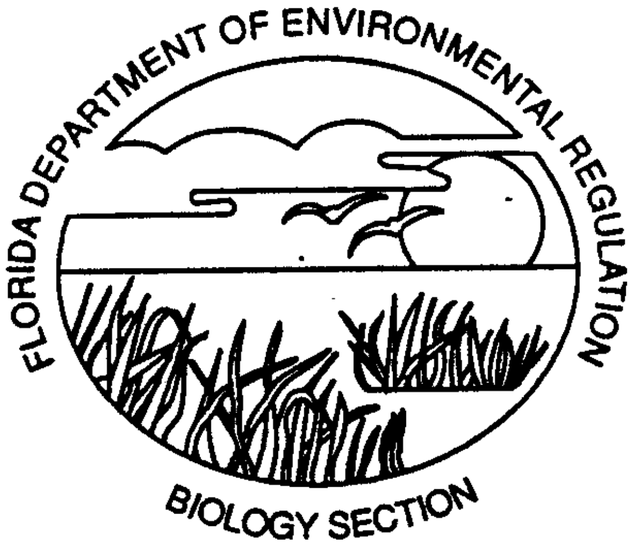


Bioassays of the City of

Boca Raton Wastewater Treatment Plant

Boca Raton, Palm Beach County, Florida

NPDES #FL0026344

Sampled 2/5/90

February 23, 1990

Biology Section
Division of Administrative and Technical Services

Bioassays of the City of

Boca Raton Wastewater Treatment Plant

Boca Raton, Palm Beach County, Florida

NPDES #FL0026344

Biology Section
Bureau of Laboratories
February 23, 1990

Introduction

Boca Raton Wastewater Treatment Plant, Boca Raton, Palm Beach County, Florida, NPDES #FL0026344, on 6 to 10 February, 1990.

This facility is located at 1501 West Glades Road and serves a population of approximately 150,000. The recovered water is chlorinated and piped several miles to the Atlantic Ocean, where it is discharged through a 30" pipe one mile from shore in approximately 100' of water. The facility uses an activated sludge process to treat domestic wastes and light industrial waste. The design flow is 10 MGD and the volume treated approaches this amount.

In response to a request from the FDER Southeast District, the Biology Section performed bioassays on a sample of discharge from this facility. The toxicity tests discussed in this report were performed in accordance with methods described by Peltier and Weber, 1985, *Methods for Measuring the Acute Toxicity of Effluents to Aquatic Organisms*, 3rd Edition, and by the FDER Biology Section, 1985, *Quality Assurance Manual for Performing Acute Toxicity Tests*, 2nd Edition.

Results and Discussion

The results of the Biology Section's 96-hour static test indicated that the sample was toxic to the bioassay test organism, the waterflea, *Ceriodaphnia dubia*, producing a 72 hour LC_{50} of 91.2%. The sample was not toxic to the bioassay test organism, the fish, *Notropis leedsi*. The Microtox® assay indicated that the sample was stimulatory to the Microtox® test organism, *Photobacterium phosphoreum*.

The total and unionized ammonia concentrations were 14.3 mg/l and 0.20 mg/l, respectively. No total residual chlorine was detected in the sample. No further chemical analyses were performed on the sample. The cause of toxicity to the test organism, *C. dubia*, was not determined.

Conclusion

The sample of discharge from this facility was toxic on 5 February, 1990. The cause of toxicity was not determined.

Table 1. Concentration Series and Volumes Used for These Static Bioassays.

Ceriodaphnia dubia (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	15.0 ml	0.0 ml	15 ml
10.0%	13.5 ml	1.5 ml	15 ml
30.0%	10.5 ml	4.5 ml	15 ml
50.0%	7.5 ml	7.5 ml	15 ml
70.0%	4.5 ml	10.5 ml	15 ml
85.0%	2.25 ml	12.75 ml	15 ml
100.0%	0.0 ml	15.0 ml	15 ml

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Sample	Total Volume
Control	500 ml	0 ml	500 ml
100.0%	0 ml	500 ml	500 ml

Table 2. Data recorded during the 96-hour static acute bioassay of a sample of discharge from the Boca Raton WWTP, Boca Raton, Palm Beach County, Florida, NPDES #FL0026344, on 6 to 10 February, 1990

Facility:	**City of Boca Raton Wastewater Treatment Plant**		NPDES #	FL0026344	Facility Type: **Sewage Treatment**
Location:	1501 Glades Road, Boca Raton		Contact/District:	D. White / SE	
County:	Palm Beach County		Test type:	static definitive	
Sample Collection Date:	**2/5/90**	Time: 1200	# tests:	2	Receiving Water: Atlantic Ocean
Test Beginning Date:	2/6/90	Time: 1125	Chlorination Type:	**Chlorinated***	
Test Ending Date:	2/10/90	Time: 1300		* no residual chlorine	**Page 1 of 2**

Total Residual Cl2	mg/l	Method
Field:	-	-
Lab:	0.0	Hach
Lab:	-	-

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	10.10	0.54
100% Sample:	14.30	0.20

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	115	115
Cond. Control Water (daphnids):	135	120
100% Sample:	105	110

Salinity (ppt)	
Control Water:	0
100% Sample:	0

Organism: ***Ceriodaphnia dubia*** Life stage: neonate

LC50: 91.22% Binomial: 91.22% Moving Average: - Probit: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 48 hr	Live at 96 hr	0 hour	24 hour	96 hour	0 hour	24 hour	96 hour	0 hour	24 hour	96 hour	0 hour	96 hour
Control	5	5	5	7.8	-	8.8	8.0	-	8.5	22.1	-	19.3	-	-
Control	5	5	5	7.8	-	8.8	8.1	-	8.5	-	-	-	-	-
Control	5	5	5	7.8	-	8.9	8.1	-	8.5	-	-	-	-	-
Control	5	5	5	7.8	-	8.9	8.1	-	8.5	-	-	-	240	240
10%	5	5	5	7.8	-	8.9	8.0	-	8.5	22.1	-	19.2	-	-
10%	5	5	5	7.8	-	8.8	8.0	-	8.4	-	-	-	-	-
10%	5	5	5	7.8	-	8.8	8.0	-	8.5	-	-	-	-	-
10%	5	5	5	7.8	-	8.8	8.0	-	8.5	-	-	-	285	280
30%	5	5	5	8.1	-	8.7	7.9	-	8.4	22.1	-	19.3	-	-
30%	5	5	5	8.1	-	8.7	7.9	-	8.4	-	-	-	-	-
30%	5	5	5	8.1	-	8.7	7.9	-	8.4	-	-	-	-	-
30%	5	5	5	8.1	-	8.8	7.7	-	8.4	-	-	-	360	260
50%	5	5	5	7.8	-	8.8	7.7	-	8.3	22.2	-	19.3	-	-
50%	5	5	5	7.8	-	8.7	7.7	-	8.3	-	-	-	-	-
50%	5	5	5	7.8	-	8.7	7.7	-	8.3	-	-	-	-	-
50%	5	5	5	7.9	-	8.7	7.7	-	8.3	-	-	-	410	435
70%	5	5	5	7.7	-	8.7	7.6	-	8.3	22.2	-	19.2	-	-
70%	5	5	5	7.7	-	8.7	7.6	-	8.3	-	-	-	-	-
70%	5	5	5	7.8	-	8.7	7.6	-	8.3	-	-	-	-	-
70%	5	5	5	7.8	-	8.7	7.6	-	8.3	-	-	-	495	490
85%	5	5	5	7.9	-	8.7	7.5	-	8.3	22.1	-	19.2	-	-
85%	5	5	5	7.9	-	8.7	7.5	-	8.3	-	-	-	-	-
85%	5	5	5	7.9	-	8.7	7.5	-	8.3	-	-	-	-	-
85%	5	4	4	7.9	-	8.8	7.6	-	8.3	-	-	-	525	510
100%	5	0	0*	7.9	-	8.9*	7.4	-	8.3*	22.2	-	19.8*	-	-
100%	5	0	0*	7.9	-	8.4*	7.4	-	8.1*	-	-	-	-	-
100%	5	1	0*	7.9	-	8.8*	7.4	-	8.2*	-	-	-	-	-
100%	5	0	0*	8.0	-	8.8*	7.4	-	8.3*	-	-	-	575	555*

* Data recorded at 72 hours

Table 2. Continued.

Facility:	**City of Boca Raton Wastewater Treatment Plant**		**NPDES #**	**FL0026344**	**Facility Type: Sewage Treatment**
Location:	1501 Glades Road, Boca Raton		Contact/District:	D. White / SE	
County:	Palm Beach County		Test type:	static screening	
Sample Collection Date:	**2/5/90**	Time: 1200	# tests:	2	Receiving Water: Atlantic Ocean
Test Beginning Date:	2/6/90	Time: 1125	Chlorination Type:	**Chlorinated***	
Test Ending Date:	2/10/90	Time: 1300		* no residual chlorine	**Page 2 of 2**

Organism:	***Notropis leedsi***	Life stage:	21		
LC50: -	Binomial: -	Moving Average: -		Probit: -	

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 48 hr	Live at 96 hr	0 hour	48hour	96 hour	0 hour	48 hour	96 hour	0 hour	48 hour	96hour	0 hour	96 hour
Control	5	5	5	8.2	8.9	8.8	7.8	8.4	8.4	21.7	19.2	19.2	230	250
Control	5	5	5	8.2	8.7	8.9	7.8	8.4	8.4	-	-	-	-	-
100.0%	5	5	5	8.0	8.3	8.3	7.3	8.0	8.0	21.8	19.0	19.2	605	610
100.0%	5	5	5	7.9	8.4	8.3	7.3	8.0	8.0	-	-	-	-	-

Total Residual Cl2	mg/l	Method
Field:	-	-
Lab:	0.0	Hach
Lab:	-	-

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	10.10	0.54
100% Sample:	14.30	0.20

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	115	115
Cond. Control Water (daphnids):	135	120
100% Sample:	105	110

Salinity (ppt)	
Control Water:	0
100% Sample:	0

Table 3. Microtox test results, Boca Raton WWTP, Palm Beach County, NPDES# FL0026344, on 6 February, 1989.

% Sample	Chlorinated* Final Reclaimed Water	
	5-min	15-min
0	64	43
0	60	41
0	60	42
12.38	63	45
12.38	65	46
12.38	66	47
24.75	66	49
24.75	64	46
24.75	62	44
49.5	63	45
49.5	69	50
49.5	71	52
99	71	52
99	69	52
99	72	55

*no residual chlorine detected in the sample

EC_{50} Unchlorinated (15 minute, 15 °C) = stimulatory

EC_{50} (15 minute, 15 °C) is calculated using the Data Reduction Computer Program developed by Microbics Corporation for the Sharp Model EL-5100 calculator (*Microbics Systems Operating Manual,* 1982, Microbics Corporation, Carlsbad, CA).

Table 4. LC_{50} Data for Bioassay of Boca Raton WWTP, NPDES# FL0026344.

Organism	Method of Data Analysis	72 Hour LC_{50} (95% Confidence Intervals)
Chlorinated discharge		
Ceriodaphnia dubia	Binomial	91.22%(85.00%, 100.00%)
	Moving Average	a
	Probit	a

a Due to an insufficient number of dead organisms, or to the irregular distribution of mortality, an LC_{50} value cannot be calculated using this method of statistical analysis.

DER Biology Section — Acute-bioassay Bench Sheet

Sample Source: City of Boca Raton WWTP
Address/City: 1501 GLADES ROAD Boca Raton
County: PALM BEACH
Contact/District: C. Forrigan / SE
NPDES Permit #: _____ Outfall #: 001 Beach

Sample Collection: Date 2/5/90 Time 1200
Test Beginning: Date 2/6/90 Time 1125
Test Ending: Date 2/10/90 Time 1300
Test Organism: _____
Life Stage/Age: Ceriodaphnia dubia/<24hrs old

Test Number: 1 of 2 Test Type: Screening (Definitive)
(Static) Static Renewal | Flow-through

Remarks: 24 hour composite. Split sample delivered @ 48 hrs old with Commonwealth Technology, Inc, NO Cl^- * remeasure after dilution error SHW

Instrument Calibrations:

	pH	DO	Cond	Temp
0 hr	7.0, 7.0, 4.0	8.6 @ 23.5°C	1413 @ 22.9°C	1330 22.4 @ 22.4
24 hr	7.0, 7.0, 4.0	8.7 @ 23°C	1413 @ 24.4°C	1330 22.4 @ 23.4
48 hr	_____	_____	_____	_____

Conc.	Chamber #	Number Live 0	24	48	DO (mg/l) 0	24	48	pH 0	24	48	Temp. (°C) 0	24	48	Cond. (µmhos/cm) 0 *	24	48
Control		5	5	5	7.8			8.0			22.1					
Control		5	5	5	7.8			8.1								
Control		5	5	5	7.8			8.1						240		
Control		5	5	5	7.8			8.1						~~255~~		
10 %		5	5	5	7.8			8.0			22.1					
10 %		5	5	5	7.8			8.0								
10 %		5	5	5	7.8			8.0						285		
10 %		5	5	5	7.8			8.0						~~295~~		
30 %		5	5	5	8.1			7.6			22.1					
30 %		5	5	5	8.1			7.6								
30 %		5	5	5	8.1			7.6						360		
30 %		5	5	5	8.1			7.7						470		
50 %		5	5	5	7.8			7.7			22.2					
50 %		5	5	5	7.8			7.7								
50 %		5	5	5	7.8			7.7						410		
50 %		5	5	5	7.9			7.7						~~430~~		
70 %		5	5	5	7.7			7.6			22.2					
70 %		5	5	5	7.7			7.6								
70 %		5	5	5	7.8			7.6						495		
70 %		5	5	5	7.8			7.6						~~545~~		
85 %		5	5	5	7.9			7.5			22.1					
85 %		5	5	5	7.9			7.5								
85 %		5	5	5	7.9			7.5						525		
85 %		5	5	4	7.9			7.6						~~530~~		
100 %		5	5	0	7.9			7.4			22.2					
100 %		5	5	0	7.9			7.4								
100 %		5	5	1	7.9			7.4						575		
100 %		5	5	0	8.0			7.4						~~550~~		
Measured by:		MF	MF	SW	MF			MF			MF			MF		
Recorded by:		MF	MF	SW	SW			SW			SW			SW		

96 hr test continued on "next" page

Investigators' Signatures

Marshall Faircloth

Steven H Wolfe

_____

_____

Reviewer

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:					
Lab Tot. Resid. Cl2:	-	-	0.0	Hach	SHW
Alkalinity:	115	135	105	Hach	MF
Hardness:	115	120	110	Hach	MF
Total Ammonia:	0.0	10.1	14.3	Hach	MF

Mg = 60.5

DER Biology Section — Acute-bioassay Bench Sheet

Sample Source: Boca Raton
Address/City:
County:
Contact/District:
NPDES Permit #: Outfall #:

Sample Collection: Date 2/5/90 Time
Test Beginning: Date Time
Test Ending: Date 2/10/90 Time 1300
Test Organism:
Life Stage/Age:

Test Number: 1 of 2 Test Type: Screening | (Definitive)
(Static) | Static Renewal | Flow-through

Remarks: Continued from page 1 of Test 1 of 2

Instrument Calibrations:

	pH	DO	Cond	Temp
72 hr	7.9	9.0@21°C	1325@21°C/1327	22.0@22.3
96 hr	7.9	9.0@21°C	1326@21.9/1323	20.8@21.0
48 hr				

Conc.	Chamber #	Number Live 72	96	48	DO (mg/l) 72	96	48	pH 72	96	48	Temp. (°C) 72	96	48	Cond. (µmhos/cm) 72	96	48
Control		5	5			8.8			8.5			19.3				
Control		5	5			8.8			8.5							
Control		5	5			8.9			8.5							
Control		5	5			8.9			8.5						240	
10%		5	5			8.9			8.5			19.2				
10%		5	5			8.8			8.4							
10%		5	5			8.8			8.5							
10%		5	5			8.8			8.5						280	
30%		5	5			8.7			8.4			19.3				
30%		5	5			8.7			8.4							
30%		5	5			8.7			8.4							
30%		5	5			8.8			8.4						360	
50%		5	5			8.8			8.3			19.3				
50%		5	5			8.7			8.3							
50%		5	5			8.7			8.3							
50%		5	5			8.7			8.3						435	
70%		5	5			8.7			8.3			19.2			435	
70%		5	5			8.7			8.3							
70%		5	5			8.7			8.3							
70%		5	5			8.7			8.3						490	
85%		5	5			8.7			8.3			19.2			490	
85%		5	5			8.7			8.3							
85%		5	5			8.7			8.3							
85%		4	4			8.8			8.3						510	
100%		0	—		8.9	—		8.3	—		19.8	—				
100%		0	—		8.4	—		8.1	—							
100%		0	—		8.8	—		8.2	—							
100%		0	—		8.8	—		8.3	—					555	—	
	Measured by:	mf	mf		mf	mf		mf	mf		mf	mf		mf	mf	
	Recorded by:	mf	mf		mf	mf		mf	mf		mf	mf		mf	mf	

Investigators' Signatures

Marshall Faircloth

Reviewer

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:					
Lab Tot. Resid. Cl2:					
Alkalinity:					
Hardness:					
Total Ammonia:					

DER Biology Section — Acute-bioassay Bench Sheet

mple Source: City of Boca Raton
Address/City:
County:
ntact/District:
DES Permit #: Outfall #:

Sample Collection: Date 2/5/90 Time 1200
Test Beginning: Date 2/6/90 Time 1100
Test Ending: Date 2/10/90 Time 1300
Test Organism:
Life Stage/Age: Mytilopsis leucosi 2 days

st Number: 2 of 2 Test Type: (Screening) Definitive
(Static) Static Renewal | Flow-through

marks: 24hour Composite Split Sample
RC Intest = fed at 48hr w/algae

Instrument Calibrations:

	pH	DO	Cond	Temp
0 hr				
24 hr				
48 hr				

Conc.	Chamber #	Number Live 0	24	48	DO (mg/l) 0	24	48	pH 0	24	48	Temp. (°C) 0	24	48	Cond. (µmhos/cm) 0	24	48
Control	87	5	5	5	8.2	8.1	8.9	7.8	8.3	8.4	21.7	19.0	19.2			
Control	63	5	5	5	8.2	8.1	8.7	7.8	8.3	8.4				230		230
100%	43	5	5	5	8.0	7.8	8.3	7.3	7.8	8.0	21.8	19.0	19.0			
100%	83	5	5	5	7.9	7.8	8.4	7.3	7.8	8.0				605		585
100%																
100%																
		72	96		72	96		72	96		72	96		72	96	
Control	87	5	5		8.7	8.8		8.4	8.4		19.3	19.2				
Control	63	5	5		8.7	8.9		8.4	8.4						250	
100%	43	5	5		8.4	8.3		8.0	8.0		19.3	19.2				
100%	83	5	5		8.4	8.3		8.0	8.0						610	
72h/96	init															
72h/96	init															
96hr	init															
96hr	init															
Measured by:																
Recorded by:																

Investigators' Signatures
Steven H Wolfe
Marshall Faircloth

Reviewer

Water-quality Parameters

	Well Water	Cond. Water	Sample	Method	Measured by
Field Tot. Resid. Cl2:					
Lab Tot. Resid. Cl2:					
Alkalinity:					
Hardness:					
Total Ammonia:					

MICROTOX™ Data Reduction Sheet

SOURCE: Brea Refin

GRAPH CALC EC 50 (15 MIN, 15 °C) = Stimulatory %SAMPLE mg/L

SAMPLE DATA:

SAMPLE TYPE (EFFLUENT, LEACHATE, ETC.):

DATE ASSAYED: 2/6/90 TIME:

VISUAL COLOR: CORRECTION REQUIRED: YES NO

VISUAL TURBIDITY: SEPARATION REQUIRED: YES NO

INITIAL pH: pH ADJUSTED TO: WITH:

OSMOTICALLY ADJUSTED WITH: MOAS (DRY NaCl) OTHER

PRIMARY DILUTION OF SAMPLE:

OPERATOR: MS Campin REAGENT VIAL LOT NO. M- NLN

REMARKS:

MICROTOX™ TEST

SAMPLE CUVETTE	% SAMPLE	READINGS 5 MIN	READINGS 15 MIN	Γ5	Γ15	NOTES
A1	0	64	43	X	X	
B1		60	41			
C1		60	42			
A2	12.38	63	45		-.09	
B2		65	46			
C2		66	47			
A3	24.75	66	49		-.09	
B3		64	46			
C3		62	44			
A4	49.5	63	45		-.14	
B4		69	50			
C4		71	52			
A5	99	71	52		-.21	
B5		69	52			
C5		72	55			
EC_{50} (MIN, °C)						Stimulatory

REVIEWED BY:

DATE: 2/28/90