.03** (0.860-1.25)	**1.35** (1.12-1.64)	**1.75** (1.45-2.13)	**2.07** (1.70-2.54)	**2.50** (1.99-3.18)	**2.83** (2.20-3.68)	**3.16** (2.40-4.21)	**3.50** (2.58-4.80)	**3.95** (2.79-5.66)	**4.30** (2.93-6.38)
6-hr	**1.53** (1.27-1.86)	**1.99** (1.65-2.42)	**2.57** (2.13-3.14)	**3.04** (2.50-3.74)	**3.66** (2.91-4.65)	**4.12** (3.20-5.36)	**4.59** (3.48-6.11)	**5.06** (3.72-6.94)	**5.68** (4.01-8.14)	**6.16** (4.20-9.14)
12-hr	**2.09** (1.74-2.54)	**2.73** (2.27-3.32)	**3.54** (2.93-4.31)	**4.18** (3.43-5.13)	**5.01** (3.98-6.38)	**5.64** (4.38-7.32)	**6.25** (4.74-8.33)	**6.87** (5.06-9.42)	**7.68** (5.42-11.0)	**8.30** (5.65-12.3)
24-hr	**2.85** (2.52-3.28)	**3.77** (3.33-4.35)	**4.92** (4.34-5.69)	**5.82** (5.10-6.79)	**7.01** (5.93-8.44)	**7.88** (6.54-9.69)	**8.74** (7.08-11.0)	**9.60** (7.57-12.4)	**10.7** (8.12-14.5)	**11.6** (8.47-16.2)
2-day	**3.49** (3.09-4.02)	**4.71** (4.16-5.43)	**6.27** (5.53-7.25)	**7.52** (6.58-8.77)	**9.20** (7.79-11.1)	**10.5** (8.68-12.9)	**11.7** (9.50-14.8)	**13.0** (10.3-16.9)	**14.8** (11.2-19.9)	**16.1** (11.8-22.4)
3-day	**3.74** (3.32-4.31)	**5.13** (4.54-5.92)	**6.96** (6.14-8.05)	**8.45** (7.40-9.86)	**10.5** (8.90-12.7)	**12.1** (10.0-14.9)	**13.7** (11.1-17.3)	**15.4** (12.1-20.0)	**17.7** (13.4-23.9)	**19.6** (14.3-27.3)
4-day	**4.00** (3.55-4.61)	**5.55** (4.91-6.40)	**7.60** (6.70-8.79)	**9.30** (8.14-10.8)	**11.7** (9.87-14.0)	**13.5** (11.2-16.6)	**15.4** (12.5-19.4)	**17.4** (13.7-22.6)	**20.2** (15.3-27.3)	**22.5** (16.4-31.3)

7-day	**4.58** (4.06-5.28)	**6.42** (5.68-7.41)	**8.88** (7.83-10.3)	**10.9** (9.56-12.7)	**13.8** (11.7-16.6)	**16.0** (13.3-19.7)	**18.4** (14.9-23.1)	**20.8** (16.4-27.0)	**24.3** (18.4-32.8)	**27.1** (19.8-37.8)
10-day	**4.95** (4.38-5.71)	**6.98** (6.17-8.05)	**9.70** (8.56-11.2)	**12.0** (10.5-14.0)	**15.2** (12.9-18.3)	**17.7** (14.7-21.8)	**20.3** (16.5-25.6)	**23.1** (18.2-30.0)	**27.1** (20.5-36.5)	**30.2** (22.1-42.2)
20-day	**5.90** (5.23-6.80)	**8.40** (7.43-9.69)	**11.8** (10.4-13.7)	**14.7** (12.8-17.1)	**18.8** (15.9-22.6)	**22.0** (18.3-27.1)	**25.5** (20.6-32.1)	**29.2** (23.0-37.8)	**34.4** (26.0-46.4)	**38.7** (28.3-54.0)
30-day	**6.89** (6.10-7.94)	**9.82** (8.68-11.3)	**13.8** (12.2-16.0)	**17.3** (15.1-20.2)	**22.2** (18.8-26.7)	**26.2** (21.7-32.2)	**30.4** (24.6-38.3)	**34.9** (27.5-45.2)	**41.4** (31.3-55.9)	**46.8** (34.2-65.2)
45-day	**8.23** (7.28-9.48)	**11.6** (10.3-13.4)	**16.4** (14.5-19.0)	**20.5** (17.9-23.9)	**26.4** (22.3-31.8)	**31.2** (25.9-38.4)	**36.3** (29.4-45.8)	**41.9** (33.0-54.3)	**50.0** (37.8-67.4)	**56.7** (41.4-79.1)
60-day	**9.57** (8.47-11.0)	**13.4** (11.9-15.5)	**18.8** (16.6-21.7)	**23.4** (20.5-27.3)	**30.2** (25.6-36.4)	**35.7** (29.7-44.0)	**41.7** (33.8-52.5)	**48.2** (38.0-62.5)	**57.7** (43.7-77.8)	**65.6** (48.0-91.5)

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

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

Please refer to NOAA Atlas 14 document for more information.

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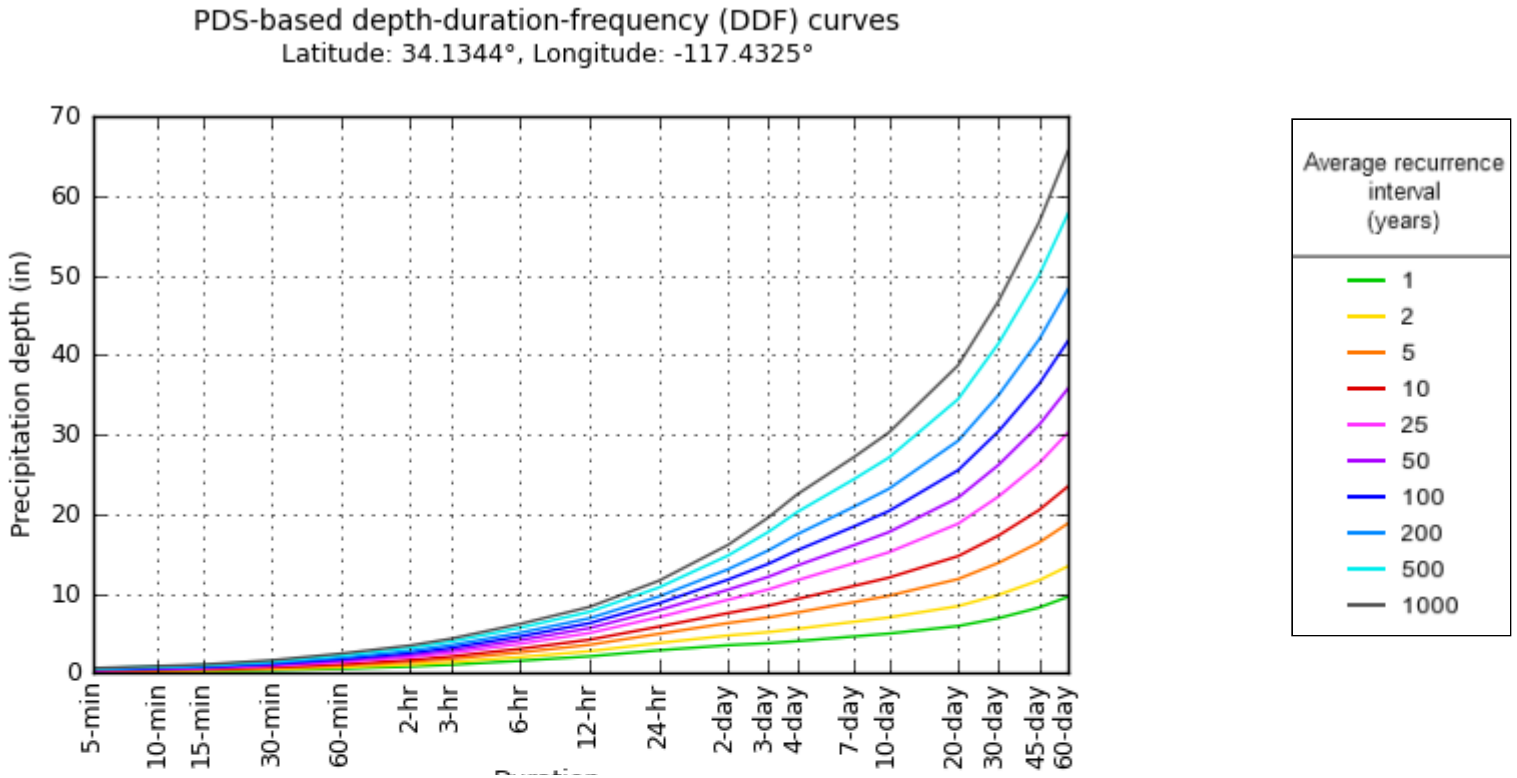
PF graphical



San Bernardino County Southwestern Part, California

TvC—Tujunga gravelly loamy sand, 0 to 9 percent slopes

Map Unit Setting

National map unit symbol: hcl2
Elevation: 10 to 1,500 feet
Mean annual precipitation: 10 to 25 inches
Mean annual air temperature: 59 to 64 degrees F
Frost-free period: 250 to 350 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Tujunga

Setting

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

Typical profile

H1 - 0 to 36 inches: gravelly loamy sand
H2 - 36 to 60 inches: gravelly sand

Properties and qualities

Slope: 0 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Available water capacity: Low (about 3.8 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

Minor Components

Unnamed
Percent of map unit: 5 percent
Landform: Drainageways
Hydric soil rating: Yes

Soboba, gravelly loamy sand
Percent of map unit: 5 percent
Hydric soil rating: No

Delhi, fine sand
Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 12, May 27, 2020

Map Scale: 1:1,360 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: San Bernardino County Southwestern Part, California
Survey Area Data: Version 12, May 27, 2020

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

Date(s) aerial images were photographed: Apr 1, 2018—Jun 30, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
TvC	Tujunga gravelly loamy sand, 0 to 9 percent slopes	5.7	100.0%
Totals for Area of Interest		**5.7**	**100.0%**

ACTUAL IMPERVIOUS COVER

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

Notes:

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

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

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

SAN BERNARDINO COUNTY
HYDROLOGY MANUAL

ACTUAL IMPERVIOUS COVER FOR DEVELOPED AREAS

Figure C-4

Hydrology Calculation
Rational Method Hydrology

Developed Condition (100-yr, 1 hr Storm Event)

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**************************************************************************
            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 1400

                          Analysis prepared by:




 ************************* DESCRIPTION OF STUDY *************************
* HIGHLAND/MANGO TOWNHOME                                                *
* FONTANA                                                                *
* 100-YR STORM EVENT                                                     *
 ************************************************************************

  FILE NAME: HGH.DAT
  TIME/DATE OF STUDY: 15:05 06/14/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   8.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *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) = 1.7400

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (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      0.00 TO NODE      1.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =  1180.00
  ELEVATION DATA: UPSTREAM(FEET) =   1522.00  DOWNSTREAM(FEET) =   1509.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   13.517
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  4.255
  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.)
  APARTMENTS                 A        6.45      0.74     0.200    52   13.52
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.74
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  0.200
  SUBAREA RUNOFF(CFS) =     23.84
```

```
  TOTAL AREA(ACRES) =      6.45   PEAK FLOW RATE(CFS) =     23.84
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.4  TC(MIN.) =     13.52
  EFFECTIVE AREA(ACRES) =      6.45  AREA-AVERAGED Fm(INCH/HR)=  0.15
  AREA-AVERAGED Fp(INCH/HR) =  0.74  AREA-AVERAGED Ap = 0.200
  PEAK FLOW RATE(CFS)   =      23.84
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Existing Condition (100 yr, 1 hr Storm Event)

```
**************************************************************************
            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 1400

                          Analysis prepared by:



 ************************* DESCRIPTION OF STUDY *************************
* HIGHLAND/MANGO TOWNHOME                                                *
* FONTANA                                                                *
* 100-YR STORM EVENT                                                     *
 ************************************************************************

  FILE NAME: HGH.DAT
  TIME/DATE OF STUDY: 18:07 06/14/2021
==========================================================================
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
==========================================================================
                    --*TIME-OF-CONCENTRATION MODEL*--

  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   8.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  *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) = 1.7400

  *ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD*

  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (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      0.00 TO NODE      1.00 IS CODE =  21
--------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
  >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
==========================================================================
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   850.00
  ELEVATION DATA: UPSTREAM(FEET) =   1523.00  DOWNSTREAM(FEET) =   1508.00

  Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
  SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) =   17.482
  * 100 YEAR RAINFALL INTENSITY(INCH/HR) =  3.647
  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.)
  NATURAL POOR COVER
  "OPEN BRUSH"               A        6.45      0.35     1.000    81   17.48
  SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) =  0.35
  SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap =  1.000
```

```
  SUBAREA RUNOFF(CFS) =     19.12
  TOTAL AREA(ACRES) =      6.45   PEAK FLOW RATE(CFS) =     19.12
================================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.4  TC(MIN.) =     17.48
  EFFECTIVE AREA(ACRES) =      6.45  AREA-AVERAGED Fm(INCH/HR)=  0.35
  AREA-AVERAGED Fp(INCH/HR) =  0.35  AREA-AVERAGED Ap = 1.000
  PEAK FLOW RATE(CFS)   =      19.12
================================================================================
================================================================================
  END OF RATIONAL METHOD ANALYSIS
```

Drainage Exhibit

Existing Condition

LEGEND

SITE

ELEVATION
NODE
1500
0
Q_{100} = 0 CFS
RUNOFF

UND
LAND USE (OPEN BRUSH-POOR)
UNDEVELOPED
6.45
850
ACREAGE (AC.)
TRAVEL LENGTH (FT.)

SCALE: 1"=160

Prepared By:

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Civil Engineering - Land Surveying - Land Planning
16866 Seville Avenue
Fontana, California 92335
(909) 356-1815 Fax (909) 356-1795

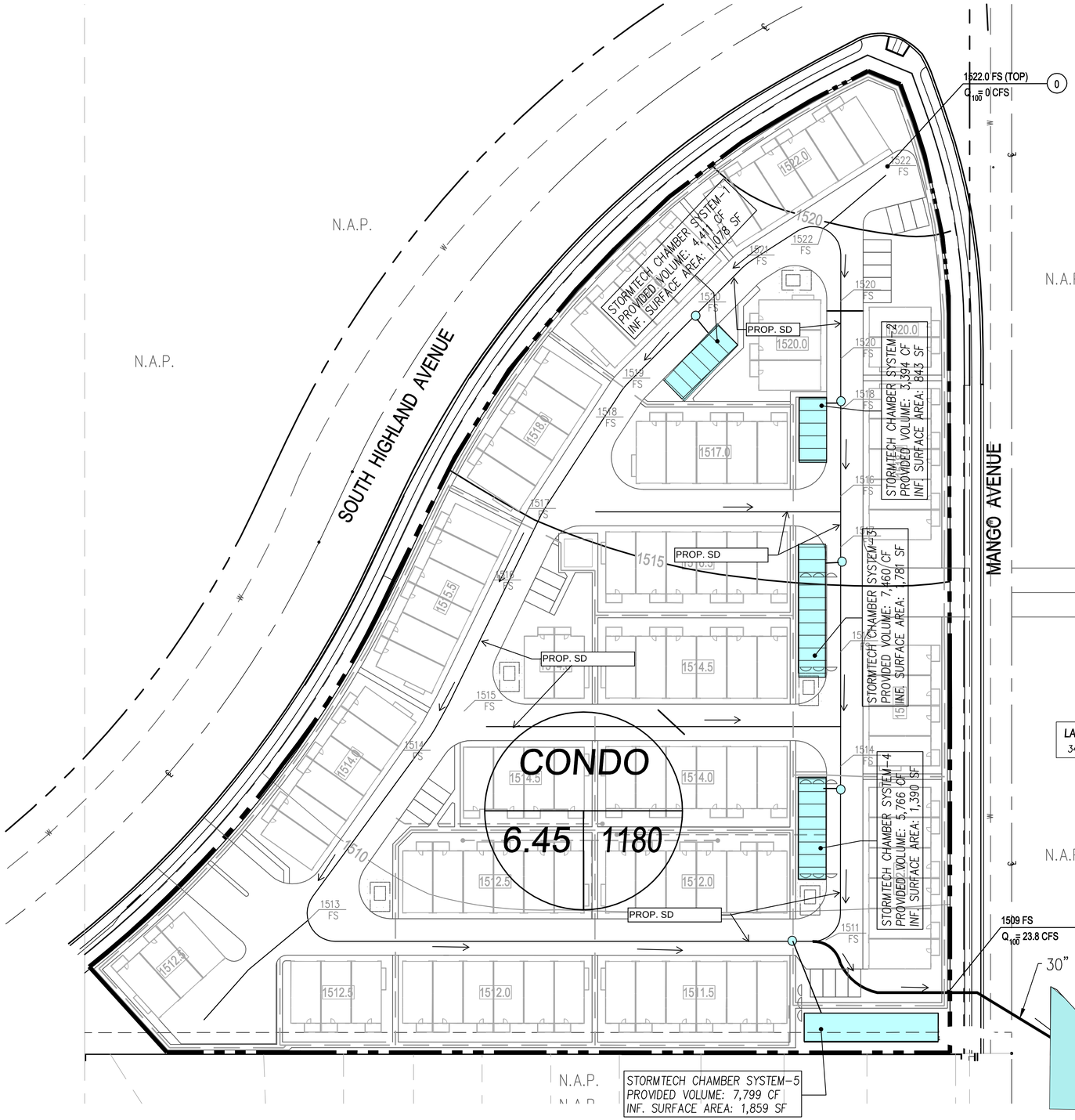
HIGHLAND/MANGO AVE TOWNHOME
CITY OF FONTANA
DRAINAGE EXHIBIT-EXISTING CONDITION

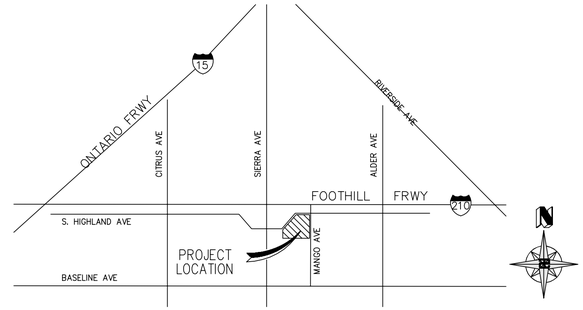
PLOT DATE: June 14, 2021 ashafiq

Filename: I:\Frontier Enterprises\Highland Ave Fontana\DWG's\ENTITLEMENT\EXHIBITS\DRAINAGE E;

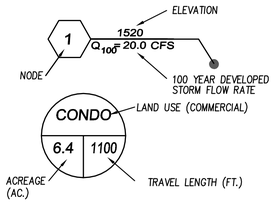
Drainage Exhibit

Developed Condition





VICINITY MAP
NOT TO SCALE



INDICATES DRAINAGE BOUNDARY
INDICATES FLOW DIRECTION ON SURFACE
CONC SWALE FLOW PATH
ONSITE STORM DRAIN
ONSITE CATCH BASIN

LATITUDE & LONGITUDE
34.13444 N, 117.43248 W

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 INCH = 40FT.

PLOT DATE: June 14, 2024 cshollig

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CITY OF FONTANA
CALIFORNIA

DRAINAGE EXHIBIT-DEVELOPED

FOOTHILL / HEMLOCK AVE APARTMENT

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