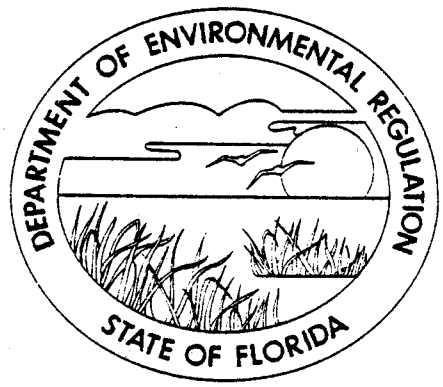


BIOASSAYS OF HARRIS CORPORATION, SEMICONDUCTOR DIVISION

BREVARD COUNTY, FLORIDA

(NPDES # FL0034690)

SAMPLED 2/10/81

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Biological Section
Bureau of Water Analysis
April 21, 1981

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INTRODUCTION

The Harris Corporation, Semiconductor Division, is located near the town of Palm Bay, in Brevard County, Florida (Fig. 1). This facility has been in operation since 1970, producing electronic components, specifically, semiconductor wafers amounting to 46 lbs./day. The Harris Semiconductor Corporation generates between 0.175 and 0.383 MGD of industrial wastewater which flows through an unnamed ditch to Turkey Creek, a tributary of the Indian River (Fig. 2). The wastewater discharge includes: semiconductor process rinse water, reverse osmosis reject water, regeneration wastes from the cationic/anionic resin exchange system, exhaust air scrubber water, cooling tower blowdown and non-contact cooling water. Treatment prior to discharge consists of pH adjustment with caustic and lime and retention in two polishing/mixing ponds. A schematic diagram of plant water flow is presented in Figure 3.

Based on the Harris Semiconductor Corporation's NPDES permit limitations and on chemical analyses of its effluent, many potentially toxic substances may be present in the discharge. These substances include: chromium, copper, lead, zinc, fluoride, hydrochloric acid, sodium hydroxide and ammonia. In October 1979, and again in November 1980, the Harris Semiconductor Corporation received Notices of Violation for exceeding various NPDES permit limitations. The company responded by submitting a new design for waste treatment to be completed in 1982.

In January and February of 1980, the Biological Section conducted toxicity bioassays on samples collected from the Harris Semiconductor Corporation's Outfall #001. The water flea, Daphnia pulex, and the fathead minnow, Pimephales promelas, were used to test the effects of the effluent on biota of the receiving waters. The effluent was not acutely toxic to either of the organisms tested (FDER 1980). However, results of chemical analyses performed on effluent samples collected at a different time than the bioassay samples indicated that several potentially toxic substances were present. Therefore, to further evaluate the possible toxicity of the Harris Semiconductor Corporation's effluent, additional bioassays were performed on 11 to 13 February, 1981. The results of these tests are presented in this report.

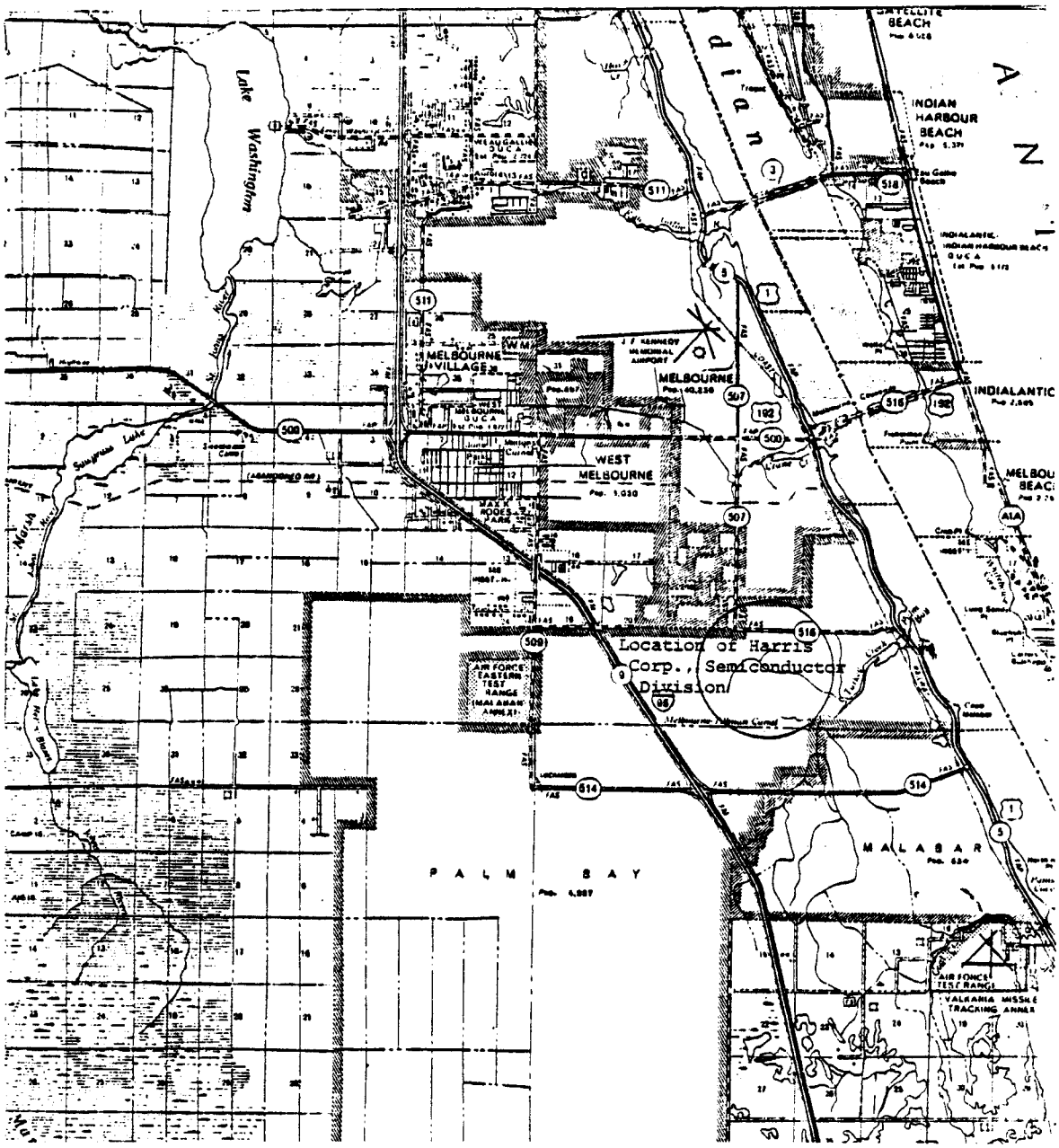


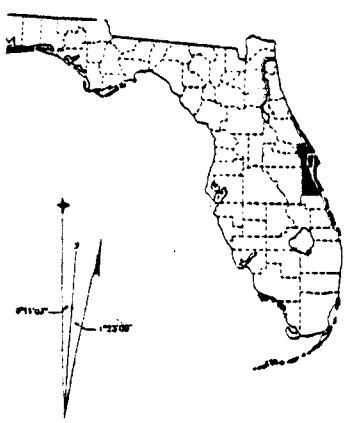
Figure 1. Portions of **BREVARD COUNTY**
including study area
FLORIDA

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

SCALE

SCALE FOR INSETS

MARCH, 1966



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

REPRINTED JANUARY, 1974

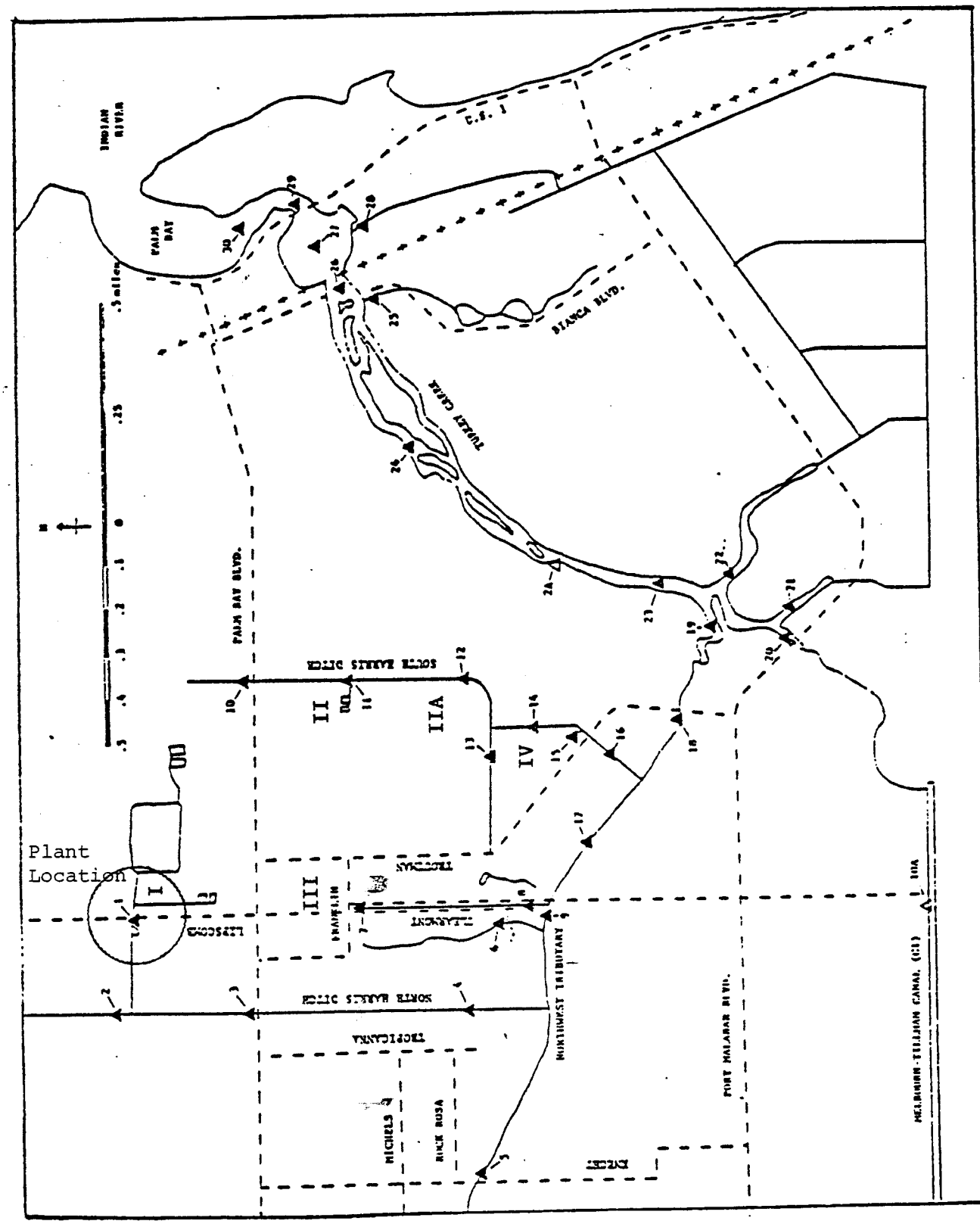
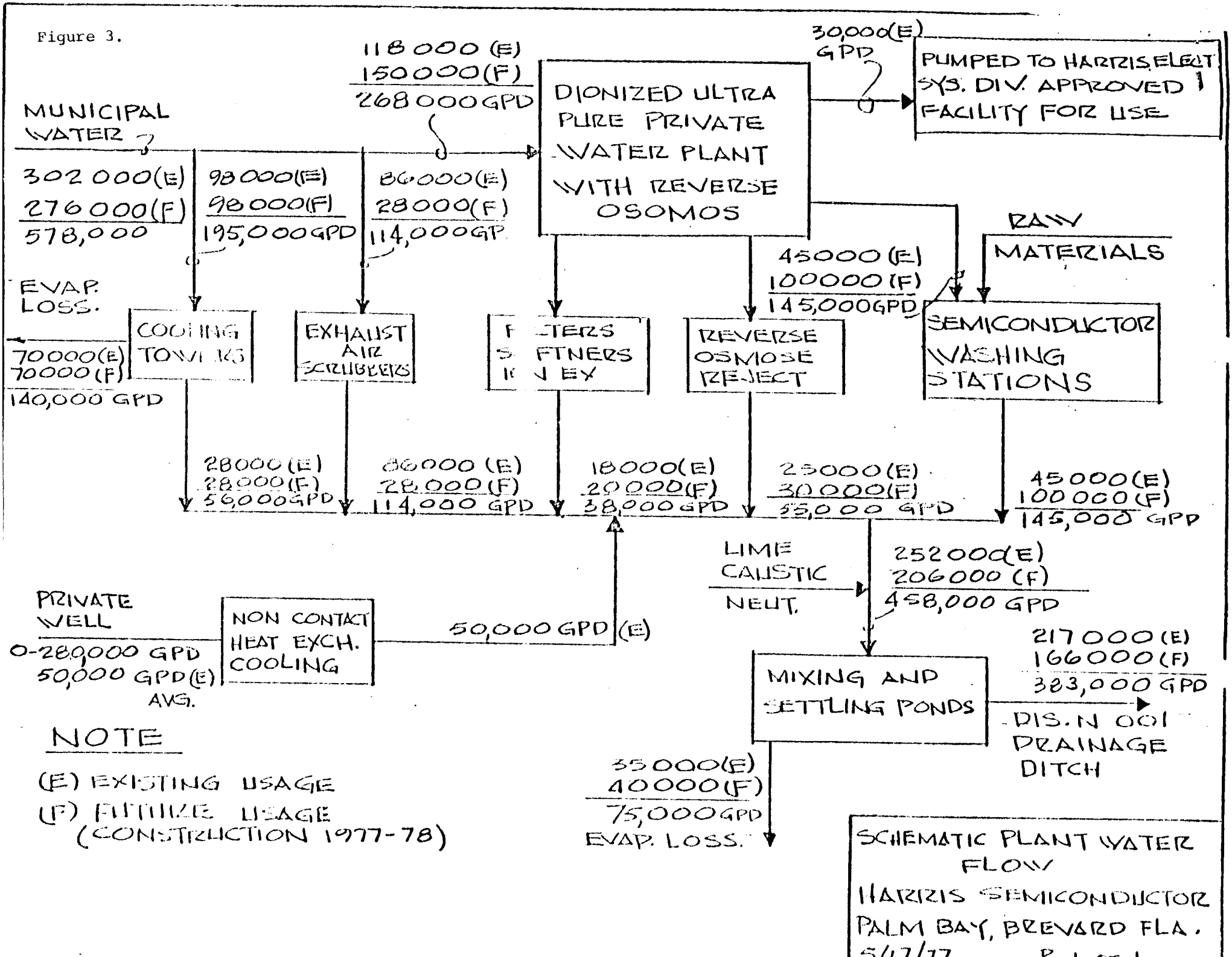


Figure 2. Station Location Map. Harris Corp., Semiconductor Division, Palm Bay, Brevard Co.

Figure 3.



NOTE

(E) EXISTING USAGE

(F) FUTURE USAGE (CONSTRUCTION 1977-78)

SCHEMATIC PLANT WATER FLOW

HARRIS SEMICONDUCTOR

PALM BAY, BREVARD FLA.

5/17/77

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978). The organisms selected for this study include species recommended by Peltier (1978) and the U.S. EPA (1978). Additionally, the Biological Section maintains cultures of several species of organisms indigenous to the State of Florida. 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 2½ gallon all glass aquaria filled with unchlorinated DER well water, using a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of 22° ± 1°C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess daphnids. They are then refilled 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.

Simocephalus serrulatus (water flea) - An indigenous breeding population of S. serrulatus was collected from Lake Jackson, Leon County, Florida, in March of 1980, by personnel from DER's Biological Section. Positive identification of the organism was performed by Mr. Jeff Foran of the Department of Environmental Engineering Sciences, University of Florida in Gainesville. The cultures are maintained in 2½ gallon all glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. The organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of 22° ± 1°C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess population. They are then refilled with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances.

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biological Section conducts monthly Standard Reference Toxicant Bioassays using sodium lauryl sulfate as the reference toxicant.

Test Methods

Two separate 48 hour static bioassays were conducted from 1055 hours on 11 February 1981 to 1100 hours on 13 February 1981, on a grab sample of effluent from Outfall # 001. The sample was collected by Mr. Guy Hadley of DER's St. Johns River District, at 1515 hours on 10 February 1981, 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 DER well that is used to culture the test organisms. The concentration series selected for this study (Table 1) is that recommended by APHA (1976).

Two replicates, each with six concentrations and a control, were used to test with Daphnia pulex and Simocephalus serrulatus. 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 and Simocephalus were siphoned into respective large culture dishes through nested stainless steel screens to isolate the proper size and age organisms (neonates). These neonates were then transferred individually by glass pipette and were loaded 10 per chamber, resulting in 20 per test concentration.

Dissolved oxygen, pH, temperature and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours and 48 hours. Total alkalinity, and total hardness were recorded at the beginning of the test for the controls and the 100% effluent concentration. Additionally, total ammonia (expressed as mg/l as N) and unionized ammonia (expressed as mg/l as NH_3) and specific conductance were determined for the controls and several effluent concentrations. These values were recorded on the bioassay data forms and are in Tables 2 and 3. Organisms were not fed during these tests.

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

Water fleas (Daphnia pulex and Simocephalus serrulatus)

Concentration	Freshwater diluent	Effluent	Total Vol.
Control	200 ml	0 ml	200 ml
5.6%	188.8 ml	11.2 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
100.0%	0 ml	200 ml	200 ml

Table 2. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay of Harris Corp., Semiconductor Div., Palm Bay, Brevard County, Florida, NPDES # FL0034690, Outfall # 001, on 11 to 13 February 1981.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (μmhos)
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0
Control	10	10	10	8.9	9.1	9.1	7.9	8.3	8.3	116		117		20.7	19.5	20.2	0/.04		
Control	10	10	9	8.9	9.1	9.1	7.9	8.3	8.3										202
5.6%	10	10	10	8.7	9.2	8.0	8.1	8.3	8.3					21.0	19.5	20.2			
5.6%	10	10	10	8.8	9.2	9.1	8.1	8.3	8.3										330
10.0%	10	10	10	8.9	9.2	9.1	8.3	8.3	8.3					21.0	19.5	20.2			
10.0%	10	10	10	8.9	9.2	9.2	8.3	8.3	8.3										442
18.0%	10	10	10	9.2	9.2	9.2	8.5	8.4	8.6					20.9	19.5	20.2			
18.0%	10	10	10	9.2	9.2	9.3	8.5	8.4	8.6										690
32.0%	10	10	10	9.3	9.1	9.7	8.7	8.5	8.6					20.9	19.5	20.1			
32.0%	10	10	10	9.4	9.2	9.8	8.7	8.5	8.5								.04/.224		990
56.0%	10	10	10	9.8	9.3	10.2	9.1	8.7	8.8					20.7	19.7	20.1			
56.0%	10	10	10	9.8	9.3	10.2	9.1	8.7	8.8										1510
100%	10	10	9	10.3	9.4	11.8	9.4	9.0	9.0	105		290		20.8	19.8	20.3	.34/.49		
100%	10	10	10	10.4	9.3	11.5	9.5	9.0	8.9										2490

Remarks:

Table 3. Data recorded during 48 hour, Simocephalus serrulatus, static acute toxicity bioassay of Harris Corp., Semiconductor Division, Palm Bay, Brevard County, Florida, NPDES # FL0034690, Outfall # 001, 11 to 13 February, 1981.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (μmhos)
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0
Control	10	10	10	8.8	9.2	9.2	7.8	8.3	8.4	116		117		20.7	19.0	20.1	0/.04		
Control	10	9	9	8.8	9.2	9.2	7.9	8.3	8.4										202
5.6%	10	10	10	8.9	9.2	9.2	8.1	8.3	8.3					20.7	19.0	20.2			
5.6%	10	10	10	8.9	9.2	9.2	8.1	8.3	8.3										332
10.0%	10	10	10	9.0	9.2	9.3	8.3	8.3	8.3					20.7	19.5	20.1			
10.0%	10	10	10	9.0	9.2	9.3	8.3	8.3	8.3										445
18.0%	10	9	9	9.1	9.1	9.4	8.5	8.4	8.4					20.6	19.5	20.2			
18.0%	10	10	10	9.1	9.1	9.4	8.5	8.4	8.4										690
32.0%	10	10	10	9.3	9.1	9.7	8.8	8.5	8.5					20.6	19.5	20.1			
32.0%	10	10	10	9.3	9.1	9.6	8.8	8.5	8.5								.04/.224		1000
56.0%	10	10	10	9.8	9.1	9.9	9.1	8.7	8.6					20.5	19.7	20.1			
56.0%	10	10	10	9.8	9.1	9.9	9.1	8.7	8.6										1480
100%	10	10	10	10.4	9.0	11.0	9.5	9.0	8.9	105		290		20.5	19.8	20.4	.34/.49		
100%	10	10	10	10.4	9.0	10.6	9.5	9.0	8.8										2490

Remarks:

RESULTS AND DISCUSSIONS

This particular sample of effluent from Harris Corporation, Semiconductor Division's Outfall # 001 was not toxic to either Daphnia pulex or to Simocephalus serrulatus. These bioassays are the third successive tests that have shown the nontoxic characteristics of Harris Corporation, Semiconductor Division's effluent (FDER 1980).

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