AECOM

AMENDMENT #1

August 2010

Nipomo Community Services District

Southland Wastewater Treatment Facility Master Plan
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Introduction

As part of the preliminary design effort for the Southland Wastewater Treatment Facility (WWTF) Upgrade Project, the Nipomo Community Services District (District) has provided AECOM with recent wastewater influent monitoring data. AECOM has used the data to update design parameters and to predict startup conditions for plant improvements. The updated flow and BOD loading projections using the new data are lower than those estimated in the January 2009 Southland WWTF Master Plan and preceding reports. These findings are summarized in a memorandum dated February 12, 2010, included as Appendix A.

As described in the memorandum, influent wastewater flows and BOD concentrations have “decreased” since 2004, either due to an actual flow reduction or to more accurate flow recording techniques used at the WWTF. As a result, the startup influent conditions for the WWTF Upgrade Project will likely be less than previously anticipated, requiring revisions to the phasing plan described in the Southland WWTF Master Plan (AECOM, January 2009).

Scope of Work

AECOM’s scope of work for this Amendment #1 included the following tasks:

- Review of current WWTF flows and BOD loading;
- Develop a revised site plan, including sizes and phases of process equipment, basins, and appurtenances;
- Develop updated opinions of probable construction cost for each of the proposed phases of the project through Master Planned future flows; and
- Provide updated opinions of the annual operations and maintenance costs.

Existing Flows and Loading

Flows

Daily flow totals from September 2007 through August 2009 were examined for the basis of this evaluation. Two sources of data were reviewed and compared for the evaluation. Flow rates manually recorded from the totalizer on the WWTF influent flow meter are plotted in Figure 1, and data downloaded from the District’s SCADA system (electronically recorded from the same meter and totalizer) are shown in Figure 2. Both sets were evaluated for purposes of comparison.

Since data from the SCADA system is more reliable, it will be used for the basis of design. The SCADA system records data at the same time each day, resulting in more consistent 24-hour averages. Analysis of the manually recorded data is included in this report for both historical purposes.

Two flow values appear to be outliers from the manually recorded data set: (1) A total flow of 0.067 million gallons (MG) reported on September 21, 2007 and (2) a total flow of 1.184 MG reported on

September 26, 2007 (see Figure 1). The average daily flow over the study period is 0.571 million gallons per day (MGD), with a standard deviation of 0.0974 MGD. The high flow reported on 9/26/07 is larger than the average plus six times the standard deviation, and the low (9/21/007) is smaller than the average minus five times the standard deviation. Considering the large variance from the average, these two flow values were disregarded for this analysis.

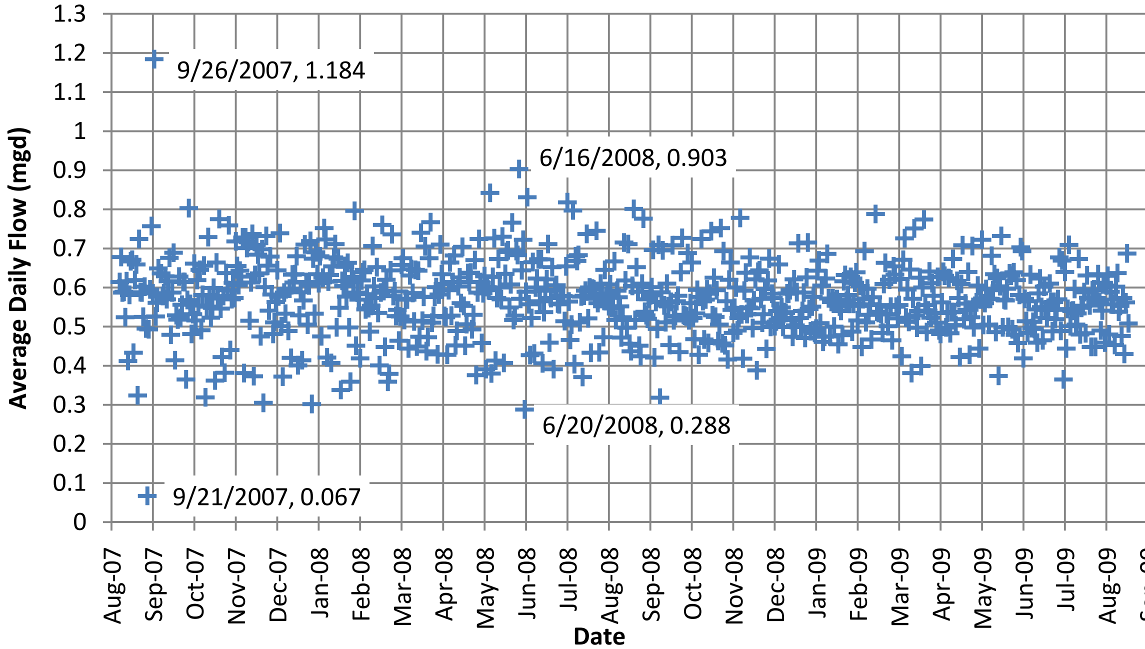


Figure 1 Manually Recorded Southland WWTF Daily Flows

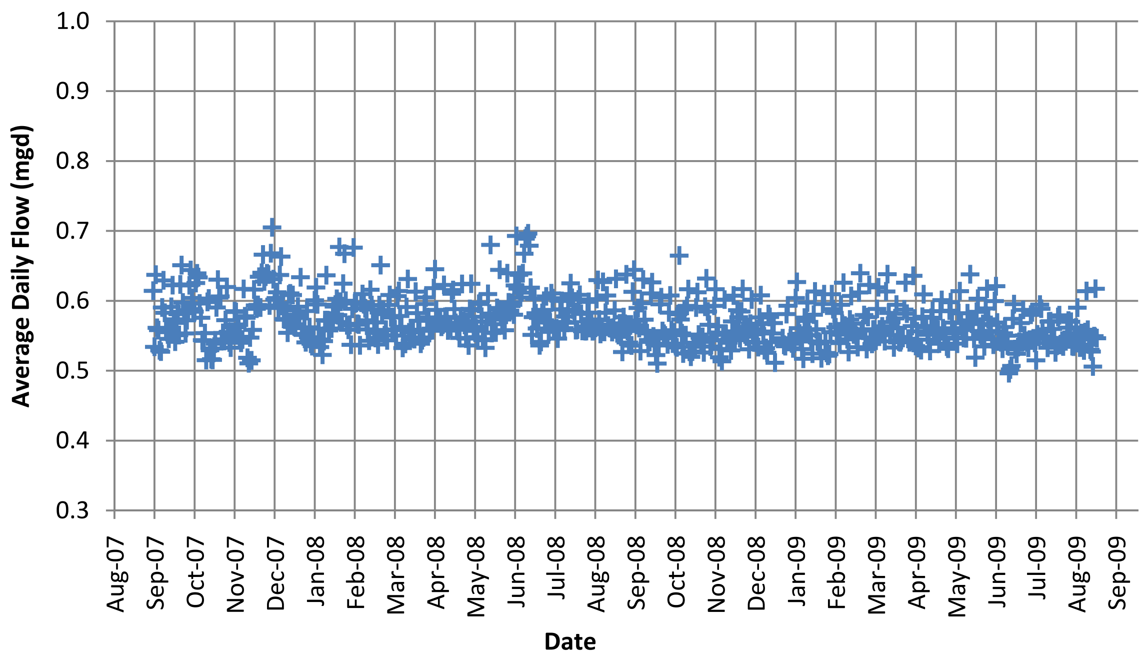


Figure 2 SCADA Recorded Southland WWTF Daily Flows

The 30-day average daily flow (ADF) and peak daily flow (PDF) were calculated for each month under each of the two data sets. Table 1 summarizes these values for both sets of data (values for the manually recorded data disregard the two outlier values in September 2007). Also included in Table 1 are monthly precipitation data measured at the Southland WWTF by San Luis Obispo County.

Comparison of flow rates reveals the average annual flow and the maximum month flow to be very similar between the two data sets. The peak day flows (PDF), however, are lower in the SCADA recorded data than in the manually recorded data.

Table 1 Comparison of Average and Peak Daily Flows for Two Data Sets

	Manually Recorded		SCADA Recorded		
Month	ADF (mgd)	PDF (mgd)	ADF (mgd)	PDF (mgd)	Precip (in)
Sep-07	0.580*	0.757*	0.579	0.651	0.00
Oct-07	0.575	0.803	0.573	0.639	0.27
Nov-07	0.578	0.775	0.582	0.666	0.00
Dec-07	0.594	0.739	0.595	0.705	2.77
Jan-08	0.583	0.752	0.580	0.677	9.03
Feb-08	0.573	0.796	0.580	0.676	2.91
Mar-08	0.570	0.760	0.571	0.631	0.03
Apr-08	0.578	0.767	0.579	0.645	0.00
May-08	0.569	0.842	0.576	0.680	0.00
Jun-08	0.613	0.903	0.611	0.696	0.00
Jul-08	0.583	0.818	0.579	0.625	0.00
Aug-08	0.570	0.745	0.573	0.631	0.00
Sep-08	0.568	0.801	0.571	0.644	0.00
Oct-08	0.561	0.727	0.560	0.660	0.00
Nov-08	0.570	0.778	0.565	0.630	0.00
Dec-08	0.552	0.674	0.555	0.610	0.52
Jan-09	0.563	0.715	0.556	0.627	0.63
Feb-09	0.559	0.693	0.563	0.626	3.89
Mar-09	0.572	0.788	0.570	0.639	1.68
Apr-09	0.564	0.774	0.561	0.636	0.65
May-09	0.569	0.732	0.565	0.638	0.14
Jun-09	0.553	0.703	0.557	0.621	0.00
Jul-09	0.553	0.709	0.553	0.594	0.00
Aug-09	0.554	0.687	0.553	0.617	0.00
AAF		0.571		0.571	
MMF		0.613		0.611	
PDF		0.903		0.705	
ADWF		0.571		0.572	
AWWF		0.570		0.570	
PDWF		0.903		0.696	
PWWF		0.796		0.705	

Precipitation data collected from onsite rain gauge and provided by SLO County.
* Outlier daily values were removed to calculate monthly ADF and PDF

Several flow conditions analyzed in the Facility Master Plan were updated using the SCADA recorded flow data:

The *Average Annual Flow (AAF)* is the flow rate averaged over the course of the year and is the base flow for the WWTF. Collection and analysis of 2 years of historical flow data (September 2007 through August 2009) yielded an AAF of 0.571 million gallons per day (MGD).

Average Wet Weather Flow (AWWF) is defined as the average daily flow during “wet” months, or months that experience a total rainfall greater than 0.5 inches. San Luis Obispo County provided precipitation data, collected from a gauge at the WWTF. Flow and rainfall records indicate the service area has an AWWF of 0.571 MGD.

Maximum Month Flow (MMF) is an important design flow for the Waste Discharge Requirements (WDR’s) since it is the basis of the WWTF’s permitted capacity. MMF is defined as the average daily flow during the maximum month. Flow records for the past two years indicate a MMF of 0.611 MGD. The MMF occurred during the month of June 2008.

Peak Day Flow (PDF) is the maximum average daily flow rate experienced at the WWTF. PDF is used for design of several WWTF components, including clarifiers and sludge pumping facilities. Flow records indicate the PDF is 0.705 MGD (December 2, 2007).

Peak Hour Flow (PHF) is the maximum one-hour flow experienced by the system, and can usually be derived from WWTF records, flow monitoring, or empirical equations used to estimate PHF based on service area population. It is important for design of pumps, pipes, screens, flow meters, grit removal devices and clarifiers. Data from the SCADA system was analyzed to determine the PHF. Flow is currently measured and recorded at 15-minute intervals. One year of data from the study period was examined (September 2007 through August 2008). The data indicates the PHF was 1.65 MGD (8/10/2008 11:00 AM). This value was used to approximate existing conditions and calculate a peaking factor used to project future flow conditions.

Peak Dry Weather Flow (PDWF) is the maximum daily flow rate recorded at the WWTF during months when less than 0.5 inches of rain occurs. PDWF for the WWTF is 0.696 MGD (June 17, 2008).

Peak Wet Weather Flow (PWWF) is the maximum daily flow rate recorded at the WWTF during months when 0.5 inches or more rain is recorded. The larger of the PWWF and the PDWF is used as the PDF (0.705 as described above). PWWF for the District is 0.705 MGD (December 2, 2007).

Infiltration and Inflow

The Facility Master Plan found no indication of significant inflow or infiltration influence on the WWTF flows. The updated flow data were compared to monthly area precipitation totals to re-examine the potential impact of inflow and infiltration. *Infiltration* is the water entering a sewer system and service connections from groundwater, through such means as defective pipe, pipe joints, connections, or manhole walls. *Inflow* is the water discharged to into a sewer system and service connections from such sources as roof and foundation drains, manhole covers, cross connections from storm sewers, and catch basins. Figure 3 compares the total precipitation, as measured by San Luis Obispo County at the WWTF, with the average daily flow for each month between September 2007 and August 2009. Typically, potential influence of infiltration on treatment plant flow rates can be estimated by observing patterns in the total rainfall plotted with the average daily flows for each month. Based on comparison of rainfall and monthly flows, it appears infiltration is not significant.

The impact of inflow can be estimated by the difference between wet weather and dry weather peak daily flows. Plant records indicate peak daily flows during wet weather months are approximately the same as dry weather peak day flows (Table 1), suggesting that inflow is not a significant contribution to wastewater flows.

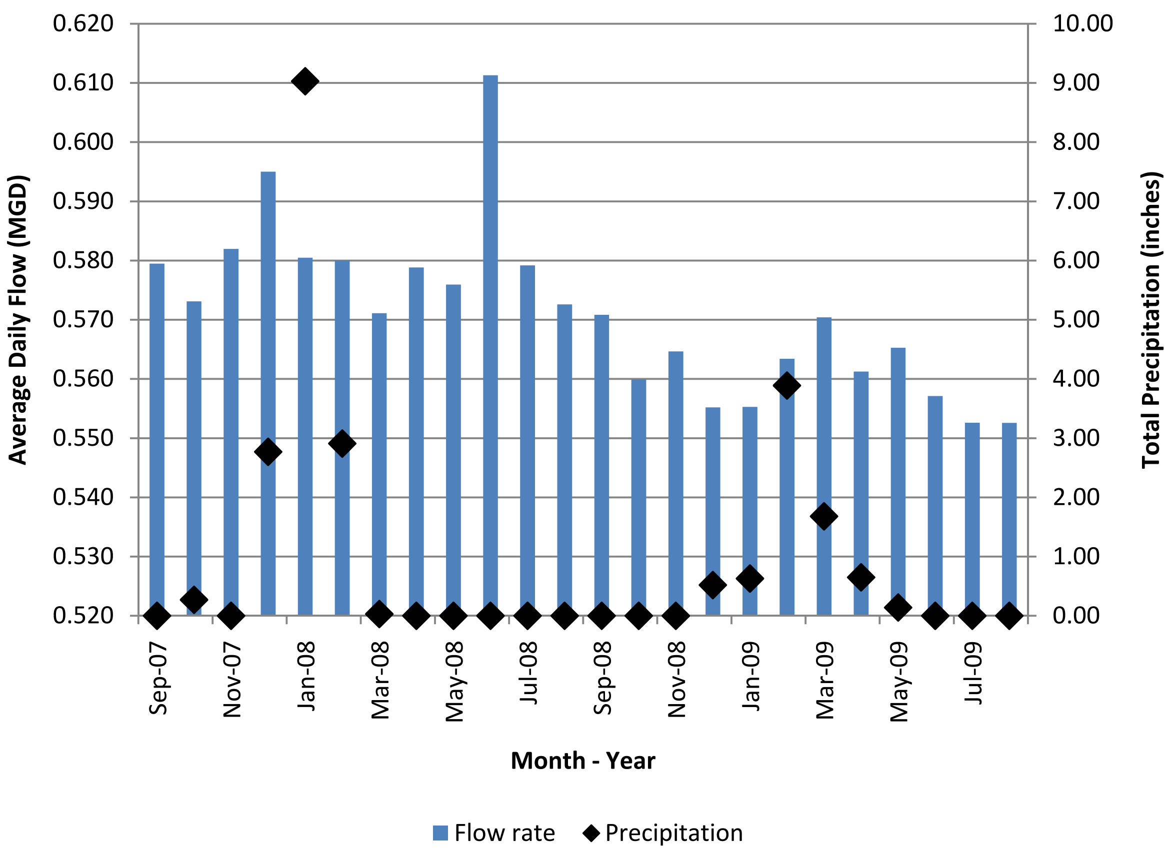


Figure 3 Southland WWTF Monthly Average Daily Flows and Total Precipitation

Flows Used in Capacity Analysis

Infiltration and inflow are not considered significant for this capacity analysis. The 2-year annual average flow (AAF), peak daily flow (PDF), and peak hourly flow (PHF) were utilized to analyze existing and future capacity. Table 2 contains the flow conditions and corresponding peaking factors.

Table 2 Summary of Existing Flow Conditions and Peaking Factors

Flow Condition	Existing Flow (MGD)	Peaking Factor
Average Annual Flow (AAF)	0.571	--
Maximum Monthly Flow (MMF)	0.611	1.07
Peak Daily Flow (PDF)	0.705	1.23
Peak Hourly Flow (PHF)	1.65	2.89

Existing Plant Loading

The solids and organic loading as determined by total suspended solids and BOD concentrations in domestic wastewater are an important factor for determining the capacity of a WWTF. The loading is estimated through monitoring flow rates and concentrations of five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) of the influent wastewater. The Southland WWTF measures influent BOD_5 and TSS weekly. Monitoring records from September 2007 through August 2009 (two years of data) were reviewed to estimate existing plant loading (Table 3). Loading conditions (lb/day) are estimated by multiplying the average concentration by the average daily flow rate for the month.

Table 3 Existing BOD and TSS Loading Data

Month-Year	Average Daily Flow (MGD)	Monthly Average BOD_5 (mg/L)	Monthly Average TSS (mg/L)	Average Daily BOD_5 loading (lb/day)	Average Daily TSS loading (lb/day)
Sep-07	0.580	297	208	1,437	1,006
Oct-07	0.575	272	244	1,304	1,170
Nov-07	0.578	273	290	1,318	1,398
Dec-07	0.594	243	188	1,205	931
Jan-08	0.580	238	252	1,150	1,219
Feb-08	0.590	262	*408	1,288	*2,008
Mar-08	0.570	290	*333	1,379	*1,583
Apr-08	0.580	247	262	1,196	1,267
May-08	0.570	252	274	1,197	1,303
Jun-08	0.610	242	194	1,230	987
Jul-08	0.580	237	240	1,144	1,161
Aug-08	0.570	264	205	1,255	975
Sep-08	0.570	252	230	1,196	1,093
Oct-08	0.560	227	200	1,059	934
Nov-08	0.570	220	208	1,043	989
Dec-08	0.550	287	216	1,316	991
Jan-09	0.560	256	*179	1,193	*836
Feb-09	0.540	247	218	1,114	982
Mar-09	0.570	279	234	1,325	1,112
Apr-09	0.560	271	231	1,265	1,079
May-09	0.570	223	*90	1,061	*428
Jun-09	0.550	245	*142	1,123	*651
Jul-09	0.550	243	*89	1,114	*408
Aug-09	0.550	218	*95	999	*436
AVERAGE				1,205	* 1,039
MINIMUM				999	*408
MAXIMUM				1,437	*2,008
Notes: * Average TSS concentrations and loadings are suspected to be inaccurate due to inconsistent weekly concentrations					

The BOD data shown in Table 3 is relatively consistent, providing a level of confidence in the data. However, the TSS data is inconsistent, with average monthly concentrations ranging from 89 to 408 mg/L. Inconsistent data is indicated in Table 3 with an asterisk (*). Because of the inconsistencies reported on the TSS concentrations, TSS loading is conservatively assumed to be equal to the BOD loading. Table 4 contains the assumed plant loading to be used for existing conditions and for projecting future conditions.

Table 4 Existing Influent Loading Rates

	Average Daily BOD_5 loading (lb/day)	Average Daily TSS loading (lb/day)
AVERAGE	1,200	1,200
MINIMUM	1,000	1,000
MAXIMUM	1,450	1,450
Notes: Data from Table 3 used. TSS loading assumed to be equal to BOD_5 loading, due to inconsistent TSS concentrations.		

Projected Flows

As presented above, WWTF records from the past two years revealed an AAF of 0.57 MGD. Based on direction from the District, the projected buildout[1] AAF from the January 2009 Southland WWTF Master Plan was used in this Amendment #1. Table 5 shows the existing and projected flow rates under various design flow conditions.

The peaking factors were established based on existing flow rates. The peaking factor for a particular flow condition is calculated by dividing the value for that condition by the AAF. For example, the peaking factor for MMF is calculated by dividing the MMF (0.611 MGD) by the AAF (0.571 MGD), which equals 1.07. Peaking factors are then used to project future values for the various flow conditions. For example, buildout MMF is estimated by multiplying the projected AAF (1.67 MGD) by the MMF peaking factor (1.07), for a projected buildout MMF of 1.79 MGD. This same process was used for PDF and PHF.

Table 5 Existing and Projected Influent Flow Rates

Flow Condition	Peaking Factor	Existing Flow (MGD)	Buildout Flow (MGD)
Average Annual Flow (AAF)	--	0.571	1.67
Maximum Monthly Flow (MMF)	1.07	0.611	1.79
Peak Daily Flow (PDF)	1.23	0.705	2.05
Peak Hourly Flow (PHF)	2.89	1.65	4.83

Projected Loads

Future influent WWTF loading in terms of BOD and TSS can be projected using a ratio of existing and projected future flow rates. This assumes that the future wastewater characteristics will not differ significantly from the existing wastewater (the ratios of domestic to commercial and industrial wastewater sources will remain relatively constant).

[1] Buildout as defined by the Land Use and Circulation Elements of the SLO County General Plan for South County - Inland (revised June 23, 2006)

Table 6 Existing and Projected Influent Loading Rates

	Existing	Buildout
AAF (MGD)	0.571	1.67
Average Annual BOD_5 Loading (lb/day)	1200	3520
Average Annual TSS Loading (lb/day)	1200	3520
MMF (MGD)	0.611	1.79
Maximum Monthly BOD_5 Loading (lb/day)	1450	4260
Maximum Monthly TSS Loading (lb/day)	1450	4260
Minimum Monthly BOD_5 Loading (lb/day)	1000	2930
Minimum Monthly TSS Loading (lb/day)	1000	2930

The buildout per capita loading was checked using the projected population from Appendix A of the Water and Sewer Master Plan Update (Cannon Associates, December 2007). Assuming a buildout population of 21,190, the average per capita BOD loading at buildout is 0.17 lb/capita-day. This is within the anticipated range of 0.11 to 0.26 lb/capita-day[2]. Higher loadings may be more typical for areas with a large number of homes using garbage disposals. This feature is more common in newer homes. With increasing usage of garbage disposals and implementation of water conservation practices, it can be anticipated that loading will increase. Therefore, it is important to consider not only average loadings, but other (higher) loadings for design parameters.

Frequency diagrams are useful for determining design conditions when planning wastewater treatment plant improvements. A frequency diagram was created for BOD_5 influent concentrations (Figure 4) revealing that 90% of the time the influent BOD_5 concentration is less than 300 mg/L. The 90^{th} percentile TSS concentration is assumed to be the same.

[2] Tchobanoglous, et al. Wastewater Engineering Treatment and Reuse. 4^{th} Edition. Boston: McGraw-Hill, 2003.

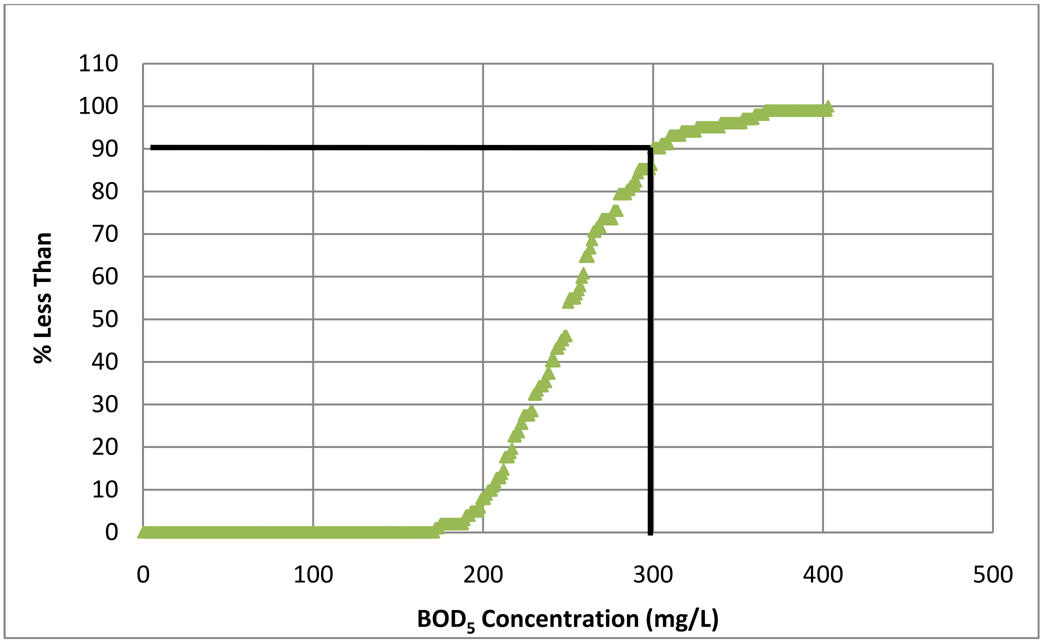


Figure 4 Influent BOD_5 Frequency Diagram (Sept 2007 – Aug 2009)

Recommended Improvements

Influent Lift Station

The January 2009 Facility Master Plan examined the capacity of the existing lift station and recommended that the District budget for a lift station replacement. The wet well was found to be undersized for existing conditions and the capacity of the pumps were insufficient for future flows. Current operational issues include frequent pump clogging from rags and large materials and power supply imbalances, causing temporary pump failure. The Facility Master Plan recommended installation of screw centrifugal pumps (which have better solids-handling characteristics than the existing submersible pumps) to reduce clogging and a solid-state starter or slightly oversized motor on the pumps to reduce impacts of the power supply imbalances. VFDs were also evaluated and, while a viable solution, relatively high cost and complexity were considered to be a disadvantage. Instead new power supply infrastructure was the selected solution. A new flow-metering manhole was also recommended.

Our recommendations for the influent lift station have not changed from those in the January 2009 Facility Master Plan. We recommend the District budget for a lift station replacement, with a new flow metering manhole, new wet well and three screw centrifugal pumps, sized so that any two can handle the buildout peak hour flow. Design flows have been modified as summarized in Table 5.

Screening

Two screening technologies were evaluated in the January 2009 Facility Master Plan: shaftless spiral and in-channel moving screens. Each screen would feature 6-mm openings, all stainless steel hardware of wetted parts, pressure wash capability, and capacity for future PHF. Two shaftless screw screens in parallel operation, each with 100% PHF capacity were recommended. The shaftless screw screens require lower capital cost and provide better compaction and dewatering of solids than a mechanical bar screen. Our recommendation has not changed from the January 2009 Facility Master Plan. The design flows have changed as summarized in Table 5. The effect of the updated flows has been evaluated and it has been determined that they will not affect AECOM's recommendation for the screening technology.

Grit Removal

Two technologies were investigated for grit removal in the January 2009 Facility Master Plan: vortex and aerated systems. A vortex grit removal system, with vortex flow and tangential entry grit trap (such as the Jones & Attwood Jetair) and a screw classifier, was recommended to separate inorganic solids from influent wastewater. While the capital costs are higher, the vortex system typically requires less maintenance than an aerated grit chamber which requires regular repair and replacement of air valves, fittings, diffusers, and piping in the basins. Two units, each with capacity to handle 50% of the projected buildout PHF, were recommended. Our recommendation has not changed from the January 2009 Facility Master Plan. The design flows have changed as summarized in Table 5. The effect of the updated flows has been evaluated and it has been determined that they will not affect AECOM's recommendation for the vortex grit removal system. However, it will impact the phasing recommendation as described below.

Extended Aeration

The January 2009 Facility Master Plan evaluated four treatment upgrade and/or expansion alternatives: additional aerated lagoons (current technology), the Biolac® wave oxidation system, conventional activated sludge, and oxidation ditch system technologies. The Biolac® system was recommended because of the high level of treatment, future flexibility, relatively low capital and operating costs, and relative ease of routine operations and maintenance. Two Biolac® basins and two secondary clarifiers were recommended for the project. The two new basins and clarifiers were to be installed within the existing footprint of two of the four current aerated ponds.

The main disadvantage to the Biolac® system identified in the Master Plan was the increased maintenance and control requirements. However, this is inherent in the higher level of technology, delivering a higher quality of effluent. For the level of treatment, the Biolac® system appears to be the easiest to maintain, with simple, accessible parts, relatively inexpensive to replace, and lower capital cost when compared with the other technologies reviewed in the Master Plan.

Based on the revised flows and loadings, the design recommendations are modified as follows:

- Install earthen berms along the center of two of the existing ponds to create four smaller cells.
- Phase construction of three basins as described below.

Secondary Clarifiers

Two circular secondary clarifiers were recommended in the January 2009 Facility Master Plan as part of the treatment process upgrade. The Biolac® system is designed as a completely mixed system. Suspended solids in the mixed liquor are conveyed to the secondary clarifiers. Secondary clarifiers provide settling of the mixed liquor suspended solids (MLSS) to reduce the TSS concentration in the effluent. The settled solids, rich in biology, is then returned to the front of the extended aeration process for enhancement of biological treatment ("return activated sludge," RAS). As needed, part of the sludge stream is wasted to solids handling facilities ("waste activated sludge," WAS).

In consideration of the revised flows and loadings, three smaller (45-foot diameter) circular secondary clarifiers are recommended with phasing described below. The clarifiers will be below grade to allow for gravity flow from the aeration basins. Sidewater depth is anticipated to be between 12- and 16-feet, and will be determined during the concept design phase.

RAS/WAS Pumping Station

The RAS/WAS pumping station will consist of a wet well equipped with solids-handling submersible pumps capable of handling 150% of the ADF with the largest pump out of service.

Aerobic Digester Conversion

The January 2009 Master Plan recommended construction of a sludge holding facility that would provide anaerobic digestion of the sludge and flow equalization of sludge flows prior to solar drying. The original plan consisted of converting two of the four existing aeration ponds to sludge holding ponds and installing brush aerators on them to maintain an aerobic zone at the surface. This would prevent odors without mixing and aerating the entire pond volume.

AECOM is currently recommending installation of two berms in one of the existing ponds to create three cells and using existing surface aerators to promote aerobic digestion. This does present an increase in capital cost over the original proposal; however, it will provide the following advantages:

- Reduction of the total dry tons of sludge in the range of 30% to 60% depending on retention time;
- Reduction of odors from the drying beds during solar drying, as a result of removing volatile organic solids through aerobic digestion; and
- Pathogen inactivation.

As proposed, each aerobic digester would include the following features:

- Impermeable lining (HDPE or suitable material);
- Relocation of existing conventional aerators from the District's current treatment pond system for mixing and aeration;
- Sidewater depth of 11 feet;
- Approximate volume of 1.17 million gallons, which would provide approximately 10 - 20 days of hydraulic retention time at Phase 3 flows, depending on recirculation rates. One cell could be out of service for maintenance or settling/sludge transfer operations and the system will still provide adequate hydraulic retention time;
- Transfer of sludge into the digesters will be performed by the WAS pumping system; and

- Transfer of sludge out of the digesters will be performed by a portable transfer pump that will be purchased separately by the District. Buried pipelines and appropriate pump connections will be provided to allow District staff to pump supernatant from the digesters to the plant headworks and to pump sludge to the drying beds. A flexible pipe can be adjusted by operations staff to different depths to draw either sludge or supernatant from the ponds.
- An alternative transfer option was evaluated as described below.

It is assumed that each digester cell will automatically receive WAS from the clarifiers, and the manual transfer pump will be operated in coordination with wasting activities in order to keep a minimum volume of sludge in each cell. By constructing multiple cells, redundancy is provided so that aerators can be deactivated and settling can occur in a cell prior to transferring sludge. This activity can be performed while the WAS pumps continue to deliver WAS to the other cell(s).

The number and spacing of aerators will be based on oxygen and mixing requirements, balanced with size limits of the cells and assumed area of influence for each aerator.

Alternatives to In-Ground Aerobic Digesters with Manual Transfer Pump

The transfer of sludge out of the digesters using a portable transfer pump may be a labor intensive operation. Above-grade aerated tank digesters were considered. However, at $1,500,000 to $2,000,000, this option was determined cost-prohibitive at this time.

AECOM evaluated an alternative to using a portable transfer pump. The alternative consists of permanent piping from the digesters to a wet well with a solids-handling pump, along with a discharge manifold and piping to the drying beds. Two pipes would be constructed from the pond to the wetwell – one at the pond floor for removing sludge, and a second pipe at the same elevation that would be connected to a flexible pipe and floating outlet for decanting the pond. A connection to the plant's non-potable water system would add the ability to flush the sludge suction line just before the sludge pumping. Before sludge is removed, the digester aerators would be turned off, allowing the sludge to settle for a day or two. Supernatant would be drawn from the decanter and pumped to the headworks for treatment. After decanting, the aerators would be utilized to stir the settled sludge. Then sludge would be pumped from the bottom of the digesters to the drying beds for solar drying.

AECOM prepared a planning-level opinion of probable construction cost for this addition to the sludge digesters and estimate a range of $150,000 to $180,000 for Phase 1 (in addition to the cost to construct the digesters in the existing pond). An additional pump may be required for Phase 3, along with piping, valves, and decanter. The cost opinion for this addition to the Phase 3 sludge digester is approximately $90,000 to $100,000.

The current plan (portable transfer pump and flexible sludge suction / decanting pipeline) is preferred. Permanent piping, valves, and submersible pumps present clogging and maintenance issues. A portable transfer pump completes the function with greater accessibility and operational flexibility at a lower cost. In addition, the pump can be used for other maintenance functions around the plant or in the collection system. For this reason, AECOM recommends the portable transfer pump.

Sludge Drying Beds

The District currently utilizes two sludge drying beds. The January 2009 Facility Master Plan recommended upgrading the existing sludge drying facilities with a concrete liner and decant system. Decanted water would be pumped to the WWTF's headworks for treatment. Two new sludge drying beds with concrete liners and a decanting system were recommended for the future phase.

Recommendations for the upgrades and new construction have not changed. The concrete liner will protect groundwater quality and allow operators to drive equipment into the drying beds for more effective drying and disposal operations. Phasing recommendations are described below.

Prior Phasing Plan

Two phases were recommended in January 2009 Facility Master Plan. The first phase included the following:

- Upgrade of the Frontage Road influent sewer line from 12-inch to 21-inch
- Influent lift station upgrade
- (2) Shaftless Screw Screens
- (2) Vortex Grit Removal Systems
- (2) Biolac Basins with aeration equipment sufficient to meet 75% of buildout
- (2) Circular Secondary Clarifiers
- Conversion of two existing ponds into sludge holding lagoons
- Upgrade two existing sludge drying beds with concrete liner and decant system

Phase two included additional aeration equipment for the Biolac system and two new sludge drying beds with concrete liners and decant systems.

Current Phasing Plan

Based on the revised flows and loadings, three phases are recommended with details as follows. Figure 1 shows the phasing plan and layout. Tables 7 through 9 summarize the major system components for each phase.

Table 7 Phase 1 Components

Major System Component	Notes
Influent lift station	Install new wetwell, designed for future phasing; ▪ New flow monitoring manhole and associated instrumentation; and ▪ Two screw centrifugal pumps with associated valves, piping, and controls.
Shaftless screw screens	Two will be installed and can handle future flows.
Vortex grit removal system & screw classifier	One will be installed with a configuration that is compatible with a second future grit chamber and classifier.
Biolac System	Regrade side slopes in one existing pond (Pond 1) to 2:1 side slopes. Install earthen berm in existing Pond 1 to create two basins; ▪ New plastic liner in one basin (Aeration Basin #1); ▪ Air piping and air headers for two basins (Aeration Basins #1 & #2); ▪ Controls for two basins (Aeration Basins #1 & #2); ▪ Three blowers; and ▪ Aeration equipment in one basin (Aeration Basin #1).
Secondary Clarifiers	Construct one 45-foot diameter secondary clarifier; ▪ RAS/WAS pump station designed for future phases; and ▪ Distribution boxes designed for future phases.
Aerobic Sludge Digesters	Install two earthen berms in one existing pond (Pond 4) to create three cells; ▪ New plastic liner in two basins; and ▪ Existing surface aerators to two basins.
Sludge Drying Beds	Construct two new drying beds with concrete liners and decant system; and ▪ Decant pump station to return decant water to the headworks.

Table 8 Phase 2 Components

Major System Component	Notes
Influent Lift Station	Install one screw-centrifugal pump and associated valves, piping, and controls (for total of three pumps).
Biolac System	Install new plastic liner in second basin (Aeration Basin #2); ▪ One additional blower; and ▪ Aeration equipment in second basin (Aeration Basin #2).
Secondary Clarifiers	Install one 45-foot diameter secondary clarifier. Install one additional pump in RAS/WAS pump station.
Sludge Drying Beds	Construct concrete liners & decant system in one existing drying bed.
Emergency Generator	The existing emergency generator will be sufficient for Phase 1 loads, but anticipate a lifespan of 15 – 20 years. Budget for 400 KW generator.

Table 9 Phase 3 Components

Major System Component	Notes
Vortex grit removal system & screw classifier	Install a second grit removal system and screw classifier.
Biolac System	Regrade side slopes in one existing primary pond (Pond 2) to 2:1 side slopes. Install earthen berm in existing Pond 2 to create two basins; ▪ New plastic liner in one basin (Aeration Basin #3); ▪ Air piping and air headers for one basin; ▪ Controls for one basin; and ▪ Aeration equipment in one basin (Aeration Basin #3).
Secondary Clarifiers	Construct one 45-foot diameter secondary clarifier.
Aerobic Sludge Digesters	Install new plastic liner in one basin; and ▪ Existing surface aerators in one basin
Sludge Drying Beds	Install concrete liners & decant system in one existing drying bed.

Capacities and Phasing Triggers

Aeration basin capacity is the limiting factor in the overall plant capacity. Capacity assumptions are based on several variables, including anticipated plant loading, aeration basin volume, aeration equipment capabilities, pond dimensions and required aeration spacing. Capacities and phasing triggers between Phases 1 and 2 will be confirmed during concept design. The planning-level project phase capacities and planning “triggers” are summarized in Table 10 and described below.

Phase 1 will be designed to improve treatment, but not expand the existing capacity of the plant (currently rated for a MMF of 0.9 MGD). We recommend that the “trigger” to begin planning for Phase 2 construction is the occurrence and calculation of a 30-day average flow equal to 80% of the Phase 1 capacity, or 0.7 MGD. Phase 2 includes a second aeration basin and clarifier. In Phase 2, the plant will be able to operate with one aeration basin out of service for average flow rates up to 1.28 MGD.

For process redundancy and operation flexibility, we recommend a planning “trigger” for construction of Phase 3 is occurrence of a monthly flow equal to 80% of the minimum required loading for three aeration basins, which is equivalent to approximately 1.70 MGD. The corresponding “trigger” is a 30-day average flow equal to 1.37 MGD. Following implementation of Phase 3, the plant will be able to operate with one aeration basin out of service (and two basins running) for average flow rates up to 1.8 MGD.

Table 10 Project Phasing Capacities and Planning Triggers

Project Phase	Capacity (MMF, MGD)	Planning Trigger (MMF, MGD)
Phase 1	0.9	--
Phase 2	1.28	0.7
Phase 3	1.80	1.4

Opinion of Probable Construction Cost

AECOM developed updated opinions of the project construction costs for each phase. Table 11 summarizes the costs per major component. The total probable construction cost opinion for Phase 1 is approximately $8.9 million, including a 25% project contingency and escalated to the anticipated midpoint of construction.

Table 11 Phase 1 Construction Cost Opinion

Project Component	Cost
Influent Pump Station	$571,600
Spiral Screening System	$371,600
Grit Removal System	$284,100
Extended Aeration System	$1,834,200
Secondary Clarifiers	$1,837,100
Aerobic Sludge Digesters	$166,300
New Drying Beds	$992,300
Controls & Blower Building	$232,600
Non-Potable Plant & Irrigation Water Systems	$191,200
Site Piping	$642,000
Subtotal	***$7,123,000***
Contingency (25%)	*$1,780,750*
Total Construction Cost Opinion	***$8,904,000***

Notes:
1. ENR CCI (April 2010) = 8677
2. Phase 1 costs are escalated by 2% per year to midpoint of construction (estimated 1/10/2012).
3. Construction costs do not include design fees, construction managements fees, permitting fees, or other "non-construction," project related costs.
4. The opinion of probable construction cost prepared by AECOM represents our judgment and is supplied for general guidance to the District. Since AECOM has no control over the cost of labor and materials, or over competitive bidding or market conditions, AECOM does not guarantee the accuracy of such opinions as compared to contractor bids or actual costs.

Probable construction cost opinions for Phase 2 and Phase 3 were developed, and summarized in Tables 12 and 13. The costs listed are April 2010 dollars, and not escalated. A 30% contingency was added to the base construction cost opinion. The cost opinion for Phase 2 came to approximate $2.28 million. The Phase 3 cost opinion came to approximately $2.84 million.

Table 12 Phase 2 Construction Cost Opinion

Project Component	Cost
Influent Pump Station	$102,500
Extended Aeration System	$586,040
Secondary Clarifiers	$974,125
Upgrade Existing Drying Beds	$165,000
Emergency Generator (400 KW)	$250,000
Subtotal	**$2,078,000**
Contingency (30%)	$623,400
Total Construction Cost Opinion	**$2,701,000**

Notes:
1. ENR CCI (April 2010) = 8677
2. Phase 2 costs are not escalated.
3. Construction costs do not include design fees, construction managements fees, permitting fees, or other "non-construction," project related costs.
4. The opinion of probable construction cost prepared by AECOM represents our judgment and is supplied for general guidance to the District. Since AECOM has no control over the cost of labor and materials, or over competitive bidding or market conditions, AECOM does not guarantee the accuracy of such opinions as compared to contractor bids or actual costs

Table 13 Phase 3 Construction Cost Opinion

Project Component	Cost
Grit Removal System	$270,900
Extended Aeration System	$704,210
Secondary Clarifiers	$901,000
Aerobic Sludge Digesters	$15,700
Upgrade Existing Drying Beds	$165,000
Site Piping	$52,800
Subtotal	**$2,110,000**
Contingency (30%)	$633,000
Total Construction Cost Opinion	**$2,743,000**

Notes:
1. ENR CCI (April 2010) = 8677
2. Phase 3 costs are not escalated.
3. Construction costs do not include design fees, construction managements fees, permitting fees, or other "non-construction," project related costs.
4. The opinion of probable construction cost prepared by AECOM represents our judgment and is supplied for general guidance to the District. Since AECOM has no control over the cost of labor and materials, or over competitive bidding or market conditions, AECOM does not guarantee the accuracy of such opinions as compared to contractor bids or actual costs

Power and Replacement Costs

Power consumption and periodic Biolac replacement costs were estimated for Phase 3 (Table 13). Power consumption was estimated for the major treatment equipment only, including the influent lift station pumps, blowers for the Biolac aeration basins, surface aerators in the aerobic sludge digesters, RAS/WAS pumps, and included an allowance of 131,000 kilowatt-hours per year (kwh/yr) for all other minor usage. Power consumption is estimated to be 2,365,000 kwh/yr. Electricity cost was estimated at $0.13 per kilowatt-hour and assumed 24 hours per day operations.

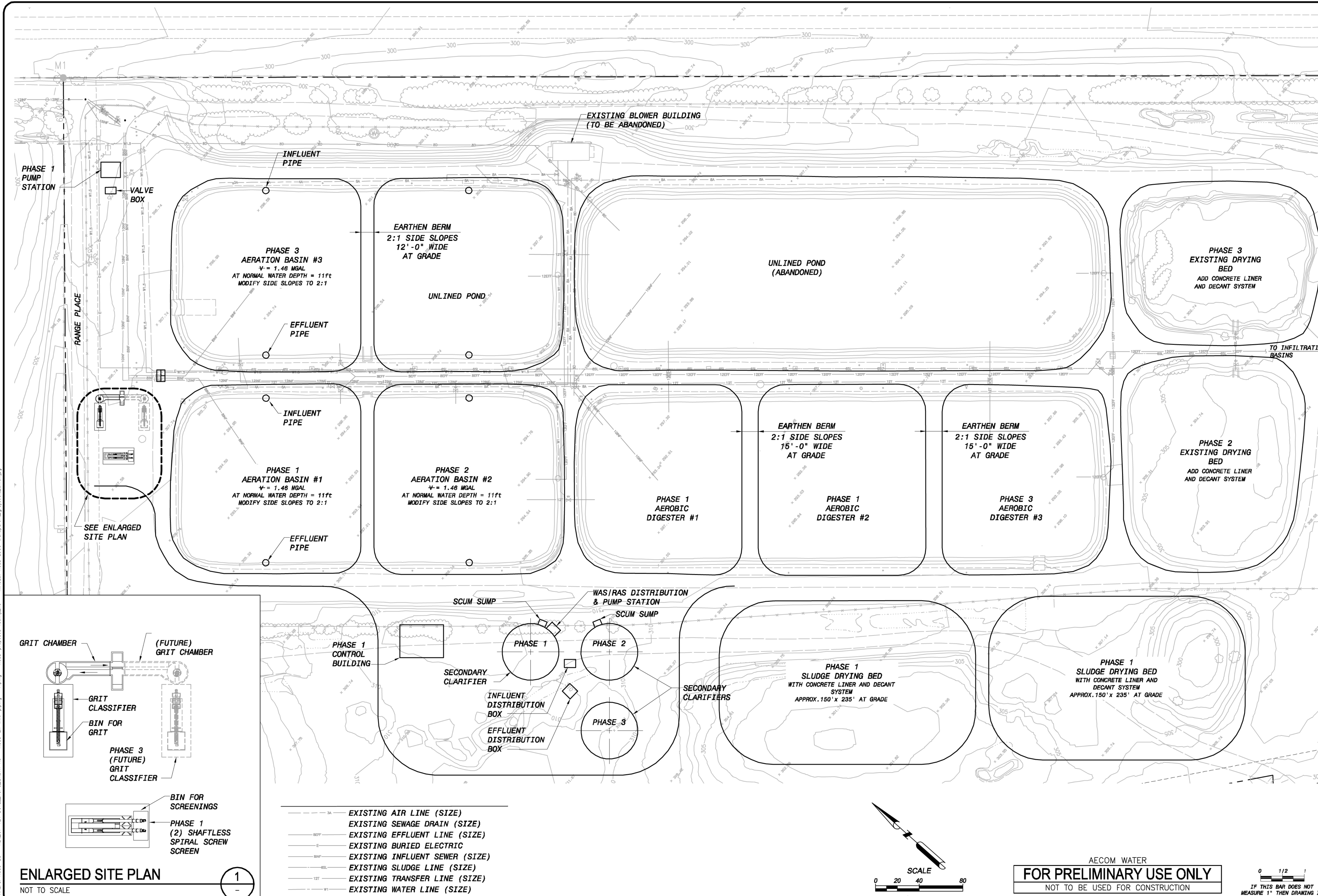
Biolac diffusers will need to be replaced every 5 to 10 years, and the air hoses will be replaced every 10 to 15 years. Table 14 costs assume all diffusers will be replaced at 7 years (budgeted at $25 each) and air hoses at 12 years (budgeted at $40 per linear foot). Labor costs for installation were added assuming 50% of material cost.

Table 14 Phase 3 Power and Biolac Replacement Costs

	Annual Cost (2010 US $)
Electricity	$308,000
Biolac® Diffuser replacement	$6,800
Biolac® Air Hose replacement	$17,900
Total	**$332,700**

Capital Improvements Plan

We recommend that the District proceeds with design and construction of Phase 1 of the project as summarized in Tables 7 and 11, above. Components will include a new influent lift station, headworks, extended aeration treatment (Biolac), secondary clarifiers, aerobic sludge digesters, and new sludge drying beds. The construction cost opinion came to approximately $8.9 million, with a 25% contingency.



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REV	DATE	DESCRIPTION	APPR
PROJECT ENGINEER		REG NUMBER	EXP DATE
MICHAEL K. NUNLEY		C61801	06/30/2011

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NIPOMO COMMUNITY SERVICES DISTRICT

NIPOMO COMMUNITY SERVICES DISTRICT
SOUTHLAND W.W.T.F. AMENDMENT #1

PHASING PLAN
FACILITY MASTER PLAN

DESIGNED: EKS
DETAILED: DTG/JPF
CHECKED:
APPROVED:
DATE: DEC. 2009
AECOM PROJECT NO. 60099595
NCSD PROJECT NO.
CADD STDS. AECOM

C-101
SHEET 1 OF 2

APPENDIX A

FEBRUARY 12, 2010 REVISED DRAFT MEMORANDUM
CHANGES IN DESIGN FLOW AND STARTUP CONDITIONS FOR SOUTHLAND WWTF
UPGRADE PROJECT

AECOM

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REVISED DRAFT Memorandum

To	Mr. Michael LeBrun, General Manager	Page	1
CC	Mr. Peter Sevcik, PE, District Engineer Ms. Tina Grietens, Utilities Superintendent		
Subject	Changes in Design Flows and Startup Conditions for Southland WWTF Upgrade Project		
From	Mike Nunley, PE Eileen Shields, PE		
Date	February 12, 2010		

As part of the preliminary design effort for the Southland Wastewater Treatment Facility (WWTF) Upgrade Project, the Nipomo Community Services District (District) has been providing AECOM with recent influent monitoring results. AECOM has been using the data to develop a comprehensive picture of the design loads and startup conditions for plant improvements, and has projected considerably different load projections than those estimated in the January 2009 Southland WWTF Master Plan and preceding reports. This memorandum will provide a review of prior flow estimates, a summary of the current projections, and recommendations for moving forward with the Southland WWTF Upgrade Project.

Background

For nearly four years, AECOM has been tracking influent flows and biological oxygen demand (BOD) concentrations at Southland WWTF. Figure 1 displays flow data collected since spring of 2004. AECOM has completed several reports for the District to summarize these records, assess the capacity of the District's Southland WWTF, and assist with planning for improvements.

In May 2006, AECOM (formerly Boyle Engineering) completed a report entitled *Southland Wastewater Treatment Facility Action Plan*. This report represented phase one of the District's two-phase response to the Regional Water Quality Control Board (RWQCB) Notice of Violation (NOV), received in February 2006. The NOV was issued for a series of Waste Discharge Requirement violations at the Southland WWTF, occurring during 6 months in 2005. The Action Plan provided a review of the violations and potential causes, an assessment of plant capacity, and a summary of work completed by operators to address violations. Recommendations were provided for short-term improvements (including positioning of new aerators in all ponds and removal of baffles in Ponds 3 and 4), development of a Facility Master Plan, and effluent monitoring.

AECOM completed the *Draft Southland Master Plan* in February 2007. The Facility Master Plan represented phase two of the District's response to the RWQCB NOV. The report provided a more detailed capacity analysis, discussed water quality goals for the treated effluent, identified improvements needed for WWTF and the influent trunk line to meet existing and projected demands, and developed a capital improvements plan.

As a result of the geotechnical investigations performed by the District simultaneously with the Draft Master Plan, a growing mound of effluent was discovered beneath the infiltration basins on the Southland WWTF site. This spurred additional hydrogeologic studies (performed by Fugro West, Inc.) to characterize the effluent mound, evaluate fate and transport of the treated effluent, and estimate onsite disposal capacity. It was concluded that the mound would continue to grow at current flows, and would grow more quickly as flows increase in the future. Using the results from these studies, AECOM evaluated future alternatives for reuse and/or disposal of treated effluent (Preliminary Screening Evaluation of Southland WWTF Disposal Alternatives, completed January 2009). The report provided a preliminary ranking of nine alternatives, including offsite infiltration at various locations and reuse as irrigation for landscape or agriculture.

After the conclusion of these investigations, the District requested that AECOM finalize the Southland WWTF Master Plan. Completed in January 2009, the Final Master Plan included a full update to the capacity analysis, recommendations, and capital improvements plan initially set forth in the 2007 Draft Master Plan.

Historical Plant Loading

As described above, various reports have summarized flow and loading data at Southland WWTF. The Action Plan was AECOM's first study addressing this issue and it assessed data collected between April 2004 and March 2006. Flow data indicated that the recorded maximum month flow[1] (MMF) was equal to 0.79 million gallons per day (MGD), which is approximately 88% of permitted capacity of 0.9 MGD. Influent wastewater strength was examined by measuring the influent biological oxygen demand, recorded at 5 days (BOD_5). The 2005 maximum month average BOD_5 was measured to be 290 mg/L. This value was used to evaluate the plant's treatment capacity. It was concluded that with some minor modifications, the plant had sufficient capacity for current demands, but flow projections should be prepared in the subsequent Facility Master Plan in order to estimate when capacity would be exceeded.

The capacity analysis in the Draft Facility Master Plan assessed two complete years of data from September 2004 through August 2006, in order to develop design flows. The MMF was equal to 0.79 MGD. Existing flow data was used to develop peaking factors to estimate flows at various conditions. A design value for BOD loading was developed by calculating the 90th percentile influent BOD_5. The 90th percentile represents the value at which 90% of the values in the data set are equivalent or lower. Based on the data set, the 90% percentile influent BOD_5 was equal to 350 mg/L.

The average annual flow (AAF) estimate from the *Water and Sewer Master Plan* (Cannon Associates, December 2007), for the year 2030 was utilized to develop projected flow rates at 5-year increments for the Wastewater Treatment Facility. These values, along with the peaking factors and projected loading rates, provided the basis for evaluating the future capacity of the facility and evaluating various upgrade options. The existing and projected average annual and maximum monthly flow rates from the Draft Facility Master Plan are summarized in Table 1. The report estimated that the permitted capacity (MMF = 0.9 mgd) could be reached within the year.

[1] Maximum month flow is the average daily flow rate for the maximum month in the study period and is used to describe the plant's permitted hydraulic capacity in the Waste Discharge Requirements, issued by the RWQCB. The permitted capacity for the Southland WWTF is a MMF of 0.9 mgd.

Table 1 Projected Flow Rates

Flow Condition	Peaking Factor	Existing Flow (mgd)	Projected Flow (mgd)*				
			2010	2015	2020	2025	2030
Average Annual Flow (AAF)	--	0.591	0.838	1.05	1.25	1.45	1.67
Maximum Monthly Flow (MMF)	1.34	0.791	1.12	1.41	1.68	1.94	2.34
* Projected AAF based on Draft Water and Sewer Master Plan (GTA & Cannon Assoc.)							

The Final Facility Master Plan (January 2009) re-evaluated the data, using flow and BOD concentrations from September 2006 through August 2008. The MMF was nearly 20% less than that from the previous data set, at 0.64 MGD. Peaking factors were revised accordingly. The 90th percentile BOD_5 was slightly greater, at 360 mg/L.

The 2030 AAF was held at 1.67 MGD. However, the "five-year" projections were interpolated between current and 2030 flows. The existing and projected average annual and maximum monthly flow rates from the Final Master Plan are summarized in Table 2. The updated projections indicated that the permitted capacity (MMF = 0.9 mgd) could be reached by December 2010.

Table 2 Projected Flow Rates

Flow Condition	Peaking Factor	Existing Flow (mgd)	Projected Flow (mgd)*				
			2010	2015	2020	2025	2030
Average Annual Flow (AAF)	--	0.59	0.73	0.97	1.20	1.44	1.67
Maximum Monthly Flow (MMF)	1.09	0.64	0.80	1.06	1.31	1.57	1.82
* Projected AAF based on Water and Sewer Master Plan Update (Cannon Assoc., December 2007)							

Re-evaluation of Data

Flow Rates

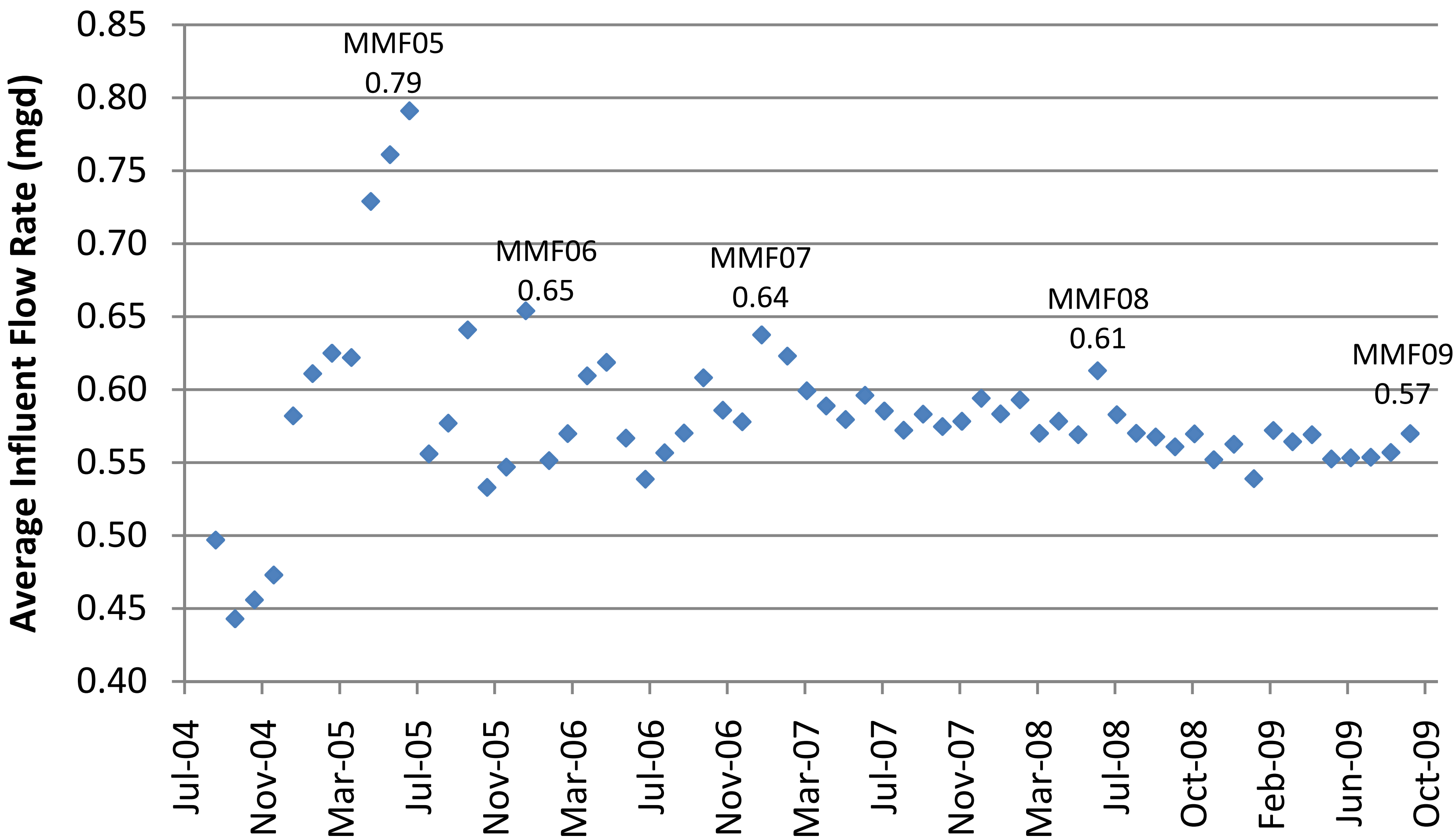
The 30-day average daily flow rates (ADF) for each month between September 2004 and October 2009 were graphed to evaluate for trends (Figure 1). Upon review of Figure 1, the first apparent trend is higher precision in the data set over time. The flow rates during the first two years of the graph show a relatively wide variability. Between September 2004 and August 2005 the flows vary by approximately 0.35 MGD, ranging from 0.44 to 0.79 MGD. During the next eighteen months, the variation is reduced to approximately 0.12 MGD, with flow rates ranging between 0.53 and 0.65 MGD.

Whereas, after February 2007 the spread is reduced further to 0.07 MGD, with the flow rates ranging from 0.54 to 0.61 MGD.

In addition, a reduction of flow over time is observed. The maximum month flows (MMF) are noted on the graph for each year between 2005 and 2009, measured between the months of September and August. Between 2005 and 2009, the MMF dropped each year from 0.79 MGD to 0.57 MGD.

AECOM and District staff expect that the recent data is more accurate than prior records. Prior to November 2006, flows were manually read from a flow totalizer, sometimes at varying times of day. Since then, staff has automated the data collection process, and has been using SCADA data to report flows and calculate daily totals, adding consistency to the data.
In addition, some of the high flow measurements recorded in the past could be due to high flow backing up from the influent lift station, surcharging the upstream trunk main and flow meter. While this condition could also affect current data, these high data readings could have contributed considerably to errors in prior daily and monthly flow measurements when coupled with inconsistent flow measurement procedures.

Figure 1. Average Influent Flow

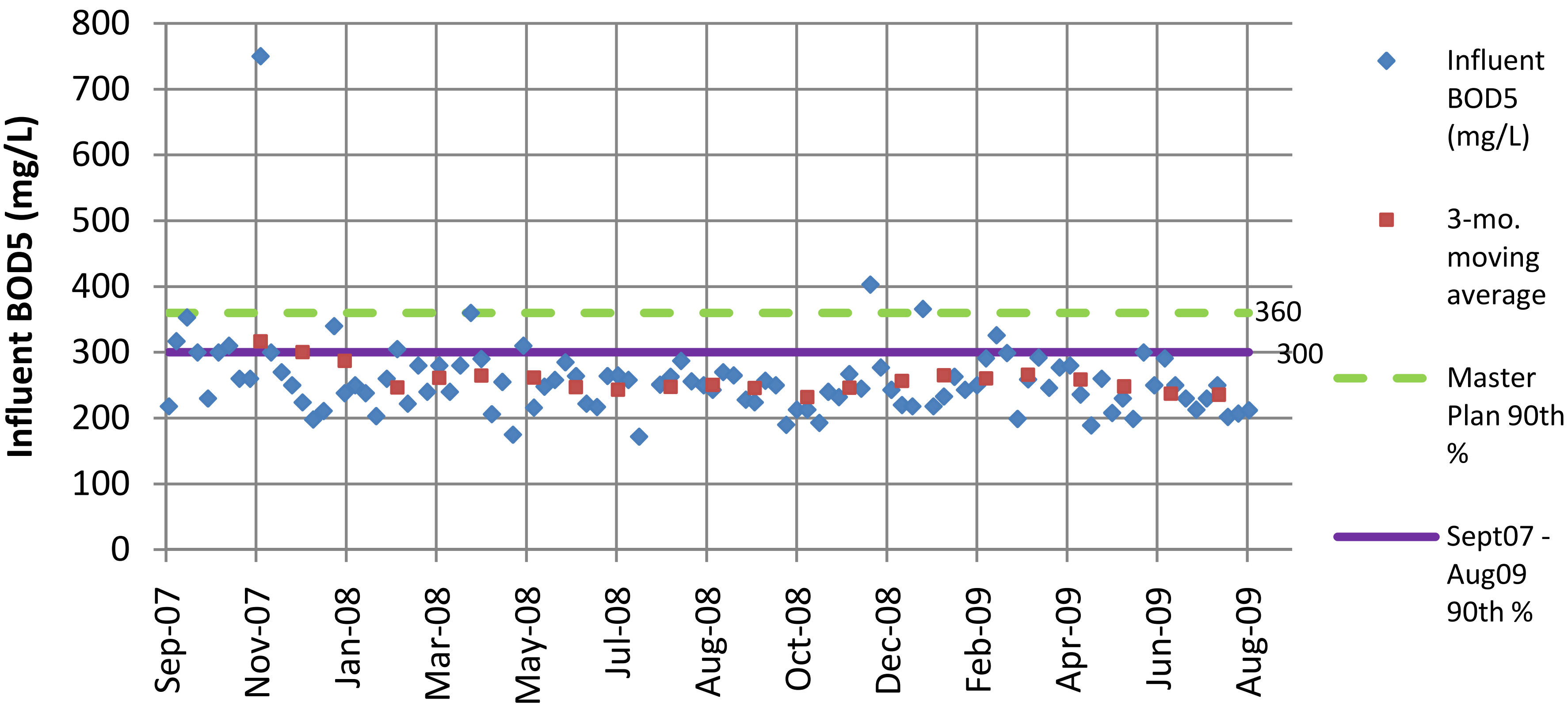


Influent Loading

The most recent 2-years of BOD_5 data (September 2007 through August 2009) were graphed to examine the current influent conditions (Figure 2). Samples of the WWTF influent are taken weekly and analyzed for BOD_5. Figure 2 shows the 3-month moving average alongside weekly BOD_5 values. The moving average is used to examine trends over a data set. Here, it indicates a downward trend of the influent BOD_5. At first glance, a “rolling,” or seasonal trend might be estimated, but upon further evaluation, the increases and decreases don’t correlate with seasons over the two years of data. For example, a decrease is seen for November 2007 through February 2008, the winter season. However, from October or November 2008 through March 2009, the moving average is rising.

Figure 2 also shows the 90^{th} percentile BOD_5 for this period (300 mg/L) and the 90^{th} percentile BOD_5 calculated for the Master Plan, which is 20% higher than the current value.

Figure 2. Influent BOD_5



Flow Projections

As previously mentioned, the Facility Master Plan utilized flow projections developed as part of the Water and Sewer Master Plan (Cannon Associates, December 2007). Projected for year 2030, the buildout average annual flow rate for the WWTF is estimated at 1.67 MGD. Intermediate flow rates were projected in the Draft Facility Master Plan, and updated in the final, to assist with phasing recommendations. Using the latest two years of flow rate data, the projections were recreated with the same rate of increase to 1.67 MGD. The three sets of flow data and projections were graphed together for comparison purposes (Figure 3). By projecting the same rate of flow increase starting from the existing average annual flow, the estimated buildout flow rate of 1.67 MGD is reached in 2032, two years later than previously estimated.

To assess the implications of the revised flow projections, the treatment capacity of the existing pond system was re-evaluated utilizing the spreadsheet model developed for the Facility Master Plan. First-order rate kinetics were used to estimate BOD_5 degradation in the aeration ponds. Updated BOD_5 values were utilized and various flow and temperature conditions were considered. Two operational configurations were analyzed: ponds in parallel (the current operational configuration, equally split flow between 2 trains of 2 ponds), and ponds in series (full flow through all 4 ponds, sequentially).

The analysis suggests that the existing pond system has capacity to handle an AAF of 0.83 MGD while operating in parallel. This flow corresponds to a MMF of approximately 0.9 MGD, the facility's permitted hydraulic capacity. If the ponds are operated in series configuration, the model suggests the pond volume is sufficient handle an average annual flow of 1.0 MGD, or approximately 1.1 MGD on a MMF basis if additional aeration is provided[2].

These two capacity estimates are shown as horizontal lines on Figure 3. Following the projection from the most recent flow data (project titled Dec 09 Design), Figure 3 indicates that the WWTF may reach the treatment capacity for parallel configuration and the permitted hydraulic capacity (0.83 MGD, AAF) around the year 2015. Figure 3 also shows that changing to series configuration could provide an additional 3 ½ years of capacity.

However, there are limitations to the model. Typically the model is effective at evaluating detention times and at sizing ponds during design. Several variables impact the performance of pond systems that are difficult to model, including solids buildup, algal growth and decay, wind mixing, and temperature stratification. Therefore, conclusions must be conservative when predicting effluent concentrations and estimating treatment capacity.

Another reason to be conservative is the existing evidence of limited capacity in the ponds provided by historical waste discharge reports. In 2008, the WWTF experienced high effluent BOD_5 concentrations during 4 months (April through July) and high TSS concentrations in July. In 2009, TSS values were high during 7 months (March through June and August through October), and high BOD_5 concentrations were seen during 2 months, November and December.

These high BOD concentrations correlate with seasonal shift from high summer temperatures to cooler fall temperatures. Typically, pond systems can experience "overturning" in the fall whereby the pond surface cools, temperature stratification no longer protects lower depths from surface mixing, and lower-quality water begins to mix into the top layers of the ponds.

---

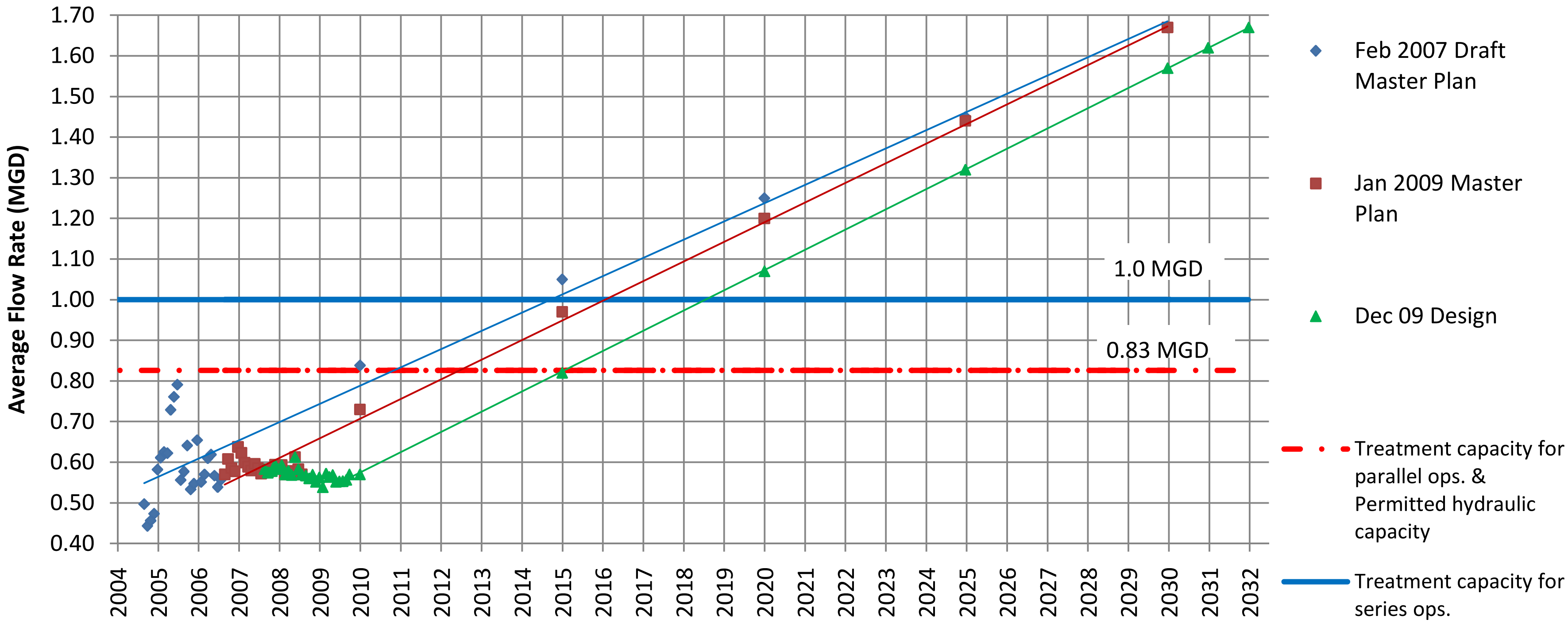
[2] Additional aeration capacity will be required for both scenarios; approximately 15 horsepower (hP) more (for a total of 135 hP) for a flowrate of 0.83 MGD and an additional 45 hP (total of 165 hP) for 1.0 MGD.

Another potential reason for the high BOD concentrations could be low oxygen levels caused by aerator failures, due to ragging. One of the two grinders at the plant failed, allowing rags and other debris to flow into the ponds. Several aerators were clogged with debris and were not functioning consistently throughout November and December.

High TSS values could result from several factors. Late fall readings could be caused by algal blooms. Aerators could be pulling water with higher solids into the surface of the pond, near the outlet depth. The outlet and downstream pipes could have sediment or sludge that are picked up in the effluent samples.

The high BOD and TSS values, which occur in spite of model results suggesting pond and aeration capacity are adequate to meet permit limitations, are examples of the difficulties inherent in modeling, controlling, and operating treatment pond systems. Ponds with surface aerators cannot be simulated as “ideal reactors” due to short-circuiting, dead spots, and other flow characteristics that occur in large, irregularly-mixed volumes. These factors significantly increase error between predicted and actual BOD results, in particulary. Unlike modern treatment technologies, pond systems have few variables that can be controlled by operators other than turning aerators on or off. In activated sludge systems, for example, operators can control air flow, air distribution, and also the population and concentration of microbes that degrade waste. This allows operators to optimize system performance (and BOD and TSS removal) as waste flows and characteristics change seasonally. Sludge cannot settle properly in a partially-mixed pond, whereas activated sludge systems use independent clarifiers to settle solids, reducing both TSS and BOD.

Figure 3. Flow Projections & WWTF Capacities



Impacts to WWTF Upgrade Design

The Facility Master Plan analysis that led to the recommendation of Biolac® wave oxidation system for Southland WWTF remains valid. The recommendation was based on a comparison of well-proven biological treatment processes, all of which would be impacted by a reduction in influent loading. Relative to systems with comparable treatment levels, Biolac® has a lower life cycle cost, with simpler day-to-day operations and maintenance, but with system capabilities that will allow the operators to handle fluctuations in flow and waste concentrations unlike the existing pond system. However, the sizing is impacted by changes in influent loading and will need to be revisited.

AECOM and District staff have discussed the possibility of upgrading the existing influent lift station and installing new screening and grit removal systems without replacing the existing aerated pond systems. This approach would not address the prior NOV, current poor performance of the pond systems, and continued inability to meet permit limitations in spite of sludge extraction from all four ponds, installation of new aerators, and outlet improvements. AECOM recommends replacing the pond system while the bidding climate is good for new construction and while flows and loads are sufficiently low that a partial plant shutdown can be mitigated.

However, plant sizing and construction phasing should be reassessed. Treatment systems can perform very poorly at loads that are significantly less than their design values. If the project were installed without an increase in loading, it is unlikely that the manufacturer would provide a process warranty at a satisfactory treatment level. Based on the analyses discussed herein, the WWTF is experiencing a lower loading than was anticipated for startup conditions (approximately 30% lower flow rate and 20% lower influent BOD_5 concentration). A decreased loading equates to less nutrients and carbon for the microbes contained in the biological treatment process, which could result in decreased treatment level overall.

Phasing Plan

In order to develop an appropriate long-term strategy for upgrading the Southland WWTF, AECOM recommends revisiting the two-stage phasing plan from the Master Plan and developing a three-stage program. This would require a new 2030 site plan and updated capital improvement plan as provided in the last sections of the report.

A significant part of the improvement plan will remain the same. Due to hydraulic limitations in the Frontage Road Trunk Main and plant headworks, the influent lift station should be replaced as recommended in the Facility Master Plan.

The primary difference from the Facility Master Plan would be modifications to Ponds 1 and 2 in order to accommodate more, smaller Biolac cells (possibly four) instead of the two cells initially proposed. The 2009 Facility Master Plan developed a two-phase program that included the following, in addition to sludge holding lagoons and drying beds:

> Phase I – 1.25 MGD[3]: Construct new influent lift station, screens, grit chambers, a Biolac cell in each of Ponds 1 and 2, and two clarifiers.
>
> Phase II – 1.67 MGD: Install additional aeration in each Biolac cell.

[3] Note all flows in this section are AAF

It is now recommended that the District consider phasing the project as follows:

Phase I - 0.9 MGD: Construct new influent lift station, screens, grit chamber, and Biolac cells. Install aeration equipment in only one Biolac cell. Consider construction of two clarifiers or possibly one complete clarifier and one unfinished clarifier with equipment in storage.

Phase II – 1.3 MGD: Install aeration equipment in second Biolac cell

Phase III – 1.67 MGD: Construct and install equipment for third and fourth Biolac cells and bring second clarifier online

Recommendations

In our original May 11, 2009 contract with the District, it was assumed the Concept Design Report phase of the work would focus on detailed design of the Phase I project developed in the Facility Master Plan. The work to modify this phasing plan and update the cost opinions to accommodate a "smaller" Phase I project was not anticipated in our scope.

AECOM recommends the District direct us to prepare a budget revision request for the additional planning work to develop a new phasing plan and capital improvement plan that reflect the lower organics loads and flows. The plan would meet existing demands as well as the future flow conditions specified in the 2007 Water and Sewer Master Plan. This work would allow us to develop a strategy that optimizes the District's future investments at the plant, anticipates future needs, protects treatment process warranties, and ensures the initial stages of the Southland WWTF will be operable and meet anticipated effluent limitations.

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