Drainage Study
for
El Camino Real Assisted Living Facility
PTS 675732

Date: January 2021
Job No.: SDR 05.01-09.16

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Date: 8/16/2021

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Purpose

The purpose of this report is to examine the pre-development vs. post-development hydraulic characteristics and subsequent drainage improvements of the below mentioned site. Determinations made herein will be incorporated into the proposed site design.

Project Location

The proposed project is located east of Interstate 5, lying southeasterly of El Camino Real, bounded by Gonzales Canyon to the east, The “Evangelical Formosan Church”; 13885 El Camino Real) to the west and the “Villas at Stallions Crossing”; Map 14299) to the South. The parcel is an ~4 AC parcel lying south of the adjacent ~13 AC parcel which is currently being developed for the St John Armenian Apostolic Church. After approval of the CUP for the Church, the Church was successful in acquiring the subject property, adding 4.0 acres to the overall campus which is now being developed by PMB Carmel Valley LLC. The current site is completely disturbed, being used as late as 2008 as an equine boarding and training facility. Prior to this use, the land was cleared for farming activity. A location map of the project site is located in Exhibit A.

Project Description

The proposed development will include the construction of an Intermediate Care Facility with 105 Assisted Living and Memory Care units, along with associated support facilities for dining and recreation.

Method of Calculation

This study proposes to calculate the total runoff from the site using the guidelines set forth in the City of San Diego’s Drainage Design Manual, dated January 2017 (See Appendix I). The specific method used is the Rational Formula for watersheds under 0.5 square miles.

Pre-Development Conditions (See Exhibit B, Pre-Development Basin Map)

The existing site consists of one basin leaving the site via an existing private 18” HDPE installed as part of the development of the St John Garabed Aremenian Church Campus to the north. This existing system connects to the public storm drain located in El Camino Real and subsequently discharges into the San Dieguito River Valley on the North Side of El Camino Real.

The existing Basin (B) is completely disturbed with minimal to no vegetation and is currently lying in a fallow state. According to the City of San Diego Drainage Design Manual, A rural lot configuration (greater than 0.5 acre) would be the most accurate classification with a runoff coefficient of C=0.45, see Appendix II, this value will be used in analyzing the pre-development runoff from this basin.

In order to be able to examine the runoff from the existing basin and compute the Q contribution to the public drain systems, a Time of Concentration was determined using the City of San Diego's Drainage Design Manual (Time of Concentration *Appendix V*) time for overland flow using the equation provided $T_C=[1.8(1.1-C)\sqrt{D}]/(\sqrt[3]{s})$. From this, the intensity of the basin was determined using the City of San Diego's Drainage Design Manual (Rainfall Intensity Duration Frequency Curves *Appendix IV*), both are provided for reference in Appendix III.

For a 100-year storm event the below Tc and resultant flows were calculated:

Basin	Acres	C	Length (ft)	Upper Elev. (ft)	Lower Elev. (ft)	Slope (%)	Tc (min)	Q_{100} (cfs)
B1	2.81	0.45	465	58.8	43.5	3.3%	16.97	3.3

Using the Rational Method, the Q_{100} for each basin was analyzed within SSA. Per the City of San Diego Drainage Design Manual section 1-102.2(3)(a), "For tributary areas under one square mile, the storm drain system shall be designed so that the combination of storm drain system capacity and overflow will be able to carry the 100-year frequency storm without damage to or flooding of adjacent existing buildings or potential building sites."

Post-Development Conditions (See Exhibit D, Post-Development Basin Map)

The proposed site creates 10 Basins (B-1 through B-10) out of the existing 1 Basin (B1). Basins B-1 through B-10 are collected via a series of on-site catch basins that will be routing all site runoff through the existing stormdrain facilities on the St John Garabed Armenian Church development before entering the public storm drain system in El Camino Real. The proposed land use for the site is assisted living which is not specifically identified within the City of San Diego Drainage Design Manual. A commercial land use would most closely apply and has a runoff coefficient of C=0.85, see Appendix II. Note number 2 as shown on Appendix II provides the deviation option should site design dictate. Our proposed imperviousness is ~2.1 Ac of the total ~2.8 acres being developed or ~74% impervious. With this data, we conclude a revised C value of 0.78.

This value will be used in analyzing the post-development runoff from the site. The Site Time of Concentration was recalculated based on the proposed grading and revised C and this value was input into SSA for analysis.

For a 100-year storm event the below Tc and resultant flows were calculated:

Basin	Acres	C	Length (ft)	Upper Elev. (ft)	Lower Elev. (ft)	Slope (%)	Tc (min)	Q_{100} (cfs)
B1	0.24	0.78	465	58.8	44.5	3.1%	8.54	0.67
B2	0.41	0.78	465	58.8	44.5	3.1%	8.54	1.14
B3	0.13	0.78	465	58.8	44.5	3.1%	8.54	0.36
B4	0.37	0.78	465	58.8	44.5	3.1%	8.54	1.03
B5	0.24	0.78	465	58.8	44.5	3.1%	8.54	0.67
B6	0.48	0.78	465	58.8	44.5	3.1%	8.54	1.33
B7	0.10	0.78	465	58.8	44.5	3.1%	8.54	0.28
B8	0.20	0.78	465	58.8	44.5	3.1%	8.54	0.56
B9	0.37	0.78	465	58.8	44.5	3.1%	8.54	1.03
B10	0.28	0.78	465	58.8	44.5	3.1%	8.54	0.78

The 100-year frequency storm was again used to analyze site runoff to ensure flows will be conveyed from the site without damage to or flooding of adjacent existing buildings or potential building sites

Comparison of Pre-Development and Post Development Conditions

Pre-Development Runoff

Outfall 1 Q_{100} = 3.3 cfs

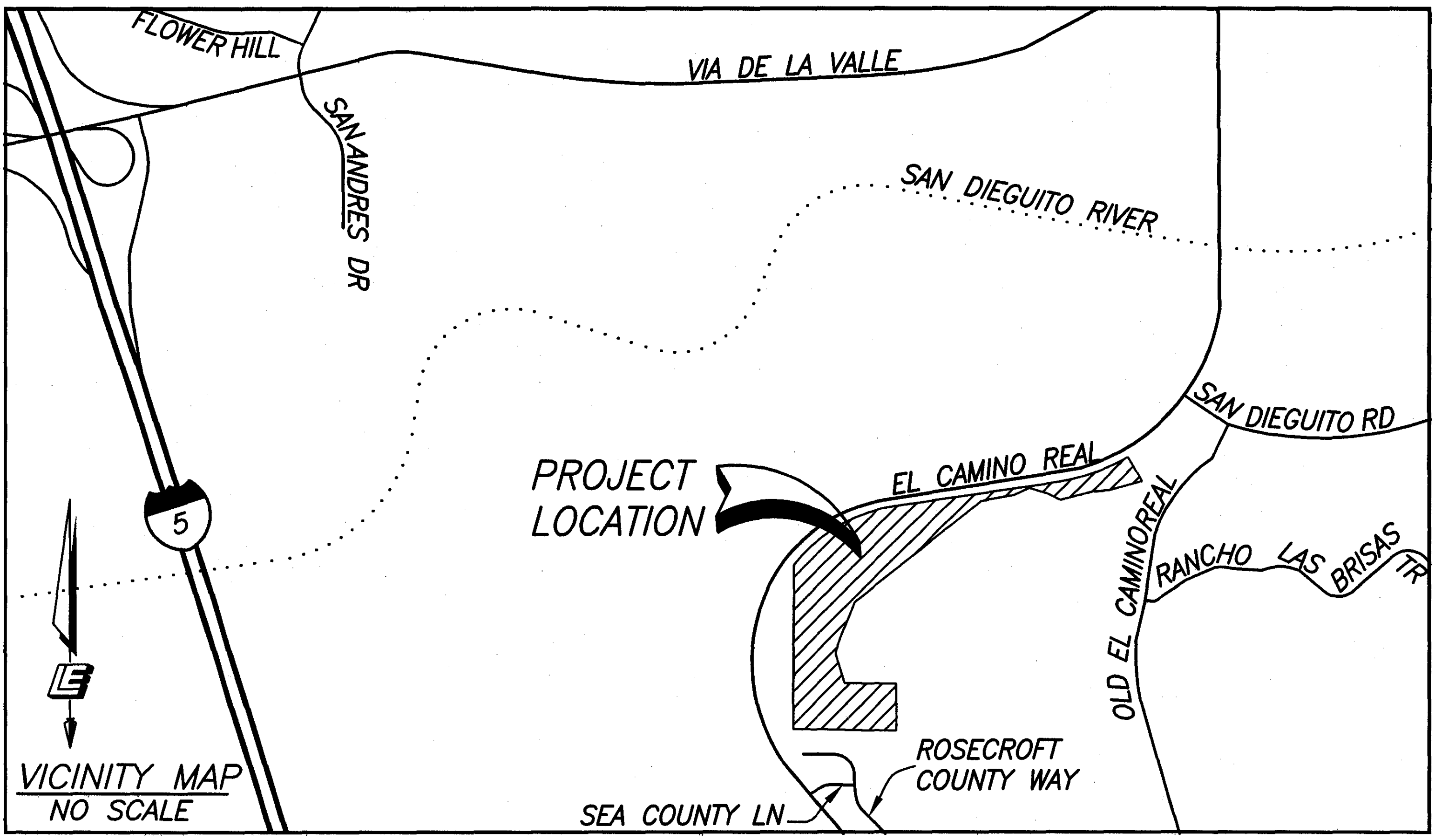
Post-Development Runoff

Outfall 1 Q_{100} = 7.0 cfs

Conclusion

Based on the above calculations, the development of the subject property as proposed results in an increase in runoff from 3.3 CFS to 7.0 CFS, which means the total increased runoff due to the proposed development is 3.7 CFS. As shown in the attached Post Development Storm and Sanitary Analysis (Exhibit E), said increase can be accommodated by the existing stormdrain associated with the adjacent St John Garabed Church project. It can be concluded that the proposed development will create minimal change to the existing downstream storm drain facilities and due to being within the floodway no negative downstream impact is anticipated and no increase potential for erosion or damage to downstream properties is anticipated. A 401/404 permit is not needed for the proposed development.

EXHIBIT "A" – Location Map



FLOWER HILL
VIA DE LA VALLE
SAN ANDRES DR
SAN DIEGUITO RIVER
SAN DIEGUITO RD
EL CAMINO REAL
PROJECT LOCATION
5
OLD EL CAMINOREAL
RANCHO LAS BRISAS TR
ROSECROFT COUNTY WAY
SEA COUNTY LN
VICINITY MAP
NO SCALE

EXHIBIT "B" – Existing Condition Drainage Basin Map

LEGEND

BASIN BOUNDARY

BASIN DESIGNATION — BASIN / AREA

PROPOSED DRAINAGE PATTERN

PROPERTY LINE

PROPOSED PRIVATE STORM DRAIN

PROPOSED CONTOUR — 30

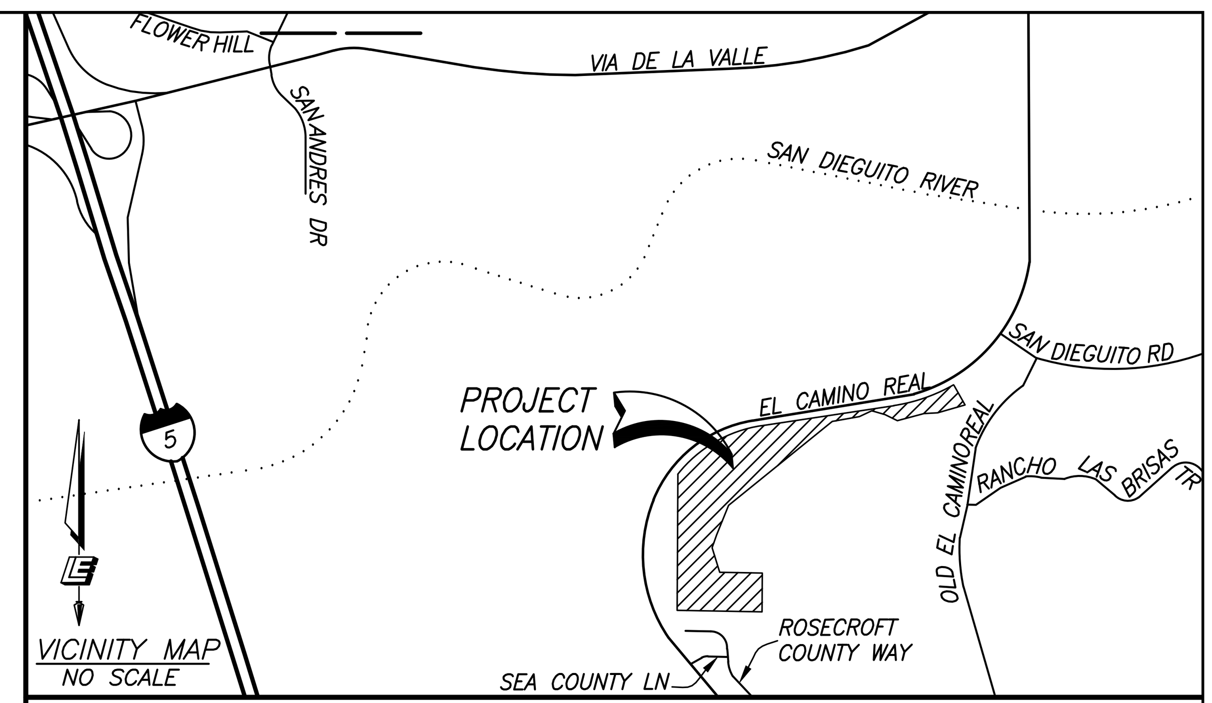
DAYLIGHT LINE

INLET NO. — 1

JUNCTION NO. — 1

40 0 40 80

SCALE: 1" = 40'



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SAN DIEGO, CA 92131

PROJECT NAME:
EL CAMINO REAL ASSISTED LIVING FACILITY

SHEET TITLE:
DRAINAGE BASIN MAP
EXISTING CONDITION

REVISION 14:
REVISION 13:
REVISION 12:
REVISION 11:
REVISION 10:
REVISION 9:
REVISION 8:
REVISION 7:
REVISION 6:
REVISION 5:
REVISION 4:
REVISION 3:
REVISION 2: 04/08/2021
REVISION 1: 01/20/2021

ORIGINAL DATE: 09/15/2020

SHEET 1 OF 1

DEP#

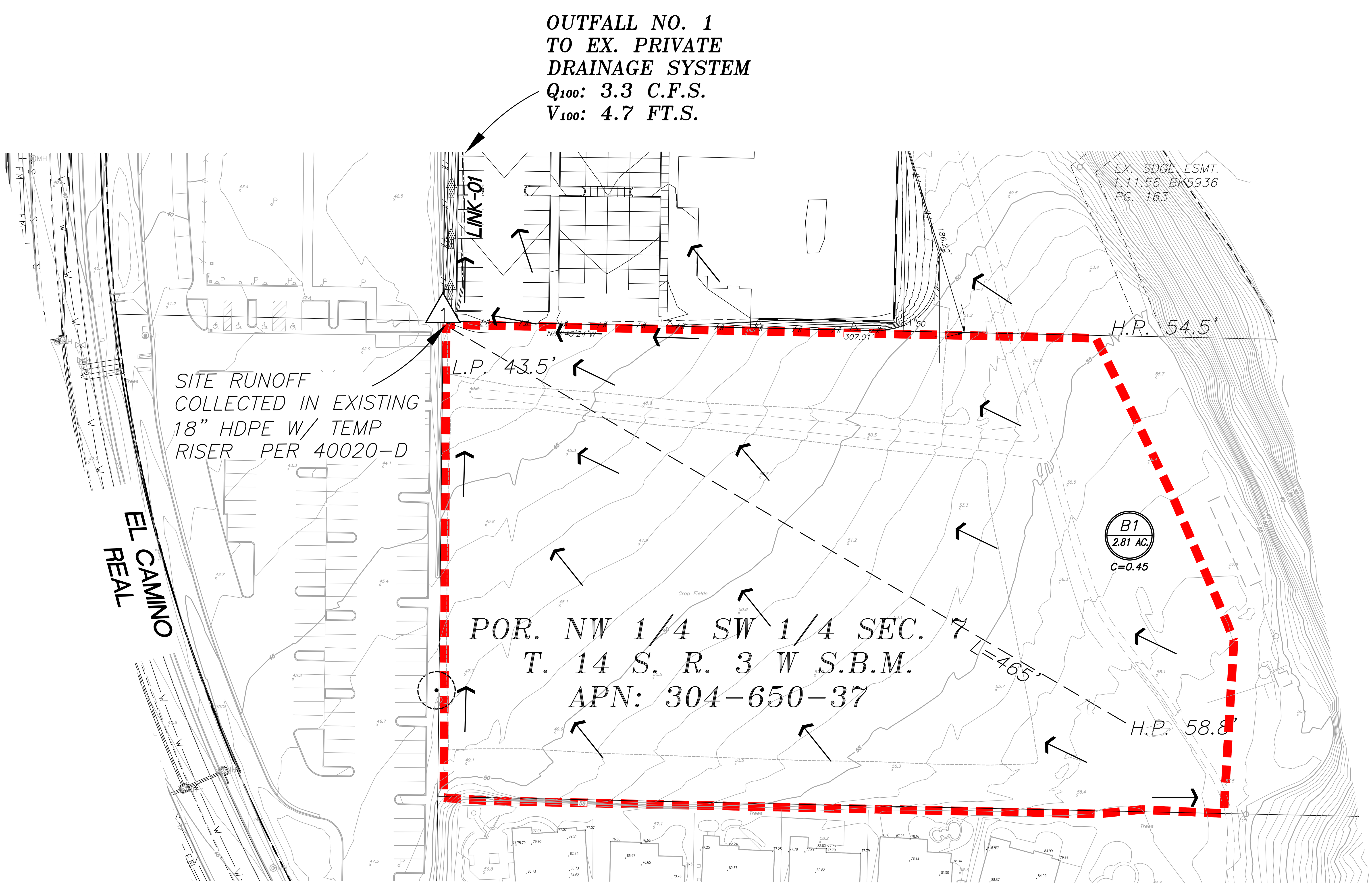


EXHIBIT “C” – Existing Condition SSA Calculations

Project Description

File Name	SSA Analysis - Ex.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Mar 04, 2013	00:00:00
End Analysis On	Mar 05, 2013	00:00:00
Start Reporting On	Mar 04, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	1
Nodes	2
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	1
Storage Nodes	0
Links	1
Channels	0
Pipes	1
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	100 year(s)

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
Basin-B1	2.81	0.4500	0.76	0.34	0.96	3.38	0 00:16:58

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
Out-02	Outfall	31.40				3.33	32.03					

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
Link-01	Pipe	Inlet-01	Out-02	331.55	33.88	31.40	0.75	18.00	0.013	3.33	9.08	0.37	4.65	0.64	0.43	0.00	Calculated

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
Link-01	331.55	33.88	0.00	31.40	0.00	2.48	0.7500	CIRCULAR	18	0.0130	0.2000	0.5000	0.0000	0.00	No	1

Inlet Input

Element ID	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Max (Rim) Elevation (ft)	Inlet Depth (ft)	Grate Clogging Factor (%)
Inlet-01	On Sag	1	33.88	33.00	-0.88	50.00

Inlet Results

Element ID	Peak Flow (cfs)	Peak Lateral Inflow (cfs)	Peak Flow Intercepted by Inlet (cfs)	Peak Flow Bypassing Inlet (cfs)	Inlet Efficiency during Peak Flow (%)	Max Gutter Water Elev. during Peak Flow (ft)	Max Gutter Water Depth during Peak Flow (ft)	Time of Max Depth Occurrence (days hh:mm)
Inlet-01	3.38	3.38	N/A	N/A	N/A	36.43	1.55	0 00:17

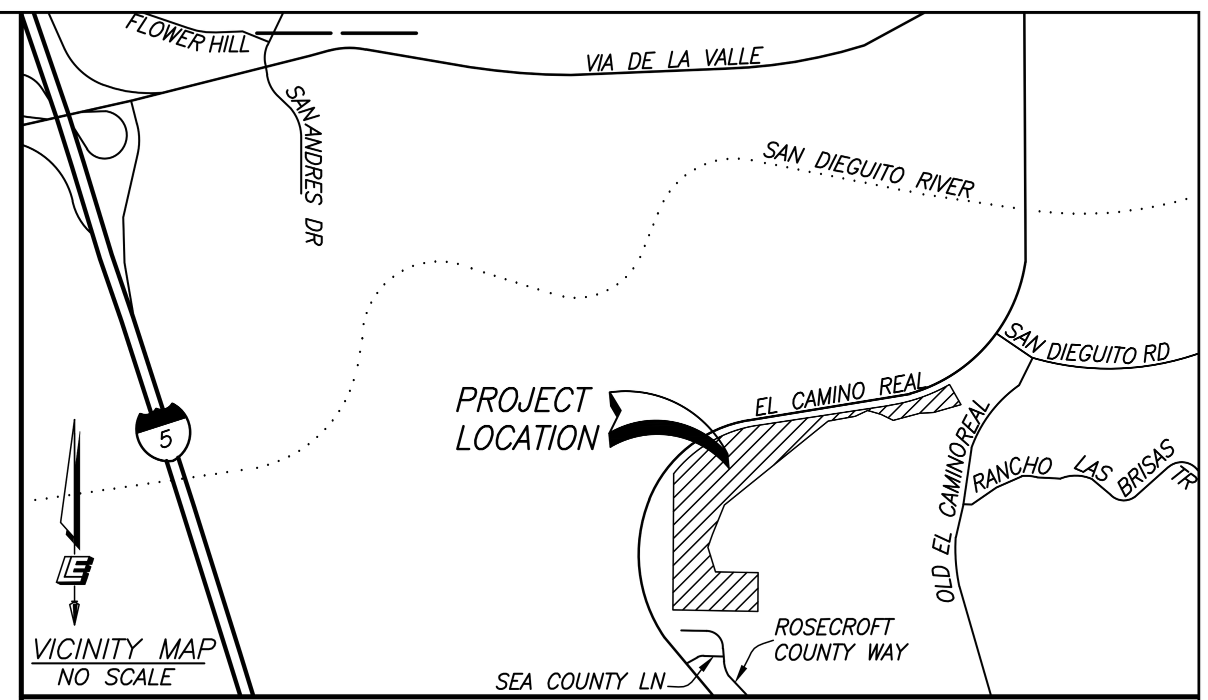
EXHIBIT “D” – Proposed Condition Drainage Basin Map

LEGEND

BASIN BOUNDARY	
BASIN DESIGNATION	BASIN / AREA
PROPOSED DRAINAGE PATTERN	
PROPERTY LINE	
PROPOSED PRIVATE STORM DRAIN	
PROPOSED CONTOUR	30
DAYLIGHT LINE	
INLET NO.	1
JUNCTION NO.	1

40 0 40 80

SCALE: 1" = 40'



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REVISION 4:
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SHEET 1 OF 1

DEP#

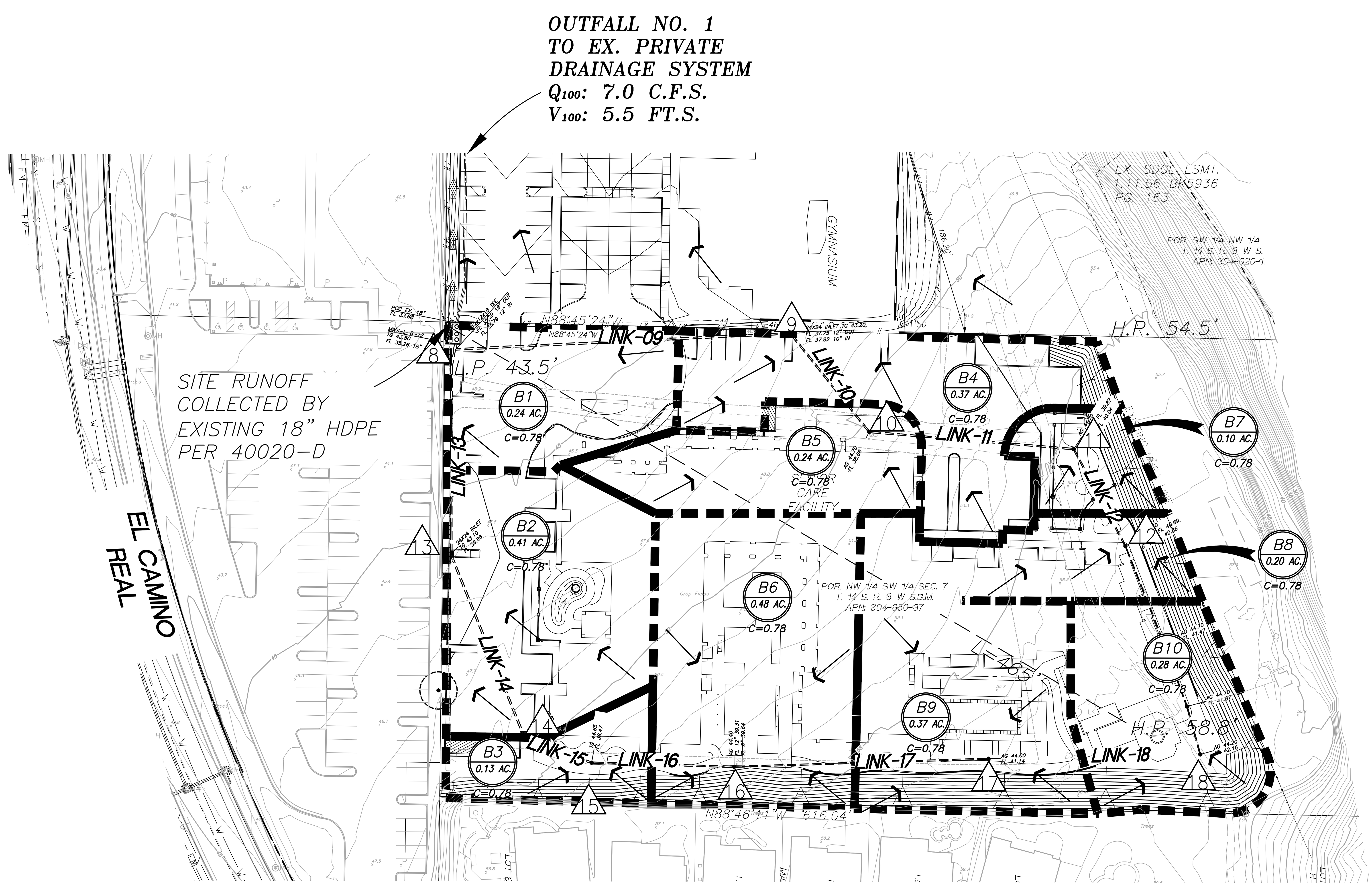

EXHIBIT “E” – Proposed Condition SSA Calculations

Project Description

File Name	SSA Analysis - Pro.SPF

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Rational
Time of Concentration (TOC) Method	User-Defined
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	NO

Analysis Options

Start Analysis On	Mar 04, 2013	00:00:00
End Analysis On	Mar 05, 2013	00:00:00
Start Reporting On	Mar 04, 2013	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	0
Subbasins	10
Nodes	12
Junctions	0
Outfalls	1
Flow Diversions	0
Inlets	11
Storage Nodes	0
Links	11
Channels	0
Pipes	11
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

Return Period	100 year(s)

Subbasin Summary

Subbasin ID	Area (ac)	Weighted Runoff Coefficient	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
Basin-B01	0.24	0.7800	0.50	0.39	0.09	0.67	0 00:08:32
Basin-B02	0.41	0.7800	0.50	0.39	0.16	1.14	0 00:08:32
Basin-B03	0.13	0.7800	0.50	0.39	0.05	0.36	0 00:08:32
Basin-B04	0.37	0.7800	0.50	0.39	0.15	1.03	0 00:08:32
Basin-B05	0.24	0.7800	0.50	0.39	0.09	0.67	0 00:08:32
Basin-B06	0.48	0.7800	0.50	0.39	0.19	1.33	0 00:08:32
Basin-B07	0.10	0.7800	0.50	0.39	0.04	0.28	0 00:08:32
Basin-B08	0.20	0.7800	0.50	0.39	0.08	0.56	0 00:08:32
Basin-B09	0.37	0.7800	0.50	0.39	0.15	1.03	0 00:08:32
Basin-B10	0.28	0.7800	0.50	0.39	0.11	0.78	0 00:08:32

Node Summary

Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
Out-01	Outfall	31.40				6.99	32.39					

Link Summary

Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length (ft)	Inlet Invert Elevation (ft)	Outlet Invert Elevation (ft)	Average Slope (%)	Diameter or Height (in)	Manning's Roughness	Peak Flow (cfs)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Reported Condition
Link-08	Pipe	Inlet-08	Out-01	331.55	33.88	31.40	0.75	18.00	0.013	6.99	9.08	0.77	5.51	1.01	0.68	0.00	Calculated
Link-09	Pipe	Inlet-09	Inlet-08	148.21	37.05	35.20	1.25	12.00	0.013	2.98	3.98	0.75	5.26	0.68	0.68	0.00	Calculated
Link-10	Pipe	Inlet-10	Inlet-09	69.20	38.26	37.22	1.50	10.00	0.013	2.07	2.69	0.77	4.97	0.59	0.71	0.00	Calculated
Link-11	Pipe	Inlet-11	Inlet-10	121.18	39.64	38.43	1.00	10.00	0.013	1.47	2.19	0.67	4.10	0.52	0.63	0.00	Calculated
Link-12	Pipe	Inlet-12	Inlet-11	64.83	40.46	39.81	1.00	8.00	0.013	1.23	1.21	1.01	3.73	0.60	0.89	0.00	> CAPACITY
Link-13	Pipe	Inlet-13	Inlet-08	111.50	36.06	34.95	1.00	12.00	0.013	3.47	3.55	0.98	4.89	0.87	0.87	0.00	Calculated
Link-14	Pipe	Inlet-14	Inlet-13	117.60	37.49	36.31	1.00	12.00	0.013	2.54	3.57	0.71	4.57	0.68	0.68	0.00	Calculated
Link-15	Pipe	Inlet-15	Inlet-14	41.20	37.90	37.49	1.00	12.00	0.013	2.54	3.55	0.71	4.21	0.72	0.72	0.00	Calculated
Link-16	Pipe	Inlet-16	Inlet-15	84.20	39.12	38.07	1.25	10.00	0.013	2.21	2.45	0.90	4.80	0.66	0.79	0.00	Calculated
Link-17	Pipe	Inlet-17	Inlet-16	150.30	41.54	39.29	1.50	8.00	0.013	0.99	1.48	0.67	3.92	0.46	0.69	0.00	Calculated
Link-18	Pipe	Inlet-18	Inlet-12	125.03	42.79	41.54	1.00	6.00	0.013	0.73	0.56	1.30	3.85	0.46	0.93	0.00	> CAPACITY

Pipe Input

Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
Link-08	331.55	33.88	0.00	31.40	0.00	2.48	0.7500	CIRCULAR	18	0.0130	0.2000	0.5000	0.0000	0.00	No	1
Link-09	148.21	37.05	0.00	35.20	1.32	1.85	1.2500	CIRCULAR	12	0.0130	0.2000	0.8000	0.0000	0.00	No	1
Link-10	69.20	38.26	0.00	37.22	0.17	1.04	1.5000	CIRCULAR	10	0.0130	0.2000	0.8000	0.0000	0.00	No	1
Link-11	121.18	39.64	0.00	38.43	0.17	1.21	1.0000	CIRCULAR	10	0.0130	0.2000	0.8000	0.0000	0.00	No	1
Link-12	64.83	40.46	0.00	39.81	0.17	0.65	1.0000	CIRCULAR	8	0.0130	0.2000	0.7000	0.0000	0.00	No	1
Link-13	111.50	36.06	0.00	34.95	1.07	1.11	1.0000	CIRCULAR	12	0.0130	0.2000	0.5000	0.0000	0.00	No	1
Link-14	117.60	37.49	0.00	36.31	0.25	1.18	1.0000	CIRCULAR	12	0.0130	0.2000	0.6000	0.0000	0.00	No	1
Link-15	41.20	37.90	0.00	37.49	0.00	0.41	1.0000	CIRCULAR	12	0.0130	0.2000	0.6000	0.0000	0.00	No	1
Link-16	84.20	39.12	0.00	38.07	0.17	1.05	1.2500	CIRCULAR	10	0.0130	0.2000	0.5000	0.0000	0.00	No	1
Link-17	150.30	41.54	0.00	39.29	0.17	2.25	1.5000	CIRCULAR	8	0.0130	0.2000	0.5000	0.0000	0.00	No	1
Link-18	125.03	42.79	0.00	41.54	1.08	1.25	1.0000	CIRCULAR	6	0.0130	0.2000	0.6000	0.0000	0.00	No	1

Inlet Input

Element ID	Inlet Location	Number of Inlets	Catchbasin Invert Elevation (ft)	Max (Rim) Elevation (ft)	Inlet Depth (ft)	Grate Clogging Factor (%)
Inlet-08	On Sag	2	33.88	44.50	10.62	50.00
Inlet-09	On Sag	1	37.05	43.60	6.55	50.00
Inlet-10	On Sag	1	38.26	44.70	6.44	50.00
Inlet-11	On Sag	1	39.64	44.70	5.06	50.00
Inlet-12	On Sag	1	40.46	44.70	4.24	50.00
Inlet-13	On Sag	1	36.06	43.70	7.64	50.00
Inlet-14	On Sag	1	37.49	44.70	7.21	50.00
Inlet-15	On Sag	1	37.90	44.65	6.75	50.00
Inlet-16	On Sag	1	39.12	44.40	5.28	50.00
Inlet-17	On Sag	1	41.54	44.00	2.46	50.00
Inlet-18	On Sag	1	42.79	44.20	1.41	50.00

Inlet Results

Element ID	Peak Flow (cfs)	Peak Lateral Inflow (cfs)	Peak Flow Intercepted by Inlet (cfs)	Peak Flow Bypassing Inlet (cfs)	Inlet Efficiency during Peak Flow (%)	Max Gutter Water Elev. during Peak Flow (ft)	Max Gutter Water Depth during Peak Flow (ft)	Time of Max Depth Occurrence (days hh:mm)
Inlet-08	0.67	0.67	N/A	N/A	N/A	44.76	0.26	0 00:10
Inlet-09	1.03	1.03	N/A	N/A	N/A	43.99	0.39	0 00:09
Inlet-10	0.67	0.67	N/A	N/A	N/A	45.06	0.36	0 00:09
Inlet-11	0.28	0.28	N/A	N/A	N/A	44.85	0.15	0 00:09
Inlet-12	0.55	0.55	N/A	N/A	N/A	45.00	0.30	0 00:09
Inlet-13	1.14	1.14	N/A	N/A	N/A	44.11	0.41	0 00:10
Inlet-14	0.00	0.00	N/A	N/A	N/A	44.70	0.00	0 00:09
Inlet-15	0.36	0.36	N/A	N/A	N/A	44.84	0.19	0 00:09
Inlet-16	1.33	1.33	N/A	N/A	N/A	45.23	0.83	0 00:09
Inlet-17	1.03	1.03	N/A	N/A	N/A	44.55	0.55	0 00:09
Inlet-18	0.78	0.78	N/A	N/A	N/A	44.62	0.42	0 00:08

APPENDIX I – Rational Method: City of San Diego Drainage Design Manual

Appendix A

Rational Method and Modified Rational Method

A.1. Rational Method (RM)

The Rational Method (RM) is a mathematical formula used to determine the maximum runoff rate from a given rainfall. It has particular application in urban storm drainage where it is used to estimate peak runoff rates from small urban and rural watersheds for the design of storm drains and drainage structures. The RM is recommended for analyzing the runoff response from drainage areas for watersheds less than 0.5 square miles. It should not be used in instances where there is a junction of independent drainage systems or for drainage areas greater than approximately 0.5 square mile in size. In these instances, the Modified Rational Method (MRM) should be used for junctions of independent drainage systems in watersheds up to approximately 1 square mile in size (see Section A.2); or the NRCS Hydrologic Method should be used for watersheds greater than approximately 1 square mile in size (see Appendix B).

A.1.1. Rational Method Formula

The RM formula estimates the peak rate of runoff at any location in a watershed as a function of the drainage area (A), runoff coefficient (C), and rainfall intensity (I) for a duration equal to the time of concentration (T_c), which is the time required for water to flow from the most remote point of the basin to the location being analyzed. The RM formula is expressed in Equation A-1.

Equation A-1. RM Formula Expression

$$Q = C\ I\ A$$

where:

Q	=	peak discharge, in cubic feet per second (cfs)
C	=	runoff coefficient expressed as that percentage of rainfall which becomes surface runoff (no units); Refer to Appendix A.1.2
I	=	average rainfall intensity for a storm duration equal to the time of concetrnatation (T_c) of the contributing draiange area, in inches per hour; Refer to Appendix A.1.3 and Appendix A.1.4
A	=	drainage area contributing to the design location, in acres

APPENDIX II – Design Runoff: City of San Diego Drainage Design Manual

2. For all drainage channels and storm water conveyance systems, which will convey drainage from a tributary area equal to or greater than one (1) square mile, the runoff criteria, shall be based upon a 100-year frequency storm.
3. For tributary areas under one (1) square mile:
   a. The storm water conveyance system shall be designed so that the combination of storm drain system capacity and overflow (streets and gutter) will be able to carry the 100-year frequency storm without damage to or flooding of adjacent existing buildings or potential building sites.
   b. The runoff criteria for the underground storm drain system shall be based upon a 50-year frequency storm.

2.3. Soil Type

For storm drain, culverts, channels, and all associated structures, Type D soil shall be used for all areas.

2.4. Other Requirements

1. Design runoff for drainage and flood control facilities within the City shall be based upon full development of the watershed area in accordance with the land uses shown on the City of San Diego, Progress Guide and General Plan.
2. When determining criteria for floodplain management and flood proofing, design runoff within the City shall be based upon existing conditions in accordance with the City Floodplain Management Requirements and FEMA Regulations.
3. Under City requirements, the minimum elevation of the finished, first floor elevation of any building is 2 feet above the 100-year frequency flood elevation.

2.5. Water Quality Considerations

Requirements for hydrologic studies specific to the design of pollution prevention controls and hydromodification management controls are detailed in the Storm Water Standards. Where the Storm Water Standards specify modifications to the guidelines stated herein on discharge flow methods, design storm frequency, or soil type, the modifications shall supersede these but only for the purposes stated in the Storm Water Standards. Where the Storm Water Standards does not specify a modification, the guidance found here in Chapter 2 shall apply.

APPENDIX III – Runoff Coefficients: City of San Diego Drainage Design Manual

Table A-1. Runoff Coefficients for Rational Method

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

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

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

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

A.1.3. Rainfall Intensity

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

APPENDIX IV – Rainfall Intensity-Duration-Frequency Curves: City of San Diego Drainage Design Manual

RAINFALL

INTENSITY - DURATION - FREQUENCY
CURVES

FOR

COUNTY OF SAN DIEGO

ELEV.	FACTOR
0-1500	1.00
1500-3000	1.25
3000-4000	1.42
4000-5000	1.60
5000-6000	1.7
DESERT	1.25

TO OBTAIN CORRECT INTENSITY, MULTIPLY INTENSITY ON CHART BY FACTOR FOR DESIGN ELEVATION.

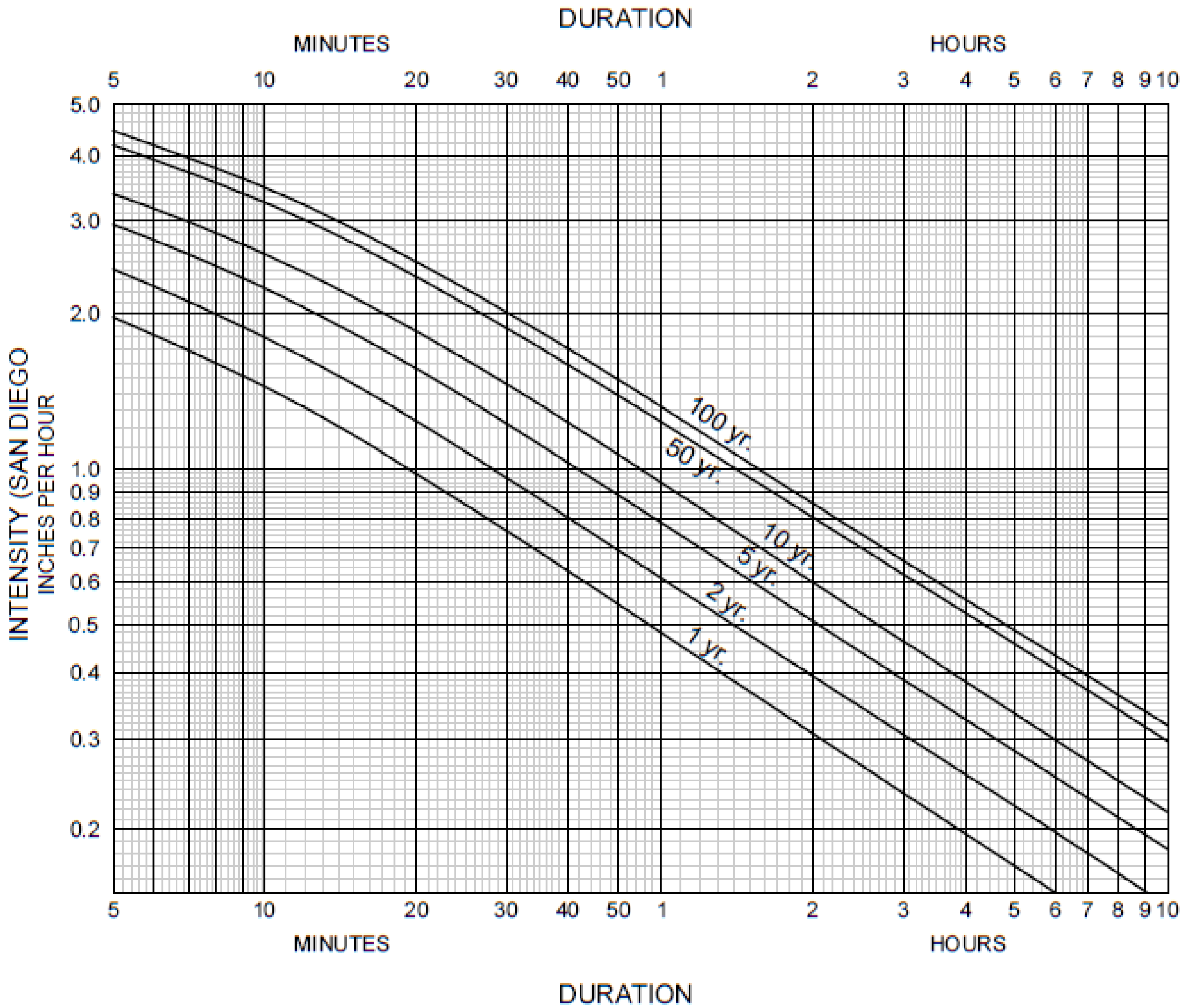

Figure A-1. Intensity-Duration-Frequency Design Chart

APPENDIX V – Time of Concentration: City of San Diego Drainage Design Manual

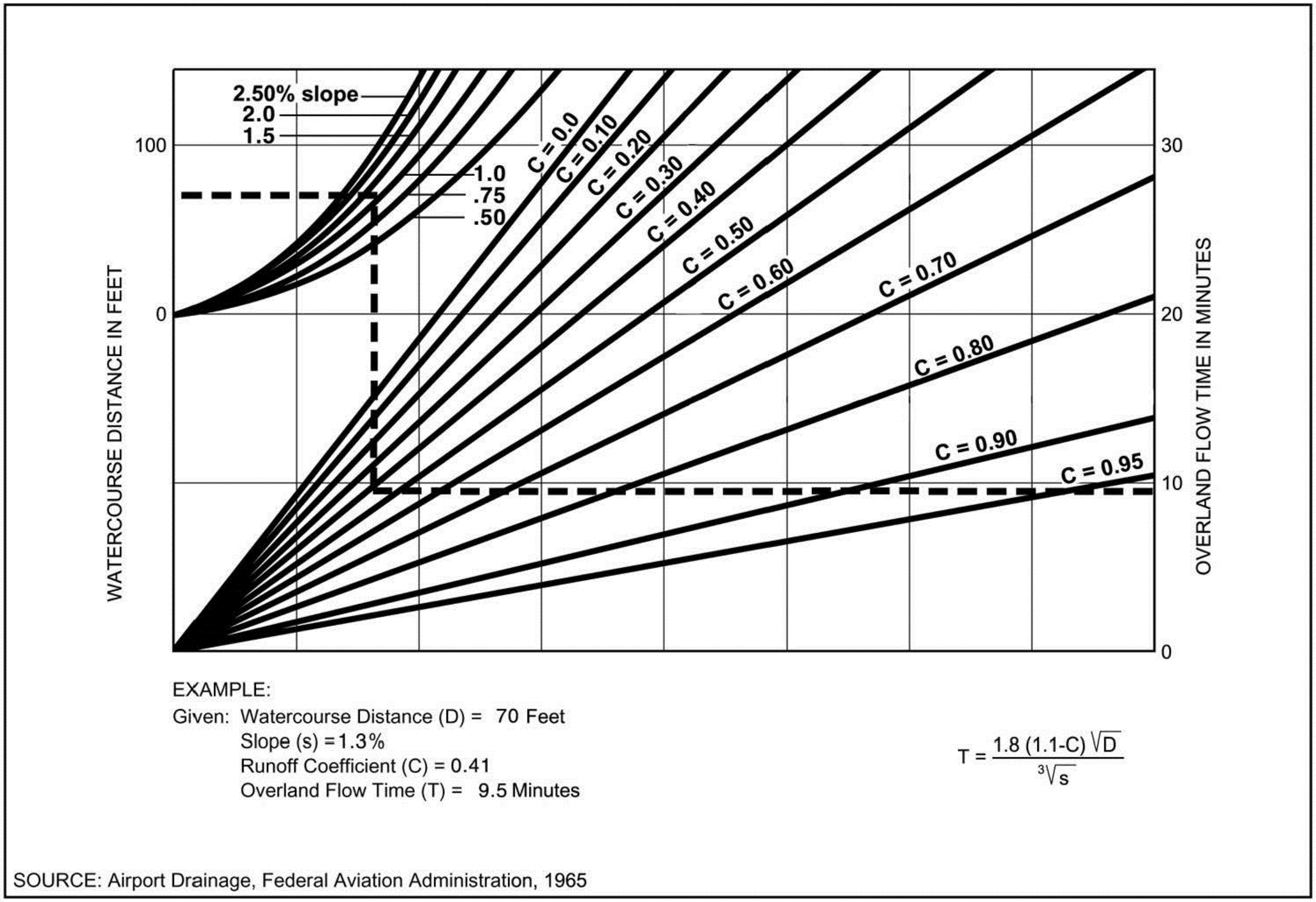

Figure A-4. Rational Formula – Overland Time of Flow Nomograph

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