SECTION 6

HYDROLOGY

The hydrology studies conducted for this master plan update are prepared in accordance with the 1986 Orange County Hydrology Manual (Hydrology Manual) and its subsequent amendments. The Rational Method and Unit Hydrograph Method are applied to simulate the design storm events. Details of the hydrologic methods and procedures are described in the Hydrology Manual.

The RMH OC Version 6.6e computer program is used to conduct Rational Method studies. The hydrologic calculations were performed with the 10-year and 25-year frequency design storms under ultimate conditions.

6-1 METHODOLOGY

The Rational Method is a storm runoff calculation method, which determines the flow rates for various storm frequency events. The rational method provides a peak runoff rate for each subarea and for the main line.

6-1.1 Rational Method

The equation for calculating the maximum runoff generated from a specific drainage area under a given rainfall event with the Rational Method is:

$$Q = C * I * A$$ Equation 6.1

where;
Q = peak flow rate in cubic feet per second
C = runoff coefficient
I = rainfall intensity in inches per hour
A = drainage area in acres

The runoff coefficient, C, is a ratio of runoff to rainfall.

The rainfall intensity, I, is specific to the time of concentration (T_c) and the storm frequency. The time of concentration is generally defined as the time interval (in minutes) required for the runoff to travel from the hydraulically most remote point in the drainage area to the selected location.

The size of the initial drainage area must be limited to 3 to 4 acres and the travel length to 200 to 300 feet for accurate results with the Rational Method. Following the initial area, the size of subsequent subarea is limited by its travel time, grade breaks, conveyance type, and confluence. In general, the subsequent subarea travel time shall be less than 3 minutes when T_c is less than 30 minutes; less than 5 minutes when T_c is between 30 minutes and 60 minutes; and less than 10 minutes when T_c is more than one (1) hour.

The T_c, I, and C are determined iteratively by the following steps.

1. The initial subarea T_c is determined by using Kirpich Formula.

   where;
   K = Coefficient (K =0.935 to 0.304 depending on the land use type)

   $$T_c = K * \left(\frac{L^3}{\Delta H} \right)^{0.2}$$

   L = Travel Length (ft)
   ΔH = Elevation Difference (ft)

2. Calculate the rainfall intensity at time (t) with the following equation:

   $I(t) = a * b^t$
   where:
   $I(t)$ = rainfall intensity for the given duration, t (in/hr)
   For 10-year return frequency: a = 10.209, and b = - 0.573
   For 25-year return frequency: a = 11.995, and b = - 0.566
   t = duration (min)

3. The runoff coefficient (C) is related to the soil type, land use type, and rainfall intensity. The runoff loss rate is related to the pervious area of the soil type and ground cover. The Rational Method Equation 6.1 can be modified to the following form.

   $$Q = 0.90 * (I - F_m) * A$$ Equation 6.2

   where:
   F_m = total loss rate in the tributary area (in/hr)

   The total loss rate is determined from the maximum effective pervious area loss rate (F_p) based upon Hydrologic Soil Group, and the pervious area fraction. The maximum loss rates are:

SOIL GROUP :	A	B	C	D
F_p (in/hr)	0.40	0.30	0.25	0.20

   In general, the Soil Group "A" is classified of having high infiltration rate and Soil Group "D" of having very low infiltration rate.

   Applying the maximum loss rate (F_p) to each pervious area friction (a_p) of land use within a subarea, the specific maximum loss rate (F_m) can be determined by the equation below.

   $$F_m = a_p * F_p$$ Equation 6.3

6-2 DRAINAGE AREA DELINEATION

As discussed in Section 4 – EXISTING DRAINAGE SYSTEM, the study area is subdivided into eleven (11) drainage areas. Each of these drainage areas is subdivided into multiple sub-areas, which are organized and numbered to calculate the storm runoff at each specific location.

The following sources were used for determining the flow routing and sub-area delineation:

1) City's one-foot contour maps
2) City Parcel Maps
3) Existing Storm Drain System
4) Street Surface Flow Maps
5) County of Orange Drainage Map
6) Field Reconnaissance to verify the actual flow pattern and routing

6-3 SUB-AREA PARAMETERS (RATIONAL METHOD)

The hydrologic parameters that characterize each sub-area are entered into the appropriate algorithm for the Rational Method to calculate the peak flow rate for each sub-area. These parameters are listed and described below.

6-3.1 Area (acres)

The surface area of each sub-area was determined using the Arcview GIS program.

6-3.2 Impervious Factor (0.0 to 0.98)

Imperviousness is a function of land use. The City's Zoning Map along with the Hydrology Manual's standard impervious factors, shown in Table 6-1, were used to determine the impervious factor for each sub-area.

TABLE 6-1
STANDARD IMPERVIOUS FACTORS

Type of Land Use	Average Impervious
Natural or Agriculture	0.00
Public Park	0.15
School	0.40
Single Family (2.5 acre lots)	0.10
Single Family (1.0 acre lots)	0.20
Single Family (2 dwellings/ac)	0.30
Single Family (3-4 dwellings/ac)	0.40
Single Family (5-7 dwellings/ac)	0.50
Single Family (8-10 dwellings/ac)	0.60
Single Family (>10 dwellings/ac)	0.80
Multi-Family (Condominiums)	0.65
Multi-Family (Apartments)	0.80
Mobile Home Park	0.75
Commercial or Industrial	0.90
Lake	0.98

6-3.3 Soil Type

The infiltration rate of soil affects the surface runoff. In general, soil with a higher infiltration capacity can transmit more water to subsurface layers and generates less surface runoff. The 1986 Orange County Hydrology Manual classifies the soils into four hydrologic soil groups: Group “A”, “B”, “C” and “D” based upon their ability to transmit water and surface runoff potential when thoroughly wet. This information is utilized in the hydrologic analyses to determine the runoff rates from design storms. The descriptions of the hydrologic soil groups are as follows:

- Group A Soils are sands or gravels with high infiltration and water transmission rates. These soils generate lowest surface runoff potential.
- Group B Soils are generally well drained, sandy-loam having moderate infiltration and water transmission rates. Group B soils have moderate infiltration rates when thoroughly wet and have moderate surface runoff potential.
- Group C Soils are mostly silty-loam with slow infiltration and water transmission rates. This soil group consists of silty loam soils with a layer that impedes downward movement of water, resulting in low infiltration rates and higher surface runoff potential.
- Group D Soils consist primarily of clays which have very slow infiltration rates when thoroughly wet; therefore, it generates highest surface runoff potential.

For comparison purposes, the Soil Group A was classified as mainly deep, well-drained sands or gravels and has the highest infiltration rate for water transmission. Therefore, the flow rate over this soil type is the lowest. Soil Group D is a clay layer or shallow soils over nearly impervious material and has the lowest water transmission rate. Therefore the flow rate over this soil type is the highest.

The soil classifications for the City are illustrated on Figure 6-1. The majority of the soils in the City is classified as Soil Group C. A majority of Marina Hill, the west side of the Wildlife Refuge, as well as portions of the Sunset Aquatic Park consist of Soil Group D. Old Town, Gold Coast, and parts of Bridgeport, Marina Hill, Hellman Ranch, and College Park East are classified by Soil Group B. Surfside and parts of the Wildlife Refuge and the Sunset Aquatic Park consist of Soil Group A.

6-3.4 Rainfall Depth (in)

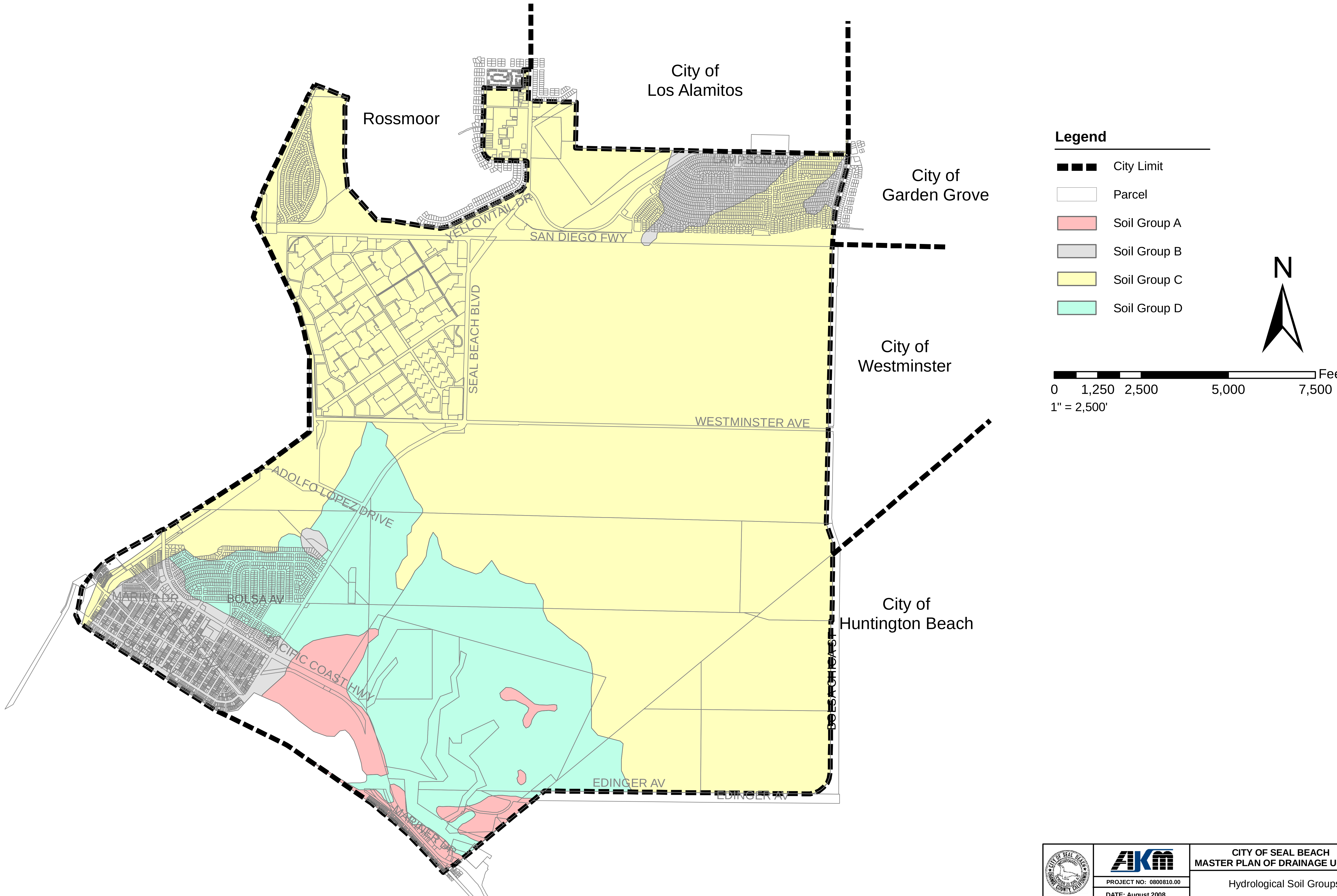
The relationship between the 24-hour rainfall depth and rainfall duration are described by the regression equations and were used in the Rational Method studies to determine the storm runoff rates for various storm frequencies. Listed below are the mean 24-hour precipitations in inches by return frequencies.

Duration	2-year	5-year	10-year	25-year	50-year	100-year
24-hour	2.11	3.17	3.79	4.7	5.28	5.78

The rainfall depth for non-mountainous areas was determined from a depth-duration regression equation which is shown below.

$$D(t) = a * t^b$$

where;
For 25-year return frequency: a = 0.200, and b = 0.434
For 10-year return frequency: a = 0.170, and b = 0.427
t (min) = duration less than 24 hours



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Hydrological Soil Groups

Figure 6-1

6-3.5 Flow Path Length

The initial flow path is defined as the flow length from the hydraulically most remote point to its outlet point. Subsequent flow path lengths were selected based upon the design and topographic map information and confluence locations.

6-4 SUB-AREA PARAMETERS (UNIT HYDROGRAPH METHOD)

6-4.1 Effective Rainfall in Unit Hydrograph Method

Within the City boundary, the point precipitation data (inches) for a single-day design storm is listed below. It is used in the unit hydrograph studies for developing design peak runoff rates and runoff volumes for the areas tributary to stormwater pump stations.

Duration	2-year	5-year	10-year	25-year	50-year	100-year
24-hour	2.05	3.03	3.68	4.49	5.07	5.63

When applying the unit hydrograph method to the design storm, the effective rainfall quantity is determined by subtracting the drainage losses from the design storm rainfall.

The drainage losses depend on the design storm frequency, soil type, land use, and the 24-hour storm rainfall depth. The Antecedent Moisture Condition (AMC) II is applied to the 10-year and 25-year return frequency storms. Curve Numbers (CN) corresponding to various hydrologic soil groups and ground cover type/quality are provided in the Hydrology Manual for AMC II. The 24-hour storm runoff yield fraction, Y_j, is determined as:

$$Y_j = \frac{(P_{24} - Ia)^2}{((P_{24} - Ia + S) * P_{24})}$$

where;

Ia = 0.2 * S

S = (1000 / CN) -10

P_{24} = 24-hour storm rainfall depth

A weighted average storm runoff yield (Y) is determined for drainage areas with various soil types and land uses.

$$Y = \frac{(Y_1 A_1 + ... + Y_m A_m)}{(A_1 + A_2 + ...A_m)}$$

where;

Y = weighted storm runoff yield fraction

A_j = sub-area

The low loss fraction ($\overline{Y}$) is determined by the following equation:

$$\overline{Y} = 1 - Y$$

The corresponding low loss rate $F*$ (in/hr) is given by

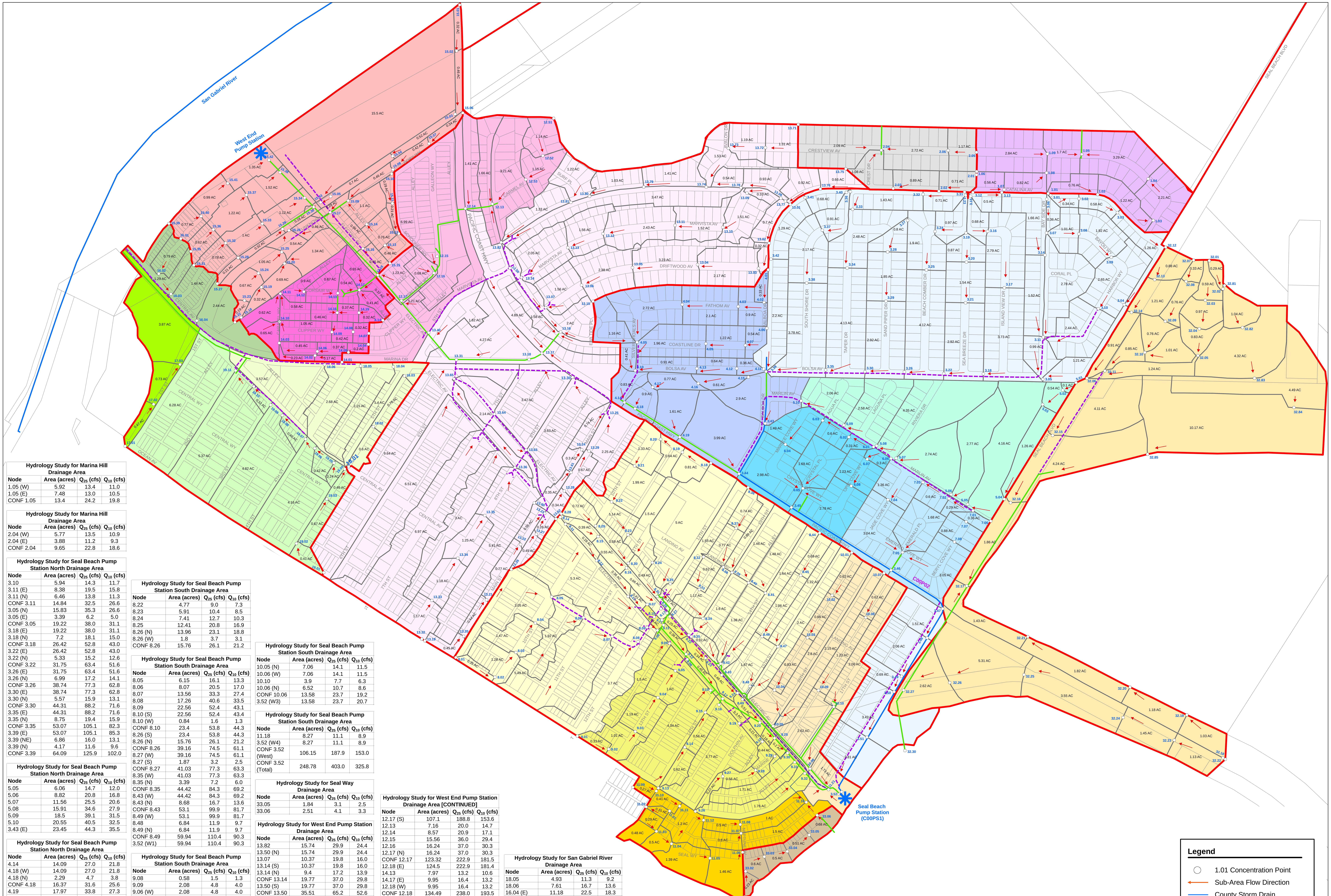
$$F* = \overline{Y} * I$$

where I is the rainfall intensity.

The low loss rate $F*$ is used to determine the losses from the design storm rainfall unless it exceeds F_m, the maximum loss rate.

6-5 HYDROLOGIC CALCULATION RESULTS

The results of the hydrologic calculations for the 10-year and 25-year frequency design storms, using the Rational Method, are located in Appendices B and C respectively. These appendices include the individual flow rates generated from each sub-area, as well as the accumulated flow rates at the confluence points. These results are utilized in the hydraulic analyses for the City's drainage system. Details of the hydraulic analysis are described in Section 7 – HYDRAULIC ANALYSIS. The hydrology maps for the study areas are shown on Figure 6-2 through Figure 6-4. The hydrologic analysis for Los Alamitos Drainage Area was performed using the U.S.G.S. map as the base map since this specific area was not included on the City's topographic 1 foot contour map.



Hydrology Study for Marina Hill Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
1.05 (W)	5.92	13.4	11.0
1.05 (E)	7.48	13.0	10.5
CONF 1.05	13.4	24.2	19.8

Hydrology Study for Marina Hill Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
2.04 (W)	5.77	13.5	10.9
2.04 (E)	3.88	11.2	9.3
CONF 2.04	9.65	22.8	18.6

Hydrology Study for Seal Beach Pump Station North Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
3.10	5.94	14.3	11.7
3.11 (E)	8.38	19.5	15.8
3.11 (N)	6.46	13.8	11.3
CONF 3.11	14.84	32.5	26.6
3.05 (N)	15.83	35.3	26.6
3.05 (E)	3.39	6.2	5.0
CONF 3.05	19.22	38.0	31.1
3.18 (E)	19.22	38.0	31.1
3.18 (N)	7.2	18.1	15.0
CONF 3.18	26.42	52.8	43.0
3.22 (E)	26.42	52.8	43.0
3.22 (N)	5.33	15.2	12.6
CONF 3.22	31.75	63.4	51.6
3.26 (E)	31.75	63.4	51.6
3.26 (N)	6.99	17.2	14.1
CONF 3.26	38.74	77.3	62.8
3.30 (E)	38.74	77.3	62.8
3.30 (N)	5.57	15.9	13.1
CONF 3.30	44.31	88.2	71.6
3.35 (E)	44.31	88.2	71.6
3.35 (N)	8.75	19.4	15.9
CONF 3.35	53.07	105.1	82.3
3.39 (E)	53.07	105.1	85.3
3.39 (NE)	6.86	16.0	13.1
3.39 (N)	4.17	11.6	9.6
CONF 3.39	64.09	125.9	102.0

Hydrology Study for Seal Beach Pump Station North Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
5.05	6.06	14.7	12.0
5.06	8.82	20.8	16.8
5.07	11.56	25.5	20.6
5.08	15.91	34.6	27.9
5.09	18.5	39.1	31.5
5.10	20.55	40.5	32.5
3.43 (E)	23.45	44.3	35.5

Hydrology Study for Seal Beach Pump Station North Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
4.14	14.09	27.0	21.8
4.18 (W)	14.09	27.0	21.8
4.18 (N)	2.29	4.7	3.8
CONF 4.18	16.37	31.6	25.6
4.19	17.97	33.8	27.3
3.44 (W)	21.96	40.5	32.7
3.39	64.09	125.9	102.0
3.43 (N)	64.09	125.9	102.0
3.43 (E)	23.45	44.3	35.5
CONF 3.43	87.54	168.9	136.6
3.44 (N)	87.54	168.9	136.6
CONF 3.44	109.5	207.9	168.1
3.45 (W)	109.5	207.9	168.1
3.45 (N)	11.38	19.1	15.3
CONF 3.45	120.88	225.3	181.9
3.46 (W)	120.88	225.3	181.9
3.46 (N)	11.25	20.6	16.8
CONF 3.46	132.13	241.5	194.8
3.47	132.13	241.5	194.8
3.48	133.6	241.5	194.8
3.49	135.7	241.5	194.8
3.50	136.4	241.5	194.8
3.51	139.8	241.5	194.8
3.52 (N)	142.6	241.5	194.8

Hydrology Study for Seal Beach Pump Station South Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
8.22	4.77	9.0	7.3
8.23	5.91	10.4	8.5
8.24	7.41	12.7	10.3
8.25	12.41	20.8	16.9
8.26 (N)	13.96	23.1	18.8
8.26 (W)	1.8	3.7	3.1
CONF 8.26	15.76	26.1	21.2

Hydrology Study for Seal Beach Pump Station South Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
8.05	6.15	16.1	13.3
8.06	8.07	20.5	17.0
8.07	13.56	33.3	27.4
8.08	17.26	40.6	33.5
8.09	22.56	52.4	43.1
8.10 (S)	22.56	52.4	43.4
8.10 (W)	0.84	1.6	1.3
CONF 8.10	23.4	53.8	44.3
8.26 (S)	23.4	53.8	44.3
8.26 (N)	15.76	26.1	21.2
CONF 8.26	39.16	74.5	61.1
8.27 (W)	39.16	74.5	61.1
8.27 (S)	1.87	3.2	2.5
CONF 8.27	41.03	77.3	63.3
8.35 (W)	41.03	77.3	63.3
8.35 (N)	3.39	7.2	6.0
CONF 8.35	44.42	84.3	69.2
8.43 (W)	44.42	84.3	69.2
8.43 (N)	8.68	16.7	13.6
CONF 8.43	53.1	99.9	81.7
8.49 (W)	53.1	99.9	81.7
8.48	6.84	11.9	9.7
8.49 (N)	6.84	11.9	9.7
CONF 8.49	59.94	110.4	90.3
3.52 (W1)	59.94	110.4	90.3

Hydrology Study for Seal Beach Pump Station South Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
9.08	0.58	1.5	1.3
9.09	2.08	4.8	4.0
9.06 (W)	2.08	4.8	4.0
9.06 (S)	3.53	8.3	6.8
CONF 9.06	5.61	13.0	10.7
9.10 (W)	5.61	13.0	10.7
9.10 (S)	5.15	12.1	10.0
CONF 9.10	10.76	24.4	20.1
9.17 (W)	10.76	24.4	20.1
9.17 (S)	4.95	13.5	11.1
9.17 (E)	0.51	1.4	1.2
CONF 9.17	16.22	37.2	30.6
9.20 (W)	16.22	37.2	30.6
9.20 (N)	1.58	2.7	2.2
CONF 9.20	17.8	39.6	32.6
9.25	17.98	39.6	32.6
9.30 (N)	18.18	39.6	32.6
9.30 (S)	1.27	3.0	2.5
CONF 9.30	19.45	42.4	34.8
9.31	21.16	42.4	34.8
9.32	22.66	44.6	36.5
3.52 (W2)	22.66	44.6	36.5

Hydrology Study for Seal Beach Pump Station South Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
10.05 (N)	7.06	14.1	11.5
10.06 (W)	7.06	14.1	11.5
10.10	3.9	7.7	6.3
10.06 (N)	6.52	10.7	8.6
CONF 10.06	13.58	23.7	19.2
3.52 (W3)	13.58	23.7	20.7

Hydrology Study for Seal Beach Pump Station South Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
11.18	8.27	11.1	8.9
3.52 (W4)	8.27	11.1	8.9
CONF 3.52 (West)	106.15	187.9	153.0
CONF 3.52 (Total)	248.78	403.0	325.8

Hydrology Study for Seal Way Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
33.05	1.84	3.1	2.5
33.06	2.51	4.1	3.3

Hydrology Study for West End Pump Station Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
13.82	15.74	29.9	24.4
13.50 (N)	15.74	29.9	24.4
13.07	10.37	19.8	16.0
13.14 (S)	10.37	19.8	16.0
13.14 (N)	9.4	17.2	13.9
CONF 13.14	19.77	37.0	29.8
13.50 (S)	19.77	37.0	29.8
CONF 13.50	35.51	65.2	52.6
13.40 (N)	35.51	65.2	52.6
13.16 (E)	3.58	10.3	8.6
13.17	8.47	24.0	19.9
13.18 (N)	8.47	24.0	19.9
13.25	4.65	10.5	8.6
13.30	8.28	17.9	14.6
13.18 (E)	11.75	24.3	19.8
CONF 13.18	20.22	43.2	35.5
13.31 (E)	24.49	49.4	40.4
13.23	2.92	6.3	5.1
13.63 (E)	2.92	6.3	5.1
13.63 (W)	9.01	22.3	18.4
CONF 13.63	11.93	27.8	22.8
13.64	21.9	49.3	22.8
13.65	30.55	65.4	53.5
13.31 (S)	40.05	85.7	70.1
CONF 13.31	64.54	127.9	104.3
13.40 (S)	66.36	127.9	104.3
CONF 13.40	101.87	188.8	153.6

Hydrology Study for West End Pump Station Drainage Area [CONTINUED]			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
12.17 (S)	107.1	188.8	153.6
12.13	7.16	20.0	14.7
12.14	8.57	20.9	17.1
12.15	15.56	36.0	29.4
12.16	16.24	37.0	30.3
12.17 (N)	16.24	37.0	30.3
CONF 12.17	123.32	222.9	181.5
12.18 (E)	124.5	222.9	181.4
14.13	7.97	13.2	10.6
14.17 (E)	9.95	16.4	13.2
12.18 (W)	9.95	16.4	13.2
CONF 12.18	134.49	238.0	193.5
15.30 (S)	134.49	238.0	193.5
15.29	5.8	13.6	11.3
15.30 (W)	6.08	13.8	11.4
15.09	4.03	6.1	4.9
15.05	6.28	9.2	7.4
15.43(N)	21.78	32.2	26.0
15.43 (S)	1.51	3.3	2.7
CONF 15.43	23.29	34.4	27.8
15.30 (E)	23.29	34.4	27.8
CONF 15.30	163.86	277.6	225.8
15.34 (E)	163.86	277.6	225.8
15.34 (W)	2.89	6.8	5.6
CONF 15.34	166.75	283.2	230.3
15.38 (E)	166.75	283.2	230.3
15.38 (W)	3.36	8.3	6.8
CONF 15.38	170.1	289.6	235.6
15.42 (E)	170.1	289.6	235.6
15.42 (W)	3.12	7.2	5.9
CONF 15.42	173.22	295.6	240.4

Hydrology Study for San Gabriel River Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
18.05	4.93	11.3	9.2
18.06	7.61	16.7	13.6
16.04 (E)	11.18	22.5	18.3

Hydrology Study for San Gabriel River Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
19.07	6.4	13.5	11.1
19.08	6.86	14.1	11.6
19.09	11.68	23.5	19.3
19.10	12	23.5	19.3
19.11	17.37	33.5	27.5
16.04 (SE)	23.65	44.5	36.5

Hydrology Study for San Gabriel River Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
16.04 (SE)	23.65	44.5	36.5
16.04 (NE)	5.96	17.0	14.1
16.04 (E)	11.18	22.5	18.3
16.04 (SW)	5.07	13.9	11.5
CONF 16.04	45.86	87.2	71.5

Hydrology Study for Anaheim Bay Drainage Area			
Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
32.06 (E)	3.92	7.8	6.4
32.06 (NE)	3.71	7.6	6.2
32.06 (N)	3	7.4	6.1
CONF 32.06	10.63	21.3	17.4
32.15	14.74	28.6	23.3
32.16 (N)	18.98	36.1	29.5
32.16 (E)	20.02	45.3	36.8
CONF 32.16	39	80.4	65.9
32.17 (N)	40.86	80.4	65.9
32.17 (SE)	5.46	10.2	8.3
CONF 32.17	46.32	90.6	74.1
32.27 (N)	46.32	90.6	74.1
32.27 (E)	14.06	21.7	17.2
CONF 32.27	60.38	111.6	90.8
32.30	60.38	111.6	90.8

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Southwest Region Hydrology

Figure 6-2

Hydrology Study for College Park East Drainage Area

Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
22.06	7.19	13.1	10.6
22.07	9.33	16.7	13.4
22.09 (S)	11.22	19.6	15.8
22.09 (N)	2.9	4.4	3.6
CONF 22.09	14.12	23.6	19.0
22.15	16.52	25.3	20.3
22.16	19.28	28.5	22.8
22.17 (E)	21.33	30.9	24.7
22.17 (N)	8.39	11.2	9.0
CONF 22.17	29.72	41.4	33.2
22.24 (E)	30.85	42.4	33.9
22.24 (S)	14.51	19.6	15.7
CONF 22.24	45.36	61.2	49.0
22.38	48.3	63.5	50.7
22.39	53.71	68.2	54.4
22.40 (E)	54.99	68.3	54.4
22.40 (N)	10.46	10.1	7.8
22.54	6.35	12.4	10.1
22.55	8.76	16.6	13.4
22.56	10.72	19.3	15.6
22.57	12.4	21.7	17.5
22.40 (W)	14.48	24.2	19.4
CONF 22.40	79.93	95.7	75.9

Hydrology Study for College Park East Drainage Area

Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
23.06	4.76	8.9	7.1
23.07 (N)	6.14	10.8	8.6
23.07 (E)	4.73	8.8	7.1
CONF 23.07	10.87	19.3	15.4
23.12 (S)	13.71	22.9	18.3
23.12 (N)	4.44	6.7	5.4
CONF 23.12	18.15	28.9	23.3
23.17	19.77	30.6	24.6
23.18	22.78	33.8	27.1
23.19 (E)	24.07	35.1	28.1
23.19 (N)	3.56	5.1	4.2
CONF 23.19	27.63	40.0	32.1
23.24 (E)	30.31	42.8	34.3
23.24 (S)	5.17	7.6	6.1
CONF 23.24	35.48	50.3	40.5
23.31	37.4	51.9	41.6
23.32	40.76	54.8	43.9
23.33 (E)	44.41	56.3	44.9
23.33 (S)	12.63	16.6	13.2
CONF 23.33	57.04	70.1	55.7

Hydrology Study for College Park East Drainage Area

Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
24.06	14.5	23.9	19.2
24.12	15.33	24.6	19.7
24.13	17.27	27.0	21.6
24.14	20.07	30.2	24.1
24.15 (S)	23.58	33.5	26.6
24.15 (E)	9.15	15.1	12.1
24.15 (N)	4.52	6.5	5.3
CONF 24.15	37.25	53.1	42.2
24.26	40.68	56.2	44.6
24.27	43.97	58.7	46.5
24.44 (E)	47.84	60.9	48.1
24.33	6.55	11.8	9.5
24.34	8.35	14.6	11.8
24.35	11.42	19.3	14.1
24.36	14.26	23.2	18.7
24.37	15.76	24.7	19.9
24.38	17.26	26.4	21.2
24.39	19.21	28.5	22.9
24.40 (E)	22.01	31.3	25.0
24.40(S)	3.63	7.2	5.9
CONF 24.40	25.64	36.5	29.2
24.44 (S)	26.08	36.5	29.2
CONF 24.44	73.92	95.0	75.3
24.45	76.8	96.9	76.7

Hydrology Study for College Park East Drainage Area

Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
25.04	5.88	11.9	9.7
25.05	8.59	16.8	13.6
25.10 (E)	8.59	16.8	13.6
25.10 (N)	6.44	10.0	8.0
CONF 25.10	15.03	25.6	20.6
25.11	17.12	27.0	21.7
25.12	19.24	29.9	24.0
25.13	26.4	41.1	33.0

Hydrology Study for Bolsa Chica Channel Drainage Area

Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
20.06	5.42	11.1	9.0
20.07	6.61	13.1	10.6
20.13 (N)	13.12	23.4	18.8
20.13 (W)	7.92	15.5	12.5
20.13	22.68	40.7	30.4

Hydrology Study for Bolsa Chica Channel Drainage Area

Node	Area (acres)	Q_{25} (cfs)	Q_{10} (cfs)
21.06	8.4	14.9	11.9
21.10	10.13	17.4	13.9
21.11 (N)	12.07	20.0	16.0
21.20	9	18.9	15.4
21.24 (S)	9.83	18.9	15.4
21.24 (N)	3.82	6.5	5.2
CONF 21.24	13.65	24.7	20.1
21.11 (W)	13.65	24.7	20.1
CONF 21.11	25.72	42.6	34.3
21.16	6.17	12.9	10.5

CITY OF SEAL BEACH
MASTER PLAN OF DRAINAGE UPDATE

PROJECT NO: 0800810.00

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Northeast Region Hydrology

Figure 6-3