& Program
Management
Division

and

Operations &
Maintenance
Division

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METROPOLITAN WASTEWATER DEPARTMENT STAFF

City

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Robert Ferrier	Assistant Director, Metropolitan Wastewater Department
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Chandra Reddy	Senior Electrical Engineer
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ACRONYMS AND ABBREVIATIONS

AHU	Air Handling Unit
APCD	Air Pollution Control District
AVAR	Air-Vacuum and Air Release
Avg	Average
BOD	Biochemical Oxygen Demand
CAMP	Capacity, Condition and Operation Assessment and Master Plan
cf	Cubic feet
cfm	Cubic feet per minute
CN	Centrate
COGEN	Co-Generation Facility
CW	Chilled Water
CWP	Clean Water Program
DBST	Digested Biosolids Storage Tanks
DCS	Distributed Control System
DF	Digester Feed
DPU	Data Processing Unit
DSL	Dewatered Sludge
dtpd	Dry tons per day
DWT	Dewatering Transfer
FC	Ferric Chloride
FIRP	Fiesta Island Replacement Project
gpm	Gallons per minute
hp	Horsepower
HW	Hot Water
I/O	Input/ Output
LWL	Lower Water Level
MBC	Metropolitan Biosolids Center
MCC	Motor Control Center
M&E	Metcalf & Eddy
MER	Mass Emission Rate
mgd	Million gallons per day
MPSG	Main Plant Switchgear
mt/yr	Metric tons/ year
MVWTP	Mission Valley Wastewater Treatment Plant
MWP	Metropolitan Wastewater Plan
NCRSP	North City Raw Sludge Pipeline
NCWRP	North City Water Reclamation Plant
NPDES	National Pollution Discharge Elimination System
NSPF	North Sludge Processing Facility
NWRP	Northern Water Reclamation Plants
OC	Odor Control
OCS	Odor Control System
OF	Overflow
O&M	Operations and Maintenance
OPRA	Ocean Pollution Reduction Act
PE	Polymer Emulsion
PLC	Programmable Logistics Control

PLWTP	Point Loma Wastewater Treatment Plant
PM	Polymer Mannich
ppd	Pounds per day
PRV	Pressure Regulating Valve
PRW	Process Water
PVC	Polyvinyl Chloride
PW	Potable Water
RW	Reclaimed Water
SBWTP	South Bay Wastewater Treatment Plant
scf/lb	Standard cubic feet/ pound
SDAPCD	San Diego Air Pollution Control District
SDGE	San Diego Gas and Electric
SSPF	Southern Sludge Processing Facility
SWD	Storm Water Drainage
TBOD	Total Biochemical Oxygen Demand
TDH	Total Dynamic Head
TSL	Thickened Sludge
TSS	Total Suspended Solids
UPS	Uninterruptible Power Supply
UW	Utility Water
UWLP	Utility Water Low Pressure
VFD	Variable Frequency Drive
VSS	Volatile Suspended Solids
WC	Water Column
WD	Water Department
wtpd	Wet tons per day
WWPS	Wastewater Pump Station

CHAPTER 1 - EXECUTIVE SUMMARY

1.1 Background

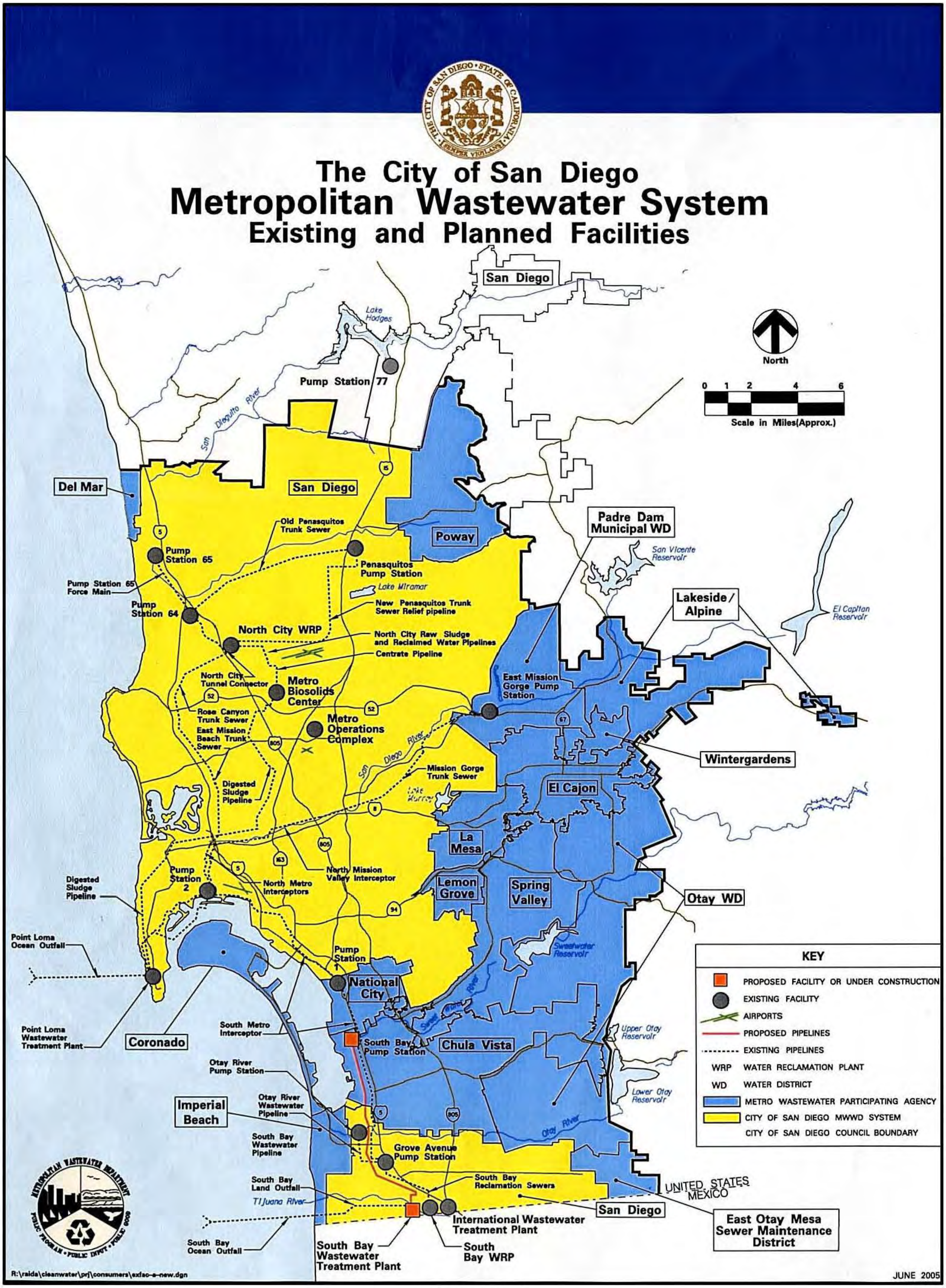
In 1987, the City of San Diego established the Clean Water Program (CWP), a massive construction program with the goal to bring the City into compliance with the federal Clean Water Act. Through a hired Program Manager, CWP Alternative IV Plan, was selected among 6 recommended alternative plans to upgrade existing City facilities, and build new water reclamation plants, sludge processing facilities, and several sewage pumping stations. It also provided for sewage and reclaimed water conveyance and processing of biosolids through Year 2050. Two of the projects identified in the CWP Alternative IV Plan were the Fiesta Island Replacement Project (FIRP) and the Northern Sludge Processing Facilities (NSPF). The goals of these two facilities were to provide treatment and processing of all digested biosolids from the Point Loma Wastewater Treatment Plant (PLWTP) and all raw biosolids from the Northern Areas Water Reclamation Plants (NWRP) respectively.

In 1992, the City opted to implement a more economical alternative construction program called the Consumer's Alternative. This alternative program retained the FIRP and NSPF facilities among other planned facilities for implementation and was conceived to be completed in two construction phases: Phase 1 to provide capacity through Year 2010; and Phase 2 through Year 2050. The City created and tasked the Metropolitan Wastewater Department (MWWD) with the responsibility for meeting the goals of the Clean Water Program and the Consumer's Alternative Plan.

After extensive investigations, the City decided to jointly locate the FIRP and NSPF facilities in a formerly Navy-owned site south of the old Miramar Naval Air Station. This combined facility was later to be called the Metropolitan Biosolids Center (MBC). The Metropolitan Wastewater System is shown on Figure 1-1 and a site plan of the MBC facility is shown on Figure 1-2. Only two of the 5 water reclamation plants planned in the Alternative IV Plan were included in the Consumer's Alternative Plan. The North City Water Reclamation Plant (NCWRP), the first of these 2 plants, started construction in 1994 and was completed in 1996. It became fully operational in 1997. NCWRP is the only north county reclamation plant built to date that is being served by MBC's NSPF. The Fiesta Island biosolids processing facilities for treating PLWTP digested biosolids were relocated to the FIRP facility in MBC in pursuant to a California Coastal Commission directive. Construction of MBC was started in 1995 and completed in 1998. The FIRP and NSPF facilities became operational in 1998 and 1999 respectively.

1.2 Purpose/Objectives

In 1995, MWWD issued the first Metropolitan Wastewater Plan (MWP) which presented recommended improvements to the Consumer's Alternative Plan including updates on wastewater flow and load projections and further water reclamation developments. One of the



The City of San Diego
Metropolitan Wastewater System
Existing and Planned Facilities
San Diego
Lake Hodges
Pump Station 77
San Dieguito River
North
0 1 2 4 6
Scale in Miles(Approx.)
Del Mar
San Diego
Old Penasquitos Trunk Sewer
Poway
Padre Dam Municipal WD
San Vicente Reservoir
Pump Station 65
Penasquitos Pump Station
Pump Station 65 Force Main
Lake Miramar
New Penasquitos Trunk Sewer Relief pipeline
Pump Station 64
Lakeside / Alpine
El Capitan Reservoir
North City WRP
North City Raw Sludge and Reclaimed Water Pipelines
Centrate Pipeline
North City Tunnel Connector
Metro Biosolids Center
East Mission Gorge Pump Station
Rose Canyon Trunk Sewer
East Mission Beach Trunk Sewer
Metro Operations Complex
San Diego River
Wintergardens
Mission Gorge Trunk Sewer
Digested Sludge Pipeline
Lake Murray
El Cajon
La Mesa
Digested Sludge Pipeline
Pump Station 2
North Metro Interceptors
North Mission Valley Interceptor
Lemon Grove
Spring Valley
Otay WD
Point Loma Ocean Outfall
Pump Station 1
Sweetwater Reservoir
National City
Point Loma Wastewater Treatment Plant
Coronado
South Metro Interceptor
South Bay Pump Station
Chula Vista
Upper Otay Reservoir
Otay River Pump Station
Otay River Wastewater Pipeline
Lower Otay Reservoir
Imperial Beach
South Bay Wastewater Pipeline
Otay River
Grove Avenue Pump Station
South Bay Land Outfall
South Bay Reclamation Sewers
Tijuana River
UNITED STATES
MEXICO
San Diego
East Otay Mesa Sewer Maintenance District
International Wastewater Treatment Plant
South Bay Ocean Outfall
South Bay Wastewater Treatment Plant
South Bay WRP
KEY
PROPOSED FACILITY OR UNDER CONSTRUCTION
EXISTING FACILITY
AIRPORTS
PROPOSED PIPELINES
EXISTING PIPELINES
WRP WATER RECLAMATION PLANT
WD WATER DISTRICT
METRO WASTEWATER PARTICIPATING AGENCY
CITY OF SAN DIEGO MWWD SYSTEM
CITY OF SAN DIEGO COUNCIL BOUNDARY
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JUNE 2005

FIGURE 1-1

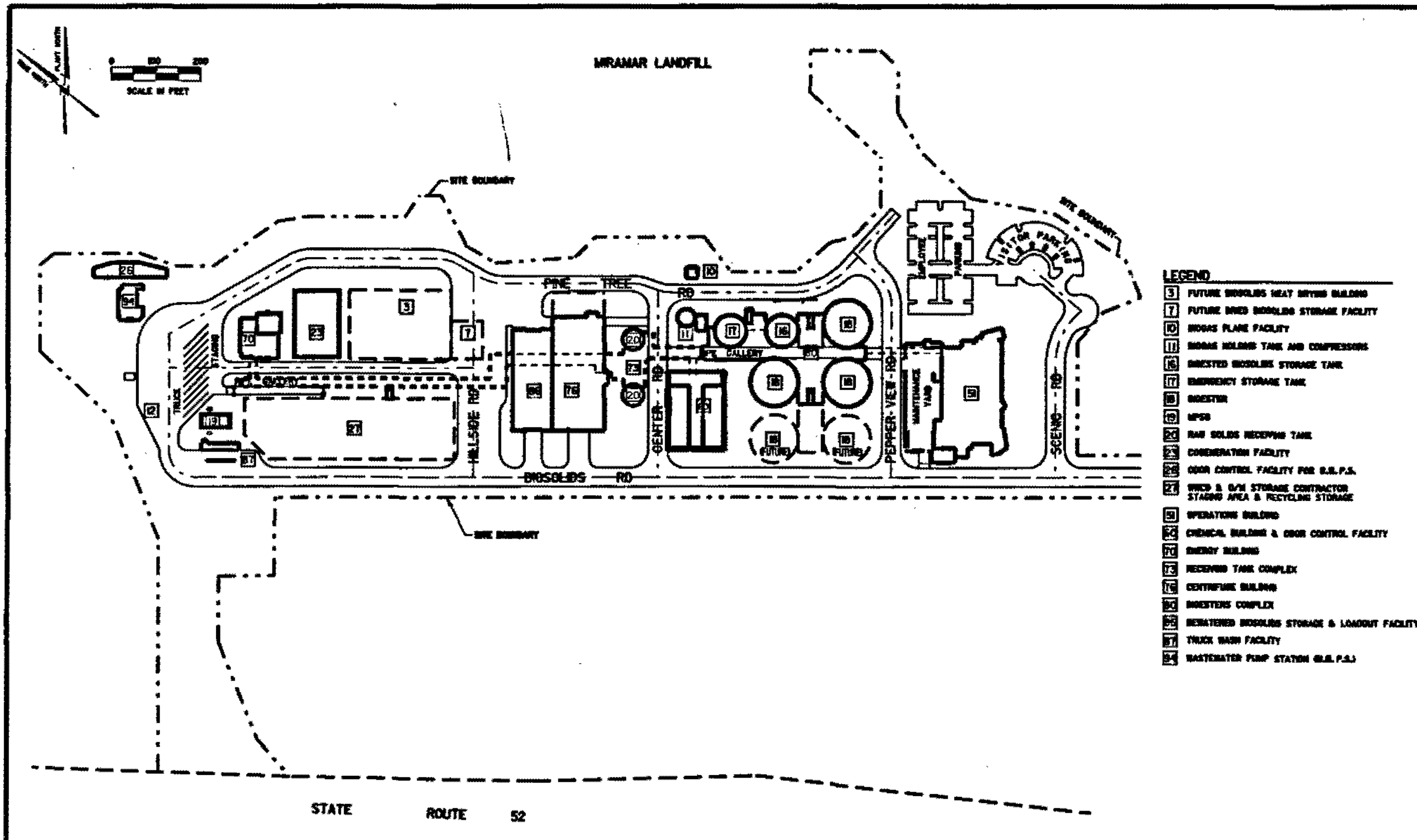


FIGURE 1-2

METRO BIOSOLIDS CENTER
SITE PLAN

highlights of the 1995 MWP was the proposed construction of a secondary treatment facility in the South San Diego area sooner than originally planned in the Consumer's Alternative Plan.

Not until 2003 was a review of the 1995 MWP started. Based upon revisions in the SANDAG projections, and reevaluation of current regulatory requirements, a new 2005 MWP was drafted describing proposed new major facilities. The draft 2005 MWP (currently under review for final adoption) provides a planning horizon up to the year 2050. With the recent construction of the South Bay Water Reclamation Plant in 2002, the draft 2005 MWP recommends delaying any additional treatment capacity until 2025. Based on revised flow and load projections, a 21 mgd South Bay Wastewater Treatment Plant (SBWTP) and Southern Sludge Processing Facility (SSPF) will have to be operational by 2025. These will be required in order for PLWTP to continue to meet its current NPDES (National Pollution Discharge Elimination System) permit requirement of a projected mass emission rate (MER) of 13,599 metric tons per year (mt/yr) beginning 2006. The Mission Valley Wastewater Treatment Plant (MVWTP) and NCWRP-Phase II are targeted to be operational in 2030 and 2045 respectively to continue providing the needed MER relief further in the 2050s.

The draft 2005 MWP's recommended schedule of construction for the new MWWD facilities is shown in Table 1-1 below:

TABLE 1-1
Draft 2005 MWP's Recommended New MWWD Facilities

Proposed Facility	Capacity	On-Line by Year
Wet Weather Storage Facility- Phase 1	7 MG	2011
Wet Weather Storage Facility- Phase 2	14 MG	2016
South Bay Wastewater Treatment Plant- Phase 1	21 MGD	2025
Southern Sludge Processing Facility	1 MGD	2025
South Bay Pump Station- Phase 1	21 MGD	2025
South Bay Conveyance System- Phase 1	103 MGD[1]	2025
Wet Weather Storage Facility- Phase 3	14 MG	2021
Point Loma Tunnel Outfall	162 MGD [1]	2040
Mission Valley Wastewater Treatment Plant	15 MGD[1]	2030
Mission Valley Effluent Pipeline	24 MGD	2030
Mission Valley Sludge Pipeline	2.1 MGD	2030
North City Water Reclamation Plant- Phase 2	10 MGD[2]	2045
East Mission Bay Pipeline	90 MGD[2]	2045
North City Effluent Pipeline	90 MGD[2]	2045
Point Loma Parallel Outfall	TBD[3]	TBD[3]

Note: The planning horizon for 2005 MWP is 2050.
1-Pump stations and pipelines are designed to carry build-out peak wet weather flows.
2-This facility will be built as a secondary treatment plant with option to upgrade to water reclamation plant.
3-The need for this facility will be revised every 5 years as inspection of Point Loma tunnel outfall is being conducted.

As the end of Phase I of the Consumer's Alternative Plan is closely approaching and due to the need to reassess the original planned improvements for the Phase II in light of the 2005 MWP recommendations, MWWD is preparing a master plan for MBC for years 2005 to 2030. The master plan effort presented in this report was divided into two phases. Phase I prepared an assessment report of current conditions of process facilities and their operations at the Metro Biosolids Center and how these impacted its biosolids processing capability for the projected flows and loads. Based on these issues, recommendations for improvement projects were made.

The Phase II planning effort estimated the year when certain MBC processes must be expanded or upgraded to accommodate the increase in solids load resulting from population growth projected for the MWWD service area. A hydraulic and solids mass balance model currently being used for master planning of MWWD facilities was modified for this MBC solids evaluation study.

These Phase I and II planning efforts became the basis for the recommendation of a number of expansion and/or upgrade projects for the existing MBC facilities as the primary objective of this Capacity, Condition and Operation Assessment Report and Master Plan (CAMP) for 2005-2030.

1.3 Flow, Condition and Operation Assessment

Phase I Assessment

Based on the condition/operation assessment conducted, significant operational difficulties exist that hamper success in meeting daily biosolids processing requirements. Three major factors contribute to these operational difficulties.

1. *Low peaking factor:* A low 1.38 (versus 2.0 or higher used for PLWTP and NCWRP flows) design peaking factor was used for flows to the MBC dewatering and biosolids storage facilities.

2. *Complexity of processes/control strategies and O&M procedures:* Highly complex processes and equipment control strategies have necessitated a significant effort to operate and maintain the facility.

3. *Inadequacies in design and poor as-built drawings:* Design flaws coupled with inaccurate and incomplete as-built drawings have further contributed to operational difficulties. System upgrades are made more difficult and more costly because of as-built drawing shortcomings.

In addition, special equipment construction, incorrect control strategies, premature equipment/material failures, and/or extended repair times have collectively resulted in system production reduction and even failures or shutdowns. Some of these operational difficulties are considered as "capacity limiters" or "constraints" as they have critically affected the entire process and reduced MBC's overall biosolids processing capacity.

Phase II Assessment

The current average and peak hydraulic and solids daily loadings from PLWTP and NCWRP are below the average loads projected for Phase 1 (year 2010) of the Consumer's Alternative Plan. Likewise, MBC's dewatered biosolids production figures are also below the Consumer's Alternative Plan 2010 projections. The mass balance model prepared for this Phase II Assessment indicates the following:

1. Facility expansion/upgrades for the dewatering centrifuges are adequate until year 2025.

2. Based on the facility's design strategy of operating 6 silos with 2 silos in standby while also providing capability to store 3 days of solids produced without truck loadout (on long weekends), the current biosolids silo capacity is exceeded. In order to maintain this operating strategy until year 2025, two new additional silos are needed to be built as soon as funds are available.

3. The truck loadout facility's strategy of operating 5 days per week and 8 hours per day is adequate until year 2013. To maintain this operation, additional loadout stations (1 or 2) are needed in 2014. However, operating on more hours per day or more days per week will allow the existing loadout facility to handle current and future biosolids cake production until year 2025, but will result in more work for the O/M staff and an increase in operating costs.

1.4 Class "A" Biosolids

Though Metcalf & Eddy has made provisions in its design of the present MBC facility, this master plan does not address the issue of the conversion of the related MBC process facilities from Class "B" to Class "A" biosolids production as may be required by future regulations on disposal and beneficial use of biosolids (40 CFR, Part 503). Presently, Class "B" has been determined as the minimum acceptable level of treatment for the MBC biosolids. In light of this and although the construction of the South Bay Wastewater Treatment Plant (SBWTP) and a Southern Sludge Processing Facility (SSPF) in 2025 may result in reduced volume of biosolids sent to MBC, a comprehensive study to look into this very important issue and for facilities planning purposes will have to be conducted separately by MWWD at the earliest.

1.5 Summary of Recommendations

Each of the improvement or upgrade projects identified and listed in this report were justified on the basis of four criteria: 1) how it impacts the biosolids processing capacity of MBC; 2) how it affects operations and/or maintenance procedures; 3) how it affects the operator's and/or public's safety; and 4) how it impacts federal, state or city regulatory permitting requirements.
Table A-1 of Appendix A presents all the recommended improvement projects identified from the Phase I condition and operation assessment.

Based on the condition and operational assessment performed and presented in this report, the major projects (each with an estimated total construction cost of $0.5 Million or more) recommended for implementation within 2005-2030 are shown in the following Table 1-2.

TABLE 1-2
Major Upgrade Projects for MBC

Project No.	Project Name	C.I.P. No.	Projected Construction Start (FY)	Projected Completion (FY)	Estimated Total Cost ($ Million)
P-9.3	Dewatering Transfer Pumps Upgrade	42-915.9	2005	2006	0.7
P-10.1	Standby Centrifuge Sludge Feed and Polymer Feed Pumps Installation	45-981.0	2007	2010	1.5
P-10.2	Centrate Collection Piping Upgrades –Phases 2 and 3	45-982.0	2012	2016	2.0
P-10.6	Replace 4 Dewatering Centrifuges with Larger Capacity Units	45-983.0	2009	2014	6.0
P-11.1	Additional Biosolids Storage Silos	45-984.0	2007	2014	8.0
P-11.3	Valve Access Platforms Installation In Biosolids Storage Building	45-985.0	2017	2019	4.5
P-11.5	Emergency Direct Pipeline Loadout Station	45-986.0	2007	2009	0.7
P-11.6	New Biosolids Truck Loadout Facility	TBA	2024	2030	20.0
N-1	Wastewater Pump Station Upgrade and Forcemain Extension	45-988.0	2007	2010	1.2
N-2	Odor Control Facility Upgrades & Dampers Access Platforms Installation	45-989.0	2007	2009	5.0
N-6.1 N-6.2	Storm Water Drainage System Improvements	45-990.0	2013	2016	3.0
E-6.2	Emergency Electric Generating Units Installation	45-991.0	2013	2016	2.0
				TOTAL	**$54.6**

TBA - To be assigned later

After a review of the projects by the Engineering and Program Management Division and the Operations and Maintenance Division, a package of projects are proposed for fund allocation in the next 10 fiscal years (2007-2016). These projects are presented in Chapter 6-Implementation Plan.

CHAPTER 2 - SOLIDS QUANTITIES AND MASS MODELING

2.1 General

The purpose of this chapter is to present the flow and solids loading criteria used in the design of the FIRP and the NSPF, and to compare the criteria with recorded solids production rates since the start-up of the Metro Biosolids Center. Figures 2-1, 2-2 and 2-3 present the overall plant, NSPF and FIRP Process Flow Diagrams respectively. The latter two diagrams indicate the flows and solids load quantities used as the design basis for the Consumer Alternative Plan Phase I facilities. Lastly, Figure 2-4 presents the hydraulic profile of MBC.

The latter part of this chapter summarizes the solids mass modeling done for MBC to evaluate three projects identified from the Phase I Condition/Operation Assessment of this master planning effort.

2.2 MBC Influent Solids Loading

Table 2-1 presents the projected average and peak solids production from the NCWRP and PLWTP based on the key process parameters shown in Table 2-2.

TABLE 2-1
NCWRP and PLWTP Projected Average and Peak Solids Flow Rates[1]
(CONSUMER'S ALTERNATIVE PLAN)

Source	Phase I (2010)		Phase II (2050)	
	Avg	Peak	Avg	Peak
NCWRP (Raw Solids @ 0.5%) -Flow, mgd -Solids, ppd	 1.69 75,940	 2.71 121,774	 2.40 107,648	 3.85 172,685
Other Northern WRPs[2] -Flow, mgd -Solids, ppd	 0 0	 0 0	 0.65 29,358	 1.04 46,647
Total to NSPF -Flow, mgd -Solids, ppd	 1.69 75,940	 2.71 121,774	 3.05 137,006	 4.89 219,332
PLWTP (Digested Biosolids @ 3%)[3] -Flow, mgd -Solids, ppd	 1.04 259, 961	 1.43 357,446	 1.36 344,033	 1.90 480,634

[1] Loadings taken from M&E's "FIRP/NSPF Design Concept Report" dated August 1993. 3.3 Design Criteria, Tables 3-2, 3-3 and 3-8.
[2] Other Northern and Central WRPs include Mission Valley, Mission Gorge and Santee.
[3] PLWTP receives raw solids from South Bay Plant through the sewers. The digested solids figures above include the South Bay Plant solids.

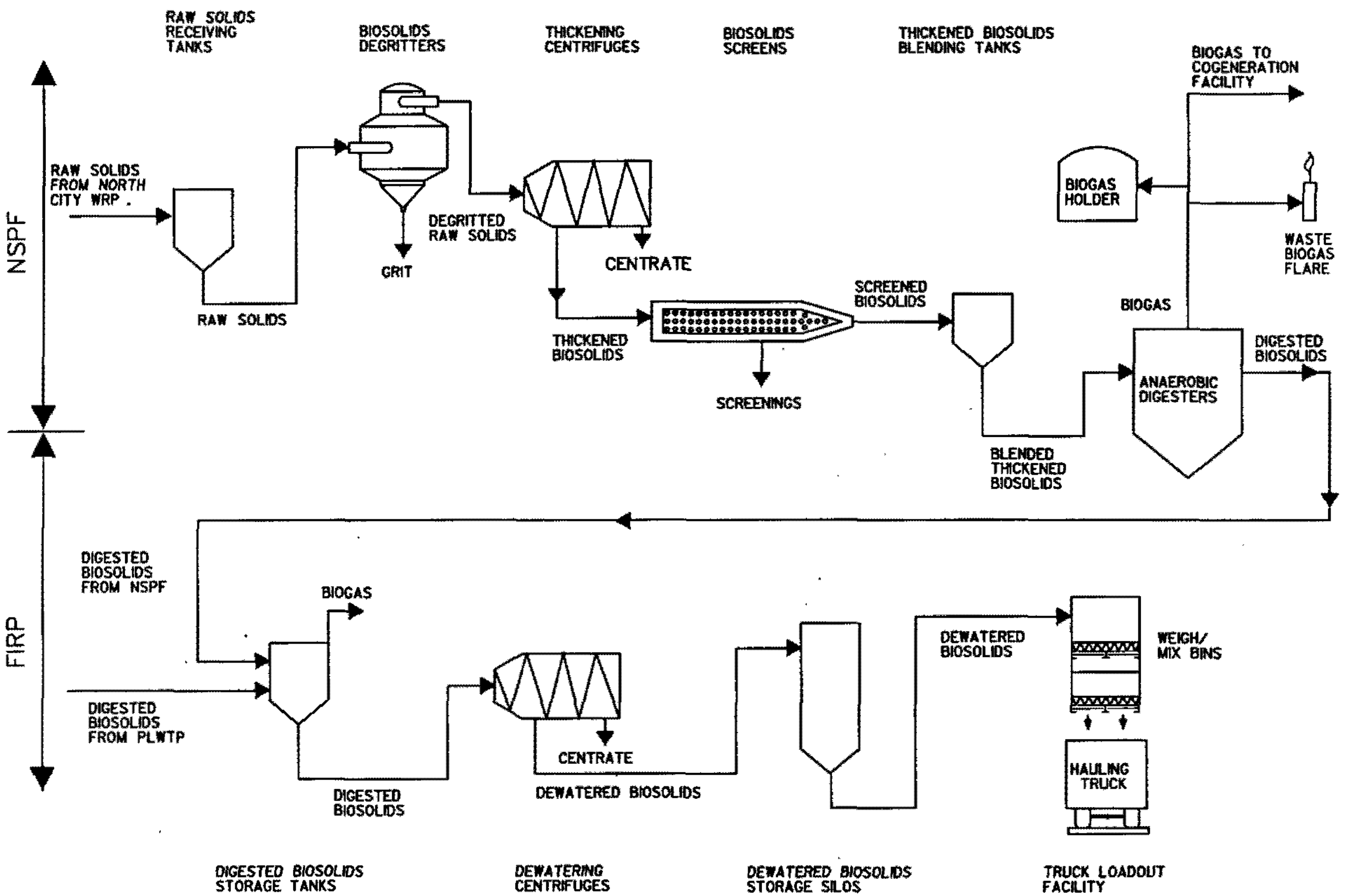
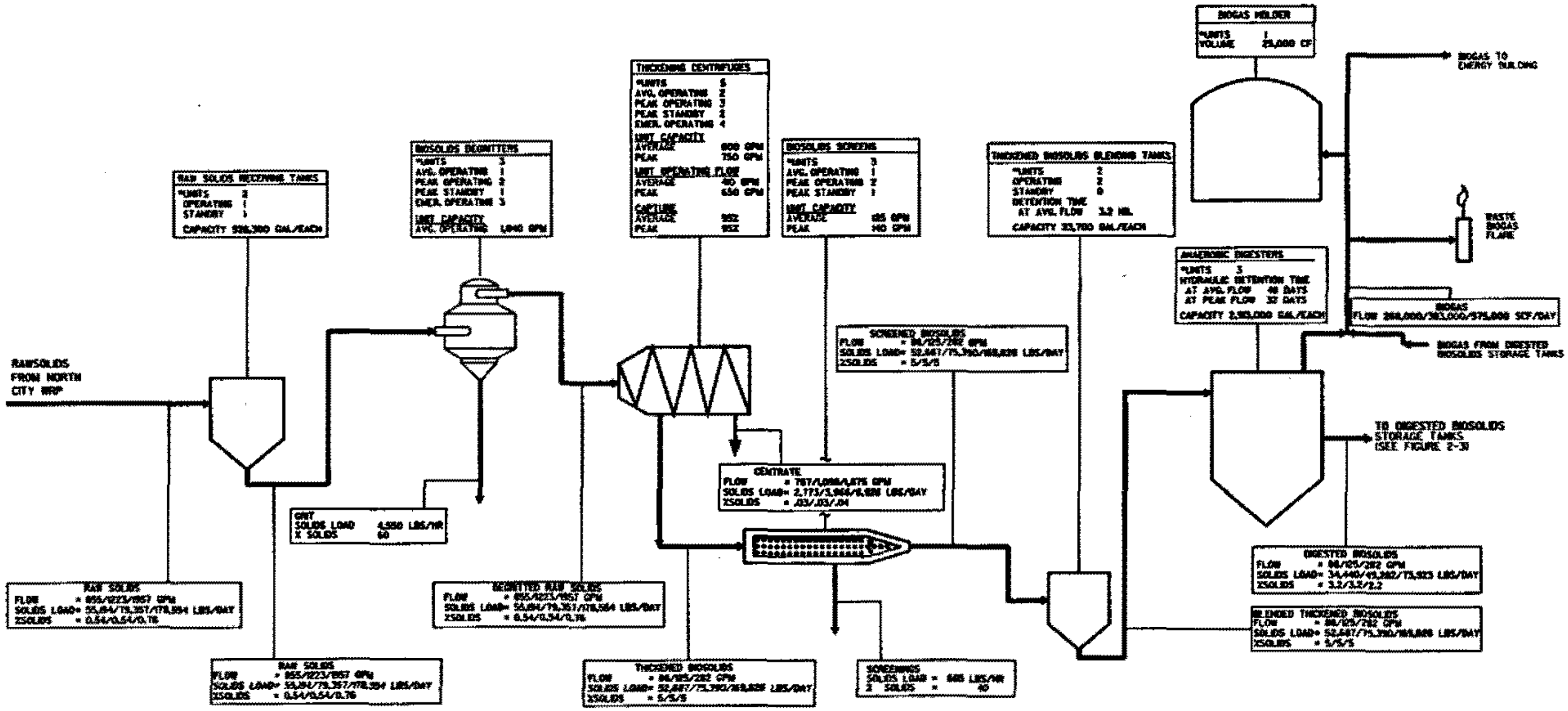


FIGURE 2-1

MBC OVERALL PROCESS FLOW DIAGRAM



FLOW LEGEND:

MINIMUM AVERAGE FLOW
AVERAGE FLOW
PEAK FLOW

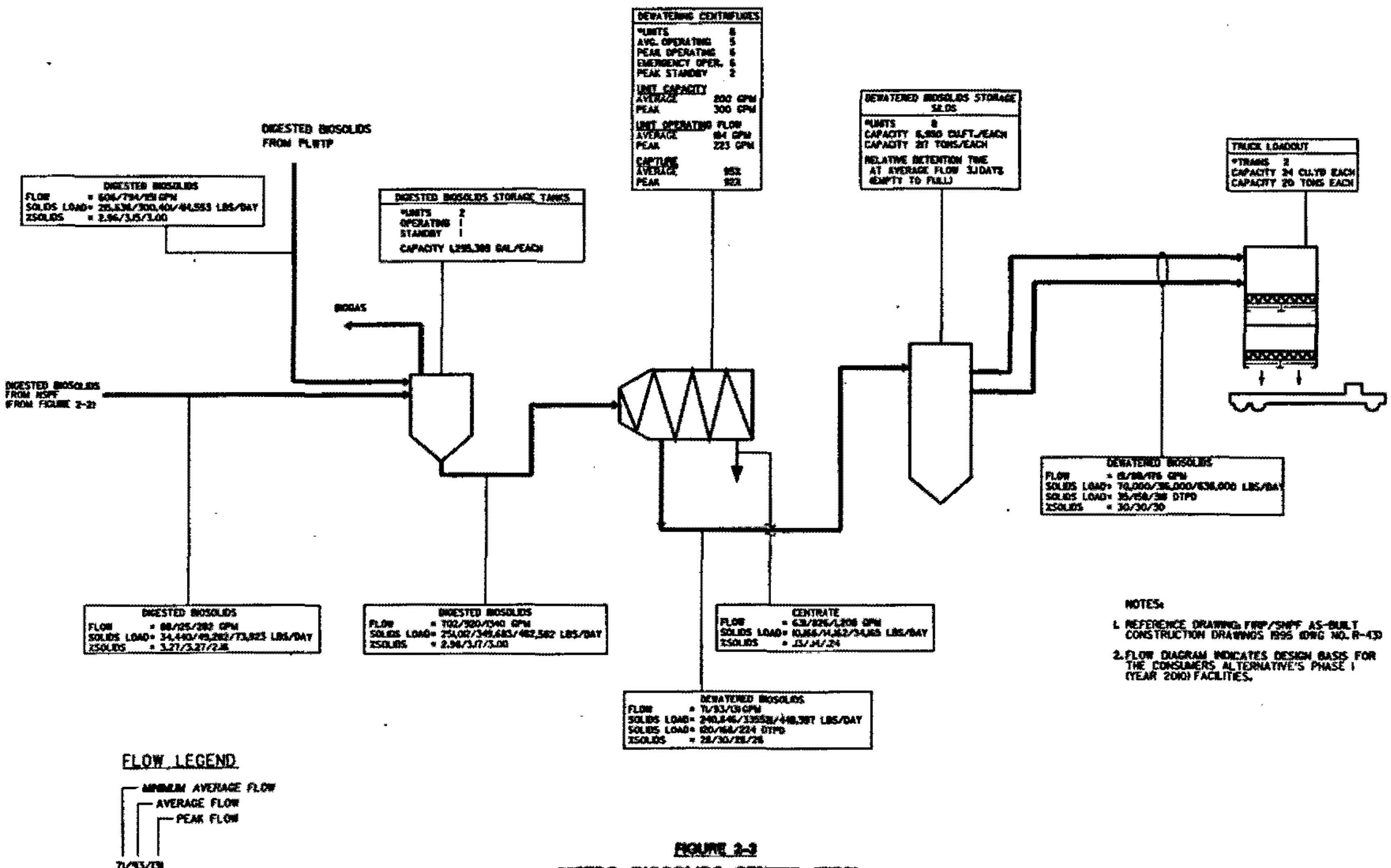
71/93/131

NOTES:

1. REFERENCE DRAWING: FIRP/SNPF AS-BUILT CONSTRUCTION DRAWINGS 1995 (DWG NO. R-42)
2. FLOW DIAGRAM NUMBERS INDICATES DESIGN BASIS FOR THE CONSUMERS ALTERNATIVE'S PHASE I (YEAR 2010) FACILITIES.

FIGURE 2-2

METRO BIOSOLIDS CENTER (NSPF)
PROCESS FLOW DIAGRAM-1



NOTES:

1. REFERENCE DRAWING: FIRP/SNPF AS-BUILT CONSTRUCTION DRAWINGS 1995 (DWG NO. R-43)
2. FLOW DIAGRAM INDICATES DESIGN BASIS FOR THE CONSUMERS ALTERNATIVE'S PHASE I (YEAR 2010) FACILITIES.

FIGURE 2-2
METRO BIOSOLIDS CENTER (FIRP)
PROCESS FLOW DIAGRAM-2

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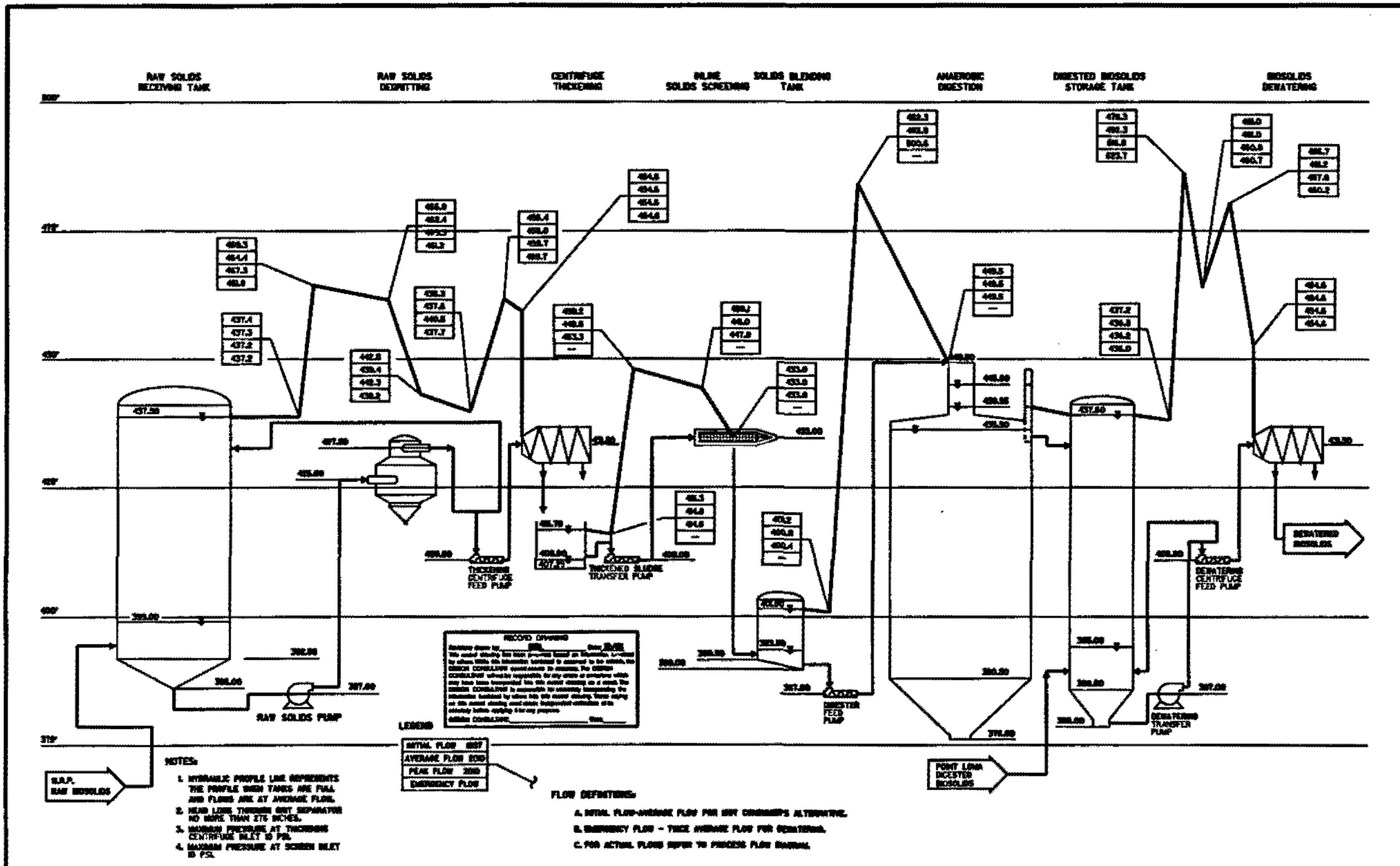

FIGURE 3-4
HYDRAULIC PROFILE

AS-BUILT HYDRAULIC PROFILE FOR FIRP/NSPF, 1995 (DWG NO. R-44)

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TABLE 2-2 Key Assumptions in Solids Production Projections			
Parameter	Unit	NCWRP	PLWTP
Influent TSS Levels	mg/l	220	306
Influent BOD Levels	mg/l	220	306
Primary TSS Removal Efficiency	%	60	75-85[a]
Primary BOD Removal Efficiency	%	35	45-55[a]
Final Effluent TSS	mg/l	5	10
VSS/TSS Primary Solids Ratio	%	74	71
VSS/TSS Secondary Solids Ratio	%	80	80
BVSS/VSS Primary Solids Ratio	%	60	60
BVSS per pound of BOD Removed. Y_{net}	lb/lb	0.6	0.6
Ferric Chloride Added to Primary Tanks	mg/l	0	50
VSS Destruction in Anaerobic Digesters	%	50	50
Thickening Capture Rate[b]	%	95	95
Dewatering Capture Rate[b]	%	95	95
Centrate from Biosolids Thickening and Dewatering sent to PLWTP	%	100	100
Amount of Digested Biosolids going to FIRP to Dewatering	%	100	100
Dewatered Biosolids Concentration	%	30	30

Reference: Table 3-4 of M&E's "FIRP/ NSPF Design Concept Report: August 1993"
a. First number for secondary treatment, second number for advanced primary treatment only.
b. 95% capture rate for solids related equipment design and 90% capture rate for side stream related equipment design.

2.3 Historic Solids Loadings from NCWRP AND PLWTP

Tables 2-3 and 2-4 display the amount of biosolids produced at PLWTP and NCWRP from 1999 to 2003. Comparing these historic quantities to the design loadings of the Consumer's Alternative in Table 2-1 demonstrates that NCWRP's historic average and peak solids are less than those projected for Phase I.

The average loads from PLWTP for 4 years were equal to or greater than the Phase I projections. However, in terms of the lbs/day sent to MBC from 1999 to 2003, the digested biosolids quantities are lower than the projections. The higher sludge flows are due to the lower concentration of solids being sent versus percent solids used during design (2.5% actual vs. 3 % design).

TABLE 2-3 NCWRP Raw Biosolids Sent to MBC [2, 3]					
	1999	2000	2001	2002	2003
Average - mgd - ppd	 1.44 60,050	 Complete Data not available [1]	 1.04 43,370	 1.05 43,790	 1.13 47,120
Peak -mgd -ppd	 1.97 82,150	 1.08 45,040	 1.17 48,790	 1.21 50,460	 1.29 53,790

[1] Complete readings not available.
[2] Based on NCWRP Annual Monitoring Reports for indicated years.
[3] Raw solids @ 0.5% solids.
mgd- million gallons per day
ppd - pounds per day

TABLE 2-4 PLWTP Digested Biosolids [1, 2, 3]					
	1999	2000	2001	2002	2003
Average - mgd - ppd	 1.18 232,000	 1.03 214,000	 1.04 210,000	 1.09 208,000	 1.13 216,000
Peak -mgd -ppd	 1.24 248,000	 1.12 226,000	 1.14 222,000	 1.18 220,000	 1.25 238,000

[1] Based on Point Loma Ocean Outfall Annual Monitoring Reports for indicated years.
[2] Includes raw solids received from South Bay WRP.
[3] Digested biosolids @ 2.5% solids
mgd- million gallons per day
ppd - pounds per day

2.4 Dewatered Biosolids Production

The table below shows the projected dewatered biosolids production for the MBC facility for years 2010 and 2050. These quantities were the basis for the design of MBC's FIRP Facility including the storage silos, truck loadout silos and biosolids transfer pumps.

TABLE 2-5 **MBC Dewatered Biosolids Projections** [1]		
	2010	2050
Annual Average -ppd -dtpd -wtpd (@ 32 % solids)	 288,337 144 450	 401,449 201 628
Annual Peak -ppd -dtpd -wtpd (@ 30% solids)	 385,340 193 643	 536,572 268 893
Solids flow, mgd -avg -peak	 0.11 0.15	 0.15 0.21
1-From the M&E "FIRP/ NSPF Design Concept Report," Appendix B. ppd – pounds per day dtpd – dry tons per day wtpd – wet tons per day		

Table 2-6 below shows the actual average biosolids production at MBC from year 2001 to 2004. Compared with the Consumer's Alternative projections in Table 2-1 and M&E's design quantities in Figure 2-2 and Figure 2-3, these actual quantities are shown to be smaller than the planning and design biosolids projections.

TABLE 2-6 **MBC Biosolids Cake Production (Average)**				
	2001[1]	2002	2003	2004[2]
Wtpd	265	343	357	367
% solids	29.6	29.4	28.8	28.5
Dtpd	79	101	103	105
[1] Only for months of July to December. [2] Only for months of January to September. dtpd – dry tons per day wtpd – wet tons per day				

The above comparisons appear to show that the MBC dewatering facilities have plenty of capacity to process current solids loads up to year 2010. However, these actual production rates are deemed to be a truer indication of MBC's real capacity as affected by various design and operational constraints described in this report.

2.5 Phase II Mass Modeling

In the Phase II effort of this master plan for MBC, a computerized mass balance modeling based on more accurate assumptions learned and honed from five years of operation of the upgraded PLWTP (with advanced primary treatment) and the new NCWRP including MBC's operations was performed with the assistance of MWWD 's as-needed engineer Brown and Caldwell (B&C). The Phase II mass balance model runs (also called MBC CAMP runs) also estimated the construction timing for certain MBC facilities identified for upgrade or expansion in the Phase I condition and operation assessment. A copy of the Technical Memorandum submitted by Brown & Caldwell as requested by the City is presented in Appendix C. A summary of this technical memorandum is presented herein.

The three MBC facility improvements of interest due to their criticality to MBC operation, as listed in the *MBC UPGRADES PROJECTS* resulting from the Phase I Condition and Operation Assessment (see Chapter 1, Table 1-2), are the following:

- Project P-10.6 – Replace 4 Dewatering Centrifuges with Larger Capacity Units
- Project P-11.1 - Additional Biosolids Storage Silos
- Project P-11.6 – New Biosolids Truck Loadout Facility

2.5.1 MODELING METHODOLOGY

The step-by step process performed to arrive at the projected estimates were as follows:

1. ***Collected influent and effluent flow, TBOD, and TSS information for PLWTP, NCWRP, SBWRP, and MBC.*** Data collected for years 2001, 2002 and 2003 were used for model calibration purposes.
2. ***Determined average, minimum, maximum, and 90th and 95th percentile values of the collected data.*** The 95th percentile values of 7-day rolling averages were used to calibrate the models for capacity assessment of MBC centrifuge and cake storage facilities.
3. ***Calibrated Model*****.** Model parameters such as removal efficiencies for primary sedimentation process, capture efficiencies for thickening and dewatering processes were adjusted to match 95th percentile effluent concentrations for daily and 7-day rolling averages.
4. ***Determined Calendar Year When Capacities are Reached.*** After establishing the model parameters, the model was run using projected flows for the service area at a given year. Using an iteration procedure, the year when available capacities match projected biosolids production was determined.

2.5.2 GENERAL KEY ASSUMPTIONS

For all MBC CAMP model runs, it was assumed that PLWTP, NCWRP and SBWRP were the only wastewater treatment plants in service and that the WRPs produce secondary effluent. The NCWRP effluent was assumed to be returned to the sewer for re-treatment at PLWTP and the

SBWRP effluent was disposed through the South Bay Ocean Outfall. SBWRP solids are returned to the South Metro Interceptor for treatment at PLWTP and eventual conveyance to MBC. PLWTP is assumed to continue operating as an advanced primary treatment plant. Model runs were performed only until 2025 when the draft 2005 MWWD Framework Plan indicates that the Southern Sludge Processing Facility and a South Bay Secondary Treatment Plant would be in service. Solids from the SBWRP will then be processed at this new south facility relieving load on MBC.

The process parameters provided in Table 2-7 below were used in all model runs for this project. These parameters were based on data collected from the three treatment plants including MBC for 2001, 2002, and 2003. These parameters were confirmed by the operational staff of the plants. A detailed discussion of the changes made on the operational parameters originally used for PLWTP, NCWRP and MBC based on MWWD staff comments and suggestions is presented in the B&C CAMP Technical Memorandum (See Appendix C).

TABLE 2-7
MBC CAMP Mass Balance Model Parameters[1]

Parameter	Old	New
Chemical Sludge Production, lb TSS/lb $FeCl_3$ Added (see Attachment C for backup calculation)	0.7	1.1
Capture of Chemical Sludge, %	95%	100%
Chemical Addition – ferric chloride, mg/L	40	30
Combined Sludge Specific Gravity	1.0	1.01
Thickened Sludge Specific Gravity	1.01	1.03
Combined Sludge VSS Destruction, %	45%	52%
Gas Production Rate, scf/lb VSS destroyed	15	14.5
Digester Influent to Effluent Ratio	1.0	0.99
Digested Sludge Specific Gravity	1.02	1.03
Solids Concentration of Dewatered Sludge, % (w/w)	30%	28%
Solids Recovery in Thickener, %	90%	97%
Thickened Sludge Solids Concentration, % (w/w)	3.0%	3.5%
NCWRP TSS Removal in Primaries	60%	65%
NCWRP TBOD Removal in Primaries	35%	38%
NCWRP Secondary MLTSS Concentration, mg/L	2800	2155
NCWRP MCRT, days	5	5.86
NCWRP $FeCl_3$ Addition, mg/L	15	10
$FeCl_3$ Solution Strength, %	40%	44%
$FeCl_3$ Solution Specific Gravity	1.31	1.467

[1] See "List of Acronyms and Abbreviations" at front of this report.

Copies of the CAMP model runs performed are provided in the Technical Memorandum Appendix C.

2.5.3 MODEL RESULTS

Additional adjustments to the original mass balance model resulting from the calibration runs for each of the three projects in consideration are reported in the Technical Memorandum in Appendix C.

A. Project P-10.6 – Replace 4 Dewatering Centrifuges with Larger Capacity Units

Additional assumptions made regarding the dewatering centrifuges include the following:

- 6 of 8 dewatering centrifuges are in operation (i.e., two are in standby mode at all times)
- Each existing centrifuge can process up to 225 gpm average or 300 gpm peak of digested biosolids, using average capacity for determining expansion needs
- 3.0% solids content in digested biosolids

Results

The existing dewatering centrifuges at MBC are adequate until the year 2025. Therefore, designing for upgrade or expansion of the units will have to be started in about 2020. Any earlier modifications will be driven by the useful life of the equipment.

B. Project P-11.1 - Additional Biosolids Storage Silos

Additional assumptions made specific to the operation of the existing silos include the following:

- Dewatering centrifuges produce a dewatered cake with 28% solids
- Maximum storage capacity required is equivalent to the amount of dewatered cake produced in 3.63 days (during a 3-day weekend starting 3 p.m. on Friday when truck loadout stops until 6 a.m. on the following Tuesday when loadout resumes) or in 2.63 days (during a 3-day weekend except with MBC staff working 9 hours on Saturday).
- One or two silos are out of service for each storage scenario
- Each silo has a maximum storage capacity of 6,950 cubic feet, only 90% of this volume can be used on a daily basis based on actual operation.

Results

1. With 3.63-day weekend storage and 6 of 8 silos in operation (2 on standby), existing silo capacity is currently exceeded.
2. With 3.63-day weekend storage and 8 of 8 silos in operation, capacity is currently exceeded.
3. With 2.63-day weekend storage and 7 of 8 silos in operation, capacity will be adequate until 2014.

4. With 2.63-day storage and 8 of 10 silos (2 new silos added now), capacity will be adequate until 2025.
5. With 3.63-day storage and 10 of 12 silos in operation (4 new silos added now), capacity will be adequate until 2017.
6. With 3.63-day storage and 11of 13 silos in operation (5 new silos added now), capacity will be adequate until 2025.

C. Project P-11.6 – New Biosolids Truck Loadout Facility

Additional assumptions specifically related to the Truck Loadout Facility include the following:

- Each truck loadout bay has the capacity to hold 648 cubic feet of dewatered biosolids per load
- Two loadout bays are available at all times
- Each truck requires a total of 25 minutes to drive in, accept load, and drive out
- Cake pumps are capable of transferring biosolids from the silos to the truck loadout within the loading duration noted above
- Bays are only open 5 or 6 days per week and 8 or more hours per day (Various operating scenarios are indicated in Table 2-8)
- Truck loadout opens one hour extra than the hours indicated on Table 7 to account for startup and cleanup time at the beginning and end of each work day

Results

1. At normal operation of 5 days per week and 8 hours per day, the existing two truck loadout bays are adequate until 2014.
2. If the City chooses to operate on Saturdays, the existing bays are adequate until 2025.
3. At normal operation of 5 days per week and but at a little over 9 hours per day, the existing bays are adequate until 2025.

2.5.4 CONCLUSIONS / RECOMMENDATIONS

Recommended startup years for the selected MBC expansion projects are provided in Table 2-8 under the various operating scenarios for each project. Based on project needs and funding allocation, the final MWWD recommendations/decisions made are also indicated.

TABLE 2-8
Final Recommendations on MBC CAMP Projects

Project / Operating Scenarios	Recommended Start-Up Year by Model	Final MWWD Decision
P-10.6 – Replace 4 Dewatering Centrifuges with Larger Capacity Units	• Beyond 2025	**Due to current wear and tear conditions, replace 8 existing units with new same-size units. Implement in 2007-2014.**
P-11.1 – Additional Biosolids Storage Silos • 3.63 days storage; 6 of 8 in Operation • 3.63 days storage; 8 of 8 in Operation • 2.63 days storage; 7 of 8 in Operation • 3.63 days storage; 10 of 12 in Operation – 4-unit Expansion has Occurred • 2.63 days storage; 8 of 10 in Operation – 2-unit Expansion has Occurred • 3.63 days storage; 11 of 13 in Operation – 5-unit Expansion has Occurred	 • Currently Exceeds Capacity • Currently Exceeds Capacity • 2014 • 2017 • Beyond 2025 • Beyond 2025	**Implement 2- unit expansion in 2007-2014. In the interim until 2014, during 3-day weekends MBC to load silos on Saturdays for 8 hours.**
P-11.6 – New Biosolids Truck Loadout Facility • 2 Bays in Operation; 5 days/week; 8 hours/day • 2 Bays in Operation; 6 days/week; 8 hours/day • 2 Bays in Operation; 5 days/week; 9 hours/day	 • 2014 • Beyond 2025 • Beyond 2025	**Construct new Loadout Facility in 2024-2030. In the interim, MBC to operate bays at 9 hrs/day, 5 days per week.**

CHAPTER 3 – SOLIDS TREATMENT FACILITIES

3.0 General

The condition of the various process facilities at the Metropolitan Biosolids Center are discussed in this chapter. For each process facility, a description of the treatment process and function, the design criteria's used for sizing and determining number of units, process equipment and its existing condition, problems relating to capacity issues, its physical, mechanical and operational conditions, and lastly recommended improvements to address the problems are identified. The problems relating to the non-process systems are discussed separately in Chapter 4 while problems related to electrical instrumentation and controls are discussed in Chapter 5.

3.1 Solids Process Facilities

All biosolids from NCWRP are sent to MBC NSPF's raw biosolids receiving tanks. Biosolids from future northern and central water reclamation plants (e.g. MVWRP) will be also received by these tanks. The raw biosolids (combined primary and waste activated biosolids) are then degritted and thickened by high-solids rate scroll-type centrifuges. All thickened biosolids are screened and blended prior to discharge to anaerobic digesters. The thickened biosolids are anaerobically digested in circular, mesophilic pre-stressed concrete digesters.

The MBC facility includes a storage tank to receive digested biosolids from both the PLWTP and the NSPF digesters. The biosolids are then mechanically dewatered using centrifuges. Silos are provided to store dewatered biosolids before transferring to the truck loading facilities. Biosolids are trucked offsite for beneficial use or landfill disposal. The centrate is collected and pumped back to the sewers.

3.1.1 Design Criteria

Table 3-1 presents the sizing criteria used in designing each process system for projected average and peak load conditions during Phase I (Year 2010) of the Consumer's Alternative.

TABLE 3-1
FIRP/NSPF Process Unit Sizing Criteria [1]

Process	**Unit**	**For 2010 Average Load**	**For 2010 Peak Load**
NSPF RAW SOLIDS RECEIVING			
Number of Tanks (Duty/Total) [2]		1 / 2	1 / 2
Diameter	ft	45	45
Depth	ft	42	42
Total Volume	gal	528,000 [3]	528,000 [3]
RAW SOLIDS DEGRITTING			
Number of Degritters (Duty/Total) [2]		3/3	3/3
Type		Eutek	Eutek
Capacity	mgd	1.5	1.5

TABLE 3-1 (Continued) FIRP/NSPF Process Unit Sizing Criteria [1]			
Process	**Unit**	**For 2010 Average Load**	**For 2010 Peak Load**
THICKENING WITH CENTRIFUGES			
Number of Centrifuges (Duty/Total) [2]		2/5	3/5
Type		high solids	high solids
Feed solids concentration	%	0.5	0.5
Unit capacity	gpm	600	750
THICKENED BIOSOLIDS SCREENS			
Number of Screens (Duty/Total) [2]		1/3	2/3
Type		inline	inline
Unit Capacity, max.	gpm	250	250
THICKENED BIOSOLIDS BLENDING			
Number of Tanks (Duty/Total) [2]		2/2	2/2
Type		rectangular	rectangular
Length /Width	ft/ft	12/12	12/12
Depth	ft	11	11
Total Volume	gal	24,000	24,000
ANAEROBIC DIGESTION			
Number of Digesters (Duty/Total) [2]		1/3	2/3
Type		cylindrical w/	cylindrical w/
-Shape		bottom cone	bottom cone
-Cover		fixed	fixed
-Mixing		pumped	pumped
VSS Loading	Lb VSS/cu ft	0.10	0.15
Detention Time	days	20	20
Volatile Solids Destroyed	%	50	50
Diameter	ft	105	105
Liquid sidewater depth	ft	35	35
Volume	gal	2,900,000	2,900,000
Pump mix power	hp/1000 cf	0.3	0.3
Pump mix flow	gpm	20,000	20,000
Biogas production	cf/lb VSS destroyed	15	15
Operating Temperature	Deg-F	95	95
DIGESTED BIOSOLIDS STORAGE			
Number of Tanks (Duty/Total) [2]		2/4	3/4
Type			
-Shape		cylindrical	cylindrical
-Cover		fixed	fixed
-Mixing		pumped	pumped
Diameter	ft	70 [3]	70 [3]
Liquid Depth	ft	40	40
Working Volume	gal	1,300,000 [3]	1,300,000 [3]
Pump mix power	hp/1000 cf	0.3	0.3
CENTRIFUGE DEWATERING			
Number of Centrifuges (Duty/Total) [2]		5/8	6/8
Type			
-Machine		centrifuge	centrifuge
Model		high solids	high solids
Unit Capacity	gpm	225	225
Solids Capture	%	95	95

TABLE 3-1 (Continued) FIRP/NSPF Process Unit Sizing Criteria [1]			
Process	**Unit**	**For 2010 Average Load**	**For 2010 Peak Load**
DEWATERED BIOSOLIDS STORAGE			
Number of Silos (Duty/Total) [2]		10	13
Type			
-Shape		cylindrical	cylindrical
Diameter	ft.	18	18
Operating Depth	ft.	24	24
Working Volume	cu. ft.	6,950 [3]	6,950 [3]
Solids capacity	tons	220	220

[1] From Table 3-6 of the FIRP/NSPF Design Concept Report, August 1993
[2] Number of units (Duty/ Total) is not provided in the original Table 3-6
[3] Based on as-built drawings

Table 3-2 shows the projected number of major process units required during Phase 1 (up to Year 2010) and Phase II (up to year 2050).

TABLE 3-2 Number of Process Units Required[1]			
Process Unit	**Consumer's Alternative**		**Existing Units**
	2010	**2050**	**2005**
Raw Solids Receiving Tank	1	1	2
Thickening Centrifuges	5	7	5
Thickened Solids Blending Tanks[2]	2	2	2
Thickened Biosolids Screens	5	5	3
Anaerobic Digesters	3	4	3
Digested Biosolids Storage Tanks -NSPF -Point Loma	 1 2	 1 2	 1 2
Dewatering Centrifuges -FIRP & NSPF -NSPF only -Point Loma only	 8 2 6	 11 3 8	 8 2 6
Dewatered Biosolids Storage Silos	10[3]	13	8

[1] From Appendix B Final FIRP/NSPF Design Concept Report, August 1993.
[2] No stand-by limits provided
[3] Only 8 silos built

3.2 Description of the MBC Solids Treatment Process Facilities - General

The following describes the various MBC solids processing facilities, beginning with the MBC pig receiving facility for the two biosolids forcemains from the Point Loma WWTP and the North City WRP, and ending with the dewatered biosolids storage and truck load out facility. Each facility or process system description includes discussions of existing conditions (equipment, quantity, design capacity, process arrangement, and design flow). These operational conditions described herein were taken from the MBC Maintenance Report prepared by the FIRP/NSPF design engineer as required for state certification of state funded biosolids processing facilities. Also discussed are current and past physical, mechanical and/or operational problems. Also included are recommended improvements to correct or alleviate the identified problems, or suggested steps or alternative solutions to address a problem. Discussions related to electrical and instrumentation and controls issues are discussed separately in a later section. Figures 2-2 and 2-3 in the previous Chapter 2 show the design flows for the phase 1 facilities.

3.2.1 Condition Assessment -"Capacity Limiters"

As noted in the previous chapter, the current MBC process units appear to have adequate capacity to meet the biosolids average and peak flows identified for Phase I of the Consumer's Alternative Plan. However, experience during the first five years of operation indicates that can only be accomplished if all processes or facilities are functioning ideally. Process complexities, inadequacies in installed systems including physical deficiencies, mistakes in control strategies, redundant conceptual flaws and other factors, have significantly reduced the operational efficiency. During some peak operating conditions in the past, the plant is unable to fully process the flows.

Three major factors were identified as "capacity limiters". The term "capacity" here refers to the capacity of the MBC Plant to process the biosolids inflow to the plant. These "capacity limiters" or "capacity constraints" have significantly impacted the entire process thereby reducing MBC's biosolids production.

1. *Low Design Peaking Factor*: For the MBC biosolids storage and dewatering facilities, the design peaking factor used for both the solids loading and hydraulic flow was 1.38. A peaking factor of 2.0 or higher would be typical. Occasions of 8-hour plant shutdowns in the past have shown that MBC is unable to recover to provide a second shut down the next day, even with stand-by systems running. This limits the speed of constructing upgrades and increases the risk of spills should an unexpected event occur.

2. *Complexity of Treatment Processes*: The MBC solids treatment processes are highly complex and difficult to operate. An operator generally requires a full year to understand all the operation and maintenance requirements of the various process facilities, systems and equipment. Complexity of control strategies and a multitude of operational functions and procedures have resulted in high turnover of O&M personnel, contributing to slow response to process events, equipment damage and other problems.

3. *Inadequacies in Design, Poor As-Built Drawings, and Inaccurate Operations/ Maintenance Manuals*: MBC suffers from several errors in design, equipment, sizing and specifications, piping configurations, control strategies, and materials specifications. The as-built drawings including the operations and maintenance manuals are inaccurate and incomplete, leading to more difficulties for plant engineers, maintenance staff and operators trying to resolve problems. This also results in a significant increase in the design cost and duration of upgrades.

3.2.2 Facility Descriptions and Problems Identification

PIG RETRIEVAL (P-1)

Raw biosolids from the NCWRP and digested biosolids from PLWTP are transported to MBC through two biosolids forcemains (5 miles long, NCRSP-16-inch diameter and 17 miles long, FIRP-12 and 14-inch diameter). In the future, a third forcemain may be constructed to convey raw biosolids from the Mission Valley Water Reclamation Plant (MVWRP) to MBC. These pipelines were designed to permit pigging the line without interruption of the biosolids pumping operations. The MBC pig retrieval facilities are located besides the associated receiving tanks.

The PLWTP sludge forcemain to MBC has been pigged three times since its installation in 1998 and there are no known problems related to the facility. Likewise, there are no known problems with the pigging facility for the NCWRP pipeline. The NCWRP sludge forcemain has not been pigged since the plant was commissioned in 1998. Therefore, the operational effectiveness of this facility has not been tested.

Recommended Improvements

It is recommended to trend the NCRSP pipeline pressures and pig pipeline when pressures increase.

RAW SOLIDS RECEIVING (P-2)

Design Flows:
Average 1,200 gpm; Peak 2,000 gpm @ 0.5% solids
Current Flows: 600/800/1,000 gpm (min/avg/peak)

Process Description

Raw solids (primary and waste activated sludge) is pumped at 1,000 gpm average and 1,300 gpm maximum from the North City Water Reclamation Plant to MBC's two (2)

Raw Solids Receiving Tanks. Each tank has a volume of 528,000 gallons with both tanks providing a total design storage volume of less than one day at current maximum flow. As NCWRP has the ability to redirect the raw solids flow to the sewer system, the limited quantity of raw solids storage available at MBC is not currently a concern but will need to be evaluated when the MVWRP is constructed.

Mixing of the biosolids in the tanks is provided by six Raw Solids Mixing Pumps (3 per tank) each rated at 1,500 gpm at 40 ft head, driven by dual-speed 25-hp motors. Three (2 duty plus 1 standby) Raw Solids Transfer pumps (rated at 1,500 gpm at 90 ft head with 60-hp motors and variable frequency drives (VFD)) send the biosolids to the raw solids feed loop which feeds the degritting system and the thickening centrifuges.

Currently, there are no capacity problems with the transfer and mix pumps.

RAW SOLIDS RECEIVING TANKS

Problems

1. *Clogging of suction piping*: The long suction piping header from the duty receiving tank to the raw solids transfer pumps is prone to clogging and the flushing connections provided are too small.

2. *Lack of isolation valves at the tank outlet pipes*. The receiving tanks are fitted with flexible rubber connectors adjacent to the wall connections. When the connectors inevitably develop leaks or rupture, there will be no means to isolate the leak from the tank and the contents of the tank may spill.

Recommended Improvements

No additional storage tank or pumps are needed as NCWRP has the capability to send its raw solids to PLWTP in the event that all MBC storage is exhausted.

1. Provide isolation valves and larger connections to facilitate flushing and draining the long header suction pipe to remove accumulated solids.

2. Install isolation valves between the tank walls and flexible pipe connectors to prevent emptying of a tank in the event that a connector possibly ruptures during a seismic or abnormal hydraulic surge event.

3. Have NCWRP implement a periodic schedule for pigging the raw sludge pipeline.

RAW SOLIDS DEGRITTING (P-3)

Design Flows:
Average @ 1,200 gpm; Peak @ 2,000 gpm @ 0.5% solids

Process Description

Flows in the raw solids feed loop are fed to three 1.5 mgd constant flow Eutek "Teacup" degritters. (1 unit running normally with 2 units on standby). From the Teacups, grit slurry flows by gravity into two "Snail" grit dewatering units (1 duty plus 1 spare, each rated at 2 cubic yards/hr) and then into two screw conveyors each rated at 2,400 lbs grit per hour. Dewatered grit is finally discharged into a 34 cubic yard disposal bin. This degritting facility is designed to produce grit with 50% to 60% solids to be trucked out to landfills at 4,550 lbs/hr (55 tons per day).

The grit system can be by-passed but this will result in increased wear and tear on the thickening centrifuges.

TEACUP DEGRITTERS


GRIT DEWATERING UNIT AND SCREW CONVEYOR

Problems

The need for a 4th "Teacup" degritter for 2030 flows is not necessary which is fortunate as the space reserved for the 4th unit is not accessible. The existing degritting system will be able to handle the future Phase 2 flows.

1. *Inaccessible teacup valves*: The teacups, associated valves and accessories are very difficult if not impossible to access for repair and maintenance without putting plant staff at safety risk. This results in reduced reliability due to inability of plant staff to perform needed maintenance.

2. *Inadequately-designed grit hoses:* Lack of vertical separation between the grit teacups and the dewatering units result in minimally sloped 3-inch diameter discharge hoses. These hoses develop low spots that collect grit and cause frequent plugging. In addition, the utility water connection to these grit hoses is too small to provide the needed flushing action.

3. *Faulty feed pumps control strategy*: As designed, the control strategy to operate the degritting system automatically requires close coordination with the Raw Solids transfer pumps which feed the degritting system. The strategy has timing problems and cannot start up the system automatically. Plant staff has been operating the system manually.

4. *Foul odors problem:* Strong foul odors from the open snails, screw conveyors and grit bins are present because of poor foul air collection from these odor sources. Two open wastewater discharge lines from the snails to a floor drain also contribute to room odors.

Recommended Improvements

The following improvements are recommended:

1. Install access platforms and hoisting equipment in the teacup and screen area. Construction work on the Grit Teacup Access Platforms and Hoists Installation Project will be completed in late 2005.

2. Provide proper supports for the grit hoses to minimize low spots and provide a larger (2 or 3 inch) UW connection to facilitate flushing.

   When replacing the snails in the future, evaluate the feasibility of installing longer and steeper units that could be mounted directly on the floor. This would provide more slope for the grit hoses and would eliminate low spots. This would also allow the hoses to be run below the access platform and would eliminate tripping hazard.

3. Review and tune the control strategy so that the degritters function automatically under a wide range of operating conditions.

4. Included in the Brown & Caldwell Odor Control Facility Evaluation done in 2003 are alternatives for enclosing the snails and grit/screenings bins. These alternatives should be revised and the most feasible alternative should be selected for implementation.

   Additionally, the snail waste discharge line should be piped directly into a domestic sewer drain pipe or the pipe connections to the floor drain should be enclosed. (This has been installed recently as part of the Grit Teacup Access Platforms Installation Project)

BIOSOLIDS THICKENING (P-4)

Design Flows:
Minimum @ 800 gpm; Average @ 1,200 gpm; Peak @ 2,000 gpm @ 0.5% solids
Current Flows: 800-1,500 gpm

Process Description

From the grit teacups, the degritted raw solids are sent to the thickening centrifuges area. Five (5) progressing cavity-type pumps feed the degritted raw solids into the five (5) thickening centrifuges (3 duty and 2 standby units). Each pump discharges at 300 to 1,000 gpm at 65 ft head and are driven by a 50 hp variable frequency drive motor. Any degritted flow that is not sent to the thickening centrifuges is returned to the raw solids receiving tanks. These centrifuge feed pumps are operating satisfactorily and do not have flow capacity or head problems.

Except for the first feed pump which can feed into any of the 5 thickening centrifuges, each of the other 4 pumps is dedicated to a centrifuge.

The 3 duty 300 hp scroll/bowl-type thickening centrifuges are designed to handle 800 to 2,000 gpm total flow of thickened biosolids (0.5 to 0.8 % solids content). Each centrifuge is designed to handle average and maximum flows of 600 and 750 gpm respectively with 95% solids capture. Currently, a maximum of 2 units operate to handle peak flows at 1, 500 gpm while 3 units are on standby. There is space available for one additional centrifuge.

THICKENING CENTRIFUGES

Problems

Thickening Centrifuge Feed Pumps and Polymer Feed Pumps

Initially, the thickening centrifuge feed pumps plugged frequently at their suction piping due to the vertical connection to the suction header as designed originally. The header connections have been revised to horizontal connections which eliminated the plugging. These centrifuge feed pumps are now operating satisfactorily and do not have flow capacity or head problems.

While the #1 pumps for both the centrifuge and polymer feed systems are tasked to provide redundant capability if any of the other 4 pumps breaks down, this can only be accomplished if thickening centrifuge #1 is solely on standby and never on duty service. Redundancy is lost anytime thickening centrifuge #1 is ran.

Thickened Solids Wetwell

1. Only a single wetwell observation and access hatch is provided. A second hatch is needed over the far end of the wetwell to facilitate wetwell monitoring during thickening operations and ventilation during maintenance activities.

2. No lighting is provided at the thickened sludge wetwell for proper monitoring of the thickening operation.

3. No means of mixing the wetwell contents to prevent solids accumulation is provided. The installation of the second hatch opening will also allow installation of a permanent mixer.

Thickened Biosolids Transfer Pumps

4. Plugging occurs at the transfer pumps suction bells. Because of the suction action at the inlet bells, the protective liner on the wetwell floor has become loose and plugs the suction inlet. The bells have been removed which eliminated this plugging problem. Their removal however can aggravate the solids accumulation in the wetwell. The damaged protective liner requires repair or removal and replacement with a more reliable liner.

5. O&M staff would like the ability to send thickened sludge directly to the digesters when the screens and blending tanks are bypassed during repair/maintenance procedures. However, the thickened sludge transfer pumps do not have sufficient head to accomplish this task.

Recommended Improvements

Thickening Centrifuge Feed Pumps and Polymer Feed Pumps

Although the original design did not correctly address redundancy of the feed pumps and the polymer pumps, no corrective action is recommended at this time as flow projections indicate that additional thickening capacity is not needed.

Thickened Solids Wetwell

1. Install a second hatch on the wetwell roof.
2. Install lighting in the wetwell.
3. Evaluate options for the installation of a wetwell mixing system.

Thickened Biosolids Transfer Pumps

4. Remove the T-lock liner from the floor of the wetwell and apply a painted coating. Re-install the pump suction bells.
5. Install a pipe connection between the thickened sludge transfer pumps discharge piping and the TSL feed piping into the digesters. This will significantly reduce the length of the pipe and the headlosses in the system.

THICKENED BIOSOLIDS SCREENING (P-5)

Design Flows:
Minimum @ 90 gpm; Average @ 125 gpm; Peak @ 280 gpm @ 5% solids.

Process Description

Thickened biosolids from the centrifuges are discharged to a common thickened solids wetwell. Three progressing cavity-type pumps (2 duty and 1 standby) withdraw the thickened biosolids cake from the wetwell at 150 gpm, 76 ft head each with 10 hp constant speed motor and send the cake to the sludge screens.

Three “Strainpress” inline-type screen/ compactor units (2 duty plus 1 standby) each rated for 125 gpm average flow are provided to remove fibrous materials to increase the efficiency of the digestion process and to reduce the frequency of digester cleaning.

Each screen can process a maximum flow of 250 gpm. Screened biosolid flows range from 90 to 280 gpm at a maximum discharge pressure of 14.5 psig. The screenings are conveyed by two (1 duty plus 1 standby) 2 hp shaftless screw conveyors (250 lbs/hr capacity) into a 295 cu. ft. screenings hopper which discharges to a trash bin.

Problems

1. *Cyclic operation problem*: The screens which need to operate continuously are interlocked with the thickened sludge transfer pumps. However, the thickened sludge (TSL) transfer pumps have constant speed drives and thus cycle on and off frequently. This cycling causes the screens to cycle frequently also which results in their premature wear and high torque and amperage conditions when restarting the screens.

2. *Control timing problem*: Additionally, a control timing problem exists which prevents the screens and the TSL transfer pumps from starting simultaneously when set to full AUTO mode in the DCS.

Recommended Improvements

1. The screens are interlocked with the upstream thickened sludge transfer pumps and need to be running continuously. The following options are suggested for addressing this problem:

Alternative 1

Investigate the proposal to install a valved thickened sludge (TSL) recycle line that will return sludge continuously to the wetwell to maintain sufficient liquid level (See discussion on alternative solutions to screen problems in next section on Thickened Biosolids Blending). Though more expensive operationally, this would allow the TSL transfer pumps and screens to operate continuously with less maintenance/ repair works and extended equipment life.

Alternative 2

Another proposed improvement to eliminate the screen problem of intermittent operation is to bypass the screens and blending tanks and have the thickened biosolid transfer pumps discharge directly to the digesters. This would require replacing the existing transfer pumps with higher head pumps.

These two alternative screens solutions are evaluated further in the next Thickened Biosolids Blending section because the operation and controls of the thickening and blending processes are directly interrelated.

2. MBC staff will be addressing the control timing problem in conjunction with the recommend solution for Problem 1 above.

THICKENED BIOSOLIDS BLENDING (P-6)

Design Flows: Minimum @ 90 gpm; Average @ 120 gpm; Peak @ 250 gpm @ 5% solids

Process Description

Screened thickened biosolids are sent to one of two (2) thickened biosolids blending tanks (with one unit on standby) each having 24,000 gallons capacity. Detention time is about 3 hours at average flows.

Three (3) centrifugal mixing (or recirculation) pumps, each rated at 300 gpm and 35 feet head, and coupled to a 10-hp belt-driven motor, keep the tank contents stirred. Two (2) spiral heat exchangers provide pre-heating of the thickened and screened biosolids and also provide back-up heating for the digesters.

Thickened sludge from the Blending tanks is sent to the digesters by three (3) progressing cavity-type Digester Feed (DF) Pumps (2 duty plus 1 standby). Each pump is rated at a flow of 300 gpm at 46 ft head and driven by a 15 hp electric motor.

TOP OF BLENDING TANKS

Problems

1. *Inadequate pump head*: In order to send thickened biosolids to the digesters, the digester feed pumps must overcome 46-feet of static head plus piping and equipment friction losses. With a total head of only 46-feet, the design of digester feed pumps gave no allowance to overcome any headloss in the discharge pipeline or in the heat exchangers (which typically have higher friction headlosses than the pipeline) and are therefore undersized for their intended purpose. This has resulted in the digester feed pumps frequently tripping off service due to high discharge pressure. To alleviate this head problem, the discharge piping was disconnected from the heat exchangers and instead routed to the suction side of the digester mix pumps. Although this reduced the TDH on the digester feed pumps, it did not completely eliminate the pump operational problems.

2. *Reverse flow and spill at the blending tanks:* Any planned or unplanned shutdown of the digester feed pumps results in a reverse flow from the digesters through the digester feed pumps and into the blending tanks. Due to the high head imposed by the liquid level in the digesters, this reverse flow can exceed 300 gpm. However, the blending tank overflow pipes are not sized to accommodate this large backflow which means that the blending tanks can fill quickly and spill. This has occurred in the past and resulted in the spilled flow getting into a nearby storm drain inlet.

   Any attempt to start or restart a pump while the reverse flow is occurring creates high torque on the pump shaft and on some occasions has caused it to break or required the pump to start on a high amperage. Neither a ratchet device on the pump to prevent impeller back-spin nor a discharge pipe check valve is provided to address this reverse flow problem.

Plant staff tried out several operational strategies for the digester feed pumps to prevent the reverse flow from the digesters and thereby reduce a spill risk. A strategy found to be most effective is to run the digester feed pumps continuously for longer periods of time. The control strategy was modified to limit the maximum pump speed and to ramp it up and down so as to maintain a set liquid level in the blending tanks. Although this reduces the spill risk, the pump operation is still subject to low liquid level shutdown failures, power outages and forced shutdowns required for pump maintenance.

The risk of spilling at the blending tanks is comprised of the following factors:

a. High head differential between the liquid level in the digesters and that in the blending tanks causing reverse flow from the digesters during pump shutdowns

b. Inadequate capacity on the blending tanks overflow pipes

c. Small volume of blending tanks results in tanks filling quickly giving operators very limited response time

d. Close proximity of spill outlet to the storm drain inlet

3. *Under-designed emergency overflow pipes*: The blending tanks are provided with emergency overflow pipes and valves. However, due to their relatively flat slopes and the thickness of the biosolids, these overflow pipes do not have sufficient capacity to handle the reverse flow from the digesters. On a few occasions, these overflow pipes have plugged. To minimize spills, the overflow valve on each blending tank has been locked shut. However, this only delays a similar spill from the tank's ventilation air inlet by a few minutes.

4. *Plugging- prone solids heat exchangers*: Because they plug easily, the spiral-plate heat exchangers designed to heat the recirculated thickened biosolids of the blending tanks are now permanently bypassed. The manufacturer has confirmed that the plugging problem will continue because the heat exchangers were never intended for use on undigested biosolids. Because of this, the heat exchangers were taken off service and no preheating is presently being provided for the digesters.

Recommended Improvements

1. The digester feed pumps need to be upgraded to attain the required operating head for the process. Remove the existing pumps and replace with higher head pumps.

2. The following nine (9) alternative solutions were developed to address the problems with the screen control/operation, digester biosolids backflow, and the spill risk at the blending tanks. Figure 3-1 shows the existing process diagram while Figures 3-2 through 3-10 illustrate the nine proposed solutions.

   Alternative 1
   Keep screens as they are and install a downstream recycle line which will reroute flows in excess of the screen capacity back to the Thickened Biosolids Wetwell.

   Alternative 2
   Keep screens, add a downstream recycle line with a flow diversion valve to the TSL wetwell and bypass the blending tanks. This results in a two-stage pumping configuration to send screened solids to the digesters.

   Alternative 3
   Bypass both the screens and blending tanks. This also results in a 2-stage pumping operation.

   Alternative 4
   Bypass screens, blending tanks and digester feed pumps. Upgrade TSL pumps to feed directly into digesters.

   Alternative 5
   Provide one-stage pumping to send screened solids directly from the screens to the digesters. Keep screens, add a downstream recycle line with a flow diversion valve to the TSL wetwell. Remove or bypass the blending tanks and digester feed pumps.

   Alternative 6
   Install a variable frequency drive on each TSL transfer pump motor. The VFD/ pump speed would be based on the sludge level in the Thickened Sludge Wetwell thereby allowing the pump discharge rate to match the sludge production rate of the centrifuges. Cycling of the pump would thereby be eliminated.

   Alternative 7
   Keep screens. Install a check valve on the digester feed line and/or install a non-reverse ratchet device on the digester feed pump.

   Alternative 8
   Combine alternatives 1 and 7. Install a flow diversion valve, a recycle line to the TSL wetwell and a check valve on the digester feed piping.

   Alternative 9
   Combine alternatives 6 and 7. Install VFDs on the TSL transfer pumps and check valve/s on the digester feed piping.

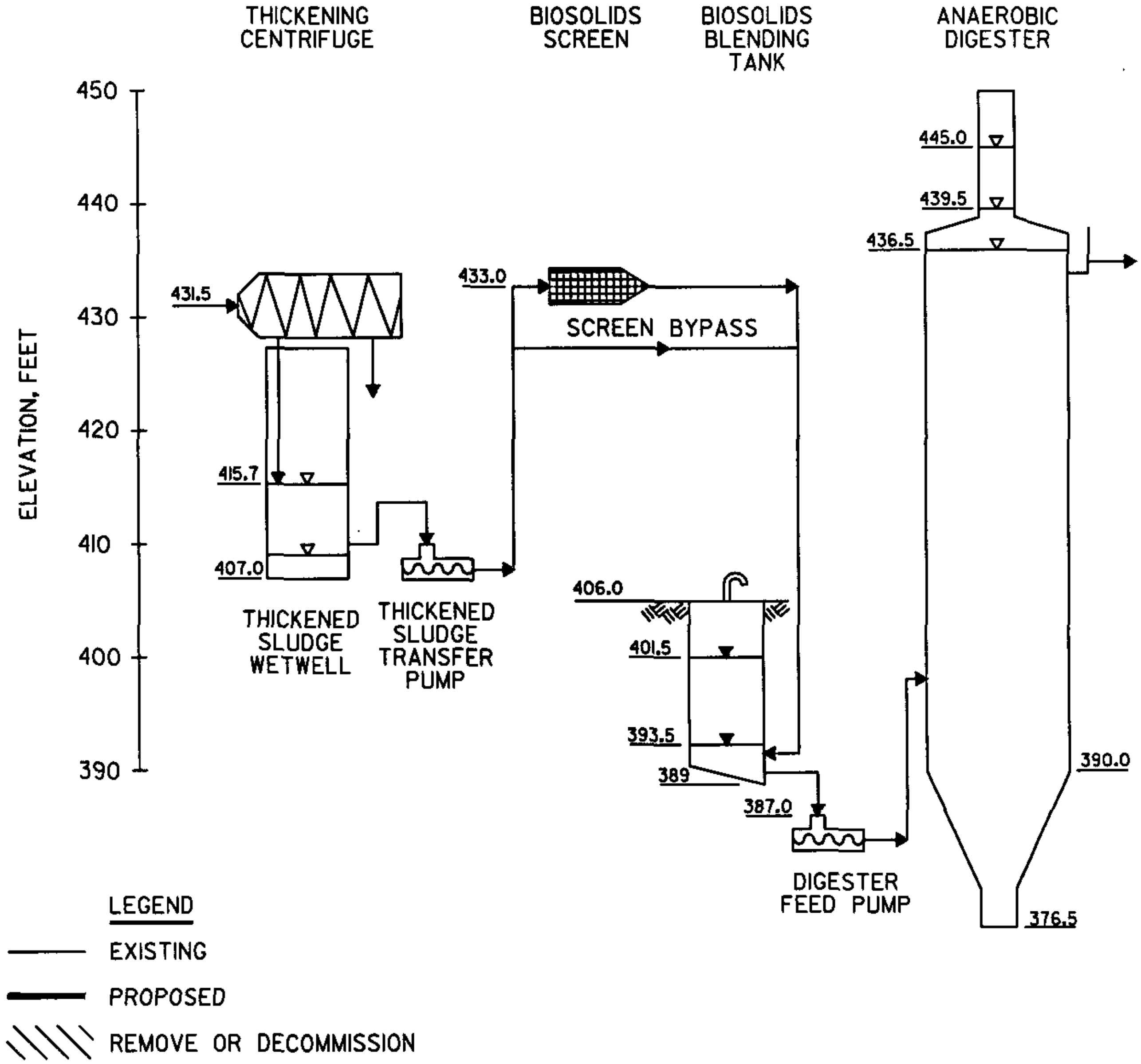


FIGURE 3-1

BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS EXISTING CONDITION

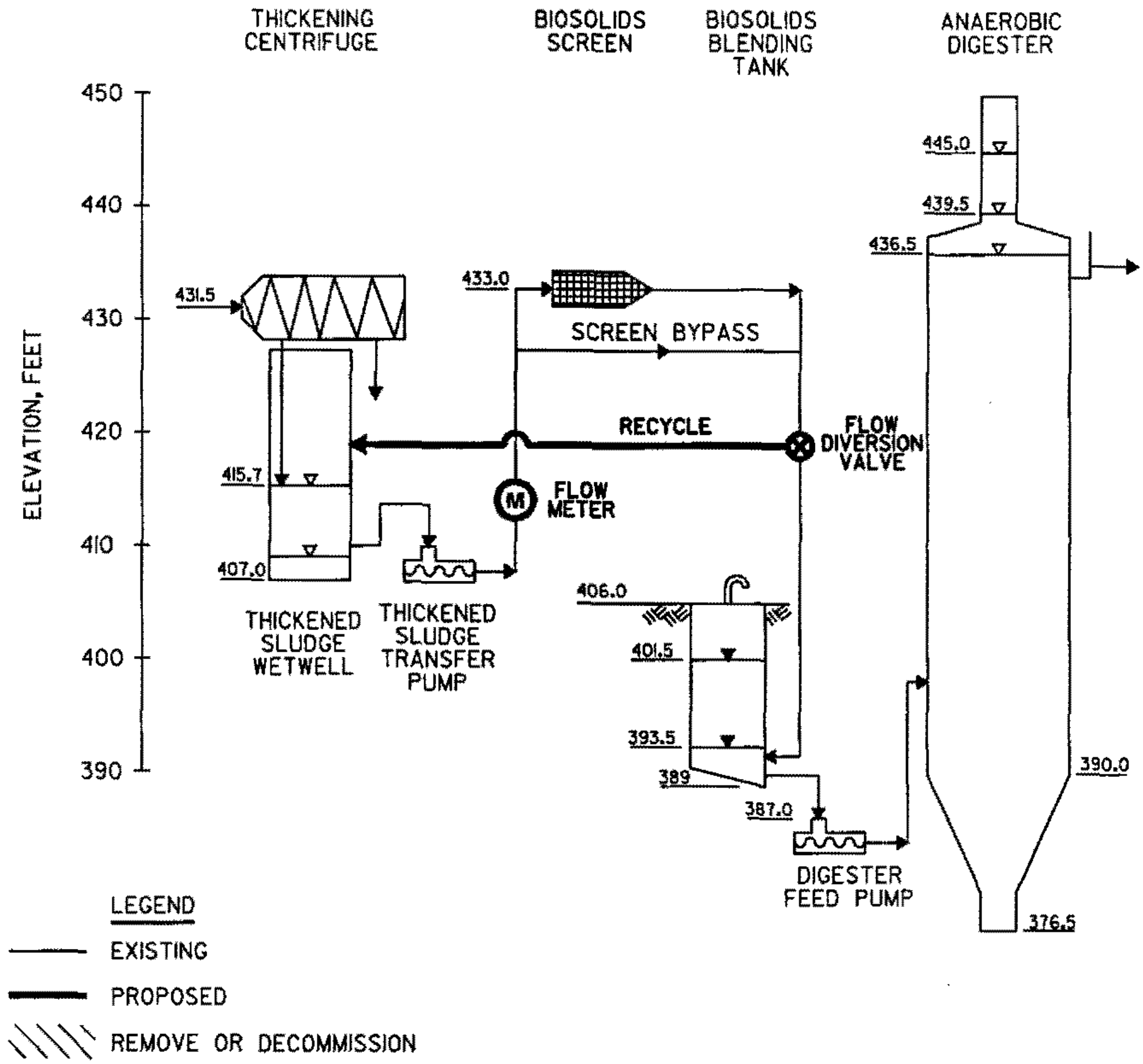


FIGURE 3-2

BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS
ALTERNATIVE 1

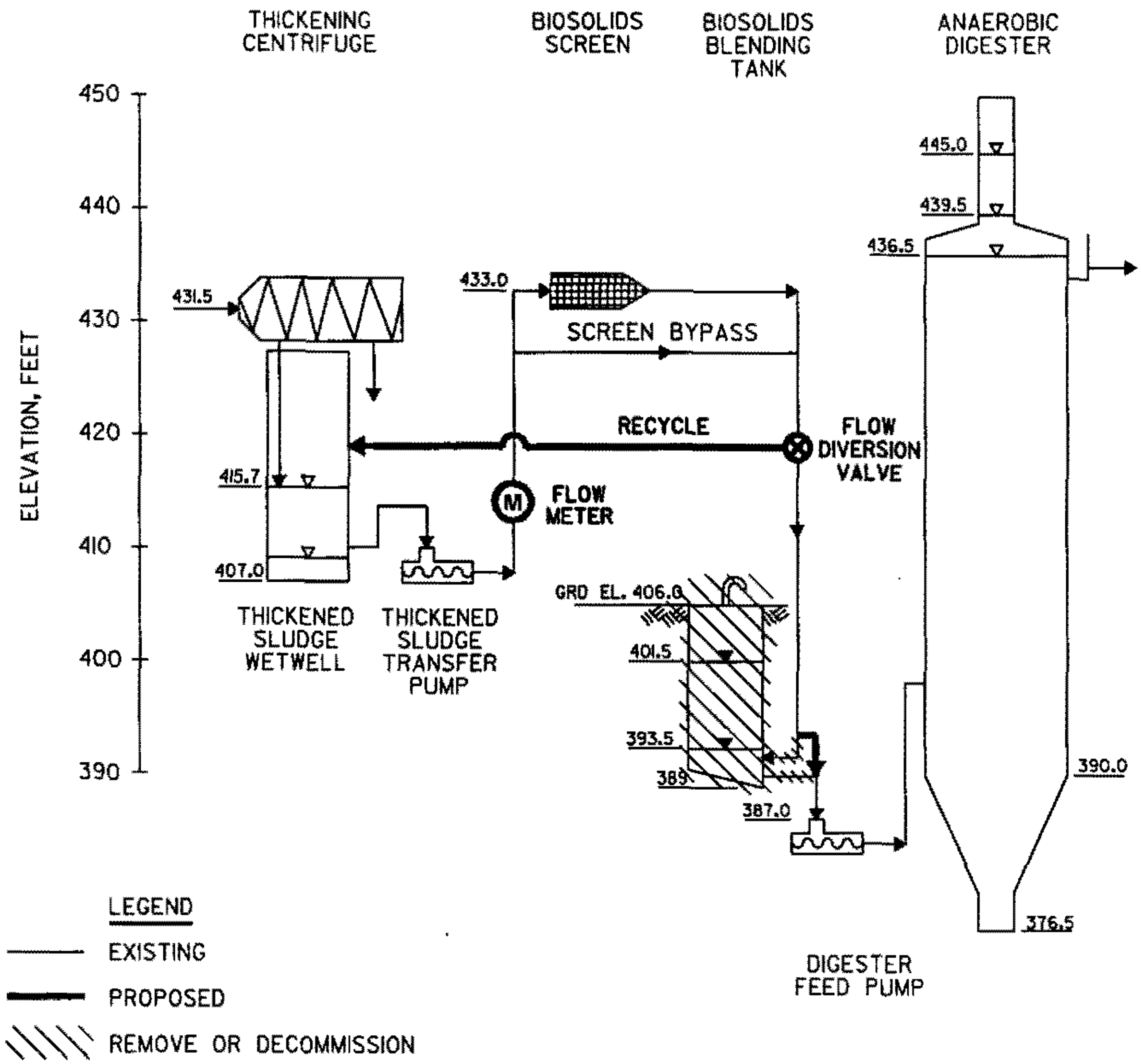


FIGURE 3-3

BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS ALTERNATIVE 2

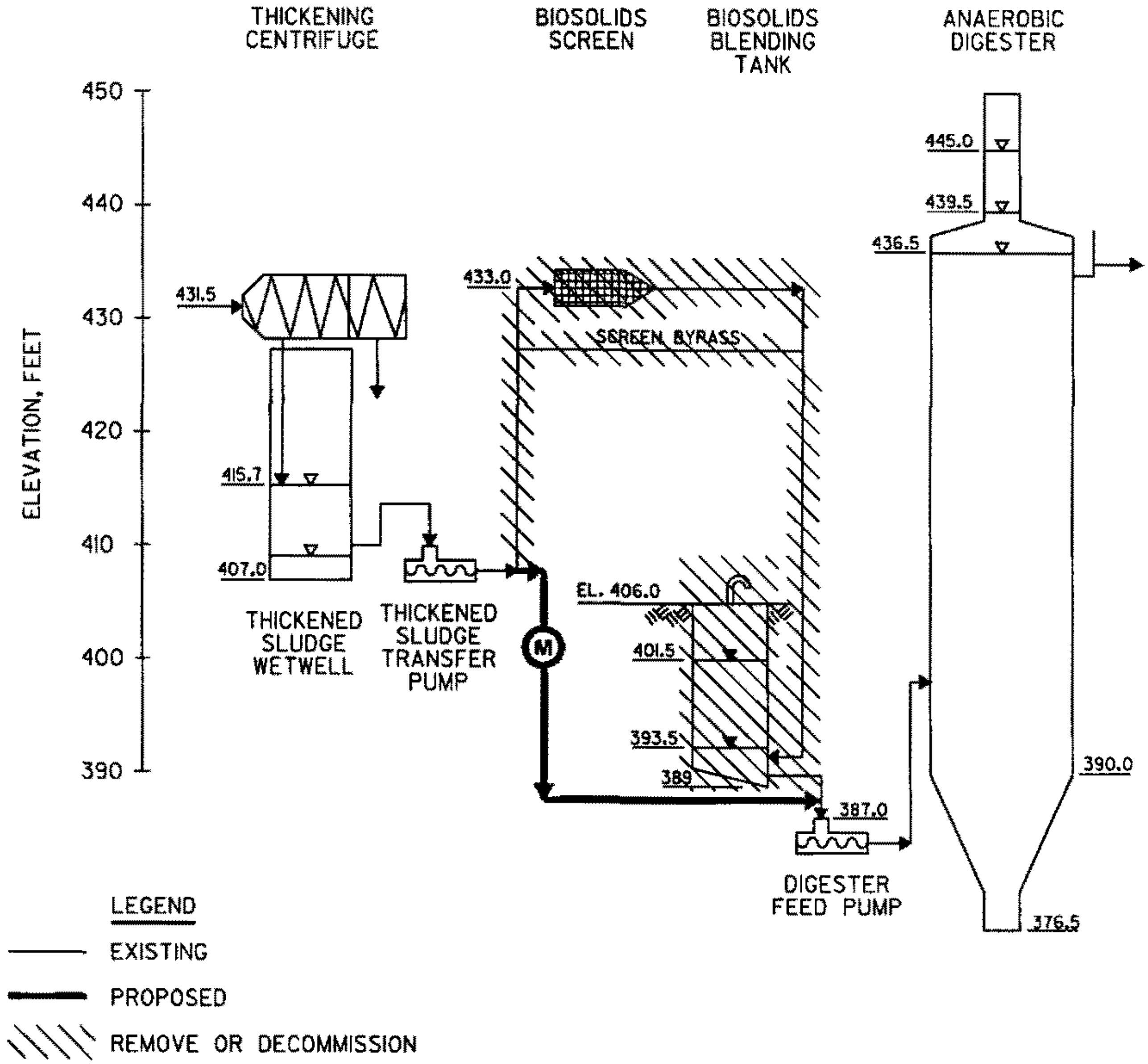


FIGURE 3-4

**BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS
ALTERNATIVE 3**

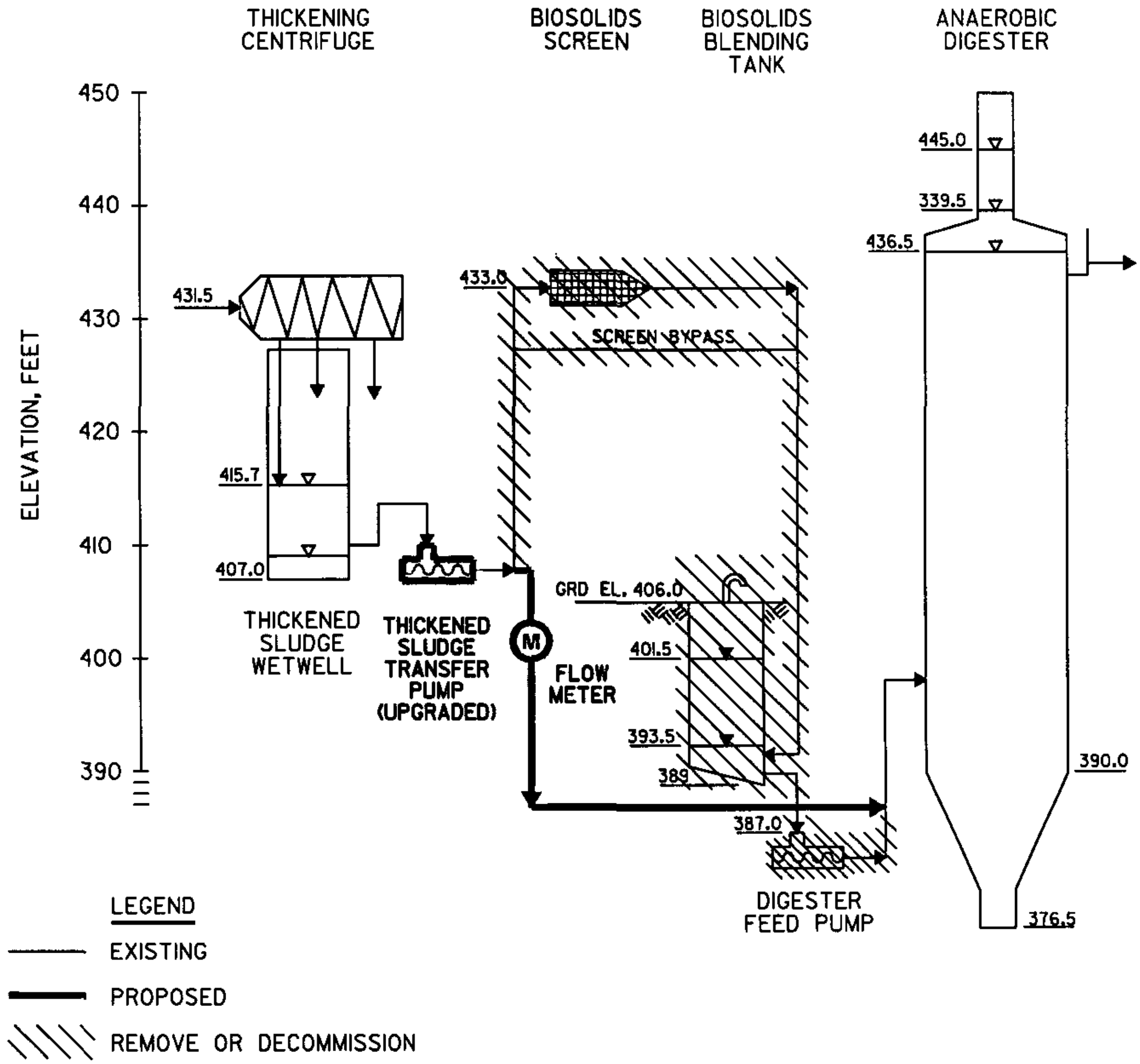


FIGURE 3-5

BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS
ALTERNATIVE 4

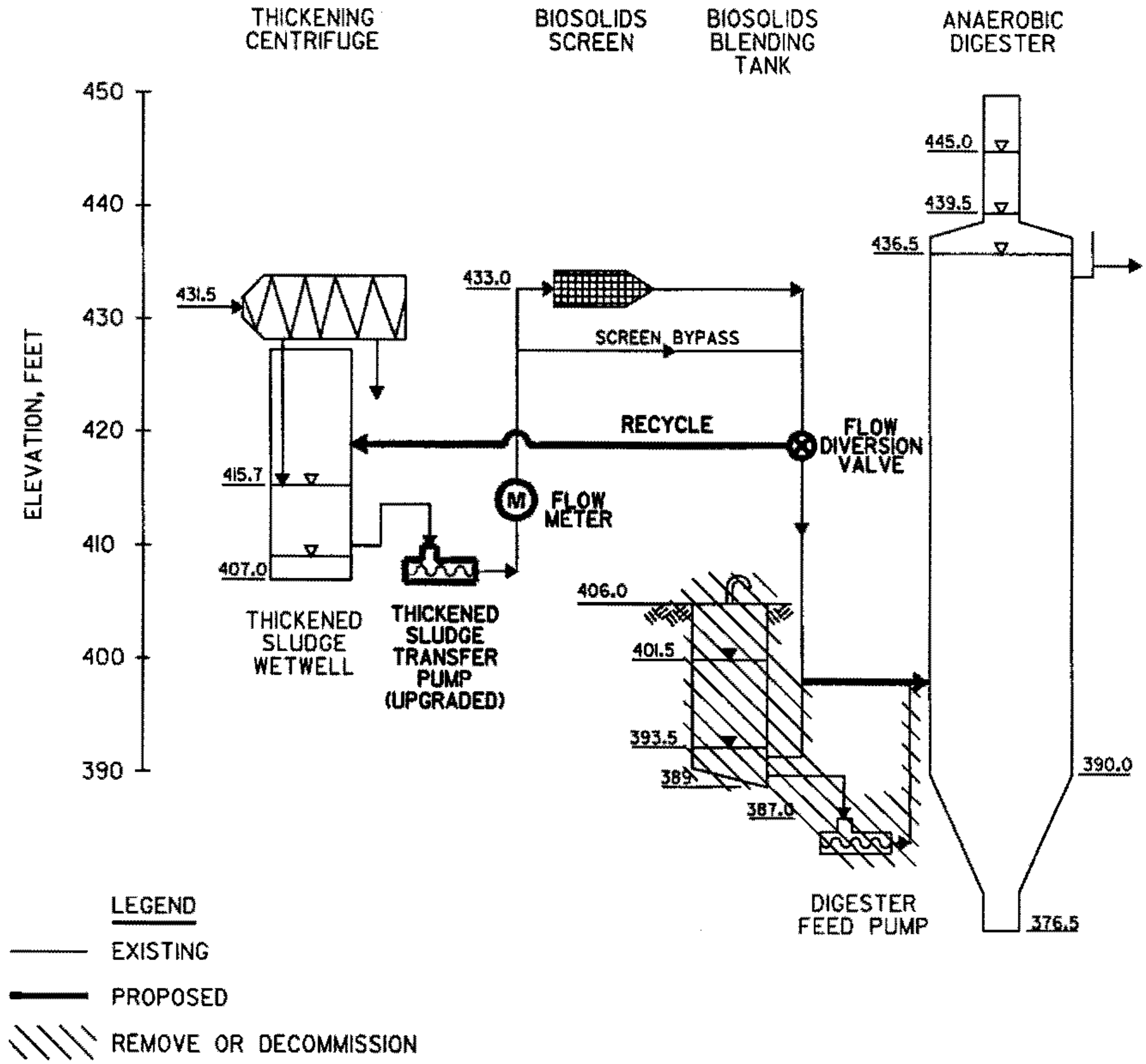


FIGURE 3-6

BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS ALTERNATIVE 5

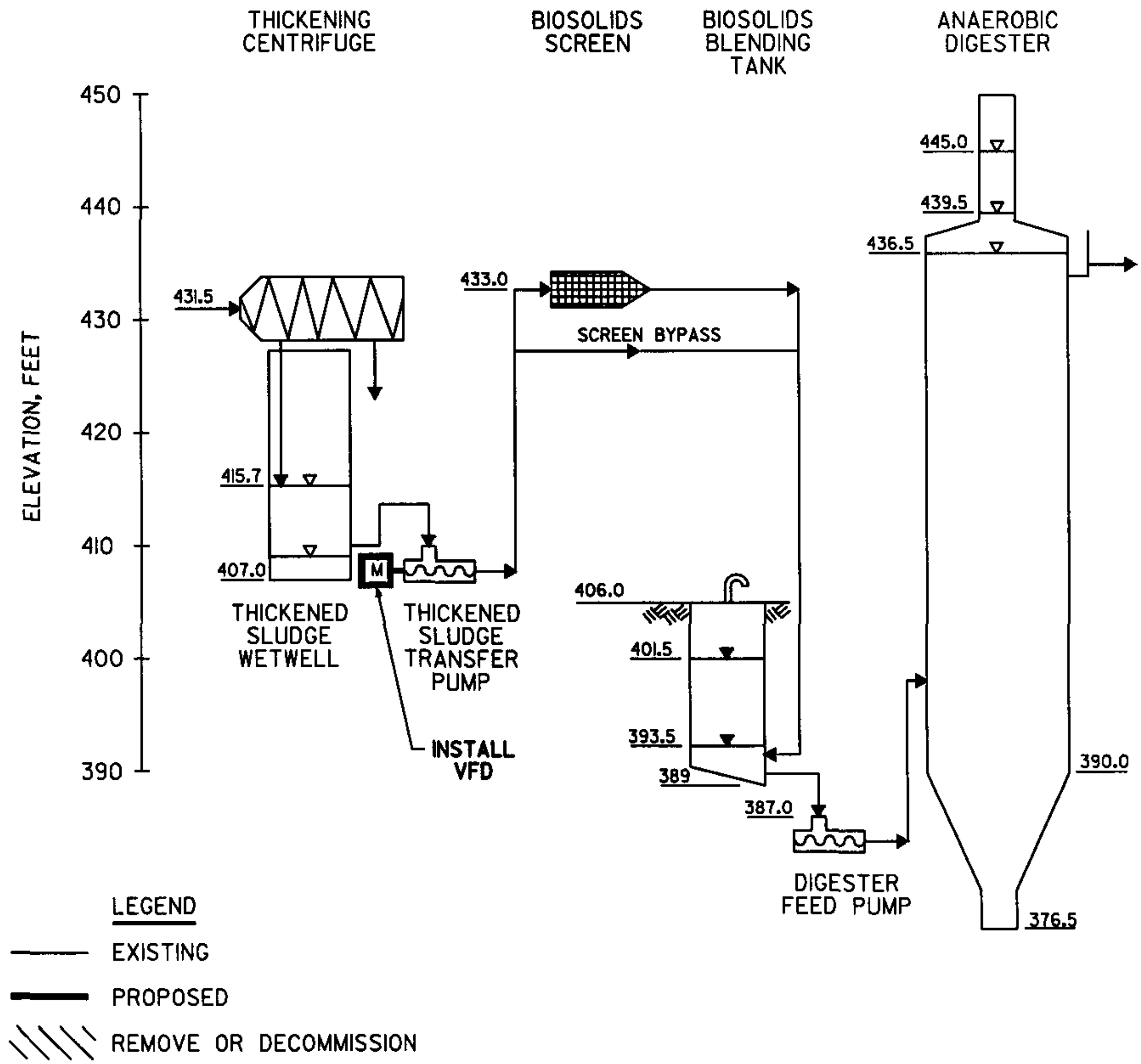


FIGURE 3-7

BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS
ALTERNATIVE 6

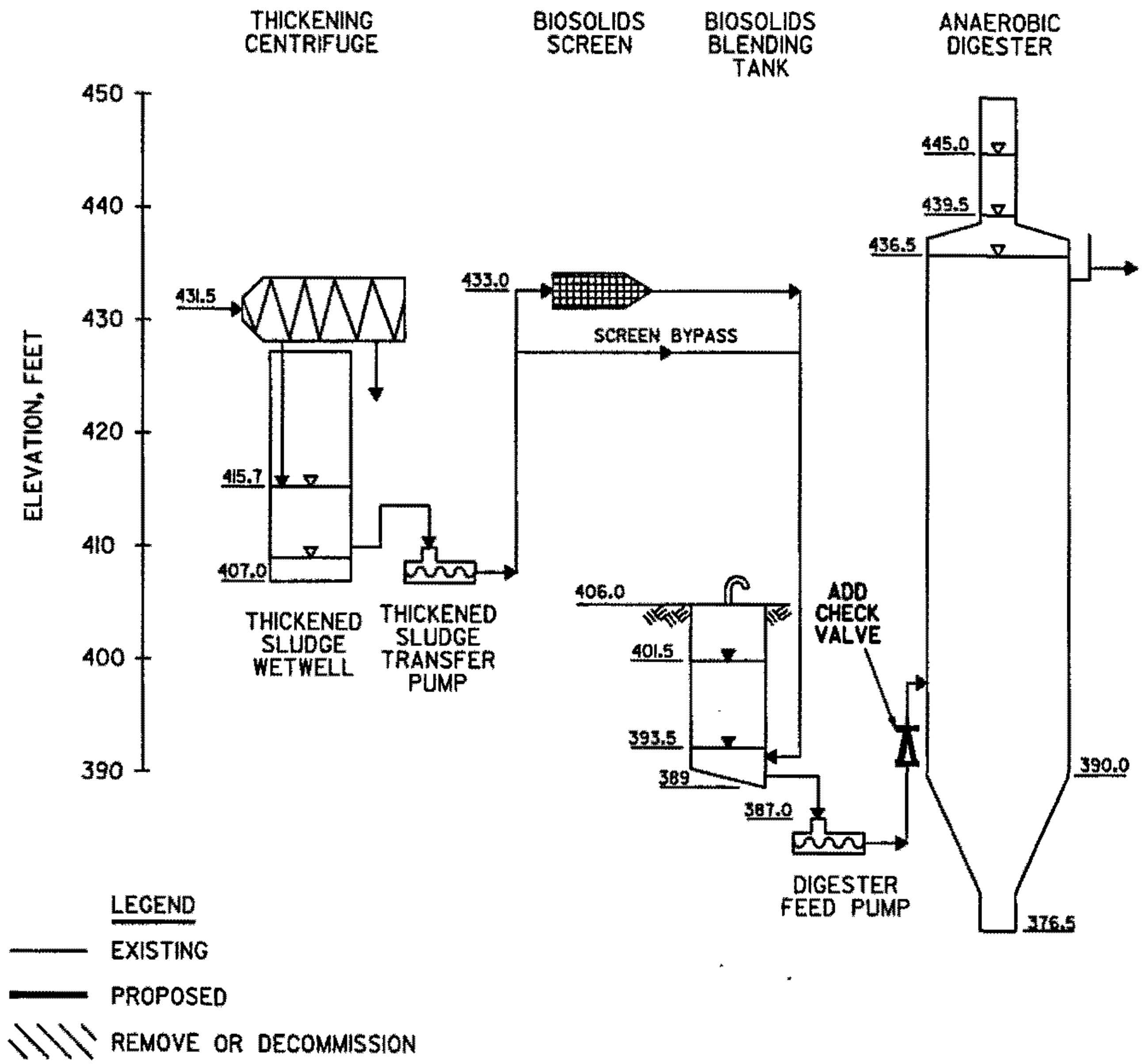


FIGURE 3-8

BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS
ALTERNATIVE 7

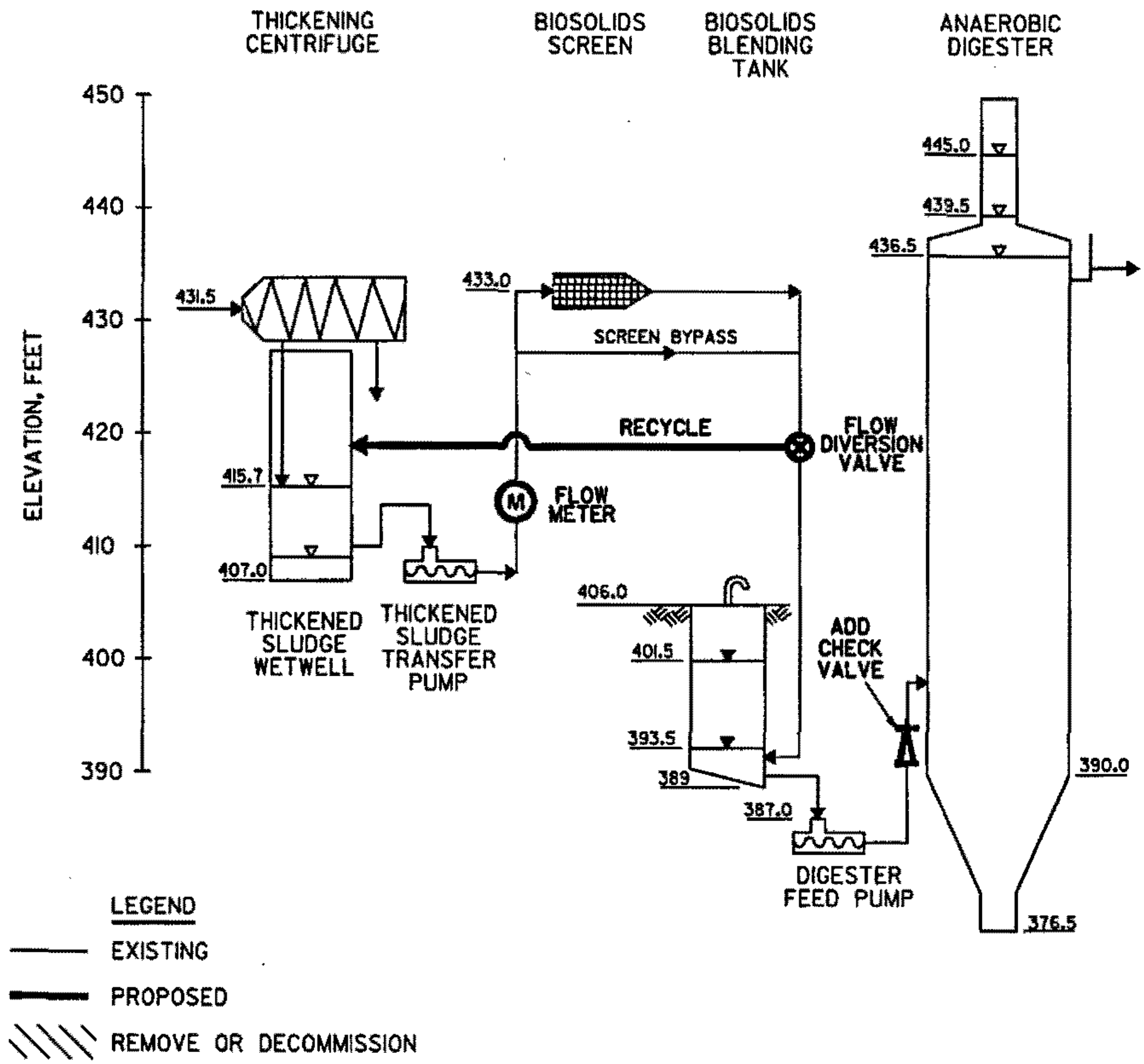


FIGURE 3-9

BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS
ALTERNATIVE 8

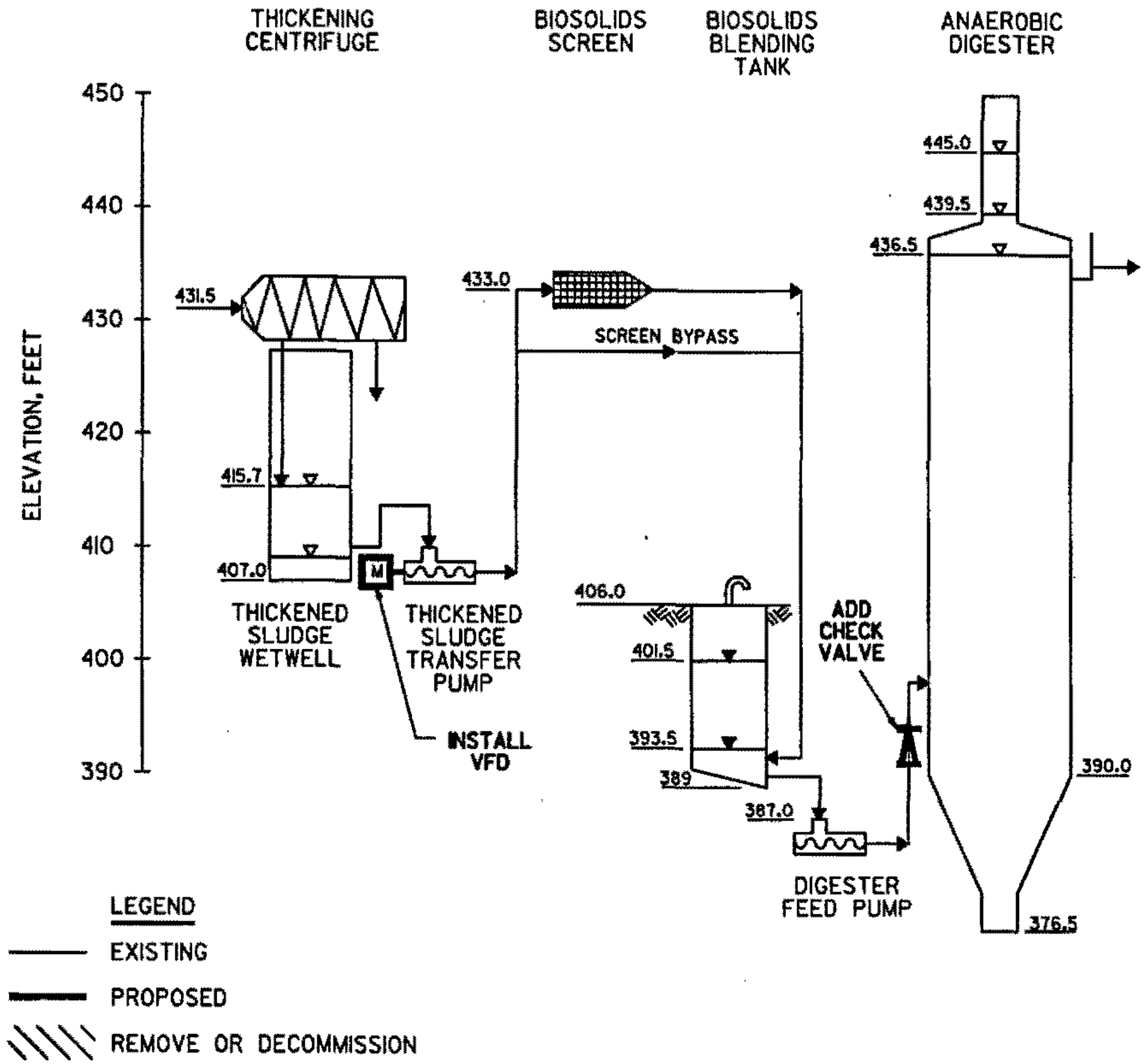


FIGURE 3-10

BIOSOLIDS SCREEN & BLENDING TANK PROBLEMS
ALTERNATIVE 9

These nine alternatives along with their advantages and disadvantages are shown in the table below.

TABLE 3-3
Alternative Solutions to Screens and Blend Tanks Problems

Alternative	Description	Advantages	Disadvantages
Alternative No. 1	Keep screens. Install a recycle line to the thickened biosolids wetwell. (2-stage pumping)	1. Minimal additional DCS reprogramming needed 2. Low capital cost 3. Solves screens wear problem from intermittent operation	1. Spill risk at blending tanks remains 2. High O&M cost 3. DCS control of multiple process equipment remains 4. DPU capacity limits 5. DF pump upgrade still needed
Alternative No. 2	Keep screens. Install recycle line; and bypass blend tanks. (2-stage pumping)	1. Eliminates spill risk at blending tanks 2. Solves screens wear problem from intermittent operation 3. Relatively low equipment cost to implement 4. Eliminates maintenance on blend tanks and pumps	1. Tricky 2-stage pumping controls 2. Lots of existing control strategy modifications 3. Significant amount of new controls to reprogram 4. Numerous pieces of equipment to maintain remains-high maintenance cost 5. DPU capacity limits
Alternative No. 3	Do 2-stage pumping from cake wetwell to digesters. Bypass screens and blend tanks.	1. Minimum DCS reprogramming 2. Low equipment cost 3. Eliminates blending tank spill risk 4. Eliminates maintenance on screen and reduces odor	1. Tricky 2-stage pumping controls 2. Lots of existing control strategy modifications
Alternative No. 4	Do 1-stage pumping to the digesters. Bypass screens and blend tanks and digester feed pumps.	1. Eliminates screen and blending tank problems 2. Eliminates several DCS strategies 3. Frees up many I/Os badly needed in Area 76 4. Low OM cost (no screens, blend tanks, and digester feed pumps) 5. Eliminates spill risk at blend tanks	1. Reprogramming of TSL pump control strategy 2. Requires TSL pump upgrade

TABLE 3-3 (Continued) Alternative Solutions to Screens and Blend Tanks Problems			
Alternative	**Description**	**Advantages**	**Disadvantages**
Alternative No. 5	Do 1-stage pumping thru screens and to the digesters, bypassing blending tanks and digester feed pumps. Add a downstream recycle line to TSL wetwell.	1. Eliminates spill risk at blending tanks 2. Solves screen wear problem from intermittent operation 3. Simplifies existing DCS control strategies 4. Less equipment to maintain remains	1. Costly control strategy modifications 2. Significant amount of controls reprogramming
Alternative No. 6	Install a variable frequency drive on the TSL transfer pump motor.	1. Solves intermittent wear problem on screens 2. Moderate change in control strategy 3. No re-pumping of recycled sludge 4. VS operation well understood by OM staff	1. VFD installation is relatively expensive 2. VFD's require significant additional DCS monitoring points 3. DCS control of multiple process equipment remains
Alternative No. 7	Keep screens. Install check valve on digester feed line to digesters. Or a non-reverse ratchet on the digester feed pump.	1. Simple and very inexpensive solution 2. Does not require additional DCS monitoring	1. Check valves need constant maintenance 2. Changing digester feed pumps may still be required to match head requirements. New pump could possibly be fitted with an anti-rotation ratchet.
Alternative No. 8	Combine Alternatives 1 and 7 –Install recycle pipe and flow diversion valve and install check valves on digester feed piping.	See Alternatives 1 and 7 advantages	See Alternatives 1 and 7 disadvantages
Alternative No. 9	Combine Alternatives Nos. 6 and 7- Install VFD on TSL transfer pumps and check valve on digester feed piping.	See Alternatives 6 and 7 advantages	See Alternatives 6 and 7 disadvantages

The following five criteria were used to evaluate the above nine alternatives:

1. *Feasibility*: Is the alternative technically feasible?
2. *Meet Objectives*: Does the alternative meet both objectives of mitigating the screen operational problems and reduce the risk of overflows at the blending tanks from the digester backflow?
3. *Impacts*: What are the construction and implementation impacts of the alternative?
4. *DCS Resources*: What is the relative impact on DCS requirement?
5. *Cost*: What are relative construction and operation costs?

Preferred Solution:

Based on an evaluation workshop conducted between MWWD and MBC Design Consultant Metcalf & Eddy in April 2005, the participants ranked Alternative 8 as the best among the 9 alternative solutions. M&E has been tasked to perform preliminary hydraulic analysis to define pump head requirements on two operational systems: 1) the thickened sludge transfer pumps and screens system; and 2) the digester feed system. Operational parameters will also have to be defined in this evaluation effort. A design task order will be issued to M&E for this evaluation work.

After discussions with MBC staff, it was decided to revise the operational strategy of the sludge screens. Because of this, a request was made to M&E to consider in addition to the evaluation work identified above alternatives which totally bypass both the screens and the blending tanks and upgrade the TSL pumps to provide one- or two-stage pumping from the thickening centrifuges to the digesters (Alternatives No. 3 and No. 4).

3. See item #2 above for mitigation of the spill risk at the blending tanks.

4. Presently only one spiral heat exchanger is provided at each digester. It is recommended that these two blending tanks heat exchangers be relocated to the digester facility to provide standby heating and flexibility. These relocated heat exchangers could be trailer-mounted for easier installation.

ANAEROBIC DIGESTION (P-7)

Design Flows:
Minimum @ 90 gpm; Average @ 120 gpm; Peak @ 250 gpm @ 5% solids

Process Description

Biosolids Digestion in MBC is provided by three (3) fixed cover, single-stage, high-rate, complete-mix mesophilic (98^{o}F operation) circular digesters each at 3 million gallons capacity. These pre-stressed concrete tanks are 105 ft in diameter with 45 ft side water depth, and operate within a biogas pressure range of 9 to 14 inches water column. Currently, only one digester is in service which provides approximately 21 days detention time at average flows. The minimum required is 15 days.

Each digester is provided with the following equipment: 1) two (2) recirculation pumps at 550 gpm, 65 feet, 20 hp; three (3) centrifugal digester mixing pumps at 2,200 gpm with 41 feet head, 40 hp (two duty and one standby units); 2) three (3) axial mixing pumps 4,400 gpm, 18 feet head, 40 hp; 3) one (1) spiral-type sludge heat exchanger at 2.5 million Btu/hr heating capacity with 550 gpm sludge flow; and 4) three (3) digested

biosolids transfer pumps each rated at 550 gpm, 85 feet head and driven by 30-hp constant-speed motor for common use of the 3 digesters.
With the first digester utilized to handle average and maximum daily process flows, the second digester is reserved for standby emergency storage (overflows or transfers). The third digester is presently reserved for MWWD's peak wet weather flow management.

ANAEROBIC DIGESTERS

Problems

1. *Poor design of the ferric chloride (FC) system:*

    a. The FC injectors are mounted in steel pipe sleeves that penetrate the digester side walls near the base of the digesters. These pipe sleeves are subject to FC concentrations that can corrode the sleeve and cause a digester spill.

    b. The actuators provided are too large for the size of the PVC piping in the FC system. These oversized actuators can exert too much torque on the valve operators and can break the valves. A valve breakage will cause a chemical spill.

2. *Undersized overflow pipe:* The common overflow pipe from the 3 digesters to the Digested Biosolids Storage Tanks (DBST) has insufficient capacity when the receiving DBST is near its high operating level. In addition, this common overflow pipe is inadequately sized to handle flows generated during digester transfer operations and in the past resulted in overfilling the digester and spilling from the digester overflow boxes.

3. *High overflow weir level*. The Digester Emergency Overflow Weir Level is too high: This has caused the digester liquid to rise above the digester's roof level before it can overflow to the emergency overflow system. This could result in hydraulic uplift force that can potentially damage the roof structure. This was of great concern after construction to the plant's designer.

4. *Unstable gas and foaming operations*: These occur due to excessive digester mixing (to prevent solids accumulation). MBC O&M staff has alleviated the gas foaming problem by reducing the axial mixing pumps operating duration to 2 days per week.

Recommended Improvements

1. Recommended corrective measures for the FC feed piping /valves problems:

   a. On one of the digesters, MBC O&M staff has capped the ferric chloride injection pipes (at 3 locations) and instead extended the FC feed pipe up to roof level and into a roof-mounted injector so that the corrosive chemical is dripped down onto the digester liquid eliminating risk of corroding any ferrous digester material. Modify the FC injector piping for the other digesters similarly.

   b. Reduce the risk of breaking the FC valves by eliminating unnecessary actuators in the FC system and modifying the strategies accordingly. Routinely check with equipment vendors for smaller actuators that are better suited for this type of service.

2. The operating high water level in the digested biosolids storage tanks (DBSTs) needs to be lowered to provide more capacity in the common overflow pipe. The 10-inch overflow main splits into two 6-inch pipe branches each discharging to a DBST. This pipe size reduction restricts the overflow. If space allows, these 6-inch branches need to be enlarged to 10 inches.

   It is recommended that a hole be cored through the wall between the overflow boxes and the emergency overflow box to avoid submerging the digester roof.

3. The emergency overflow weir level needs to be lowered to eliminate this risk of structural damage to the digester roof. Core a hole through the wall between the overflow box and the emergency overflow box to avoid submerging the digester roof.

4. It is recommended that the current 2 days per week operation of the mixing pumps be maintained.

BIOGAS COLLECTION AND STORAGE (P-8)

Design Flows:
Biogas flow: 268,000 std. cu. ft./ day (minimum) / 383,000 std. cu. ft./day (average) 575,000 std. cu. ft./day (peak)

Process Description

Biogas is collected from the 3 digesters and 2 biosolids receiving tanks via 12-, 24-, and 30-inch diameter gas piping. The biogas is compressed and transferred to the COGEN Facility where it is mixed with the landfill gas and used as fuel for the electric generators. Any biogas not sent to COGEN is burned using biogas flares. The biogas system consists of the following equipment:

- One 40 ft. diameter biosolids gas holder provides 25,000 cu. ft. capacity, at 12 inches WC design pressure (8 to 16 inches WC operating pressure)

- Two 25-hp gas compressors withdraw biogas from the biogas collection header and/or from the biogas holder and each discharge between 75 to 350 scfm (designed for 550 scfm) at 2 to 5 psig for use at the COGEN facility. Standby natural gas feed from SDGE is available for safety to avoid low pressure delivery and to prevent drawing air into the gas pipeline. Compressors currently deliver about 300 scfm as set by plant O&M staff.

- The system also consists of two biogas burners or flares plus auxiliary equipment: collection headers, condensate sediment traps, condensate wet wells and pumps. The flares use natural gas to ignite the pilots which in turn ignite the biogas burners.

WASTE BIOGAS FLARES

Problems

1. *No emergency power to the gas flares*: During a plant power outage, the gas flares shut off and fail to reignite as they are not connected to any emergency power supply. Flares become inoperative during an outage.

2. *Condensate accumulation*: Problems associated with condensate accumulation in the biogas piping are present.

   a. Condensate accumulates at condensate traps installed in valve pits. Each trap (total of 6) is at the terminus of a branch pipe connected to a low point of the gas collection header (low pressure). At each trap, the occasional failure of the automatic (motorized) drain valve combined with gas pressure transients resulting from sudden increase in flows from PLWTP have caused the water in the trap to be blown out and resulted in occasional hazardous biogas emissions. Because of this, operators have opted to close the upstream manual isolation valve and perform the daily task of manually draining any accumulated condensate in the gas header. The installed condensate trap device itself has thus become, manually-operated instead of automatic.

   b. Condensate accumulation in biogas pipe: Due to its design, the high pressure discharge piping of the biogas compressors is subject to condensate accumulation. Cooling of the hot gas as it travels through the buried cooler pipe may form condensate. The low point of the biogas piping is buried under a road with a vertical curve section to avoid interference with utility pipes. Per construction drawings, this pipe section is not provided with a condensate trap or drain. Installing a condensate drain will be very tricky. With the 5 psig gas pressure, the condensate can collect at this low point and carry over by the biogas flow to the COGEN engines. Presently, it is not known if the moisture observed in the biogas feed to the COGEN facility is from the MBC biogas or from the Miramar landfill biogas.

Recommended Improvements

1. A recommendation to provide emergency power from Area 76 diesel engine-generator sets to the flares and its biogas motorized valves is under review for implementation.

2. a. In 4 of the 6 condensate traps, plant staff installed a water U-trap with a utility water connection. The upstream manual isolation valve operator was fitted with an extended shaft to allow manual operation from ground level. These modifications need to be done on the two remaining traps.

b. Before implementing a corrective action, plant staff needs to continue monitoring for evidence of condensate accumulation in the buried pipe. Once confirmed, evaluate alternative solutions and develop the design of the drain installation.

DIGESTED BIOSOLIDS STORAGE (P-9)

Design flows:
NSPF: Average @ 125 gpm; Peak @ 280 gpm @ 3% solids
PLWTP: Average @ 800 gpm; Peak @ 2,100 gpm @ 3% solids
Total: Average @ 925 gpm; Peak @ 1480 gpm

Process Description

Biosolids storage and pumping equipment consists of the following: 1) Two (2) receiving tanks (one duty, one stand-by) at 1.3 million gallons each at 70 ft diameter, 45 feet sidewater depth; 2) Three (3) Dewatering Transfer (DWT) Pumps each rated at 750 gpm, 67 ft TDH, with 20 hp variable-speed motor: 3) Five (5) digested biosolids mixing pumps (4 duty and 1 stand-by); and 4) one pig receiver.

The Digested Biosolids Storage Tanks (DBST):
1. Receive digested biosolids at a rate of 90-300 gpm from the MBC Anaerobic Digesters (biosolids from NCWRP)
2. Receive digested biosolids from PLWTP (800 gpm ave and 2,100 gpm peak)
3. Provide over one day of storage at average biosolids flows from PLWTP

DIGESTED BIOSOLIDS STORAGE TANKS

Problems

1. *Gas venting at PLWTP sludge feed pipeline:* Small increases in flow from PLWTP result in unstable inflows into the DBSTs. These abnormal flow spikes are observed for a period of 15-20 minutes after PLWTP varies its flow. This is of particular concern when restarting the sludge flow in the PLWTP forcemain. At a minimum starting sludge flow of 350 gpm from PLWTP, MBC can see peak inflows exceeding the PLWTP flow by a factor of 5. During these spike events, upsurge can cause the biogas to be vented from the DBSTs. (See problem #4 in previous Biosolids Storage section). This problem is believed to be caused by "gas binding" at a high point in the incoming pipeline. Although an air-vacuum and air-relief (AVAR) was provided at this high point, it has been isolated from the pipeline to avoid continuous venting of methane gas immediately upwind of the Area 19 Main Plant Switchgear (MPSG) air intake. The continuous venting is a result of the AVAR being at an elevation higher than the DBST low operating level. MBC O&M resorted to periodic manual venting of the pipeline. This practice was discontinued due to compliance concerns with the APCD and due to safety concerns.

2. *Incorrectly located pressure relief device:* A rupture disc installed to protect the PLWTP sludge pipeline from abnormal high pressures is incorrectly located. This pressure relief device was installed on a piping section near the DBST's area which has the lowest pressure rating at 150 psig. Plugging of the pipeline at the intermediate upstream pipe section (250 psig rated) can potentially result in higher pressures (up to 405 psig). This pipe clog could rupture this important pipeline.

3. *Undersized dewatering transfer pumps:* The existing dewatering transfer pumps are undersized in flow capacity. Most of the time, all three pumps (including standby) are required to run to keep pace with the dewatering process biosolids inflows. Additionally, the existing control strategy for these pumps is needlessly complicated and further handicaps the output of the pumps.

4. *Too much grit in PLWTP inflow:* On inspection of the DBSTs, the PLWTP inflow was found to have a large amount of grit. This abnormal grit volume causes plugging of the dewatering transfer pumps, its suction piping, and results in more frequent cleaning of the storage tanks. These problems are magnified anytime PLWTP draws down one of its digesters for maintenance.

5. *Risk of biosolids tank wall punch-through:* One of two overflow pipes between the biosolids storage tank and the emergency storage tank is hard-piped. This rigid piping is not recommended by the tank designer. Rubber expansion joints are provided at the wall connection to one tank but not on the overflow piping tank connection. Without the expansion joint, even a moderate seismic event could cause this hard piping to punch through a tank wall, damaging the tank and risking a spill.

Recommended Improvements

1. Investigate the cause of the unstable inflows and develop a corrective plan.

2. A technically feasible solution is to install a new pressure relief device or relocate the existing device on the intermediate pressure section of the pipeline. The exact location of this new pressure relief device will be further investigated.

3. Install pumps with the necessary flow and head capacities. A project to reestablish the intended design flows and redundancies and to simplify the control strategy has already been designed and bid. Completion of this project is recommended.

4. Several improvements are implemented to address the grit problem:

    a. As part of the dewatering pump upgrade project (under construction, to be completed in October 2005), chopper-type pumps will be installed to better handle the grit and unscreened solids.

    b. Also included in the dewatering transfer (DWT) pumps upgrade project is the installation of an 8-inch reclaimed water flushing connection on the pump suction header.

    c. All of PLWTP's digester sludge screens are now on-line and should help reduce the grit amount in the MBC inflow. Continued operation of the PLWTP screens is recommended.

    d. The design of a PLWTP project to upgrade its existing grit tanks and equipment has been completed and bid but construction is currently on hold. Depending on acceptance by the City of the BAF and the secondary treatment technology that will be selected, construction of the grit tanks project should be implemented as soon as possible.

5. An in-house project is underway to reconfigure the overflow piping between the DBSTs and install expansion joints at the tank wall connections for seismic protection. The project is being constructed in conjunction with the DWT pumps upgrade.

CENTRIFUGE DEWATERING (P-10)

Design flows:
Minimum @ 700 gpm; Average @ 920 gpm; Peak @ 1900 gpm
Design Dewatered Biosolids: flows: Minimum @ 70 gpm; Average @ 90 gpm; Peak @ 130 gpm

Process Description

The 250-hp dewatering centrifuges process the digested biosolids sent from MBC's anaerobic digesters and from the Point Loma Wastewater Treatment Plant. There are a total of eight (8) solid bowl, scroll-type centrifuges each designed for biosolids flows of 180 gpm average and 300 gpm maximum. Actual flows are at 200 gpm and 225 gpm respectively with 2.5 to 3.5 % solids. Solids capture rates are from 95% average to 97% peak. Four units operate on average plant flows while 5 or 6 units run on "catch-up" or "recovery" mode or during peak flows. The remaining two units are assigned standby duty due to lengthy repair times needed.

Cake from the 8 centrifuges is discharged to 4 centrifuge bins each with two reversible screws. Each cake bin can unload 10 tons per hour of cake to 2 cake hoppers. A piston-type cake pump withdraws cake from each cake hopper and sends the cake to the Biosolids Storage silos. There are a total of eight (8) cake transfer pumps (Schwing Model KSP 25), each capable of pumping the cake at 150 gpm with 1740 psi head.

DEWATERING CENTRIFUGES

Problems

1. *Standby capability deficiency*: Presently, there are 8 dewatering centrifuges and 8 dedicated sludge feed pumps. If a pump goes out of service, then the corresponding centrifuge also is put out of service or vice-versa. Centrifuge units #1 and #8, including their paired feed pumps, are designated for standby service only for centrifuge units #3/#5/#7 and #2/ #4/ #6, respectively. Due to this present control strategy, all auxiliary equipment of the centrifuge (sludge feed pump and chemical feed pump included) are routed and controlled via the centrifuge controls. Feed pumps #1 and #8 by themselves cannot provide standby service if a pump in its group is put out of service. As the shutdowns for repair and maintenance of the centrifuges become more frequent, standby pair units #1 and #8 are called to duty more often and for longer periods than intended. On occasions when a standby pair is on duty and an auxiliary equipment of a regular duty centrifuge fails, that whole unit will have to be shutdown as the control strategy dictates, decreasing the dewatering process output.

2. *Inadequately-designed centrate collection pipe system*: Existing undersized and inadequately designed centrate (CN) collection headers result in centrate surcharging at the centrate discharge chutes and causes centrate to overflow into the foul air duct connections. The surcharging is caused by flow interruption at the CN header tees (instead of lateral wyes) and insufficient slope of the centrate collection headers. Centrate in the odor collection ducting eventually gets to and damages the odor fans and scrubbers in Area 60. The presence of centrate in the foul air ducts reduces their exhaust capacities. O&M staff has thus connected drain piping on the odor headers and routed these drains to the area floor drains for centrate removal. The large amount of drained centrate overspills at the floor drains creating a safety hazard for the operators.

   The centrate routed to the area floor drains ends up at the plant's wastewater disposal system instead of the centrate collection system. This overloads the wastewater pump station and also violates discharge regulations for the monitoring of MBC's centrate flows.

   The centrate-loaded foul air duct header in the pipe gallery also runs the risk of collapsing if its hanger supports fail from the extra weight. With a failed foul air duct header, safety of O&M personnel is at risk.

3. *Scaling of centrate pipe headers*: Significant scaling is observed in the centrifuge's centrate (CN) discharge chutes and in the two existing CN collection headers directly under the centrifuges. These CN collection headers must be cleaned with high pressure water every 3 months via flushing ports installed at the header ends. Similar scale build-up due to the centrate's high pH is suspected in the inaccessible 36-inch diameter main centrate collection header in the pipe gallery. With no access means into this 36-inch pipe, its condition has not been verified nor can it be addressed.

In addition, the 36-inch CN header has very minimal slope which limits flow capacity and is conducive to solids settling. There is no provision for flushing/draining this CN main.

4. *Cake hopper level sensor problem*: Centrifuge cake pump operation is controlled by a level sensor mounted on a 5-ft tall cake hopper. With the cake's tendency to "cone up," a requirement for a minimum of 2 feet sensor distance above the cake, and lower water level (LWL) at 6 inches above the hopper bottom, an actual hopper operating range of no more than 2 feet (vs. 3.5 ft design) is only available. The cake spatters in the hopper and also on the level sensor result in erroneous level readings. Worse, this short sensor operating height causes intermittent operation of the centrifuge, bin screws and cake pumps. This causes the bin screw motors to trip out due to high amperage when the bin level exceeds 1 foot (design was for 4 feet). This in turn causes excessive wear on the cake pumps when they ramp up from zero to full speed in short time. This problem also occurs with the cake pumps in the truck loadout area.

5. *Absence of biosolids preheating*: Due to constant plugging of the heat exchangers plant staff has rerouted the biosolids flow to bypass them. Per manufacturer, these heat exchangers are not applicable for the digested biosolids application.

6. *Capacity limitation of centrifuges*: Average flows to the dewatering centrifuges are within the design flows set for the Consumer's Alternatives Phase 1 year 2010 figures. However, due to operational conditions, MBC's experience shows the need for an extra unit available for standby service or the need for larger capacity centrifuge units. Several factors contribute to this need:

    a. Very slow recovery from a shutdown
    b. Undersized capacity of the dewatering transfer pumps including quick wear and poor reliability (about 1,000 hrs actual operation life vs. 2,000 hrs design life)
    c. Inadequate capacity of the centrate collection headers under the centrifuges
    d. Equipment redundancy inadequacy resulting from operational control problems
    e. Low flow peaking factor used in design (1.4 vs. 2.0 needed) resulting in process equipment being undersized to handle significantly larger flows than projected

Recommended Improvements

1. With the lack of space inside the existing centrifuge facility structure, the addition of two more centrifuges (one for each set of 4) to provide standby capability is not feasible. On the other hand, the alternative of enlarging the structure to provide the needed space is economically prohibitive. A solution that provides a more flexible arrangement with true redundancy would be the addition of a 5th sludge feed and 5th polymer feed pumps to each set of centrifuges, independent of the centrifuge controls and dedicated as standby pumps for each centrifuge group. Regardless, the current

overall control strategy of having a single piece of equipment providing standby service to many units as well as dedicated service to a specific centrifuge needs to be reevaluated and revised.

With the MBC mass balance model runs performed by Brown and Caldwell (see Appendix C), it has been determined that the addition of one of two more centrifuge units or replacement with larger units to provide more dewatering capacity (Problem P-10.6) will not be required until 2025. In the interim period, due to increasing wear and tear, the existing centrifuges will be replaced with new same size units. The centrifuge capacity and redundancy problems will be addressed with the implementation of a number of projects (See recommendation #6). Among these, the addition of the 5th sludge and 5th polymer feed pumps for each of the 2 sets of dewatering centrifuges (4 units each set) will alleviate the redundancy problem. This project has been approved for implementation in FY 2007-2010.

2. To address centrate header overflow problems, a project was recently completed in 2005 that installed a U-pipe trap at the CN's 36-inch tee connection to prevent centrate overflows into the odor control exhaust ducting. A phase 2 construction will replace the odor header ducting with ductile iron piping with wye connections and with steeper pipe slope. This will provide a second header for added centrate withdrawal capacity while the header also serves as a foul air conduit. A final third phase is planned to address future larger units or additional centrifuge units. This phase consists of replacing the two existing original centrate headers under the dewatering centrifuges with larger size headers.

3. Install access ports on the 36-inch drain header for needed flushing and cleaning work.

4. Inadequate room height and congested space do not present options for installing taller bins. A water spray system to flush the level sensor periodically, manually or automatically, should be investigated. Additionally, investigate modifying the cake pump operation to reduce to operating level in the cake hoppers.

5. The spiral-type solids heat exchangers have been isolated and bypassed. As these heat exchangers are not suited for the digested biosolids as manufacturer admits, their removal is recommended. The proper type of heat exchanger needs to be looked into.

6. Because of the many factors constraining operating capability of the dewatering centrifuges, increased capacity is needed. This can be accomplished by replacing existing units or adding more units as recommended in Consumer's Alternative Plan Phase 2. However, existing space constraint negates the option of adding more units. Due to this space constraint, replacement of some of the existing units with larger capacity units appears to be the only feasible expansion alternative. This capacity upgrade though has been determined in the Phase 2 Mass Balance Model Runs of this

planning effort to be required not until 2025. It should be noted that mechanical equipment in general is allotted a 20-year life span. For these 24-hour duty heavily used and high speed equipment, a lower life of about 10 to 15 years may be expected. MBC was constructed in 1998 and its frequently repaired/maintained centrifuges will be close to their 15-year life in 2010. Their replacement should be done about that time.

MWWD has decided to implement three projects to address the capacity (including redundancy) problems of MBC's dewatering process namely the following:

1. ***Dewatering Transfer Pumps Upgrade (P-9.3)***
2. ***Standby Centrifuge Sludge Feed and Polymer Feed Pumps Installation (P-10.1)***
3. ***Centrate Collection Piping Upgrades-Phases 2 and 3 (P-10.2)***

These projects are listed in Table 1-3 (also Table 6-1) among other major projects approved for construction capital funding from FY 2007 to FY 2030.

DEWATERED BIOSOLIDS STORAGE AND LOADOUT (P-11)

Design Flows

Minimum 35 dtpd; Average 150 dtpd; Maximum 180 dtpd.
Actual flows (Year 2001-2004): 250-400 wtpd ave.; 100-125 dtpd avg.; 180 dtpd max

Process Description

There are eight storage silos, each at 7,000 cu. ft. capacity (18 ft diameter and 28 ft height). Ten silos were originally planned for installation for Phase I of the Consumer's Alternative. The whole storage system presently provides an average of two days storage for the dewatered biosolids at the design capacity of 180 dry tons per day (dtpd). Currently solids hauled out range from 70 dtpd to a maximum of 180 dtpd. Each storage silo is equipped on top with a pug mill cake chopper and at the bottom with three live-bottom screws. Each set of live-bottom screws feed to a cake hopper assembly then to a silo cake pump. Each silo cake pump (total 8) can also pump the cake at 10 to 150 gpm at 1,200 psi maximum pressure to one of the two loadout bins.

The Biosolids Loadout Facility consists of two trains; each train equipped with lime feed system, cake/lime mixer (90-100 gpm), a weigh bin assembly, a truck load bin assembly and a 60-ton truck scale. A lime bulk storage system was not provided so the lime mixer is not needed. The loadout system can unload 20 wet tons of cake batches in ten minutes. Presently, the load out facility loads 20 trucks per day on the average. After a long weekend storage (when no truck load out is done), 30 trucks each day are required on Mondays and Tuesdays and sometimes Wednesdays to haul out stored cake from all the silos.

DEWATERED BIOSOLIDS STORAGE BINS
AND TRUCK LOADOUT STATIONS

Problems

1. *Inadequate storage capacity for dewatered solids*. The MBC cake load-out facility was designed for a continuous 24 hours per day and 7 days per week operation. However, as landfill operations only allow 9 hours per day for truck delivery, the MBC loadout operation is restricted likewise. Dewatered solids storage silos normally fill up during weekends when no truck hauling is done. Therefore, any repair or maintenance work on the storage silos and loadouts after the weekend will lengthen unloading time for the stored cake. As haul trucks need to be loaded past the regular hours and landfills would have closed by those late hours, loaded trucks would need to park in the facility overnight and wait until next day to travel to the landfills. Parking loaded trucks overnight at MBC results in the emission of fugitive odors and odor complaints. The limited hours for disposal further compound capacity issues when O&M work is required on the cake feed piping system. This work can result in shutting down nearly half of the cake silo system. Thus a half-capacity loadout operation severely limits the dewatering and loadout capacity.

2. *Lime/cake mixer plugging*: The present lime storage and feed system has not been utilized due to the absence of a bulk storage tank. Instead, a small day tank along with a dry feeder and a lime and cake mixer are provided for each load-out system. Except for the lime/cake mixers, MBC has not operated other equipment. Presently, there is no need for lime treatment on the cake product. Frequent plugging of a

lime/cake mixer has reduced loadout capacity and created maintenance (odors and sludge spills) problems.

The following issues need to be addressed:

a. Currently, there is no bypass piping provided around the lime mixers to feed directly into the loadout bins.
b. A lime mixer limits the cake feed into a bin up to 100 gpm (200 gpm for 2 bins).
c. In addition to, if a lime mixer plugs, then cake feed to the 2 loadout bins is cut in half.

3. *Inaccessible frequently failing valve actuators*: Frequent failure of valves is compounded by the lack of access to many of the valve actuators for servicing and position determination. Depending on the valve position at time of failure, several silos and dewatering centrifuges could be forced out of service significantly reducing process capacity.

4. *Potential piping leak damage to electrical equipment*: Chilled water valves and piping for Air Handling Units. 7 and 8 are dangerously located above MCCs and pose risk of damaging electrical equipment in the event of a leak or spill from these assets during repair/maintenance work.

5. *Short landfill operating hours*: This combined with odor control issues related to on-site storage of loaded trucks, have reduced loadout capacity to the point that operating just one of the two loadouts will not meet production demands.

6. Need for Class “A” biosolids in future?: Changing regulations may likely require the production of Class “A” biosolids.

Recommended Improvements

1. Provide 2 additional storage silos and either of the two alternatives described below.

Alternative 1- Reuse Existing Loadout Facility

Provide a direct truck loading station to provide load-out capacity in emergencies. Install in the existing loadout facility two additional storage silos or a pair of additional loadout stations so that the biosolids can be pumped directly from the centrifuges or silos. These stations will not be provided with weigh/mix bin assemblies; however, truck scales will be provided.

Alternative 2- Construct New Loadout Facility

Provide a new loadout facility: This alternative will require the construction of a new automated loadout facility to provide a 3rd and 4th loadout stations. This new facility can provide emergency duty service to allow necessary O&M work shutdown on any of the two existing loadout stations in Area 86 without impacting loadout capability. Compared to Alternative 1, this is a very costly alternative.

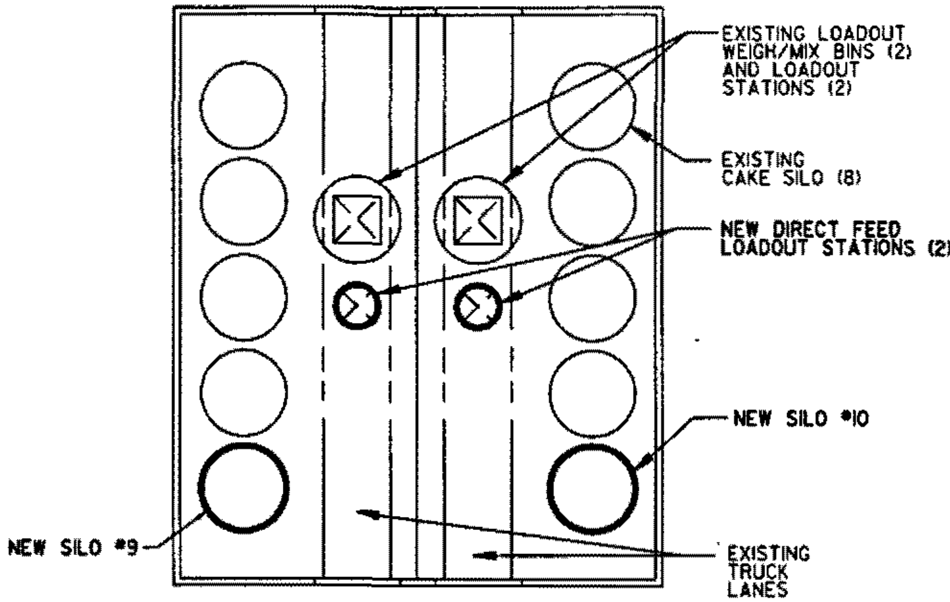
A comparison of the two Loadout alternatives is presented in Table 3-4. Figure 3-11 shows the concept plan for each alternative.

TABLE 3-4
Biosolids Truck Loadout Alternatives

ALTERNATIVE 1 REUSE EXISTING LOADOUT FACILITY	**ALTERNATIVE 2** CONSTRUCT NEW LOADOUT FACILITY
Advantages	**Advantages**
1. Uses existing facility	1. Significantly increases loadout capacity; independent loadout capability
2. Inexpensive	2. New structure designed to accommodate future Class A biosolids facility requirements.
3. Easier to design	3. New structure designed to provide complete area classifications separation per OSHA safety requirements.
4. Cake pumps need not be upgraded	
5. Assumes continuance of Class B biosolids production	
Disadvantages	**Disadvantages**
1. Does not significantly increase existing loadout capacity	1. Very costly; more/longer cake piping needed
2. Requires operator work booth enclosures for personnel safety	2. Needs new odor control facility
3. Requires the addition of 2 additional silos sooner.	3. Requires upgrade of existing cake pumps to handle higher head or install dedicated higher head pumps for new facility
	4. Enlarges area of work responsibility for operators.

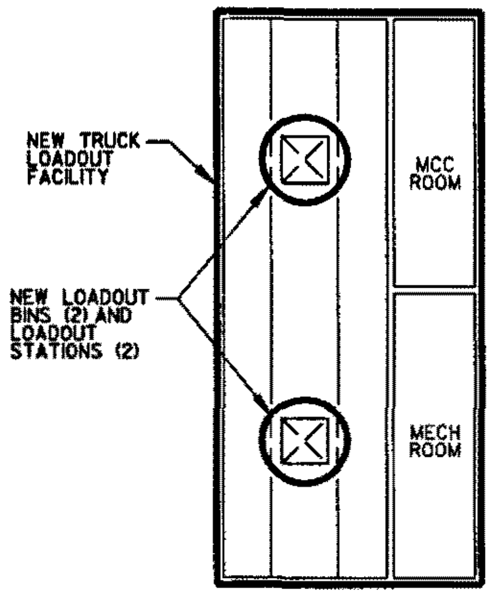
If Class A biosolids will be required in the future, Alternative 2 is recommended. If regulations will not require Class A biosolids production in the future, then Alternative 1 is recommended.

Per Alternative 1 above, MWWD has made a decision to install the emergency loadout stations (including direct feed pipeline) in FY 2007 in conjunction with Recommendations 2 and 5 below. MWWD has also determined that 2 additional silos (units #9 and #10) are critically needed and implementation of this 2-silo addition project is scheduled for 2007- 2014 (See Table 2-8).



ALTERNATIVE 1

REUSE EXISTING LOADOUT FACILITY



ALTERNATIVE 2

CONSTRUCT NEW LOADOUT FACILITY

FIGURE 3-11

BIOSOLIDS LOADOUT FACILITY UPGRADE ALTERNATIVES

2. Install bypass piping around the lime mixer on each cake weigh/mix bin. Bypassing the lime mixers will allow for a 33 percent increase in cake loading capacity (3 cake pumps in operation) of each bin. If MBC decides in the future to provide lime treatment, then the lime storage/ feed system can be recommissioned easily.

   A design project has been initiated to install the bypass piping around the lime mixers. However, it was realized during design that during this piping installation, a weigh/mix bin and loadout station will have to be taken out of operation which will place the entire loadout operation in a stressed condition. It was decided to install the emergency loadout stations in Recommendation 1 above prior to the installation of the lime mixer bypass piping to mitigate the operational interruption. (See also Recommendation No.5 below).

3. Evaluate valve accessibility conditions. Either provide access platforms or catwalks to subject valves or relocate where easily accessible. Overhead valves with motorized operators need to be furnished with chain operators.

4. Relocate valves away from problem area. Piping may have to be rerouted to do this.

5. The installation of two new, totally independent, manually- operated emergency truck loadout stations with direct-feed cake piping from the existing centrifuges or storage silos and built next to the existing loadout bays is recommended to provide capability to increase loadout capacity during peak biosolids production hours,

   Per City decision mentioned in Recommendation No. 1 above, a in-house MWWD project to install these two emergency loadout stations is now under an accelerated design and construction schedule to have it operational for the lime mixer bypass project by the start of Fiscal Year 2007.

6. Provide a new loadout facility with 2 new loadout stations similar to the existing stations and a sludge drying process to generate Class A biosolids.

CHEMICAL STORAGE AND HANDLING SYSTEMS (P-12)

General

The MBC Facility uses various chemicals in liquid form for its solids processes and the odor control systems. These chemicals and their applications are listed below:

TABLE 3-5 Chemical Application at MBC	
Chemical	**Application**
Caustic Soda	Odor control
Sodium Hypochlorite	Odor control
Sulfuric Acid	Odor control
Ferric Chloride	Scale/Sulfides/Odor control; Dewatering Aid
Polymer (emulsion-type)	Thickening (discontinued)
Polymer (mannich-type)	Thickening and Dewatering

All chemical bulk storage tanks, storage transfer pumps, chemical mixing tanks and mixed chemical tank transfer pumps are centrally located in the Chemical Building (Area 60). From the Chemical Building the chemicals are fed to local day tanks in areas where the chemicals are used. Chemical metering pumps feed the chemicals to various points of application in the process. At least one standby pump is provided for each chemical feed system.

CHEMICAL BUILDING

General Problems

The general problems described below and their recommended improvements apply to all chemical feed systems. The Ferric Chloride and Polymer Feed Systems and their unique problems, in addition to these general problems, are discussed in more detail in later sections.

1. *Inaccessible motorized tank valves*: Motorized isolation valves of bulk storage tanks and pumps are located at floor level in the spill containment cells. In the event of chemical or rain flooding, these valves get submerged and damaged in the flooded containment cell. Many of these motorized isolation valves are inaccessible for repair during flooding.

2. *Complex tandem piping and valves*: Dual bulk storage tanks are piped in tandem such that if a valve on one tank fails or leaks and needs service, both tanks would require shutdown. Repair of a single valve requires that the entire chemical feed system be shutdown and drained.

3. *Potential tank spills*: All chemical transfers from the Chemical Building occur via transfer pipes routed through the pipe gallery located below grade. A break or leak in the transfer pipe can empty out the bulk storage tank(s). In addition, a valve failure in the transfer line can overfill a day tank and cause a chemical spill.

4. *Pump suction capacity imbalance*: Different sizes of chemical metering pumps are manifolded to a common suction header. When the larger chemical transfer pumps operate, they starve out the smaller pumps.

5. *Electrical damage from flooding*: Electrical conduits are routed thru the floor of the containment cells and connect to motorized operators of tank valves on the bulk storage tanks. Containment cell flooding has resulted in chemicals entering into the conduits and damaging the wiring and other electrical equipment.

6. *Containment cell flooding*: In the event of heavy rains, the perforated roofing above the bulk storage tanks has resulted in flooding of the containment cells and caused flooding alarms.

7. *Single-walled chemical pipe spills*: Unshielded single-walled chemical piping outside of containment cells or trenches can develop leaks or accidentally rupture and cause an uncontained spill.

8. *Inaccessible tank isolation valves*: Isolation valves for the bulk storage tanks can only be operated from within the chemical containment cells.

Recommended Improvements

The following improvements are recommended to address the problems identified above:

1. Eliminate unnecessary motorized valves. Relocate remaining valves or provide adequate maintenance access.

2. Evaluate existing dual feed piping from bulk storage tanks to allow feed flexibility/ redundancy.

3. Due to hydraulic conditions, a high spot (standpipe with bleed line return to the storage tank) on each chemical transfer piping system must be installed to prevent potential chemical spills.

4. Revise suction header connections to the pumps to prevent uneven flow distribution.

5. Evaluate alternatives to reroute electrical wiring to spill containment cells. Electrical conduits need to be rerouted to ceiling level or to a level above the flood submergence level.

6. Raise the level of the flood sensors in the containment cells to prevent these flooding problems. Evaluate a way to install a solid roofing system without requiring fire protection revisions to this bulk chemical storage area.

7. Secondary containment piping equipped with a leak monitoring system should be installed to prevent a potential hazardous spill event.

8. Provide access/ maintenance catwalks to these isolation manual valve locations or consider installing motor operators on these manual valves for remote operation.

POLYMER STORAGE AND MIXING SYSTEM (P-13)

Process Description

The initial design of the polymer system is shown in Figure 3-12. The design was based on using two different types of polymer for the dewatering and thickening applications. After 5 years of operation and process optimization, this two-polymer operation was modified as discussed herein.

Initial Design:

Emulsion Polymer (PE) System for the Thickening Centrifuge:
The PE system equipment consisted of four 8,500 gallon 10 ft diameter FRP tanks, two recycle/ transfer pumps (50 gpm, 35 psi), two emulsion polymer dispensers, two emulsion polymer dispensers, one 5,300 gal 8 ft diameter mixing tanks with mixers, one transfer pump (90 gpm, 35 psi), two day tanks, and five polymer feed pumps (5-20 gpm @ 50 psi). This system has been revised as discussed in the problems subsection.

POLYMER STORAGE

Mannich Polymer (PM) System for the Dewatering Centrifuges:
The PM system equipment consisted of two 12,000 gallon, 14 feet diameter and two 8,500 gal. 10 feet diameter FRP tanks, two storage tank transfer/ recycle pumps (35 gpm, 35 psi), two 5,300 gal 8 ft diameter mixing tanks with mixers, one mixing tank transfer pump (230 gpm, 35 psi), two day tanks, five centrifuge polymer feed pumps (10-40 gpm, 50 psi).
Piped common to these two polymer feed systems is a set of one mixing tank with a mixer and a mix tank transfer pump serving as a standby feed unit.

Problems

The initial polymer system was beset with problems associated with the use of two types of incompatible polymers. This dual-polymer use contributed to the following operational and maintenance difficulties:

1. *Polymer usage problem:*   The amount of emulsion polymer usage at the Thickening Centrifuges is very small compared to the usage of the Dewatering Centrifuges. Emulsion polymer storage tanks lay idle for long periods as their volumes are used up very slowly, while the dewatering mannich polymer is consumed inefficiently in short periods. Due to the heavy use of the mannich polymer and its mixing equipment, the feed redundancy needed for the dewatering process has not been provided.

2. *Dual polymer handling difficulties*: Mannich and emulsion-type polymers are not compatible and existing system design could accidentally allow the two polymers to mix. The use of two different polymers, separated or mixed, created handling difficulties for the operators. Among these difficulties are: standby piping, valves, tanks and equipment used for the emulsion polymer need to be drained /cleaned thoroughly prior to switching to mannich use or vice versa. Also, existing piping design can by accident allow the two polymers to mix forming a gel that clogs the piping and is difficult to remove.

Recommended System Improvements

MBC has discontinued the use of emulsion polymer and decided to use the Mannich polymer for both the Thickening and Dewatering Centrifuges. No emulsion polymer is currently used.

With the plant's decision to use only the mannich polymer, the old polymer bulk storage systems were tied together to allow O&M optimal use of all storage tanks for use at both the dewatering and the thickening processes. The suction headers of the transfer pumps for each tank system were connected. The lack of feed/ mixing equipment redundancy for the dewatering process has thus been eliminated.

Likewise, a piping change and valve relocation on the polymer feed header of the common (standby unit) mix/ batch tank, will now allow all four tanks to be utilized for either dewatering or thickening processes, more importantly 4 batch tanks can now adequately cope with polymer mixing demand at the dewatering centrifuges. The use of a single polymer has expanded the feed capacity of the polymer batching for the dewatering use. With only one-type of polymer now used in the plant, the handling difficulties associated with two-polymer use has been eliminated. The polymer system control strategy is being revised for single polymer operation but has not been tested. Present polymer feed operations are still per original design except for use of a single polymer type. This will allow plant staff to switchover to the old strategy of using two polymers in the future if a more compatible emulsion polymer with competitive cost becomes available. It is recommended that testing of the control strategy for the use of single polymer be completed and finalized.

DEWATERING FERRIC CHLORIDE FEED SYSTEM (P-14)

Process Description

Ferric chloride is stored in two 11,000-gallon bulk storage tanks. Two transfer/ recycle pumps (at 20 gpm and 40 ft head, 1 duty and 1 standby unit) send the ferric chloride solution (42%) to two 4,500 gal day tanks in the Centrifuge Building. The day tanks are manifolded to serve eight diaphragm type chemical metering pumps. Each of these metering pumps feed the ferric chloride into the biosolids feed pipe of a dedicated dewatering centrifuge.


FERRIC CHLORIDE FEED AND TRANSFER (RIGHT) PUMPS

Problems

1. *Chemical leakage into centrifuges*: Soon after plant start-up, the plant staff learned that ferric chloride (FC) could leak into the biosolids inlet pipe of a centrifuge unit that was taken out of service. This results in catastrophic corrosion of the centrifuge unit including its associated dewatered biosolids feed pump. The corrosive chemical leaked also into the electrical and instrumentation conduits and panels and, worse, migrated to other electrical conduits/ panels of other centrifuge units resulting in very costly damage.

   To eliminate this major design piping error, operators have disconnected all ferric chloride piping into the centrifuge biosolids inlet pipes and instead piped them into the biosolids suction header of the centrifuge feed pumps. Thus, the corrosive FC is now being fed into a pipe that always has liquid flow in it and this prevents it from doing corrosion damage to the centrifuges.

   For this new feed strategy, four of the original 8 Tuthill metering pumps were retained (3 duty plus 1 stand-by), the other 4 were removed which allowed more access space around the remaining 4 pumps.
   As the original Tuthill pumps were complicated to maintain and repair (with long repair turnaround times), they have been discontinued (replacement parts are no longer available) and not supported by the manufacturer; 3 of the 4 Tuthill pumps were replaced with 2 Micropump units and 1 Seepex unit. For the single Tuthill pump remaining, parts are replenished from the removed units.

The 2 Micropumps work well but require frequent replacement of costly micro filters. The lone Seepex pump is under testing. After testing, the plant will change out all four pumps to a single manufacturer.

2. *Poor equipment access:* The ferric chloride metering pumps are very difficult to maintain due to poor access and very tight working space.

Recommended System Improvements

MBC has reconfigured the FC feed piping by disconnecting each dedicated feed pipe and in lieu connected the main FC feed line to the biosolids feed loop header to the centrifuges. This way, FC is being fed to a live pipe header that always has flow.

1. It is recommended for plant staff to continue its operational testing of the Seepex and Micropumps to determine which pump is best suited for this application.

2. It is recommended that the pump and piping layout be reconfigured when the new pumps are selected.

CENTRATE PUMPING STATION (P-15)

Existing Conditions

The centrate flow from the centrifuges is collected by 16-inch pipe headers which connect to a 36-inch gravity centrate/ plant drain header routed from the pipe gallery to the Centrate Pump Station on the western side of the plant. The flow comes from the following sources:

1. Centrate from the thickening and dewatering centrifuges.
2. Overflow from the digesters.
3. Overflow from the degritting system.
4. Emergency overflows from the blending tanks and the digesters.

The centrate wetwell has a capacity of 4,000 gallons and was designed to be "self-cleaning." Three (3) 100-hp variable-speed non-clog centrifugal pumps, each discharging a flow of 2,500 gpm at 95 feet of head, send the centrate to NCWRP where it flows by gravity via the Rose Canyon Trunk sewer to PLWTP. A magnetic flow-meter on the discharge pipe header measures the total flow from the pump station.

CENTRATE PIPE HEADER
IN THE PIPE GALLERY

Problems

Two old problems related to the centrate system have been addressed by the plant staff recently:

- Undersized air vacuum relief valves on centrate forcemain: During operation of the MBC centrate pumps, air gets trapped in the centrate forcemain to NCWRP due to inadequate venting of the undersized air and vacuum relief valves (one of each). This contributes to reduced centrate flow rate and probable internal pipe corrosion. This was corrected with the installation of the correct valve sizes, dual valves and added manual vent valves for redundancy. The revised air/ vacuum relief valving system on the centrate pipe has been working satisfactorily.

- Start-up priming of centrate pumps: A combination air-vacuum and air-release valve was installed on each pump which eliminated priming problems at pump start-up.

Current problems of the Centrate Pump Station are as follows:

1. *Scaling and reduced pump flow*. Actual discharge flow of each pump ranges from 1,500 to 2,000 gpm which is significantly lower than their 2,500 gpm rating. Scaling was observed on the pump discharge valves and piping. It was highly suspected that the 10- and 36-inch headers in the pipe gallery are severely scaled also. This was confirmed recently when a 36-inch pipe tee and the connecting piping from the

thickening and dewatering centrifuges was discovered to have thick scaling. The extent of scaling of the downstream centrate collection header (36-in. diameter) in the pipe gallery is unknown and cannot be determined due to the absence of provisions for pipe access and inspection including flushing and draining taps on the header.

2. *Non- "self-cleaning" Wetwell:* This problem is due to a poorly designed ogee ramp built to create the required hydraulic jump for flow turbulence, and the inadequate flow during a cleaning cycle to complete an effective "self-cleaning" operation. Plant staff has difficulty running the pumps in "self-cleaning" mode via the faulty DCS control strategy. Plant staff continues its testing to produce a workable automatic "self-cleaning" strategy.

   The wetwell could not be cleaned out by the special Vactor truck because of the absence of a hatch above it. Cleaning of the wetwell can only be done by the operator entering the space and manually hosing down the wetwell trench with high-pressure utility water. Foaming which is inherent of the centrate liquids has been observed in the wetwell which makes visual determination of water level difficult.

3. *Faulty operating valve:* Even at MANUAL mode, the motorized isolation valves for pump #2 close by themselves and shut off the pump. The cause of this problem has not yet been identified by MBC staff.

Recommended Station Improvements

1. Provide inspection ports flushing/ draining connections. Evaluate replacement of pumps with larger capacity units. Evaluate future ultimate flows with the scheduled addition of more thickening and dewatering centrifuge units for the Phase 2 expansion in 2010. The addition of a chemical to prevent scaling should also be looked at.

2. Install a hatch directly above the wetwell to allow easy access for vactor trucks. Plant staff is continuing with testing the DCS control strategy for the "self-cleaning" operation by trying out various liquid levels versus pump start-stop levels. Staff is confident that they will be able to develop a functional revised control strategy.

3. In order to identify root cause of valve malfunction, it is recommended that O&M staff initiate a trial-and-error testing procedure of replacing components. Start with the cheapest items first, replacing the control wiring, then the electrical feed wiring, then the valve master station, etc.

CHAPTER 4 - NON-PROCESS FACILITES

4.1 General

This chapter discusses the non-process facilities which support the process facilities at the Metropolitan Biosolids Center. The following support facilities will be discussed more in detail in this chapter because of their large impact on the operations of the main processes. These are the Wastewater Collection System, Odor Control System, and the Plant Water Systems (potable water, process water, reclaimed or utility water). Problems related to the Chilled Water System, Hot Water System and the Storm Water Drainage System are also discussed.

Other non-process or utility systems not discussed here are the following systems: Heating/ Ventilation and Air-Conditioning, Fire Protection Water, and the Natural Gas systems. These systems have no significant problems or concerns related to this condition and operational assessment.

The Electrical and Instrumentation and Control Systems are discussed later in Chapter 5.

4.2 WASTEWATER PUMPING SYSTEM (N-1)

System Description

The MBC wastewater is collected from the plant's sanitary facilities, process blowdowns and drains, washdowns and other miscellaneous drains including sanitary drains from the Cogeneration Facility. The wastewater is collected and discharged to the Wastewater Pump Station (WWPS). This station has a typical box wetwell of 2,000 gallons capacity and was originally served by two (2) 5-hp non-clog submersible pumps. Each pump delivered a flow of 200 gpm at 40 ft head to Municipal Pump Station 86 located south of MBC across Freeway 52. The original wastewater pumps plugged frequently and did not have enough capacity to keep up with plant discharges. On numerous occasions, this caused overflows to the centrate wetwell. The pumps have been replaced with larger 350 gpm pumps.

Problem

Undersized PS 86: Muni-PS86, equipped with two 800 gpm pumps (1 duty and 1 spare), was designed and constructed based on a projected ultimate flow of only 520 gpm from area subdivisions. Based on current area inflow this allows the WWPS to discharge at only 280 gpm, less than that sent now at 350 gpm and significantly less than the projected peak flow of 1,200 gpm from the MBC WWPS.

With the limited capacity of PS86, overflows from the WWPS into the centrate wetwell occur. The overflows distort the actual centrate flow sent to PLWTP which impacts the regulatory OPRA mass emission rate accounting required from the City. Overall, any future increase in the hydraulic and solids loading or expansion of facilities at MBC will increase the wastewater volume and exacerbate these present pumping and spill problems.

WASTEWATER PUMP STATION

Recommended Improvement

The WWPS still cannot fully handle the projected WW discharges. It is recommended that the pump capacity be increased and that a bypass for PS86 is constructed.

Due to the depth of the Muni PS86 wetwell, there is no plan to increase its pumping capacity so that it can send the combined area inflows and MBC wastewater flows to PLWTP. Alternatively, a diversion pipe has been proposed that will divert pumped MBC wastewater via a new 8-inch forcemain directly to the 15-inch diameter gravity trunk sewer main at Clairemont Mesa Boulevard. The Muni PS86 dual forcemains presently discharge to this gravity sewer main.

4.3 ODOR CONTROL FACILITIES (N-2)

Facilities Description

Various solids treatment facilities are ventilated to remove the resulting odors from the biosolids processing and to provide a safe working environment for the plant staff. Foul odors are generated in the following areas of the solids processing facilities: Area 73 (Raw Solids Receiving and Thickened Solids Blending), Area 76 (Centrifuges), Area 80 (Digesters Complex), Area 86 (Biosolids Storage and Truck Loadout), and Area 94 (Centrate and Wastewater Pump Station).

The foul air from the process facilities is collected and conveyed by fans and fiberglass ducting to the Odor Control (OC) Facility in Area 60-Chemical Building. The Odor Control Facility consists of three treatment trains (2 duty and one standby), each train providing two- or three-stage treatment depending on the foul air source. All of the foul air drawn from Areas 73, 76, 80 and 86 (designed at 52,000 total cfm, the actual flow is lower) goes through packed-bed hydrogen sulfide chemical scrubbers, then through the carbon adsorption scrubbers and is finally discharged to the atmosphere through vertical stacks by fans. A total of 16,000 cfm of foul air is drawn from post-digestion areas is first treated by an ammonia scrubber before being sent to the hydrogen sulfide chemical and carbon scrubbers. The chemical scrubbers remove about 80 percent of the odor while the carbon adsorption units polish the foul air-stream to about 95 percent odor-free level.

The odor control system servicing Area 94 consists of two trains of 3-stage scrubbers. The flow diagrams for these odor control systems are shown in Figure 13 of Appendix B.

In 2003, MWWD's odor control consultant, Brown and Caldwell, conducted an evaluation of the existing foul air ventilation systems in the MBC process areas and identified a number of odor-related problems. Based on this evaluation, several improvements were recommended and are presented in summary herein. (For the complete report, see B&C's "Odor Control Modifications Assessment Report," November 2003).

Brown and Caldwell's evaluation of hydrogen sulfide readings concluded that the chemical scrubbers in Area 94 can be bypassed with minimal effect on treatment efficiency. Bypassing of the chemical scrubbers was recommended as part of the MBC OC facilities improvement project. The APCD has allowed MBC to temporarily bypass the chemical scrubbers.

ODOR CONTROL FACILITY

Problems

1. Area 60:

   a. *High system pressure/under capacity fans*: Odor control fans are operating under higher total static pressures than anticipated by the design, thereby exhausting and treating less volume of foul air than needed at the facilities and resulting in the fans being under capacity.

   b. *Inaccessible dampers*: In Areas 94 and 60, there is very limited or no access to repair motorized dampers at upper levels or to verify their damper positions including instrumentation status. Based on air flow measurement, most dampers are suspected of not fully opening or closing.

   c. *Moisture in the foul air stream*. There is difficulty in removing moisture from ducts, fans and carbon scrubber vessels due to inadequate negative pressure throughout the system (because the main OC fan is located downstream vs. upstream in the OC train).

      Moisture carryover from chemical scrubbers has also resulted in loss of capacity by the carbon scrubbers. It was also observed that loss of capacity is caused by backflows through OCS units that are out of service.

2. Area 76: *Inadequate foul air ventilation*. The Screening and Degritting Room has many open wastewater surfaces contributing as odor sources. Existing room foul air

ventilation rate is below the designed rate. Odor collection fans for this area are operating below their design capacities due to several pressure losses identified in item 1 above.

3. Area 86: *Ventilation imbalance*: There is a large imbalance between the volume of exhausted general ventilation air versus that of exhausted foul air in this very odorous facility. A large volume of building ventilation air (over 200,000 cfm) is being exhausted to the outside through the building roof fans while a meager amount of foul air (12,000 cfm) is being captured and sent to the odor control systems.

    a. *Ineffective foul air capture at truck bays*: Odors from the truck loadout lanes are ineffectively captured by the foul air exhaust ducts while work areas are insufficiently ventilated with fresh outside air.
    With ineffective capture of foul air, the presence of truck exhaust fumes and the lack of truck loading enclosures make this open work area an unpleasant working environment.

    b. *Non-capture of truck exhaust fumes*: Uncollected truck engine exhaust fumes disperse into the facility and create an unfavorable environment for the operators.

4. Area 94:

    a. *Under capacity fan*: The odor control exhaust fan is operating below its rated capacity and thus inadequately provides the necessary foul air removal rate for the pump station.

    b. *Uncovered wetwell trench*: The centrate wetwell trench is uncovered requiring the entire wetwell room to be ventilated at a higher rate. Covering the wetwell trench to contain odors and just exhausting this contained volume reduce the foul air volume to be treated.

Recommended Improvements

The following are the recommended improvements as also recommended in the B&C evaluation report. Implementation of these improvements will be in accordance with MBC/MWWD priorities.

1. Area 60:

    a. The capacity of the main odor control fans needs to be upgraded and the causes of the increased resistance to air flow in the ducts need to be identified and addressed.

    b. Provide maintenance access to the motorized dampers and provide visual position indicators for all dampers.

c. Remove excess moisture from odor control ducts by providing a deep (greater than 17 inches) in-line sump and gravity drain line prior to the carbon scrubbers. The location of the main foul air exhaust fans within the OC trains needs to be reviewed. Relocation to the upstream side may increase negative pressure in the system to prevent moisture collection.

2. Area 76: Implement B&C recommendations for Grit/ Screen Room Odor removal improvements. Replace 3 area odor fans to attain desired withdrawal rates.

3. Area 86:

   a. Evaluate foul air quantities in the Biosolids Storage Facility. Consider improvement of foul air collection at the truck loadouts by installing enclosures. Improve the ventilation air supply duct routing and location of supply registers in this facility. Consider constructing an independent loadout facility separate from the present building. This new loadout facility will be built with operator control rooms totally separate from the loadout area.

   b. Due to safety concerns associated with the truck exhaust fumes, the installation of an enclosure at the operator control station has become a high priority. Funding for the operators work station enclosure at the truck loadout has been provided and its construction will begin soon.

      To contain and immediately remove truck exhaust fumes, truck lane enclosures need to be considered.

4. Area 94:

   a. Investigate and correct causes of low air flow through the odor control system.

   b. Provide cover on the wetwell trench and withdraw air from under the cover. Provide general ventilation for the wetwell room so as to only require exhaust to the outside instead of treatment by the odor scrubbers.

4.4 PLANT WATER SYSTEMS (N-3)

4.4.1 Potable Water (PW) System (N-3.1)

System Description

The Potable Water System provides the domestic water needs of the plant including those of the emergency eyewashes and showers. Two 16-inch PW mains feed into the MBC site and tie into a 12-inch piping loop around the MBC facilities. A 6-inch Water

Department (WD) connection, downsized from M&E's original 8-inch design, connects to a 6-inch magnetic flow meter, a backflow preventer and into the 6-inch PW main. A 6-inch branch pipe feeds the Energy Building and the Process Water (PRW) System air gap tanks. The 6-inch PW main then goes thru a pressure regulating valve (PRV) and continues into the plant's pipe gallery where it is downsized to a 4-inch main. Several 2- and 3-inch branch pipes feed into the various buildings throughout the plant.

A second PW source branches off the12-inch PW pipe loop and passes thru a 4-inch flow meter and a PRV device before connecting to the 4-inch backbone PW main in the pipe gallery which serves the entire plant. The Potable Water System piping schematic is shown in Figure 15 of the Appendix.

Problem

Inadequate flow for peak PRW demand: Aside from the primary goal of providing for the domestic PW demands of the plant, the PW system is configured to be the main water source for the PRW system. The downsized 6-inch PW flow meter cannot provide the peak 1,700 gpm maximum flow demand originally calculated for the plant's PRW system. The downsizing proved to be a critical error as current experience shows that the PW feed to the PRW system is inadequate during peak flow conditions when RW is not available. Excluding MBC's PRW demands, the existing PW system is adequate.

Recommended Improvement

It is proposed that a new 4-inch PW branch line be connected to the existing 4-inch PW main on the east side of the pipe gallery. This new 4-inch PW branch pipe will feed into one or two proposed new 3,000-gallon air-gap tanks served by two new 325 gpm (or larger) PRW pumps. The discharge piping of this new air-gap system will connect to the existing 4-inch PRW main in the pipe gallery by the Chemical Building. This proposed new 4-inch PW pipe connection and supplementary PRW equipment are shown in Figure 4-1.

4.4.2 Process Water (PRW) System (N-3.2)

System Description

The Process Water System provides water for use on pump seals and area housekeeping. As mentioned in the PW System section, the PRW air gap tanks are fed from a 6-inch branch out of the 12-inch PW main loop. This 6-inch PW branch feeds three 3,000-gallon air-gap tanks (3 duty, no standby) in the Energy Building. Four PRW pumps (three 325 gpm and one 100 gpm units) draw from the air-gap tanks and feed into a 6-inch backbone PRW pipeline. This main pipe branches out to two bladder-type hydro-

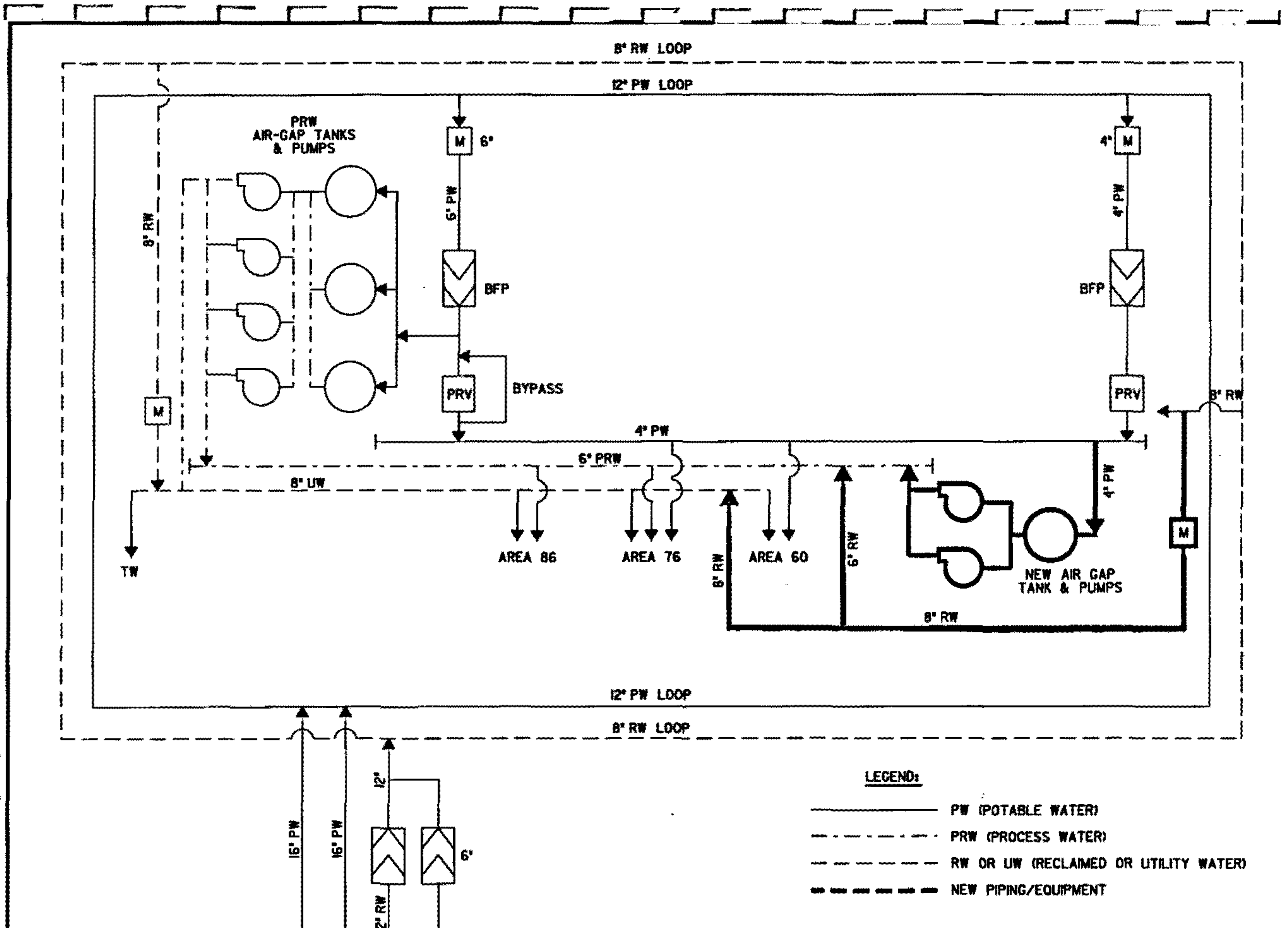


FIGURE 4-1

MBC PLANT WATER SYSTEMS TIE INS FLOW DIAGRAM

pneumatic tanks and connects to a PRV station. The backbone PRW main is routed to underground pipe gallery branching off to the various PRW users. For the PRW system's back-up water source, Utility Water (UW) is tied into discharge piping side of the PRW pumps. Vice-versa, with this tie-in connection, PRW can be fed into the UW system when the Reclaimed Water feed is not available.

Problem

Under-designed PRW system: The final design of MBC's PRW system was not as initially conceived. PRW demands were inexplicably reduced by the designer at the end of design resulting in a smaller PRW main (6-inch installed vs. 8-inch original) and fewer PRW pumps (3 @ 325 gpm installed out of 4 original). Thus, inadequate flows and pressures to the PRW users are routinely experienced. A malfunction of an air gap tank or pumping equipment reduces the PRW capacity and results in centrifuges and cake pumps tripping off-line, thereby reducing plant biosolids production and creating major operational problems in MBC.

During construction, a 6-inch connection spool was installed to allow the Utility (or Reclaimed) Water to feed into the PRW system or vice versa. Although this connection was intended to be temporary, it was made permanent when it was discovered that the downsized 6-inch PW supply was inadequately sized to meet the peak demands of the PRW system. (Refer to Figure 16 of the Appendix for the PRW flow diagram). However, UW supply to MBC can be shut off without notice by the Water Department. In such event, the undersized PRW, has to perform double-duty by supplying flow to the UW system. This event has occurred on several occasions in the past and has placed the plant operation in a critical condition.

This undersized PW main and its lengthy piping run in the pipe gallery have resulted in periods of low supply pressure causing tripping off of critical process equipment.

Recommended Improvements

As recommended in the PW System, the installation of a new 4-inch PW source connection and new PRW air-gap tanks and pumps will augment flow and provide an operating cushion on the existing PRW system. It is also recommended that an alternate feed from the RW system be provided. A new 8 or 6-inch branch pipe from the 8-inch RW line (for Peak Wet Weather Flow Management) can be installed and connected to both the existing 6-inch PRW and UW mains in the pipe gallery. This added connection will provide more capacity and flexibility to both PRW and UW systems. See Figure 4-1 for the PRW system flow diagram and recommended improvements.

4.4.3 Utility (or Reclaimed) Water (UW or RW) System (N-3.2)

System Description and Problems

The Utility or Reclaimed Water System meets the demands at the truck wash, biosolids, centrifuges, and the chemical dilution facilities. A 12-inch RW main enters the MBC site, branches into two 6-inch lines with backflow preventers which then reconnects to become a 10-inch RW main. It then feeds into an 8-inch pipe loop around the entire MBC facility. An 8-inch line branches out of the west side of the loop to the Energy Building, goes thru a pressure reducing station and flow meter and connects to the 8-inch backbone UW main in the Pipe Gallery. The lengthy UW main coupled with large demands result in low supply pressures which cause process equipment to trip off many times in the past.

On the east side of the 12-inch RW loop line at the Operations Building, another 8-inch branch pipe was installed and routed to Digester No. 3 designated for peak flows management. This new 8-inch branch pipe does not tie-in with the 8-inch UW backbone main in the pipe gallery.

As stated above, a spool pipe for the tie-in connection with the PRW system is installed in the Energy Building. In the event the RW system is placed out of service by the Water Department, PRW can be fed to augment the UW system. The UW system can also be used to supplement PRW demands.

Recommended Improvements

The installation of a supplementary RW piping connection from the 8-inch RW pipe for peak flow management needs described in the Process Water System above is recommended to augment the plant's UW system in times when the reclaimed water supply from the Water Department is cut off. See Figure 4-1 for this piping improvement.

4.4.4 Other Plant Water System Problems/Recommendations

(N-3.3): There is a general lack of all necessary shut-off valves to isolate piping sections for repair/maintenance work. Installation of these missing isolation valves will be very helpful to the O&M staff.

(N-3.4): The airgap tank inlet valves on the PRW system are missing its UPS connections proper automatic controls. The UPS connections must be installed.

4.4.5 Hot Water (HW) System (N-4)

Existing Condition

Plant heating water is supplied from the Hot Water System. The system consists of primary and secondary loops - the primary loop providing the heat source and the secondary loop distributing the heat to load demands throughout the plant via variable speed pumps (See Figure 17 of the Appendix). The heat source comes from recovered heat from the CoGeneration Facility engines and is supplemented by two hot water boilers (each rated at 10 million Btu/hr heating capacity at 850 gpm flow). Aside from the plant's main demand for space heating, it is also used for digester heating. The operation with the CoGen Facility was not taken into consideration in MBC's original HWS design.

Biogas connections to the hot water boilers were recently disconnected. Only Natural Gas is currently fed into the boilers. This was also done to avoid annual source testing required by APCD on biogas emissions and to obtain higher annual NG usage allowances.

Problems

Two major problems currently being experienced are as follows:

1. *Faulty boiler control problem:* Boilers get stuck in low-fire mode when the system calls for maximum heating. Transitioning heat supply from the CoGen heat source system to the Secondary system and vice versa is not accomplished automatically and must be done manually instead. This transitioning problem is mainly due to the Cogen connections made at the secondary loop instead of the primary loop. With the Cogen connections on the Secondary loop, control of the temperature control valve on the secondary loop is dictated by timing algorithms instead of temperature and pressure sensors located at the MBC Operations Building.

2. *Inefficient boiler operation*. This is due to poor flow coordination between the CoGen hot water feed pumps and the MBC HWS secondary feed pumps. The constant speed pumps at the CoGen facility force the secondary loop pumps to operate at maximum speed resulting in wasted energy and unsafe high pressure in the system.

A minor leak has been observed in the pipe gallery. This is believed to come from the buried HW pipe in the transition area between the pipe gallery and the Operations Building. If this leak worsens to eventually warrant attention/ repair, accessing the leak location without undermining the building ground footing will be a very difficult task. Increased solids loading to MBC in the future will require an increase in digester heat demand and higher system operating pressures.

Recommended Improvements

1. Review HWS control strategy considering relocating Cogen pipe tie-ins to the primary piping loop.

2. Install variable speed drives on the CoGen HW pumps.

4.4.6 Chilled Water (CW) System (N-5)

Existing Condition and Problems

Two 300-ton centrifugal chillers (lead-lag operation) provide centralized cooling for HVAC units at the various MBC buildings and facilities (See Figure 18 of the Appendix). The CWS equipment is located in the Energy Building and feeds into primary and secondary pumping loops. The latter loop supplies chilled water to the various MBC process areas.

Current problems associated with the chilled water system operation are the following:

1. *Lack of capacity.* The two existing chillers operate together to meet plant peak cooling demands during hot summer days. The back-up chilled water supply from the Cogen Facility has been decommissioned. Added CW demand from the CoGen facility and the "re-heat" HVAC system in the Area 51 Operations Building has saddled the MBC CW system with a large load that was not considered in original design.

2. *Inefficient operation of the system due to lack of a temperature control valve.* This is aggravated by the Cogen tie-ins to the secondary loop instead of the primary loop.

An increase in the plant hydraulic and solids loading will require additional electrical loads. MCC room cooling loads will increase and may require more cooling and enlargement of the existing CW system.

Recommended Improvements

1. With marginal capacity on hot days and lack of standby capacity, the installation of a third chiller is recommended.

2. The installation of a temperature control valve for better control of system operation is needed urgently. Review/ optimize existing controls.

4.5 STORMWATER DRAINAGE (SWD) SYSTEM (N-6)

Existing Condition and Problems

Storm water and surface drains are directed to two drainage structures located at the east and west sides of the MBC site. Current concerns with these drainage structures are as follows:

1. *Ground erosion at the West Drainage Structure.* Due to its steep slope, the downstream area is subject to severe erosion during discharges.

2. Accidental w*astewater and chemical spills*: Several process areas can directly discharge wastewater, biosolids or chemicals into the storm drains. These areas include the roof of the digesters and the blending tanks, the truck loadouts and the chemical storage tanks. By design, these unwanted materials can and do get flushed into the storm drain system.

3. *Access road erosion:* Due to poor CALTRANS drainage provisions, MBC's main access road is gradually being eroded during heavy rain events.

BIOSOLIDS RD

MBC ACCESS ROAD

Recommended Improvements

1. Elimination of the West Drainage Structure is part of a consultant's design project that has been recently completed. This project which revised MBC's stormwater drainage system is ready for construction.

2. Area grading will be revised to have all drainage directed to the East Drainage Structure. A diversion gate, a 10,000 gallon concrete holding tank and a return pump

station will be constructed to capture any spilled wastewater or chemicals and prevent them from entering the nearby creek.

3. Drainage improvements to intercept and redirect stormwater away from the access road needs to be constructed.

CHAPTER 5 - ELECTRICAL AND INSTRUMENTATION / CONTROL FACILITIES

The following report gives an assessment on the existing condition of the electrical and instrumentation/controls facilities at MBC with recommendations for improvement.

5.1 ELECTRICAL FACILITIES

5.1.1 ELECTRICAL – General (E-6.1, 6.2, 6.3)

In analyzing the existing power capacity from the San Diego Gas and Electric (SDG&E) incoming feed and the energy generated from the CoGeneration Facility (COGEN), it appears that the existing services have sufficient capacity to handle the maximum demand for MBC. However, the power system tends to be unreliable. When the utility power feed from SDG&E goes down, the COGEN tries to feed the grid but trips off due to overload. Thus, the COGEN similarly goes down resulting in a complete power outage for the facility. Consideration needs to be given for the overall reliability of the entire distribution system. Consideration should be given to reconfiguring the existing switchgear to provide COGEN a direct connection to SDGE without using the MBC's "A" side bus facility-wide standby diesel engine-generator sets (E-6.2)

In addition to the above, the reliability on the Utility side should be discussed with SDG&E as necessary upgrades need to be considered on the SDG&E side of the equipment. (E-6.3)

Reliability of the existing UPS needs to be determined and necessary upgrades need to be considered particularly for the UPSs in Areas 51, 60, 70 and 80. (E-6.1)

5.1.2 OPERATIONS BUILDING – AREA 51 (E-1)

Problem

The facility's existing Uninterruptible Power Supply System (UPS) that feeds the Distributed Control System (DCS) and the fiber optic hub needs to be supported through the existing emergency power generator located in Area 51. A power outage can result in loss of critical data to COMC. This task shall be accomplished in the near future by O&M staff.

Recommendation

Connect the 3 UPSs in Area 51 to the existing emergency power generator as planned under the M&E contract.

5.1.3 DIGESTERS COMPLEX- AREA 80 (E-2.1)

Problem

The gas flares become inoperative during a power outage.

Recommendation

The panel that feeds the gas flares needs to be connected through the existing emergency power generator in Area 76. This panel is presently connected to Bus “A” of the plant’s electrical system, which is connected to SD&E. This task shall be accomplished in the near future by either O&M staff or the GRC contractor.

5.1.4 CENTRIFUGE BUILDING- AREA 76 (E-2.2)

Problem

There is a concern with possible interruption of ventilation air supply into the Area 76 Control Room during a power outage. It is suggested to provide a new external air supply fan in Area 76 Control Room independent of the room’s existing Air Handling Unit. This new air supply fan needs to be connected through the generator panel for back-up power. The available capacity of the existing back-up generator in this area has to be determined for this new electrical load.

Recommendation

The UPS that feeds Work Station Drops 210 and 220 needs to be connected through the emergency power generator for this area to provide extended power to these drops during a power failure.

5.1.5 CENTRIFUGE BUILDING –AREA 76 (E-2.3)

Problem

The UPS that feeds the DCS bridge Work Stations Drop 210 and Drop 220 is not supported by the emergency generator in this building.

Recommendation

Connect the UPS that feeds Drops 210 and 220 to the power generator in this area.

5.1.6 BIOSOLIDS THICKENING – AREA 76 (E-2.4)

Problem

There are no existing lights for the thickened biosolids wetwell in the Centrifuge Building.

Recommendation

Provide lighting for the wetwell as planned and designed under the M&E Contract.

5.1.7 WASTEWATER PUMP STATION – AREA 94 (E-3)

Problem

No back-up power is available for the 15 hp wastewater pumps in Area 94. A power outage (planned or unplanned) can flood the drywell and can result in an on-site sewage spill.

Recommendation

To avoid costly sewage spills, it is recommended to install a small emergency generator to provide back-up power to the 15-hp pumps.

5.2 INSTRUMENTATION AND CONTROLS

5.2.1 DISTRIBUTED CONTROL SYSTEM (DCS)

Description of Design and Capacity

- 3 data highways, #1&2 are full with no more expansion possible, #3 has a lot of space.
- #1 is totally maxed-out on I/O and DPU programming space
- #2 has minimum I/O & DPU space available

Problems

- I/O limitations, highways #1 & #2 cannot be expanded.
- Attempts to clean-up the programming and to retrieve I/O space is a lengthy process that will generate uncertain results.
- Impact on upgrades (manual alternatives considered, selection, design).
- DPU database limitations

- Historian optical drive is needed; however the new drives are not compatible with the existing software. A full operating system is therefore needed.
- DCS reprogramming clean-out will cost a lot of time and money
- DCS graphics need to be updated to reflect changes in the plant.
- The alarms and points disabled are still in the system using space in the I/O & DPU.

Recommendations

- Recover unused or bypassed SID's. Note: This involves high cost, man-hours, and down time.
- Database recovery from cleaning-up DPU by reprogramming.
- If the recovery is not sufficient for the expansion needs of the plant, an upgrade to Ovation is recommended as the best solution.
- If the testing of the Octopus system by Alfa Laval for the centrifuge is successful, this system can be easily incorporated into OVATION.

5.2.2 VALVE MASTER STATIONS

- Description of what exists/types/compatibility
- Advantages/Disadvantages Limitorque vs. Rotork and other brands.
- Support/Installation/Program availability/Reliability/Parts/Maintenance.
- Relocate the Valve Master Station from Area 76 Centrifuge level to Area 76 MCC Room.

Problems

- Limitorque vendors not responsive/lack of support & software not readily available
- System not compatible.
- Excessive use of valve actuators
- Installation location of actuators (inside chemical containment area)
- Unreliability of Limitorque (lack of support from the dealers and manufacturer)
- Limitorque Valve Master Station does not have HMI to quick change settings, addressing, and manipulating the valves
- The Valve Master Station located at Area 76 Centrifuge level creates frequent problems due to bad atmospheric conditions and water wash downs.

Recommendations

- Remove the valve master station then direct connect to the DCS or use the DCS as valve master station (Limitorque).
- Relocate the valve actuators above or outside the chemical containment area.
- Remove the unneeded valve actuators then clean-out the control loop/wiring/etc.

- Upgrade to Ovation.
- Relocate the Valve Master Station to Area 76 MCC room for better condition and eliminate water wash down problems. Running the cables/conduits to the new location should be done by an electrical contractor and should be connected by Rotork to the VMS.

5.2.3 SIEMENS CONTROL SYSTEM

(STAEFA-Building Controls & HVAC)

- Description of HVAC, PRW (including AGT inlet valves & levels), HW, CW, PA, Chemical Leak Detection, Eyewash Stations, Interlock of smoke detectors to dampers, AHU's & EF's.
- BCU program is MS1800 (DOS based – Not user friendly and not standard to PLC).
- The network front-end program is INSIGHT.
- Uses telephone wires (very slow).

Problems

- STAEFA Systems product line discontinued.
- Not all is monitored or controlled by the DCS.
- Ethernet link needed to upgrade to newer version of INSIGHT telephone line will not work.
- MS1800 support is limited due to lack of Siemens staff that is familiar with the program.

Recommendations

- Change BCU's to Allen-Bradley PLC
- Replace telephone link with Ethernet.
- Add monitoring and control to the DCS.
- Upgrade to OVATION

NOTE: ***MWWD has decided to upgrade the existing MBC control systems to OVATION. Upgrade will be completed by FY 2009.***

CHAPTER 6 - IMPLEMENTATION PLAN

This chapter discusses the implementation plan and schedules for the improvement projects for the Metropolitan Biosolids Center (MBC). After reviewing the various projects proposed in Chapter 1, MWWD classified the projects based on costs, implementation timing, and also implementation methodology.

Presented in Table 6-1 are the major projects (with total construction costs larger than $0.5 Million) recommended for implementation from Fiscal Years 2006 to 2030 with an estimated total construction cost of about $55 Million. ***(These projects have been recently approved by MWWD for CIP funding and implementation as indicated.)***

TABLE 6-1
Major Upgrade Projects for MBC

Project No.	Project Name	C.I.P. No.	Projected Construction Start (FY)	Projected Completion (FY)	Estimated Total Cost ($ Million)
P-9.3	Dewatering Transfer Pumps Upgrade	42-915.9	2005	2006	0.7
P-10.1	Standby Centrifuge Sludge Feed and Polymer Feed Pumps Installation	45-981.0	2007	2010	1.5
P-10.2	Centrate Collection Piping Upgrades – Phases 2 and 3	45-982.0	2012	2016	2.0
P-10.6	Replace 4 Dewatering Centrifuges with Larger Capacity Units	45-983.0	2009	2014	6.0
P-11.1	Additional Biosolids Storage Silos	45-984.0	2007	2014	8.0
P-11.3	Valve Access Platforms Installation In Biosolids Storage Building	45-985.0	2017	2019	4.5
P-11.5	Emergency Direct Pipeline Loadout Station	45-986.0	2007	2009	0.7
P-11.6	New Biosolids Truck Loadout Facility	TBA	2024	2030	20.0
N-1	Wastewater Pump Station Upgrade and Forcemain Extension	45-988.0	2007	2010	1.2
N-2	Odor Control Facility Upgrades & Dampers Access Platforms Installation	45-989.0	2007	2009	5.0
N-6.1 N-6.2	Storm Water Drainage System Improvements	45-990.0	2013	2016	3.0
E-6.2	Emergency Electric Generating Units Installation	45-991.0	2013	2016	2.0
				TOTAL	**54.6**

TBA - To be assigned later

Presented in Table 6-2 below are the projects that can be done either by MWWD (via in-house design and/or construction) using the Engineering and Program Management Division (EPMD) or the Operations and Maintenance Division (OMD) staff or by selected outside consulting engineering firms. These projects, recommended for the MWWD Annual Allocation budget, are presented in Table 6-2 and projected to cost a total of about $6 Million over the next ten years until year 2016.

TABLE 6-2
Projects Proposed for C.I.P. Funding Allocation

Project No.	Project Name	Total Cost (in $ Million)	Implementation Schedule (FY)
Done By: **DESIGN CONSULTANT**			
P-3.3 & 3.4	Degritting Facility Foul Air Collection Upgrades	0.10	2010-2013
P-4.1, 4.2, 4.3, 4.4	Thickened Solids Wetwell Improvements	0.30	2010-2013
P-5	TSL Pumping & Blending Tanks Bypass Upgrades	0.70	2007-2010
P-11.2	Lime Mixers Bypass	0.50	2007-2008
P-12.1, 12.2, 12.3, 12.4	Chemical Storage/Handling Systems Improvements	1.20	2011-2015
N-3	Potable/Process/ Utility Water Systems Improvements	0.50	2014-2016
E-3	Wastewater Pump Station Backup Power	0.25	2014-2016
Done By: **MWWD / EPMD**			
P-2.2	Raw Solids Receiving Tanks Isolation Valves	0.10	2008-2009
P-8.1	Gas Flares Backup Power	0.10	2007
P-10.3	Centrate Pipeline Access Ports	0.25	2008-2011
P-11.4	Cake Storage/Loading Facility- AHU Piping Modifications	0.08	2010-2011
P-14.2	Ferric Chloride Feed System Upgrades	0.12	2009-2011
P-15.1	Centrate Forcemain Upgrade	0.25	2010-2012
P-15.2	Centrate PS Wetwell Access Hatch	0.08	2015-2016
E-2.2	Area 76 Control Room Emergency Air Supply Fan	0.07	2013-2014
Done By: **MWWD/ OMD-MBC**			
P-9.1	Digested Biosolids Storage Inflow Surges Control	0.50	2010-2013
P-10.4B	Cake Bins Level Control Upgrade	0.20	2007-2009
P-12.7	Double- Walled Chemical Piping	0.20	2014-2016
N-2.3B	Area 86 Operator's Control Booth	0.20	2007-2008
N-3.4	Process Water Isolation Valves	0.20	2007-2009
	TOTAL	**5.90**	

The following Table 6-3 presents the projects proposed for implementation using MBC's annual O&M budget allocation. These projects will be primarily designed by MBC's O&M staff and constructed by a selected MWWD contractor or by plant staff and will cost about a total of about $0.5 Million in the next 6 years.

TABLE 6-3 **Projects Proposed for Annual O&M Budget Funding**			
Project No.	**Project Name**	**Total Cost (in $ Million)**	**Implementation Schedule (FY)**
P-1	Monitor Pressures on NC Raw Solids Pipeline	0.00	2006
P-2.1	Raw Solids Receiving Tanks Suction Pipe F/D Ports	0.04	2010-2011
P-3.2	Raw Solids Degritters/ Flexible Grit Piping Upgrade	0.02	2007
P-6.4	Trailer-Mounted Blending Tanks Heat Exchangers	0.01	2009
P-7.1	FC Injectors Relocation to /Digester Roof	0.01	2006
P-7.3	Digester Emergency Overflow Weir	0.02	2008
P-9.2	On-Site FIRP Emergency Plan	0.05	2006-2007
P-9.4	Monitor Grit from PLWTP	0.00	2006
P-9.5	Digester Biosolids Storage Flex Piping Installation	0.05	2006
P-10.4A	Cake Pump Controls Upgrade	0.05	2006
P-12.6	Raise Level Sensors In Chemical Containment Cells	0.01	2006
P-13	Combine Polymer Storage & Mixing Systems	0.065	2004 -2006
P-14.1	Pilot Testing of Ferric Chloride Pumps	0.01	2006
P-15.3	Area 94 –Troubleshooting Master Valve Stations	0.02	2006
E-4.1	Fire Alarm System Upgrade	0.15	2006-2008
	TOTAL	**0.51**	

APPENDIX A

Table A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS FOR MBC UPGRADES

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
Process Facilities									
P-1	Pig Retrieval Facility	NCWRP sludge forcemain not pigged since startup.	Trend pipeline pressures and pig pipeline when pressures show an increase.	O	NO	----	$0		
P-2	Raw Solids Receiving	1. Solids accumulation in suction pipe of mixing pumps.	Install flush/drain provisions	M O	NO	2	$40,000	IH	
		2. Lack of tank isolation valves can result in spill.	Install isolation valves at tank walls.	S	NO	1	$100,000	IH	
P-3	Raw Solids Degritting	1. No access to teacups and valves.	Install access platforms and hoist.	M O S	NO	1	$0	DC/BID	BC-3: Under construction
		2. Plugging of flexible grit piping.	Install properly sloped grit flex pipes with flush connections.	M	NO	1	$20,000	IH	
		3. Control strategy problems in operating the degritting system.	Review and tune the control strategy so that system functions automatically	O	NO	2	$0	IH	
		4. Odors from open grit waste lines. Inadequate foul air collection.	Pipe waste line directly to floor sink and enclose the floor sink. Upgrade foul air collection and ventilation system.	P S	NO	2	$120,000	DC	Note: Wasteline reroute done.
P-4	Biosolids Thickening	1. Single access hatch on cake wetwell.	Install a 2nd access hatch.	M O S	NO	2	$300,000	IH/ GRC	Cost is for items 1, 2 and 3.
		2. No lighting in wetwell for viewing.	Provide lighting in the wetwell.	M O S	NO	2	$0	IH/ GRC	ME-60: Design done. For construction.
		3. No mixing of biosolids in wetwell.	Install portable mixing system.	M	NO	2	$0	IH/ GRC	
		4. Plugging at transfer pump suction bells.	Remove loose floor liner and spray apply new liner.	M	NO	2	$10,000	IH /OM	
		5. Insufficient head of the thickened sludge transfer pumps to send flow to the digesters when screens/ blending tanks are by-passed during maintenance work.	Install pipe connection to reduce headloss	C_1	YES	2	$700,000	DC	Cost includes items P-4.5, P-5.1, P-6.1 and P-6.2

JUSTIFICATION CATEGORY:
C1 - MBC Capacity-Related; **C2** - Process System Capacity Related; **O** - Operation; **M** - Maintenance; **S** - Safety
PRIORITY:
Priority 1- Construct 1 to 2 years; **Priority 2**- Construct withing 2 to 5 years; **Priority 3**-Construct within 5 to 10 years; **Priority 4**- Construct after 10 years
DONE BY:
DC- Design Consultant; **IH**- In-House; **OM**- Operations & Maintenance; **GRC**- General Requirements Contracting; **BID**-Advertise Bid and Award Construction

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
P-5	Thickened Biosolids Screening	Sludge screens not in service. Intermittent operation of the thickened sludge transfer pumps configuration caused operational problems and would result in high wear and damage to screens.	Run thickened sludge transfer pumps constantly by providing a 3-way valve and a recycle pipe, downstream of the screens, to route sludge back to the wetwell.	M O	NO	2	$0	DC	
P-6	Thickened Biosolids Blending	1. Undersized digester feed pumps	Replace with higher head pumps.	C_1 M O	YES	2	See P-4.5	DC	
		2. Potential sludge spill from blending tank due to backflow from digesters.	Nine alternative solutions proposed which mitigate blending tank problems.	P S	NO	2	See P-4.5	DC	MBC-10: Alternatives under ME review.
		3. Undersized tank emergency overflow lines.	Same as 2 above	P S	NO	2	$0	DC	
		4. Plugging of sludge heat exchangers.	Relocate and trailer-mount heat exchangers to provide backup heating at the digesters instead.	C_1 M O P	YES	2	$10,000	IH /OM	
P-7	Anaerobic Digestion	1. Corrosion near the ferric injectors could cause digester spill.	Relocate FC injectors. Install double walled chemical piping.	M S	NO	1	$10,000	IH /OM	
		2. Combined digester overflow pipes.	Review overflow system.	C_1 O P	YES	2	$10,000	IH /OM	
		3. Structural damage risk from flawed tank overflow system.	Lower emergency overflow weir.	S	NO	1	$20,000	OM	
		4. Unsable gas generation and foaming due to excessive mixing	Maintain current 2 days per week operation of mixing pumps	O	NO	3	$0	OM	
P-8	Biogas Collection and Storage	1. Inoperative flares during power outage.	Provide emergency power to flares. See E 2.1 for details.	P S	NO	1	$100,000	IH/ GRC	Design Done. Negotiating construction contract.
		2. Condensate accumulation in biogas collection piping.	Continue to monitor biogas system.	O	NO	1	$0	OM	

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
P-9	Digested Biosolids Storage	1. PLWTP inflow surges cause Biosolids Storage Tanks to vent gas. Gas venting problem.	Determine and correct the cause of unstable flows.	C_1 P S	NO	1	$500,000	IH	
		2. Inadequate over pressure protection on the MBC portion of the FIRP pipeline.	Relocate rupture disk so that all on site portions of the FIRP pipeline are protected.	S	YES	1	$50,000	IH	
		3. Inadequate capacity of the dewatered biosolids transfer pumps.	Provided chopper type pumps with the correct Q/ H capacity.	C_1 M O	NO	1	$0	DC/BID	MBC-18: Design done. Under Construction
		4. Excessive grit in PLWTP inflow.	See #3 above. Also, continue to monitor now that PLWTP screens are online.	M	NO	1	$0	IH/OM	
		5. Spill risk from pipe punching through tank wall during a seismic event.	Install pipe expansion joints.	S	NO	2	$50,000	IH/EPM	
P-10	Centrifuge Dewatering	1. Redundancy problem as the standby centrifuge feed pump and polymer feed pump are not always available.	Add two dedicated standby centrifuge feed pumps and two dedicated polymer feed pumps.	C_1 O	YES	2	$1,500,000	DC	
		2. Undersized centrate collection piping system. Centrate backs up into centrifuges and overflows into foul Air duct system.	Complete phases 2 and 3 of this 3-phased project to address safety issues and to increase the capacity of the centrate collection system.	C_1 O M	YES	3	$2,000,000	DC/BID	MBC-3: Phase 1 done. Phase 2-Preliminary design completed.
		3. Scaling and solids cannot be cleaned from the 36" centrate collection pipe in gallery.	Investigate and install access/flush/drain ports on 36" centrate pipeline in gallery.	C_1 M	NO	1	$250,000	IH/EPM/ GRC	MBC-11: For design
		4. Erratic cake pump operation due to short cake bins resulting in increased pump maintenance. This occurs in process P-11 also.	Tune pump controls. Install and evaluate sensor flushing system.	C O	YES	1	$200,000	IH/EPM/ GRC	Preliminary design completed.
		5. No preheating of solids sent to centrifuges due to plugged sludge heat exchangers .	Review the need for heat exchangers. If not needed, remove units to provide space to work on nearby equipment.	O M	NO	4	$0	IH/GRC	
		6. Capacity limitations of centrifuges due to design/ operational constraints (Low hydraulic P.F. of 1.38 used)	Replace 4 of 8 existing centrifuges with 4 new and larger capacity units.	C_1 O M	YES	3	$6,000,000	IH/BID	

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
P-11	Dewatered Biosolids Storage and Loadout	1. Inadequate silo capacity during a "no loadout" weekend especially if a silo is out of service.	Add 2 more storage silos. Evaluate alternatives for additional truck loadout stations.	$\underline{C_1}$ O	YES	2	$8,000,000	DC/BID	
		2. Lime mixers plug frequently and limit cake feed to loadout bins.	By-pass the lime mixers.	C_1 $\underline{M}$ O	YES	1	$500,000	DC/BID	MBC-16: Under ME design. Construction bid package to include P-11.5.
		3. Piping configuration causes multiple trains of equipment to be removed from service when a valve or its actuator fails. Poor and/or unsafe access to these valves results in lengthy repair times impacting capacity.	Evaluate valve accessibility options including the use of scaffolding and provide best alternative.	C_1 $\underline{M}$ O $\underline{S}$	YES	2	$4,500,000	DC/BID	
		4. Leak from chilled water valves can damage MCC room equipment.	Reroute piping, relocate leaky valves and provide condensate drain from AHU.	$\underline{M}$ S	NO	1	$80,000	IH/GRC	
		5. Short landfill operating hours, combined with odor control issue related to on-site storage of loaded trucks, have reduced loadout capacity to the point that operating just one of the two loadouts will not meet production demands.	Provide totally independent, manually operated emergency loadout capabilities by installing direct feed piping from the centrifuges and the storage silos to two new truck loading stations.	$\underline{C_1}$ O	YES	2	$700,000	IH/BID	See P-11.2
		6. Changing regulations will likely require the production of Class A biosolids.	Construct new biosolids truck loadout facility separate from the existing facility.	$\underline{C_1}$ O	YES	4	$20,000,000	DC/BID	

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PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
P-12	Chemical Storage & Handling Systems	1. Motorized pump isolation and routing valves subject to damage by chemical flooding. Valves inaccessible for repair.	Eliminate unnecessary motorized valves. Relocate remaining valves or provide maintenance access.	M O P	NO	1	$1,200,000	DC/BID	MBC-13 and 14: To be designed. Cost is for items P-12.1,12.2,12.3, and 12.4
		2. Dual tank piping does not allow isolation of a single tank for maintenance. Entire chemical system must be shut down.	Evaluate tank piping for improvement.	M O P	NO	1	$0	IH/GRC	
		3. A break in the chemical transfer pipes can drain bulk storage tanks into the gallery.	Install a pipe highpoint to prevent tank siphon	O P S	YES	1	$0	IH/GRC	
		4. Operation of chemical transfer pumps starves the chemical feed pumps because of poor configuration of suction header.	Revise pump suction piping arrangement.	O P	NO	1	$0	DC/ BID	
		5. Electrical conduits penetrate the floor of chemical containment cells and allow migration of chemical to non-contained areas. This creates safety problems and damages equipment and wiring.	Evaluate options for re-routing electrical conduits.	C_1 M O S	NO	1	$600,000	DC	
		6. Perforated roof causes flooding of tanks containment cells which sets off leak detection alarms and shuts down the chemical system.	Raise the level of the liquid sensors to minimize problems. Evaluate installation of a solid roof to eliminate the problem.	O S	NO	1	$10,000	IH/ OM	MBC-2: O&M to do
		7. Unprotected single-walled chemical pipes can be easily damaged causing a chemical spill.	Install secondary containment piping around existing chemical pipes with visual leak indicators.	O P S	NO	1	$200,000	IH/ GRC	
		8. Isolation valves for the bulk chemical tanks can only be operated from within the containment cell.	Provide catwalk access to the valves or replace the existing manual valves with remotely operated motorized valves.	O S	NO	1	$300,000	DC/BID	

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NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
P-13	Polymer Storage & Mixing System	Use of two types of polymer resulted in inefficient use of the polymer mixing equipment and eliminates the redundancy needed for the dewatering process.	As only one polymer type is used at a time, combine the two systems to allow common use of mixing tanks and transfer pumps. This would also correct the lack of redundancy. Plant has accomplished this and is doing functional testing.	$\underline{C_1}$ O	YES	1	$65,000	IH/OM	MBC-24: Piping upgrade completed. New control strategy to be tested.
P-14	Dewatering Ferric Chloride Feed System	1. Original metering pumps have been discontinued and replacement parts will soon be unavailable.	Continue operational testing and performance evaluation of alternative pumps to determine the best selection.	$\underline{M}$ O	NO	1	$10,000	IH/ OM	
		2. The pumps are difficult to maintain due to very poor access.	Reconfigure pump and piping layout when new pumps are selected.	$\underline{M}$	NO	1	$120,000	IH/ GRC	
P-15	Centrate Pumping Station	1. Low capacity of centrate pumps due to higher pressures resulting from scale buildup in the pipe.	Provide the ability to clean the pipe or prevent scale formation.	$\underline{C_1}$ M	YES	1	$250,000	IH/GRC	
		a. Inability to inspect or clean the 36-inch gravity pipline in gallery.	a. Provide inspection ports flushing/ draining connections.						
		2. Wetwell design is not "self-cleaning" and very difficult to manually clean.	Install a hatch directly above the wetwell to allow easy access for vactor trucks. Plant staff is testing the DCS controls strategy.	M	NO	3	$80,000	IH/ GRC	
		3. Even when in MANUAL mode, the motorized isolation valves for pump #2 close by themselves and shut off the pump. Staff has been unable to identify the cause of this problem.	Initiate a trial and error testing approach to replacing components, starting with the cheapest items first: replace the control wiring, then the electrical feed wiring, then the valve master station, etc.	$\underline{C_1}$ M O	YES	1	$20,000	IH/ O&M	

Non-Process Facilities

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
N-1	Wastewater Pumping System	Discharge flow rate from the MBC wastewater pumps is restricted because of capacity issues at the downstream pump station, Muni PS86. Restricting MBC's discharge flow causes wastewater to overflow to centrate pump station which impacts OPRA emissions.	Upgrade WW pumps and by-pass Muni PS86 by extending MBC's discharge pipeline and discharge directly to a gravity trunk sewer.	C_2 P	NO	1	$1,200,000	DC/BID	

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
N-2	Odor Control Facilities	1. Area 60:		C_2 M P	NO	1	$2,400,000	DC/BID	MBC-4: For design
		a. High static pressures on odor fans resulting in low foul air flow	a. Upgrade main odor control fans and address causes of high headloss						
		b. No maintenance access or position indicators for motorized dampers. (Includes access platforms in other areas)	b. Provide access and position indicators						
		c. Excess moisture in ducts and in carbon scrubbers increases pressure losses across the carbon and reduces air flow resulting in capacity loss.	c. Provide a deep in-line sump with a gravity drain line prior to the carbon scrubber.						
		2. Area 76 Grit Room:							
		Open odor sources and poor foul air collection.	Implement B&C's recommended improvements to better capture foul air.	O P S	NO	1	$500,000	DC/BID	
		3. Area 86:	Area 86:						
		a. Poor foul air collection from loadout process creates an unfavorable work environment.	a. Upgrade foul air collection system at truck loading bay.	P S	NO	1	$1,650,000	DC/BID	
		b. Truck exhaust fumes create an unfavorable environment for operators.	b. Provide operator control booth with fresh air supply. Also, evaluate the possibility of using truck exhaust snorkle ducts.	P S		1	$200,000	IH/GRC	Design complete. Negotiating construction contract.
		4. Area 94:							
		a. Low foul air flow through the odor control system.	a. Investigate and correct cause of low air flow.	C_2 M P	NO	1	$250,000	DC/BID	Cost is for N-2.4a and 2.4b
		b. Uncovered centrate wetwell requires that the entire room be ventilated at a higher exchange rate.	b. Cover centrate wetwell and draw foul air from below the cover. Reduce the air exchange rate in the rest of the room.	M O		1	$0		

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
N-3	Plant Water Systems	1. The capacity of the 6-inch potable water (PW) supply to the plant's air gap tanks and the capacity of the process water (PRW) system cannot meet the peak plant water demands when the reclaimed water (RW) supply is interrupted.	Use the plant's 4-inch PW supply to feed additional water into the PRW system. This would require installation of a new air gap tank and 2 new process water pumps at the east end of the pipe gallery. See Figure 4-1 for details.	C_1 O	YES	1	$500,000	DC/BID	Cost is for items N-3.1 & 3.2.
		2. The water supply and the water demands are located on opposite ends of both the PRW and the WU systems. The length of these distribution systems results in low supply pressures which cause process equipment to trip off.	Use the existing 8-inch RW pipe, located at the east end of the pipe gallery, to provide additional water into and stabilize the pressures in the PRW and the UW systems. See Figure 4-1 for details.	C_1 O	YES	1	$0	DC	
		3. The bladders in the hydroneumatic tanks rip immediately after the tanks are placed in service and the manufacturer has been unable to identify the problem. This causes rapid pressure fluctuations in the PRW system as the pumps cycle on and off quickly.	Eliminate the internal bladder by relocating the PRW connection from the top to the bottom of the hydropneumatic tanks.	M O	NO	2	$30,000	IH/OM	
		4. Missing general isolation valves throughout water systems	Install missing isolation valves	O M	NO	1	$200,000	IH	
		5. Missing UPS connection on airgap tank inlet valves	Provide UPS for air gap tank inlet valves	O M	NO	1	$50,000	IH/GRC	

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
N-4	Hot Water System	1. Control problem where the boilers get stuck in low-fire mode. This problem is complicated by COGEN's tie-in location.	Re-evaluate the HWS controls and the location of the COGEN tie-in. Optimize if possible.	O	NO	1	$20,000	IH/OM	
		2. Inefficient operation of MBC's HW secondary loop pumps due to poor design coordination with COGEN's and HWS feed pumps.	Investigate the use of a variable speed drives for COGEN's pump.	O	NO	1		IH/OM	For review with Energy Group
N-5	Chilled Water System	1. Lack of capacity (redundancy) during peak summer demands due to decommissioning of COGEN CWS.	Evaluate adding a 3rd chiller or upgrading the existing ones.	$\underline{C_2}$ O	NO	1	$20,000	IH	
		2. Inefficient operation due to the absence of a 3-way temperature control valve and the location of the COGEN tie-in.	Re-evaluate the CWS controls and the location of the COGEN tie-in. Install a temperature control valve.	O	NO	1	$0		For review with Energy Group
N-6	Storm Water Drainage System	1. Erosion downstream of the west storm water discharge structure.	Eliminate the west discharge structure by re-routing flow to the east discharge structure.	M S	NO	2	$3,000,000	DC/BID	BC-2: Design done. Cost is for items N-6.1 and 6.2
		2. Several process areas, including sludge and chemicals, flow directly to storm drains.	In addition to the above items, provide a new holding tank just prior to the east discharge structure to catch the first flush and any chemical spills. Return the captured flow to the plant's sewer system.	O <u>P</u> S	NO	2	See # 6.1		
		3. Access road erosion caused by poor CALTRANS drainage.	Construct drainage improvements to intercept and re-direct the storm water away from the access road.	M <u>S</u>	NO	1	$100,000	DC/BID	BC-2: Design done. For construction

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

Electrical Facilities

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
E-1	OPS Building (Area 51)	The three UPS's that feed the DCS workstations and the fiber optic hub to COMC are not supported by the emergency generator located in this building. A power outage can result in the loss of critical data as well as a loss in communication to COMC.	Connect the three UPS's in Area 51 to the existing generator as planned under the M&E Contract.	O	NO	1	$10,000	IH	
E-2.1	Digesters Complex (Area 80)	Flares are inoperable during power outages. See P-8.	Connect the electrical panel feeding the flares to the existing generator in Area 76 as planned under the M&E Contract.	P S	NO		$0		See P-8.
E-2.2	Centrifuge Building (Area 76)	During a power outage, foul air and hazardous gases accumulate in the centrifuge building, including the operator control room.	Provide a new external Air Supply Fan to the control room that is independent of the air handling unit. Connect this fan through the generator in this building for back-up power during a power outage. Identify the load on the existing generator to make sure the generator is not overloaded.	S	NO	1	$70,000	IH/EPM	
E-2.3	Centrifuge Building (Area 76)	The UPS's that feed the DCS bridge workstations, Drop 210 and Drop 220, are not supported by the emergency generator located in this building.	Connect the UPS that feeds Drops 210 and 220 to the emergency generator in this area.	C_2 O	NO	1	$50,000	IH	
E-2.4	Centrifuge Building (Area 76)	No lights in Thickened Biosolids wetwell (See P-4.2)	Provide lighting for the wet well as planned under the M&E Contract.	O	NO	1	$0		See P-4.2
E-3	Wastewater Pump Station (Area 94)	No back-up power to any pumps in Area 94. Power outages, either planned or unplanned, can result in on-site sewage spills and can flood the dry well.	Provide a small generator for back-up power for the 15 hp wastewater pump in Area 94.	M P S	NO	1	$250,000	DC/GRC	

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
E-4	Fire Alarm System	Self diagnostic feature for the smoke detectors does not function.	Check the self diagnostic features of the existing Fire Alarm devices to comply with code. Repair/upgrade as needed.	PS	NO	1	$150,000	IH/OM	
E-5	Sub Stations & Main Plant Switchgear	IQ analyzers cannot be serviced or replaced with COGEN on-line. This significantly impacts the ability to service or repair these units.	Provide maintenance and service as needed for the Power Quality Analyzers.		NO		$0	IH	
			Replace IQ Analyzers if needed. Provide coordination with COGEN provider for off season repair or replacement.				$0		
			Investigate ways to service IQ analyzers without having the COGEN off-line.				$0		
E-6.0	Electrical - General	As-Built drawings are not up to date.	Determine a process to update as-built drawings and existing conditions.	----	NO	----	$0	-----	
E-6.1	Electrical-General	Existing UPS's are un reliable, particularly UPS in Areas 51, 60, 70 and 80	Determine reliability of the existing UPS's and identify necessary upgrades.	O	NO	1	$0	DC	
E-6.2	Electrical-General	When a fault is detected on the Utility side the Utility breaker trips and the COGEN goes down resulting in Plant power outage. When the Utility power goes down the COGEN tries to feed the grid and trips off due to overload.	**Alternative Solutions:** 1. Provide Dual Fuel Generating units to feed Bus "B". Utility and COGEN to feed Bus "A".	C_1, O	YES	1	$2,000,000	DC	
			2. Reconfigure switchgear configuration to provide Plant wide diesel standby units.				$0		
			3. Identify all critical loads of the Plant and connect to smaller generators.				$0		
			4. Reconfigure COGEN to connect to main B breaker and landfill demand current COGEN breaker				$0		

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

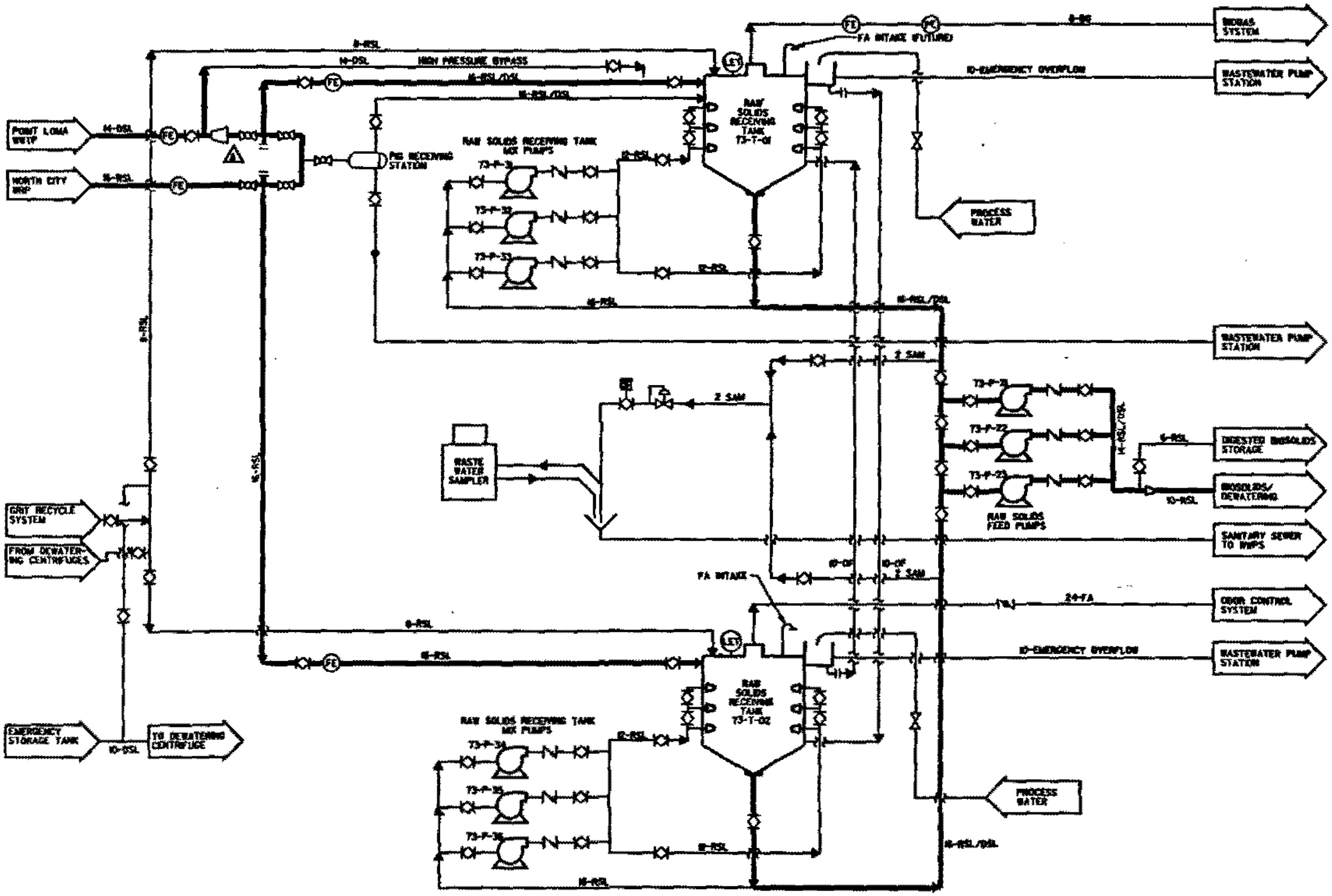
NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
E-6.3	Electrical-General	Utility feed to MBC has not been very reliable, resulting in unpredictable power outages. When SDG&E goes down the COGEN also goes down resulting in complete unreliability of power for the Plant.	Discuss power reliability with SDG&E and provide necessary power upgrades on SDGE side of equipment.	C1	YES		$0		
Instrumentation/ Control Facilities									
C-1	All Areas	I/O limitations, Data Highway #1 & 2 cannot be expanded. #1 is totally maxed-out on I/O & DPU #2 has minimum I/O & DPU available #3 is expandable	Unused or bypassed SID recovery and DPU cleanup can be achieve by reprogramming. Note that this process involves high cost, high man-hours, and down time.	----	----				
C-2	All Areas	Impact on upgrades (alternatives considered, selection, design). Positive impact.	Upgrade to Ovation, and also other peripherals that's not compatible with the system. Costly but will solve most or all problems by having new program & system.	----	----				
C-3	All Areas	Will not know how much I/O space will be able to retrieve before clean-out.	Will have to be studied and planned very carefully before performing to see if it is beneficial than upgrading to Ovation. Will be a big waste of time and money if not well planned and compared to upgrade.	----	----				
C-4	All Areas	DPU database limitations	Database recovery cleaning-up DPU by reprogramming.	----	----				
C-5	All Areas	Historian Optical drive should be upgraded/expanded the new drives are not compatible with the existing software	The software should also be upgraded to work with the new drive. Upgrade to Ovation.	----	----				
C-6	All Areas	DCS reprogramming clean-out will cost a lot of time and money.	Thorough study and planning before performing or upgrade to Ovation.	----	----				
C-7	All Areas	DCS graphics outdated	Reprogram graphics or upgrade to Ovation.	----	----				

TABLE A-1
SUMMARY OF PROBLEMS AND RECOMMENDATIONS
PROCESS, NON-PROCESS, ELECTRICAL AND INSTRUMENTATION/ CONTROL FACILITIES

NO	FACILITY	PROBLEM	RECOMMENDATION	JUSTIFIC'N	CAPACITY LIMITER ?	PRIORITY	COST	DONE BY	REMARKS
C-8	All Areas	The alarms and points disabled are still in the system using space in the I/O & DPU	Reprogramming to retrieve alarm points & I/O. If the recovery is not sufficient for the need to expand the time used and high cost spent will be wasted. The best way is to upgrade to Ovation.	----	----				
C-9	76 Area	Centrifuge expansion on Octopus system by Square D. Outcome not known yet.	If successful, this system can be easily incorporated to Ovation.	----	----				
C-10	All Areas	Limitorque vendors not responsive/lack of support & software not readily available.	Remove the Valve Master Station (VMS) then direct connect to the DCS.	----	----				
C-11	All Areas	Excessive use of valve actuators.	Remove unneeded valve actuators then cleanout the control loop/wiring/etc…	----	----				
C-12	Areas 60, 94	Actuators installed inside chemical containment area.	Relocate the valve actuators above or outside the chemical containment area.	----	----				
C-13	All Areas	Unreliability of Limitorque	Replace with Rotork or equivalent.	----	----				
C-14	All Areas	Limitorque VMS does not have HMI to quick change settings, addressing, and manually manipulating the valves.	Replace with a more reliable Rotork.	----	----				
C-15	Area 76	The VMS located at Area 76 centrifuge level create frequent problems due to bad atmospheric conditions and water wash downs.	Relocate the VMS to Area 76 MCC room for better condition and eliminate water wash down problems.	----	----				
C-16	Areas 70, 51	STAEFA Systems product line discontinued.	Change BCUs' to Allen-Bradley PLC	----	----				
C-17	Areas 70, 51	Not all is monitored or controlled by the DCS.	Replace system control to A-B PLC then interface to the DCS to control the system.	----	----				
C-18	Areas 70, 51	Ethernet link needed to upgrade to newer version of INSIGHT, telephone line will not work.	Replace telephone link with Ethernet.	----	----				
C-19	Areas 70, 51	MS 1800 support is limited due to lack of Siemens staff that is familiar with the program.	Upgrade to Ovation.	----	----				

APPENDIX B

PROCESS FLOW DIAGRAMS



MAIN PROCESS PIPING
(Typ- all diagrams)

FIGURE 1

PROCESS FLOW DIAGRAM
RAW SOLIDS RECEIVING/STORAGE

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05-OCT-2005 08:35

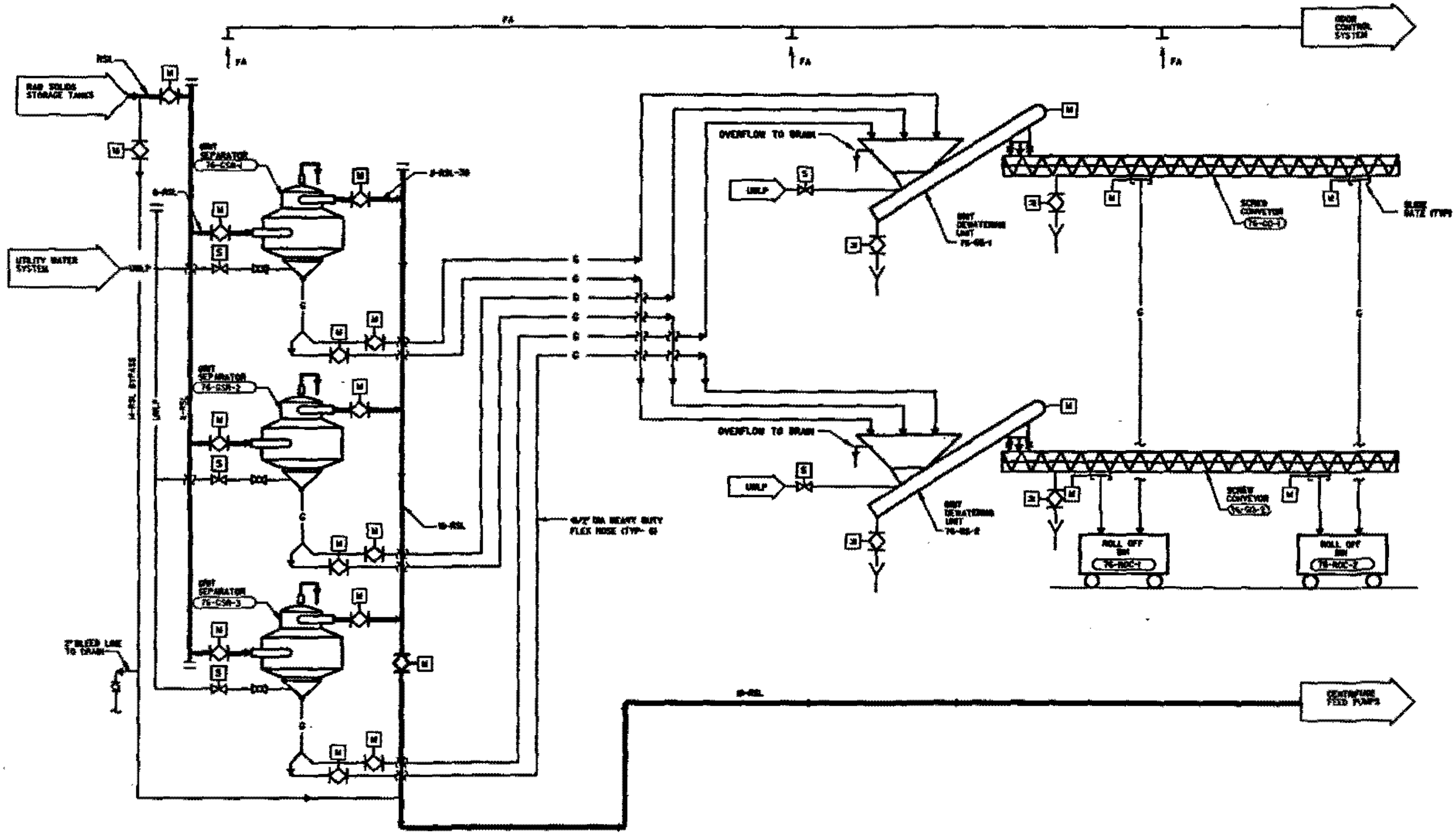

FIGURE 2

PROCESS FLOW DIAGRAM GRIT REMOVAL

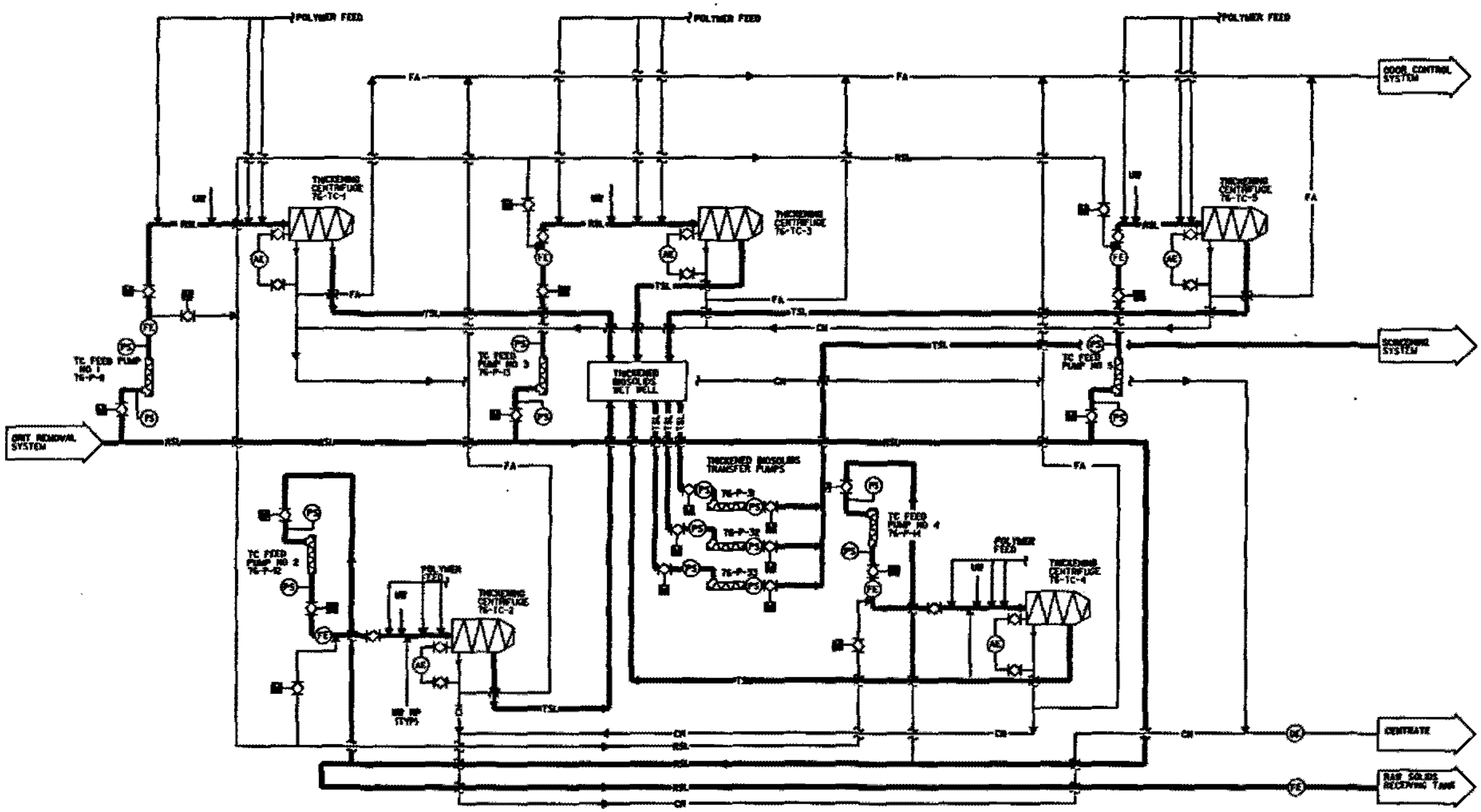

FIGURE 3

PROCESS FLOW DIAGRAM
BIOSOILDS THICKENING

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06-OCT-2005 08:38 cbreve

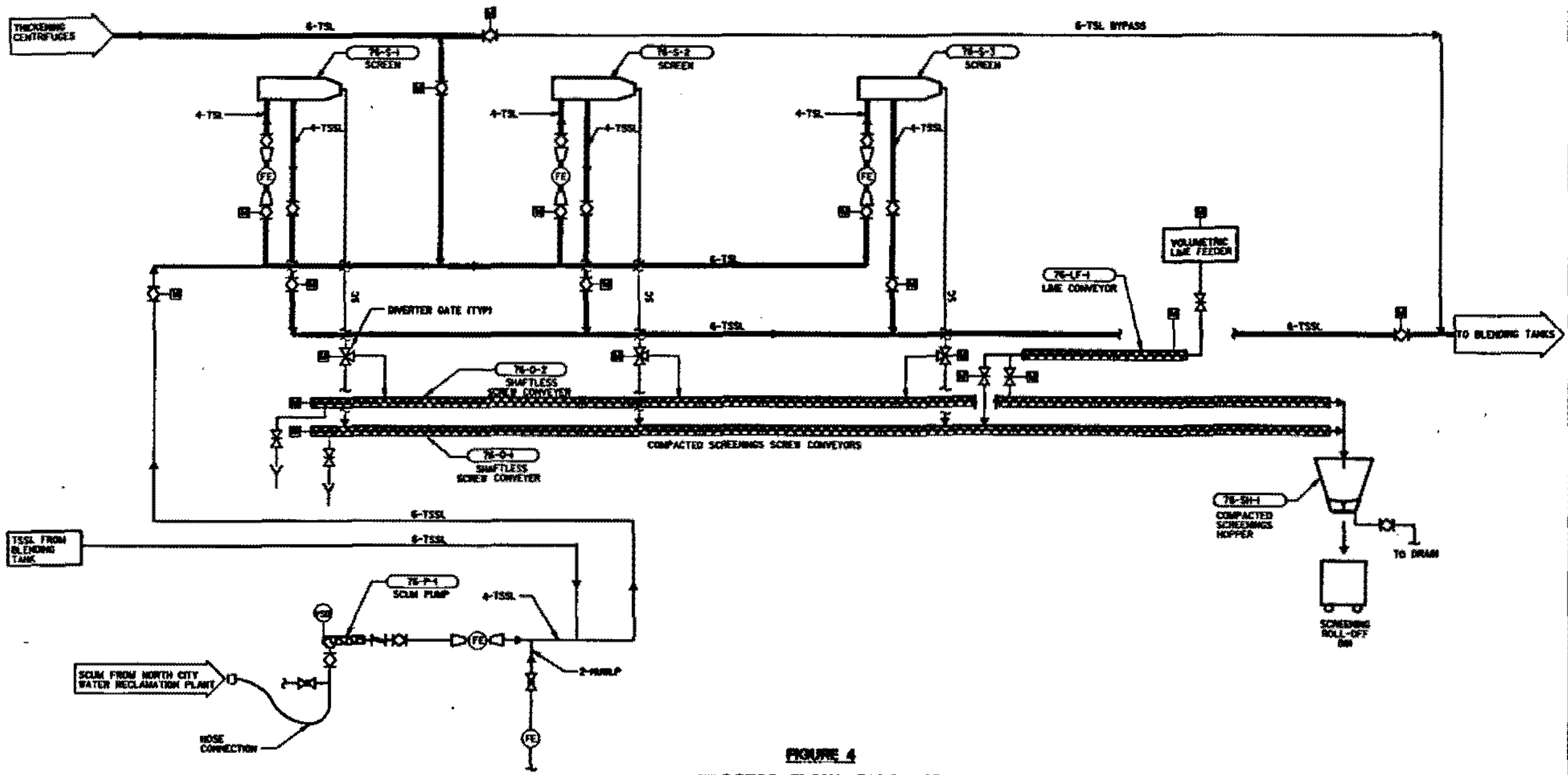

FIGURE 4

PROCESS FLOW DIAGRAM
BIOSOLIDS SCREENING

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05-OCT-2006 08:38

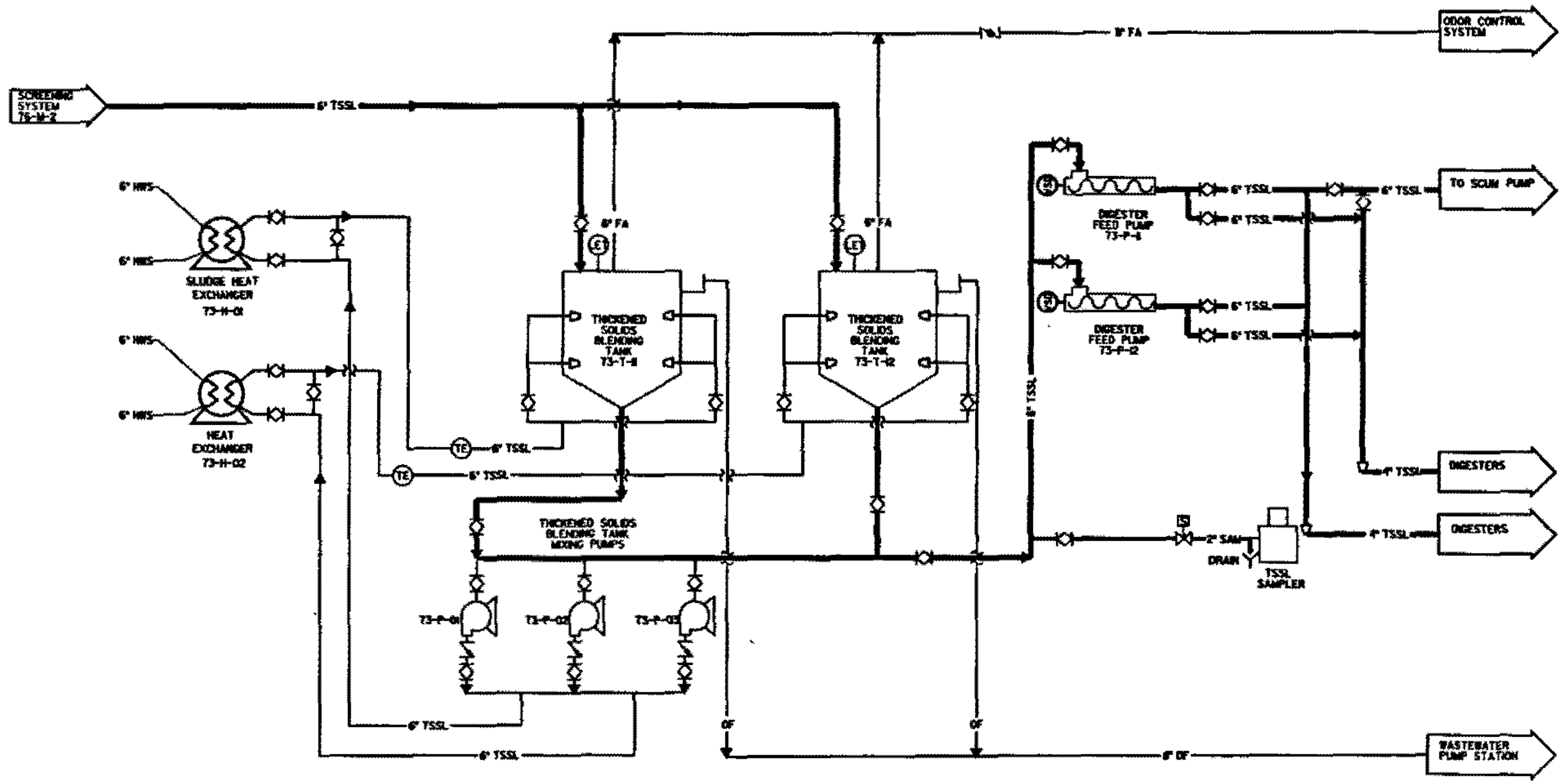

FIGURE 5

PROCESS FLOW DIAGRAM
THICKENED SOLIDS BLENDING STORAGE

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05-OCT-2006 08:38

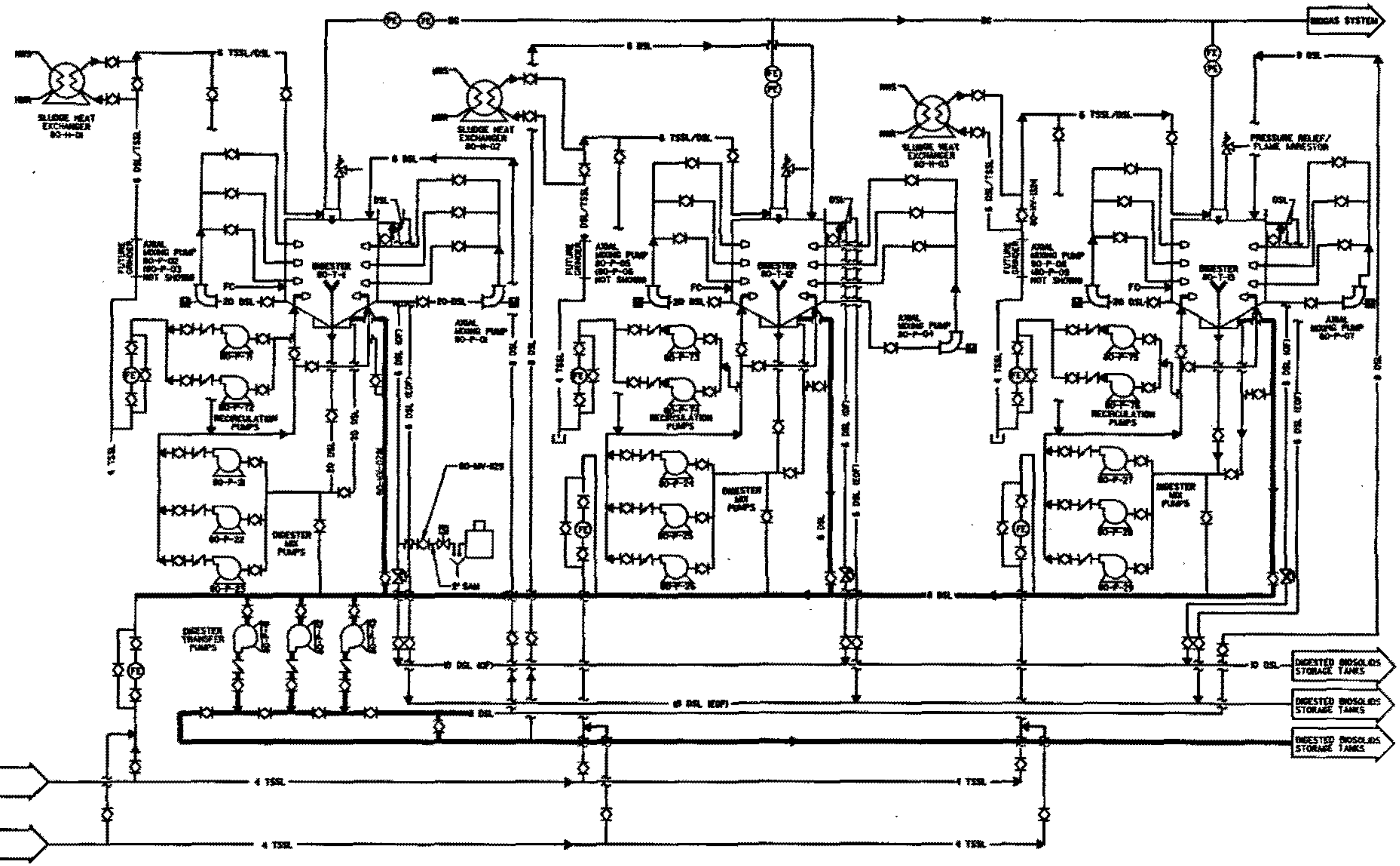

FIGURE 6

PROCESS FLOW DIAGRAM
ANAEROBIC DIGESTION

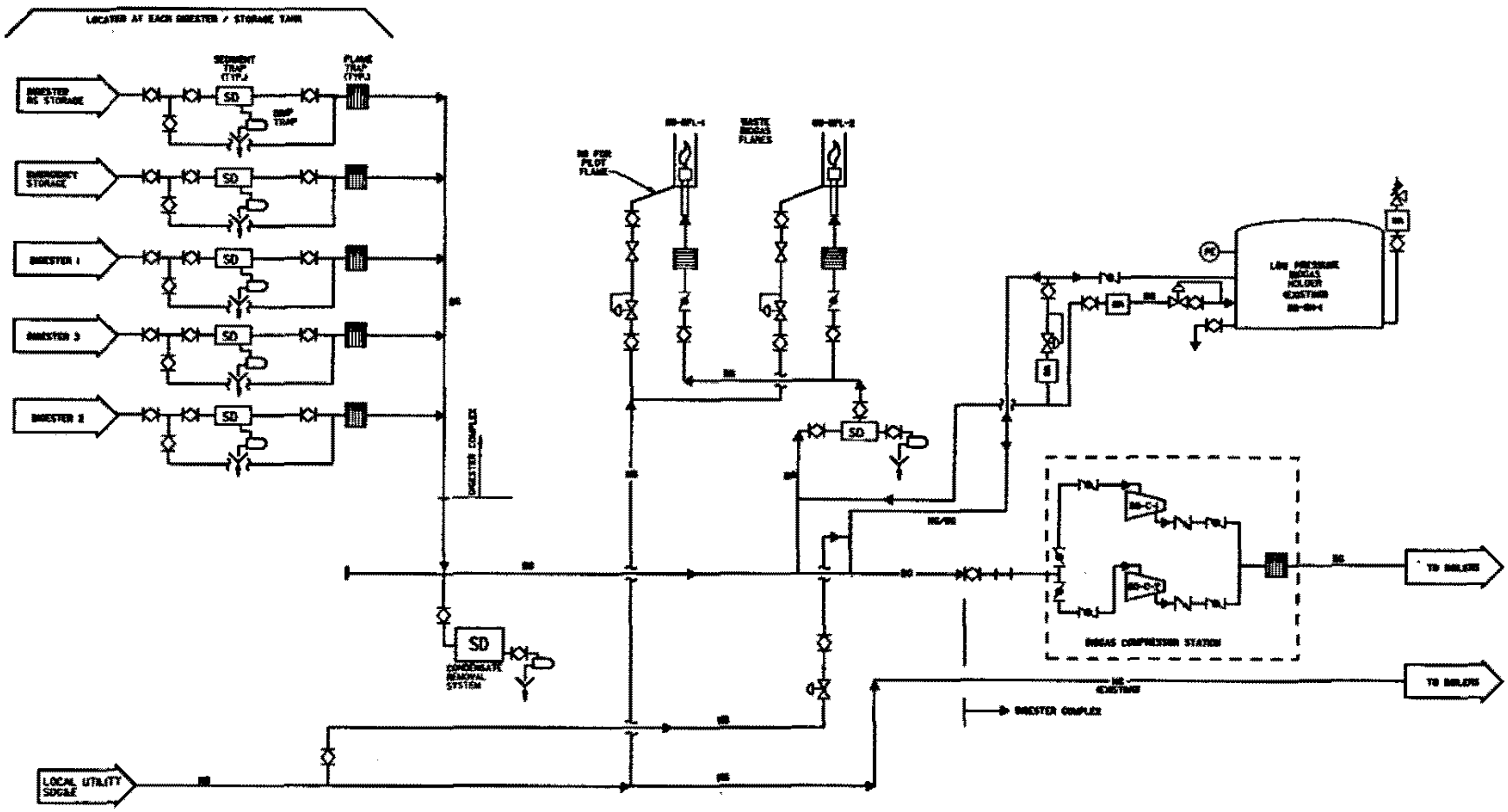

FIGURE 7

PROCESS FLOW DIAGRAM
BIOGAS COMPRESSORS & FLARES

R:\mbo-camp\figure7.dgn ebrave
06-OCT-2006 08:40

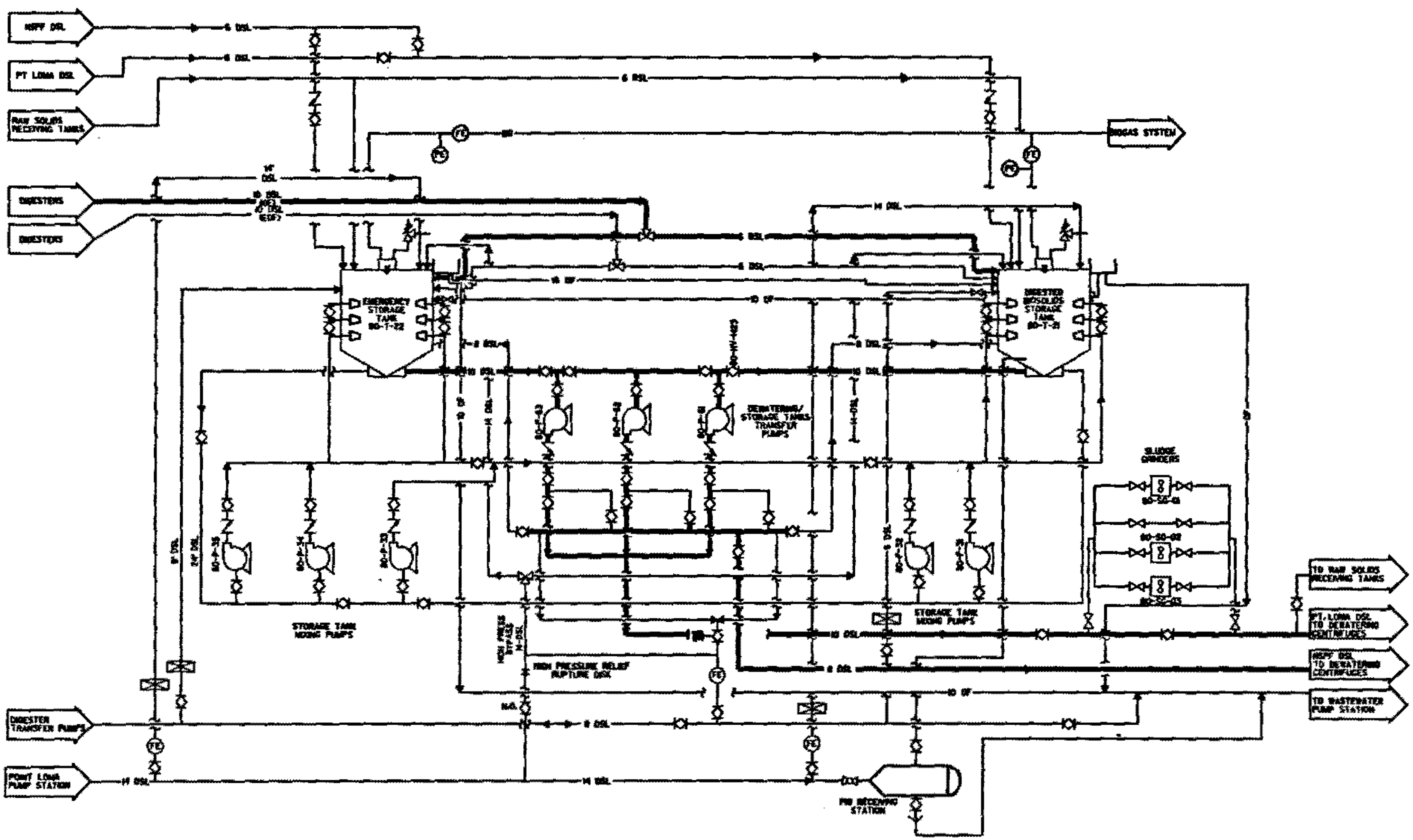

FIGURE 8

PROCESS FLOW DIAGRAM
DIGESTED BIOSOLIDS STORAGE

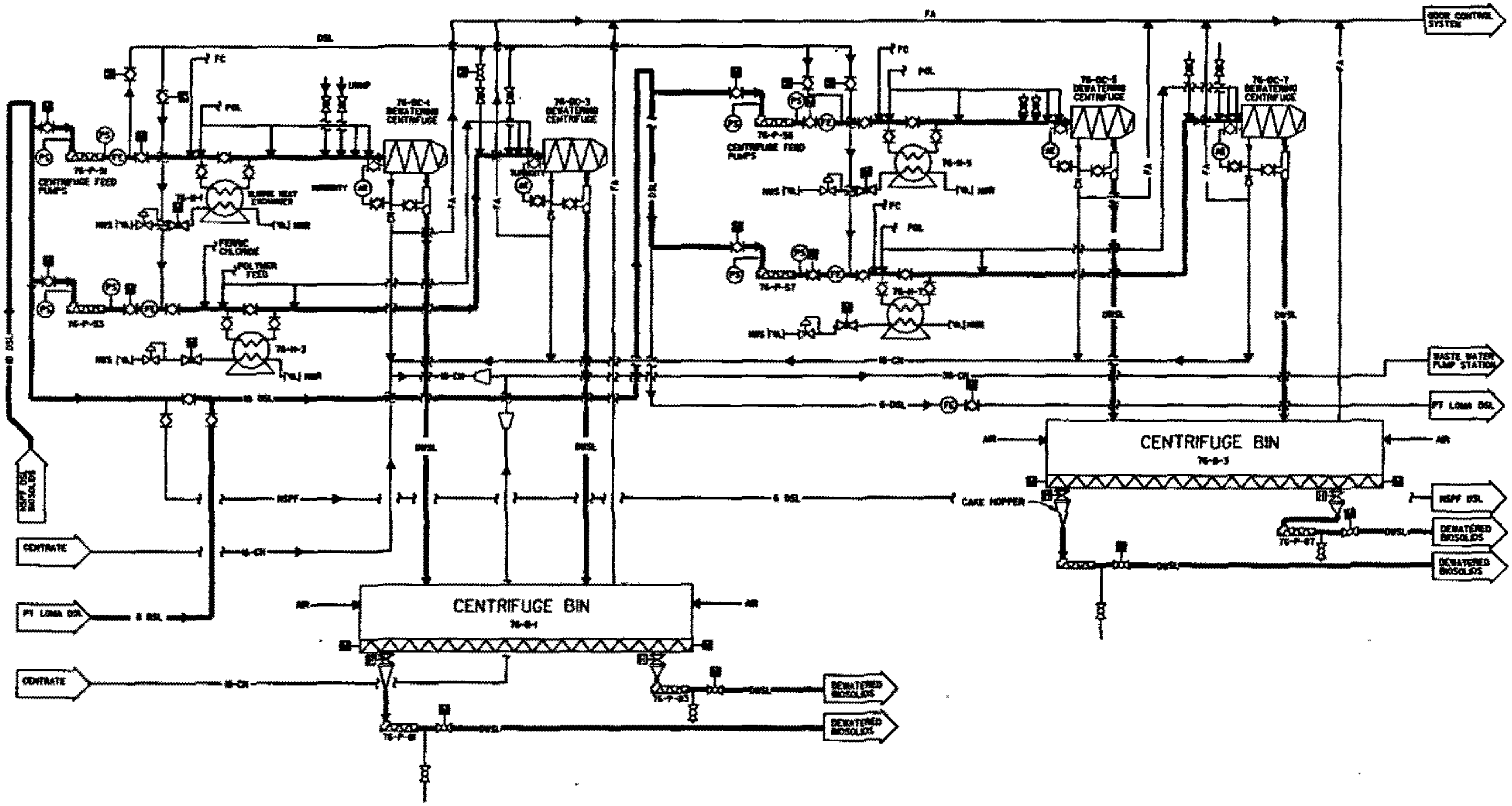

FIGURE 9

PROCESS FLOW DIAGRAM
DEWATERING

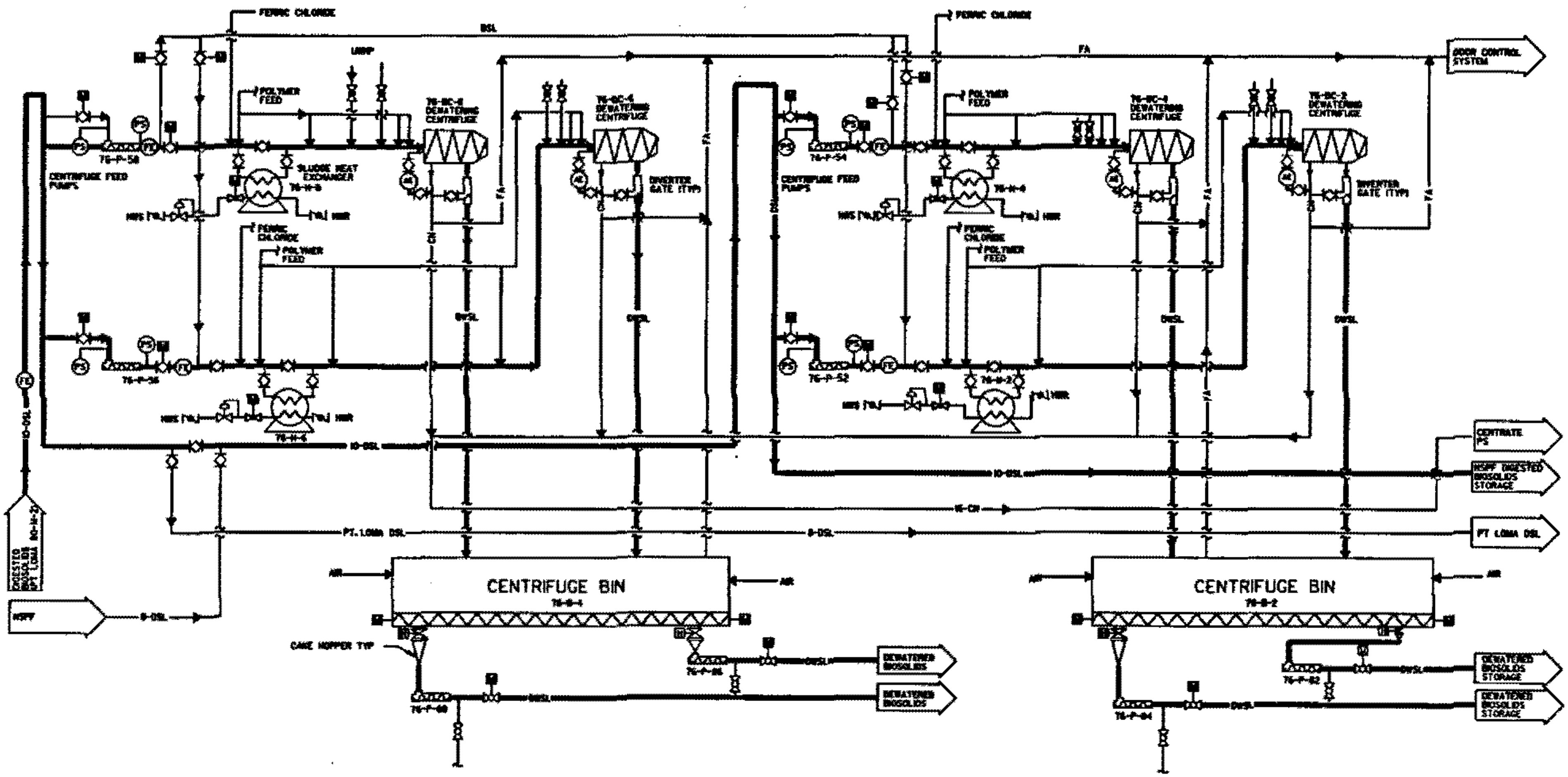

FIGURE 10
PROCESS FLOW DIAGRAM
DEWATERING

R:\mbc-camp\figure10.dgn cbravo
05-OCT-2006 08:42

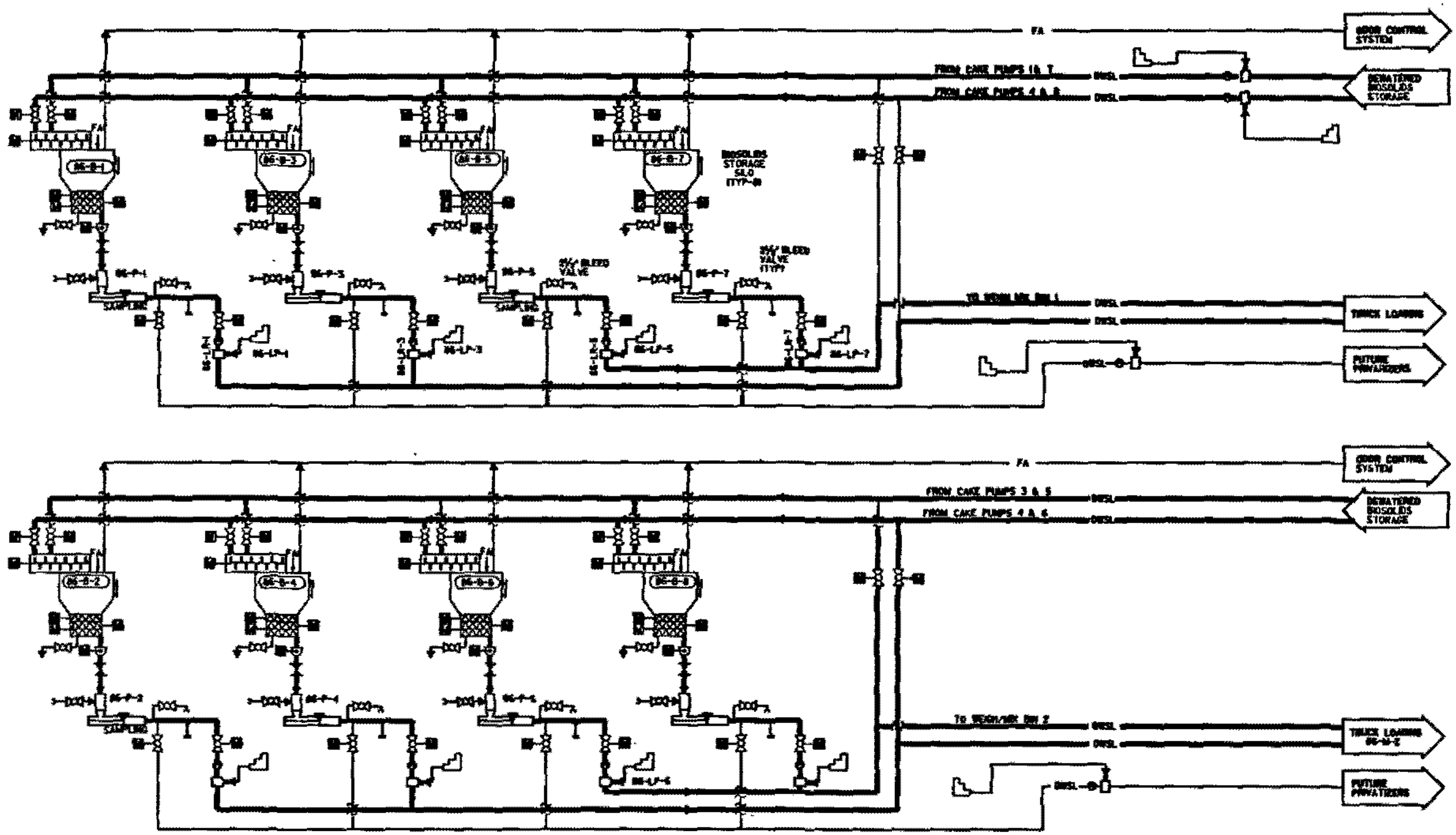

FIGURE 11

PROCESS FLOW DIAGRAM
DEWATERING BIOSOLIDS STORAGE

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06-OCT-2005 08:42

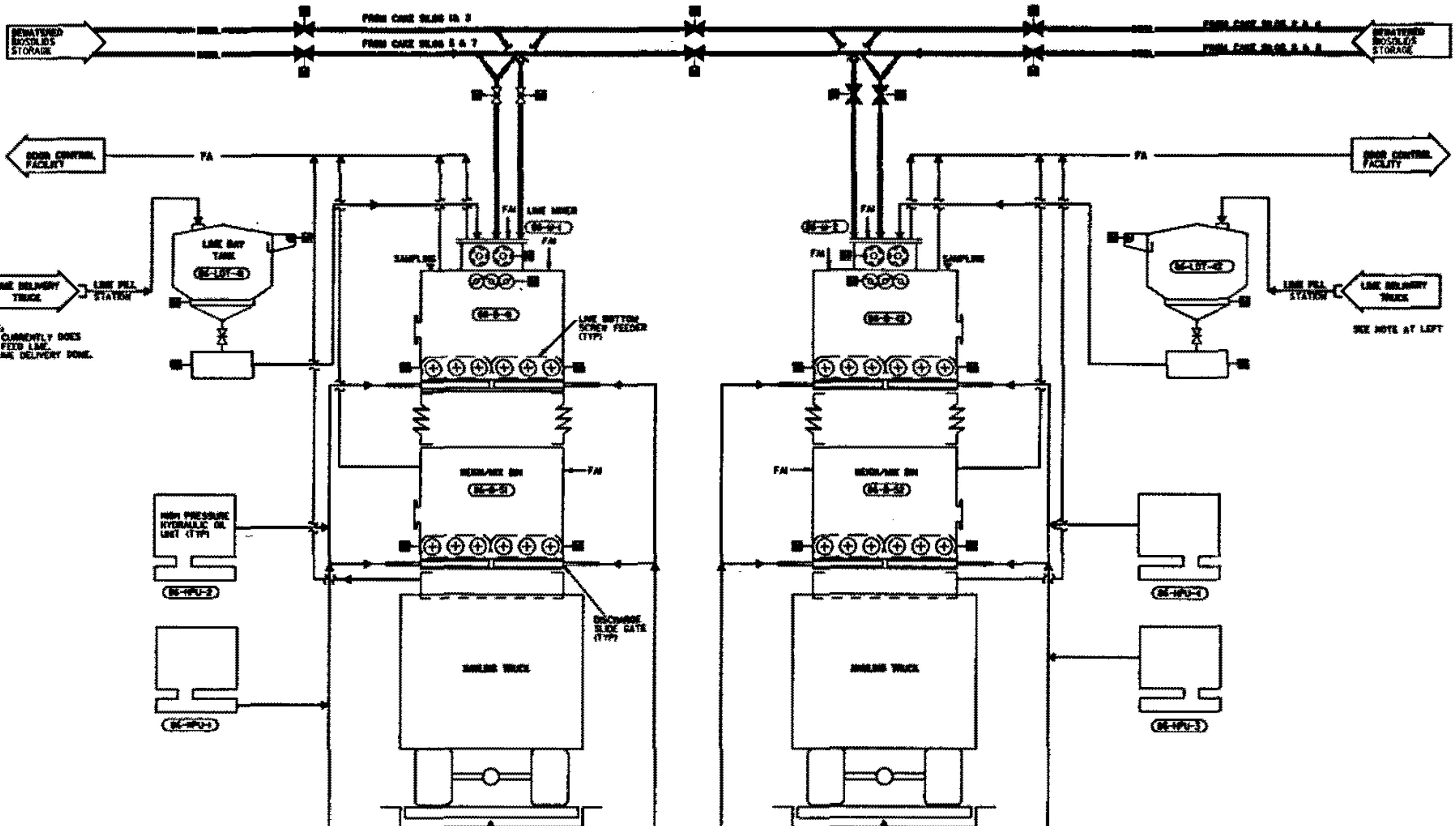

FIGURE 12

PROCESS FLOW DIAGRAM
DEWATERED BIOSOLIDS LOADOUT

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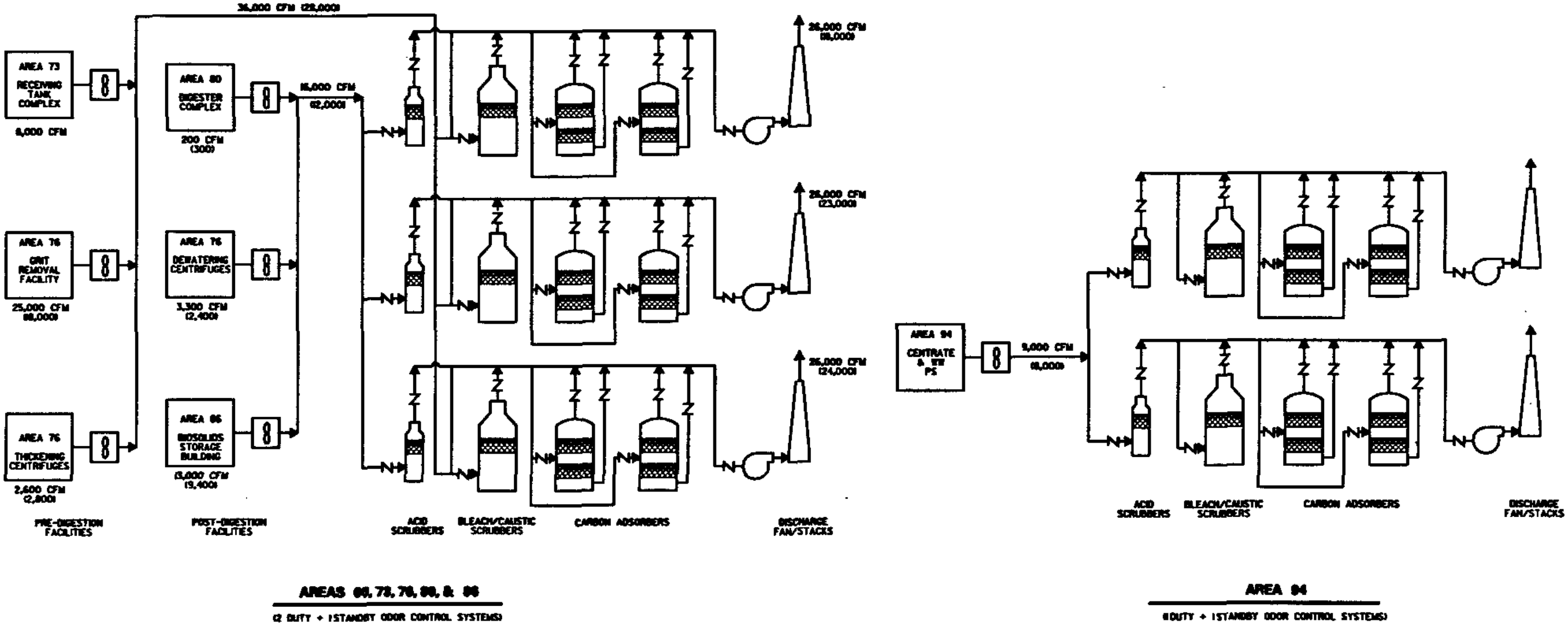
05-OCT-2005 06:45



NOTES:

1. REFERENCE: "MBC AIR BALANCE SUMMARY FINAL TM" BY B&C, FIGURES 1 & 2, NOVEMBER 2003.
2. AIR CFMS SHOWN ARE DESIGN & (ACTUAL)

FIGURE 13

MBC ODOR CONTROL FOUL AIR FLOW DIAGRAMS

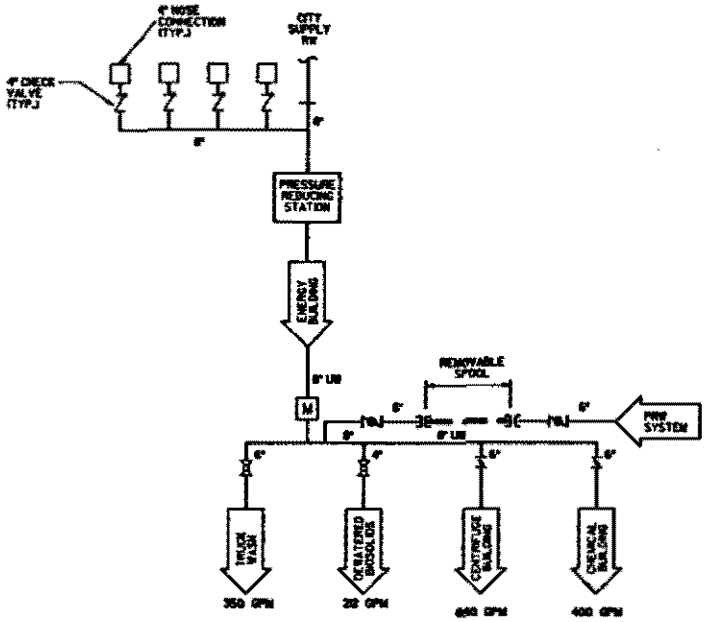


FIGURE 14

UTILITY WATER LOW PRESSURE (UWLP) SYSTEM FLOW DIAGRAM

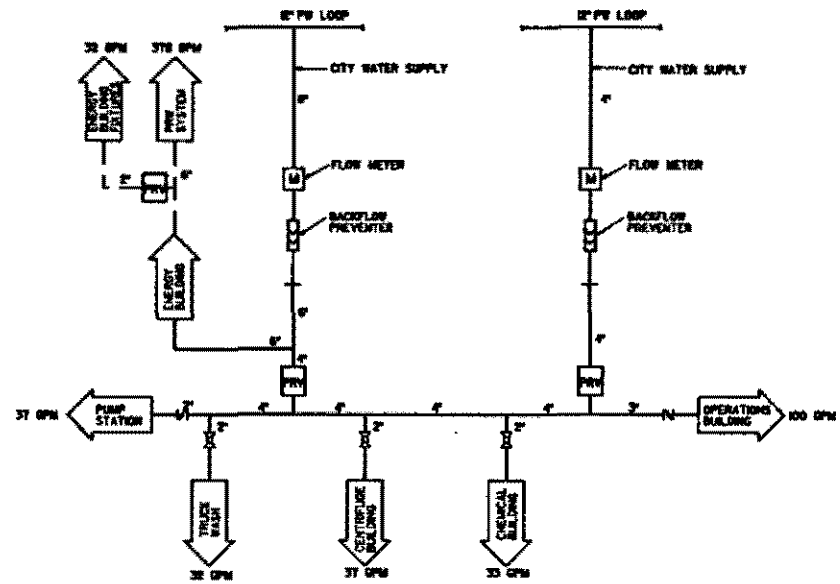


FIGURE 15

POTABLE WATER (PW) SYSTEM FLOW DIAGRAM

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06-OCT-2008 08:44

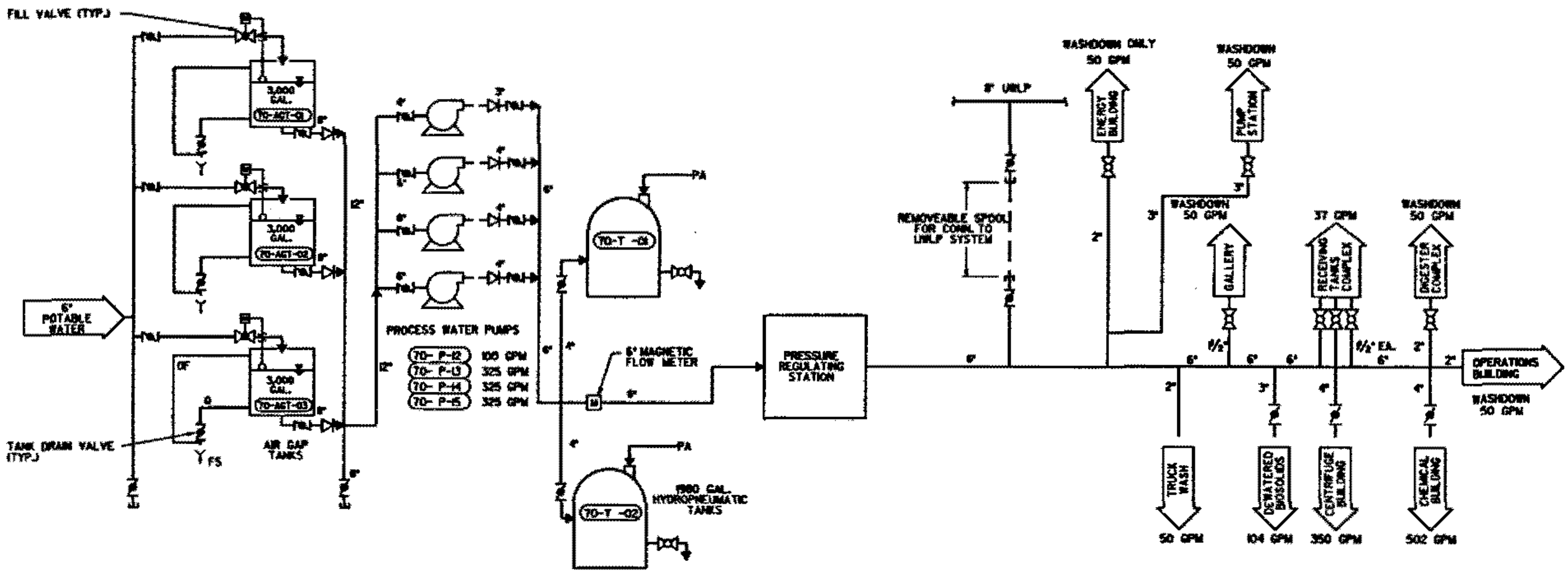

FIGURE 16

PROCESS WATER (PRW) SYSTEM
FLOW DIAGRAM

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05-OCT-2006 08:44

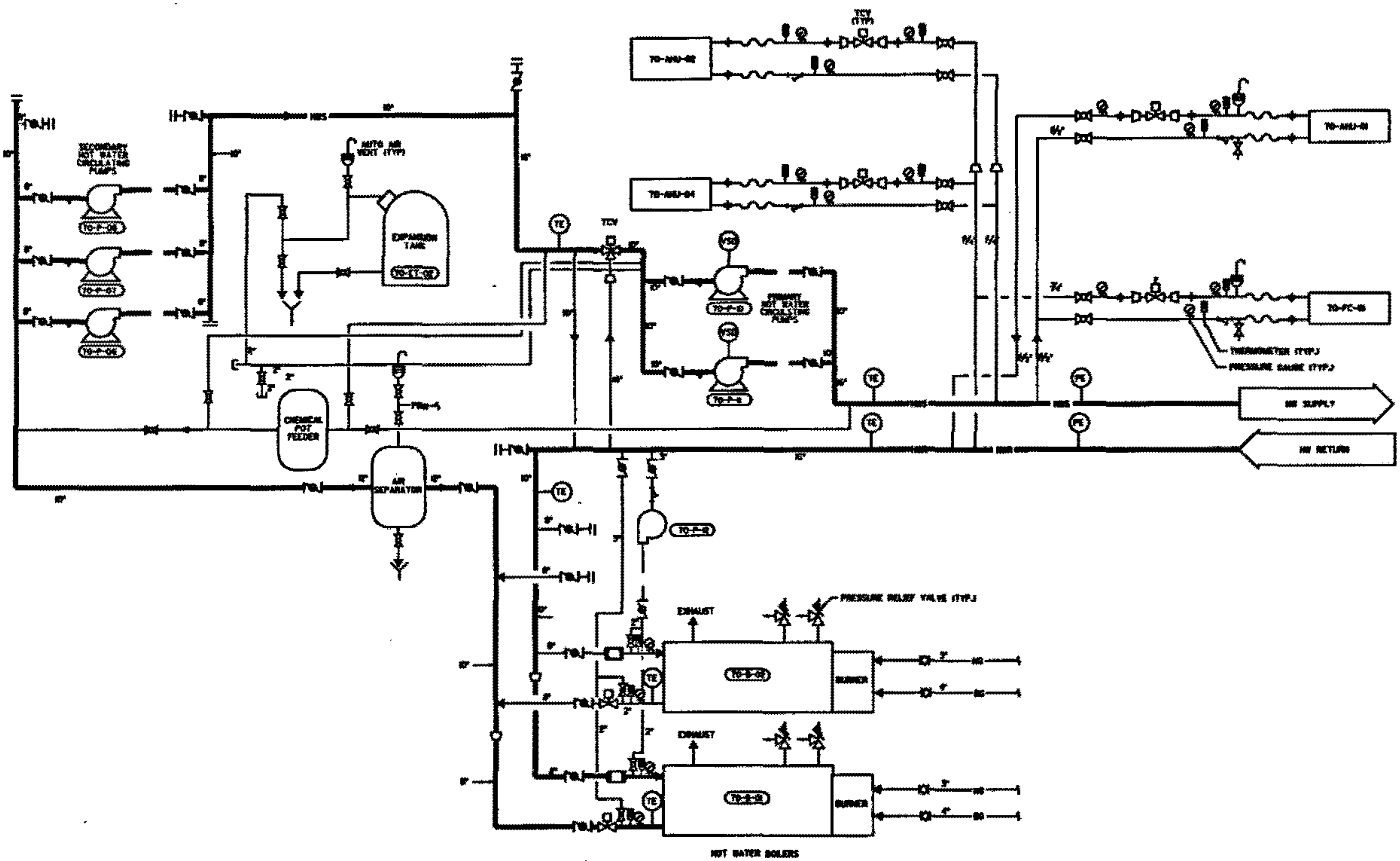

FIGURE 17

HEATING HOT WATER SYSTEM FLOW DIAGRAM

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06-OCT-2006 08:46

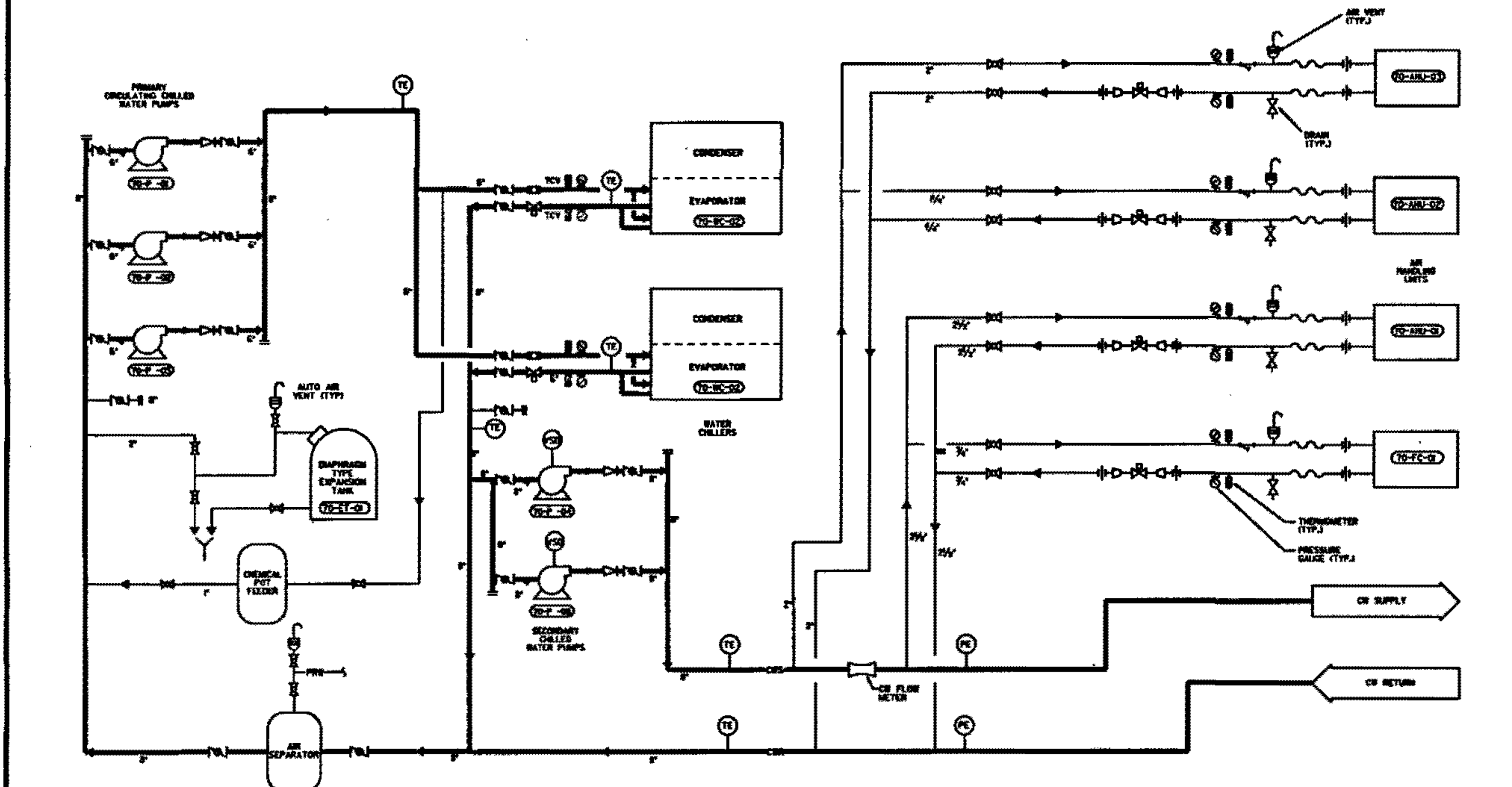

FIGURE 10

CHILLED WATER SYSTEM FLOW DIAGRAM

APPENDIX C

Brown & Caldwell's
Technical Memorandum
On

MBC CAMP- EQUIPMENT UPGRADE
AND EXPANSION

TECHNICAL MEMORANDUM

DATE: Wednesday, October 12, 2005

TO: REY SACRO, CITY OF SANDIEGO

FROM: VICTOR OCCIANO

SUBJECT: MBC CAMP – EQUIPMENT UPGRADES AND EXPANSION (BC Job No. 124901 & 123653) – Revision 2

PURPOSE

The purpose of this study is to estimate the year when certain MBC facilities must be expanded or upgraded to accommodate the growth projected for the MWWD service area. A mass balance model contained in an MSExcel workbook (currently being used for master planning of MWWD facilities) was modified for the analysis.

The MBC facility improvements of interest, as listed in the *MBC UPGRADES PROJECTS 012805*, include the following:

- Project P-10.6 – Replace 4 Dewatering Centrifuges with Larger Capacity Units
- Project P-11.1 - Additional Biosolids Storage Silos
- Project P-11.6 – New Biosolids Truck Loadout Facility

METHODOLOGY

The step-by-step process instituted to arrive at the projected estimates is as follows:

1. **Collect influent and effluent flow, TBOD, and TSS information for PLWTP, NCWRP, SBWRP, and MBC –** The collected data was used to calibrate the mass balance model. The City initially provided Brown and Caldwell (BC) information for the noted facilities for calendar years 1999 to 2003, with only half-year data provided for 2001. The data showed that during 1999 and 2000 calendar years, the TSS and TBOD concentrations in the NCWRP return streams (i.e., wastewater from NCWRP that is returned to the sewers for eventually re-treatment at PLWTP) were

two orders of magnitude higher than what is currently observed. BC and City staff both decided to use data collected for 2001, 2002 and 2003 only for model calibration purposes.

2. **Determine Average, Minimum, Maximum, and 90th and 95th Percentile Values of the Collected Data** - In a meeting held between BC and City staff on March 25, 2005, it was decided to use the 95th percentile values of **7-day rolling averages** in calibrating models for Projects P-11.1 and P-11.6. The group felt that this provided enough margin of safety to ensure that sufficient treatment capacity existed. It was also decided to use the maximum daily values recorded between 2001 and 2003 in calibrating the model for determining upgrade needs of existing dewatering centrifuges, i.e., Project P-10.6. However, this proved to be an extremely high value which may result in ultra conservative output. Therefore, the model runs for evaluating dewatering centrifuges were calibrated based on the 95th percentile of **daily average** values for calibration and TSS and TBOD concentrations assumed for the influent and effluent streams. Data tables are provided in Attachment A.

3. **Calibrate Model –** Model parameters such as percent removal efficiencies for primary sedimentation process, capture efficiencies for thickening and dewatering processes were changed to match the 95th percentile effluent concentrations for daily and 7-day rolling averages.

4. **Determine Calendar Year When Capacities are Reached** – After establishing model parameters that result in closely matching 95th percentile of measured values, the model was run for future flows predicted for the service area at a given year. Flow projections were developed separately by the City using SANDAG population projections and unit generation rates established by the City. These projected flows are included in the workbook as a data base.

   The mass balance model is programmed to ask the model operator for a future calendar year that he/she would like to evaluate. The model then extracts the associated flow from the data base within the workbook and proceeds into an iteration phase until the flows and loads balance. Depending on the project, the amount of digested and dewatered solids is compared against available capacities. If the amount of solids production exceeds the capacity, a lower input year is entered and the iteration step is repeated. If not, a higher input year is entered. This process continues until the capacities and production rate closely match.

MODEL RESULTS

General key assumptions different from previous mass model runs, assumptions specific to each project borne from the calibration runs, and model results are discussed below. Copies of actual model runs are provided in Attachment B.

Revised General Key Assumptions

Revisions in assumptions contained in the original MS Excel workbook provided to Brown and Caldwell by the City (masmdl20a2.xls) are provided in Table 1. Parameters provided in the table were commonly used in all model runs for this project. Most changes were a result of suggestions by City staff intimately familiar with the operation of the facilities/plants indicated.

Table 1
Revisions to Previous Mass Balance Model Parameters
Common to all MBC CAMP Project Model Runs

Item	Old	New
Chemical Sludge Production, lb TSS / lb $FeCl_3$ Added (see Attachment C for backup calculation)	0.7	1.1
Capture of Chemical Sludge, %	95%	100%
Chemical Addition – ferric chloride, mg/L	40	30
Combined Sludge Specific Gravity	1.0	1.01
Thickened Sludge Specific Gravity	1.01	1.03
Combined Sludge VSS Destruction, %	45%	52%
Gas Production Rate, scf/lb VSS destroyed	15	14.5
Digester Influent to Effluent Ratio	1.0	0.99
Digested Sludge Specific Gravity	1.02	1.03
Solids Concentration of Dewatered Sludge, % (w/w)	30%	28%
Solids Recovery in Thickener, %	90%	97%
Thickened Sludge Solids Concentration, % (w/w)	3.0%	3.5%
NCWRP TSS Removal in Primaries	60%	65%
NCWRP TBOD Removal in Primaries	35%	38%
NCWRP Secondary MLTSS Concentration, mg/L	2800	2155
NCWRP MCRT, days	5	5.86
NCWRP $FeCl_3$ Addition, mg/L	15	10
$FeCl_3$ Solution Strength, %	40%	44%
$FeCl_3$ Solution Specific Gravity	1.31	1.467

For all MBC CAMP model runs, it was assumed that NCWRP and SBWRP were the only wastewater treatment plants in service and that they produce secondary effluent. The NCWRP effluent was assumed to be returned to the sewer for re-treatment at PLWTP and the SBWRP effluent was disposed through the South Bay Ocean Outfall. PLWTP is assumed to continue operating as an advanced primary treatment plant. Model runs were performed only up to the year 2025. At this time, the current Master Plan indicates that the Southern Sludge Processing Facility and a South Bay Secondary Treatment Plant will be in service. Solids from the SBWRP will then be processed at the new facility, relieving the MBC of the need to process these solids.

Project P-10.6 – Replace 4 Dewatering Centrifuges with Larger Capacity Units

Revisions made in the original Mass Balance model resulting from the calibration run for Project P-11.0 are presented in Table 2. Note that the calibration run was based on the 95th percentile of **daily average** values for calendar year 2001-2003.

Table 2
Revisions Made in Previous Mass Balance Model for MBC CAMP Project P-11.0

Item	Old	New
TBOD Concentration - Total MSS, mg/L	284	317
TBOD Concentration – PQPS & NCWRP, mg/L	225	282
TBOD Concentration – SBWRP, mg/L	300	468
TSS Concentration - Total MSS, mg/L	293	296
TSS Concentration – PQPS & NCWRP, mg/L	225	278
TSS Concentration – SBWRP, mg/L	275	528
PLWTP Removal of MSS and Retreat TSS, %	86.3%	82.9%
PLWTP Removal of TSS in Recycle and Thickening & Dewatering Centrate, %	85%	82.9%
PLWTP Overall Removal of TBOD, %	60%	59.0%
Solids Recovery in Thickeners & Dewatering Centrifuges, %	95%	82.5%
NCWRP Secondary Effluent TSS Concentration, mg/L	9	5.7
NCWRP Secondary Effluent TBOD Concentration, mg/L	9	7.0
SBWRP Chemical Addition, mg/L	15	0
SBWRP Secondary Effluent TSS Concentration, mg/L	9	10.3
SBWRP Secondary Effluent TBOD Concentration, mg/L	9	23.4

Additional assumptions made regarding the dewatering centrifuges include the following:

- Six of the eight dewatering centrifuges are in operation (i.e., two are in standby mode at all times)
- Each existing centrifuge can process up to 225 gpm (average) or 300 gpm (peak) of digested sludge; average capacity was used in determining expansion needs
- 3.0% Solids content in digested sludge

Results

The existing dewatering centrifuges at MBC are adequate until the year 2025. Therefore, upgrade or expansion is unnecessary up to the planning horizon of for this evaluation study. Any modifications will be driven by the equipment useful lives.

Project P-11.1 - Additional Biosolids Storage Silos

Revisions made in the original mass balance model resulting from the calibration run for Projects P-11.1 and P-11.6 are reported in Table 3. Note that the calibration run was based on the 95th percentile of **7-day running average** values for calendar year 2001-2003.

Table 3
Revisions Made in Previous Mass Balance Model for MBC CAMP Project P-11.1 & P-11.6

Item	Old	New
TBOD Concentration - Total MSS, mg/L	284	300
TBOD Concentration – PQPS & NCWRP, mg/L	225	256
TBOD Concentration – SBWRP, mg/L	300	365
TSS Concentration - Total MSS, mg/L	293	273
TSS Concentration – PQPS & NCWRP, mg/L	225	272

Table 3
Revisions Made in Previous Mass Balance Model for MBC CAMP Project P-11.1 & P-11.6

Item	Old	New
TSS Concentration – SBWRP, mg/L	275	376
PLWTP Removal of MSS and Retreat TSS, %	86.3%	82.7%
PLWTP Removal of TSS in Recycle and Thickening & Dewatering Centrate, %	85%	82.7%
PLWTP Overall Removal of TBOD, %	60%	59.2%
Solids Recovery in Thickeners & Dewatering Centrifuges, %	95%	80%
NCWRP Secondary Effluent TSS Concentration, mg/L	9	4.9
NCWRP Secondary Effluent TBOD Concentration, mg/L	9	5.9
SBWRP Chemical Addition, mg/L	15	0
SBWRP Secondary Effluent TSS Concentration, mg/L	9	7.7
SBWRP Secondary Effluent TBOD Concentration, mg/L	9	9.8

Additional assumptions made specific to the operation of the existing silos that impact capacity estimates include the following:

- Dewatering centrifuges produce a dewatered cake that is 28% solids
- Maximum storage capacity required is equivalent to the amount of dewatered cake produced in 2.63 or 3.63 days, i.e., two scenarios were evaluated
- One or two silos were out of service (again, two scenarios were evaluated)
- Each silo has a maximum storage capacity of 6,950 ft^3, however, only 90% of the volume can be used on a daily basis

Results

The required upgrades are summarized in Table 4 below.

Table 4
Recommended Startup Year for MBC CAMP Silo Upgrades Under Various Scenarios

Scenario		Recommended Startup Year[a]
Storage Provided (days)	Number in Operation	
3.63	6 out of 8	Capacity Currently Exceeded
3.63	8 out of 8	Capacity Currently Exceeded
2.63	7 out of 8	2014
3.63	10 out of 12	2017
2.63	8 out of 10	Beyond 2025
3.63	11 out of 13	Beyond 2025

(a) Indicates when capacity of the operating silos noted is exceeded and startup of new silos required.

The storage time requirement was determined as follows:

Table 5
Determination of Maximum Downtime for Silos for Estimating Required Capacity
(Holiday Falls on Friday)

Condition	Hours of Downtime for Silos					Total (Days)
	Thursday (stop at 15:00)	Friday (HOLIDAY)	Sat	Sun	Mon (start at 06:00)	
No work on Sat. & Holiday	9	24	24	24	6	87/24 = 3.63 d
Work on Saturday	9	24	6 9	24	6	Max down time 39/24 = 1.63 d

Table 6
Determination of Maximum Downtime for Silos for Estimating Required Capacity
(Holiday Falls on Monday)

Condition	Hours of Downtime for Silos					Total (Days)
	Friday (stop at 15:00)	Sat	Sun	Mon (HOLIDAY)	Tues (start at 06:00)	
No work on Sat. & Holiday	9	24	24	24	6	87/24 = 3.63 d
Work on Saturday		9	24	24	6	Max down time 63/24 = 2.63 d

The 2.63 days of storage assumes two days of down time (i.e., weekend day plus a Monday holiday) plus 15 hours between shutdown and startup. This was selected for determination of required silo capacity because it represented the worst-case scenario for a holiday event that includes a Saturday workday. The 3.63 days of storage requirement assumes that the facility is closed on Saturdays.

If only one silo is required for back up (i.e., 7 of the existing 8 silos are in operation) and if 2.63 days of storage must be provided, the existing silos provide adequate capacity until 2014. However, if 3.63 days of storage is required, four additional silos would be required to provide capacity up to year 2017. Furthermore, to provide sufficient capacity beyond year 2025 (when the southern sludge processing facility will be in service) with two units in standby, two silos must be constructed under the 2.63 days of storage scenario or five silos (for a total of 13 silos) if 3.63 days of storage is required.

Project P-11.6 – New Biosolids Truck Loadout Facility

Model revisions shown in Table 3 are valid for Project P-11.6 as well since this MBC project also uses the 95th percentile of 7-day averages for calibration. Additional assumptions specifically related to the Truck Loadout Facility include the following:

- Each bay has the capacity to hold 648 ft^3 of dewatered sludge per load
- Two bays are available at all times
- Each truck requires 25 minutes drive in, accept a load, and drive out
- Cake pumps are capable of transferring biosolids from the silos to the truck loadout within the assumed loading duration noted above
- Bays are only open 5 or 6 days per week and 8 or more hours per day (various scenarios evaluated as indicated in Table 7)
- Truck loadout opens one hour extra than the hours indicated on Table 7 to account for startup and cleanup time at the beginning and end of each work day

Results

The required upgrades are summarized in Table 7 below.

Table 7
Recommended Startup Year for MBC CAMP Truck Loadout Upgrades Under Various Scenarios

Loadout Operation		Recommended Startup Year(b)
Number of Days per Week	Number Hours per Day(a)	
5	8	2014
6	8	Beyond 2025
5	9.1	Beyond 2025

(a) Hours indicated represents actual operating hours of the loadout facility. Building opens one hour extra to account for startup and cleanup at the beginning and end of each work day. Work period exceeding eight hours may require special agreement with the landfill operator.
(b) Indicates when capacity of the operating units noted is exceeded and startup of new units required.

At 5 days per week operation and 8 hours per day, two truck loadout bays are adequate until 2014. If the City chooses to operate on Saturdays, the existing bays are adequate beyond the year 2025. This can also be achieved without operating on Saturdays by simply allowing loadout operations to continue for a little over 9 hours per day for five days a week (work period exceeding eight hours may require special agreement with the landfill operator).

CONCLUSION/RECOMMENDATIONS

Recommended startup years for the MBC expansion projects are provided in Table 8 under various scenarios for each project.

Table 8
Recommended Startup Year for MBC CAMP Projects

Project Number, Name and Scenarios	Recommended Startup Year[a]
P-10.6 – Replace 4 Dewatering Centrifuges with Larger Capacity Units	Beyond 2025
P-11.1 – Additional Biosolids Storage Silos	
• 3.63 days storage; 6 of 8 in Operation	• Currently Exceeds Capacity
• 3.63 days storage; 8 of 8 in Operation	• Currently Exceeds Capacity
• 2.63 days storage; 7 of 8 in Operation	• 2014
• 3.63 days storage; 10 of 12 in Operation – Expansion has Occurred	• 2017
• 2.63 days storage; 8 of 10 in Operation – Expansion has Occurred	• Beyond 2025
• 3.63 days storage; 11 of 13 in Operation – Expansion has Occurred	• Beyond 2025
P-11.6 – New Biosolids Truck Loadout Facility	
• 2 Bays in Operation; 5 days/week; 8 hours/day	• 2014
• 2 Bays in Operation; 6 days/week; 8 hours/day	• Beyond 2025
• 2 Bays in Operation; 5 days/week; 9.1 hours/day	• Beyond 2025

(a) Indicates when capacity of the operating units noted is exceeded and startup of new units required.

Since additional data can improve the accuracy of the model, follow-up model runs are recommended when more data are available.

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File

SUB-APPENDIX A

2001 – 2003 MWWD DATA TABLES

City of San Diego MWWD
2001-2003 Daily and 7-Day Averages, Minimum, Maximum, and 90th and 95th Percentiles
for MBC, PLWTP, SBWRP, and NCWRP

	MBC					
	Centrate Flow (mgd)		TSS Conc. (mg/L)		BOD Conc. (mg/L)	
Date	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg
2001						
Average	2.232	2.24	693	698	359	357
Minimum	0.980	1.34	195	253	67	193
Maximum	3.318	2.54	12,600	6,046	4,120	2,488
90%tile	2.50	2.38	874	752	485	448
95%tile	2.62	2.43	997	1,088	550	538
2002						
Average	2.254	2.25	677	673	307	311
Minimum	0.602	1.22	140	309	67	184
Maximum	2.988	2.55	9,840	3,893	2,270	1,214
90%tile	2.57	2.46	980	1,104	406	395
95%tile	2.65	2.49	1,417	1,512	480	507
2003						
Average	2.307	2.31	684	690	287	284
Minimum	0.770	1.14	105	304	67	167
Maximum	3.028	2.68	15,000	3,504	1,380	587
90%tile	2.74	2.58	867	1,124	415	371
95%tile	2.85	2.62	1,355	1,318	477	421
OVERALL						
Average	2.256	2.26	685	686	324	324
Minimum	0.602	1.14	105	1	67	1
Maximum	3.318	2.68	15,000	3	4,120	3
90%tile	2.61	2.49	900	902	442	411
95%tile	2.71	2.52	1,320	1,466	523	514

City of San Diego MWWD
2001-2003 Daily and 7-Day Averages, Minimum, Maximum, and 90th and 95th Percentiles for MBC, PLWTP, SBWRP, and NCWRP

Point Loma

	Influent Flow (mgd)		Infl. TSS Conc. (mg/L)		Eff TSS Conc. (mg/L)		TSS Removal Rate (%)		Sys Wide TSS Removal (%)		Infl. BOD Conc. (mg/L)		Eff BOD Conc. (mg/L)		BOD Removal (%)	
Date	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg
2001																
Average	174.7	174.8	274.7	274.2	41.4	41.7	85.04%	85.01%	85.35%	85.30%	257	253.1	95	93.6	62.17%	62.17%
Minimum	151.3	165.9	186.0	250.4	19.0	22.9	76.92%	80.92%	77.00%	81.14%	165	200.3	64	72.4	42.42%	50.56%
Maximum	221.6	201.3	417.0	326.1	60.0	55.0	94.67%	92.27%	92.00%	90.29%	446	292.4	224	123.4	74.16%	69.75%
90%tile	183.06	183.7	299.60	286.5	51.00	50.2	89.08%	88.90%	88.00%	87.61%	281.10	273.3	112.00	106.0	68.97%	66.74%
95%tile	189.78	190.9	321.00	290.7	53.00	51.4	91.73%	91.19%	89.00%	88.73%	290.55	276.7	117.60	107.6	70.22%	67.35%
2002																
Average	168.8	168.8	285.7	286.0	43.5	43.5	84.21%	84.20%	84.02%	84.16%	265	265.2	94	93.7	64.61%	64.59%
Minimum	154.9	162.1	23.0	224.1	28.0	33.7	-56.52%	63.57%	57.00%	63.57%	178	240.4	60	74.6	37.46%	53.12%
Maximum	188.6	180.8	397.0	343.4	69.0	58.0	90.11%	88.17%	93.00%	89.14%	369	295.9	177	119.7	77.03%	73.00%
90%tile	174.26	172.5	321.00	302.8	51.00	50.1	87.50%	86.55%	88.00%	87.51%	288.00	279.2	112.00	109.9	71.08%	69.65%
95%tile	176.46	174.0	328.80	311.4	55.00	51.8	88.33%	87.15%	89.00%	88.14%	300.00	287.5	117.00	113.4	72.32%	70.24%
2003																
Average	171.8	171.9	289.9	290.0	42.2	42.2	85.33%	85.34%	85.96%	85.69%	270	269.9	107	106.6	60.20%	60.40%
Minimum	158.1	163.2	225.0	252.6	26.5	32.5	77.49%	81.05%	62.43%	72.48%	206	224.9	70	85.2	40.96%	53.35%
Maximum	223.2	197.9	399.0	321.9	68.9	52.8	91.88%	88.25%	92.40%	88.74%	355	299.0	173	129.7	70.07%	67.95%
90%tile	182.90	185.0	316.00	304.9	49.50	47.1	88.23%	87.09%	89.13%	87.86%	293.20	287.1	127.00	121.6	66.07%	65.18%
95%tile	193.18	190.2	327.00	310.3	52.40	49.2	88.58%	87.19%	89.58%	88.03%	301.10	290.7	129.00	124.3	67.54%	65.87%
OVERALL																
Average	171.8	171.815	282.3	282.088	42.5	42.520	84.74%	84.72%	84.90%	84.89%	261.6	261.4	96.3	96.245	62.86%	62.83%
Minimum	151.3	1.142	23.0	1.142	19.0	1.142	-56.52%	114.16%	57.00%	114.16%	165.0	1.1	60.0	1.142	37.46%	114.16%
Maximum	223.2	2.684	417.0	2.684	69.0	2.684	94.67%	268.39%	93.00%	268.39%	369.0	2.7	177.0	2.684	77.03%	268.39%
90%tile	179.60	178.98	315.00	300.80	51.00	49.80	88.04%	86.91%	88.65%	87.67%	289.00	281.1	116.70	112.25	69.76%	67.85%
95%tile	186.38	185.53	325.00	305.83	54.00	51.40	88.80%	87.55%	89.00%	88.15%	298.00	286.7	123.00	117.46	71.22%	69.32%

City of San Diego MWWD
2001-2003 Daily and 7-Day Averages, Minimum, Maximum, and 90th and 95th Percentiles
for MBC, PLWTP, SBWRP, and NCWRP

SOUTH BAY WRP

	Infl. Flow (mgd)		Infl. TSS Con (mg/L)		Infl. BOD Con (mg/L)		Eff. Flow (mgd)		Eff TSS Con (mg/L)		Eff BOD Con (mg/L)		Return to SMI (mgd)	
Date	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg
2001														
Average														
Minimum														
Maximum														
90%tile														
95%tile														
2002														
Average	4.43	4.43	256.9	260.8	316.3	321.5	4.4	4.38	3.64	3.81	5.33	6.75	0.66	0.66
Minimum	1.99	3.97	40	106.7	121	237.1	3.00	3.81	1.6	1.94	2	3.43	0.33	0.45
Maximum	4.84	4.65	1050	438.4	695	441.3	5.41	4.96	13.7	8.35	34.7	10.31	1.11	0.84
90%tile	4.62	4.56	345.60	344.3	394.10	359.3	4.93	4.73	6.86	7.26	10.00	9.50	0.91	0.78
95%tile	4.66	4.61	519.90	375.9	466.05	364.9	5.00	4.77	8.97	7.74	11.95	9.77	0.94	0.80
2003														
Average	4.54	4.54	259.5		312.0		4.0	3.97	5.18		11.10		0.72	0.72
Minimum	2.03	4.08	43		193		1.72	3.37	1.6		2		0.23	0.53
Maximum	5.31	4.80	832		1370		6.28	4.75	20.2		44.3		1.12	0.96
90%tile	4.82	4.73	417.60		382.60		4.40	4.29	9.30		23.24		0.92	0.87
95%tile	4.90	4.74	528.80		437.40		4.50	4.42	10.34		25.98		0.96	0.89
OVERALL														
Average	4.49	4.48	258	260.8	315	321.5	4.17	4.166	4.42	3.813	8	6.751	0.69	0.691
Minimum	1.99	1.14	40	1.1	121	1.1	1.72	1.142	1.60	1.142	2	1.142	0.23	1.142
Maximum	5.31	2.68	1,050	2.7	1,370	2.7	6.28	2.684	20.20	2.684	44	2.684	1.12	2.684
90%tile	4.76	4.71	374.20	344.3	390.00	359.3	4.80	4.66	9.00	7.26	15.46	9.50	0.92	0.84
95%tile	4.82	4.73	527.60	375.9	467.70	364.9	4.96	4.73	10.30	7.74	23.39	9.77	0.96	0.87

City of San Diego MWWD
2001-2003 Daily and 7-Day Averages, Minimum, Maximum, and 90th and 95th Percentiles
for MBC, PLWTP, SBWRP, and NCWRP

	NCWRP Influent Flow (mgd)		Influent TSS (mg/L)		Influent BOD (mg/L)		NCWRP Effluent Flow (mgd)		Effluent TSS (mg/L)		Effluent BOD (mg/L)	
Date	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg	Daily	7-d Rng Avg
2001												
Average	23.6	23.55	233.5	231.60	209.7	207.24	21.4	21.26	3.0	3.05	2.6	2.60
Minimum	17.9	22.42	153.6	0.90	0.0	0.90	15.9	0.90	0.0	0.90	0.0	0.71
Maximum	26.3	24.67	1194.8	377.64	569.8	274.92	25.8	23.59	10.9	5.01	8.9	8.50
90%tile	24.58	24.32	260.83	251.75	245.37	232.21	23.10	22.73	5.20	4.66	5.20	5.46
95%tile	24.93	24.46	278.34	271.87	281.98	255.56	23.55	23.02	5.65	4.86	7.00	5.91
2002												
Average												
Minimum												
Maximum												
90%tile												
95%tile												
2003												
Average												
Minimum												
Maximum												
90%tile												
95%tile												
OVERALL												
Average	23.566	23.552	233.455	232.923	209.710	208.422	21.369	21.378	3.025	3.063	2.576	2.610
Minimum	1.142	1.142	1.142	1.142	1.142	1.142	1.142	1.142	1.142	1.142	1.142	1.142
Maximum	2.684	2.684	2.684	2.684	2.684	2.684	2.684	2.684	2.684	2.684	2.684	2.684
90%tile	24.58	24.32	260.83	251.75	245.37	232.21	23.10	22.73	5.20	4.66	5.20	5.46
95%tile	24.93	24.46	278.34	271.87	281.98	255.56	23.55	23.02	5.65	4.86	7.00	5.91

SUB-APPENDIX B

MBC CAMP MASS BALANACE MODEL RUNS

MODEL SUMMARY FOR CALENDAR YEAR CALIBRATION

Case No.:	CALIBRATION RUN - MBC CAMP PROJECT 10.6	**Year MER Reached:**	CALIBRATION
System AADF	189.3 mgd	**Year PS2 Cap. Reached:**	N/A
PS1 PWWF:	N/A mgd	**PS2 Storage Design Year:**	No Storage Provided
PS2 PWWF:	N/A mgd	**PS2 Storage Cap. (mgd):**	N/A
PL Eff TSS:	54 mg/L	**Year PS1 Cap. Reached:**	N/A
MBC Gas Prd:	312,087 scf	**Storage Tank Design Year:**	No Storage Provided
SSPF Gas Prd	0 scf	**Storage Tank Cap. (mgd):**	N/A

Assumptions:

- 83% solids recovery in dewatering cenrifuge
- 82.900% removal of non-centrate recylce TSS at PLWTP
- 100.000% Capture of Chemical Sludge
- 82.900% removal of thickener centrate TSS at PLWTP
- 82.900% removal of dewatering centrate TSS at PLWTP
- 13,600 mt/yr TSS MER limit at PLWTP
- 317 mg/L TBOD in the MSS Flow
- 296 mg/L TSS in the MSS Flow
- 82.900% removal of TSS from MSS and WRP Secondary Effluent
- 1.1 lb TSS/lb FeCl3 added
- 59% removal of TBOD at PLWTP
- 0.0% Diverted at PLWTP for Secondary Treatment
- 0.00 mgd diverted at PLWTP for Secondary Treatment
- 25 mgd NCWRP
- 0 mgd CWRP
- 5 mgd SBWRP (Southern Facility)
- 0 mgd CSTP
- 0 mgd SBSTP
- 298 mg/L TBOD in the PLWTP Influent
- 325 mg/L TSS in the PLWTP Influent
- 282 mg/L TBOD in the NCWRP Influent
- 278 mg/L TSS in the NCWRP Influent
- 250 mg/L TBOD in the Central WRP Influent
- 250 mg/L TSS in the Central WRP Influent
- 468 mg/L TBOD in the South Bay Influent
- 528 mg/L TSS in the South Bay Influent
- 0.0% Reclamation at NCWRP Annually
- 0.0% Reclamation at CWRP Annually
- 0.0% Reclamation at SBWRP Annually
- 30 mgd of WRP Capacity - VIOLATES OPRA
- *No WTP Sludge discharged to the sewer*
- NCES/PLTO Not Utilized
- SSPF Not Online
- *TSS MER Limit Applies to PLOO Only*

Source/Plant	Flow (mgd)	TSS (lb/d)	VSS (lb/d)	TBOD (lb/d)	SBOD (lb/d)
Total System Generation					
MSS (Basic + Other Major Ind/Com Sources)	189.30	467,314	350,485	500,468	200,187
Tijuana	0.00	0	0	0	0
PS No. 2 Chemical	0.00	17,095	0	0	0
Subtotal A - Total Generated	189.30	484,408	350,485	500,468	200,187
NCWRP					
Applied	24.90	57,731	43,298	58,562	23,425
Returned	23.21	1,103	883	1,355	472
Subtotal B - Net Change	(1.69)	(56,628)	(42,416)	(57,207)	(22,952)
SWRP/MVWRP/MGWRP (i.e., CWRP)					
Applied	0.00	0	0	0	0
Returned	0.00	0	0	0	0
Subtotal C - Net Change	0.00	0	0	0	0
SBWRP					
Applied	4.80	21,137	15,853	18,735	7,494
Returned	0.57	23,627	18,268	11,811	236
Subtotal D - Net Change	(4.23)	2,490	2,415	(6,924)	(7,258)
SBSTP					
Applied	0.00	0	0	0	0
Returned	0.00	0	0	0	0
Subtotal D - Net Change	0.00	0	0	0	0
NSPF (MBC)					
Returned Thickener Centrate	1.55	12,325	9,512	6,466	517
Dewatering Centrate	0.12	6,088	4,080	1,804	1,733
Subtotal E - Net Change	1.68	18,412	13,592	8,271	2,251
SSPF					
Returned Thickener Centrate	0.00	0	0	0	0
Dewatering Centrate	0.00	0	0	0	0
Subtotal F - Net Change	0.00	0	0	0	0
PLWTP					
Applied					
- w/o FISDF/FIRP, Plant & PS2 Chem	185.05	431,589	324,077	444,607	172,227
- with PS No. 2 Chem & FISDF/FIRP	186.34	504,878	350,614	462,885	180,666
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem	186.35	556,162	350,614	462,885	180,666
Effluent	184.95	83,411	47,334	189,783	177,935
Removal Efficiency					
- w/o FISDF/FIRP, Plant & PS2 Chem (per Waiver)	---	80.7%	85.4%	57.3%	-3.3%
- with PS No. 2 Chem & FISDF/FIRP	---	83.5%	86.5%	59.0%	1.5%
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem	---	85.0%	86.5%	59.0%	1.5%
Secondary Effluent from NCWRP	0.00	0	0	0	0
Secondary Effluent from SWRP	0.00	0	0	0	0
Secondary Effluent from SBWRP/SBSTP	0.00	0	0	0	0
Total Ocean Discharge (PLWTP+NCWRP+SWRP/SBSTP)	184.95	83,411	47,334	189,783	177,935
(TOTAL OCEAN DISCHARGE IN MT/YEAR)		13807			

TSS	TBOD
279.6	288.1
324.9	297.9
357.9	297.8

Metropolitan Sewerage System
2001-2003 Wastewater Quality and Flow Used for Model Calibration
MBC CAMP Silos and Truck Loadout Capacity Estimates

Daily - 95th Percentile

	PLWTPin			PLWTPout			Removal (%)		SBWRPin			SBWRPout			Removal (%)		SBWRPret	MBC Centrate			NCWRPin			NCWRPout			Removal (%)	
Year	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	Flow	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD
2001	189.8	321.0	290.6	188.7	53.0	117.6	91.7%	70.2%						-			-	2.6	997	550	24.9	278.3	282	23.6	5.7	7	98.0%	97.5%
2002	176.5	328.8	300.0	175.4	55.0	117.0	88.3%	72.3%	4.7	520	466	5.0	9.0	12.0	98.3%	97.4%	0.94	2.7	1417	480								
2003	193.2	325 0	301 1	192.1	52.4	129.0	88.6%	67 5%	4.9	529	437	4.5	10.3	26.0	98.1%	94.1%	0.96	2.9	1355	477								
3-yr	186 4	325 0	298 0	185 3	54 0	123.0	88 8%	71.2%	4 8	528	468	5.0	10.3	23.4	98 0%	95 0%	0.96	2.7	1320	523	24.9	278.3	282.0	23.6	5 7	7 0	98 0%	97 5%
Model	186.3	325	298	184.9	54.1	123.0	85.0%	59.0%	4 80	528	468	4 23	10.3	23 4	---	---	0.57	1.7	1317	592	24 90	278	282	23 21	5.7	7.0	---	---

Project P-10.6 - Replacement of Dewatering Centrifuges with Larger Capacity Units

30% = Solids Content (%)
355,898 = Mass Production Rate (dry lb/d)
178 = Mass Production Rate (dry ton/d)
1,522,983 = Volumetric Production Rate (gpd) - VPR
203,607 = Volumetric Production Rate (ft³/d) - VPR

(i.e., 2 weekend days + 16 hours or 64 hours)

[illegible] = Dewatering Centrifuge Capacity required (gpm)

8 = Number of Centrifuges Available
6 = Assumed Number of Centrifuges in Operation
200 = Average Capacity per Centrifuge (gpm)
300 = Peak Capacity per Centrifuge (gpm)
1,200 = Total available average capacity (gpm)
1,800 = Total available peak capacity (gpm)

[illegible]

Plant Performance Criteria

Category	Process	Parameter	Units	Value	Model Designation	Comments
Permit Requirement		TSS MER	lb/d	82,159	TSS_MER	
			mt/yr	13,600		
		System Wide = 1; Specific to PLOO = 0	------->	0	MER_CRITERIA	
SBSTP		Advanced Primary Treatment Toggle	0=No; 1=Yes	0	SBSTP.ADV.PRIM	
Water Tmt Sludge		Water Treatment Sludge Solids Load	(1 = IN; 0 = OUT)	0	WTP.SLUDGE	
		- North (Poway WTP)	% of total load	3.0%	WTPLOAD.N	
		- Central (Helix WTP)	% of total load	11.4%	WTPLOAD.C	
		- South (Otay WTP)	% of total load	11.4%	WTPLOAD.S	
		- PLWTP Direct (Miramar and Alvarado WTPs)	% of total load	74.2%	WTPLOAD.PL	
AWT		AWT On-Line	(1 = Yes; 0 = No)	0	AWT	
San Pasqual/RB		San Pasqual Valley Situation	Scenario	0	SPVWRP.SCEN	0-Base; 1-Raw; 2-Raw-1; 3-TE
PS1		Peak Capacity	mgd	160	PS1.CAP	
PS2		Peak Capacity	mgd	432	PS2.CAP	
NCES/PLTO		Online? (1=Yes; 0=No)	---	0	NCES	
Peaking Factors		NCWRP	---	2.00	NCWRP.PEAK.Q	Based on Actual Design
		SBWRP	---	2.57	SBWRP.PEAK.Q	Based on Actual Design
		SBSTP	---	1.80	SBSTP.PEAK.Q	Based on Project Report
		CWRP	---	1.20	CWRP.PEAK.Q	Based on Project Report
		Impact of Flow removal at GAPS on PS1	---	1.34	GAPS.PS1.PF	Provided by PPG (2/19/97)
		Impact of Flow removal at GAPS on PS2	---	1.30	GAPS.PS2.PF	Provided by PPG (2/19/97)
		Impact of Flow removal at SRPS on PS1	---	1.62	SRPS.PS1.PF	Provided by PPG (2/19/97)
		Impact of Flow removal at SRPS on PS2	---	1.47	SRPS.PS2.PF	Provided by PPG (2/19/97)
		GAPS - Local	---	1.36	GAPS.LOCAL.PF	Provided by PPG (2/19/97)
		SRPS - Local	---	1.93	SRPS.LOCAL.PF	Provided by PPG (2/19/97)
		Criterion for Using which PF - % of PF	%	70.0%	PERCENT.PF	Provided by PPG (2/19/97)
		Peak Q at GAPS at MER Year	mgd	8.3	GAPS.MAX.Q	
		Peak Q at GAPS for PS1/PS2 Capacity Calc.	mgd	7.0	GAPS.MAX.PS1PS2	
SMI Flow Equalization		Design Life - Capacity till Year? (0=No Storage)	Year	0	STOR_YEAR	
System Flow Equalization		Design Life - Capacity till Year? (0=No Storage)	Year	0	STOR_YEAR.PS2	
		Provided where? (1=Central/North; 0=South)	---	0	STOR.LOC.PS2	
Raw Wastewater Quality		VSS	% of TSS	75%	RAWVSS%	
		SBOD	% of TBOD	40%	RAWSBOD%	
		Chemical Addition at PS2	mg/L	10	PS2.CHEM	
		Chemical Sludge Production	lb TSS/lb FeCl3	1.10	PS2.CHEM.PROD	3-yr average at PLWTP
		TBOD Concentration				
		- Total MSS	mg/L	317	TBOD.MSS	iterate to match "2001-2003" sheet
		- Rancho Bernardo	mg/L	200	TBOD.RB	
		- SPVWRP Effluent	mg/L	5	TBOD.SPVWRP	
		- PQPS Influent	mg/L	282	TBOD.PQPS	Match "2001-2003" sheet
		- NCWRP Service Area	mg/L	282	TBOD.NCWRP	Match "2001-2003" sheet
		- Central WRP Service Area	mg/L	250	TBOD.CENTRAL	
		- SBWRP Influent	mg/L	468	TBOD.SOUTH	Match "2001-2003" sheet
		- SBSTP Influent	mg/L	468	TBOD.SBSTP	Match "2001-2003" sheet
		- OWRP Influent	mg/L	0	TBOD.OWRP	
		TSS Concentration				
		- Total MSS	mg/L	296	TSS.MSS	iterate to match "2001-2003" sheet
		- Rancho Bernardo	mg/L	220	TSS.RB	
		- SPVWRP Effluent	mg/L	270	TSS.SPVWRP	
		- PQPS Influent	mg/L	278	TSS.PQPS	Match "2001-2003" sheet
		- NCWRP Service Area	mg/L	278	TSS.NCWRP	Match "2001-2003" sheet
		- Central WRP Service Area	mg/L	250	TSS.CENTRAL	
		- SBWRP Influent	mg/L	528	TSS.SOUTH	Match "2001-2003" sheet
		- SBSTP Influent	mg/L	528	TSS.SBSTP	Match "2001-2003" sheet
		- OWRP Influent	mg/L	0	TSS.OWRP	
WRP	Primary	TSS Removal	%	60%	WRP.TSS.REM	
		BOD Removal	%	35%	WRP.BOD.REM	
		Wastewater Temperture	deg-C	30.0	TEMP	
		Chemical Addition	mg/L	15	WRP.CHEM.CONC.P	
		Chemical Sludge Production	lb TSS/lb FeCl3	1.10	WRP.CHEM.PROD	
		Sludge Concentration	% (w/w)	0.50%	WRP.PR.SLD.C	
		VSS to TSS Ratio in Sludge	%	75%	WRP.PR.VSS%	
		VSS to TSS Ratio in Effluent	%	78%	WRP.PE.VSS%	
		Equalized Flow Peaking Factor	Dimensionless	1.20	EQPF	
	Secondary	Effluent TSS Conc.	mg/L	9	SEC.EFF.TSS	
		Effluent BOD Conc.	mg/L	9	SEC.EFF.BOD	
		Nonbiodeg Fraction of Inf VSS	%	40%	NBVSS	
		MLTSS Conc.	mg/L	2,800	MLTSS	
		RAS/WAS Solids Conc.	% (w/w)	0.50%	WAS%	
		VSS to TSS Ratio in Sludge	%	80%	WRP.SEC.VSS%	
		MCRT	days	5	MCRT	
		Net Yield	lb TSS gen/lb BOD rem	0.60	TSS.GEN.SEC	
		Decay Coefficient	Dimensionless	0.05	DECAY	
		RAS:Influent Flow Ratio	Dimensionless	0.50	RAS.INF	

Plant Performance Criteria

Category	Process	Parameter	Units	Value	Model Designation	Comments
		Particulate BOD to VSS Ratio	%	100%	PBOD.VSS.SEC	

Plant Performance Criteria

Category	Process	Parameter	Units	Value	Model Designation	Comments
	Tertiary	Effluent TSS Conc.	mg/L	4	TER.EFF.TSS	
		Effluent BOD Conc.	mg/L	8	TER.EFF.BOD	
		Chemical Addition - NaOCl	mg/L	5	WRP.CHEM.CONC.T	
		VSS to TSS Ratio in Tert Inf/Eff	%	47%	TER.VSS	
		Particulate BOD to VSS Ratio	%	47%	PBOD.VSS	
	Misc	Utility Water Flow	% of Plant Flow	3.0%	UTILITY	
PLWTP	Adv. Primary	Average TSS removal	%	69.0%	PL.TSS.AVGREM	
		MSS TSS removal	%	82.9%	PL.TSS.MSSREM	Iterate to match "2001-2003" sheet
		Waiver Required Removal	%	80.0%	WAIVER.TSS%	
		Influent Recycle TSS Removal	%	82.9%	PL.TSS.RECREM	
		Influent Thickener Centrate TSS Removal	%	82.9%	PL.TSS.TCENT	
		Influent Dewatering Centrate TSS Removal	%	82.9%	PL.TSS.DCENT	
		Influent Retreat TSS Removal	%	82.9%	PL.TSS.RETREM	
		Average BOD removal	%	59.0%	PL.BOD.AVGREM	
		MSS BOD removal	%	59.0%	PL.BOD.MSSREM	Iterate to match "2001-2003" sheet
		Waiver Required Removal	%	58.0%	WAIVER.TBOD%	
		Influent Recycle BOD Removal	%	59.0%	PL.BOD.RECREM	
		Influent Retreat BOD Removal	%	59.0%	PL.BOD.RETREM	
		Chemical Addition - FeCl3	mg/L	30	ADVPRI.CHEM	
		Chemical Sludge Production	lb TSS/lb FeCl3	1.10	ADVPRI.CHEM.PRD	
		Capture of Chemical Sludge	%	100%	CHEM.SLDG.PL	See chemical sludge spreadsheet
		Sludge Concentration	% (w/w)	4%	ADVPRI.SLD	
		VSS to TSS Ratio in Sludge	%	75%	ADVPRI.VSS%	
		SBOD to TBOD Ratio in Sludge	%	1%	ADVPRI.SBOD%	
		Bypass to Ocean Outfall	%	0%	PLWTP.BP	
Sludge Processing	General	Combined Sludge Specific Gravity	Dimensionless	1.01	SG.SLUDGE	Per 5/25/04 changes provided by MWWD
		SBOD to TBOD Ratio in Combined Sludge	%	2%	SBOD.CS	
	Thickening	Solids Recovery	%	82.5%	THCK.REC	Iterate to match "2001-2003" Sheet
		Sludge Concentration	% (w/w)	5%	THCK.SLD%	
		Thickened Sludge Specific Gravity	Dimensionless	1.03	SG.THCKSL	Per 5/25/04 changes provided by MWWD
		Fraction of TBOD Retained in Centrate	%	10%	TBOD.TC%	
		Fraction of SBOD Retained in Centrate	%	70%	SBOD.TC%	
	Digestion	Primary Sludge VSS Destroyed	%	50%	VSS.DES	
		Combined Sludge VSS Destroyed	%	52%	VSS.DES.COMB	Per 5/25/04 changes provided by MWWD
		Gas Production Rate	scf/lb VSS des	14.5	GAS.PROD	Per 5/25/04 changes provided by MWWD
		Influent to Effluent Flow Ratio	%	99%	INF.EFF.DIG	Per 5/25/04 changes provided by MWWD
		Digested Sludge Specific Gravity	Dimensionless	1.03	SG.DIG	Per 5/25/04 changes provided by MWWD
		Solubilization of Primary VSS (Inc. in VSS Des.)	%	5%	VSS.SOL	
		Solubilization of Combined VSS (Inc. in VSS Des.)	%	7%	VSS.SOL.COMB	
		Fraction of Solubilized VSS is SBOD	%	75%	SBOD.VSS.DIG	
		TBOD Reduction in Digester - Primary Sludge	%	75%	TBOD.RED%	
		TBOD Reduction in Digester - Combined Sludge	%	55%	TBOD.RED%.COMB	
		SBOD Reduction in Digester - Primary Sludge	%	75%	SBOD.RED%	
		SBOD Reduction in Digester - Combined Sludge	%	55%	SBOD.RED%.COMB	
	Dewatering	Solids Recovery - Centrifuge	%	[illegible]	DEW.REC	Iterate to match "2001-2003" Sheet
		Solids Recovery - Belt Filter Press	%	92%	DEW.BFP	
		Sludge Concentration	% (w/w)	28%	DEW.SLD%	Per 5/25/04 changes provided by MWWD
		Dewatered Sludge Specific Gravity	Dimensionless	1.07	SG.DWTR	
		Dewatered Centrate Specific Gravity	Dimensionless	1.00	SG.DC	
		Fraction of TBOD Retained in Centrate	%	10%	TBOD.DWTR%	
		Fraction of SBOD Retained in Centrate	%	70%	SBOD.DWTR%	
		BFP Washwater Added to Filtrate	gpm	90	BFP.WW	
		Number of BFPs Operating at FISDF	Dimensionless	6	BFP	
		FIRP Startup Year	---	1998.5	FIRP.YEAR	
Centrate Treatment		Solids Recovery	%	97%	CENT.TMT.REC	Per 5/25/04 changes provided by MWWD
		Thickened Sludge Concentration	% (w/w)	3.5%	CENT.TMT.SLD%	Per 5/25/04 changes provided by MWWD
		Toggle to activate	0=off; 1=on	0	CENT.TMT.TGL	

Wastewater Quality and Quantity

Source	Facility Design Cap. (mgd)	Flow AADF (mgd)	TSS Concentration (mg/L)	VSS Concentration (mg/L)	TBOD Concentration (mg/L)	SBOD Concentration (mg/L)
MSS		189.30	296	222	317	127
NCWRP Influent	24.9	24.90	278	209	282	113
CWRP Influent	0	0.00	250	188	250	100
CSTP Influent	0					
OWRP Influent	0	0.00	0	0	0	0
SBWRP Influent	4.8	4.80	528	396	468	187
Tijuana	---	0.00	0	0	0	0
SBSTP Influent	0	0.00	260	195	315	126

Flow Distribution 0.00 = flow to AWT Analysis Year

Plant	Percent to Tertiary	Secondary Effluent (mgd)			Tertiary			Combined Raw Sludge		Centrate		
		Tertiary	Retreatment	Outfall	Reuse	Retreatment	Outfall	MBC/SSPF	Retreatment	Treatment	Recycle	Retreat
NCWRP	0%	0.00	23.21	0.00	0%	100%	0%	100%	0%	NA	NA	NA
SWRP (CWRP)	0%	0.00	0.00	0.00	100%	0%	0%	0%	100%	NA	NA	NA
OVWRP	0%	0.00	0.00	0.00	100%	0%	0%	0%	100%	NA	NA	NA
SBWRP	0%	0.00	0.00	4.23	0%	0%	100%	0%	100%	NA	NA	NA
SBSTP to Sec	0%	0.00	0.00	0.00	100%	0%	0%	100%	0%	NA	NA	NA
NSPF		NA	NA	NA	NA	NA	NA	NA	NA	0%	0%	100%
FIRP		NA	NA	NA	NA	NA	NA	NA	NA	0%	0%	100%
SSPF		NA	NA	NA	NA	NA	NA	NA	NA	0%	0%	100%
Node D (Raw Wastewater)			100%	0%	NA	NA	NA	NA	NA	NA	NA	NA
SBWRP											0%	

PLWTP: 0

Flow Diverted for Secondary Treatment at PLWTP: 0.00%
0 mgd

Flow Diverted for Secondary Treatment at SBSTP: 0%
0 mgd

Mass Balance for the NSPF Portion of MBC - Y:CALIBRATION

Process	Units	Value		Assumtions
SLUDGE THICKENING				
Influent Flow				
●ADWF	mgd	1.69		
●PWWF	mgd			
Influent Character				
- TSS	mg/l	4,950	1.01	Specific Gravity of Combined Sludge
	lb/d	70,428		(Relative to H20 = 1.0)
- VSS	mg/l	3,820		
	lb/d	54,352		
- TBOD	mg/l	2,597		
	lb/d	36,950		
- SBOD	mg/l	52		
	lb/d	739		
Thickener Centrate Flow				
●ADWF	mgd	1.55	1.00	Centrate Specific Gravity
●PWWF	mgd			
Thickener Centrate Character				
- TSS	mg/l	951	82.5%	Solids Recovery
	lb/d	12,325		
- VSS	mg/l	734		
	lb/d	9,512		
- TBOD	mg/l	499		
	lb/d	6,466		
- SBOD	mg/l	40		
	lb/d	517	70%	SBOD Fraction Retained in Centrate
Thickened Sludge Flow				
●ADWF	mgd	0.14	5.0%	Thickened Sludge Concentration
●PWWF	mgd		1.03	Thickened Sludge Specific Gravity
Thickened Sludge Character				
- TSS	mg/l	50,000	82.5%	Solids Recovery
	lb/d	58,103		
- VSS	mg/l	38,587		
	lb/d	44,840		
- TBOD	mg/l	26,233		
	lb/d	30,484		
- SBOD	mg/l	191		
	lb/d	222		
SLUDGE DIGESTION				
Digester Effluent				
●ADWF	mgd	0.13	99%	Flow Conserved
●PWWF	mgd			
Digested Sludge Character				
- TSS	mg/l	30,237		
	lb/d	34,786		
- VSS	mg/l	20,268	1.03	Specific Gravity of Digested Sludge
	lb/d	23,317	52.0%	VSS Destruction in Digester
- TBOD	mg/l	11,924	7%	Fraction of Influent VSS Solubilized
	lb/d	13,718	75%	Fraction of Solubilized VSS is SBOD
- SBOD	mg/l	2,152	55%	TBOD Reduction in Digester
	lb/d	2,476	55%	SBOD Reduction in Digester
Digester Gas Production	scf	312,067	15	scf/lb VSS destroyed
SLUDGE DEWATERING				
Sludge Cake Flow				
●ADWF	mgd	0.011		
●PWWF	mgd			
Sludge Cake Character				
- TSS	mg/l	280,000	28%	Solids Content
	lb/d	28,698	83%	Solids Capture (Appliese to TSS, VSS & TBOD)
- VSS	mg/l	187,683	1.07	Specific Gravity
	lb/d	19,236	0.170	= (1-Cent TSS Rem Eff)*(DAFT TSS Rem Eff) - b
- TBOD	mg/l	116,235	0.005	= (1-Cent TSS Rem Eff)*(1-DAFT TSS Rem Eff) - a
	lb/d	11,913		
- SBOD	mg/l	7,247		
	lb/d	743	70%	Fraction of SBOD Retained in Centrate
Centrate Flow			7,112	Recycle Stream-TSS
●ADWF	mgd	0.122	4,767	Recycle Stream-VSS
●PWWF	mgd		2,298	Recycle Stream-TBOD
Centrate Character				
- TSS	mg/l	5,962	1.00	Specific Gravity of Centrate
	lb/d	6,088		
- VSS	mg/l	3,996		
	lb/d	4,080		
- TBOD	mg/l	1,767		
	lb/d	1,804		
- SBOD	mg/l	1,697		
	lb/d	1,733		

Process	Units	Value		Assumptions
INFLUENT FLOW & WASTEWATER QUALITY (w/o FIRP Recycle & PS2 Chem)				
@ AADF	mgd	185.05		
@PWWF	mgd	333.10	1.8	peaking factor
TSS	mg/L	280		
	lb/d	431,589		
VSS	mg/L	210		
	lb/d	324,077		
TBOD	mg/L	288		
	lb/d	444,607		
SBOD	mg/L	112		
	lb/d	172,227		
PRIMARY SEDIMENTATION				
Total influent flow	mgd			
@ AADF		186.34	1.28	mgd from FIRP Recycle (MBC dewatering centrate cc
@ PWWF		334.38	0.00	mgd Thickening Centrate (the thinkening centrate at F
Influent TSS	lbs/day	504,878	56,195	lb/d from FIRP Recycle
	mg/L	325	0	lb/d from Thickening Centrate
Influent VSS	lbs/day	350,614	26,537	lb/d from FIRP Recycle
	mg/L	226	0	lb/d from Thickening Centrate
Influent TBOD	lbs/day	462,885	18,277	lb/d from FIRP Recycle
	mg/L	298	0	lb/d from Thickening Centrate
Influent SBOD	lbs/day	180,666	8,439	lb/d from FIRP Recycle
	mg/L	116	0	lb/d from Thickening Centrate
MSS TSS removal efficiency		82.90%		
MSS BOD removal efficiency		59.00%	83%	TSS Rem in other recycle stream
Dewatering Centrate TSS removal effiency		82.90%	83%	TSS Rem in Thickener Centrate
Dewatering Centrate BOD Removal efficiency		59.00%	59%	TBOD Rem in Thickener Centrate
In Plant Chemical Addition (FeCl▲d3▲0d)	mg/L	30	44%	Ferric Chloride Solution Added at PS2 & PLWTP
	lbs/day	46,622	1.5	Specific Gravity of FeCl3 Solution
	mgd	0.009	100%	Capture of Chemical Sludge
Chemical Sludge (as TSS) Produced	lbs/day	51,285	1.10	lb TSS Produced/lb FeCl3 Added
Primary sludge TSS	lbs/day	472,751		
Primary sludge VSS	lbs/day	303,279	75%	of Sludge TSS is VSS (exc. chem sludge)
Primary sludge TBOD	lbs/day	273,102	0.90	TBOD to VSS Ratio (Calculated)
Primary sludge SBOD	lbs/day	2,731	1%	of Sludge TBOD is SBOD
Primary sludge flow	mgd	1.40	4%	Advance Primary Sludge
Primary effluent TSS	lbs/day	83,411	1.01	Specific Gravity of Primary Sludge
Primary effluent TSS conc @AADF	mg/L	54.1	32,126	
Primary effluent VSS	lbs/day	47,334	83.4790%	Actual Removal (Plant Performance)
Primary effluent VSS conc @AADF	mg/L	30.7		
Primary effluent TBOD	lbs/day	189,783		
Primary effluent TBOD conc @AADF	mg/L	123.0		
Primary effluent SBOD	lbs/day	177,935	59.00%	Actual Removal (Plant Performance)
Primary effluent SBOD conc @AADF	mg/L	115.4		
Primary effluent flow	mgd			
@ AADF		184.95		
@ PWWF		332.99		
DIGESTION				
Digester Effluent				
@ AADF	mgd	1.39	99%	Flow Conserved
Digested Sludge Character				
- TSS	mg/l	26,911		
	lb/d	321,112		
- VSS	mg/l	12,708	1.03	Specific Gravity of Digested Sludge
	lb/d	151,640	50.0%	VSS Destruction in Digester
- TBOD	mg/l	5,722	5%	Fraction of Influent VSS Solubilized
	lb/d	68,276	75%	Fraction of Solubilized VSS is SBOD
- SBOD	mg/l	1,010	75%	TBOD Reduction in Digester
	lb/d	12,056	75%	SBOD Reduction in Digester
FISDF/FIRP SLUDGE DEWATERING				
Sludge Cake Flow				
@ AADF	mgd	0.106		
@PWWF	mgd			
Sludge Cake Character				
- TSS	mg/l	280,000	28%	Solids Content
	lb/d	264,917	83%	Solids Capture
- VSS	mg/l	132,225	1.07	Specific Gravity
	lb/d	125,103	0.47	VSS to TSS Ratio (Calculated)
- TBOD	mg/l	52,845	0.40	TBOD to VSS Ratio (Calculated)
	lb/d	49,998		
- SBOD	mg/l	3,823		
	lb/d	3,617	70%	Fraction of SBOD Retained in Centrate
Dewatering Centrate Flow				
@ AADF	mgd	1.28		
@PWWF	mgd		1.00	Specific Gravity of Centrate
Dewatering Centrate Character			0	gpm/BFP washwater added to centrate
- TSS	mg/l	5,252	0	BFP operating
	lb/d	56,195		
- VSS	mg/l	2,480	0.170	= (1-Cent TSS Rem Eff)*(DAFT TSS Rem Eff) - b
	lb/d	26,537	0.005	= (1-Cent TSS Rem Eff)*(1-DAFT TSS Rem Eff) - a
- TBOD	mg/l	1,708	65,653	Recycle Stream-TSS
	lb/d	18,277	31,004	Recycle Stream-VSS
- SBOD	mg/l	789	11,495	Recycle Stream-TBOD
	lb/d	8,439		

Process	Units	Value	Assumptions
INFLUENT FLOW			
@ AADF	mgd	4.8	
@PWWF	mgd	9.6	2 peaking factor
INFLUENT WASTEWATER QUALITY			
- TSS	mg/l	528	
- BOD	mg/l	468	
PRIMARY SEDIMENTATION			
Total influent flow	mgd		
@ AADF		4.80	0.00 mgd flow contributed by backwash
@ PWWF		9.60	
Influent TSS	lbs/day	21,137	
Influent BOD	lbs/day	18,735	
TSS removal efficiency for MSS Component		60%	
BOD removal efficiency		35%	
Chemical Addition (FeCl▲d3▲0d)	mg/L	0	
	lbs/day	0	44% by weight FeCl▲d3▲0d Sol'n
	mgd	0.0000	1.476 Specific Gravity of FeCl▲d3▲0d Sol'n
Chemical Sludge (as TSS) Produced	lbs/day	0	1.10 lb TSS Produced/lb FeCl3 Added
Primary sludge TSS	lbs/day	12,682	100% Chemical Sludge Removal Rate
Primary sludge flow	mgd	0.30	0.5% solids concentration.
Primary effluent TSS	lbs/day	8,455	
Primary effluent TSS conc @AADF	mg/l	225.49	Contribution during PWWF is mostly
Primary effluent BOD	lbs/day	12,178	dillution water with no BOD and TSS.
Primary effluent BOD conc @AADF	mg/l	324.78	
Primary effluent VSS	lbs/day	6,595	75% of raw wastewater TSS is VSS
Primary effluent VSS conc @AADF	mg/l	175.88	78% of primary effluent TSS is VSS
Primary effluent flow	mgd		
@ AADF		4.50	
@ PWWF		9.30	
ACTIVATED SLUDGE			
Gross Nonbiodeg. Incoming TSS	lbs/day	4,498	1,860 = NVSS (lb/day) including RAS fraction
MLTSS concentration	mg/l	2,800	40.0% = nonbiodeg fraction of inf. VSS (lb/day)
Influent flow	mgd		2,638 = NBVSS (lb/day) including RAS fraction
- Average		4.50	
- Peak		5.40	1.20 Peak equalized flow factor
Returned activated sludge flow	mgd	2.25	0.5% RAS solids concentration
RAS/influent ratio		0.50	80% of secondary TSS is VSS
Reactor inf/eff flow	mgd		
- Average		6.74	Assuming RAS flow remains constant.
- Peak		7.64	
Reactor effluent TSS	lbs/day	157,481	
Active biomass plus endogenous			5 SRT (MCRT)
biomass decay products	lbs/day	6,811	30 C assumed influent temperature
			0.6 =Ynet
SECONDARY SEDIMENTATION			
Influent flow	mgd		
- Average		4.50	
- Peak		5.40	
- TSS	lbs/day	8,455	
- TSS concentration	mg/l	225.49	
- BOD	lbs/day	12,178	
- BOD concentration	mg/l	324.78	
- VSS	lbs/day	6,595	
- VSS concentration	mg/l	175.88	157,481 lbs/day solids loading based on
Secondary effluent flow	mgd		2800 mg/l MLSS conc @ ADWF
- Average		4.23	178,479 lbs/day solids loading based on
- Peak		5.13	2800 mg/l MLSS conc @ PWWF
Secondary eff TSS	lbs/day	364	10.0 mg/l of TSS at the secondary effluent.
Secondary eff BOD	lbs/day	826	23.4 mg/l of BOD at the secondary effluent

Process	Units	Value		Assumptions
Waste activated sludge TSS	lbs/day	10,945		
Waste activated sludge flow	mgd	0.26	0.50	% solids
RAS & WAS flow	mgd	2.510411088		
Secondary's BOD removal eff		93.2%		
Secondary's TSS removal eff		95.7%		
TERTIARY FILTERS/ DISINFECTION				
Influent total flow	mgd			
- Average		0.00		utility water included
- Peak		0.00	1.20	Peaking Factor
Influent TSS	lbs/day	0		
Influent VSS	lbs/day	0	47%	VSS to TSS Ratio
Influent TBOD	lbs/day	0	47%	Particulate BOD to VSS Ratio
Influent SBOD	lbs/day	0		
Effluent flow	mgd			
- Average		0.00		
- Peak		0.00		
Effluent TSS	lbs/day	0	4.4	mg/l of TSS at the effluent.
Effluent VSS	lbs/day	0	8	mg/L of BOD at the effluent
Effluent TBOD	lbs/day	0	47%	VSS to TSS Ratio
Effluent SBOD	lbs/day	0	47%	Particulate BOD to VSS Ratio
Utility water flow WRP	mgd	0	3%	of plant flow
Utility water TSS	lbs/day	0		
Utility water BOD	lbs/day	0		backwash flow is recycled to primaries
Backwash cumulative daily flow	mgd	0.00	20.0	gpm/sf of filter area.
Backwash cumulative TSS	lbs/day	0	15	minute backwash event.
Backwash TSS conc	mg/l	0		
Backwash cumulative BOD (lbs/day)	lbs/day	0		
Backwash BOD conc (mg/l)	mg/l	0		
Filters' BOD % removal		0%		
DISINFECTION				
Influent total flow	mgd			
- Average		0.00		
- Peak		0.00	1.2	Peaking Factor
Influent TSS	lbs/day	0		
Influent VSS	lbs/day	0		
Influent TBOD	lbs/day	0		
Inffluent SBOD	lbs/day	0		
Effluent flow	mgd			
- Average		0.00		
- Peak		0.00		
Effluent TSS	lbs/day	0	2	mg/l of TSS at the effluent.
Effluent VSS	lbs/day	0	4	mg/L of BOD at the effluent
Effluent TBOD	lbs/day	0	47%	VSS to TSS Ratio
Effluent SBOD	lbs/day	0		

COMBINED SLUDGE FLOW =	0.57	MGD
COMBINED SLUDGE TSS MASS RATE =	23,627	lb/d
COMBINED SLUDGE VSS MASS RATE =	18,268	lb/d
COMBINED SLUDGE TBOD MASS RATE =	11,811	lb/d
COMBINED SLUDGE SBOD MASS RATE =	236	lb/d

Process	Units	Value	Assumptions
INFLUENT FLOW			
@AADF	mgd	24.9	
@PWWF	mgd	49.8	2 peaking factor
INFLUENT WASTEWATER QUALITY			
- TSS	mg/l	278	
- BOD	mg/l	282	
PRIMARY SEDIMENTATION			
Total influent flow	mgd		
@ AADF		24.90	0.00 mgd flow contributed by backwash
@ PWWF		49.80	
Influent TSS	lbs/day	57,731	
Influent BOD	lbs/day	58,562	
TSS removal efficiency		65%	
BOD removal efficiency		38%	
Chemical Addition (FeCl▲d3▲0d)	mg/L	10	
	lbs/day	2,077	44% by weight FeCl▲d3▲0d Sol'n
	mgd	0.0004	1.467 Specific Gravity of FeCl▲d3▲0d Sol'n
Chemical Sludge (as TSS) Produced	lbs/day	2,284	1.10 lb TSS Produced/lb FeCl3 Added
Primary sludge TSS	lbs/day	39,810	100% Chemical Sludge Removal Rate
Primary sludge flow	mgd	0.95	0.5% solids concentration.
Primary effluent TSS	lbs/day	20,206	
Primary effluent TSS conc @AADF	mg/l	101.18	Contribution during PWWF is mostly
Primary effluent BOD	lbs/day	36,308	dillution water with no BOD and TSS.
Primary effluent BOD conc @AADF	mg/l	181.81	
Primary effluent VSS	lbs/day	15,761	75% of raw wastewater TSS is VSS
Primary effluent VSS conc @AADF	mg/l	78.92	78% of primary effluent TSS is VSS
Primary effluent flow	mgd		
@ AADF		23.95	
@ PWWF		48.85	
ACTIVATED SLUDGE			
Gross Nonbiodeg. Incoming TSS	lbs/day	10,750	4,445 = NVSS (lb/day) including RAS fraction
MLTSS concentration	mg/l	2,155	40.0% = nonbiodeg fraction of inf. VSS (lb/day)
Influent flow	mgd		6,304 = NBVSS (lb/day) including RAS fraction
- Average		23.95	
- Peak		28.73	1.20 Peak equalized flow factor
Returned activated sludge flow	mgd	11.97	0.5% RAS solids concentration
RAS/influent ratio		0.50	80% of secondary TSS is VSS
Reactor inf/eff flow	mgd		
- Average		35.92	Assuming RAS flow remains constant.
- Peak		40.71	
Reactor effluent TSS	lbs/day	645,554	
Active biomass plus endogenous			5.36 SRT (MCRT)
biomass decay products	lbs/day	20,972	30 C assumed influent temperature
			0.6 =Ynet
SECONDARY SEDIMENTATION			
Influent flow	mgd		
- Average		23.95	
- Peak		28.73	
- TSS	lbs/day	20,206	
- TSS concentration	mg/l	101.18	
- BOD	lbs/day	36,308	
- BOD concentration	mg/l	181.81	
- VSS	lbs/day	15,761	
- VSS concentration	mg/l	78.92	645,554 lbs/day solids loading based on
Secondary effluent flow	mgd		2155 mg/l MLSS conc @ ADWF
- Average		23.21	731,628 lbs/day solids loading based on
- Peak		28.00	2155 mg/l MLSS conc @ PWWF
Secondary eff TSS	lbs/day	1,103	5.7 mg/l of TSS at the secondary effluent.
Secondary eff BOD	lbs/day	1,355	7.0 mg/l of BOD at the secondary effluent

Process	Units	Value	Assumptions
Waste activated sludge TSS	lbs/day	30,618	
Waste activated sludge flow	mgd	0.73	0.50 % solids
RAS & WAS flow	mgd	12.71	
Secondary's BOD removal eff		96.3%	
Secondary's TSS removal eff		94.5%	
TERTIARY FILTERS/ DISINFECTION			
Influent total flow	mgd		
- Average		0.00	utility water included
- Peak		0.00	1.20 Peaking Factor
Influent TSS	lbs/day	0	
Influent VSS	lbs/day	0	47% VSS to TSS Ratio
Influent TBOD	lbs/day	0	47% Particulate BOD to VSS Ratio
Influent SBOD	lbs/day	0	
Effluent flow	mgd		
- Average		0.00	
- Peak		0.00	
Effluent TSS	lbs/day	0	4.4 mg/l of TSS at the effluent.
Effluent VSS	lbs/day	0	8 mg/L of BOD at the effluent
Effluent TBOD	lbs/day	0	47% VSS to TSS Ratio
Effluent SBOD	lbs/day	0	47% Particulate BOD to VSS Ratio
Utility water flow WRP	mgd	0	3% of plant flow
Utility water TSS	lbs/day	0	
Utility water BOD	lbs/day	0	backwash flow is recycled to primaries
Backwash cumulative daily flow	mgd	0.00	20.0 gpm/sf of filter area.
Backwash cumulative TSS	lbs/day	0	15 minute backwash event.
Backwash TSS conc	mg/l	0	
Backwash cumulative BOD (lbs/day)	lbs/day	0	
Backwash BOD conc (mg/l)	mg/l	0	
Filters' BOD % removal		0%	
DISINFECTION			
Influent total flow	mgd		
- Average		0.00	
- Peak		0.00	1.2 Peaking Factor
Influent TSS	lbs/day	0	
Influent VSS	lbs/day	0	
Influent TBOD	lbs/day	0	
Inffluent SBOD	lbs/day	0	
Effluent flow	mgd		
- Average		0.00	Flow to the AWT
- Peak		0.00	
Effluent TSS	lbs/day	0	4.4 mg/l of TSS at the effluent.
Effluent VSS	lbs/day	0	8 mg/L of BOD at the effluent
Effluent TBOD	lbs/day	0	47% VSS to TSS Ratio
Effluent SBOD	lbs/day	0	

COMBINED SLUDGE FLOW =	1.69	MGD
COMBINED SLUDGE TSS MASS RATE =	70,428	lb/d
COMBINED SLUDGE VSS MASS RATE =	54,352	lb/d
COMBINED SLUDGE TBOD MASS RATE =	36,950	lb/d
COMBINED SLUDGE SBOD MASS RATE =	739	lb/d

MODEL SUMMARY FOR CALENDAR YEAR 2026

Case No.:	MBC CAMP PROJECT 10.6	Year MER Reached:	2026
System AADF:	241.5 mgd	Year PS2 Cap. Reached:	N/A
PS1 PWWF:	N/A mgd	PS2 Storage Design Year:	No Storage Provided
PS2 PWWF:	N/A mgd	PS2 Storage Cap. (mgd):	N/A
PL Eff TSS:	57 mg/L	Year PS1 Cap. Reached:	N/A
MBC Gas Prd:	376,008 scf	Storage Tank Design Year:	No Storage Provided
SSPF Gas Prd	0 scf	Storage Tank Cap. (mgd):	N/A

Assumptions:

83%	solids recovery in dewatering centrifuge	303	mg/L TBOD in the PLWTP influent
82.900%	removal of non-centrate recycle TSS at PLWTP	333	mg/L TSS in the PLWTP influent
100.000%	Capture of Chemical Sludge	262	mg/L TBOD in the NCWRP influent
82.900%	removal of thickener centrate TSS at PLWTP	278	mg/L TSS in the NCWRP influent
82.900%	removal of dewatering centrate TSS at PLWTP	250	mg/L TBOD in the Central WRP influent
13,600	mt/yr TSS MER limit at PLWTP	250	mg/L TSS in the Central WRP influent
317	mg/L TBOD in the MSS Flow	468	mg/L TBOD in the South Bay influent
296	mg/L TSS in the MSS Flow	523	mg/L TSS in the South Bay influent
82.900%	removal of TSS from MSS and WRP Secondary Effluent	0.0%	Reclamation at NCWRP Annually
1.1	lb TSS/lb FeCl3 added	0.0%	Reclamation at CWRP Annually
59%	removal of TBOD at PLWTP	0.0%	Reclamation at SBWRP Annually
0.0%	Diverted at PLWTP for Secondary Treatment	45	mgd of WRP Capacity - Satisfies OPRA
0.00	mgd diverted at PLWTP for Secondary Treatment		*No WTP Sludge discharged to the sewer*
30	mgd NCWRP		NCES/PLTO Not Utilized
0	mgd CWRP		SSPF Not Online
15	mgd SBWRP (Southern Facility)		*TSS MER Limit Applies to PLOO Only*
0	mgd CSTP		
0	mgd SBSTP		

Source/Plant		Flow (mgd)	TSS (lb/d)	VSS (lb/d)	TBOD (lb/d)	SBOD (lb/d)
Total System Generation						
MSS (Basic + Other Major Ind/Com Sources)		241.62	596,226	447,169	638,526	265,419
Tijuana		0.00	0	0	0	0
PS No. 2 Chemical		0.00	21,093	0	0	0
Subtotal A - Total Generated		241.62	617,319	447,169	638,526	265,419
NCWRP						
Applied		30.00	69,556	52,167	78,558	30,223
Returned		27.97	1,329	1,064	1,633	869
Subtotal B - Net Change		(2.03)	(68,226)	(51,103)	(68,924)	(27,853)
SWRP/MVWRP/MGWRP (i.e., CWRP)						
Applied		0.00	0	0	0	0
Returned		0.00	0	0	0	0
Subtotal C - Net Change		0.00	0	0	0	0
SBWRP						
Applied		15.00	66,053	49,540	58,547	23,419
Returned		1.77	73,835	57,087	36,909	738
Subtotal D - Net Change		(13.23)	7,783	7,547	(21,638)	(22,681)
SBSTP						
Applied		0.00	0	0	0	0
Returned		0.00	0	0	0	0
Subtotal D - Net Change		0.00	0	0	0	0
NSPF (MBC)						
Returned	Thickener Centrate	1.87	14,849	11,460	7,791	623
	Dewatering Centrate	0.15	7,334	4,916	2,174	2,088
Subtotal E - Net Change		2.02	22,184	16,376	9,965	2,711
SSPF						
Returned	Thickener Centrate	0.00	0	0	0	0
	Dewatering Centrate	0.00	0	0	0	0
Subtotal F - Net Change		0.00	0	0	0	0
PLWTP						
Applied						
- w/o FISDF/FIRP, Plant & PS2 Chem		228.28	557,968	418,988	557,929	207,788
- with PS No. 2 Chem & FISDF/FIRP		229.93	650,833	464,255	581,088	218,867
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem		229.94	714,213	454,255	581,968	218,867
Effluent		228.14	107,703	62,852	238,246	215,230
Removal Efficiency						
- w/o FISDF/FIRP, Plant & PS2 Chem (per Waiver)		—	80.7%	85.1%	57.3%	-3.6%
- with PS No. 2 Chem & FISDF/FIRP		—	83.5%	86.2%	59.0%	1.6%
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem		—	84.9%	86.2%	59.0%	1.6%
Secondary Effluent from NCWRP		0.00	0	0	0	0
Secondary Effluent from SWRP		0.00	0	0	0	0
Secondary Effluent from SBWRP/SBSTP		0.00	0	0	0	0
Total Ocean Discharge (PLWTP+NCWRP+SWRP/SBSTP)		228.14	107,703	62,852	238,246	215,230
(TOTAL OCEAN DISCHARGE IN MT/YEAR)			17826			

TSS	TBOD
293.1	293.1
339.5	303.0
372.4	303.0

Metropolitan Sewerage System
2001-2003 Wastewater Quality and Flow Used for Model Calibration
MSC CAMP Silos and Truck Loadout Capacity Estimates

Daily - [illegible] Percentile

Year	PLWTPin Flow	PLWTPin TSS	PLWTPin TBOD	PLWTPout Flow	PLWTPout TSS	PLWTPout TBOD	Removal (%) TSS	Removal (%) TBOD	SBWRPin Flow	SBWRPin TSS	SBWRPin TBOD	SBWRPout Flow	SBWRPout TSS	SBWRPout TBOD	Removal (%) TSS	Removal (%) TBOD	SBWRPtsd Flow	MSC Centrate Flow	MSC Centrate TSS	MSC Centrate TBOD	NCWRPin Flow	NCWRPin TSS	NCWRPin TBOD	NCWRPout Flow	NCWRPout TSS	NCWRPout TBOD	Removal (%) TSS	Removal (%) TBOD
2001	[illegible]	321.0	[illegible]	[illegible]	[illegible]	117.[illegible]	[illegible]	[illegible]										2.6	[illegible]	[illegible]	24.0	278.3	282	23.6	5.7	7	98.0%	97.5%
2002	178.6	[illegible]	300.0	175.4	88.0	117.0	[illegible]	72.3%	4.7	[illegible]	[illegible]	6.0	9.0	12.0	[illegible]	97.4%	0.94	2.7	1417	480								
2003	193.2	325.0	301.1	192.1	92.4	129.0	[illegible]	[illegible]	[illegible]	[illegible]	437	4.5	10.5	26.0	98.1%	94.1%	0.98	2.9	1365	477								
3-yr	185.4	325.0	296.0	185.3	84.0	123.0	[illegible]	71.2%	[illegible]	528	[illegible]	5.0	10.3	23.4	98.0%	95.0%	0.96	2.7	1329	523	24.01	278.31	282.0	23.61	5.71	7.0	98.0%	97.5%
Model	[illegible]	[illegible]	303	229.1	[illegible]	126.2	[illegible]	[illegible]	16.90	328	[illegible]	13.23	10.3	23.4	—	—	1.77	2.0	1317	592	30.00	278	282	27.97	5.7	7.0	—	—

Project P-10.6 - Replacement of Dewatering Centrifuges with Larger Capacity Units

7% = Solids Content (%)
[illegible] = Mass Production Rate (dry lb/d)
228 = Mass Production Rate (dry tons/d)
1,943,430 = Volumetric Production Rate (gpd) - VPR
259,817 = Volumetric Production Rate (ft^3/d) - VPR

1,350 = Dewatering Centrifuge Capacity required (gpm)

8 = Number of Centrifuges Available
6 = Assumed Number of Centrifuges in Operation
225 = Average Capacity per Centrifuge (gpm) — 75% of peak capacity
300 = Peak Capacity per Centrifuge (gpm)
1,350 = Total available average capacity (gpm)
1,800 = Total available peak capacity (gpm)

1.00 = Required/Available

Should be less than or equal to 1 if sufficient capacity is available. Based on average capacity.

MODEL SUMMARY FOR CALENDAR YEAR CALIBRATION

Case No.:	CALIBRATION RUN - PROJECTS P-11.1 & 11.6	**Year MER Reached:**	CALIBRATION
System AADF	188.6 **mgd**	**Year PS2 Cap. Reached:**	N/A
PS1 PWWF:	N/A **mgd**	**PS2 Storage Design Year:**	No Storage Provided
PS2 PWWF:	N/A **mgd**	**PS2 Storage Cap. (mgd):**	N/A
PL Eff TSS:	51 **mg/L**	**Year PS1 Cap. Reached:**	N/A
MBC Gas Prd:	**286,911 scf**	**Storage Tank Design Year:**	No Storage Provided
SSPF Gas Prd	**0 scf**	**Storage Tank Cap. (mgd):**	N/A

Assumptions:

80% solids recovery in dewatering cenrifuge
82.700% removal of non-centrate recylce TSS at PLWTP
100.000% Capture of Chemical Sludge
82.700% removal of thickener centrate TSS at PLWTP
82.700% removal of dewatering centrate TSS at PLWTP
13,600 mt/yr TSS MER limit at PLWTP
300 mg/L TBOD in the MSS Flow
273 mg/L TSS in the MSS Flow
82.700% removal of TSS from MSS and WRP Secondary Effluent
1.1 lb TSS/lb FeCl3 added ...
59% removal of TBOD at PLWTP
0.0% Diverted at PLWTP for Secondary Treatment
0.00 mgd diverted at PLWTP for Secondary Treatment
25 mgd NCWRP
0 mgd CWRP
5 mgd SBWRP (Southern Facility)
0 mgd CSTP
0 mgd SBSTP

286 mg/L TBOD in the PLWTP Influent
306 mg/L TSS in the PLWTP Influent
256 mg/L TBOD in the NCWRP Influent
272 mg/L TSS in the NCWRP Influent
250 mg/L TBOD in the Central WRP Influent
250 mg/L TSS in the Central WRP Influent
365 mg/L TBOD in the South Bay Influent
376 mg/L TSS in the South Bay Influent
0.0% Reclamation at NCWRP Annually
0.0% Reclamation at CWRP Annually
0.0% Reclamation at SBWRP Annually
29 mgd of WRP Capacity - VIOLATES OPRA
No WTP Sludge discharged to the sewer
NCES/PLTO Not Utilized
SSPF Not Online
TSS MER Limit Applies to PLOO Only

Source/Plant		Flow (mgd)	TSS (lb/d)	VSS (lb/d)	TBOD (lb/d)	SBOD (lb/d)
Total System Generation						
MSS (Basic + Other Major Ind/Com Sources)		188.60	429,408	322,056	471,877	188,751
Tijuana		0.00	0	0	0	0
PS No. 2 Chemical		0.00	17,019	0	0	0
Subtotal A - Total Generated		188.60	446,427	322,056	471,877	188,751
NCWRP						
Applied		24.50	55,578	41,683	52,308	20,923
Returned		22.90	936	749	1,127	378
Subtotal B - Net Change		(1.60)	(54,642)	(40,935)	(51,181)	(20,545)
SWRP/MVWRP/MGWRP (i.e., CWRP)						
Applied		0.00	0	0	0	0
Returned		0.00	0	0	0	0
Subtotal C - Net Change		0.00	0	0	0	0
SBWRP						
Applied		4.70	14,738	11,054	14,307	5,723
Returned		0.41	17,073	13,216	8,958	179
Subtotal D - Net Change		(4.29)	2,335	2,163	(5,349)	(5,544)
SBSTP						
Applied		0.00	0	0	0	0
Returned		0.00	0	0	0	0
Subtotal D - Net Change		0.00	0	0	0	0
NSPF (MBC)						
Returned	Thickener Centrate	1.47	13,114	10,113	6,582	468
	Dewatering Centrate	0.11	6,308	4,223	1,664	1,592
Subtotal E - Net Change		1.58	19,422	14,336	8,246	2,060
SSPF						
Returned	Thickener Centrate	0.00	0	0	0	0
	Dewatering Centrate	0.00	0	0	0	0
Subtotal F - Net Change		0.00	0	0	0	0
PLWTP						
Applied						
- w/o FISDF/FIRP, Plant & PS2 Chem		184.30	396,523	297,620	423,592	164,722
- with PS No. 2 Chem & FISDF/FIRP		185.51	473,426	325,504	442,152	172,611
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem		185.52	524,483	325,504	442,152	172,611
Effluent		184.20	78,958	42,418	180,398	169,993
Removal Efficiency						
- w/o FISDF/FIRP, Plant & PS2 Chem (per Waiver)		---	80.1%	85.7%	57.4%	-3.2%
- with PS No. 2 Chem & FISDF/FIRP		---	83.3%	87.0%	59.2%	1.5%
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem		---	84.9%	87.0%	59.2%	1.5%
Secondary Effluent from NCWRP		0.00	0	0	0	0
Secondary Effluent from SWRP		0.00	0	0	0	0
Secondary Effluent from SBWRP/SBSTP		0.00	0	0	0	0
Total Ocean Discharge (PLWTP+NCWRP+SWRP/SBSTP)		184.20	78,958	42,418	180,398	169,993
(TOTAL OCEAN DISCHARGE IN MT/YEAR)			13070			

TSS	TBOD
258.0	275.6
306.0	285.8
339.0	285.8

Metropolitan Sewerage System
2001-2003 Wastewater Quality and Flow Used for Model Calibration
MBC CAMP Silos and Truck Loadout Capacity Estimates

7-day Rolling Average - 95th Percentile

	PLWTPin			PLWTPout			Removal (%)		SBWRPin			SBWRPout			Removal (%)		SBWRPret	MBC Centrate			NCWRPin			NCWRPout			Removal (%)	
Year	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	Flow	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD
2001	190.9	290.7	276 7	189.8	51.4	107 6	91 2%	67 4%										2.4	1088	538	24.5	272	256	23.0	4.9	5.9	98.2%	97.7%
2002	174.0	311.4	287 5	172.9	51.8	113.4	87.2%	70.2%	4.6	376	365	4.8	7 7	9.8	97.9%	97.3%	0.80	2.5	1512	507								
2003	190 2	310.3	290.7	189 1	49 2	124.3	87.2%	65 9%	4.7			4.4					0.89	2 6	1318	421								
3-yr	185 5	306	287	164 4	51 4	117 5	87.6%	69 3%	4.7	376	365	4.7	7 7	9.8	97 9%	97.3%	0.87	2 5	1466	514	24 5	272	256	23 0	4 9	5.9	98.2%	97.7%
Model	185.5	306	286	184.2	51.4	117.4	84.9%	59.2%	4.7	376	365	4.3	7.7	9.8	---	---	0.41	1.6	1469	624	24.5	272	256	22.[illegible]	4.9	5.9	---	---

Project P-11.1 - Additional Biosolids Storage Silos

28% = Solids Content (%)
269,807 = Mass Production Rate (dry lb/d)
135 = Mass Production Rate (dry ton/d)
107,981 = Volumetric Production Rate (gpd) - VPR
14,436 = Volumetric Production Rate (ft^3/d) - VPR

2.67 = Maximum days of storage required (i.e., 2 weekend days + 16 hours or 64 hours)

[illegible] = Truck Storage Cap Required (gal)
[illegible] = Truck Storage Cap Required (ft^3)

8 = Number of Silos Available
[illegible] = Assumed Number of Silos in Operation
6,950 = Storage Capacity per Silo (ft^3)
51,986 = Storage Capacity per Silo (gal)
55,600 = Total available capacity (ft^3)
415,888 = Total available capacity (gal)

[illegible]

Project P-11.6 - New Biosolids Truck Loadout Facility

Capacity Estimate

648 = Loadout Capacity per Bay (ft^3)
4,847 = Loadout Capacity per Bay (gallon)
2 = Number of Bays
20 = Loading Duration per Truck (min)
5 = Number of days of operation per week
8 = Number of hours operation per day
480 = Maximum Operating Minutes per day
15,552 = Maximum Daily Volumetric Disposal per Bay (ft^3)

Maximum Daily Mass Load Disposal per Bay (ft^3) = (Maximum Operating Minutes per day / Loading Duration per Truck (min)) * Loadout Capacity per Bay (ft^3)

[illegible] = Volumetric Production Rate (ft^3/d) - VPR
[illegible]

[illegible]

Mass Balance for the NSPF Portion of MBC - Y:CALIBRATION

Process	Units	Value	Assumtions
SLUDGE THICKENING			
Influent Flow			
●ADWF	mgd	1.60	
●PWWF	mgd		
Influent Character			
- TSS	mg/l	4,950	1.01 Specific Gravity of Combined Sludge
	lb/d	66,568	(Relative to H20 = 1.0)
- VSS	mg/l	3,818	
	lb/d	51,336	
- TBOD	mg/l	2,485	
	lb/d	33,411	
- SBOD	mg/l	50	
	lb/d	668	
Thickener Centrate Flow			
●ADWF	mgd	1.47	1.00 Centrate Specific Gravity
●PWWF	mgd		
Thickener Centrate Character			
- TSS	mg/l	1,068	80.3% Solids Recovery
	lb/d	13,114	
- VSS	mg/l	824	
	lb/d	10,113	
- TBOD	mg/l	536	
	lb/d	6,582	
- SBOD	mg/l	38	
	lb/d	468	70% SBOD Fraction Retained in Centrate
Thickened Sludge Flow			
●ADWF	mgd	0.12	5.0% Thickened Sludge Concentration
●PWWF	mgd		1.03 Thickened Sludge Specific Gravity
Thickened Sludge Character			
- TSS	mg/l	50,000	80.3% Solids Recovery
	lb/d	53,454	
- VSS	mg/l	38,559	
	lb/d	41,223	
- TBOD	mg/l	25,095	
	lb/d	26,829	
- SBOD	mg/l	188	
	lb/d	200	
SLUDGE DIGESTION			
Digester Effluent			
●ADWF	mgd	0.12	99% Flow Conserved
●PWWF	mgd		
Digested Sludge Character			
- TSS	mg/l	30,252	
	lb/d	32,018	
- VSS	mg/l	20,253	1.03 Specific Gravity of Digested Sludge
	lb/d	21,436	52.0% VSS Destruction in Digester
- TBOD	mg/l	11,407	7% Fraction of Influent VSS Solubilized
	lb/d	12,073	75% Fraction of Solubilized VSS is SBOD
- SBOD	mg/l	2,149	55% TBOD Reduction in Digester
	lb/d	2,274	55% SBOD Reduction in Digester
Digester Gas Production	scf	286,911	15 scf/lb VSS destroyed
SLUDGE DEWATERING			
Sludge Cake Flow			
●ADWF	mgd	0.010	
●PWWF	mgd		
Sludge Cake Character			
- TSS	mg/l	280,000	28% Solids Content
	lb/d	25,711	80% Solids Capture (Applies to TSS, VSS & TBOD)
- VSS	mg/l	187,455	1.07 Specific Gravity
	lb/d	17,213	0.191 = (1-Cent TSS Rem Eff)*(DAFT TSS Rem Eff) - b
- TBOD	mg/l	113,361	0.006 = (1-Cent TSS Rem Eff)*(1-DAFT TSS Rem Eff) - a
	lb/d	10,409	
- SBOD	mg/l	7,431	
	lb/d	682	70% Fraction of SBOD Retained in Centrate
Centrate Flow			7,564 Recycle Stream-TSS
●ADWF	mgd	0.113	5,064 Recycle Stream-VSS
●PWWF	mgd		2,315 Recycle Stream-TBOD
Centrate Character			
- TSS	mg/l	6,698	1.00 Specific Gravity of Centrate
	lb/d	6,306	
- VSS	mg/l	4,484	
	lb/d	4,223	
- TBOD	mg/l	1,767	
	lb/d	1,664	
- SBOD	mg/l	1,691	
	lb/d	1,592	

Process	Units	Value		Assumptions
INFLUENT FLOW & WASTEWATER QUALITY (w/o FIRP Recycle & PS2 Chem)				
@ AADF	mgd	184.30		
@PWWF	mgd	331.74	1.8	peaking factor
TSS	mg/L	258		
	lb/d	396,523		
VSS	mg/L	194		
	lb/d	297,620		
TBOD	mg/L	276		
	lb/d	423,592		
SBOD	mg/L	107		
	lb/d	164,722		
PRIMARY SEDIMENTATION				
Total influent flow	mgd			
@ AADF		185.51	1.21	mgd from FIRP Recycle (MBC dewatering centrate cc
@ PWWF		332.95	0.00	mgd Thickening Centrate (the thinkening centrate at F
Influent TSS	lbs/day	473,426	59,884	lb/d from FIRP Recycle
	mg/L	306	0	lb/d from Thickening Centrate
Influent VSS	lbs/day	325,504	27,884	lb/d from FIRP Recycle
	mg/L	210	0	lb/d from Thickening Centrate
Influent TBOD	lbs/day	442,152	18,560	lb/d from FIRP Recycle
	mg/L	286	0	lb/d from Thickening Centrate
Influent SBOD	lbs/day	172,611	7,889	lb/d from FIRP Recycle
	mg/L	112	0	lb/d from Thickening Centrate
MSS TSS removal efficiency		82.70%		
MSS BOD removal efficiency		59.20%	83%	TSS Rem in other recycle stream
Dewatering Centrate TSS removal effiency		82.70%	83%	TSS Rem in Thickener Centrate
Dewatering Centrate BOD Removal efficiency		59.20%	59%	TBOD Rem in Thickener Centrate
In Plant Chemical Addition (FeCl▲d3▲0d)	mg/L	30	44%	Ferric Chloride Solution Added at PS2 & PLWTP
	lbs/day	46,415	1.5	Specific Gravity of FeCl3 Solution
	mgd	0.009	100%	Capture of Chemical Sludge
Chemical Sludge (as TSS) Produced	lbs/day	51,057	1.10	lb TSS Produced/lb FeCl3 Added
Primary sludge TSS	lbs/day	445,524		
Primary sludge VSS	lbs/day	283,087	75%	of Sludge TSS is VSS (exc. chem sludge)
Primary sludge TBOD	lbs/day	261,754	0.92	TBOD to VSS Ratio (Calculated)
Primary sludge SBOD	lbs/day	2,618	1%	of Sludge TBOD is SBOD
Primary sludge flow	mgd	1.32	4%	Advance Primary Sludge
Primary effluent TSS	lbs/day	78,958	1.01	Specific Gravity of Primary Sludge
Primary effluent TSS conc @AADF	mg/L	51.4	27,902	
Primary effluent VSS	lbs/day	42,418	83.3219%	Actual Removal (Plant Performance)
Primary effluent VSS conc @AADF	mg/L	27.6		
Primary effluent TBOD	lbs/day	180,398		
Primary effluent TBOD conc @AADF	mg/L	117.4		
Primary effluent SBOD	lbs/day	169,993	59.20%	Actual Removal (Plant Performance)
Primary effluent SBOD conc @AADF	mg/L	110.7		
Primary effluent flow	mgd			
@ AADF		184.20		
@ PWWF		331.63		
DIGESTION				
Digester Effluent				
@ AADF	mgd	1.31	99%	Flow Conserved
Digested Sludge Character				
- TSS	mg/l	27,032		
	lb/d	303,981		
- VSS	mg/l	12,587	1.03	Specific Gravity of Digested Sludge
	lb/d	141,543	50.0%	VSS Destruction in Digester
- TBOD	mg/l	5,819	5%	Fraction of Influent VSS Solubilized
	lb/d	65,439	75%	Fraction of Solubilized VSS is SBOD
- SBOD	mg/l	1,002	75%	TBOD Reduction in Digester
	lb/d	11,270	75%	SBOD Reduction in Digester
FISDF/FIRP SLUDGE DEWATERING				
Sludge Cake Flow				
@ AADF	mgd	0.098		
@PWWF	mgd			
Sludge Cake Character				
- TSS	mg/l	280,000	28%	Solids Content
	lb/d	244,097	80%	Solids Capture
- VSS	mg/l	130,377	1.07	Specific Gravity
	lb/d	113,659	0.47	VSS to TSS Ratio (Calculated)
- TBOD	mg/l	53,773	0.41	TBOD to VSS Ratio (Calculated)
	lb/d	46,878		
- SBOD	mg/l	3,878		
	lb/d	3,381	70%	Fraction of SBOD Retained in Centrate
Dewatering Centrate Flow				
@ AADF	mgd	1.21		
@PWWF	mgd		1.00	Specific Gravity of Centrate
Dewatering Centrate Character			0	gpm/BFP washwater added to centrate
- TSS	mg/l	5,927	0	BFP operating
	lb/d	59,884		
- VSS	mg/l	2,760	0.191	= (1-Cent TSS Rem Eff)*(DAFT TSS Rem Eff) - b
	lb/d	27,884	0.006	= (1-Cent TSS Rem Eff)*(1-DAFT TSS Rem Eff) - a
- TBOD	mg/l	1,837	71,810	Recycle Stream-TSS
	lb/d	18,560	33,437	Recycle Stream-VSS
- SBOD	mg/l	781	12,796	Recycle Stream-TBOD
	lb/d	7,889		

Process	Units	Value	Assumptions
INFLUENT FLOW			
@ AADF	mgd	4.7	
@PWWF	mgd	9.4	2 peaking factor
INFLUENT WASTEWATER QUALITY			
- TSS	mg/l	376	
- BOD	mg/l	365	
PRIMARY SEDIMENTATION			
Total influent flow	mgd		
@ AADF		4.70	0.00 mgd flow contributed by backwash
@ PWWF		9.40	
Influent TSS	lbs/day	14,738	
Influent BOD	lbs/day	14,307	
TSS removal efficiency for MSS Component		60%	
BOD removal efficiency		35%	
Chemical Addition (FeCl▲d3▲0d)	mg/L	0	
	lbs/day	0	44% by weight FeCl▲d3▲0d Sol'n
	mgd	0.0000	1.476 Specific Gravity of FeCl▲d3▲0d Sol'n
Chemical Sludge (as TSS) Produced	lbs/day	0	1.10 lb TSS Produced/lb FeCl3 Added
Primary sludge TSS	lbs/day	8,843	100% Chemical Sludge Removal Rate
Primary sludge flow	mgd	0.21	0.5% solids concentration.
Primary effluent TSS	lbs/day	5,895	
Primary effluent TSS conc @AADF	mg/l	157.51	Contribution during PWWF is mostly
Primary effluent BOD	lbs/day	9,300	dillution water with no BOD and TSS.
Primary effluent BOD conc @AADF	mg/l	248.46	
Primary effluent VSS	lbs/day	4,598	75% of raw wastewater TSS is VSS
Primary effluent VSS conc @AADF	mg/l	122.86	78% of primary effluent TSS is VSS
Primary effluent flow	mgd		
@ AADF		4.49	
@ PWWF		9.19	
ACTIVATED SLUDGE			
Gross Nonbiodeg. Incoming TSS	lbs/day	3,136	1,297 = NVSS (lb/day) including RAS fraction
MLTSS concentration	mg/l	2,800	40.0% = nonbiodeg fraction of inf. VSS (lb/day)
Influent flow	mgd		1,839 = NBVSS (lb/day) including RAS fraction
- Average		4.49	
- Peak		5.39	1.20 Peak equalized flow factor
Returned activated sludge flow	mgd	2.24	0.5% RAS solids concentration
RAS/influent ratio		0.50	80% of secondary TSS is VSS
Reactor inf/eff flow	mgd		
- Average		6.73	Assuming RAS flow remains constant.
- Peak		7.63	
Reactor effluent TSS	lbs/day	157,203	
Active biomass plus endogenous			5 SRT (MCRT)
biomass decay products	lbs/day	5,369	30 C assumed influent temperature
			0.6 =Ynet
SECONDARY SEDIMENTATION			
Influent flow	mgd		
- Average		4.49	
- Peak		5.39	
- TSS	lbs/day	5,895	
- TSS concentration	mg/l	157.51	
- BOD	lbs/day	9,300	
- BOD concentration	mg/l	248.46	
- VSS	lbs/day	4,598	
- VSS concentration	mg/l	122.86	157,203 lbs/day solids loading based on
Secondary effluent flow	mgd		2800 mg/l MLSS conc @ ADWF
- Average		4.29	178,164 lbs/day solids loading based on
- Peak		5.19	2800 mg/l MLSS conc @ PWWF
Secondary eff TSS	lbs/day	276	7.7 mg/l of TSS at the secondary effluent.
Secondary eff BOD	lbs/day	351	9.8 mg/l of BOD at the secondary effluent

Process	Units	Value	Assumptions
Waste activated sludge TSS	lbs/day	8,230	
Waste activated sludge flow	mgd	0.20	0.50 % solids
RAS & WAS flow	mgd	2.441335848	
Secondary's BOD removal eff		96.2%	
Secondary's TSS removal eff		95.3%	
TERTIARY FILTERS/ DISINFECTION			
Influent total flow	mgd		
- Average		0.00	utility water included
- Peak		0.00	1.20 Peaking Factor
Influent TSS	lbs/day	0	
Influent VSS	lbs/day	0	47% VSS to TSS Ratio
Influent TBOD	lbs/day	0	47% Particulate BOD to VSS Ratio
Influent SBOD	lbs/day	0	
Effluent flow	mgd		
- Average		0.00	
- Peak		0.00	
Effluent TSS	lbs/day	0	4.4 mg/l of TSS at the effluent.
Effluent VSS	lbs/day	0	8 mg/L of BOD at the effluent
Effluent TBOD	lbs/day	0	47% VSS to TSS Ratio
Effluent SBOD	lbs/day	0	47% Particulate BOD to VSS Ratio
Utility water flow WRP	mgd	0	3% of plant flow
Utility water TSS	lbs/day	0	
Utility water BOD	lbs/day	0	backwash flow is recycled to primaries
Backwash cumulative daily flow	mgd	0.00	20.0 gpm/sf of filter area.
Backwash cumulative TSS	lbs/day	0	15 minute backwash event.
Backwash TSS conc	mg/l	0	
Backwash cumulative BOD (lbs/day)	lbs/day	0	
Backwash BOD conc (mg/l)	mg/l	0	
Filters' BOD % removal		0%	
DISINFECTION			
Influent total flow	mgd		
- Average		0.00	
- Peak		0.00	1.2 Peaking Factor
Influent TSS	lbs/day	0	
Influent VSS	lbs/day	0	
Influent TBOD	lbs/day	0	
Inffluent SBOD	lbs/day	0	
Effluent flow	mgd		
- Average		0.00	
- Peak		0.00	
Effluent TSS	lbs/day	0	2 mg/l of TSS at the effluent.
Effluent VSS	lbs/day	0	4 mg/L of BOD at the effluent
Effluent TBOD	lbs/day	0	47% VSS to TSS Ratio
Effluent SBOD	lbs/day	0	

COMBINED SLUDGE FLOW =	0.41	MGD
COMBINED SLUDGE TSS MASS RATE =	17,073	lb/d
COMBINED SLUDGE VSS MASS RATE =	13,216	lb/d
COMBINED SLUDGE TBOD MASS RATE =	8,958	lb/d
COMBINED SLUDGE SBOD MASS RATE =	179	lb/d

Mass Balance - NCWRP

Process	Units	Value	Assumptions
INFLUENT FLOW			
@AADF	mgd	24.5	
@PWWF	mgd	49.0	2 peaking factor
INFLUENT WASTEWATER QUALITY			
- TSS	mg/l	272	
- BOD	mg/l	256	
PRIMARY SEDIMENTATION			
Total influent flow	mgd		
@ AADF		24.50	0.00 mgd flow contributed by backwash
@ PWWF		49.00	
Influent TSS	lbs/day	55,578	
Influent BOD	lbs/day	52,308	
TSS removal efficiency		65%	
BOD removal efficiency		38%	
Chemical Addition (FeCl▲d3▲0d)	mg/L	10	
	lbs/day	2,043	44% by weight FeCl▲d3▲0d Sol'n
	mgd	0.0004	1.467 Specific Gravity of FeCl▲d3▲0d Sol'n
Chemical Sludge (as TSS) Produced	lbs/day	2,248	1.10 lb TSS Produced/lb FeCl3 Added
Primary sludge TSS	lbs/day	38,373	100% Chemical Sludge Removal Rate
Primary sludge flow	mgd	0.92	0.5% solids concentration.
Primary effluent TSS	lbs/day	19,452	
Primary effluent TSS conc @AADF	mg/l	98.91	Contribution during PWWF is mostly
Primary effluent BOD	lbs/day	32,431	dilution water with no BOD and TSS.
Primary effluent BOD conc @AADF	mg/l	164.91	
Primary effluent VSS	lbs/day	15,173	75% of raw wastewater TSS is VSS
Primary effluent VSS conc @AADF	mg/l	77.15	78% of primary effluent TSS is VSS
Primary effluent flow	mgd		
@ AADF		23.58	
@ PWWF		48.08	
ACTIVATED SLUDGE			
Gross Nonbiodeg. Incoming TSS	lbs/day	10,349	4,279 = NVSS (lb/day) including RAS fraction
MLTSS concentration	mg/l	2,155	40.0% = nonbiodeg fraction of inf. VSS (lb/day)
Influent flow	mgd		6,069 = NBVSS (lb/day) including RAS fraction
- Average		23.58	
- Peak		28.30	1.20 Peak equalized flow factor
Returned activated sludge flow	mgd	11.79	0.5% RAS solids concentration
RAS/influent ratio		0.50	80% of secondary TSS is VSS
Reactor inf/eff flow	mgd		
- Average		35.37	Assuming RAS flow remains constant.
- Peak		40.09	
Reactor effluent TSS	lbs/day	635,699	
Active biomass plus endogenous			5.86 SRT (MCRT)
biomass decay products	lbs/day	18,783	30 C assumed influent temperature
			0.6 =Ynet
SECONDARY SEDIMENTATION			
Influent flow	mgd		
- Average		23.58	
- Peak		28.30	
- TSS	lbs/day	19,452	
- TSS concentration	mg/l	98.91	
- BOD	lbs/day	32,431	
- BOD concentration	mg/l	164.91	
- VSS	lbs/day	15,173	
- VSS concentration	mg/l	77.15	635,699 lbs/day solids loading based on
Secondary effluent flow	mgd		2155 mg/l MLSS conc @ ADWF
- Average		22.90	720,459 lbs/day solids loading based on
- Peak		27.62	2155 mg/l MLSS conc @ PWWF
Secondary eff TSS	lbs/day	936	4.9 mg/l of TSS at the secondary effluent.
Secondary eff BOD	lbs/day	1,127	5.8 mg/l of BOD at the secondary effluent

Process	Units	Value	Assumptions
Waste activated sludge TSS	lbs/day	28,195	
Waste activated sludge flow	mgd	0.68	0.50 % solids
RAS & WAS flow	mgd	12.47	
Secondary's BOD removal eff		96.5%	
Secondary's TSS removal eff		95.2%	
TERTIARY FILTERS/ DISINFECTION			
Influent total flow	mgd		
- Average		0.00	utility water included
- Peak		0.00	1.20 Peaking Factor
Influent TSS	lbs/day	0	
Influent VSS	lbs/day	0	47% VSS to TSS Ratio
Influent TBOD	lbs/day	0	47% Particulate BOD to VSS Ratio
Influent SBOD	lbs/day	0	
Effluent flow	mgd		
- Average		0.00	
- Peak		0.00	
Effluent TSS	lbs/day	0	4.4 mg/l of TSS at the effluent.
Effluent VSS	lbs/day	0	8 mg/L of BOD at the effluent
Effluent TBOD	lbs/day	0	47% VSS to TSS Ratio
Effluent SBOD	lbs/day	0	47% Particulate BOD to VSS Ratio
Utility water flow WRP	mgd	0	3% of plant flow
Utility water TSS	lbs/day	0	
Utility water BOD	lbs/day	0	backwash flow is recycled to primaries
Backwash cumulative daily flow	mgd	0.00	20.0 gpm/sf of filter area.
Backwash cumulative TSS	lbs/day	0	15 minute backwash event.
Backwash TSS conc	mg/l	0	
Backwash cumulative BOD (lbs/day)	lbs/day	0	
Backwash BOD conc (mg/l)	mg/l	0	
Filters' BOD % removal		0%	
DISINFECTION			
Influent total flow	mgd		
- Average		0.00	
- Peak		0.00	1.2 Peaking Factor
Influent TSS	lbs/day	0	
Influent VSS	lbs/day	0	
Influent TBOD	lbs/day	0	
Inffluent SBOD	lbs/day	0	
Effluent flow	mgd		
- Average		0.00	Flow to the AWT
- Peak		0.00	
Effluent TSS	lbs/day	0	4.4 mg/l of TSS at the effluent.
Effluent VSS	lbs/day	0	8 mg/L of BOD at the effluent
Effluent TBOD	lbs/day	0	47% VSS to TSS Ratio
Effluent SBOD	lbs/day	0	

COMBINED SLUDGE FLOW =	1.60	MGD
COMBINED SLUDGE TSS MASS RATE =	66,568	lb/d
COMBINED SLUDGE VSS MASS RATE =	51,336	lb/d
COMBINED SLUDGE TBOD MASS RATE =	33,411	lb/d
COMBINED SLUDGE SBOD MASS RATE =	668	lb/d

Wastewater Quality and Quantity

Source	Facility Design Cap. (mgd)	Flow AADF (mgd)	TSS Concentration (mg/L)	VSS Concentration (mg/L)	TBOD Concentration (mg/L)	SBOD Concentration (mg/L)
MSS		188.60	273	205	300	120
NCWRP Influent	24.5	24.50	272	204	256	102
CWRP Influent	0	0.00	250	188	250	100
CSTP Influent	0					
OWRP Influent	0	0.00	0	0	0	0
SBWRP Influent	4.7	4.70	376	282	365	146
Tijuana	---	0.00	0	0	0	0
SBSTP Influent	0	0.00	260	195	315	126

Flow Distribution 0.00 = flow to AWT Analysis Year

Plant	Percent to Tertiary	Secondary Effluent (mgd)			Tertiary			Combined Raw Sludge		Centrate		
		Tertiary	Retreatment	Outfall	Reuse	Retreatment	Outfall	MBC/SSPF	Retreatment	Treatment	Recycle	Retreat
NCWRP	0%	0.00	22.90	0.00	0%	100%	0%	100%	0%	NA	NA	NA
SWRP (CWRP)	0%	0.00	0.00	0.00	100%	0%	0%	0%	100%	NA	NA	NA
OVWRP	0%	0.00	0.00	0.00	100%	0%	0%	0%	100%	NA	NA	NA
SBWRP	0%	0.00	0.00	4.29	0%	0%	100%	0%	100%	NA	NA	NA
SBSTP to Sec	0%	0.00	0.00	0.00	100%	0%	0%	100%	0%	NA	NA	NA
NSPF		NA	NA	NA	NA	NA	NA	NA	NA	0%	0%	100%
FIRP		NA	NA	NA	NA	NA	NA	NA	NA	0%	0%	100%
SSPF		NA	NA	NA	NA	NA	NA	NA	NA	0%	0%	100%
Node D (Raw Wastewater)			100%	0%	NA	NA	NA	NA	NA	NA	NA	NA
SBWRP											0%	

PLWTP: 0

Flow Diverted for Secondary Treatment at PLWTP: 0.00%
0 mgd

Flow Diverted for Secondary Treatment at SBSTP: 0%
0 mgd

Plant Performance Criteria

Category	Process	Parameter	Units	Value	Model Designation	Comments
Permit Requirement		TSS MER	lb/d	82,159	TSS_MER	
			mt/yr	13,600		
		System Wide = 1; Specific to PLOO = 0	-------->	0	MER_CRITERIA	
SBSTP		Advanced Primary Treatment Toggle	0=No; 1=Yes	0	SBSTP.ADV.PRIM	
Water Tmt Sludge		Water Treatment Sludge Solids Load	(1 = IN; 0 = OUT)	0	WTP.SLUDGE	
		- North (Poway WTP)	% of total load	3.0%	WTPLOAD.N	
		- Central (Helix WTP)	% of total load	11.4%	WTPLOAD.C	
		- South (Otay WTP)	% of total load	11.4%	WTPLOAD.S	
		- PLWTP Direct (Miramar and Alvarado WTPs)	% of total load	74.2%	WTPLOAD.PL	
AWT		AWT On-Line	(1 = Yes; 0 = No)	0	AWT	
San Pasqual/RB		San Pasqual Valley Situation	Scenario	0	SPVWRP.SCEN	0-Base; 1-Raw; 2-Raw-1; 3-TE
PS1		Peak Capacity	mgd	160	PS1.CAP	
PS2		Peak Capacity	mgd	432	PS2.CAP	
NCES/PLTO		Online? (1=Yes; 0=No)	---	0	NCES	
Peaking Factors		NCWRP	---	2.00	NCWRP.PEAK.Q	Based on Actual Design
		SBWRP	---	2.57	SBWRP.PEAK.Q	Based on Actual Design
		SBSTP	---	1.80	SBSTP.PEAK.Q	Based on Project Report
		CWRP	---	1.20	CWRP.PEAK.Q	Based on Project Report
		Impact of Flow removal at GAPS on PS1	---	1.34	GAPS.PS1.PF	Provided by PPG (2/19/97)
		Impact of Flow removal at GAPS on PS2	---	1.30	GAPS.PS2.PF	Provided by PPG (2/19/97)
		Impact of Flow removal at SRPS on PS1	---	1.62	SRPS.PS1.PF	Provided by PPG (2/19/97)
		Impact of Flow removal at SRPS on PS2	---	1.47	SRPS.PS2.PF	Provided by PPG (2/19/97)
		GAPS - Local	---	1.38	GAPS.LOCAL.PF	Provided by PPG (2/19/97)
		SRPS - Local	---	1.93	SRPS.LOCAL.PF	Provided by PPG (2/19/97)
		Criterion for Using which PF - % of PF	%	70.0%	PERCENT.PF	Provided by PPG (2/19/97)
		Peak Q at GAPS at MER Year	mgd	8.3	GAPS.MAX.Q	
		Peak Q at GAPS for PS1/PS2 Capacity Calc.	mgd	7.0	GAPS.MAX.PS1PS2	
SMI Flow Equalization		Design Life - Capacity till Year? (0=No Storage)	Year	0	STOR_YEAR	
System Flow Equalization		Design Life - Capacity till Year? (0=No Storage)	Year	0	STOR_YEAR.PS2	
		Provided where? (1=Central/North; 0=South)	---	0	STOR.LOC.PS2	
Raw Wastewater Quality		VSS	% of TSS	75%	RAWVSS%	
		SBOD	% of TBOD	40%	RAWSBOD%	
		Chemical Addition at PS2	mg/L	10	PS2.CHEM	
		Chemical Sludge Production	lb TSS/lb FeCl3	1.10	PS2.CHEM.PROD	3-yr average at PLWTP
		TBOD Concentration				
		- Total MSS	mg/L	300	TBOD.MSS	Iterate to match "2001-2003" sheet
		- Rancho Bernardo	mg/L	200	TBOD.RB	
		- SPVWRP Effluent	mg/L	5	TBOD.SPVWRP	
		- PQPS Influent	mg/L	256	TBOD.PQPS	Match "2001-2003" sheet
		- NCWRP Service Area	mg/L	256	TBOD.NCWRP	Match "2001-2003" sheet
		- Central WRP Service Area	mg/L	250	TBOD.CENTRAL	
		- SBWRP Influent	mg/L	365	TBOD.SOUTH	Match "2001-2003" sheet
		- SBSTP Influent	mg/L	365	TBOD.SBSTP	Match "2001-2003" sheet
		- OWRP Influent	mg/L	0	TBOD.OWRP	
		TSS Concentration				
		- Total MSS	mg/L	273	TSS.MSS	Iterate to match "2001-2003" sheet
		- Rancho Bernardo	mg/L	220	TSS.RB	
		- SPVWRP Effluent	mg/L	270	TSS.SPVWRP	
		- PQPS Influent	mg/L	272	TSS.PQPS	Match "2001-2003" sheet
		- NCWRP Service Area	mg/L	272	TSS.NCWRP	Match "2001-2003" sheet
		- Central WRP Service Area	mg/L	250	TSS.CENTRAL	
		- SBWRP Influent	mg/L	376	TSS.SOUTH	Match "2001-2003" sheet
		- SBSTP Influent	mg/L	376	TSS.SBSTP	Match "2001-2003" sheet
		- OWRP Influent	mg/L	0	TSS.OWRP	
WRP	Primary	TSS Removal	%	60%	WRP.TSS.REM	
		BOD Removal	%	35%	WRP.BOD.REM	
		Wastewater Temperture	deg-C	30.0	TEMP	
		Chemical Addition	mg/L	15	WRP.CHEM.CONC.P	
		Chemical Sludge Production	lb TSS/lb FeCl3	1.10	WRP.CHEM.PROD	
		Sludge Concentration	% (w/w)	0.50%	WRP.PR.SLD.C	
		VSS to TSS Ratio in Sludge	%	75%	WRP.PR.VSS%	
		VSS to TSS Ratio in Effluent	%	78%	WRP.PE.VSS%	
		Equalized Flow Peaking Factor	Dimensionless	1.20	EQPF	
	Secondary	Effluent TSS Conc.	mg/L	9	SEC.EFF.TSS	
		Effluent BOD Conc.	mg/L	9	SEC.EFF.BOD	
		Nonbiodeg Fraction of Inf VSS	%	40%	NBVSS	
		MLTSS Conc.	mg/L	2,800	MLTSS	
		RAS/WAS Solids Conc.	% (w/w)	0.50%	WAS%	
		VSS to TSS Ratio in Sludge	%	80%	WRP.SEC.VSS%	
		MCRT	days	5	MCRT	
		Net Yield	lb TSS gen/lb BOD rem	0.60	TSS.GEN.SEC	
		Decay Coefficient	Dimensionless	0.05	DECAY	
		RAS:Influent Flow Ratio	Dimensionless	0.50	RAS.INF	

Plant Performance Criteria

Category	Process	Parameter	Units	Value	Model Designation	Comments
		Particulate BOD to VSS Ratio	%	100%	PBOD.VSS.SEC	

Plant Performance Criteria

Category	Process	Parameter	Units	Value	Model Designation	Comments
	Tertiary	Effluent TSS Conc.	mg/L	4	TER.EFF.TSS	
		Effluent BOD Conc.	mg/L	8	TER.EFF.BOD	
		Chemical Addition - NaOCl	mg/L	5	WRP.CHEM.CONC.T	
		VSS to TSS Ratio in Tert Inf/Eff	%	47%	TER.VSS	
		Particulate BOD to VSS Ratio	%	47%	PBOD.VSS	
	Misc	Utility Water Flow	% of Plant Flow	3.0%	UTILITY	
PLWTP	Adv. Primary	Average TSS removal	%	89.0%	PL.TSS.AVGREM	
		MSS TSS removal	%	82.7%	PL.TSS.MSSREM	Iterate to match "2001-2003" sheet
		Waiver Required Removal	%	80.0%	WAIVER.TSS%	
		Influent Recycle TSS Removal	%	82.7%	PL.TSS.RECREM	
		Influent Thickener Centrate TSS Removal	%	82.7%	PL.TSS.TCENT	
		Influent Dewatering Centrate TSS Removal	%	82.7%	PL.TSS.DCENT	
		Influent Retreat TSS Removal	%	82.7%	PL.TSS.RETREM	
		Average BOD removal	%	59.2%	PL.BOD.AVGREM	
		MSS BOD removal	%	59.2%	PL.BOD.MSSREM	Iterate to match "2001-2003" sheet
		Waiver Required Removal	%	58.0%	WAIVER.TBOD%	
		Influent Recycle BOD Removal	%	59.2%	PL.BOD.RECREM	
		Influent Retreat BOD Removal	%	59.2%	PL.BOD.RETREM	
		Chemical Addition - FeCl3	mg/L	30	ADVPRI.CHEM	
		Chemical Sludge Production	lb TSS/lb FeCl3	1.10	ADVPRI.CHEM.PRD	
		Capture of Chemical Sludge	%	100%	CHEM.SLDG.PL	See chemical sludge spreadsheet
		Sludge Concentration	% (w/w)	4%	ADVPRI.SLD	
		VSS to TSS Ratio in Sludge	%	75%	ADVPRI.VSS%	
		SBOD to TBOD Ratio in Sludge	%	1%	ADVPRI.SBOD%	
		Bypass to Ocean Outfall	%	0%	PLWTP.BP	
Sludge Processing	General	Combined Sludge Specific Gravity	Dimensionless	1.01	SG.SLUDGE	Per 5/25/04 changes provided by MWWD
		SBOD to TBOD Ratio in Combined Sludge	%	2%	SBOD.CS	
	Thickening	Solids Recovery	%	80%	THCK.REC	Iterate to match "2001-2003" Sheet
		Sludge Concentration	% (w/w)	5%	THCK.SLD%	
		Thickened Sludge Specific Gravity	Dimensionless	1.03	SG.THCKSL	Per 5/25/04 changes provided by MWWD
		Fraction of TBOD Retained in Centrate	%	10%	TBOD.TC%	
		Fraction of SBOD Retained in Centrate	%	70%	SBOD.TC%	
	Digestion	Primary Sludge VSS Destroyed	%	50%	VSS.DES	
		Combined Sludge VSS Destroyed	%	52%	VSS.DES.COMB	Per 5/25/04 changes provided by MWWD
		Gas Production Rate	scf/lb VSS des	14.5	GAS.PROD	Per 5/25/04 changes provided by MWWD
		Influent to Effluent Flow Ratio	%	99%	INF.EFF.DIG	Per 5/25/04 changes provided by MWWD
		Digested Sludge Specific Gravity	Dimensionless	1.03	SG.DIG	Per 5/25/04 changes provided by MWWD
		Solubilization of Primary VSS (Inc. in VSS Des.)	%	5%	VSS.SOL	
		Solubilization of Combined VSS (Inc. in VSS Des.)	%	7%	VSS.SOL.COMB	
		Fraction of Solubilized VSS is SBOD	%	75%	SBOD.VSS.DIG	
		TBOD Reduction in Digester - Primary Sludge	%	75%	TBOD.RED%	
		TBOD Reduction in Digester - Combined Sludge	%	55%	TBOD.RED%.COMB	
		SBOD Reduction in Digester - Primary Sludge	%	75%	SBOD.RED%	
		SBOD Reduction in Digester - Combined Sludge	%	55%	SBOD.RED%.COMB	
	Dewatering	Solids Recovery - Centrifuge	%	80%	DEW.REC	Iterate to match "2001-2003" Sheet
		Solids Recovery - Belt Filter Press	%	92%	DEW.BFP	
		Sludge Concentration	% (w/w)	28%	DEW.SLD%	Per 5/25/04 changes provided by MWWD
		Dewatered Sludge Specific Gravity	Dimensionless	1.07	SG.DWTR	
		Dewatered Centrate Specific Gravity	Dimensionless	1.00	SG.DC	
		Fraction of TBOD Retained in Centrate	%	10%	TBOD.DWTR%	
		Fraction of SBOD Retained in Centrate	%	70%	SBOD.DWTR%	
		BFP Washwater Added to Filtrate	gpm	90	BFP.WW	
		Number of BFPs Operating at FISDF	Dimensionless	6	BFP	
		FIRP Startup Year	—	1998.5	FIRP.YEAR	
Centrate Treatment		Solids Recovery	%	97%	CENT.TMT.REC	Per 5/25/04 changes provided by MWWD
		Thickened Sludge Concentration	% (w/w)	3.5%	CENT.TMT.SLD%	Per 5/25/04 changes provided by MWWD
		Toggle to activate	0=off; 1=on	0	CENT.TMT.TGL	

MODEL SUMMARY FOR CALENDAR YEAR 2014

Case No.:	CALIBRATION RUN - PROJECTS P-11.1 & 11.6	Year MER Reached:	2014
System AADF:	218.0 mgd	Year PS2 Cap. Reached:	N/A
PS1 PWWF:	N/A mgd	PS2 Storage Design Year:	No Storage Provided
PS2 PWWF:	N/A mgd	PS2 Storage Cap. (mgd):	N/A
PL Eff TSS:	54 mg/L	Year PS1 Cap. Reached:	N/A
MBC Gas Prd:	351,319 scf	Storage Tank Design Year:	No Storage Provided
SSPF Gas Prd	0 scf	Storage Tank Cap. (mgd):	N/A

Assumptions:

80%	solids recovery in dewatering centrifuge	289	mg/L TBOD in the PLWTP influent
82.700%	removal of non-centrate recylce TSS at PLWTP	319	mg/L TSS in the PLWTP influent
100.000%	Capture of Chemical Sludge	258	mg/L TBOD in the NCWRP influent
82.700%	removal of thickener centrate TSS at PLWTP	272	mg/L TSS in the NCWRP influent
82.700%	removal of dewatering centrate TSS at PLWTP	250	mg/L TBOD in the Central WRP influent
13,600	mt/yr TSS MER limit at PLWTP	250	mg/L TSS in the Central WRP influent
300	mg/L TBOD in the MSS Flow	365	mg/L TBOD in the South Bay influent
273	mg/L TSS in the MSS Flow	376	mg/L TSS in the South Bay influent
82.700%	removal of TSS from MSS and WRP Secondary Effluent	0.0%	Reclamation at NCWRP Annually
1.1	lb TSS/lb FeCl3 added	0.0%	Reclamation at CWRP Annually
59%	removal of TBOD at PLWTP	0.0%	Reclamation at SBWRP Annually
0.0%	Diverted at PLWTP for Secondary Treatment	45	mgd of WRP Capacity - Satisfies OPRA
0.00	mgd diverted at PLWTP for Secondary Treatment		*No WTP Sludge discharged to the sewer*
30	mgd NCWRP		NCES/PLTO Not Utilized
0	mgd CWRP		SSPF Not Online
15	mgd SBWRP (Southern Facility)		*TSS MER Limit Applies to PLOO Only*
0	mgd CSTP		
0	mgd SBSTP		

Source/Plant		Flow (mgd)	TSS (lb/d)	VSS (lb/d)	TBOD (lb/d)	SBOD (lb/d)	TSS	TBOD
Total System Generation								
	MSS (Basic + Other Major Ind/Com Sources)	217.98	496,301	372,226	545,386	218,154		
	Tijuana	0.00	0	0	0	0		
	PS No. 2 Chemical	0.00	18,923	0	0	0		
	Subtotal A - Total Generated	217.98	515,224	372,226	545,386	218,154		
NCWRP								
	Applied	30.00	68,054	51,041	64,051	25,620		
	Returned	28.05	1,146	917	1,380	463		
	Subtotal B - Net Change	(1.95)	(66,908)	(50,124)	(62,671)	(25,157)		
SWRP/MVWRP/MGWRP (i.e., CWRP)								
	Applied	0.00	0	0	0	0		
	Returned	0.00	0	0	0	0		
	Subtotal C - Net Change	0.00	0	0	0	0		
SBWRP								
	Applied	14.35	44,987	33,740	43,671	17,468		
	Returned	1.25	52,114	40,341	27,343	547		
	Subtotal D - Net Change	(13.10)	7,127	6,601	(16,328)	(16,921)		
SBSTP								
	Applied	0.00	0	0	0	0		
	Returned	0.00	0	0	0	0		
	Subtotal D - Net Change	0.00	0	0	0	0		
NSPF (MBC)								
	Returned — Thickener Centrate	1.80	16,058	12,383	8,060	573		
	Dewatering Centrate	0.14	7,724	5,171	2,037	1,950		
	Subtotal E - Net Change	1.94	23,782	17,554	10,097	2,522		
SSPF								
	Returned — Thickener Centrate	0.00	0	0	0	0		
	Dewatering Centrate	0.00	0	0	0	0		
	Subtotal F - Net Change	0.00	0	0	0	0		
PLWTP								
	Applied							
	- w/o FISDF/FIRP, Plant & PS2 Chem	204.87	460,301	346,258	476,484	178,598	269.4	278.9
	- with PS No. 2 Chem & FISDF/FIRP	206.27	548,009	378,582	497,551	187,728	318.6	289.2
	- with PS No. 2 Chem, FISDF/FIRP & Plant Chem	206.28	604,779	378,582	497,551	187,728	351.5	289.2
	Effluent	204.76	91,532	50,416	203,001	184,782		
	Removal Efficiency							
	- w/o FISDF/FIRP, Plant & PS2 Chem (per Waiver)	—	80.1%	85.4%	57.4%	-3.5%		
	- with PS No. 2 Chem & FISDF/FIRP	—	83.3%	86.7%	59.2%	1.6%		
	- with PS No. 2 Chem, FISDF/FIRP & Plant Chem	—	84.9%	86.7%	59.2%	1.6%		
	Secondary Effluent from NCWRP	0.00	0	0	0	0		
	Secondary Effluent from SWRP	0.00	0	0	0	0		
	Secondary Effluent from SBWRP/SBSTP	0.00	0	0	0	0		
	Total Ocean Discharge (PLWTP+NCWRP+SWRP/SBSTP)	204.76	91,532	50,416	203,001	184,782		
	(TOTAL OCEAN DISCHARGE IN MT/YEAR)		15152					

Metropolitan Sewerage System
2001-2003 Wastewater Quality and Flow Used for Model Calibration
MSC CAMP Silos and Truck Loadout Capacity Estimates

7-day Rolling Average - 90th Percentile

	PLWTPin			PLWTPout			Removal (%)		SSWRPin			SSWRPout			Removal (%)		SSWRPout	MSC Centrate			NCWRPin			NCWRPout			Removal (%)	
Year	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	Flow	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD
2001	190.9	290.7	278.7	189.8	51.4	107.9	81.2%	67.4%										2.4	1088	838	24.8	272	256	23.0	4.9	5.9	98.2%	97.7%
2002	174.0	311.4	287.5	172.8	51.8	113.4	87.2%	73.2%	4.8	378	385	4.8	7.7	9.8	97.9%	97.3%	0.80	2.8	1512	807								
2003	190.2	310.3	290.7	189.1	48.2	124.3	87.2%	86.9%	4.7			4.4					0.88	2.9	1319	421								
3-yr	185.5	306	287	184.4	51.4	117.5	87.8%	69.3%	4.7	378	385	4.7	7.7	9.8	97.9%	97.3%	0.87	2.5	1406	514	24.8	272	256	23.0	4.9	5.9	98.2%	97.7%
Model	208.3	319	289	204.8	53.8	118.9	84.9%	59.2%	14.3	378	385	13.1	7.7	9.8	—	—	1.28	1.9	1480	624	30.0	272	256	25.08	4.9	5.9	—	—

Project P-11.1 - Additional Biosolids Storage Silos

29% = Solids Content (%)
311,851 = Mass Production Rate (dry lb/d)
156 = Mass Production Rate (dry ton/d)
124,811 = Volumetric Production Rate (gpd) - VPR
16,686 = Volumetric Production Rate (ft³/d) - VPR

2.63 = Maximum days of storage required

328,263 = Truck Storage Cap Required (gal)
43,884 = Truck Storage Cap Required (ft³)

6 = Number of Silos Available
7 = Assumed Number of Silos in Operation
6,950 = Storage Capacity per Silo (ft³)
51,988 = Storage Capacity per Silo (gal)
90% = Percent of Total Silo Capacity Available Operationally
43,785 = Total available capacity (ft³)
327,512 = Total available capacity (gal)

1.00 = Required/Available — should be less than or equal to 1 if sufficient capacity is available.

Project P-11.6 - New Biosolids Truck Loadout Facility

Capacity Estimate

648 = Loadout Capacity per Bay (ft³)
4,847 = Loadout Capacity per Bay (gallon)
90% = Percent of Total Loadout Capacity Available Operationally
2 = Number of Bays
25 = Loading Duration per Truck (min)
5 = Number of days of operation per week
8 = Number of hours operation per day
480 = Maximum Operating Minutes per day
11,197 = Maximum Daily Volumetric Disposal per Bay (ft³)

Maximum Daily Mass Load Disposal per Bay (ft³) = (Maximum Operating Minutes per day / Loading Duration per Truck (min)) * Loadout Capacity per Bay (ft³)

16,686 = Volumetric Production Rate (ft³/d) - VPR
23,360 = Daily disposal rate based on operational parameters noted above (ft³/d)

1.04 = Required/Available — Should be equal to 1 if sufficient capacity is available

MODEL SUMMARY FOR CALENDAR YEAR 2017

Case No.:	CALIBRATION RUN - PROJECTS P-11.1 & 11.6	Year MER Reached:	2017
System AADF:	224.8 mgd	Year PS2 Cap. Reached:	N/A
PS1 PWWF:	N/A mgd	PS2 Storage Design Year:	No Storage Provided
PS2 PWWF:	N/A mgd	PS2 Storage Cap. (mgd):	N/A
PL Eff TSS:	54 mg/L	Year PS1 Cap. Reached:	N/A
MBC Gas Prd:	351,319 scf	Storage Tank Design Year:	No Storage Provided
SSPF Gas Prd	0 scf	Storage Tank Cap. (mgd):	N/A

Assumptions:

80%	solids recovery in dewatering cenrifuge	290	mg/L TBOD in the PLWTP Influent
82.700%	removal of non-centrate recylce TSS at PLWTP	320	mg/L TSS in the PLWTP Influent
100.000%	Capture of Chemical Sludge	256	mg/L TBOD in the NCWRP Influent
82.700%	removal of thickener centrate TSS at PLWTP	272	mg/L TSS in the NCWRP Influent
82.700%	removal of dewatering centrate TSS at PLWTP	250	mg/L TBOD in the Central WRP Influent
13,600	mt/yr TSS MER limit at PLWTP	250	mg/L TSS in the Central WRP Influent
300	mg/L TBOD in the MSS Flow	365	mg/L TBOD in the South Bay Influent
273	mg/L TSS in the MSS Flow	376	mg/L TSS in the South Bay Influent
82.700%	removal of TSS from MSS and WRP Secondary Effluent	0.0%	Reclamation at NCWRP Annually
1.1	lb TSS/lb FeCl3 added	0.0%	Reclamation at CWRP Annually
59%	removal of TBOD at PLWTP	0.0%	Reclamation at SBWRP Annually
0.0%	Diverted at PLWTP for Secondary Treatment	45	mgd of WRP Capacity - Satisfies OPRA
0.00	mgd diverted at PLWTP for Secondary Treatment		*No WTP Sludge discharged to the sewer*
30	mgd NCWRP		NCES/PLTO Not Utilized
0	mgd CWRP		SSPF Not Online
15	mgd SBWRP (Southern Facility)		*TSS MER Limit Applies to PLOO Only*
0	mgd CSTP		
0	mgd SBSTP		

Source/Plant		Flow (mgd)	TSS (lb/d)	VSS (lb/d)	TBOD (lb/d)	SBOD (lb/d)
Total System Generation						
MSS (Basic + Other Major Ind/Com Sources)		224.84	511,920	383,940	562,550	225,020
Tijuana		0.00	0	0	0	0
PS No. 2 Chemical		0.00	19,502	0	0	0
Subtotal A - Total Generated		224.84	531,422	383,940	562,550	225,020
NCWRP						
Applied		30.00	68,054	51,041	64,051	25,620
Returned		28.05	1,146	917	1,380	463
Subtotal B - Net Change		(1.95)	(66,908)	(50,124)	(62,671)	(25,157)
SWRP/MVWRP/MGWRP (i.e., CWRP)						
Applied		0.00	0	0	0	0
Returned		0.00	0	0	0	0
Subtotal C - Net Change		0.00	0	0	0	0
SBWRP						
Applied		15.00	47,038	35,278	45,662	18,265
Returned		1.31	54,489	42,180	28,590	672
Subtotal D - Net Change		(13.69)	7,452	6,902	(17,072)	(17,593)
SBSTP						
Applied		0.00	0	0	0	0
Returned		0.00	0	0	0	0
Subtotal D - Net Change		0.00	0	0	0	0
NSPF (MBC)						
Returned	Thickener Centrate	1.80	16,058	12,383	8,060	573
	Dewatering Centrate	0.14	7,724	5,171	2,037	1,950
Subtotal E - Net Change		1.94	23,782	17,554	10,097	2,522
SSPF						
Returned	Thickener Centrate	0.00	0	0	0	0
	Dewatering Centrate	0.00	0	0	0	0
Subtotal F - Net Change		0.00	0	0	0	0
PLWTP						
Applied						
- w/o FISDF/FIRP, Plant & PS2 Chem		211.13	476,245	358,273	492,903	184,692
- with PS No. 2 Chem & FISDF/FIRP		212.58	566,846	391,713	514,697	194,137
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem		212.59	625,354	391,713	514,697	194,137
Effluent		211.01	94,691	52,221	209,996	191,090
Removal Efficiency						
- w/o FISDF/FIRP, Plant & PS2 Chem (per Waiver)		—	80.1%	85.4%	57.4%	-3.5%
- with PS No. 2 Chem & FISDF/FIRP		—	83.3%	86.7%	59.2%	1.6%
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem		—	84.9%	86.7%	59.2%	1.6%
Secondary Effluent from NCWRP		0.00	0	0	0	0
Secondary Effluent from SWRP		0.00	0	0	0	0
Secondary Effluent from SBWRP/SBSTP		0.00	0	0	0	0
Total Ocean Discharge (PLWTP+NCWRP+SWRP/SBSTP)		211.01	94,691	52,221	209,996	191,090
(TOTAL OCEAN DISCHARGE IN MT/YEAR)			15674			

TSS	TBOD
270.5	279.9
319.7	290.3
352.7	290.3

Metropolitan Sewerage System
2001-2003 Wastewater Quality and Flow Used for Model Calibration
MBC CAMP Silos and Truck Loadout Capacity Estimates

7-day Rolling Average - 95th Percentile

	PLWTPin			PLWTPout			Removal (%)		SBWRPin			SBWRPout		
Year	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD
2001	190.9	290.7	276.7	189.8	51.4	107.6	81.2%	67.4%						
2002	174.0	311.4	287.5	172.9	51.8	113.4	87.2%	70.2%	4.8	378	386	4.8	7.7	9.8
2003	190.2	310.3	290.7	189.1	49.2	124.3	87.2%	65.9%	4.7			4.4		
3-yr	185.5	308	287	184.4	51.4	117.6	87.6%	69.3%	4.7	378	386	4.7	7.7	9.8
Model	212.8	320	290	211.0	53.8	119.3	84.9%	69.2%	15.0	378	386	13.7	7.7	9.8

	Removal (%)		SBWRPret	MBC Centrate			NCWRPin			NCWRPout			Removal (%)	
Year	TSS	TBOD	Flow	Flow	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD
2001				2.4	1080	838	24.5	272	258	23.0	4.9	5.9	98.2%	97.7%
2002	97.9%	97.3%	0.90	2.5	1512	807								
2003			0.89	2.9	1318	421								
3-yr	97.9%	97.3%	0.87	2.5	1466	514	24.5	272	258	23.0	4.9	5.9	98.2%	97.7%
Model	—	—	1.31	1.9	1469	624	30.0	272	258	26.05	4.9	5.9	—	—

Project P-11.1 - Additional Biosolids Storage Silos

29% = Solids Content (%)
321,298 = Mass Production Rate (dry lb/d)
161 = Mass Production Rate (dry ton/d)
128,588 = Volumetric Production Rate (gpd) - VPR
17,191 = Volumetric Production Rate (ft^3/d) - VPR

3.63 = Maximum days of storage required

466,776 = Truck Storage Cap Required (gal)
62,403 = Truck Storage Cap Required (ft^3)

12 = Number of Silos Available
10 = Assumed Number of Silos in Operation
6,950 = Storage Capacity per Silo (ft^3)
51,986 = Storage Capacity per Silo (gal)
90% = Percent of Total Silo Capacity Available Operationally
62,550 = Total available capacity (ft^3)
467,874 = Total available capacity (gal)

1.00 = Required/Available — Should be less than or equal to 1 if sufficient capacity is available.

Project P-11.6 - New Biosolids Truck Loadout Facility

Capacity Estimate

648 = Loadout Capacity per Bay (ft^3)
4,847 = Loadout Capacity per Bay (gallon)
90% = Percent of Total Loadout Capacity Available Operationally
2 = Number of Bays
25 = Loading Duration per Truck (min)
5 = Number of days of operation per week
8 = Number of hours operation per day
480 = Maximum Operating Minutes per day
11,197 = Maximum Daily Volumetric Disposal per Bay (ft^3)

Maximum Daily Mass Load Disposal per Bay (ft^3) = (Maximum Operating Minutes per day / Loading Duration per Truck (min)) * Loadout Capacity per Bay (ft^3)

17,191 = Volumetric Production Rate (ft^3/d) - VPR
24,087 = Daily disposal rate based on operational parameters noted above (ft^3/d)

1.07 = Required/Available — Should be equal to 1 if sufficient capacity is available

MODEL SUMMARY FOR CALENDAR YEAR 2025

Case No.:	CALIBRATION RUN - PROJECTS P-11.1 & 11.6	Year MER Reached:	2025
System AADF:	*239.5 mgd*	*Year PS2 Cap. Reached:*	*N/A*
PS1 PWWF:	N/A mgd	PS2 Storage Design Year:	No Storage Provided
PS2 PWWF:	N/A mgd	PS2 Storage Cap. (mgd):	N/A
PL Eff TSS:	54 mg/L	Year PS1 Cap. Reached:	N/A
MBC Gas Prd:	351,319 scf	Storage Tank Design Year:	No Storage Provided
SSPF Gas Prd	0 scf	Storage Tank Cap. (mgd):	N/A

Assumptions:

90%	solids recovery in dewatering cenrifuge	282	mg/L TBOD in the PLWTP Influent
82.700%	removal of non-centrate recylce TSS at PLWTP	320	mg/L TSS in the PLWTP Influent
100.000%	Capture of Chemical Sludge	256	mg/L TBOD in the NCWRP Influent
82.700%	removal of thickener centrate TSS at PLWTP	272	mg/L TSS in the NCWRP Influent
82.700%	removal of dewatering centrate TSS at PLWTP	250	mg/L TBOD in the Central WRP Influent
13,600	mt/yr TSS MER limit at PLWTP	250	mg/L TSS in the Central WRP Influent
300	mg/L TBOD in the MSS Flow	365	mg/L TBOD in the South Bay Influent
273	mg/L TSS in the MSS Flow	376	mg/L TSS in the South Bay Influent
82.700%	removal of TSS from MSS and WRP Secondary Effluent	0.0%	Reclamation at NCWRP Annually
1.1	lb TSS/lb FeCl3 added	0.0%	Reclamation at CWRP Annually
59%	removal of TBOD at PLWTP	0.0%	Reclamation at SBWRP Annually
0.0%	Diverted at PLWTP for Secondary Treatment	45	mgd of WRP Capacity - Satisfies OPRA
0.00	mgd diverted at PLWTP for Secondary Treatment		*No WTP Sludge discharged to the sewer*
30	*mgd NCWRP*		*NCES/PLTO Not Utilized*
0	mgd CWRP		SSPF Not Online
15	mgd SBWRP (Southern Facility)		*TSS MER Limit Applies to PLOO Only*
0	mgd CSTP		
0	mgd SBSTP		

Source/Plant		Flow (mgd)	TSS (lb/d)	VSS (lb/d)	TBOD (lb/d)	SBOD (lb/d)
Total System Generation						
	MSS (Basic + Other Major Ind/Com Sources)	239.50	545,298	408,974	599,229	239,692
	Tijuana	0.00	0	0	0	0
	PS No. 2 Chemical	0.00	20,856	0	0	0
	Subtotal A - Total Generated	239.50	566,154	408,974	599,229	239,692
NCWRP						
	Applied	30.00	68,054	51,041	64,051	25,620
	Returned	28.05	1,146	917	1,380	463
	Subtotal B - Net Change	(1.95)	(66,908)	(50,124)	(62,671)	(25,157)
SWRP/MVWRP/MGWRP (i.e., CWRP)						
	Applied	0.00	0	0	0	0
	Returned	0.00	0	0	0	0
	Subtotal C - Net Change	0.00	0	0	0	0
SBWRP						
	Applied	15.00	47,036	35,276	45,662	18,265
	Returned	1.31	54,489	42,180	28,590	572
	Subtotal D - Net Change	(13.69)	7,452	6,902	(17,072)	(17,693)
SBSTP						
	Applied	0.00	0	0	0	0
	Returned	0.00	0	0	0	0
	Subtotal D - Net Change	0.00	0	0	0	0
NSPF (MBC)						
	Returned Thickener Centrate	1.80	16,058	12,383	8,060	573
	Dewatering Centrate	0.14	7,724	5,171	2,037	1,950
	Subtotal E - Net Change	1.94	23,782	17,554	10,097	2,522
SSPF						
	Returned Thickener Centrate	0.00	0	0	0	0
	Dewatering Centrate	0.00	0	0	0	0
	Subtotal F - Net Change	0.00	0	0	0	0
PLWTP						
	Applied					
	- w/o FISDF/FIRP, Plant & PS2 Chem	225.79	509,623	383,306	529,583	199,364
	- with PS No. 2 Chem & FISDF/FIRP	227.34	606,552	419,089	552,969	209,473
	- with PS No. 2 Chem, FISDF/FIRP & Plant Chem	227.35	669,121	419,089	552,969	209,473
	Effluent	225.67	101,325	55,811	225,611	206,199
	Removal Efficiency					
	- w/o FISDF/FIRP, Plant & PS2 Chem (per Waiver)	---	80.1%	85.4%	57.4%	-3.4%
	- with PS No. 2 Chem & FISDF/FIRP	—	83.3%	86.7%	59.2%	1.6%
	- with PS No. 2 Chem, FISDF/FIRP & Plant Chem	—	84.9%	86.7%	59.2%	1.6%
	Secondary Effluent from NCWRP	0.00	0	0	0	0
	Secondary Effluent from SWRP	0.00	0	0	0	0
	Secondary Effluent from SBWRP/SBSTP	0.00	0	0	0	0
	Total Ocean Discharge (PLWTP+NCWRP+SWRP/SBSTP)	225.67	101,325	55,811	225,611	206,199
	(TOTAL OCEAN DISCHARGE IN MT/YEAR)		16773			

TSS	TBOD
270.6	281.2
319.9	291.6
352.9	291.6

Metropolitan Sewerage System
2001-2003 Wastewater Quality and Flow Used for Model Calibration
MBC CAMP Silos and Truck Loadout Capacity Estimates

7-day Rolling Average - 95th Percentile

	PLWTPin			PLWTPout			Removal (%)		SBWRPin			SBWRPout		
Year	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD
2001	180.6	290.7	276.7	180.6	51.4	107.6	91.2%	67.4%						
2002	174.0	311.4	287.5	172.9	51.8	113.4	87.2%	70.2%	4.8	376	386	4.8	7.7	9.8
2003	190.2	310.3	290.7	189.1	49.2	124.3	87.2%	65.9%	4.7			4.4		
3-yr	185.5	308	287	184.4	51.4	117.5	87.6%	69.3%	4.7	376	386	4.7	7.7	9.8
Model	227.3	320	292	225.7	53.8	119.9	84.9%	59.2%	15.0	376	386	13.7	7.7	9.8

	Removal (%)		SBWRPret	MBC Centrate			NCWRPin			NCWRPout			Removal (%)	
Year	TSS	TBOD	Flow	Flow	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD
2001				2.4	1088	838	24.8	272	255	23.0	4.9	6.9	98.2%	97.7%
2002	97.9%	97.3%	0.80	2.6	1512	807								
2003			0.90	2.8	1318	421								
3-yr	97.9%	97.3%	0.87	2.6	1466	514	24.6	272	255	23.0	4.9	6.9	98.2%	97.7%
Model	—	—	1.31	1.9	1460	624	30.0	272	255	28.05	4.9	6.9	—	—

Project P-11.1 - Additional Biosolids Storage Silos

28% = Solids Content (%)
341,556 = Mass Production Rate (dry lb/d)
171 = Mass Production Rate (dry ton/d)
136,700 = Volumetric Production Rate (gpd) - VPR
18,275 = Volumetric Production Rate (ft^3/d) - VPR

3.63 = Maximum days of storage required

496,219 = Truck Storage Cap Required (gal)
66,339 = Truck Storage Cap Required (ft^3)

13 = Number of Silos Available
11 = Assumed Number of Silos in Operation
6,950 = Storage Capacity per Silo (ft^3)
51,986 = Storage Capacity per Silo (gal)
90% = Percent of Total Silo Capacity Available Operationally
68,805 = Total available capacity (ft^3)
514,661 = Total available capacity (gal)

0.96 = Required/Available — Should be less than or equal to 1 if sufficient capacity is available.

Project P-11.6 - New Biosolids Truck Loadout Facility

Capacity Estimate
648 = Loadout Capacity per Bay (ft^3)
4,847 = Loadout Capacity per Bay (gallon)
90% = Percent of Total Loadout Capacity Available Operationally
2 = Number of Bays
25 = Loading Duration per Truck (min)
5 = Number of days of operation per week
8 = Number of hours operation per day
480 = Maximum Operating Minutes per day
11,197 = Maximum Daily Volumetric Disposal per Bay (ft^3)

Maximum Daily Mass Load Disposal per Bay (ft^3) = (Maximum Operating Minutes per day / Loading Duration per Truck (min)) * Loadout Capacity per Bay (ft^3)

18,275 = Volumetric Production Rate (ft^3/d) - VPR
25,565 = Daily disposal rate based on operational parameters noted above (ft^3/d)

1.14 = Required/Available — Should be equal to 1 if sufficient capacity is available

MODEL SUMMARY FOR CALENDAR YEAR 2025

Case No.:	CALIBRATION RUN - PROJECTS P-11.1 & 11.6	Year MER Reached:	2025
System AADF:	239.5 mgd	Year PS2 Cap. Reached:	N/A
PS1 PWWF:	N/A mgd	PS2 Storage Design Year:	No Storage Provided
PS2 PWWF:	N/A mgd	PS2 Storage Cap. (mgd):	N/A
PL Eff TSS:	54 mg/L	Year PS1 Cap. Reached:	N/A
MBC Gas Prd:	351,319 scf	Storage Tank Design Year:	No Storage Provided
SSPF Gas Prd	0 scf	Storage Tank Cap. (mgd):	N/A

Assumptions:

80%	solids recovery in dewatering cenrifuge	292	mg/L TBOD in the PLWTP influent
82.700%	removal of non-centrate recycle TSS at PLWTP	320	mg/L TSS in the PLWTP influent
100.000%	Capture of Chemical Sludge	256	mg/L TBOD in the NCWRP influent
82.700%	removal of thickener centrate TSS at PLWTP	272	mg/L TSS in the NCWRP influent
82.700%	removal of dewatering centrate TSS at PLWTP	250	mg/L TBOD in the Central WRP influent
13,600	mt/yr TSS MER limit at PLWTP	250	mg/L TSS in the Central WRP influent
300	mg/L TBOD in the MSS Flow	365	mg/L TBOD in the South Bay influent
273	mg/L TSS in the MSS Flow	376	mg/L TSS in the South Bay influent
82.700%	removal of TSS from MSS and WRP Secondary Effluent	0.0%	Reclamation at NCWRP Annually
1.1	lb TSS/lb FeCl3 added	0.0%	Reclamation at CWRP Annually
59%	removal of TBOD at PLWTP	0.0%	Reclamation at SBWRP Annually
0.0%	Diverted at PLWTP for Secondary Treatment	45	mgd of WRP Capacity - Satisfies OPRA
0.00	mgd diverted at PLWTP for Secondary Treatment		*No WTP Sludge discharged to the sewer*
30	mgd NCWRP		NCES/PLTO Not Utilized
0	mgd CWRP		SSPF Not Online
15	mgd SBWRP (Southern Facility)		*TSS MER Limit Applies to PLOO Only*
0	mgd CSTP		
0	mgd SBSTP		

Source/Plant	Flow (mgd)	TSS (lb/d)	VSS (lb/d)	TBOD (lb/d)	SBOD (lb/d)	TSS	TBOD
Total System Generation							
MSS (Basic + Other Major Ind/Com Sources)	239.50	545,298	408,974	599,229	239,692		
Tijuana	0.00	0	0	0	0		
PS No. 2 Chemical	0.00	20,856	0	0	0		
Subtotal A - Total Generated	239.50	566,154	408,974	599,229	239,692		
NCWRP							
Applied	30.00	68,054	51,041	64,051	25,620		
Returned	28.05	1,146	917	1,380	463		
Subtotal B - Net Change	(1.95)	(66,908)	(50,124)	(62,671)	(25,157)		
SWRP/MVWRP/MGWRP (i.e., CWRP)							
Applied	0.00	0	0	0	0		
Returned	0.00	0	0	0	0		
Subtotal C - Net Change	0.00	0	0	0	0		
SBWRP							
Applied	15.00	47,038	35,278	45,662	18,265		
Returned	1.31	54,489	42,180	28,590	572		
Subtotal D - Net Change	(13.69)	7,452	6,902	(17,072)	(17,693)		
SBSTP							
Applied	0.00	0	0	0	0		
Returned	0.00	0	0	0	0		
Subtotal D - Net Change	0.00	0	0	0	0		
NSPF (MBC)							
Returned Thickener Centrate	1.80	16,058	12,383	8,060	573		
Dewatering Centrate	0.14	7,724	5,171	2,037	1,950		
Subtotal E - Net Change	1.94	23,782	17,554	10,097	2,522		
SSPF							
Returned Thickener Centrate	0.00	0	0	0	0		
Dewatering Centrate	0.00	0	0	0	0		
Subtotal F - Net Change	0.00	0	0	0	0		
PLWTP							
Applied							
- w/o FISDF/FIRP, Plant & PS2 Chem	225.79	509,623	383,306	529,583	199,364	270.6	281.2
- with PS No. 2 Chem & FISDF/FIRP	227.34	606,552	419,089	552,969	209,473	319.9	291.6
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem	227.35	669,121	419,089	552,969	209,473	352.9	291.6
Effluent	225.67	101,325	55,811	225,611	206,199		
Removal Efficiency							
- w/o FISDF/FIRP, Plant & PS2 Chem (per Waiver)	—	80.1%	85.4%	57.4%	-3.4%		
- with PS No. 2 Chem & FISDF/FIRP	—	83.3%	86.7%	59.2%	1.6%		
- with PS No. 2 Chem, FISDF/FIRP & Plant Chem	—	84.9%	86.7%	59.2%	1.6%		
Secondary Effluent from NCWRP	0.00	0	0	0	0		
Secondary Effluent from SWRP	0.00	0	0	0	0		
Secondary Effluent from SBWRP/SBSTP	0.00	0	0	0	0		
Total Ocean Discharge (PLWTP+NCWRP+SWRP/SBSTP)	225.67	101,325	55,811	225,611	206,199		
(TOTAL OCEAN DISCHARGE IN MT/YEAR)		16773					

Metropolitan Sewerage System
2001-2003 Wastewater Quality and Flow Used for Model Calibration
MBC CAMP Silos and Truck Loadout Capacity Estimates

7-day Rolling Average - 95th Percentile

	PLWTPin			PLWTPout			Removal (%)		SBWRPin			SBWRPout			Removal (%)		SBWRPrel	MBC Centrate			NCWRPin			NCWRPout			Removal (%)	
Year	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD	Flow	Flow	TSS	TBOD	Flow	TSS	TBOD	Flow	TSS	TBOD	TSS	TBOD
2001	190.8	290.7	278.7	169.8	51.4	107.6	81.2%	97.4%										2.4	1085	836	24.8	272	255	23.0	4.9	5.9	98.2%	97.7%
2002	174.0	311.4	287.5	172.9	51.8	113.4	87.2%	70.2%	4.8	376	395	4.8	7.7	9.8	97.9%	97.3%	0.80	2.5	1612	607								
2003	180.3	310.3	290.7	189.1	49.2	124.3	87.2%	86.9%	4.7			4.4					0.80	2.8	1316	421								
3-yr	185.5	305	287	184.4	51.4	117.5	87.8%	59.3%	4.7	376	395	4.7	7.7	9.8	97.9%	97.3%	0.87	2.5	1458	514	24.8	272	255	23.0	4.9	5.9	98.2%	97.7%
Model	227.3	320	292	225.7	53.8	118.9	84.9%	59.2%	15.8	376	395	13.7	7.7	9.8	---	---	1.31	1.9	1459	524	30.0	272	255	28.05	4.9	5.9	---	---

Project P-11.1 - Additional Biosolids Storage Silos

28% = Solids Content (%)
341,880 = Mass Production Rate (dry lb/d)
171 = Mass Production Rate (dry ton/d)
136,700 = Volumetric Production Rate (gpd) - VPR
18,275 = Volumetric Production Rate (ft^3/d) - VPR

2.63 = Maximum days of storage required

359,520 = Truck Storage Cap Required (gal)
48,064 = Truck Storage Cap Required (ft^3)

10 = Number of Silos Available
8 = Assumed Number of Silos in Operation
6,950 = Storage Capacity per Silo (ft^3)
51,986 = Storage Capacity per Silo (gal)
90% = Percent of Total Silo Capacity Available Operationally
50,040 = Total available capacity (ft^3)
374,299 = Total available capacity (gal)

0.96 = Required/Available — Should be less than or equal to 1 if sufficient capacity is available.

Project P-11.8 - New Biosolids Truck Loadout Facility

Capacity Estimate

648 = Loadout Capacity per Bay (ft^3)
4,847 = Loadout Capacity per Bay (gallon)
90% = Percent of Total Loadout Capacity Available Operationally
2 = Number of Bays
25 = Loading Duration per Truck (min)
5 = Number of days of operation per week
8 = Number of hours operation per day
480 = Maximum Operating Minutes per day
11,197 = Maximum Daily Volumetric Disposal per Bay (ft^3)

Maximum Daily Mass Load Disposal per Bay (ft^3) = (Maximum Operating Minutes per day / Loading Duration per Truck (min)) * Loadout Capacity per Bay (ft^3)

18,275 = Volumetric Production Rate (ft^3/d) - VPR
25,585 = Daily disposal rate based on operational parameters noted above (ft^3/d)

1.14 = Required/Available — Should be equal to 1 if sufficient capacity is available

ATTACHMENT C

ESTIMATE OF TSS PRODUCTION FROM FERRIC CHLORIDE ADDITION

City of San Diego MWWD
Mass Balance and MBC CAMP Project
Calculation Sheet

Line No. ITEM

Purpose

To determine the amount of TSS generated per pound of ferric chloride added at PLWTP

Given/Assumptions

Use the following simplified equation (assumes 100% removal of chem sludge):

$$TSSin + TSSchem = TSSps + TSSout$$

or

$$TSSchem = TSSps + TSSout - TSSin$$

$$TSSin = Qin \times C_{TSSin} \times 8.34$$

$$TSSout = Qout \times C_{TSSout} \times 8.34$$

$$Qout = Qin - Qps$$

$$M_{FeCl3} = Q_{FeCl3} \times SG \times 8.34 \times \text{Solution Strength}$$

where:
- TSSin = Daily TSS mass (lb/d) in the raw wastewater influent to PLWTP (pre-ferric addition)
- TSSchem = Daily TSS mass (lb/d) associated with ferric chloride addition (includes generation of hydroxides, sulfides, etc. and removal of soluble BOD colloids not typically associated with advance primary treatment
- TSSps = Daily TSS mass (lb/d) in the primary sludge sent to PLWTP digesters
- TSSout = Daily TSS mass (lb/d) in the PLWTP effluent
- C_{TSSin} = TSS concentration of raw wastewater influent to PLWTP (mg/L)
- C_{TSSout} = TSS concentration in the PLWTP effluent (mg/L)
- Qin = Annual average daily flow of PLWTP influent (mgd)
- Qout = Annual average daily flow of PLWTP effluent (mgd)
- Qps = Annual average daily flow of PLWTP primary sludge (mgd)
- Q_{FeCl3} = Annual average daily flow of ferric chloride used at PLWTP (gpd)
- SG = Specific gravity (relative to water)
- M_{FeCl3} = Daily mass of ferric chloride added at PLWTP (lb/d)

Ferric Chloride Quality

SG = 1.467 (based on assay of $FeCl_3$ solution delivered to PS2 on 1/28/03 - Order # 49747)

Solution Strength = 0.44 (based on assay of $FeCl_3$ solution delivered to PS2 on 1/28/03 - Order # 49747)

Calculations

Solving for TSSchem...

Calendar Year	Qin (1) (mgd)	C_{TSSin} (1) (mg/L)	TSSin (lb/d)	Qps (1) (mgd)	Qout (mgd)	C_{TSSout} (1) (mg/L)	TSSout (lb/d)	TSSps (1) (ton/d)	TSSps (lb/d)	TSSchem (lb/d)
2001	174.8	275	400,904	1.07	173.73	43	62,303	190	380,000	41,399
2002	168.9	287	404,276	1.11	167.79	44	61,572	189	378,000	35,297
2003	169.8	285	403,598	1.15	168.65	42	59,075	197	394,000	49,477

(1) Average annual daily values as reported in the 2001, 2002 and 2003 Point Loma Ocean Outfall Annual Monitoring Report

Ferric Chloride Added at PLWTP....

Calendar Year	Q_{FeCl3} (1) (gpy)	Q_{FeCl3} (gpd)	M_{FeCl3} (lb/d)
2001	2,398,457	6,571	35,374
2002	2,468,148	6,762	36,402
2003	2,864,716	7,849	42,251

(1) Average annual daily values as reported in the 2001, 2002 and 2003 Point Loma Ocean Outfall Annual Monitoring Report

Mass Ratios...

Calendar Year	TSSchem (lb/d)	M_{FeCl3} (lb/d)	Ratio TSSchem:M_{FeCl3}	
2001	41,399	35,374	1.17	
2002	35,297	36,402	0.97	
2003	49,477	42,251	1.17	
Average	42,058	38,009	1.10	<= Use this value for Mass Balance calculations

END OF CALCULATIONS