



COFFEY ENGINEERING, INC.

Preliminary Drainage Study

Lookout Residences Parcel 4 & 5, PM 17817

**2 Lots-Lookout Drive
San Diego, CA 92116**

APN 352-012-19

APN 352-012-20

Project Information

**Owner: Lookout LLC
Developer: Lookout LLC**



April 11, 2018

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1. Existing Conditions

The site (Parcels 4 and 5 of Parcel Map 17817) lie north of the developed Parcel 1 site at 7727 Lookout Drive in La Jolla, CA. The existing site condition is vacant, with dispersed sparse vegetation. The total site area contributing to the drainage basin is 0.29 acres, and generally flows from south to north at an average slope of 6:1. Runoff from this basin is currently forced by a neighboring retaining wall (to the north) to travel along/near that wall so that it discharges into Lookout Drive.

See Drainage Map 'A'.

2. Proposed Project

The project proposes the construction of two new single-family residences on Parcels 4 and 5. The basin configurations for Parcels 4 & 5 are designed based on the proposed site features. Parcel 4 is composed one drainage basin (Basin A.1). Storm water runoff generated from this basin is conveyed to 3 – 3” PVC drains that discharge into Lookout Dr. Parcel 5 is composed of two drainage basins (B.1, B.2). Storm water runoff generated from Basin B.1 and B.2 is conveyed to separate 3”-PVC drains located within the site that will discharge into Lookout Dr. The overall flows generated from the site will increase the pre-existing condition flow of $Q_{(100)}= 0.45\text{cfs}$ to the post-construction flow of $Q_{(100)}= 0.81\text{cfs}$.

See Drainage Map 'B'.

3. Purpose and Scope of Report

This report will evaluate the existing and proposed site water run-off flow patterns and discharge flow rates based on pre-construction/post-construction conditions. All calculations are performed to anticipate generated flows for a 100-year storm event.

4. Method of Calculations

The Rational Method, as defined by *County of San Diego Hydrology Manual (2003)*, 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

(Runoff coefficient per County of San Diego Hydrology Manual Table 3-1 reproduced in Appendix C. Soil type D determined from the *Soil Hydrologic Groups* map from the County of San Diego Hydrology Manual reproduced in Appendix C also.)

I = Rainfall intensity (in/hr.)

A = Area (acres)

Rainfall Intensity (per County of San Diego Hydrology Manual Figure 3-1 reproduced in Appendix C)

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

$T_c = T_i + T_t + T_p$ (time-of-concentration), where

T_i = Over land initial time.

T_t = Travel time on natural watersheds.

T_p = Travel time on drainage structures (pipes, brow ditch, gutter etc.)

Overland Time of Flow (per County of San Diego Hydrology Manual Figure 3-3 reproduced in Appendix C)

$T_i = 1.8(1.1 - C) D^{0.50} / (s^{0.33})$ (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

T_i = Initial time of concentration (min.)

5. Results and Conclusions:

The anticipated runoff is calculated using the Rational Method outlined in Appendix A.11 of *The City of San Diego Drainage Design Manual, January 2017 Edition*. More particularly, the estimated 100-year storm event flows are calculated based on varied time of concentration and intensities based on the storm water path of travel. Each drainage basin contains a different path of travel. The time-of-concentration used to calculate the estimated $Q(100)$ for each basin is based on said paths of travel, since each basin contains varied remote high points. This is shown on the drainage maps located in Appendix B. The calculated flows outlined in Appendix A show that the 3”- PVC underdrains have the capacity to handle the expected flows.

Flows are expected to increase from pre-existing condition flow of $Q(100) = 0.45$ cfs to the post-construction flow of $Q(100) = 0.81$ cfs. Due to this increase in flow, it is expected that these flows

will contribute to an increased amount of runoff collected by the existing 18"-RCP storm drain located on Lookout Dr. This increase is not expected to adversely affect downstream drainage conditions. The existing 18"-RCP has a capacity of 20.03 cfs. The proposed site will contribute an increase of an estimated 0.36 cfs during a 100-yr. storm event, which is approx. 1.8% of the overall capacity of the system. It is expected that the existing 18"-RCP is adequate to handle this increase in flow.

6. Clean Water Act (CWA) Compliance

The proposed project is exempt from permitting under Federal Clean Water Act section 401 or 404 because it does not directly discharge into navigable waters of the United States.

7. 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.

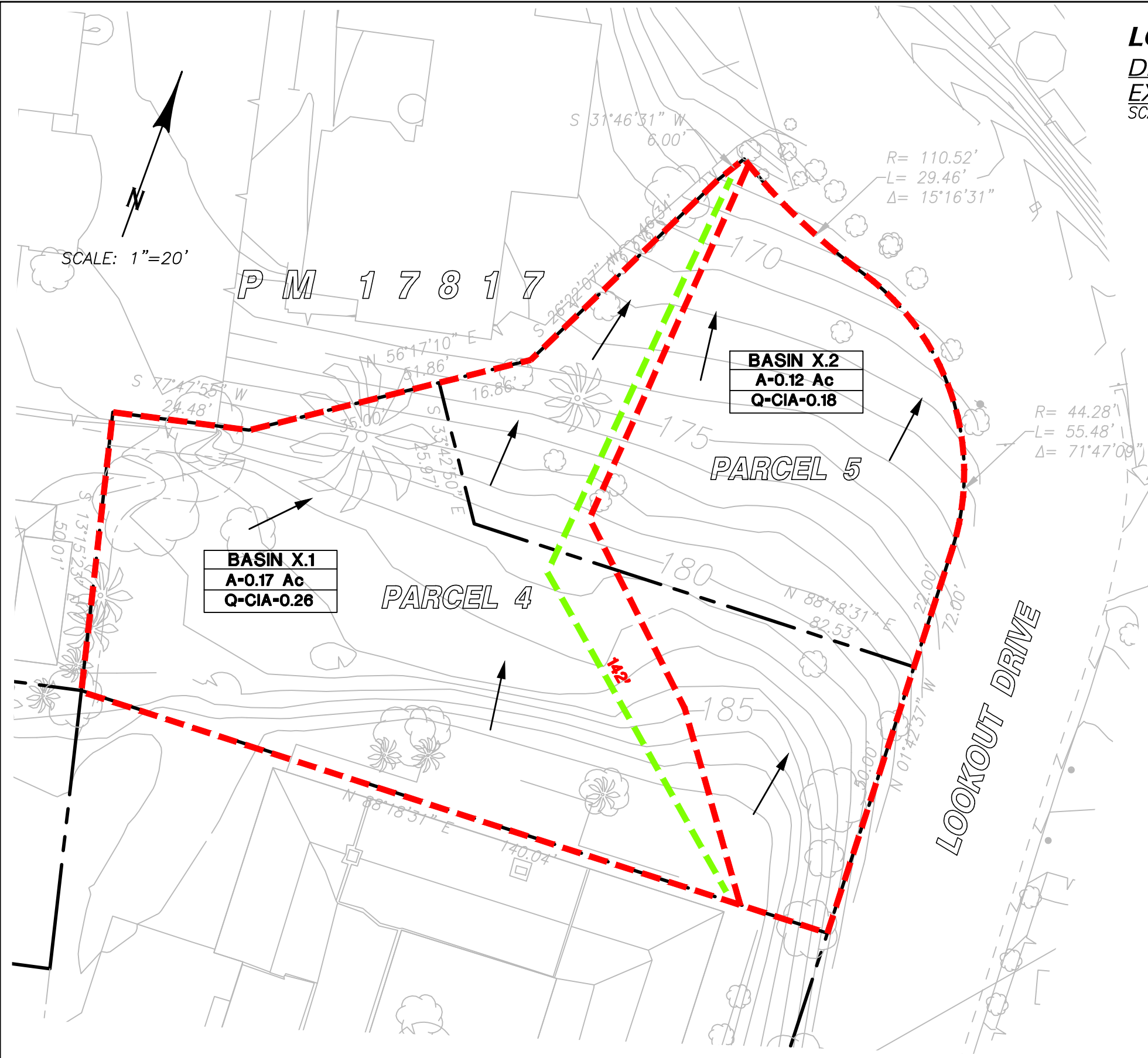
PRELIMINARY

John S. Coffey
RCE 62716
Exp. 06-30-18

Date

Appendix A –Reference Plans Drainage Maps

LOOKOUT DRIVE: PARCELS 4 & 5 OF PM 17817
DRAINAGE MAP 'A'
EXISTING CONDITIONS
 SCALE: 1"=20'

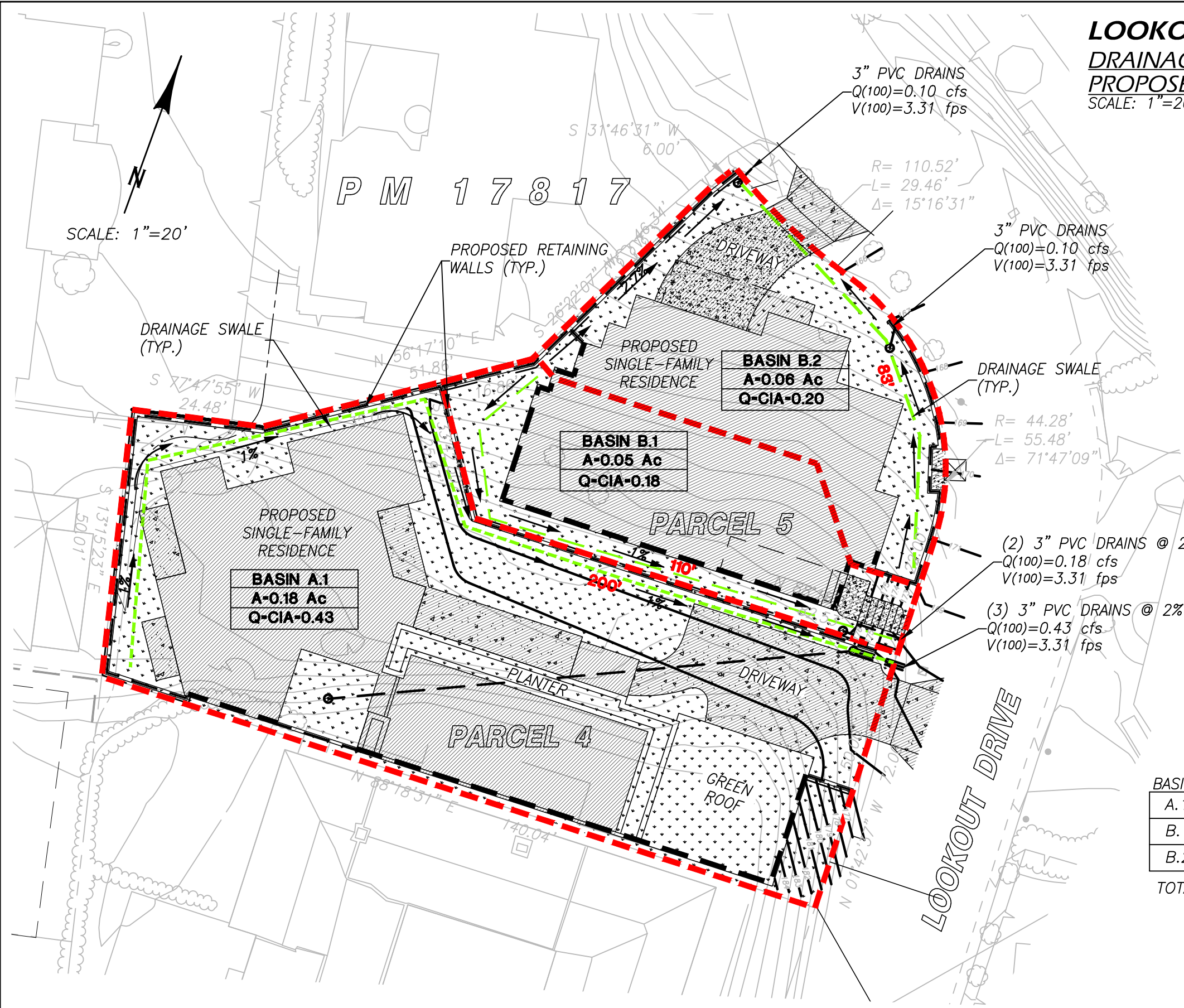


LEGEND

DESCRIPTION	SYMBOL
PROPERTY LINE	— — — — —
EXISTING CONTOUR	— 90 —
DIRECTION OF FLOW	→ → →
BASIN LIMIT	- - - - -
WATER COURSE DISTANCE	— — — — —

BASIN	BASIN AREA (AC.)	IMPER. AREA (SF.)	IMPER. AREA %	PERVIOUS AREA (SF.)	SOILS TYPE	SLOPE COND. %	RUNOFF COEFF.
X.1	0.17	0	0	4,405	D	15	0.35
X.2	0.12	0	0	5,227	D	15	0.35
TOTAL	0.29						

LOOKOUT DRIVE: PARCELS 4 & 5 OF PM 17817
DRAINAGE MAP 'B'
PROPOSED CONDITIONS
 SCALE: 1"=20'



LEGEND

DESCRIPTION	SYMBOL
PROPERTY LINE	--- --
EXISTING CONTOUR	90
PROPOSED CONTOUR	90
DIRECTION OF FLOW	→ →
BASIN LIMIT	- - - -
LANDSCAPE DRAIN	⊙
3" PVC DRAIN LINE	- - - -
PERVIOUS AREA	[Stippled pattern]
IMPERVIOUS AREA	[Hatched pattern]
WATER COURSE DISTANCE	- - - -

BASIN	AREA (AC.)	IMPER. AREA (SF.)	IMPER. AREA %	PERVIOUS AREA (SF.)	SOILS TYPE	SLOPE COND. %	RATIONAL C.COEFF.
A.1	0.18	5,227	64	2,614	D	1	0.55
B.1	0.05	1,655	76	523	D	1	0.55
B.2	0.06	1,873	68	741	D	1	0.55
TOTAL	0.29						

Appendix B –Calculation/Evaluations

Table A - Time of Concentration Flow Characteristics

	Urban Overland Flow				Pipe Flow			Summary P₆ = 2				Flow Description	
Flow ID	Urban watercourse distance, D _u (ft)	Watercourse slope, s (%)	Runoff Coefficient, C	Overland Flow Time, T (min)	Pipe Length, L _p (ft)	Average velocity, V (fps)	Pipe travel time, D _p (min)	(5 min minimum) Total time-of-concentration, T _c (min)	Rainfall Intensity, I (in/hr)	Basin Area, A (acres)	Q (cfs)		
PRE-CONSTRUCTION CONDITIONS													
X.1	142	15.00	0.35	6.52	0	0.0	0.00	6.52	4.44	0.17	0.26	Sheet flow to Lookout Dr.	
X.2	142	15.00	0.35	6.52	0	0.0	0.00	6.52	4.44	0.12	0.19	Sheet flow to Lookout Dr.	
											Total=	0.45	
POST-CONSTRUCTION CONDITIONS													
(Parcel 4) A.1	200	1.00	0.71	9.93	9.34	3.31	0.05	9.97	3.38	0.18	0.43	(3)3" pvc pipes@2% to Lookout Dr.	
											Total=	0.43	
(Parcel 5) B.1	110	1.00	0.77	6.23	11.20	3.31	0.06	6.29	4.55	0.05	0.18	(2)3" pvc pipe@2% to Lookout Dr.	
(Parcel 5) B.2	83	1.00	0.73	6.07	3.61	3.31	0.02	6.09	4.64	0.06	0.20	(2)3" pvc pipe@2% to Lookout Dr.	
											Total=	0.38	
											Q(100) Total=	0.81	Total flows to Lookout Dr. in post-construction conditions.

(1) 3" PVC@2% PER D-27

DATE: 10-13-2017

TIME: 15:41:06

(1) Diameter (inches) ... 3. (2) Mannings n010

(3) slope (ft/ft)0200 (4) Q (cfs) 0.16

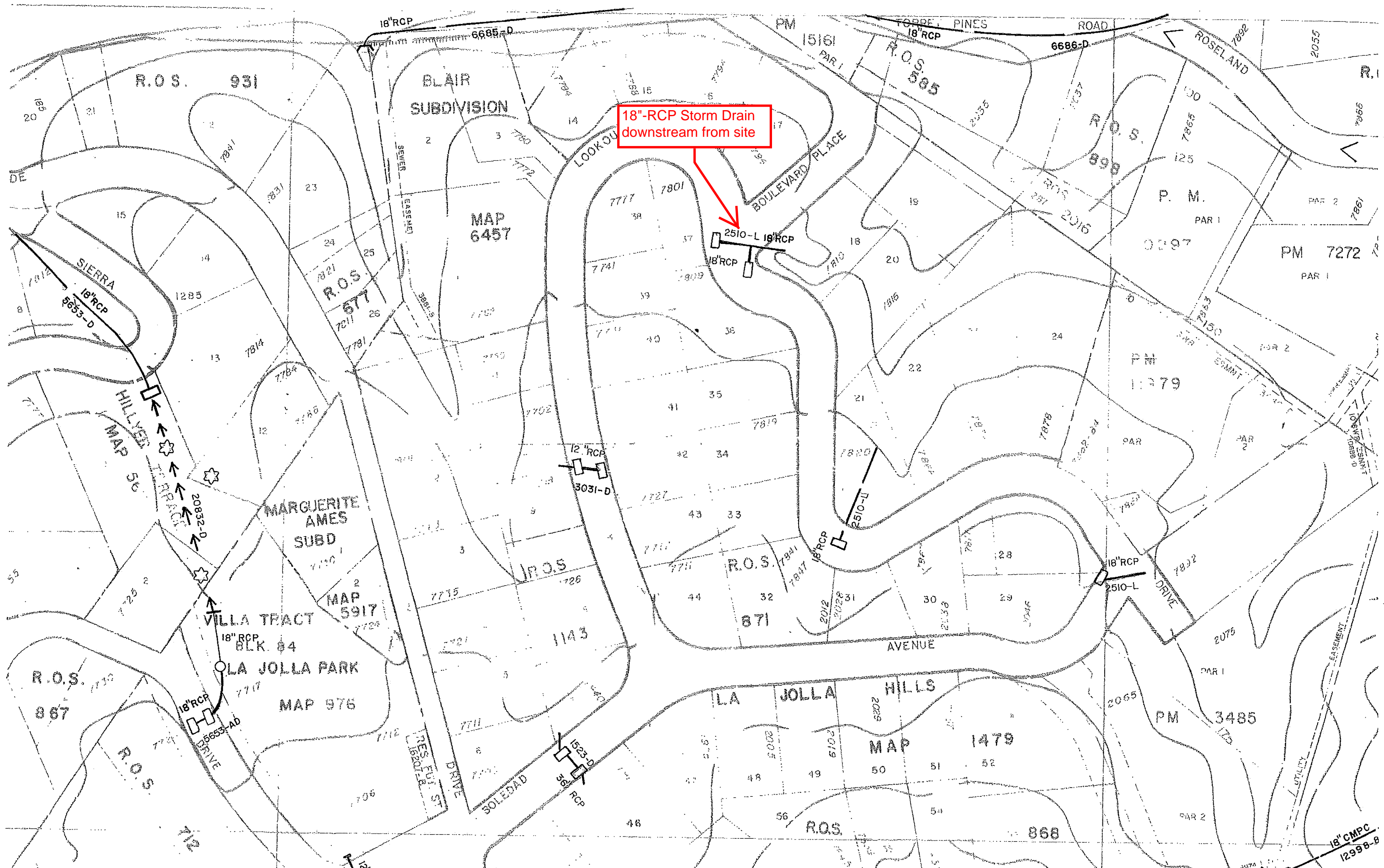
(5) depth (ft) 0.25 (6) depth/Diameter ... 1.00

Velocity (fps) 3.31 Velocity Head 0.17

Area (Sq. Ft.) 0.05

Critical Depth 0.23 Critical Slope ... 0.0173

Critical Velocity ... 3.42 Froude Number N/A



18"-RCP Storm Drain
downstream from site

2510-L 18"RCP

18"RCP

12"RCP

3031-D

18"RCP

2510-D

18"RCP

2510-L

18"RCP

18653-AD

1523-D

58" RCP

18" CMPC

12998-8

R.O.S. 931

BLAIR
SUBDIVISION

MAP
6457

R.O.S.
577

MARGUERITE
AMES
SUBD

MAP
5917

VILLA TRACT

18"RCP
BLK. 84

OLA JOLLA PARK

MAP 976

R.O.S.
867

R.O.S.

1143

LA JOLLA HILLS

MAP 1479

R.O.S.

868

PM 7272

PM 1:279

PM 3485

FORREST PINES ROAD

6686-D

ROSELAND

LOOKOUT

BOULEVARD PLACE

AVENUE

DRIVE

HILLYER

DRIVE

RES. FUT. ST
RES. FUTURE
16201E

SOLEADAD

UTILITY
EASEMENT

SEWER
EASEMENT

UTILITY
EASEMENT

18" RCP @ 3.64%

DATE: 04-11-2018

TIME: 09:53:01

(1) Diameter (inches) ... 18. (2) Mannings n013

(3) slope (ft/ft)0364 (4) Q (cfs) 20.03

(5) depth (ft) 1.50 (6) depth/Diameter ... 1.00

Velocity (fps) 11.34 Velocity Head 2.00

Area (Sq. Ft.) 1.77

Critical Depth 1.47 Critical Slope ... 0.0325

Critical Velocity ... 11.40 Froude Number N/A

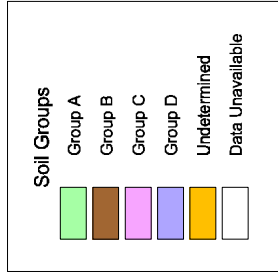
Appendix C –Reference Tables & Figures (County of San Diego Hydrology Manual)

County of San Diego Hydrology Manual

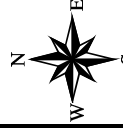


Soil Hydrologic Groups

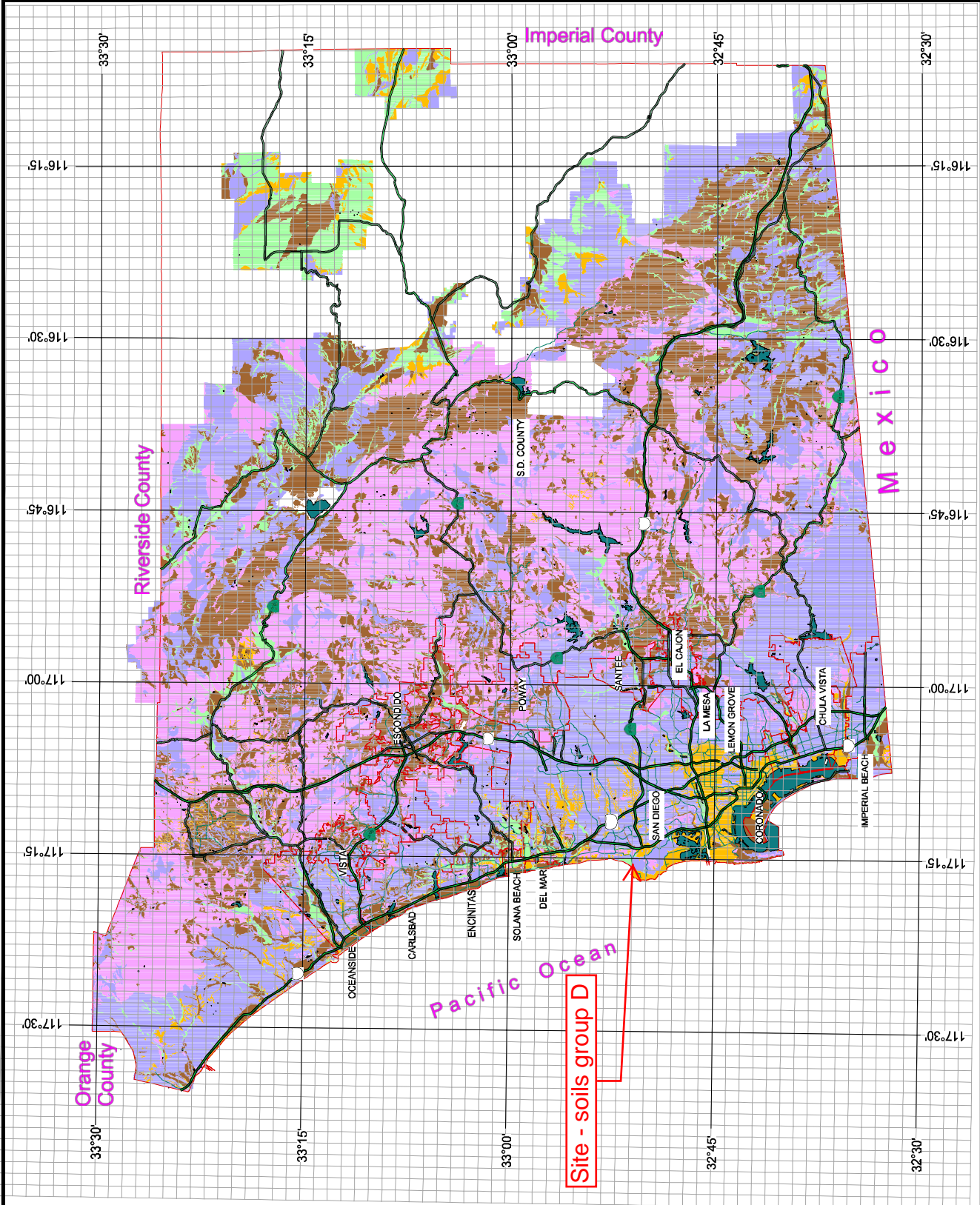
Legend



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3 0 3 Miles



Site Soil type 'D'

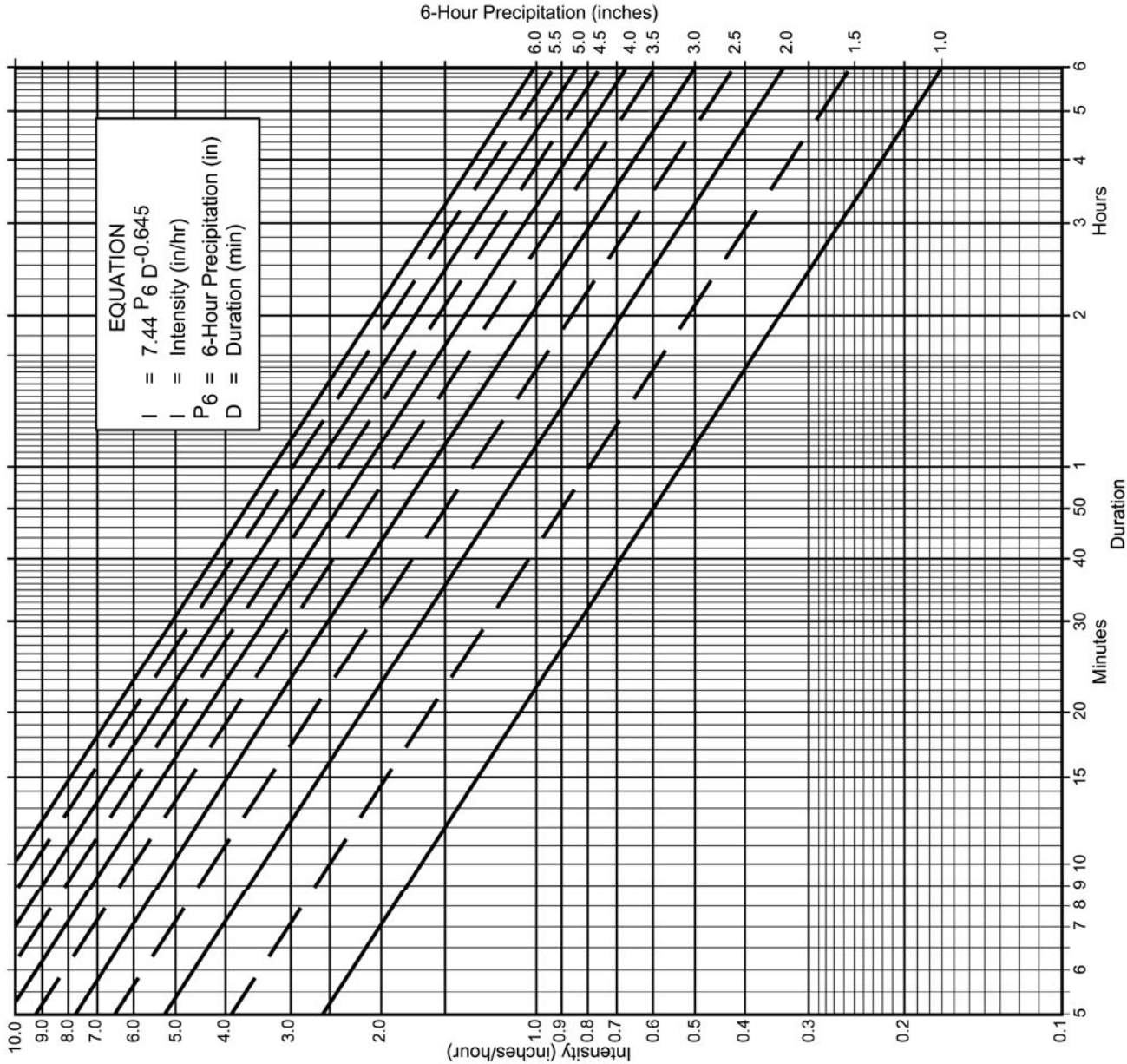
**Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS**

Land Use	Runoff Coefficient "C"	Soil Type			
		A	B	C	D
	% IMPER.				
Undisturbed Natural Terrain (Natural)	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).

DU/A = dwelling units per acre

NRCS = National Resources Conservation Service



Directions for Application:

- From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).
- Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicable to Desert).
- Plot 6 hr precipitation on the right side of the chart.
- Draw a line through the point parallel to the plotted lines.
- This line is the intensity-duration curve for the location being analyzed.

Application Form:

- Selected frequency 100 year
- $P_6 = 2.0$ in., $P_{24} = 4.0$, $\frac{P_6}{P_{24}} = 50$ %⁽²⁾
- Adjusted $P_6^{(2)} = 2.0$ in.
- $t_x = 5.0$ min.
- $I = 5.27$ in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.09	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1

County of San Diego Hydrology Manual



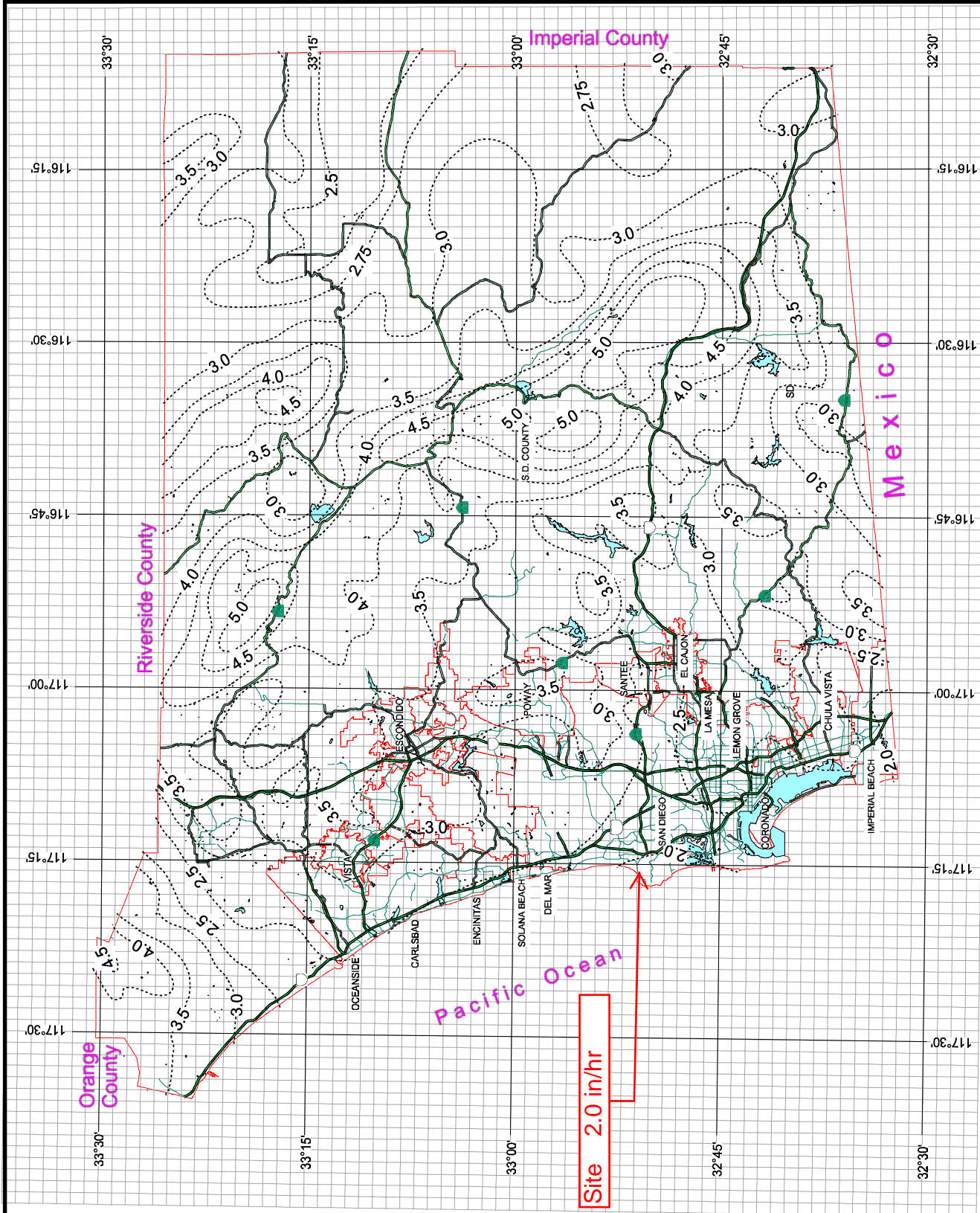
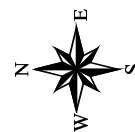
Rainfall Isopleths

100 Year Rainfall Event - 6 Hours



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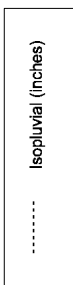


County of San Diego Hydrology Manual



Rainfall Isopleths

100 Year Rainfall Event - 24 Hours



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