

APPENDIX B
PRELIMINARY DRAINAGE REPORT



ALLARD ENGINEERING

civil engineering land surveying land planning

Mango Ave. Industrial Hydrology & Hydraulics Report

November 26, 2019

Prepared For:

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Discussion

Introduction

Mango Avenue Industrial comprises of an area of approximately 5.8 acres in the City of Fontana, San Bernardino County. The site lies at the Northwest corner of Mango avenue and Sierra Lakes Parkway.

Purpose

The purpose of this Preliminary Drainage Report is to discuss existing and proposed drainage patterns.

Criteria

The criteria utilized for drainage analysis is the San Bernardino County Hydrology Manual and the City of Fontana Master Storm Drain Plan. Civil D and AES software were used to compute the various calculations.

Findings

The natural terrain of this site drains in a southerly direction at a slope of 2-3%. There is an existing master plan storm drain line in Mango Avenue and the site is tabled to drain to it. A 100 year runoff of 21.8 CFS (Runoff Rate 3.75 CFS/AC) calculated using Rational Method Hydrology which is little over than the 100 year runoff rate of 3.4 CFS/Acre from the report for the Sierra Avenue Masterplan (Refer to the Developed Hydrology Map-Mango Avenue). In total 21.8 CFS exit the site in the developed condition during the 100 year storm, and the 10 year runoff is 13.7 CFS.

The onsite drainage surface flows into a network of storm drain system onsite that include ribbon gutter/swale/storm drain/grate inlet to the proposed underground Stormtech Chamber System for low flow infiltration (WQ storm event). The runoff from larger storm events will be diverted at the proposed weir manhole and will continue to drain out at the outlet via the proposed storm drain at the southeast corner of the site into the existing Mango Avenue Master Storm Drain System (60" RCP). Due to the development being part of the masterplan drainage system and consistent with the City's general plan, and the fact that downstream facilities were sized in accordance with the proposed development, no detention is required. Onsite systems were analyzed to confirm that they can handle the 10 year storm event, per city requirements. In addition the building pad and adjacent pads were taken into consideration and set a minimum of 2 feet above the inlet to protect against the 100 year storm event.

Further calculations and exhibits are included which illustrate these findings.

Hydrology Analysis

Rational Method Hydrology-100 Yr storm
Rational Method Hydrology-10 Yr storm

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 SAN BERNARDINO CO. HYDROLOGY CRITERION)
(c) Copyright 1983-2006 Advanced Engineering Software (aes)
Ver. 13.0 Release Date: 06/01/2006 License ID 1400

Analysis prepared by:

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***** DESCRIPTION OF STUDY *****
* MANGO AVE INDUSTRIAL *
* Q100 CALC *
* 100-YR STORM DEVELOPED CONDITION *

FILE NAME: MANGO.DAT
TIME/DATE OF STUDY: 11:05 11/27/2019

=====
USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
=====
--*TIME-OF-CONCENTRATION MODEL*--

USER SPECIFIED STORM EVENT(YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 24.00
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) = 1.7800

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL
Table with 10 columns: NO., WIDTH (FT), CROSSFALL (FT), SIDE / SIDE/ WAY, HEIGHT (FT), CURB GUTTER-GEOMETRIES: WIDTH (FT), LIP (FT), HIKE (FT), MANNING FACTOR (n). Row 1: 1, 30.0, 20.0, 0.018/0.018/0.020, 0.67, 2.00, 0.0312, 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) = 1320.00
ELEVATION DATA: UPSTREAM(FEET) = 1575.00 DOWNSTREAM(FEET) = 1564.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 14.026

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.257

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	5.80	0.80	0.100	52	14.03

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.80

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100

SUBAREA RUNOFF(CFS) = 21.81

TOTAL AREA(ACRES) = 5.80 PEAK FLOW RATE(CFS) = 21.81

=====
END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 5.80 TC(MIN.) = 14.03

EFFECTIVE AREA(ACRES) = 5.80 AREA-AVERAGED Fm(INCH/HR)= 0.08

AREA-AVERAGED Fp(INCH/HR) = 0.80 AREA-AVERAGED Ap = 0.100

PEAK FLOW RATE(CFS) = 21.81

=====
END OF RATIONAL METHOD ANALYSIS



RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
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***** DESCRIPTION OF STUDY *****
* MANGO AVE INDUSTRIAL *
* Q10 CALC *
* 10-YR STORM (DEVELOPED CONDITION) *

FILE NAME: MANGO.DAT
TIME/DATE OF STUDY: 10:58 11/27/2019

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

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

USER SPECIFIED STORM EVENT(YEAR) = 10.00
SPECIFIED MINIMUM PIPE SIZE(INCH) = 24.00
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) = 1.1400

ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD

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

NO.	WIDTH (FT)	CROSSFALL (FT)	IN- / SIDE	OUT- / SIDE	PARK- / WAY	HEIGHT (FT)	CURB GUTTER-GEOMETRIES: WIDTH (FT)	LIP (FT)	HIKE (FT)	MANNING FACTOR (n)
1	30.0	20.0	0.018	0.018	0.020	0.67	2.00	0.0312	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) = 1320.00
ELEVATION DATA: UPSTREAM(FEET) = 1575.00 DOWNSTREAM(FEET) = 1564.00

Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 14.026

* 10 YEAR RAINFALL INTENSITY(INCH/HR) = 2.727

SUBAREA Tc AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
COMMERCIAL	A	5.80	0.98	0.100	32	14.03

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.97

SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100

SUBAREA RUNOFF(CFS) = 13.72

TOTAL AREA(ACRES) = 5.80 PEAK FLOW RATE(CFS) = 13.72

=====
END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 5.80 TC(MIN.) = 14.03

EFFECTIVE AREA(ACRES) = 5.80 AREA-AVERAGED Fm(INCH/HR)= 0.10

AREA-AVERAGED Fp(INCH/HR) = 0.97 AREA-AVERAGED Ap = 0.100

PEAK FLOW RATE(CFS) = 13.72

=====
END OF RATIONAL METHOD ANALYSIS



Hydraulic Analysis

Storm Drain Capacity Calc
Ribbon Gutter Capacity Calc
Discharge Storm Drain Capacity Calc (24" RCP)

HYDRAULIC ELEMENTS - I PROGRAM PACKAGE
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TIME/DATE OF STUDY: 14:16 11/27/2019
=====

Problem Descriptions:
8" PVC Capacity Calc

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

PIPE DIAMETER(FEET) = 0.670
FLOWDEPTH(FEET) = 0.620
PIPE SLOPE(FEET/FEET) = 0.0100
MANNINGS FRICTION FACTOR = 0.011000
>>>> NORMAL DEPTH FLOW(CFS) = 1.56
=====

NORMAL-DEPTH FLOW INFORMATION:

NORMAL DEPTH(FEET) = 0.62
FLOW AREA(SQUARE FEET) = 0.34
FLOW TOP-WIDTH(FEET) = 0.352
FLOW PRESSURE + MOMENTUM(POUNDS) = 13.76
FLOW VELOCITY(FEET/SEC.) = 4.565
FLOW VELOCITY HEAD(FEET) = 0.324
HYDRAULIC DEPTH(FEET) = 0.97
FROUDE NUMBER = 0.818
SPECIFIC ENERGY(FEET) = 0.94
=====

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TIME/DATE OF STUDY: 14:27 11/27/2019
=====

Problem Descriptions:
12" PVC Capacity Calc

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

PIPE DIAMETER(FEET) = 1.000
FLOWDEPTH(FEET) = 0.950
PIPE SLOPE(FEET/FEET) = 0.0100
MANNINGS FRICTION FACTOR = 0.011000
>>>> NORMAL DEPTH FLOW(CFS) = 4.52
=====

NORMAL-DEPTH FLOW INFORMATION:

NORMAL DEPTH(FEET) = 0.95
FLOW AREA(SQUARE FEET) = 0.77
FLOW TOP-WIDTH(FEET) = 0.436
FLOW PRESSURE + MOMENTUM(POUNDS) = 73.58
FLOW VELOCITY(FEET/SEC.) = 5.870
FLOW VELOCITY HEAD(FEET) = 0.535
HYDRAULIC DEPTH(FEET) = 1.77
FROUDE NUMBER = 0.778
SPECIFIC ENERGY(FEET) = 1.49
=====

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TIME/DATE OF STUDY: 14:28 11/27/2019
=====

Problem Descriptions:
18" PVC Capacity Calc

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

PIPE DIAMETER(FEET) = 1.500
FLOWDEPTH(FEET) = 1.420
PIPE SLOPE(FEET/FEET) = 0.0100
MANNINGS FRICTION FACTOR = 0.011000
>>>> NORMAL DEPTH FLOW(CFS) = 13.35
=====

NORMAL-DEPTH FLOW INFORMATION:

NORMAL DEPTH(FEET) = 1.42
FLOW AREA(SQUARE FEET) = 1.73
FLOW TOP-WIDTH(FEET) = 0.674
FLOW PRESSURE + MOMENTUM(POUNDS) = 273.55
FLOW VELOCITY(FEET/SEC.) = 7.711
FLOW VELOCITY HEAD(FEET) = 0.923
HYDRAULIC DEPTH(FEET) = 2.57
FROUDE NUMBER = 0.848
SPECIFIC ENERGY(FEET) = 2.34
=====

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TIME/DATE OF STUDY: 14:33 11/27/2019
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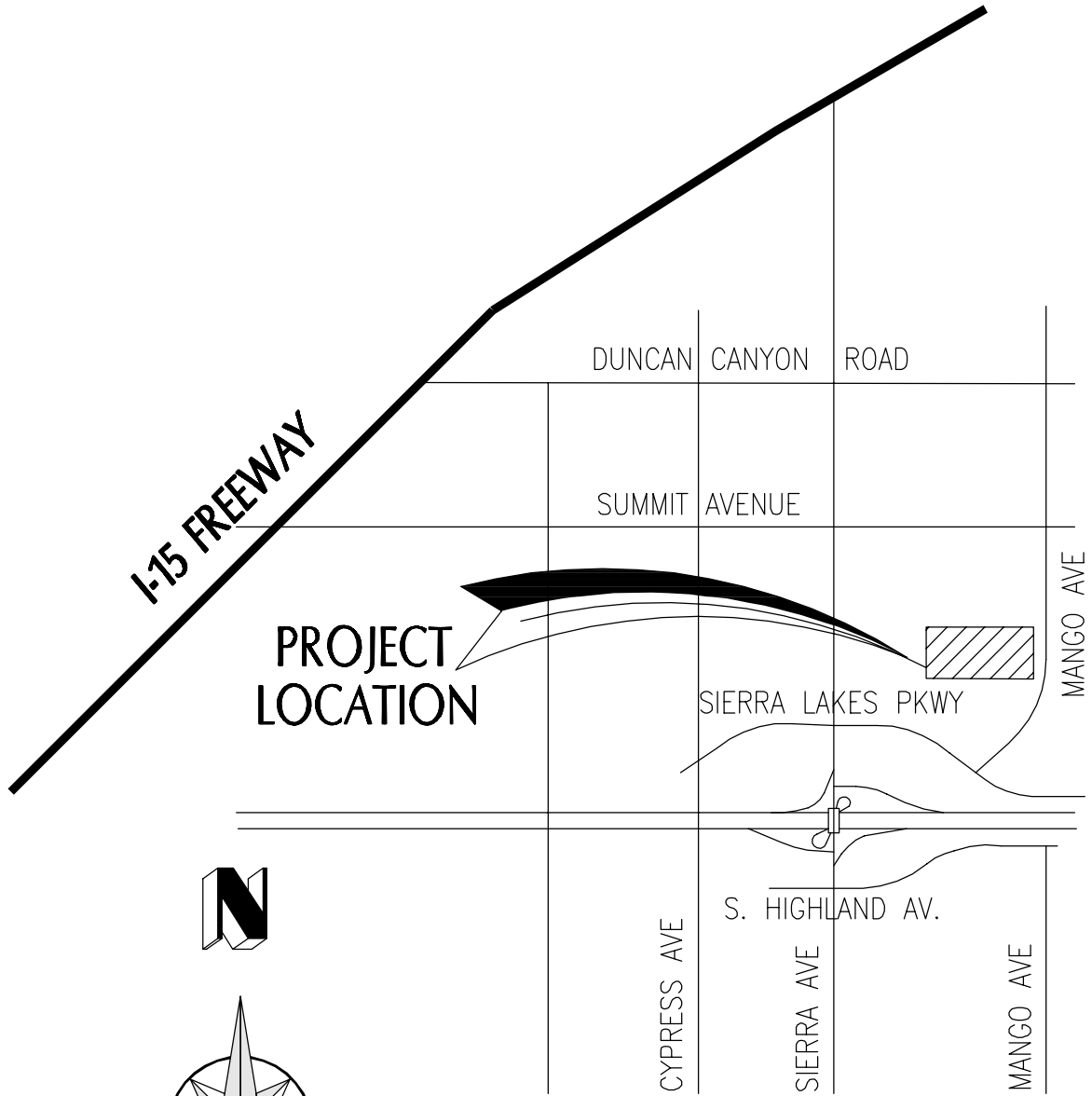
Problem Descriptions:
24" RCP Capacity Calc

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

PIPE DIAMETER(FEET) = 2.000
FLOWDEPTH(FEET) = 1.900
PIPE SLOPE(FEET/FEET) = 0.0100
MANNINGS FRICTION FACTOR = 0.013000
>>>> NORMAL DEPTH FLOW(CFS) = 24.31 > Discharge runoff 21.8 CFS OK
=====

NORMAL-DEPTH FLOW INFORMATION:

NORMAL DEPTH(FEET) = 1.90
FLOW AREA(SQUARE FEET) = 3.08
FLOW TOP-WIDTH(FEET) = 0.872
FLOW PRESSURE + MOMENTUM(POUNDS) = 548.32
FLOW VELOCITY(FEET/SEC.) = 7.885
FLOW VELOCITY HEAD(FEET) = 0.965
HYDRAULIC DEPTH(FEET) = 3.54
FROUDE NUMBER = 0.739
SPECIFIC ENERGY(FEET) = 2.87
=====



I-15 FREEWAY

DUNCAN CANYON ROAD

SUMMIT AVENUE

PROJECT LOCATION

SIERRA LAKES PKWY

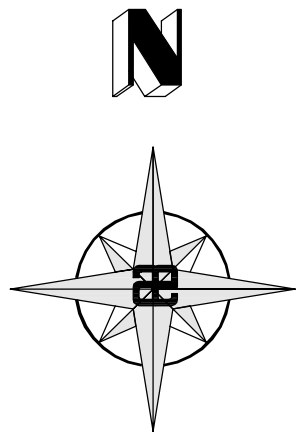
MANGO AVE

S. HIGHLAND AV.

CYPRESS AVE

SIERRA AVE

MANGO AVE



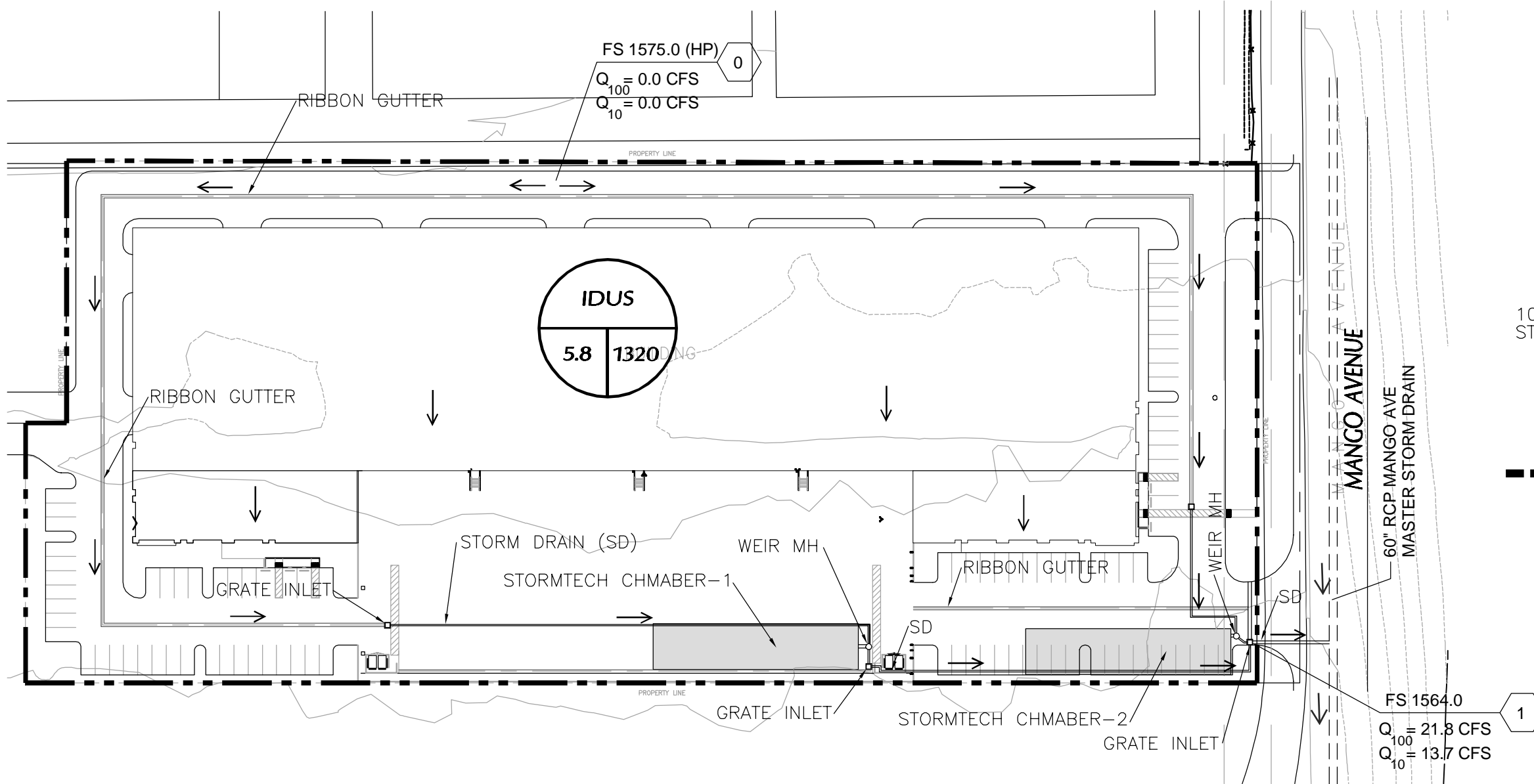
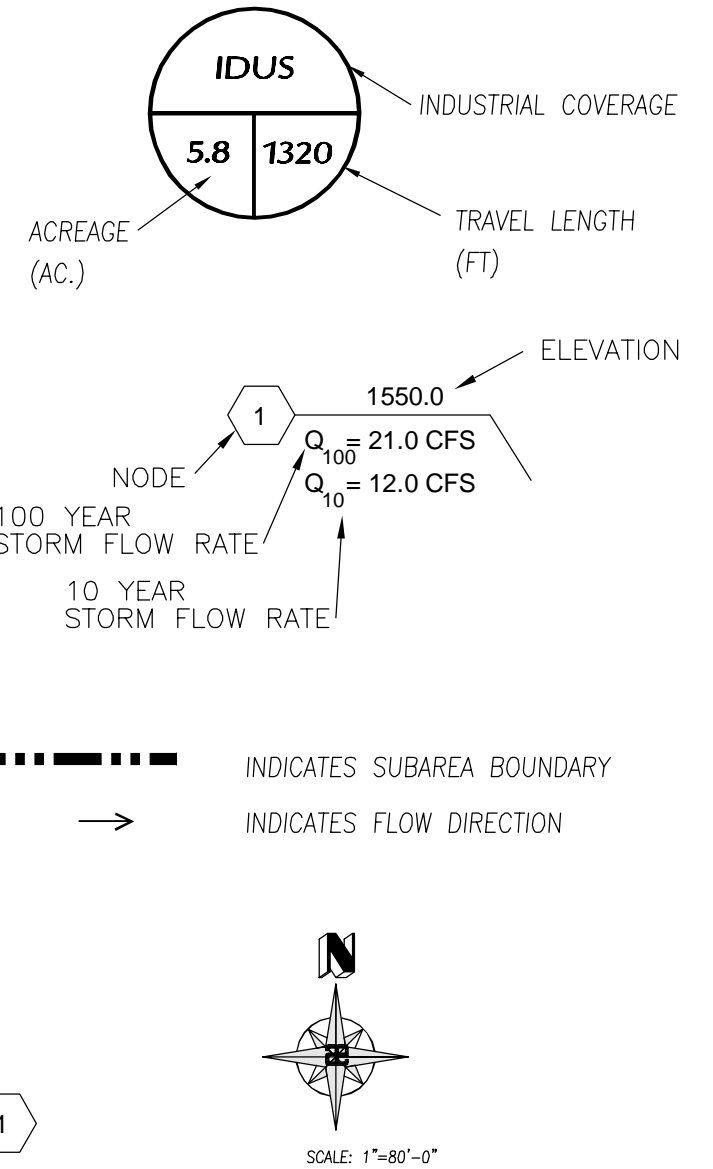
VICINITY MAP

NTS

**Drainage Exhibit
Developed Condition**

CITY OF FONTANA
DEVELOPED DRAINAGE EXHIBIT
MANGO AVENUE INDUSTRIAL

LEGEND:



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PREPARED FOR:

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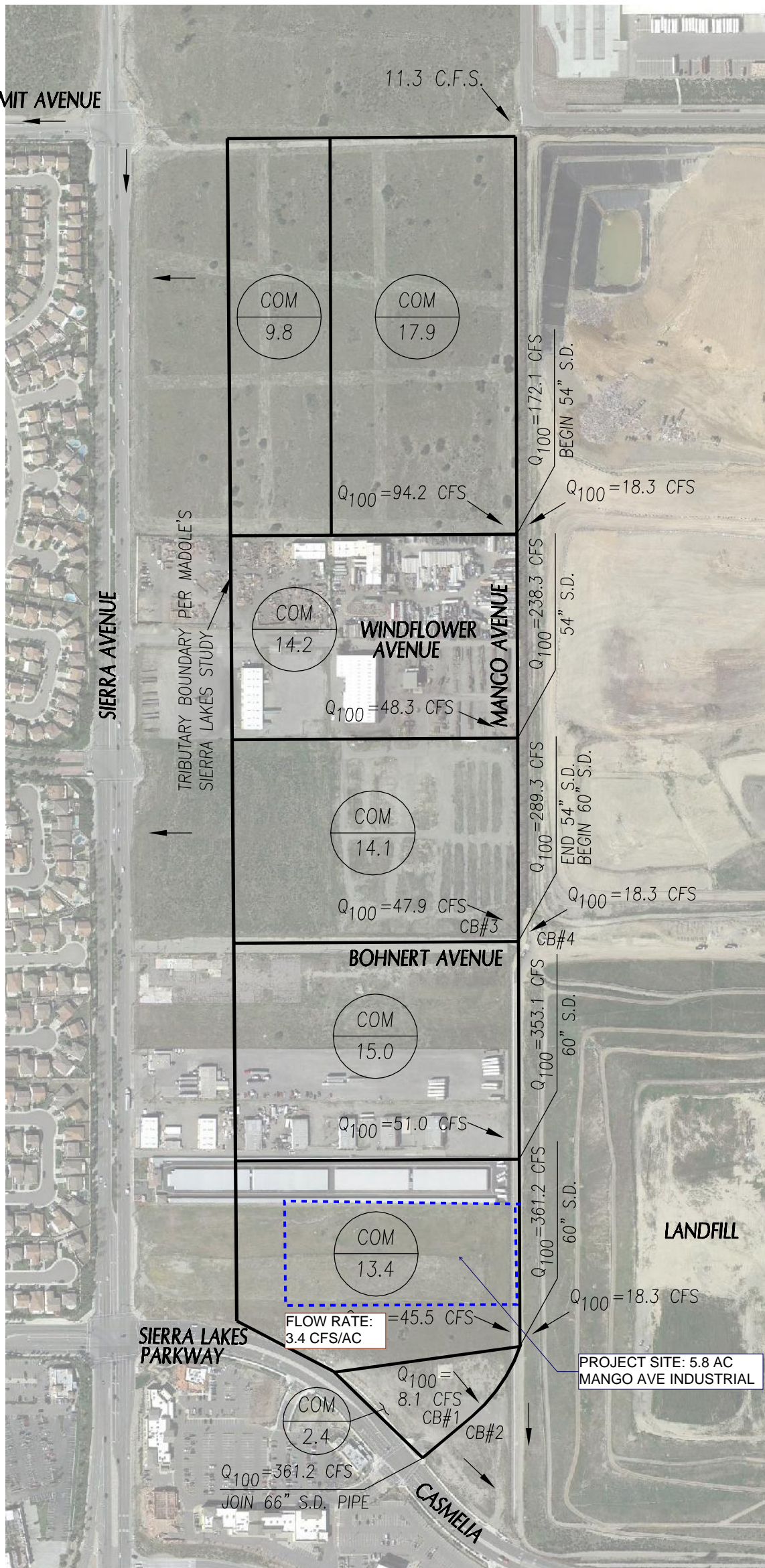
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**Developed Hydrology Map
Mango Avenue**

DEVELOPED HYDROLOGY MAP

CITY OF FONTANA

MANGO AVENUE



LEGEND

100 YEAR STORM RUNOFF (CFS) → $Q_{100} = 105.1$ CFS
 PIPE SIZE → 54" S.D.

PG → COVERAGE
 17.4 → ACREAGE (AC.)

— INDICATES SUBAREA BOUNDARY

→ FLOW DIRECTION

COM COMMERCIAL LAND COVERAGE



N.T.S.

DEVELOPED HYDROLOGY MAP

MANGO AVENUE

NOTE:
 FOR CALCULATIONS, COMMERCIAL (COM) RUNOFF WAS TAKEN TO BE 3.4 CFS/ACRE WHICH MATCHES MADOLE'S STUDY FOR SIERRA AVENUE MASTERPLAN. DRAINAGE FROM LANDFILL WAS TAKEN FROM SWT'S CLOSURE PLAN.



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