City of San José

San José/Santa Clara Water Pollution Control Plant Master Plan

TASK NO. 3
PROJECT MEMORANDUM NO. 8
PROJECTED WASTEWATER FLOWS AND CHARACTERISTICS

FINAL DRAFT
July 2009

in association with

2700 YGNACIO VALLEY ROAD • SUITE 300 • WALNUT CREEK, CALIFORNIA 94598 • (925) 932-1710 • FAX (925) 930-0208

CITY OF SAN JOSÉ

SAN JOSÉ/SANTA CLARA WATER POLLUTION CONTROL PLANT MASTER PLAN

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PROJECT WASTEWATER FLOWS AND CHARACTERISTICS

1.0 INTRODUCTION

The purpose of this project memorandum (PM) is to develop projections of influent wastewater flows, loads, and concentrations for the San José/Santa Clara Water Pollution Control Plant (WPCP). These projections will be used in master planning future facility needs for the WPCP to determine future capacity needs and sizing, as well as the WPCP's ability to meet regulations in the future, and timing of new or rehabilitated facilities. Influent wastewater load projections include conventional pollutants, biochemical oxygen demand (BOD) and total suspended solids (TSS), as well as ammonia-nitrogen. Projections for influent and effluent concentrations and removal efficiencies include nutrients (ammonia as well as other nutrients) and non-conventional pollutants.

The flow, load, and concentration projections are based on historically recorded data for the WPCP. The evaluation of historical flows is presented in PM 3.1. The evaluation of historical wastewater characteristics (loads and concentrations) is presented in PM 3.2. Evaluation of the existing performance of the WPCP is presented in PM 3.3.

Flows and loads projections will be presented in 5-year increments over the 30-year planning period, 2010 through 2040. Flow projections with existing and future water conservation will also be presented. Load projections for low, medium, and high loadings will also be generated.

This PM also includes projections for nutrient and non-conventional pollutants, as well as a discussion of projected impacts of onsite stormwater and groundwater.

2.0 OVERALL APPROACH TO FLOW AND LOAD PROJECTIONS

Two methods were used to project influent wastewater average dry weather flows (ADWF) and average dry weather loads (ADWL): 1) population projections developed in PM 3.6 were used in conjunction with per capita wastewater flows and loads, and 2) trend analysis of historical influent wastewater flows and loads. Seasonal and peak flows and loads were calculated using selected peaking factors based on the historical data analysis presented in PM 3.1 and PM 3.2.

Several wastewater flow and loading terms are used in this PM. A summary of these terms and their definitions is presented in Table 1.

Table 1	Wastewater Flow and Loading Definitions San José/Santa Clara Water Pollution Control Plant Master Plan City of San José	
Term	**Definition**	**Purpose**
Wastewater Flow Definitions		
ADWIF	Average Dry Weather Influent Flow The average daily flow over any five weekday period between the months of June and October. The maximum of the weekday averages is reported for permit compliance.	To assess future permit compliance.
ADWF[1]	Average Dry Weather Flow The average daily influent flow occurring over the three consecutive lowest flow months in the dry weather season (May through October).	To develop base wastewater flow projections and to evaluate taking various process units out of service. Often used when describing nameplate capacity of treatment plants.
ADWEF	Average Dry Weather Effluent Flow The average daily effluent flow occurring over the three consecutive lowest flow months in the dry weather season (May through October).	To assess future permit compliance.
ADAF	Average Daily Annual Flow The average daily flow or loading for an annual period.	To evaluate annual power use.
ADMMF	Average Daily Maximum Month Flow The average daily flow occurring during the peak flow month of the year. Peak flow and peak loadings do not necessarily have to occur in the same month. ADMMF typically occurs in the wet season (November through April).	To size wastewater treatment facilities to meet 30-day National Pollutant Discharge Elimination System (NPDES) permit requirements.
PHWWF	Peak Hour Wet Weather Flow The peak hour flow resulting from a rainfall event.	To set plant hydraulic capacity.
MDWWF	Maximum Day Wet Weather Flow The maximum daily flow occurring in the wet season (November through April).	Used to evaluate ability to meet daily max permit limits.
Wastewater Load Definitions		
ADWL	Average Dry Weather Load The average daily loading occurring over the three consecutive lowest flow months in the dry weather season (May through October)	To develop base wastewater load projections and to provide the basis for sizing certain treatment facilities.

Table 1	Wastewater Flow and Loading Definitions San José/Santa Clara Water Pollution Control Plant Master Plan City of San José	
ADAL	Average Daily Annual Load The average daily loading for an annual period.	To size certain solids facilities (such as lagoons and drying beds) and evaluate annual power use.
ADMML	Average Daily Maximum Month Load The average daily organic or suspended solids loading occurring during the peak loading month of the year. Peak flow and peak loadings do not necessarily have to occur in the same month.	To size wastewater treatment facilities to meet 30-day NPDES permit requirements and sizing for various solids handling facilities including digesters and thickening equipment.
AWL	Average Week Load The average daily solids loading occurring during the average week flow.	To size certain liquids facilities for operational considerations.
MDDWL	Maximum Day Dry Weather Load The maximum day loading occurring during the dry weather season (May through October).	Together with consideration of diurnal variation, often used to determine aeration demands as well as to check max day requirements.
MDWWL	Maximum Day Wet Weather Load The maximum daily loading occurring in the wet season (November through April).	Together with consideration of diurnal variation, often used to determine aeration demands as well as to check max day requirements.
MWWWL	Maximum Week Wet Weather Load The maximum week loading occurring in the wet season (November through April).	Used in a biological nutrient removal plant to determine the solids retention time for nitrification and denitrification
MPWL	Mean Peak Week Load The average daily solids loading occurring during the maximum average week.	Used in solids process calculations to determine process sizing.

Note:

(1) This definition for ADWF is equivalent to the Average Dry Weather Effluent Flow (ADWEF) in the WPCP NPDES Permit (No. CA0037842). In this PM, the ADWF averaging period is also used for influent flows and loads for the purpose of developing base wastewater flow and load projections.

2.1 Historical Per Capita Wastewater Flow Generation

Historical per capita ADWFs were determined for each year between 1998 and 2007. For each year, the historical ADWF (presented in PM 3.1) was divided by the WPCP residential service area population for that year (presented in PM 3.6). By dividing the ADWF by the residential population, the wastewater generated by all uses including residential, commercial and industrial, is captured in the per capita ADWF. Table 2 presents the historical per capita wastewater ADWFs for the WPCP.

Table 2 Historical Per Capita ADWF
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Year	Service Area Population	ADWF (mgd)	Per Capita ADWF (gpcd)
1998	1,226,150	121	99
1999	1,241,070	107	86
2000	1,258,700	126	100
2001	1,276,050	120	94
2002	1,289,110	117	90
2003	1,299,530	116	89
2004	1,310,350	110	84
2005	1,324,500	113	85
2006	1,342,100	118	88
2007	1,364,700	112	82

Notes:
gpcd = Gallons Per Capita Per Day.
mgd = Million Gallons Per Day.

The per capita wastewater ADWFs have decreased between 1998 and 2007. This is due to decreasing ADWFs and increasing population. As discussed in PM 3.1, the decrease in ADWF between 1998 and 2007 is likely due to water conservation measures and changes in industry in the service area. Given these changes, it was assumed that the per capita wastewater ADWFs for the most recent five years is representative of future per capita wastewater generation. The average per capita wastewater ADWF from 2003 to 2007, 86 gpcd, was used for the population based ADWF flow projections. The projection based on 86 gpcd represents the projection assuming the existing level of per capita water conservation. Section 3.2 includes an estimate of the “additional future water conservation” that may be realized within the planning period, and a separate projection is presented.

2.2 Historical Flow Trend Analysis

Regression analysis, flow versus year, was conducted on the historical ADWFs from 1998 to 2007. The regression analysis resulted in a negative slope and a poor correlation between flow and year. The trend analysis led to a projection of decreasing flows between 2010 and 2040. Review of the analysis results by City staff and subsequent meetings (Nov 17th, 2008) led to the conclusion that a downward trend in future flows was not realistic given that the population in the service area is projected to increase.

2.3 Historical Per Capita Wastewater Load Generation

Historical per capita ADWLs were determined for each year between 1998 and 2007 for BOD, TSS, and ammonia-nitrogen. For each year, the historical ADWLs for BOD, TSS and ammonia-nitrogen (presented in PM 3.2), were divided by the WPCP residential service area population for that year (presented in PM 3.6). By dividing ADWL by the residential population, the wastewater loads generated by all uses including residential, commercial and industrial is captured in the per capita load. As discussed in PM 3.2, the ADWLs also include the load contributions from the recycle streams. Therefore, the per capita loads include the load contributions from the recycle streams.

Table 3 presents the historical per capita wastewater loads for BOD, TSS and ammonia-nitrogen for 1998 to 2007.The resulting per capita wastewater loads varied over the 10-year period.

Table 3 Historical Per Capita Influent BOD, TSS and Ammonia-Nitrogen ADWLs
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Year	Service Area Population	BOD (ppcd)	TSS (ppcd)	Ammonia-Nitrogen (ppcd)
1998	1,226,150	0.26	0.26	0.018
1999	1,241,070	0.23	0.19	0.017
2000	1,258,700	0.26	0.25	0.022
2001	1,276,050	0.26	0.25	0.022
2002	1,289,110	0.23	0.23	0.019
2003	1,299,530	0.20	0.22	0.017
2004	1,310,350	0.23	0.21	0.016
2005	1,324,500	0.21	0.21	0.017
2006	1,342,100	0.19	0.17	0.019
2007	1,364,700	0.23	0.20	0.018

Notes:
ppcd = Pounds Per Capita Per Day.

2.4 Historical Load Trend Analysis

Regression analysis, load versus year, was conducted on the historical ADWLs from 1998 to 2007. The regression analysis resulted in a negative slope and a poor correlation between flow and year. The trend analysis led to a projection of decreasing BOD and TSS loads, and slightly increasing ammonia-nitrogen loads, between 2010 and 2040. Review of the analysis results by City staff and subsequent meetings (Nov 17th, 2008) led to the conclusion that a downward trend in TSS and BOD, and an almost flat projection of ammonia-nitrogen loads were not realistic given that the population in the service area is projected to increase.

3.0 PROJECTED WASTEWATER FLOWS

3.1 Projected Flows

To determine the ADWF projections, the projected populations developed in PM 3.6 were multiplied by the per capita wastewater generation rate of 86 gpcd. Peaking factors were used to calculate projected ADAFs, ADWIFs, ADMMF, MDWWFs and PHWWFs. The selected peaking factors for ADAF, ADWIF, ADMMF, and MDWWF were based on the peaking factors from 2006, which are relatively conservative, but consistent with peaking factors seen in other years during the review period.

Because there was significant variability in the historical PHWWF, and the projected PHWWFs will have a significant impact on the results of the capacity assessment, there was much discussion with the City about the projected PHWWF during review meetings on March 5th and March 23rd, 2009. It was decided that the PHWWF peaking factor to be used on the project is 2.7, which is based on the February 3rd, 1998 storm where a PHWWF of 330 mgd was recorded. While the peaking factor of 2.7 is higher than was seen during other years, it is reflective of a real event that could happen again.

Another approach to determining the PHWWF peaking factor to use for projections is to identify how much wastewater can actually get to the plant through the interceptors. Based on discussions with the tributary agencies and the City, the interceptor capacity is estimated to be approximately 450 mgd, and it is believed that this magnitude of flow would be most likely to occur towards the end of the planning period when the greatest flows are projected. Using the projected 2040 ADWF of 166 mgd and a PHWWF of 450 mgd corresponding to the estimated interceptor capacity results in a peaking factor of 2.7. This result is also consistent with the PHWWF peaking factor generated from the 1998 storm.

The resulting influent wastewater flow projections with existing water conservation are shown in Figure 1 and summarized in Table 4.

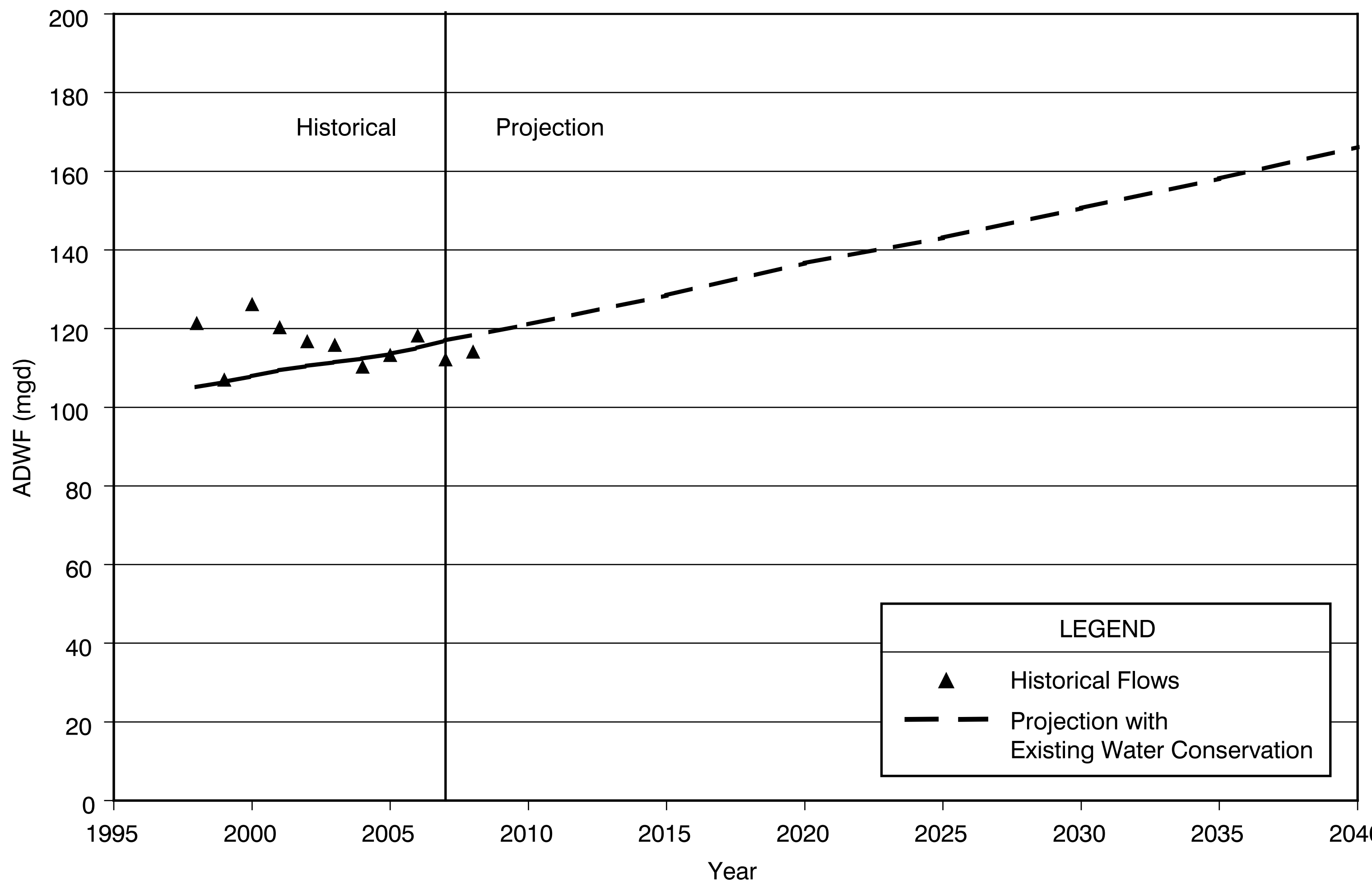

Figure 1
POPULATION BASED FLOW PROJECTIONS
WITH EXISTING WATER CONSERVATION
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Table 4	Wastewater Influent Flow Projections with Existing Water Conservation[1] San José/Santa Clara Water Pollution Control Plant Master Plan City of San José					
Year	**ADWF (mgd)**	**ADAF (mgd)**	**ADWIF (mgd)**	**ADMMF (mgd)**	**MDWWF (mgd)**	**PHWWF (mgd)**
2010	121	125	133	142	179	327
2015	128	133	141	151	190	347
2020	137	141	150	161	202	369
2025	143	148	157	168	212	386
2030	151	156	165	177	223	407
2035	158	164	173	186	234	427
2040	166	172	182	195	246	449
Peaking Factor[2]	–	1.03	1.10	1.17	1.48	2.70

Notes:

(1) Flow projections assume the existing level of water conservation.

(2) 2006 peaking factors were used with the exception of the PHWWF peaking factor, which was based on the 1998 PHWWF of 330 mgd.

3.2 Projected Water Consumption

The tributary agencies serviced by the WPCP receive potable water from a number of sources and providers. Table 5 provides a summary of potable water sources and providers for each of the tributary agencies serviced by the WPCP. The number of different water purveyors that provide water in WPCP service area complicates the calculation of projected water demands in the service area. The primary wholesale water supply agency for Santa Clara County is the Santa Clara Valley Water District (SCVWD). As shown in Table 5, the several of the tributary agencies in the WPCP service area receive water from the SCVWD, and from the San Francisco Public Utilities Commission (SFPUC).

The Urban Water Management Plan (Santa Clara Valley Water District, 2005) includes municipal and industrial (M&I) water projections for Santa Clara County. The projected M&I demand includes the SPFUC customer demands and the SCVWD demand for non-SFPUC retailers. Based on projected populations and projected M&I demands, the per capita demand is approximately 184 gal/cap/day. A portion of the water demand is for outdoor use and therefore does not contribute directly to wastewater flows.

The SFPUC Wholesale Customer Water Demand Projections Technical Report (URS, 2004) established 2001 for the base year used in modeling future water demands. As shown in Table 5, a portion of the City of San José (City), City of Milpitas, and City of Santa Clara receive water from the SFPUC. The population based weighted average of indoor water consumption for the areas serviced by the SFPUC was 101 gal/capita-day. This indoor estimate is comparable to the per capita wastewater ADWF. In 2001, the estimated per capita wastewater ADWF was 95 gpcd.

Table 5	Water Sources and Providers in the WPCP Service Area San José/Santa Clara Water Pollution Control Plant Master Plan City of San José			
City	**Water Provider**	**Sources**		
San José	San José Water Company	Well Water	Surface water from Los Gatos Creek watershed	SCVWD
	Great Oaks Water Company	Well Water	–	–
San José	Municipal Water System	Hetch Hetchy(1) SCVWD		Well Water
Santa Clara	City of Santa Clara Water Department	Well Water	Hetch Hetchy (1) SCVWD	
Milpitas	City of Milpitas Community Services	Hetch Hetchy(1) SCVWD		–
Cupertino	San José Water Company	SCVWD –		–
California	Water Service Company	SCVWD –		–
Campbell	San José Water Company	Blend, primarily: SCVWD	Remainder: Well Water	–
Los Gatos	San José Water Company	Blend of: 80% surface water from Los Gatos Creek watershed	20% SCVWD	–
Monte Sereno	San José Water Company	Blend of: 80% surface water from Los Gatos Creek watershed	20% SCVWD	–
Saratoga	San José Water Company	Surface water from Saratoga Creek	SCVWD –	

Note:
(1) Hetch Hetchy refers to surface water provided by the SFPUC.

Section 3.3 addresses existing and planned measures for decreasing water consumption through conservation measures, and the anticipated impacts on wastewater flows realized at the WPCP.

3.3 Impacts of Water Conservation

A water conservation analysis was conducted based on the SFPUC Wholesale Customer Water Demand Projections Technical Report (SFPUC Report) (URS, 2004).The water conservation analysis in the SFPUC Wholesale Customer Water Demand Projections Technical Report identified 2001 as the base year for the analysis with a projection to 2030.

The SFPUC Report indicates that the weighted average residential water consumption in 2001 was approximately 65 gallons per capita per day (gpcd), and 57 gpcd in 2030, reflecting a reduction of 8 gpcd.

The projections included in the SFPUC Report were used to develop a linear projection of ADWF water conservation from 0 gpcd in 2001 to 8 gpcd in 2030. This projection was then used to extrapolate to 2040, resulting in 11 gpcd of water conservation, and to determine the magnitude of water conservation at 5-year increments between 2010 and 2040. Once the ADWF water conservation rate was determined at a 5 year increment, the water conservation rate was multiplied by the total projected population as presented in Table 2 for the corresponding year. The total water conserved was then subtracted from the projected ADWF wastewater influent flow projections to determine the projected wastewater influent flow rate with water conservation. For the subsequent flow conditions, ADAF, ADWIF and ADMMF, the peaking factor for each of these flow conditions was multiplied by the ADWF. Water conservation is not reflected in the MDWWF and PHWWF projections since water conservation will likely not reduce flows during these events MDWWF and PHWWF are generally dependent on storm events and the resulting infiltration and inflow into the collection system. Therefore, MDWWF and PHWWF are not considered in the water conservation analysis and remains the same as summarized in Table 4.

Table 6 summarizes the wastewater influent flow projections with additional future water conservation. Figure 2 shows the resulting influent wastewater flow projections with existing and additional future water conservation.

Table 6 Wastewater Influent Flow Projections with Additional Future Water Conservation(1)
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Year	ADWF (mgd)	ADAF (mgd)	ADWIF (mgd)	ADMMF (mgd)	MDWWF (mgd)	PHWWF (mgd)
2010	118	122	129	138	179	327
2015	123	127	135	144	190	347
2020	128	133	141	150	202	369
2025	132	137	145	154	212	386
2030	137	141	150	160	223	407
2035	141	146	154	165	234	427
2040	145	150	159	170	246	449
Peaking Factor(2)	–	1.03	1.10	1.17	-(3)	-(3)

Notes:
(1) Flow projections assume additional water conservation.
(2) The 2006 peaking factors were used for ADAF, ADWIF and ADMMF.
(3) Water conservation is not reflected in the MDWWF and PHWWF. Water conservation does not decrease storm flow, therefore, peaking factors increase with year. MDWWF and PHWWF are the same as Table 4 above.

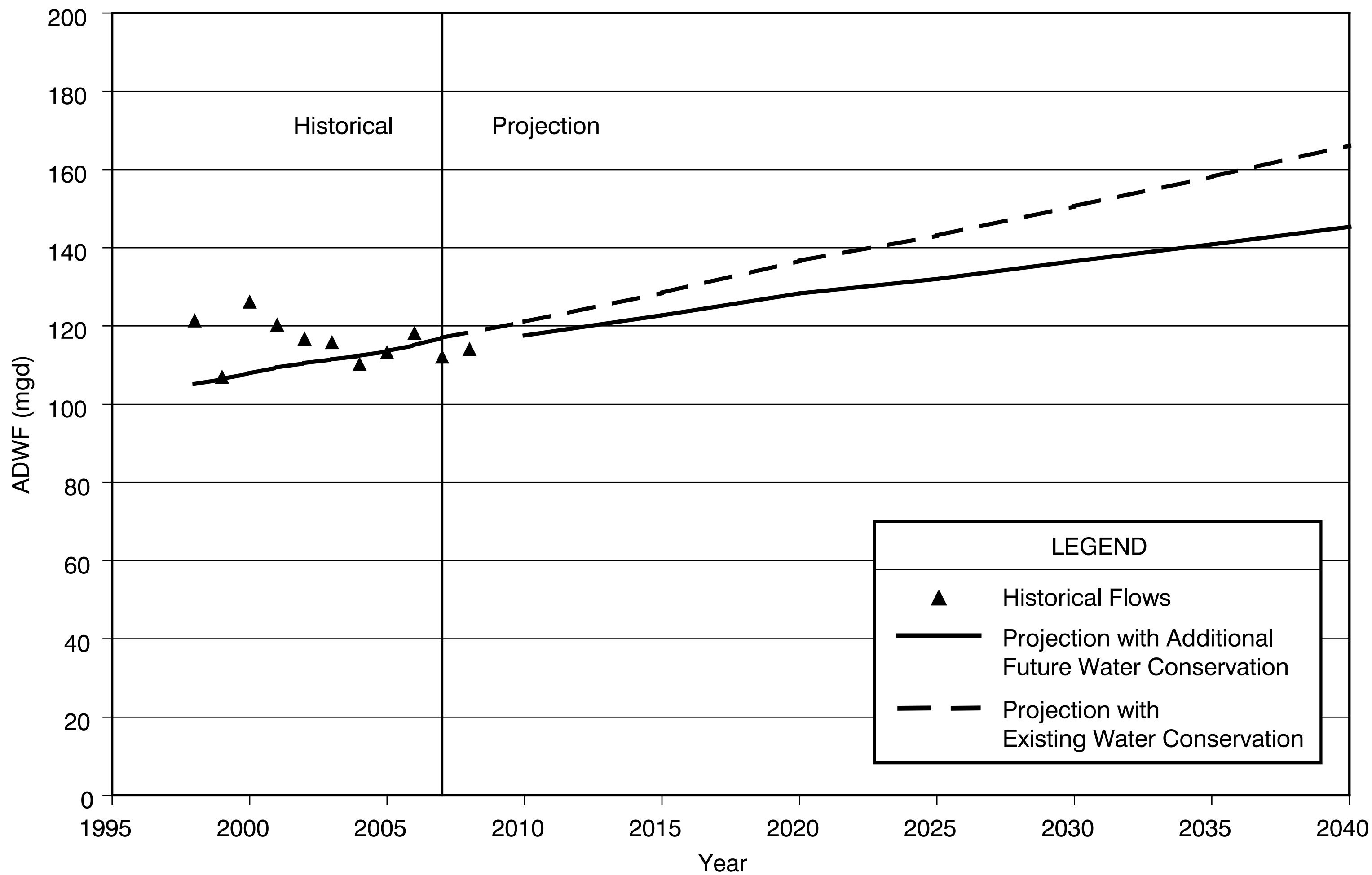


Figure 2
POPULATION BASED FLOW PROJECTIONS WITH EXISTING AND ADDITIONAL FUTURE WATER CONSERVATION
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

4.0 PROJECTED WASTEWATER LOADS

For the ADWL projections, the projected populations developed in PM 3.6 were multiplied by the per capita wastewater loads to yield projected ADWLs. The per capita wastewater loads varied over the 10-year data period. Per discussion with City staff it was agreed that a single projection line based on a single per capita generation rate would not reflect the potential future variability in TSS, BOD and ammonia-nitrogen loads. Therefore, it was decided that three projections, high, medium and low, would be developed as follows:

- High projections - The 2000 and 2001 per capita BOD, TSS and ammonia-nitrogen generation rates were the highest values in the 10-year data set. The high projection was based on a per capita generation rate between the 2000 and 2001 values, and the generation rate computed for 2008. Per capita loadings for 2008 and the selected per capita loadings for the high projection are presented in Table 7.

- Medium projections - The medium projections are based on the 2007 per capita loading rates and are summarized in Table 7.

- Low projections - The low load projections are based on a 20 percent reduction of the per capita loading of the medium projections by 2040 due to source control measures to remove grinders from use in the service area. The 20 percent reduction is based on a range of values reported in Metcalf and Eddy (2002, Fourth Edition) as well as information obtained from an evaluation of the impact of adding grinders in New York City. It was determined that the effects of a grinder source control program would not be realized until 2020, Therefore, a linear extrapolation of the per capita loads between 2020 and 2040 was used to generate the low load projection. Table 7 includes the per capita loading rates for 2040 that account for the effect of removing grinders from the service area.

Table 7 Per Capita Loading Rates Used for the Low, Medium and High Projections
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Pollutant	Low (ppcd)	Medium (ppcd)	High (ppcd)	2008 (ppcd)
BOD	0.18	0.23	0.25	0.24
TSS	0.16	0.20	0.22	0.21
Ammonia-nitrogen	0.014	0.018	0.022	0.020

Peaking factors were used to calculate projected ADALs, MDDWLs, MDWWLs, MWWWLs, and ADMMLs. The general approach to selecting the peaking factors was to use the highest value calculated for years 1998 to 2007, unless it appeared to be an outlier. Outlier peaking factors were identified through visual inspection and not used for projections if they were significantly higher than peaking factors for other years. In general, the 2006 BOD peaking factors were not considered because the 2006 BOD ADWL was the lowest ADWL over the data period. In general, the 1999 and 2006 TSS peaking factors were not considered because the 1999 and 2006 TSS ADWLs were significantly lower than other years. For ammonia-nitrogen, all years were considered in selection of the peaking factors.

The resulting influent wastewater load projections for low, medium, and high loading for BOD, TSS, and ammonia-nitrogen, respectively, are shown in Figures 3 through 5 and summarized in Tables 8 through 10.

5.0 NUTRIENTS AND NON-CONVENTIONAL POLLUTANTS

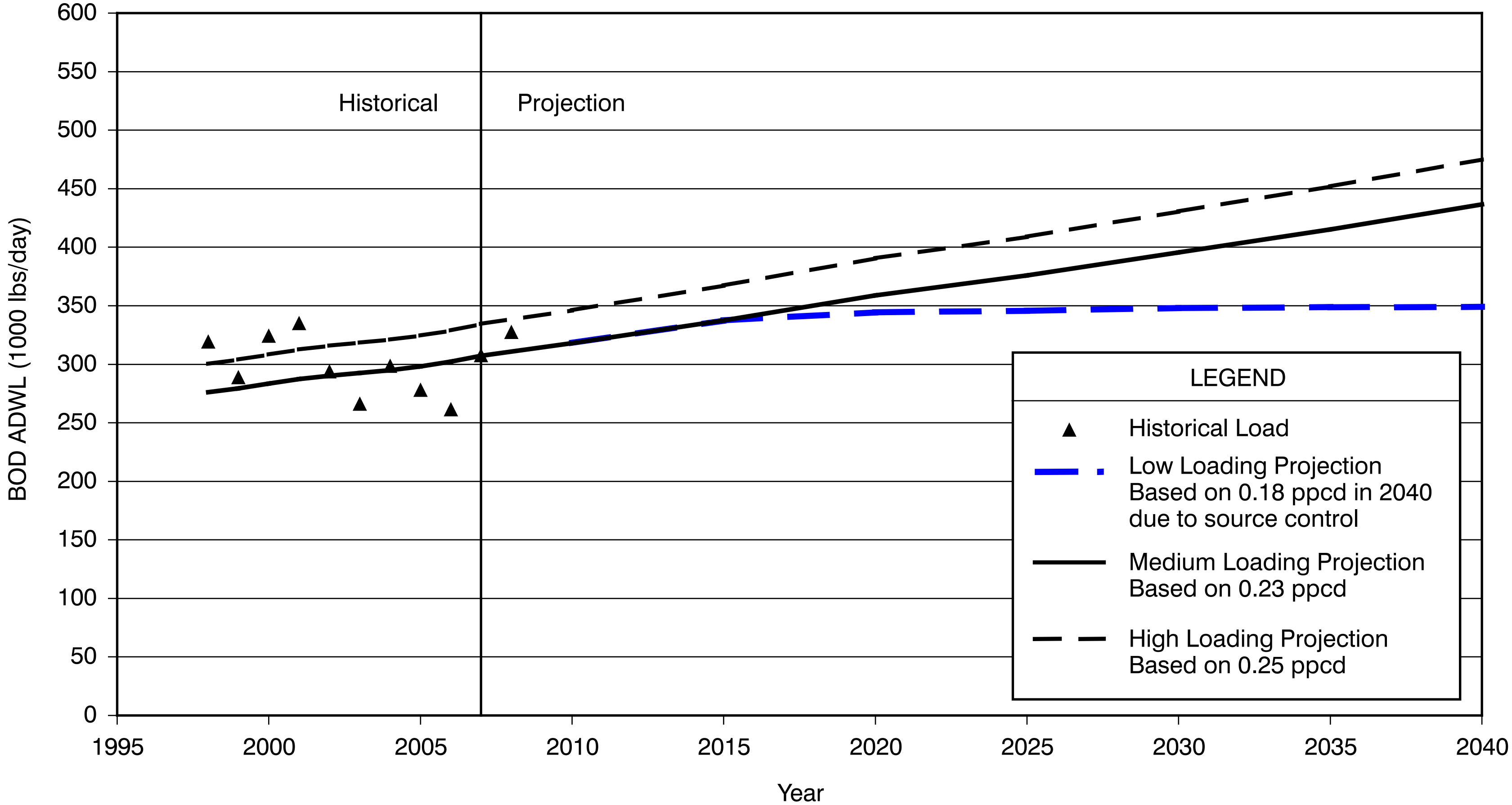
The nutrients and non-conventional pollutants examined in the PM include the following:

- Nutrients: Ammonia-nitrogen, nitrite and nitrate
- Metals: Copper, mercury, nickel and selenium.
- Cyanide.
- Organics: 4,4'-DDE, dieldrin, heptachlor, heptachlor epoxide, benzo(b)fluoranthene, indeno(1,2,3-cd)pyrene, dioxin, tributyltin, and polychlorinated biphenyls (PCBs).
- Other Constituents: total dissolved solids (TDS), conductivity, and hardness.

Ammonia-nitrogen was previously addressed in Section 4.0 from a loading perspective, and projected loads will be used in evaluating future process needs. Ammonia nitrogen is addressed in this section on a concentration basis because it has been identified as one of the pollutants of concern (POCs) from a regulatory perspective. The other POCs addressed in this section include metals, cyanide, and organics.

Projections of influent and effluent nutrient and non-conventional pollutant concentrations were based on the historical data analysis presented in PM 3.2 and the evaluation of treatment performance in PM 3.3. As discussed in PM 3.2, the historical influent concentrations used as the basis for this analysis include the contributions from the recycle streams. The projections are based on the assumption of using the existing treatment processes to treat future flows and loads. In addition, the projections of future influent concentrations do not account for the effects of water conservation.

For several parameters, influent concentrations were not available or the data set was very limited, therefore it was not possible to project influent concentrations or the expected percent removal by the WPCP. For these parameters, the historical effluent concentrations are presented, and it is assumed that the WPCP will produce wastewater effluent of similar water quality in the future.



The low load projections are based on a 20 percent reduction of the per capita loading of the medium projections by 2040 due to source control measures to remove grinders from use in the service area. It was determined that the effects of a grinder source control program would not be realized until 2020, Therefore, a linear extrapolation of the per capita loads between 2020 and 2040 was used to generate the low load projection.

Figure 3
POPULATION BASED BOD PROJECTIONS - LOW, MEDIUM AND HIGH
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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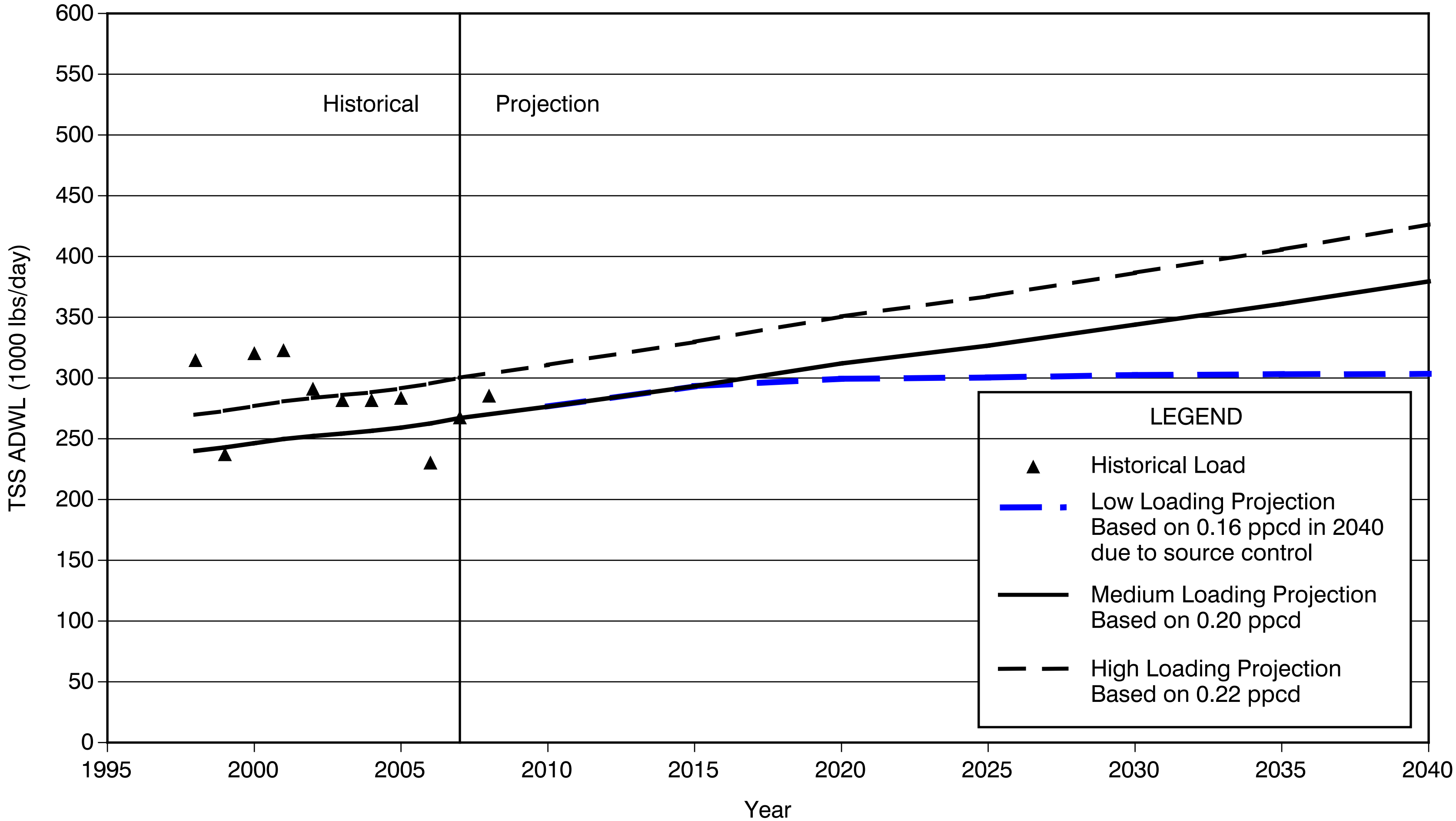

The low load projections are based on a 20 percent reduction of the per capita loading of the medium projections by 2040 due to source control measures to remove grinders from use in the service area. It was determined that the effects of a grinder source control program would not be realized until 2020, Therefore, a linear extrapolation of the per capita loads between 2020 and 2040 was used to generate the low load projection.

Figure 4
POPULATION BASED TSS PROJECTIONS - LOW, MEDIUM AND HIGH
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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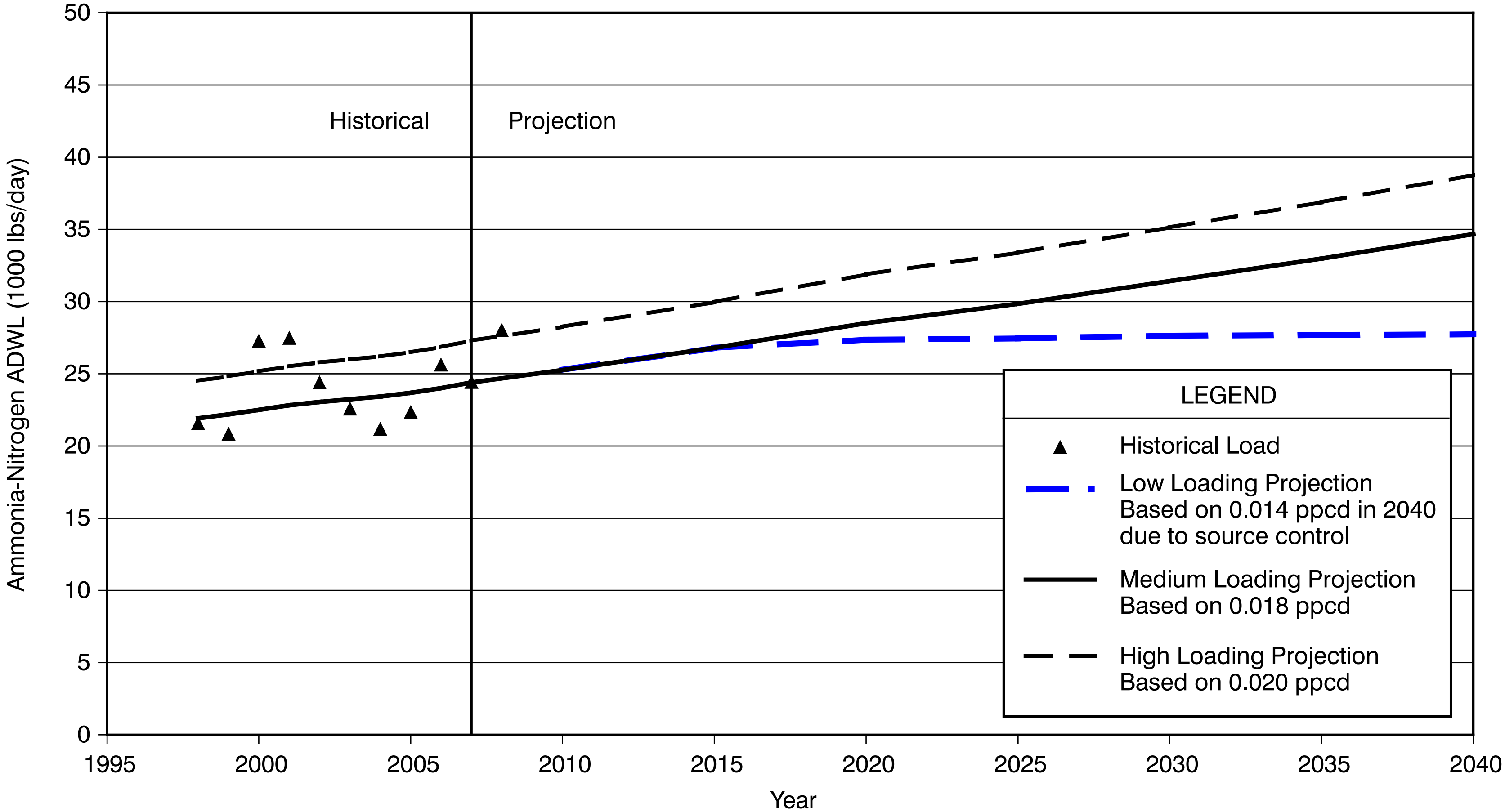

The low load projections are based on a 20 percent reduction of the per capita loading of the medium projections by 2040 due to source control measures to remove grinders from use in the service area. It was determined that the effects of a grinder source control program would not be realized until 2020, Therefore, a linear extrapolation of the per capita loads between 2020 and 2040 was used to generate the low load projection.

Figure 5
POPULATION BASED AMMONIA-NITROGEN PROJECTIONS - LOW, MEDIUM AND HIGH
SAN JOSÉ/SANTA CLARA WPCP MASTER PLAN
CITY OF SAN JOSÉ

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Table 8	Wastewater Influent BOD Load Projections - Low, Medium, and High San José/Santa Clara Water Pollution Control Plant Master Plan City of San José					
Year	**ADWL (1000 lbs/day)**	**ADAL (1000 lbs/day)**	**MDDWL (1000 lbs/day)**	**MDWWL (1000 lbs/day)**	**MWWWL (1000 lbs/day)**	**ADMML (1000 lbs/day)**
Low Load Projection						
2010	318	355	470	582	539	498
2015	337	377	499	617	572	528
2020	344	385	510	630	584	539
2025	346	386	511	632	586	541
2030	348	389	515	636	590	545
2035	349	389	516	638	591	546
2040	349	390	516	638	591	546
Peaking Factor(1)	–	1.12	1.48	1.83	1.69	1.56
Medium Load Projection						
2010	318	355	470	582	539	498
2015	337	377	499	617	572	528
2020	359	401	531	656	608	562
2025	376	420	556	687	637	588
2030	396	442	585	724	670	619
2035	415	464	614	759	704	650
2040	436	487	646	798	739	683
Peaking Factor(1)	–	1.12	1.48	1.83	1.69	1.56
High Load Projection						
2010	346	386	512	633	586	541
2015	367	410	543	672	622	575
2020	391	436	578	714	662	611
2025	409	457	605	748	693	640
2030	430	481	637	787	729	674
2035	452	505	669	826	766	707
2040	475	530	703	869	805	743
Peaking Factor(1)	–	1.12	1.48	1.83	1.69	1.56

Table 9	Wastewater Influent TSS Load Projections - Low, Medium, and High San José/Santa Clara Water Pollution Control Plant Master Plan City of San José					
Year	**ADWL (1000 lbs/day)**	**ADAL (1000 lbs/day)**	**MDDWL (1000 lbs/day)**	**MDWWL (1000 lbs/day)**	**MWWWL (1000 lbs/day)**	**ADMML (1000 lbs/day)**
Low Load Projection						
2010	276	307	434	471	446	389
2015	293	325	461	500	473	413
2020	299	332	471	511	483	421
2025	300	333	472	512	484	423
2030	302	336	475	516	488	426
2035	303	336	476	517	489	426
2040	303	336	477	517	489	427
Peaking Factor(1)	–	1.11	1.57	1.71	1.61	1.41
Medium Load Projection						
2010	276	307	434	471	446	389
2015	293	325	461	500	473	413
2020	312	346	490	532	503	439
2025	327	362	513	557	527	460
2030	344	381	540	586	555	484
2035	361	400	567	615	582	508
2040	379	421	596	647	612	534
Peaking Factor(1)	–	1.11	1.57	1.71	1.61	1.41
High Load Projection						
2010	311	345	488	530	501	437
2015	330	366	518	562	532	464
2020	351	389	551	598	565	493
2025	367	407	577	626	592	517
2030	387	429	608	659	623	544
2035	406	450	638	692	654	571
2040	426	473	670	727	688	600
Peaking Factor(1)	–	1.11	1.57	1.71	1.61	1.41

Table 10	Wastewater Influent Ammonia - Nitrogen Load Projections - Low, Medium, and High San José/Santa Clara Water Pollution Control Plant Master Plan City of San José					
Year	**ADWL (1000 lbs/day)**	**ADAL (1000 lbs/day)**	**MDDWL (1000 lbs/day)**	**MDWWL (1000 lbs/day)**	**MWWWL (1000 lbs/day)**	**ADMML (1000 lbs/day)**
Low Load Projection						
2010	25	28	39	40	37	33
2015	27	29	41	43	39	35
2020	27	30	42	44	40	36
2025	27	30	42	44	40	36
2030	28	30	42	44	40	36
2035	28	30	42	44	40	36
2040	28	30	42	44	40	36
Peaking Factor(1)	–	1.09	1.53	1.59	1.46	1.31
Medium Load Projection						
2010	25	28	39	40	37	33
2015	27	29	41	43	39	35
2020	29	31	43	45	42	37
2025	30	33	46	48	43	39
2030	31	34	48	50	46	41
2035	33	36	50	53	48	43
2040	35	38	53	55	51	45
Peaking Factor(1)	–	1.09	1.53	1.59	1.46	1.31
High Load Projection						
2010	28	31	43	45	41	37
2015	30	33	46	48	44	39
2020	32	35	49	51	46	42
2025	33	37	51	53	49	44
2030	35	38	54	56	51	46
2035	37	40	56	59	54	48
2040	39	42	59	62	56	51
Peaking Factor(1)	–	1.09	1.53	1.59	1.46	1.31

5.1 Nutrients

Influent data were available for ammonia-nitrogen and are presented in PM 3.2. Influent ammonia-concentrations showed a generally increasing trend. This is likely due to a concentrating effect as influent flow to the WPCP has decreased. It is unclear why this trend has not been seen for BOD and TSS despite numerous discussions with WPCP staff. The estimate of future concentrations was based on data from 2006 through 2007 to capture the relatively higher influent ammonia nitrogen concentrations. The average influent and effluent ammonia-nitrogen concentrations were 27 mg/L as N and 0.44 mg/L as N, respectively. The average removal efficiency for this time period was 98 percent.

Influent data for nitrate and nitrite were not available. However, nitrate and nitrite data from the effluent of the primary settling tanks from 2000 to 2005 were available. Average nitrite and nitrate concentrations were 0.10 mg/L as N, and 0.76 mg/L as N, respectively. A possible source of nitrate and nitrite in the plant influent are the recycled streams that are introduced upstream of the sampling location. As expected, the inorganic nitrogen concentrations are low relative to the ammonia-nitrogen concentrations and therefore represent a small fraction of the influent inorganic nitrogen load to the WPCP. Future concentrations are assumed to be similar to the historical averages of 0.10 mg/L as N for nitrite and 0.76 mg/L as N for nitrate, respectively.

5.2 Pollutants of Concern (POC)

The POCs addressed in this section include metals, cyanide and organic compounds. Ammonia-nitrogen, previously addressed in Section 5.1, is also a POC.

5.2.1 Metals and Cyanide

Influent and effluent concentrations and removal efficiencies for metals and cyanide are presented in PMs 3.2 and PM 3.3. There were no apparent trends in the copper, mercury, nickel or selenium influent and effluent concentration data. Therefore, historical average concentrations and average removal efficiencies were assumed to be representative of future concentrations and removal efficiencies. Projected concentrations and projected removal efficiencies are included in Table 11.

As discussed in PM 3.2, most of the influent and effluent cyanide values are below the detection limit, but there are instances where the effluent cyanide concentration exceeds the influent concentration. If disinfection and filter backwashing practices remain the same in the future, then it is anticipated that the effluent cyanide values may occasionally exceed the influent cyanide values as a result of the chlorination process. Projected cyanide concentrations and removal efficiencies are included in Table 11.

Table 11	Projected Influent and Effluent Metals and Cyanide Concentrations and Percent Removals San José/Santa Clara Water Pollution Control Plant Master Plan City of San José				
	Projected Influent Concentration		Projected Effluent Concentration		
Pollutant	Average (μg/L)	Standard Deviation (μg/L)	Average (μg/L)	Standard Deviation (μg/L)	Projected Percent Removal (%)
Copper	104	27	2.90	1.1	97
Mercury	0.260	0.10	0.00368	0.003	98
Nickel	13.3	4.5	6.29	1.2	51
Selenium	2.1	0.65	0.45	0.15	77
Cyanide	5.0	1.2	5.1	1.6	-2.8

5.2.2 Organic Compounds of Concern

Influent and effluent concentrations for organic compounds are presented in PMs 3.2 and 3.3. For most of the organic compounds, either influent data were not available or influent concentrations were below the reporting limits for all samples collected. Where possible removal efficiencies were calculated and are presented in PM 3.3. Due to the limited data on influent and effluent concentrations, it is not possible to determine if there are any long terms trends. Therefore, existing concentrations and removal efficiencies are assumed to be representative of future concentrations. Projected influent and effluent concentrations and removal efficiencies are presented in Table 12.

5.2.3 Other Constituents of Concern

Effluent concentrations for TDS, conductivity, and hardness are presented in PM 3.2. Influent data were not available for any of these constituents. There were no apparent long term trends in the data. Therefore, historical effluent concentrations are assumed to be representative of future effluent concentrations. Projected average effluent concentrations for TDS, conductivity, and hardness concentrations are presented in Table 13.

6.0 FUTURE STORMWATER IMPACTS

6.1 Stormwater Flow

Onsite stormwater runoff from the WPCP is collected and directed to the headworks. The total area of the WPCP is 2,600 acres of which 150 acres is impervious. According to the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP) (SCVURPP, 2004), a design rainfall of 0.17 inches per hour is used to estimate the onsite runoff which is the amount of runoff produced by a rain event equal to at least two times the 85th percentile hourly rainfall intensity for the applicable area. It is estimated that this rate of rainfall would

Table 12 Projected Influent and Effluent Organics Concentrations and Percent Removals
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Pollutant	Projected Influent Concentration	Projected Effluent Concentration	Projected Percent Removal (%)
	Average (μg/L)	Average (μg/L)	
4,4'-DDE	NA	0.008	NA (1)
Dieldrin	0.024	0.013	NA (2)
Heptachlor	0.018	0.014	NA (2)
Heptachlor Epoxide	0.015	0.012	NA (2)
Benzo(b)Fluoranthene	NA	0.243	NA (1)
Indeno(1,2,3-cd)Pyrene	NA	0.049	NA (1)
Dioxin	1.04	0.108	88
Tributyltin	2.6	0.059	92
PCBs	2.71	2.24	77

Notes:
NA = Not Available.
(1) Percent removal not calculated because influent data were not available.
(2) Percent removal not calculated because all influent data were below the reporting limit.

Table 13 Projected Influent and Effluent TDS, Conductivity, and Hardness Concentrations and Percent Removals
San José/Santa Clara Water Pollution Control Plant Master Plan
City of San José

Pollutant	Units	Projected Influent Concentration		Projected Effluent Concentration		Projected Percent Removal (%)
		Average	Standard Deviation	Average	Standard Deviation	
TDS	Mg/L	NA	NA	727	47	NA(1)
Conductivity	μmhos/cm	NA	NA	1229	53	NA(1)
Hardness	mg/L as $CaCO_3$	NA	NA	245	13	NA(1)

Notes:
NA = Not Available.
$CaCO_3$ = Calcium Carbonate.
(1) Percent removal not calculated because influent data were not available.

result in treatment of, on average, 85 percent of the total average annual rainfall of a 50-year return period. The factor of 2 is intended to account for the fact that average rainfall intensities increase for shorter duration events, and intensities estimated from hourly data tend to under-predict flow rates in small catchments where the time of concentration is less than 1 hour. As presented in PM 3.2, the Rational Method was used to calculate a flow rate from rainfall intensity, area, and runoff coefficient. The resulting existing onsite stormwater runoff is 19.1 cfs (12.4 mgd).

Future stormwater runoff will be proportional to the impervious area on the site. The projected stormwater flow should therefore be revisited when the master plan treatment alternative and area requirements have been determined.

6.2 Stormwater Loads

The onsite stormwater runoff is treated with the influent wastewater; hence, the WPCP does not characterize the quality nor measure the total amount of onsite stormwater runoff. Any nutrient or POC from the onsite stormwater is contained to what is collected from the WPCP site. Therefore, onsite stormwater impacts should not have any increased impacts to the influent loads unless the WPCP operations change or stormwater flows from the outside the WPCP are introduced to influent flow.

7.0 FUTURE GROUNDWATER IMPACTS

7.1 Groundwater Flow

The WPCP's residual sludge management (RSM) facility is located immediately north and northeast of the WPCP. It consists of 56 sludge storage/thickening lagoons, 20 drying beds, and an operations center. In order to assess the impact of RSM facility processes on groundwater quality, 36 monitoring wells have been constructed at 20 locations across the RSM site and at one location south of the WPCP to monitor background conditions at the upstream end of RSM. Of the 36 monitoring wells, 21 wells have been constructed to a depth of the uppermost sandy soil (A-zone), 12 wells to a depth of the intermediate sandy soil (B-zone), and 3 wells to a depth of the deep sandy soils (C-zone). Groundwater quality information presented in this section is from a hydrogeologic report prepared by the City as required by the San Francisco Bay Regional Water Quality Control Board (RWQCB) (City of San José, 1992). Groundwater table is influenced by it's surrounding such as the Guadalupe Creek, the salt ponds and San Francisco Bay water level. Therefore, monitoring wells at the RSM should continue to monitor the groundwater.

7.2 Groundwater Loads

It is assumed that the 36 monitoring wells at the RSM will continue to monitor the groundwater and analyze for POCs that would include general chemical parameters (specific conductance, pH, carbonate, bicarbonate, chloride, sulfate, and TDS), metals, coliform bacteria, volatile organic compounds, semi-volatile organic compounds, pesticides, and PCBs.

The current groundwater quality in the area is not suitable for drinking now or in the future. Trace elements such as antimony, arsenic, cadmium, and chromium are above the primary Maximum Contaminant Levels (MCLs) established for drinking water by the California Department of Public Health (CDPH). TDS is consistently above the secondary MCL for aesthetic quality and is directly correlated to the distance from the salt ponds. Current monitoring indicates that the greatest TDS concentration is found in the vicinity of the salt ponds and lowest concentrations furthest from the salt ponds, indicating the influence of salt pond water on the shallow groundwater. TDS will continue to consistently be above the secondary MCL due to the vicinity of the RSM to the salt ponds. Similar trend should also be observed with chloride and sodium concentration in the shallow monitoring wells. Monitoring wells at the RSM should continue to monitor the POC in the groundwater.

8.0 CONCLUSION

Population based flow and load projections were developed using historical data to determine representative per capita flows and loads. These per capita values were then multiplied by the population projections to determine projected flows and loads. Projections were made in five (5) years within the planning horizon of 2010 to 2040.

The projected ADWF and ADWIF with existing water conservation for 2040 are 166 mgd and 182 mgd, respectively. Water conservation measures on future flows were estimated for 2030 and were extrapolated to determine estimated reductions realized by 2040. The projected ADWF and ADWIF with additional future water conservation for 2040 are 145 mgd and 159 mgd, respectively.

The projected 2040 BOD ADWLs for the low, medium and high projection are 349,000 lbs/day, 436,000 lbs/day and 475,000 lbs/day, respectively. The projected 2040 TSS ADWLs for the low, medium and high projection are 303,000 lbs/day, 379,000 lbs/day and 426,000 lbs/day, respectively. The projected 2040 ammonia-nitrogen ADWLs for the low, medium and high projection are 28,000 lbs/day, 35,000 lbs/day and 39,000 lbs/day, respectively.

Projected influent concentrations, effluent concentrations, and removal efficiency for ammonia-nitrogen was based on analysis of the 2006 and 2007 data only, because an increasing trend in the influent concentrations were observed in recent years. Projected influent concentrations, effluent concentrations, and removal efficiencies for the non-conventional pollutants were assumed to be the same as existing influent and effluent concentrations and removal efficiencies.

Future stormwater runoff will be proportional to the impervious area on the site. The projected stormwater flow will be revisited when the master plan treatment alternative and area requirements have been determined. Onsite stormwater flows are not anticipated to have an increased impact on influent flow, pollutant loads, or concentrations unless the WPCP operations change or stormwater flow from outside the WPCP site is introduced to the WPCP.

Ongoing groundwater monitoring should be conducted to determine if operation of the RSM facilities will further affect the groundwater quality. Historical analysis of onsite groundwater suggests that the salt ponds located northwest of the WPCP have impacted the groundwater TDS and should be monitored.

REFERENCES

REFERENCES

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