

**Appendix D:
Preliminary Hydrology Report**

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16C004.00 Costa Mesa Subdivision
Tentative Tract 18064
Preliminary Hydrology



Preliminary Hydrology Report

TENTATIVE TRACT MAP NO. 18064

Project Name:

COSTA MESA RESIDENTIAL DEVELOPMENT

440 Fair Drive, Costa Mesa, CA

Prepared for:



Prepared By:



Integrated Design Services

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Phone: 949- 387-8500

Prepared on:

September 21, 2016

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I. INTRODUCTION

PURPOSE

The purpose of this hydrology report is to evaluate the impact of the 2-year, 5-year and 10-year storm runoff flow from the watershed tributary to the boundaries of the proposed project site. This study also evaluates the pre & post-development hydrological conditions of the site and helps in implementing development mitigation requirements and providing storm drain systems for flood protection of the proposed structures.

PROJECT LOCATION

The site is located at 440 Fair Drive within the city of Costa Mesa, California. The property is bordered by Automotive Facilities to the north and northwest, a gas station to the southwest, Fair Drive to the south, and Carnegie Avenue to the east. The site in relation to the surrounding area is shown on Vicinity Map.

EXISTING CONDITION

The site is currently developed with a two-story commercial building (mini-mall) and a large, asphalt paved parking lot. Associated improvements include some concrete flatwork, underground utilities and a masonry block screen wall along the east margin of the site. Chain-link fencing also bounds the property on the north and west property lines.

Vegetation on site consists of some mature trees along the east property line with some small landscape islands and planters around the building area. Based on Google Earth, topography on site is relatively level at approximately 70 feet above mean sea level. Drainage is generally directed as sheet flow to the north east towards Carnegie.

The site is relatively flat and the elevation of the site ranges from about 73 feet above mean sea level (MSL) within the southern portion of the site to about 70 feet above MSL in the northern portion of the site.

Drainage Area	AREA		Flow Rate (cfs)			
	(ft2)	(ac)	2-yr	10-yr	25-yr	100-yr
Existing	72,729	1.67	2.10	3.79	4.54	5.80

FLOODING HARZARDS

Based on the Flood Insurance Rate Map prepared by The Federal Emergency Management Agency (FEMA), the site is determined to be outside the 1% (100yr) and 0.2% (500yr) annual chance floodplain. See attached map in Appendix A.

The finish floor of the building’s elevation is more than 1’ above the top of the curb and therefore the buildings are safe from 100 yr. storm frequency flood.

PROPOSED DEVELOPMENT

The proposed site is located at 440 Fair Drive within the city of Costa Mesa, California. The proposed site consists of 8 two-story detached homes and 20 three-story duplex units with a total of 28 homes. The site includes interior driveways, decorative hardscape, parking areas, perimeter walls, fences, underground utilities and a shallow infiltration system (CMP detention System). Refer to “Post-Development Hydrology Map” in Appendix F for a graphical presentation of this information. The storm water runoff generated from the proposed site will be treated to minimize the storm water pollution prior to discharging into the street. A Preliminary Water Quality Management Plan (WQMP) Report has been prepared for this project to implement the best management practices.

The pre and post drainage patterns will remain the same; however, under the redeveloped scenario, the site will have a BMP system that will treat and retain the storm water runoff and infiltrate the runoff with CMP detention and percolation system. All the Units front area and the Private Street sheet flows to gutter. The flow collected in the gutter is intercepted by a catch basin located at the entrance of the site. The landscape areas runoff will be collected by area drains. An 8” pipe will then carry the flow from the area drain (located at various location) to the catch basin. The catch basin includes the triton filters (TR filters) that act as primary treatment. TR Filter is a multipurpose catch basin insert designed to capture sediment, trash, debris, suspended solids, oils & grease and other storm water pollutants. A 12” pipe will then carry the flow from the catch basin to 96” storm drain detention system that will retain and infiltrate the 100% Design Captured Volume runoff. The 85th percentile 24-hr storm event runoff volume will be fully captured and infiltrated by the above system. For Q₁₀ 24-hr storm event, the runoff will sheet flows easterly to the Carnegie Avenue.

There are no existing public storm drain systems near property and therefore, the runoff will be collected at the nearest (intersection of Princeton Dr. and Carnegie Ave) catch basin. From there, runoff will be carried out by an existing storm drain system to Paularino Channel to Santa Ana Delhi Channel that eventually will carry out the discharge to the Newport Bay.

Drainage Area	AREA		Flow Rate (cfs)			
	(ft2)	(ac)	2-yr	10-yr	25-yr	100-yr
Proposed	72,729	1.67	1.91	3.4	4.08	5.22

METHODOLOGY

The County of Orange Hydrology Manual, Rational Method was used to determine the flow rate for the 2-year, 10-year, 25-year and 100-yr 24hr. storm event. Information pertinent to Soil Type (Appendix B) as published in the manual were used. The nomograph (Appendix C) published in the manual was used to compute time of concentration for each area in accordance with the Hydrology Manual. The Tc of longest path of travel was used to determine each overall area flowrate. The non-mountainous formulas were used to develop the intensities for this study. The maximum loss rate (Fm) due to infiltration which is a function of the soil type and impervious fraction were computed for each subarea using the watershed data and the formulas from the Hydrology Manual. See Appendix D for calculations. In the proposed condition, the project site consists of overall site drainage areas which are shown in the attached "Post-development Hydrology Map" and can be described as follows:

1. Area I consists of Units 1 through 28, Private Street, parking lots.

RESULTS

Based on the Hydrologic classification of Soils of Orange County Plate B, the soil type was determined to be in Group D.

The calculated flow rate at:

Drainage Area	AREA		Flow Rate (cfs)			
	(ft ²)	(ac)	2-yr	10-yr	25-yr	100-yr
Existing	72,729	1.67	2.1	3.79	4.54	5.8
Proposed	72,729	1.67	1.91	3.4	4.08	5.22

DRAINAGE PATTERN

The pre and post drainage patterns will remain the same, except the site will have BMP system that will retain the storm water runoff and infiltrate the runoff with CMP detention System. The landscape areas runoff will be collected by area drains. An 8" pipe will then carry the flow from the area drain (located at various location) to the catch basin. Also all the lots and private street will sheet flow to the gutter that will intercept at catch basin. Catch basin includes the triton filters (TR filters) that act as primary treatment. TR Filter is a multipurpose catch basin insert designed to capture sediment, trash, debris, suspended solids, oils & grease and other storm water pollutants. An 8" pipe will then carry the flow from the catch basin to 96" storm drain detention system that will retain and infiltrate the 100% Design Captured Volume runoff. For Q₁₀ 24-hr and greater frequency storm event, the overflow from the catch basin will surface flows easterly to the Carnegie Avenue.

There are no existing storm drain systems near property and therefore, the runoff will be collected at the nearest (intersection of Princeton Dr. and Carnegie Ave) catch basin. From there, runoff will be

carried out by an existing storm drain system to Paularino Channel to Santa Ana Delhi Channel that eventually will carry out the discharge to the Newport Bay.

CONCLUSION

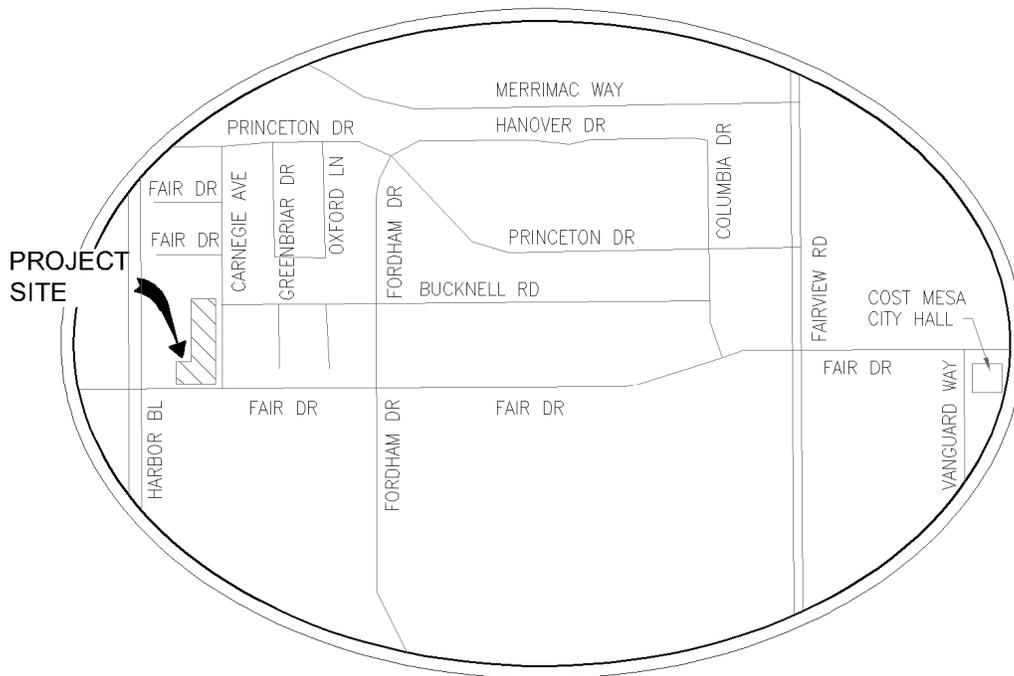
The proposed development will slightly decrease the runoff from the site for the 2-yr, 10-yr, 25-yr and 100-yr 24-hr storm event due to longer time of concentration and increase in pervious area. The existing site consists of commercial building and parking structure with a greater amount of impervious area, while the proposed development which includes residential single family homes, town homes, landscape areas, and private streets, will have less impervious area and a lower time of concentration for the proposed site.

The proposed condition will not increase the peak discharge (runoff) for any of the storm frequencies due to a decrease in impervious area for new development and the infiltration of 0.265 cfs of storm water runoff through BMP; therefore, mitigation of peak runoff is not require for this project.

The proposed site is outside of the 100 year flood zone boundary. Buildings are more than 1' above the top of the curb and therefore they are free from flooding.

The proposed area drain of the lots will be maintained by Home Owner Association (HOA). It will also be HOA's responsibility to service the catch basin and catch basin inserts for any clogging. The overflow from the site for all frequencies will surface flows to the Carnegie Avenue.

II. VICINITY MAP



VICINITY MAP 
NTS

APPENDIX A: FEMA MAP

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **footprints** have been determined, users are encouraged to consult the **Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations** files contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only to landward of 0.0 North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **footprints** were compiled at cross sections and interpolated between cross sections. The footprints were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Footway width and other pertinent footway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11. The **horizontal datum** was NAD 83, GRS80 spheroid. Dimensions of the map, as projected on UTM areas used in the publication of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov> or contact the National Geodetic Survey at the following address:

NCS Information Services
 NOAA, NNGS-12
 National Geodetic Survey
 SDCM-3, #6202
 1315 East-West Highway
 Silver Spring, Maryland 20910-3282
 (301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was derived from the National Agriculture Imagery Program, dated 2005.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and footprints that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

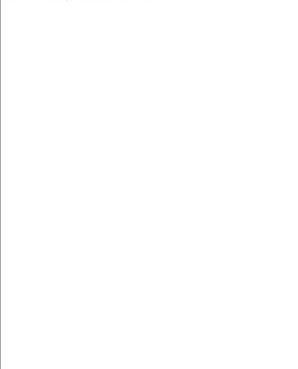
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels, community map repository addresses, and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-368-9629 and its website at <http://www.fema.gov>.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA-MAP (1-877-336-2927) or visit the FEMA website at <http://www.fema.gov>.

Accreted Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance levee) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at <http://www.fema.gov/business/flood/index.htm>.



33°39'22.5" N 117°56'11" W 14°00'00" E JOINS PANEL 0268 14°00'00" E 33°39'22.5" N

City of Costa Mesa 060216

6055000 FT 6055000 FT 117°54'23.2" W

117°54'23.2" W

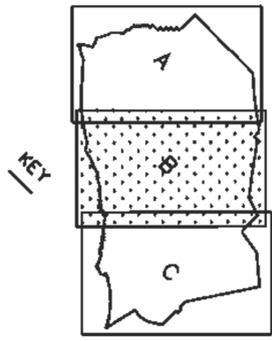
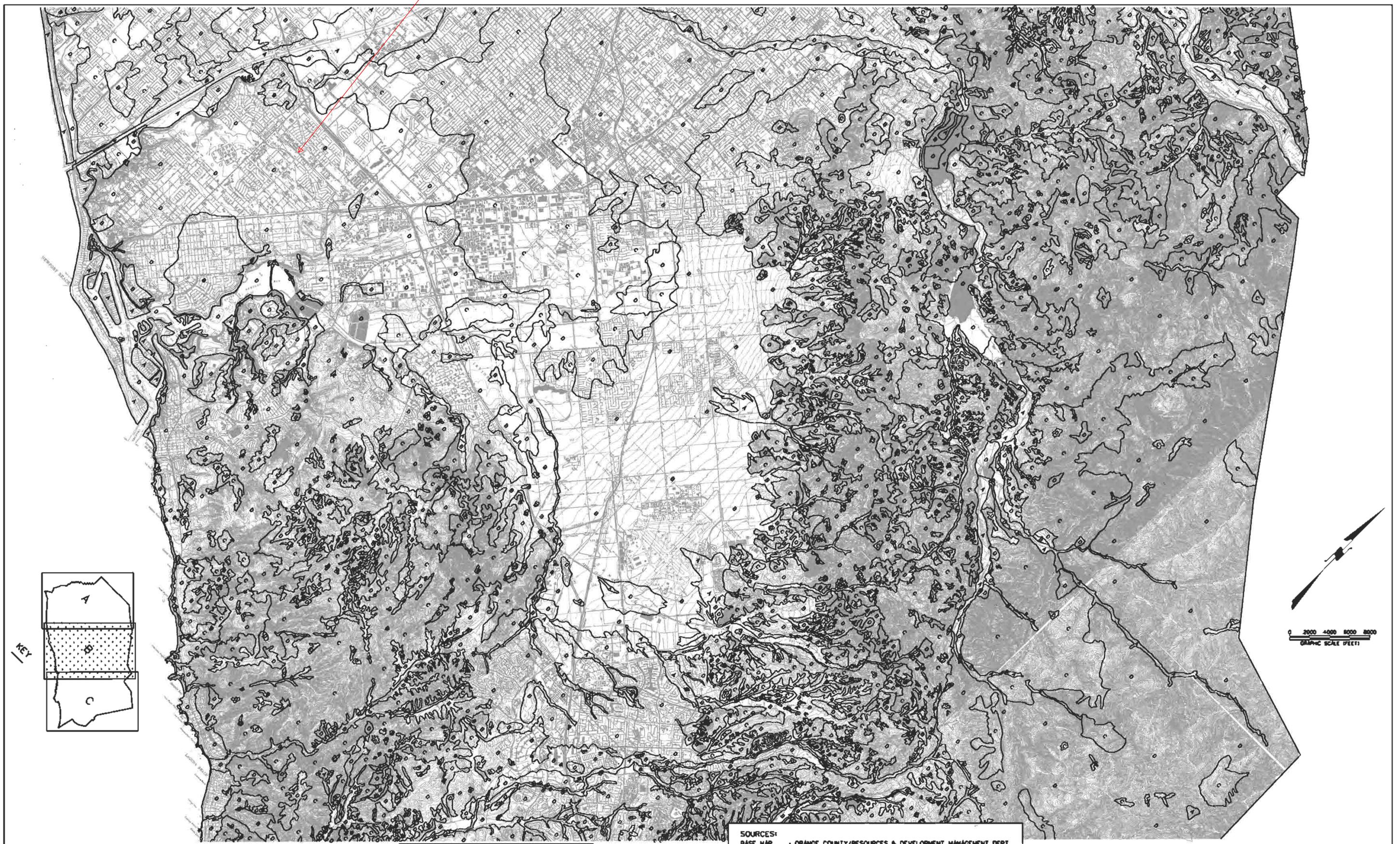
2195000 FT 2195000 FT 32°27'00" N

32°27'00" N

2195000 FT 2195000 FT 32°

APPENDIX B: SOIL INDEX MAP

PROPOSED SITE
Soil Group D



LEGEND
A B C D HYDROLOGIC SOIL GROUPS
— HYDROLOGIC SOIL GROUP BOUNDARY

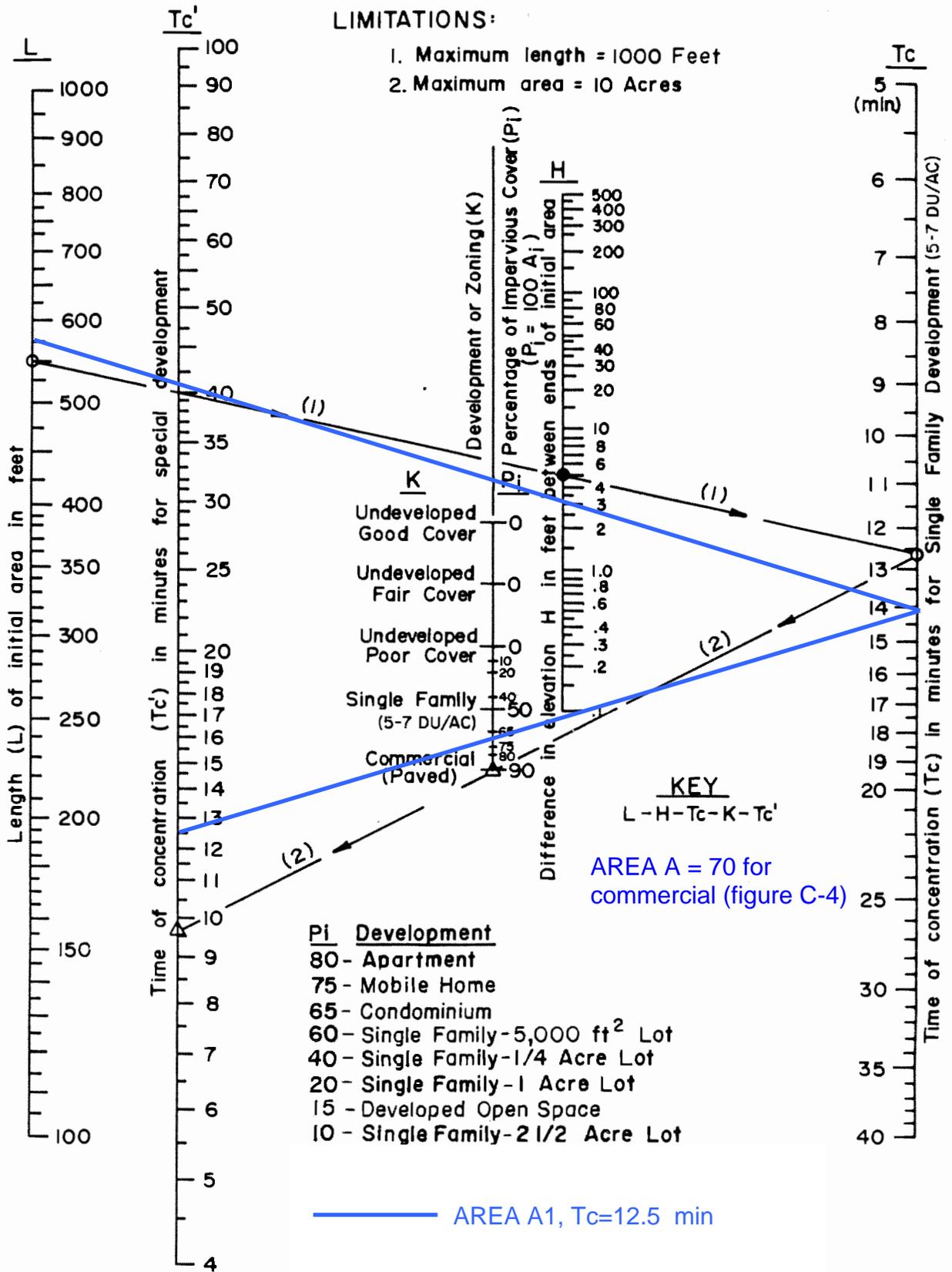
SOURCES:
BASE MAP - ORANGE COUNTY/RESOURCES & DEVELOPMENT MANAGEMENT DEPT
GEOMATICS AND LAND INFORMATION SYSTEMS DIVISION
SOIL GROUPS - SOIL SURVEY OF ORANGE COUNTY AND
WESTERN PART OF RIVERSIDE COUNTY, CALIFORNIA,
USDA, SOIL CONSERVATION SERVICE, 1978.

APPENDIX C: TIME OF CONCENTRATION NOMOGRAPH

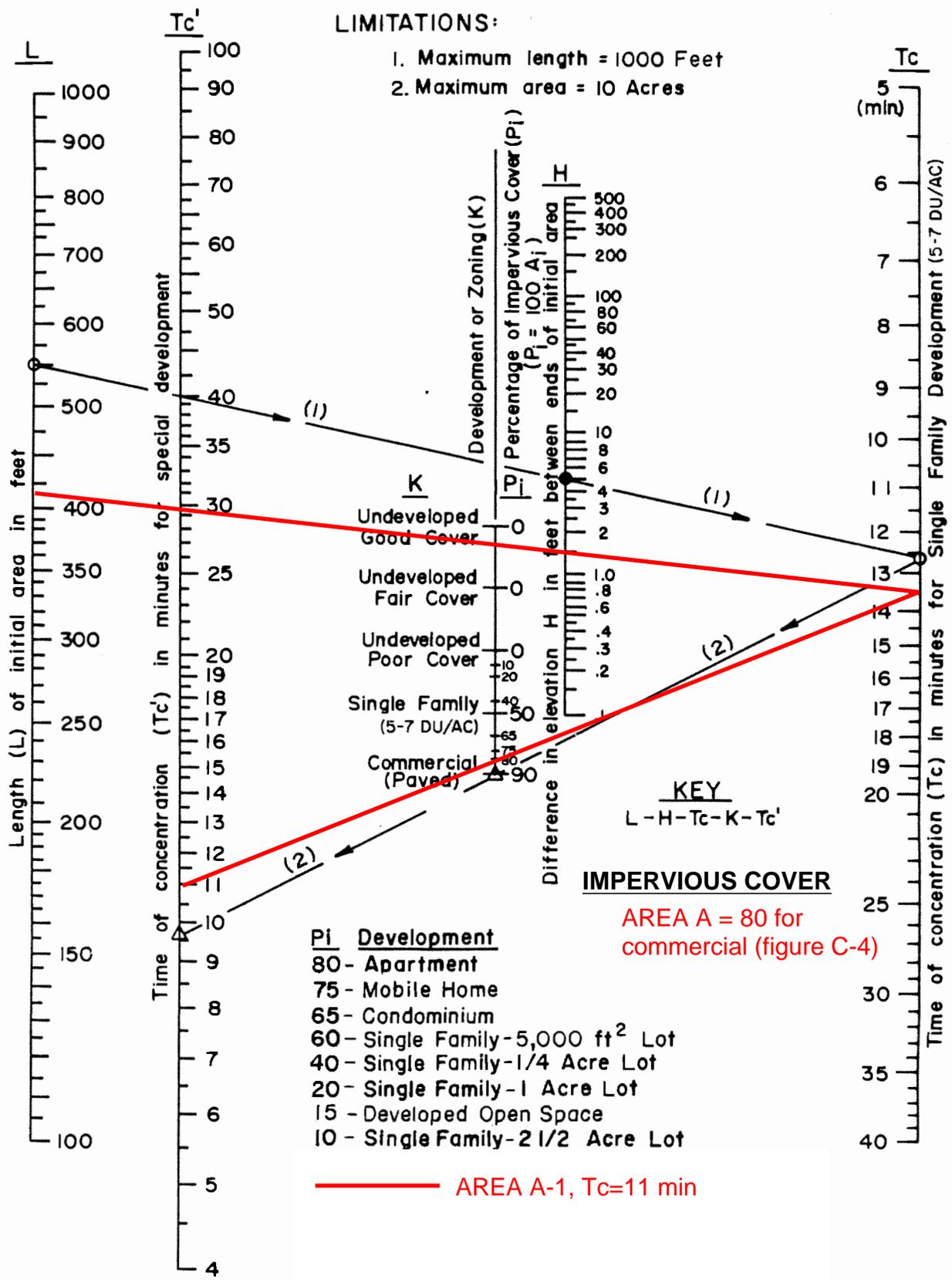
POST-DEVELOPMENT (CM)

LIMITATIONS:

1. Maximum length = 1000 Feet
2. Maximum area = 10 Acres



PRE-DEVELOPMENT (CM)



APPENDIX D: RATIONAL METHOD STUDY FORM

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

$I(t) = at^b$

B-7

Soil Group D

EXISTING AREA		Elev 1	Elev 2	Length	Diff	Slope	impervious	Pervious	% imp	%per	
ft ²	ac	ft	ft	ft	ft	ft/ft	ft ²	ft ²	(%)	(%)	
Area I	72,729	1.67	72.1	70.62	420.5	1.48	0.004	65,824	6,905	0.905	0.095

RATIONAL METHOD STUDY FORM

ORANGE COUNTY		STUDY NAME: 440 Fair Drive, Costa Mesa, CA								Calc'd By: T.G		Date: 6/28/2016		
HYDROLOGY MANUAL		PRE- DEVELOPMENT								Checked: P.G.		Date: 7/2/2016		
		2-YEAR STORM RATIONAL METHOD STUDY										Page 1 of 1		
Concentration Point	AREA (Acres)		Soil Type	Dev. Type	Tt min	Tc min	I in/hr	Fm in/hr	Fm avg	Q Total	Flow Path	Slope ft/ft	V ft/sec	Hydraulics and Notes
	Subarea	Total												
Area I	1.67	1.67	D	S.F.	-	11.0	1.440	0.0189883	0.018988	2.10	420.5	0.0035	-	INITIAL SUBAREA
a_p = pervious area fraction			F_p = infiltration rate for pervious area, from soil group											
				AREA I		AREA II						AREA I		
				a_p	0.095				$F_m = a_p * F_p$	=			0.01899	
				a_i	0.905				F_p		0.2			
$C = 0.9 (a_i + (1 - F_p)(a_p / I))$				C	0.888									
				1	2				C					
				a_p / I	$1 - F_p$	$2 * 1$	$a_i + 3$							
				I	0.0659	1.240	0.1	1.0	0.8881297					

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

$I(t) = at^b$ page Hydrology manual B-7

Soil group - pg c-13

YEARS	a (+)	b (-)	Soil Group	Fp- max. effective pervious area loss rates (in/hr)
			A	0.4
2	5.702	0.574	B	0.3
5	7.87	0.562	C	0.25
10	10.209	0.573	D	0.2
25	11.995	0.566		
50	13.521	0.566		
100	15.56	0.573		

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

$I(t) = at^b$

B-7

Soil Group D

EXISTING AREA		Elev 1	Elev 2	Length	Diff	Slope	impervious	Pervious	% imp	%per	
	ft ²	ac	ft	ft	ft	ft/ft	ft ²	ft ²	(%)	(%)	
Area I	72,729	1.67	72.1	70.62	420.5	1.48	0.004	65,824	6,905	0.905	0.095

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL		STUDY NAME: 440 Fair Drive, Costa Mesa, CA								Calc'd By: T.G		Date: 6/28/2016		
		PRE- DEVELOPMENT 10-YEAR STORM RATIONAL METHOD STUDY								Checked I.P.G.		Date: 7/2/2016		
		Page 1 of 1												
Concentration Point	AREA (Acres)		Soil Type	Dev. Type	Tt min	Tc min	I in/hr	Fm in/hr	Fm avg	Q Total	Flow Path	Slope ft/ft	V ft/sec	Hydraulics and Notes
	Subarea	Total												
Area I	1.67	1.67	D	S.F.	-	11.0	2.584	0.0189883	0.018988	3.79	420.5	0.0035	-	INITIAL SUBAREA
a _p = pervious area fraction			F _p = infiltration rate for pervious area, from soil group											
					AREA I	AREA II								AREA I
					a _p	0.095				F _m =a _p *F _p	=		0.01899	
					a _i	0.905				F _p	0.2			
C=0.9 (ai + (I-Fp)(ap/I))			C											
					1	2								C
					a _p /I	I-F _p	2*1	a _i +3						
					I	0.0367	2.384	0.1	1.0	0.893386				

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

$I(t) = at^b$

B-7

Soil Group D

EXISTING AREA		Elev 1	Elev 2	Length	Diff	Slope	impervious	Pervious	% imp	%per	
ft ²	ac	ft	ft	ft	ft	ft/ft	ft ²	ft ²	(%)	(%)	
Area I	72,729	1.67	72.1	70.62	420.5	1.48	0.004	65,824	6,905	0.905	0.095

RATIONAL METHOD STUDY FORM

ORANGE COUNTY		STUDY NAME: 440 Fair Drive, Costa Mesa, CA								Calc'd By: T.G		Date: 9/20/2016		
HYDROLOGY MANUAL		PRE- DEVELOPMENT								Checked: P.G.		Date: 9/20/2016		
		25-YEAR STORM RATIONAL METHOD STUDY										Page 1 of 1		
Concentration Point	AREA (Acres)		Soil Type	Dev. Type	Tt min	Tc min	I in/hr	Fm in/hr	Fm avg	Q Total	Flow Path	Slope ft/ft	V ft/sec	Hydraulics and Notes
	Subarea	Total												
Area I	1.67	1.67	D	S.F.	-	11.0	3.087	0.0189883	0.018988	4.54	420.5	0.0035	-	INITIAL SUBAREA
a _p = pervious area fraction			F _p = infiltration rate for pervious area, from soil group											
					AREA I	AREA II							AREA I	
					a _p	0.095				F _m = a _p * F _p	=		0.01899	
					a _i	0.905				F _p	0.2			
C = 0.9 (a _i + (1 - F _p)(a _p /I))					C	0.894								
					1	2								C
					a _p /I	I - F _p	2*1	a _i +3						
					I	0.0308	2.887	0.1	1.0	0.8944645				

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

Soil Group D

EXISTING AREA		Elev 1	Elev 2	Length	Diff	Slope	impervious	Pervious	% imp	%per	
	ft ²	ac	ft	ft	ft	ft/ft	ft ²	ft ²	(%)	(%)	
Area I	72,729	1.67	72.1	70.62	420.5	1.48	0.004	65,824	6,905	0.905	0.095

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL		STUDY NAME: 440 Fair Drive, Costa Mesa, CA								Calc'd By: T.G		Date: 9/20/2016		
		PRE- DEVELOPMENT								Checked I P.G.		Date: 9/20/2016		
		100-YEAR STORM RATIONAL METHOD STUDY										Page 1 of 1		
Concentration Point	AREA (Acres)		Soil Type	Dev. Type	Tt min	Tc min	I in/hr	Fm in/hr	Fm avg	Q Total	Flow Path	Slope ft/ft	V ft/sec	Hydraulics and Notes
	Subarea	Total												
Area I	1.67	1.67	D	S.F.	-	11.0	3.938	0.0189883	0.018988	5.80	420.5	0.0035	-	INITIAL SUBAREA
a _p = pervious area fraction			F _p = infiltration rate for pervious area, from soil group											
					AREA I	AREA II								AREA I
				a _p	0.095				F _m =a _p *F _p	=				0.01899
				a _i	0.905				F _p		0.2			
C=0.9 (a _i + (I-F _p)(a _p /I))			C											
				1	2				C					
				a _p /I	I-F _p	2*1	a _i +3							
			I	0.0241	3.738	0.1	1.0	0.8956605						

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

Soil Group D

PROPOSED AREA		Elev 1	Elev 2	Length	Diff	Slope	impervious	Pervious	% imp	%per	
	ft ²	ac	ft	ft	ft	ft/ft	ft ²	ft ²	(%)	(%)	
Area I	72,729	1.67	72.98	69.94	564	3.04	0.005	55,329	17,400	0.761	0.239

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL		STUDY NAME: 440 Fair Drive, Costa Mesa, CA								Calc'd By: T.G		Date: 9/20/2016		
		POST- DEVELOPMENT 2-YEAR STORM RATIONAL METHOD STUDY								Checked I P.G.		Date: 9/20/2016		
		Page 1 of 1												
Concentration Point	AREA (Acres)		Soil Type	Dev. Type	Tt min	Tc min	I in/hr	Fm in/hr	Fm avg	Q Total	Flow Path	Slope ft/ft	V ft/sec	Hydraulics and Notes
	Subarea	Total												
Area I	1.67	1.67	D	S.F.	-	12.5	1.338	0.0478489	0.047849	1.91	564	0.0054	-	INITIAL SUBAREA
a _p = pervious area fraction			F _p = infiltration rate for pervious area, from soil group											
					AREA I	AREA II							AREA I	
				a _p	0.239				F _m =a _p *F _p	=			0.04785	
				a _i	0.761				F _p		0.2			
C=0.9 (a _i + (I-F _p)(a _p /I))			C											
				1	2				C					
				a _p /I	I-F _p	2*1	a _i +3							
			I	0.1788	1.138	0.2	1.0	0.8678106						

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

$I(t) = at^b$ page Hydrology manual B-7

Soil group - pg c-13

YEARS	a	b	Soil Group	Fp- max. effective pervious area loss rates (in/hr)
	(+)	(-)		
2	5.702	0.574	A	0.4
5	7.87	0.562	B	0.3
10	10.209	0.573	C	0.25
25	11.995	0.566	D	0.2
50	13.521	0.566		
100	15.56	0.573		

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

Soil Group D

PROPOSED AREA		Elev 1	Elev 2	Length	Diff	Slope	impervious	Pervious	% imp	%per	
	ft ²	ac	ft	ft	ft	ft/ft	ft ²	ft ²	(%)	(%)	
Area I	72,729	1.67	72.98	69.94	564	3.04	0.005	55,329	17,400	0.761	0.239

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL		STUDY NAME: 440 Fair Drive, Costa Mesa, CA								Calc'd By: T.G		Date: 9/20/2016		
		POST- DEVELOPMENT 10-YEAR STORM RATIONAL METHOD STUDY								Checked I P.G.		Date: 9/20/2016		
		Page 1 of 1												
Concentration Point	AREA (Acres)		Soil Type	Dev. Type	Tt min	Tc min	I in/hr	Fm in/hr	Fm avg	Q Total	Flow Path	Slope ft/ft	V ft/sec	Hydraulics and Notes
	Subarea	Total												
Area I	1.67	1.67	D	S.F.	-	13.0	2.348	0.0478489	0.047849	3.40	564	0.0054	-	INITIAL SUBAREA
a _p = pervious area fraction			F _p = infiltration rate for pervious area, from soil group											
					AREA I	AREA II							AREA I	
				a _p	0.239				F _m =a _p *F _p	=			0.04785	
				a _i	0.761				F _p		0.2			
C=0.9 (a _i + (I-F _p)(a _p /I))			C											
				1	2				C					
				a _p /I	I-F _p	2*1	a _i +3							
			I	0.1019	2.148	0.2	1.0	0.8816591						

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

Soil Group D

PROPOSED AREA		Elev 1	Elev 2	Length	Diff	Slope	impervious	Pervious	% imp	%per	
	ft ²	ac	ft	ft	ft	ft/ft	ft ²	ft ²	(%)	(%)	
Area I	72,729	1.67	72.98	69.94	564	3.04	0.005	55,329	17,400	0.761	0.239

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL		STUDY NAME: 440 Fair Drive, Costa Mesa, CA								Calc'd By: T.G		Date: 9/20/2016		
		POST- DEVELOPMENT 25-YEAR STORM RATIONAL METHOD STUDY								Checked I P.G.		Date: 9/20/2016		
		Page 1 of 1												
Concentration Point	AREA (Acres)		Soil Type	Dev. Type	Tt min	Tc min	I in/hr	Fm in/hr	Fm avg	Q Total	Flow Path	Slope ft/ft	V ft/sec	Hydraulics and Notes
	Subarea	Total												
Area I	1.67	1.67	D	S.F.	-	13.0	2.809	0.0478489	0.047849	4.08	564	0.0054	-	INITIAL SUBAREA
a _p = pervious area fraction			F _p = infiltration rate for pervious area, from soil group											
					AREA I	AREA II							AREA I	
				a _p	0.239				F _m =a _p *F _p	=			0.04785	
				a _i	0.761				F _p		0.2			
C=0.9 (a _i + (I-F _p)(a _p /I))			C											
				1	2				C					
				a _p /I	I-F _p	2*1	a _i +3							
			I	0.0852	2.609	0.2	1.0	0.8846678						

TENTATIVE TRACT NO. 18064

Preliminary Hydrology

Soil Group D

PROPOSED AREA		Elev 1	Elev 2	Length	Diff	Slope	impervious	Pervious	% imp	%per	
	ft ²	ac	ft	ft	ft	ft/ft	ft ²	ft ²	(%)	(%)	
Area I	72,729	1.67	72.98	69.94	564	3.04	0.005	55,329	17,400	0.761	0.239

RATIONAL METHOD STUDY FORM

ORANGE COUNTY HYDROLOGY MANUAL		STUDY NAME: 440 Fair Drive, Costa Mesa, CA								Calc'd By: T.G		Date: 9/20/2016		
		POST- DEVELOPMENT 100-YEAR STORM RATIONAL METHOD STUDY								Checked I.P.G.		Date: 9/20/2016		
		Page 1 of 1												
Concentration Point	AREA (Acres)		Soil Type	Dev. Type	Tt min	Tc min	I in/hr	Fm in/hr	Fm avg	Q Total	Flow Path	Slope ft/ft	V ft/sec	Hydraulics and Notes
	Subarea	Total												
Area I	1.67	1.67	D	S.F.	-	13.0	3.579	0.0478489	0.047849	5.22	564	0.0054	-	INITIAL SUBAREA
a _p = pervious area fraction			F _p = infiltration rate for pervious area, from soil group											
					AREA I	AREA II							AREA I	
				a _p	0.239				F _m =a _p *F _p	=			0.04785	
				a _i	0.761				F _p		0.2			
C=0.9 (a _i + (I-F _p)(a _p /I))			C											
				1	2				C					
				a _p /I	I-F _p	2*1	a _i +3							
			I	0.0669	3.379	0.2	1.0	0.8879664						

APPENDIX E: HYDROLOGY MAP

- **HYDROLOGY MAP – PRE DEVELOPMENT**
- **HYDROLOGY MAP – POST DEVELOPMENT**

