

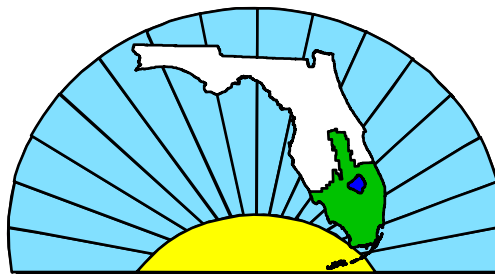
**US ARMY CORPS OF ENGINEERS
SOUTH FLORIDA WATER MANAGEMENT DISTRICT**

**TREATMENT OBJECTIVES
DRAFT REPORT SEPTEMBER 25, 2003**

Wastewater Reuse Pilot Project -Miami-Dade

Project Managers

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**COMPREHENSIVE EVERGLADES
RESTORATION PLAN**

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1. Introduction

Task 37-2230 of the Wastewater Reuse Pilot Project Project Management Plan (PMP) established the preparation and distribution of a *Treatment Objective Report* for the pilot project. This report provides a useful frame of reference and basis for comparison to be used in the technology research contract for the selection and design of treatment trains. As the final water quality objectives are not available until the discharge permits are received, the water treatment objectives shall be designed in accordance with permits and any applicable stringent regulatory requirements, including narrative antidegradation standards for Outstanding Florida Waters, during the PPDR phase.

The environmental staff and PDT members will review and comment on the Treatment Objective Report prepared by District Project Manager, and the document shall be presented at a PDT meeting.

2. Objective

The goal of this report is to develop treatment objectives that can be used by the PDT for evaluation and comparison of various advanced wastewater treatment technologies. This report includes summary data compiled from other more detailed reports on existing wastewater quality, general regulatory requirements, and long-term monitoring of Biscayne Bay surface waters. These results were used to guide development of numerical targets to address narrative antidegradation standards for Biscayne Bay, an Outstanding Florida Water, which will ultimately receive the reclaimed water generated during the pilot project..

3. Background information

As noted in the Work Breakdown Schedule of the PMP there are four precedent tasks to the Treatment Objective Report:

- Miami-Dade Wastewater Treatment Facilities Performance Report and Potential for M-D Influent/Effluent Changes report (Tasks 37- 2210 and 37-2200)
- Review of Existing Reports/Studies (Task 37-2180)
- Regulations Report (Task 37-2200)
- Receiving Water Quality Report (Task 37-3475)

3.1 Miami-Dade Wastewater Treatment Facilities Performance Report and Potential for M-D Influent/Effluent Changes report

This report reviews the existing information provided by the Publicly Owned Treatment Works (POTWs) and DERM, and identifies the physical, chemical and biological characteristics of the influent and effluent wastewater of the three regional POTWs operated by the Miami-Dade Water & Sewer Department (MDWASD). Understanding the characteristics of the wastewater and the performance of the existing wastewater treatment facilities, currently in operation in Miami-Dade, provides a basis for determining appropriate and cost effective tertiary treatment

technologies for reclaimed water.

The South Miami-Dade District Wastewater Treatment (SMDWWT) Facility consists of influent screening, four (4) aerated grit chambers, six (6) oxygenation trains, two (2) cryogenic oxygen plants, six (6) final clarifiers, a chlorination system, an effluent pump station to seventeen (17) deep injection wells, and residuals stabilization by six (6) primary and (6) secondary digesters followed by sludge two (2) dewatering centrifuges and composting facilities. The facility discharges to deep injection wells and has a NPDES permit covering emergency bypasses and disposal of solid residuals. Table 1 summarizes the available information on influent and effluent characteristics of this facility and assesses its removal capabilities.

Table 1. Average values for BOD-5, CBOD-5 and TSS at the SMDWWT Facility

	Influent	Effluent	Removal (%)	Testing Period
BOD-5 (mg/L)	99.6	10.4	89	January 1985 to June 1999
CBOD-5 (mg/L)	126.1	5.3	96	October 1995 to July 2002
TSS (mg/L)	104.0	13.3	86	January 1985 to July 2002
pH	7.4-6.7	7.0-6.4		January 2001 to September 2002
Total Nitrogen (mg/L)	30.9	18.3	41	
Total P (mg/L)	4	1.3	67	

There is no current information at the SMDWWT Facility on Ammonia-N, nitrate-N, TKN and Ortho-P influent and effluent concentrations.

A Letter Report prepared by the Project Managers and Miami-Dade Water and Sewer Department (MDWASD) engineering staff, confirmed that MDWSA is not predicting any changes to the quality of the wastewater influent into the three wastewater treatment plants (WWTPs) in the next 20 years.

The MDWASD updated Facilities Master Plan projects that the SMDWWT Facility will be expanded from 112.5 MGD to 131.25 MGD by 2020. In addition, as a result of a draft Consent Order with the Florida Department of Environmental Protection (FDEP), the MDWASD will upgrade the current treatment process at SMDWWTP Facility by adding High Level Disinfection (HLD), or equivalent, within 5 years (excluding the time it takes for permitting). The process to be added (most likely filtration and chlorination) is to meet the performance requirements stated in Chapter 62-600.440, FAC.

3.2 Review of Existing Reports/Studies

The “*Summary of reviews for existing reports and Studies*” report, dated May 29, 2003 report reviews state regulations and background water quality data for canals and groundwater, and summarizes conceptual design treatment goals for receiving sites or point of discharge (e.g., Canals, Ground Water, Aquifer Storage and Recovery, Public Access Reuse Sites, Agricultural Irrigation

Sites, Wetlands) of reuse alternatives. Table 2 contains the summary of the treatment goals for receiving waters, categorized as canals, ground Water, Aquifer Storage and Recovery, Public Access Reuse Sites, Agricultural Irrigation Sites, and Wetlands

Table 2- Summary of Conceptual Design Treatment Goals for receiving waters in Florida

Parameter	Conceptual Design Treatment Goal
Canal and Other Surface Water Discharge	
TSS	5.0 mg/L
Disinfection	High Level
TN	1.0 mg/L
TP	0.010 mg/L
Chemical Feed Facilities for Coagulants, etc.	Required
Ground Water (Deep Injection Wells)	
CBOD ₅	20 mg/L
TSS	20 mg/L
Aquifer Storage and Recovery	
TSS	5 mg/L
Chemical Feed Facilities for Coagulants, etc.	Required
Primary and Secondary Drinking Water Standards	Required, except standard for asbestos shall not apply.
Total Organic Carbon (TOC)	3.0 mg/L (monthly avg.) 5.0 mg/L (single sample)
Total Organic Halogen (TOX)	0.2 mg/L (monthly avg.) 0.3 mg/L (single sample)
Multiple Barrier Treatment Processes	Required
Public Access Reuse	
TSS	5.0 mg/L
Disinfection	High Level
Nitrate (NO _x -N)	10 mg/L
Chemical Feed Facilities for Coagulants, etc.	Required
Agricultural Irrigation	
TSS	5.0 mg/L
Disinfection	High Level
Nitrate (NO _x -N)	10 mg/L
Chemical Feed Facilities for Coagulants, etc.	Required
Wetlands	
TSS	5.0 mg/L
Disinfection	High Level
TN	1.0 mg/L
TP	0.010 mg/L
Chemical Feed Facilities for Coagulants, etc.	Required
Outstanding Florida Waters (OFWs)	
All parameters	No degradation of ambient water quality (See Table 5 below)

3.3 Regulation Report

Chapter 62-611, F.A.C., provides State regulations and standards for domestic wastewater discharges to wetlands. Essentially, this rule controls (1) the quality and quantity of wastewater which may be discharged to wetlands and (2) the quality of water discharged from wetlands to contiguous surface waters. It also provides water quality, vegetation, and wildlife standards that provide protection of other wetland functions and values, and establishes permitting procedures and extensive monitoring requirements for wastewater discharges to wetlands.

A facility may discharge domestic wastewater to a wetland if a permit is issued pursuant to Chapter 62-611, F.A.C. Additionally, certain facilities may discharge to wetlands through an “experimental wetland exemption” upon issuance of an Order (usually in the form of a permit) in accordance with Rule 62-600.120(3), F.A.C. In either case a wastewater permit application must be submitted.

Since the proposed project is considered “pilot”, it may be able to be permitted under the “experimental wetland exemption” criteria of Rule 62-600.120(3), F.A.C. The stated intent of Rule 62-600.120(3), F.A.C., is to “encourage experiments which are designed to lead to the development of new information regarding low-energy approaches to the advanced treatment of domestic wastes and to encourage the conservation of wetlands and fresh waters.” In either case a domestic wastewater permit application must be submitted.

Chapter 62-611, F.A.C., classifies natural wastewater wetlands based on the level of treatment provided by the wastewater facility. A treatment wetland must receive a minimum of secondary treatment with nitrification; whereas, a receiving wetland must receive effluent that has been treated to advanced wastewater treatment standards. Certain classes of natural wetlands are prohibited for use as wastewater wetlands. Wetlands within Outstanding Florida Waters (OFWs), Class I waters, and areas designated as areas of critical state concern as of October 1, 1985, are all **not** allowed to be used as treatment wetlands, but can be used as receiving wetlands.

For the pilot project, the wastewater wetland will be regarded as a receiving wetland and should not be considered part of the treatment train. Table 3.1 provides the average annual concentrations for a receiving wetland (Chapter 62-611, F.A.C., specifically Section 62-611.420, F.A.C).

Table 3.1 Annual Average Concentrations for receiving wetlands
(Chapter 62-611, F.A.C., specifically Section 62-611.420, F.A.C)

Parameters	Limits (mg/L)
CBOD-5	5
TN	3
TSS	5
TP	1

Chapter 62-611, F.A.C., limits the quantity of wastewater allowed to be discharged to a wetland permitted under the rule. Per Rule 62-611.350(1), F.A.C., natural unaltered wetlands may receive hydraulic loading rates up to two inches per week (equivalent to 128.90 acres per mgd), while natural hydrologically altered wetlands may receive hydraulic loading rates up to six inches per week (equivalent to 42.967 acres per mgd).

In addition to limitations on the quality of wastewater allowed to be discharged to wetlands, Chapter 62-611, F.A.C., sets forth minimum requirements on the quantity of wastewater allowed to be discharged to wetlands permitted under the rule. Limitations on total nitrogen and total phosphorus loading rates to treatment wetlands are established in Rule 62-611.400(2), F.A.C.

Table 3.2 Loading rates Limits for treatment wetlands

Type of Wetland	Total N (g/m ² /yr)	Total P (g/m ² /yr)
Natural unaltered treatment wetland	25	3
Hydrologically altered treatment wetland	75	9

Regardless of these allowable maximums, the applicant must provide the Department with reasonable assurance that all other Department rules, including the qualitative design criteria, water quality standards and criteria, and the biological criteria in Chapter 62-611, F.A.C., will be met including the antidegradation policy requirements associated with Outstanding Florida Waters in Rules 62-4.242 and 62-302.300, F.A.C. .

Rule 62-611.450(1), F.A.C., limits the discharge from both natural treatment and receiving wetlands to 3.0 mg/L total nitrogen, 0.2 mg/L total phosphorus, and 0.02 mg/L un-ionized ammonia, unless a Water Quality Based Effluent Limitations (WQBELs) has have been established, or phosphorus has been shown not to be a limiting nutrient on the downstream waters. However, Rule 62-611.450(2) also notes that the applicant shall provide the Department with reasonable assurance that the discharge from a treatment or receiving wetland shall not cause or contribute to violations of water quality criteria contained in Chapter 62-302, F.A.C. in contiguous waters, downstream waters, including a lake, estuary or lagoon, or Outstanding Florida Waters.

In addition to the above requirements, the reclaimed water will need to meet other discharge limitations established by procedures within Chapter 62-650, F.A.C. (see Rule 62-610.555(4)(f), F.A.C.). Specifically, the reclaimed water will also need to meet any water quality based effluent limitations (WQBELs) to ensure compliance with state water quality standards in the receiving surface water. For most surface waters in Florida, the WQBEL analysis probably will result in limitations on Total Nitrogen (TN) more stringent than the 10-mg/L limit. A complete listing of surface water quality standards are contained within Rule 62-302, F.A.C.

As is true for any new or expanded surface water discharge, the Antidegradation Policy in Rules 62-4.242 and 62-302.300, F.A.C. also applies (see Rule 62-610.555(4)(f), F.A.C.). This includes the public interest and reuse feasibility tests and represents a significant constraint on any new or expanded surface water discharge. It is important to note that, in light of the foregoing, it would be very difficult to permit any new or expanded surface water discharge that does not qualify for

classification as “reuse.” Criteria for categorizing projects as either “reuse” or “effluent disposal” are contained within Rule 62-610.810, F.A.C.

In addition to the foregoing requirements, Rule 62-610.555(4)(f), F.A.C. requires that reuse recharge projects be designed and operated such that the ground water standards in Chapter 62-520, F.A.C. will be met at the point or points where the reclaimed water/surface water mixture enters the ground water system. The ground water standards are, for the most part, the primary and secondary drinking water standards. The main difference is that Chapter 62-520, F.A.C., establishes a ground water standard for total coliforms of 4 per 100 mL in lieu of the primary drinking water standards for coliform organisms. Depending on a number of factors (location of the points of entry into the ground water system, quality of the reclaimed water, and others), this may result in additional treatment needs at the wastewater treatment facility.

3.4 Receiving WQ Report

Table 4 summarizes the mean and median values of the parameters of interest for both the FIU and DERM datasets for Biscayne Bay. These data have been used to establish numerical targets that describes typical or prevailing water quality conditions near the western shore of Biscayne Bay, as an approach to meeting the OFW “antidegradation” standard. This table also includes the target antidegradation concentrations published in the Biscayne Bay Partnership Initiative (BBPI) Survey Team reports in 2001, for total Ammonia- N, Nitrate+Nitrite, and Total Phosphorus.

Table 4. Summary of FIU and M-D DERM median values for water quality parameters assessed.

Parameter	Units	Pooled Mean Conc.	MEDIAN CONCENTRATIONS		BBPI Target Conc.
			Nearshore/ Alongshore	Inshore	
<i>Total Ammonia-N</i>					
FIU		0.014	0.016	0.013	0.02
DERM	mg/L	0.071	0.05	*	0.05
<i>TOC</i>					
FIU		3.0	4.7	3.9	
DERM	mg/L	*	*	*	NA
<i>Chl-A</i>					
FIU		0.33	0.30	0.20	
DERM	mg/L	0.62	0.34	*	NA
<i>Nitrate+Nitrite</i>					
FIU		0.03	0.042	0.014	
DERM	mg/L	0.220	0.02	*	0.01
<i>TP</i>					
FIU		0.006	0.006	0.005	
DERM	mg/L	0.006	0.004	*	0.005
<i>TKN</i>					
FIU		0.22	0.36	0.26	
DERM	mg/L	*	*	*	NA
<i>Total Nitrogen</i>					
FIU		0.27	0.38	0.26	
DERM	mg/L	*	*	*	NA
<i>Turbidity</i>					
FIU		0.8	0.5	0.5	
DERM	NTU	1.1	0.5	*	NA
<i>DO</i>					
FIU		6.6	7.3	6.7	
DERM	mg/L	5.90	6.43	*	NA
<i>Total Coliform</i>					
FIU	cfu/10	*	*	*	
DERM	0 ml	144	<10	*	NA
<i>Salinity</i>					
FIU		32.9	27.5	31.3	
DERM	ppt	28.0	27.5	*	NA

4. Treatment Objectives

As stated in the PMP, the pilot project and indeed the final project treatment objectives may go beyond the minimum requirements specified in Florida's rules (notably in Chapters 62-600, 62-610, and 62-611, F.A.C.) because of Water Quality Based Effluent Limits (WQBEL) / Total Maximum Daily Load (TMDL) considerations and because the ultimate receiving waters of tidal wetlands and Biscayne Bay are Outstanding Florida Waters. Therefore, the narrative antidegradation requirements associated with Outstanding Florida Waters must be met.

The degree or level of treatment required shall depend upon:

- 1) Antidegradation targets.
- 2) The nature and quality of the ultimate receiving water.
- 3) Federal/State and local regulations.
- 4) Quantity and quality of flow from the treatment plant.

Table 5 summarizes these treatment objectives:

Table 5.1- Statute/Rule and Antidegradation targets as Treatment Objectives for the Selection of the Treatment Technologies

Parameter	Range	Statute/Rule targets	Antidegradation targets
BOD-5		5 mg/L	
TOC		3 mg/L	
COD		10 mg/L	
TSS		5 mg/L	
Total Residual Chlorine		0.01 mg/L	
Total Ammonia- N			0.02 –0.05 mg/L(depends on method of collection and analysis)
Nitrite/Nitrate-N			0.01 mg/L
TKN			0.22 mg/L
Total Nitrogen		3	0.27 mg/L
Ortho-P			0.002 mg/L
Total P		1	0.005 mg/L
Fecal coliforms			<10 cfu/100 mL
Total coliform			<10 CFU/100 ml
Dissolved Oxygen	5.0-7.3		
Turbidity			0.5 NTU
Salinity			Shall not change salinity in test site by more than 5 ppt
pH	6.5-7.5 (*)		
Heavy Metals			See Table 5.2

Parameter	Range	Statute/Rule targets	Antidegradation targets
EPOC			Lowest possible levels(**)
Cryptosporidium and Giardia			Lowest possible levels(**)

(*) Appropriate limits for pH in the estuarine zone will require further evaluation.

(**) Even though, currently there are no established numerical criteria or antidegradation targets for these parameters, available information shall be gathered on removal efficiency of various treatment technologies and detectable levels after advanced treatment for these parameters for comparative assessment. In practical terms, the objective would be to identify the technology that reduces such contaminants to the lowest level.

Table 5.2 Treatment Objectives and MDLs/PQLs for metals of interest

Heavy Metals Except for those listed with **	Methodology Required or Equivalent	Required MDL (ug/L)	Required PQL (ug/L)	Sea Water Composition (ug/L) ^{1,2}	Target Levels (ug/L)
Aluminum**	EPA 200.9	7.8	30	10	10
Antimony	EPA 200.9	0.8	3	0.5	0.8
Arsenic, tot	EPA 200.9	0.5	2	3	3
Barium**	EPA 200.7	1	4	30	30
Cadmium	EPA 200.9	0.05	0.2	0.1	0.1
Chromium, total	EPA 200.9	0.1	0.4	0.05	0.1
Copper	EPA 200.9	0.7	3	3	3
Iron	EPA 200.7	7	30	10	10
Lead	EPA 200.9	0.7	3	0.03	0.7
Manganese	EPA 200.9	0.3	1	2	2
<i>Mercury, total</i>	EPA 1631C	0.0001	0.0005	0.03	0.03
<i>Mercury, methyl</i>	EPA 1630 Draft	0.00002	0.00005		0.03
Nickel	EPA 200.9	0.6	2	2	2
Selenium**	EPA 200.9	0.6	2	4	4
Silver	EPA 200.9	0.5	2	0.04	0.5
Thallium	EPA 200.9	0.7	3	< 0.01	0.7
Tin	EPA 200.9	1.7	7	3	3
Zinc	EPA 200.7	2	8	10	10
Bolded Metals:					
Indicates typical parameters monitored in waste water					
<i>Bolded and Italic Metals</i>					

Metal added because it was part of the Class III Surface Water FDEP Rule

Italic Metals:

Total Mercury is monitored in waste water and it is part of the Class III Surface Water FDEP Rule. Methyl and total mercury at low levels are not, but were added to be consistent with current District monitoring.

1 - Geological Survey Water-Supply Paper 1473, Study and Interpretation of the Chemical Characteristics of Natural Water, Second Edition, p. 11 (1971)

2 - Horne R.A. , Marine Chemistry The Structure of Water and the Chemistry of the Hydrosphere, Wiley-Interscience, 1969

5. Conceptual Treatment Processes

As noted in Tables 1 and 2, the average effluent concentrations for CBOD, TSS, TN and TP at the SMDWWT Facility all exceed the conceptual treatment goals for discharging to a receiving wetland. Therefore, additional treatment of the effluent will be necessary to meet the discharge requirements.

Table 6 summarizes this information and shows the average effluent BOD, CBOD, TSS, TN and TP concentrations at the South Miami-Dade Facility and the required removal efficiencies necessary to achieve the treatment objectives for receiving wetlands and more stringent Outstanding Florida Waters

Table 6. Treatment Requirements and Removal Efficiencies for BOD, CBOD, TSS, TN, TP

	South District Effluent	Wetland Treatment Objectives	Required Removal Efficiency	Outstanding Florida Water Treatment Objective	Required Removal Efficiency
BOD	10.4 mg/L	-----	-----		
CBOD	5.3 mg/L	5 mg/L	5.7%		
TSS	13.3 mg/L	5 mg/L	62.5%		
TN	18.3 mg/L	3 mg/L	83.6%	0.27 mg/L	98.5%
TP	1.3 mg/L	1 mg/L	23.1%	0.005 mg/L	99.6%

As shown in this Table, additional treatment for nutrient removal in order to meet over and discharge requirements to prevent degradation of Biscayne Bay is required. Based on a review of the data available, the PDT has determined that the following nutrient discharge requirements are appropriate to protect conditions in Outstanding Florida Water and Biscayne Bay: 0.27 mg/L for TN and 0.005 mg/L for TP. This indicates that for TN, there is over a one magnitude reduction needed and the TP requirement for an Outstanding Florida Water is 200 times less than the TP requirements for a wetland that is not connected to an OFW.

Treatment objectives shall also address the removal of other parameters, such as ammonia nitrogen and nitrate/nitrite nitrogen (0.02 mg/L and 0.01 mg/L respectively), metals, pathogens, turbidity, and EPOCs.

Under a separate task (Task 37-2380, Section 7.3.3.1.7.3 of the PMP), it will be necessary to compare the use and to evaluate the additional costs for several advanced biological, physical and chemical nutrient removal systems, filtration and disinfection technologies to achieve the treatment objectives of discharging the secondary treated to a receiving wetland and an Outstanding Florida Water.

6. Summary.

As indicated in Task 37-2240, Section 37-7.3.3.1.5 of the Project Management Plan, this report presents the treatment objectives for discharging into different classifications of receiving waters. This report demonstrates that the most stringent of these treatment objectives is discharging to an Outstanding Florida Water and that in order to achieve the treatment objectives, additional treatment of the effluent will be necessary.

The evaluation, selection and cost comparison on advanced treatment technologies that will meet the Treatment Objectives as outlined in this report will be assessed in a separate report.

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