Appendix G

Preliminary Hydrology and Hydraulics Report

OTH2019-01204

CITY OF ANAHEIM RECEIVED DEC 18 2019 RG PUBLIC WORKS ENGINEERING

RCH 3

CRF ENGINEERING

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Date:	06-05-2018
Date Revised:	12-11-2019
Attention:	City of Anaheim Public Works.
Subject:	Hydrology/Hydraulics Report
Reference Project:	CRF # 17-084
Permit #:	OTH2019-01204

Property Owner:	Vasken Tatarian
Mailing Address:	8469 Beach Circle, Cypress, CA., 90630.
Phone Number:	(714) 717-0400
E-mail Address:	SakoTatarian@yahoo.com

REGISTERED PROFESSIONAL ENGINEER CESAR R. RAMIREZ No. C 78100 CIVIL STATE OF CALIFORNIA

12/12/2019.

PRELIMINARY HYDROLOGY / HYDRAULICS REPORT
3175 WEST BALL ROAD
ANAHEIM, CALIFORNIA, 92804.

APPROVED JAN 14 2020 PUBLIC WORKS DEPARTMENT SUBDIVISION SERVICES SECTION

APN: 079-882-34

The scope of the project is to comply with county regulations for the design of drainage runoff needed for a 10, 25 & 100 year storm event to maintain the project storm run-off diversion area with adequate drainage.

Existing Conditions: The area of work is approximately 15,863 sf and consists of an empty lot surrounded by apartment buildings to the North & East, and is adjacent to the centerlines of Ball Rd. and Western Ave. to the South & West. The site is outlined by an existing 6 ft block screen wall along the North & East property lines and will remain along with the proposed development. The site is mildly sloped with slopes not exceeding 1% and almost entirely consists of pervious existing grade.

Proposed Conditions: The proposed 11 apartment home development will include a three-story structure surrounded by landscape and driveway areas. The roof & second floor are partially open to the patio below on the first living floor in the center of the structure (about 620 sf). A large portion of runoff will be attributed to roof areas which will be directed towards the building limits and then underground into a BMP treatment facility. The proposed site layout is designed to gravity flow into a HDPE detention system and then pumped into one bioretention planter which will overflow into catch basins if water ponds 6". From there, water will be diverted towards the relocated catch basin located on Ball Road and into the existing storm drain system.

The project site is regulated by the City of Anaheim Drainage Criteria and the County of Orange and shall be capable of sustaining a 10, 25 & 100 year storm event using the Orange County Hydrology Manual.

C. R. F.

Sincerely,
Cesar R. Ramirez, R.C.E. 78100

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1.) HYDROLOGY CALCULATIONS

1.1 TOTAL AREA:

Net Project Area	15,863 SF
Acres =	0.364 AC

1.2 DRAINAGE MANAGEMENT AREAS:

Existing Conditions:

Drainage Management Area (Vacant Lot)

Total SQ. FT. =	15,541 SF
Total Acres =	0.357 AC

Proposed Conditions:

Drainage Management Area #1

Total SQ. FT. =	2,602 SF
Total Acres =	0.060 AC

Drainage Management Area #2

Total SQ. FT. =	5,117 SF
Total Acres =	0.117 AC

Drainage Management Area #3

Total SQ. FT. =	620 SF
Total Acres =	0.014 AC

Drainage Management Area #4

Total SQ. FT. =	1,429 SF
Total Acres =	0.033 AC

Drainage Management Area #5

Total SQ. FT. =	1,196 SF
Total Acres =	0.027 AC

Drainage Management Area #6

Total SQ. FT. =	636 SF
Total Acres =	0.015 AC

Drainage Management Area #7

Total SQ. FT. =	417 SF
Total Acres =	0.010 AC

Drainage Management Area #8

Total SQ. FT. =	551 SF
Total Acres =	0.013 AC

Drainage Management Area #9

Total SQ. FT. =	1,899 SF
Total Acres =	0.044 AC

Drainage Management Area #10

Total SQ. FT. =	317 SF
Total Acres =	0.007 AC

Drainage Management Area #11

Total SQ. FT. =	394 SF
Total Acres =	0.009 AC

Drainage Management Area #12

Total SQ. FT. =	363 SF
Total Acres =	0.008 AC

1.3 SOIL TYPE

Soil Type B

Soil Group B: Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures. Some soils having loam, silt loam, silt, or sandy clay loam textures may be placed in this group if they are well aggregated, of low bulk density, or contain greater than 35 percent rock fragments.

- Taken from NRCS Hydrology national engineering Handbook Chapter 7 – Hydrologic Soil Groups.

- See Attachments

1.4 TIME OF CONCENTRATION (Tc)

Existing Conditions (Vacant Lot):

DMA:

Length (L) of initial area =	165.8 FT
Inlet Elevation =	64.9 FT
Outlet Elevation =	64.2 FT
Difference in Elevation for Initial Area =	0.7 FT
Hydrologic Area =	15,541 SF/0.357 AC
Impervious Areas =	125 SF
Percentage of Impervious Cover (Pi) =	1%
Time of Concentration (Tc) (min.) =	9.00 MIN.

Tc calculated from the Orange county Hydrology Manual Figure D-1 **(see attachments)**

Proposed Conditions:

DMA-1:

Length (L) of initial area =	104.5 FT
Inlet Elevation =	93.16 FT
Outlet Elevation =	91.92 FT
Difference in Elevation for Initial Area =	1.24 FT
Hydrologic Area =	2,602 SF/0.060 AC
Impervious Areas =	2,602 SF
Percentage of Impervious Cover (Pi) =	100%
Time of Concentration (Tc) (min.) =	6.25 MIN.

DMA-2:

Length (L) of initial area =	121.0 FT
Inlet Elevation =	93.16 FT
Outlet Elevation =	91.92 FT
Difference in Elevation for Initial Area =	1.24 FT
Hydrologic Area =	5,117 SF/0.117 AC
Impervious Areas =	5,117 SF
Percentage of Impervious Cover (Pi) =	100%
Time of Concentration (Tc) (min.) =	6.75 MIN.

DMA-3:

Length (L) of initial area =	15.1 FT
Inlet Elevation =	64.67 FT
Outlet Elevation =	64.40 FT
Difference in Elevation for Initial Area =	0.27 FT
Hydrologic Area =	620 SF/0.014 AC
Impervious Areas =	620 SF
Percentage of Impervious Cover (Pi) =	100%
Time of Concentration (Tc) (min.) =	8.25 MIN.

DMA-4:

Length (L) of initial area =	54.6 FT
Inlet Elevation =	65.12 FT
Outlet Elevation =	64.31FT
Difference in Elevation for Initial Area =	0.81 FT
Hydrologic Area =	1,429 SF/0.033 AC
Impervious Areas =	1,329 SF
Percentage of Impervious Cover (Pi) =	93%
Time of Concentration (Tc) (min.) =	6.50 MIN.

DMA-5:

Length (L) of initial area =	9.2 FT
Inlet Elevation =	64.00 FT
Outlet Elevation =	63.61 FT
Difference in Elevation for Initial Area =	0.39 FT
Hydrologic Area =	1,196 SF/0.027 AC
Impervious Areas =	130 SF
Percentage of Impervious Cover (Pi) =	11%
Time of Concentration (Tc) (min.) =	7.50 MIN.

DMA-6:

Length (L) of initial area =	2.0 FT
Inlet Elevation =	64.00 FT
Outlet Elevation =	63.83 FT
Difference in Elevation for Initial Area =	0.17 FT
Hydrologic Area =	636 SF/0.015 AC
Impervious Areas =	110 SF
Percentage of Impervious Cover (Pi) =	17%
Time of Concentration (Tc) (min.) =	8.00 MIN.

DMA-7:

Length (L) of initial area =	15.4 FT
Inlet Elevation =	64.67 FT
Outlet Elevation =	63.54 FT
Difference in Elevation for Initial Area =	1.13 FT
Hydrologic Area =	417 SF/0.010 AC
Impervious Areas =	417 SF
Percentage of Impervious Cover (Pi) =	100%
Time of Concentration (Tc) (min.) =	6.00 MIN.

DMA-8:

Length (L) of initial area =	7.6 FT
Inlet Elevation =	64.00 FT
Outlet Elevation =	63.32 FT
Difference in Elevation for Initial Area =	0.68 FT
Hydrologic Area =	551 SF/0.013 AC
Impervious Areas =	14 SF
Percentage of Impervious Cover (Pi) =	3%
Time of Concentration (Tc) (min.) =	6.75 MIN.

DMA-9:

Length (L) of initial area =	25.1 FT
Inlet Elevation =	64.50 FT
Outlet Elevation =	64.14FT
Difference in Elevation for Initial Area =	0.36 FT
Hydrologic Area =	1,899 SF/0.044 AC
Impervious Areas =	100 SF
Percentage of Impervious Cover (Pi) =	5%
Time of Concentration (Tc) (min.) =	8.00 MIN.

DMA-10:

Length (L) of initial area =	23.4 FT
Inlet Elevation =	64.73 FT
Outlet Elevation =	64.07 FT
Difference in Elevation for Initial Area =	0.66 FT
Hydrologic Area =	317 SF/0.007 AC
Impervious Areas =	317 SF
Percentage of Impervious Cover (Pi) =	100%
Time of Concentration (Tc) (min.) =	7.00 MIN.

DMA-11:

Length (L) of initial area =	7.7 FT
Inlet Elevation =	64.40 FT
Outlet Elevation =	64.01 FT
Difference in Elevation for Initial Area =	0.39 FT
Hydrologic Area =	394 SF/0.009 AC
Impervious Areas =	393 SF
Percentage of Impervious Cover (Pi) =	0%
Time of Concentration (Tc) (min.) =	7.50 MIN.

DMA-12:

Length (L) of initial area =	22.9 FT
Inlet Elevation =	64.39 FT
Outlet Elevation =	63.84 FT
Difference in Elevation for Initial Area =	0.55 FT
Hydrologic Area =	363 SF/0.008 AC
Impervious Areas =	330 SF
Percentage of Impervious Cover (Pi) =	9%
Time of Concentration (Tc) (min.) =	7.25 MIN.

Tc calculated from the Orange county Hydrology Manual Figure D-1 **(see attachments)**

1.5 RAINFALL INTENSITY

$I(t) = (a)(t^b)$
I = Intensity (in/hr)
$a_{10} = 10.209$, $a_{25} = 11.995$, $a_{100} = 15.560$
$b_{10} = -0.573$, $b_{25} = -0.566$, $b_{100} = -0.573$
$t_1 = T_c$

Values and equations taken from the Orange County Hydrology Manual (Figure B-3) see attached.

Existing Conditions:

AREA 1

Return Period **10 Years (24hr)**

$I(t) = at^b$

$$I(t) = (10.209)(9.0)^{-0.573}$$

$I(t_1) = 2.90$ Intensity (in/hr)

Return Period **25 Years (24hr)**

$I(t) = at^b$

$$I(t) = (11.995)(9.0)^{-0.566}$$

$I(t_1) = 3.46$ Intensity (in/hr)

Return Period **100 Years (24hr)**

$I(t) = at^b$

$$I(t) = (15.560)(9.0)^{-0.573}$$

$I(t_1) = 4.42$ Intensity (in/hr)

Proposed Conditions:

RAINFALL INTENSITY				
DMA #	TC (Min.)	I (10 YR)	I (25 YR)	I (100 YR)
DMA1	6.25	3.57	4.25	5.44
DMA2	6.75	3.42	4.07	5.21
DMA3	8.25	3.05	3.63	4.64
DMA4	6.50	3.49	4.16	5.32
DMA5	7.50	3.22	3.83	4.90
DMA6	8.50	3.00	3.57	4.57
DMA7	6.00	3.66	4.35	5.57
DMA8	6.75	3.42	4.07	5.21
DMA9	8.00	3.10	3.70	4.73
DMA10	7.00	3.35	3.99	5.10
DMA11	7.50	3.22	3.83	4.90
DMA12	7.25	3.28	3.91	5.00

1.6 RUNOFF COEFFICIENT

$$C = \begin{cases} 0.90\left(A_I + \dfrac{(I - F_P)A_P}{I}\right), \text{for I greater than } F_P; \\ 0.90A_I, \text{for I less than or equal to } F_p \end{cases}$$

C	=	runoff coefficient
I	=	rainfall intensity (inches/hour)
F_p	=	infiltration rate for pervious areas (inches/hour)
A_I	=	ration of impervious area to total area (decimal fraction)
A_p	=	ration of pervious area to total area (decimal fraction

Existing Conditions:

I	=	4.42 in/hr
F_P	=	0.30 in/hr
A_I	=	0.01
A_P	=	0.99

$$C = 0.90\left(0.01 + \frac{(4.42-0.30)0.99}{4.42}\right)$$

C = 0.84

Proposed Conditions:

RUNOFF COEFFICIENT CALCULATOR												
	DMA-1	DMA-2	DMA-3	DMA-4	DMA-5	DMA-6	DMA-7	DMA-8	DMA-9	DMA-10	DMA-11	DMA-12
I =	5.44	5.21	4.64	5.32	4.90	4.57	5.57	5.21	4.73	5.10	4.90	5.00
F_P =	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
A_I =	1.00	1.00	1.00	1.00	0.11	0.17	1.00	0.03	0.06	1.00	0.00	0.09
A_p =	0.00	0.00	0.00	0.00	0.89	0.83	0.00	0.97	0.94	0.00	1.00	0.91
C =	0.90	0.90	0.90	0.90	0.85	0.85	0.90	0.85	0.85	0.90	0.84	0.85

1.7 EXISTING PEAK DISCHARGE CALCULATIONS

Q=C(I)(A)

Q = Flow (cfs)
C = Run-Off Coefficient
I = Intensity Rating (in/hr)
A = Area (Acres)

Existing Conditions:

EXISTING CONDITIONS 10 YEAR STORM FREQUENCY (24-HR)					
Inputs		Outputs (Flow Q)			
C (Runoff Coefficient)	0.84	Area 1		Area 2	
I (Rainfall Intensity in/hr A1)	2.90	CFS	0.87	CFS	0.00
I (Rainfall Intensity in/hr A2)	0	GPM	390.3	GPM	0.0
A1 (AC)	0.357				
A2 (AC)					

EXISTING CONDITIONS 25 YEAR STORM FREQUENCY (24-HR)					
Inputs		Outputs (Flow Q)			
C (Runoff Coefficient)	0.84	Area 1		Area 2	
I (Rainfall Intensity in/hr A1)	3.46	CFS	1.04	CFS	0.00
I (Rainfall Intensity in/hr A2)	0	GPM	465.7	GPM	0.0
A1 (AC)	0.357				
A2 (AC)					

EXISTING CONDITIONS 100 YEAR STORM FREQUENCY (24-HR)					
Inputs		Outputs (Flow Q)			
C (Runoff Coefficient)	0.84	Area 1		Area 2	
I (Rainfall Intensity in/hr A1)	4.42	CFS	1.33	CFS	0.00
I (Rainfall Intensity in/hr A2)	0	GPM	594.9	GPM	0.0
A1 (AC)	0.357				
A2 (AC)					

1.8 PROPOSED PEAK DISCHARGE CALCULATIONS

Proposed Conditions:

10 YEAR - 24 HOUR STORM EVENT					
INPUTS				OUTPUTS (Flow Q)	
DMA #	Coeff. C	Intensity I (in/hr)	Area A	Flow Q (cfs)	Flow Q (gpm)
DMA 1	0.90	3.57	0.060	0.19	87
DMA 2	0.90	3.42	0.117	0.36	162
DMA 3	0.90	3.05	0.014	0.04	17
DMA 4	0.90	3.49	0.033	0.10	47
DMA 5	0.85	3.22	0.027	0.07	33
DMA 6	0.85	3.10	0.015	0.04	18
DMA 7	0.90	3.66	0.010	0.03	15
DMA 8	0.85	3.42	0.013	0.04	17
DMA 9	0.85	3.10	0.044	0.12	52
DMA 10	0.90	3.35	0.007	0.02	9
DMA 11	0.84	3.22	0.009	0.02	11
DMA 12	0.85	3.28	0.008	0.02	10
			∑=	1.06	477

25 YEAR - 24 HOUR STORM EVENT					
INPUTS				OUTPUTS (Flow Q)	
DMA #	Coeff. C	Intensity I (in/hr)	Area A	Flow Q (cfs)	Flow Q (gpm)
DMA 1	0.90	4.25	0.060	0.23	103
DMA 2	0.90	4.07	0.117	0.43	192
DMA 3	0.90	3.63	0.014	0.05	21
DMA 4	0.90	4.16	0.033	0.12	55
DMA 5	0.85	3.83	0.027	0.09	39
DMA 6	0.85	3.70	0.015	0.05	21
DMA 7	0.90	4.35	0.010	0.04	18
DMA 8	0.85	4.07	0.013	0.04	20
DMA 9	0.85	3.70	0.044	0.14	62
DMA 10	0.90	3.99	0.007	0.03	11
DMA 11	0.84	3.83	0.009	0.03	13
DMA 12	0.85	3.91	0.008	0.03	12
			∑=	1.27	568

100 YEAR - 24 HOUR STORM EVENT					
INPUTS				OUTPUTS (Flow Q)	
DMA #	Coeff. C	Intensity I (in/hr)	Area A	Flow Q (cfs)	Flow Q (gpm)
DMA 1	0.90	5.44	0.060	0.29	132
DMA 2	0.90	5.21	0.117	0.55	246
DMA 3	0.90	4.64	0.014	0.06	26
DMA 4	0.90	5.32	0.033	0.16	71
DMA 5	0.85	4.90	0.027	0.11	50
DMA 6	0.85	4.73	0.015	0.06	27
DMA 7	0.90	5.57	0.010	0.05	22
DMA 8	0.85	5.21	0.013	0.06	26
DMA 9	0.85	4.73	0.044	0.18	79
DMA 10	0.90	5.10	0.007	0.03	14
DMA 11	0.84	4.90	0.009	0.04	17
DMA 12	0.85	5.00	0.008	0.03	15
			∑=	1.62	727

2.0) HYDRAULIC CALCULATIONS

2.1 PIPE DEPTH CALCULATIONS FOR 4” PVC, 6” PVC, and 12” PVC

DMA SUMMARY

Q_1 = 0.29 CFS	Q_4 = 0.16 CFS	Q_7 = 0.05 CFS	Q_{10} = 0.03 CFS
Q_2 = 0.55 CFS	Q_5 = 0.11 CFS	Q_8 = 0.06 CFS	Q_{11} = 0.04 CFS
Q_3 = 0.06 CFS	Q_6 = 0.06 CFS	Q_9 = 0.18 CFS	Q_{12} = 0.03 CFS

All DMAs will carry water to the proposed detention system before being pumped to the proposed BMP planter for a total discharge of 1.62 cubic feet per second. As extra precaution for overflow, a 1 foot diameter pipe is being proposed that will core into an existing storm drain catch basin on Western Avenue.

PIPE DEPTH CALCULATOR					
$Q = \frac{1.49}{n}(A)(R_h^{\frac{2}{3}})(S_e^{\frac{1}{2}})$		n=	0.009	Slope =	0.005
		D=	0.33	4" PVC	
Y(ft)	Y/D D=0.25	θ (rads)	Area(A)	Hyd. Rad. (Rh)	Q (cfs)
0.100	0.303	1.166	0.022	0.057	0.038
0.20	0.606	1.785	0.054	0.092	0.129
0.300	0.909	2.529	0.082	0.098	0.203
0.33	1.000	3.142	0.086	0.083	0.190

PIPE DEPTH CALCULATOR					
$Q = \frac{1.49}{n}(A)(R_h^{\frac{2}{3}})(S_e^{\frac{1}{2}})$		n=	0.009	Slope =	0.005
		D=	0.5	6" PVC	
Y(ft)	Y/D D=0.50	θ (rads)	Area(A)	Hyd. Rad. (Rh)	Q (cfs)
0.100	0.200	0.927	0.028	0.060	0.050
0.20	0.400	1.369	0.073	0.107	0.194
0.300	0.600	1.772	0.123	0.139	0.386
0.40	0.800	2.214	0.168	0.152	0.562
0.45	0.900	2.498	0.186	0.149	0.612
0.48	0.960	2.739	0.194	0.141	0.616
0.50	1.000	3.142	0.196	0.125	0.575

PIPE DEPTH CALCULATOR					
$Q = \frac{1.49}{n}(A)(R_h^{\frac{2}{3}})(S_e^{\frac{1}{2}})$		n=	0.009	Slope =	0.082
		D=	1	12" PVC	
Y(ft)	Y/D D=0.25	θ (rads)	Area(A)	Hyd. Rad. (Rh)	Q (cfs)
0.100	0.100	0.644	0.041	0.064	0.308
0.20	0.200	0.927	0.112	0.121	1.294
0.300	0.300	1.159	0.198	0.171	2.894
0.40	0.400	1.369	0.293	0.214	4.979
0.50	0.500	1.571	0.393	0.250	7.388
0.60	0.600	1.772	0.492	0.278	9.927
0.70	0.700	1.982	0.587	0.296	12.371
0.80	0.800	2.214	0.674	0.304	14.443
0.90	0.900	2.498	0.745	0.298	15.749
1.000	1.000	3.142	0.785	0.250	14.776

DMA #5 towards to the 36" ADS HPDE Detention pipe.

$Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 + Q_7 + Q_8 + Q_9 + Q_{10} + Q_{11} + Q_{12} = 1.62$ CFS.

3.0) CONCLUSION

3.1 HYDROLOGY CONCLUSIONS

The peak flow rates for the existing and proposed conditions are summarized as follows:

STORM EVENT DURATION (YR)	EXISTING CONDITIONS (CFS)	PROPOSED CONDITIONS (CFS)	DIFFERENCE (CFS)
10	0.87	1.06	+0.19
25	1.04	1.27	+0.23
100	1.33	1.62	+0.29

After analyzing the peak flows for the existing and proposed conditions we can calculate the percentage of additional flow created by the development when comparing the proposed and existing conditions

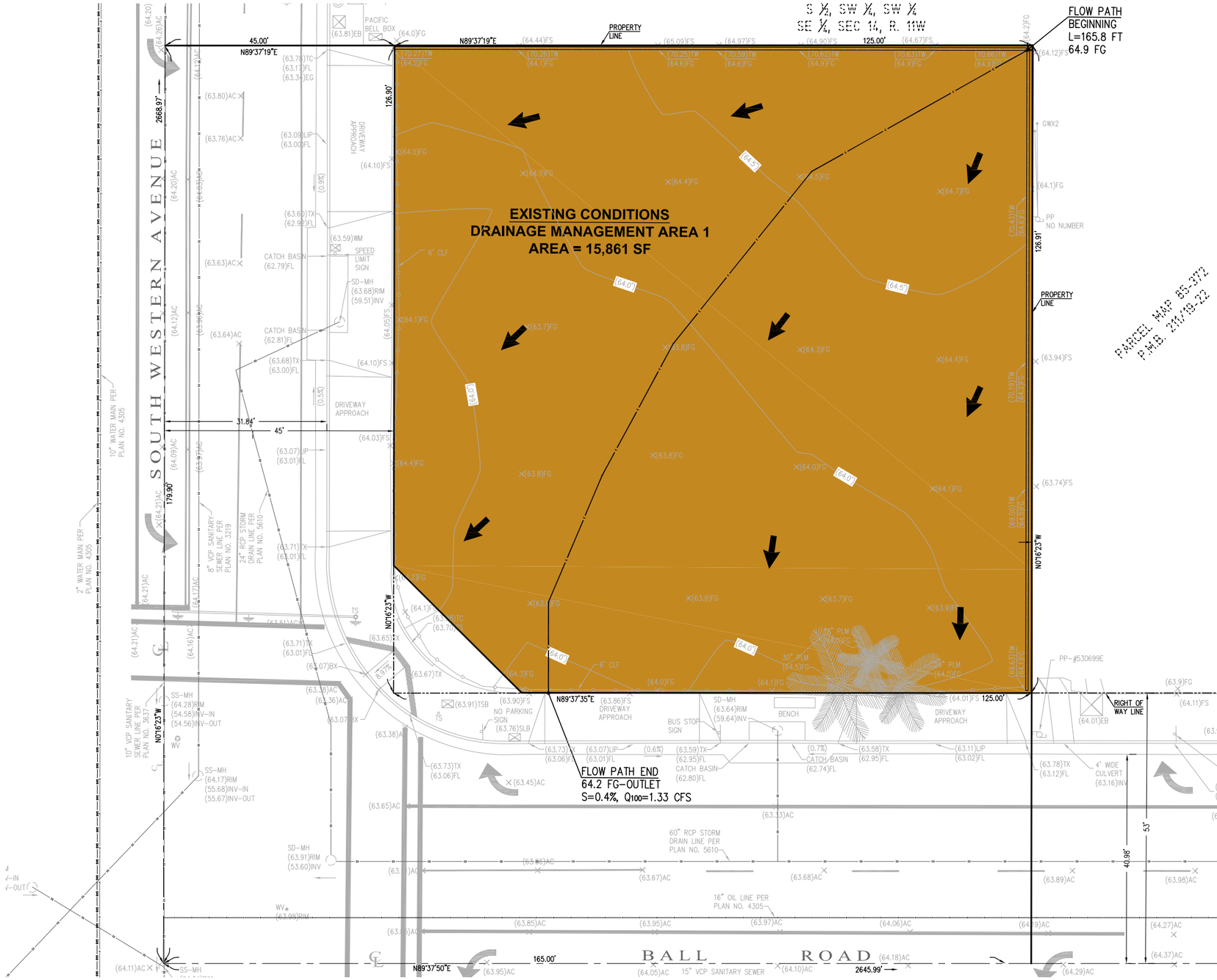
- A 10 Year Event the development is creating an additional 22% more discharge.
- A 25 Year Event the development is creating an additional 22% more discharge.
- A 100 Year Event the development is creating an additional 22% more discharge.

This development has been required to include structural BMP's as part of WQMP requirements for the project. These BMP's are focused around keeping the same hydrological conditions for a proposed development as currently existing to not overwhelm the current public drains. These BMP's also help mitigate the amount of pollutants which get released into the surrounding rivers and streams. For this project, an HDPE detention tank system and a biotreatment planter BMP have been proposed which allow runoff to be captured and treated before entering the existing storm drainage system.

For a 100 year storm, the proposed conditions have 0.28 CFS of additional discharge compared to existing conditions. Analyzing the storage volume needed using a small area runoff hydrograph, a volume of 22.27 CF is needed. The proposed detention tanks will hold 812.89 CF of volume which is 790.62 more volume than what is needed. The proposed 36" HDPE detention tank will be a total of 115 linear feet. Please see the hydrograph in the attachments.

Compared to existing conditions, the proposed conditions of the project will provide relief to the public storm drain lines. The existing conditions had water sheet flowing into the street and into the public system.

EXISTING CONDITIONS HYDROLOGY MAP



HYDROLOGY LEGEND

- DMA EXISTING CONDITIONS
- SURFACE DRAINAGE PATTERN
- HYDROLOGIC PATH OF TRAVEL

HYDROLOGIC AREA =	15,541 SF OR 0.357 AC
EXISTING CONDITIONS	
EXISTING IMPERVIOUS AREA =	125 SF
EXISTING PERVIOUS AREA =	15,416 SF
% IMPERVIOUS =	1%
RUNOFF COEFFICIENT =	0.84
LENGTH OF INITIAL AREA =	165.8 FT
DIFFERENCE IN ELEVATION =	0.7 FT
TIME OF CONCENTRATION =	9.0 MIN
PEAK DISCHARGE Q_{100} =	**1.33 CFS**

10' 0' 10' 20'

SCALE: 1"=10'

REVISIONS

NO.	INIT.	DATE	DESCRIPTION

BENCHMARK:

DESIGNATION: 7A-03

FOUND CITY OF ANAHEIM BENCHMARK, BRASS CAP MARKED CITY OF ANAHEIM BENCHMARK #300 B, IN THE TOP OF CURB AT THE SOUTHWEST END OF CURVE ON THE INTERSECTION OF BALL ROAD AND WESTERN AVENUE.

DATUM: NAVD88
ELEVATION: 63.52 FT.

"FOR PLAN CHECK ONLY"

BASIS OF BEARINGS:

THE CENTERLINE OF WEST BALL RD. STREET HAVING A BEARING OF N89°37'50"E, AS SHOWN ON P.M.B. NO. 85-372 PAGES 19-22 RECORDED IN THE COUNTY OF ORANGE RECORDER'S OFFICE.

LEGAL DESCRIPTION:

THE W'LY 170 FT OF THE S. ½ OF THE S.W. ¼ OF THE S.W. ¼ OF THE S.E. ¼ OF THE SECTION 14 TOWNSHIP 4 S., RANGE 11 W. IN THE RANCHO LOS COYOTES PER P.M.B. 85-372 PG'S. 19-22.

APN: 079-882-34

Date Printed:	11-07-2019
Date Surveyed:	12-21-2017
Project number:	17-084
Drafted By:	R.T.
Surveyed by:	U.L.
Checked by:	C.R., RCE

HYDROLOGY/HYDRAULICS MAP

SITE ADDRESS: 3175 WEST BALL ROAD

GRA 2017-XXXXX

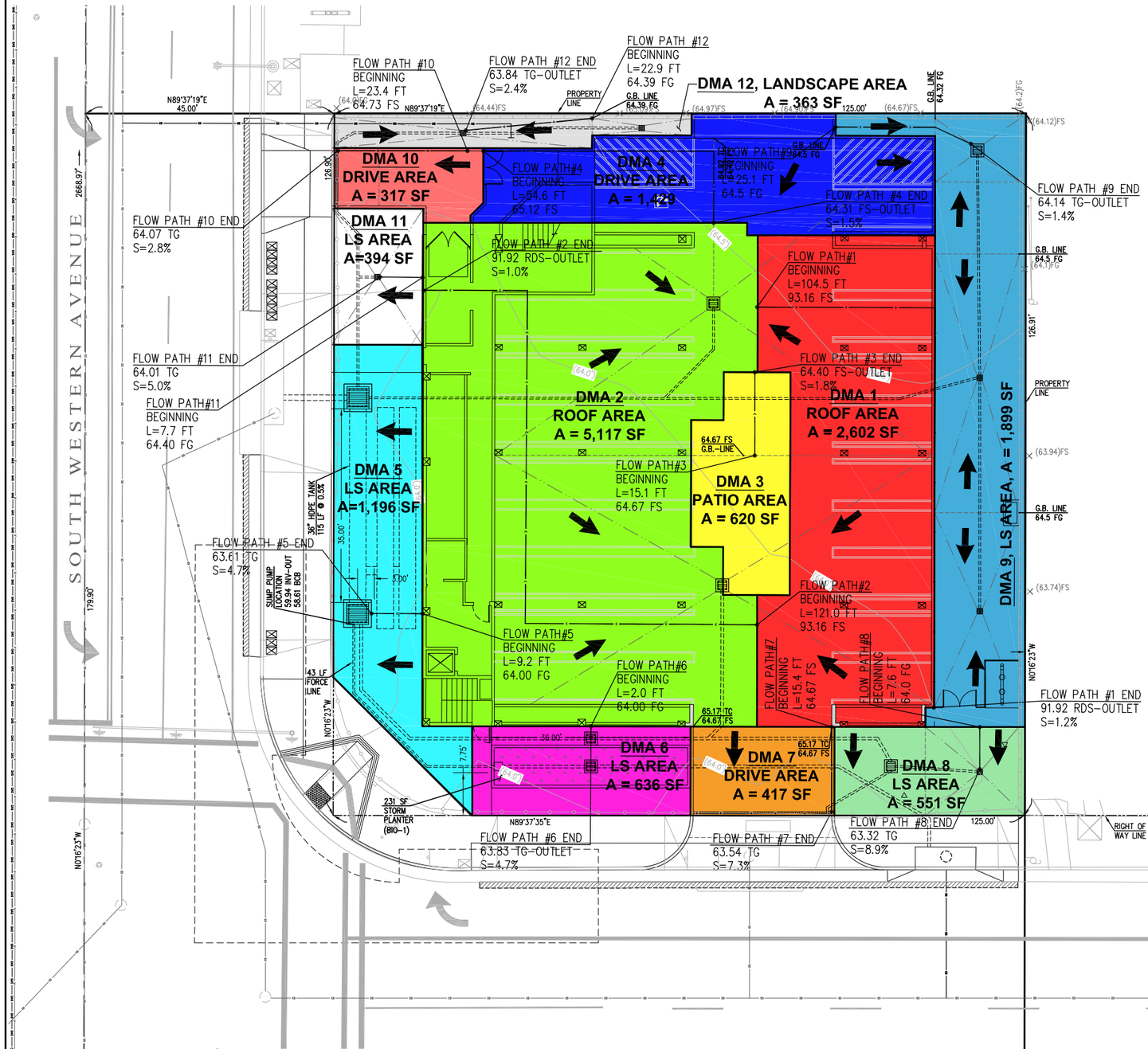
SHEET H1 OF 2

SCALE: 1"=10' | DRAWN BY: R.T. | CHECKED BY: C.R.

CITY OF ANAHEIM

FOR CITY USE ONLY

PROPOSED CONDITIONS HYDROLOGY MAP

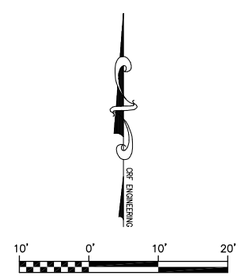


HYDROLOGIC AREA =	15,541 SF OR 0.357 AC

DMA#1		DMA#5		DMA#9	
DMA AREA =	2,602 SF OR 0.060 AC	DMA AREA =	1,196 SF OR 0.027 AC	DMA AREA =	1,899 SF OR 0.044 AC
IMPERVIOUS AREA =	2,602 SF	IMPERVIOUS AREA =	130 SF	IMPERVIOUS AREA =	100 SF
PERVIOUS AREA =	0 SF	PERVIOUS AREA =	1,066 SF	PERVIOUS AREA =	1,799 SF
PERCENTAGE IMP. =	100%	PERCENTAGE IMP. =	11%	PERCENTAGE IMP. =	5%
PEAK DISCHARGE =	**0.29 CFS**	**PEAK DISCHARGE =**	**0.11 CFS**	**PEAK DISCHARGE =**	**0.18 CFS**
DMA#2		**DMA#6**		**DMA#10**	
DMA AREA =	5,117 SF OR 0.117 AC	DMA AREA =	636 SF OR 0.015 AC	DMA AREA =	317 SF OR 0.007 AC
IMPERVIOUS AREA =	5,117 SF	IMPERVIOUS AREA =	110 SF	IMPERVIOUS AREA =	317 SF
PERVIOUS AREA =	0 SF	PERVIOUS AREA =	526 SF	PERVIOUS AREA =	0 SF
PERCENTAGE IMP. =	100%	PERCENTAGE IMP. =	17%	PERCENTAGE IMP. =	100%
PEAK DISCHARGE =	**0.55 CFS**	**PEAK DISCHARGE =**	**0.06 CFS**	**PEAK DISCHARGE =**	**0.03 CFS**
DMA#3		**DMA#7**		**DMA#11**	
DMA AREA =	620 SF OR 0.014 AC	DMA AREA =	417 SF OR 0.010 AC	DMA AREA =	394 SF OR 0.009 AC
IMPERVIOUS AREA =	620 SF	IMPERVIOUS AREA =	417 SF	IMPERVIOUS AREA =	1 SF
PERVIOUS AREA =	0 SF	PERVIOUS AREA =	0 SF	PERVIOUS AREA =	393 SF
PERCENTAGE IMP. =	100%	PERCENTAGE IMP. =	100%	PERCENTAGE IMP. =	0%
PEAK DISCHARGE =	**0.06 CFS**	**PEAK DISCHARGE =**	**0.05 CFS**	**PEAK DISCHARGE =**	**0.04 CFS**
DMA#4		**DMA#8**		**DMA#12**	
DMA AREA =	1,429 SF OR 0.033 AC	DMA AREA =	551 SF OR 0.013 AC	DMA AREA =	363 SF OR 0.008 AC
IMPERVIOUS AREA =	1,329 SF	IMPERVIOUS AREA =	14 SF	IMPERVIOUS AREA =	33 SF
PERVIOUS AREA =	100 SF	PERVIOUS AREA =	537 SF	PERVIOUS AREA =	330 SF
PERCENTAGE IMP. =	93%	PERCENTAGE IMP. =	3%	PERCENTAGE IMP. =	9%
PEAK DISCHARGE =	**0.16 CFS**	**PEAK DISCHARGE =**	**0.06 CFS**	**PEAK DISCHARGE =**	**0.03 CFS**

CIVIL ENGINEER NOTE:

(1) EXISTING PERIMETER WALLS TO RECEIVE FLOOD PROOFING TO PREVENT ANY RUN OFF FROM DISCHARGING INTO NEIGHBORING PROPERTIES.



HYDROLOGY LEGEND

- DMA AREA BOUNDARY
- SURFACE DRAINAGE PATTERN
- HYDROLOGIC PATH OF TRAVEL

REVISIONS

NO.	INIT.	DATE	DESCRIPTION

BENCHMARK:

DESIGNATION: 7A-03

FOUND CITY OF ANAHEIM BENCHMARK, BRASS CAP MARKED CITY OF ANAHEIM BENCHMARK #300 B, IN THE TOP OF CURB AT THE SOUTHWEST END OF CURVE ON THE INTERSECTION OF BALL ROAD AND WESTERN AVENUE.

DATUM: NAVD88
ELEVATION: 63.52 FT.

"FOR PLAN CHECK ONLY"

BASIS OF BEARINGS:

THE CENTERLINE OF WEST BALL RD. STREET HAVING A BEARING OF N89°37'50"E, AS SHOWN ON P.M.B. NO. 85-372 PAGES 19-22 RECORDED IN THE COUNTY OF ORANGE RECORDER'S OFFICE.

LEGAL DESCRIPTION:

THE W'LY 170 FT OF THE S. ½ OF THE S.W. ¼ OF THE S.W. ¼ OF THE S.E. ¼ OF THE SECTION 14 TOWNSHIP 4 S., RANGE 11 W. IN THE RANCHO LOS COYOTES PER P.M.B. 85-372 PG'S. 19-22.

APN: 079-882-34

Date Printed:	12-11-2019
Date Surveyed:	12-21-2017
Project number:	17-084
Drafted By:	R.T.
Surveyed by:	U.L.
Checked by:	C.R., RCE

PROPOSED HYDROLOGY/HYDRAULICS MAP

SITE ADDRESS: 3175 WEST BALL ROAD

GRA 2017-XXXXX

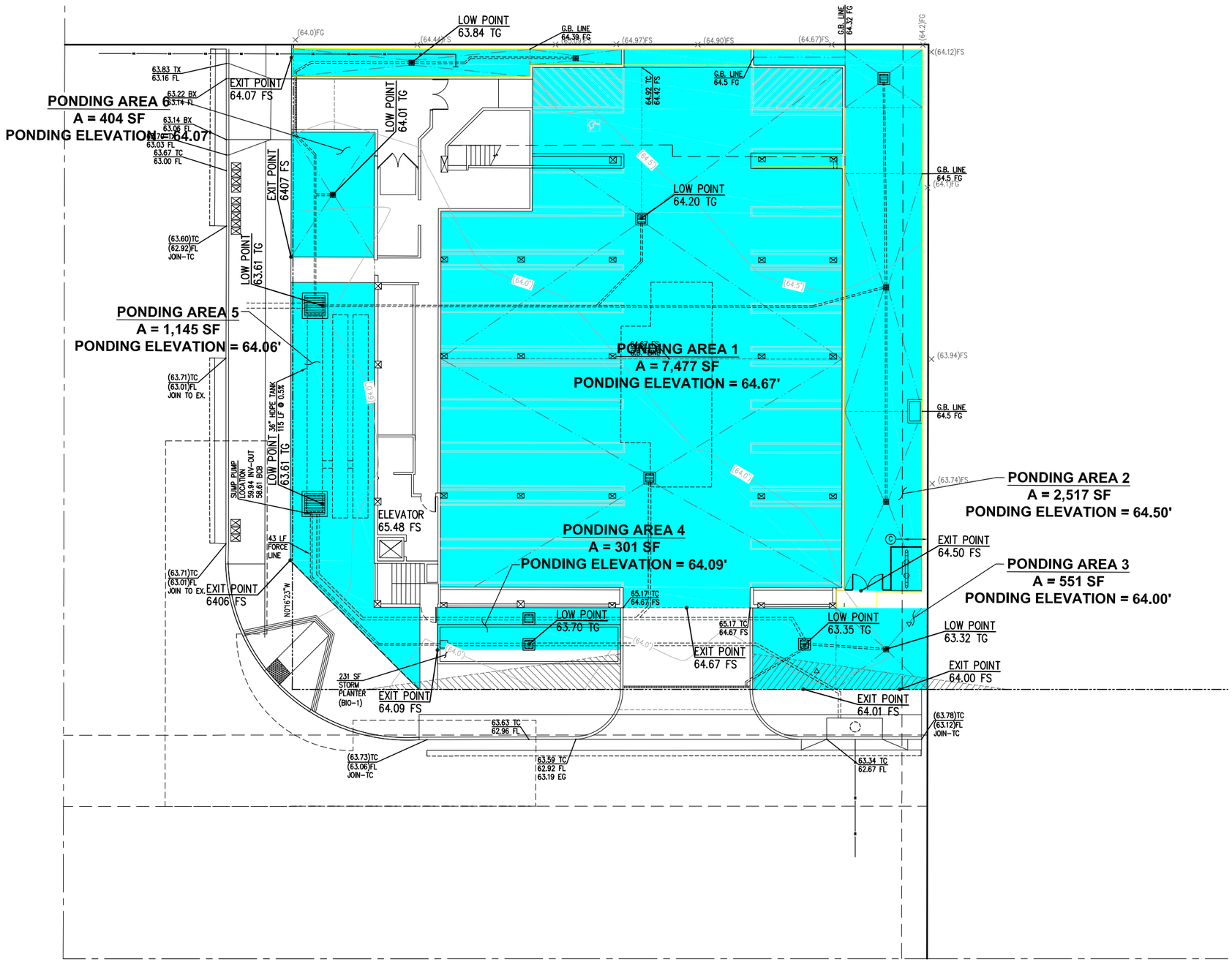
SHEET H2 OF 2

SCALE: 1"=10' | DRAWN BY: R.T. | CHECKED BY: C.R.

CITY OF ANAHEIM

FOR CITY USE ONLY

PONDING EXHIBIT



CIVIL ENGINEER NOTES:

- LOWEST FLOOR OF PROPOSED BUILDING IS A PARKING AREA SO THE 1 FOOT FREEBOARD REQUIREMENT IS MET AS THE NEXT FLOOR IS ABOVE SAID REQUIREMENT AT AN ELEVATION OF 73.92'.
- THE FINISHED SURFACE ELEVATION OF THE ELEVATOR IS 65.48' WHICH IS HIGHER THAN THE MAXIMUM PONDING ELEVATION FOR THE WHOLE PROJECT WHICH IS 64.67'.
- EXISTING PERIMETER WALLS TO RECEIVE FLOOD PROOFING TO PREVENT ANY RUN OFF FROM DISCHARGING INTO NEIGHBORING PROPERTIES.

10' 0' 10' 20'

SCALE: 1"=10'

FOR REVIEW PURPOSES ONLY, NOT FOR CONSTRUCTION

REVISIONS			
NO.	INT.	DATE	DESCRIPTION

CITY BENCHMARK:

DESIGNATION: 7A-03

FOUND CITY OF ANAHEIM BENCHMARK, BRASS CAP MARKED CITY OF ANAHEIM BENCHMARK #300 B, IN THE TOP OF CURB AT THE SOUTHWEST END OF CURVE ON THE INTERSECTION OF BALL ROAD AND WESTERN AVENUE.

DATUM: NAVD88
ELEVATION: 63.52 FT.

REGISTERED PROFESSIONAL ENGINEER
CESAR R. RAMIREZ
No. 78100
CIVIL
STATE OF CALIFORNIA

BASIS OF BEARINGS:

THE CENTERLINE OF WEST BALL ROAD HAVING A BEARING OF N89°37'35"E, AS SHOWN ON RECORD OF SURVEY NO. 2007-1051, BOOK 231, PAGE 14 RECORDED IN THE COUNTY OF ORANGE RECORDER'S OFFICE.

ARCHITECT:

A&D DESIGN
ALI DAVASLIGIL

14122 SAWSTON CIRCLE
WESTMINISTER, CA., 92683.

O: 714-894-8960
C: 714-584-7178
E: ALI@ARCHITECT1.US

Date Printed:	12-11-2019
Date Surveyed:	12-19-2017
Project Number:	17-084
Drafted By:	U.L.
Surveyed By:	U.L.
Checked By:	C.R., RCE

PONDING EXHIBIT

SITE ADDRESS: 3175 WEST BALL ROAD

GRA
2017-XXXXX

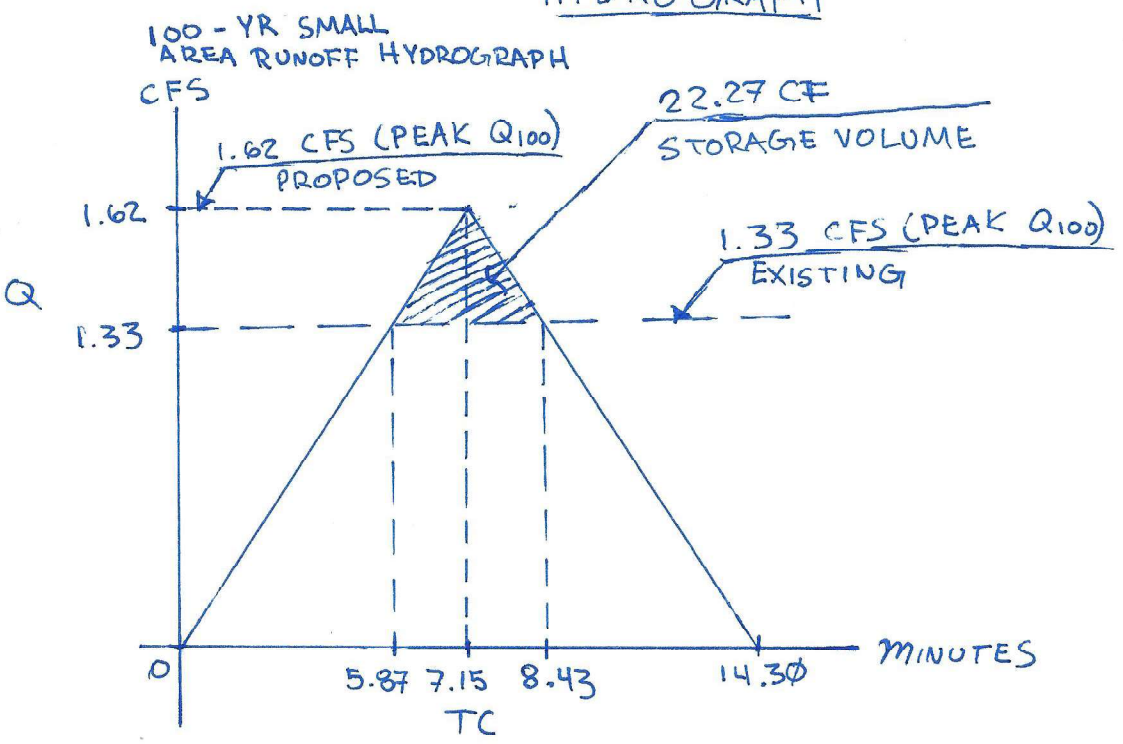
SHEET 1 OF 1

SCALE: 1"=10' | DRAWN BY: R.T. | CHECKED BY: C.R.

CITY OF ANAHEIM

FOR CITY USE ONLY

HYDROGRAPH



CALCULATIONS:

V = VOLUME IN EXCESS OF Q ALLOWABLE OVER 24-HRS

$V = \frac{1}{2}(dQ)(dTIME)$

$dTIME = 8.43 - 5.87 = 2.56 \text{ min} \times 60 \text{ sec/min} = 153.6 \text{ sec}$

$dCFS = 1.62 - 1.33 = 0.29 \text{ CFS}$

$VOLUME = \frac{1}{2}(153.6)(0.29) = 22.27 \text{ CF}$

DETENTION VOLUME PROVIDED = 812.89 CF > 22.27 CF (OK)

LEGEND:

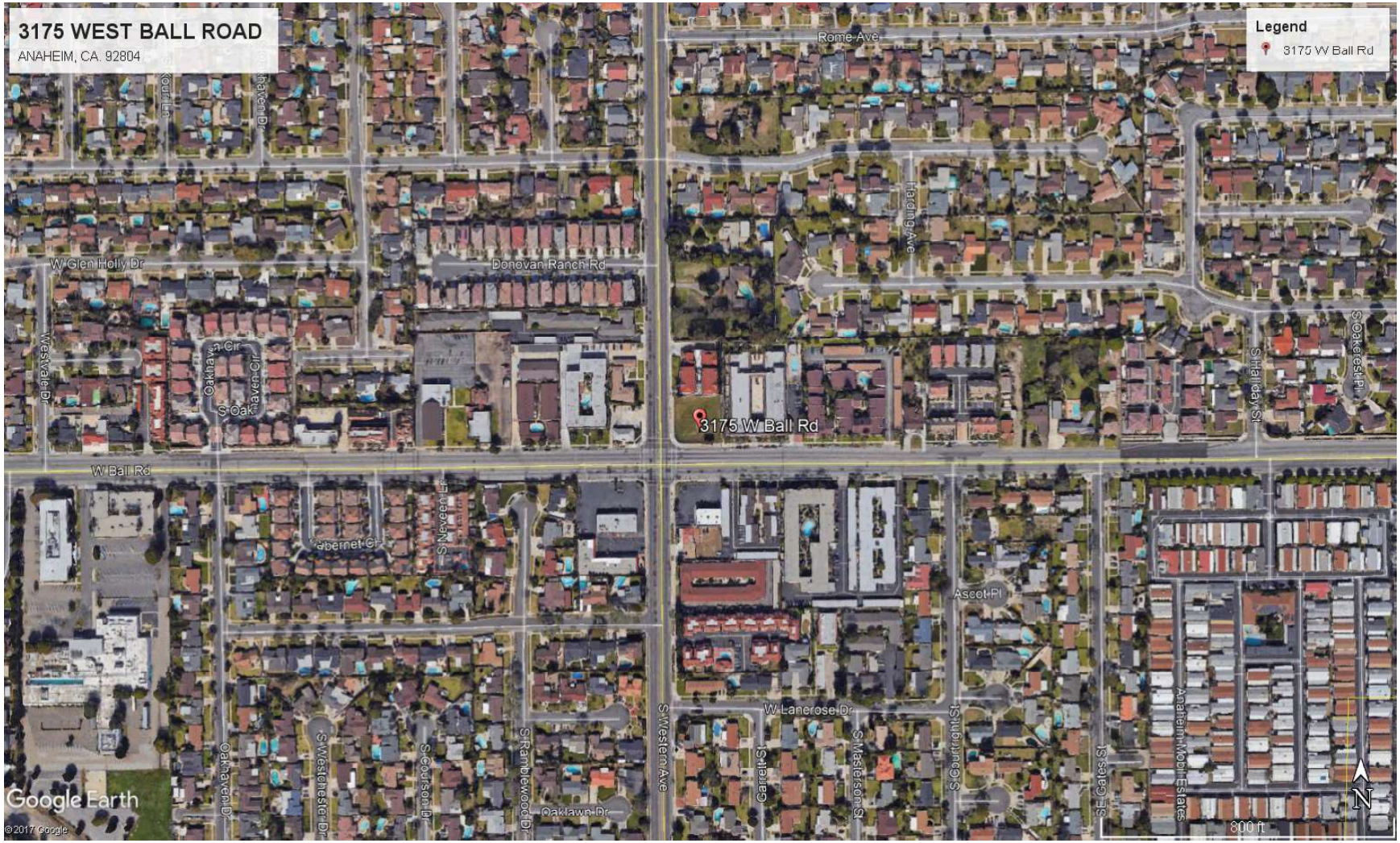
T_C - TIME OF CONCENTRATION

d - RATE OF CHANGE

NOTE:

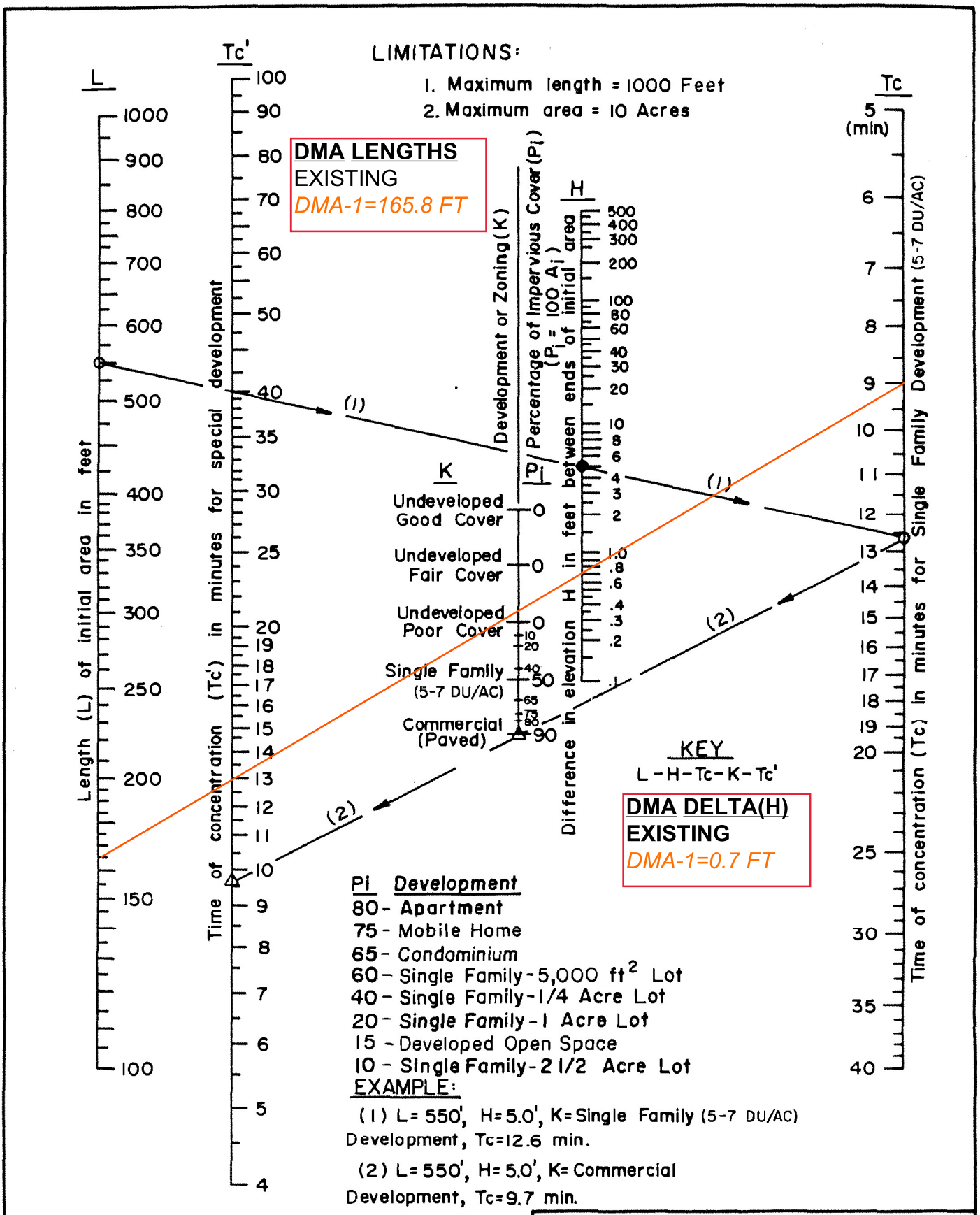
T_C - BASED ON (100-YR STORM EVENT)

VICINITY MAP



LATITUDE: 33°49’03.44” N, LONGITUDE: 118°00’06.42” W, SITE ELEVATION: 57 ft

EXISTING CONDITIONS DMA



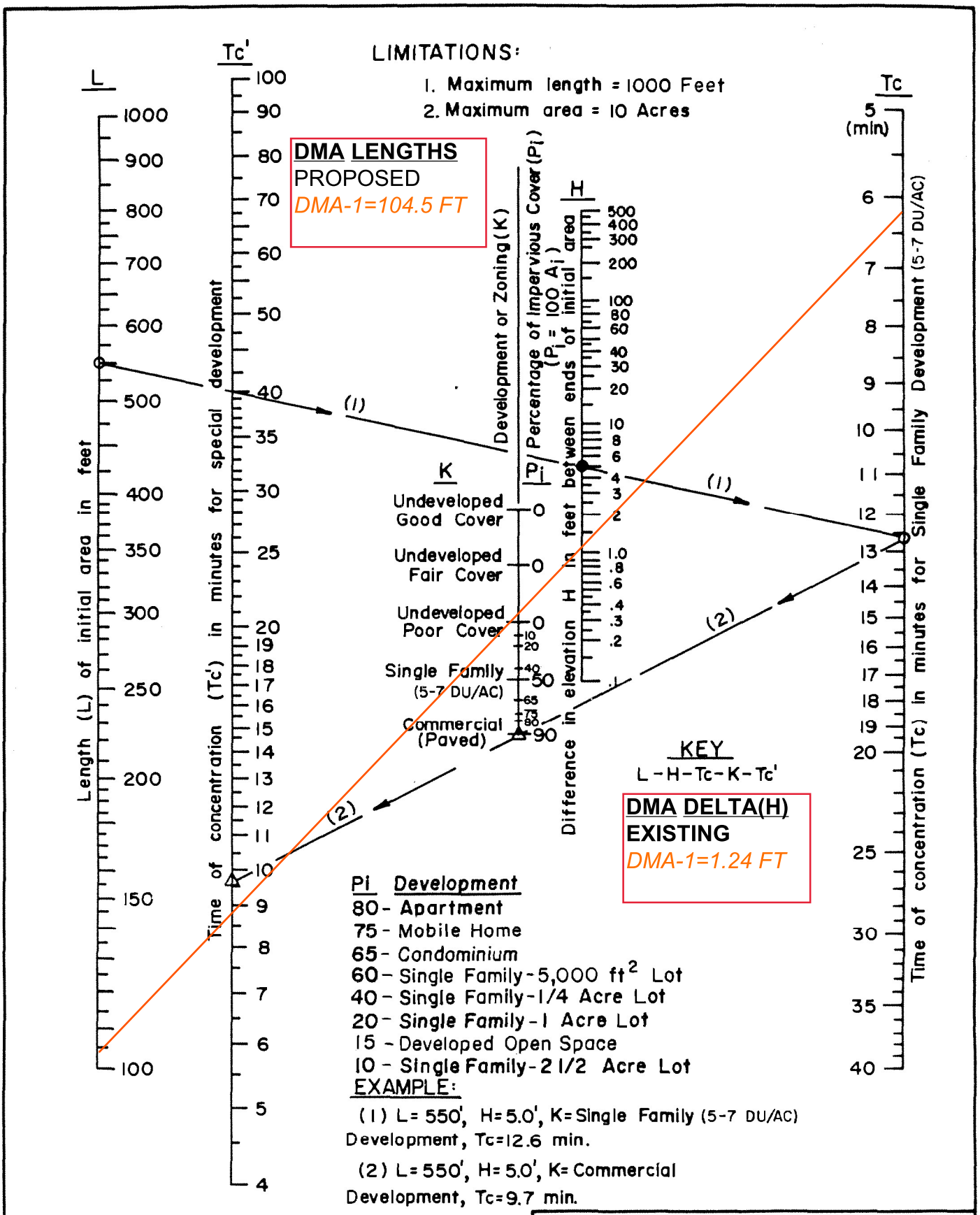
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #1



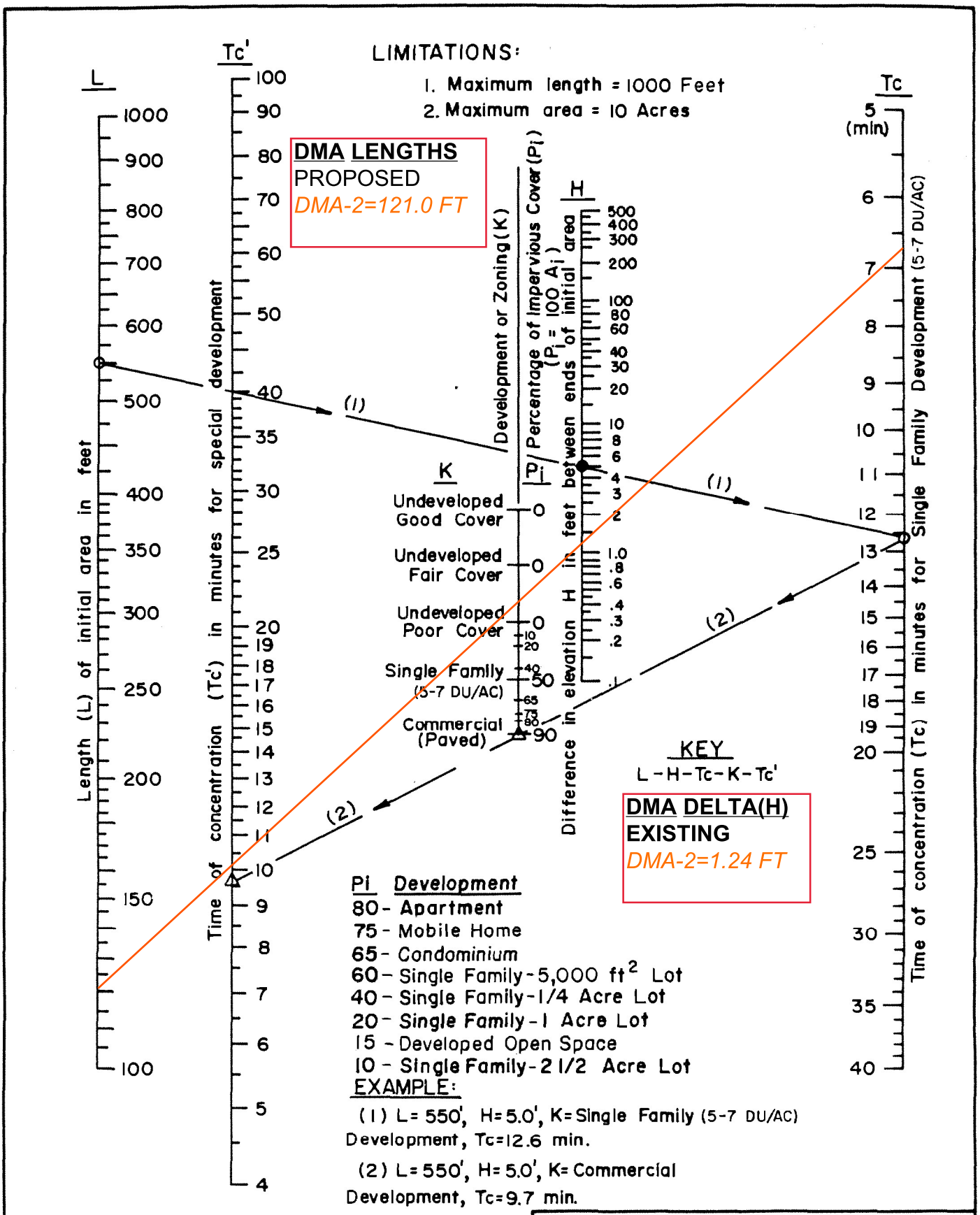
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #2



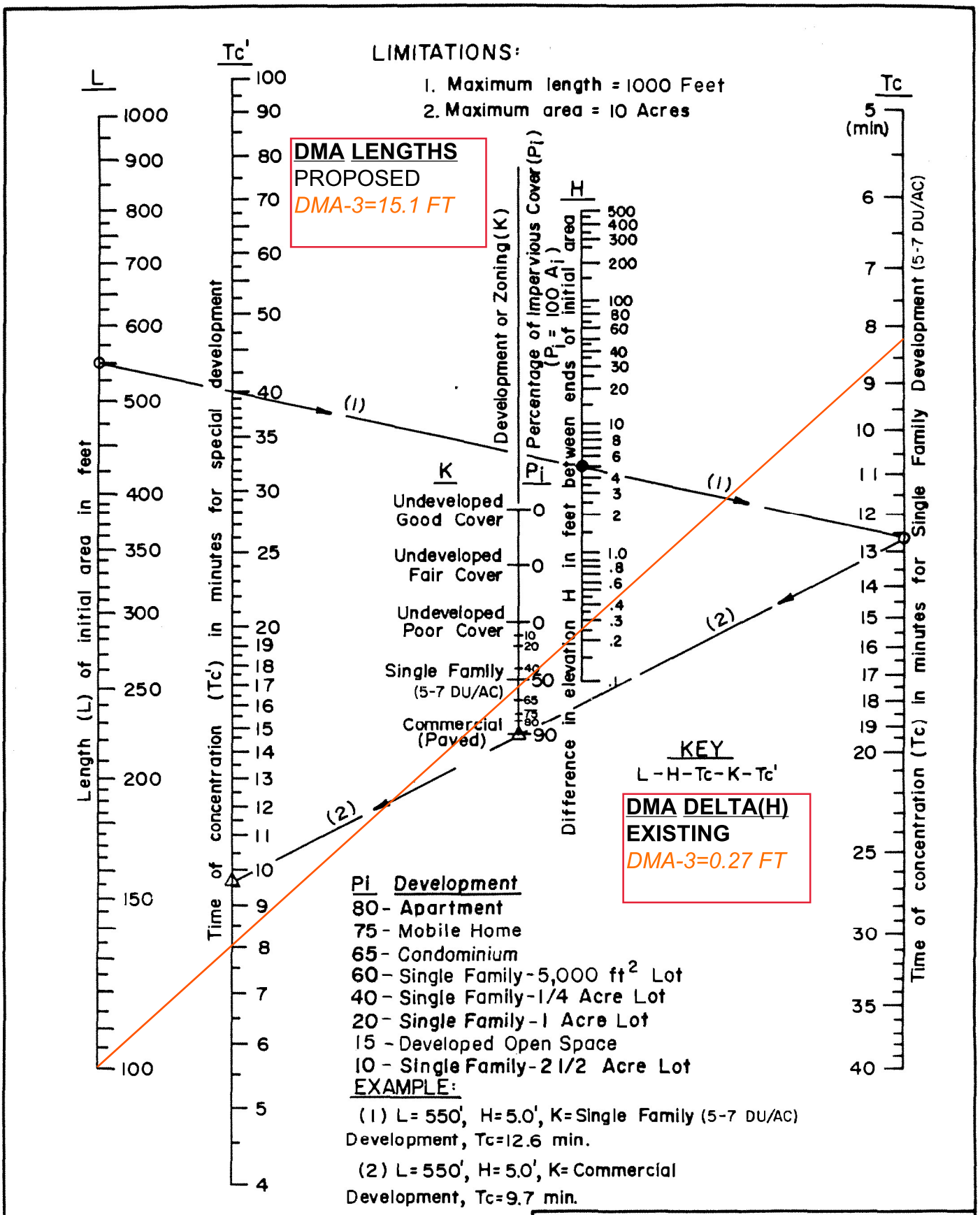
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #3



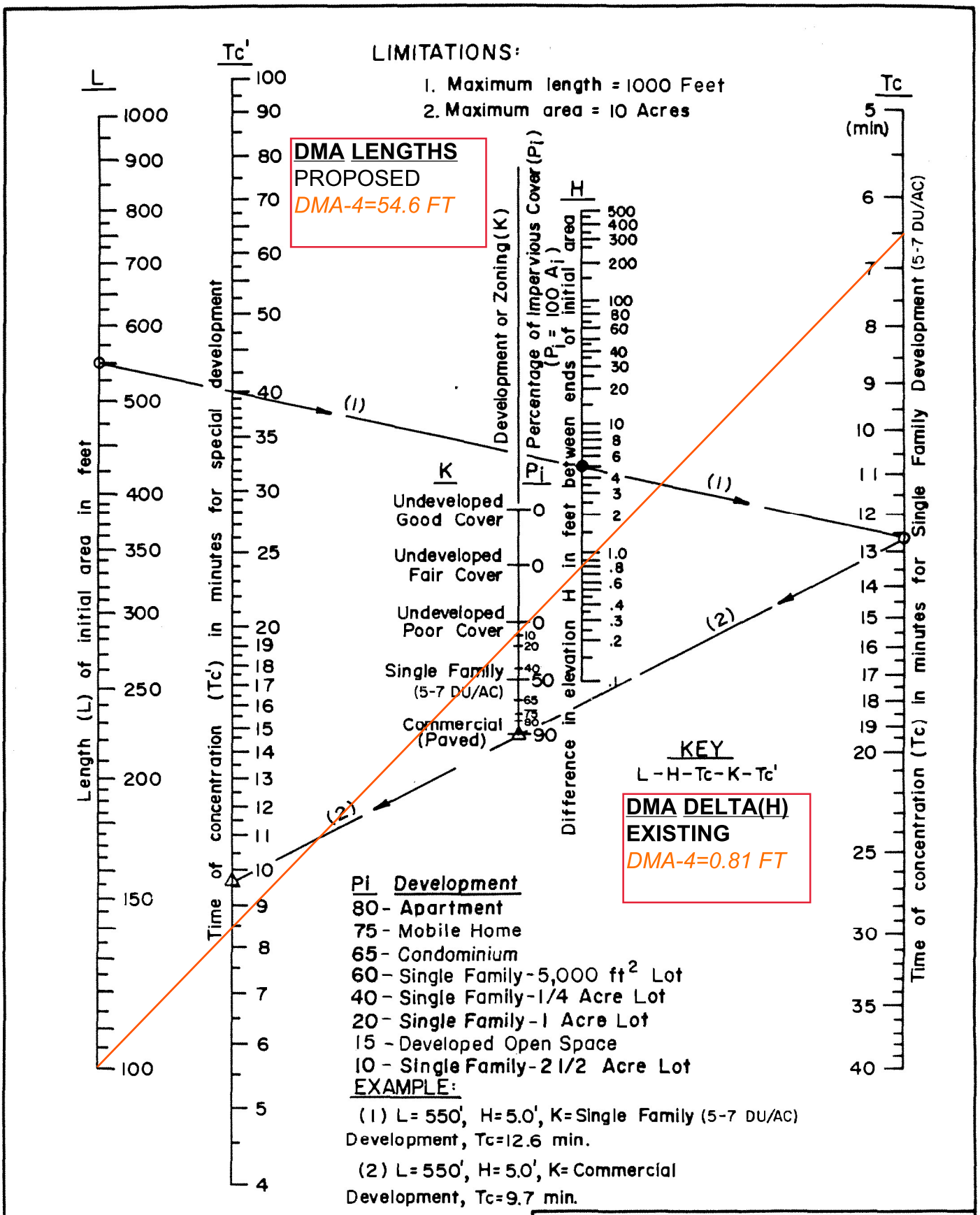
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #4



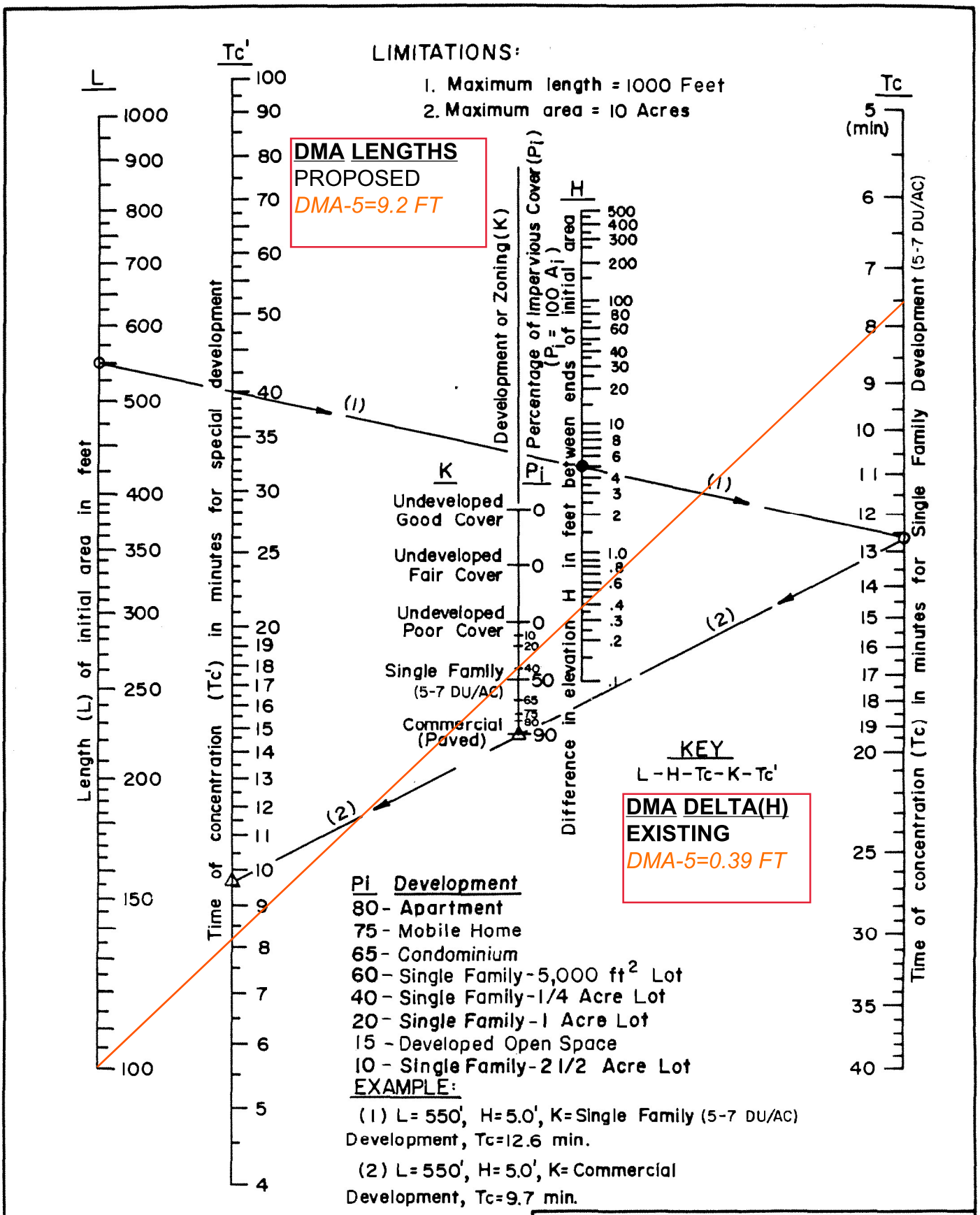
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #5



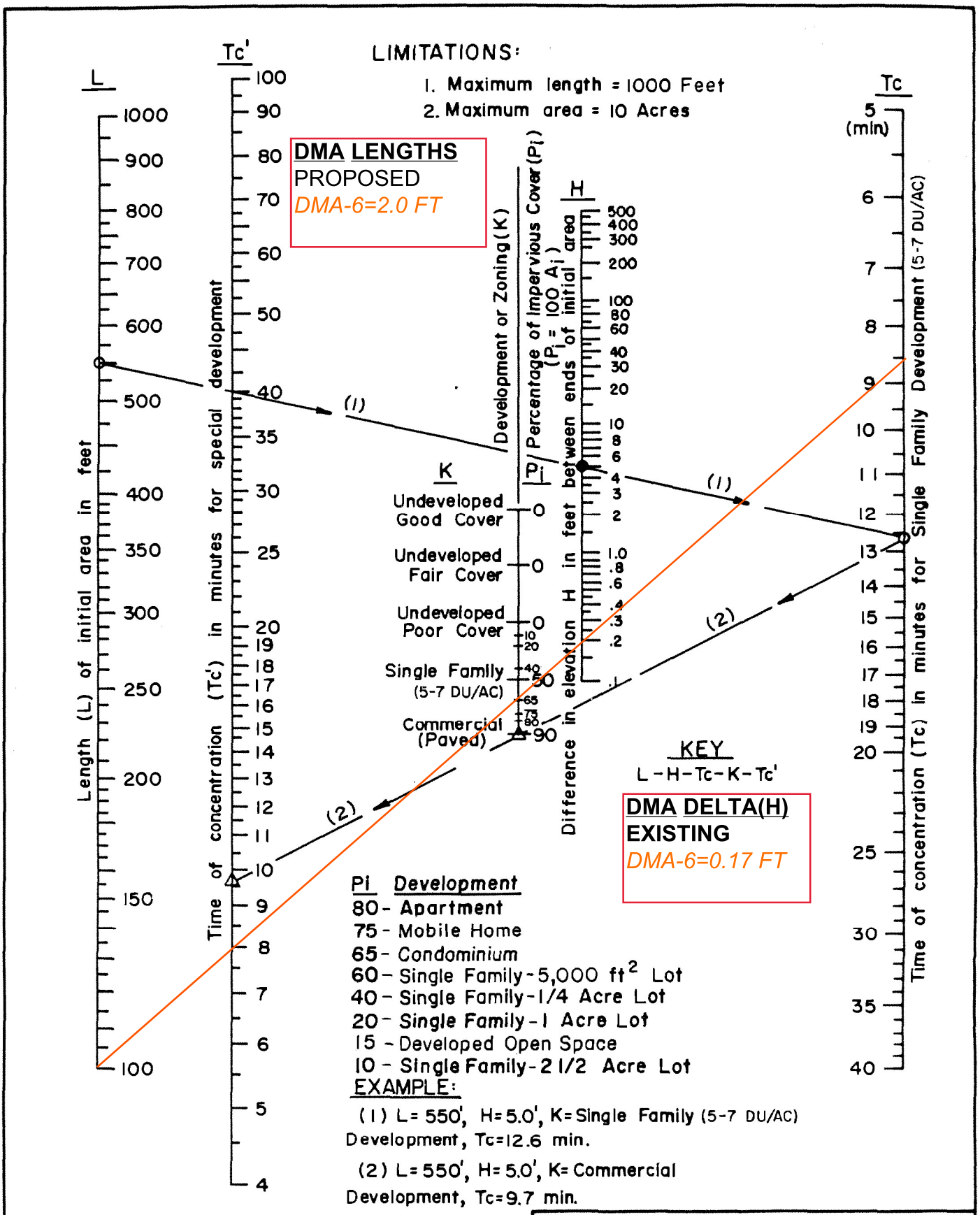
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #6



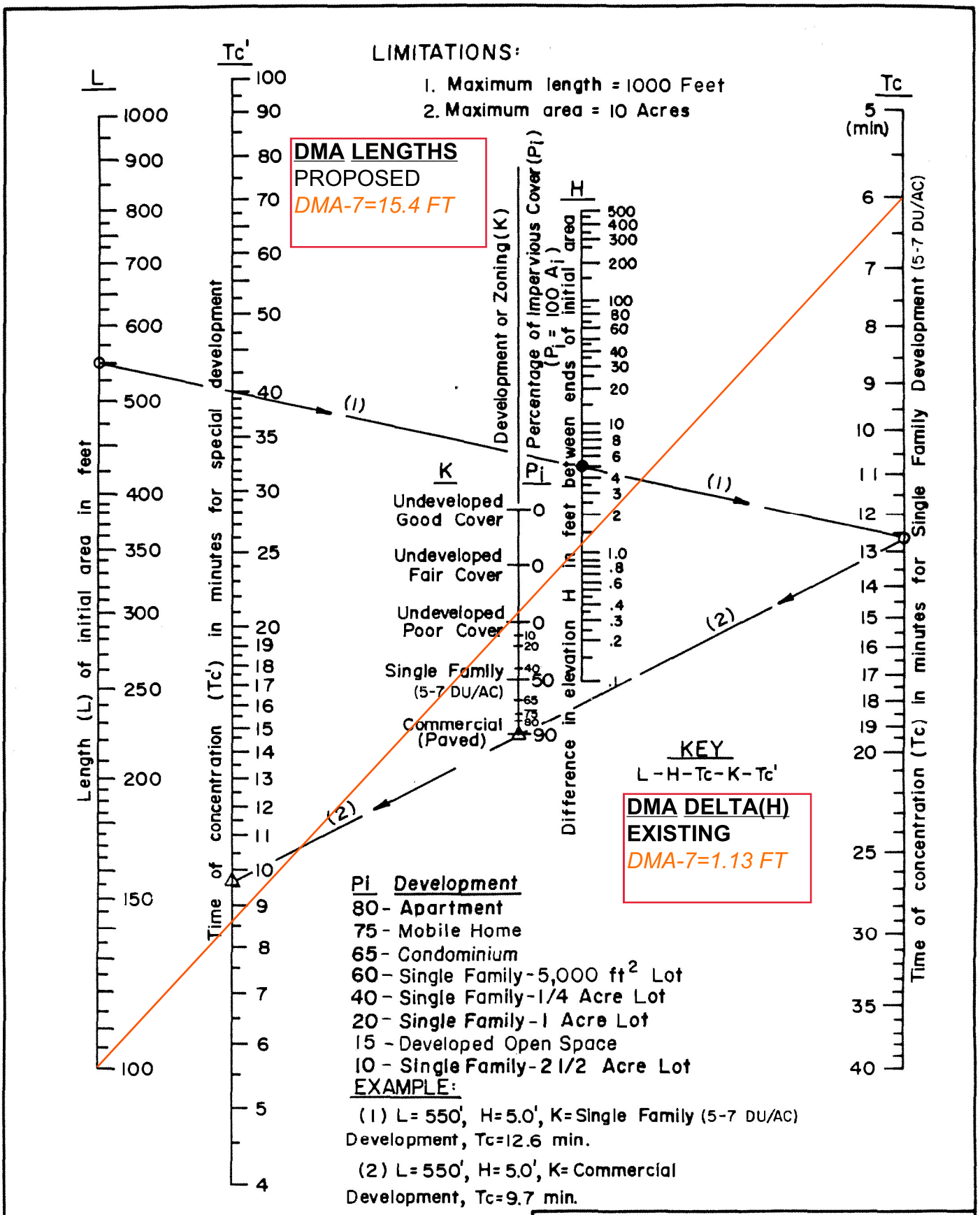
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #7



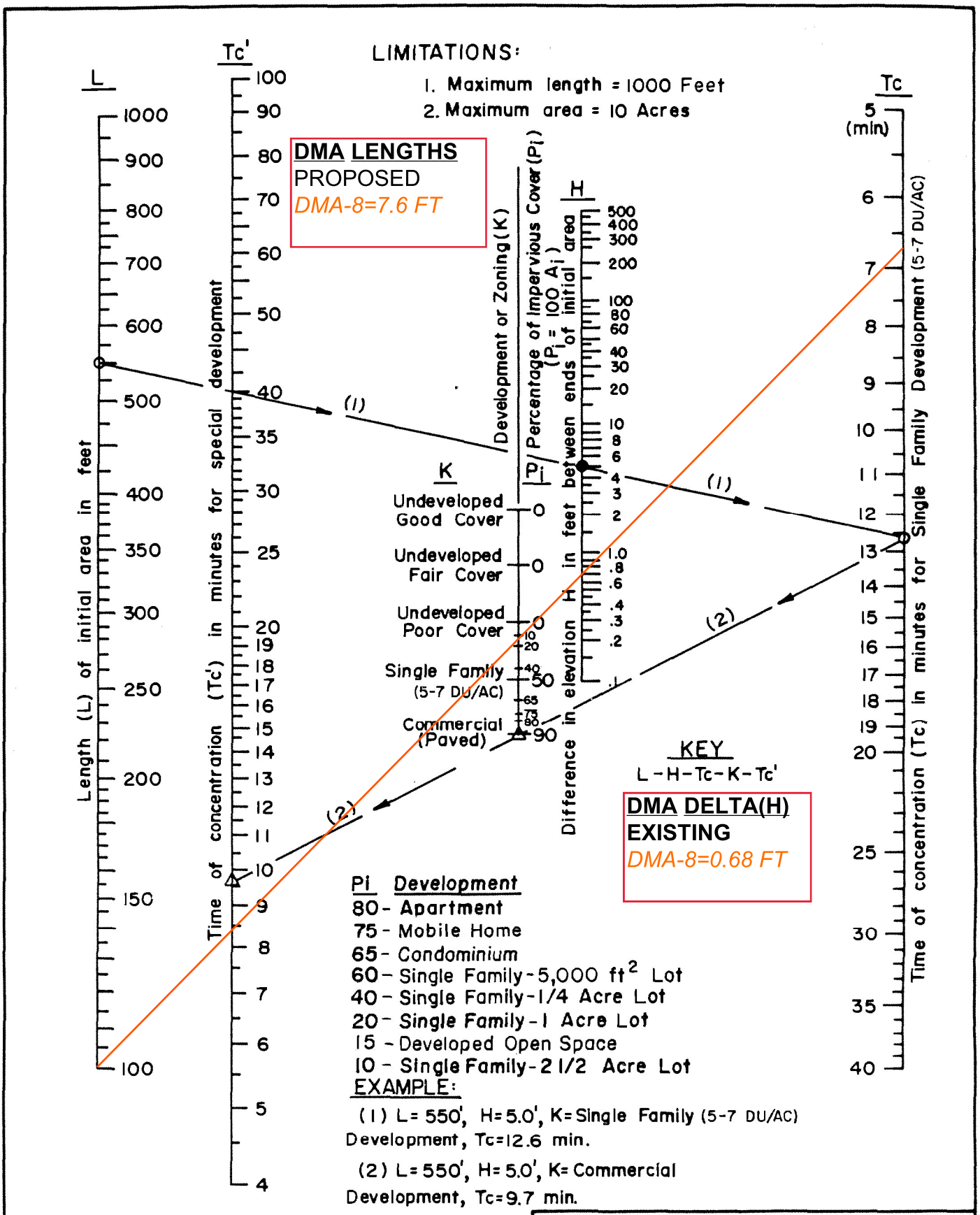
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #8



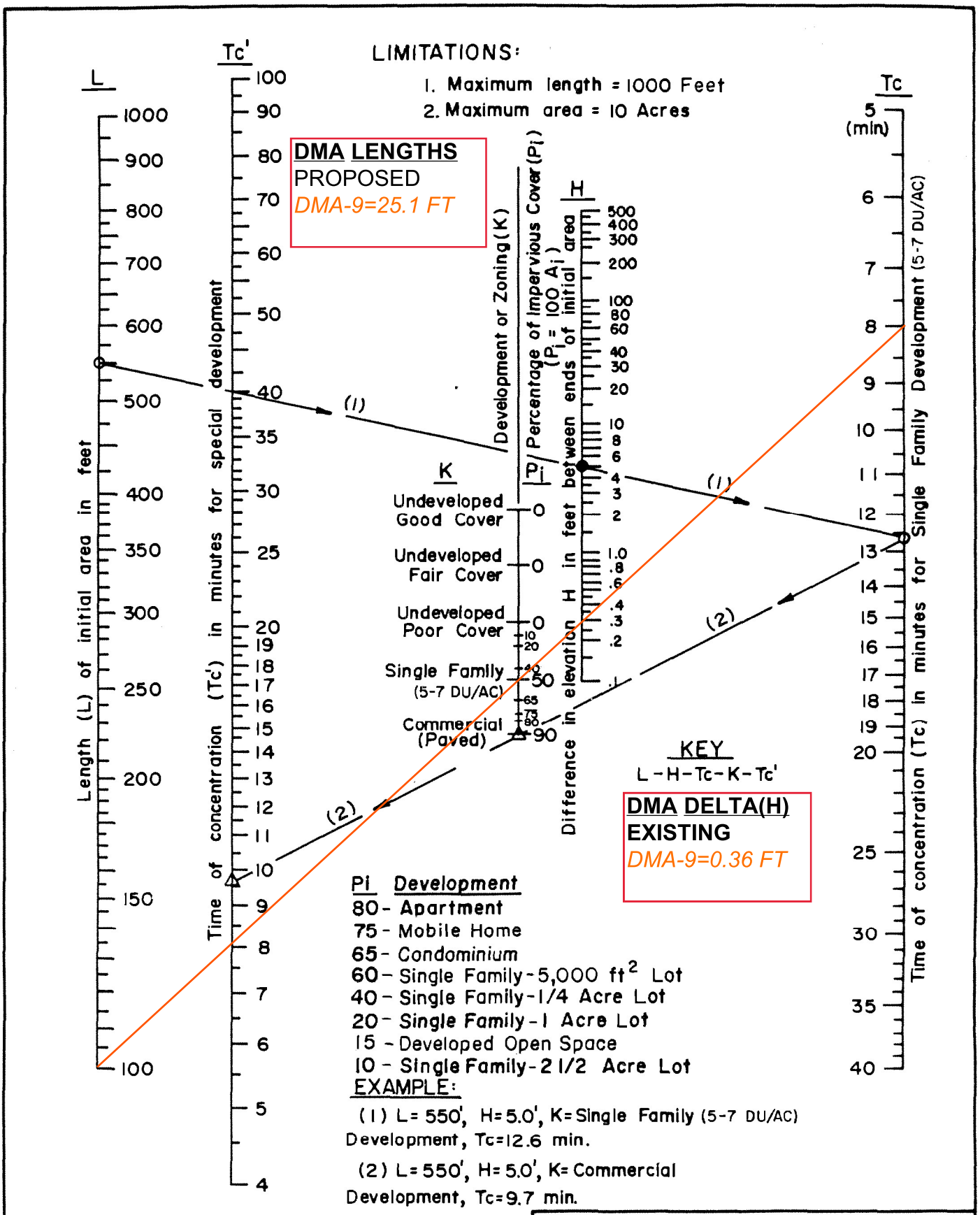
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #9



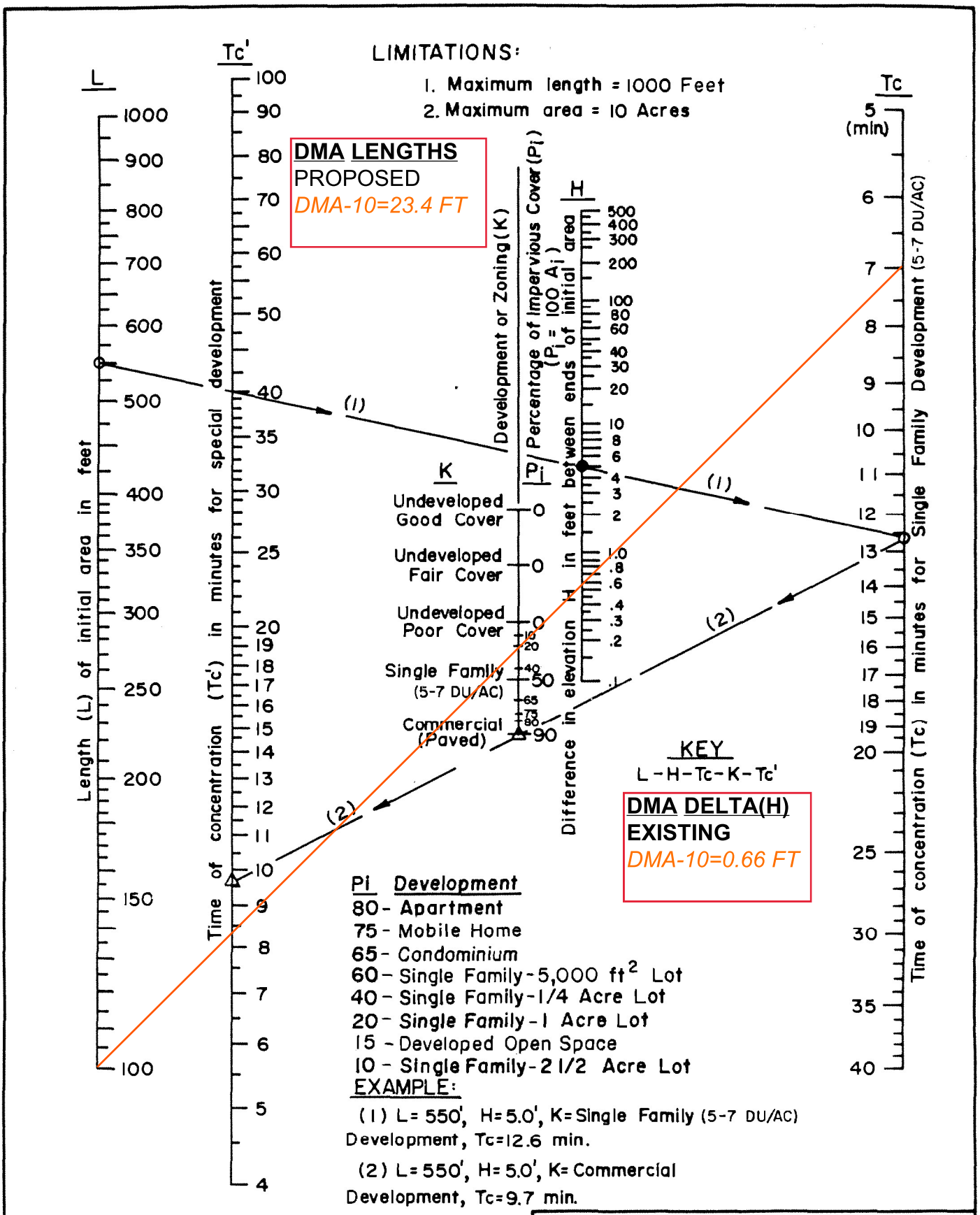
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #10



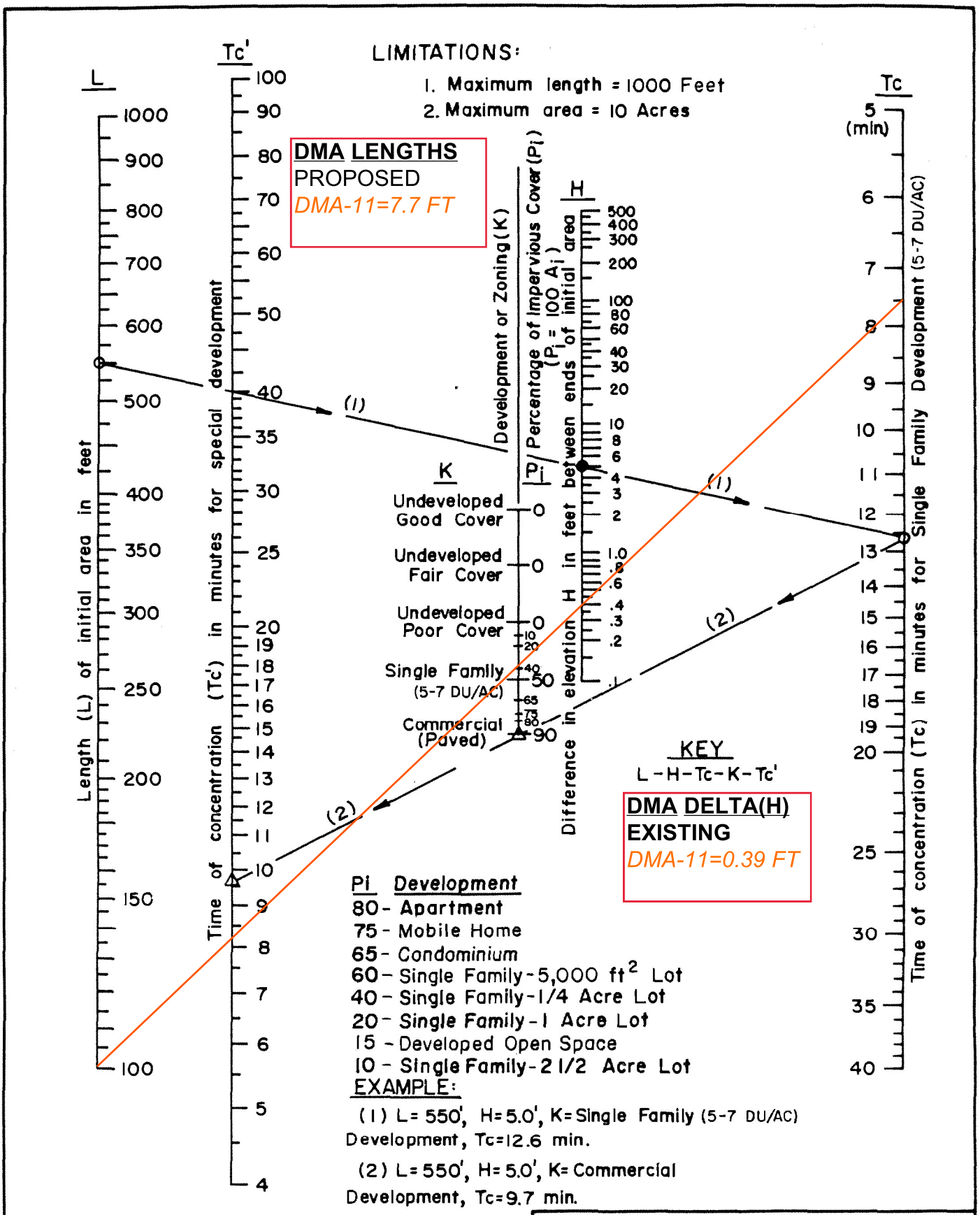
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #11



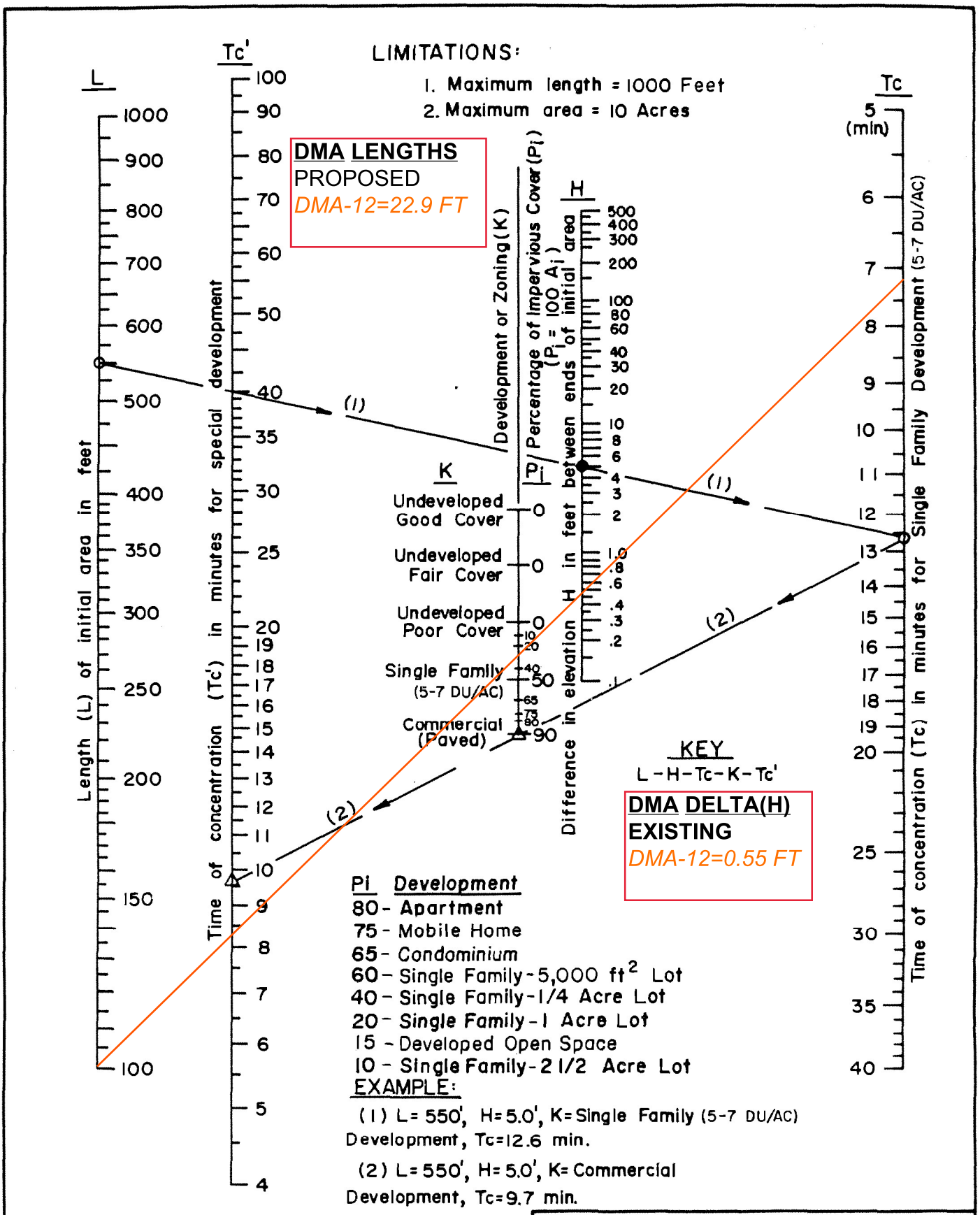
ORANGE COUNTY

HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

PROPOSED CONDITIONS DMA #12



ORANGE COUNTY

HYDROLOGY MANUAL

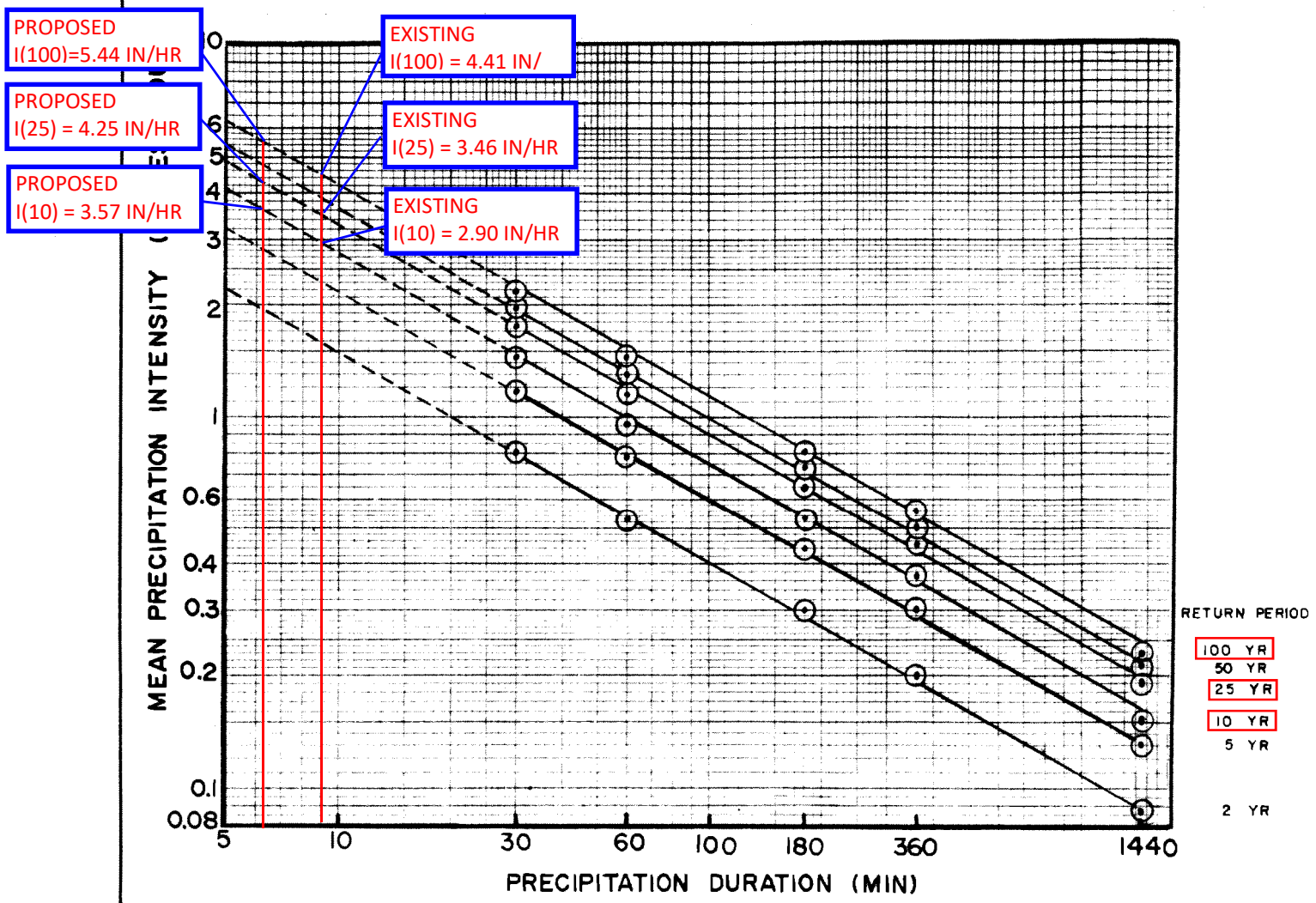
TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

Regression Equations: $I(t) = at^b$

(I= Intensity in inches/hour, t= duration in minutes)

Return Frequency (years)	a	b
2	5.702	-0.574
5	7.870	-0.562
10	10.209	-0.573
25	11.995	-0.566
50	13.521	-0.566
100	15.560	-0.573



ORANGE COUNTY
HYDROLOGY MANUAL

MEAN PRECIPITATION INTENSITIES FOR NONMOUNTAINOUS AREAS

Figure B-3

SUBJECT TO FURTHER REVISION

3175 WEST
BALL ROAD
SOIL TYPE: B

LOS ANGELES COUNTY
ORANGE COUNTY

SAN BERNARDINO COUNTY
ORANGE COUNTY

RIVERSIDE COUNTY
ORANGE COUNTY

LOS ANGELES COUNTY
ORANGE COUNTY

LEGEND

City Boundaries

Hydrologic Soil Groups

- A Soils
- B Soils
- C Soils
- D Soils

Source:
Soils: Natural Resources Conservation Service (NRCS)
Soil Survey - soil_ca678, Orange County & Western Riverside
Date of publication: 2006-02-08
http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

0 2.5 5 10 Kilometers
0 1.8 3.6 7.2 Miles

P:\9526E\GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2a_HydroSoils_20110215.mxd

TITLE
NRCS HYDROLOGIC SOILS GROUPS

JOB
ORANGE COUNTY INFILTRATION STUDY
ORANGE CO. CA

SCALE	1" = 1.8 miles
DESIGNED	TH
DRAWING	TH
CHECKED	BMP
DATE	02/09/11
JOB NO.	9526-E

PACE
Advanced Water Engineering

FIGURE
XVI-2a

TABLE 1 *Values of Runoff Coefficient* C

URBAN AREAS:	
Type of drainage area	Runoff coefficient C
Lawns: Sandy soil, flat 2% Sandy soil, average, 2 - 7% Sandy soil, steep, 7% Heavy soil, flat, 2% Heavy soil, average, 2 - 7% Heavy soil, steep, 7%	0.05 - 0.10 0.10 - 0.15 0.15 - 0.20 0.13-0.17 0.18 - 0.22 0.25 - 0.35
Business: Downtown areas Neighborhood areas	0.70 - 0.95 0.50.0.70
Residential: Single-family areas Multi units, detached Multi units, attached Suburban Apartment dwelling areas	0.30 - 0.50 0.40 - 0.60 0.60 - 0.75 0.25 - 0.40 0.50 - 0.70
Industrial: Light areas Heavy areas	 0.50 - 0.80 0.60 - 0.90
Parks, cemeteries	0.10 - 0.25
Playgrounds	0.20 - 0.35
Railroad yard areas	0.20 - 0.40
Unimproved areas	0.10 - 0.30
Streets: Asphaltic Concrete Brick	0.70 - 0.95 0.80 - 0.95 0.70 - 0.85
Drives and walks Roofs	0.75 - 0.85 0.75 - 0.95

AGRICULTURAL AREAS:

Topography and Vegetation	Runoff Coefficient C Soil Texture		
	Soil Texture		
	Open Sandy Loam	Clay and Silt Loam	Tight Clay
Woodland Flat 0 - 5% Slope Rolling 5 - 10% Slope Hilly 10 - 30% Slope	 0.10 0.25 0.30	 0.30 0.35 0.50	 0.40 0.50 0.60
Pasture Flat Rolling Hilly	0.10 0.16 0.22	0.30 0.36 0.42	0.40 0.55 0.60
Cultivated Flat Rolling Hilly	 0.30 0.40 0.52	 0.50 0.60 0.72	 0.60 0.70 0.82

Orange County and Part of Riverside County, California

163—Metz loamy sand

Map Unit Setting

National map unit symbol: hcn8
Elevation: 30 to 2,500 feet
Mean annual precipitation: 20 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 200 to 340 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Metz and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Metz

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from mixed

Typical profile

H1 - 0 to 17 inches: loamy sand
H2 - 17 to 63 inches: stratified sand to fine sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B

Ecological site: SANDY (1975) (R019XD035CA)
Hydric soil rating: No

Minor Components

Riverwash
Percent of map unit: 4 percent
Landform: Fans
Hydric soil rating: Yes

San emigdio, fine sandy loam
Percent of map unit: 4 percent
Hydric soil rating: No

Hueneme, fine sandy loam
Percent of map unit: 4 percent
Hydric soil rating: No

Corralitos, loamy sand
Percent of map unit: 4 percent
Hydric soil rating: No

Metz, mod fine substratum
Percent of map unit: 4 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Orange County and Part of Riverside County, California
Survey Area Data: Version 11, Sep 12, 2017

Manning's n for Closed Conduits Flowing Partly Full (Chow, 1959).

Type of Conduit and Description	Minimum	Normal	Maximum
1. Brass, smooth:	0.009	0.010	0.013
2. Steel:			
Lockbar and welded	0.010	0.012	0.014
Riveted and spiral	0.013	0.016	0.017
3. Cast Iron:			
Coated	0.010	0.013	0.014
Uncoated	0.011	0.014	0.016
4. Wrought Iron:			
Black	0.012	0.014	0.015
Galvanized	0.013	0.016	0.017
5. Corrugated Metal:			
Subdrain	0.017	0.019	0.021
Stormdrain	0.021	0.024	0.030
6. Cement:			
Neat Surface	0.010	0.011	0.013
Mortar	0.011	0.013	0.015
7. Concrete:			
Culvert, straight and free of debris	0.010	0.011	0.013
Culvert with bends, connections, and some debris	0.011	0.013	0.014
Finished	0.011	0.012	0.014
Sewer with manholes, inlet, etc., straight	0.013	0.015	0.017
Unfinished, steel form	0.012	0.013	0.014
Unfinished, smooth wood form	0.012	0.014	0.016
Unfinished, rough wood form	0.015	0.017	0.020
8. Wood:			
Stave	0.010	0.012	0.014
Laminated, treated	0.015	0.017	0.020
9. Clay:			
Common drainage tile	0.011	0.013	0.017
Vitrified sewer	0.011	0.014	0.017
Vitrified sewer with manholes, inlet, etc.	0.013	0.015	0.017
Vitrified Subdrain with open joint	0.014	0.016	0.018
10. Brickwork:			
Glazed	0.011	0.013	0.015
Lined with cement mortar	0.012	0.015	0.017
Sanitary sewers coated with sewage slime with bends and connections	0.012	0.013	0.016
Paved invert, sewer, smooth bottom	0.016	0.019	0.020
Rubble masonry, cemented	0.018	0.025	0.030

It is noted that the Tc computation procedure is based upon the summation of an initial subarea time of concentration with the several travel times estimated by normal depth flow-velocities through subsequent subareas.

D.4. INTENSITY-DURATION CURVES

The precipitation intensity-duration curves presented in Section B.3 (Figures B-3 and B-4) are appropriate for the rational method.

D.5. RUNOFF COEFFICIENT

The runoff coefficient (C) is the ratio of rate of runoff to the rate of rainfall at an average intensity (I) when the total drainage area is contributing. The selection of the runoff coefficient depends on rainfall intensity, soil infiltration rate (F_p), and impervious and pervious area fractions (a_i and a_p).

Since one acre-inch/hour is equal to 1.008 cfs, the rational formula is generally assumed to estimate a peak flowrate in cfs. Runoff coefficient curves are developed using the relationship:

$$C = \begin{cases} 0.90\ (a_i + \dfrac{(I - F_p)a_p}{I}), \text{ for I greater than } F_p; \\ 0.90\ a_i, \text{ for I less than or equal to } F_p \end{cases} \qquad (D.3)$$

where the proportion factor of 0.90 is a calibration constant determined by an average fit between the rational method and design storm unit hydrograph (see Section E) peak flow rate estimates, and where

C	=	runoff coefficient
I	=	rainfall intensity (inches/hour)
F_p	=	infiltration rate for pervious areas (inches/hour) (see Section C.6.4)
a_i	=	ratio of impervious area to total area (decimal fraction)
a_p	=	ratio of pervious area to total area (decimal fraction), ($a_p = 1 - a_i$)

C.6.4. Estimation of Maximum Loss Rates for Pervious Areas, F_p

Table C.2 lists the maximum loss rates (inch/hour), F_p, for pervious area as a function of soil group.

TABLE C.2.

MAXIMUM EFFECTIVE PERVIOUS AREA LOSS RATES (inch/hour), F_p

SOIL GROUP:	A	B	C	D
F_p:	0.40	0.30	0.25	0.20

Table C.2 reflects the model calibration assuming an F_p of 0.30 in/hr. for all the considered catchments and storm return frequencies. This mean value of F_p of 0.30 in/hr. was assigned to Hydrologic Soil Group B due to the actual average soil conditions in the reconstitution study areas. The F_p values for Hydrologic Soil Groups A, C, and D, were assigned to account for the different soil types that may be found in Orange County.

C.6.5. Estimation of Catchment Maximum Loss Rates, F_m

The maximum loss rate selected from Table C.2 applies to the pervious area fraction of the watershed. The loss rate assumed for an impervious surface is 0.0 inch/hour. The maximum loss rate, F_m, for a catchment is therefore given by

$$F_m = a_p F_p \qquad (C.7)$$

where a_p is the pervious area fraction and F_p is the maximum loss rate for the pervious area (Section C.6.4).

Should a catchment contain several F_m values, the composite F_m value is determined as a simple area average of the several F_m values.