



PREPARED FOR
MIAMI-DADE COUNTY
WATER AND SEWER
DEPARTMENT

Biscayne Bay Coastal Wetlands Rehydration Pilot Project

WATER QUALITY EVALUATION | MAY 2009



TECHNICAL MEMORANDUM #1



MWH

BUILDING A BETTER WORLD

In Association with Brown & Caldwell

Executive Summary

This technical memorandum documents the influent water quality representative of the influent water quality for the Biscayne Bay Coastal Wetlands Rehydration Pilot Plant. This includes a variety of sampling events. This technical memorandum also provides a summary of the effluent water quality requirements for the pilot plant and divides the requirements in accordance with regulatory guidelines. Final water quality parameters and targets are expected to be developed as a result of forthcoming ecological tests. Produced water will be tested in controlled ecological studies to evaluate the effects of different water quality on a wetlands environment. Thus, approach used in this project was to first develop a range of water quality parameters and targets. From that, a number of treatment processes were developed that could produce water quality within this range (subject of Technical Memorandum No. 2 Process Technology Assessment). Water quality targets were set with an upper and lower range coinciding with the Wetlands Application Standards (Chapter 62-611, FAC) as the upper limit, and Class III / Outstanding Florida Water (Chapter 62-302, FAC) as the lower limit.

Based on the currently available data, the following preliminary conclusions were reached:

- » Treatment processes to be considered for possible application of reuse water on wetlands must target mainly nitrogen and phosphorus species that are present in the wastewater exceeding established guidelines. Regulatory requirements for N and P can vary depending on the regulation, but very strict requirements could apply and may require very low levels of N and P.
- » No established numerical criteria or antidegradation data exists for microconstituents that may be found in the wastewater. Nevertheless, some type of treatment should be considered for destruction of these compounds.
- » Trace amounts of heavy metals and other constituents have been found in SDWWTP effluent.

INTRODUCTION

This technical memorandum documents the influent water quality evaluation and effluent water quality requirements as described below:

- » Influent Water Quality Evaluation – A compilation of historical South District WWTP (SDWWTP) effluent is provided as representative of the influent water quality for the Biscayne Bay Coastal Wetlands Rehydration Pilot Plant.
- » Effluent Water Quality Requirements – A summary of the water quality requirements for the Biscayne Bay Coastal Wetlands Rehydration Pilot Plant is provided and divides the requirements in accordance with the varying regulatory guidelines.

Water quality parameters and targets are expected to be developed as a result of forthcoming ecological tests. Produced water will be tested in controlled ecological studies to evaluate the effects of different water quality on a wetlands environment. Thus, approach used in this project was to, first, develop a range of plausible water quality parameters and targets that could sustain

a wetlands system. From that, we developed a number of treatment processes that could produce water quality within this range. Water quality targets were set with an upper and lower range coinciding with the Wetlands Application Standards (Chapter 62-611, FAC) as the upper limit, and Class III / Outstanding Florida Water (Chapter 62-302, FAC) as the lower limit.

Influent Water Quality Evaluation

The SDWWTP has the following available effluent water quality data sets.

- » Daily sampling results required by the SDWWTP operating permit (from January 2004 until December 2007).
- » Monthly sampling results required by the operating permit (from January 2004 until December 2007),
- » Annual sampling results for primary and secondary drinking water standards required by the operating permit (from January 2004 until December 2007),
- » Periodic microconstituent testing is performed on the effluent at the plant. This sampling does not include any single body of parameters. This sampling was between 2004 and 2007; however, while the parameters are all parameters within the DERM groundwater contaminant list, the parameters tested change each year and only encompass a small fraction of the total groundwater contaminant list.
- » A one-time sampling event carried out in support of disinfection pilot testing carried out at the plant in 2004, and
- » A one-time sampling campaign for microconstituents carried out by the USGS. The USGS performed a one-time sampling event on the SDWWTP influent in order to determine if a wide range of micro-constituents appeared in the waste stream. The event was carried out as a voluntary fact-finding effort.

The following paragraphs present a summary of the above sampling efforts. The complete data set is found in the **Appendix A** of this report.

Daily Sampling Results

The SDWWTP samples effluent CBOD₅, TSS and pH on a daily basis to comply with the plant's operating permit. The CBOD₅ and TSS are 24-hour flow proportioned composite samples. Table 1 provides a summary of this data for the data compiled from January, 2004 through December, 2007.

TABLE 1 – SDWWTP SUMMARY OF DAILY SAMPLING RESULTS

PARAMETER	SDWWTP EFFLUENT CONCENTRATION, % OF SAMPLES LESS THAN VALUE SHOWN				
	10%	50%	90%	95%	MAXIMUM
CBOD ₅ (mg/L)	2.9	4.4	7.4	8.8	21.0
TSS (mg/L)	5.4	8.0	12.8	16.4	53.0

Monthly Operating Reports Sampling Results

The SDWWTP performs grab sampling of a set of parameters on a monthly basis to comply with the plant's operating permit. **Table 2** provides a summary of this data for the period from 2004 through 2008.

TABLE 2 –SDWWTP MONTHLY OPERATING REPORTS

PARAMETER	SDWWTP EFFLUENT CONCENTRATION, % OF SAMPLES LESS THAN VALUE SHOWN				
	10%	50%	90%	95%	MAXIMUM
TOC (mg/L)	9.0	11.3	13.7	15.0	28.7
TN (mg/L)	17.5	23.5	30.4	33.1	37.4
TKN (mg/L)	17	23.1	30.3	32.7	37.0
NH ₃ -N (mg/L)	15.2	20.9	27.4	29.4	31.5
NO ₂ -N (mg/L)	0.11	0.37	0.98	1.6	2.27
NO ₃ -N (mg/L)	0.09	0.21	0.54	0.65	0.73
TP (mg/L)	1.18	1.81	2.66	3.61	10.10
Temperature (Degrees, F)	77.9	83.3	86.5	87.4	87.8
TDS (mg/L)	328	368	472	480	580
Sulfate (mg/L)	22	28	35	37	55
Chloride (mg/L)	68	77	120	125	127
pH	6.3	6.6	6.8	6.92	7.3
Conductivity (micro-ohms/cm)	696	785	991	1020	2000
Fecal Coliform (# col/100 ml)	9,819	74,775	600,000	4,700,000	6,000,000

Annual Primary and Secondary Drinking Water Sampling Results

The SDWWTP obtains annual grab samples and tests primary and secondary drinking water parameters to comply with the plant's operating permit. **Table 3** provides a summary of primary and secondary parameters that were detected in the data compiled from 2004 through 2008. The complete data set is provided in the Appendices.

TABLE 3 – SDWWTP SUMMARY OF SELECTED PRIMARY AND SECONDARY DRINKING WATER PARAMETERS

PARAMETER	SDWWTP EFFLUENT CONCENTRATION		
	MEDIAN	AVERAGE	MAXIMUM
Aluminum (µg/L)	67.2	72.5	140.0
Antimony (µg/L)	Undetected	0.90	3.60
Arsenic (ug/L)	Undetected	0.48	1.20
Barium (µg/L)	7.6	6.05	9.2
Beryllium (µg/L)	Undetected	0.10	0.50
Chromium (µg/L)	Undetected	0.26	1.3
Cis-1,2-Dichloroethylene (µg/L)	Undetected	0.08	0.32
Color (Pt-Co)	25	29	50
Copper (µg/L)	Undetected	1.89	6.84
Cyanides (µg/L)	Undetected	19.0	40.0
Di(2-ethylhexyl)phthalate (µg/L)	Undetected	0.5	1.1
Fluoride (µg/L)	210	202	320
Iron (µg/L)	130	68	140
Lead (µg/L)	Undetected	0.4	1.1
Manganese (µg/L)	12	12	14
Mercury (µg/L)	0.10	0.41	1.9
Nickel (µg/L)	2.1	1.9	5.9
Oil and Grease (mg/L)	2.0	1.6	2.8
Phenol (µg/L)	Undetected	15	62
Selenium (µg/L)	Undetected	0.3	1.7
Sodium (mg/L)	71	65	82
Tetrachloroethylene (µg/L)	Undetected	0.5	2.0
Toluene (µg/L)	Undetected	0.02	0.12
Trihalomethanes (TTHM) (µg/L)	1.7	4.6	10.96
Zinc (µg/L)	20	14	35

Notes:

1. As the detection limits during at the time of the test are unknown, zero was used in determining the average when an undetected item was in the data set.

Periodic Microconstituent Testing

Between 2004 and 2007, SDWWTP performed annual microconstituent testing on the effluent at the plant. This sampling did not include any single body of parameters. This sampling has been performed on an annual basis; however, while the parameters are all parameters within the DERM groundwater contaminant list, the parameters tested change each year and only encompass a small fraction of the total groundwater contaminant list.

TABLE 4 – SDWWTP SUMMARY OF SELECTED RESULTS FROM THE PERIODIC MICROCONSTITUENT TESTING

PARAMETER	SDWWTP EFFLUENT CONCENTRATION	
	MEDIAN	MAXIMUM
Bromodichloromethane (µg/L)	Undetected	1.02
Chloroform (µg/L)	1.80	9.94
Dichlorobenzene, 1,4	1.75	2.90
Methylene Chloride (µg/L)	Undetected	0.47
Nitroso-dimethylamine, N-(NDMA) (µg/L)	Undetected	Undetected
Tetrachloroethene (PCE) (µg/L)	Undetected	0.28
Trichloroethene (TCE) (µg/L)	Undetected	0.53

High Rate Disinfection Pilot Plant Influent Sampling

A set of microconstituents was sampled during the SDWWTP's high rate disinfection pilot plant activities in 2004. This sampling campaign focused on three primary types of microconstituents: 1) hormones, 2) antibiotics, and 3) pharmaceuticals. The complete data set for this sampling campaign is provided in the Appendices.

USGS Micro-Constituent and Emerging Pollutants of Concern Sampling Campaign

In 2004, a one-time USGS sampling campaign was performed on microconstituents. However, this data set has limited value for the purposes of this study as it shows only whether a parameter was detected (or not) with no reference to concentration.

Effluent Water Quality Requirements

The following summarizes the regulations that regulate water quality requirements pertaining to this project. There are four major regulations that govern water quality for this project, as follows:

1. **Reuse Water Quality** – Water quality standards required by FDEP for reuse water quality is dictated by Chapter 62-610 of the Florida Administrative Code (FAC).
2. **Wetlands Application Standards** – Water quality standards required by FDEP for application of water to wetlands is dictated by Chapter 62-611, FAC.
3. **Miami-Dade County Code** – Water quality standards required by the Miami-Dade County Department of Environmental Resources Management (DERM) are specified in the Miami-Dade County Code Article III 24-42.
4. **Class III / Outstanding Florida Water (OFW)** – Discharge to Outstanding Florida Waters (OFW) is regulated by Chapter 62-302.700, FAC. The requirements of these discharges are that they must not degrade the ambient water quality in OFW. The Comprehensive Everglades Restoration Plan (CERP) proposed water quality targets for the Biscayne Bay and nearby wetlands. Quantitative water quality parameters will be developed as part of forthcoming ecological studies.

Table 5 provides an overall summary of the most critical of the effluent requirements for this project based on annual average conditions.

TABLE 5 – SUMMARY OF WATER QUALITY REQUIREMENTS AND PROPOSED TARGETS BY REGULATION

PARAMETER/UNITS	FDEP REUSE	FDEP WETLANDS APPLICATION	CLASS III/OFW*
TSS, mg/L	5 (1)	5	3.5
CBOD ₅ , mg/L	20 (2)	5	
Total Nitrogen, mg/L		3	0.27
Total Phosphorous, mg/L		1	0.005
Fecal Coliform, #/100 ml	<1.0	<1.0	<1.0
Total Ammonia-N, mg/L			0.02 -0.05 (3)
Nitrate/Nitrite, mg/L			0.01
TKN, mg/L			0.22
Ortho-P, mg/L			0.002
Dissolved Oxygen, mg/L			5.0-7.3
Turbidity, NTU			0.5
Salinity			(4)
pH range			6.5-7.5
Heavy Metals	(6)	(7)	(5)
Microconstituents			(5)
Cryptosporidium and Giardia			(5)

Notes:

- 1) Represents single sample maximum
- 2) Represents annual average
- 3) Dependent on sample method of collection and analysis
- 4) Background salinity shall not change by more than 5 ppt
- 5) See Tables in Appendix
- 6) Reference FAC 62-610
- 7) Reference FAC 62-611

*) Targets previously proposed under CERP program. Final goals will be developed as a result of forthcoming ecological studies.

Reuse Water Quality (Chapter 62-610, FAC)

Reuse water quality for irrigation of landscaped areas, edible crops, golf courses and parks are governed by Part III of Chapter 62-610, FAC. These regulations dictate that reuse water shall receive high level disinfection (HLD) and meet secondary drinking water standards, as well as an annual average CBOD₅ of 20 mg/L. Additionally, the reuse water shall also not contain more than 5.0 mg/L of TSS before the application of a disinfectant.

Also required are continuous on-line monitoring of turbidity (TSS an acceptable surrogate for turbidity) and chlorine residual, and an approved operations plan for the system to ensure that only reuse water meeting the requirements of this regulation is used.

Wetlands Application Standards (Chapter 62-611, FAC)

Discharge to wetlands systems is governed by Chapter 62-611, FAC. Treatment requirements and loading vary depending on the type of wetland. Wetlands are categorized by the following: 1) herbaceous or woody, 2) hydrologically altered or unaltered, 3) used for polishing treatment or as final receiving wetlands, and 4) natural or man-made. These variations are the principal cause of different specified loading and application rates.

Reclaimed water discharged to a receiving wetland must contain no more than, 5.0 mg/L TSS, 5.0 mg/L CBOD₅, 3.0 mg/L total nitrogen (TN), and 1.0 mg/L total phosphorus (TP), all based on an annual average basis.

Miami-Dade County Code

The Miami-Dade County Code regulates environmental issues within Miami-Dade County, including those affecting groundwater and surface water quality. These Water Quality Standards (WQSs) are specified under Article III Section 24-42.

Class III / Outstanding Florida Water (Chapter 62-302, FAC)

Discharge to Outstanding Florida Waters (OFW) is regulated by Chapter 62-302.700, FAC. The requirements of these discharges are that they must not degrade the ambient water quality in OFW.

In 2004 the U.S. Army Corps of Engineers prepared a study as part of the CERP Wastewater Reuse Pilot Project that proposed targets that are stricter than standards for receiving wetlands. This study also set goals for microconstituents such that the treatment system achieves the “lowest possible” residual microconstituents in a treatment system that is available. The forthcoming ecological testing will assist in determining the appropriate limits for discharge to a wetland such that there is no degradation to the Biscayne Bay.

CONCLUSIONS

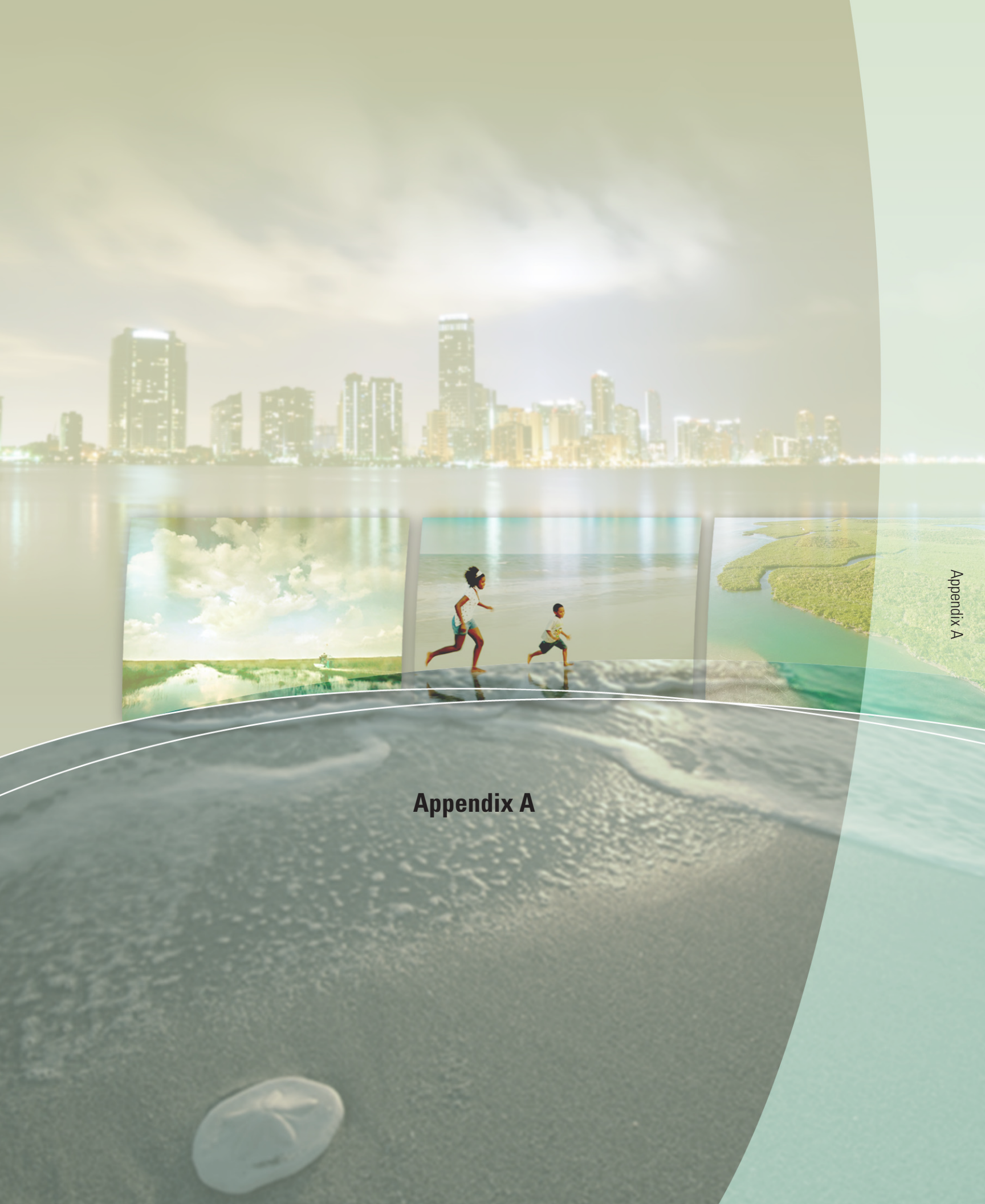
The SDWWTP effluent is considered representative of the influent to be treated for the Biscayne Bay Coastal Wetlands Rehydration Pilot Project. This effluent data was compared to current water quality requirements that apply, including federal, state and local requirements. The data shows that the effluent is in compliance with most parameters that are regulated for water reuse, with some significant exceptions. For the stringent water quality requirements associated with proposed application on a wetlands environment there are a number of parameters requiring treatment and removal. These predominantly consist of nitrogen and phosphorus species remaining after secondary treatment. **Table 6** presents a summary of constituents that currently exceed water quality limits for wetlands application and warrant some type of treatment and removal.

TABLE 6 – SUMMARY OF CONSTITUENTS REQUIRING ADDITIONAL TREATMENT

CONSTITUENT	AVERAGE MEASURED CONCENTRATION OF SDWWTP EFFLUENT IN UNITS INDICATED	MAXIMUM MEASURED CONCENTRATION OF SDWWTP EFFLUENT IN UNITS INDICATED	WATER QUALITY LIMITS
Nitrogen	23.1 mg/L Total	37.4 mg/L Total	3 mg/L Total N (Wetlands App.)
	20.9 mg/L NH ₃	31.5 mg/L NH ₃	0.27 mg/L Total N (OFW)
Phosphorus			1 mg/L Total P (Wetlands App.)
	1.81 mg/L Total	10.10 mg/L Total	0.005 mg/L Total P (OFW)

In summary, the following preliminary conclusions were reached after an evaluation of required water quality requirements was completed:

- » Treatment processes to be considered for possible application of reuse water on wetlands must target mainly nitrogen and phosphorus species that are present in the wastewater exceeding established guidelines. Regulatory requirements for N and P can vary depending on the regulation, but very strict requirements could apply and may require very low levels of N and P.
- » No established numerical criteria or antidegradation data exists for microconstituents that may be found in the wastewater. Nevertheless, some type of treatment should be considered for destruction of these compounds.



Appendix A

Appendix A

APPENDIX A.1 PRIMARY POLLUTANTS				
PRIMARY POLLUTANT	INFLUENT		EFFLUENT	
	AVERAGE	MAX	AVERAGE	MAX
TSS (mg/L)	145	191	9.00	15.45
TOC (mg/L)	N/A	N/A	11.73	28.70
CBOD ₅ (mg/L)	127	175	4.88	21.00
N (mg/L)	N/A	N/A	18.66	37.40
TKN (mg/L)	N/A	N/A	23.44	37.00
NH ₃ (mg/L)	N/A	N/A	20.84	31.50
NO ₂ (mg/L)	N/A	N/A	0.49	2.27
NO ₃ (mg/L)	N/A	N/A	0.27	0.73
NO ₃ + NO ₂ (mg/L)	N/A	N/A	0.63	3.11
TP (mg/L)	N/A	N/A	2.01	10.10
Temp.,(F)	N/A	N/A	82.77	87.80
pH	N/A	N/A	6.59	7.27
TDS (mg/L)	N/A	N/A	392.70	580.00
Sulfate (mg/L)	N/A	N/A	27.83	55.00
Chlorides (mg/L)	N/A	N/A	85.96	127.00
Conductivity (Micromho/cm)	N/A	N/A	827.68	2000.00
Fecal Coliform (# Col/100ml)	N/A	N/A	571,875.36	6,000,000.00

APPENDIX A.2 DRINKING WATER STANDARD POLLUTANTS

EFFLUENT

DRINKING WATER STANDARD POLLUTANT	2004	2005	2006	2007	2008	AVERAGE	MAX
1,1,1-Trichloroethane (ug/L)	U	U	U	U	U	U	U
1,1,2-Trichloroethane (ug/L)	U	U	U	U	U	U	U
1,1-Dichloroethylene (ug/L)	U	U	U	U	U	U	U
1,2,4-Trichlorobenzene	U	U	U	U	U	U	U
1,2-Dichloroethane (ug/L)	U	U	U	U	U	U	U
1,2-Dichloropropane (ug/L)	U	U	U	U	U	U	U
2,3,7,8-TCDD (Dioxin) (pg/L)	U	U	Not Tested	Not Tested	Not Tested	U	U
2,4,5-TP (Silvex) (ug/L)	U	U	U	U	Not Tested	U	U
2,4-D (ug/L)	U	U	U	U	U	U	U
Alachlor (ug/L)	U	U	U	U	U	U	U
Aluminum (mg/L)	U	Not Tested	0.14	0.083	0.0672	0.07255	0.14
Antimony (mg/L)	U	Not Tested	0.0036	U	0.0008	0.00088	0.0036
Arsenic (mg/L)	U	U	U	0.0012	0.0012	0.00048	0.0012
Asbestos	Not Tested	Not Tested	Not Tested	Not Tested	U	U	U
Atrazine (ug/L)	U	Not Tested	U	U	U	U	U
Barium (mg/L)	U	Not Tested	0.0092	0.0074	0.0076	0.00605	0.0092
Benzene (ug/L)	U	U	U	U	U	U	U
Benzo(a)pyrene (ug/L)	U	U	U	U	U	U	U
Beryllium (mg/L)	U	U	0.0005	U	U	0.0001	0.0005
Cadmium (mg/L)	U	U	U	U	U	U	U
Carbofuran (ug/L)	U	Not Tested	U	U	U	U	U
Carbon tetrachloride (ug/L)	U	U	U	U	U	U	U
Chlordane (ug/L)	U	U	U	U	Not Tested	U	U
Chloride (mg/l)	Not Tested	Not Tested	68	100	Not Tested	84	100
Chromium (mg/L)	U	U	0.0013	U	U	0.00026	0.0013
cis-1,2-Dichloroethylene (ug/L)	U	U	U	0.32	Not Tested	0.08	0.32
Color (Pt-Co)	22.5	Not Tested	25	50	20	29.375	50
Copper (mg/L)	U	U	0.0026	U	0.00684	0.001888	0.00684
Cyanides (mg/L)	0.029	U	0.04	0.026	U	0.019	0.04
Dalapon (ug/L)	U	U	U	U	U	U	U
Detergents (mg/L)	0.11	Not Tested	Not Tested	Not Tested	U	0.055	0.11
Di(2-ethylhexyl)adipate (ug/L)	U	Not Tested	U	U	U	U	U
Di(2-ethylhexyl)phthalate (ug/L)	U	U	0.79	Not Tested	1.1	0.4725	1.1
Dibromochloropropane (DBCP) (ug/L)	U	Not Tested	Not Tested	Not Tested	Not Tested	U	U
Dichloromethane	Not Tested	Not Tested	U	Not Tested	Not Tested	U	U
Dinoseb (ug/L)	U	U	U	U	U	U	U
Diquat (ug/L)	U	Not Tested	U	U	U	U	U
Endothall	Not Tested	Not Tested	U	U	U	U	U
Endrin (ug/L)	U	U	U	U	U	U	U
Ethylene dibromide (EDB) (ug/L)	U	Not Tested	Not Tested	Not Tested	Not Tested	U	U
Fluoride (mg/L)	0.21	Not Tested	0.32	0.28	U	0.2025	0.32
Glyphosate	Not Tested	Not Tested	U	U	U	U	U
Gross alpha particle activity (pCi/l)	Not Tested	U	U	1.5	U	0.375	1.5
Gross beta particle activity	Not Tested	Not Tested	Not Tested	Not Tested	U	U	U

APPENDIX A.2 DRINKING WATER STANDARD POLLUTANTS

DRINKING WATER STANDARD POLLUTANT	EFFLUENT						
	2004	2005	2006	2007	2008	AVERAGE	MAX
Heptachlor (ug/L)	U	U	U	U	0.007	0.0014	0.007
Heptachlor epoxide (ug/L)	U	U	U	U	U	U	U
Hexachlorobenzene (ug/L)	U	U	U	U	U	U	U
Hexachlorocyclopentadiene (ug/L)	U	U	U	U	U	U	U
Iron (mg/L)	U	Not Tested	0.13	0.14	U	0.0675	0.14
Lead (mg/L)	U	U	0.00074	0.0011	U	0.000368	0.0011
Lindane (ug/L)	U	U	Not Tested	Not Tested	U	U	U
Manganese (mg/L)	0.014	Not Tested	0.013	0.012	0.0112	0.01255	0.014
Mercury (mg/L)	U	0.0019	U	0.00006	0.000103	0.0004126	0.0019
Methoxychlor (ug/L)	U	U	U	U	Not Tested	U	U
Nickel (mg/L)	U	U	0.0021	0.0059	0.0014	0.00188	0.0059
o-Dichlorobenzene (ug/L)	U	Not Tested	Not Tested	Not Tested	Not Tested	U	U
Odor (TON)	U	Not Tested	5.0	Not Tested	64	23	64
Oil and grease (mg/L)	Not Tested	U	2.0	Not Tested	2.8	1.6	2.8
Oxamyl (vydate) (ug/L)	U	Not Tested	U	U	U	U	U
para-Dichlorobenzene (ug/L)	U	Not Tested	Not Tested	Not Tested	Not Tested	U	U
Pentachlorophenol (ug/L)	U	U	U	U	U	U	U
Phenol (mg/L)	0.062	U	Not Tested	U	U	0.0155	0.062
Picloram (ug/L)	U	Not Tested	U	U	U	U	U
Polychlorinated biphenyls (PCBs) (ug/L)	U	U	U	U	U	U	U
Radium, combined -226 and -228 (pCi/l)	Not Tested	Not Tested	Not Tested	0.2	0.3	0.25	0.3
Selenium (mg/L)	U	U	0.0017	U	U	0.00034	0.0017
Silver (mg/L)	U	U	U	Not Tested	U	U	U
Simazine (ug/L)	U	Not Tested	U	U	Not Tested	U	U
Sodium (mg/L)	60	Not Tested	46.4	71	81.6	64.75	81.6
Styrene (ug/L)	U	U	U	U	U	U	U
Tetrachloroethylene (ug/L)	U	U	0.41	2	0.28	0.538	2
Thallium (mg/L)	U	U	U	U	U	U	U
Toluene (ug/L)	U	U	U	U	0.12	0.024	0.12
Toxaphene (ug/L)	U	U	U	U	U	U	U
trans-1,2-Dichloroethylene	Not Tested	U	U	U	Not Tested	U	U
Trichloroethylene (ug/L)	U	U	U	0.53	U	0.106	0.53
Trihalomethanes, Total (TTHM) (ug/L)	10.96	Not Tested	1.7	Not Tested	1.14	4.6	10.96
Vinyl chloride (ug/L)	U	U	U	U	U	U	U
Xylenes (total) (ug/L)	U	U	U	U	U	U	U
Zinc (mg/L)	0.035	U	0.02	0.015	U	0.014	0.035

APPENDIX A.3 MICROCONSTITUENT TESTING: HORMONES									
MICROCONSTITUENT TESTING: HORMONES 2004 HIGH RATE DISINFECTION PILOT PLANT INFLUENT (SDWWTP EFFLUENT)									
LEVEL	02/03/2004	03/03/2004	20/07/2004	05/10/2004	06/10/2004	20/10/2004	21/10/2004	AVERAGE	MAX
IMB-17 Beta Estradiol (E2) (ug/L)	30.88	16.19	35.67	28.36	2.85	27.78	1.63	20.48	35.67
IME2-Ethynylestradiol (EE2) (ug/L)	U	U	U	0.04	U	U	U	0.008	0.041
IME1-Estrone (E1) (ug/L)	0.023	0.010	0.031	0.052	0.073	0.011	0.025	0.032	0.073

APPENDIX A.4 MICROCONSTITUENT TESTING: ANTIBIOTICS									
MICROCONSTITUENT TESTING: ANTIBIOTICS 2004 HIGH RATE DISINFECTION PILOT PLANT INFLUENT (SDWWTP EFFLUENT)									
ANTIBIOTICS	02/03/2004	03/03/2004	20/07/2004	05/10/2004	06/10/2004	20/10/2004	21/10/2004	AVERAGE	MAX
Chlorotetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Anhydro-chlorotetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Epi-anhydro-chlorotetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Epi-chlorotetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Iso-chlorotetracycline (ug/L)	Not Tested	Not Tested	Not Tested	0.077	Not Tested	U	Not Tested	0.039	0.077
Epi-iso-chlorotetracycline (ug/L)	Not Tested	Not Tested	Not Tested	0.03	Not Tested	U	Not Tested	0.015	0.03
Demeclocycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Doxycycline (ug/L)	Not Tested	Not Tested	Not Tested	0.14	Not Tested	U	Not Tested	0.07	
Minocycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Oxytetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Alpha apo-oxytetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Beta apo-oxytetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Epi-oxytetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Tetracycline (ug/L)	Not Tested	Not Tested	Not Tested	0.163	Not Tested	0.547	Not Tested	0.355	0.547
Anhydro-tetracycline (ug/L)	Not Tested	Not Tested	Not Tested	0.028	Not Tested	U	Not Tested	0.014	0.028
Epi-anhydro-tetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	U	Not Tested	U	U
Epi-tetracycline (ug/L)	Not Tested	Not Tested	Not Tested	U	Not Tested	0.013	Not Tested	0.0065	0.013

APPENDIX A.5 MICROCONSTITUENT TESTING: PHARMACEUTICALS

2004 HIGH RATE DISINFECTION PILOT PLANT INFLUENT (SDWWTP EFFLUENT)									
MICROCONSTITUENT TESTING:									
PHARMACEUTICALS	02/03/2004	03/03/2004	20/07/2004	05/10/2004	06/10/2004	20/10/2004	21/10/2004	AVERAGE	MAX
Metformin (ug/L)	0.081	Not Tested	U	Not Tested	Not Tested	U	Not Tested	0.027	0.081
Cotinine (ug/L)	2.04	Not Tested	1.60	Not Tested	Not Tested	1.171	Not Tested	1.602	2.040
Salbutamol (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Cimetidine (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Acetaminophen (ug/L)	26	Not Tested	20.5	Not Tested	Not Tested	28.061	Not Tested	24.854	28.061
Ranitidine (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
1,7-dimethylxanthine (ug/L)	22.5	Not Tested	13.11	Not Tested	Not Tested	15.50	Not Tested	17.036	22.500
Enalaprilat (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Trimethoprim (ug/L)	0.06635	Not Tested	0.04415	Not Tested	Not Tested	U	Not Tested	0.037	0.066
Digoxigenin (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Diltiazem (ug/L)	0.0216	Not Tested	0.00305	Not Tested	Not Tested	U	Not Tested	0.008	0.022
Fluoxetine (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Warfarin (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Ibuprofen (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Gemfibrozil (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Paroxetine metabolite (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Lisinopril (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Furosemide (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Amoxicillin (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Caffeine (ug/L)	20.5	Not Tested	16.982	Not Tested	Not Tested	14.54	Not Tested	17.342	20.500
Sulfamethoxazole (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Dehydronifedipine (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Digoxin (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Codeine (ug/L)	0.138	Not Tested	0.0883	Not Tested	Not Tested	0.097	Not Tested	0.108	0.138
Cephalexin (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Thiabendazole (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Urobilin (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Diphenhydramine (ug/L)	0.06095	Not Tested	0.0148	Not Tested	Not Tested	U	Not Tested	0.025	0.061
Azithromycin (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Erythromycin (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Clarithromycin (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Carbamazepine (ug/L)	0.05985	Not Tested	0.0435	Not Tested	Not Tested	0.061	Not Tested	0.055	0.061
Miconazole (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Naproxen (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U
Nicotinamid4ISTD (ug/L)	1.15	Not Tested	1.1343	Not Tested	Not Tested	1.161	Not Tested	1.148	1.161
Ethyl Nicotinate-d4 Surr (ug/L)	1.165	Not Tested	1.1899	Not Tested	Not Tested	2.04	Not Tested	1.464	2.037
Caffeine13C (ug/L)	U	Not Tested	U	Not Tested	Not Tested	U	Not Tested	U	U

APPENDIX A.6
HEAVY METALS TARGET LEVELS FOR CLASS III OFW¹

CONSTITUENT	TARGET LEVELS (UG/L)
Aluminum	10
Antimony	0.8
Arsenic, Total	3
Barium	30
Cadmium	0.1
Chromium, Total	0.1
Copper	3
Iron	10
Lead	0.7
Manganese	2
Mercury, Total	0.03
Mercury, Methyl	0.03
Nickel	2
Selenium	4
Silver	0.5
Thallium	0.7
Tin	3
Zinc	10

1. From Task 5 - Final Report South Dade Advanced Water Treatment Alternatives, (USCOE, 2004)

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