SEAL WAY AT ELECTRIC AVENUE DRAINAGE SYSTEM

CITY OF SEAL BEACH, CALIFORNIA

BACKGROUND

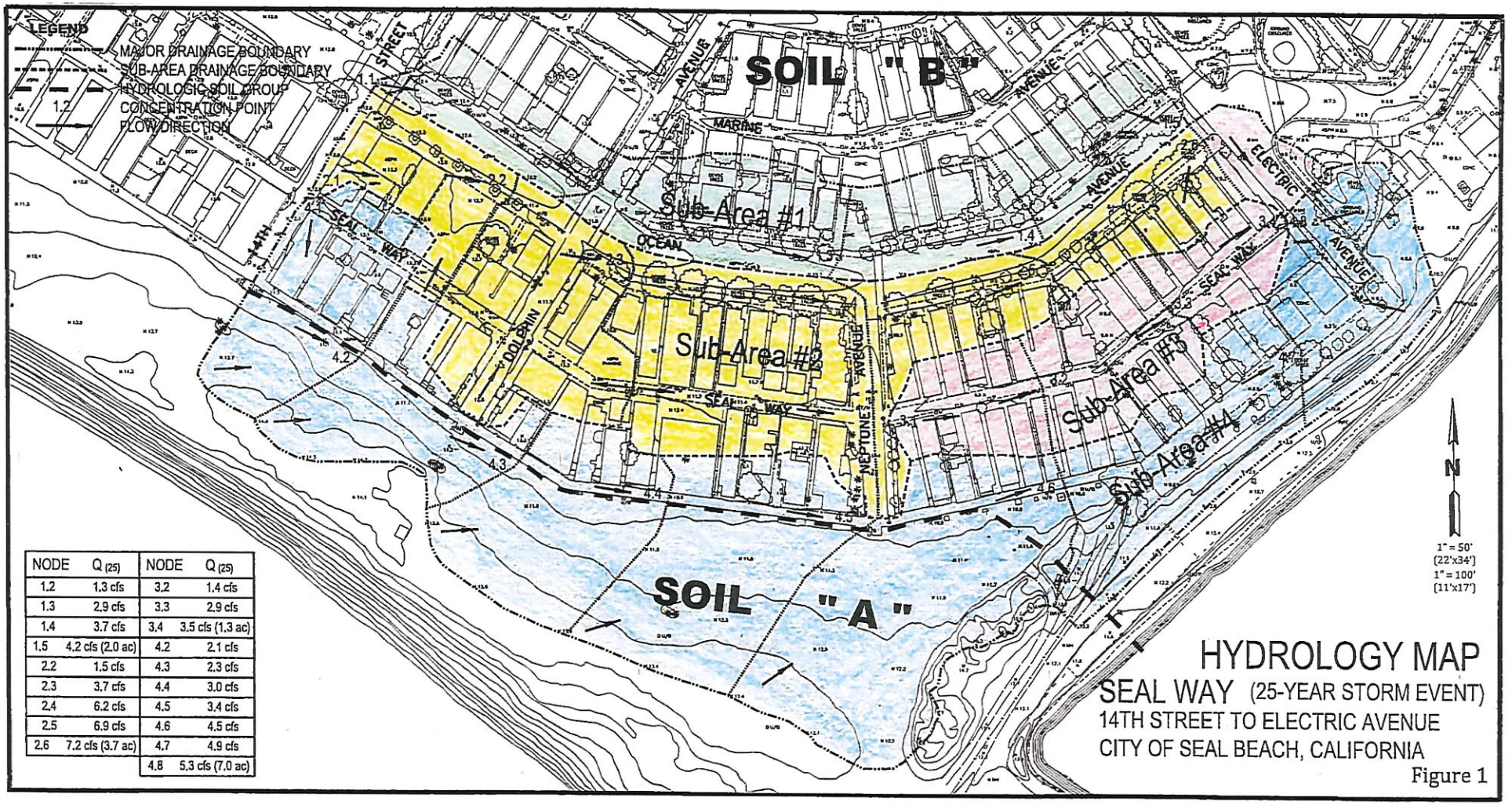
The southernmost area of the City of Seal Beach, located south of Marine Avenue between 14th Street and Electric Avenue has experienced flooding due to lack of adequate drainage facilities, and its low elevations that are subject to backwater during higher tide periods. The portion of this area along Seal Way from Neptune Avenue to the west and Electric Avenue to the east, as well as Electric Avenue at its intersection with Seal Way is in a sump condition. An existing 15-inch diameter corrugated metal pipe (CMP) along the south side of Electric Avenue between Ocean Avenue and the Pacific Ocean and two small grated inlets (20" x 20" and 27" x 15.5"), is the only storm drain system serving this area. It outlets to Anaheim Bay with a flap gate to prevent backwater during higher tides. This gravity drainage system can only function during low tide cycles.

The City of Seal Beach constructed the Electric Avenue Storm Drain and several lateral drains in 2011, which intercepted the runoff from a portion of this area. This includes a 2 acre area, shown as Sub-area No.1 on the hydrology Map, north of the Ocean Avenue street center line and south of 14th Street, which drains into a 14-foot catch basin located on the southwest corner of Ocean Avenue and Electric Avenue intersection. The catch basin connects to the Electric Avenue Storm Drain, which in turn extends to Orange County Flood Control District's Seal Beach Stormwater Pump Station (Facility C00PS1). With the construction of the Electric Avenue Storm Drain system, the tributary area draining into the 15-inch corrugated metal pipe was reduced from 33 acres to 12 acres. However, the remaining area does not have adequate flood protection due to the constraints described above.

The Seal Way Storm Drain project will construct seven catch basins, and 18-inch and 24-inch storm drains to collect the peak flow from a 25-year storm and convey it to the Electric Avenue Storm Drain. Exhibit 2 illustrates the proposed storm drain system. The existing 15-inch CMP will be plugged at the south end of Catch Basin No.6 to eliminate the possibility of backwater from the ocean. The proposed improvements will provide Expected Value 100-year flood protection to this area in accordance with Orange County Flood Control District criteria. The project will include a hydrodynamic separator system for removal of trash from the stormwater.

DESIGN DISCHARGE

The design discharge is selected to be the peak runoff resulting from a high-confidence 25-year storm (Expected Value 100-year flood) per the Orange County Flood Control District criteria. The total tributary area includes three sub-areas (2, 3, and 4), delineated on the Hydrology Map (Figure 1). The proposed storm drain system is illustrated on Figure 2.



NODE	Q (25)	NODE	Q (25)
1.2	1.3 cfs	3.2	1.4 cfs
1.3	2.9 cfs	3.3	2.9 cfs
1.4	3.7 cfs	3.4	3.5 cfs (1.3 ac)
1.5	4.2 cfs (2.0 ac)	4.2	2.1 cfs
2.2	1.5 cfs	4.3	2.3 cfs
2.3	3.7 cfs	4.4	3.0 cfs
2.4	6.2 cfs	4.5	3.4 cfs
2.5	6.9 cfs	4.6	4.5 cfs
2.6	7.2 cfs (3.7 ac)	4.7	4.9 cfs
		4.8	5.3 cfs (7.0 ac)

HYDROLOGY MAP

SEAL WAY (25-YEAR STORM EVENT)

14TH STREET TO ELECTRIC AVENUE

CITY OF SEAL BEACH, CALIFORNIA

Figure 1

Figure 2 – Proposed Storm Drain Facility

Proposed Storm Drain

Existing Storm Drain

Runoff of 4.2 cfs that is generated from Sub-area No. 1 (2 acres) is conveyed to the existing 14-foot catch basin as described above and is not in part of this drainage system.

Runoff of 7.2 cfs is generated from Sub-area No. 2 (3.7 acres) drains to the two proposed catch basins (Catch Basins #1 and #2) located on the south side of Ocean Avenue just west of Electric Avenue.

Sub-area No. 3, covering 1.3 acres along Seal Way east of Neptune Avenue, generates a peak 25-year flow of 3.5 cfs. This flow will be intercepted at a grating catch basin in Seal Way just south of Electric Avenue (Catch Basin #7), and two modified grating catch basins (Catch Basins #3 and #4) on the south side of Electric Avenue and west of Seal Way. These catch basins will connect to the existing 15-inch CMP.

Sub-Area No.4 covers 7 acres, and generates a peak 25-year flow of 5.3 cfs. The runoff from this area will be captured by two catch basins (Catch Basin #5 and #6) located at the north and south curbs of Electric Avenue east of Seal Way.

Because the 5 catch basins collecting the runoff from Sub-areas No. 3 and 4 are located in a sump, the design included a clogging factor of 1.5.

HYDRAULIC ANALYSIS OF THE NEW DRAINAGE SYSTEM

The WSPG models are established for the proposed drainage system. A minimum freeboard of six inches at each catch basin is provided in the system. The results of the analysis are tabulated below. The design plan of the entire drainage system is attached herein.

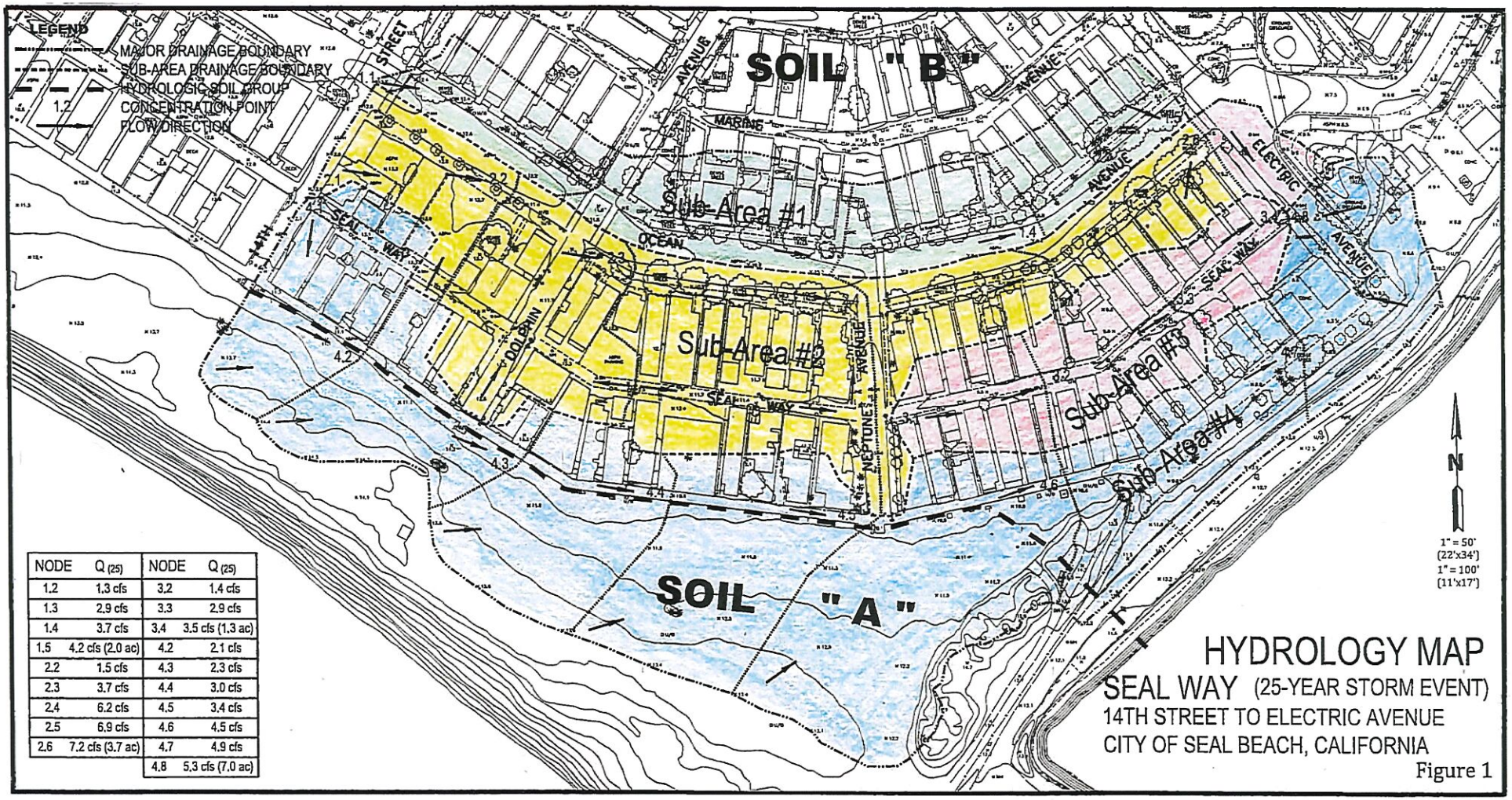
Location – All catch basins are on south side of Electric Avenue	**Design Flow**	**Type of Facility**	**Length**
45' east of Ocean Avenue		7-Grate Inlet	25'
70' east of Ocean Avenue		Ext. 15" Pipe	45'
10' west of Seal Way		5-Grate Inlet	18'
10' west of Seal Way		18" RCP	25'
At Seal Way intersection		Ext. 15" Pipe	25'
15' east of Seal Way		3-Grate Inlet	11'
15' east of Seal Way		18" RCP	20'
25' east of Seal Way		Ext. 15" Pipe	50'
75' east of Seal Way		8-Grate Inlet	28'
Starting at 75' east of Seal Way as a main line crossing Seal Beach Boulevard to Ext. 54-inch RCP on Electric Avenue.	8.7 cfs to 15.9 cfs	24" RCP	215'

HYDROLOGY STUDY

Seal Way, City of Seal Beach

A) 25-Year Storm Event

B) 50-Year Storm Event



NODE	Q (25)	NODE	Q (25)
1.2	1.3 cfs	3.2	1.4 cfs
1.3	2.9 cfs	3.3	2.9 cfs
1.4	3.7 cfs	3.4	3.5 cfs (1.3 ac)
1.5	4.2 cfs (2.0 ac)	4.2	2.1 cfs
2.2	1.5 cfs	4.3	2.3 cfs
2.3	3.7 cfs	4.4	3.0 cfs
2.4	6.2 cfs	4.5	3.4 cfs
2.5	6.9 cfs	4.6	4.5 cfs
2.6	7.2 cfs (3.7 ac)	4.7	4.9 cfs
		4.8	5.3 cfs (7.0 ac)

HYDROLOGY MAP

SEAL WAY (25-YEAR STORM EVENT)

14TH STREET TO ELECTRIC AVENUE

CITY OF SEAL BEACH, CALIFORNIA

Figure 1

Orange County R M H ver 6.6e by Jack Norris (C)'99	Filename: 25YR Description too wide for this space. Please see below.	Calc'ed by M. Y. Checked by _____ 25 - yr storm	Date 11-15-2019 Date _____ Page 1 of _____

SEAL WAY BETWEEN 14TH STREET AND ELECTRIC AVENUE
25-YEAR STORM EVENT
CITY OF SEAL BEACH, CALIFORNIA

Node #	Area(acres) Sub	Area(acres) Total	Soil Type	Dev. Type	Tt min.	Tc min.	I "/hr	Fm "/hr	Fm avg.	Q total	Path Ln '	Slope '/'	V fps	Hydraulics and Notes
1.1											265	.0060	0.53	Initial subarea
1.2	0.42	0.42	B	10		8.39	3.60	.060	.060	1.34				
					3.01						280	.0068	1.55	44'Street, Dn=0.25' Qav= 2.1
1.3	0.68	1.10	B	10		11.40	3.03	.060	.060	2.94				
					2.92						240	.0037	1.37	44'Street, Dn=0.30' Qav= 3.3
1.4	0.46	1.56	B	10		14.33	2.66	.060	.060	3.65				
					2.56						200	.0030	1.30	44'Street, Dn=0.33' Qav= 3.9
1.5	0.43	1.99	B	10		16.88	2.42	.060	.060	4.23				
					0.54						200	.0130	6.14	18" pipe, Dn=0.62' Q= 4.2
10	0	1.99				17.43	2.38		.060	4.23				
														New stream: # 2
2.1											300	.0043	0.53	Initial subarea
2.2	0.50	0.50	B	10		9.42	3.37	.060	.060	1.49				
					3.37						300	.0057	1.48	44'Street, Dn=0.27' Qav= 2.6
2.3	0.96	1.46	B	10		12.79	2.83	.060	.060	3.65				
					2.18						240	.0058	1.83	44'Street, Dn=0.32' Qav= 4.9
2.4	1.27	2.73	B	10		14.97	2.59	.060	.060	6.22				
					2.28						210	.0033	1.54	44'Street, Dn=0.37' Qav= 6.5
2.5	0.54	3.27	B	10		17.25	2.39	.060	.060	6.87				
					2.66						220	.0023	1.38	44'Street, Dn=0.40' Qav= 7.0
2.6	0.43	3.70	B	10		19.91	2.21	.060	.060	7.15				
					0.49						200	.0130	6.82	18" pipe, Dn=0.86' Q= 7.1
10	0	3.70				20.40	2.18		.060	7.15				

Dev.Type: 10= >10 dwellings/acre 14= Commercial

Orange County R M H ver 6.6e by Jack Norris (C)'99	See sheet 1 for description.	Calc'ed by M. Y. Checked by _____ 25 - yr storm	Date 11-15-2019 Date _____ Page 2 of _____

Node #	Area(acres) Sub	Area(acres) Total	Soil Type	Dev. Type	Tt min.	Tc min.	I "/hr	Fm "/hr	Fm avg.	Q total	Path Ln '	Slope '/'	V fps	Hydraulics and Notes
10	Confluencing 2 streams													
@ Tc	Stream 1 +		Stream 2 =		Confluenced									
17.43	Q=	4.23	+	6.69	=	10.92 cfs								
	A=	1.99	+	3.16	=	5.15 ac.								
20.40	Q=	3.86	+	7.15	=	11.01 cfs *								
	A=	1.99	+	3.70	=	5.69 ac.								
Qmax =	11.01 cfs	at	Tc = 20.40 minutes		A = A(contributing) =		5.69 ac							
Fm(avg) =	0.060 "/hr.						A(total) =		5.69 ac					
														New stream: # 3
3.1														
											170	.0047	0.38	Initial subarea
3.2	0.40	0.40	B	10		7.38	3.87	.060	.060	1.37				
					1.83						175	.0046	1.59	V-Chan. Dn= 0.2' Q= 1.4
3.3	0.56	0.96	B	10		9.21	3.41	.060	.060	2.90				
					1.60						165	.0048	1.72	V-Chan. Dn= 0.3' Q= 2.3
3.4	0.31	1.27	B	10		10.81	3.12	.060	.060	3.50				
					0.32						100	.0100	5.18	18" pipe, Dn=0.61' Q= 3.5
4.8	0	1.27				11.13	3.07		.060	3.50				
														New stream: # 4
4.1														
											300	.0057	0.47	Initial subarea
4.2	0.79	0.79	Mix	8		10.72	3.13	.170	.170	2.11				
					6.31						210	.0005	0.55	_|Chan B= 10' Dn=0.4' Q=2.11
4.3	0.70	1.49	Mix	8		17.03	2.41	.177	.174	3.00				
					3.60						180	.0011	0.83	_|Chan B= 10' Dn=0.4' Q=3.00
4.4	0.87	2.36	Mix	8		20.63	2.16	.188	.179	4.21				
					5.22						220	.0005	0.70	_|Chan B= 10' Dn=0.6' Q=4.21
4.5	1.08	3.44	Mix	7		25.85	1.90	.234	.196	5.29				

Dev.Type: 7= 3- 4 dwellings/acre 8= 5- 7 dwellings/acre 10= >10 dwellings/acre

Orange County		Calc'ed by M. Y. Date 11-15-2019
R M H ver 6.6e	See sheet 1 for description.	Checked by _____ Date _____
by Jack Norris (C)'99		25 - yr storm Page 3 of _____

Node #	Area(acres) Sub	Area(acres) Total	Soil Type	Dev. Type	Tt min.	Tc min.	I "/hr	Fm "/hr	Fm avg.	Q total	Path Ln '	Slope '/'	V fps	Hydraulics and Notes

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|-------|-----|-----|----|----|2.76|-----|----|----|----|-----| 230|.0030|1.39| |_|Chan B= 10' Dn=0.4' Q=5.29|
|  4.6  | 1.60| 5.04| Mix|  7 |----|28.61|1.80|.228|.206| 7.22|----|-----|----|---------------------------|
|-------|-----|-----|----|----|2.70|-----|----|----|----|-----| 300|.0053|1.85| |_|Chan B= 10' Dn=0.4' Q=7.22|
|  4.7  | 0.97| 6.01| B  |  8 |----|31.31|1.71|.150|.197| 8.17|----|-----|----|---------------------------|
|-------|-----|-----|----|----|3.23|-----|----|----|----|-----| 240|.0013|1.24| |_|Chan B= 10' Dn=0.7' Q=8.17|
|  4.8  | 0.96| 6.97| B  |  9 |----|34.54|1.62|.120|.186| 8.96|----|-----|----|---------------------------|
|-------|-----|-----|----|----|    |-----|----|----|----|-----|                                                |
|  4.8   Confluencing 2 streams                                                                                  |
| @ Tc     Stream 3 +  Stream 4 =   Confluenced                                                                  |
|------    --------    --------    ------------                                                                  |
| 11.13 Q=     3.50 +      5.82 =      9.32 cfs                                                                  |
|       A=     1.27 +      2.25 =      3.52 ac.                                                                  |
| 34.54 Q=     1.81 +      8.96 =     10.77 cfs *                                                                |
|       A=     1.27 +      6.97 =      8.24 ac.                                                                  |
| Qmax =    10.77 cfs  at  Tc = 34.54 minutes   A = A(contributing) =    8.24 ac                                 |
| Fm(avg) = 0.167 "/hr.                                 A(total) =    8.24 ac                                    |
|                          |----|                          |----|-----|----|---------------------------|
|-------|-----|-----|----|----|0.35|-----|----|----|----|-----| 200|.0240|9.50|   24" pipe, Dn=0.78' Q= 10.8 |
|  10   |  0  | 8.24|    |    |----|34.89|1.61|    |.167|10.77|----|-----|----|---------------------------|
|-------|-----|-----|----|----|    |-----|----|----|----|-----|                                                |
|  10    Confluencing 2 streams                                                                                  |
| @ Tc     Stream 1 +  Stream 3 =   Confluenced                                                                  |
|------    --------    --------    ------------                                                                  |
| 20.40 Q=    11.01 +      8.79 =     19.80 cfs *                                                               |
|       A=     5.69 +      4.82 =     10.51 ac.                                                                 |
| 34.89 Q=     8.04 +     10.77 =     18.82 cfs                                                                 |
|       A=     5.69 +      8.24 =     13.93 ac.                                                                 |
| Qmax =    19.80 cfs  at  Tc = 20.40 minutes   A = A(contributing) =   10.51 ac                                 |
| Fm(avg) = 0.109 "/hr.                                 A(total) =   13.93 ac                                    |
|                          |----|                          |----|-----|----|---------------------------|
|-------|-----|-----|----|----|----|-----|----|----|----|-----|----|-----|----|---------------------------|
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Orange County R M H ver 6.6e by Jack Norris (C)'99	Filename: 50YR Description too wide for this space. Please see below.	Calc'ed by M. Y. Checked by _____ 50 - yr storm	Date 11-25-2019 Date _____ Page 1 of _____

SEAL WAY BETWEEN 14TH STREET AND ELECTRIC AVENUE
50-YEAR STORM EVENT
CITY OF SEAL BEACH, CALIFORNIA

Node #	Area(acres) Sub	Area(acres) Total	Soil Type	Dev. Type	Tt min.	Tc min.	I "/hr	Fm "/hr	Fm avg.	Q total	Path Ln '	Slope '/'	V fps	Hydraulics and Notes
1.1											265	.0060	0.53	Initial subarea
1.2	0.42	0.42	B	10		8.39	4.06	.060	.060	1.51				
					2.89						280	.0068	1.62	44'Street, Dn=0.26' Qav= 2.4
1.3	0.68	1.10	B	10		11.28	3.43	.060	.060	3.34				
					2.87						240	.0037	1.39	44'Street, Dn=0.32' Qav= 3.7
1.4	0.46	1.56	B	10		14.15	3.02	.060	.060	4.15				
					2.48						200	.0030	1.34	44'Street, Dn=0.34' Qav= 4.5
1.5	0.43	1.99	B	10		16.63	2.75	.060	.060	4.83				
					0.54						200	.0130	6.20	18" pipe, Dn=0.68' Q= 4.8
10	0	1.99				17.17	2.71		.060	4.83				
														New stream: # 2
2.1											300	.0043	0.53	Initial subarea
2.2	0.50	0.50	B	10		9.42	3.80	.060	.060	1.68				
					3.20						300	.0057	1.56	44'Street, Dn=0.28' Qav= 2.9
2.3	0.96	1.46	B	10		12.62	3.22	.060	.060	4.15				
					2.15						240	.0058	1.86	44'Street, Dn=0.33' Qav= 5.6
2.4	1.27	2.73	B	10		14.77	2.95	.060	.060	7.09				
					2.19						210	.0033	1.60	44'Street, Dn=0.39' Qav= 7.5
2.5	0.54	3.27	B	10		16.96	2.72	.060	.060	7.84				
					2.64						220	.0023	1.39	44'Street, Dn=0.42' Qav= 8.0
2.6	0.43	3.70	B	10		19.61	2.51	.060	.060	8.16				
					0.48						200	.0130	7.00	18" pipe, Dn=0.94' Q= 8.2
10	0	3.70				20.08	2.48		.060	8.16				

Dev.Type: 10= >10 dwellings/acre 14= Commercial

Orange County R M H ver 6.6e by Jack Norris (C)'99	See sheet 1 for description.	Calc'ed by M. Y. Checked by _____ 50 - yr storm	Date 11-25-2019 Date _____ Page 2 of _____

Node #	Area(acres) Sub	Area(acres) Total	Soil Type	Dev. Type	Tt min.	Tc min.	I "/hr	Fm "/hr	Fm avg.	Q total	Path Ln '	Slope '/'	V fps	Hydraulics and Notes
10	Confluencing 2 streams													
@ Tc	Stream 1 +		Stream 2 =		Confluenced									
17.17	Q=	4.83 +		7.63 =		12.46 cfs								
	A=	1.99 +		3.16 =		5.15 ac.								
20.08	Q=	4.41 +		8.16 =		12.56 cfs *								
	A=	1.99 +		3.70 =		5.69 ac.								
Qmax =	12.56 cfs	at	Tc = 20.08 minutes		A = A(contributing) =		5.69 ac							
Fm(avg) =	0.060 "/hr.					A(total) =		5.69 ac						
3.1														New stream: # 3
											170	.0047	0.38	Initial subarea
3.2	0.40	0.40	B	10	7.38	4.36	.060	.060	1.55					
					1.79						175	.0046	1.63	V-Chan. Dn= 0.2' Q= 1.5
3.3	0.56	0.96	B	10	9.17	3.86	.060	.060	3.28					
					1.60						165	.0048	1.72	V-Chan. Dn= 0.3' Q= 2.3
3.4	0.31	1.27	B	10	10.76	3.52	.060	.060	3.96					
					0.31						100	.0100	5.39	18" pipe, Dn=0.65' Q= 4.0
4.8	0	1.27			11.07	3.47		.060	3.96					
4.1														New stream: # 4
											300	.0057	0.47	Initial subarea
4.2	0.79	0.79	Mix	8	10.72	3.53	.170	.170	2.39					
					6.00						210	.0005	0.58	_|Chan B= 10' Dn=0.4' Q=2.39
4.3	0.70	1.49	Mix	8	16.72	2.75	.177	.174	3.45					
					3.48						180	.0011	0.86	_|Chan B= 10' Dn=0.4' Q=3.45
4.4	0.87	2.36	Mix	8	20.20	2.47	.188	.179	4.86					
					4.90						220	.0005	0.75	_|Chan B= 10' Dn=0.7' Q=4.86
4.5	1.08	3.44	Mix	7	25.11	2.18	.234	.196	6.15					

Dev.Type: 7= 3- 4 dwellings/acre 8= 5- 7 dwellings/acre 10= >10 dwellings/acre

Orange County
R M H ver 6.6e
by Jack Norris (C)'99

See sheet 1 for description.

Calc'ed by M. Y. Date 11-25-2019
Checked by _____ Date _____
50 - yr storm Page 3 of _____

Node #	Area(acres) Sub	Area(acres) Total	Soil Type	Dev. Type	Tt min.	Tc min.	I "/hr	Fm "/hr	Fm avg.	Q total	Path Ln '	Slope '/'	V fps	Hydraulics and Notes
					2.62						230	.0030	1.46	_|Chan B= 10' Dn=0.4' Q=6.15
4.6	1.60	5.04	Mix	7	27.72	2.06	.228	.206	8.42					

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|-------|-----|-----|----|----|2.55|-----|----|----|----|-----| 300|.0053|1.96| |_|Chan B= 10' Dn=0.4' Q=8.42|
|  4.7  | 0.97| 6.01| B  |  8 |----|30.28|1.96|.150|.197| 9.55|----|-----|----|--------------------------|
|-------|-----|-----|----|----|3.06|-----|----|----|----|-----| 240|.0013|1.31| |_|Chan B= 10' Dn=0.7' Q=9.55|
|  4.8  | 0.96| 6.97| B  |  9 |----|33.34|1.86|.120|.186|10.48|----|-----|----|--------------------------|
|-------|-----|-----|----|----|    |-----|----|----|----|-----|                                                  |
|  4.8   Confluencing 2 streams                                                                                    |
| @ Tc     Stream 3 +  Stream 4 =   Confluenced                                                                    |
|------    --------    --------    ------------                                                                    |
| 11.07 Q=     3.96 +      6.84 =     10.79 cfs                                                                    |
|       A=     1.27 +      2.32 =      3.59 ac.                                                                    |
| 33.34 Q=     2.09 +     10.48 =     12.57 cfs *                                                                  |
|       A=     1.27 +      6.97 =      8.24 ac.                                                                    |
| Qmax =    12.57 cfs  at  Tc = 33.34 minutes   A = A(contributing) =    8.24 ac                                   |
| Fm(avg) = 0.167 "/hr.                                 A(total) =    8.24 ac                                    |
|                           |----|                                    |----|-----|----|--------------------------|
|-------|-----|-----|----|----|0.34|-----|----|----|----|-----| 200|.0240|9.89|   24" pipe, Dn=0.85' Q= 12.6 |
|  10   |  0  | 8.24|    |    |----|33.67|1.85|    |.167|12.57|----|-----|----|--------------------------|
|-------|-----|-----|----|----|    |-----|----|----|----|-----|                                                  |
|  10    Confluencing 2 streams                                                                                    |
| @ Tc     Stream 1 +  Stream 3 =   Confluenced                                                                    |
|------    --------    --------    ------------                                                                    |
| 20.08 Q=    12.56 +     10.30 =     22.86 cfs *                                                                  |
|       A=     5.69 +      4.91 =     10.60 ac.                                                                    |
| 33.67 Q=     9.30 +     12.57 =     21.87 cfs                                                                    |
|       A=     5.69 +      8.24 =     13.93 ac.                                                                    |
| Qmax =    22.86 cfs  at  Tc = 20.08 minutes   A = A(contributing) =   10.60 ac                                   |
| Fm(avg) = 0.110 "/hr.                                 A(total) =   13.93 ac                                    |
|                           |----|                                    |----|-----|----|--------------------------|
|-------|-----|-----|----|----|----|-----|----|----|----|-----|----|-----|----|--------------------------|
|                                                                                                                  |
|                                                                                                                  |
|==================================================================================================================|
| Dev.Type:  7= 3- 4 dwellings/acre  8= 5- 7 dwellings/acre  9= 8-10 dwellings/acre                                |
|==================================================================================================================|
```