

BIOASSAY OF ST. CLOUD SANITARY WASTEWATER TREATMENT PLANT

OSCEOLA COUNTY, FLORIDA

NPDES #FL0028959

Biological Section
Bureau of Water Analysis
January 22, 1980

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INTRODUCTION

The St. Cloud Sanitary Wastewater Treatment Plant is located on West Lakeshore Boulevard in St. Cloud (Fig. 1). This facility has been in operation since 1953 serving a population of 7500. Secondary sewage treatment at this facility includes primary sedimentation, trickle filtration, clarification and chlorination for a design capacity of 2.0 MGD. Half of the treated effluent (1.0 MGD) is piped to an underdrained spray field with a discharge to an adjoining marsh. The remaining effluent is discharged directly to the St. Cloud Flood Control Canal C-31 which flows into West Lake Tohopekaliga (Fig. 1). The plant is currently under a Temporary Operating Permit pending sprayfield modifications which will accommodate the entire discharge as per 201 Plan requirements.

On January 22, 1980 the Biological Section obtained prechlorinated effluent samples and performed a static bioassay to determine the existence and extent of toxicity to the biota of the receiving waters. The results of this test are reported here.

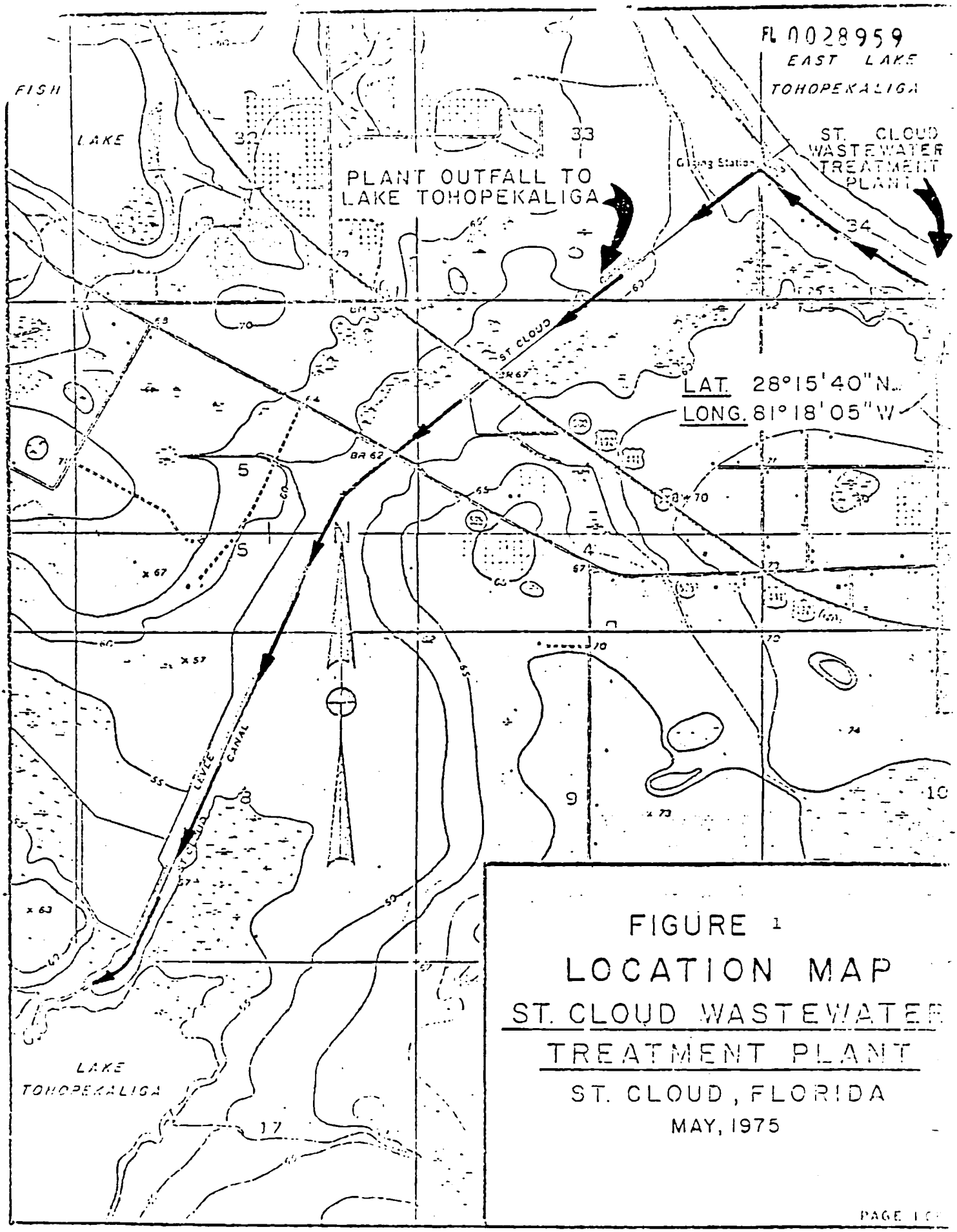


FIGURE 1

LOCATION MAP

ST. CLOUD WASTEWATER TREATMENT PLANT

ST. CLOUD, FLORIDA

MAY, 1975

METHODS AND MATERIALS

Test methods used for conducting this static bioassay are extensively described by Peltier (1978). The organism selected for this study is among those recommended by Peltier (1978) and the U.S. EPA (1978). The life history of this test organism and maintenance procedures used to culture it are detailed below.

History and Maintenance of Bioassay Organisms

Daphnia pulex (Water flea)

A breeding culture of *Daphnia pulex* was obtained from the EPA laboratory in Athens, Georgia on March 9, 1979. This culture has been maintained continually since its arrival, in 2½ gallon all glass aquaria using a 16:8 hour light-dark cycle. Organisms have been fed a liquified blend of Purina Trout Chow^{R} and Cerophyl^{R} twice daily. *Daphnia* used in this bioassay were siphoned into a large culture dish through a series of nested stainless steel screens to isolate the proper size and age organisms (neonates). These neonates were then pipetted individually from the culture dish and placed randomly into the test chambers at the beginning of the test.

Test Methods

A 48-hour static bioassay was conducted from 23 January to 25 January 1980 on a prechlorinated grab sample of effluent from outfall #001. The sample was collected by Mr. G. Graves, Mr. A. Walker, and Mr. T. Godsey of the DER Ft. Pierce Branch Office (South Florida Subdistrict) on 22 January 1980 using standard wastewater sampling procedures. The unpreserved sample was iced and transported to the DER laboratory in Tallahassee within 24 hours of collection.

Freshwater for dilution of the effluent sample was obtained from the same City of Tallahassee well that is used to culture the test organisms. The concentration series selected for this study are those recommended by APHA (1976) (Table 1).

Two replicates, each with six concentrations and a control, were used to test with *Daphnia pulex*. Flint glass jars of 250 ml capacity were used as test chambers, 200 ml of the appropriate test concentration was placed in each chamber (Table 2). *Daphnia* were transferred individually by glass pipette and were loaded 10 per chamber, resulting in 20 per test concentration.

Table 1

CONCENTRATION SERIES AND VOLUMES USED FOR THIS BIOASSAY

Water flea (*Daphnia pulex*)

Concentration	Dilution Water	Effluent	Total Vol.
Control	200 ml	-	200 ml
5.6%	189 ml	11 ml	200 ml
10.0%	180 ml	20 ml	200 ml
18.0%	164 ml	36 ml	200 ml
32.0%	136 ml	64 ml	200 ml
56.0%	88 ml	112 ml	200 ml
100%	-	200 ml	200 ml

Test Methods (continued)

Dissolved oxygen, pH, and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours, and 48 hours. Total alkalinity, total hardness and conductivity were recorded at the beginning of the test for the controls and high concentrations. These values were recorded daily on the bioassay data form and are presented in Table 2. The organisms were not fed during this test.

RESULTS AND DISCUSSION

LC_{50} results for this effluent are presented in Table 3. Using the binomial method, an LC_{50} value of 81.6% was calculated at 24 and 48 hours. The 96 hour LC_{50} would, therefore, be $\leq$ 81.6%. Since no chlorine was detectable in the bioassay sample the cause of the Daphnia mortality noted in the 100% effluent concentrations is unknown. Although the dissolved oxygen in the 100% concentration fell to 4.4 mg/l after 24 hours this concentration is well within the tolerance limits of this organism.

Chapter 17-3.051, Florida Administrative Code, indicates that "all waters of the State shall at all places and at all times be free from...components of discharges which...are acutely toxic." "Acute toxicity" is defined in Chapter 17-3.021(1) to mean "the presence of one or more substances...in amounts which are greater than one-third (1/3) of the amount lethal to 50% of the test organisms in 96 hours (96 hour LC_{50})...". In the absence of a mixing zone, this 1/3 of the 96 hour LC_{50} applies at the point of discharge. Chapter 17-4.244(4) states that "in no event shall the maximum concentration of wastes in the mixing zone exceed the amount lethal to 50% of the test organisms in 96 hours (96 hour LC_{50}) for a species significant to the indigenous aquatic community..." This criterion applies at the point of discharge if there is a mixing zone. The distinction between presence or absence of a mixing zone is not relevant here, however, since the testing procedure used does not involve effluent concentration. The 1/3 of the 96 hour LC_{50} criterion is three times as stringent as the 96 hour LC_{50} criterion, and, therefore, in the absence of a mixing zone, the procedure used is very lenient. The procedure followed is also lenient in that testing is only done for 48 hours. The 96 hour LC_{50} derived from this testing is therefore reported as "less than or equal to" the 48 hour measurement. The value found after 48 hours can never be more restrictive than the value found after 96 hours. It must be noted that all organisms used in these tests are significant to the indigenous aquatic community since they are sensitive to toxic substances which may be expected to impact the indigenous community.

The toxicity reported here is in excess of allowable limits.

Table 2. Data recorded during 48-hour, *Daphnia pulex*, static acute toxicity bioassay performed on the St. Cloud Sanitary Wastewater Treatment Plant, Osceola County, Florida. 21 Jan. to 25 Jan. 1980. NPDES Permit #FL0020959.

Conc. or %	Test Container Number	Number of Live Organisms					Dissolved Oxygen (mg/l)					pH					Total Alkalinity (mg/l as $CaCO_3$)					Total Hardness (mg/l as $CaCO_3$)					Conductivity (umhos)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Control	A	10	10	10			8.6	9.1	9.1			7.9	7.9	8.6			125					115					100				
Control	B	10	10	10			8.6	9.1	9.1			7.85	8.0	8.6																	
5.6	A	10	10	10			8.5	8.8	8.7			7.75	7.8	8.4																	
5.6	B	10	10	10			8.4	8.8	8.8			7.75	7.9	8.4																	
10.0	A	10	10	10			8.1	8.6	8.3			7.7	7.9	8.3																	
10.0	B	10	10	10			8.3	8.7	8.4			7.7	7.9	8.3																	
18.0	A	10	10	10			7.8	8.1	8.2			7.6	7.8	8.2																	
18.0	B	10	10	10			7.9	8.2	8.1			7.6	7.8	8.2																	
32.0	A	10	10	10			7.3	7.3	7.2			7.45	7.8	8.0																	
32.0	B	10	10	10			7.4	7.4	7.3			7.45	7.8	8.1																	
56.0	A	10	10	10			6.1	6.1	6.1			7.3	7.7	8.0																	
56.0	B	10	10	10			6.0	5.7	6.3			7.3	7.7	8.0																	
100	A	10	10	1			3.6* 7.3	4.4	4.7			7.15	7.7	7.9																	
100	B	10	10	2			3.6* 7.4	4.4	4.6			7.15	7.7	7.9			215					145					575				

Remarks:

* Chambers aerated due to low dissolved oxygen content.

1. Temperature range during test 22.0 to 24.0°C.
2. Total chlorine residual of 100% effluent not detectable.
3. Salinity of 100% effluent 0.25o/oo.

Table 3. LC_{50} Data

Organism	Data Analysis	24 hr LC_{50}	48 hr LC_{50}
Daphnia pulex	Binomial method	81.6%	81.6%
	Moving average method	*	*
	Probit method	*	*

* When there are < 2 concentrations at which the percent dead is between 0 and 100 neither the moving average nor probit method can be used.

LITERATURE CITED

American Public Health Association. 1976. Standard Methods for the Examination of Water and Wastewater. 14th ed. pp. 1193.

Peltier, William. 1978. Methods for measuring the acute toxicity of effluents to aquatic organisms. Environmental Research Laboratory. Athens, Georgia. EPA-600/4-78-012 (Revised July 1978) 51p.

U.S. Environmental Protection Agency. 1978. Bioassay procedures for the Ocean Disposal Permit Program. Environmental Research Laboratory. Gulf Breeze, Florida. EPA-600/9-78-010.