

[Client Name]

[PROJECT NAME]

[REPORT NAME]

TABLE OF CONTENTS

Page No.

Chapter 3	3-1
3.1 SUMMARY	3-1
3.2 BACKGROUND.....	3-1
3.3 POPULATION	3-2
3.3.1 Morro Bay Population Information	3-2
3.3.2 Cayucos Population Information.....	3-3
3.4 ANNUAL AVERAGE DAILY FLOW.....	3-3
3.4.1 Morro Bay Annual Average Daily Flow	3-3
3.4.2 Cayucos Annual Average Daily Flow.....	3-5
3.5 PEAK SEASONAL DRY WEATHER FLOW.....	3-7
3.6 AVERAGE DAY MAXIMUM MONTH FLOW.....	3-9
3.7 PEAK HOURLY FLOW.....	3-10
3.8 PROJECTED INFLUENT FLOWS	3-11
3.8.1 Morro Bay Projected Influent Flows.....	3-11
3.8.2 Cayucos Sanitary District Projected Influent Flows	3-12
3.9 HISTORICAL INFLUENT LOADINGS.....	3-13
3.9.1 General.....	3-13
3.9.2 Influent BOD ₅	3-13
3.9.3 Influent TSS.....	3-16
3.10 HISTORICAL PLANT PERFORMANCE	3-16
3.10.1 Effluent BOD ₅	3-16
3.10.2 Effluent TSS.....	3-18
3.11 PROJECTED INFLUENT LOADINGS.....	3-18
3.11.1 BOD ₅	3-19
3.11.2 TSS	3-19
3.11.3 Summary of Projected Influent Flows and Loadings	3-19

LIST OF REFERENCES

1. "Sewer Collection System Master Plan Update", prepared by the Wallace Group, for the City of Morro Bay, May 2006.
2. "2004 Water Management Plan Update", prepared by Boyle Engineering Corporation, for the Cayucos Area Water Organization, October 2005.

LIST OF TABLES

Table 3.1	Flow Contributions from Morro Bay and Cayucos	3-2
Table 3.2	Morro Bay Historical AAD Flows.....	3-5
Table 3.3	Cayucos Sanitary District Historical Water Service Connections	3-6
Table 3.4	Cayucos Sanitary District Wastewater Flows Per Service Connection	3-7
Table 3.5	Morro Bay Historical AADF and PSDWF	3-8
Table 3.6	Cayucos Sanitary District Historical AADF and PSDWF	3-8
Table 3.7	Morro Bay Historical AADF and ADMM Flows	3-9
Table 3.8	Cayucos Sanitary District Historical AADF and ADMM Flows.....	3-9
Table 3.9	Morro Bay Flow Projections Factors.....	3-10
Table 3.10	Cayucos Sanitary District Flow Projection Factors	3-11
Table 3.11	Morro Bay Projected Influent Flows.....	3-11
Table 3.12	Cayucos Sanitary District Projected Influent Flows	3-12
Table 3.13	Total Projected Influent Flows	3-13
Table 3.14	Historical Influent BOD ₅ Loading	3-15
Table 3.15	Existing Design Criteria	3-15
Table 3.16	Historical Influent TSS Loading	3-16
Table 3.17	Historical Effluent BOD ₅	3-18
Table 3.18	Historical Effluent TSS.....	3-18
Table 3.19	Summary of Design Influent Flows and Loadings	3-19

LIST OF FIGURES

Figure 3.1	Historical Monthly Average Flows.....	3-4
Figure 3.2	Historical Monthly Average BOD ₅ Concentrations.....	3-14
Figure 3.3	Historical Monthly Average TSS Concentrations.....	3-17

HISTORICAL AND PROJECTED FLOWS AND LOADINGS

3.1 SUMMARY

The purpose of this chapter is to summarize the historical and projected flows and loadings for the MBCSD WWTP during the twenty-year planning period. New flows and loadings projections will be used to design treatment alternatives discussed later in this report as well as aid the City of Morro Bay (City) and the Cayucos Sanitary District (CSD) in creating a new joint powers agreement.

Because of the nature of the WWTP, flows and loadings were determined for Morro Bay and Cayucos separately. While a traditional per capita flow approach was followed for the City, flow projections for the CSD were determined using historical sewer connection data provided by CSD staff. Several flow conditions were included for the analysis including the average annual daily flow (AADF), the peak seasonal dry weather flow (PSDWF), the average day maximum month flow, and the peak hour (PH) flow. The PSDWF condition is the average daily flow of the greater month between July and August, and was chosen because it encompasses the traditional peak tourist season for the service area. The PSDWF represents the worst-case scenario the WWTP encounters for organic loading.

Based on flow analysis, the City will reach build-out in 2021 with a PSDWF of 1.05 mgd, and the CSD will reach build-out in 2015 with a PSDWF of 0.40 mgd. At the end of the twenty-year planning period, the total PSDWF at the WWTP will be 1.45 mgd with the City contributing 72 percent of the total flow, slightly less than its current five-year average of 77 percent. This new total PSDWF is less than the existing design capacity of 2.36 mgd. The current split in WWTP ownership is

Historical plant data has shown that the strength of the wastewater at the WWTP is greater than the existing design criteria for 5-day biochemical oxygen demand (BOD5) and total suspended solids (TSS). The five-year average PSDW BOD5 and TSS concentrations are 409 milligrams per liter (mg/L) and 416 mg/L respectively. For the design of treatment alternatives, a BOD5 concentration of 410 mg/L and a TSS concentration of 420 mg/L will be used. This increase in wastewater strength and a corresponding decrease in PSDWF results in new loadings, which are consistent with the existing design criteria.

The PH flow was also evaluated and a flow factor of 4.5 was chosen. Therefore, the MBCSD WWTP will need to be designed to pass 5.92 mgd during heavy storm events.

3.2 BACKGROUND

The flows received by the MBCSD WWTP originate from two distinct locations. An average of 77 percent of the total flow is generated within the City, and the remaining 23 percent travels from the CSD by way of a dedicated trunk line. Table 3.1 shows the relationship

between total flow and the contribution from each community between 2001 and 2005. The two flows converge outside of the City and flow by gravity in a 30-inch diameter, jointly owned trunk running in Main Street to the headworks of the WWTP. Because of this unique situation and the nature of flows from both communities, flows and loadings for this chapter will be analyzed for each community separately in order to ensure the most accurate future design projections.

Table 3.1 Flow Contributions from Morro Bay and Cayucos Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District						
	Morro Bay	Average Annual Daily Flows (mgd)		Total	Percent of Total (%)	
			Cayucos			
2001	1.22		0.28	1.50	81%	19%
2002	0.90		0.26	1.16	78%	22%
2003	0.79		0.27	1.06	74%	26%
2004	0.81		0.28	1.10	74%	26%
2005	0.94		0.32	1.25	75%	25%
5-Year Average					77%	23%

Flow data for both the City and the CSD is available from 1986 to present day. However, there is an observed marked decrease in average flow at the WWTP beginning in 2002. This decrease in flow can be partially attributed to the installation of a new Palmer Bowlus Flume in August 2001 in the Main Street trunk upstream of the headworks. In order to ensure the accuracy of future projections, only flows recorded using the new flume will be used to determine per capita usage and the necessary design flow factors.

3.3 POPULATION

Based on the 2000 census, the combined current population for the City and CSD is approximately 13,293 (10,350 for Morro Bay, and 2,943 for Cayucos). It should be noted that the population in the two communities has remained relatively constant over the past decade. In 1984, the City passed Measure F, which established an ultimate population cap of 12,200. Similarly in 1985, a building moratorium was enacted for Cayucos to curb increasing water usage in the community.

3.3.1 Morro Bay Population Information

A report recently prepared for the City in May 2006 by the Wallace Group titled Sewer Collection System Master Plan Update (Master Plan) (REF 1) uses an estimate of 12,500 as the ultimate build-out population for the City. This estimate was provided for the Master Plan by the Morro Bay Planning Department and will be used as the City build-out for the

calculation of flow projections in this report. Population growth for the Master Plan was based on an increase of approximately 60 housing units per year or 125 people per year. Based on this growth rate, the City will reach build-out capacity in approximately 16 years.

Economic Research Associates (ERA) recently developed population projections in a report for the San Luis Obispo Council of Governments (SLOCOG) in May 2006. The report titled Long Range Socio-Economic Projections (Year 2030) provides population projections for all incorporated and unincorporated cities in San Luis Obispo County. Their projections anticipate an annual growth rate for the City between 0.58 and 0.80 percent through 2030. Based on an annual growth rate of 0.80, the City is expected to reach its ultimate build-out population in 2027, or approximately 22 years.

The similarities between the population projections obtained from the Master Plan and those obtained from SLOCOG validate the assumptions made in the Master Plan. Using the assumptions outlined in both reports, the estimated time needed to reach the build-out population for the City are within six years of each other. Therefore, in order to determine future flows generated by the City for this report, a build-out population of 12,500 with an annual growth rate of 125 people per year will be used in order to be consistent with the Master Plan.

3.3.2 Cayucos Population Information

Although population will not be used directly to develop future flow projections for the CSD service area, population data was obtained from SLOCOG for Cayucos. Growth projections for Cayucos are even more conservative than for Morro Bay at 0.59 and 0.60 percent growth annually. The methods used to develop flow projections for the CSD will be based on historical sewer connection data detailed in Section 3.4.2 of this report.

3.4 ANNUAL AVERAGE DAILY FLOW

3.4.1 Morro Bay Annual Average Daily Flow

For Morro Bay, the relationship between past population and annual average daily flows (AADF) is used to determine the wastewater flows per capita in gallons per day (gpcd). The historical gpcd is then used to estimate the projected gpcd for the twenty-year planning period. The flows used to determine the gpcd include the flows into the WWTP that come from the City only. Historical AADF for the last four years are shown in Table 3.2 and graphically represented on Figure 3.1.

Figure 3.1 Historical Monthly Average Flows

Table 3.2 Morro Bay Historical AAD Flows Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District			
Year	Population¹	Flow (mgd)	Per Capital Flow (gpcd)
2002	10,502	0.90	85
2003	10,490	0.79	75
2004	10,531	0.81	77
2005	10,535	0.94	89
5-Year Average		0.86	82
Note:			
1. California Department of Finance Demographic Research Unit.			

The calculated average value for the per capita wastewater flow for the past four years is 82 gpcd. This value is similar to the 80 gpcd used in the Master Plan. Therefore, for the purpose of this report, a per capita flow rate of 80 gpcd will be used for projecting future annual average daily flows.

3.4.2 Cayucos Annual Average Daily Flow

The approach to flow analysis for the CSD for this report is handled differently than for the City. Because of the size of the community and its relatively slow population growth in recent years, the use of population data to determine per capita use and future projections could result in inaccurate flow estimates. For these reasons, historical sewer connection data provided by CSD staff and water use data from the Cayucos Area Water Organization (CAWO) will be used to provide accurate estimates of past and future wastewater flows. This approach is aided by the fact that Cayucos has a limited number of vacant lots and hence sewer connections that are available for new construction, which sets an ultimate boundary for future flows.

In October 2005, Boyle Engineering completed the 2004 Water Management Plan Update (Water Plan) for the CAWO (REF 2). The CAWO is comprised of the four water providers that service the entire Cayucos area. These purveyors are the Paso Robles Beach Water Association (PRBWA), Morro Rock Mutual Water Company (MRM), County Service Area 10A (CSA-10A), and the Cayucos Cemetery District. The Water Plan includes a ten-year historical average for the total number of active service connections in the area and total water usage. The information regarding water usage for active service connections in Cayucos will be used to validate estimates made for historical wastewater flows generated per sewer connection for this report.

Two additional assumptions that will be adapted from the Water Plan to aid flow analysis is an assumed vacancy rate and an estimated occupancy density. Due to the large number of vacation residences located in Cayucos, an average vacancy rate of 9 percent was assumed for past and future flow calculations. The occupancy density used both in this report and the Water Plan is 2.08, which is consistent with other coastal cities including Morro Bay. Information obtained from CSD staff regarding sewer connections includes an estimate for the total number of active service connections currently in the CSD, the number of new service connections made between 1996 and present day, and the total number of connections available for future growth. All of the sewer connection data obtained from CSD staff is given in equivalent dwelling units (EDU).

In order to establish the number of connections for each year between 1996 and present day, an annual growth rate of 1.01 percent for the connections was determined based on information provided by CSD staff. The number of sewer connections for the years between 1996 and present day were interpolated using this growth rate. The number of active sewer connections by year can be seen in Table 3.3.

Table 3.3 Cayucos Sanitary District Historical Water Service Connections Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District	
Year	Number of Service Connections¹
1996	2,369
1997	2,393
1998	2,417
1999	2,441
2000	2,466
2001	2,491
2002	2,516
2003	2,541
2004	2,567
2005	2,593
2006	2,619

Note:
 1. Number of connections based on an annual growth rate of 1.01% between 1995 and 2006.

For the CSD, the number of service connection is used to establish the average wastewater flow per connection. Table 3.4 shows the historical wastewater flows attributed to each connection and per capita flows for the last four years.

Table 3.4 Cayucos Sanitary District Wastewater Flows Per Service Connection Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District				
Year	Number of Service Connections¹	AADF (mgd)	Flow per EDU (gpd)²	Per Capita Flow (gpcd)³
2002	2,516	0.26	113	54
2003	2,541	0.27	117	56
2004	2,567	0.28	121	58
2005	2,593	0.32	134	65
4-Year Average			121	58
Notes:				
1. Expressed in number of EDUs and based on an annual growth rate of 1.01%.				
2. Assumes a vacancy rate of 9%.				
3. Based on an occupancy density of 2.08 capita per EDU.				

The calculated average flow per connection is 121 gallons per day (gpd) per connection and the average per capita flow is 58 gpcd. For the purpose of this report, the average flow per connection of 120 gpd is used along with the number of connections to determine future AADF. As mentioned previously, the information obtained from the Water Plan can be used to validate the assumption of 120 gpd made for flow generation per sewer connection. According to the Water Plan, the average total water use for active connections was 176.8 gpd per connection. Flow generation of 110 gpd per connection represents approximately 68 percent of total water usage.

Although slight discrepancies exist for per capita flow between the City and CSD, the figures obtained during this flow analysis are within the range recommended in Wastewater Engineering (Metcalf and Eddy) for an EDU with an occupancy density of two capita per EDU. These discrepancies are most likely due to the high vacancy rates found in Cayucos as well as the small population.

3.5 PEAK SEASONAL DRY WEATHER FLOW

While it is important to incorporate the hydraulic capacity of a WWTP into the design process, other flow characteristics are needed to determine design parameters such as organic and solid loadings. Since maximum month flows include wet weather flows, the presence of rainwater in the system results in the dilution of normal sanitary sewer influent at the WWTP. For this reason, an analysis of the peak seasonal dry weather flow (PSDWF) is included in this report. Because of the nature of the two communities in the study area and the heavy influence of summer tourism, the PSDWF represents the average monthly flow that is greater between the months of July and August. Future PSDWF is determined by analyzing the ratio of the historical PSDWF to the AADF of the previous five years is determined. As shown in Table 3.5 and Table 3.6, the average PSDWF to AADF ratio for

the City for the most recent five-year period is 1.03, and for the CSD is 1.23. Therefore, a 1.05 and 1.25 PSDWF to AADF flow factor will be used to determine the PSDWF for the future planning period for the City and CSD respectively. Using the PSDWF for WWTP design is consistent with other coastal communities including the City of Pismo Beach.

Table 3.5 Morro Bay Historical AADF and PSDWF Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District				
Year	Population	AADF (mgd)	PSDWF¹ (mgd)	PSDWF:AADF Factor
2001	10,420	1.22	1.31	1.07
2002	10,502	0.90	0.83	0.93
2003	10,490	0.79	0.88	1.12
2004	10,531	0.81	0.82	1.01
2005	10,535	0.94	0.96	1.02
5-Year Average				1.03
Note:				
1. Peak Seasonal represents the greater month of July and August.				

Table 3.6 Cayucos Sanitary District Historical AADF and PSDWF Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District			
Year	AADF (mgd)	PSDWF¹ (mgd)	PSDWF:AADF Factor
2001	0.28	0.28	1.02
2002	0.26	0.37	1.43
2003	0.27	0.33	1.24
2004	0.28	0.35	1.25
2005	0.32	0.39	1.23
5-Year Average			
Note:			
1. Peak Seasonal represents the greater month of July and August.			

Discrepancies are apparent between the ratio of PSDWF to AADF for the City and CSD. While the ratio for the City is consistent with other coastal cities such as Pismo Beach, the ratio for the CSD is significantly higher. This discrepancy can again be attributed to the relatively small population of Cayucos. According to Metcalf and Eddy, wastewater flow peaking factors begin to sharply decrease as populations surpass 5,000 people. Since the

current population of Cayucos is approximately 3,000 and the City is more than 10,000, the CSD service area would be expected to have a higher peaking factor for PSDWF.

3.6 AVERAGE DAY MAXIMUM MONTH FLOW

The design of a WWTP can be based on the average day maximum month flow (ADMMF), which may include wet weather month flows. Using this approach the WWTP will have the capacity to treat the wastewater from the maximum month conditions as well as the average month. To project the ADMM flows, the ratio of the historical ADMMF to the AADF of the previous five years is determined. As shown in Table 3.7 and Table 3.8, the average ADMMF to AADF ratio for the City for the most recent five-year period is 1.19, and for the CSD is 1.30. Therefore, a 1.20 and 1.30 ADMMF to AADF flow factor will be used to determine the ADMMF for the future planning period for the City and CSD respectively. These values are typical for a coastal city.

Table 3.7 Morro Bay Historical AADF and ADMM Flows Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District				
Year	Population	AADF (mgd)	ADMM (mgd)	ADMM:AADF Factor
2001	10,420	1.22	1.46	1.19
2002	10,502	0.90	1.20	1.34
2003	10,490	0.79	0.88	1.12
2004	10,531	0.81	0.89	1.10
2005	10,535	0.94	1.11	1.19
5-Year Average				1.19

Table 3.8 Cayucos Sanitary District Historical AADF and ADMM Flows Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District			
Year	AADF (mgd)	ADMM (mgd)	ADMM:AADF Factor
2001	0.28	0.35	1.26
2002	0.26	0.37	1.43
2003	0.27	0.33	1.24
2004	0.28	0.35	1.25
2005	0.32	0.42	1.32
5-Year Average			1.30

3.7 PEAK HOURLY FLOW

The peak hourly (PH) flow is required to make certain pipelines, meters, and other critical hydraulic appurtenances are sized adequately, and to minimize any potential for flooding or overflow during high flow events. Usually, wastewater flows increase in wet weather because of infiltration and inflow. To determine this peaking factor, the peak hourly flows during large storm events are compared to the average daily flows. For this analysis, the peak rainfall recorded in Morro Bay in 2004 - 2005 was in December 2004 and January 2005. The hourly flow monitoring data was reviewed for this period. The flow data on December 31, 2004 revealed that the peak flow at the WWTP in the early morning hours was abnormally high and exceeded the maximum flow range for the flume. These readings may have been caused by back up in the flume caused by the bar screens or wet well at the headworks facility. With the exception of these two readings, the flow readings for the remainder of the event were within the flow range of the flume. Disregarding these abnormal readings, the peak hourly flow for the event was 5.49 mgd. Compared to an AADF of 1.25 mgd, the ratio of PH flow to AADF was 4.39. For the purpose of this report, the PH flow will be 4.5 times the AADF. This factor is consistent with the PH flow sited in the Master Plan for the City.

The flow projection factors and the corresponding flows to be used in this analysis are presented in Table 3.9 and Table 3.10 below.

Table 3.9 Morro Bay Flow Projections Factors Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District	
Flow Condition	Flow Projection Factor
Average Wastewater Flow per Person per Day (gpcd)	80
Average Annual Daily Flow (AADF)	1.0
Average Day Maximum Month Flow (ADMM)	1.20
Peak Seasonal Dry Weather Flow (PSDWF)	1.05
Peak Hourly (PH) Flow	4.5

Table 3.10 Cayucos Sanitary District Flow Projection Factors Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District	
Flow Condition	Flow Projection Factor
Average Wastewater Flow per Connection per Day (gpd)	120
Average Annual Daily Flow (AADF)	1.0
Average Day Maximum Month Flow (ADMM)	1.30
Peak Seasonal Dry Weather Flow (PSDWF)	1.25
Peak Hourly (PH) Flow	4.5

3.8 PROJECTED INFLUENT FLOWS

3.8.1 Morro Bay Projected Influent Flows

Applying the above flow projection factors to the estimated future population for the City at a growth rate of 125 people per year, results in the following projected yearly flows as shown in Table 3.11 below. Based on the current growth rate, the City will reach its maximum build-out capacity in 2021 with a PSDWF of 1.05 mgd.

Table 3.11 Morro Bay Projected Influent Flows Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District					
Year	Population¹	AADF (mgd)	ADMMF (mgd)	PSDWF (mgd)	PHF (mgd)
2005	10,535	0.84	1.01	0.88	3.79
2006	10,660	0.85	1.02	0.90	3.84
2007	10,785	0.86	1.04	0.91	3.88
2008	10,910	0.87	1.05	0.92	3.93
2009	11,035	0.88	1.06	0.93	3.97
2010	11,160	0.89	1.07	0.94	4.02
2011	11,285	0.90	1.08	0.95	4.06
2012	11,410	0.91	1.10	0.96	4.11
2013	11,535	0.92	1.11	0.97	4.15
2014	11,660	0.93	1.12	0.98	4.20
2015	11,785	0.94	1.13	0.99	4.24
2016	11,910	0.95	1.14	1.00	4.29
2017	12,035	0.96	1.16	1.01	4.33

Table 3.11 Morro Bay Projected Influent Flows Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District					
2018	12,160	0.97	1.17	1.02	4.38
2019	12,285	0.98	1.18	1.03	4.42
2020	12,410	0.99	1.19	1.04	4.47
2021	12,500	1.00	1.20	1.05	4.50
Note:					
1. Assumes a 125-person yearly growth rate for years 2006 and beyond.					

3.8.2 Cayucos Sanitary District Projected Influent Flows

Applying the above flow projection factors to the estimated future number of service connections for the CSD at a growth rate of 1.01 percent annually, results in the following projected yearly flows as shown in Table 3.12 below. This reveals, based on the current growth rate of connections, the CSD will reach its maximum number of available connections in 2015 with a PSDWF of 0.40 mgd.

Table 3.12 Cayucos Sanitary District Projected Influent Flows Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District					
Year	Number of Service Connections¹	AADF (mgd)²	ADMMF (mgd)	PSDWF (mgd)	PHF (mgd)
2006	2,619	0.29	0.38	0.36	1.30
2007	2,645	0.29	0.38	0.37	1.31
2008	2,672	0.29	0.38	0.37	1.33
2009	2,699	0.30	0.39	0.37	1.34
2010	2,726	0.30	0.39	0.38	1.35
2011	2,753	0.30	0.40	0.38	1.37
2012	2,781	0.31	0.40	0.38	1.38
2013	2,809	0.31	0.40	0.39	1.40
2014	2,838	0.31	0.41	0.39	1.41
2015	2,865	0.32	0.41	0.40	1.42
Notes:					
1. Expressed in number of EDUs and based on an annual growth rate of 1.01%.					
2. Assumes a vacancy rate of 9%.					

Table 3.13 below shows the combined projected future influent wastewater flows for major milestones throughout the twenty-year planning period. At 2021, the influent flow at the WWTP will reach a maximum combined PSDWF of 1.45 mgd.

Table 3.13 Total Projected Influent Flows Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District				
Year	AADF (mgd)	ADMMF (mgd)	PSDWF (mgd)	PHF (mgd)
2006	1.14	1.40	1.26	5.14
2007	1.15	1.42	1.27	5.20
2008	1.17	1.43	1.29	5.25
2009	1.18	1.45	1.30	5.31
2010	1.19	1.46	1.31	5.37
2011 ¹	1.21	1.48	1.33	5.43
2015 ²	1.26	1.54	1.39	5.67
2021 ³	1.32	1.61	1.45	5.92
2026 ⁴	1.32	1.61	1.45	5.92
Notes:				
1. Anticipated design start date.				
2. Build-out of 2,865 connections for CSD reached.				
3. Build-out population of 12,500 for Morro Bay reached.				
4. End of 20-year planning period.				

3.9 HISTORICAL INFLUENT LOADINGS

3.9.1 General

Generally, wastewater strength is defined by its 5-day biochemical oxygen demand (BOD₅) and total suspended solids (TSS) content. The BOD₅ is described as the amount of oxygen required over a five-day period at 20 degrees Celsius by bacteria while stabilizing the decomposable organic matter under aerobic conditions. The TSS is a measure of the suspended material in the influent.

3.9.2 Influent BOD₅

Historical influent BOD₅ loadings for the past five years are shown in Table 3.14 below and graphically in Figure 3.2. The five-year historical BOD₅ concentration for this period was 338 milligrams per liter (mg/L) for the annual average loads, and 409 mg/L for the peak SDWF average loads.

Figure 3.2 Historical Monthly Average BOD₅ Concentrations

Table 3.14 Historical Influent BOD₅ Loading Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District					
Year	Annual Average		Peak Seasonal		PSDW:AAD Factor ¹
	mg/L	ppd	mg/L	ppd	
2001	362	3,715	495	5,169	1.39
2002	386	3,711	425	3,781	1.02
2003	306	2,702	356	3,572	1.32
2004	336	3,074	406	3,811	1.24
2005	303	3,171	365	4,102	1.29
5-Year Average					
Notes:					
1. Factor for annual average ppd to peak seasonal ppd.					
2. Peak seasonal represents the greater month between July and August.					

Table 3.15 Existing Design Criteria Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District	
Parameters	PSDW
Flow	2.36
BOD ₅	280
BOD ₅ Loading, ppd	5,510
TSS - mg/L	280
TSS - Loading, ppd	5,510

Design criteria from the 1982 construction plans prepared by Brown and Caldwell can be seen in Table 3.15.

Based on a review of the plant data and historic design criteria, a PSDWF BOD₅ concentration of 410 mg/L and an AADF BOD₅ concentration of 340 mg/L will be used as future design values. It should be noted that the peak seasonal loadings represented the maximum month loadings for 2001, 2003, 2004, and 2005. These findings are consistent with the highest expected loadings occurring during the summer tourism season of July and August.

3.9.3 Influent TSS

Historical influent TSS loadings for the past five years are shown in Table 3.16 below and graphically on Figure 3.3. The five-year historical TSS concentration for this period was 357 mg/L for the annual average, and 416 mg/L for the peak seasonal average loads.

Table 3.16 Historical Influent TSS Loading Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District					
Year	Annual Average		Peak Seasonal		PSDW:AAD Factor ¹
	mg/L	ppd	mg/L	ppd	
2001	373	3,860	422	4,409	1.13
2002	374	3,576	492	4,707	1.32
2003	311	2,753	340	3,458	1.09
2004	354	3,225	418	3,929	1.18
2005	373	3,906	406	4,562	1.09
5-Year Average	357		416		1.16
Notes:					
1. Factor for ppd to peak seasonal ppd.					
2. Peak seasonal represents the greater month between July and August.					

Based on a review of the plant data and historic design criteria, a PSDWF TSS concentration of 420 mg/L, and an AADF TSS concentration of 360 mg/L will be used as design values.

3.10 HISTORICAL PLANT PERFORMANCE

The records for the effluent quality from the WWTP for the last five years have also been reviewed and tabulated. Generally, the WWTP has produced an excellent quality effluent that is well below the limits established by its 301(h) waiver permit for BOD₅ and TSS.

3.10.1 Effluent BOD₅

The effluent BOD₅ represented in both concentration (mg/L) and loading (ppd) is shown in Table 3.17 below. Based on this data, over the last five years the plant effluent has averaged 58 mg/L. The corresponding BOD₅ removal rates, determined from comparing the annual average influent and effluent concentration values, have also been shown with a five-year average BOD₅ removal rate of 82.6 percent. As mentioned previously, both of these parameters exceed the requirements of the current discharge permit, WDR No. 98-15, which stipulates a 30-day average BOD₅ concentration less than 120 mg/L and removal efficiency greater than 30 percent before ocean discharge.

Figure 3.3 Historical Monthly Average TSS Concentrations

Table 3.17 Historical Effluent BOD₅ Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District			
Year	Annual Average		Percent Removal
	mg/L	ppd	
2001	65	675	81%
2002	67	641	83%
2003	56	494	82%
2004	53	486	84%
2005	50	521	83%
5-Year Average	58		82.6%

3.10.2 Effluent TSS

Likewise, the effluent TSS represented in both concentration (mg/L) and loading (ppd) is shown in Table 8.18 below. Based on this data, over the last five years the plant effluent TSS has averaged 37 mg/L. The corresponding TSS removal rates, determined from a comparing the annual average influent and effluent concentration values have also been shown with a five-year average TSS removal rate of 89.5 percent. Again, these parameters are well within the discharge requirements of a 30-day average TSS concentration less than 70 mg/L and removal efficiency greater than 75 percent.

Table 3.18 Historical Effluent TSS Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District			
Year	Annual Average		Percent Removal
	mg/L	ppd	
2001	41	426	89%
2002	49	468	86%
2003	39	345	87%
2004	29	263	92%
2005	24	255	93%
5-Year Average	37		89.5%

3.11 PROJECTED INFLUENT LOADINGS

Based on the nature of the City and the CSD, as well as the design approach previously taken for other coastal cities in the area, the design loading for the WWTP is determined by

the PSDWF and PSDW loadings previously identified. These projected values will be used to determine the organic loading for the planning period.

3.11.1 BOD₅

The projected BOD₅ loadings are determined using the previously identified PSDWF BOD₅ concentration of 410 mg/L. The PSDWF BOD₅ loading at the end of the planning period 2026 with a flow of 1.45 mgd is approximately 4,945 ppd.

3.11.2 TSS

Utilizing PSDWF influent flows and the PSDWF TSS concentrations previously identified as 420 mg/L, the PSDWF design TSS loading for the year 2026 is projected to be 5,066 ppd.

Although the PSDWF of 1.45 mgd determined previously in this report is significantly less than the PSDWF of 2.36 mgd in the existing design criteria, historical plant data has shown that the concentration of BOD₅ and TSS in the wastewater has increased. Therefore, the existing design loadings for the WWTP are consistent with loading history over the last five years.

It is important to note that although the hydraulic capacity of upgrades made to the WWTP may be less than the existing design capacity, future organic capacity will be similar to the existing design criteria. This fact is particularly important for the design of new secondary treatment processes such as oxidation ditches, membranes, or activated sludge.

3.11.3 Summary of Projected Influent Flows and Loadings

The following table outlines the recommended year 2026 influent design flows and loadings to be used in the alternative evaluations included as part of this Facility Master Plan.

It is recommended that these planning period design flows and loadings will be confirmed and further refined during the design period.

Table 3.19 Summary of Design Influent Flows and Loadings Wastewater Treatment Plant Facility Master Plan Morro Bay Cayucos Sanitary District		
Parameter	AADF	PSDWF
Flow	1.32	1.45
BOD ₅ - mg/L	340	410
BOD ₅ - ppd	3,734	4,945
TSS - mg/L	360	420
TSS - ppd	3,954	5,066

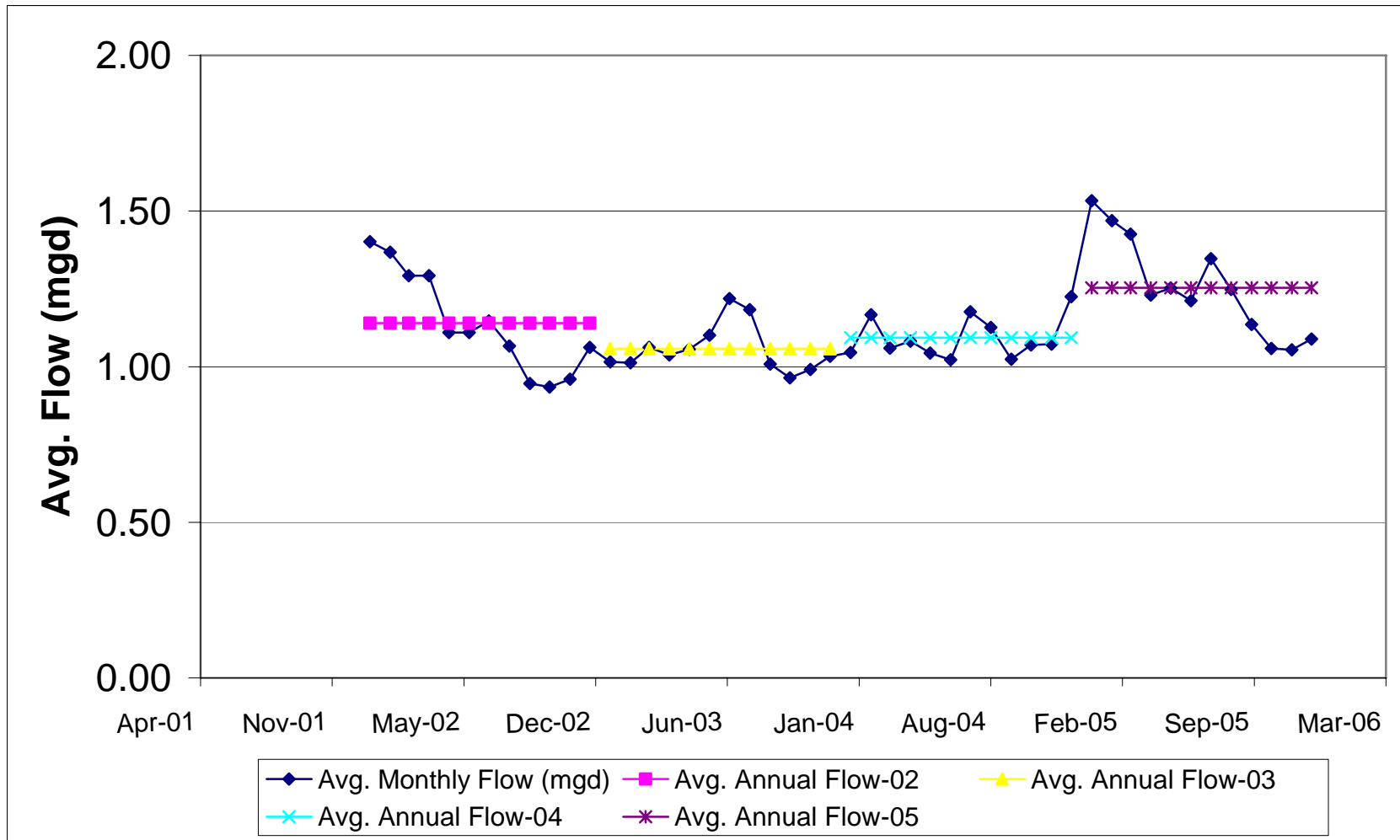


Figure 3.1
HISTORICAL MONTHLY
AVERAGE FLOWS
 Morro Bay Cayucos Sanitary District
 Wastewater Treatment Plant Facility Master Plan

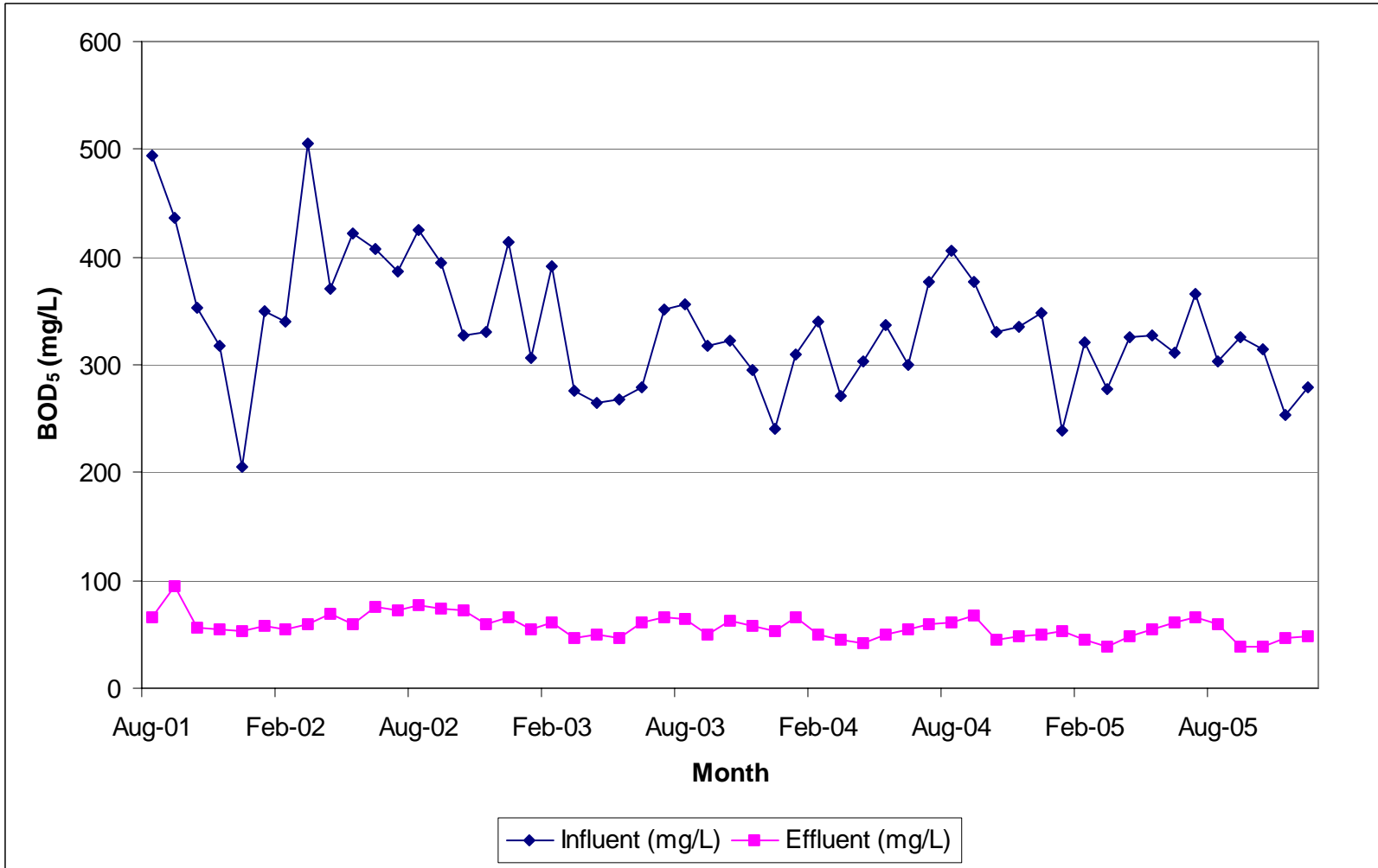


Figure 3.2
HISTORICAL MONTHLY
AVERAGE BOD₅
CONCENTRATIONS
 Morro Bay Cayucos Sanitary District
 Wastewater Treatment Plant Facility Master Plan

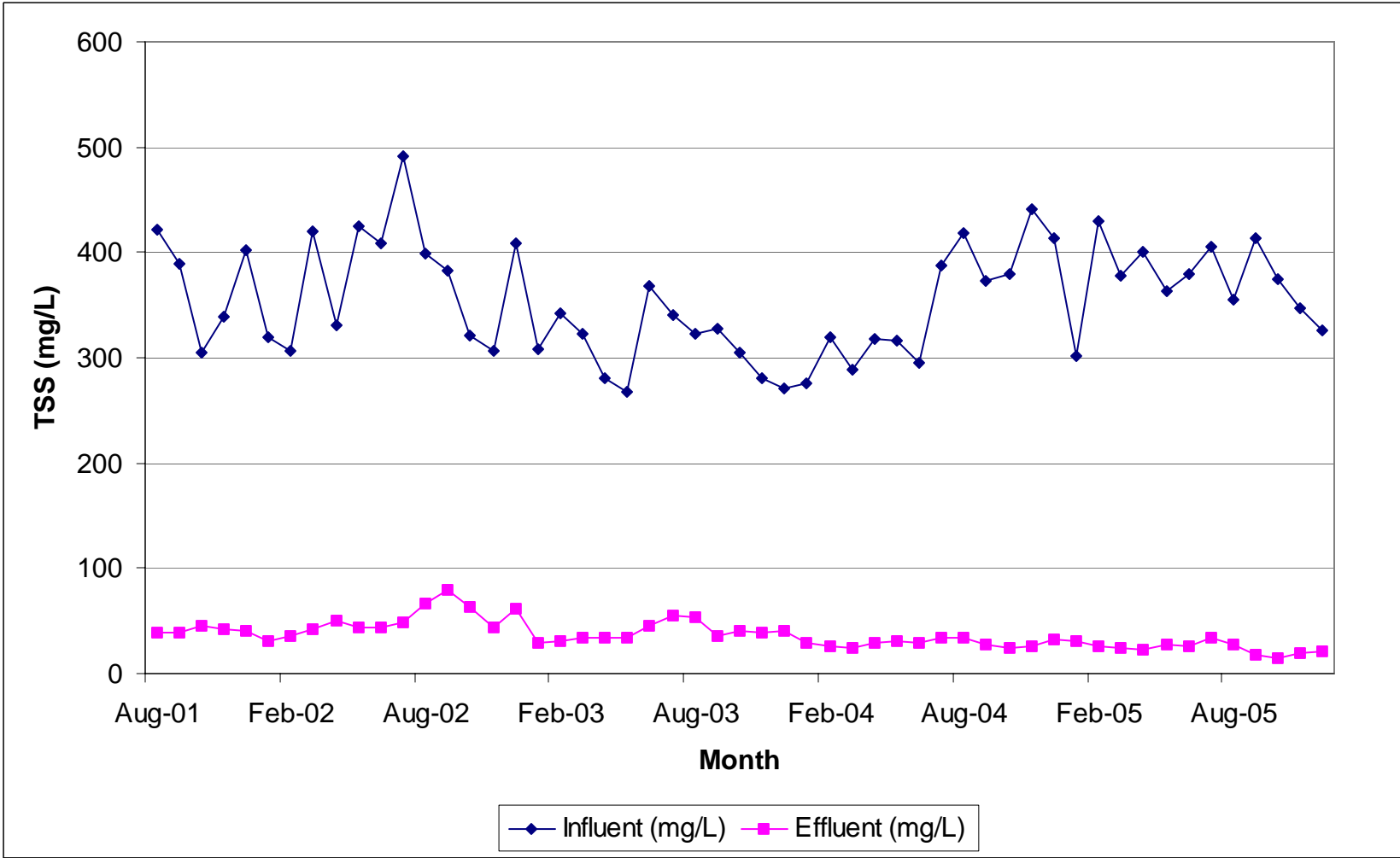


Figure 3.3
HISTORICAL MONTHLY
AVERAGE TSS
CONCENTRATIONS
 Morro Bay Cayucos Sanitary District
 Wastewater Treatment Plant Facility Master Plan

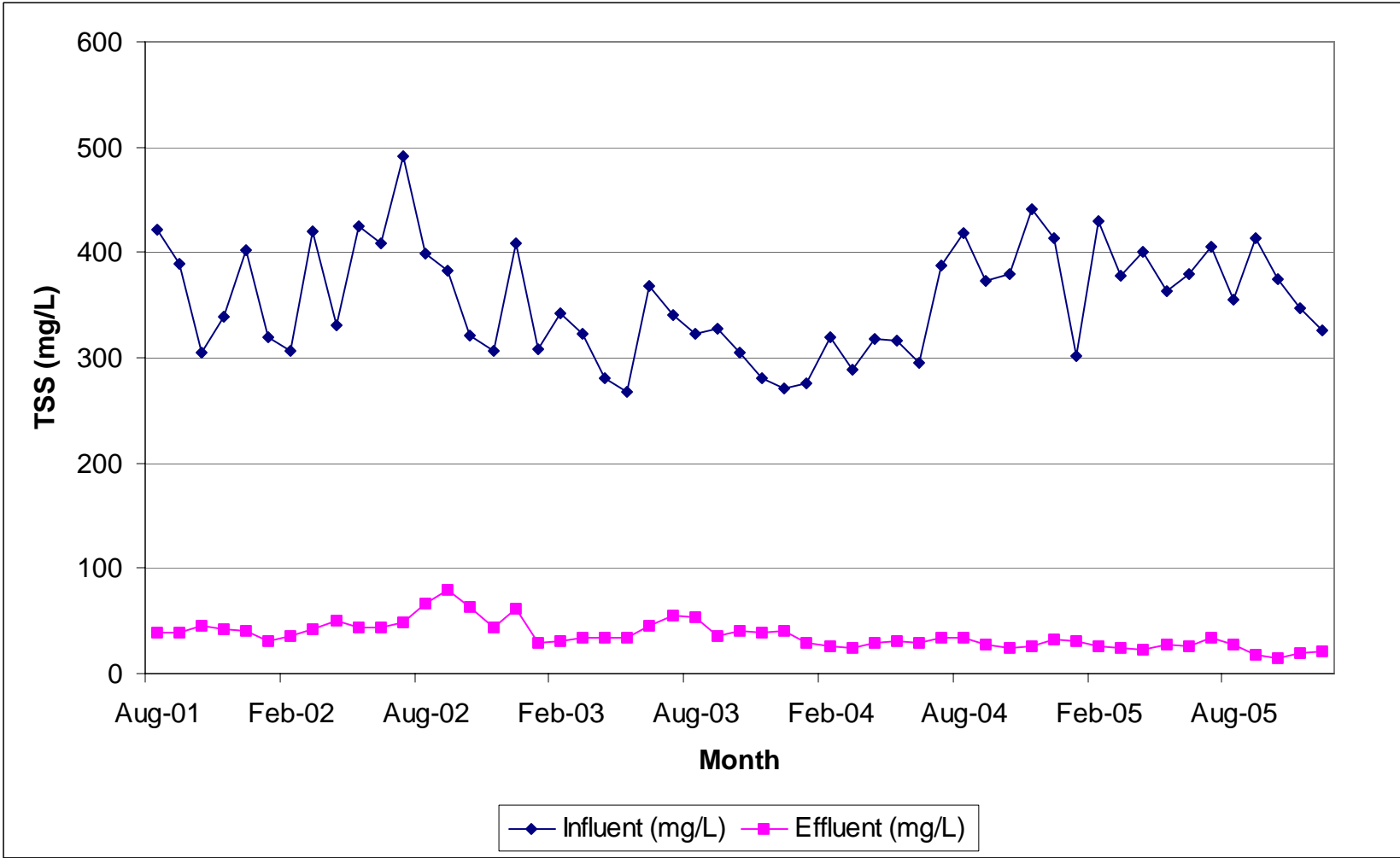


Figure 3.4
HISTORICAL MONTHLY
AVERAGE TSS
CONCENTRATIONS
 Morro Bay Cayucos Sanitary District
 Wastewater Treatment Plant Facility Master Plan