San Luis Obispo County
Los Osos Wastewater Project Development

TECHNICAL MEMORANDUM

FLOWS AND LOADS

FINAL DRAFT
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Los Osos Wastewater Project Development

TECHNICAL MEMORANDUM

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1.0 INTRODUCTION

The purpose of this technical memorandum (TM) is to further explore the estimates of the flows and loads to the future treatment facility. The design size of the facility will be based on the estimates of flows and loads.

Wastewater from the Los Osos Prohibition Zone is currently discharged onsite from septic tanks at each home, therefore its volume and quality cannot be directly measured. Instead, dry weather wastewater flows for the design of the future wastewater treatment facility were estimated based on wintertime water use rate that are reflected in gallons per month billed by the water purveyors. This assumes that limited outside watering is occurring during the wintertime. These estimated home wastewater contributions are added to any additional flows that would accumulate in the piping system due to inflow or infiltration. Inflow and infiltration (I/I) flow estimates were estimated using literature values and the project team's experience with other cities' sewers. Because of the uncertainties inherent in estimating flows for a collection system that does not yet exist, a sensitivity analysis was performed to determine how the cost of the treatment facilities would vary depending on different assumptions of dry weather flow and I/I.

1.1 Flow Parameters

Several different flow parameters contributed to sizing different elements of the treatment facility. The parameters that are relevant to this discussion of flows and loads are:

- Average daily dry weather flow (ADDWF): This is the average daily flow that is attributable to wastewater flows alone. For Los Osos, ADDWF was calculated based on rainy season indoor water use (i.e. when there is minimal irrigation). Along with influent concentration, the ADDWF is used to calculate the loading to the plant. Because Los Osos is not a vacation community, and because there is no seasonal industry, the ADDWF is expected to be fairly constant throughout the year.

- Peak hour dry weather flow (PHDWF): This is the maximum hourly flow that can be expected in a day, which is higher than the average daily flow due to diurnal water use patterns. The PHDWF itself is not directly used to size any components of a wastewater treatment facility, but contributes the wastewater portion to the peak flow that is also made up of wet weather flows. There is usually a peak in wastewater flows in the morning when residents wake up, followed by a higher peak when residents return home in the evening. The ratio of PHDWF is typically a factor of 1.8 higher than ADDWF, based on the metered flows of several California cities. The PHDWF will be lower for STEP and low pressure sewer systems, where the flow to the treatment facility is triggered when the tank is full, so hourly wastewater flows are less directly dependent on water use. Low pressure sewers will have a PHDWF to ADDWF ratio of 1.6, and STEP sewers will have a ratio of 1.4, since the STEP tank is larger and therefore is pumped out less frequently.

$$PHDWF_{gravity} = 1.8 \times ADDWF$$

$$PHDWF_{low\ pressure} = 1.6 \times ADDWF$$

$$PHDWF_{STEP} = 1.4 \times ADDWF$$

- Average daily wet weather flow (ADWWF): This is the average flow during wet months consisting of average wastewater flow and the inflow and infiltration (I/I) during the rainy season. It is used for process sizing at the wastewater treatment facility.

$$ADWWF = ADDWF + I/I_{average}$$

- Peak hour wet weather flow (PHWWF): This is the highest flow that is expected at the wastewater treatment plant. It is the sum of the peak I/I and the PHDWF. It is important to design a wastewater treatment plant so that these flows can be accommodated in the headworks.

$$PHWWF = PHDWF + I/I_{peak}$$

- I/I Peaking factor: This is the ratio of the peak I/I to the average I/I. This is a parameter that is useful for calculating the PHWWD. A typical value for the I/I peaking factor for a community the size of Los Osos is 1.6 (Metcalf & Eddy 1981).

$$I/I\ Peaking\ Factor = I/I_{peak} / I/I_{average} = 1.6$$

Table 1 shows which treatment plant elements are designed based on which flow parameters.

2.0 WASTEWATER FLOWS

2.1 Historical Data

The ADDWF to the future treatment facility was estimated using winter potable water flows from the past three years.

2.1.1 Purveyors Data

The Los Osos Community Services District (District) and the Golden State Water Company (Golden State), together provide water to more than 95 percent of the population to be served by a future wastewater treatment facility. *The project team has not been granted access to Golden State's recent records as of the writing of this draft, but it was hoped that they would be released during the first couple of months of 2008.*

Table 1	Flows used to Size Treatment Elements Los Osos Wastewater Project Development San Luis Obispo County
Flow Parameter	**Elements Sized by Flow Parameter**
ADWWF	• Secondary processes[(1)] • Chemical storage facilities • Solids handling facilities
PHWWF	• Influent pump station • Headworks (screening)[(2)] • Secondary sedimentation tanks[(3)] • UV disinfection • Effluent pump station

Notes:

(1) Aerated lagoon for facultative pond; oxidation ditch for oxidation ditch treatment; earthen aerated tank for Biolac.

(2) Includes grit removal for oxidation ditch and Biolac.

(3) Facultative ponds do not require sedimentation tanks.

Winter wet weather domestic water flows were assumed to be roughly equal to wastewater flow rates as outdoor irrigation usage during the rainy season is at a minimum. The District bills its customers on two-month cycles, and sends out bills to only half its customers each month, the other half getting billed the following month. The flow data from January to April 2005-2007 was selected for analysis since those months reflect billing cycles with significant rainfall, therefore outdoor water use would be minimal. Flow data from previous years was not used because more recent years best reflect current water conservation levels. Table 2 summarizes the water use rates in early 2005-2007 for the District customers.

**Table 2 — 2005-2007 Water Use Estimate for the District
Los Osos Wastewater Project Development
San Luis Obispo County**

	Gallons Billed			
Month	**2005**	**2006**	**2007**	**Water Usage (gpcd)[1]**
January	15,499,800	14,860,600	15,744,300	58
February	20,261,000	21,122,300	22,015,800	80
March	14,620,100	15,917,600	15,092,500	57
April	18,224,800	17,301,500	21,507,300	72
			Average:	**67**

Note:

(1) Gallons per capita per day (gpcd). Based on population served by LOCSD, estimated at 8,500 people. Water Usage = Gallons Billed / Population

Records for Golden State were unavailable for this TM, but previous reports from 2001 estimated that during the 1990s, water use for Golden State users was approximately 65 gpcd. It is reasonable to assume that this usage has not increased over the past decade, due to the building moratorium and due to the implementation water conservation measures since the 1990s. Since the types of homes that are served by the District and by Golden State are generally similar size and age, it is reasonable to assume that their water usage rates will be approximately the same. Therefore, 65 gpcd serves as a conservative water use estimate for Golden State customers.

Using these figures for the District and Golden State water customers, indoor domestic water consumption for the community was estimated to be 66 gpcd (average of 67 gpcd for the District and 65 gpcd for Golden State). Assuming a buildout population of 18,428 (estimated by the LOCSD and used in previous reports), this corresponds to an ADDWF to the future treatment facility of 1.2 mgd.

2.1.2 <u>Previous Reports</u>

The Wastewater Facilities Project Final Project Report (March 2001), the Los Osos Wastewater Project Revised Project Report (March 2003) and the Los Osos Wastewater Management Plan Update (July 2006) included estimates for these parameters.

The 2001 Final Project Report based water usage rates on reported rainy-season potable water volumes delivered to residences in the relevant communities. It cited a Los Osos plan to reduce domestic water usage by 8 gallons per capita per day (gpcd) through water conservation methods. These measures would reduce indoor consumption from 77 gpcd, which it estimated was the usage rate during the 1990s, to 69 gpcd. This latter figure was used in the 2001 report to estimate wastewater treatment plant capacity. The 2006 Management Plan Update based a water usage rate of 70 gpcd (gallons per person per day) on prior studies that it did not cite.

2.2 Other Data

Several texts list a range of indoor water use rates. Typical values range from 30 to 100 gpcd, but can be much higher (Crites and Tchobanoglous, 1998; ASCE, 1982).

2.3 Potential for Conservation - Planned and On-Going Efforts

Over the past decade, both the District and Golden State have encouraged water conservation measures. They have each provided low-flow showerheads to customers, and the District has distributed water conservation retrofit kits and has instituted rated increases for their customers' water bills (Table 3). In a rated increase billing system, customers are charged more per unit of water as total water usage increases. This type of rate structure discourages high water use. Golden State Water has a continuous rate structure, which does not discourage high water use.

Table 3	Rate Structures for Los Osos Water Purveyors Los Osos Wastewater Project Development San Luis Obispo County	
LOCSD		**Units[(1)]**
Minimum Bi-Monthly Charge:	$28.34	9 ccf
Consumption Charges:		
For 10 ccf to 15 ccf	$3.28	Per ccf
For 16 ccf to 21 ccf	$3.61	Per ccf
For 22 ccf and above	$4.56	Per ccf
Golden State Water		
Minimum Monthly Charge:	$19.10	0 ccf
Consumption Charges:	$1.92	Per ccf
Note: (1) ccf = 100 cubic feet		

In a previous report on water conservation measures, "Los Osos Community Services District Urban Water Management Plan," (December 2000), several alternatives for further conservation were identified. Three options were selected as being the most cost effective: Community Fixture Replacement - mandating that bathrooms be retrofitted with all low-flow fixtures prior to hookup to the new sewer; Public Education; and High-Efficiency Appliance Promotion Programs. The Urban Water Management Plan predicted that these three programs would reduce indoor water consumption by 14.5 percent in nine years.

For the purposes of this project, it is estimated that the community would reduce its per capita water consumption by a more conservative estimate of 10 percent by buildout in 2020. Costs for a toilet replacement program were included in project cost estimates in the Fine Screening Report. Therefore, the design dry weather flow of the plant can be reduced by approximately 0.1 mgd. **Therefore, the design ADDWF of the wastewater treatment plant will be 1.1 mgd** (1.2 mgd minus 0.1 mgd from conservation)**. The PHDWF will be 2.0 mgd for a gravity sewer** (1.1 mgd ADDWF multiplied by 1.8), **1.8 mgd for a low pressure sewer** (1.1 mgd ADDWF multiplied by 1.6), **and 1.5 for a STEP sewer** (1.1 mgd ADDWF multiplied by 1.4)**.**

3.0 INFLOW/INFILTRATION (I/I) ASSUMPTIONS

In the Fine Screening Report, the PHWWF was assumed to be 2.75 mgd for a gravity system and 2.2 for a STEP system. Upon further analysis, these values were deemed too high, and were revised to be lower, as described in the following sections.

3.1 Gravity Sewers

Gravity sewers utilize bell and spigot joint construction. Properly installed bell-and-spigot sewers will be watertight at first, and then may slowly lose their integrity as the surrounding soils shift, compressing the pipes, and compromising their seals at the joints. Some studies show that PVC pipe with bell and spigot joint can perform as new, even after decades of use, indicating that infiltration rates may be near zero (Bauer, 1990; Alferink, 1995; Whittle, 2005). However, a treatment plant should be designed to accommodate a reasonably conservative level of inflow and infiltration (I/I). If, in the future, levels of I/I rise to the point that they threaten to overwhelm treatment capacity, then a maintenance and rehabilitation program can be instituted, or more treatment capacity can be added at that time. However, communities with excessive I/I often are those with sewer systems dating from an era before modern sewer construction techniques and materials.

The Fine Screening Report recommended an I/I allowance of 0.3 mgd additional flow for the average monthly wet weather flow. This value was derived from an average infiltration allowance of 530 gpd/acre, (with a service area of 595 acres), which is appropriate for sewer systems with precast manholes and rubber-gasketed joints (Metcalf and Eddy, 1981).

Table 4 shows a range of infiltration factors developed by various textbooks and other references. These represent I/I rates of older sewer systems. The I/I expected in a brand-new system would be an order of magnitude lower than these values, and increase to these levels over a period of decades. The gravity sewer infiltration allowance used in this TM is greater than most of the rates suggested in these other references. It is therefore a conservative estimate. **The ADWWF expected for the wastewater treatment plant with a gravity collection system is 1.4 mgd** (1.1 mgd ADDWF, plus 0.3 mgd average I/I).

The project team used its experience with sewer master planning in other California cities to project a PHWWF for Los Osos (Table 5). None of these cities is directly comparable to Los Osos, since while many of their sewers have sections constructed with modern materials and construction techniques, they are generally a mix of older and newer construction. Most collection systems include areas that range from less than 5 years to 50 years or more. Additionally, each city has some storm drain connections directly to the sewer system. A peak I/I value of 0.5 mgd was estimated, corresponding to 1.6 (the I/I peaking factor) times the average I/I value, or 840 gpd/acre. This area-based calculation for peak I/I value is comparable to the cities with moderate I/I. This estimate would be conservative for Los Osos, since a new sewer is expected to have low I/I for many years**. Therefore the PHWWF expected for the wastewater treatment plant with a gravity collection system is 2.5 mgd** (2.0 mgd PHDWF plus 0.5 peak I/I.

Table 4	Gravity Sewer Average Infiltration References Los Osos Wastewater Project Development San Luis Obispo	
Source	**Recommendation[1]**	**Corresponding Infiltration for Los Osos**
"Recommended Standards for Wastewater Facilities," Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, 1997.	200 gpd/in-mi	77,000 gpd (0.077 mgd)
"Gravity Sanitary Sewer Design and Construction," American Society of Civil Engineers , 1982	500 gpd/in-mi[2]	190,000 gpd (0.190 mgd)
"Wastewater Engineering; Collection and Pumping of Wastewater," Metcalf & Eddy, 1981.	530 gpd/acre[3]	318,000 gpd (0.318 mgd)
"Civil Engineering Reference Manual", Michael R. Lindeburg, 2001.	200 gpd/in-mi or 10% of average flow	77,000 gpd (0.077mgd) or 120,000 gpd (0.120 mgd)
Infiltration Allowance for Viable Project Alternatives in Fine Screening Report (Gravity)	**780 gpd/in-mi**	**300,000 gpd (0.30 mgd)**

Notes:
(1) Total of sewer = 254,000 linear feet; 8 in diameter (gravity sewer average).
(2) Predominant value reported - many communities had much less.
(3) Los Osos service area = 595 acres

3.2 STEP Sewers

With new septic tanks where drains and runoff are diverted away from the area around the tank, the I/I presumably would be much lower than that estimated for a gravity collection system. The major source of I/I in a STEP sewer is the tank and the connection to the house. I/I into the tank will be retained there and will not immediately translate into peak flows to the treatment plant. Based on these factors, average I/I is estimated to be 0.1 mgd.

Table 5 California Cities' Flow Data
Los Osos Wastewater Project Development
San Luis Obispo

City/District	Year (1)	Developed Sewer Service Area (acres)	ADDWF (mgd)	PHWWF (mgd)	I/I_{peak} (gpd/acre)	Sandy Soils(2)	Pipe Material (3)
Los Banos	2006	3,723	3.57	6.4	520	No	VCP, PVC
Livingston	2004	1,065	1.12	2.7	995	No	VCP, PVC, CI, DI
Selma-Kingsburg-Fowler CSD	2006	6,166	4.35	13.81	1,320	No	VCP, PVC, RCP (large diameter trunk sewers)
Modesto	2004	23,818	26.2	71.7	1,385	No	VCP, CI, DI, PVC, RCP (39" Diam. or greater)
Hughson	2006	692	0.83	1.7	900	No	VCP, CI, DI, PVC
Porterville	1997	3,566	4.87	9.55	900	No	Not Available
Gilroy	2002	8,936	3.6	14.5	750	No	Not Available
Morro Bay	2006	1,650	0.83	3.8	1,300	Yes	Not Available
Los Osos		*595*	*1.1*	*2.5*	*840*	*Yes*	*Likely PVC*

Notes:
(1) Year in which master plan was prepared or flow data was collected.
(2) Sandy soils are more likely to direct stormwater past sewer lines and will therefore lead to less infiltration, so most of these cities will have higher infiltration than Los Osos due to clay soils.
(3) Pipe material for each city/district varies from PVC for new sewers, and VCP and RCP for older sewers. No city/district exclusively used one pipe material for their entire collection system. A new collection system could expect lower I/I rates initially, but could increase with time; VCP = vitrified clay pipe; PVC = polyvinyl chloride; RCP = reinforced concrete pipe; DI = ductile iron; CI = cast iron.

Therefore, the ADWWF expected for the wastewater treatment plant for the STEP collection is 1.2 mgd (1.1 mgd ADDWF, plus 0.1 mgd average I/I).

Using the I/I peaking factor of 1.6 to compare the peak I/I to the average I/I, the peak I/I is calculated to be 0.16 mgd. The PHDWF for the STEP system is 1.5 mgd. **Therefore the PHWWF for a STEP system is 1.7 mgd.**

3.3 Low Pressure Sewers

A low pressure sewer would have many of the same characteristics as a STEP sewer, except that some of the lines would have a smaller diameter in some places due to the need for the wastewater to obtain cleaning velocities. Additionally, in a low pressure sewer, homes would have a small grinder tank rather than a large septic tank, which would presumably be less susceptible to inflow. However, these smaller tanks also have less capacity to equalize flow compared to STEP tanks. Therefore, the average I/I for low pressure sewers is estimated equivalent to a STEP sewer, which is 0.1 mgd with a peak I/I of 0.16 mgd. The PHWWF expected for a low pressure sewer is 1.8 mgd, **therefore the PHWWF for a low pressure sewer is expected to be 1.9 mgd.**

4.0 EXFILTRATION

The EPA (Amick, 2000) reports that exfiltration rates in leaking sewers are related to the relative depths of the sewer lines to the groundwater table, with greater depth to groundwater leading to higher rates of exfiltration. The groundwater table in Los Osos is high (less than 5 feet deep in some areas), so exfiltration is expected to be limited.

While exfiltration is a risk with any sewer system, STEP sewers and low pressure sewers have the potential to leak wastewater faster in the case of a rupture than a gravity sewer because they are under pressure. However, because these sewers are constructed from sealed pipe (typically fusion-welded joints), leaks are less likely than for gravity sewers, whose bell and spigot joints are more susceptible to having their seals broken. Regardless of these differences, exfiltration is not expected to occur in any of these systems to the extent that it would affect treatment plant design.

In the case of exfiltration, the wastewater entering the groundwater would be higher in BOD and solids in a gravity or low pressure sewer compared with a STEP sewer. However, in Los Osos the major concern for groundwater quality is nitrogen. Wastewater flows from each type of sewer would have approximately the same concentration of nitrogen.

5.0 REMEDIATION

If in the future, sewer remediation is required due to either excessive exfiltration or infiltration, leaking areas of the sewer will first need to be identified. This can be accomplished by directly measuring flows in different areas of the collection system, and by using closed-circuit television equipment to visually inspect the sewer pipes. Leaks in pressurized sewers can be detected with a microphone, since the release of pressure produces noise. Remediation can be performed by grouting leaks, by adding an elastomeric compound to failed joints, by adding a lining (although this reduces the pipe capacity) or by replacing the failed areas of pipe.

6.0 FLOW SUMMARY

Estimates of the projected wastewater flows and loads were outlined in the Fine Screening Report and are updated in this TM. The estimate for the dry weather flow at buildout without conservation remains at 1.2 mgd and with conservation at 1.1 mgd.

Inflow/infiltration (I/I) estimates for the collection system alternatives were the main source of uncertainty in calculating the future treatment facility influent flow volume. If a gravity collection system is selected, only a system that was constructed of fusion-welded PVC piping could be operated with as little I/I as the other types systems. However, fusion welded PVC sewers are a fairly new technology with little long-term operating history, and can be significantly more costly to install than traditional bell-and-spigot gravity sewers. Therefore, I/I for a gravity system will be higher than for the other systems.

The summary of flow estimates for each type of sewer is shown in Table 6.

Table 6 Flow Estimates, 2006 Water Use Estimate
Los Osos Wastewater Project Development
San Luis Obispo County

Collection System	Population Estimate	Water Use Estimate (gpcd/mgd)	Conservation (mgd)	$I/I_{average}$ (mgd)	ADWWF (mgd)$^{(1)}$	PHWWF
Gravity	18,428	66/1.2	0.1	0.3	1.4	2.5
STEP	18,428	1.2	0.1	0.1	1.2	1.7
Low Pressure	18,428	1.2	0.1	0.1	1.2	1.9

Note:
(1) Average Daily Wet Weather Flow = Water Use (mgd) - Conservation + $I/I_{average}$ Utilized for sizing processes.

7.0 SENSITIVITY ANALYSIS

The flow estimates presented in Table 6 were calculated based on assumptions derived from literature data and previous experience with I/I as well as information about current water use in Los Osos. However, the estimates would vary if the assumptions changed. A sensitivity analysis was performed to evaluate how the cost of the treatment facilities would change with upper and lower boundary estimates of dry and wet weather flows.

7.1 Higher Dry Weather Flows

There is some uncertainty in the anticipated per capita wastewater flows in the Prohibition Zone. While the per-capita water use calculated for this study was 66 gpcd, previous studies have made estimates that are as high as 77 gpcd. If the prohibition zone had this level of consumption, then the dry weather flow at buildout would be 1.4 mgd with no conservation, compared to the estimate of 1.1 mgd with the higher population and with conservation. Therefore, 1.4 mgd provides an upper bracket for dry weather estimates. Table 7 shows the percentage change in the capital and O&M costs of the three treatment technologies that passed fine screening if the dry weather flow was 1.4 mgd, but without a change in I/I assumptions.

Table 7 Cost Sensitivity of Higher Dry Weather Flows (1.4 mgd Dry Weather Flow Compared to 1.1 mgd)
Los Osos Wastewater Project Development
San Luis Obispo County

	Facultative Pond	Oxidation Ditch	BioLac
Construction Cost	5%	6%	5%
Operation and Maintenance Cost	9%	9%	10%

7.2 Lower Dry Weather Estimates

For a lower dry weather flow estimate, it is assumed that the current water use rate is accurate, and that the community grows to 17,839 in the Prohibition Zone, which is the build-out population estimated in 2002 by the San Luis Obispo County Planning Department. This is a lower population than the 18,428 assumed in this report. Additionally, it is assumed that 14.5 percent conservation, as described in the Urban Water Management Plan, 2000, is obtained. These two factors would reduce the estimate of dry weather flows to 1.0 mgd.

Table 8 shows the percentage change in capital and O&M costs of the three treatment technologies that passed fine screening if the dry weather flow was 1.0 mgd, but without a change in I/I.

7.3 Lower Wet Weather Estimates

In the Fine Screening Report, the PHWWF was assumed to be 2.75 mgd for a gravity sewer. This value was deemed too high, and was revised to be 2.5 mgd in this TM. There was no resulting change in costs due to this update.

Table 8	Cost Sensitivity of Lower Dry Weather Flows (0.8 mgd Dry Weather Flow Compared to 1.1 mgd) Los Osos Wastewater Project Development San Luis Obispo County		
	Facultative Pond	**Oxidation Ditch**	**BioLac**
Construction Cost	-2%	-3%	-3%
Operation and Maintenance Cost	-3%	-7%	-7%

7.4 Summary of Sensitivity Analysis for Flow

A summary of the costs associated with different flow assumptions is presented in Table 9.

Table 9	Summary of Costs with Different Flow Assumptions Los Osos Wastewater Project Development San Luis Obispo County		
	Facultative Pond	**Oxidation Ditch**	**BioLac**
Construction Costs ($M)			
Original estimated capital costs	14.7	19.6	17.2
Estimate if higher dry flows	15.4	20.8	18.1
Estimate if lower dry flows	14.4	19.0	16.7
Estimate if lower wet flows	14.7	19.6	17.2
Operations and Maintenance Costs ($K/year)			
Original estimated capital costs	510	570	550
Estimate if higher dry flows	560	620	610
Estimate if lower dry flows	490	530	510
Estimate if lower wet flows	510	570	550

The treatment component comprises approximately 12 percent of the cost of the entire wastewater project. This sensitivity analysis shows that changing the dry weather or wet weather flow assumptions change the cost of the treatment facility by up to six percent, which corresponds to less than one percent of the total project cost. This difference is lower than was anticipated for the various flow estimates, and is much less than the contingency of the cost estimates, and is therefore insignificant.

8.0 LOAD ESTIMATES

The Rough Screening Report listed influent concentration for the future wastewater treatment facility. These values are considered valid and will be used for treatment facilities sizing for a gravity collection system.

If a STEP collection system is selected, the concentrations of BOD and suspended solids in the treatment plant influent are expected to be lower, due to solids removal and degradation in the septic tanks. Nitrogen concentrations are expected to be unchanged. Estimates for the percentage removal of BOD and suspended solids in septic tanks were obtained from a review of septic tank performance studies (Bounds, 1997). In seven studies, septic tanks reduced BOD by an average of 58 percent and suspended solids by an average of 78 percent. In 14 septic tanks fitted with filtering devices, it was estimated in the review that approximately 64 percent of BOD and 90 percent of suspended solids were removed. Concentrations of total nitrogen were expected to be unaffected by septic tanks. Using these removal efficiencies and the influent quality listed in Table 10 the septic tank effluent quality was calculated and presented in Table 11.

Table 10 Projected Characteristics of Wastewater, Gravity Collection System[(1)]
Los Osos Wastewater Project Development
San Luis Obispo County

Parameter	Units	Average Day	Peak Day
BOD	mg/L	340	350
Suspended Solids	mg/L	390	400
Total Nitrogen	mg/L	56	58

Note:
(1) The Wastewater Facilities Project Final Project Report, 2003.

Table 11 Projected Characteristics of Wastewater, STEP[(1)]
Los Osos Wastewater Project Development
San Luis Obispo County

Parameter	Units	Unfiltered Septic Tank Effluent	Filtered Septic Tank Effluent
BOD	mg/L	140	120
Suspended Solids	mg/L	80	40
Total Nitrogen	mg/L	56	56

Note:
(1) Removal efficiencies from Bounds, T.R., 1997.

Smaller loads of solids and BOD can reduce the size and cost of the wastewater treatment facility when reducing the concentration of these two constituents is the primary concern. However, nitrogen removal can be inhibited by low BOD because it depends on the presence of a carbon source for the microorganisms that perform this task. In order to ensure nitrogen removal, as will likely be required for the new RWQCB waste discharge requirement (depending on the final selected reuse/disposal alternative), plant operators may have to add a supplemental carbon source such as methanol to the biological treatment processes, which would increase the cost of treatment.

9.0 SUMMARY

The estimates of flows remains unchanged from the Fine Screening Report and the estimates for loading remain unchanged from the Rough Screening Report. An ADDWF of 1.1 mgd was assumed, including 0.1 mgd of conservation, to be implemented before buildout in 2020. Different collection alternatives will be associated with different levels of inflow/infiltration. Therefore, the facility will be designed to treat an ADWWF of 1.4 mgd if a gravity sewer is selected, or an ADWWF of 1.2 mgd if a STEP or low pressure sewer is selected. The PHWWF was estimated to be 2.5 for gravity, 1.7 for STEP and 1.9 for low pressure.

A sensitivity analysis was performed to examine how the treatment facility capital and O&M costs would change if dry weather flows varied from 1.0 mgd to 1.4 mgd, and if the PHWWF factor changed to 2.5 from the Fine Screening Report estimate of 2.75. None of the costs for the three treatment technologies that have passed fine screening changed by more than approximately 6 percent which translates to less than 1 percent of total project cost. Because of the small fraction of the treatment component as part of the total project cost, these upper and lower boundary assumptions would not have a significant impact on the total project cost.

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