

Appendix

Appendix H Preliminary Drainage Study IACC

Appendix

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PRELIMINARY DRAINAGE STUDY

Date: October 22, 2021

BKF Job Number: 20181414

Deliver To: City of Irvine
1 Civic Center Plaza
Irvine, CA 92606



From: **Bruce W. Kirby, PE** - BKF Engineers

Subject: Irvine Animal Care Center – Preliminary Drainage Study

Introduction

The purpose of this preliminary drainage study is to present the stormwater design and analysis for the Irvine Animal Care Renovation project. This project will renovate the existing Irvine Animal Care Center located at 6443 Oak Canyon, Irvine. The project site is comprised of 1.56 acres. Treatment for the project was designed per the OC Technical Guidance Document Standards. Hydrology requirements for the site were designed per the Orange County Hydrology Manual. The Hydrology analysis for proposed project was performed using the 25-year storm event. See Attachment 1 for the Hydrology Maps showing the drainage basins for the existing and proposed sites.

Existing Conditions

The existing site is comprised of existing buildings, asphalt parking lot, landscaping and sidewalk. Drainage is captured via area drains throughout the landscaped areas and conveyed through storm drain pipe, ultimately discharging from the south-west corner of the site into the storm drain main on Oak Canyon.

A geotechnical report was prepared by GMU, dated March 26, 2021. Based on the report, the proposed project is located in the El Toro Marine Base Plume Protection Boundary. Therefore, infiltration is not feasible for this project.

Proposed Conditions

The proposed site will expand the footprint of the existing buildings by adding a clinic on the north side of the site and an entry building on the west side. Additional sidewalk will be constructed for access around the expanded building areas. Drainage for the project is comprised of three drainage basins. Basin 1 includes the new entry building, walkways, and landscaped area. Basin 2 consists of an existing building, the new clinic building and the parking lot area. Basin 3 is a landscaped area that will be renovated with additional storm drain infrastructure to alleviate some of the previous issues with ponding on the existing site.

Stormwater Management Design

The proposed site will be treated for the Design Capture Volume (DCV) calculated from the 95th percentile design capture storm depth of 1.46 inch in order to satisfy the treatment requirements for both the OC Technical Guidance Document standards and LEED Gold certification. The 95th percentile storm generated a DCV of 3,991 cf. Since infiltration is infeasible, the stormwater treatment for the site will be handled using a Modular Wetland System and detention chamber system to treat the DCV.

Based on the basin delineation, flow paths, slopes and land use coverage of the project site, the existing and proposed peak flow rate were calculated using the procedures from the OC Hydrology Manual. These calculations show that the proposed renovations increase the peak flows from 4.36 cfs to 4.46 cfs. This minor increase in peak flow rate will be mitigated with the detention chamber storage system. See Attachment 2 for calculations.

Conclusion

The proposed stormwater management design for the Irvine Animal Care Center Renovation project includes a Modular Wetland System for treatment of the DCV calculated from the 95th percentile storm. The detention chamber system will be used for temporary storage of stormwater runoff prior to treatment through the Modular Wetland System. The detention system will also serve to reduce the peak flows to the existing conditions.

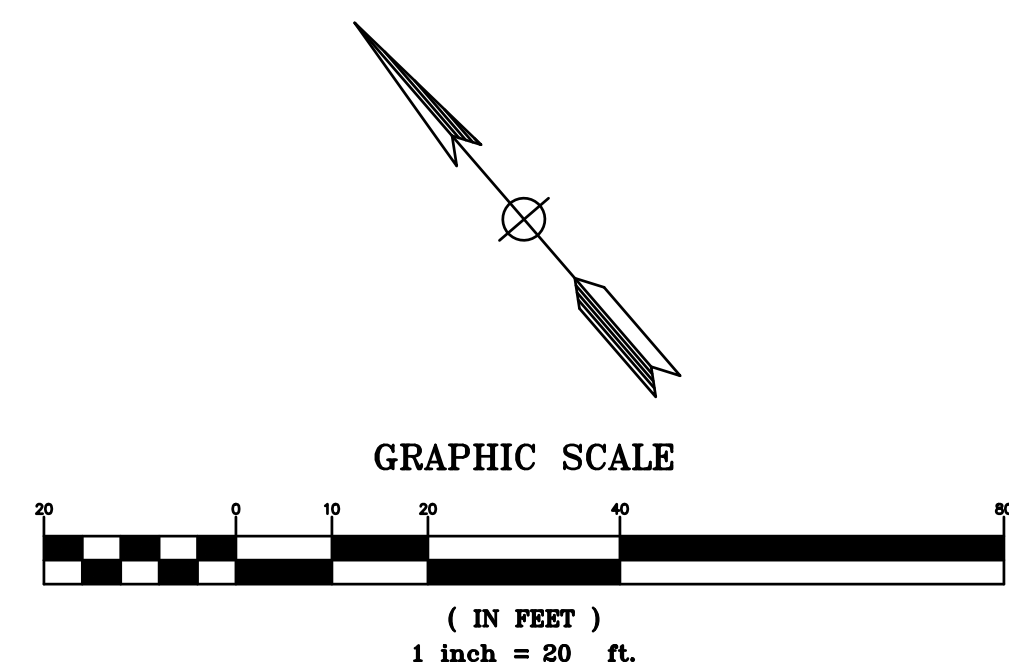
Attachments

Attachment 1 – Drainage Maps

Attachment 2 – Hydrology Calculations



- LEGEND:**
- DMA BOUNDARY
 - SD STORM DRAIN LINE
 - FLOW ARROWS
 - DRAINAGE SUB-AREA LABEL
 - DRAINAGE SUB-AREA SIZE (ACRES)
 - FLOW PATH



			CITY OF IRVINE		PREPARED BY			GEOTECHNICAL FIRM			BENCHMARK			LEGAL DESCRIPTION:			IRVINE ANIMAL CARE CENTER RENOVATION PRE-DEVELOPED HYDROLOGY MAP			<input type="checkbox"/> PRELIMINARY GRADING PERMIT <input type="checkbox"/> PRECISE GRADING PERMIT GRADING PLAN CHECK # _____ GRADING PERMIT # _____			JOB NO.
6					CIVIL ENGINEER LICENSE NO. EXP. DATE			GEOTECHNICAL ENGINEER LICENSE NO. EXP. DATE															
5								GEOLOGICAL FIRM															
4																							
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1											CITY OF IRVINE COMMUNITY DEVELOPMENT DEPARTMENT			ATTACHMENT 1 SHEET 1 OF 2									
NO.	DATE	REVISIONS		APP.	DATE	ENGINEERING GEOLOGIST LICENSE NO. EXP. DATE			SITE ACREAGE _____ ACRES														

ATTACHMENT 2

ORANGE COUNTY HYDROLOGY MANUAL PRECIPITATION DEPTHS

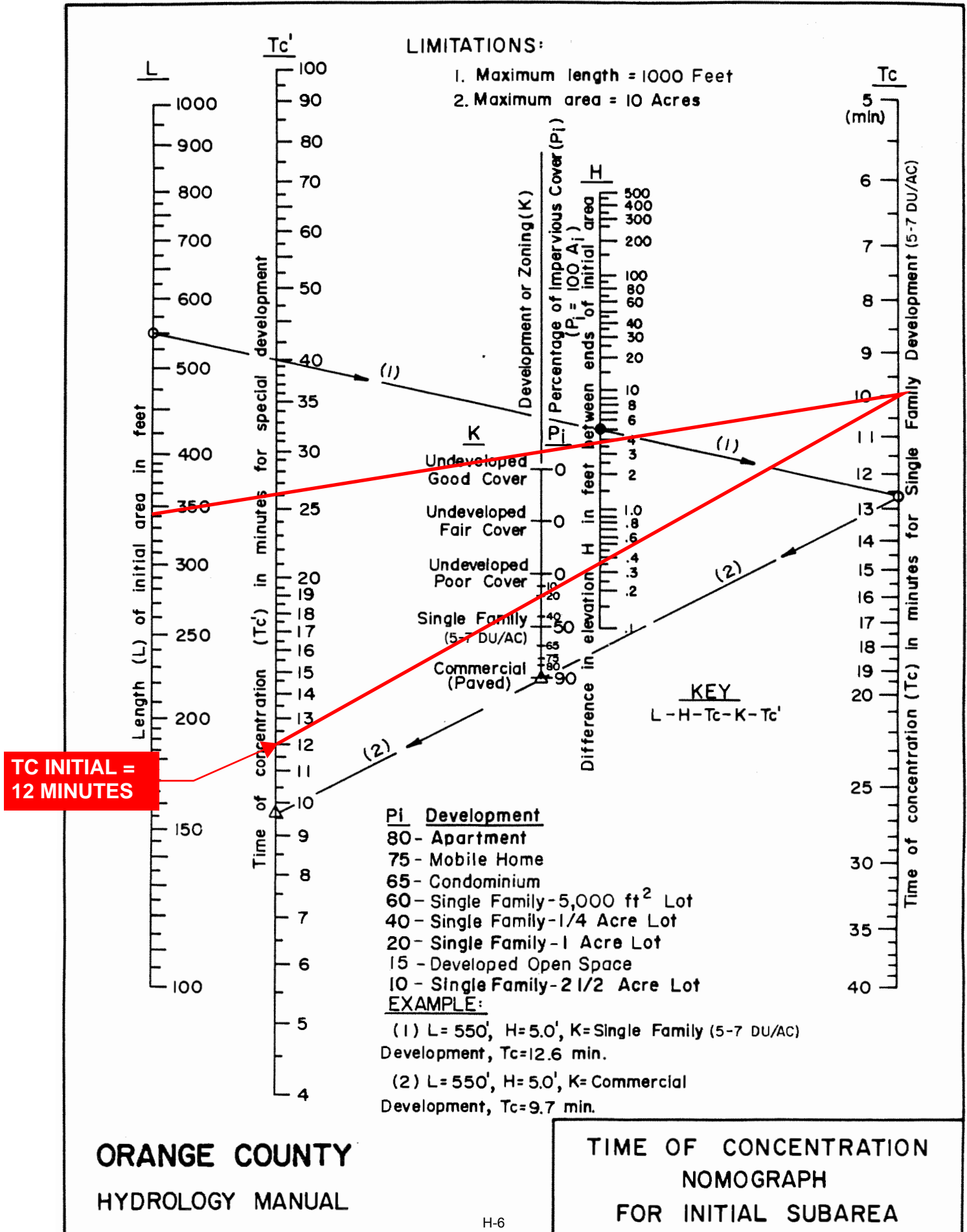
TABLE B.2.
ORANGE COUNTY POINT PRECIPITATION DATA (inches)

T-YR.	DURATION					
	5M	30M	1H	3H	6H	24H
100	0.52(.78)	1.09(1.34)	1.45(1.94)	2.43(3.96)	3.36(6.19)	5.63(11.27)
50	0.45(.71)	0.98(1.19)	1.30(1.73)	2.19(3.52)	3.02(5.51)	5.07(10.02)
25	0.40(.63)	0.87(1.04)	1.15(1.51)	1.94(3.08)	2.71(4.81)	4.49(8.76)
10	0.34(.50)	0.72(.84)	0.95(1.22)	1.59(2.48)	2.20(3.87)	3.68(7.05)
5	0.26(.40)	0.59(.68)	0.78(.99)	1.31(2.01)	1.81(3.14)	3.03(5.71)
2	0.19(.26)	0.40(.45)	0.53(.66)	0.89(1.34)	1.22(2.09)	2.05(3.81)

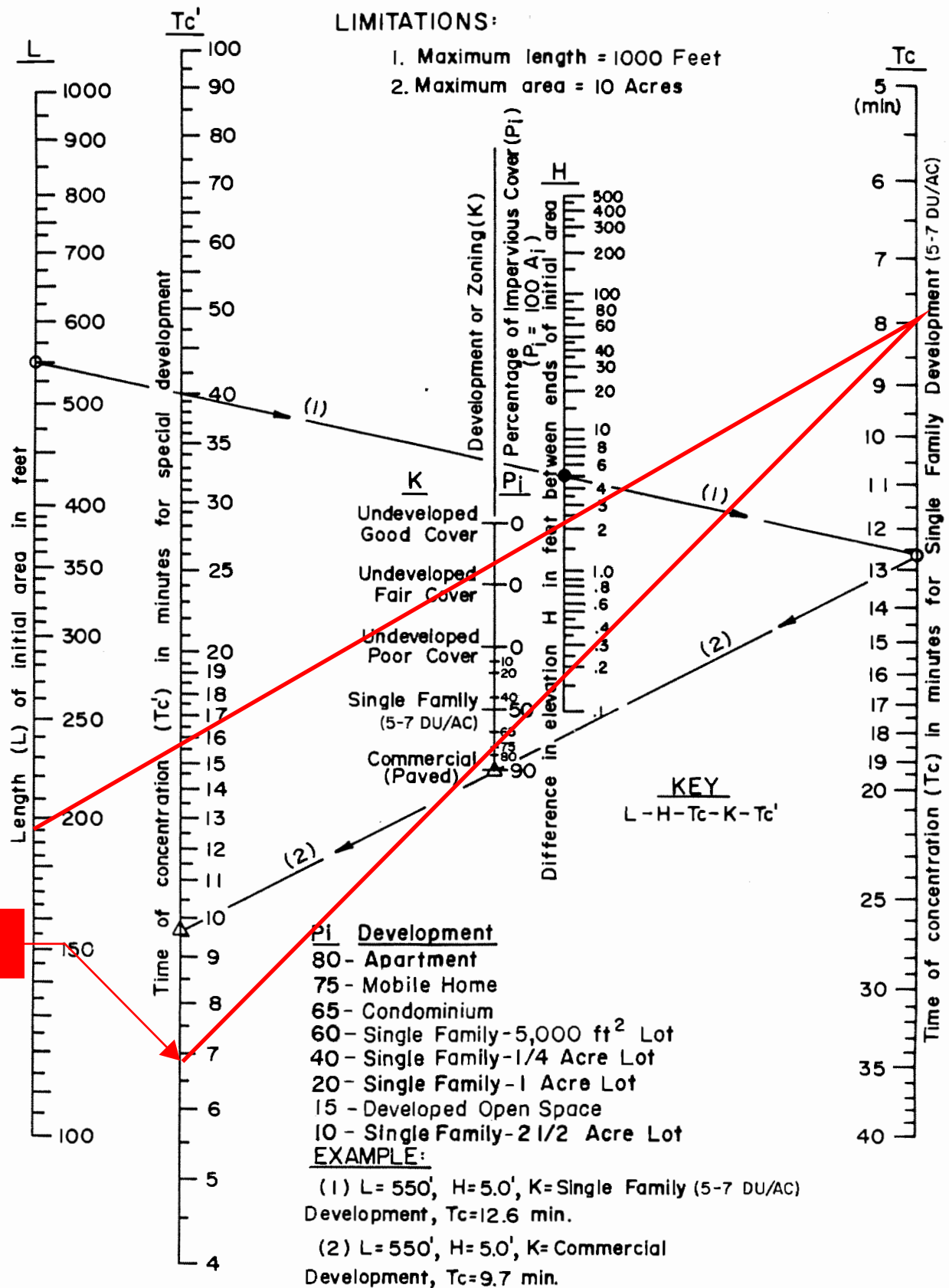
NOTES:

- (1.) Numbers in () are from the Santiago Peak gage station #156, DWR depth-duration-frequency table (1983). Use in areas above 2,000 feet in elevation.
- (2.) Precipitation data for nonmountainous areas taken from an average of 25 rain gages (see ref. 7). Use in areas below 2,000 feet in elevation.
- (3.) All 5M values are extrapolations (see ref. 7).
- (4.) M = minutes; H = hours.

TIME OF CONCENTRATION CALCULATIONS BASIN 1, PRE-DEVELOPED



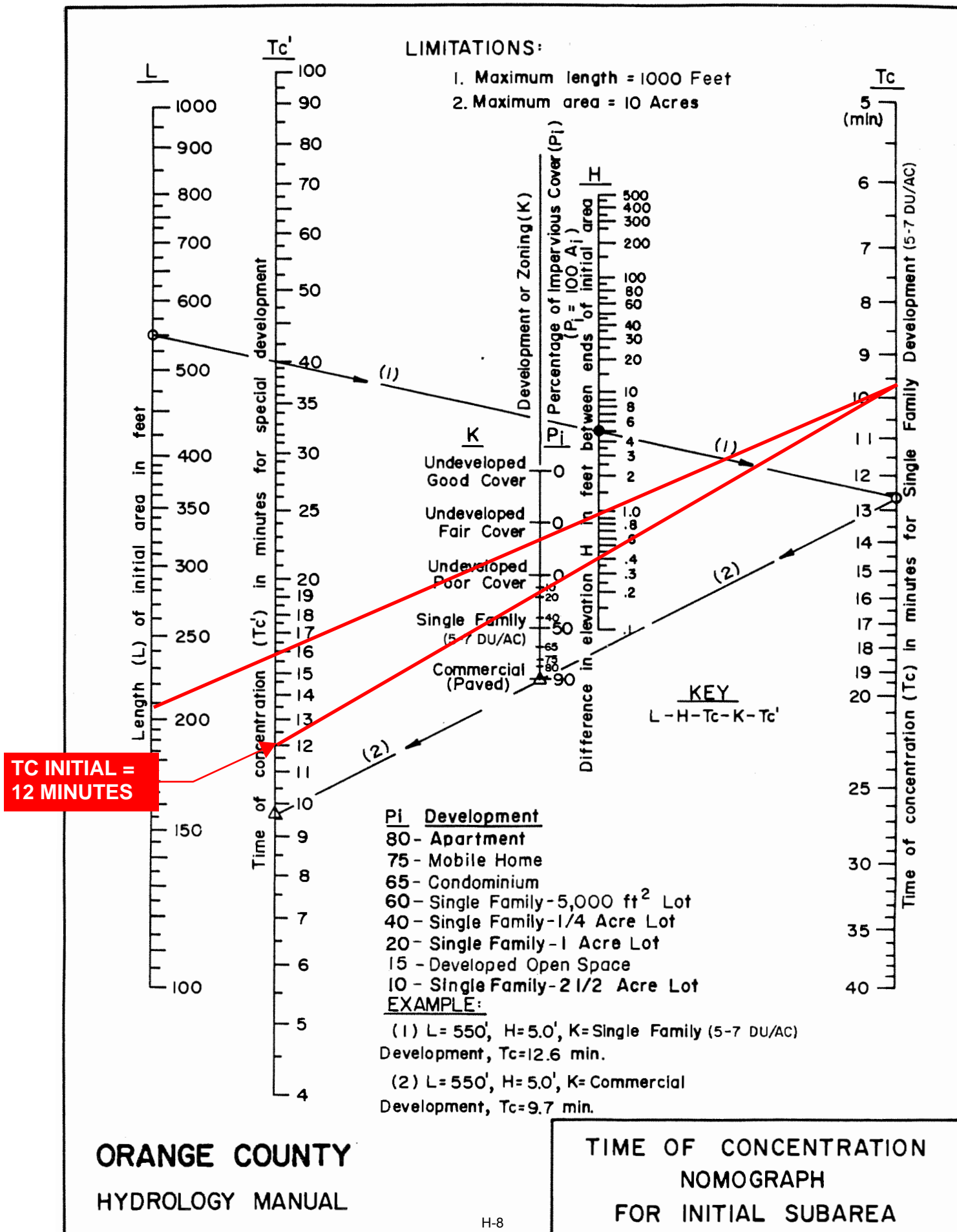
TIME OF CONCENTRATION CALCULATIONS BASIN 2, PRE-DEVELOPED



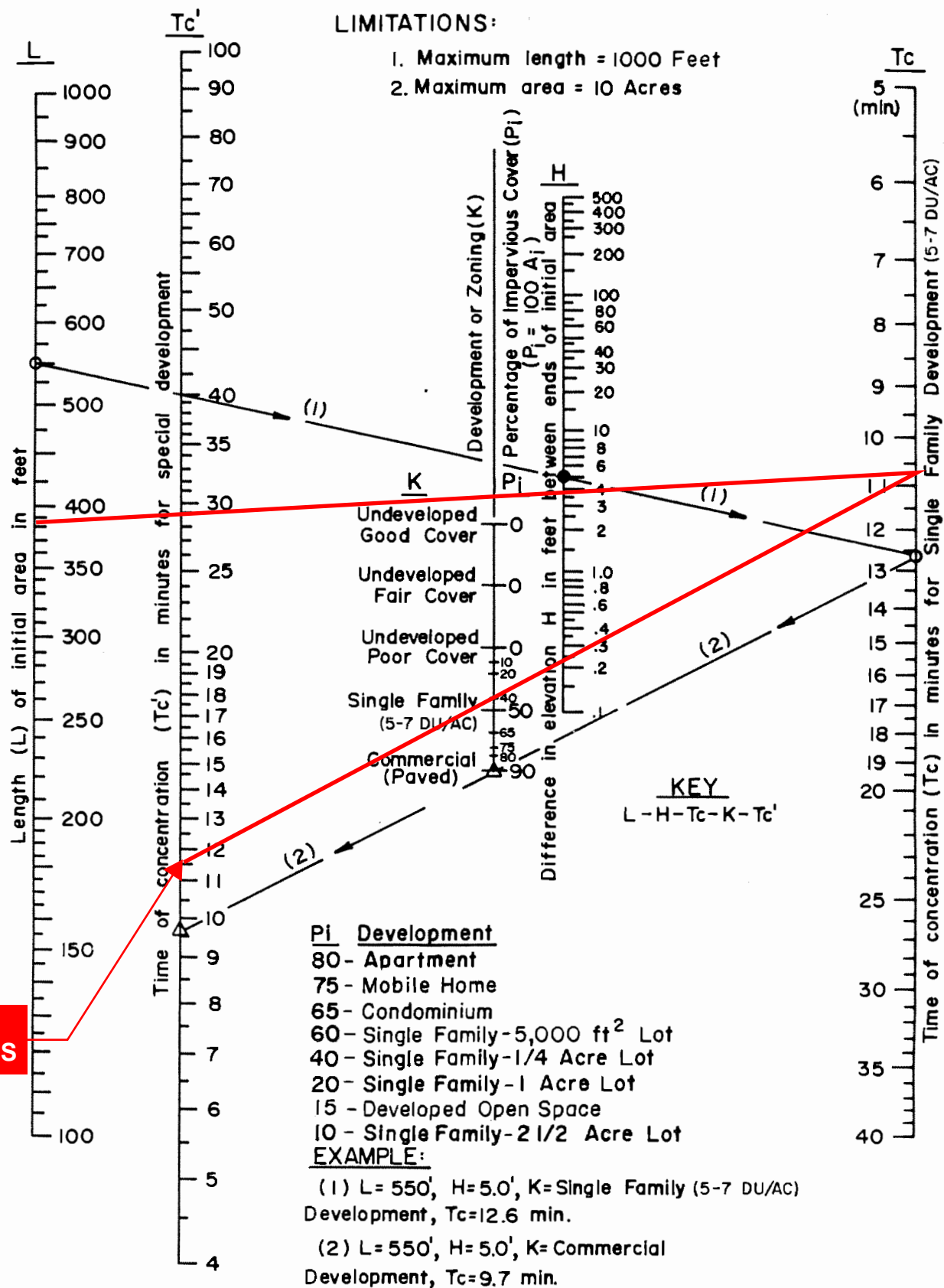
ORANGE COUNTY
HYDROLOGY MANUAL

**TIME OF CONCENTRATION
NOMOGRAPH
FOR INITIAL SUBAREA**

TIME OF CONCENTRATION CALCULATIONS BASIN 3, PRE-DEVELOPED



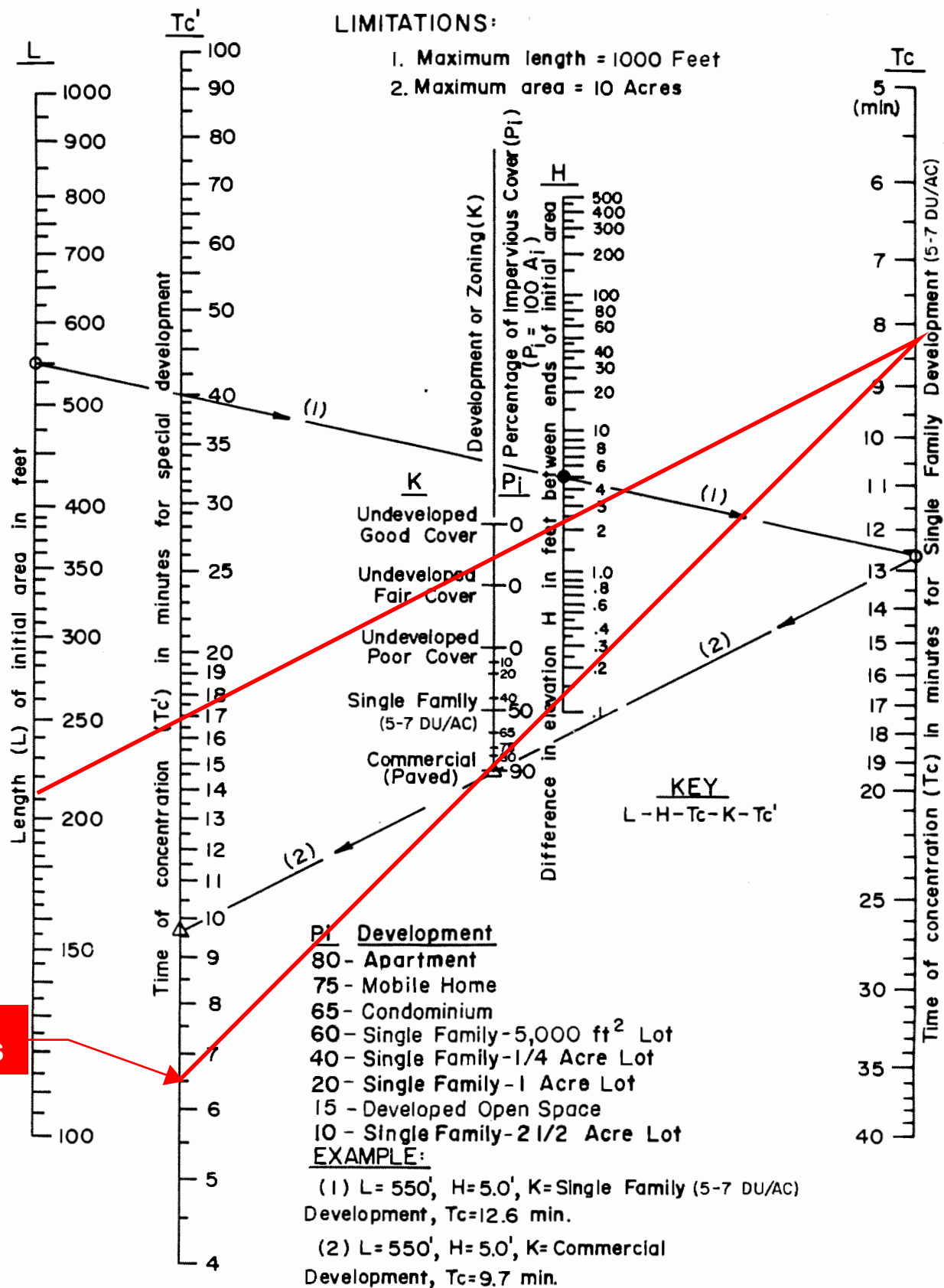
TIME OF CONCENTRATION CALCULATIONS BASIN 1, POST-DEVELOPED



ORANGE COUNTY
HYDROLOGY MANUAL

**TIME OF CONCENTRATION
NOMOGRAPH
FOR INITIAL SUBAREA**

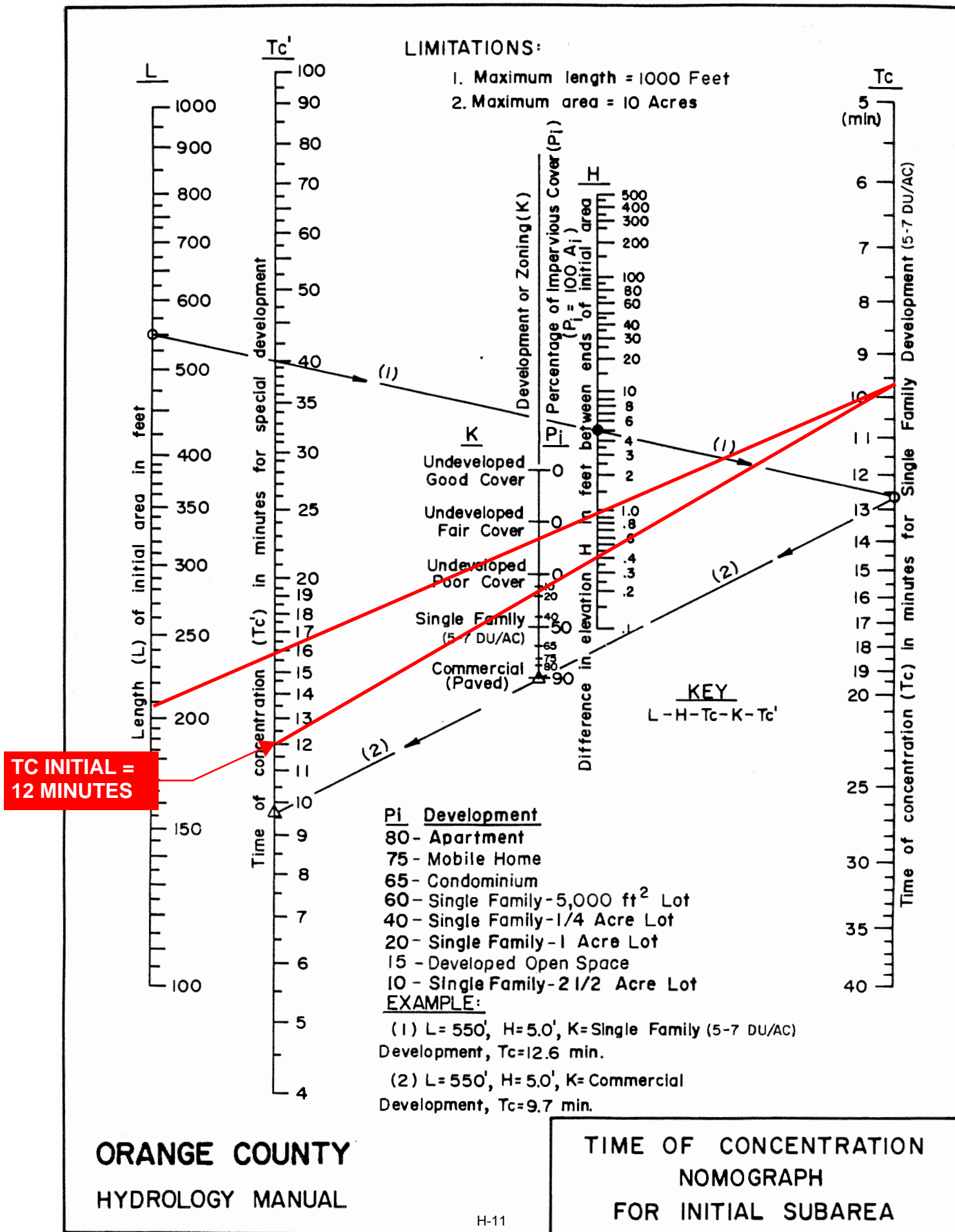
TIME OF CONCENTRATION CALCULATIONS BASIN 2, POST-DEVELOPED



ORANGE COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION
NOMOGRAPH
FOR INITIAL SUBAREA

TIME OF CONCENTRATION CALCULATIONS BASIN 3, POST-DEVELOPED



HYDROLOGY ANALYSIS - 25YR STORM EVENT



Date: 10/21/2021
Job No.: 181414
Project: Irvine Animal Care Center Renovation

Description and Assumptions:

*Based on Orange County Hydrology Manual

Design Frequency = 25 Year Storm Event

HYDROLOGY GIVENS:

1. Determine Initial Time of Concentration

Time of Concentration per Orange County Hydrology Manual - Figure D-1. See Appendix C

Pre-Project

Basin 1	12	min
Basin 2	6.8	min
Basin 3	12	min

Post-Project

Basin 1	11.5	min
Basin 2	6.5	min
Basin 3	12	min

2. Determine Intensity, (I)

Return Frequency = 25 Year Storm

a = 11.995

b = -0.566

time of concentration, t = (Per Orange County Hydrology Manual, Figure D-1)

Peak Intensity, I = at^b

Areas	Intensity, I (in/hr)
EXISTING CONDITIONS	
1	2.94
2	4.05
3	2.94
PROPOSED CONDITIONS	
1	3.01
2	4.16
3	2.94

3. Calculate Maximum Loss-Rate, F_m

$$F_m = a_p \times F_p$$

Where:

a_p = pervious area fraction

F_p = maximum loss rate for the pervious area

Soil Group	A	B	C	D
F _p	0.4	0.3	0.25	0.2

Subareas	Impervious Area (SF)	Impervious Area (Acres)	Pervious Area (SF)	Pervious Area (Acres)	Total Area (Acres)	Hydrologic Soil Group	Maximum Loss Rate Pervious Area, F _p	Maximum Loss-Rate, F _m
EXISTING CONDITIONS								
1	5,662	0.13	23,086	0.53	0.66	B	0.3	0.16
2	13,068	0.30	3,920	0.09	0.39	B	0.3	0.03
3	3,920	0.09	18,295	0.42	0.51	B	0.3	0.13
PROPOSED CONDITIONS								
1	11,325	0.26	17,423	0.40	0.66	B	0.3	0.12
2	14,374	0.33	2,614	0.06	0.39	B	0.3	0.02
3	3,920	0.09	18,295	0.42	0.51	B	0.3	0.13

4. Calculate Peak Flow Rate, Q

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

Where:

Q = Peak Flow Rate (cfs)

I = Rainfall Intensity (in/hr)

F_m = Maximum Loss Rate

A = Drainage Area (acres)

Subareas	Intensity (in/hr)	Maximum Loss Rate, F _m	Drainage Area (Acres)	Peak Flow Rate, Q ₂₅ (cfs)
EXISTING CONDITIONS				
1	2.94	0.16	0.66	1.65
2	4.05	0.03	0.39	1.41
3	2.94	0.13	0.51	1.29
Total			1.56	4.36
PROPOSED CONDITIONS				
1	3.01	0.12	0.66	1.72
2	4.16	0.02	0.39	1.45
3	2.94	0.13	0.51	1.29
Total			1.56	4.46