DRAINAGE STUDY

FOR

QUINCE SENIOR HOUSING

Escondido, California

Engineer:

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Prepared by: _____ Date: _____
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Date	Comments
9/11/17	Original - Planning
11/15/18	2nd Planning Submittal

TABLE OF CONTENTS

APPENDICES

EXHIBITS

1.0 PROJECT DESCRIPTION

The proposed project is a senior housing project located at the NE corner of Quince and Valley Center Parkway. The site currently has three industrial buildings on it with parking and drive aisles. The existing landscape is minimal.

The project will construct a three story apartment complex over a concrete podium with parking under the podium. Access to the site will come off Quince Street. The property is currently zoned for 100 dwelling units per acre.

2.0 PURPOSE

The purpose of this study is to determine the peak runoff rates and velocities for the pre-development and post-development conditions. Comparisons will be made at the same discharge points for each drainage basin affecting the site and adjacent properties. The adequacy of existing and proposed conveyance facilities affected by the project will be determined.

3.0 METHODOLOGY

The Rational Method as outlined in the Escondido Design Standards and Standard Drawings, dated April 2, 2014, was used to determine the runoff flow rate. The 100-year frequency storm event was analyzed to determine peak runoff rates discharging the site for both the existing and post-development condition.

Runoff coefficients, "C" are summarized below:

Pre-development "C"
General Industrial, C=0.87

Post-development "C"
High Density Residential, C=0.79

4.0 HYDROLOGY

4.1 Pre-Development Conditions

The site currently drains east to west. The surface drainage leaves the site onto Quince and then enters into the City maintained storm drain system through an inlet located at approximately the middle of the site.

A pre-development hydrology map delineating basin areas, flow paths, and concentration points has been prepared and is attached to this report as Exhibit "A". Pre-development hydrology calculations can be found in Appendix B.

4.2 Post-Development Conditions

The post-development flow will maintain the existing drainage pattern. The runoff from the podium and apartment roofs will be directed to onsite inlets which will then be piped below the podium. This system will be connected directly to the existing inlet in Quince.

A post-development hydrology map delineating basin areas, flow paths, concentration points, and proposed drainage facilities has been prepared and is attached to this report as Exhibit "B". Post-development hydrology calculations can be found in Appendix C and hydraulic calculations for the proposed site can be found in Appendix D.

5.0 CONCLUSION

The proposed project will maintain the flow patterns and drainage areas as in the pre-developed condition. Development of the project site will decrease the runoff from the pre-developed condition due to the increase in the overall landscaped areas. Table 1 provides a summary of the pre- and post-development areas and flows prior to detention.

Table 1 – Pre and Post-Development Areas and Flows

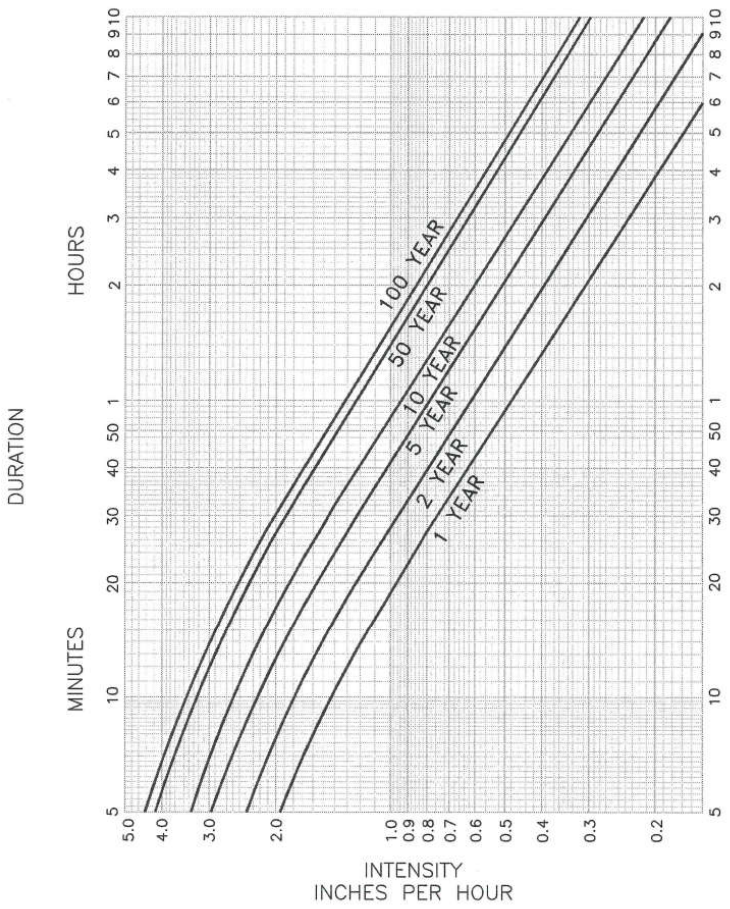
	Area (ac)		Q_{100} (cfs)		
Basin / Node	**Pre-Dev**	**Post-Dev**	**Pre-Dev**	**Post-Dev**	**+/-**
100	1.48	1.48	10.9	9.6	-1.3

REFERENCES

CivilDesign Corporation. *San Diego County Rational Method*. (Software Version 7.7)

City of Escondido Department of Public Works. *Design Standards and Standard Drawings.* 2014

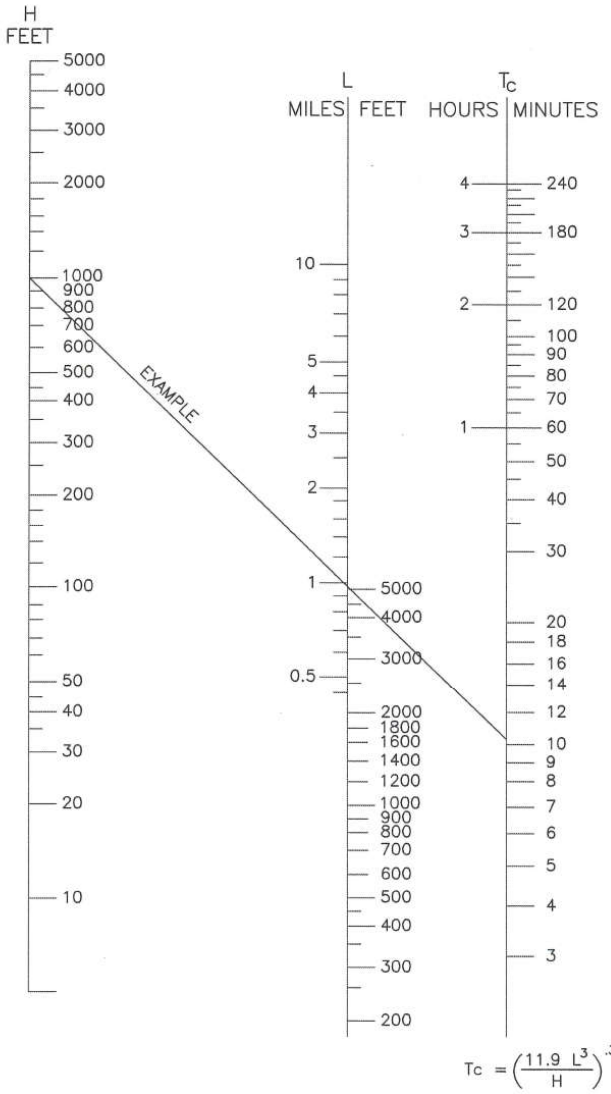
APPENDIX A



ESCONDIDO RUNOFF COEFFICIENTS

PARKS, GOLF COURSES, CEMETERIES	0.25
UNDEVELOPED LAND, OPEN SPACE	0.35
RURAL – OVER 1/2 ACRE LOTS	0.45
SINGLE FAMILY	0.55
MOBILE HOME	0.65
MULTIPLE UNITS	0.70
COMMERCIAL	0.85
INDUSTRIAL	0.95

APPROVED: DATE: 04-02-2014 P. W. DIRECTOR/CITY ENGINEER	CITY OF ESCONDIDO DEPARTMENT OF PUBLIC WORKS	SCALE: NOT TO SCALE
REVISED / APPROVED	RUN-OFF INTENSITY DURATION CURVE	FIGURE NO. 1



$$Tc = \left(\frac{11.9\ L^3}{H}\right)^{.385}$$

NOTE:

THIS CHART SHALL BE USED FOR ALL BASINS WITHIN THE CITY OF ESCONDIDO LESS 0.5 SQUARE MILE. THE MINIMUM Tc TO BE USED IS 10 MINUTES

Tc = TIME OF CONCENTRATION (HOURS)
L = LENGTH OF DRAINAGE COURSE (MILES)
H = DIFFERENCE IN ELEVATION FROM FURTHER MOST POINT OF DESIGN (FEET)

APPROVED: Edward N. Domingue DATE: 04-02-2014 P. W. DIRECTOR/CITY ENGINEER	CITY OF ESCONDIDO DEPARTMENT OF PUBLIC WORKS	SCALE: NOT TO SCALE
REVISED / APPROVED	RUNOFF TIME CHART	FIGURE NO. 2

APPENDIX B

Pre-Development Hydrology Calculations

Quince100pre.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 09/15/17

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

Program License Serial Number 6144

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.200
24 hour precipitation(inches) = 6.000
P6/P24 =   53.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   101.000 to Point/Station   102.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type   ]
(General Industrial   )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance =   42.000(Ft.)
Highest elevation = 644.200(Ft.)
Lowest elevation = 643.900(Ft.)
Elevation difference =   0.300(Ft.) Slope = 0.714 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.71 %, in a development type of
 General Industrial
In Accordance With Table 3-2

```
Initial Area Time of Concentration =   3.70 minutes
 (for slope value of   0.50 %)
Calculated TC of    3.700 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      8.431(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.954(CFS)
Total initial stream area =        0.130(Ac.)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Process from Point/Station      102.000 to Point/Station      100.000
**** IMPROVED CHANNEL TRAVEL TIME ****
________________________________________________________________________
Upstream point elevation =   643.900(Ft.)
Downstream point elevation =   642.900(Ft.)
Channel length thru subarea  =   110.000(Ft.)
Channel base width      =    1.000(Ft.)
Slope or 'Z' of left channel bank =  10.000
Slope or 'Z' of right channel bank =  10.000
Estimated mean flow rate at midpoint of channel =      5.905(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =      5.905(CFS)
Depth of flow =   0.375(Ft.), Average velocity =   3.321(Ft/s)
Channel flow top width =    8.493(Ft.)
Flow Velocity =    3.32(Ft/s)
Travel time  =    0.55 min.
Time of concentration =    4.25 min.
Critical depth =      0.418(Ft.)
 Adding area flow to channel
Calculated TC of    4.252 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      8.431(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[INDUSTRIAL area type                        ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Rainfall intensity =      8.431(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.870  CA =      1.288
Subarea runoff =      9.902(CFS) for      1.350(Ac.)
Total runoff =     10.856(CFS)  Total area =       1.480(Ac.)
Depth of flow =   0.482(Ft.), Average velocity =   3.872(Ft/s)
```

Critical depth = 0.547(Ft.)
End of computations, total study area = 1.480 (Ac.)

APPENDIX C

Post-Development Hydrology Calculations

Quince100post.out

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2006 Version 7.7

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study   Date: 09/15/17

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

Program License Serial Number 6144

Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 3.200
24 hour precipitation(inches) = 6.000
P6/P24 =   53.3%
San Diego hydrology manual 'C' values used

++
Process from Point/Station   101.000 to Point/Station   102.000
**** INITIAL AREA EVALUATION ****
_____
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL   ]
(43.0 DU/A or Less   )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.790
Initial subarea total flow distance =   42.000(Ft.)
Highest elevation = 644.200(Ft.)
Lowest elevation = 643.700(Ft.)
Elevation difference =   0.500(Ft.) Slope = 1.190 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 65.00 (Ft)
for the top area slope value of   1.19 %, in a development type of
 43.0 DU/A or Less
In Accordance With Table 3-2

```
Initial Area Time of Concentration =   4.70 minutes
 (for slope value of   1.00 %)
Calculated TC of    4.700 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      8.431(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.790
Subarea runoff =      0.866(CFS)
Total initial stream area =        0.130(Ac.)


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Process from Point/Station      102.000 to Point/Station      100.000
**** PIPEFLOW TRAVEL TIME (User specified size) ****
________________________________________________________________________
Upstream point/station elevation =   642.000(Ft.)
Downstream point/station elevation =   641.120(Ft.)
Pipe length  =   110.00(Ft.) Slope =   0.0080  Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     0.866(CFS)
Given pipe size =     15.00(In.)
Calculated individual pipe flow  =     0.866(CFS)
Normal flow depth in pipe =    3.93(In.)
Flow top width inside pipe =   13.19(In.)
Critical Depth =    4.37(In.)
Pipe flow velocity =      3.39(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =     5.24 min.


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Process from Point/Station      102.000 to Point/Station      100.000
**** SUBAREA FLOW ADDITION ****
________________________________________________________________________
Rainfall intensity (I) =      8.179(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[HIGH DENSITY RESIDENTIAL                    ]
(43.0 DU/A or Less      )
Impervious value, Ai = 0.800
Sub-Area C Value = 0.790
Time of concentration =     5.24 min.
Rainfall intensity =      8.179(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.790  CA =      1.169
Subarea runoff =      8.697(CFS) for      1.350(Ac.)
Total runoff =      9.562(CFS)  Total area =       1.480(Ac.)
End of computations, total study area =           1.480 (Ac.)
```

APPENDIX D

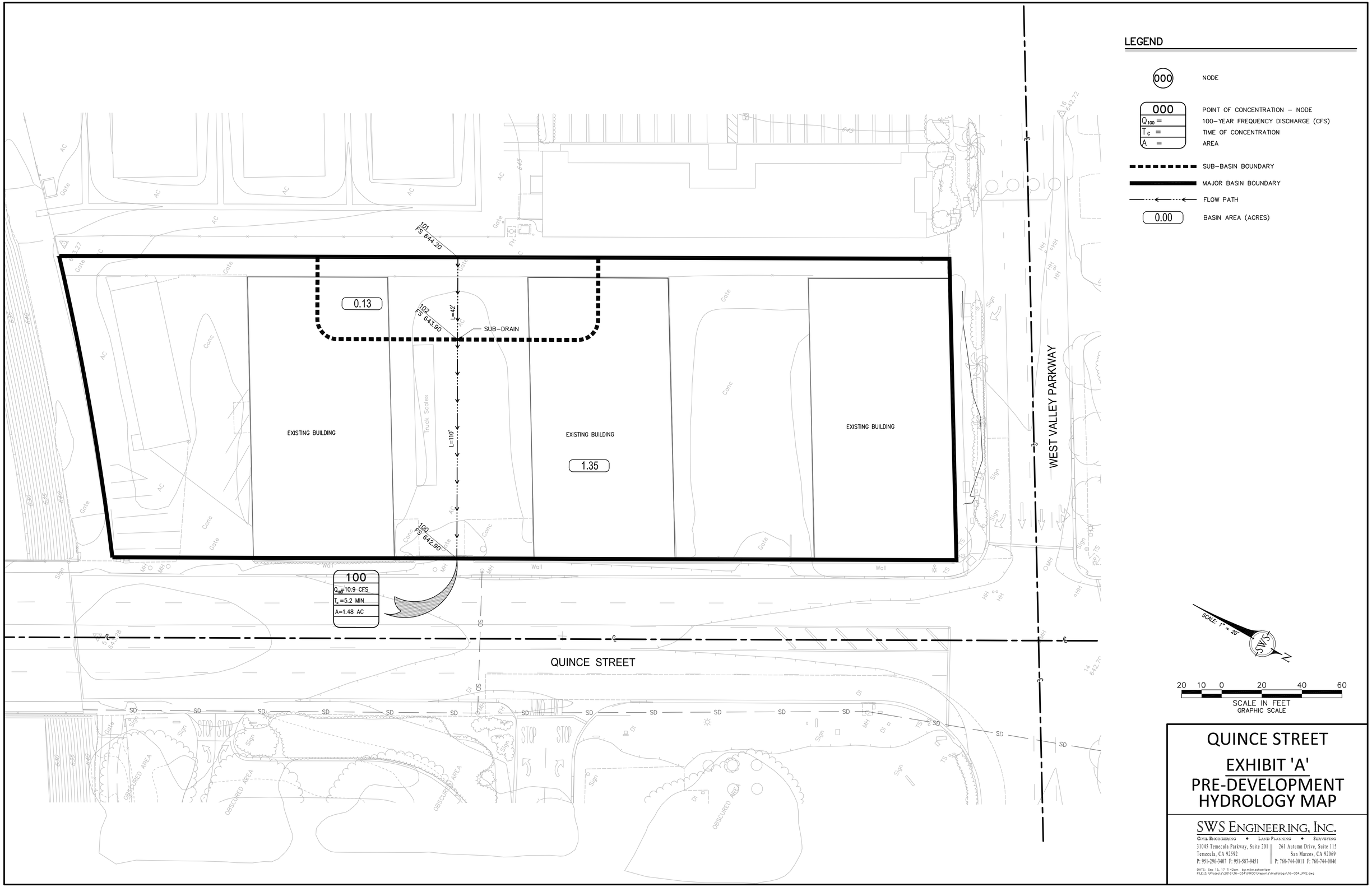
Post-Development Hydraulic Calculations

APPENDIX E

Detention Analysis

EXHIBIT A

Pre-Development Hydrology Map



QUINCE STREET

EXHIBIT 'A'

PRE-DEVELOPMENT HYDROLOGY MAP

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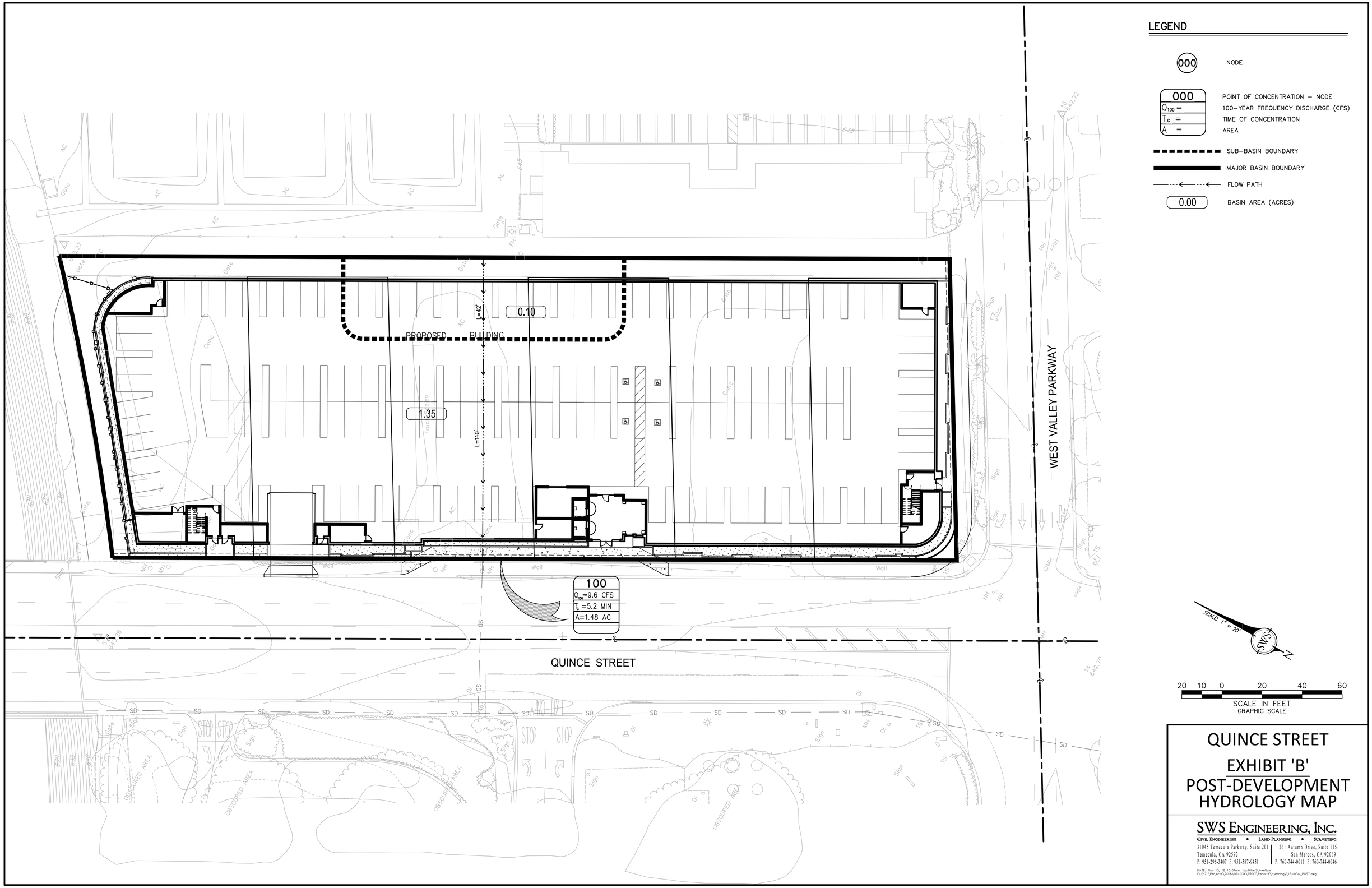
DATE: Sep 15, 17 7:42am by:mike.schweitzer
FILE: Z:\Projects\2016\16-034\PR001\Reports\Hydrology\16-034_PRE.dwg

EXHIBIT B

Post-Development Hydrology Map



QUINCE STREET

EXHIBIT 'B'

POST-DEVELOPMENT HYDROLOGY MAP

SWS ENGINEERING, INC.

CIVIL ENGINEERING ◆ LAND PLANNING ◆ SURVEYING

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DATE: Nov 13, 18 10:01am by:MikeSchweitzer
FILE: Z:\Projects\2016\16-034\PROD\Reports\Hydrology\16-034_POST.dwg