COFFEY ENGINEERING, INC.

Drainage Study
Nunez Lot Split

7306 Draper Avenue
La Jolla, CA 92037
APN: 351-024-08
PTS No. 655382

Prepared For:

Bellava Construction, LLC.
and
The City of San Diego

December 7, 2020

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Table of Contents

1. **Project Description**

The 6,325 ft^2 site is located in the city of La Jolla at 7306 Drape Avenue. The lot currently contains a single family residence, attached garage, and paved driveway. Proposed is the demolition of the existing residence and the construction of two separate single family residences and one detached garage. The lot will be subdivided into two legal lots.

2. **Drainage Patterns**

The lot falls in elevation from the east to the west. The fronting streets (Draper Avenue to the east and Sea Lane to the south) are fully improved with concrete curb & gutter, therefore no stormwater run-on enters the property from the street. No run-on from adjacent properties enters the site either. A southerly portion (approximately 1/3 of the lot) sheet flows southwesterly to Sea Lane. The remaining 2/3^rds^ of the lot sheet flows to the northwesterly corner of the lot, discharging to adjacent properties to the west, eventually discharging (via sheet flow) to Cuvier Street.

Runoff from Sea Lane travels to Cuvier Street as well, draining northerly to Marine Street then westerly, ultimately entering the public storm drain system at the intersection of La Jolla Blvd. and Marine Street. This section of the public storm drain system discharges to the Pacific Ocean at Windandsea Beach.

Refer to Drainage Map ‘A.1’ included in Appendix B of this report for a map of the existing conditions.

The drainage patterns of the proposed site will generally remain the same. However, a larger portion of the site will drain to the south (to Sea Lane) via sheet flow and a central portion of the site will be now be directed to the east to Draper Avenue via sheet flow as well. A smaller portion of the site will continue to sheet flow to the northwest corner of the site. However, instead of allowing storm water to discharge from the site to the private properties to the northwest, storm water will be captured by a grated inlet and pumped to a catch basin just inside the property line/Draper Ave. right-of-way where it will then gravity flow the curb & gutter of Draper Avenue. Refer to Drainage Map ‘B.1’ included in Appendix B of this report for the proposed conditions.

3. **Purpose and Scope of Report**

The purpose of this report is to evaluate the drainage conditions of the existing site as well as the proposed conditions and to also size drainage system components accordingly. A 100-year storm was used in the calculations of site runoff.

4. **Method of Calculations**

The Rational Method, as defined by the *City of San Diego Drainage Design Manual* (2017), will be used to calculate storm water flow rates. Where noted, the following calculations were used to determine flow properties:

Rainfall Characteristics

$Q = C * I * A$, where

Q = Flow rate (ft^3/sec)
C = Runoff coefficient
I = Rainfall intensity (in/hr)
A = Area (acres)

$I = 7.44 * P_6 * D^{-0.645}$, where

I = Rainfall intensity (in/hr)
P_6 = Adjusted 6-hour precipitation (inches)
D = Storm duration (min), equal to T_c for time-of-concentration storms

$Tc = Ti+Tt+Tp$ (time-of-concentration), where
Ti=Over land initial time.
Tt=Travel time on natural watersheds.
Tp=Travel time on drainage structures (pipes, brow ditch, gutter etc.)

$Ti= 1.8(1.1-C)\ D^{0.50} /(s^{0.33})$ (Overland initial time of concentration formula),where

D= Watercourse Distance (feet)(see table 3-2 for the max. overland flow length)
s = Slope (%)
C= Runoff Coefficient
Ti=Initial time of concentration (min.)

$T_t = (11.9*L^3\ /\ \Delta H)^{0.385}$ (formula for travel time for natural watersheds), where

T_c = Time of Concentration or Travel time (hours)
L = Length of watercourse (miles)
ΔH = Change in effective slope height (ft)

Pipe and Open Channel Flow Characteristics

$V = 1/n * R^{2/3} * S^{1/2}$ (from Manning), where
V = Average cross-sectional velocity (ft/sec)
n = Manning roughness coefficient
R = Hydraulic radius (ft)
S = Slope of water surface (ft height/ft length)

$p/\gamma + V^2/2g + z_1 + h_L = p/\gamma + V^2/2g + z_2$ (from Bernoulli), where

p = pressure (lbs/ft^2)
γ = density (lbs/ft^3)
V = velocity (ft/sec)
g = gravity (ft/sec/sec)
z = height of fluid (ft)
h_L = head loss (ft)

5. **Results and Conclusions:**

Due to the existing use of the site remaining unchanged, no overall increases in runoff are anticipated from the project. Even though a smaller portion of the lot will drain to the northwest corner (reducing runoff), the incorporation of the grated inlet and sump pump in the northwest corner will effectively eliminate storm water discharges from the site to adjacent private properties. Therefore no negative impacts to adjacent properties are anticipated. Since the overall drainage patterns will remain the same (i.e. drainage to the same public storm drain system), no adverse effects are expected to result from the project. Complete runoff calculations have been included in Appendix B of this report.

6. **Declaration of Responsible Charge**

I hereby declare that I am the Civil Engineer of work for this project, that I have exercised responsible charge over the design of the project as defined in section 6703 of the business and professions code, and that the design is consistent with current design.

I understand that the check of project drawings and specifications by the City of San Diego is confined to a review only and does not relieve me, as Engineer of Work, of my responsibilities for project design.

8/19/20

Daniel Valdez
RCE 76074
Exp. 6-30-22

Date

Bibliography

- City of San Diego. 2017. *Drainage Design Manual*. http://www.sandiego.gov/publicworks/edocref/index.shtml

Appendix A –Reference Maps

NUNEZ LOT SPLIT -GENERAL VICINITY TOPOGRAPHY & PUBLIC STORM DRAIN

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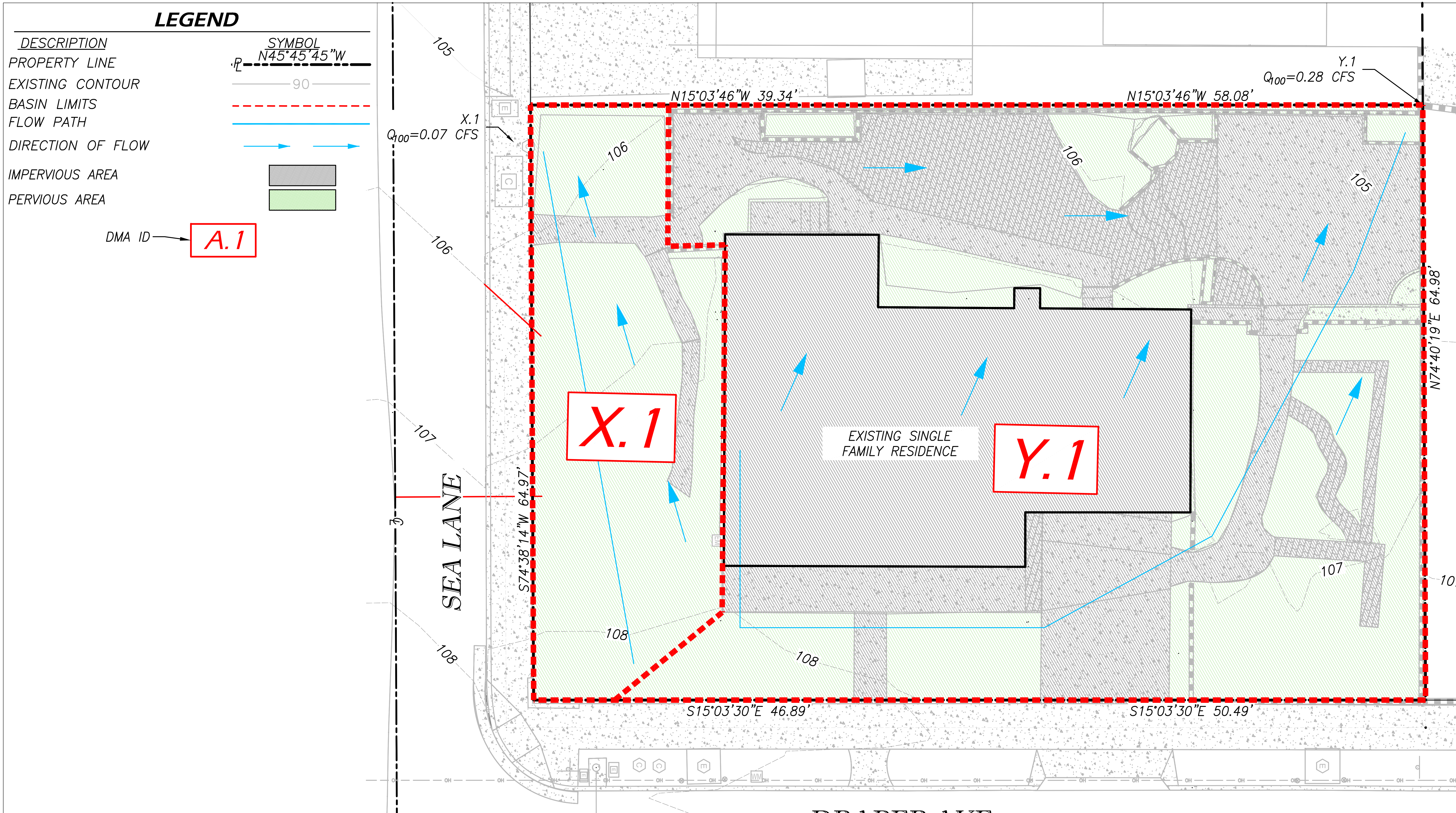
NUNEZ LOT SPLIT - DRAINAGE MAP A.1 - EXISTING CONDITIONS



Drainage Area	Impervious Area (ft^2)	Pervious Area (ft^2)	Total (ft^2)	Total (AC)	Percent Impervious
X.1	100	1,101	1,201	0.03	8.33%
Y.1	3,393	1,731	5,124	0.12	66.22%

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NUNEZ LOT SPLIT - DRAINAGE MAP B.1 - PROPOSED CONDITIONS

LEGEND

DESCRIPTION	SYMBOL
PROPERTY LINE	P/L N45°45'45"W
EXISTING CONTOUR	90
PROPOSED CONTOUR	90
BASIN LIMITS	
FLOW PATH	
DIRECTION OF FLOW	
IMPERVIOUS AREA	
PERVIOUS AREA	

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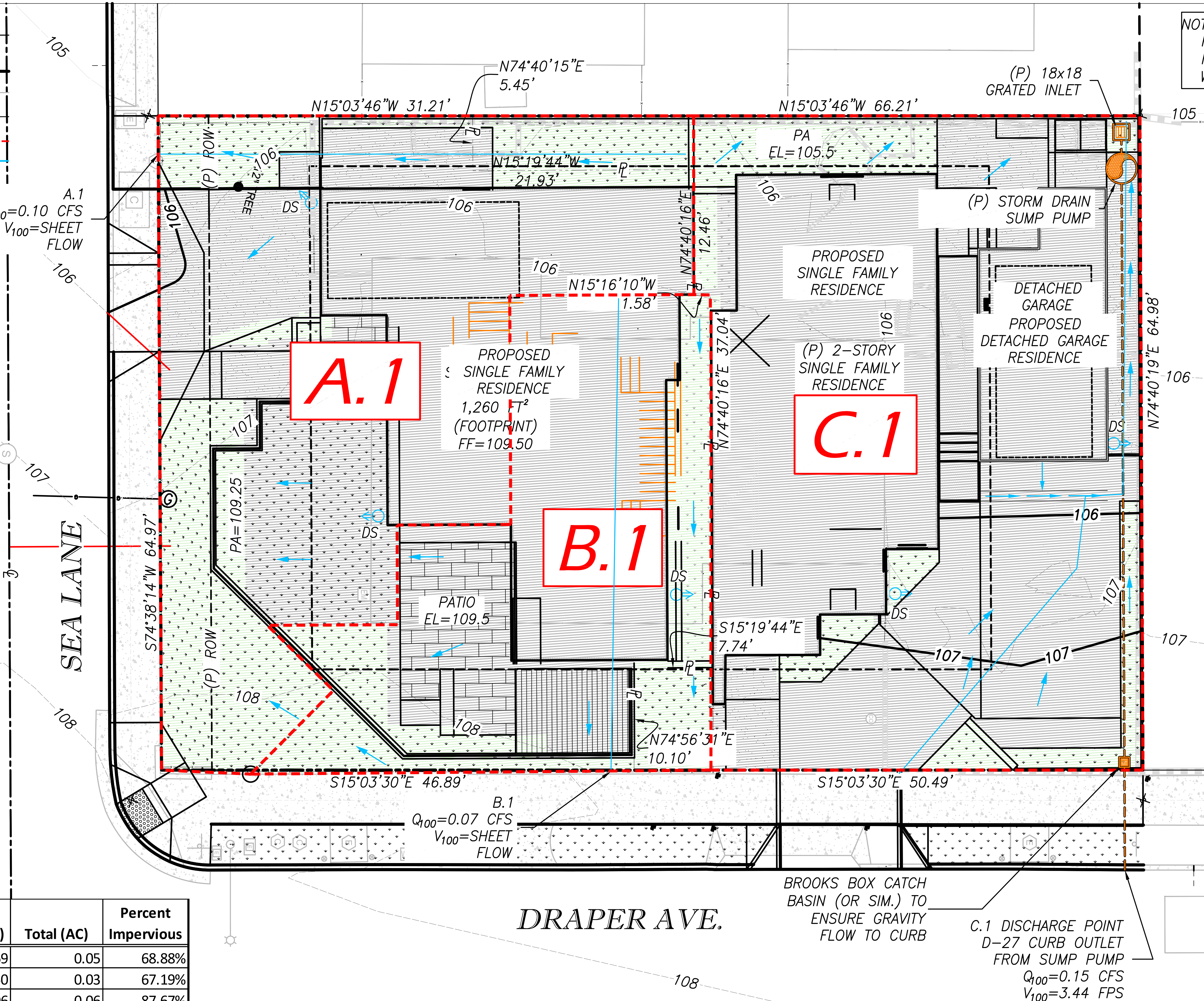

Drainage Area	Impervious Area (ft²)	Pervious Area (ft²)	Total (ft²)	Total (AC)	Percent Impervious
A.1	1,494	675	2,169	0.05	68.88%
B.1	907	443	1,350	0.03	67.19%
C.1	2,460	346	2,806	0.06	87.67%

Appendix B – Calculations/Evaluations

Table A - Area Tabulations & Runoff Coefficients ('C')

Drainage Area	Impervious Area (ft^2)	Pervious Area (ft^2)	Permeable Paving	Biofiltration Area	Pool/Water Feature (ft^2)	Total (ft^2)	Total (AC)	C-Value	Percent Impervious
Existing Conditions									
X.1	100	1,101				1,201	0.03	0.55	8.33%
Y.1	3,393	1,731				5,124	0.12	0.55	66.22%
Proposed Conditions									
A.1	1,494	675				2,169	0.05	0.55	68.88%
B.1	907	443				1,350	0.03	0.55	67.19%
C.1	2,460	346				2,806	0.06	0.55	87.67%

Table B - Pre Construction Flow Characteristics

	Natural Watercouse (per Fig. 3-4)					Urban Overland (Sheet) Flow (per Fig. 3-3)				Pipe/Channel Flow			Summary				
Flow ID (Basin)	Watercourse distance, L (ft)	Elev. 1	Elev. 2	Change in Elevation, H (ft)	Natural watercourse duration, D_n (min)	Urban watercourse distance, **Ti** (ft) (≤ LM)	Watercourse slope, s (%)	Runoff Coefficient, C	Overland Flow Time, **Tt** (min)	Pipe Length, L_p (ft)	Average velocity, V (fps)	Pipe travel time, T_p (min)	(5 min minimum) Total time-of-concentration, T_c (min)	Runoff Coefficient, C	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs) = C*I*A**
X.1				0	*0.00*	55	3.00	0.55	*5.09*			*0.00*	5.09	0.55	4.40	0.03	**0.0667**
Y.1	23	108	105	3	*0.19*	99	2.50	0.55	*0.03*			*0.00*	5.00	0.55	4.40	0.12	**0.2847**

Table C - Post Construction Flow Characteristics

	Natural Watercouse (per Fig. 3-4)					Urban Overland (Sheet) Flow (per Fig. 3-3)				Pipe/Channel Flow			Summary			100 -yr P_6 =	
Flow ID (Basin)	Watercourse distance, L (ft)	Elev. 1	Elev. 2	Change in Elevation, H (ft)	Natural watercourse duration, D_n (min)	Urban watercourse distance, **Ti** (ft) (≤ LM)	Watercourse slope, s (%)	Runoff Coefficient, C	Overland Flow Time, **Tt** (min)	Pipe Length, L_p (ft)	Average velocity, V (fps)	Pipe travel time, T_p (min)	(5 min minimum) Total time-of-concentration, T_c (min)	Runoff Coefficient, C	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	**Q (cfs) = C*I*A**
A.1				0	*0.00*	58	1.00	0.55	*7.54*			*0.00*	7.54	0.55	3.80	0.05	**0.1041**
B.1				0	*0.00*	47	1.00	0.55	*6.79*			*0.00*	6.79	0.55	4.00	0.03	**0.0682**
C.1				0	*0.00*	75	3.00	0.55	*5.94*			*0.00*	5.94	0.55	4.20	0.06	**0.1488**

Appendix C – Reference Tables & Figures (City of San Diego Drainage Design Manual, 2017)

Table A-1. Runoff Coefficients for Rational Method

Land Use	Runoff Coefficient (C)
	Soil Type [1]
Residential:	
Single Family	0.55
Multi-Units	0.70
Mobile Homes	0.65
Rural (lots greater than ½ acre)	0.45
Commercial [2]	
80% Impervious	0.85
Industrial [2]	
90% Impervious	0.95

Note:
[1] Type D soil to be used for all areas.
[2] Where actual conditions deviate significantly from the tabulated imperviousness values of 80% or 90%, the values given for coefficient C, may be revised by multiplying 80% or 90% by the ratio of actual imperviousness to the tabulated imperviousness. However, in case shall the final coefficient be less than 0.50. For example: Consider commercial property on D soil.

Actual imperviousness = 50%
Tabulated imperviousness = 80%
Revised C = (50/80) x 0.85 = 0.53

The values in Table A–1 are typical for urban areas. However, if the basin contains rural or agricultural land use, parks, golf courses, or other types of nonurban land use that are expected to be permanent, the appropriate value should be selected based upon the soil and cover and approved by the City.

A.1.3. Rainfall Intensity

The rainfall intensity (I) is the rainfall in inches per hour (in/hr.) for a duration equal to the T_C for a selected storm frequency. Once a particular storm frequency has been selected for design and a T_C calculated for the drainage area, the rainfall intensity can be determined from the Intensity-Duration-Frequency Design Chart (Figure A-1).

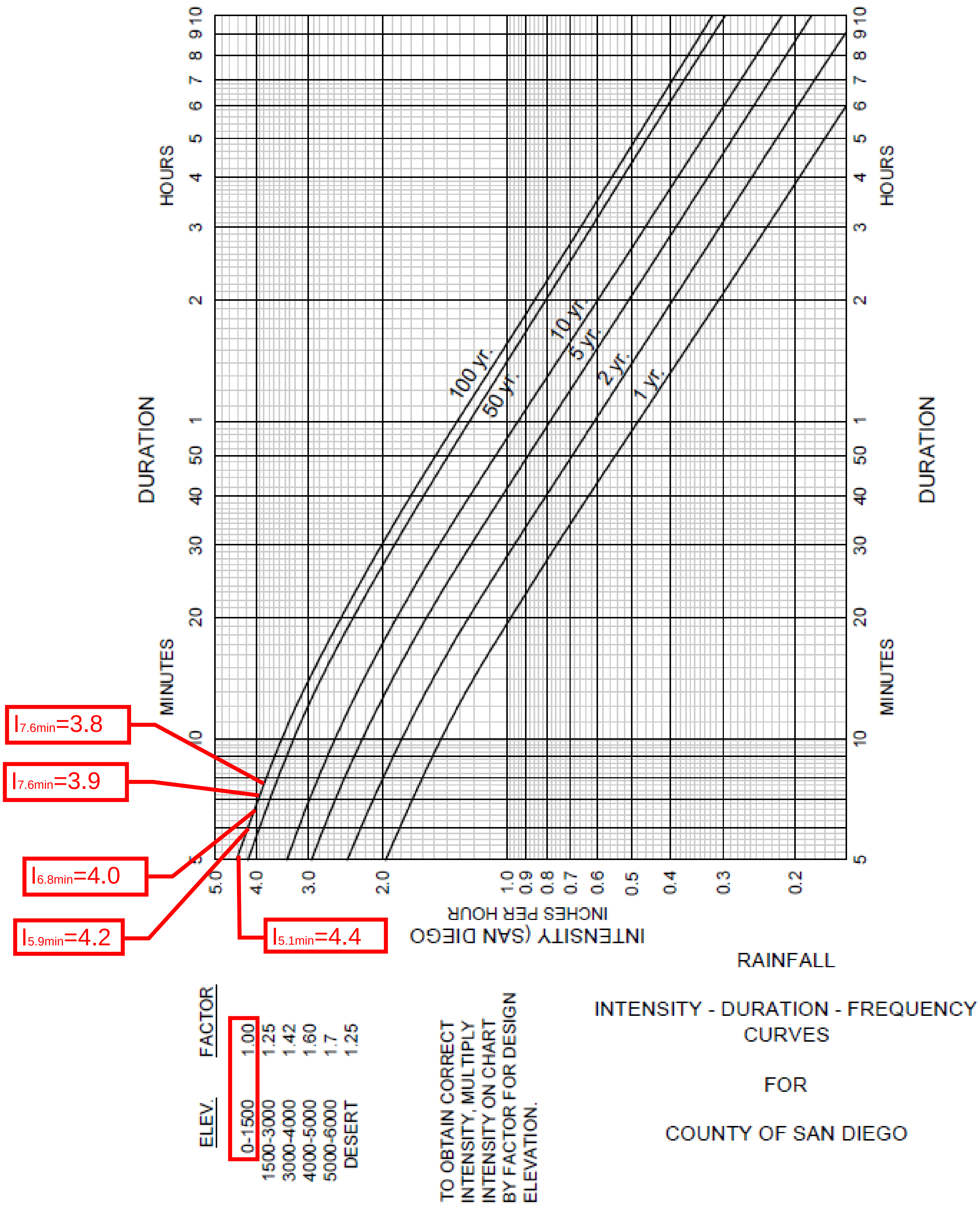

Figure A-1. Intensity-Duration-Frequency Design Chart

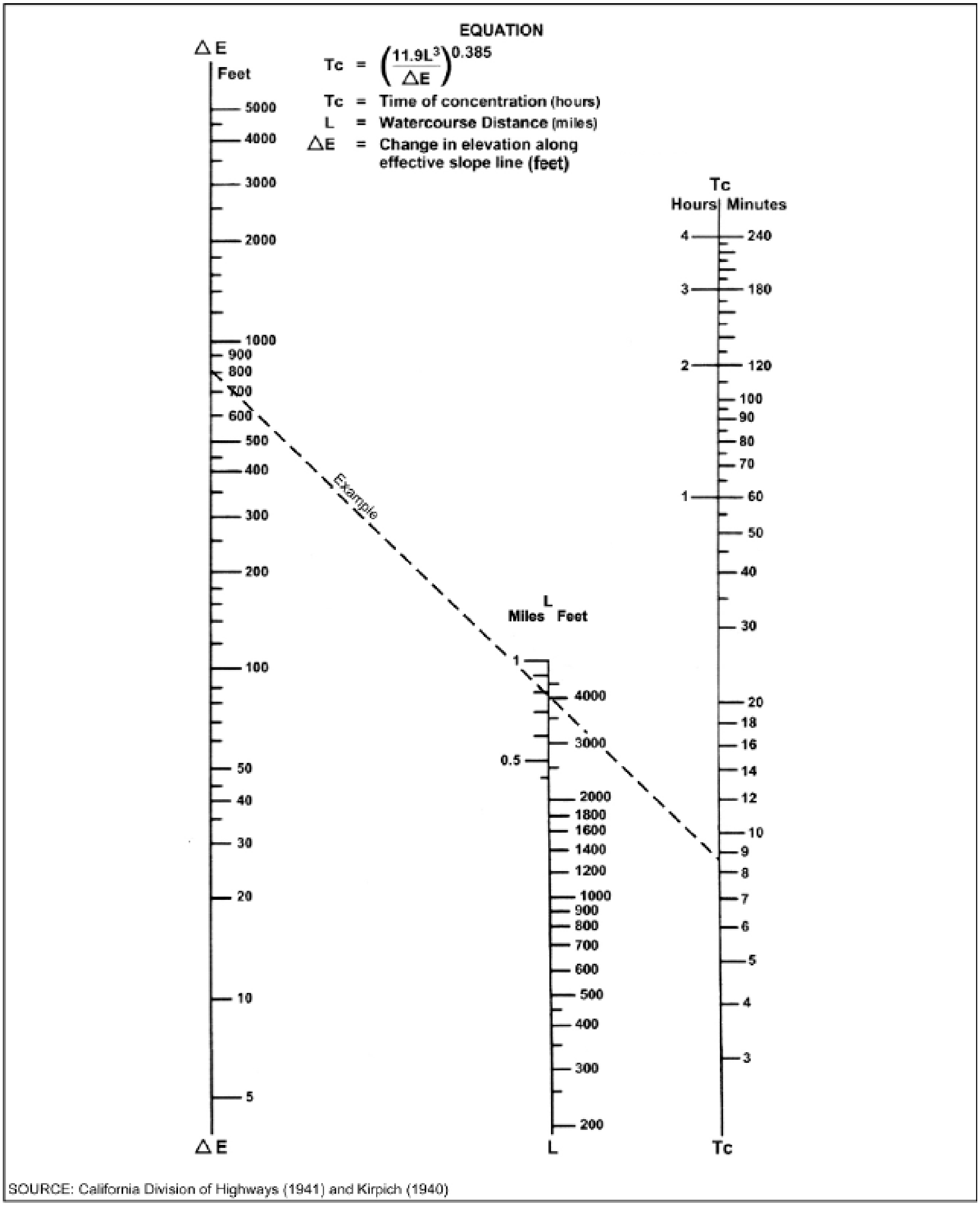

Figure A-2. Nomograph for Determination of T_c for Natural Watersheds

<u>Note</u>: Add ten minutes to the computed time of concentration from Figure A-2.

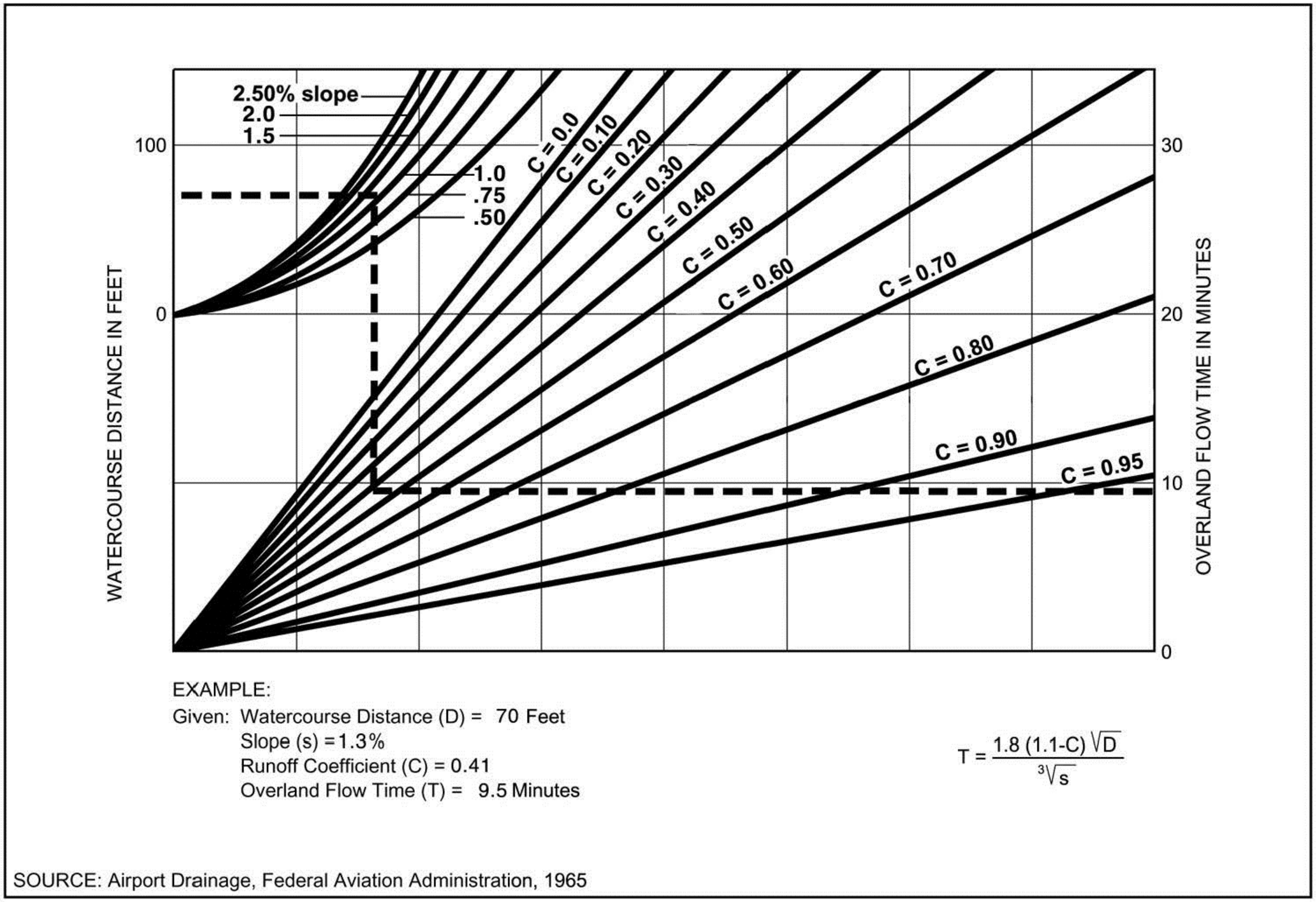

Figure A-4. Rational Formula – Overland Time of Flow Nomograph

Note: Use formula for watercourse distances in excess of 100 feet.