PRELIMINARY HYDROLOGY REPORT
MOUNTAIN VIEW AFFORDABLE HOUSING COMMUNITY

24551 RAYMOND WAY, LAKE FOREST, CA

May 12, 2020

PREPARED FOR:
National CORE

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Purpose of Report

The purpose of this report is to assess the project site, identify the pre-development and post-development drainage conditions, and identify storm water facilities to meet the requirements of the Orange County Hydrology Manual (Orange County Environmental Management Agency, 1986). The Mountain View Affordable Housing Community project proposes to demolish an existing commercial building and construct a single three- to four-story multifamily housing facility and associated parking.

Location

The proposed affordable housing project is located at 24551 Raymond Way in Lake Forest, California on a 3.76 acre site which has been previously developed. Currently the site contains two existing commercial buildings and a surface parking lot. The proposed project includes a lot split dividing the parcel into two separate parcels. The proposed development will occur on Parcel 1. Other than required stormwater treatment measures, no development is proposed on Parcel 2. The proposed development on Parcel 1 includes the demolition of the existing commercial building and the construction of a single building varying from three to four stories in height. The building will contain 71 residential units and a community center. A playground, teen center, and barbeque area are proposed outside of the building. The existing parking lot will be reconfigured for the change in use of the site. See the project vicinity map in Figure 1 below.

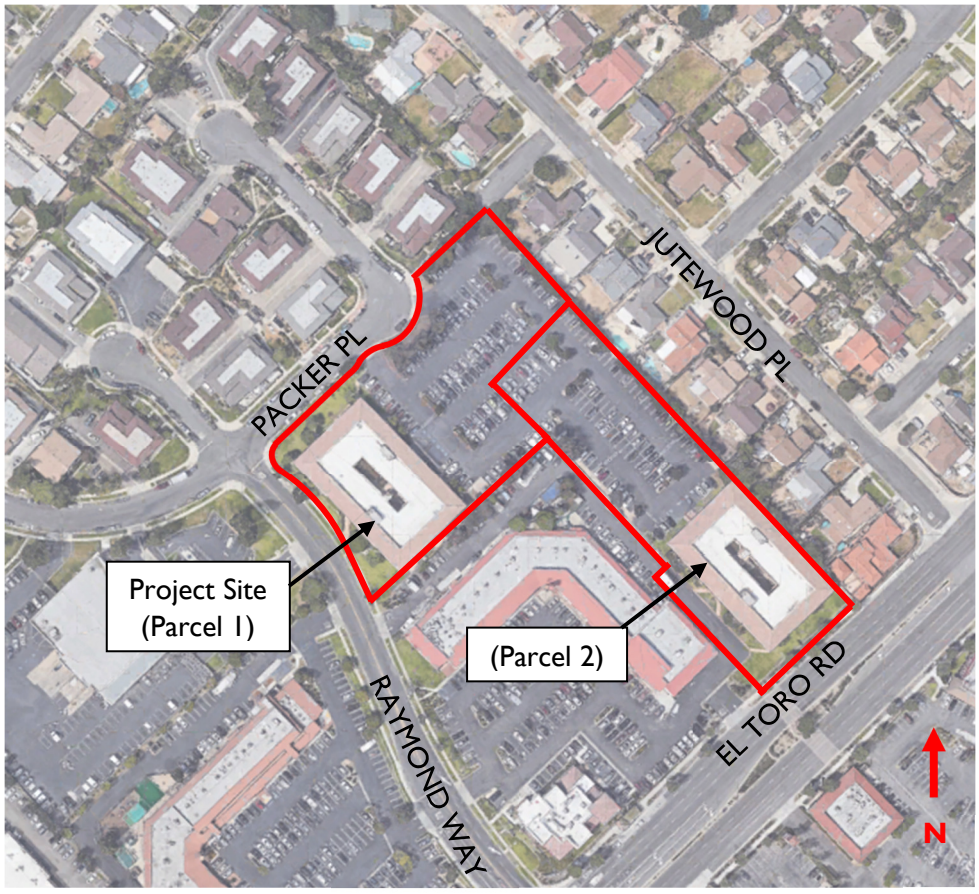


Figure 1. Project Vicinity Map

Background

The site is currently occupied by a commercial building and a parking lot. Soils belong to Hydrologic Soil Group D, see Orange County Soils Map (Orange County Environmental Management Agency, 1986) in Attachment 1.

Currently, drainage sheet flows from the parking lot in a northwesterly direction toward Packer Place, see Existing Hydrology Map, Exhibit A. Runoff from Drainage Area X1 flows out of the existing driveway into the curb and gutter on Packer Place. Eventually, runoff enters the municipal storm drain system through a curb inlet at the end of Bendricon Lane. Runoff from Drainage Area X2 from the building flows overland in a westerly direction toward Raymond Way where it enters the municipal storm drain system through an inlet near the easterly corner of the Raymond Way and Packer Place intersection. Runoff from Drainage Area X3 flows to El Toro Road and enters the municipal storm drain system through an inlet on El Toro Road. The drainage boundary for this analysis will follow the property line as depicted in the Existing Hydrology Map, Exhibit A.

Time of Concentration

The existing and proposed time of concentrations for each drainage area are shown in Table 1. Calculations are provided in Attachment 3.

Table 1. Time of Concentration

Drainage Area	Time of Concentration (min)
X1	7.3
X2	6.3
X3	6.4
A	10.0
B	7.9

Proposed Development

The proposed development will maintain existing drainage patterns and discharge locations, see Proposed Hydrology Map, Exhibit B. To address stormwater quality and retention, dry well BMPs have been chosen for the site due to limited flat permeable areas at the site that would allow other infiltration BMPs. Storage chambers are proposed to operate in-line with the dry wells and provide additional storage to meet the required retention volume, per the separate Post-Construction Stormwater Management Plan. Together, Parcels 1 and 2 have been divided into three drainage areas: A, B and X3.

- Runoff from drainage area 'A' will be collected by the on-site storm drain system and directed to a dry well system near the southern corner of the site. Overflow from the dry well and storage chamber system will flow out through the curb and enter the municipal storm drain system through inlets located near the eastern corner of the Raymond Way/Packer Place intersection.
- Runoff from drainage area 'B' will flow overland through the parking lot and be collected by the on-site storm drain system which will outlet into a dry well and storage chamber system near the driveway entry to the site. Overflow from the dry wells will outlet through the curb face on Packer Place. Runoff will enter the municipal storm drain system through an inlet at the end of the Bendricon Lane cul-de-sac.

- Runoff from drainage area 'X3' will flow to the southeast and be captured in a proposed dry well and chamber system. Overflow will continue to flow toward El Toro Road as it has historically.

The site currently falls in Zone 'X' with a minimal chance of flood hazard according to FEMA NFHL, see Attachment 2 for FIRMette download from FEMA interactive maps (Federal Emergency Management Agency, 2009).

Method of Analysis

The approach to analyze the runoff from the project site follows the Orange County Hydrology Manual requirements. The hydrologic analysis is a comparison of the pre-project condition to the post-project condition.

The proposed project will increase the time of concentration from 7.3 minutes to 10 minutes. See calculation in Attachment 3. This increase in time of concentration results in a reduced peak flow generated from the project site and eliminates the need for detention.

The method of analysis as described in the Orange County Hydrology Manual for local facilities utilized for this project is the Rational Method as outlined in Section D of the manual.

Step 1. Draw drainage area on a topographic map. See Exhibits A and B.

Step 2. Determine Time of Concentration. See Attachment 3.

Step 3. Determine Intensity from Figure B-3. See Attachment 4.

Step 4. Calculate area-averaged maximum loss rate, F_m. See Attachment 4.

$$F_m = a_p F_p \quad \text{(equation C.7 from OC Hydrology Manual)}$$

a_p = fraction of pervious area coverage F_p= maximum loss rate of pervious area from table C.2.

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

Step 5. Determine area of watershed tributary to the point of concentration. See Exhibits A and B.

Step 6. Compute peak flows for the point of concentration for each storm event. See calculations in Attachment 4 and a summary in Tables 2, 3 and 4.

$$Q = 0.90(I - F_m)A$$

Table 2. Peak Flows to Raymond Way

Storm Event	Existing Q (cfs)	Proposed Q (cfs)
10-Year	1.95	1.68
25-Year	2.33	2.01
100-Year	3.00	2.58

Table 3. Peak Flows to Packer Place

Storm Event	Existing Q (cfs)	Proposed Q (cfs)
10-Year	7.62	7.09
25-Year	9.10	8.46
100-Year	11.67	10.84

Table 4. Peak Flows to El Toro Road

Storm Event	Existing Q (cfs)	Proposed Q (cfs)
10-Year	1.58	1.58
25-Year	1.89	1.89
100-Year	2.44	2.44

Conclusions

Based on the findings of this report, the proposed drainage design for this project meets applicable standards and requirements of the Orange County Hydrology Manual. The proposed drainage plan is consistent with the historical drainage patterns for the site. There is an increase in the time of concentration decreasing the peak flow of runoff from the site. Therefore, the proposed development:

- Reduces the post-development peak flow of runoff to that of the pre-development rate for the hydrological analysis for all storm events at all outlet locations.

References

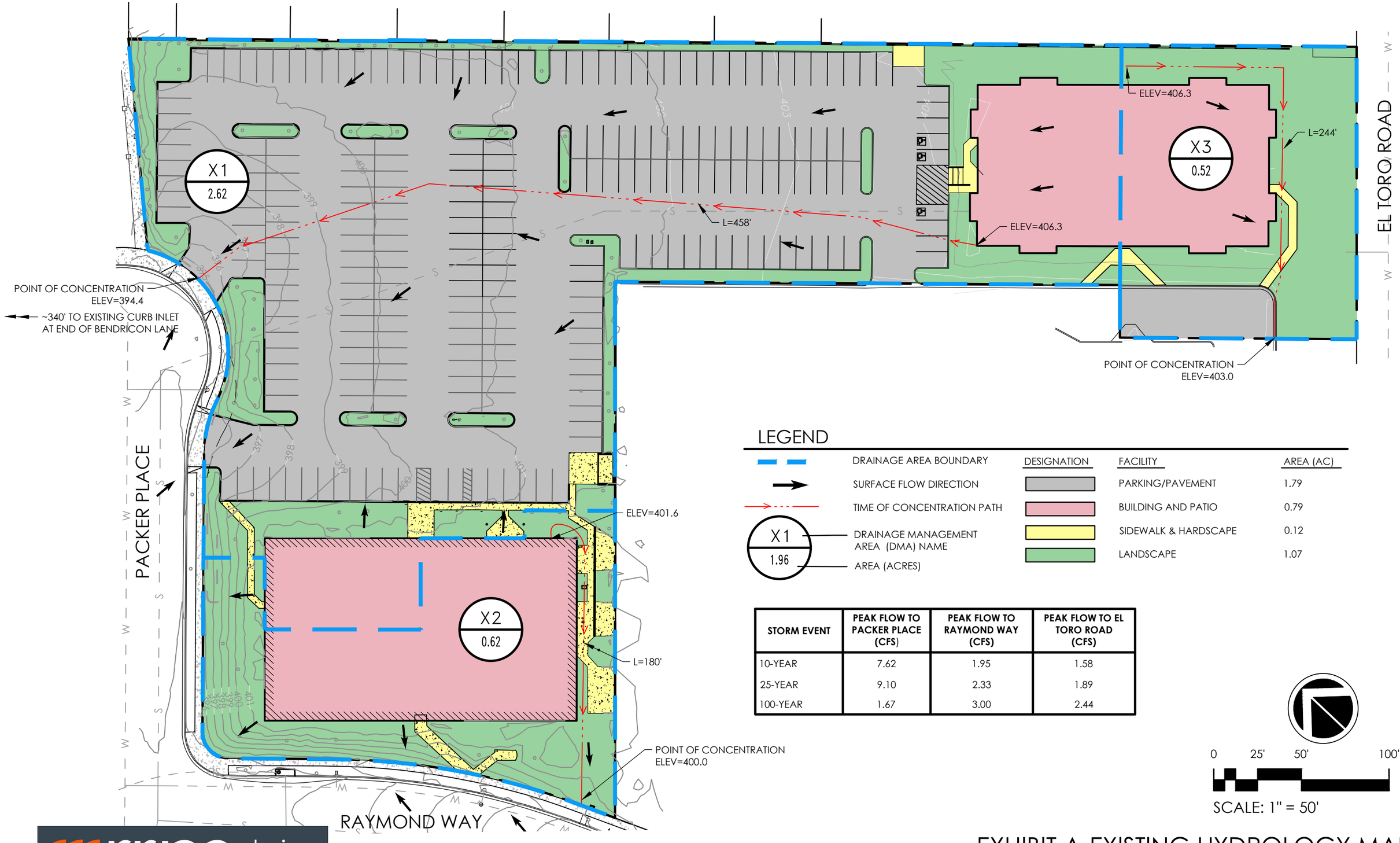
Federal Emergency Management Agency. (2009, December 3). *FEMA Flood Map Service Center*. Retrieved from https://msc.fema.gov/

Orange County Environmental Management Agency. (1986). *Orange County Hydrology Manual.*

EXHIBITS

EXHIBIT A

Pre-Development Hydrology Map



LEGEND

DRAINAGE AREA BOUNDARY	DESIGNATION	FACILITY	AREA (AC)
SURFACE FLOW DIRECTION		PARKING/PAVEMENT	1.79
TIME OF CONCENTRATION PATH		BUILDING AND PATIO	0.79
X1 / 1.96 — DRAINAGE MANAGEMENT AREA (DMA) NAME / AREA (ACRES)		SIDEWALK & HARDSCAPE	0.12
		LANDSCAPE	1.07

STORM EVENT	PEAK FLOW TO PACKER PLACE (CFS)	PEAK FLOW TO RAYMOND WAY (CFS)	PEAK FLOW TO EL TORO ROAD (CFS)
10-YEAR	7.62	1.95	1.58
25-YEAR	9.10	2.33	1.89
100-YEAR	1.67	3.00	2.44

0 25' 50' 100'

SCALE: 1" = 50'

rrm design group

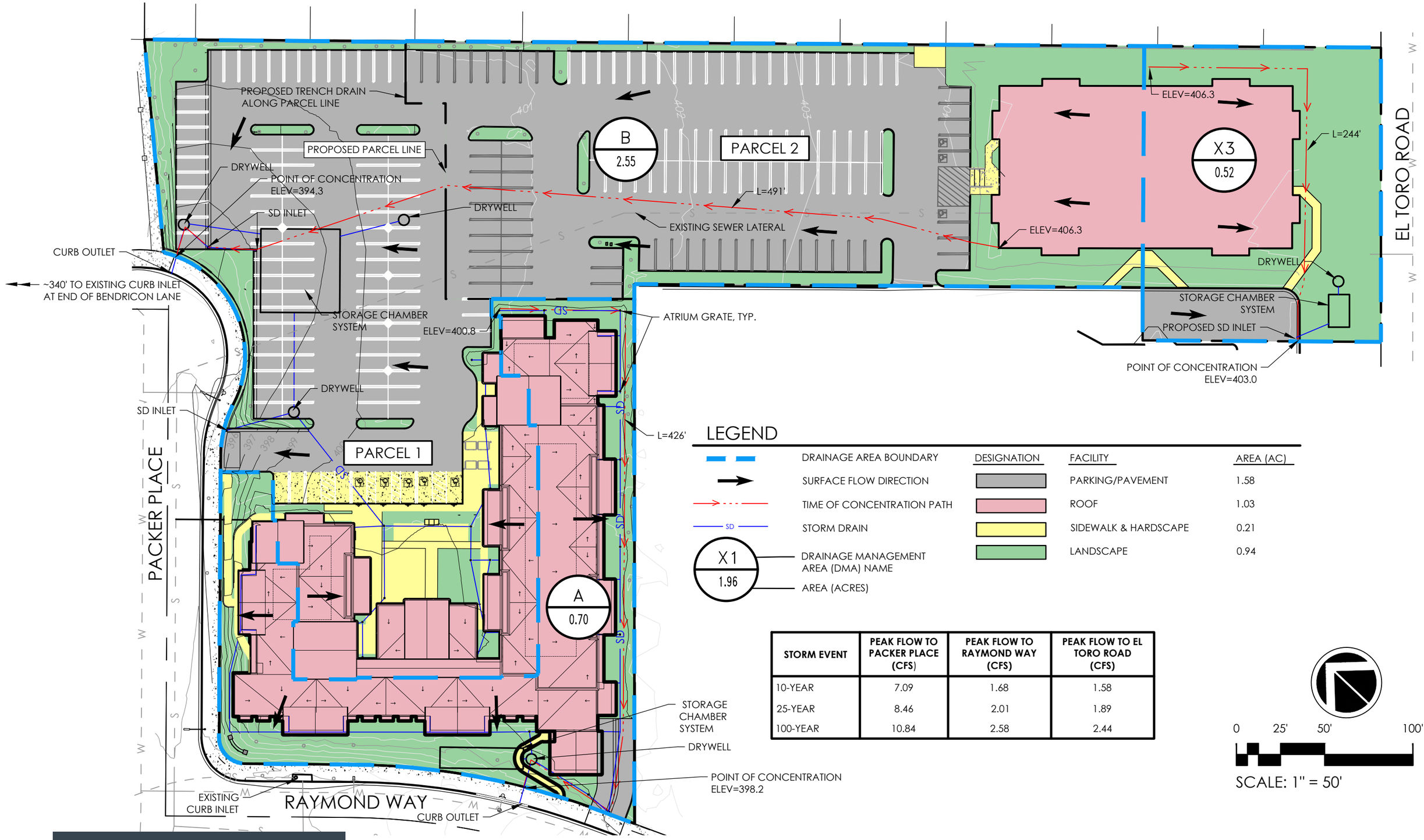
MAY 7, 2020

EXHIBIT A-EXISTING HYDROLOGY MAP

24551 RAYMOND WAY, LAKE FOREST, CA

EXHIBIT B

Post-Development Hydrology Map



LEGEND

	DESIGNATION	FACILITY	AREA (AC)
DRAINAGE AREA BOUNDARY			
SURFACE FLOW DIRECTION		PARKING/PAVEMENT	1.58
TIME OF CONCENTRATION PATH		ROOF	1.03
STORM DRAIN		SIDEWALK & HARDSCAPE	0.21
		LANDSCAPE	0.94

X1 / 1.96 — DRAINAGE MANAGEMENT AREA (DMA) NAME; AREA (ACRES)

STORM EVENT	PEAK FLOW TO PACKER PLACE (CFS)	PEAK FLOW TO RAYMOND WAY (CFS)	PEAK FLOW TO EL TORO ROAD (CFS)
10-YEAR	7.09	1.68	1.58
25-YEAR	8.46	2.01	1.89
100-YEAR	10.84	2.58	2.44

0 25' 50' 100'

SCALE: 1" = 50'

rrm design group

EXHIBIT B-PROPOSED HYDROLOGY MAP

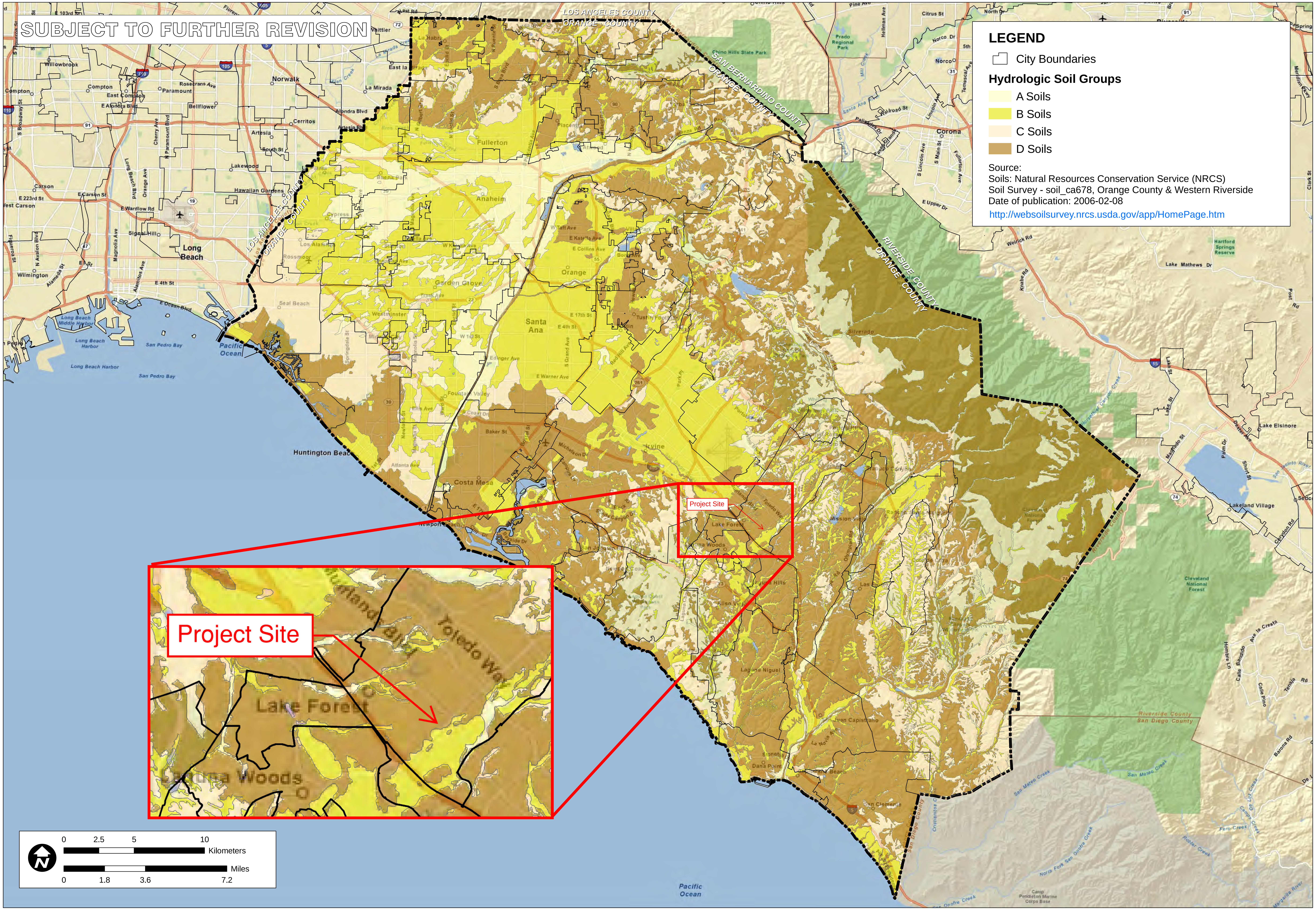
MAY 11, 2020

24551 RAYMOND WAY, LAKE FOREST, CA

ATTACHMENTS

ATTACHMENT 1

Soils Maps



P:\9526E\6-GIS\Mxds\Reports\InfiltrationFeasability_20110215\9526E_FigureXVI-2a_HydroSoils_20110215.mxd

TITLE

NRCS HYDROLOGIC SOILS GROUPS

ORANGE COUNTY INFILTRATION STUDY

JOB

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

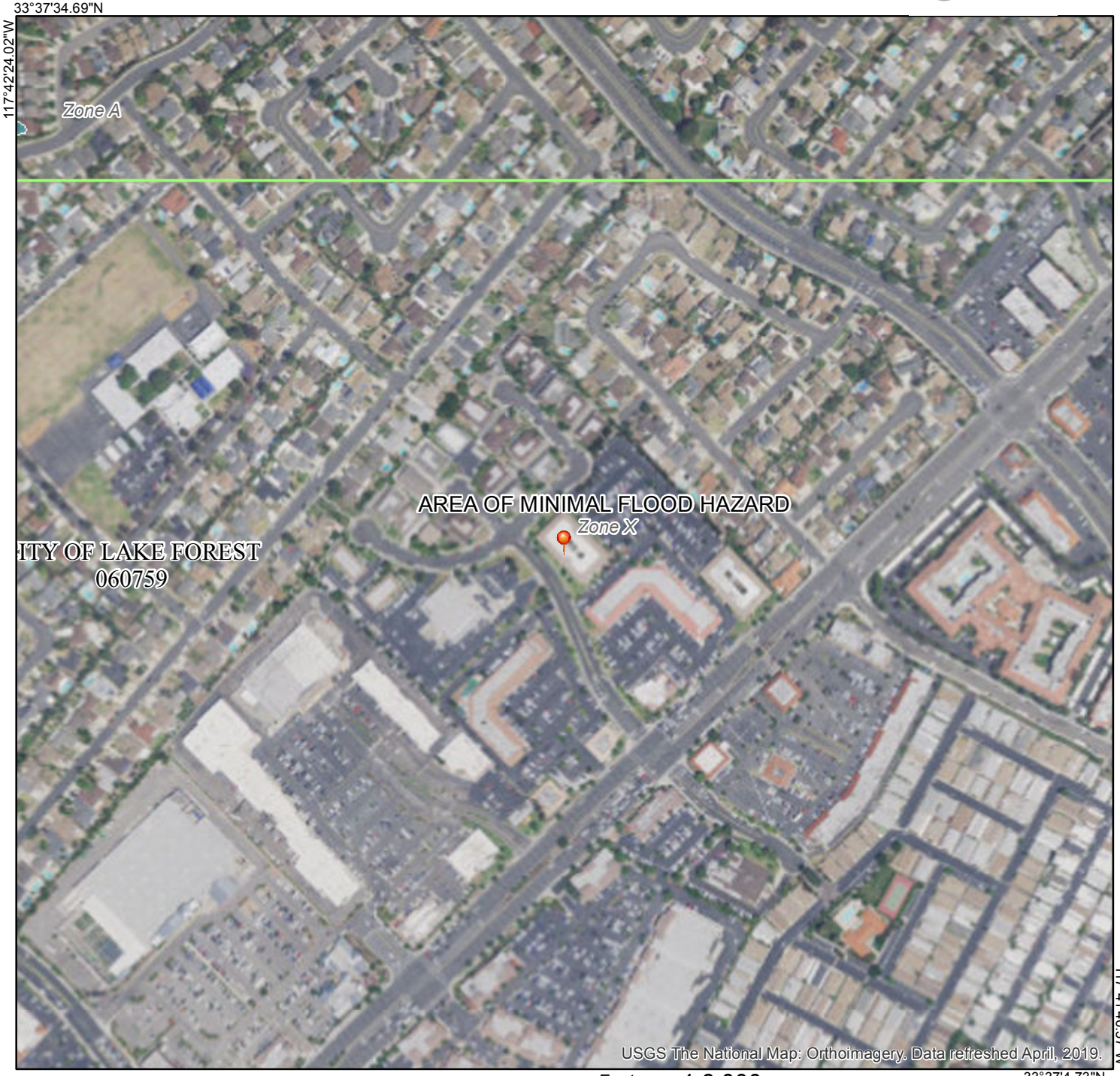
XVI-2a

ATTACHMENT 2

FEMA Flood Map

National Flood Hazard Layer FIRMette

FEMA



Feet

0 250 500 1,000 1,500 2,000

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

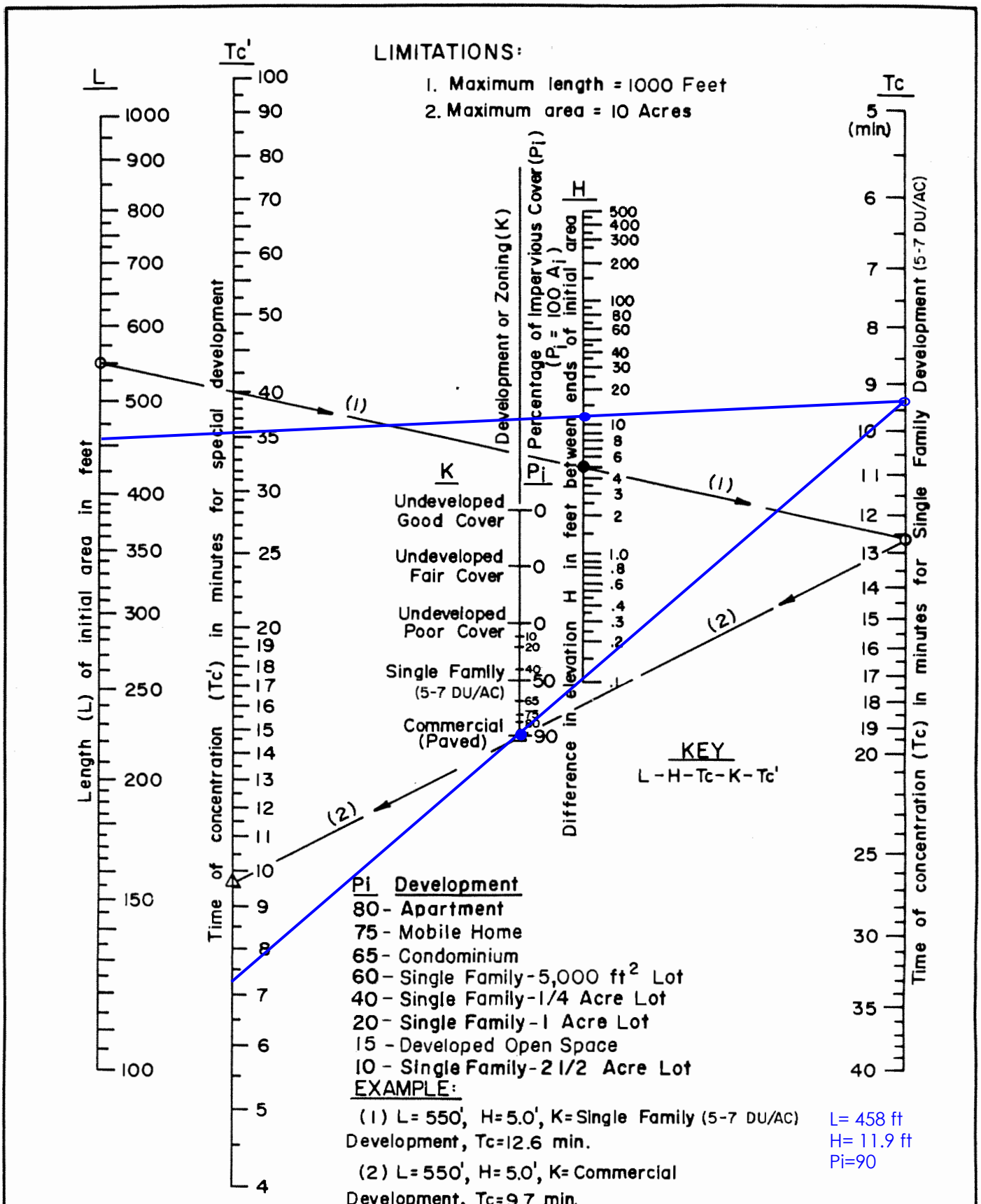
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 11/7/2019 at 7:20:03 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

ATTACHMENT 3

Time of Concentration Nomograph



ORANGE COUNTY

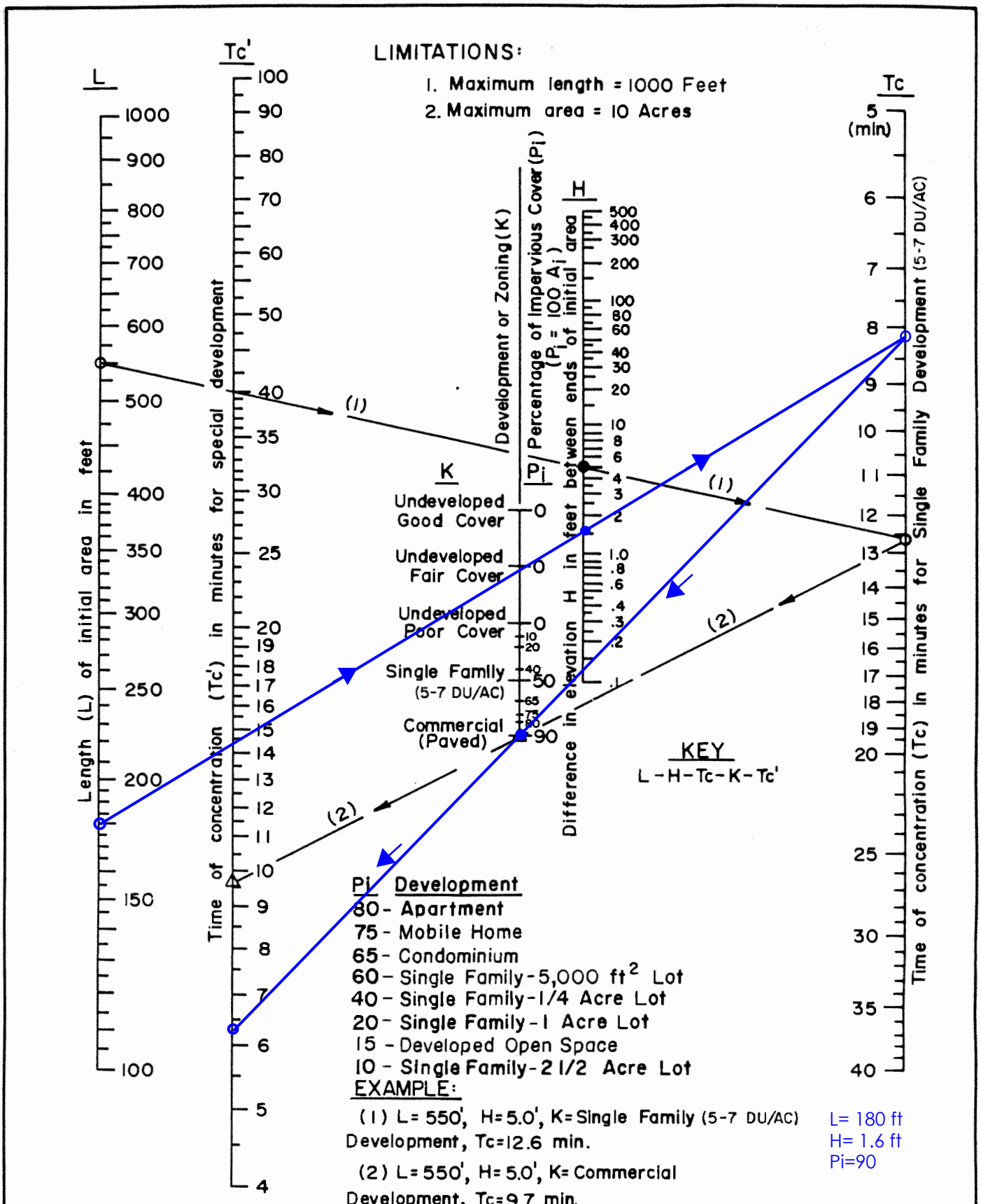
HYDROLOGY MANUAL

Existing Condition
Area X1

Tc'= 7.3 min

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

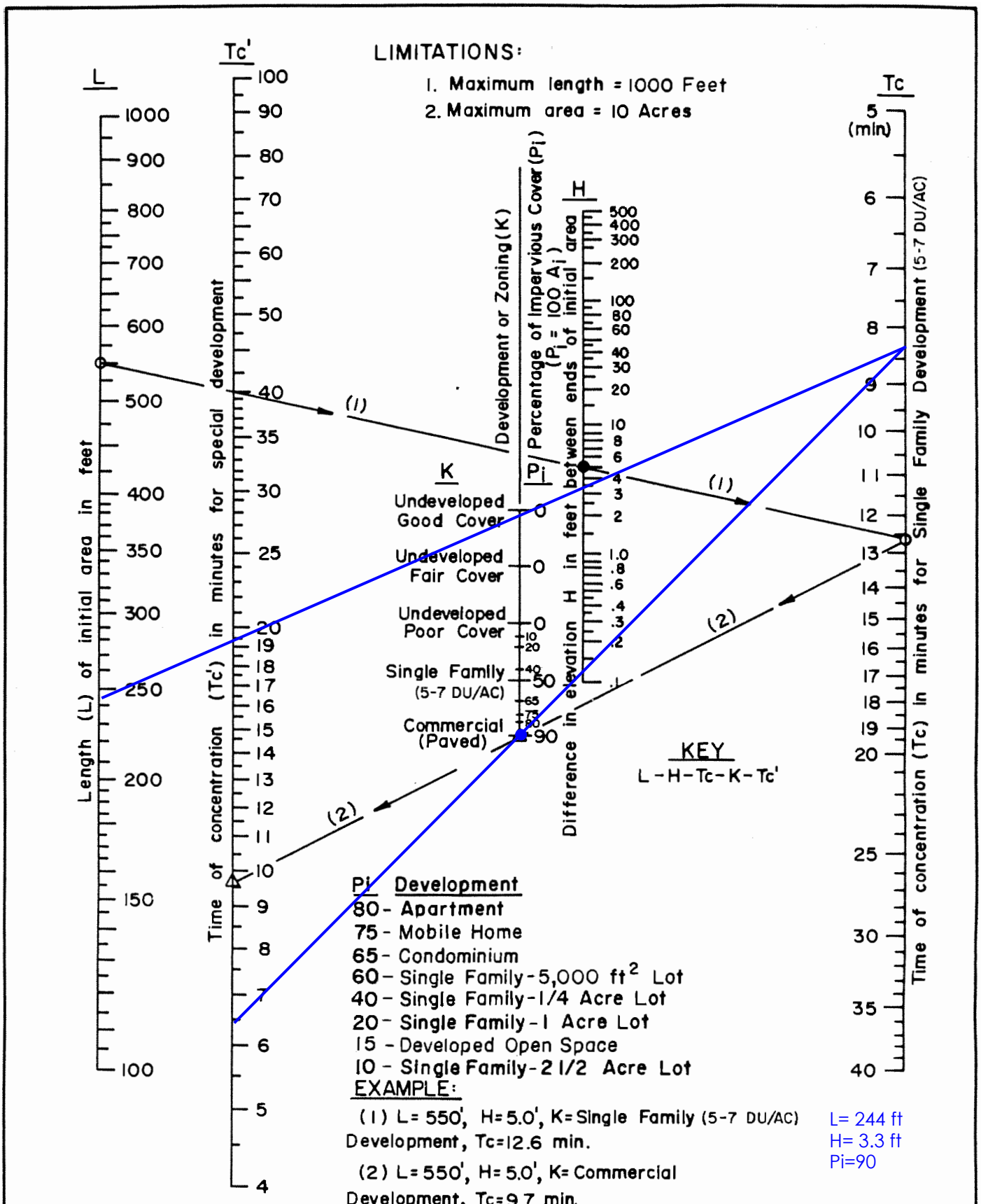
Figure D-1



ORANGE COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1



L= 244 ft
H= 3.3 ft
Pi=90

Existing and Proposed Condition
Area X3

Tc'= 6.4 min

ORANGE COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

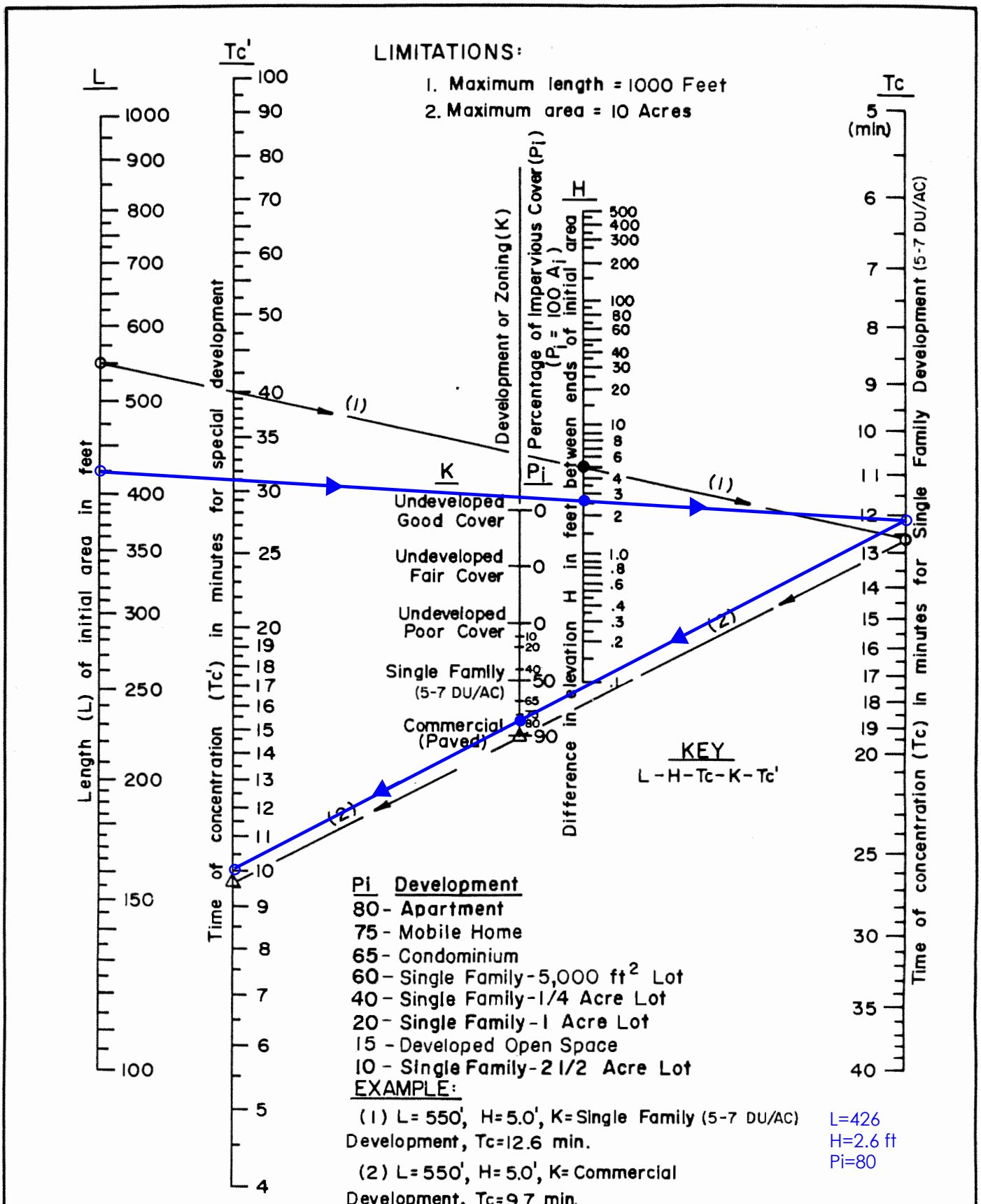
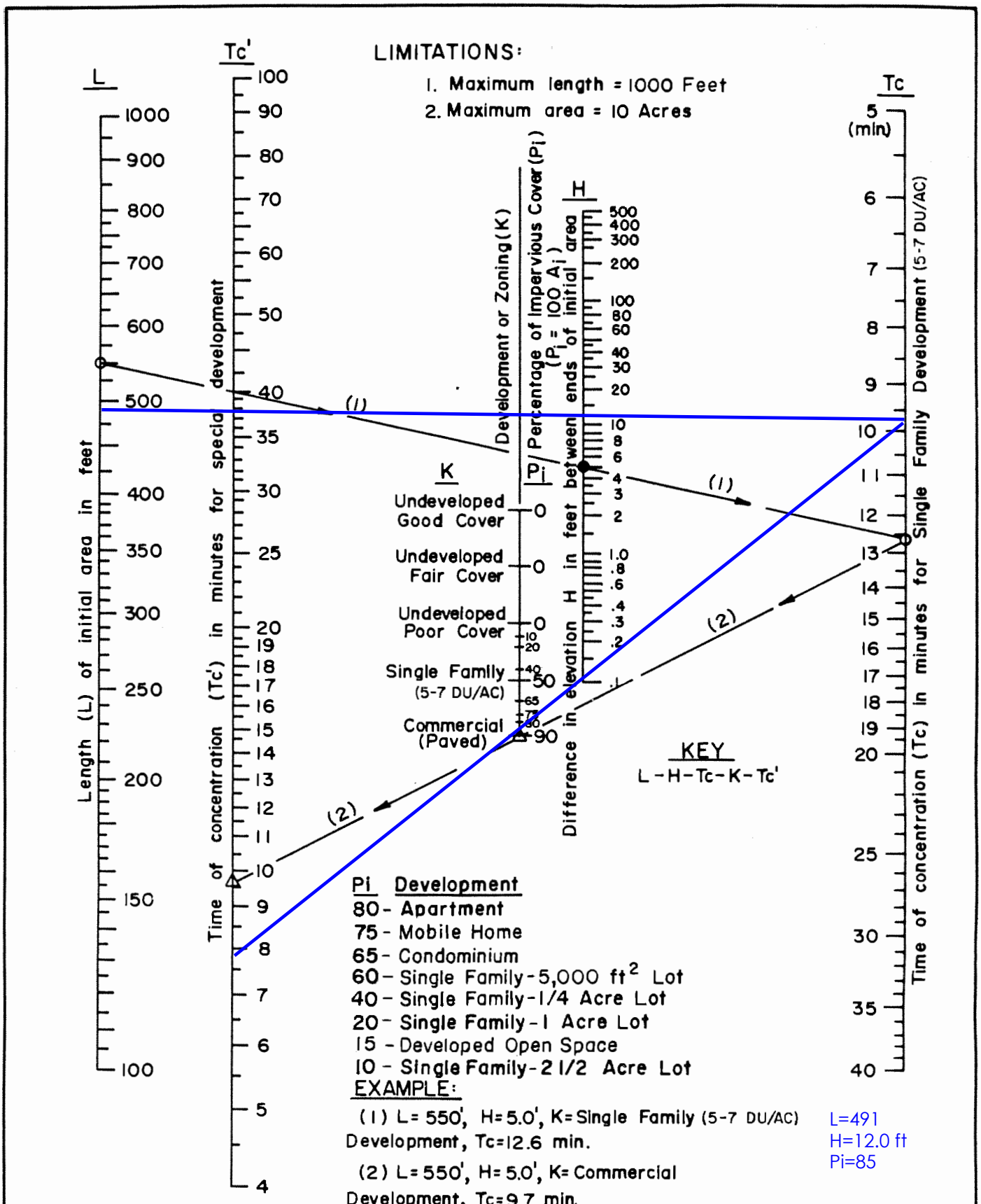

LIMITATIONS:
1. Maximum length = 1000 Feet
2. Maximum area = 10 Acres
L
Tc'
Tc
Length (L) of initial area in feet
Time of concentration (Tc') in minutes for special development
Development or Zoning (K)
Pi / Percentage of Impervious Cover (Pi)
(Pi = 100 Ai)
H
Difference in elevation H in feet between ends of initial area
Time of concentration (Tc) in minutes for Single Family Development (5-7 DU/AC)
K
Undeveloped Good Cover
Undeveloped Fair Cover
Undeveloped Poor Cover
Single Family (5-7 DU/AC)
Commercial (Paved)
(1)
(2)
KEY
L-H-Tc-K-Tc'
Pi Development
80- Apartment
75- Mobile Home
65- Condominium
60- Single Family-5,000 ft2 Lot
40- Single Family-1/4 Acre Lot
20- Single Family-1 Acre Lot
15- Developed Open Space
10- Single Family-2 1/2 Acre Lot
EXAMPLE:
(1) L= 550', H= 5.0', K= Single Family (5-7 DU/AC) Development, Tc=12.6 min.
(2) L= 550', H= 5.0', K= Commercial Development, Tc=9.7 min.
L=426
H=2.6 ft
Pi=80
Proposed Condition
Area A
Tc'= 10 min
ORANGE COUNTY
HYDROLOGY MANUAL
TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1



ORANGE COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

ATTACHMENT 4

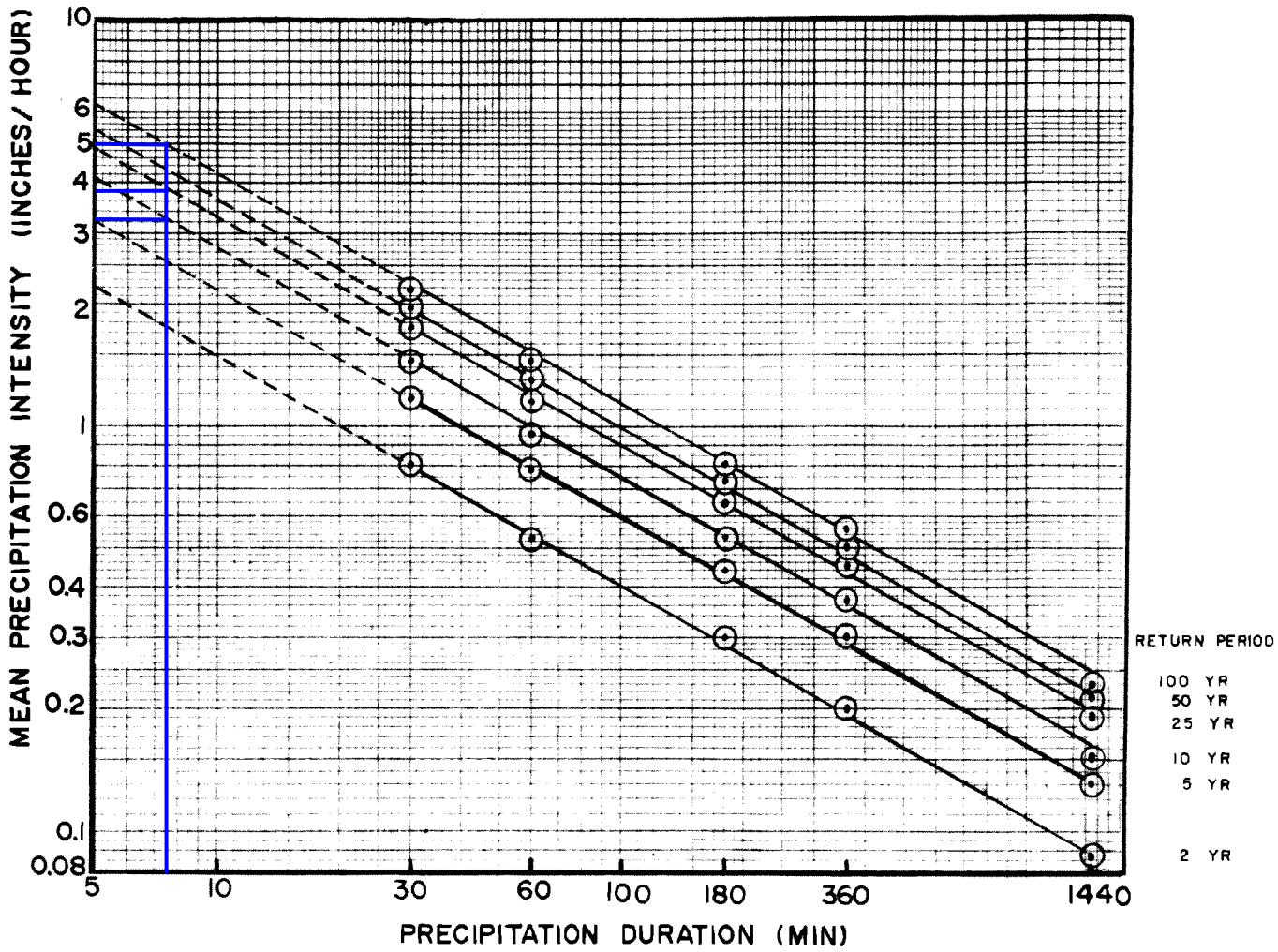
Hydrology Calculations

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

Existing Area X1
For t= 7.3 min
10 yr I= 3.27 in/hr
25 yr I= 3.89 in/hr
100 yr I= 4.98 in/hr



ORANGE COUNTY
HYDROLOGY MANUAL

MEAN PRECIPITATION INTENSITIES FOR NONMOUNTAINOUS AREAS

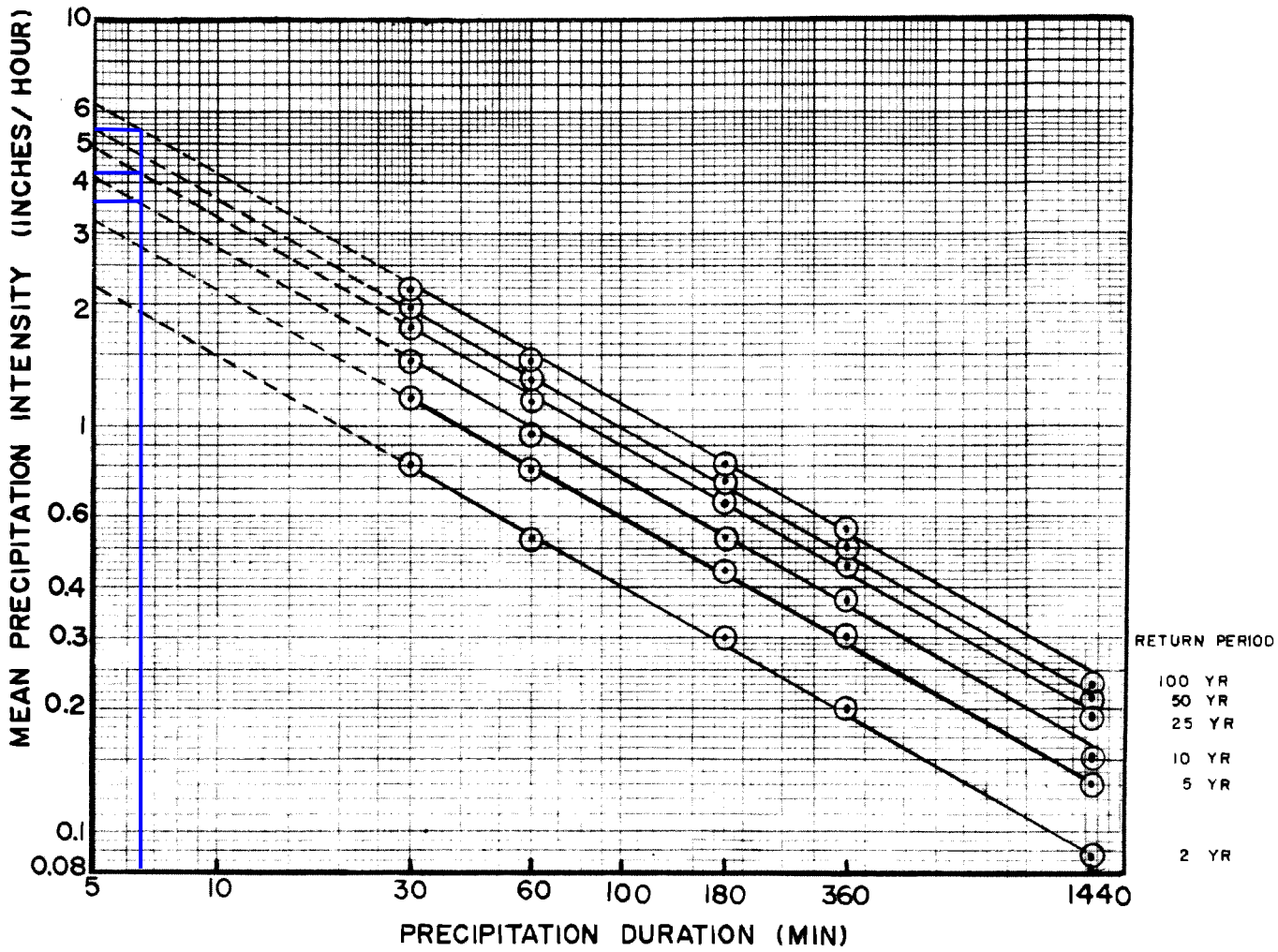
Figure B-3

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

Existing Area X2
For t= 6.3 min
10 yr I=3.56 in/hr
25 yr I=4.23 in/hr
100 yr I=5.42 in/hr



ORANGE COUNTY
HYDROLOGY MANUAL

MEAN PRECIPITATION INTENSITIES FOR NONMOUNTAINOUS AREAS

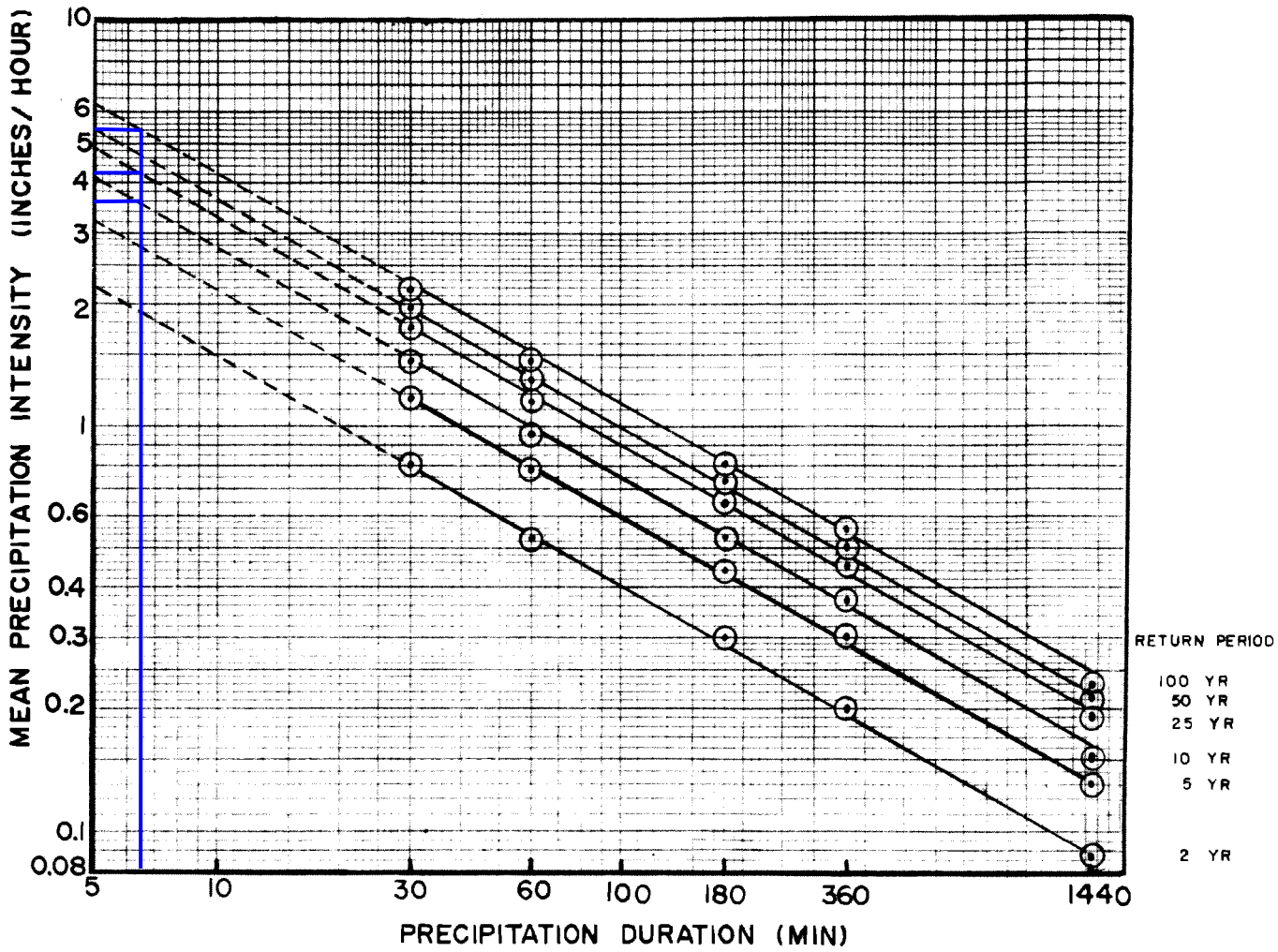
Figure B-3

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

Existing Area X3
For t= 6.4min
10 yr I=3.52 in/hr
25 yr I=4.19 in/hr
100 yr I=5.37 in/hr



ORANGE COUNTY
HYDROLOGY MANUAL

MEAN PRECIPITATION INTENSITIES FOR NONMOUNTAINOUS AREAS

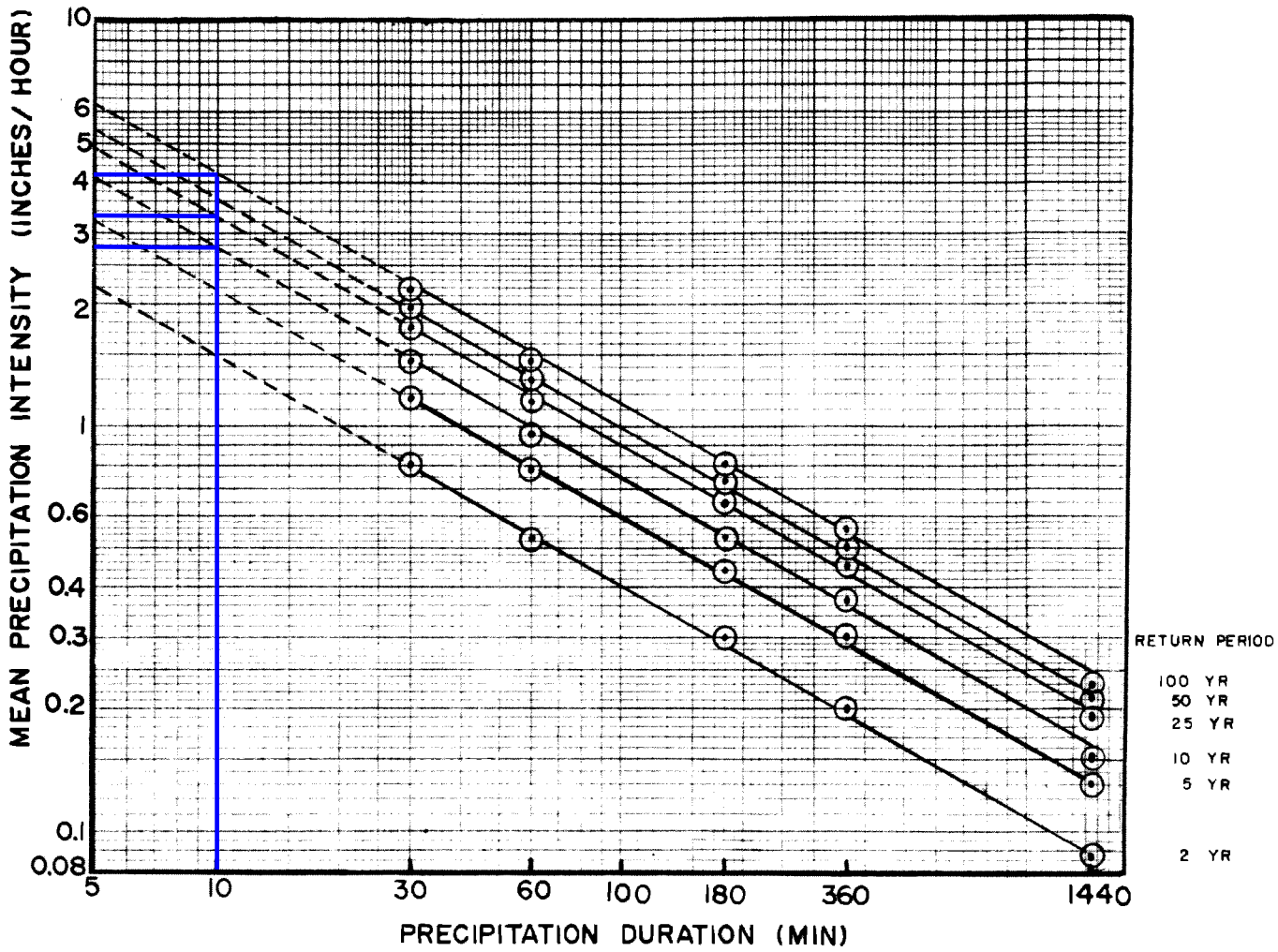
Figure B-3

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

Proposed Area A
For t= 10.0 min
10 yr I=2.73 in/hr
25 yr I=3.26 in/hr
100 yr I=4.16 in/hr



ORANGE COUNTY
HYDROLOGY MANUAL

MEAN PRECIPITATION INTENSITIES FOR NONMOUNTAINOUS AREAS

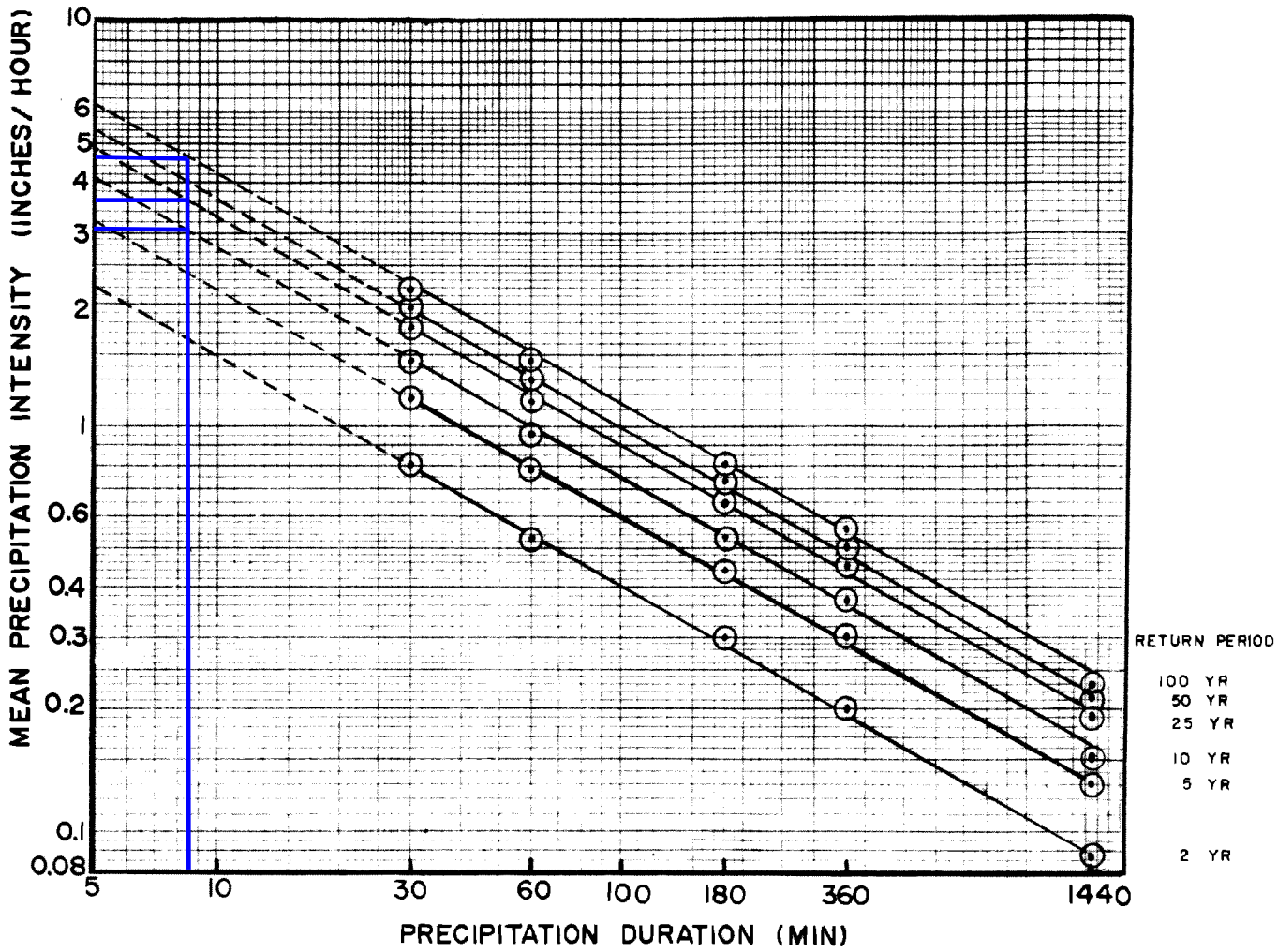
Figure B-3

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

Proposed Area B
For t= 7.9 min
10 yr I=3.12 in/hr
25 yr I=3.72 in/hr
100 yr I=4.76 in/hr



ORANGE COUNTY
HYDROLOGY MANUAL

MEAN PRECIPITATION INTENSITIES FOR NONMOUNTAINOUS AREAS

Figure B-3

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL

STUDY NAME: El Toro Road Multifamily Existing Condition

10 –YEAR STORM RATIONAL METHOD STUDY

Calculated by ADW Date 5/6/20

Checked by MCH Date 5/6/20

Page 1 of 1

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm* in/hr	Fm avg.	Q** Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
Packer Place (X1)	2.62	2.62	D	COM	-	7.3	3.27	0.0374	0.0374	7.62	458	0.03		Only Subarea
Raymond Way (X2)	0.62	0.62	D	COM		6.3	3.56	0.0823	0.0823	1.95	180	0.009		Only Subarea
El Toro Road (X3)	0.52	0.52	D	COM		6.4	3.52	0.1235	0.1235	1.58	244	0.01		Only Subarea

Equations

*$F_m = a_p F_p$ (Equation C.7 - OC Hydrology Manual)

a_p = pervious area fraction

F_p = 0.20 in/hr (Table C.2 - OC Hydrology Manual)

X1: $F_m = (0.187)(0.20) = 0.0374$

X2: $Fm = (0.412)(0.20) = 0.0823$

X3: $Fm = (0.617)(0.20) = 0.1235$

** $Q = 0.9\ (I-F_m)A$

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

Figure D-4

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL

STUDY NAME: El Toro Road Multifamily Existing Condition

25 –YEAR STORM RATIONAL METHOD STUDY

Calculated by ADW Date 5/6/20

Checked by MCH Date 5/6/20

Page 1 of 1

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm* in/hr	Fm avg.	Q** Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
Packer Place (X1)	2.62	2.62	D	COM	-	7.3	3.89	0.0374	0.0374	9.10	458	0.03		Only Subarea
Raymond Way (X2)	0.62	0.62	D	COM		6.3	4.23	0.0823	0.0823	2.33	180	0.009		Only Subarea
El Toro Road (X3)	0.52	0.52	D	COM		6.4	4.19	0.1235	0.1235	1.89	244	0.01		Only Subarea

Equations

*$F_m = a_p F_p$ (Equation C.7 - OC Hydrology Manual)

a_p = pervious area fraction

F_p = 0.20 in/hr (Table C.2 - OC Hydrology Manual)

X1: $F_m = (0.187)(0.20) = 0.0374$

X2: $Fm = (0.412)(0.20) = 0.0823$

X3: $Fm = (0.617)(0.20) = 0.1235$

** $Q = 0.9 (I-F_m)A$

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

Figure D-4

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL

STUDY NAME: El Toro Road Multifamily Existing Condition

100 –YEAR STORM RATIONAL METHOD STUDY

Calculated by ADW Date 5/6/20

Checked by MCH Date 5/6/20

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Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm* in/hr	Fm avg.	Q** Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
Packer Place (X1)	2.62	2.62	D	COM	-	7.3	4.98	0.0374	0.0374	11.62	458	0.03		Only Subarea
Raymond Way (X2)	0.62	0.62	D	COM		6.3	5.42	0.0823	0.0823	3.00	180	0.009		Only Subarea
El Toro Road (X3)	0.52	0.52	D	COM		6.4	5.37	0.1235	0.1235	2.44	244	0.01		Only Subarea

Equations

*$F_m = a_p F_p$ (Equation C.7 - OC Hydrology Manual)

a_p = pervious area fraction

F_p = 0.20 in/hr (Table C.2 - OC Hydrology Manual)

X1: $F_m = (0.187)(0.20) = 0.0374$

X2: $Fm = (0.412)(0.20) = 0.0823$

X3: $Fm = (0.617)(0.20) = 0.1235$

** $Q = 0.9\ (I-F_m)A$

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

Figure D-4

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL	STUDY NAME: El Toro Road Multifamily Proposed Condition 10 -YEAR STORM RATIONAL METHOD STUDY	Calculated by ADW Date 5/6/20 Checked by MCH Date 5/6/20 Page 1 of 1

Concentration Point	Area (Acres) Subarea	Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm* in/hr	Fm avg.	Q** Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
Raymond Way (A)	0.70	0.70	D	MFR	-	10	2.73	0.0688	0.0688	1.68	426	0.0061		Only Subarea
Packer Place (B)	2.55	2.55	D	MFR	-	7.9	3.12	0.0301	0.0301	7.09	491	0.024		Only Subarea
El Toro Road (X3)	0.52	0.52	D	COM		6.4	3.52	0.1235	0.1235	2.44	244	0.01		Only Subarea

Equations

*$F_m = a_p F_p$ (Equation C.7 - OC Hydrology Manual)

a_p = pervious area fraction

F_p = 0.20 in/hr (Table C.2 - OC Hydrology Manual)

Area A: F_m = (0.344)(0.20) = 0.0688

Area B: Fm = (0.151)(0.20) = 0.0301

Area X1: Fm = (0.617)(0.20) = 0.1235

** Q = 0.9 (I-F_m)A

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

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL

STUDY NAME: El Toro Road Multifamily Proposed Condition

10 -YEAR STORM RATIONAL METHOD STUDY

Calculated by ADW Date 5/6/20

Checked by MCH Date 5/6/20

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Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm* in/hr	Fm avg.	Q** Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
Raymond Way (A)	0.70	0.70	D	MFR	-	10	3.26	0.0688	0.0688	2.01	426	0.0061		Only Subarea
Packer Place (B)	2.55	2.55	D	MFR	-	7.9	3.72	0.0301	0.0301	8.46	491	0.024		Only Subarea
El Toro Road (X3)	0.52	0.52	D	COM		6.4	4.19	0.1235	0.1235	1.89	244	0.01		Only Subarea

Equations

*$F_m = a_p F_p$ (Equation C.7 - OC Hydrology Manual)

a_p = pervious area fraction

F_p = 0.20 in/hr (Table C.2 - OC Hydrology Manual)

Area A: $F_m = (0.344)(0.20) = 0.0688$

Area B: $Fm = (0.151)(0.20) = 0.0301$

Area X1: $Fm = (0.617)(0.20) = 0.1235$

** $Q = 0.9\ (I-F_m)A$

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

Figure D-4

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL

STUDY NAME: El Toro Road Multifamily Proposed Condition

100-YEAR STORM RATIONAL METHOD STUDY

Calculated by ADW Date 5/6/20

Checked by MCH Date 5/6/20

Page 1 of 1

Concentration Point	Area (Acres) Subarea	Area (Acres) Total	Soil Type	Dev. Type	T_t min.	T_c min.	I in/hr	Fm* in/hr	Fm avg.	Q** Total	Flow Path Length ft.	Slope ft./ft.	V ft./sec.	Hydraulics and Notes
Raymond Way (A)	0.70	0.70	D	MFR	-	10	4.16	0.0688	0.0688	2.58	426	0.0061		Only Subarea
Packer Place (B)	2.55	2.55	D	MFR	-	7.9	4.76	0.0301	0.0301	10.84	491	0.024		Only Subarea
El Toro Road (X3)	0.52	0.52	D	COM		6.4	5.37	0.1235	0.1235	2.44	244	0.01		Only Subarea

Equations

*$F_m = a_p F_p$ (Equation C.7 - OC Hydrology Manual)

a_p = pervious area fraction

F_p = 0.20 in/hr (Table C.2 - OC Hydrology Manual)

Area A: $F_m = (0.344)(0.20) = 0.0688$

Area B: $Fm = (0.151)(0.20) = 0.0301$

Area X1: $Fm = (0.617)(0.20) = 0.1235$

** $Q = 0.9 (I-F_m)A$

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

Figure D-4