HYDROLOGY STUDY

For:

Latitude Business Park

Project Location:
NW Corner of Temescal Canyon Road and Tom Barnes Street
Corona, CA

(APN 279-121-004 thru 006
APN 279-122-001 thru 004
APN 279-123-001 thru 003
APN 279-125-003 thru 004
APN 279-134-001 thru 004)

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Prepared Date: 12/17/2019

Prepared under the supervision of:

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RCE 43714, Exp. 3/31/21

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Discussion

The purpose of this preliminary study is to determine the storm flows for the developed condition of the project site. A final hydrology study will be submitted later as part of design review and permitting for the phases of development which will show storm drain sizing and further consider the stormwater treatment BMPs, etc.

The project site is located on thirteen parcels that total 76.17 acres. These parcels will be re-subdivided through a subdivision map. The project proposes to disturb 68.68 acres of Tentative Parcel Map No. 37608. The project site is located at the northeast corner of Temescal Canyon Road and Tom Barnes Street. The whole site is undeveloped land, 0% impervious.

The site is bounded on the north by single-family residential lots, a nursery and undeveloped slope areas. The Interstate 15 Freeway abuts the property along the westerly boundary. Tom Barnes Street, an improved street, abuts the property to the south. Temescal Canyon Road, a partially improved street, abuts the project to the west. The project currently accepts flows from the north from a tributary area of approximately 18 acres in the unincorporated area of Riverside County. There are no tributary flows from the freeway right-of-way, Tom Barnes Street right-of-way or Temescal Canyon Road right-of-way. The current topography of the site forms a couple of sumps created by previous clay mining activities. The mining activities ceased and grading activities were conducted within the last 10-15 years to start filling in the borrow area created by the mine.

The project proposes to develop the site with fifteen buildings for commercial use, AC pavement parking areas, and landscaping throughout. Off-site run-on along the northerly boundary of the project will bypass the site through proposed underground storm drain pipe. Along the northerly boundary of the project site, a brow ditch is proposed on-site to intercept off-site run-on. This run-on is conveyed to proposed down drains that discharge into the proposed public storm drain system throughout the project site, and eventually into the public storm drain system within the right-of-way of Tom Barnes St. Each drainage area of the developed condition of the project site directs storm water runoff to proposed catch basin inlets that discharge into proposed underground storage systems and then into modular wetlands for treatment. The overflows of these modular wetlands discharge into the proposed public storm drain system that runs through the project site and then discharges into the public storm drain system of Tom Barnes St.

The calculations for the 100-year rational study were prepared using CivilDesign. According to the Hydrologic Soils Group Map for Riverside County Hydrology Manual, the soil type is a mixture of Type “B” and “C”. Soil testing shows the site is primarily underlain by clayey soils, so Type “C” is used for

the rational method calculations. The rainfall was calculated using the Corona rainfall data. The off-site runoff was assumed to be single-family ½ acre to approximate 40% impervious area. The project site was assumed to be "Commercial" to approximate 90% impervious area in most subareas, and "Apartments" to approximate 80% impervious area where the subarea includes graded slopes. The results of the Rational Study are summarized as follows:

	Q_{PRE} (CFS)	Q_{POST} (CFS)	$T_{C,POST}$ (MIN)	ΔV (CF)	$V_{STORAGE}$ (CF)
100-YR	207.63	252.65	12.17	49,310	145,895

The change in run-off volume due to the proposed development has been calculated as follows:

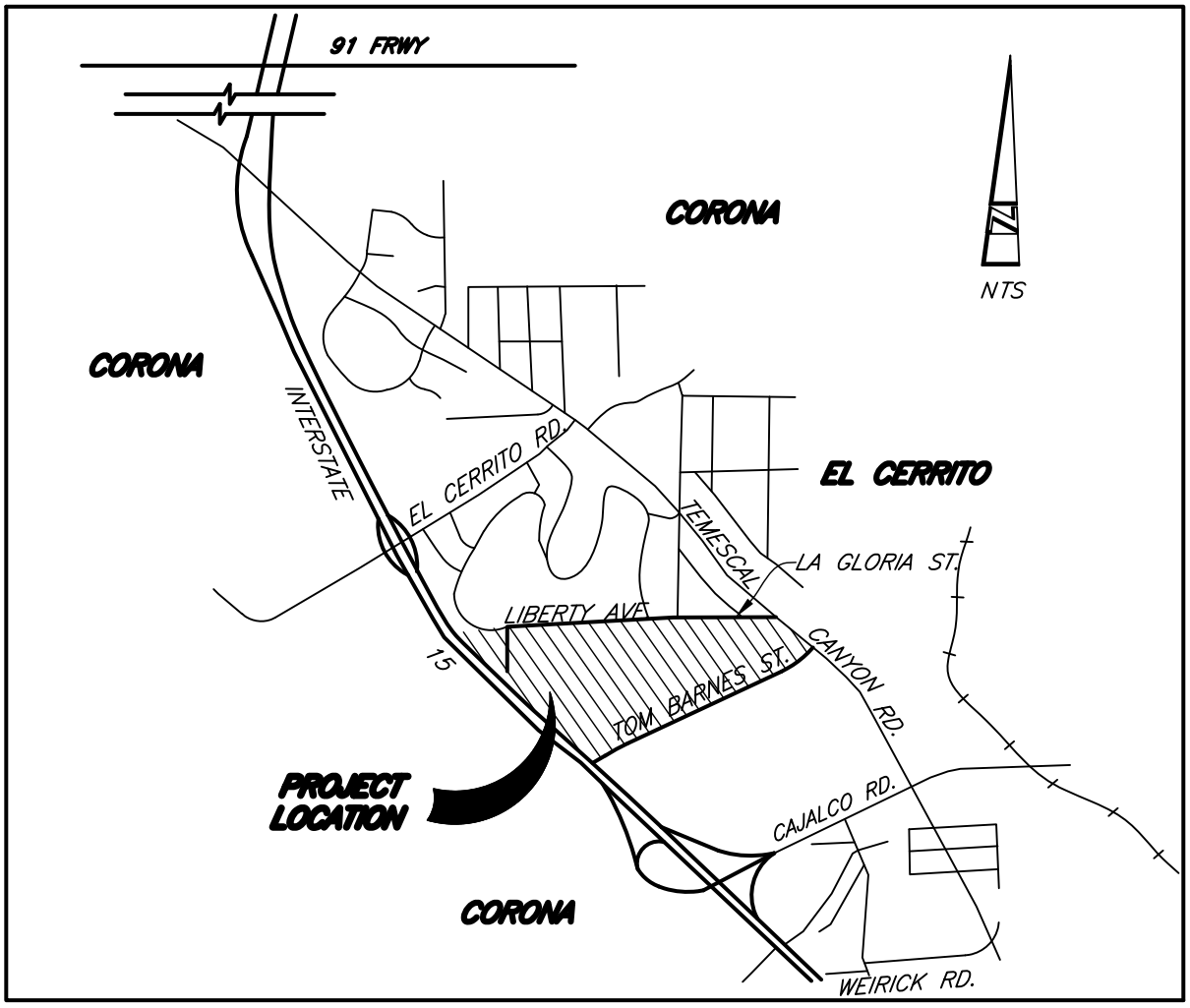
$$\Delta V = 1.5\ (\Delta Q)\ (T_{C,POST}*60)$$

This formula models an estimation of the change in storm water volume, hence it is multiplied by a factor of safety of 1.5. The underground storage systems were designed in accordance with the Riverside County Flood Control District LID Design Manual (2011) and the Technical Guidance Document (2012). These provide the volume of storage shown in the above table. See the LID design in Appendix F.

Due to the proposed development and increase in impervious area of the project site, the volume of storm water runoff (ΔV) generated by the project site increases from the volume of the pre-developed site. The volume of retention ($V_{STORAGE}$) provided by the proposed underground storage systems is greater than the increase in said runoff (ΔV). Therefore, the project will not increase the discharge of stormwater runoff from the site.

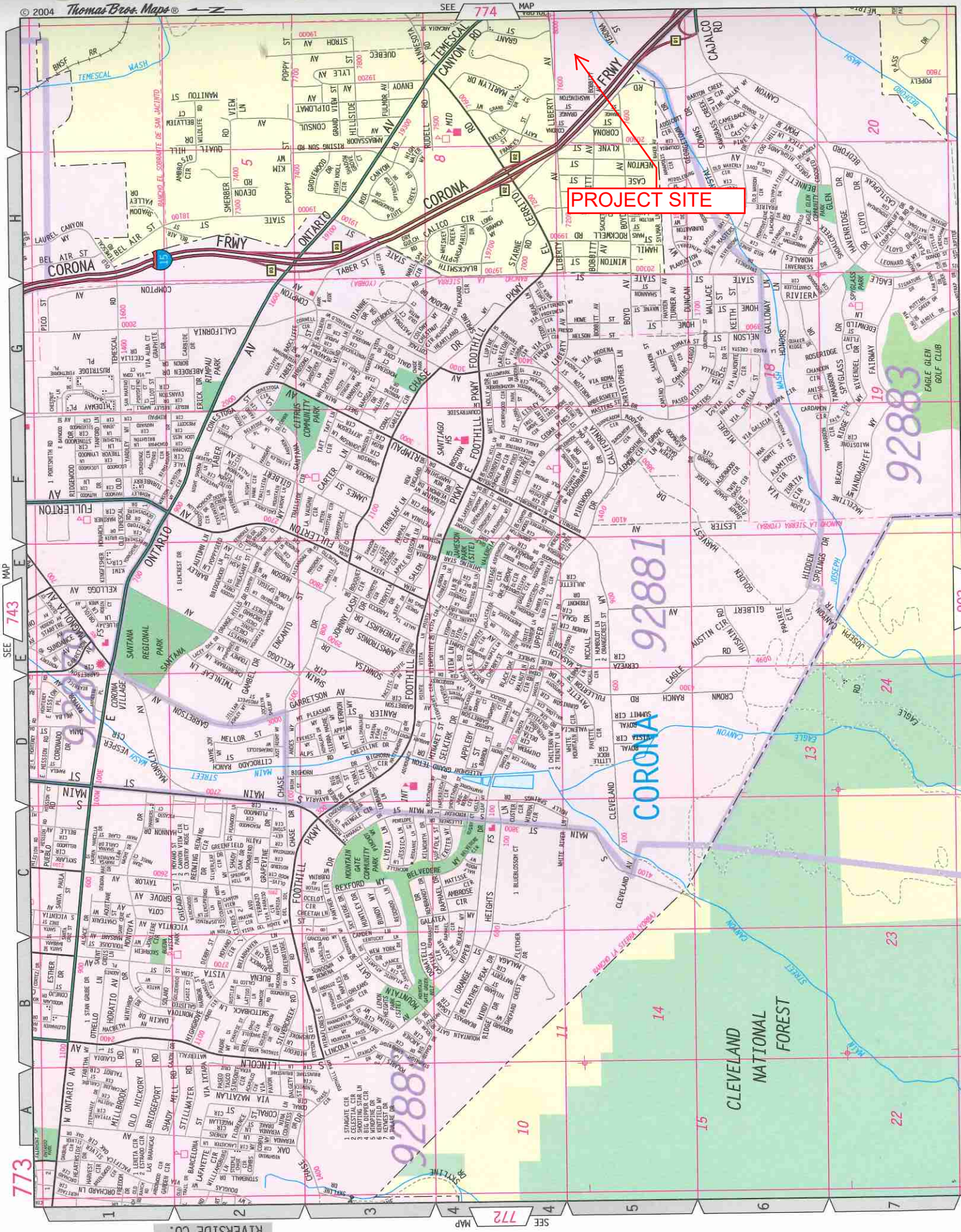
Appendix A

Vicinity Map
Thomas Guide Map



VICINITY MAP

NTS

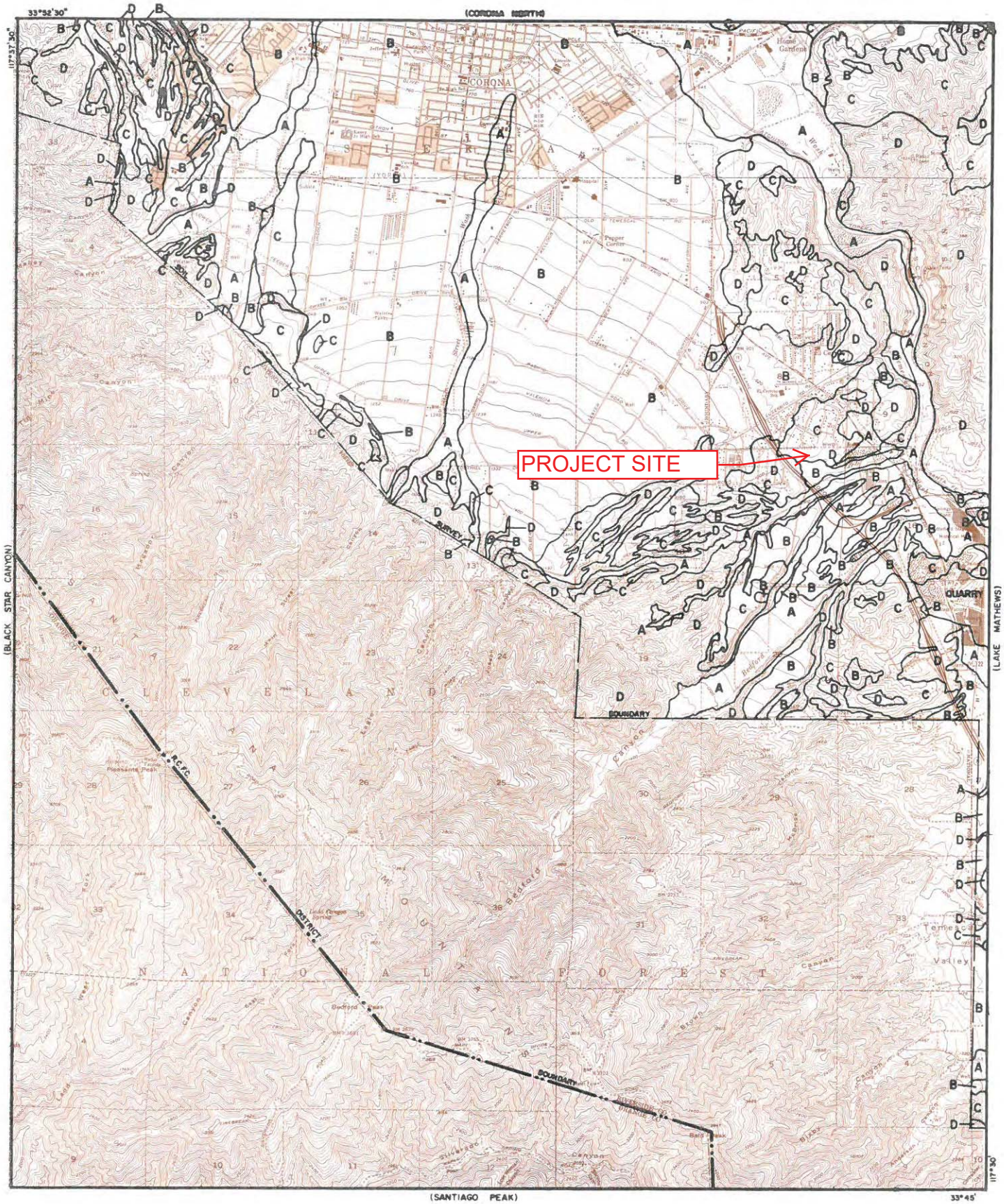

PROJECT SITE
CORONA
CLEVELAND NATIONAL FOREST
92881
92883
92882
FRWY
TEMESCAL CANYON RD
CAJALCO RD
ONTARIO
FOOTHILL PKWY
SANTANA REGIONAL PARK
CORONA VILLAGE
EAGLE GLEN GOLF CLUB
SEE MAP 774
SEE MAP 743
SEE MAP 803
SEE MAP 772
RIVERSIDE CO.

Appendix B

Hydrology Manual Reference Data

-Soils Map

-Rainfall Data



LEGEND

—— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

RCFC & WCD

HYDROLOGY MANUAL

0 FEET 5000

HYDROLOGIC SOILS GROUP MAP FOR CORONA-SOUTH

PLATE C-1.27

RAINFALL INTENSITY—INCHES PER HOUR

CATHEDRAL CITY			CHERRY VALLEY			CORONA			DESERT HOT SPRINGS			ELSINORE - WILDOMAR		
DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY		DURATION MINUTES	FREQUENCY	
	10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR		10 YEAR	100 YEAR
5	4.14	6.76	5	3.65	5.49	5	3.10	4.78	5	4.39	6.76	5	3.23	4.94
6	3.73	6.08	6	3.30	4.97	6	2.84	4.38	6	3.95	6.08	6	2.96	4.53
7	3.41	5.56	7	3.03	4.56	7	2.64	4.07	7	3.62	5.56	7	2.75	4.21
8	3.15	5.15	8	2.82	4.24	8	2.47	3.81	8	3.35	5.15	8	2.58	3.95
9	2.95	4.81	9	2.64	3.97	9	2.34	3.60	9	3.13	4.81	9	2.44	3.73
10	2.77	4.52	10	2.49	3.75	10	2.22	3.43	10	2.94	4.52	10	2.32	3.54
11	2.62	4.28	11	2.36	3.56	11	2.12	3.27	11	2.78	4.28	11	2.21	3.39
12	2.49	4.07	12	2.25	3.39	12	2.04	3.14	12	2.65	4.07	12	2.12	3.25
13	2.38	3.88	13	2.16	3.25	13	1.96	3.02	13	2.53	3.88	13	2.04	3.13
14	2.28	3.72	14	2.07	3.12	14	1.89	2.92	14	2.42	3.72	14	1.97	3.02
15	2.19	3.58	15	1.99	3.00	15	1.83	2.82	15	2.32	3.58	15	1.91	2.92
16	2.11	3.44	16	1.92	2.90	16	1.77	2.73	16	2.24	3.44	16	1.85	2.83
17	2.04	3.32	17	1.86	2.80	17	1.72	2.66	17	2.16	3.32	17	1.80	2.75
18	1.97	3.22	18	1.80	2.71	18	1.68	2.58	18	2.09	3.22	18	1.75	2.67
19	1.91	3.12	19	1.75	2.64	19	1.63	2.52	19	2.03	3.12	19	1.70	2.60
20	1.85	3.03	20	1.70	2.56	20	1.59	2.46	20	1.97	3.03	20	1.66	2.54
22	1.75	2.86	22	1.61	2.43	22	1.52	2.35	22	1.86	2.86	22	1.59	2.43
24	1.67	2.72	24	1.54	2.32	24	1.46	2.25	24	1.77	2.72	24	1.52	2.33
26	1.59	2.60	26	1.47	2.22	26	1.40	2.17	26	1.69	2.60	26	1.46	2.24
28	1.52	2.49	28	1.41	2.13	28	1.36	2.09	28	1.62	2.49	28	1.41	2.16
30	1.46	2.39	30	1.36	2.05	30	1.31	2.02	30	1.55	2.39	30	1.37	2.09
32	1.41	2.30	32	1.31	1.98	32	1.27	1.96	32	1.50	2.30	32	1.33	2.03
34	1.36	2.22	34	1.27	1.91	34	1.23	1.90	34	1.45	2.22	34	1.29	1.97
36	1.32	2.15	36	1.23	1.85	36	1.20	1.85	36	1.40	2.15	36	1.25	1.92
38	1.28	2.09	38	1.20	1.80	38	1.17	1.81	38	1.36	2.09	38	1.22	1.87
40	1.24	2.02	40	1.16	1.75	40	1.14	1.76	40	1.32	2.02	40	1.19	1.82
45	1.16	1.89	45	1.09	1.64	45	1.08	1.66	45	1.23	1.89	45	1.13	1.72
50	1.09	1.78	50	1.03	1.55	50	1.03	1.58	50	1.16	1.78	50	1.07	1.64
55	1.03	1.68	55	.98	1.47	55	.98	1.51	55	1.09	1.68	55	1.02	1.56
60	.98	1.60	60	.93	1.40	60	.94	1.45	60	1.04	1.60	60	.98	1.50
65	.94	1.53	65	.89	1.34	65	.90	1.40	65	.99	1.53	65	.94	1.44
70	.90	1.46	70	.85	1.29	70	.87	1.35	70	.95	1.46	70	.91	1.39
75	.86	1.41	75	.82	1.24	75	.84	1.30	75	.91	1.41	75	.88	1.35
80	.83	1.35	80	.79	1.20	80	.82	1.26	80	.88	1.35	80	.85	1.31
85	.80	1.31	85	.77	1.16	85	.80	1.23	85	.85	1.31	85	.83	1.27
SLOPE = .580			SLOPE = .550			SLOPE = .480			SLOPE = .580			SLOPE = .480		

STANDARD INTENSITY—DURATION CURVES DATA

Appendix C

Rational Study
Pre-Developed Condition

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 01/15/19 File:5957RU100A.out

JN5957 RATIONAL STUDY
PRE-DEVELOPED CONDITION
100YR STORM
DA A

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

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Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION **** DA A1

Initial area flow distance = 459.000(Ft.)
Top (of initial area) elevation = 978.700(Ft.)
Bottom (of initial area) elevation = 944.000(Ft.)
Difference in elevation = 34.700(Ft.)
Slope = 0.07560 s(percent)= 7.56
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.171 min.
Rainfall intensity = 3.776(In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.867
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Initial subarea runoff = 14.238(CFS)
Total initial stream area = 4.350(Ac.)
Pervious area fraction = 0.600

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Process from Point/Station        2.000 to Point/Station        2.000
**** SUBAREA FLOW ADDITION ****  DA A2
------------------------------------------------------------------------
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.867
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.600; Impervious fraction =  0.400
Time of concentration =     8.17 min.
Rainfall intensity =      3.776(In/Hr) for a   100.0 year storm
Subarea runoff =      3.371(CFS) for      1.030(Ac.)
Total runoff =     17.610(CFS)      Total area =       5.380(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** IMPROVED CHANNEL TRAVEL TIME ****  DA A3
------------------------------------------------------------------------
Upstream point elevation =   944.000(Ft.)
Downstream point elevation =   913.400(Ft.)
Channel length thru subarea  =   982.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =     33.511(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     33.511(CFS)
Depth of flow =   0.327(Ft.), Average velocity =   3.136(Ft/s)
Channel flow top width =   65.374(Ft.)
Flow Velocity =    3.14(Ft/s)
Travel time  =    5.22 min.
Time of concentration =   13.39 min.

Sub-Channel No. 1 Critical depth =      0.371(Ft.)
  '     '       '     Critical flow top width =     74.219(Ft.)
  '     '       '     Critical flow velocity=    2.433(Ft/s)
  '     '       '     Critical flow area =     13.771(Sq.Ft)

 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  94.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.979(In/Hr) for a   100.0 year storm
Subarea runoff =     31.730(CFS) for     12.150(Ac.)
Total runoff =     49.340(CFS)      Total area =      17.530(Ac.)
Depth of flow =   0.378(Ft.), Average velocity =   3.455(Ft/s)

Sub-Channel No. 1 Critical depth =      0.434(Ft.)
  '     '       '     Critical flow top width =     86.719(Ft.)
  '     '       '     Critical flow velocity=    2.624(Ft/s)
  '     '       '     Critical flow area =     18.800(Sq.Ft)
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Process from Point/Station        3.000 to Point/Station        4.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   908.400(Ft.)
Downstream point/station elevation =   860.000(Ft.)
Pipe length  =   645.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    49.340(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    49.340(CFS)
Normal flow depth in pipe =   12.77(In.)
Flow top width inside pipe =   34.45(In.)
Critical Depth =   27.42(In.)
Pipe flow velocity =     21.94(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =    13.88 min.


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Process from Point/Station        4.000 to Point/Station        5.000
**** IMPROVED CHANNEL TRAVEL TIME ****  DA A4
------------------------------------------------------------------------
Upstream point elevation =   860.000(Ft.)
Downstream point elevation =   855.800(Ft.)
Channel length thru subarea  =   377.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =     57.422(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     57.422(CFS)
Depth of flow =   0.485(Ft.), Average velocity =   2.440(Ft/s)
Channel flow top width =   97.023(Ft.)
Flow Velocity =    2.44(Ft/s)
Travel time  =    2.58 min.
Time of concentration =   16.45 min.

Sub-Channel No. 1 Critical depth =      0.461(Ft.)
  '     '       '     Critical flow top width =     92.188(Ft.)
  '     '       '     Critical flow velocity=    2.703(Ft/s)
  '     '       '     Critical flow area =     21.246(Sq.Ft)

 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.874
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  94.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.698(In/Hr) for a   100.0 year storm
Subarea runoff =     16.066(CFS) for      6.810(Ac.)
Total runoff =     65.406(CFS)      Total area =      24.340(Ac.)
Depth of flow =   0.509(Ft.), Average velocity =   2.521(Ft/s)

Sub-Channel No. 1 Critical depth =      0.484(Ft.)
  '     '       '     Critical flow top width =     96.875(Ft.)
  '     '       '     Critical flow velocity=    2.788(Ft/s)
  '     '       '     Critical flow area =     23.462(Sq.Ft)
```

End of computations, total study area = 24.34 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.912
Area averaged RI index number = 82.2

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 01/15/19 File:5957RU100B.out

JN5957 RATIONAL STUDY
PRE-DEVELOPED CONDITION
100YR STORM
DA B

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

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Process from Point/Station 11.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION **** DA B1

Initial area flow distance = 299.000(Ft.)
Top (of initial area) elevation = 994.000(Ft.)
Bottom (of initial area) elevation = 954.000(Ft.)
Difference in elevation = 40.000(Ft.)
Slope = 0.13378 s(percent)= 13.38
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.141 min.
Rainfall intensity = 4.330(In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.871
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Initial subarea runoff = 2.979(CFS)
Total initial stream area = 0.790(Ac.)
Pervious area fraction = 0.600

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Process from Point/Station       12.000 to Point/Station       13.000
**** IMPROVED CHANNEL TRAVEL TIME ****  DA B2
------------------------------------------------------------------------------
Upstream point elevation =   954.000(Ft.)
Downstream point elevation =   895.100(Ft.)
Channel length thru subarea  =   776.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =      8.219(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      8.219(CFS)
Depth of flow =   0.163(Ft.), Average velocity =   3.082(Ft/s)
Channel flow top width =   32.661(Ft.)
Flow Velocity =    3.08(Ft/s)
Travel time  =    4.20 min.
Time of concentration =   10.34 min.

Sub-Channel No. 1 Critical depth =      0.211(Ft.)
  '     '       '     Critical flow top width =     42.188(Ft.)
  '     '       '     Critical flow velocity=    1.847(Ft/s)
  '     '       '     Critical flow area =      4.449(Sq.Ft)

 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.879
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  94.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      3.373(In/Hr) for a   100.0 year storm
Subarea runoff =     10.380(CFS) for      3.500(Ac.)
Total runoff =     13.360(CFS)      Total area =       4.290(Ac.)
Depth of flow =   0.196(Ft.), Average velocity =   3.480(Ft/s)

Sub-Channel No. 1 Critical depth =      0.256(Ft.)
  '     '       '     Critical flow top width =     51.172(Ft.)
  '     '       '     Critical flow velocity=    2.041(Ft/s)
  '     '       '     Critical flow area =      6.546(Sq.Ft)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   890.100(Ft.)
Downstream point/station elevation =   859.000(Ft.)
Pipe length  =   255.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.360(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    13.360(CFS)
Normal flow depth in pipe =    5.85(In.)
Flow top width inside pipe =   26.57(In.)
Critical Depth =   13.95(In.)
Pipe flow velocity =     17.89(Ft/s)
Travel time through pipe =    0.24 min.
Time of concentration (TC) =    10.58 min.
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Process from Point/Station       14.000 to Point/Station       15.000
**** IMPROVED CHANNEL TRAVEL TIME **** DA B3
------------------------------------------------------------------------
Upstream point elevation =   859.000(Ft.)
Downstream point elevation =   845.400(Ft.)
Channel length thru subarea  =   549.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =     43.247(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     43.247(CFS)
Depth of flow =   0.375(Ft.), Average velocity =   3.067(Ft/s)
Channel flow top width =   75.098(Ft.)
Flow Velocity =    3.07(Ft/s)
Travel time  =    2.98 min.
Time of concentration =   13.56 min.

Sub-Channel No. 1 Critical depth =      0.410(Ft.)
  '     '       '     Critical flow top width =     82.031(Ft.)
  '     '       '     Critical flow velocity=    2.571(Ft/s)
  '     '       '     Critical flow area =     16.823(Sq.Ft)

 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.877
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  94.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.961(In/Hr) for a   100.0 year storm
Subarea runoff =     59.722(CFS) for     23.010(Ac.)
Total runoff =     73.082(CFS)      Total area =      27.300(Ac.)
Depth of flow =   0.457(Ft.), Average velocity =   3.497(Ft/s)

Sub-Channel No. 1 Critical depth =      0.508(Ft.)
  '     '       '     Critical flow top width =    101.563(Ft.)
  '     '       '     Critical flow velocity=    2.834(Ft/s)
  '     '       '     Critical flow area =     25.787(Sq.Ft)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   842.400(Ft.)
Downstream point/station elevation =   842.000(Ft.)
Pipe length  =    60.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    73.082(CFS)
Given pipe size =     36.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     2.810(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      0.720(Ft.)
 Minor friction loss =      2.490(Ft.)    K-factor =   1.50
Pipe flow velocity =     10.34(Ft/s)
Travel time through pipe =    0.10 min.
```

```
Time of concentration (TC) =    13.65 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       17.000
**** IMPROVED CHANNEL TRAVEL TIME **** DA B4
------------------------------------------------------------------------
Upstream point elevation =   842.000(Ft.)
Downstream point elevation =   835.100(Ft.)
Channel length thru subarea  =  1258.000(Ft.)
Channel base width      =    0.000(Ft.)
Slope or 'Z' of left channel bank = 100.000
Slope or 'Z' of right channel bank = 100.000
Estimated mean flow rate at midpoint of channel =     97.839(CFS)
Manning's 'N'    = 0.025
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     97.839(CFS)
Depth of flow =   0.677(Ft.), Average velocity =   2.137(Ft/s)
Channel flow top width =  135.320(Ft.)
Flow Velocity =    2.14(Ft/s)
Travel time  =    9.81 min.
Time of concentration =   23.47 min.

Sub-Channel No. 1 Critical depth =      0.570(Ft.)
  '     '       '     Critical flow top width =    114.063(Ft.)
  '     '       '     Critical flow velocity=    3.008(Ft/s)
  '     '       '     Critical flow area =     32.526(Sq.Ft)

 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.870
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  94.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.276(In/Hr) for a   100.0 year storm
Subarea runoff =     49.439(CFS) for     24.980(Ac.)
Total runoff =    122.521(CFS)      Total area =      52.280(Ac.)
Depth of flow =   0.736(Ft.), Average velocity =   2.261(Ft/s)

Sub-Channel No. 1 Critical depth =      0.621(Ft.)
  '     '       '     Critical flow top width =    124.219(Ft.)
  '     '       '     Critical flow velocity=    3.176(Ft/s)
  '     '       '     Critical flow area =     38.576(Sq.Ft)



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       17.000
**** SUBAREA FLOW ADDITION ****  DA B5
------------------------------------------------------------------------
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.847
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.600; Impervious fraction =  0.400
Time of concentration =    23.47 min.
Rainfall intensity =      2.276(In/Hr) for a   100.0 year storm
```

Subarea runoff = 19.703(CFS) for 10.220(Ac.)
Total runoff = 142.224(CFS) Total area = 62.500(Ac.)
End of computations, total study area = 62.50 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.930
Area averaged RI index number = 83.0

Appendix D

Rational Study

Post-Developed Condition

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 11/08/19 File:5957RD100A.out

JN5957 RATIONAL STUDY
POST-DEVELOPED CONDITION
100YR STORM
DA A

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION **** DA A1

Initial area flow distance = 492.000(Ft.)
Top (of initial area) elevation = 978.700(Ft.)
Bottom (of initial area) elevation = 939.500(Ft.)
Difference in elevation = 39.200(Ft.)
Slope = 0.07967 s(percent)= 7.97
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.313 min.
Rainfall intensity = 3.744(In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.867
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Initial subarea runoff = 24.955(CFS)
Total initial stream area = 7.690(Ac.)
Pervious area fraction = 0.600

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   896.490(Ft.)
Downstream point/station elevation =   887.500(Ft.)
Pipe length  =   612.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    24.955(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    24.955(CFS)
Normal flow depth in pipe =   16.85(In.)
Flow top width inside pipe =   21.95(In.)
Critical Depth =   21.13(In.)
Pipe flow velocity =     10.59(Ft/s)
Travel time through pipe =    0.96 min.
Time of concentration (TC) =     9.28 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        3.000
**** SUBAREA FLOW ADDITION **** DA A2
------------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.28 min.
Rainfall intensity =      3.553(In/Hr) for a   100.0 year storm
Subarea runoff =     14.612(CFS) for      4.600(Ac.)
Total runoff =     39.568(CFS)      Total area =      12.290(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        3.000
**** SUBAREA FLOW ADDITION **** DA A3
------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     9.28 min.
Rainfall intensity =      3.553(In/Hr) for a   100.0 year storm
Subarea runoff =     11.992(CFS) for      3.800(Ac.)
Total runoff =     51.560(CFS)      Total area =      16.090(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        3.000 to Point/Station        4.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   887.500(Ft.)
Downstream point/station elevation =   877.000(Ft.)
Pipe length  =   210.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    51.560(CFS)
Given pipe size =     24.00(In.)
```

```
Calculated individual pipe flow  =    51.560(CFS)
Normal flow depth in pipe =   18.52(In.)
Flow top width inside pipe =   20.15(In.)
Critical depth could not be calculated.
Pipe flow velocity =     19.84(Ft/s)
Travel time through pipe =    0.18 min.
Time of concentration (TC) =     9.45 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        4.000
**** SUBAREA FLOW ADDITION ****  DA A4
------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     9.45 min.
Rainfall intensity =      3.521(In/Hr) for a   100.0 year storm
Subarea runoff =     20.764(CFS) for      6.640(Ac.)
Total runoff =     72.324(CFS)      Total area =      22.730(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   876.000(Ft.)
Downstream point/station elevation =   865.300(Ft.)
Pipe length  =   406.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    72.324(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    72.324(CFS)
Normal flow depth in pipe =   20.44(In.)
Flow top width inside pipe =   35.67(In.)
Critical Depth =   32.26(In.)
Pipe flow velocity =     17.45(Ft/s)
Travel time through pipe =    0.39 min.
Time of concentration (TC) =     9.84 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station        5.000
**** SUBAREA FLOW ADDITION ****  DA A5
------------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.84 min.
Rainfall intensity =      3.453(In/Hr) for a   100.0 year storm
Subarea runoff =      5.989(CFS) for      1.940(Ac.)
Total runoff =     78.313(CFS)      Total area =      24.670(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station        5.000
**** SUBAREA FLOW ADDITION ****  DA A6
------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     9.84 min.
Rainfall intensity =      3.453(In/Hr) for a   100.0 year storm
Subarea runoff =     10.426(CFS) for      3.400(Ac.)
Total runoff =     88.740(CFS)      Total area =      28.070(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station        6.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   865.300(Ft.)
Downstream point/station elevation =   844.700(Ft.)
Pipe length  =   403.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    88.740(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    88.740(CFS)
Normal flow depth in pipe =   18.91(In.)
Flow top width inside pipe =   35.95(In.)
Critical Depth =   34.06(In.)
Pipe flow velocity =     23.59(Ft/s)
Travel time through pipe =    0.28 min.
Time of concentration (TC) =    10.12 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.000 to Point/Station        6.000
**** SUBAREA FLOW ADDITION ****  DA A7
------------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.12 min.
Rainfall intensity =      3.406(In/Hr) for a   100.0 year storm
Subarea runoff =      6.029(CFS) for      1.980(Ac.)
Total runoff =     94.769(CFS)      Total area =      30.050(Ac.)
End of computations, total study area =           30.05 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.274
Area averaged RI index number =  69.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/30/19 File:5957rd100b.out

JN5957 RATIONAL STUDY
POST-DEVELOPED CONDITION
100YR STORM
DA B

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 7.000 to Point/Station 8.000
**** INITIAL AREA EVALUATION **** DA B1

Initial area flow distance = 497.000(Ft.)
Top (of initial area) elevation = 871.200(Ft.)
Bottom (of initial area) elevation = 864.200(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.01408 s(percent)= 1.41
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.078 min.
Rainfall intensity = 3.590(In/Hr) for a 100.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Initial subarea runoff = 9.121(CFS)
Total initial stream area = 2.860(Ac.)
Pervious area fraction = 0.200

++

```
Process from Point/Station        8.000 to Point/Station        8.000
**** SUBAREA FLOW ADDITION ****  DA B2
____________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.08 min.
Rainfall intensity =      3.590(In/Hr) for a   100.0 year storm
Subarea runoff =      1.926(CFS) for      0.600(Ac.)
Total runoff =     11.047(CFS)      Total area =       3.460(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        8.000 to Point/Station        9.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
____________________________________________________________________
Upstream point/station elevation =   861.700(Ft.)
Downstream point/station elevation =   860.400(Ft.)
Pipe length  =   261.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    11.047(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    11.047(CFS)
Normal flow depth in pipe =   13.95(In.)
Flow top width inside pipe =   23.68(In.)
Critical Depth =   14.31(In.)
Pipe flow velocity =      5.84(Ft/s)
Travel time through pipe =    0.74 min.
Time of concentration (TC) =     9.82 min.
End of computations, total study area =            3.46 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.183
Area averaged RI index number =  69.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 09/30/19 File:5957RD100C.out

JN5957 RATIONAL STUDY
POST-DEVELOPED CONDITION
100YR STORM
DA C AND D

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 11.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION **** DA C1

Initial area flow distance = 916.000(Ft.)
Top (of initial area) elevation = 993.000(Ft.)
Bottom (of initial area) elevation = 877.500(Ft.)
Difference in elevation = 115.500(Ft.)
Slope = 0.12609 s(percent)= 12.61
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 9.725 min.
Rainfall intensity = 3.473(In/Hr) for a 100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.864
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.600; Impervious fraction = 0.400
Initial subarea runoff = 21.910(CFS)
Total initial stream area = 7.300(Ac.)
Pervious area fraction = 0.600

++

```
Process from Point/Station       12.000 to Point/Station       12.000
**** SUBAREA FLOW ADDITION ****  DA C2
------------------------------------------------------------------------
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.864
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.600; Impervious fraction =  0.400
Time of concentration =     9.72 min.
Rainfall intensity =      3.473(In/Hr) for a   100.0 year storm
Subarea runoff =      7.774(CFS) for      2.590(Ac.)
Total runoff =     29.684(CFS)      Total area =       9.890(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** IMPROVED CHANNEL TRAVEL TIME ****  DA C3
------------------------------------------------------------------------
Upstream point elevation =   877.500(Ft.)
Downstream point elevation =   862.500(Ft.)
Channel length thru subarea  =   443.000(Ft.)
Channel base width      =    4.500(Ft.)
Slope or 'Z' of left channel bank =   2.000
Slope or 'Z' of right channel bank =   1.000
Estimated mean flow rate at midpoint of channel =     32.078(CFS)
Manning's 'N'    = 0.013
Maximum depth of channel  =    1.500(Ft.)
Flow(q) thru subarea =     32.078(CFS)
Depth of flow =   0.513(Ft.), Average velocity =  11.872(Ft/s)
Channel flow top width =    6.038(Ft.)
Flow Velocity =   11.87(Ft/s)
Travel time  =    0.62 min.
Time of concentration =   10.35 min.

Sub-Channel No. 1 Critical depth =      1.031(Ft.)
  '     '       '     Critical flow top width =      7.594(Ft.)
  '     '       '     Critical flow velocity=    5.144(Ft/s)
  '     '       '     Critical flow area =      6.236(Sq.Ft)

 Adding area flow to channel
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.863
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.600; Impervious fraction =  0.400
Rainfall intensity =      3.371(In/Hr) for a   100.0 year storm
Subarea runoff =      4.714(CFS) for      1.620(Ac.)
Total runoff =     34.398(CFS)      Total area =      11.510(Ac.)
Depth of flow =   0.534(Ft.), Average velocity =  12.149(Ft/s)

Sub-Channel No. 1 Critical depth =      1.078(Ft.)
  '     '       '     Critical flow top width =      7.734(Ft.)
  '     '       '     Critical flow velocity=    5.216(Ft/s)
  '     '       '     Critical flow area =      6.595(Sq.Ft)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       14.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   850.830(Ft.)
Downstream point/station elevation =   848.750(Ft.)
Pipe length  =   208.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    34.398(CFS)
Given pipe size =     24.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     2.947(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      4.096(Ft.)
 Minor friction loss =      0.931(Ft.)    K-factor =   0.50
Critical depth could not be calculated.
Pipe flow velocity =     10.95(Ft/s)
Travel time through pipe =    0.32 min.
Time of concentration (TC) =    10.66 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       14.000
**** SUBAREA FLOW ADDITION ****  DA C4
------------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.888
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =    10.66 min.
Rainfall intensity =      3.323(In/Hr) for a   100.0 year storm
Subarea runoff =      3.097(CFS) for      1.050(Ac.)
Total runoff =     37.495(CFS)      Total area =      12.560(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       14.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------------
Upstream point/station elevation =   848.750(Ft.)
Downstream point/station elevation =   844.600(Ft.)
Pipe length  =   133.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    37.495(CFS)
Given pipe size =     24.00(In.)
Calculated individual pipe flow  =    37.495(CFS)
Normal flow depth in pipe =   17.25(In.)
Flow top width inside pipe =   21.58(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.51(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    10.81 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     12.560(Ac.)
```

```
Runoff from this stream =     37.495(CFS)
Time of concentration =   10.81 min.
Rainfall intensity =     3.302(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       21.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****  DA D1
------------------------------------------------------------------------
Initial area flow distance =   998.000(Ft.)
Top (of initial area) elevation =   873.300(Ft.)
Bottom (of initial area) elevation =   861.000(Ft.)
Difference in elevation =    12.300(Ft.)
Slope =    0.01232  s(percent)=       1.23
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   12.323 min.
Rainfall intensity =      3.100(In/Hr) for a   100.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Initial subarea runoff =     23.365(CFS)
Total initial stream area =        8.500(Ac.)
Pervious area fraction = 0.200


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       22.000
**** SUBAREA FLOW ADDITION ****  DA D2
------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =    12.32 min.
Rainfall intensity =      3.100(In/Hr) for a   100.0 year storm
Subarea runoff =      3.738(CFS) for      1.360(Ac.)
Total runoff =     27.103(CFS)      Total area =       9.860(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       22.000 to Point/Station       23.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   846.810(Ft.)
Downstream point/station elevation =   845.620(Ft.)
Pipe length  =   239.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    27.103(CFS)
Given pipe size =     24.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     2.310(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      2.922(Ft.)
 Minor friction loss =      0.578(Ft.)    K-factor =   0.50
```

```
Critical depth could not be calculated.
Pipe flow velocity =      8.63(Ft/s)
Travel time through pipe =    0.46 min.
Time of concentration (TC) =    12.78 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       23.000
**** SUBAREA FLOW ADDITION ****  DA D3
----------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =    12.78 min.
Rainfall intensity =      3.046(In/Hr) for a   100.0 year storm
Subarea runoff =      5.481(CFS) for      2.030(Ac.)
Total runoff =     32.584(CFS)      Total area =      11.890(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       23.000
**** SUBAREA FLOW ADDITION ****  DA D4
----------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.893
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    12.78 min.
Rainfall intensity =      3.046(In/Hr) for a   100.0 year storm
Subarea runoff =      4.407(CFS) for      1.620(Ac.)
Total runoff =     36.991(CFS)      Total area =      13.510(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       23.000 to Point/Station       15.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
----------------------------------------------------------------------
Upstream point/station elevation =   845.620(Ft.)
Downstream point/station elevation =   844.600(Ft.)
Pipe length  =   202.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    36.991(CFS)
Given pipe size =     24.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     4.657(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      4.601(Ft.)
 Minor friction loss =      1.076(Ft.)    K-factor =   0.50
Critical depth could not be calculated.
Pipe flow velocity =     11.77(Ft/s)
Travel time through pipe =    0.29 min.
Time of concentration (TC) =    13.07 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station       21.000 to Point/Station       15.000
**** CONFLUENCE OF MAIN STREAMS ****
--------------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     13.510(Ac.)
Runoff from this stream =     36.991(CFS)
Time of concentration =   13.07 min.
Rainfall intensity =     3.013(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1       37.495     10.81               3.302
2       36.991     13.07               3.013
Largest stream flow has longer or shorter time of concentration
Qp =     37.495 + sum of
        Qa          Tb/Ta
        36.991 *    0.827 =     30.583
Qp =     68.078

Total of 2 main streams to confluence:
Flow rates before confluence point:
      37.495      36.991
Area of streams before confluence:
       12.560       13.510


Results of confluence:
Total flow rate =     68.078(CFS)
Time of concentration =    10.806 min.
Effective stream area after confluence  =     26.070(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       15.000 to Point/Station       16.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
--------------------------------------------------------------------------------
Upstream point/station elevation =   843.600(Ft.)
Downstream point/station elevation =   843.000(Ft.)
Pipe length  =   791.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    68.078(CFS)
Given pipe size =     36.00(In.)
NOTE: Normal flow is pressure flow in user selected pipe size.
The approximate hydraulic grade line above the pipe invert is
     8.580(Ft.)  at the headworks or inlet of the pipe(s)
 Pipe friction loss =      7.019(Ft.)
 Minor friction loss =      2.161(Ft.)    K-factor =   1.50
Critical depth could not be calculated.
Pipe flow velocity =      9.63(Ft/s)
Travel time through pipe =    1.37 min.
Time of concentration (TC) =    12.17 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       16.000 to Point/Station       16.000
**** SUBAREA FLOW ADDITION ****  DA C5
--------------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
```

```
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =    12.17 min.
Rainfall intensity =      3.118(In/Hr) for a   100.0 year storm
Subarea runoff =     34.369(CFS) for     12.430(Ac.)
Total runoff =    102.447(CFS)      Total area =      38.500(Ac.)
End of computations, total study area =           38.50 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.315
Area averaged RI index number =  69.0
```

Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
Rational Hydrology Study Date: 10/01/19 File:5957RD100EF.out

JN5957 RATIONAL STUDY
POST-DEVELOPED CONDITION
100YR STORM
DA E AND F

********* Hydrology Study Control Information **********

English (in-lb) Units used in input data file

Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) = 100.00 Antecedent Moisture Condition = 3

Standard intensity-duration curves data (Plate D-4.1)
For the [Corona] area used.
10 year storm 10 minute intensity = 2.220(In/Hr)
10 year storm 60 minute intensity = 0.940(In/Hr)
100 year storm 10 minute intensity = 3.430(In/Hr)
100 year storm 60 minute intensity = 1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity = 1.450(In/Hr)
Slope of intensity duration curve = 0.4800

++

Process from Point/Station 31.000 to Point/Station 32.000
**** INITIAL AREA EVALUATION **** DA E1

Initial area flow distance = 293.000(Ft.)
Top (of initial area) elevation = 855.500(Ft.)
Bottom (of initial area) elevation = 848.500(Ft.)
Difference in elevation = 7.000(Ft.)
Slope = 0.02389 s(percent)= 2.39
TC = k(0.323)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 6.612 min.
Rainfall intensity = 4.180(In/Hr) for a 100.0 year storm
APARTMENT subarea type
Runoff Coefficient = 0.890
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3) = 84.40
Pervious area fraction = 0.200; Impervious fraction = 0.800
Initial subarea runoff = 8.221(CFS)
Total initial stream area = 2.210(Ac.)
Pervious area fraction = 0.200

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       33.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   835.800(Ft.)
Downstream point/station elevation =   831.860(Ft.)
Pipe length  =   394.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =     8.221(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =     8.221(CFS)
Normal flow depth in pipe =    8.20(In.)
Flow top width inside pipe =   30.20(In.)
Critical Depth =   10.83(In.)
Pipe flow velocity =      6.79(Ft/s)
Travel time through pipe =    0.97 min.
Time of concentration (TC) =     7.58 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       33.000 to Point/Station       33.000
**** SUBAREA FLOW ADDITION ****  DA E2
------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.889
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     7.58 min.
Rainfall intensity =      3.914(In/Hr) for a   100.0 year storm
Subarea runoff =      3.725(CFS) for      1.070(Ac.)
Total runoff =     11.946(CFS)      Total area =       3.280(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       33.000 to Point/Station       34.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   831.860(Ft.)
Downstream point/station elevation =   829.970(Ft.)
Pipe length  =   189.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    11.946(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    11.946(CFS)
Normal flow depth in pipe =    9.90(In.)
Flow top width inside pipe =   32.15(In.)
Critical Depth =   13.16(In.)
Pipe flow velocity =      7.56(Ft/s)
Travel time through pipe =    0.42 min.
Time of concentration (TC) =     8.00 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       34.000 to Point/Station       34.000
**** SUBAREA FLOW ADDITION ****  DA E3
------------------------------------------------------------------------
APARTMENT subarea type
Runoff Coefficient = 0.889
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
```

```
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.200; Impervious fraction =  0.800
Time of concentration =     8.00 min.
Rainfall intensity =      3.815(In/Hr) for a   100.0 year storm
Subarea runoff =      4.579(CFS) for      1.350(Ac.)
Total runoff =     16.525(CFS)      Total area =       4.630(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       34.000 to Point/Station       35.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   829.970(Ft.)
Downstream point/station elevation =   828.690(Ft.)
Pipe length  =   128.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    16.525(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    16.525(CFS)
Normal flow depth in pipe =   11.71(In.)
Flow top width inside pipe =   33.73(In.)
Critical Depth =   15.58(In.)
Pipe flow velocity =      8.29(Ft/s)
Travel time through pipe =    0.26 min.
Time of concentration (TC) =     8.25 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       35.000 to Point/Station       35.000
**** SUBAREA FLOW ADDITION ****  DA E4
------------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     8.25 min.
Rainfall intensity =      3.758(In/Hr) for a   100.0 year storm
Subarea runoff =      9.814(CFS) for      2.920(Ac.)
Total runoff =     26.339(CFS)      Total area =       7.550(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       31.000 to Point/Station       35.000
**** CONFLUENCE OF MAIN STREAMS ****
------------------------------------------------------------------------
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      7.550(Ac.)
Runoff from this stream =     26.339(CFS)
Time of concentration =    8.25 min.
Rainfall intensity =     3.758(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       41.000 to Point/Station       42.000
**** INITIAL AREA EVALUATION ****  DA F1
------------------------------------------------------------------------
Initial area flow distance =   815.000(Ft.)
```

```
Top (of initial area) elevation =   857.600(Ft.)
Bottom (of initial area) elevation =   844.100(Ft.)
Difference in elevation =    13.500(Ft.)
Slope =    0.01656  s(percent)=       1.66
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.948 min.
Rainfall intensity =      3.435(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =     11.946(CFS)
Total initial stream area =        3.890(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       42.000 to Point/Station       43.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   835.170(Ft.)
Downstream point/station elevation =   829.490(Ft.)
Pipe length  =   568.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    11.946(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    11.946(CFS)
Normal flow depth in pipe =    9.90(In.)
Flow top width inside pipe =   32.15(In.)
Critical Depth =   13.16(In.)
Pipe flow velocity =      7.56(Ft/s)
Travel time through pipe =    1.25 min.
Time of concentration (TC) =    11.20 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       43.000 to Point/Station       43.000
**** SUBAREA FLOW ADDITION ****  DA F2
------------------------------------------------------------------------
COMMERCIAL subarea type
Runoff Coefficient = 0.894
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 3)  =  84.40
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    11.20 min.
Rainfall intensity =      3.245(In/Hr) for a   100.0 year storm
Subarea runoff =     12.848(CFS) for      4.430(Ac.)
Total runoff =     24.794(CFS)      Total area =       8.320(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       43.000 to Point/Station       35.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
------------------------------------------------------------------------
Upstream point/station elevation =   829.490(Ft.)
Downstream point/station elevation =   828.690(Ft.)
Pipe length  =    80.00(Ft.)   Manning's N = 0.012
```

```
No. of pipes = 1  Required pipe flow  =    24.794(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    24.794(CFS)
Normal flow depth in pipe =   14.54(In.)
Flow top width inside pipe =   35.33(In.)
Critical Depth =   19.27(In.)
Pipe flow velocity =      9.27(Ft/s)
Travel time through pipe =    0.14 min.
Time of concentration (TC) =    11.34 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       41.000 to Point/Station       35.000
**** CONFLUENCE OF MAIN STREAMS ****
________________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      8.320(Ac.)
Runoff from this stream =     24.794(CFS)
Time of concentration =   11.34 min.
Rainfall intensity =     3.225(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                (In/Hr)


1       26.339      8.25               3.758
2       24.794     11.34               3.225
Largest stream flow has longer or shorter time of concentration
Qp =     26.339 + sum of
        Qa          Tb/Ta
        24.794 *    0.727 =     18.037
Qp =     44.376

Total of 2 main streams to confluence:
Flow rates before confluence point:
      26.339      24.794
Area of streams before confluence:
        7.550        8.320


Results of confluence:
Total flow rate =     44.376(CFS)
Time of concentration =     8.253 min.
Effective stream area after confluence  =     15.870(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       35.000 to Point/Station       36.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   828.690(Ft.)
Downstream point/station elevation =   828.200(Ft.)
Pipe length  =    70.00(Ft.)   Manning's N = 0.012
No. of pipes = 1  Required pipe flow  =    44.376(CFS)
Given pipe size =     36.00(In.)
Calculated individual pipe flow  =    44.376(CFS)
Normal flow depth in pipe =   22.92(In.)
Flow top width inside pipe =   34.63(In.)
Critical Depth =   26.04(In.)
Pipe flow velocity =      9.35(Ft/s)
Travel time through pipe =    0.12 min.
```

Time of concentration (TC) = 8.38 min.
End of computations, total study area = 15.87 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.129
Area averaged RI index number = 69.0

Appendix E

Hydraulic Design

BOX INLETS

$\frac{Q}{P} = 3.0\,H^{3/2}$ ASSUME 25% CLOGGING

CURB INLETS

$Q = 3.087\,L\,H^{3/2}$ WEIR CONDITION $H = d + 4''$ | ORIFICE CONDITION $Q = 7.0\,A\sqrt{2gh}$

NODE (2)

$Q_{100} = 24.96$ CFS CURB INLET

PER MASS GRADING STUDY: $Q_{MAX} = 7.6$ CFS IN BROW DITCH

TRY $d = 0.85$ LF $A = 0.903$ SF $R = 0.330$ LF $S = 0.020$ $n = 0.013$

$$Q = (0.903)\left(\frac{1.486}{0.013}\right)(0.330^{2/3})(0.020^{1/2}) = 7.0\text{ CFS} \sim Q_{MAX}$$

$h = 0.85 + 4/12 - 3/12 = 0.93$ LF

$24.96 = (7.0)(0.5)L\sqrt{2(32.2)(0.93)}$ $L = 0.92$ LF

$\therefore$ 2LF OPENING MIN.

NODE (3A)

$Q_{100} = 14.61$ CFS 2EA CURB INLETS $\rightarrow Q_{100} = 7.30$ CFS EACH

6" CURB AND GUTTER

TRY $d = 0.43$ LF $A = 3.12$ SF $R = 0.174$ LF $S = 0.005$ $n = 0.013$

$$Q = (3.12)\left(\frac{1.486}{0.013}\right)(0.174^{2/3})(0.005^{1/2}) = 7.8\text{ CFS} \sim Q_{100}$$

$H = 0.43 + 0.33 = 0.76$ LF

$7.30 = 3.087\,(0.76^{3/2})\,L$ $L = 3.6$ LF $\therefore$ OPENING = 4 LF

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DATE:	SCALE:	SHEET:	JOB NO.	HYDRAULIC DESIGN
			5957	

NODE (3B)

Q_{100} = 11.99 CFS 2EA BOX INLETS → Q_{100} = 6.00 CFS EACH

6" C 3.6
H = 0.4 LF $P = \frac{6.0}{(75\%)(3.0)(0.4^{3/2})} = 10.5$ LF $S = \frac{10.5}{4} = 2.6$ LF

∴ 36" x 36" GRATE (2EA)

NODE (4)

Q_{100} = 20.76 CFS 2EA CURB INLETS → Q_{100} = 10.4 CFS EA

6" C 3.6
TRY d = 0.48 LF A = 4.06 SF R = 0.198 LF S = 0.005 n = 0.013

$Q = (4.06)\left(\frac{1.486}{0.013}\right)(0.198^{2/3})(0.005^{1/2}) = 11.1$ CFS ~ Q_{100}

H = 0.48 + 0.33 = 0.81 LF

$10.4 = 3.087\,(0.81^{3/2})\,L$ L = 4.6 LF ∴ OPENING = 5 LF

NODE (5A)

BOX INLET
Q_{100} = 5.99 CFS 36" x 36" GRATE (ESTIMATED FROM NODE (3B))
6" C 3.6

NODE (5B)

CURB INLET
Q_{100} = 10.42 CFS OPENING = 5 LF (SEE NODE (4))
6" C 3.6

NODE (6)

BOX INLET
Q_{100} = 6.03 CFS 36" x 36" GRATE (SEE NODE (3B))
6" C 3.6

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NODE (8A)

$Q_{100} = 11.05$ CFS CURB INLET

6" C3.6

TRY $d = 0.48$ LF $A = 4.06$ SF $R = 0.198$ LF $S = 0.005$ $n = 0.013$

$$Q = (4.06)\left(\frac{1.486}{0.013}\right)(0.198^{2/3})(0.005^{1/2}) = 11.1 \text{ CFS} \sim Q_{100}$$

$H = 0.48 + 0.33 = 0.81$ LF

$11.05 = 3.087(0.81^{3/2})\,L$ $L = 4.9$ LF $\therefore$ OPENING = 5.0 LF

NODE (8B)

$Q_{100} = 1.93$ CF BOX INLET

6" C3.6

$H = 0.4$ LF

$$P = \frac{1.93}{(75\%)(3.0)(0.4^{3/2})} = 3.4 \text{ LF} \qquad S = \frac{3.4}{4} = 0.8 \text{ LF}$$

$\therefore$ 18" x 18" GRATE

NODE (13)

$Q_{100} = 34.40$ CFS CURB INLET

BROW DITCH

TRY $d = 1.42$ LF $A = 3.02$ SF $R = 0.584$ $S = 0.020$ $n = 0.013$

$$Q = (3.02)\left(\frac{1.486}{0.013}\right)(0.584^{2/3})(0.020^{1/2}) = 34.1 \text{ CFS} \sim Q_{100}$$

$h = 1.42 + 4/12 - 3/12 = 1.50$ LF

$34.4 = (7.0)(0.5)L\sqrt{(2)(32.2)(1.5)}$ $L = 1.0$ LF 5 LF

$\therefore$ OPENING = 1 LF

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NODE (14)

Q_{100} = 3.10 CFS BOX INLET

6" C.G

H = 0.4 LF $P = \frac{3.10}{(75\%)(3.0)(0.4^{3/2})} = 5.4$ LF $S = \frac{5.4}{4} = 1.4$ LF

∴ 18"x18" GRATE

NODE (16)

Q_{100} = 34.37 CFS 3EA CURB INLETS → Q_{100} = 11.5 CFS EACH

6" C.G OPENING = 5.0 LF (SEE NODE 8A)

NODE (22A)

Q_{100} = 23.36 CFS 2EA CURB INLETS → Q_{100} = 11.7 CFS

6" C.G

TRY d = 0.49 LF A = 4.26 SF R = 0.203 LF S = 0.005 η = 0.013

$Q = (4.26)\left(\frac{1.486}{0.013}\right)(0.203^{2/3})(0.005^{1/2}) = 11.9$ CFS ~ Q_{100}

H = 0.49 + 0.33 = 0.82 LF

$11.7 = 3.087(0.82^{3/2})L$ L = 5.10 LF ∴ OPENING = 5.5 LF

NODE (22B)

Q_{100} = 3.74 CFS BOX INLET

6" C.G H = 0.4 LF $P = \frac{3.74}{(75\%)(3.0)(0.4^{3/2})} = 6.6$ LF $S = \frac{6.6}{4} = 1.6$ LF

∴ 24"x24" GRATE

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NODE (23A)

$Q_{100} = 5.48$ CFS BOX INLET

6" C$\frac{3}{4}$G $H = 0.4$ LF $P = \frac{5.48}{(75\%)(3.0)(0.4^{3/2})} = 9.6$ LF $S = \frac{9.6}{4} = 2.4$ LF

$\therefore$ 36" x 36" GRATE

NODE (23B)

$Q_{100} = 4.41$ CFS BOX INLET

6" C$\frac{3}{4}$G $H = 0.4$ LF $P = \frac{4.41}{(75\%)(3.0)(0.4^{3/2})} = 7.7$ LF $S = \frac{7.7}{4} = 1.9$ LF

$\therefore$ 24" x 24" GRATE

NODE (32)

$Q_{100} = 8.22$ CFS CURB INLET

6" C$\frac{3}{4}$G

TRY $d = 0.44$ LF $A = 3.3$ SF $R = 0.179$ LF $S = 0.005$ $n = 0.013$

$Q = (3.3)\left(\frac{1.486}{0.013}\right)(0.179^{2/3})(0.005^{1/2}) = 8.4$ CFS $\sim Q_{100}$

$H = 0.44 + 0.33 = 0.77$ LF

$8.22 = 3.087(0.77^{3/2})L$ $L = 3.9$ LF $\therefore$ OPENING = 4 LF

NODE (33)

$Q_{100} = 3.72$ CFS BOX INLET

6" C$\frac{3}{4}$G $H = 0.4$ LF $P = \frac{3.72}{(75\%)(3.0)(0.4^{3/2})} = 6.5$ LF $S = \frac{6.5}{4} = 1.6$ LF

$\therefore$ 24" x 24" GRATE

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NODE (34)

Q_{100} = 4.58 CFS BOX INLET

6" C3G H = 0.4 LF $P = \frac{4.58}{(75\%)(3.0)(0.4^{3/2})} = 8.04$ LF $S = \frac{8.04}{4} = 2.0$ LF

∴ 24" x 24" GRATE

NODE (35)

Q_{100} = 9.81 CFS CURB INLET 6" C3G

TRY d = 0.46 LF A = 3.67 SF R = 0.188 S = 0.005 n = 0.013

$Q = (3.67)\left(\frac{1.486}{0.013}\right)(0.188^{2/3})(0.005^{1/2}) = 9.7$ CFS ~ Q_{100}

H = 0.46 + 0.33 = 0.79 LF

$9.81 = 3.087(0.78^{3/2})L$ L = 4.6 LF ∴ OPENING = 5 LF

NODE (42)

Q_{100} = 11.95 CFS CURB INLET 6" C3G

OPENING = 5.5 LF (SEE NODE (22A))

NODE (43)

Q_{100} = 12.85 CFS CURB INLET 6" C3G

OPENING = 5.5 LF (SEE NODE (4))

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STORM DRAIN PIPES

PER KING'S TABLE 6-2 FOR OPEN FLOW CONDITION

NODE (2) TO (4)

Q_{100} = 51.56 CFS η=0.012 S= 0.024 ∴ 30" ϕ MIN.

NODE (4) TO (6)

Q_{100} = 94.77 CFS η=0.012 S= 0.030 ∴ 36" ϕ MIN.

NODE (13) TO (15)

Q_{100} = 37.50 CFS η=0.012 S=0.018 ∴ 30" ϕ MIN.

NODE (15) TO (16)

Q_{100} = 68.08 CFS η=0.012 S= 0.010 ∴ 36" ϕ MIN.

NODE (22) TO (15)

Q_{100} = 36.99 CFS η=0.012 S= 0.010 ∴ 30" ϕ MIN.

NODE (32) TO (35)

Q_{100} = 16.53 CFS η=0.012 S=0.010 ∴ 24" ϕ MIN.

NODE (42) TO (35)

Q_{100} = 24.79 CFS η=0.012 S= 0.010 ∴ 24" ϕ MIN.

NODE (35) TO (36)

Q_{100} = 44.38 CFS η=0.012 S=0.007
∴ 36" ϕ MIN.

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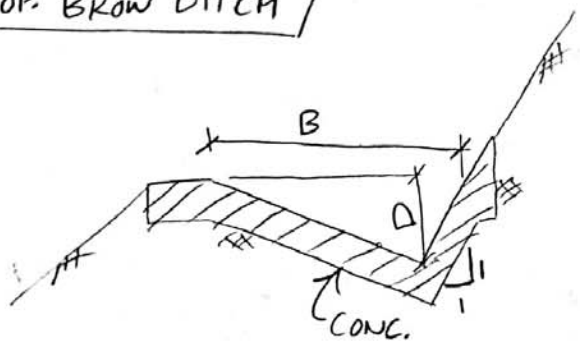
PROP. BROW DITCH



W'LY NODE (2)

$Q_{100} = 24.96/2 = 12.5$ CFS

$S = 0.020$ $n = 0.013$ $B = 37.5"$ $D = 15"$ $WP = 4.02$ LF $A = 1.95$ SF

$$Q_{CHANNEL} = \frac{1.486}{0.013}\left(\frac{1.95}{4.02}\right)^{2/3}(0.020)^{1/2}(1.95) = 19.5 \text{ CFS} > Q_{100} \checkmark$$

E'LY NODE (2)

$Q_{100} = 12.5$ CFS $< Q_{CHANNEL}$

W'LY NODE (12)

$Q_{100} = 7.74$ CFS $< Q_{CHANNEL}$

NODE (12) TO (13)

$Q_{100} = 34.40$ CFS

$S = 0.020$ $n = 0.013$ $B = 54"$ $D = 18"$ $WP = 5.48$ LF $A = 3.38$ SF

$$Q_{CHANNEL} = \frac{1.486}{0.013}\left(\frac{3.38}{5.48}\right)^{2/3}(0.020)^{1/2}(3.38) = 39.6 \text{ CFS} > Q_{100} \checkmark$$

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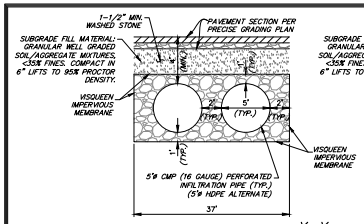
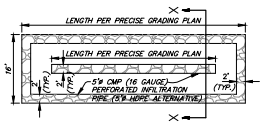
Appendix F

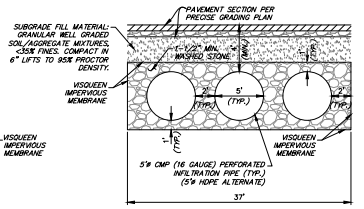
LID Storage

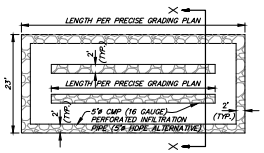
Design



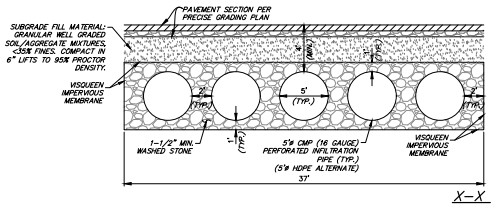


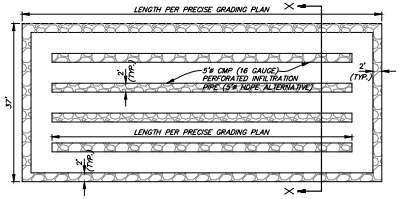
UNDEGROUND STORAGE SYSTEM
NTS



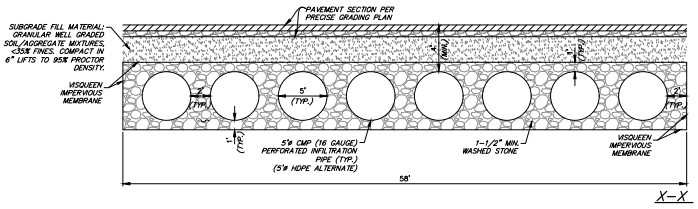


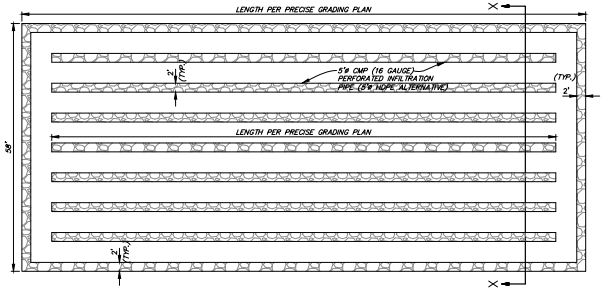
UNDEGROUND STORAGE SYSTEM
NTS



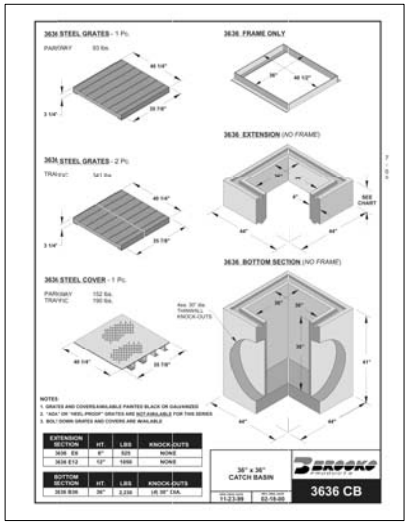


UNDEGROUND STORAGE SYSTEM
NTS

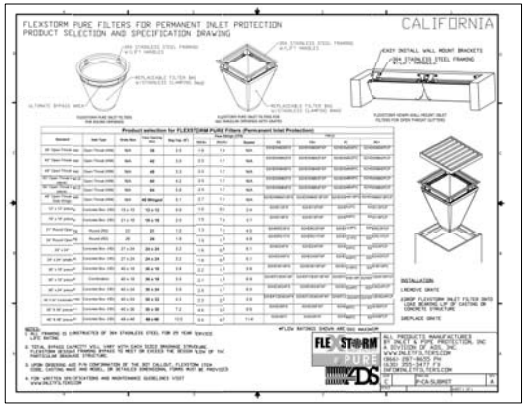




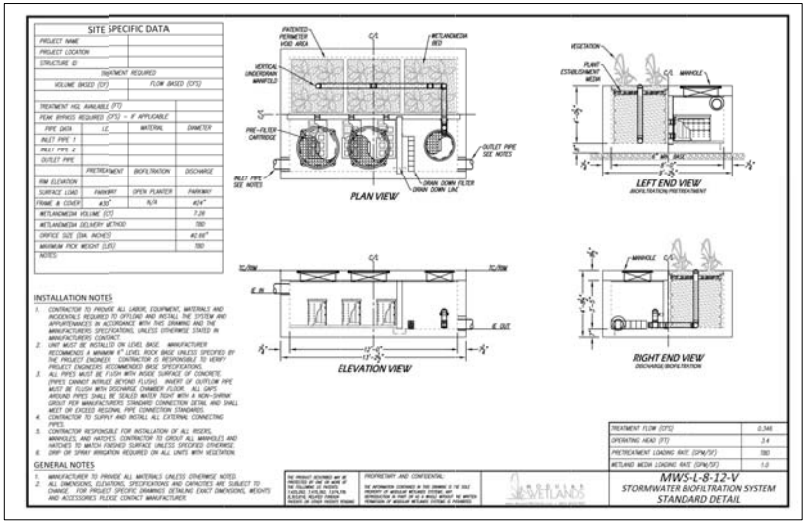
UNDEGROUND STORAGE SYSTEM
NTS



36"x36" INLET
NTS



FLEXSTORM INLET FILTER
NTS



MODULAR WETLANDS SYSTEM
NTS

INLET STENCIL
NTS

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BENCHMARK

REVISIONS:

PREPARED UNDER THE SUPERVISION OF:

KEVIN J. RICHER
R.C.E. 43714 LIC. EXP. 3/31/21 DATE

APPROVED BY:

DATE

PRELIM WQMP EXHIBIT

(TENT. PARCEL MAP NO. 37608)

SITE:
VERONA STREET
CORONA CALIFORNIA

PREPARED FOR:
REXCO DEVELOPMENT
2518 NORTH SANTIAGO BLVD.
ORANGE, CA 92867

DATE: 11/04/19	JOB NO. 5957
DRAWN BY: CAZ	SCALE AS NOTED
DESIGNED BY: KJR	SHEET 3 OF 3 SHEETS
CHECKED BY: KJR	

DA 1

$V_{BMP} = 19{,}233$ CF

$V_{TRENCH} = (7\,LF)(4{,}403\,SF) = 30{,}821$ CF

$V_{PIPES} = \frac{\pi(5\,LF)^2}{4}(591\,LF) = 11{,}604.3$ CF

$V_{GRAVEL} = (40\%)(30{,}821 - 11{,}604.3) = 7{,}686.7$ CF

STORAGE $= 11{,}604.3 + 7{,}686.7 = 19{,}291$

5EA ROWS OF 5LF Ø CMP → 37LF x 119 LF FOOTPRINT

DA 2

$V_{BMP} = 8{,}376$ CF

$V_{TRENCH} = (7\,LF)(1{,}955\,SF) = 13{,}685$ CF

$V_{PIPES} = \frac{\pi(5\,LF)^2}{4}(251\,LF) = 4{,}928.4$ CF

$V_{GRAVEL} = (40\%)(13{,}685 - 4{,}928.4) = 3{,}502.7$ CF

STORAGE $= 4{,}928.4 + 3{,}502.7 = 8{,}431$ CF → 3EA ROWS OF 5 LF Ø CMP 23 LF x 85LF FOOTPRINT

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DA 3

$V_{BMP} = 3,148$ CF

$V_{TRENCH} = (7\text{ LF})(752\text{ SF}) = 5,264$ CF

$V_{PIPES} = \frac{\pi(5\text{ LF})^2}{4}(90\text{ LF}) = 1,767.1$ CF

$V_{GRAVEL} = (40\%)(5,264 - 1,767.1) = 1,398.7$ CF

STORAGE = $1,767.1 + 1,398.7 = 3,165$ CF → 2EA ROWS OF 5LF ϕ CMP; 16 LF x 47 LF FOOTPRINT

DA 4

$V_{BMP} = 6,726$ CF

$V_{TRENCH} = (7\text{ LF})(1,554\text{ SF}) = 10,878$ CF

$V_{PIPES} = \frac{\pi(5\text{ LF})^2}{4}(206\text{ LF}) = 4,044.8$ CF

$V_{GRAVEL} = (40\%)(10,878 - 4,044.8) = 2,733.3$ CF

STORAGE = $4,044.8 + 2,733.3 = 6,778$ CF → 5EA. ROWS OF 5LF ϕ CMP; 37LF x 42LF FOOTPRINT

DA 5

$V_{BMP} = 3,316$ CF

$V_{TRENCH} = (7\text{ LF})(800\text{ SF}) = 5,600$ CF

$V_{PIPES} = \frac{\pi(5\text{ LF})^2}{4}(96\text{ LF}) = 1,885.0$ CF

$V_{GRAVEL} = (40\%)(5,600 - 1,885.0) = 1,486.0$ CF

STORAGE = $1885.0 + 1486.0 = 3,371$CF → 2EA. ROWS OF 5LF ϕ CMP; 16 LF x 50 LF FOOTPRINT

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DA 6

$V_{BMP} = 4{,}028$ CF

$V_{TRENCH} = (7\,LF)(960\,SF) = 6{,}720$ CF

$V_{PIPES} = \frac{\pi(5\,LF)^2}{4}(116\,LF) = 2{,}277.7$ CF

$V_{GRAVEL} = (40\%)(6{,}720 - 2{,}277.7) = 1{,}776.9$ CF

STORAGE = $2{,}277.7 + 1{,}776.9 = 4{,}054$ CF → 2EA ROWS OF 5LF ϕCMP; 16 LF x 60 LF FOOTPRINT

DA 7

$V_{BMP} = 2{,}334$ CF

$V_{TRENCH} = (7\,LF)(560\,SF) = 3{,}920$ CF

$V_{PIPES} = \frac{\pi(5\,LF)^2}{4}(66\,LF) = 1{,}295.9$ CF

$V_{GRAVEL} = (40\%)(3920 - 1295.9) = 1{,}049.6$ CF

STORAGE = $1{,}295.9 + 1{,}049.6 = 2{,}345$ CF → 2EA ROWS OF 5LF ϕCMP; 16 LF x 35 LF

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DA 8

$V_{BMP} = 28,388$ CF

$V_{TRENCH} = (7\text{ LF})(6,438\text{ SF}) = 45,066$ CF

$V_{PIPES} = \frac{\pi(5\text{ LF})^2}{4}(884\text{ LF}) = 17,357.3$ CF

$V_{GRAVEL} = (40\%)(45,066 - 17,357.3) = 11,083.5$ CF

STORAGE = $17,357.3 + 11,083.5 = 28,440$ CF → 8 EA ROWS OF 5LF ϕ CMP; 58LF x 111 LF FOOTPRINT

DA 9

$V_{BMP} = 8,173$ CF

$V_{TRENCH} = (7\text{ LF})(1,909\text{ SF}) = 13,363$ CF

$V_{PIPES} = \frac{\pi(5\text{ LF})^2}{4}(245\text{ LF}) = 4,810.6$ CF

$V_{GRAVEL} = (40\%)(13,363 - 4,810.6) = 3,421.0$ CF

STORAGE = $4810.6 + 3421.0 = 8,231$ CF → 3 EA ROWS OF 5LF ϕ CMP; 23 LF x 83 LF FOOTPRINT

DA 10

$V_{BMP} = 11,780$ CF → 3 EA. ROWS OF 5 LF ϕ CMP; FOOTPRINT

$V_{TRENCH} = (7\text{ LF})(2,737\text{ SF}) = 19,159$ CF

$V_{PIPES} = \frac{\pi(5\text{ LF})^2}{4}(353\text{ LF}) = 6,931.1$ CF

$V_{GRAVEL} = (40\%)(19,159 - 6931.1) = 4,891.1$ CF

STORAGE = $6931.1 + 4891.1 = 11,822$ CF

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DA 11

$V_{BMP} = 17,228$ CF

$V_{TRENCH} = (7LF)(4,048\ SF) = 28,336$ CF

$V_{PIPES} = \frac{\pi (5LF)^2}{4}(502\ LF) = 9,856.7$ CF

$V_{GRAVEL} = (40\%)(28,336 - 9,856.7) = 7,391.7$ CF

STORAGE = 9,856.7 + 7,391.7 = 17,248 CF → 2EA. ROWS OF 5LF ϕ CMP;
16 LF X 253 LF FOOTPRINT

DA 12

$V_{BMP} = 12,493$ CF

$V_{TRENCH} = (7LF)(2,886\ SF) = 20,202$ CF

$V_{PIPES} = \frac{\pi (5LF)^2}{4}(386\ LF) = 7,579.1$ CF

$V_{GRAVEL} = (40\%)(20,202 - 7,579.1) = 5,049.2$ CF

STORAGE = 7,579.1 + 5,049.2 = 12,628 CF → 5EA. ROWS OF 5LF ϕ CMP;
37LF X 74LF FOOTPRINT

DA 13

$V_{BMP} = 10,188$ CF

→ 3EA. ROWS OF 5LF ϕ CMP;
23 LF X 103 LF FOOTPRINT

$V_{TRENCH} = (7LF)(2,369\ SF) = 16,583$ CF

$V_{PIPES} = \frac{\pi (5LF)^2}{4}(305\ LF) = 5,988.7$ CF

$V_{GRAVEL} = (40\%)(16,583 - 5,988.7) = 4,237.7$ CF

STORAGE = 5988.7 + 4237.7 =
10,226 CF

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DA 14

$V_{BMP} = 9{,}854$ CF

$V_{TRENCH} = (7\,LF)(2{,}320\,SF) = 16{,}240$ CF

$V_{PIPES} = \frac{\pi(5\,LF)^2}{4}(286\,LF) = 5{,}615.6$ CF

$V_{GRAVEL} = (40\%)(16{,}240 - 5{,}615.6) = 4{,}249.8$ CF

STORAGE = 5615.6 + 4249.8 = 9,865 CF ⟶ 2EA. ROWS OF 5LF ϕ CMP; 16LF x 145LF FOOTPRINT

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			5957	

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
1A	*159470*	*Roofs*	*1*	*0.89*	*142247.2*			
1B	*145133*	*Concrete or Asphalt*	*1*	*0.89*	*129458.6*			
1C	*151945*	*Ornamental Landscaping*	*0.1*	*0.11*	*16783.5*			
	456548	**Total**			**288489.3**	**0.80**	**19232.6**	**19,291**

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
2A	*66423*	*Roofs*	*1*	*0.89*	*59249.3*			
2B	*68768*	*Concrete or Asphalt*	*1*	*0.89*	*61341.1*			
2C	*43099*	*Ornamental Landscaping*	*0.11*	*0.12*	*5035.9*			
	178290	***Total***			**125626.3**	**0.80**	***8375.1***	***8,431***

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA3

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
3A	*21711*	*Roofs*	*1*	*0.89*	*19366.2*			
3B	*28228*	*Concrete or Asphalt*	*1*	*0.89*	*25179.4*			
3C	*24128*	*Ornamental Landscaping*	*0.1*	*0.11*	*2665.1*			
	74067	**Total**			**47210.7**	**0.80**	**3147.4**	**3,165**

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA4

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
4A	*37238*	*Roofs*	*1*	*0.89*	*33216.3*			
4B	*70343*	*Concrete or Asphalt*	*1*	*0.89*	*62746*			
4C	*44613*	*Ornamental Landscaping*	*0.1*	*0.11*	*4927.9*			
	152194	**Total**			**100890.2**	**0.80**	**6726**	**6,778**

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA5

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
5A	*27224*	*Roofs*	*1*	*0.89*	*24283.8*			
5B	*26209*	*Concrete or Asphalt*	*1*	*0.89*	*23378.4*			
5C	*18783*	*Ornamental Landscaping*	*0.1*	*0.11*	*2074.7*			
	72216		*Total*		*49736.9*	*0.80*	*3315.8*	*3,371*

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA6

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
6A	*22618*	*Roofs*	*1*	*0.89*	*20175.3*			
6B	*40771*	*Concrete or Asphalt*	*1*	*0.89*	*36367.7*			
6C	*34986*	*Ornamental Landscaping*	*0.1*	*0.11*	*3864.5*			
	98375		*Total*		*60407.5*	*0.80*	*4027.2*	*4,054*

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA7

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
7A	*12000*	*Roofs*	*1*	*0.89*	*10704*			
7B	*25046*	*Concrete or Asphalt*	*1*	*0.89*	*22341*			
7C	*17703*	*Ornamental Landscaping*	*0.1*	*0.11*	*1955.4*			
	54749		*Total*		*35000.4*	*0.80*	*2333.4*	*2,345*

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA8

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
8A	*248585*	*Roofs*	*1*	*0.89*	*221737.8*			
8B	*218188*	*Concrete or Asphalt*	*1*	*0.89*	*194623.7*			
8C	*85550*	*Ornamental Landscaping*	*0.1*	*0.11*	*9449.7*			
	552323	***Total***			**425811.2**	**0.80**	***28387.4***	***28,440***

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA9

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
9A	*58254*	*Roofs*	*1*	*0.89*	*51962.6*			
9B	*75077*	*Concrete or Asphalt*	*1*	*0.89*	*66968.7*			
9C	*33111*	*Ornamental Landscaping*	*0.1*	*0.11*	*3657.4*			
	166442	***Total***			**122588.7**	**0.80**	***8172.6***	***8,231***

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA10

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
10A	*83828*	*Roofs*	*1*	*0.89*	*74774.6*			
10B	*108024*	*Concrete or Asphalt*	*1*	*0.89*	*96357.4*			
10C	*47647*	*Ornamental Landscaping*	*0.11*	*0.12*	*5567.3*			
	239499	**Total**			**176699.3**	**0.80**	**11780**	**11,822**

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA11

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
11A	*118819*	*Roofs*	*1*	*0.89*	*105986.5*			
11B	*149109*	*Concrete or Asphalt*	*1*	*0.89*	*133005.2*			
11C	*175782*	*Ornamental Landscaping*	*0.1*	*0.11*	*19416.5*			
	443710	**Total**			**258408.2**	**0.80**	**17227.2**	**17,248**

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA12

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
12A	*57610*	*Roofs*	*1*	*0.89*	*51388.1*			
12B	*141568*	*Concrete or Asphalt*	*1*	*0.89*	*126278.7*			
12C	*88034*	*Ornamental Landscaping*	*0.1*	*0.11*	*9724.1*			
	287212	***Total***			**187390.9**	**0.80**	***12492.7***	***12,628***

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA13

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
13A	*76,518*	*Roofs*	*1*	*0.89*	*68254.1*			
13B	*86,657*	*Concrete or Asphalt*	*1*	*0.89*	*77298*			
13C	*65,749*	*Ornamental Landscaping*	*0.1*	*0.11*	*7262.5*			
	228924	***Total***			**152814.6**	**0.80**	***10187.6***	***10,226***

Notes:

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: Required Entries / Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Land Development Design Company, LLC	Date	11/4/2019
Designed by	Kevin J. Richer	Case No	2019-0012
Company Project Number/Name	Latitude Business Park		

BMP Identification

BMP NAME / ID: DA14

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth, from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.80 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
14A	*44,578*	*Roofs*	*1*	*0.89*	*39763.6*			
14B	*108,672*	*Concrete or Asphalt*	*1*	*0.89*	*96935.4*			
14C	*100,564*	*Ornamental Landscaping*	*0.1*	*0.11*	*11108.1*			
	253814	**Total**			**147807.1**	**0.80**	**9853.8**	**9,865**

Notes: