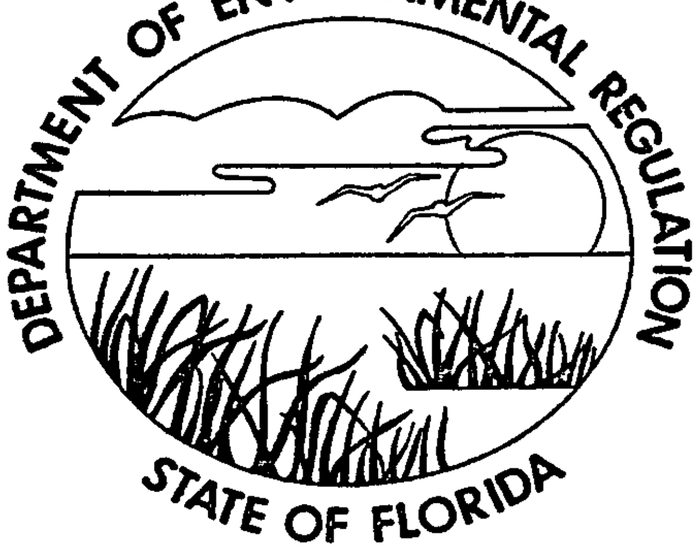


BIOASSAYS OF THE CECIL FIELD NAVAL AIR STATION

SEWAGE TREATMENT PLANT

DUVAL COUNTY, FLORIDA

NPDES #FL0020966

SAMPLED 2/11/86

APRIL 18, 1986

Biology Section
Division of Environmental Programs

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Bureau of Laboratories and
Special Programs
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EXECUTIVE SUMMARY

Cecil Field NAS Sewage Treatment Plant, Duval County, NPDES #FL0020966, on 12 to 14 February, 1986.

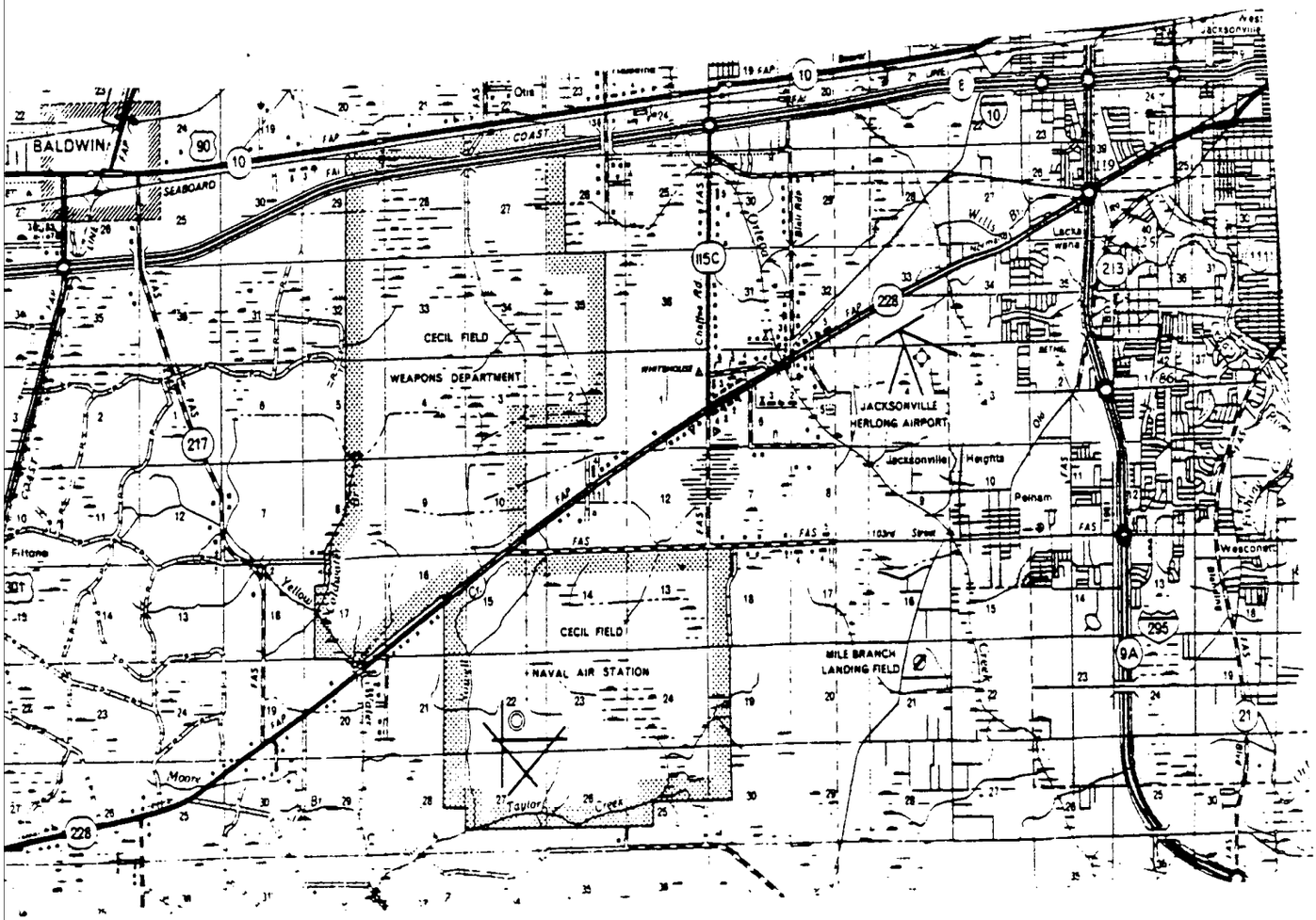
The sample of effluent from this small government facility (< 1.0 MGD), which provides treatment for the Air Station personnel and its operations, was not acutely toxic to the test organisms, Daphnia pulex and Notropis leedsi. No significant mortality was noted during the 48 hour static tests. Chlorine was not detected in this wastewater, and, the ammonia measured (1.03 mg/l total and 0.005 mg/l unionized) was insufficient to have caused any toxicity. Since the sample was not toxic, chemical analyses were not performed.

INTRODUCTION

The Cecil Field Naval Air Station Sewage Treatment Plant serves the personnel of Cecil Field NAS, and has a design capacity of 0.82 MGD. Additionally, this plant provides secondary treatment for a variety of effluents generated as a result of the Naval Air Station's standard operating and maintenance procedures.

The plant discharges treated effluent to the Caldwell Branch of Sal Taylor Creek (also known as Rowell Creek) which is a tributary of Yellow Water Creek (Figure 1). Yellow Water Creek eventually joins the North fork of Black Creek. Maintenance of good effluent standards is especially important in this case because of the low flow and consequent minimal dilution capability of Yellow Water Creek.

In October, 1979, the Biology Section obtained effluent samples from the Cecil Field Facility outfall #001 and performed static bioassays to determine the existence and extent of toxicity. The effluent was not acutely toxic at that time (FDER 1979). Since it had been a number of years since this facility was tested, the Northeast District requested additional bioassays be performed to again evaluate the toxicity. Tests were performed from 12 to 14 February, 1986. The results of these latest tests are present in this report. Those involved in performed these tests and in preparation of this report were: R. B. Frydenborg, M. L. Roll, and P. G. Weiland.



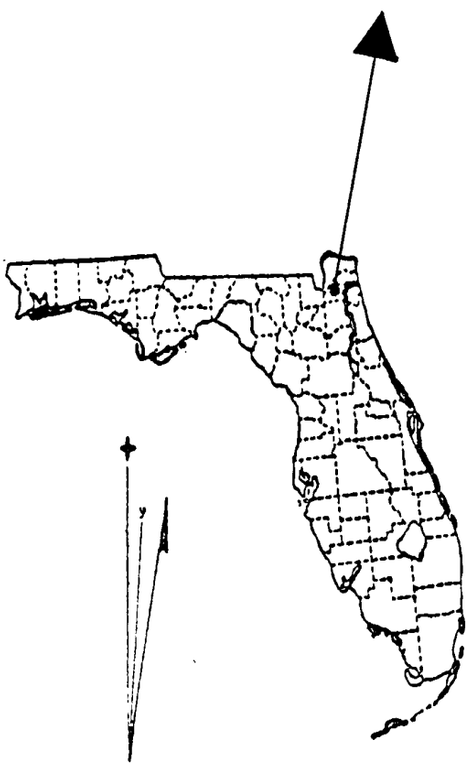


Figure 1. Portions of Duval County, Florida, including location of the Cecil Field Naval Air Station.

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier and Weber (1985) and the FDER Biology Section (1985). The organisms selected for this study include a species recommended by Peltier and Weber (1985), the U.S. EPA (1978), and the FDER Biology Section (1985). Additionally, the Biology Section maintains cultures of several species of organisms indigenous to the State of Florida. One of these indigenous species was also selected for testing. 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, in March, 1979. This culture has been maintained since its arrival in 2 1/2 gallon all-glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, once daily on weekends, and are kept at a constant temperature of 22° ± 2°C. The quaria are cleaned weekly by siphoning off half the water along with the detritus and excess organisms, and then refilling with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances such as: declining populations, ephippia formation, or excessive fungal or bacterial growth.

Notropis leedsi (bannerfin shiner) - Approximately 40 adult bannerfin shiners were obtained from an indigenous population in the upper Suwannee River during October, 1981. The breeding stock is maintaind in 30 and 125 gallon all-glass aquaria equipped with a flow-through water exchange system. Water for this system is unchlorinated and is pumped from the DER deep well. The bannerfin shiners are reared at 22° ± 2°C under a 16:8 hour light cycle and are fed Tetra-Min® and frozen Artemia (brine shrimp) twice daily, and once daily on weekends. Breeding and egg hatching are encouraged at 25°C. The eggs are laid between stacked red ceramic tiles separated by a 3mm bead of silicone. Most of the eggs adhere to the tile and are easily removed to heated, aerated hatching tanks. The narrow space between the tiles eliminates egg predation by adult fish. New hatching tanks are started regularly to segregate fry into even age groups. Newly hatched fry are fed a liquefied blend of Purina Troug Chow® and Cerophyl® twice daily. After one week, feeding is augmented with newly hatched Artemia nauplii and finely crushed Tetra Min®. The fish used in this test were approximately 30 days old at the time of the test.

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biology Section conducts monthly standard reference toxicant bioassays using sodium lauryl sulfate as the reference toxicant.

Test Methods

Methods used to perform acute toxicity bioassays are described by Peltier and Weber (1985) and the FDER Biology Section (1985). Some of the methods described below are more specific than those of Peltier and Weber. These will be noted in more detail.

Sampling Methods and Test Dates

Two 48 hour static acute toxicity bioassays were performed on a sample of final effluent from the Cecil Field STP outfall #001. The tests were performed from 0920 hours on 12 February to 0945 hours on 14 February, 1986.

The sample was collected by Ms. Lea Anne Chorlton of DER's Northeast District at 1345 hours on 11 February, 1986, using standard wastewater sampling procedures. Separate samples were obtained for chemical and biological testing. Samples for metal analyses were preserved with HNO_3. Samples for organic chemical analyses and for the bioassays was unpreserved. The samples were iced and transported to the DER laboratory in Tallahassee for analyses within 24 hours of collection.

Test Temperature

Upon arrival of the iced (4°C) bioassay samples in the Tallahassee laboratory, the containers were placed in warm water and the temperature of the samples allowed to rise to 20° $\pm$ 2°C. Although this temperature may be different than the temperature of the sample during collection, it is the temperature range to which the test organisms are acclimatized and is the range recommended in the above referenced bioassay protocols. This avoids stressful effects caused by exposure to unusally cold or warm samples.

Freshwater Tests

Freshwater for dilution of the effuent sample was obtained from the same DER deep well that is used to culture the test organisms. The concentration series selected for this study (Table 1) is an abbreviated version of that recommended by APHA (1980).

Two replicates, of each concentration and a control, were used to test with the water flea, Daphnia pulex. Flint glass jars of 250 ml capacity were used as test chambers, and 200 ml of the appropriate test concentration was placed in each chamber. Daphnia were siphoned into a large culture dish to isolate the proper size and age organisms (neonates). To accomplish this, the water fleas were siphoned through a stainless steel screen. The trapped adults were then discarded. These neonates were then transferred by glass pipette, examined for injury, and were loaded 10 per chamber, resulting in 20 per test concentration. Water fleas were fed at the beginning of this test.

Two replicates, of each concentration and a control, were used for the Notropis leedsi (bannerfin shiner) bioassay. The fish were transferred individually or by twos, into wide mouth quart jars containing 500 ml each of the appropriate test concentration, and were loaded 5 per chamber, resulting in 10 per concentration. Fish were not fed during this test.

Test Parameters

Dissolved oxygen (YSI Model 57 oxygen meter), pH (Corning Model 7 pH meter with Orion Ross® combination electrode), temperature (NBS calibrated glass thermometer), and the number of live organisms were recorded for each test concentration at 0 hours, 24 hours, and 48 hours. Total alkalainity and total hardness (measured as $CaCO_3$ using HACH Chemical Company reagents) were recorded at the beginning of the test for the control and the 100% effluent concentration. The specific conductance (YSI Model 33 S-C-T meter) of each test concentration was recorded at the beginning and end of the test. All instruments were calibrated daily according to manufacturer's recommendations. Ammonia concentrations, including the total and unionized fraction (expressed in mg/l as N and as NH_3, respectively), were recorded in the control and the 100% effluent test concentration at the beginning of the test. Total ammonia concentrations were determined using an Orion® specific ion probe and an Orion Ionalyzer®. The unionized fraction was then calculated based on the total ammonia concentration, and the pH, temperature, and salinity of the sample. These values were recorded on the bioassay data forms and are presented in Table 2 and 3.

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

Daphnia pulex (water flea)

Concentration	Dilution Water	Effluent	Total Volume
Control	200.0 ml	--------	200 ml
10.0%	180.0 ml	20.0 ml	200 ml
32.0%	136.0 ml	64.0 ml	200 ml
56.0%	88.0 ml	112.0 ml	200 ml
100.0%	--------	200.0 ml	200 ml

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Effluent	Total Volume
Control	500 ml	--------	500 ml
10.0%	450 ml	50 ml	500 ml
32.0%	340 ml	160 ml	500 ml
56.0%	220 ml	280 ml	500 ml
100.0%	------	500 ml	500 ml

Table 2. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay of the Cecil Field Naval Air Station Sewage Treatment Plant, Duval County, NPDES #FL0020966, on 12 to 14 February, 1986.

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)		
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	
Control	10	9	9	7.8	7.8	8.2	7.3	7.8	8.4	21.8	20.3	20.2			Control Water
Control	10	10	9	7.8	8.0	8.2	7.3	7.8	8.4				209	212	NH_3(as NH_3)(mg/l) 0 — Total Alkalinity (mg/l $CaCO_3$) 110
10.0%	10	10	9	7.8	7.6	8.2	7.2	7.8	8.4	21.6	20.1	20.2			
10.0%	10	10	10	7.8	7.8	8.2	7.2	7.8	8.4				220	225	
32.0%	10	10	10	7.9	7.8	8.1	7.3	7.8	8.3	21.6	20.1	20.2			Total ammonia (as N)(mg/l) 0 — Total Hardness (mg/l $CaCO_3$) 105
32.0%	10	10	10	7.9	7.8	8.1	7.3	7.8	8.3				233	235	
56.0%	10	10	10	8.1	7.9	7.9	7.1	7.6	8.2	21.7	20.4	20.1			
56.0%	11[a]	11	11	8.1	7.9	7.9	7.1	7.6	8.2				292	295	
100.0%	10	10	10	8.4	7.9	7.9	6.9	7.6	8.1	22.3	20.7	20.1			
100.0%	10	10	10	8.4	7.8	7.9	6.9	7.6	8.1				368	365	100% Effluent
															NH_3(as NH_3)(mg/l) 0.005 — Total Alkalinity (mg/l $CaCO_3$) 80
															Total ammonia (as N)(mg/l) 1.03 — Total Hardness (mg/l $CaCO_3$) 100

Total Residual Chlorine: None Detected (HACH DPD Method).

[a] Extra organism loaded by mistake, allowed to remain.

Table 3. Data recorded during 48 hour, Notropis leedsi, static acute toxicity bioassay of the Cecil Field Naval Air Station Sewage Treatment Plant, Duval County, NPDES #FL0020966, on 12 to 14 Febraury, 1986.

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)		
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	
Control	5	5	5	7.8	7.0	6.6	7.4	7.2	8.2	21.8	20.3	20.2			Control Water
Control	5	5	5	7.8	7.0	6.6	7.4	7.2	8.2				209	209	NH_3(as NH_3)(mg/l) 0 — Total Alkalinity 110 (mg/l $CaCO_3$)
10.0%	5	5	5	7.8	7.2	6.3	7.4	7.4	8.2	21.6	20.1	20.1			
10.0%	5	5	5	7.8	7.2	6.4	7.4	7.4	8.2				225	222	
32.0%	5	5	5	7.9	8.1	6.5	7.3	7.4	8.1	21.5	20.2	20.0			Total ammonia (as N)(mg/l) 0 — Total Hardness 105 (mg/l $CaCO_3$)
32.0%	5	5	5	7.9	8.1	6.5	7.3	7.4	8.1				237	264	
56.0%	5	5	5	8.1	8.1	6.5	7.1	7.4	8.1	21.8	20.3	20.1			
56.0%	5	5	5	8.1	8.1	6.5	7.1	7.4	8.1				300	282	
100.0%	5	5	5	8.4	8.2	6.5	6.9	7.2	8.0	22.5	20.4	20.3			
100.0%	5	5	5	8.4	8.1	6.5	6.9	7.2	8.0				372	366	100% Effluent
															NH_3(as NH_3)(mg/l) 0.005 — Total Alkalinity 80 (mg/l $CaCO_3$)
															Total ammonia (as N)(mg/l) 1.03 — Total Hardness 100 (mg/l $CaCO_3$)

RESULTS AND DISCUSSION

The sample of effluent from the Cecil Field Naval Air Station Sewage Treatment Plant was not acutely toxic to the test organisms, Daphnia pulex and Notropis leedsi. No significant mortality was noted during the 48 hour static tests (Table 2 and 3). Chlorine was not detected in this wastewater, and, the ammonia measured (1.03 mg/l total and 0.005 mg/l unionized) was insufficient to have caused any toxicity. Since the sample was not toxic, chemical analyses were not performed.

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