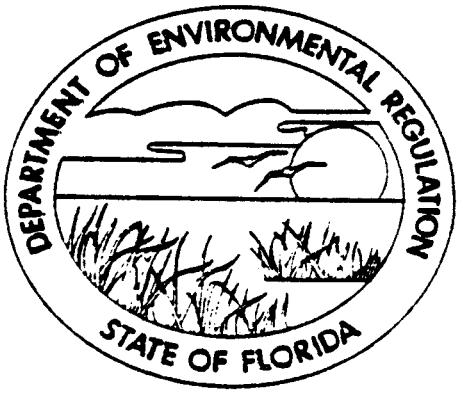

BIOASSAY OF TECO-GANNON POWER PLANT

SLAG POND DISCHARGE

HILLSBOROUGH COUNTY, FLORIDA

NPDES #FL0000809

SAMPLED 5/29/84

Biology Section
Bureau of Water Analysis
July 30, 1984

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Biology Section
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July 30, 1984

EXECUTIVE SUMMARY

TECO-Gannon's Slag Pond Discharge on 30 May to 1 June 1984.

The sample of slag pond supernatant (Outfall 004) from the TECO-Gannon Power Plant was not toxic to Mysidopsis bahia during a 48 hour static acute bioassay. Since the sample was not acutely toxic, chemical analyses were not performed.

INTRODUCTION

The TECO-Gannon Power Plant is located on Port Sutton Road near Black Point on Hillsborough Bay, Tampa, Hillsborough County, Florida (Figures 1 and 2). The plant utilizes 6 boilers, 2 of which are coal-burning, to produce 1200 megawatts of electricity daily. The remaining 4 boilers now use oil for fuel but will soon be converted to coal-burning units (H. Sahebzamani, Fla. Dept. Env. Reg., personal communication).

Coal combustion produces considerable quantities of ash and slag as by-products. Cooling water is used to transport the slag away from the boilers to slag tanks and dewatering bins (Fig. 3).

There, the slag settles and the supernatant is then discharged through Outfall 004 to Hillsborough Bay. This effluent is suspected of containing elevated concentrations of heavy metals.

To evaluate the effects of this discharge to the biota of the receiving waters, DER's Southwest District Office requested that an acute toxicity bioassay be performed. One 48 hour static acute toxicity bioassay was conducted from 30 May to 1 June, 1984. The results of this test are presented in this report. Those involved in performing the test and in preparation of this report were: P. D. Brooks, C. W. Dye, R. B. Frydenborg, and M. L. Roll.

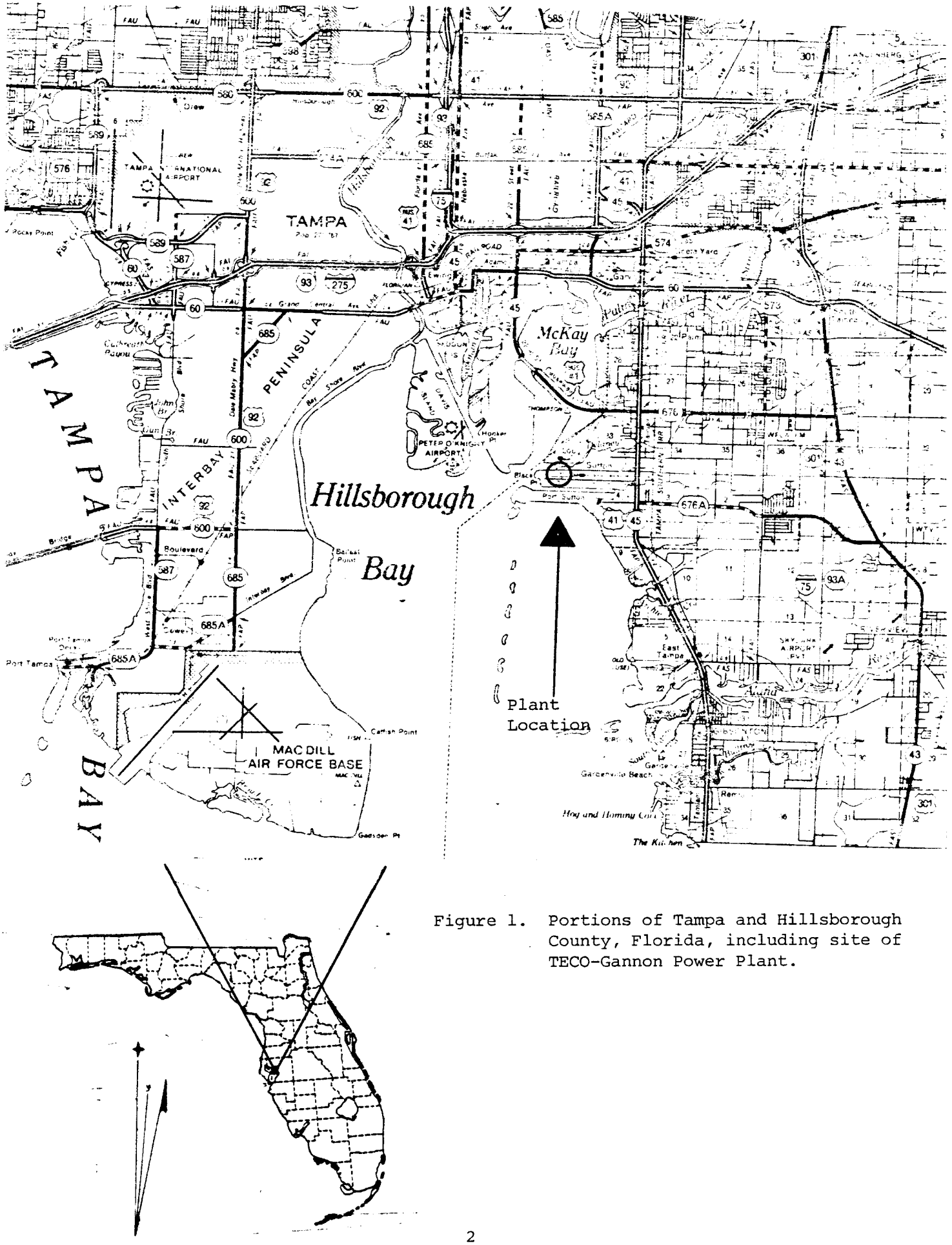

Figure 1. Portions of Tampa and Hillsborough County, Florida, including site of TECO-Gannon Power Plant.

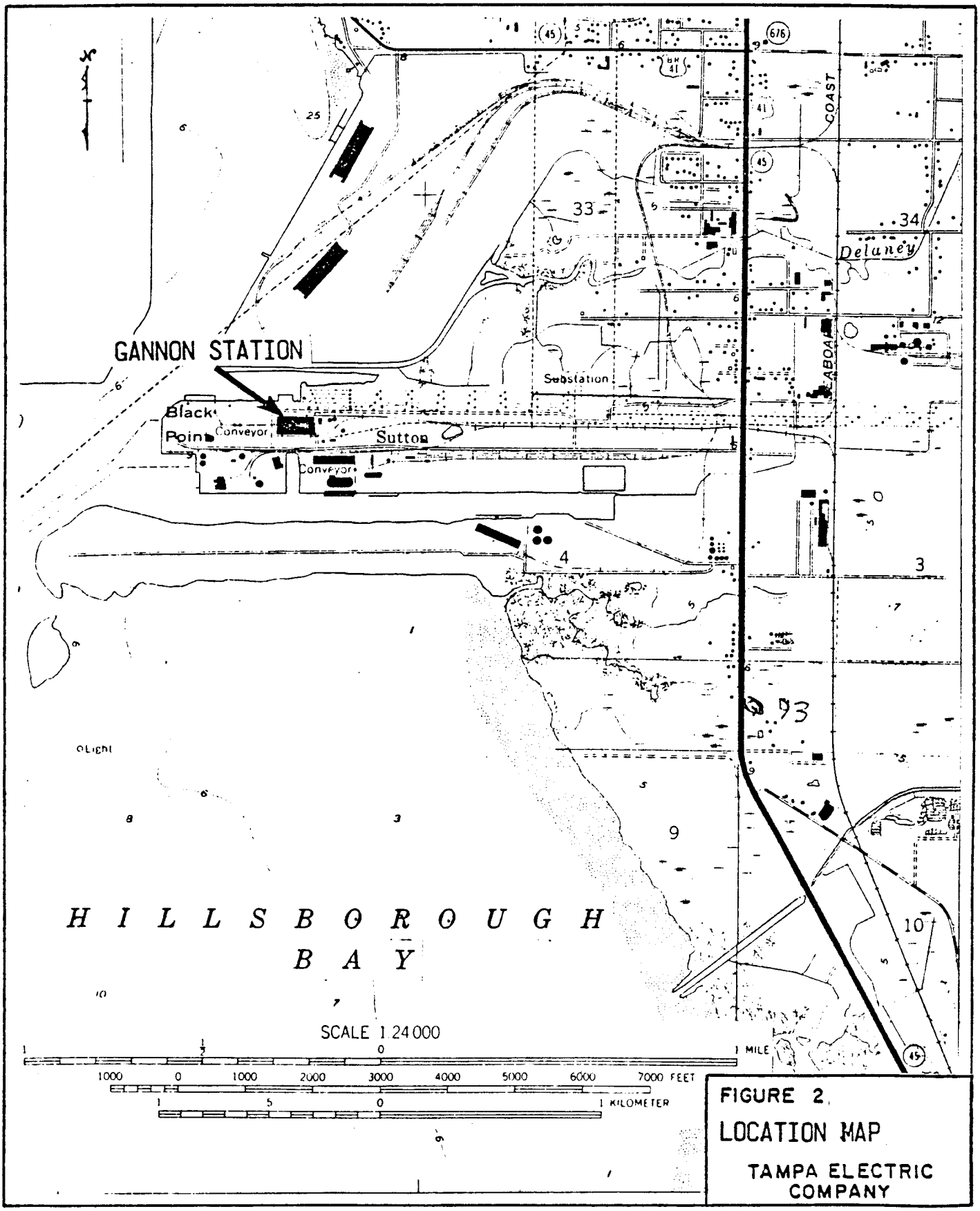

FIGURE 2.
LOCATION MAP
TAMPA ELECTRIC COMPANY

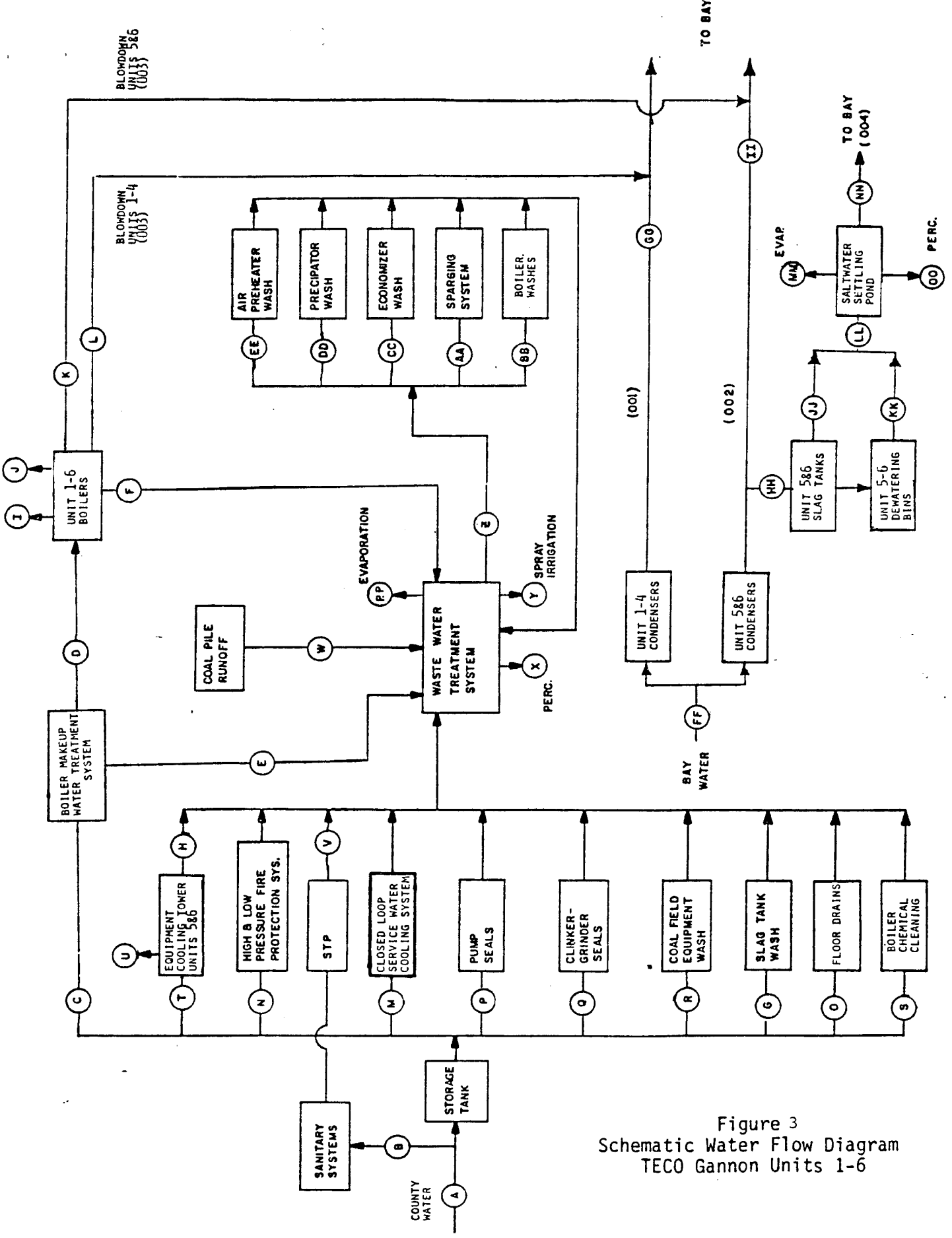

Figure 3
Schematic Water Flow Diagram
TECO Gannon Units 1-6

METHODS AND MATERIALS

Test methods used to conduct this static bioassay are extensively described by Peltier (1978) and the FDER Biology Section (1983). The organism selected for this study is among those recommended by Peltier (1978), the U.S. EPA (1978), and the FDER Biology Section (1983). The life history and maintenance procedures used to culture the organism are detailed below.

History and Maintenance of Bioassay Organisms

Mysidopsis bahia (mysid shrimp) - In September, 1978, approximately 300 adult mysid shrimp were obtained from the EPA laboratory in Gulf Breeze, Florida. The mysids are cultured under a 16:8 hour light-dark cycle in 10 and 15 gallon all-glass aquaria equipped with undergravel filtration and aeration. The mysid shrimp are cultured over a wide range of salinities (10-30 ppt) to minimize acclimation periods to low or high salinity effluents. Seawater is obtained from the FSU Marine Laboratory located at Turkey Point, Florida (salinity range 17-31 ppt) and partial water changes are performed weekly. Freshwater, for dilution of the seawater as necessary, is obtained from a deep well near the DER laboratory. The mysids are fed twice daily and once daily on weekends with freshly hatched Artemia (brine shrimp) and are kept at a constant temperature of 23° plus or minus 3°C. Adult or large juvenile mysids were used in this 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

One 48 hour saltwater definitive bioassay was performed on a sample of TECO-Gannon's slag pond discharge collected at Outfall 004. The test was conducted from 0900 hours on 30 May to 0900 hours on 1 June, 1984. The sample was collected by Mr. Tim Neldner of DER's Southwest District at 1315 hours on 29 May, 1984, using standard wastewater sampling procedures. Separate samples were obtained for chemical and biological testing. Samples for metal analyses were preserved with HNO_3. The sample for the bioassay was unpreserved. The samples were iced and transported to the DER laboratory in Tallahassee for analyses within 24 hours of collection.

Saltwater for dilution of the effluent samples was obtained from the FSU Marine Laboratory at Turkey Point (salinity = 21 ppt). This saltwater diluent was then adjusted to a salinity similar to the receiving body of water, Hillsborough Bay (salinity = 9.5 ppt) by adding an appropriate amount of DER well water. For test concentrations of 56% and below, this adjusted diluent was mixed directly with the effluent (salinity 21.0), achieving a range of final salinities (11.2 ppt to 21 ppt). A control was then used to ensure that any mortality in the test organisms was not the result of toxic properties associated with the diluent or the salinity range.

The concentration series selected for this study (Table 1) is that recommended by APHA (1980). Two replicates of each test concentration and of the control were used to test with Mysidopsis bahia. Immediately prior to the bioassays, a suitable number of mysids were transferred by net from the 10 ppt, 15 ppt, and 24 ppt salinity aquaria to culture dishes for observation and selection of individuals for the tests. Individual mysid shrimp were siphoned using a glass tube, carefully examined for injury, and transferred to wide mouth quart jars, each containing 500 ml of the appropriate concentration. For each concentration, the mysid shrimp were pre-acclimated to within 4 ppt salinity. Five organisms were loaded per test chamber, giving ten per concentration. Based on the recommendations of EPA (1978), the mysids were fed brine shrimp (Artemia) nauplii at the rate of approximately 10 to 20 nauplii per mysid per day to minimize cannibalism.

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. The salinity (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 controls 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.

Table 1. Concentration Series and Volumes Used for This Static Bioassay

Mysidopsis bahia (mysid shrimp)

Concentration	Dilution Water	Effluent	Total Volume
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
100.0%	------	500 ml	500 ml

Table 2. Data recorded during 48 hour, Mysidopsis bahia, static acute toxicity bioassay of TECO-Gannon Slag Pond Discharge, Hillsborough County, Florida, on 30 May 1984 to 1 June 1984. NPDES #FL0000809, Outfall 004.

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Total Alakalinity (mg/l as $CaCO_3$)		Total Hardness (mg/l as $CaCO_3$)		Temperature (°c)			NH_3/N (mg/l)		Salinity (umhos)	
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0	48
Control	5	5	5	8.6	7.6	7.2	8.1	8.1	7.9					21.5	19.8	20.4	0	0.04		
Control	5	5	5	8.6	7.6	7.2	8.1	8.1	7.9										11.2	11.8
5.6%	5	5	5	8.5	7.6	7.2	8.2	8.1	7.9					20.7	19.7	20.3				
5.6%	5	5	5	8.5	7.6	7.2	8.2	8.1	7.9										11.1	11.8
10%	5	5	5	8.5	7.8	7.6	8.2	8.1	8.0					20.7	19.6	20.2				
10%	5	5	5	8.5	7.8	7.6	8.2	8.1	8.0										11.8	12.2
18%	5	5	5	8.3	7.8	7.1	8.2	8.1	8.0					21.0	19.5	20.2				
18%	5	5	4(5)[a]	8.3	7.3	7.0	8.2	8.1	8.0										13.0	13.8
32%	5	5	5	8.2	7.3	7.0	8.1	8.0	8.0					20.5	19.6	20.1				
32%	5	5	5	8.2	7.3	7.0	8.3	8.1	8.0										14.0	14.9
56%	5	4	4	7.9	7.3	6.8	8.0	8.0	8.0					20.4	19.6	20.1				
56%	5	5	5	7.9	7.3	7.0	8.0	8.0	8.0										16.8	17.8
100%	5	5	5	6.9	7.2	6.7	7.8	7.9	8.0					20.6	19.8	20.2	0	0		
100%	5	5	5	7.0	7.2	6.8	7.8	7.9	8.0										21.0	22.7

Remarks: [a] Number in parentheses used since one organism jumped to side of test chamber.

RESULTS

Results of the static acute bioassay of TECO-Gannon Power Plant's slag pond discharge indicated that this particular sample was not accutely toxic to Mysidopsis bahia. Only one mortality in the 56% test concentration was noted during the test. Since the sample was not acutely toxic, chemical analyses were not performed.

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