#235

An Assessment of

TECO-Big Bend Power Station

Hillsborough County

NPDES #FL0000817

Sampled November 1997

FILE COPY
DO NOT REMOVE

November 1998

Biology Section
Division of Administrative and Technical Services
Bureau of Laboratories

Comprehensive Quality Assurance Plan No. 870346G

Department of Environmental Protection

Results of Inspections

Discharger: TECO - Big Bend Power Station
County: Hillsborough
NPDES Number: FL0000817
State Permit Expiration Date: 8/25/2002

Toxics Sampling Inspection **(XSI)**	
Date Sampled:	3 November, 1997
Results:	Copper (1.0 µg/L) and iron (130 µg/L) were detected in the effluent at concentrations that were less than the minimum quantitation limit, but greater than or equal to the minimum detection limit.

Compliance Biomonitoring Inspection **(CBI)**	
Date Sampled:	3 November, 1997
Results:	The effluent sample was not acutely toxic to the fish, *Menidia beryllina,* or to the invertebrate, *Americamysis bahia,* during the 48-hour bioassay.

Impact Bioassessment Inspection **(IBI)**	
Date Sampled:	3 November, 1997
Results:	Benthic macroinvertebrates were not sampled for this study due to the extreme hardness of substrate. Phytoplankton communities were similar at all three study sites and were typical of marine systems. High levels of some nutrients at the control and test sites may have contributed to the high levels of chlorophyll *a* measured at the study sites. Chlorophyll *a* ranged from 26 µg/L at test site 2 to 28 µg/L at the control site.

Water Quality Inspection **(WQI)**	
Date Sampled:	3 November, 1997
Results:	Ortho-phosphate and total phosphorus levels at all three study sites were greater than 85-90% of other Florida estuaries and were approximately the same as those levels found in the discharge. All other nutrient levels were low or undetected. Algal growth potential values at all three sites were well below the 10.0 mg dry wt/L "problem threshold" (EPA 1974) for marine waters.

Introduction

The TECO - Big Bend Power Station, is located in Hillsborough County, Florida (see maps in Appendix). Wastewater from this facility is discharged to an unnamed ditch that flows into Tampa Bay. The wastewater consists of once-through cooling water and intake screen wash-water which undergo no treatment. All other waste streams go to a percolation/evaporation pond and then to spray irrigation. Mean flow during this survey was 1,307 MGD.

State Permit limits for the TECO Power Plant are listed in Table 1. A new combined NPDES permit issued on August 25, 1997, calls for planning to address potential manatee impacts, benthic sampling, evaluation of a thermal gradient between Apollo Bay and Hillsborough Bay, mapping of seagrasses, and a plankton survey. According to monthly operating reports, the plant has had several dissolved oxygen violations in 1996 and 1997 (see Facility Summary in Appendix).

Benthic macroinvertebrate communities were not sampled in this study due to extreme hardness of the substrate. Without this information, a complete Fifth Year Inspection of the facility's impact on the receiving waters could not be made.

Methods

The focus of this investigation was to determine the discharger's effects on the receiving waters. A comparison of algal community health was made between a control site (located in Tampa Bay north of the TECO outfall) and two test sites (bracketing the discharge). Phytoplankton were sampled at both control and test sites via subsurface grabs. Chlorophyll *a* was also determined for phytoplankton communities. *Selenastrum capricornutum* was used as the test organism for the algal growth potential tests.

Acute toxicity bioassays, using the invertebrates, *Ceriodaphnia dubia* and, the fish, *Cyprinella leedsi*, as test organisms, were performed on an effluent sample.

Sediment from control and test sites was analyzed for grain size and percent organic matter. All field and laboratory biological methods were carried out following Biology Section Standard Operating Procedures (SOP's). The latest version of the SOP's can be viewed on our web site at: 'www.dep.state.fl.us/labs/sops.htm'.

The effluent was analyzed for nutrients, metals, and for organic constituents (base neutral and acid extractables, and pesticide extractables). Methods used for all chemical analyses are on file at the DEP Central Chemistry Laboratory in Tallahassee.

Explanation of Measurements of Community Health

Several different measurements of algal community health have been employed to determine the effects of a discharge. These are briefly discussed here.

Taxa richness: Stress tends to reduce the number of different types of organisms present in a system, although moderate nutrient enrichment may sometimes be correlated with increased algal taxa richness.

Shannon-Weaver diversity: This index is specified in the Florida Administrative Code as a measure of biological integrity. Low diversity scores are undesirable. They represent conditions where only a few organisms are abundant, to the exclusion of other taxa.

Community structure: Substantial shifts in proportions of major groups of organisms, compared to control conditions, may indicate degradation.

Algal biomass: High algal biomass (algal density or chlorophyll *a*) implies nutrient stress. A decreased diatom to blue-green algae ratio (calculated by dividing the number of individuals in the Bacillariophyta by the number of individuals in the Bacillariophyta + Cyanophyta) is often indicative of nutrient enriched conditions in flowing streams.

For graphical purposes, the percent differences between the control and test sites involving the number of taxa and the diversity index are measured as the control site minus test site divided by the control site. The percent differences between sites involving algal density, chlorophyll *a*, and algal growth potential are measured as the test site minus control site divided by the control site.

The following personnel were involved in this investigation: Andrea Grainger (DEP Southwest District) and Ken Espy, Marshall Faircloth, Russel Frydenborg, Joy Jackson, Scott Lashbrook, Elizabeth Miller, Urania Quintana, Johnny Richardson, Lisa Tamburello, Steve Wolfe, David Whiting, and Vicki Whiting (DEP Central Biology Laboratory in Tallahassee). The report

was reviewed by the Point Source Studies Review Committee, consisting of Wayne Magley, Jan Mandrup-Poulsen, and Michael Tanski, as well as District representatives.

Results and Discussion

While the pH and salinity of all three sites were similar, dissolved oxygen and temperature were different at test site 1 from either of the two other sites. The lower dissolved oxygen (8.3 mg/L) and higher temperature (32.7 °C) at test site 1 corresponded to the measurements of the effluent. This site was located closest to the point of discharge. Dissolved oxygen at both the control site and test site 2 was 11.0 mg/L. Temperatures at these sites were cooler than at test site 1 (25.3 °C and 27.2 °C at control and test site 2, respectively). Dissolved oxygen, pH, and temperature of the discharge complied with permit limits.

Copper (1.0 µg/L) and iron (130 µg/L) were detected in the effluent at concentrations that were less than the minimum quantitation limit, but greater than or equal to the minimum detection limit. Both levels complied with Class III water quality standards for marine waters. Aluminum was estimated at 240 µg/L because the analytical precision was outside the control limits.

The effluent sample was not acutely toxic to the fish, *Menidia beryllina,* or to the invertebrate, *Americamysis bahia,* during the 48-hour bioassay (see Appendix).

Nutrient levels are shown in Table 1. Ortho-phosphate and total phosphorus levels at all three study sites were greater than 85-90% of other Florida estuaries and were approximately the same as those levels found in the discharge. All other nutrient levels were low or undetected. Algal growth potential values at all three sites were well below the 10.0 mg dry wt/L "problem threshold" (EPA 1974) for marine waters.

Phytoplankton communities were similar at all three study sites. Although taxa richness was slightly higher at the control site than at either test site, the entire study area was characterized by low taxa richness, low diversity, and high percent dominance of the diatom, *Skeletonema* sp. This community structure is typical for a marine system. The high numbers of *Skeletonema* sp. probably account for the high chlorophyll *a* values encountered throughout the system. Chlorophyll *a* ranged from 26 µg/L at test site 2 to 28 µg/L at the control site. These values are higher than 95% of other Florida estuaries.

Conclusions

Lower dissolved oxygen and higher temperature at test site 2 corresponded with measurements taken at the point of discharge. Test site 2 was located closest to the point of discharge.

Copper and iron were detected in the effluent at concentrations that were less than the minimum quantitation limit, but greater than or equal to the minimum detection limit. Both levels complied with Class III water quality standards for marine waters.

The effluent sample was not acutely toxic to the fish, *Menidia beryllina,* or to the invertebrate, *Americamysis bahia,* during the 48-hour bioassay (see Appendix).

Ortho-phosphate and total phosphorus levels at all three study sites were greater than 85-90% of other Florida estuaries and were approximately the same as those levels found in the discharge. All other nutrient levels were low or undetected. Algal growth potential values at all three sites were well below the 10.0 mg dry wt/L "problem threshold" for marine waters.

Phytoplankton communities were similar at all three study sites and were typical of marine systems. A high percent dominance of *Skeletonema* sp. at all three sites probably accounted for the high chlorophyll *a* values. Chlorophyll *a* ranged from 26 µg/L at test site 2 to 28 µg/L at the control site.

Literature Cited

Miller, W. E., T. E. Maloney, and J. C. Greene. 1978. The *Selenastrum capricornutum* Printz algal assay bottle test. U. S. Environ. Prot. Agency, EPA-600/9-78-018. 126 p.

Raschke, R. L. and D. A. Schultz. 1987. The use of the algal growth potential test for data assessment. J. Wat. Poll. Cont. Fed. 59(4): 222-227.

Ross, L. T. 1990. Methods for aquatic biology. Fla. Dept. Environ. Reg. Tech. Ser. 10(1): 1-47.

Weber, C. I. 1993. Methods for measuring the acute toxicity of effluents to freshwater and marine organisms. 4th edition. EPA/600/4-90/027. U. S. EPA, Cincinnati, Ohio. 216 pp.

Table 1. Effluent permit limits and summary of chemistry data.

TECO - Big Bend Power Station	Effluent Limits	Effluent Sample	Control Site	Test Site 1	Test Site 2
Organic Constituents (µg/L)					
Oil & Grease	-	5.0 K	-	-	-
Metals (µg/L)					
Aluminum	1500**	240 J	-	-	-
Arsenic	50**	30 U	-	-	-
Cadium	9.3**	0.2 U	-	-	-
Chromium	50**	10 U	-	-	-
Copper	2.9**	1.0 I	-	-	-
Iron	300**	130 I	-	-	-
Lead	5.6**	1 U	-	-	-
Mercury	0.025**	0.10 U	-	-	-
Nickel	8.3**	40 U	-	-	-
Selenium	71**	40 U	-	-	-
Silver	0.05**	0.5 U	-	-	-
Zinc	86**	100 U	-	-	-
Nutrients (mg/L)					
Ortho-phosphate	-	0.24	0.22	0.23 A	0.21
Total phosphorus	-	0.3	0.33	0.3	0.33
Ammonia	-	0.23	0.01 U	0.021 A	0.01 U
Nitrate+Nitrite	-	0.026 I	0.021 I	0.02 U	0.02 U
TKN	-	0.57	0.58	0.62	0.71
General Phys-Chem Parameters					
Habitat Assessment	-	-	-	-	-
D.O. (mg/L)	5.0 daily avg*	7.0	11.0	8.3	11.1
pH (SU)	6.5-8.5*	7.9	8.2	7.9	8.2
Salinity (ppt)	-	-	21	20	21
Temperature (°C)	109°F daily max*	34.2	25.3	32.7	27.2
Flow (MGD)	Report*	-	-	-	-
AGP (mg dry wt/L)	-	5.9	3.4	4.6	2.3
Toxicity					
Bioassay Fish	-	No mortality	-	-	-
Bioassay Invertebrate	-	No mortality	-	-	-

* Permit limit

** Class III Water Quality Standards

A - Value reported is the mean of two or more determinations

I - Value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit

J - Estimated value

K - Actual value is known to be less than value given

U - Material analyzed for but not detected; value reported is the minimum detection limit

Table 2. Major characteristics of algae community structure of control and test sites.

TECO - Big Bend Power Station	Control Site	Test Site 1	Test Site 2
Phytoplankton Algae			
Number of Taxa	10	8	5
Shannon-Weaver Diversity	0.7	0.9	0.6
Chlorophyll a (µg/L)	28	27	26
Algal Density (#/mL)	12,228	8,044	11,806
% Blue-green	0.6	2.9	1.3
% Cryptophytes	0.6	0	0
% Diatoms	97	96	95
% Dinoflagellates	1.9	0	3.3
% Green	0	0.7	0
AGP (mg dry wt/L)	3.4	4.6	2.3

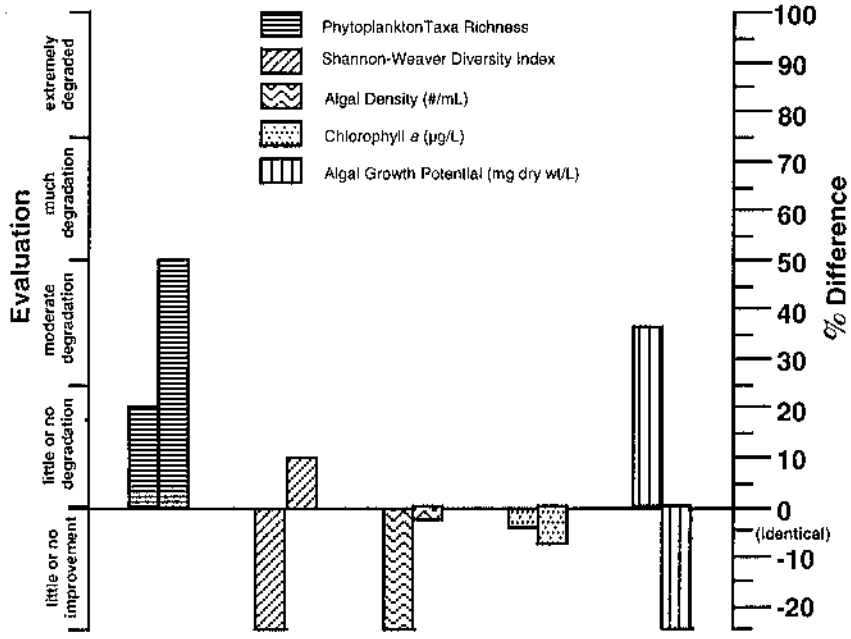


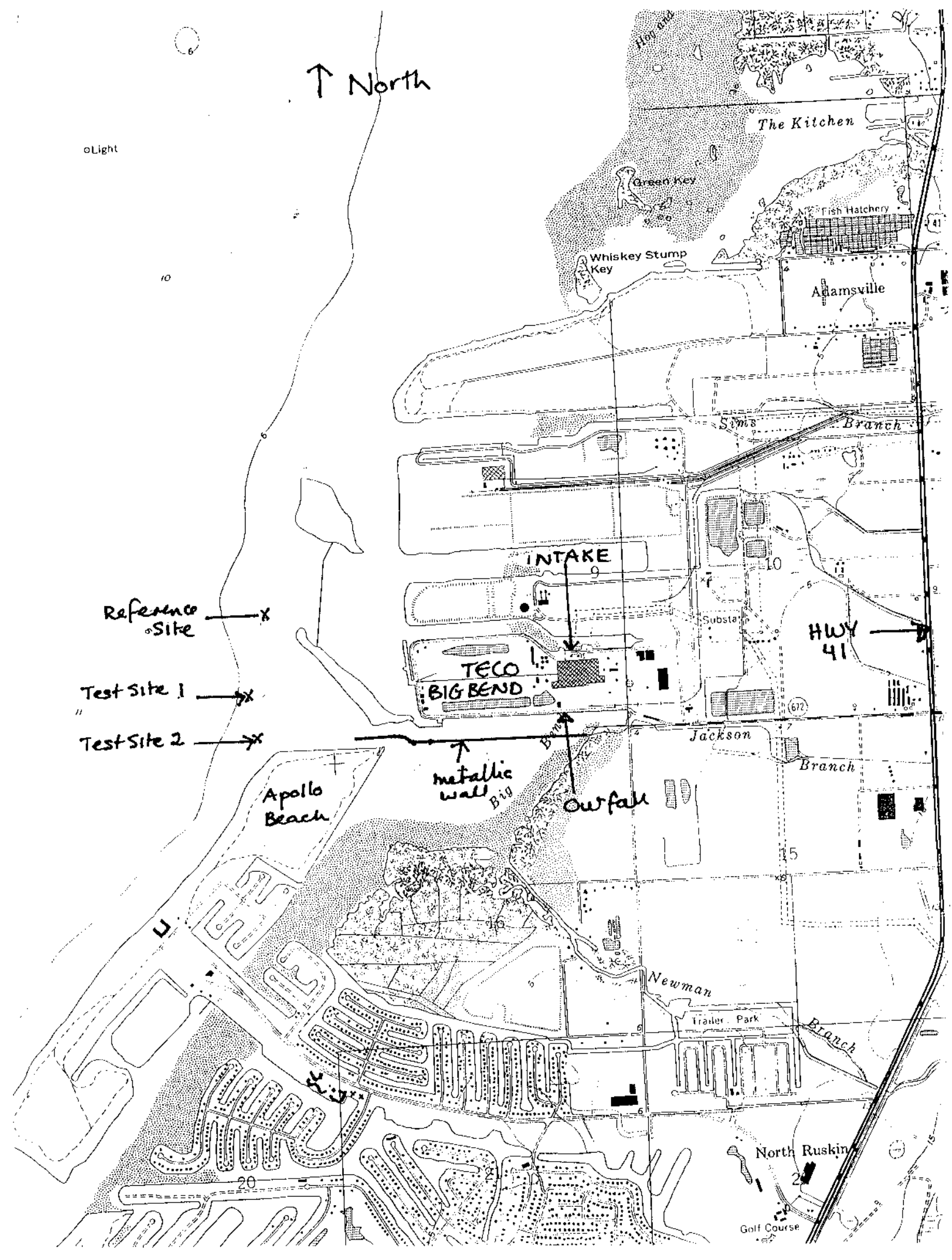
Figure 1. Effect of discharge on the phytoplankton community.

Typical Values for Selected Parameters in Florida Waters

Adapted from Joe Hand, FDER, personal communication, 1991
(data was collected between 1980 and 1989)

Parameter	Percentile Distribution										
	5 %	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%
STREAMS (1617 stations)											
Phytoplankton Chlorophyll *a*	0.22	0.52	0.94	1.60	3.02	4.63	6.72	9.87	14.68	27.35	48.70
Periphyton Chlorophyll *a*	0.31	0.43	0.77	1.04	2.16	2.94	6.45	10.51	17.00	39.51	60.85
H-D Diversity	0.84	2.12	2.48	2.74	2.88	3.09	3.25	3.40	3.52	3.76	3.90
Qualitative Taxa Richness	9.00	12.00	17.00	20.00	22.00	24.50	26.00	28.00	31.00	37.00	53.00
H-D Taxa Richness	6.00	6.50	9.00	11.50	13.00	15.00	17.00	21.50	26.00	29.00	32.00
TKN	0.30	0.39	0.56	0.73	0.87	1.00	1.11	1.26	1.49	1.93	2.80
Ammonia	0.02	0.02	0.04	0.05	0.06	0.08	0.11	0.14	0.20	0.34	0.60
NO2-NO3	0.01	0.01	0.03	0.05	0.07	0.10	0.14	0.20	0.32	0.64	1.05
Total Phosphorus	0.02	0.03	0.05	0.06	0.10	0.13	0.18	0.25	0.39	0.74	1.51
Ortho Phosphate	0.01	0.01	0.03	0.04	0.05	0.08	0.11	0.17	0.27	0.59	1.37
Turbidity	0.60	0.90	1.20	1.45	2.10	2.80	3.60	4.50	6.65	10.45	16.30
LAKES (477 stations)											
Phytoplankton Chlorophyll *a*	0.80	1.71	2.88	4.28	10.06	13.40	20.00	30.10	47.20	65.44	113.90
Dredge Diversity	0.71	0.97	1.43	1.74	1.98	2.12	2.21	2.59	2.85	3.15	3.17
Dredge Taxa Richness	3.00	5.00	6.50	7.00	9.00	10.00	11.00	13.00	15.00	17.00	21.00
TKN	0.36	0.49	0.67	0.83	1.08	1.26	1.40	1.51	1.68	2.11	3.46
NH3+NH4	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.12	0.15	0.21	0.28
NO2-NO3	0.00	0.00	0.01	0.01	0.01	0.02	0.04	0.05	0.10	0.14	0.23
Total Phosphorus	0.01	0.02	0.02	0.03	0.05	0.07	0.09	0.11	0.14	0.23	0.42
Ortho-Phosphate	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.21	0.32
Turbidity	1.00	1.25	1.55	2.05	2.75	4.50	6.45	9.60	14.10	26.00	40.00
ESTUARIES (690 stations)											
Phytoplankton Chlorophyll *a*	2.14	3.28	4.49	5.13	6.00	6.93	7.94	9.60	12.40	17.60	22.20
Dredge Diversity	1.34	1.53	1.91	2.28	2.56	2.90	3.15	3.59	4.01	4.53	4.98
Dredge Taxa Richness	4.00	6.00	9.00	11.00	15.00	18.50	25.00	35.00	41.00	62.00	90.00
TKN	0.26	0.34	0.42	0.50	0.59	0.69	0.76	0.82	0.95	1.30	1.49
NH3+NH4	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.13	0.22	0.28
NO2-NO3	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.08	0.17	0.23
Total Phosphorus	0.01	0.02	0.06	0.07	0.10	0.11	0.14	0.17	0.23	0.43	0.59
Ortho-Phosphate	0.01	0.02	0.03	0.04	0.04	0.05	0.07	0.09	0.12	0.21	0.44
Turbidity	3.50	4.00	4.50	5.05	5.40	5.60	6.30	6.80	8.00	11.40	11.75

Units:
Phytoplankton Chlorophyll *a* (ug/L), Periphyton Chlorophyll *a* (mg/m^2), Nutrients (mg/L), Turbidity (NTU), Taxa richness and diversity values are for macroinvertebrates


North
Light
The Kitchen
Green Key
Fish Hatchery
Whiskey Stump Key
Adamsville
Sims
Branch
INTAKE
Reference Site
Substa
HWY 41
TECO
BIG BEND
Test Site 1
Test Site 2
Jackson
Branch
metallic wall
Big
Outfall
Apollo Beach
Newman
Trailer Park
Branch
North Ruskin
Golf Course

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
FACILITY SUMMARY

Facility Name: TECO - Big Bend		Date Summary Prepared: 10/24/97
Location (attach detailed map): see attachment	County: Hillsborough	District: SW District
Federal Permit # and expiration date: FL0000817 8/25/2002	State GMS # and State expiration date: 4029/20085	Facility Type: (Industrial) Municipal Federal Agricultural Other (list):

Function of facility:
Power Plant

Description of treatment process:
Surface water — Discharge of once through cooling water and intake screen wash water. No treatment.
Ground water - All other wastestreams to a perc/evaporation pond, recycling system and to spray irrigation.

Receiving waters: Tampa Bay	Classification: I II (III)

Design Flow:	Mean Flow: 1,307 MGD	Flow during survey:

Discharge is: (Continuous) Intermittent Seasonal Rainfall dependent
Other (describe)

therefore, the best time to sample is:

If facility has a mixing zone, give details (size, parameters affected, etc.):
Yes - For temperature

List effluent limits (if necessary, attach relevant paperwork):

Parameter	Limit (units)
Flow	Report
Temp	Report Month AVG
	109°F Daily MAX
Temp. Rise	168°F Wkly. AVG
DO	5.0 mg/L Daily AVG.
ph	6.5-8.5 St. units

Describe special permit conditions and permit modifications:
This is the new combined NPDES Permit, issued on Aug. 25, 1997.
(S.C #14) - Plan & procedures for addressing potential MANATEE impacts.
(S.C #15) - ① Benthic Sampling ② evaluate thermal gradient between Apollo & Hillsborough BAY ③ MAP Seagrass ④ Plankton Survey

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
FACILITY SUMMARY

(Facility)

Description of permitted outfall(s): Discharges occur from each unit - D0011, D0012, D0013, and D0014 into an on-site canal. The end of the canal is outfall D001 (formerly 005), where all required NPDES sampling is performed. (TO Hillsborough BAY)

List permit violations (from MOR data or other source) and plant upsets that occurred within past year: PREVIOUS State permit MOR DATA indicates several Dissolved oxygen violations. DO shall not average less than 5.0 mg/L in a 24-hour period, and shall never be less than 4.0 mg/L.

4/96 - Daily Avg = 4.9
5/96 - Daily Avg = 3.9
Daily min = 3.1
6/96 - Daily Avg = 4.4
7/96 - Daily Avg = 3.5
Daily min = 3.0
8/96 - Daily Avg = 3.8
Daily min = 3.2
9/96 - Daily Avg = 3.9
Daily min = 3.5
10/96 - Daily Avg = 4.6
Daily min 3.8

* State MORs have only been received through 3/97. The old NPDES permit did not have DO. DMR from new permit has

Describe previous impact bioassessments, WQBEL's, and previous or current enforcement actions:
Daily Avg. DO of 3.0 for Aug 1997

Discuss comparability of MOR results to past DER results and whether there are trends (improving, declining) in the data set:

Additional information:

Staff contributing to this review (signature):
(Biologist)
Anna Luft (Inspector)
(Engineer)
( )
( )
( )

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		11/3/97	1540	Tampa Bay

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
location at TECO	Hills	TECO- Big Bend	Intake

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Land-Use in Watershed (specify relative percent in each category):

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)

Local Watershed Erosion (check box): None ☐ Slight ☐ Moderate ☐ Heavy ☐

Local Watershed NPS Pollution (check box): No evidence ☐ Slight ☐ Moderate potential ☐ Obvious sources ☐

Width of riparian vegetation (m) on least buffered side: *List & map dominant vegetation on back*

Artificially Channelized ☐ no ☐ recent, severe ☐ some recovery ☐ mostly recovered, more sinuous

Artificially Impounded ☐ yes

High Water Mark: ____ (m above present water level) + ____ (present depth in m) = ____ (m above bed)

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect

m wide → | m/s | m/s | m/s |

m deep | m deep | m deep

Canopy Cover % : Open : ☐ Lightly Shaded (11-45%): ☐ Moderately Shaded (46-80%): ☐ Heavily Shaded: ☐

SEDIMENT/SUBSTRATE

Sediment Odors: Normal: ☐ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☐ Other: ☐

Sediment Oils: Absent: ☐ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposition: Sludge: ☐ Sand smothering: none slight moderate severe Silt smothering: none slight moderate severe Other:

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Sand			
Leaf Packs or Mats				Mud/Muck/Silt			
Aquatic Vegetation				Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots				*Draw aerial view sketch of habitats found in 100 m section*			

WATER QUALITY	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	~~Cond. (µmho/cm)~~ or Salinity (ppt):			Secchi (m):
Top	0.2	24.78	8.13	9.40	21			
Mid-depth	1.5	24.31	8.0	8.34	21			
Bottom	3	24.31	8.9	7.52	21			

System Type : Stream: ☐ (1st - 2nd order, 3rd - 4th order, 5th - 6th order, 7th order or greater) Lake: ☐ Wetland: ☐ Estuary: ☐ Other: ☐

Water Odors (check box): Normal: ☐ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐

Water Surface Oils (check box): None: ☐ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity (check box): Clear: ☐ Slightly turbid: ☐ Turbid: ☐ Opaque: ☐

Color (check box): Tannic: ☐ Green (algae): ☐ Clear: ☐ Other: ☐

Weather Conditions/Notes:
At TECO- wq at intake
in-situ parameters only

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☐	☐
Fish	☐	☐	☐	☐
Aquatic Macrophytes	☐	☐	☐	☐
Iron/sulfur Bacteria	☐	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE:
Granger	Candrea Granger	11/3/97

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		11/3/97	1250	Tampa Bay

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
Waves very choppy	Hill	TECO- Big Bend	Test Site 1

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Land-Use in Watershed (specify relative percent in each category):

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
30				30	10	30	

Local Watershed Erosion (check box): None ☐ Slight ☒ Moderate ☐ Heavy ☐

Local Watershed NPS Pollution (check box): No evidence ☐ Slight ☐ Moderate potential ☒ Obvious sources ☐

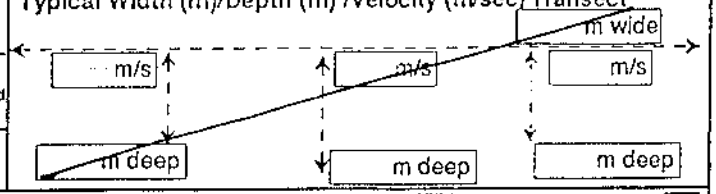
Width of riparian vegetation (m) on least buffered side: ~~(m)~~ — *List & map dominant vegetation on back*

Artificially Channelized ☐ no ☐ ☐ ☐ recent, severe ☐ some recovery ☐ mostly recovered, more sinuous

Artificially Impounded ☐ yes

High Water Mark: _____ (m above present water level) + _____ (present depth in m) = _____ (m above bed)

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect



Canopy Cover % : Open : ☒ Lightly Shaded (11-45%): ☐ Moderately Shaded (46-80%): ☐ Heavily Shaded: ☐

SEDIMENT/SUBSTRATE

-Sand was packed down hard - I could not collect grab samples

Sediment Odors: Normal: ☐ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☐ Other: ☐ _____

Sediment Oils: Absent: ☐ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposition: Sludge: ☐ Sand smothering: none ☐ slight ☐ moderate ☐ severe ☐ Silt smothering: none ☐ slight ☐ moderate ☐ severe ☐ Other:

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Sand			
Leaf Packs or Mats				Mud/Muck/Silt			
Aquatic Vegetation				Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots				*Draw aerial view sketch of habitats found in 100 m section*			

WATER QUALITY	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	~~Cond. (µmho/cm)~~ or Salinity (ppt):			Secchi (m):
Top	0.1	32.68	7.91	8.31	20.5			1 m
Mid-depth	1.0	31.63	8.13	10.89	20.5			
Bottom	2.0	24.93	8.22	12.00	20.5			

System Type : Stream: ☐ (1st - 2nd order ☐ 3rd - 4th order ☐ 5th - 6th order ☐ 7th order or greater ☐) Lake: ☐ Wetland: ☐ Estuary: ☒ Other: ☐ _____

Water Odors (check box): Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐ _____

Water Surface Oils (check box): None: ☒ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity (check box): Clear: ☐ Slightly turbid: ☐ Turbid: ☒ Opaque: ☐

Color (check box): Tannic: ☐ Green (algae): ☒ Clear: ☐ Other: ☐ _____

Weather Conditions/Notes:
Very choppy waves, 2 to 3 ft high. Wind from west at 4 to 6 knots. Low tide.

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☐	☐
Fish	☐	☐	☐	☐
Aquatic Macrophytes	☐	☐	☐	☐
Iron/sulfur Bacteria	☐	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE:
Granger / Kovach	Andrea Granger	11/3/97

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		11/3/97	1320	Tampa Bay

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
waves very choppy	Hills	TECO - Big Bend	Test Site 2

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Land-Use in Watershed (specify relative percent in each category):

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
30				30	10	30	

Local Watershed Erosion (check box): None ☐ Slight ☑ Moderate ☐ Heavy ☐

Local Watershed NPS Pollution (check box): No evidence ☐ Slight ☐ Moderate potential ☑ Obvious sources ☐

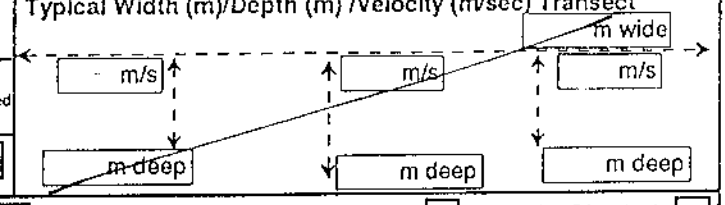
Width of riparian vegetation (m) on least buffered side: *List & map dominant vegetation on back*

Artificially Channelized ☐ no ☐ recent, severe ☐ some recovery ☐ mostly recovered, more sinuous

Artificially Impounded ☐ yes

High Water Mark: _____ (m above present water level) + _____ (present depth in m) = _____ (m above bed)

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect



Canopy Cover % : Open : ☒ Lightly Shaded (11-45%): ☐ Moderately Shaded (46-80%): ☐ Heavily Shaded: ☐

SEDIMENT/SUBSTRATE

sand was packed down hard - could not get grab sample with panel sampler

Sediment Odors: Normal: ☐ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☐ Other: ☐

Sediment Oils: Absent: ☐ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposition: Sludge: ☐ Sand smothering: none ☐ slight ☐ moderate ☐ severe ☐ Silt smothering: none ☐ slight ☐ moderate ☐ severe ☐ Other:

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Sand			
Leaf Packs or Mats				Mud/Muck/Silt			
Aquatic Vegetation				Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots				*Draw aerial view sketch of habitats found in 100 m section*			

WATER QUALITY	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	~~Cond. (µmho/cm)~~ or Salinity (ppt):			Secchi (m):
Top	0.1	27.20	8.19	11.06	21			1m
Mid-depth	1.0	26.98	8.21	11.06	21			
Bottom	2.0	26.25	8.22	11.49	21			

System Type : Stream: ☐ (1st - 2nd order ☐ 3rd - 4th order ☐ 5th - 6th order ☐ 7th order or greater ☐) Lake: ☐ Wetland: ☐ Estuary: ☑ Other: ☐ _____

Water Odors (check box): Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐ _____

Water Surface Oils (check box): None: ☒ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity (check box): Clear: ☐ Slightly turbid: ☐ Turbid: ☒ Opaque: ☐

Color (check box): Tannic: ☐ Green (algae): ☒ Clear: ☐ Other: ☐ _____

Weather Conditions/Notes:
Very choppy waves 2 to 3 feet high. Winds from west 4 to 6 knots. low tide

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☐	☐
Fish	☐	☐	☐	☐
Aquatic Macrophytes	☐	☐	☐	☐
Iron/sulfur Bacteria	☐	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE:
Granger / Kovach		11/3/97

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		11/3/97	1340	Tampa Bay

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
waves less choppy	Hills	TECO - Big Bend	Reference Site

RIPARIAN ZONE/STREAM FEATURES

Predominant Land-Use in Watershed (specify relative percent in each category):

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
30				30	10	30	

Local Watershed Erosion (check box): None ☐ Slight ☑ Moderate ☐ Heavy ☐

Local Watershed NPS Pollution (check box): No evidence ☐ Slight ☐ Moderate potential ☑ Obvious sources ☐

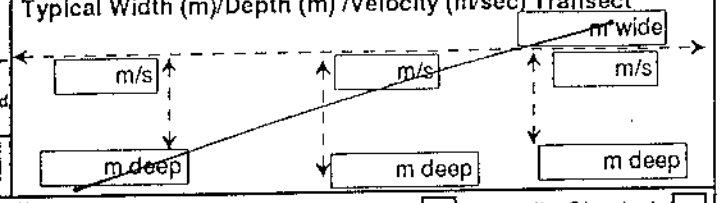
Width of riparian vegetation (m) on least buffered side: *List & map dominant vegetation on back*

Artificially Channelized ☐ no ☐ recent, severe ☐ some recovery ☐ mostly recovered, more sinuous

Artificially Impounded ☐ yes

High Water Mark: _____ (m above present water level) + _____ (present depth in m) = _____ (m above bed)

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect



Canopy Cover % : Open : ☒ Lightly Shaded (11-45%): ☐ Moderately Shaded (46-80%): ☐ Heavily Shaded: ☐

SEDIMENT/SUBSTRATE

Sediment Odors: Normal: ☐ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☐ Other: ☐ _____

Sediment Oils: Absent: ☐ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposition: Sludge: ☐ Sand smothering: none ☐ slight ☐ moderate ☐ severe ☐ Silt smothering: none ☐ slight ☐ moderate ☐ severe ☐ Other:

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Sand			
Leaf Packs or Mats				Mud/Muck/Silt			
Aquatic Vegetation				Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots							

Draw aerial view sketch of habitats found in 100 m section

WATER QUALITY	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	~~Cond. (µmho/cm)~~ or Salinity (ppt):			Secchi (m):
Top	0.1	25.26	8.17	11.04	21			1 m
Mid-depth	1.0	25.26	8.19	11.06	21			
Bottom	2.0	25.13	8.15	10.72	21			

System Type : Stream: ☐ (1st - 2nd order, 3rd - 4th order, 5th - 6th order, 7th order or greater) Lake: ☐ Wetland: ☐ Estuary: ☒ Other: ☐ _____

Water Odors (check box): Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐ _____

Water Surface Oils (check box): None: ☒ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity (check box): Clear: ☐ Slightly turbid: ☐ Turbid: ☒ Opaque: ☐

Color (check box): Tannic: ☐ Green (algae): ☑ Clear: ☐ Other: ☐ _____

Weather Conditions/Notes:
Choppy, waves 1 ft, slight wind from west. Slack tide

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☐	☐
Fish	☐	☐	☐	☐
Aquatic Macrophytes	☐	☐	☐	☐
Iron/sulfur Bacteria	☐	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE:
Granger / Kovach	Candace Granger	11/3/97

Phytoplankton taxa list and densities (#/mL) for Tampa Electric Big Bend Power Station, collected via subsurface grabs in Tampa Bay, on 3 November, 1997.

	Control Site	Test Site 1	Test Site 2
Bacillariophyceae			
Skeletonema sp.	11172	7002	10725
Cyclotella sp.	75	116	–
Chaetoceros sp.	75	289	386
Rhizosolenia sp.	75	58	154
Thalassiothrix sp.	151	–	–
Nitzschia sp.	75	174	–
Cylindrotheca sp.	226	116	–
Chlorophyceae			
Undetermined chlorophyceae	–	58	–
Cryptophyceae			
Chroomonas sp.	75	–	–
Cyanophyceae			
Oscillatoria sp.	75	231	154
Dinophyceae			
Peridinium sp.	226	–	386

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Tampa Elec. Co Big Bend
County: Hillsborough
Contact / District: Andrea Grainger / Southwest
NPDES Permit #: FL0043371
LIMS Sample #: 199079 LIMS Job #: 97-NOV-04-15
sample log: 11/24/97 DW

Sample Collection: Date 11/3/97 Time 1620
Test Beginning: Date 11/4/97 Time 1420
Test Ending: Date 11/8/97 Time 1400
Organism Batch #: 305 Diluent Batch #: 28
Organism Age: 3 days
Test Organism: American mysid Acute

Test Type: (Screening) | Definitive
(Static) | Static Renewal | Flow-through
Temperature range: room 23.5-24.5°C
incubator 24.0-25.0°C
Test Number: 1 of 2
Remarks: D = dead, M = missing

Instrument Calibrations:	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	23.5 @ 23.6	8.3 @ 25.0 °C	990 @ 1005 9960 @ 10096 @ 24.8 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.5 @ 23.5	8.6 @ 23.1 °C	993 @ 1005 10030 @ 10096 @ 24.8 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	23.1 @ 23.1	8.2 @ 25.2 °C	985 @ 1005 10050 @ 10096 @ 24.7 °C

Conc.	Chamber #	Number Live 0 hr	Number Live 24 h	Number Live 48 h	pH 0 hr	pH 24 h	pH 48 h	Temperature (°C) 0 hr	Temperature (°C) 24 h	Temperature (°C) 48 h	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 h	D.O. (mg/L) 48 h	UNCORRECTED Cond. (mmhos/cm) / Cond. (µmhos/cm) 0 hr	24 h	48 h
Ctl A	B1	5	5	5	8.4	8.3	8.2	24.3	24.6	24.8	6.8	5.9	5.7	35.2	35.7	36.2
Ctl B	B2	5	5	5	8.4	8.3	8.2	24.2	24.5	24.4	6.5	5.9	5.7	35.3	35.9	37.4
Ctl C	B3	5	5	5	8.4	8.3	8.2	24.2	24.3	24.7	6.8	6.0	5.5	35.3	35.8	36.5
Ctl D	B4	5	5	5	8.4	8.3	8.2	24.2	24.2	24.9	6.8	6.0	5.6	35.3	35.9	37.2
100% A	B5	5	5	5	8.1	8.0	8.0	25.3	24.4	24.5	6.3	6.4	5.7	37.1	37.1	37.7
100% B	B6	5	5	5	8.1	8.0	8.0	25.3	24.4	24.4	6.2	6.4	5.7	37.1	36.9	37.5
100% C	B7	5	5	5	8.1	8.0	8.0	25.2	24.4	24.8	6.2	6.3	5.6	37.1	37.3	39.0
100% D	B8	5	5	5	8.1	8.0	8.0	25.2	24.2	24.8	6.1	6.2	5.6	37.1	36.8	37.7
Measured/Loaded by:		MF	MF	DW	MF	MF	DW	MF	MF	DW	MF	MF	DW	MF	MF	DW
Recorded by:		DW	MF	DW	DW	KS	MF	DW	KS	MF	DW	KS	MF	DW	KS	MF

Investigators' Signatures

Marshall Faircloth

Keri Johnson

reviewer

form updated 4/01/96

Water Quality Parameters verified by MF

	Salt Water / Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			Not measured		
Lab Total Residual Cl2 (mg/L):	<0.03		<0.03	DR-100	MF/KJ
Alkalinity (mg/L as $CaCO_3$):	165		90	Hach	MF
Hardness (mg/L as $CaCO_3$):	—		—		
Total ammonia (mg/L as N):	<0.017		<0.017	Orion	ND

Ammonia Meter #98136 Ammonia Meter Slope: -59.9 Ammonia Blank: <0.017 Control Salinity: 23 ppt Sample Salinity: 23 ppt

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Tampa Elec. Co. Big Bend
County: Hillsborough
Contact / District: Andrea Grainger / Southwest
NPDES Permit #: FL00 43371
LIMS Sample #: 199079 LIMS Job #: 97-NOV-04-15
sample log: 11/24/97 DW

Sample Collection: Date 11/3/97 Time 1620
Test Beginning: Date 11/4/97 Time 1400
Test Ending: Date 11/6/97 Time 1400
Organism Batch #: 43 Diluent Batch #: 20
Organism Age: 13 days
Test Organism: Mysidopsis bahia

Test Type: (Screening) | Definitive
(Static) | Static Renewal | Flow-through
Temperature range: room 23.5-24.5°C
incubator 24.0-25.0°C
Test Number: 2 of 2
Remarks: D = dead, M = missing

Instrument Calibrations:	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	23.5 @ 23.6	8.3 @ 25.0 °C	990 @ 1005 9960 @ 10096 @ 24.8 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.5 @ 23.5	8.6 @ 23.1 °C	993 @ 1005 10030 @ 10096 @ 24.8 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	23.1 @ 23.1	8.2 @ 25.2 °C	985 @ 1005 10030 @ 10096 @ 24.7 °C

Conc.	Chamber #	Number Live			pH			Temperature (°C)			D.O. (mg/L)			UNCORRECTED Cond. (mmhos/cm) Cond. (µmhos/cm)		
		0 hr	24 h	48 h	0 hr	24 h	48 h	0 hr	24 h	48 h	0 hr	24 h	48 h	0 hr	24 h	48 h
Ctl A	A9	5	5	5	8.4	8.3	8.3	24.2	24.5	24.7	6.8	6.0	5.8	35.1	35.9	36.5
Ctl B	A10	5	5	5	8.4	8.3	8.3	24.2	24.3	24.6	6.8	6.0	5.8	35.2	35.9	36.6
Ctl C	A11	5	5	5	8.4	8.3	8.3	24.2	24.3	24.6	6.8	6.1	5.8	35.2	35.9	36.6
Ctl D	A12	5	5	5	8.4	8.3	8.3	24.2	24.2	24.8	6.8	6.3	5.9	35.3	35.8	36.9
100% A	B13	5	5	5	8.1	8.1	8.1	25.3	24.7	24.4	6.1	6.0	6.2	37.1	37.1	37.6
100% B	B14	5	5	5	8.1	8.0	8.1	25.3	24.3	24.6	6.0	6.0	6.3	37.1	36.8	37.7
100% C	B15	5	5	5	8.1	8.0	8.1	25.3	24.4	25.6	5.9	6.1	6.1	37.1	37.2	40.2
100% D	B16	5	5	5	8.1	8.0	8.1	25.2	24.3	24.8	5.9	6.1	6.0	37.1	36.9	37.9
Measured/Loaded by:		DW	MF	DW	MF	MF	DW	MF	MF	DW	MF	MF	DW	MF	MF	DW
Recorded by:		MF	MF	DW	DW	KS	MF	DW	KS	MF	DW	KS	MF	DW	KS	MF

Investigators' Signatures

Marshall Faircloth

Ken Johnson

(Salt Water) Well Water | 20% Min Water

Water Quality Parameters verified by MF

			Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			not measured		
Lab Total Residual Cl2 (mg/L):	<0.03		<0.03	DR-100	MF/KJ
Alkalinity (mg/L as $CaCO_3$):	165		90	Hach	MF
Hardness (mg/L as $CaCO_3$):	—		—		
Total ammonia (mg/L as N):	<0.017		<0.017	Orion	ND

Ammonia Meter #: 594 Ammonia Blank: <0.017 Control Salinity: 27 ppt Sample Salinity: 27 ppt

Phytoplankton taxa list and densities (#/mL) for Tampa Electric Big Bend Power Station, collected via subsurface grabs in Tampa Bay, on 3 November, 1997.

	Control Site	Test Site 1	Test Site 2
Bacillariophyceae			
Skeletonema sp.	11172	7002	10725
Cyclotella sp.	75	116	–
Chaetoceros sp.	75	289	386
Rhizosolenia sp.	75	58	154
Thalassiothrix sp.	151	–	–
Nitzschia sp.	75	174	–
Cylindrotheca sp.	226	116	–
Chlorophyceae			
Undetermined chlorophyceae	–	58	–
Cryptophyceae			
Chroomonas sp.	75	–	–
Cyanophyceae			
Oscillatoria sp.	75	231	154
Dinophyceae			
Peridinium sp.	226	–	386

Fill Out This Section For All Surface Water Discharger Inspections (CEI, CSI, CBI, PAI, XSI - RI Optional)

Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
1 N	2 5	3 F L C 0 0 0 8 1 7	11 12	9 7 1 1 0 3	17	18 X	19 S	20 2

Remarks

21 66

Fill Out This Section For All Surface Water Discharger Inspections (CEI, CSI, CBI, PAI, XSI - RI Optional)

Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
1 N	2 5	3 F L 0 0 0 0 8 1 7	11 12	9 7 1 1 0 3	17	18 B	19 S	20 2

Remarks

21 66