4. Storm and Sewer Study

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REVISED DRAFT MEMORANDUM

TO:	Rachel Hawkins, JD	DATE:	February 28, 2018
FROM:	Conor Murphy, EIT Andy Sterbenz, PE	JOB#:	EMCP.13.17 (001)
SUBJECT:	Storm and Sewer Study for the Garden Road Zoning Amendment		

This memorandum summarizes Schaaf & Wheeler's storm and sewer study for the Garden Road Zoning Amendment. The project area is located on the southwest side of the Monterey Peninsula Airport and is currently zoned for industrial use. The proposed zoning amendment would allow mixed use and multifamily residential development.

The project area includes 69 parcels totaling 101.2 acres (see attached Map 1). Of this, 9 parcels totaling 38.5 acres are public facilities excluded from the study (2 well lots, 2 retention basin lots, and 5 public agency/utility parcels). The analysis addresses the remaining 60 parcels totaling 62.6 acres.

Summary of Findings

The existing site totals 101.2 acres, with 486,130 square-feet of existing commercial/industrial building coverage. The proposed rezoning has the potential to add 407 residential dwelling units, and reduce the commercial/industrial coverage to 293,420 square-feet, assuming 40% of the existing buildings are converted to residential use, and all parcels are built out to their permitted maximum coverage.

Sanitary sewer flow from the project area is projected to increase from the current 30,379 gallons per day, Average Dry Weather Flow (gpd ADWF) to 67,360 gpd, ADWF. This increase appears to be within the existing conveyance capacity of the City's downstream sanitary sewer system, although the City does not have a current system model available to confirm this.

The impervious coverage on the project area is projected to increase from the current 34 acres to 41 acres with the addition of buildings and associated paved parking areas. This will increase the stormwater runoff volume by 0.75 acre-feet during a 2-year, 24-hour rain event, and by 1.27 acre-feet (a 26% increase) during a 10-year, 24-hour rain event. Stormwater runoff from the site flows into an unnamed tributary of Del Monte Lake, along the south edge of Highway 68. If required, it may be possible to detain the additional 1.27 acre-feet of stormwater runoff on-site, although it may require the installation of infiltration galleries below existing pavements.

Potential Development of Project Area

The existing lot sizes and building coverage were provided by EMC Planning Group (see attached Table A1). The potential for residential conversions were estimated based on the following factors and assumptions:

- The current zoning allows for a maximum lot coverage of 40 percent for single story structures and a maximum of 30 percent lot coverage for multistory structures. It is assumed that all

available space within those limits would be used for residential development. For example, if a site has an existing single story building covering 25% of the lot, 15% of the lot area may be added as residential space.

- It is assumed that 40% of the existing developed area (buildings) may be converted to residential use, and the remaining 60% will remain non-residential.

- The conversion rates are assumed to be one multi-family residential dwelling unit per 900 square feet of existing building, and one multi-family residential unit per 2,000 square feet of undeveloped parcel area. The larger factor allows for parking areas and non-apartment amenities.

- It is assumed that properties which have been subdivided into building portions and shared parking lots will be aggregated and converted from their current use. This affects parcel blocks 9-15, 21-43 and 57-63.

The potential future building coverage and dwelling units for each parcel is shown in Table A2 (attached).

Sanitary Sewer Capacity Study

Sanitary sewer flows are estimated for the current and potential future condition, and then compared to the capacity of the existing collection system.

Current Wastewater Flows:

Current wastewater flows for the project area are assumed to equal the indoor water demand, which is estimated based on the land use. The current buildings consist of offices, gyms, churches, and medical offices. Rule 24 from the Monterey Peninsula Water Management District's Rules & Regulations was used to estimate the indoor water use. The water demand factor for the commercial/industrial sites is 0.00007 acre-ft/year/square foot (AFY/SF). The following equation was used to calculate the current wastewater flows:

$$Q_{current} = A_{current} * (43560 \text{ SF/ac}) * (0.00007 \text{ AFY/SF}) * (325851 \text{ gal/AF}) / (365 \text{ days/year})$$

Where: $Q_{current}$ is current wastewater flow in gallons/day (gpd)

$A_{current}$ is current building area in acres

The resulting estimate of current wastewater flow is 30,379 gpd Average Dry Water Flow (ADWF), or approximately 21.1 gpm. The current wastewater return flows for each parcel are shown in Table A3.

Future Wastewater Flows:

The future wastewater flows for the project area were estimated based on the assumptions for the potential development of the project area. There were two main components to the future wastewater flows: residential flows and non-residential flows.

The residential flows were estimated based on the projected number of residential dwelling units (DU), which includes both converted buildings and new buildings. It is assumed that there are 2.19 persons per DU based on the U.S. Census estimate of persons per household for the City of Monterey.

Residential indoor water use is assumed to produce 55 gallons per day per person (gpd/person) of wastewater return flow using current water efficient toilets and fixtures. The following equation was used to calculate the future wastewater flows:

$$Q_{residential} = n * (2.19 \text{ persons/DU}) * (55 \text{ gal/person/day})$$

Where: $Q_{residential}$ is future residential wastewater flow in gpd

n is total number of residential units

A total of 407 dwelling units are projected under the future condition, resulting in an estimated wastewater flow of 49,024 gpd ADWF.

The non-residential wastewater flows are calculated the same way as they were for the current condition. Building areas in parcels where residential development is assumed to occur are reduced by 40%. The non-residential building area in the future condition is estimated to be 293,420 SF, resulting in an estimated wastewater flow of 18,336 gpd ADWF. The flows from the current and future conditions are compared in Table 1, below.

Table 1, Project Area Wastewater Flow Estimates

Quantity	Unit	Factor	Unit	Flow	Unit
Current Condition					
486,130	SF	0.0625	gpd/SF	30,379	gpd
Future Condition					
293,420	SF	0.0625	gpd/SF	18,336	gpd
407	DU	120.45	gpd/DU	49,024	gpd
Total:				67,360	gpd
Increase:				36,981	gpd

0.0625 gpd/SF = (0.00007 AFY/SF)*(325851 gal/AF)/(365 day/yr)
120.45 gpd/DU = (2.19 person/DU)*(55 gpd/person)

The projected future wastewater flow rate of 67,360 gpd ADWF (or 46.8 gpm) is approximately twice the current estimated flow rate from the parcels in the analysis. The future wastewater return flows for each parcel are shown in Table A4.

Current City of Monterey Sewer System:

The City of Monterey sanitary sewer collection system serves the project area (see Figure 1). The pipeline along the southern edge of the project area extends east along Highway 68 to serve other properties adjacent to the airport, as well as Ryan Ranch. Properties on the northeast side of the airport are served by Seaside County Sanitation District, which conveys flow along Highway 218. The collection system downstream of the project area flows through the Naval Postgraduate School Property and eventually ends at the Monterey One Water Sewer Pump Station (Monterey Pump Station). The Monterey Pump Station has a design capacity of 17.5 million gallons per day (mgd), but the current peak wet weather flow at the station is only 8 mgd, so only the gravity collection system was reviewed for available capacity.

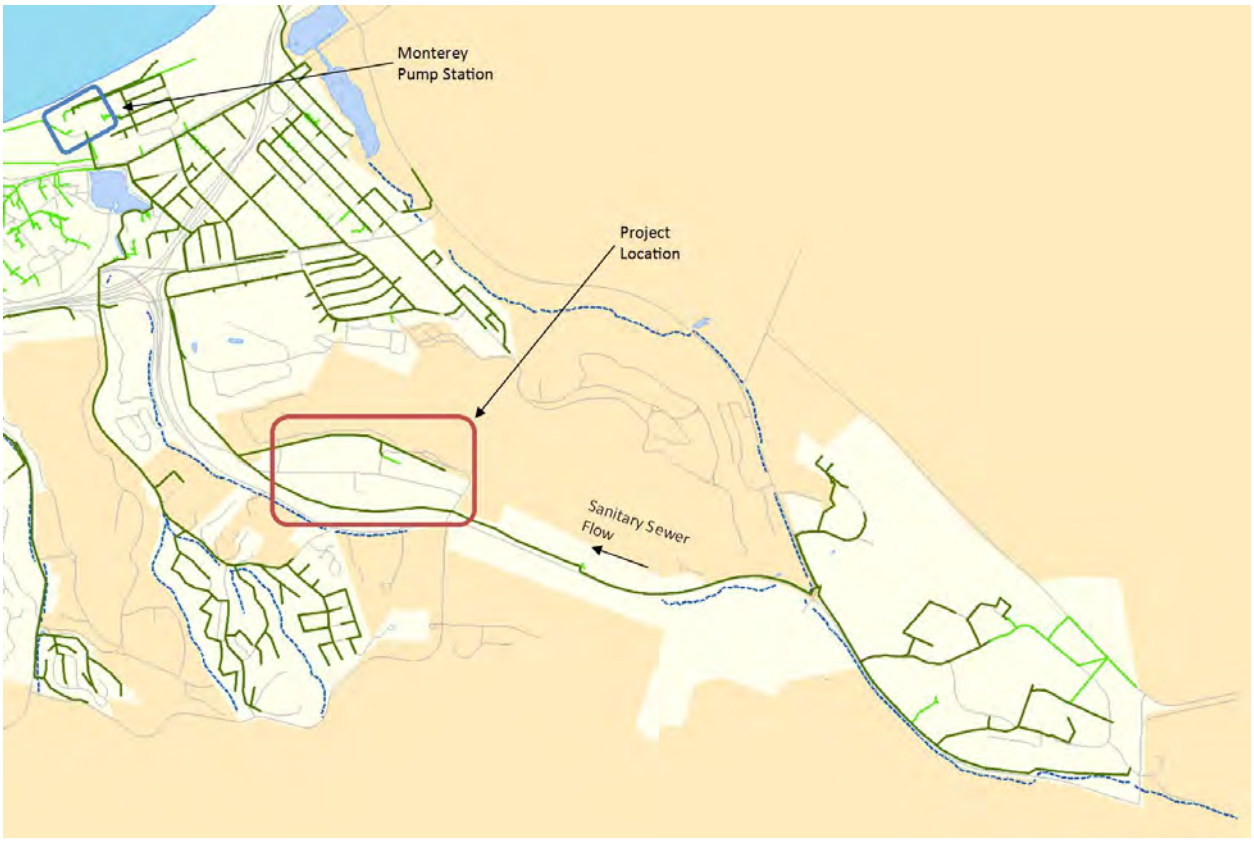

Figure 1 – City of Monterey Sanitary Sewer Collection System

The current capacity of the gravity collection system downstream of the project area was estimated based on the pipe just downstream of the project site. The current City of Monterey Sanitary Sewer Map had missing manhole depths for the pipes of interest, so the capacity of the sewer pipes was determined based on the City of Monterey Sanitary Sewer Study in 1988. The sewer study had data on the pipe lengths, pipe slopes, and pipe diameters. The capacity of the sewer pipes were calculated using Manning's Equation for partially full circular pipes. The capacity of the sewer system at manhole 610 adjacent to the Navy Golf Course is estimated to be about 1,584,000 gpd (or 1,100 gpm) based on an assumed depth to diameter ratio of 0.7 and a Manning's roughness coefficient of 0.013 for asbestos-cement pipe.

Manning's Equation: $$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

Where: Q is flow rate in cubic feet per second (cfs)

n is the roughness coefficient (-)

R is the hydraulic radius in feet (ft)

S is the slope of the energy grade line in feet per foot (ft/ft)

A is the cross-sectional area in feet (ft)

The current inflows to the sewer pipe adjacent to the golf course are from the project site, the excluded properties on Garden Road, the airport, and the properties east of the project site on Highway 68. The properties east of the project site are zoned Industrial, Commercial Office, Planned Community, and Open Space. Planned Community zoned properties were not taken into account for their future flows into the sewer system.

The excluded properties on Garden Road are estimated in the same way the industrial properties were estimated for the project site's current wastewater flows. These properties have a developed area of 3.6 acres which results in 9,811 gpd (or 7 gpm) of sewer return flow ADWF. To account for the hotel and the airport this value is assumed to double to 19,622 gpd (or 14 gpm) ADWF.

The properties due east on Highway 68 were estimated on a total land area basis. The project area produces 30,379 gpd (or 21.1 gpm) ADWF from a total area of 66.8 acres. The resulting flow per unit area is 455 gpd (or 0.32 gpm) per acre. The properties zoned Industrial and Commercial Office have a total area of 410 acres resulting in 129 gpm of sewer return flow ADWF. The properties east of the project area have a lower building density than the project area so the estimate is conservatively high.

The estimated total inflow into the sewer system is shown in Table 2. The peaking factor was assumed to be 3 for the sanitary sewer system to obtain Peak Wet Weather Flow (PWWF). 820,282 gpd PWWF (or 570 gpm) was estimated for the future condition of the project site. Since the capacity of the sewer system was estimated around 1,584,000 gpd (or 1,100 gpm), the existing sanitary sewer system can receive the estimated flows resulting from the proposed zoning amendment. Table A5 shows the estimated capacity of this section of the City of Monterey Sanitary Sewer System based on the Sewer Study in 1988.

Table 2, Sewer System Flow Estimates

Location	ADWF		PF	PWWF		Capacity	
Units	gpm	gpd	(-)	gpm	gpd	gpm	gpd
Current Condition							
Project Area	21	30,377	3	63	91,131		
Adjacent Properties	14	19,622	3	41	58,865		
Eastern Properties	129	186,444	3	388	559,333		
TOTAL:	164	236,443	3	493	709,330	1,100	1,584,000
Future Condition							
Project Area	47	67,361	3	140	202,084		
Adjacent Properties	14	19,622	3	41	58,865		
Eastern Properties	129	186,444	3	388	559,333		
TOTAL:	190	273,427	3	570	820,282	1,100	1,584,000

PWWF=ADWF*PF

Stormwater Capacity Study

Stormwater flows are estimated for the current and potential future condition, and then compared to the capacity of the existing collection system.

The stormwater capacity study compares estimated current stormwater flows to potential future stormwater flows. The current stormwater flows are estimated based on the current land use and

ground cover while the future stormwater flows will be estimated based on the future land use with the potential mixed-use, multifamily residential development.

The City of Monterey Storm Sewer serves the project site (see Figure 2). The stormwater from Garden Road flows by storm main and are added to an unnamed stream on the south side of Highway 68. The stream flows north until it eventually reaches Del Monte Lake.

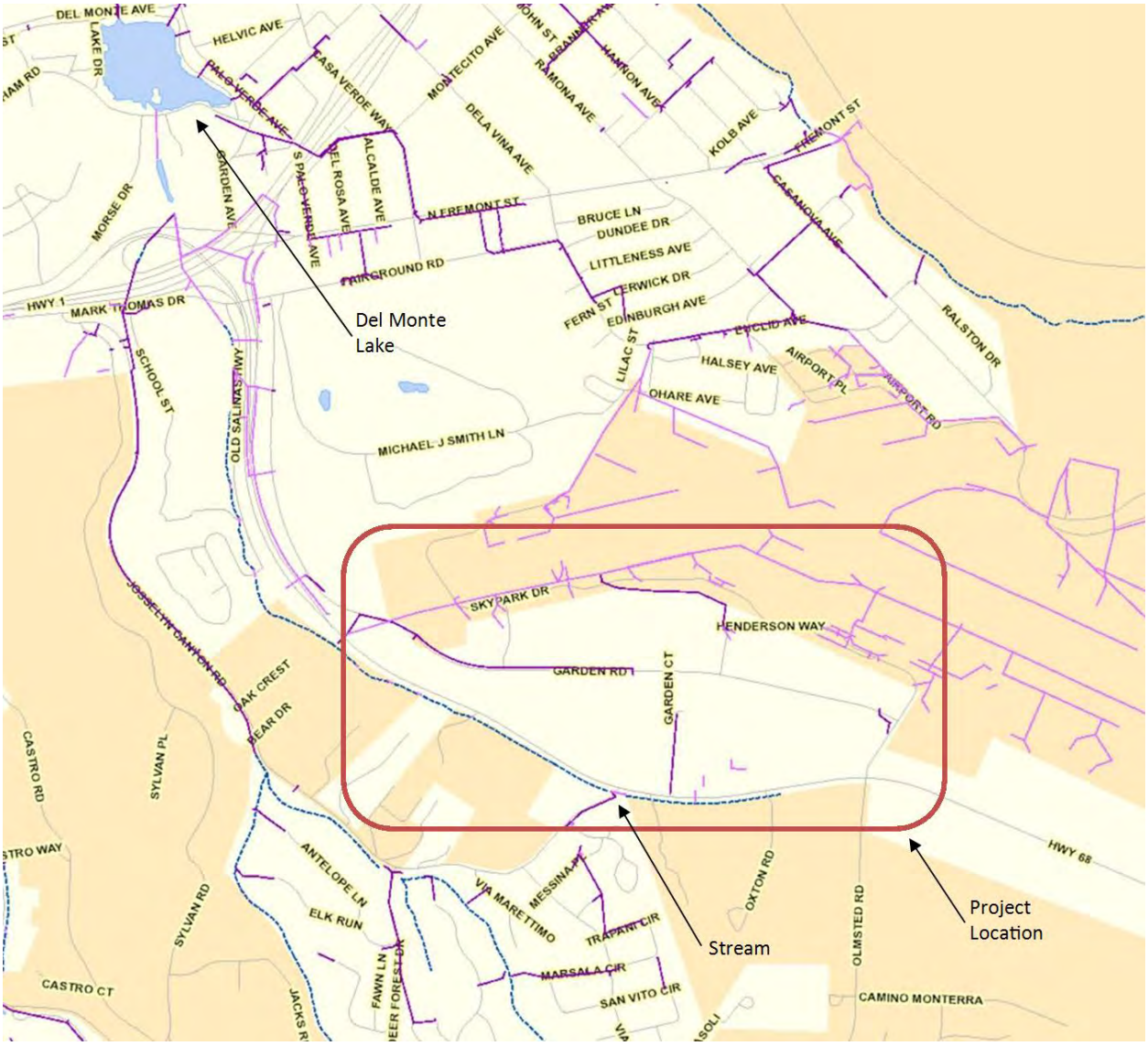

Figure 2 – City of Monterey Storm Collection System

Current Pervious and Impervious Cover Estimate:

The current pervious cover was estimated graphically using AutoCAD. The pervious land cover was traced on an aerial photograph in AutoCAD to estimate the total pervious area. Current land cover is summarized in Table 3.

Table 3 – Summary of Current Land Cover

Current Land Cover Estimate		Units
Total Area	66.8	acres
Pervious Area	32.8	acres
Impervious Area	34.0	acres
Percent Pervious	49%	(-)
Percent Impervious	51%	(-)

Future Pervious and Impervious Cover Estimate:

The impervious cover was estimated to contain the future parking area along with the future potential developed area. The future parking area considered the amount of parking spaces needed for both the residential units and the industrial units.

The amount of parking spots needed is based off of the requirements in Article 18 of the City of Monterey Zoning Ordinance. It requires that 2 parking spaces are required per unit for multifamily conversions regardless of the number of bedrooms in the unit. For mixed use projects, 1 parking space is needed per 275 square feet of business and professional offices. All of the industrial buildings were assumed to meet the requirement of 1 parking space per 275 square feet.

The parking spot dimensions were assumed to be 9-ft wide and 18-ft long. The aisle width in the parking lot is assumed to be 24-ft. From these dimensions, one parking spot is assumed to be 270 square feet. The future land cover is summarized in Table 4. The future land cover is shown for each parcel in Table A5. The estimated future parking is calculated to be 19.7 acres for the entire project area including both residential and industrial spots.

Table 4 – Summary of Future Land Cover

Future Land Cover Estimate		Units
Total Area	66.8	acres
Parking Area	20.0	acres
Developed Area	20.7	acres
Pervious Area	26.1	acres
Impervious Area	40.7	acres
Percent Pervious	39%	(-)
Percent Impervious	61%	(-)

Runoff Calculation:

Runoff was calculated for both the current condition and the future land development based on soil conditions, rainfall, and land cover. Runoff was calculated using the SCS runoff curve number method as described in TR-55. The soil type was determined through the USDA National Cooperative Soil Survey. Most of the soil in the area is classified as Arnold loamy sand which is an "A group" soil. "A group" soils have high infiltration rates which decrease potential runoff. The 2-year, 5-year, and 10-year 24 hour storms were obtained from NOAA Atlas 2 maps. The SCS runoff curve number method calculates runoff using the following equation:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \qquad S = \frac{1000}{CN} - 10$$

Where: Q is runoff in inches

P is rainfall in inches

S is potential maximum retention after runoff begins in inches

CN is the curve number

For estimating the project site curve number, CN, a weighted curve number was obtained by assuming all pervious area is good pasture cover. Table 5 shows the curve number calculation for the current condition and Table 6 shows the runoff values for different rainfall events for the current condition.

Table 5 – Current Condition Curve Number Calculation

Current Condition				
Soil Name and Group	**Cover Description**	**CN**	**% area**	**Product**
Loamy sand, A	Pervious (Pasture good)	39	49%	19.2
Loamy sand, A	Impervious	98	51%	49.8
			CN=	69.0
			S=	4.49

Table 6 – Current Condition Runoff for 2-Year, 5-Year, and 10-Year 24-Hour Storm

Current Condition	2-yr	5-yr	10-yr
24hr Rainfall (in)	1.8	2	2.5
Runoff (in)	0.15	0.22	0.42
Runoff Volume (acre-ft)	0.84	1.21	2.34

Table 7 shows the curve number calculation for the future condition and Table 8 shows the runoff values for different rainfall events for the future condition.

Table 7 – Future Condition Curve Number Calculation

Future Condition				
Soil Name and Group	**Cover Description**	**CN**	**% area**	**Product**
Loamy sand, A	Pervious (Pasture good)	39	39%	15.2
Loamy sand, A	Impervious	98	61%	59.7
			CN=	75.0
			S=	3.34

Table 8 – Future Condition Runoff for 2-Year, 5-Year, and 10-Year 24-Hour Storm

Future Condition	2-yr	5-yr	10-yr
24hr Rainfall (in)	1.8	2	2.5
Runoff (in)	0.29	0.38	0.65
Runoff Volume (acre-ft)	1.59	2.11	3.61

The watershed excluding the project site is remaining the same. Therefore, the project site could be thought of as adding additional runoff directly into the stream. For the 10-year event, there would be a 54% increase in runoff from the site to the stream which is an increase of 1.27 acre-ft added to the stream. If required, it may be possible to detain the additional 1.27 acre-feet of stormwater runoff on-site, although it may require the installation of infiltration galleries below existing pavements.

The peak discharge was calculated using the Graphical Peak Discharge Method. This method uses the CN, initial abstraction (I_a), rainfall (P), time of concentration, and rainfall distribution to calculate a unit peak discharge. The following equation is used:

$$q_p = q_u A_m Q$$

Where: q_p is peak discharge in cubic feet per second (cfs)

q_u is unit peak discharge in cubic feet per second per in per square mile per inch (csm/in)

A_m is drainage area in square miles (mi^2)

Q is runoff in inches (in)

The unit peak discharge (q_u) was obtained from Figure 3.

The Peak Discharge Method could be applied to the site individually. The results from the peak discharge method are shown in Table 9. The 17 percent increase in impervious area caused the peak discharge to increase by 276%, 265%, and 120% for the 2-year, 5-year, and 10-year rainfall event respectively.

The increase in impervious area led to a substantial decrease in the initial abstraction for the project area. The decrease in initial abstraction is due to a decrease in the infiltration capacity of the project area as well as a decrease in interception due to vegetation and small depressions in the pervious areas. A smaller initial abstraction causes runoff to occur more quickly causing a larger peak discharge. This peak discharge would pass down the receiving stream before the peak flow from the upper watershed arrives, so the impact is not cumulative. Infiltration galleries or detention basins would delay the on-site runoff and decrease the peak discharge from the project area.

Table 9 –Values for Peak Discharge Calculation for Project Area

	Current			Future		
Frequency	2-yr	5-yr	10-yr	2-yr	5-yr	10-yr
24-hr Rainfall, P (in)	1.8	2	2.5	1.8	2	2.5
I_a (in)	0.898	0.898	0.898	0.668	0.668	0.668
I_a/P	0.499	0.449	0.359	0.371	0.334	0.267
Unit Peak Discharge, q_u	48	60	112	95	125	160
Runoff (in)	0.15	0.22	0.42	0.29	0.38	0.65
Peak Discharge (cfs)	0.75	1.36	4.92	2.84	4.95	10.83

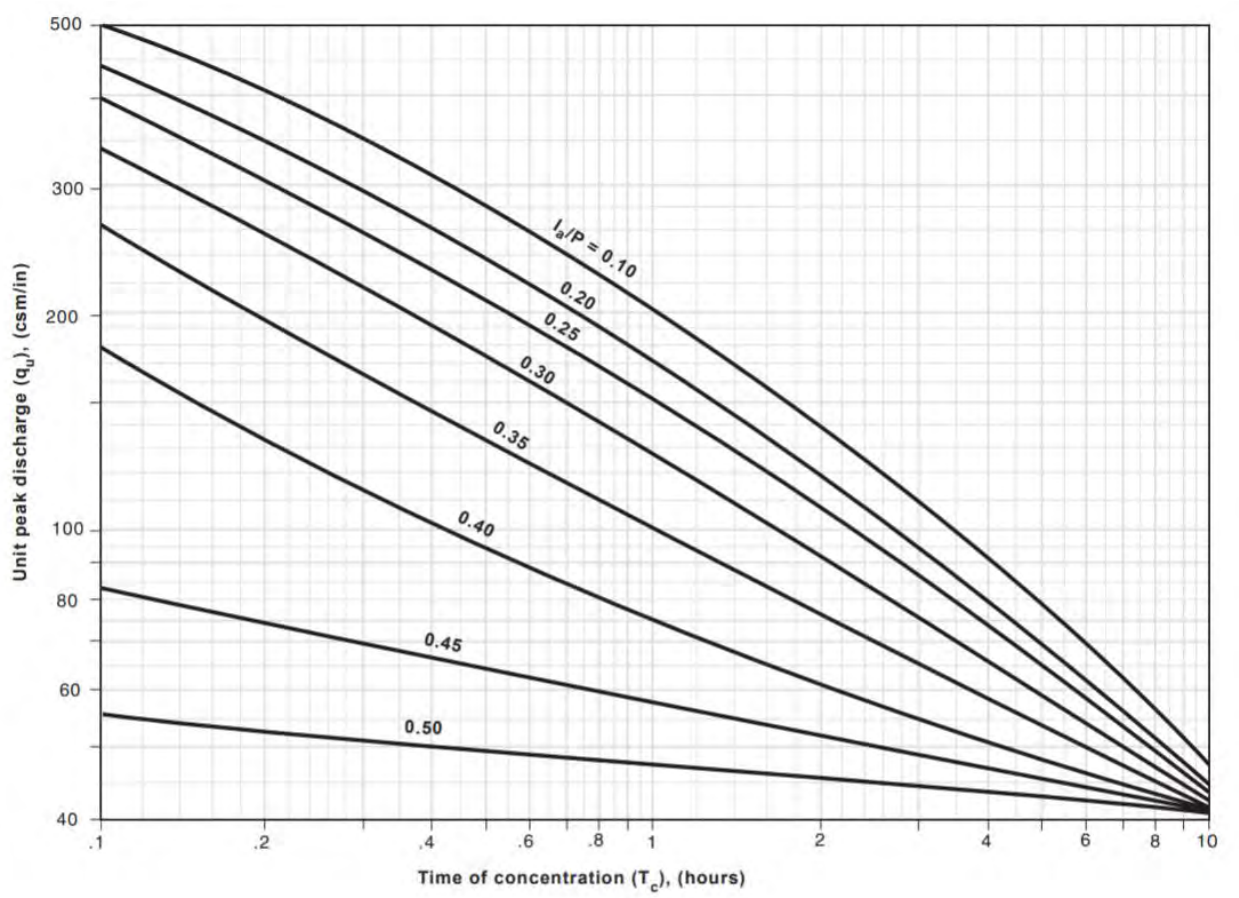

Figure 3 – Unit Peak Discharge for Type I Rainfall Based on I_a/P and T_c

Runoff Calculation for Watershed:

The storm flow from the project site flows toward an unnamed stream on the south side of Highway 68. The stream flows north until it eventually reaches Del Monte Lake. The watershed for the project area is shown in Figure 4. The watershed consists of the project area, the southern half of the airport, residential properties south of Highway 68, industrial properties east of the project site and open space. The open space consists of a small portion of the Navy Golf Course west of the project site and undeveloped land adjacent to Olmsted Road south of Highway 68.

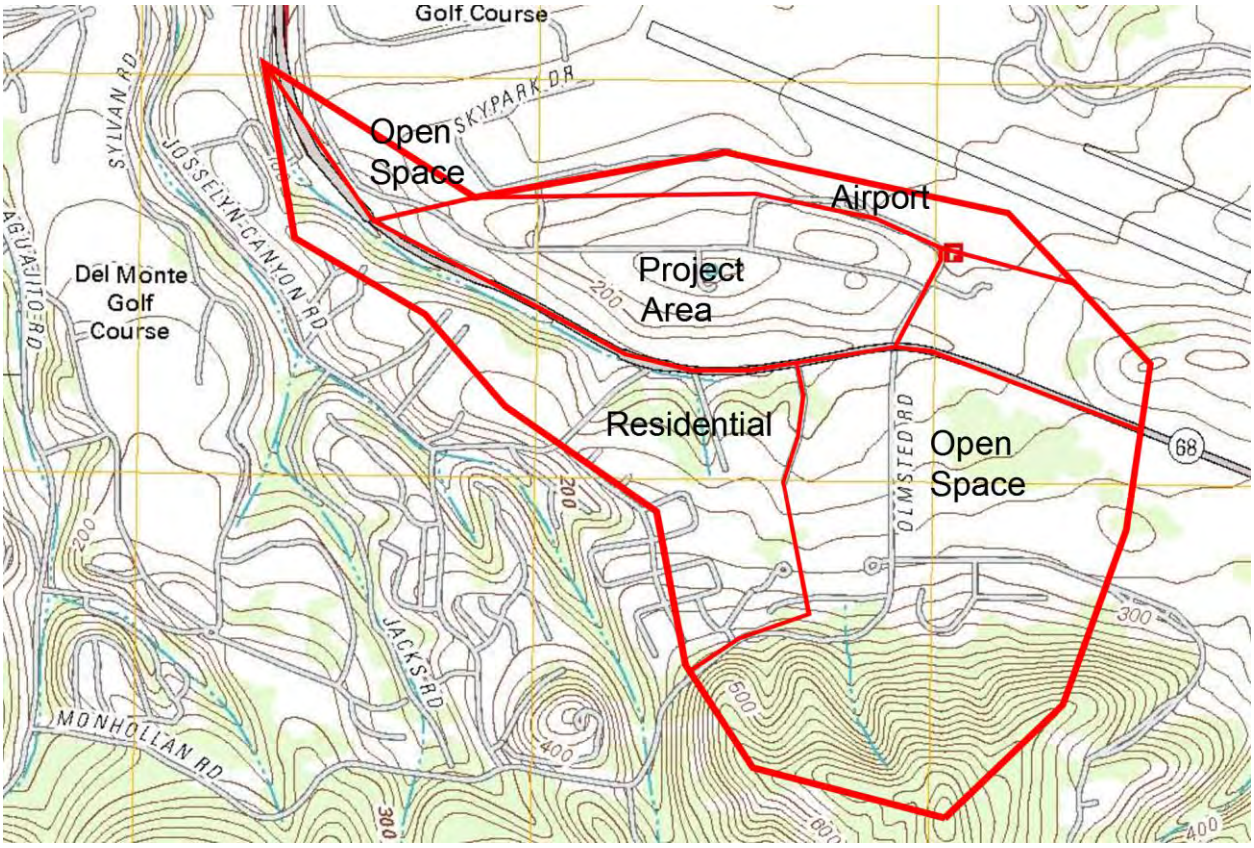

Figure 4 – Project Area Watershed

The development of the project area will increase the runoff into the stream for this watershed. The curve number for the watershed was developed using the methods of TR-55. The Peak Discharge was calculated using the Graphical Peak Discharge Method from TR-55.

The following assumptions were made for runoff calculations:

- The golf course is good pasture land cover
- The airport is impervious cover
- The eastern industrial properties are an average industrial cover
- The residential properties have an average lot size of ¼ acre
- The undeveloped land adjacent to Olmstead Road is a woods/grass combination based on area
- The rainfall distribution is Type I
- There are no pond or detention areas

Table 10 shows the watershed curve number calculation for the current condition and Table 11 shows the watershed curve number calculation for the future condition. The watershed runoff values for the different 24-hour storm rainfall events are shown in Table 12.

Table 10 – Current Condition Watershed Curve Number Calculation

Current Condition				
Area Description	**Cover Description**	**CN**	**Acreage**	**Product**
Golf Course	Good	39	14.4	562.4
Airport	Impervious	98	28.7	2808.7
Project Site	Industrial	69.0	66.8	4608.6
Residential	Residential, 1/4 Acre Lots	38	119.5	4542.3
Industrial	Industrial	72	38.0	2734.7
Open Space	Woods/Grass	43.4	211.5	9185.2
		TOTAL:	478.9	24441.9
			CN=	51
			S=	9.59

Table 11 – Future Condition Watershed Curve Number Calculation

Future Condition				
Area Description	**Cover Description**	**CN**	**Acreage**	**Product**
Golf Course	Good	39	14.420845	562.412948
Airport	Impervious	98	28.7	2808.7
Project Site	Industrial	75.0	66.8	5006.4
Residential	Residential, 1/4 Acre Lots	38	119.5	4542.3
Industrial	Industrial	72	38.0	2734.7
Open Space	Woods/Grass	43.4	211.5	9185.2
		TOTAL:	478.9	24839.7
			CN=	52
			S=	9.28

Table 12 –Watershed Runoff for 2-Year, 5-Year, and 10-Year 24-Hour Storm

	Current Condition			Future Condition		
Frequency	**2-yr***	**5-yr**	**10-yr**	**2-yr***	**5-yr**	**10-yr**
24hr Rainfall (in)	1.8	2	2.5	1.8	2	2.5
Runoff (in)	0	0.001	0.033	0	0.002	0.042
Runoff Volume (acre-ft)	0	0.03	1.33	0	0.09	1.67
Peak Discharge (cfs)	0	0.020	0.994	0	0.066	1.251

*see explanation for 2-year event

The development of the project area causes a 16.5 percent increase in impervious area. The increase in impervious area increases the curve number for the watershed by 1. The larger curve number causes a 26 percent increase in runoff to the stream for the 10-year rainfall event.

Table 13 contains the values needed for computing the peak discharge. Because the I_a/P values are so large, Time of Concentration values did not need to be computed. All of the q_u values are the limiting value of 40 csm/in. The drainage area is 0.803 mi^2 (or 513.9 acres).

Table 13 –Values for Peak Discharge Calculation for Watershed

	Current			Future		
Frequency	2-yr*	5-yr	10-yr	2-yr*	5-yr	10-yr
24-hr Rainfall, P (in)	1.8	2	2.5	1.8	2	2.5
I_a (in)	1.922	1.922	1.922	1.846	1.846	1.846
I_a/P	1.068	0.961	0.769	1.026	0.923	0.738
Unit Peak Discharge, q_u	40	40	40	40	40	40
Runoff (in)	0	0.001	0.033	0	0.002	0.042
peak discharge (cfs)	0	0.020	0.994	0	0.066	1.251

*see explanation for 2-year event below

The peak discharge value does not have a high degree of accuracy. Because the watershed has non-homogeneous land cover, the unit peak discharge is inaccurate. The difference in land cover would cause different subareas of the watershed to peak at different times. The unit peak discharge is also inaccurate due to a high initial abstraction to precipitation ratio (I_a/P). Because the ratio is above 0.5 for each rainfall event, the limiting value is used reducing accuracy. The peak discharge value is only provided to give a rough estimate of the magnitude.

The SCS equation for runoff produces results that are not necessarily realistic for precipitation values less than the initial abstraction. A plot of runoff versus precipitation is shown below in Figure 5. The runoff values for precipitation less than the initial abstraction value should all be zero because runoff does not begin until after the initial abstraction. Because the 2-yr rainfall event has less precipitation than the initial abstraction, it can be assumed that the runoff would be near zero inches for both the current and future case. The calculations produced more runoff for the current condition, but that is just a due to the equation being used.

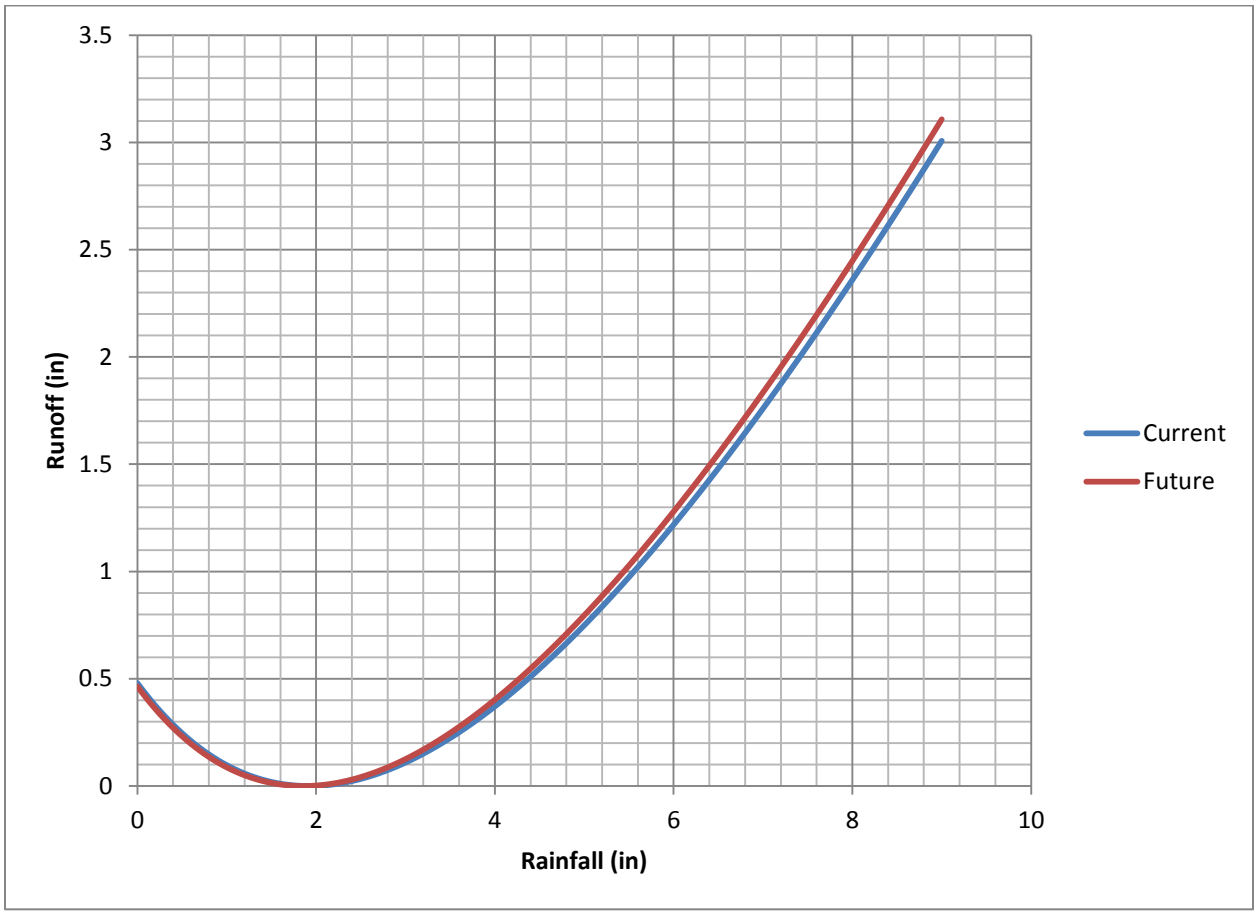

Figure 5 – Runoff versus Rainfall for the Current and Future Conditions in the Overall Watershed

The composite curve number method produced values by making a weighted curve number based on the percent area of the watershed. A large portion of the watershed is open space or residential which decreased the calculated composite curve number for the watershed. The smaller composite curve number would decrease the predicted runoff. The project area has a high curve number so it produces high runoff. Tables 6 and 8 show substantial runoff from the project area while Tables 12 and 13 do not. The composite curve number method is applying the average curve number of the entire watershed and applying it throughout the watershed, but this is not necessarily what occurs in reality. A more detailed analysis would be needed to produce accurate results since the watershed is not homogeneous in land cover. This analysis would require dividing the watershed into subareas, creating hydrographs for each subarea, and routing these hydrographs through the watershed.

References:

Monterey Peninsula Water Management District's Rules & Regulations (1980)

United States Census Bureau Quick Facts Monterey (2016)

TR-55, Urban Hydrology for Small Watersheds (1986)

City of Monterey Zoning Ordinance (2017)

USDA Web Soil Survey, National Cooperative Soil Survey (2017)

Attachments:

Map 1—Map of Project Area on Garden Road

Table A1—Existing Lot Sizes and Building Coverage

Table A2—Future Lot Sizes, Dwelling Units, and Building Coverage

Table A3—Current Sewer Return Flow for Each Parcel

Table A4—Future Sewer Return Flow for Each Parcel

Table A5—City of Monterey Sanitary Sewer Capacity

Table A6—Future Land Cover for Each Parcel

0 375 feet

Limited Mixed Use and Multi-family Residential Boundary

Source: ESRI 2017

Map 1 - Limited Mixed Use and Multi-family Residential Area in the Garden Road Corridor

Garden Road Zoning

E M C

Table A1 – Existing Lot Sizes and Building Coverage

ID # See Map 1	APN #	Total Acreage	Existing Developed Acreage	% of lot Coverage/ Excess Capacity	# of Stories *	Potential Residential Units Converted** / New	Notes
1	013352053000	1.3	0.35	27% / 3%	2	6.8/0.9	
2	013352011000	1.7	0.32	19% / 21%	1	6.2/7.8	
3	013352031000	1.5	0.44	29% / 1%	2	8.5/0.2	
4	013352049000	1.7	0.44	26% / 4%	2	8.5/1.5	
5	013352051000	5.7	0.35	6% / 24%	2	6.8/29.6	
6	013312016000	0.03	0				Well Site
7	013312016000	0.01	0				Well Site
8	001331204000	7.2	1.09	15% / 15%	2	21.1/23.3	
9***	013313003000	0.02	0.02	100% / none	2		
10***	013313004000	0.04	0.04	100% / none	2		
11	013313005000	0.34	0.34	100% / none	2	6.6/0	
12	013313006000	0.2	0.2	100% / none	2	3.9/0	
13***	013313007000	0.04	0.04	100% / none	2		
14	013312013000	0.18	0	0 / 30%		0/1.2	
15	013312012000	0.19	0.19	100% / none		3.7/0	
16	013312014000	2.8	0				Parking for 9-15
17	013312006000	7	0.31	4% / 26%	2	6.0/39.0	
18	013351004000	1.6	0				Set Back
19	013351003000	1.8	0.49	27% / 3%	2	9.5/1.1	
20	013351001000	1.8	0				Parking for 21-43
21	013352041000	0.03	0.03	100% / none			Office Building
22	013352042000	0.02	0.02	100% / none			Office Building
23	013352024000	0.03	0.03	100% / none			Office Building
24	013352021000	0.05	0.05	100% / none			Office Building
25	013352020000	0.01	0.01	100% / none			Office Building
26	013352019000	0.01	0.01	100% / none			Office Building
27	013352037000	0.01	0.01	100% / none			Office Building
28	013352036000	0.03	0.03	100% / none			Office Building
29	013352025000	0.01	0.01	100% / none			Office Building
30	013352045000	0.01	0.01	100% / none			Office Building
31	013352046000	0.01	0.01	100% / none			Office

ID # See Map 1	APN #	Total Acreage	Existing Developed Acreage	% of lot Coverage/ Excess Capacity	# of Stories *	Potential Residential Units Converted** / New	Notes
							Building
32	133520228000	0.01	0.01	100% / none			Office Building
33	013352029000	0.05	0.05	100% / none			Office Building
34	013352008000	0.01	0.01	100% / none			Office Building
35	013352053000	0.01	0.01	100% / none			Office Building
36	013352011000	0.01	0.01	100% / none			Office Building
37	013352031000	0.01	0.01	100% / none			Office Building
38	013352049000	0.05	0.05	100% / none			Office Building
39	013352051000	0.01	0.01	100% / none			Office Building
40	013352035000	0.01	0.01	100% / none			Office Building
41	013352050000	0.01	0.01	100% / none			Office Building
42	013352016000	0.01	0.01	100% / none			Office Building
43	013352015000	0.01	0.01	100% / none			Office Building
	Parcels 21-43	**0.42**	**0.42**	100% / none		8.1/0	
44	013322001000	0.7	0				Retention Basin
45	013322008000	0.78	0.24	31% / 9%	1	4.6/1.6	
46	013322010000	1	0.31	31% / none	2	6.0/0	
47	013322011000	0.6	0.2	33% / none	2	3.9/0	
48	013351002000	1.5	0.25	17% / 13%	2	4.8/4.4	
49	013322004000	6.2	0.81	13% / 17%	2	15.7/22.9	
50	013322013000	3.5	1	29% / 1%	2	19.4/1.1	
51	013322014000	2	0.35	18% / 13%	2	6.8/5.4	
52	013322006000	2.5	0.9	36% / 4%	1	17.4/2.2	
53	013321010000	1.5	0.16	11%/ 19%	2	3.1/6.3	
54	013321004000	2.5	0.12	5% / 35%	1	2.3/19.2	
55	013321003000	3	0.7	23% / 17%	1	13.6/10.9	
56	013361001000	1.6	0				Parking for 57-63
57	013362001000	0.12	0.12	100% / none		2.3/0	Office Building
58	013362002000	0.12	0.12	100% / none		2.3/0	Office Building

ID # See Map 1	APN #	Total Acreage	Existing Developed Acreage	% of lot Coverage/ Excess Capacity	# of Stories *	Potential Residential Units Converted** / New	Notes
59	013362011000	0.18	0.18	100% / none		3.5/0	Office Building
60	013362008000	0.08	0.08	100% / none		1.5/0	Office Building
61	013362009000	0.08	0.08	100% / none		1.5/0	Office Building
62	013362010000	0.1	0.1	100% / none		1.9/0	Office Building
63	013362012000	0.16	0.16	100% / none		3.1/0	Office Building
64	013321006000	3.8	0.5			Out	
65	013321007000	3	0.24	8% / 22%	2	4.6/14.4	
66	013311004000	7.7	0			Out	PF&E Storage Yard
67	013311003000	7.7	0.7			Out	
68	013311002000	10.8	1.9			Out	
69	013311005000	5.9	0.3			Out	
		101.19	14.56			214.1/192.9	

* Based on no more than 40% lot coverage for single story and 30% lot coverage for two or more stories.

** Based on no more than 40% allowed conversion to residential.

***Parcels not included due to not meeting square footage minimum for conversion

Table A2 – Future Lot Sizes, Dwelling Units, and Building Coverage

ID # See Map 1	APN #	Total Acreage	Existing Building Acreage	Potential Additional Building Acreage	Future Building Acreage	Potential Converted Units	Potential New Units	Total Potential Dwelling Units
1	013352053000	1.30	0.35	0.04	0.39	6.8	0.9	7.6
2	013352011000	1.70	0.32	0.36	0.68	6.2	7.8	14.0
3	013352031000	1.50	0.44	0.01	0.45	8.5	0.2	8.7
4	013352049000	1.70	0.44	0.07	0.51	8.5	1.5	10.0
5	013352051000	5.70	0.35	1.36	1.71	6.8	29.6	36.4
6	013312016000	0.03	0.00	0.00	0.00	0.0	0.0	0.0
7	013312016000	0.01	0.00	0.00	0.00	0.0	0.0	0.0
8	001331204000	7.20	1.09	1.07	2.16	21.1	23.3	44.4
9	013313003000	0.02	0.02	0.00	0.02	0.0	0.0	0.0
10	013313004000	0.04	0.04	0.00	0.04	0.0	0.0	0.0
11	013313005000	0.34	0.34	0.00	0.34	6.6	0.0	6.6
12	013313006000	0.20	0.20	0.00	0.20	3.9	0.0	3.9
13	013313007000	0.04	0.04	0.00	0.04	0.0	0.0	0.0
14	013312013000	0.18	0.00	0.05	0.05	0.0	1.2	1.2
15	013312012000	0.19	0.19	0.00	0.19	3.7	0.0	3.7
16	013312014000	2.80	0.00	0.00	0.00	0.0	0.0	0.0
17	013312006000	7.00	0.31	1.79	2.10	6.0	39.0	45.0
18	013351004000	1.60	0.00	0.00	0.00	0.0	0.0	0.0
19	013351003000	1.80	0.49	0.05	0.54	9.5	1.1	10.6
20	013351001000	1.80	0.00	0.00	0.00	0.0	0.0	0.0
21	013352041000	0.03	See Summation Below					
22	013352042000	0.02						
23	013352024000	0.03						
24	013352021000	0.05						
25	013352020000	0.01						
26	013352019000	0.01						
27	013352037000	0.01						
28	013352036000	0.03						
29	013352025000	0.01						
30	013352045000	0.01						
31	013352046000	0.01						
32	133520228000	0.01						
33	013352029000	0.05						
34	013352008000	0.01						
35	013352053000	0.01						
36	013352011000	0.01						
37	013352031000	0.01						
38	013352049000	0.05						

ID # See Map 1	APN #	Total Acreage	Existing Building Acreage	Potential Additional Building Acreage	Future Building Acreage	Potential Converted Units	Potential New Units	Total Potential Dwelling Units
39	013352051000	0.01						
40	013352035000	0.01						
41	013352050000	0.01						
42	013352016000	0.01						
43	013352015000	0.01						
	Parcels 21-43	0.42	0.42	0.00	0.42	8.1	0.0	8.1
44	013322001000	0.70	0.00	0.00	0.00	0.0	0.0	0.0
45	013322008000	0.78	0.24	0.07	0.31	4.6	1.6	6.2
46	013322010000	1.00	0.31	0.00	0.31	6.0	0.0	6.0
47	013322011000	0.60	0.20	0.00	0.20	3.9	0.0	3.9
48	013351002000	1.50	0.25	0.20	0.45	4.8	4.4	9.2
49	013322004000	6.20	0.81	1.05	1.86	15.7	22.9	38.6
50	013322013000	3.50	1.00	0.05	1.05	19.4	1.1	20.4
51	013322014000	2.00	0.35	0.25	0.60	6.8	5.4	12.2
52	013322006000	2.50	0.90	0.10	1.00	17.4	2.2	19.6
53	013321010000	1.50	0.16	0.29	0.45	3.1	6.3	9.4
54	013321004000	2.50	0.12	0.88	1.00	2.3	19.2	21.5
55	013321003000	3.00	0.70	0.50	1.20	13.6	10.9	24.4
56	013361001000	1.60	0.00	0.00	0.00	0.0	0.0	0.0
57	013362001000	0.12	0.12	0.00	0.12	2.3	0.0	2.3
58	013362002000	0.12	0.12	0.00	0.12	2.3	0.0	2.3
59	013362011000	0.18	0.18	0.00	0.18	3.5	0.0	3.5
60	013362008000	0.08	0.08	0.00	0.08	1.5	0.0	1.5
61	013362009000	0.08	0.08	0.00	0.08	1.5	0.0	1.5
62	013362010000	0.10	0.10	0.00	0.10	1.9	0.0	1.9
63	013362012000	0.16	0.16	0.00	0.16	3.1	0.0	3.1
64	013321006000	3.80	OUT					
65	013321007000	3.00	0.24	0.66	0.90	4.6	14.4	19.0
66	013311004000	7.70	OUT					
67	013311003000	7.70						
68	013311002000	10.80						
69	013311005000	5.90						
		TOTAL:	11.16	8.86	20.02	214.1	192.9	407.0

Table A3 – Current Sewer Return Flow for Each Parcel

ID # See Map 1	APN #	Existing Building Acreage	Existing Return Flow ADWF (gpd)	Existing Return Flow ADWF (gpm)
1	013352053000	0.350	953	0.66
2	013352011000	0.320	871	0.60
3	013352031000	0.440	1,198	0.83
4	013352049000	0.440	1,198	0.83
5	013352051000	0.350	953	0.66
6	013312016000	0.000	0	0.00
7	013312016000	0.000	0	0.00
8	001331204000	1.090	2,967	2.06
9	013313003000	0.020	54	0.04
10	013313004000	0.040	109	0.08
11	013313005000	0.340	925	0.64
12	013313006000	0.200	544	0.38
13	013313007000	0.040	109	0.08
14	013312013000	0.000	0	0.00
15	013312012000	0.190	517	0.36
16	013312014000	0.000	0	0.00
17	013312006000	0.310	844	0.59
18	013351004000	0.000	0	0.00
19	013351003000	0.490	1,334	0.93
20	013351001000	0.000	0	0.00
21	013352041000	0.030	See Summation Below	
22	013352042000	0.020		
23	013352024000	0.030		
24	013352021000	0.050		
25	013352020000	0.010		
26	013352019000	0.010		
27	013352037000	0.010		
28	013352036000	0.030		
29	013352025000	0.010		
30	013352045000	0.010		
31	013352046000	0.010		
32	133520228000	0.010		
33	013352029000	0.050		
34	013352008000	0.010		
35	013352053000	0.010		
36	013352011000	0.010		
37	013352031000	0.010		
38	013352049000	0.050		

ID # See Map 1	APN #	Existing Building Acreage	Existing Return Flow ADWF (gpd)	Existing Return Flow ADWF (gpm)
39	013352051000	0.010		
40	013352035000	0.010		
41	013352050000	0.010		
42	013352016000	0.010		
43	013352015000	0.010		
	Parcels 21-43	0.420	1,143	0.79
44	013322001000	0.000	0	0.00
45	013322008000	0.240	653	0.45
46	013322010000	0.310	844	0.59
47	013322011000	0.200	544	0.38
48	013351002000	0.250	680	0.47
49	013322004000	0.810	2,205	1.53
50	013322013000	1.000	2,722	1.89
51	013322014000	0.350	953	0.66
52	013322006000	0.900	2,450	1.70
53	013321010000	0.160	436	0.30
54	013321004000	0.120	327	0.23
55	013321003000	0.700	1,905	1.32
56	013361001000	0.000	0	0.00
57	013362001000	0.120	327	0.23
58	013362002000	0.120	327	0.23
59	013362011000	0.180	490	0.34
60	013362008000	0.080	218	0.15
61	013362009000	0.080	218	0.15
62	013362010000	0.100	272	0.19
63	013362012000	0.160	436	0.30
64	013321006000	OUT		
65	013321007000	0.240	653	0.45
66	013311004000	OUT		
67	013311003000			
68	013311002000			
69	013311005000			
		TOTAL:	28,581	21.1

Table A4 – Future Sewer Return Flow for Each Parcel

ID # See Map 1	APN #	Projected Non-Residential Building Area (SF)	Projected Non-Residential Return Flow (gpd)	Projected Residential DU	Projected Residential Return Flow (gpd)	Projected Total Return Flow (gpd)
1	013352053000	9,148	572	8	921	1,493
2	013352011000	8,364	523	14	1,691	2,213
3	013352031000	11,500	719	9	1,052	1,771
4	013352049000	11,500	719	10	1,210	1,928
5	013352051000	9,148	572	36	4,384	4,956
6	013312016000	0	0	0	0	0
7	013312016000	0	0	0	0	0
8	001331204000	28,488	1,780	44	5,349	7,129
9***	013313003000	871	54	0	0	54
10***	013313004000	1,742	109	0	0	109
11	013313005000	8,886	555	7	793	1,348
12	013313006000	5,227	327	4	466	793
13***	013313007000	1,742	109	0	0	109
14	013312013000	0	0	1	142	142
15	013312012000	4,966	310	4	443	753
16	013312014000	0	0	0	0	0
17	013312006000	8,102	506	45	5,419	5,925
18	013351004000	0	0	0	0	0
19	013351003000	12,807	800	11	1,274	2,074
20	013351001000	0	0	0	0	0
21	013352041000	See Summation Below				
22	013352042000					
23	013352024000					
24	013352021000					
25	013352020000					
26	013352019000					
27	013352037000					
28	013352036000					
29	013352025000					
30	013352045000					
31	013352046000					
32	133520228000					
33	013352029000					
34	013352008000					
35	013352053000					
36	013352011000					
37	013352031000					
38	013352049000					

ID # See Map 1	APN #	Projected Non-Residential Building Area (SF)	Projected Non-Residential Return Flow (gpd)	Projected Residential DU	Projected Residential Return Flow (gpd)	Projected Total Return Flow (gpd)
39	013352051000					
40	013352035000					
41	013352050000					
42	013352016000					
43	013352015000					
	Parcels 21-43	10,977	686	8	979	1,665
44	013322001000	0	0	0	0	0
45	013322008000	6,273	392	6	749	1,141
46	013322010000	8,102	506	6	723	1,229
47	013322011000	5,227	327	4	466	793
48	013351002000	6,534	408	9	1,108	1,516
49	013322004000	21,170	1,323	39	4,643	5,966
50	013322013000	26,136	1,633	20	2,463	4,096
51	013322014000	9,148	572	12	1,472	2,044
52	013322006000	23,522	1,470	20	2,361	3,831
53	013321010000	4,182	261	9	1,134	1,395
54	013321004000	3,136	196	21	2,588	2,784
55	013321003000	18,295	1,143	24	2,944	4,087
56	013361001000	0	0	0	0	0
57	013362001000	3,136	196	2	280	476
58	013362002000	3,136	196	2	280	476
59	013362011000	4,704	294	3	420	714
60	013362008000	2,091	131	2	187	317
61	013362009000	2,091	131	2	187	317
62	013362010000	2,614	163	2	233	397
63	013362012000	4,182	261	3	373	634
64	013321006000	OUT				
65	013321007000	6,273	392	19	2,291	2,683
66	013311004000	OUT				
67	013311003000					
68	013311002000					
69	013311005000					
	TOTAL:	293,420	18,338	407	49,024	67,361

Table A5 – City of Monterey Sanitary Sewer Capacity

U/S MH	D/S MH	L	S	d/D	Diameter	n	V	Q	Location
		(ft)	(ft/ft)	(in/in)	(in)	(-)	(ft/s)	(gpm)	
319	312A	260	0.0103	0.7	15	0.013	5.98	2463	Freeway Crossing
320	319	137	0.6	0.7	12	0.013	39.33	10366	
321	320	83	0.058	0.7	12	0.013	12.23	3223	
323	321	415	0.0182	0.7	10	0.013	6.07	1110	
328	323	190	0.0063	0.7	10	0.013	3.57	653	
329	328	119	0.015	0.7	12	0.013	6.22	1639	
330	329	115	0.016	0.7	12	0.013	6.42	1693	
331	330	131	0.02	0.7	12	0.013	7.18	1892	
332	331	98	0.13	0.7	12	0.013	18.31	4825	
333	332	60	0.026	0.7	12	0.013	8.19	2158	
347	333	75	0.008	0.7	10	0.013	4.02	736	Fairground Rd
602	347	312	0.0323	0.7	12	0.013	9.13	2405	
603	602	109	0.0897	0.7	10	0.013	13.47	2465	
604	603	179	0.0231	0.7	10	0.013	6.83	1251	Navy GC
605	604	340	0.019	0.7	10	0.013	6.20	1134	Navy GC
606	605	349	0.0169	0.7	10	0.013	5.85	1070	Navy GC
607	606	301	0.0261	0.7	10	0.013	7.26	1329	Navy GC
608	607	418	0.0758	0.7	10	0.013	12.38	2266	Navy GC
609	608	472	0.0093	0.7	10	0.013	4.34	794	Navy GC
610	609	362	0.019	0.7	10	0.013	6.20	1134	Navy GC
611	610	361	0.0119	0.7	10	0.013	4.90	898	Garden Rd
612	611	615	0.0112	0.7	10	0.013	4.76	871	
613	612	320	0.0113	0.7	10	0.013	4.78	875	
614	613	745	0.0469	0.7	10	0.013	9.74	1782	
615	614	125	0.0062	0.7	12	0.013	4.00	1054	
616	615	262	0.0026	0.7	12	0.013	2.59	682	
617	616	276	0.0033	0.7	12	0.013	2.92	769	
618	617	328	0.0025	0.7	12	0.013	2.54	669	
619	618	372	0.0032	0.7	12	0.013	2.87	757	
620	619	385	0.0024	0.7	12	0.013	2.49	656	
621	620	576	0.0019	0.7	12	0.013	2.21	583	Olmstead Rd
622	621	337	0.0015	0.7	12	0.013	1.97	518	
623	622	444	0.0019	0.7	8	0.013	1.69	198	
624	623	428	0.0415	0.7	8	0.013	7.89	924	
625	624	350	0.0296	0.7	8	0.013	6.67	781	
626	625	259	0.0403	0.7	8	0.013	7.78	911	

Table A6 – Future Land Cover for Each Parcel

ID # See Map 1	APN #	Total Acreage	Potential Total Parking Acreage	Potential Building Acreage	Potential Impervious acreage	Potential Pervious acreage
1	013352053000	1.30	0.40	0.39	0.79	0.51
2	013352011000	1.70	0.54	0.68	1.22	0.48
3	013352031000	1.50	0.48	0.45	0.93	0.57
4	013352049000	1.70	0.51	0.51	1.02	0.68
5	013352051000	5.70	1.11	1.71	2.82	2.88
6	013312016000	0.03	0.00	0.00	0.03	0.00
7	013312016000	0.01	0.00	0.00	0.01	0.00
8	001331204000	7.20	1.74	2.16	3.90	3.30
9	013313003000	0.02	0.00	0.02	0.02	0.00
10	013313004000	0.04	0.00	0.04	0.04	0.00
11	013313005000	0.34	0.00	0.34	0.34	0.00
12	013313006000	0.20	0.00	0.20	0.20	0.00
13	013313007000	0.04	0.00	0.04	0.04	0.00
14	013312013000	0.18	0.00	0.05	0.05	0.13
15	013312012000	0.19	0.00	0.19	0.19	0.00
16	013312014000	2.80	2.80	0.00	2.80	0.00
17	013312006000	7.00	1.30	2.10	3.40	3.60
18	013351004000	1.60	0.00	0.00	0.00	1.60
19	013351003000	1.80	0.55	0.54	1.09	0.71
20	013351001000	1.80	1.80	0.00	1.80	0.00
21	013352041000	See Summation Below				
22	013352042000					
23	013352024000					
24	013352021000					
25	013352020000					
26	013352019000					
27	013352037000					
28	013352036000					
29	013352025000					
30	013352045000					
31	013352046000					
32	133520228000					
33	013352029000					
34	013352008000					
35	013352053000					
36	013352011000					
37	013352031000					
38	013352049000					

ID # See Map 1	APN #	Total Acreage	Potential Total Parking Acreage	Potential Building Acreage	Potential Impervious acreage	Potential Pervious acreage
39	013352051000					
40	013352035000					
41	013352050000					
42	013352016000					
43	013352015000					
	Parcels 21-43	0.42	0.00	0.42	0.42	0.00
44	013322001000	0.70	0.00	0.00	0.00	0.70
45	013322008000	0.78	0.30	0.31	0.61	0.17
46	013322010000	1.00	0.33	0.31	0.64	0.36
47	013322011000	0.60	0.21	0.20	0.41	0.19
48	013351002000	1.50	0.38	0.45	0.83	0.67
49	013322004000	6.20	1.43	1.86	3.29	2.91
50	013322013000	3.50	1.10	1.05	2.15	1.35
51	013322014000	2.00	0.51	0.60	1.11	0.89
52	013322006000	2.50	1.02	1.00	2.02	0.48
53	013321010000	1.50	0.33	0.45	0.78	0.72
54	013321004000	2.50	0.60	1.00	1.60	0.90
55	013321003000	3.00	1.02	1.20	2.22	0.78
56	013361001000	1.60	1.60	0.00	1.60	0.00
57	013362001000	0.12	0.00	0.12	0.12	0.00
58	013362002000	0.12	0.00	0.12	0.12	0.00
59	013362011000	0.18	0.00	0.18	0.18	0.00
60	013362008000	0.08	0.00	0.08	0.08	0.00
61	013362009000	0.08	0.00	0.08	0.08	0.00
62	013362010000	0.10	0.00	0.10	0.10	0.00
63	013362012000	0.16	0.00	0.16	0.16	0.00
64	013321006000	3.80	OUT			
65	013321007000	3.00	0.61	0.90	1.51	1.49
66	013311004000	7.70	OUT			
67	013311003000	7.70				
68	013311002000	10.80				
69	013311005000	5.90				
		TOTAL:	20.0	20.0	40.7	26.1