INTRODUCTION

The subject of this report is a non-NPDES outfall from the Harris Plant (Station #7, Fig. 1). This outfall discharges to the Clermont Road ditch which flows to the northwest tributary of Turkey Creek, thence to Turkey Creek which flows to Palm Bay on the Indian River (Fig. 2).

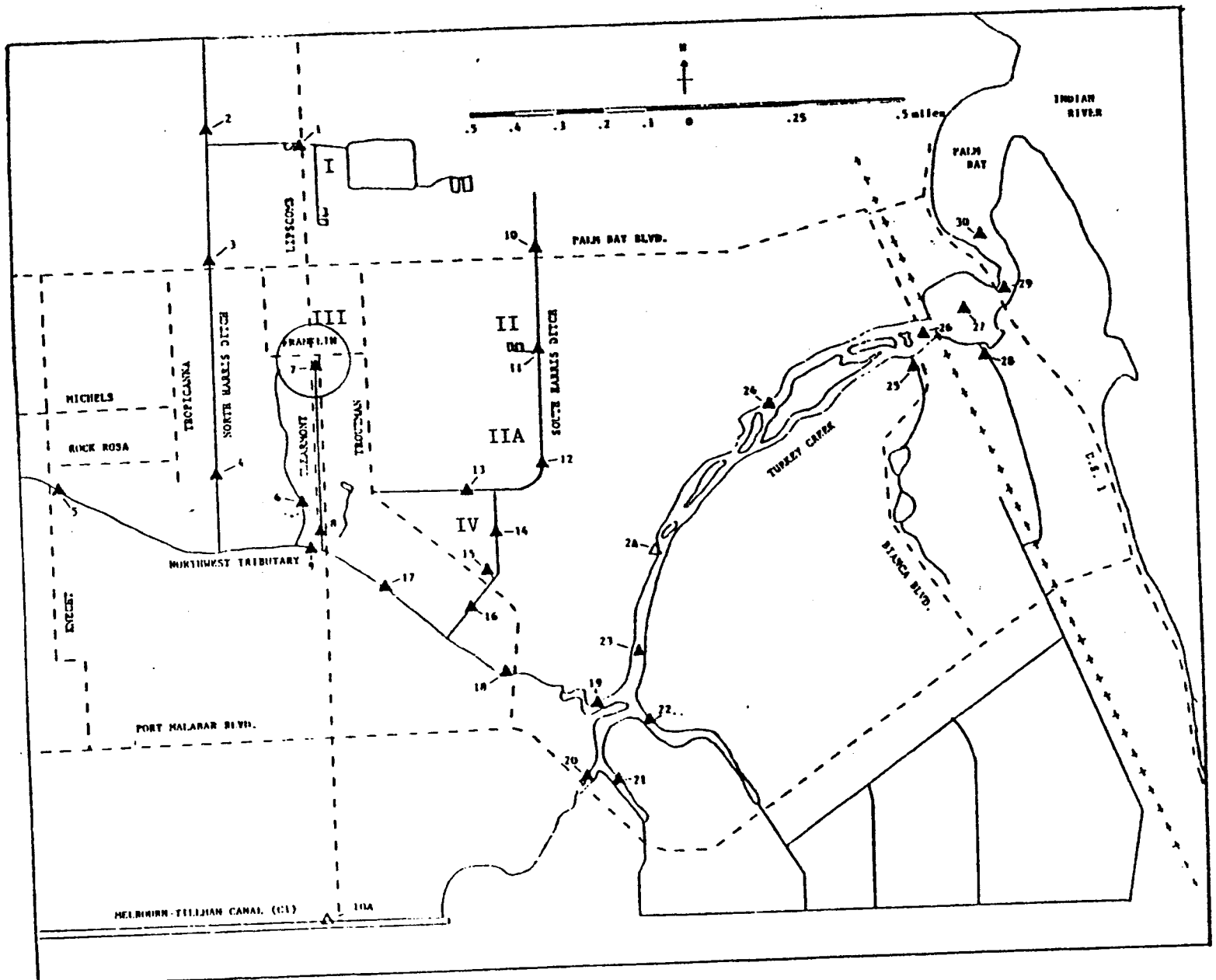
BIOASSAYS OF NON-NPDES OUTFALL FROM HARRIS PLANT TO CLERMONT ROAD DITCH

BREVARD COUNTY, FLORIDA

SAMPLED 1/21/80

FILE COPY
DO NOT REMOVE

Biological Section
Bureau of Water Analysis
May 22, 1980



I: North Harris Plant (semi-conductor)
II: South Harris Plant (communications)
IIA: South Harris Plant (future POD)
III: Harris Plant
IV: Port Malabar STP

FIGURE 1. Station Location Map

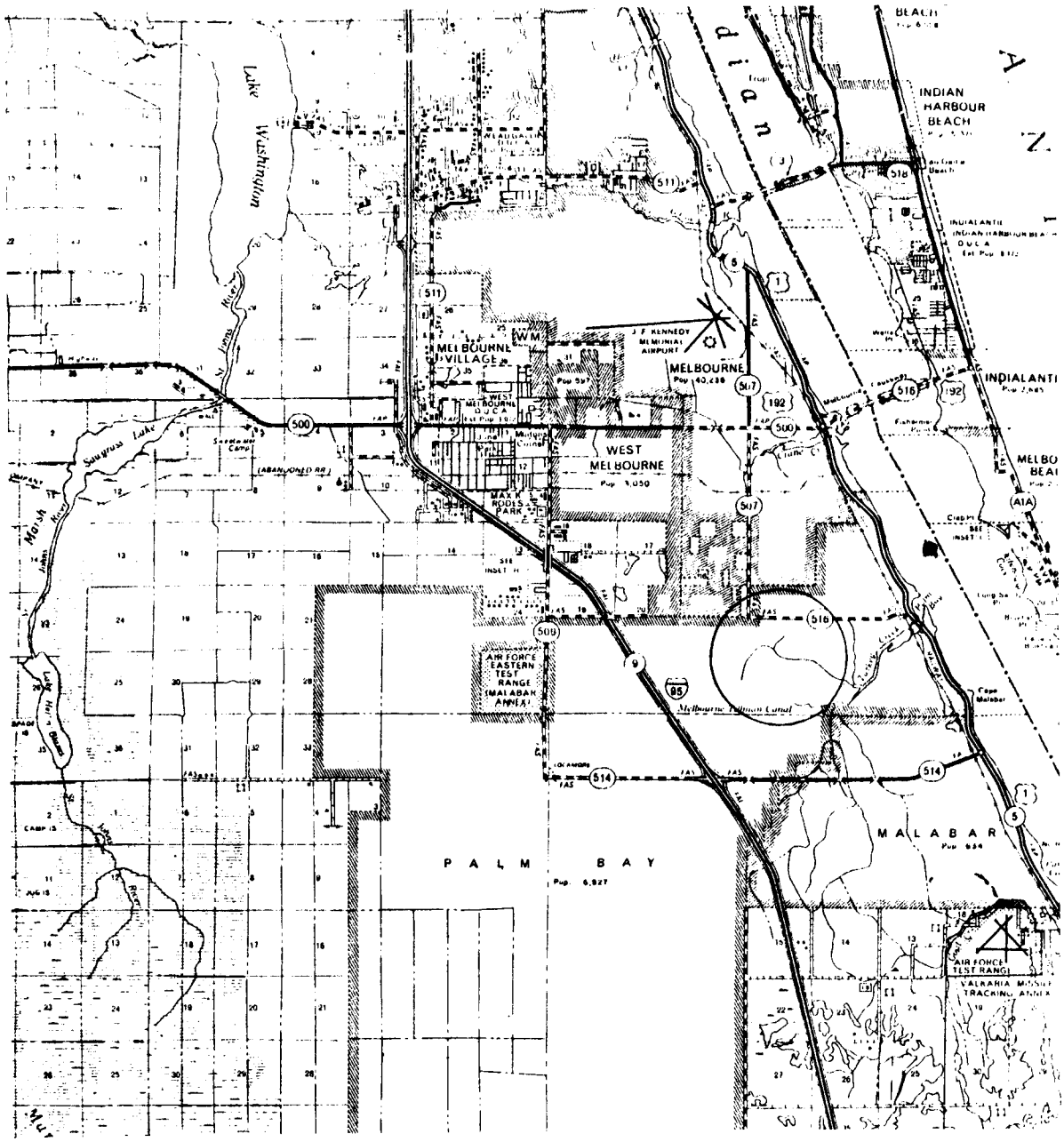


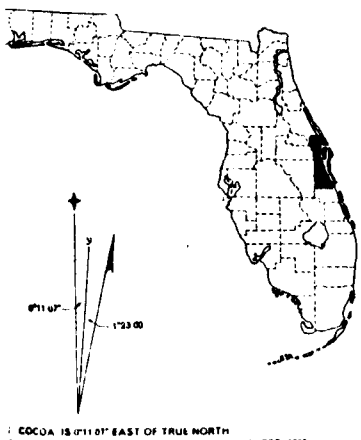
Figure 2. Portions of **BREVARD COUNTY**
including study area
FLORIDA

PREPARED BY THE
PHOTOGRAMMETRIC DIVISION
FOR THE
TRAFFIC AND PLANNING DIVISION
FLORIDA STATE ROAD DEPARTMENT
IN COOPERATION WITH THE
U.S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

0 0.5 1 2 3 4 MILES
SCALE

0 .01 .02 .03 .04 .05 MILE
SCALE FOR INSETS

MARCH, 1966



COCOA IS 0°11'01" EAST OF TRUE NORTH
BATELY 1°23'00" EAST OF TRUE NORTH IN DECEMBER, 1966

REVISIONS	
FEATURE	DATE
State Maintained Roads and City Limits	December 1966
SR 500, 514	March, 1969
MELBOURNE City Limits	Jan., 1971
US 192	Jan., 1971
I 95, SR 404	Jun., 1972

REPRINTED JANUARY, 1973

METHODS AND MATERIALS

Test methods used for conducting these static bioassays are extensively described by Peltier (1978). The organisms selected for this study are among those recommended by Peltier (1978) and the U.S. EPA (1978). Life histories of these test organisms and maintenance procedures used to culture them 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® and Cerophyl® 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.

Pimephales promelas (fathead minnow)

A breeding culture of approximately 100 adult fathead minnows were obtained from the EPA laboratory in Cincinnati, Ohio on 12 May 1979. The fish were transferred to three 125 gallon aquaria filled with unchlorinated City of Tallahassee well water and reared at 24°-25°C under 16:8 hour light-dark cycle. Water circulation, aeration and purification were accomplished with heavy-duty outside motor filters. These fish were fed Purina Trout Chow® at a rate of 0.75g/30 fish twice daily. Breeding was encouraged by placing several halved clay pots in each tank to serve as a substrate for eggs and to provide cover for the fish. Tanks were examined twice daily (at feeding time) for egg production. Clay pots containing egg clusters were immediately transferred to 15 gallon aerated aquaria for hatching. A new aquarium was prepared for each week's production of eggs thereby segregating fish into even age groups to be used for testing. After hatching fathead minnow fry were fed twice daily with freshly hatched *Artemia* (brine shrimp). The fish used in this test were all four weeks old at the time of the test.

Test Methods

The Biological Section obtained samples of effluent from a non-NPDES outfall to the Clermont Road ditch (Fig. 1), to determine the existence and extent of toxicity to the biota of the receiving waters. Static bioassays were conducted on two separate grab samples of effluent from this outfall. The initial sample of effluent was collected on 21 January 1980 by Mr. Mark Johnson and Mr. Steve Palmer of the Bureau of Water Analysis. A second sample of effluent from this outfall was collected by Mr. Johnson on 25 February 1980. Standard wastewater sampling procedures were used in each case. The initial sample was tested with Daphnia pulex in a single bioassay (Table 2). The second effluent sample was tested using both Daphnia pulex and fathead minnows (Pimephales promelas) in two separate bioassays (Tables 3 and 4). Separate samples were obtained for chemical and biological testing. Samples for metal analysis were preserved with HNO_3 (2ml/liter). Samples for organic chemical analysis and the bioassays were unpreserved. The samples were iced and transported to the DER laboratory in Tallahassee within 24 hours of collection.

Fresh water 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 of six concentrations and a control were implemented for the fathead minnow bioassay. The fish were transferred individually or by twos, by net into wide mouth quart jars containing 500 ml each of the appropriate test concentration (Table 1). The fish were loaded 5 per chamber resulting in 10 per concentration.

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 1). Daphnia were transferred individually by glass pipette and were loaded 10 per chamber, resulting in 20 per test concentration.

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 the 100% concentrations. These values were recorded daily on the bioassay data forms and are presented in Tables 2, 3 and 4. Organisms were not fed during these tests.

Table 1

CONCENTRATION SERIES AND VOLUMES USED FOR THESE STATIC BIOASSAYS

Fathead minnow (Pimephales promelas)

Concentration	Dilution Water	Effluent	Total Vol.
Control	500 ml	-	500 ml
5.6%	472 ml	28 ml	500 ml
10.0%	450 ml	50 ml	500 ml
18.0%	410 ml	90 ml	500 ml
32.0%	340 ml	160 ml	500 ml
56.0%	220 ml	280 ml	500 ml
100%	-	500 ml	500 ml

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

Table 2. Data recorded during 48-hour, Daphnia pulex, static acute toxicity bioassay performed on non-NPDES outfall to Clermont Road Ditch, Brevard County, Florida. 22 January to 24 January 1980.

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			8.0	8.5	8.9			7.8	7.75	7.8			125					135					300				
Control	B	10	10	10			7.9	8.5	8.9			7.8	7.8	7.9																	
5.6	A	10	10	10			8.1	8.4	9.0			7.9	7.8	7.8																	
5.6	B	10	10	10			8.1	8.5	9.0			7.9	7.85	7.8																	
10.0	A	10	10	10			8.3	8.6	9.0			7.9	7.8	7.8																	
10.0	B	10	9	9			8.2	8.6	9.0			8.0	7.85	7.8																	
18.0	A	10	8	3			8.3	8.7	9.1			7.9	7.8	7.8																	
18.0	B	10	10	6			8.5	8.7	9.1			7.9	7.8	7.8																	
32.0	A	10	0				8.9	8.8				8.0	7.8																		
32.0	B	10	0				8.8	8.8				8.0	7.8																		
56.0	A	10	0				8.9	8.9				7.9	7.7																		
56.0	B	10	0				9.0	8.9				7.9	7.7																		
100	A	10	0				9.1	8.9				7.6	7.4																		
100	B	10	0				9.2	8.9				7.6	7.3				30					220					510				

Remarks:

Total chlorine of 100% effluent = 0.3mg/l.
Free chlorine of 100% effluent = 0.15mg/l.

Table 3. Data recorded during 48-hour, Pimephales promelas, static acute toxicity bioassay performed on non-NPDES outfall to Clermont Road Ditch, Brevard County, Florida. 26 February to 28 February 1980.

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	5	5	5			7.8	8.0	8.2			7.8	7.8	8.0			125					125					230				
Control	B	5	5	5			7.9	8.1	8.2			7.7	7.8	8.1																	
5.6	A	5	2*	2			7.8	7.7	7.5			7.7	7.8	8.0																	
5.6	B	5	5	5			7.8	8.5	8.5			7.8	7.9	8.1																	
10.0	A	5	5	5			8.0	8.0	8.0			7.7	7.9	8.1																	
10.0	B	5	5	5			8.0	8.5	8.4			7.8	7.9	8.1																	
18.0	A	5	5	5			7.7	8.3	8.5			7.8	7.9	8.1																	
18.0	B	5	5	5			7.8	8.4	8.5			7.8	7.9	8.0																	
32.0	A	5	0				8.0	8.7				7.8	7.9																		
32.0	B	5	0				8.1	8.6				7.8	7.9																		
56.0	A	5	0				8.4	8.1				7.7	7.8																		
56.0	B	5	0				8.6	8.5				7.6	7.7																		
100	A	5	0				8.6	8.5				7.6	7.7																		
100	B	5	0				8.7	8.8				7.5	7.6				23					108					385				

Remarks:

Total chlorine of 100% effluent = 1.0mg/l.
Free chlorine of 100% effluent = 0.7 mg/l.

* Bodies not found - One of the remaining fish is considerably larger than the other (although the same age) and exhibits agressive behavior. It is believed that this fish may have cannibalized the three that are missing.

Table 4. Data recorded during 48-hour, Daphnia pulex, static acute toxicity bioassay performed on non-NPDES outfall to Clermont Road Ditch, Brevard County, Florida. 26 February to 28 February 1980.

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	9			7.7	8.7	8.6			7.8	8.0	8.2			125					125					230				
Control	B	10	10	9			7.7	8.7	8.5			7.9	8.1	8.2																	
5.6	A	10	9	2			7.7	9.0	8.7			7.8	8.2	8.2																	
5.6	B	10	10	6			7.8	8.9	8.6			7.9	8.2	8.2																	
10.0	A	10	1	1			7.8	8.9	8.6			8.0	8.2	8.3																	
10.0	B	10	1	0			7.8	9.0	8.7			7.9	8.2	8.3																	
18.0	A	10	0				7.9	9.0				8.0	8.2																		
18.0	B	10	0				8.0	8.9				8.0	8.2																		
32.0	A	10	0				8.0	8.9				7.9	8.2																		
32.0	B	10	0				8.1	9.0				7.9	8.2																		
56.0	A	10	0				8.2	9.0				7.9	8.1																		
56.0	B	10	0				8.2	8.9				7.9	8.1																		
100	A	10	0				8.4	9.0				7.7	8.0																		
100	B	10	0				8.6	9.0				7.7	7.9				23					108					385				

Remarks:

Total chlorine of 100% effluent = 1.0mg/l.
Free chlorine of 100% effluent = 0.7mg/l.

RESULTS AND DISCUSSION

Effluent from this non-NPDES outfall proved to be toxic to both Daphnia pulex and fathead minnows (Pimephales promelas). This toxicity is believed to be primarily due to significant levels of chlorine that were present in each of the effluent samples. The sample collected 21 January 1980 was tested for chlorine (Hach kit) just prior to the bioassay. This sample contained 0.3mg/l of total residual chlorine and 0.15mg/l free chlorine. The second sample (25 February 1980), also tested just prior to the bioassay, exhibited a total residual chlorine of 1.0mg/l and a free chlorine value of 0.7mg/l. Results of other chemical parameters investigated are reported in Table 6. Of these, only chromium was found to be present in appreciable amounts, however, all four samples analyzed contained amounts of chromium that were below the acknowledged threshhold of toxicity for aquatic life (U. S. EPA, 1977).

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 hr LC_{50})...". Mixing zones are not relevant to this criterion, and the restriciton on acute toxicity, therefore, applies at the point of discharge. Essentially this provision means that an effluent at the point of discharge can not cause 50% mortality in the test organisms even if the effluent is concentrated three-fold. Since the testing procedure used here does not involve any concentrating of the effluent, and since mortality is only measured for 48 hours, any toxicity reported here may be considered to be substantially in excess of allowable limits.

Table 5. LC_{50} Data

Date of Sample	Organism	Type of Test	Method of Data Analysis	24 hour LC_{50}	48 hour LC_{50}
01/21/80	Daphnia pulex	Static	Binomial test	22.5%	17.1%
			Moving average method	19.9%	16.3%
			Probit method	21.3%	16.8%
02/25/80	Daphnia pulex	Static	Binomial test	7.7%	A
			Moving average method	7.8%	A
			Probit method	7.8%	5.1%
02/25/80	Pimephales promelas	Static	Binomial test	24.0%	24.0%
			Moving average method	B	B
			Probit method	B	B

A. Neither the binomial test nor the moving average method can give any results for this data set. Either the highest concentration killed less than 50 percent or the lowest killed more than 50.

B. When there are less than two concentrations at which the percent dead is between 0 and 100, neither the moving average nor the probit method can give statistically sound results.

Table 6. Results of chemical analyses conducted on non NPDES permitted discharge to Clermont Road ditch

	24 January 1980		28 February 1980	
Parameter	Grab Sample	Composite Sample	Grab Sample	Composite Sample
Total Organic Carbon	5mg/l	5mg/l	5mg/l	6mg/l
Arsenic	<10µg/l	<10mg/l	<10µg/l	<10µg/l
Cadmium	< 1µg/l	< 1µg/l	< 1µg/l	< 1µg/l
Chromium	87.2µg/l	16.9µg/l	<10µg/l	37µg/l
Copper	7.7µg/l	13.5µg/l	< 5µg/l	8µg/l
Lead	< 5µg/l	< 5µg/l	< 5µg/l	< 5µg/l
Mercury	<0.2µg/l	<0.2µg/l	<0.2µg/l	< 0.2µg/l
Nickel	< 10µg/l	< 10µg/l	<10µg/l	<10µg/l
Silver	< 1µg/l	< 1µg/l	< 1µg/l	<1µg/l
Zinc	< 25µg/l	< 25µg/l	<25µg/l	<25µg/l
PCBs & Phthalates	N.D.	N.D.	N.D.	N.D.
Temperature	18°C	-	23°C	-
pH (field)	7.9	-	7.6	-
Conductivity	380umhos	-	470umhos	-
Dissolved oxygen	8.0mg/l	-	9.4mg/l	-
BOD_5	0.5mg/l	2.1mg/l	0.4mg/l	3.9mg/l
Ammonia (N)	0.03mg/l	0.06mg/l	0.05mg/l	0.11mg/l
Organic nitrogen	0.09mg/l	0.41mg/l	0.07mg/l	0.32mg/l
Nitrate & nitrite nitrogen	0.15mg/l	0.06mg/l	0.03mg/l	0.07mg/l
Total nitrogen	0.27mg/l	0.53mg/l	0.15mg/l	0.50mg/l
Total phosphorus	0.27mg/l	0.28mg/l	0.22mg/l	0.24mg/l
Fluoride	0.19mg/l	0.16mg/l	0.16mg/l	0.17mg/l

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. 1977. Bioassay for toxic and hazardous material. EPA-430/1-74-014.

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.