Preliminary Drainage Study

Drogin Residence

6361 Hartley Drive
La Jolla, CA 92037

Prepared for:
6361H, LLC
8060 La Jolla Shores Drive, Ste. 7C
La Jolla, CA 92037

Prepared by:
Christensen Engineering & Surveying
7888 Silverton Avenue, Suite "J"
San Diego, CA 92126
(858) 271-9901

April 26, 2022

Introduction

This project is located at 6361 Hartley Drive, Lot 3, Canyon View, Map No. 3468, in La Jolla. The project proposes the removal of the existing single-family residence and construction of a single-family residence and appurtenances. Improvements include a single-family residence, drainage system, pool, spa and landscaping.

The site, in its existing pre-construction condition drains northerly onto La Cumbre Drive and southwesterly onto Hartley Drive. The runoff from both streets converge and flow southwesterly along La Cumbre to Muirlands Drive, then flows northwesterly and northeasterly to a curb inlet in Muirlands Drive, at its intersection with El Camino del Teatro. Following construction, the same pattern will persist. The majority of the site runoff will be collected and conveyed to a Modular Wetland System unit for treatment and then conveyed to two Storm Capture vaults for detention. Runoff from these vaults will be conveyed to an onsite cleanout with pump. That detained runoff will then be pumped to a catch basin and then discharge, by gravity, through a planter wall, onto La Cumbre Drive through a curb outlet. The area contributing runoff from the site to the public storm drain will result in a decrease in runoff from 0.97 cfs to 0.96 cfs, due to precipitation being abstracted by the proposed pool. Existing site impervious area is 10,714 sf (49.1%) with proposed impervious area (including pool) being 10,482 sf (48.3%). The post-construction runoff to the public storm decreases 0.01 cfs and will have no adverse effect on it.

Section 404 of CWA regulates the discharge of dredged or fill material into waters of the United States. Section 404 is regulated by the Army Corps of Engineers. Section 401 of CWA requires that the State provide certification that any activity authorized under Section 404 is in compliance with effluent limits, the state's water quality standards, and any other appropriate requirements of state law. Section 401 is administered by the State Regional Water Quality Control Board. The project does not require a Federal CWA Section 404 permit nor Section 401 Certification because it does not cause dredging or filling in waters of the United States and is in compliance with the State Water Quality Standards.

The Rational Method was used to calculate the anticipated flow for the 100-year storm return frequency event using the method outlined in the City of San Diego Drainage Design Manual.

The proposed project will have no adverse effects on the neighboring properties nor the public storm drain system.

Antony K. Christensen
RCE 54021
Exp. 12-31-22
JN A2021-24

04-26-22
Date

REGISTERED PROFESSIONAL ENGINEER
ANTONY K. CHRISTENSEN
NO. C54021
EXP. 12-31-23
CIVIL
STATE OF CALIFORNIA

Calculations

1. Intensity Calculation

Pre-Construction
(From the City of San Diego Drainage Design Manual)
Tc = Time of concentration

$Tc = 1.8\ (1.1-C)\ (D)^{1/2} / S^{1/3}$

Since the difference in elevation is 9’ (568’-559’) and the distance traveled is 210’ (S=4.3%). C=0.55.

Tc = 8.8 minutes

From table in Manual:

I_{100} = 3.6 inches

2. Coefficient Determination

Pre-Construction

Single-Family: C=0.55

Post-Construction

Single-Family: C=0.55

3. Volume calculations

Q = CIA

Areas of Drainage:

Pre-Construction:

Area flowing northerly to La Cumbre Drive	EC = 0.1445 Acre
Area flowing southerly to the Hartley Drive	H = 0.3452 Acre
Area of precipitation abstracted by existing pool	PB = 0.0113 Acre

Q_{100EC} = (0.55) (3.6) (0.1445)
Q_{100H} = (0.55) (3.6) (0.3452)
Q_{100PB} = (0.55) (0.0) (0.0113) (abstracted)

Q_{100EC} = 0.29 cfs
Q_{100H} = 0.68 cfs
Q_{100PB} = 0.00 cfs (abstracted)

Q_{TOTAL} = 0.97 cfs

Post-Construction:

Area flowing northerly to by sheet flow to La Cumbre and Hartley Drive	SM = 0.0304 Acre
Area flowing easterly to MWS-1 and SC-1 and then pumped to La Cumbre Dr.	MWS-SC = 0.4570 Acre
Area of precipitation abstracted by pool	P = 0.0136 Acre

Q_{100SM} = (0.55) (3.6) (0.0304)
$Q_{100MWS\text{-}SC}$ = (0.55) (3.6) (0.4570)
Q_{100P} = (0.55) (0.0) (0.0136) (abstracted)

Q_{100SM} = 0.06 cfs
$Q_{100MWS\text{-}SC}$ = 0.90 cfs
Q_{100P} = 0.00 cfs (abstracted)

Q_{TOTAL} = 0.96 cfs

Site Area	Pre-Construction				Post-Construction			
	Q_{100}	V_{100}	C	Area	Q_{100}	V_{100}	C	Area
EC	0.29 cfs	< 1 fps	0.55	0.1445 ac				
H	0.68 cfs	< 1 fps	0.55	0.3452 ac				
PB	0.00 cfs	N/A	0.00	0.0113 ac				
SM					0.06 cfs	< 1 fps	0.55	0.0304 ac
MW S-SC					0.90 cfs	4.0 fps	0.55	0.4570 ac
P					0.00 cfs	N/A	0	0.0136 ac
Total	0.97 cfs			0.5010 ac	0.96 cfs			0.5010 ac

4. Discussion

Prior to construction 0.97 cfs of runoff flows to the public streets and then the public storm drain system. This volume of runoff will lessen following construction due to runoff from the proposed pool abstracting additional runoff than the existing pool (0.01) cfs of runoff. The pool intercepts precipitation and contains it until it evaporates. See discussion below. Total runoff to the public storm drain will decrease to 0.96 cfs. The total runoff collected by the public storm drain will decrease and so will not impact the public storm drain.

5.Test for Adequacy

The proposed system requires the use of a two pumps to convey 0.90 cfs (100 year storm) of runoff from A-4 catch basin onsite to a catch basin in a planter and then by 6" PCV pipe through the planter wall, onto La Cumbre Drive. Two pumps will convey the runoff to the street. Each pump will need to be capable of conveying 0.45 cfs to the catch basin and then planter outlet. Each pump needs to overcome head loss from elevation changes, friction and small bends. Entrance and exit losses are ignored since they are insignificant.

The pumps in this system will deliver flow through a 6" PVC drain to the catch, changing from each 4" outlet from the pumps in a manifold to the 6" PVC drain. The sum of the head losses results in the Total Dynamic Head.

The total elevation change is (561’ – 552’) = 10’.

To determine other head losses, the velocity in each pipe must be known. To provide conservative values for each head loss it will be assumed that the flow from the pump is at the approximate TDH value. For the 1.5 HP Goulds pump the maximum flow for a static head of 15 feet is 320 gpm. This is equivalent to 0.705 cfs.

$V=Q/A$

$A= \pi r^2$

For a 6” pipe r = .25

$A =\pi (0.25)^2$

$A= 0.196\ ft^2$

$V= 0.705/0.196$

V= 3.6 fps

The friction loss for the length of a pipe can be calculated using the following Hazen – Williams formula:

$h_f = 3.02LD^{-1.167} (V/C_h)^{1.85}$

for a 6” pipe

L = 18 ft (from pump to catch basin)

D = 6” = 0.5’

V=3.6

C_h = 140 (plastic pipe)

$h_f = 3.02(15)(0.5)^{-1.167} (3.6/140)^{1.85}$

h_f = 0.12’

Therefore the elevation and frictional headloss is

TDH = 10’ + 0.12’ = 10.12’

Say 11 feet.

Since the Q = 0.96/2 cfs = 7.48 gal/ft^3(0.48)(60sec/min) = 215 gpm

Therefore, each pump must be capable of conveying 215 gpm with a total dynamic head of 11 feet.

Each 1.5 hp Goulds pump is capable of conveying 320 gpm at a head of 15 feet and is therefore adequate. Even assuming some loss for the manifold in the system the pumps will be adequate.

The pumps will be placed in a cleanout and an alarm system will be needed to alert the development owner to the failure of the pump(s). A check valve will be needed to keep the runoff from flowing back into the catch basin, once the pumps shuts off. Should the one pump fail the system would still convey the expected 85^{th} percentile storm (0.52”) of 0.1 cfs (45 gpm).

Pool Retention of Runoff

The pool retains 0.01 cfs of runoff. The volume retained is T_C * Q = 8.8 min 60 sec/min * 0.01 cfs = 5.68 cf

Evaporation is this area of San Diego is 0.175"/sf/day

The depth resulting from 5.68 cf of retained within the pool area =

5.68 cf/594 sf=0.096' = 0.115" (~2/16")

To evaporate this volume will take 0.115"/0.175"/24 hrs = 0.66 days = 15.8 hours

The pool will have a minimum 3" freeboard. Therefore the expected addition of 5.68 cf of retained precipitation will not be greater than the freeboard.

The pool retains precipitation and does not contribute to site runoff.

APPENDIX

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

<u>Note:</u>
[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).

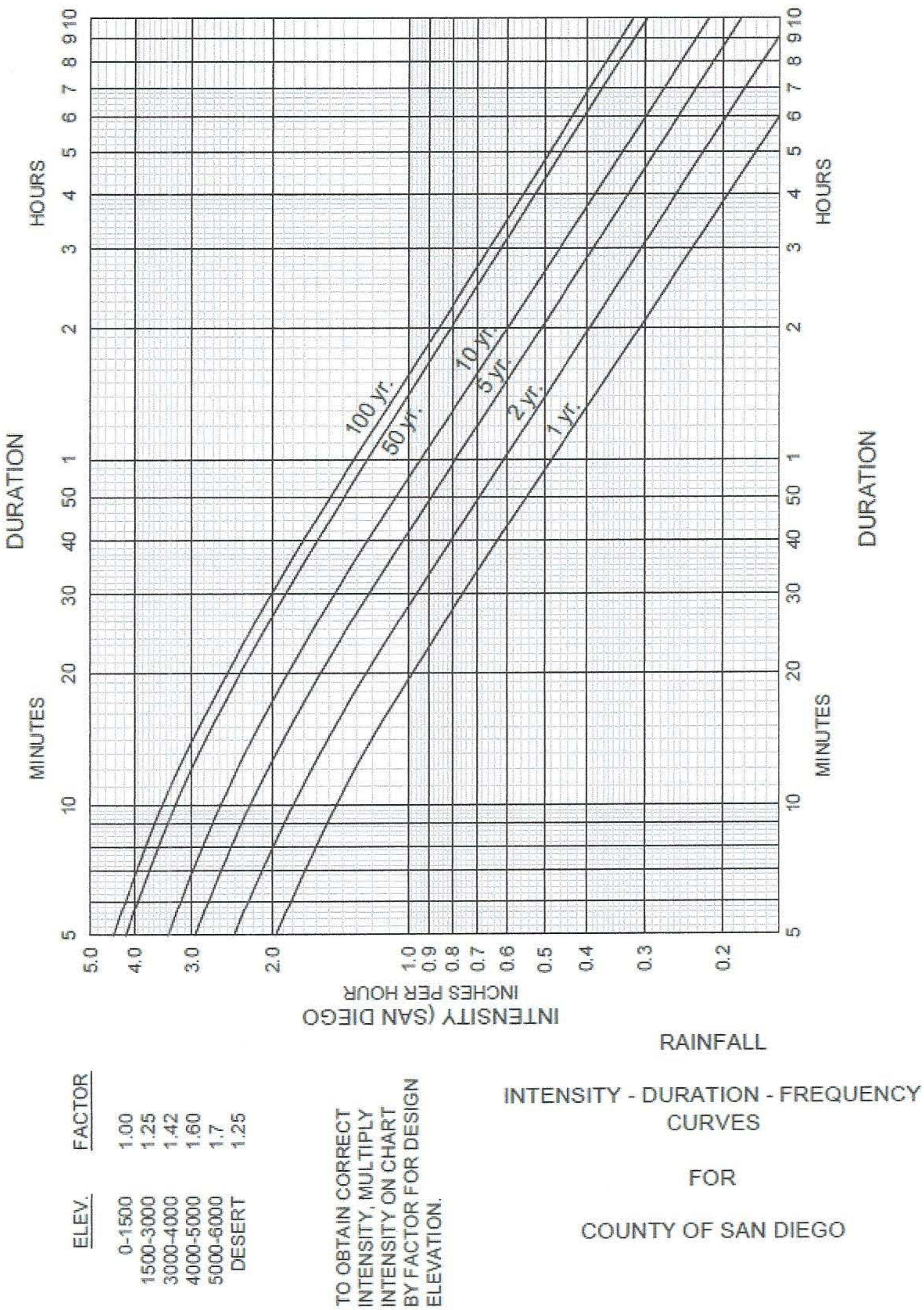
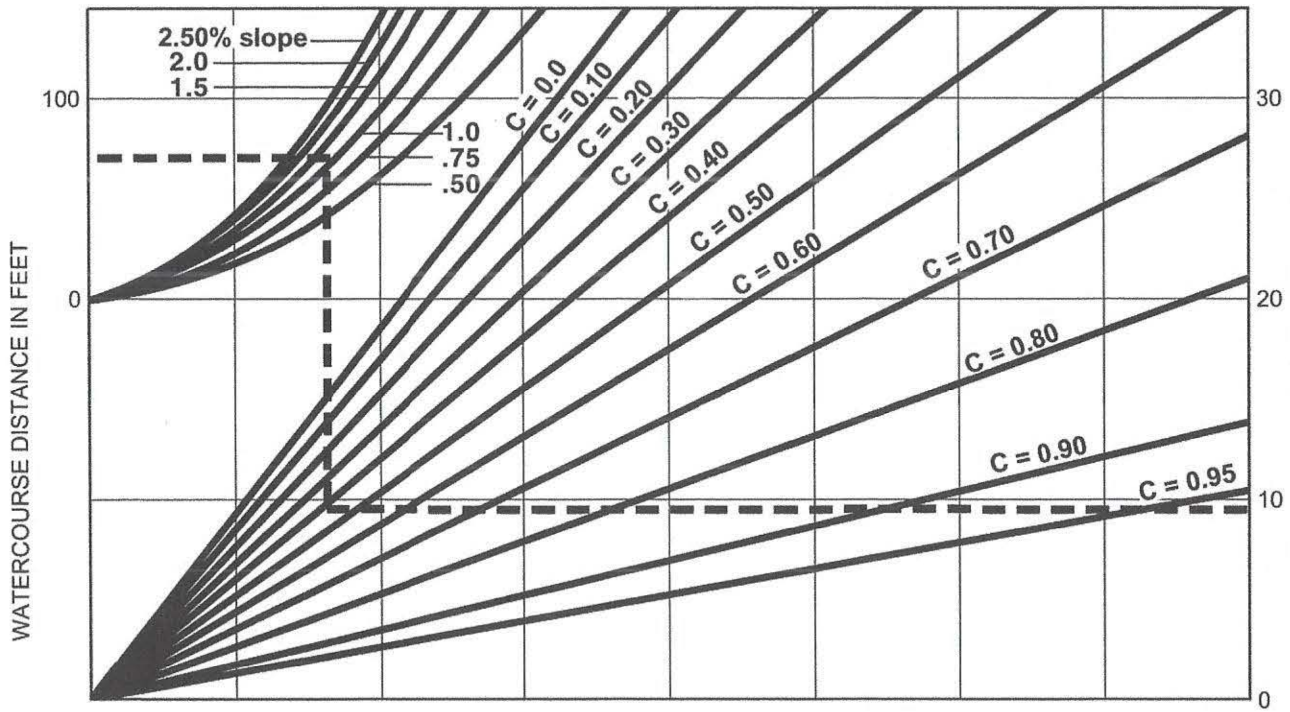


Figure A-1. Intensity-Duration-Frequency Design Chart



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet

Slope (s) = 1.3%

Runoff Coefficient (C) = 0.41

Overland Flow Time (T) = 9.5 Minutes

$$T = \frac{1.8\,(1.1 - C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

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

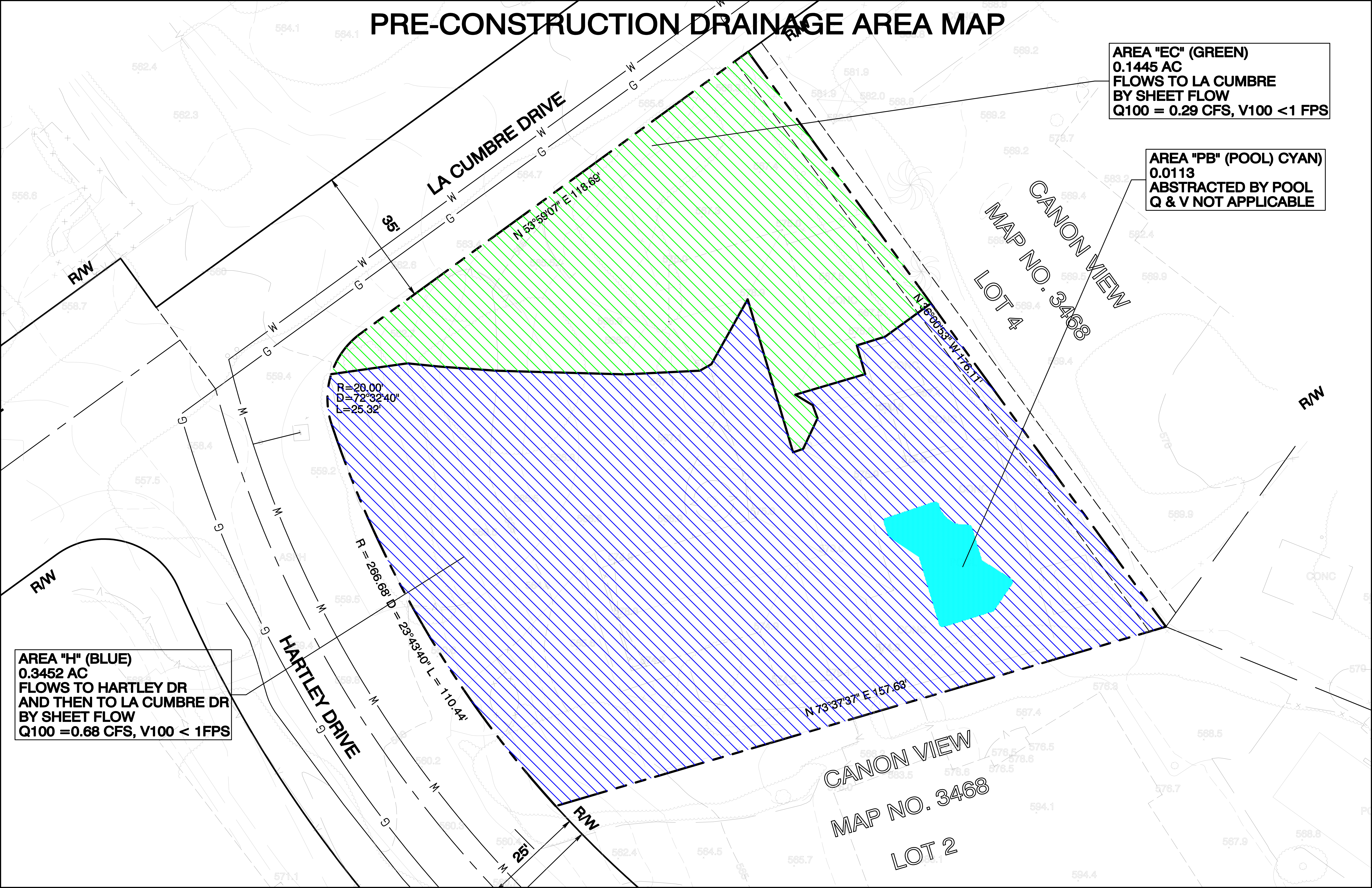
Note: Use formula for watercourse distances in excess of 100 feet.

Type of conveyance is a: Modified Curb Outlet
Depth of channel equals .25 Feet
Bottom Width Equals 2
Side slope equals .01
Slope of conveyance equals 2.8 %
Roughness equals .0135
Flow quantity equals .9002425 CFS
Area equals .2247288 Square Feet
Velocity equals 4.004827 FPS
Depth of flow equals .1123013 Feet

DRAINAGE AREA MAPS

PRE-DEVELOPMENT DRAINAGE AREA MAP

PRE-CONSTRUCTION DRAINAGE AREA MAP



POST-DEVELOPMENT DRAINAGE AREA MAP

POST-CONSTRUCTION DRAINAGE AREA MAP