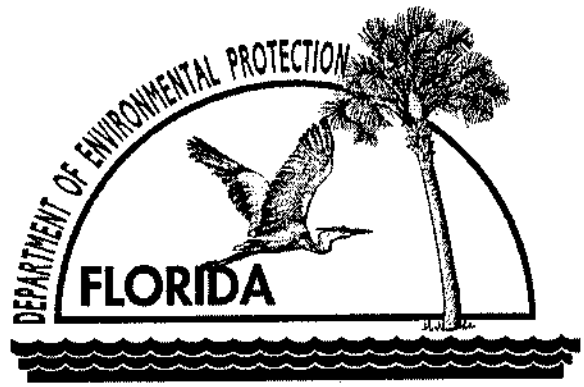


Biological Assessment of

CF Industries – Hardee Complex I

Hardee County

NPDES #FL0040177

Sampled November 1993

June 1994

Biology Section
Division of Technical Services

Department of Environmental Protection
Results of Fifth Year Inspections

Discharger: CF Industries - Hardee Phosphate Complex I
County: Hardee
NPDES Number: FL0040177
State Permit Expiration Date: 31 January 1995

Toxics Sampling Inspection (XSI)

Date Sampled: 1 November 1993

Results: No metals were detected at levels which exceeded Class III standards. No organic priority pollutants, VOC's, or pesticides were found.

Compliance Biomonitoring Inspection (CBI)

Date Sampled: 1 November 1993

Results: The sample of effluent was not acutely toxic to the bannerfin shiner, *Cyprinella leedsi*, or to the invertebrate, *Ceriodaphnia dubia*.

Impact Bioassessment Inspection (IBI)

Date Sampled: 22 November 1993

Results: Measures of benthic macroinvertebrate community health indicated no degradation resulting from the CF Industries – Hardee Complex I discharge. In fact, the majority of the metrics, such as taxa richness, diversity, EPT index, and the SIIF, were better at the test site than at the reference site, probably due to the increased flow and recruitment potential provided by the discharge. Periphyton communities at both sites were dominated by the diatom *Cocconeis placentula,* which is typically found in eutrophic conditions. With the exception of periphyton chlorophyll *a,* which was 464% more at the test site, other algal measures indicated great similarity between the two sites.

Water Quality Inspection (WQI)

Date Sampled: 1 November 1993

Results: While elevated phosphorus was associated with this discharge (1.6 mg/L in the effluent), the test site concentration of phosphorus (0.75 mg/L) was only slightly elevated from that of the reference site (0.62 mg/L). Total phosphorus at both sites was higher than those concentrations found in approximately 85% of all other Florida streams. The concentrations of nitrogenous nutrients at both stations were average to below average, when compared with other Florida streams. Algal growth potential (AGP) decreased from 3.7 mg dry wt/L at the reference site to 0.9 mg dry wt/L at the test site. Both results were less than the 5 mg dry wt/L "problem threshold".

These fifth year inspections provide the necessary information to evaluate the facility's impact on its receiving waters and to provide the basis for specific condition recommendations for permit renewal.

Introduction

The CF Industries - Hardee Phosphate Complex I Mine is located in Hardee County, Florida (see map in Appendix). This facility functions as a phosphate mine and beneficiation plant. However, no mining activities were taking place at the time of sampling. This facility has four permitted outfalls. Outfalls 1 and 2 release clear mine recirculation water into Hickey Branch. Outfalls 3 and 3A are located at the end of the facility's recirculation ditch. The wastewater from these discharge points sheet flows from a flow control pond, through a flood plain wetland to Payne Creek, and ultimately to the Peace River. During this survey, only outfall 003 was discharging.

State permit limits for the 003 effluent are as follows: TSS (60 mg/L daily maximum, 30 mg/L average), total phosphorous (5 mg/L daily maximum, 3 mg/L average), and pH (6.0 to 9.0 SU's). Additionally, specific conductance shall not be increased by more than 50% above background levels or to a maximum level of 1275 µmhos/cm (whichever is greater), and unionized ammonia shall not exceed the values (dependent upon pH and temperature) shown in Table 2 (Appendix).

This facility has a mixing zone for unionized ammonia, which extends 385 meters downstream from outfall 003 into Payne Creek. A release of process wastewater from a recharge ditch system at this facility resulted in an enforcement action by DEP.

Major characteristics of community structure of control and test sites.

	Reference Site	Test Site
Macroinvertebrate Qualitative		
Number of Taxa	36	45
Florida Index	14	18
% Contribution of Dominant Taxon	31.8	22.8
EPT Index	8	5
SIIF	27	29
# Crustaceans/Mollusks	3	10
% Crustaceans/Mollusks	8.4	17.2
% Oligochaeta	1.2	4.8
% Diptera	46.4	35.9
% Ephemeroptera	6.1	3.5
% Trichoptera	13.0	3.5
% Odonata	1.2	3.5
% Coleoptera	21.5	26.9
% Other	2.4	5
% Predators/ Carnivores	18.0	15.4
% Deposit feeders (above surface)/ Collector-Gatherers	30.9	30.3
% Deposit feeders (below surface)	1.2	4.9
% Suspension feeders/ Collector-Filterers	13.6	19.4
% Scavengers	0.4	2.6
% Scrapers	22.6	18.7
% Shredders	12.6	8.6
% Parasites	0.4	0.2
Macroinvertebrate Hester-Dendy		
Number of Taxa	42	60
Florida Index	17	27
Shannon-Weaver Diversity	3.2	3.5
EPT Index	10	12
% Diptera	76.8	66.2
% Ephemeroptera	6.9	5.1
% Trichoptera	11.9	22.2
% Coleoptera	2.8	3.0
% Odonata	0.2	0.6
% Other	1.4	3.0
% Predators/ Carnivores	22.0	20.3
% Deposit feeders (above surface)/ Collector-Gatherers	26.7	23.8
% Deposit feeders (below surface)	0	0.1
% Suspension feeders/ Collector-Filterers	26.4	31.5
% Scavengers	0.1	0.2
% Plant piercers	0.4	0
% Scrapers	7.9	8.7
% Shredders	16.4	15.3

Major characteristics of community structure of control and test sites (continued).

Periphyton Algae		
Number of Taxa	11	14
% Contribution of Dominant Taxon	88.8	44.0
Chlorophyll a (mg/sq. m)	4.9	27.8
Diatom/Diatom + B-G Abundance Ratio	0.99	0.97
% Blue-green	1.3	2.7
% Green	0.4	0.9
% Diatoms	98.3	96.4
Algal Growth Potential (mg dry wt/L)	3.7.	0.9

Methods

The focus of this investigation was to determine the discharger's effects on the receiving waters. A comparison of biological community health was made between a reference site (located in Payne Creek approximately 100 m upstream of the outfall) and a test site (also in Payne Creek, just downstream of the discharge). A habitat assessment was performed *in situ* to establish comparability between sites. Supplemental physical/chemical data were also collected on the effluent and study sites. Acute screening toxicity bioassays, using *Ceriodaphnia dubia* and *Cyprinella leedsi* as test organisms, were performed on an effluent sample (Weber 1991). The effluent was analyzed for metals and for organic constituents (base neutral and acid extractables, and volatile organic compounds). Nutrient analyses were performed on effluent, reference, and test sites. Methods used for all chemical analyses are on file at the Tallahassee DEP Chemistry Laboratory.

Benthic macroinvertebrate communities were evaluated at reference and test sites. Invertebrates were collected from multiple substrates (*e.g.*, snags, leaf packs, vegetation) using 20 discrete dip net sweeps. Additionally, Hester-Dendy multiplate samplers were incubated for 28 days (Ross 1990). Periphyton was sampled at both reference and test sites by incubating glass microscope slides in a standard periphytometer for 28 days (Ross 1990). Phytoplankton was sampled via subsurface grabs. Chlorophyll *a* and phaeophytin were also determined for algal communities (Ross 1990). Algal Growth Potential tests, using *Selenastrum capricornutum* as the test organism, followed Miller *et al.* (1978).

Explanation of Measurements of Community Health

Several different measurements of macroinvertebrate and algal community health have been employed in this report. Many of these, such as the number of taxa and Shannon-Weaver Diversity Index are well known. Others are briefly explained here. The Florida Index assigns points to stream-dwelling macroinvertebrates based on their sensitivity to pollution (see Ross 1990). A site with a high Florida Index score is considered healthy (*i.e.*, many clean-water organisms are present). The Ephemeroptera/Plecoptera/Trichoptera (EPT) Index is calculated by summing the number of distinct taxa of EPT's represented in a sample. A higher EPT Index is associated with good water quality. Excessive numerical dominance of a single type of organism (a high % contribution of dominant taxon) is usually associated with disturbance. The determination of the Quantitative Stability Index (for taxonomic % composition) is a two step process. First, the relative proportions of major taxonomic groups are calculated for each site. Then, the lesser of the two percentages for each discrete taxonomic group is totaled. A QSI (for % composition) of 100% means that the two sites being compared are identical. This same type of procedure is used for calculating the QSI (for functional feeding groups). The Stream Invertebrate Index for Florida (SIIF) is a composite metric which is based upon the macroinvertebrate communities found at Florida Eco-regional reference sites sampled with dip net sweeps (EA Engineering 1994). The SIIF assigns 5, 3, or 1 point(s) to a variety of invertebrate parameters, depending on how closely that parameter approaches the expected Eco-regional reference condition. Five points is the best score for metrics which are particularly strong at discriminating between healthy and impaired sites (see SIIF calculation table in Appendix). The following parameters are used in calculating the SIIF for the Panhandle: taxa richness, EPT Index, % contribution of the dominant taxa, % Diptera, Florida In-

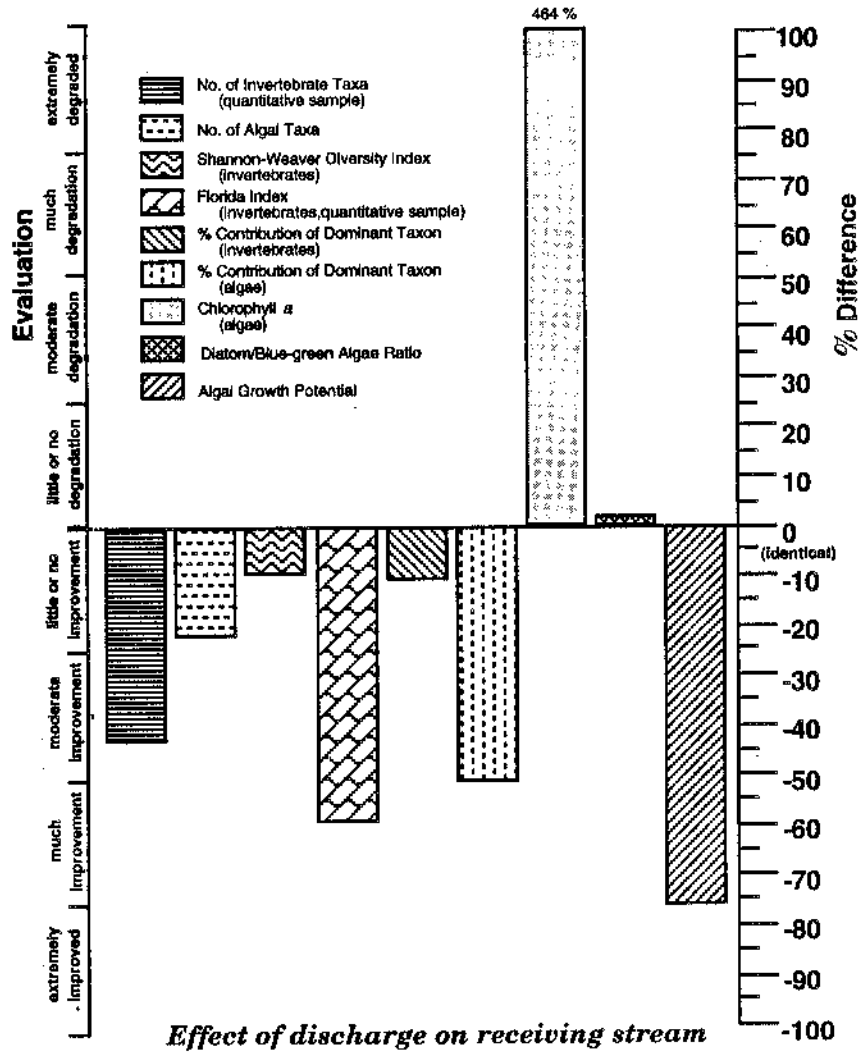
dex, % suspension feeders/filterers, and % shredders (EA Engineering 1994). In the Panhandle, 23-29 SIIF points indicates no impairment, 15-22 points indicates moderate impairment, and 7-14 points is clear evidence of severe degradation. In the Florida Peninsula, these same parameters, along with the number of crustacean and mollusk taxa and the % of crustacean and mollusk taxa, are used to calculate the SIIF. In the Peninsula, 27-33 SIIF points indicates no impairment, 17-26 points indicates moderate impairment, and 9-16 points is clear evidence of severe degradation.

For graphical purposes, the percent differences between the reference and test sites involving the number of taxa, Florida Index, and the diatom to blue-green algae ratio are measured as the reference site minus test site divided by the reference site. The percent differences between sites involving the percent contribution of dominant taxon, chlorophyll *a*, and algal growth potential are measured as the test site minus reference site divided by the reference site.

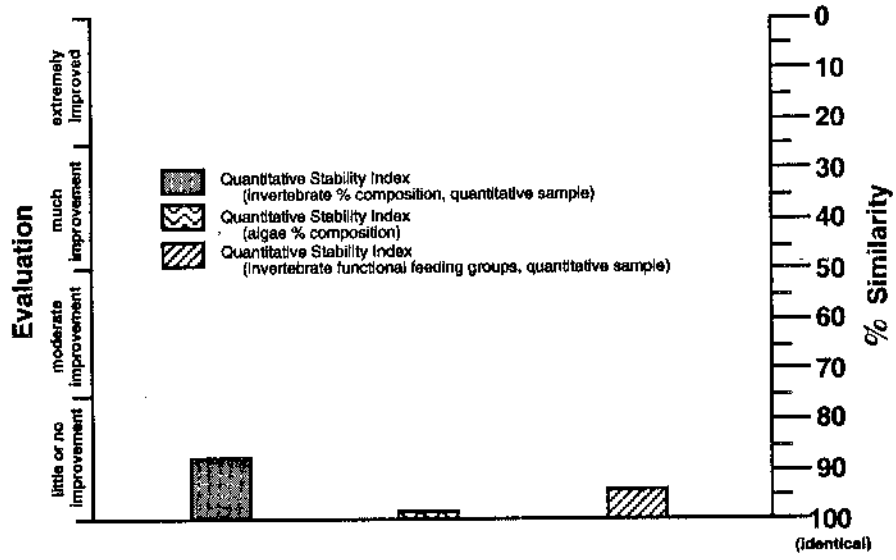
The following personnel were involved in this investigation: Pat Fricano, Lisa Carter, and Michelle Holton (DEP Southwest District) and Chris Barge, Lyn Burton, Marshall Faircloth, Russel Frydenborg, Christy LeDuc, Kathy Lurding, Edward Miller, Liz Miller, Urania Quintana, Landon Ross, Greg Wynn, and David Young (Tallahassee Biology Laboratory). The report was reviewed by the Point Source Bioassessment Review Committee, consisting of Jan Mandrup-Poulsen, Wayne Magley, and Mike Tanski, as well as District representatives.

Results

Habitat quality was excellent at both sites (with 87 and 84 points at the reference and test sites, respectively). Both sites were fairly shallow (0.3 - 1.0 m) with good water velocity (0.2 and 0.33 m/s at the reference and test sites, respectively). The reference site had slightly more available bottom substrate (woody debris and snags) than did the test site. In other respects, such as bank stability and riparian zone vegetation quality, both sites were ranked excellent. Surrounding land use at both sites was 80% forest and 20% industrial. While both sites are located downstream of the Agrico – Ft. Green Mine discharge, the test site is also subject to the effects of the CF Industries – Hardee Complex discharge. Visual observations indicated that water upstream was clear with a slight tannic stain, while water downstream of the discharge was slightly turbid with an oily sheen, and green from suspended algae. Sediments downstream had an anaerobic odor. Both sites were moderately shaded. Water was circumneutral at both sites (7.5 SU's), and conductivity increased slightly from



Effect of discharge on receiving stream
(measured as difference between control and test sites).



Effect of discharge on receiving stream
(measured as similarity between control and test sites).

192 µmhos/cm at the reference site to 221 µmhos/cm at the test site. Dissolved oxygen was adequate to support aquatic life at both sites (7.25 mg/L at the reference site and 7.36 mg/L at the test site).

The effluent sample was not toxic to the water flea, *Ceriodaphnia dubia*, or to the fish, *Cyprinella leedsi*, exposed to the full strength sample.

No organic pollutants were detected in the discharge. Iron (193 µg/L), aluminum (617 µg/L), and cadmium (0.12 µg/L) were measured in the effluent at levels within water quality standards.

While elevated phosphorus was associated with this discharge (1.6 mg/L in the effluent), the test site concentration of phosphorus (0.75 mg/L) was only slightly elevated from that of the reference site (0.62 mg/L). Total phosphorus at both sites was higher than those concentrations found in approximately 85% of all other Florida streams (see Table of Typical Water Quality Values in Appendix). Ammonia and TKN values at all stations were average to below average, when compared with other Florida streams. Nitrate-nitrite levels at the receiving water stations were lower than those found in 70% of all other Florida streams.

Algal growth potential (AGP) decreased from 3.7 mg dry wt/L at the reference site to 0.9 mg dry wt/L at the test site. Both results were less than the 5 mg dry wt/L "problem threshold" (Raschke and Schultz 1987).

Quantitative measures of benthic macroinvertebrate community health indicated no degradation resulting from the CF Industries – Hardee Complex I discharge. In fact the test site appeared to be better than the reference site. The figure on p. 3 indicates the degree of difference between the reference and test sites. Larger differences (that is, higher percentages) correspond with greater degrees of degradation. Negative values mean that the test site is better than the reference site. The relative abundance of each individual taxon appears in the Appendix. The figure on this page summarizes similarities between the sites. Smaller similarities (lower percentages) generally correspond with greater degradation.

Based on Hester-Dendy samples, macroinvertebrate taxa richness at the reference site (with 42 taxa) was excellent for a Florida stream. Taxa richness increased to 60 taxa at the test site, which is better than 95% of other Florida streams (see Table of Typical Water Quality Values in Appendix). The Shannon-Weaver diversity index was 3.2 at the reference site (slightly above average for a Florida stream), increasing to 3.5 at the test site. Similarly, the Florida Index increased from 17 at the reference site to 27 points at the test site, a value which is better than our expectations for a healthy stream in this part of the state. The Ephemeroptera/Plecoptera/Trichoptera Index increased from 10 at the reference site to 12 at the test site. The reference site and test site communities were both dominated by the dipteran, *Polypedilum convictum* group (making up 40-45% of the total population). The QSI for % composition and functional feeding groups showed that the macroinvertebrate assemblages at the reference and test sites were very similar.

In the dip net collections, the number of taxa increased from 36 at the reference site to 45 at the test site, while the Florida Index increased from 14 at the reference site to 18 at the test site. The reference site was dominated by *Polypedilum convictum* group in the dip net samples, whereas *Dubiraphia* sp. was most abundant at the test site. The Stream Invertebrate Index for Florida (SIIF) indicated that both stations were healthy. The reference

site (with 27 SIIF points) and the test site (with 29 SIIF points) both equaled or exceeded the 27 points expected from a healthy stream in peninsular Florida. Overall, the data suggest that the discharge is somewhat beneficial to the receiving water macroinvertebrate populations.

Periphyton taxa richness was better at the test site (14 taxa) than at the reference site (11 taxa). Percent contribution of the dominant taxon decreased from 88% at the reference site to 44% at the test site. The reference and test sites were both dominated by the diatom, *Cocconeis placentula*, which is typically found in eutrophic situations (Whitmore 1989). Periphyton increased from 4.9 mg/m^2 at the reference site to 27.8 mg/m^2 at the test site. The test site chlorophyll *a* was greater than the values found in 90% of other Florida streams. The periphyton diatom/blue green ratio was essentially the same (almost 1) at both sites. The QSI for algal percent composition indicated a high level of similarity (98%) between the two sites.

Conclusions

The effluent sample was not toxic to the water flea, *Ceriodaphnia dubia*, or to the fish, *Cyprinella leedsi*, exposed to the full strength sample.

No organic pollutants were detected in the discharge. Iron (193 µg/L), aluminum (617 µg/L), and cadmium (0.12 µg/L) were measured in the effluent at levels within Class III water quality standards.

While elevated phosphorus was associated with this discharge (1.6 mg/L in the effluent), the test site concentration of phosphorus (0.75 mg/L) was only slightly elevated from that of the reference site (0.62 mg/L). Total phosphorus at both sites was higher than those concentrations found in approximately 85% of all other Florida streams. The concentrations of nitrogenous nutrients at both stations were average to below average, when compared with other Florida streams.

Algal growth potential (AGP) decreased from 3.7 mg dry wt/L at the reference site to 0.9 mg dry wt/L at the test site. Both results were less than the 5 mg dry wt/L "problem threshold".

Measures of benthic macroinvertebrate community health indicated no degradation resulting from the CF Industries – Hardee Complex I discharge. In fact, the majority of the metrics, such as taxa richness, diversity, the EPT index, and the SIIF, were better at the test site than at the reference site, probably due to the increased flow and recruitment potential provided by the discharge.

Periphyton communities at both sites were dominated by the diatom *Cocconeis placentula*, which is typically found in eutrophic conditions. With the exception of periphyton chlorophyll *a*, which was 464% more at the test site, other algal measures indicated great similarity between the two sites.

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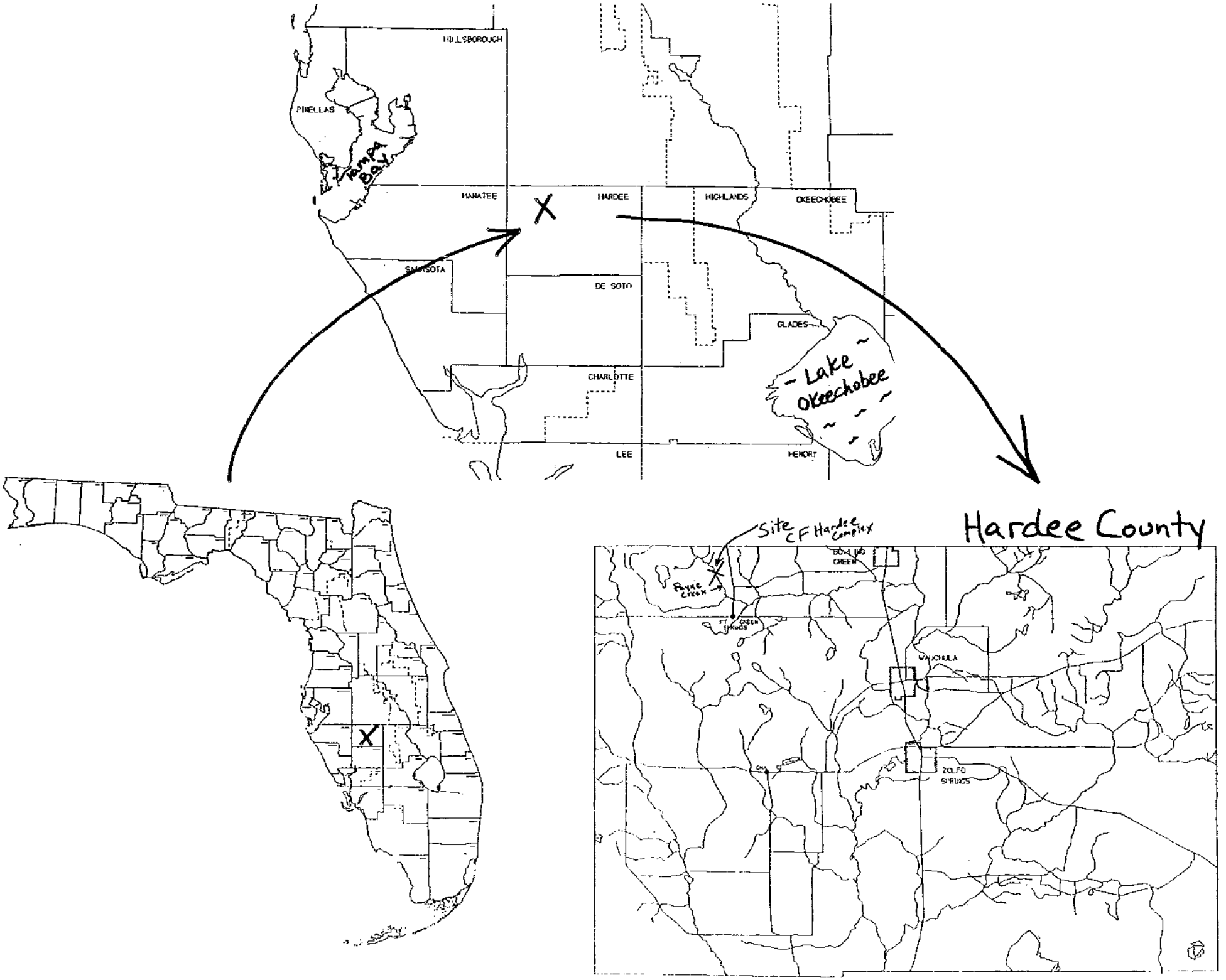
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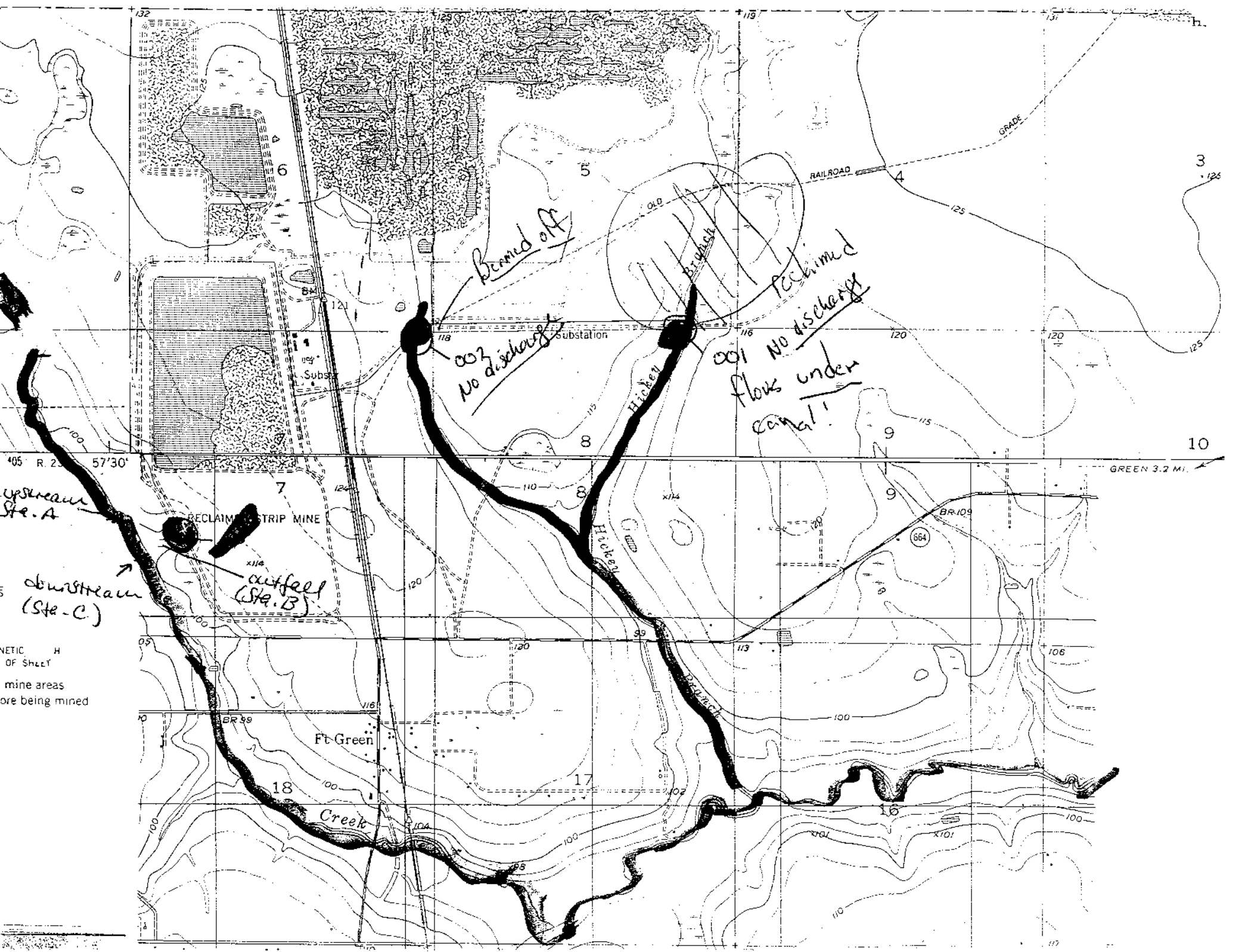
Chemistry summary table for

CF Industries	Effluent	Reference Site	Test Site
Organic Constituents (ug/L)			
None detected			
Metals (ug/L)			
Aluminum	617		
Arsenic	20 U		
Antimony	15 U		
Cadmium	0.12 I		
Copper	5 U		
Chromium	10 U		
Iron	193		
Lead	15 U		
Mercury	0.1 U		
Nickel	5 U		
Selenium	30 U		
Silver	0.05 U		
Zinc	5 U		
Nutrients (mg/L)			
Ortho-phosphate	1.22	0.57	0.70
Total phosphorus	1.60	0.62	0.75
Sulfate	34	15	19
Ammonia	0.11	0.030 I	0.035 I
Nitrate+Nitrite	0.13	0.026 I	0.054 I
TKN	1.0	0.86	0.87
Other Parameters			
Habitat Assessment		87	84
D.O. (mg/L)	7.0	7.3	7.4
pH (SU's)	7.5	7.5	7.5
Conductivity (µmhos/cm)	310	192	221
Temperature (°C)	18.2	15.7	16.2
AGP (mg dry wt/L)	5.1	3.7	0.9
Bioassay Fish	Not toxic		
Bioassay Invertebrate	Not toxic		
TSS (mg/L)	10		
Hardness (mg/L as CaCO3)	108.1		

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

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


HILLSBOROUGH
PINELLAS
Tampa Bay
MANATEE
HARDEE
HIGHLANDS
OKEECHOBEE
SARASOTA
DE SOTO
GLADES
Lake Okeechobee
CHARLOTTE
LEE
HENDRY
Site of CF Hardee Complex
Hardee County
Payne Creek
FT. GREEN SPRINGS
BOWLING GREEN
WAUCHULA
ZOLFO SPRINGS


Bermed off
002 No discharge
001 No discharge
reclaimed
flows under
canal
upstream
Ste. A
downstream
(Ste-C)
outfall
(Ste. B)
RECLAIMED STRIP MINE
Substation
Hickey
Hickey
Creek
Ft Green
Creek
RAILROAD
GRADE
OLD
BR-109
BR 99
664
GREEN 3.2 MI.
mine areas
ore being mined

DEPARTMENT OF ENVIRONMENTAL REGULATION

FACILITY SUMMARY

Facility Name: [illegible]	**Prepared by:** **Date:**	
Location (attach detailed map): 335 → SR 630 E → FM Gate Road.	**County** Hardee	**District** S
Federal Permit # FLC046107 **and expiration date:**	**State GMS # and** [illegible] **State expiration date:** 11/95	**Facility Type:** Industrial Municipal Federal Agricultural **Other (list):**
Function of facility: Phosphate mine.		
Description of treatment process: Phosphate mine. beneficiation plant.		
Receiving waters: 1) Hickory Branch → Payne Creek → Peace River (2) Headwaters → Payne Creek → Peace River	**Classification:** Class III	
Design Flow:	**Actual Mean Flow:**	
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.): Mixing zone for unionized ammonia. Spec. Cond 14 of Permit No. FL0251724 (attached). Zone extending 385 meters downstream for the point of discharge at outfall 003 into Payne Creek.		

List effluent limits:	
Parameter	**Limit (units)**
See attached permit.	

Describe special permit conditions and permit modifications:

This facility is not operating at this time.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

FACILITY SUMMARY

Ag Trade Shades Complex II
(Facility)

Description of permitted outfall(s):

Outfalls 001 + 002 release clear water from the water management system (the Hickey Branch to Wayne Creek to the Hillsborough River) [illegible] The [illegible] is [illegible] to the Hillsborough River.

List permit violations (from MOR data or other source) and plant upsets that occurred within past year:

Describe previous impact bioassessments, WQBEL's, and previous or current enforcement actions:

There is an enforcement case pertaining to a release of process water from a recharge detail system. (Vishwas Sarda).

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

Additional information:

PERMITTEE:
CF INDUSTRIES, INC.
Hardee Phosphate Complex

ID No.: 4025P20001
Permit No.: IO25-172624

TABLE 2

FINAL ACUTE VALUE FOR UNIONIZED AMMONIA (mg/l NH_3)

TO DETERMINE EFFLUENT LIMITATION FOR OUTFALL 003

pH	0 C	5 C	10 C	15 C	20 C	25 C	30 C
6.50	0.0182	0.0258	0.0384	0.052	0.072	0.102	0.102
6.75	0.0298	0.042	0.060	0.084	0.118	0.168	0.168
7.00	0.046	0.066	0.092	0.132	0.186	0.262	0.262
7.25	0.068	0.096	0.138	0.190	0.270	0.380	0.380
7.50	0.090	0.128	0.182	0.256	0.362	0.52	0.52
7.75	0.112	0.160	0.226	0.318	0.44	0.64	0.64
8.00	0.130	0.184	0.260	0.368	0.52	0.74	0.74
8.25	0.130	0.184	0.260	0.368	0.52	0.74	0.74
8.50	0.130	0.184	0.260	0.368	0.52	0.74	0.74
8.75	0.130	0.184	0.260	0.368	0.52	0.74	0.74
9.00	0.130	0.184	0.260	0.368	0.52	0.74	0.74

Facility Information Sheet

to provide information in writing bioassay reports

Facility Name: C.F. Industries - Hardee Phosphate Complex I

(as found on the permit)

NPDES permit #: FL00 40177

Facility Location: (road) 37S → SR 630E → Ft. Green Spg Rd

(city) _____

(county) Hardee Co.

Receiving Water: Hickey Branch → Payne Creek → Peace River

Chlorination Type of Sample: ___ Chlorinated
___ Sample collected after dechlorination
✓ Non-chlorinated

Design Flow and/or Average Flow: (CIRCLE ONE)

Type of Facility: Phosphate Mine

Type of Treatment that Wastewater Receives Prior to Discharge:

1. Beneficiation plant
2. Cells through (RECIRCULATION) recreational water (reuse) system which includes sand/waste clay settling area

Additional Comments:

prepared by

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 4)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		11/22/93	12:00	Payne Creek

REMARKS:	LOCATION:	FIELD ID/NAME:
other	CF. Industries - Hardee Co.	Sta. A (upstream)

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
50%					20%	

Local Watershed Erosion (check box): None [✓] Moderate [ ] Heavy [ ]

Local Watershed NPS Pollution (check box): No evidence [ ] Some potential sources [✓] Obvious sources [ ]

Point-Source Pollution (list location and describe): Imc-Agrico Ft Green Mine

Estimated System Width (range, m): 5	Estimated System Depth (range, m): 0.3-1		yes
High Water Mark (m above bed): 1.3	Velocity (range, m/s): .20	Impounded [ ] Channelized [ ]	

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 Deposits: Sludge [ ] Paper Fiber [ ] Mud [✓] Sand [✓] Shell [ ] Other [ ]

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)	20	5		Riffles			
Leaf Packs				Sand	50	5	
Aquatic Vegetation				Mud/Muck/Silt			
Rock or Shell Rubble				Benthic leaf mats	20	5	
Undercut Banks/Roots	10	5		Other:			

WATER QUALITY

	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm):			Secchi (m):
Top								1.3
Mid-depth								
Bottom								

System Type: Stream [✓] (Sand Bottomed, Swamp & Bog, Alluvial, Sand Bot w/ Spring, Calcareous, Misc.) 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: Cloudy 74°F

Abundance:	Absent	Rare	Common	Abundant
Periphyton	[✓]	[ ]	[ ]	[ ]
Fish	[ ]	[✓]	[ ]	[ ]
Aquatic Macrophytes	[ ]	[✓]	[ ]	[ ]
Iron/sulfur Bacteria	[✓]	[ ]	[ ]	[ ]

SAMPLING TEAM:	SIGNATURE:	DATE:
Fricano + Carter	[signature]	11/22

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		11/22/93	Payne Creek

REMARKS:	LOCATION:	FIELD ID/NAME:
Tannic but Clear	CF Industries - Hardee Co.	Sta. A (upstream)

Habitat Parameter score	Excellent	Good	Fair	Poor
Bottom Substrate/ Available Cover 30	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs, undercut banks, rubble, or other stable habitat. **23-30 points**	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. **16-22 points**	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat. **8-15 points**	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious. **0-7 points**
Water Velocity 19	Max. observed: >0.3 m/sec. but < 1 m/sec **23-30 points**	Max. observed; 0.1 to 0.3 m/sec **16-22 points**	Max. observed; 0.05 to 0.1 m/sec **8-15 points**	Max. observed; <0.05 m/sec, or spate occurring; > 2 m/sec **0-7 points**
Artificial Channel/ Flow Alteration 15	No artificial channelization. Little activity (impervious surface) in watershed which would cause scouring during spates. **12-15 points**	—	—	Artificially channelized, or scouring present during spates because of excess impervious surface in watershed. **0-3 points**
Bank Stability 9	Stable. No evidence of erosion or bank failure. Little potential for future problems. **9-10 points**	Moderately stable. Infrequent or small areas of erosion, mostly healed over. **6-8 points**	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. **3-5 points**	Unstable. Many raw, eroded areas. Obvious bank sloughing. **0-2 points**
Riparian Zone Vegetation Quality 9	Over 80% of streambank surfaces consist of native plants, classified as: bottomland hardwoods, understory shrubs, or non-woody macrophytes. **9-10 points**	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. **6-8 points**	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. **3-5 points**	Less than 25% of streambank surfaces are vegetated. Poor plant community (e.g. grass monoculture) present. **0-2 points**

Adjustments		TOTAL SCORE
5	Add **5 points** if cross-sectional area of flow is estimated to be greater than one square meter during periods of normal flow.	87

COMMENTS: otter

ANALYSIS DATE:	ANALYST:	SIGNATURE:
11/22/93	Fricano	Pat Fricano

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 4)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		11/22/93	12:15	Payne Creek

REMARKS:	LOCATION:	FIELD ID/NAME:
	CF. Industries - Hardee Co.	Stn C (downstream)

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
80					20	

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

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

Point-Source Pollution (list location and describe): CF Hardee Complex Outfall
IMC-Agrico Fort Green Mine

Estimated System Width (range, m): 5	Estimated System Depth (range, m): .3 - 1		yes
High Water Mark (m above bed): 1.3	Velocity (range, m/s): .33	Impounded ☐ Channelized ☐	

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 Deposits: Sludge: ☐ Paper Fiber: ☐ Mud: ☑ Sand: ☑ Shell: ☐ Other: ☐

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Riffles			
Leaf Packs				Sand	60	6	
Aquatic Vegetation				Mud/Muck/Silt	10	1	
Rock or Shell Rubble				Benthic leaf mats	20	0	
Undercut Banks/Roots	10	7		Other:			

WATER QUALITY

	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm):			Secchi (m):
Top								1
Mid-depth								
Bottom								

System Type: Stream: ☑ (Sand Bottomed ☐ Sand Bot w/ Spring ☐ Swamp & Bog ☐ Calcareous ☐ Alluvial ☐ Misc.) 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: Cloudy 74° F

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

SAMPLING TEAM:	SIGNATURE:	DATE:
Freeman + Carter	Pat Freeman	11/22

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		11/22/93	Payne Creek

REMARKS:	LOCATION:	FIELD ID/NAME:
Tannic - but green due to effluent	CF Industries - Hardee Co.	Sta. C (Colours Stream)

Habitat Parameter score	Excellent	Good	Fair	Poor
Bottom Substrate/ Available Cover 22	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs, undercut banks, rubble, or other stable habitat. **23-30 points**	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. **16-22 points**	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat. **8-15 points**	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious. **0-7 points**
Water Velocity 23	Max. observed: >0.3 m/sec. but < 1 m/sec **23-30 points**	Max. observed; 0.1 to 0.3 m/sec **16-22 points**	Max. observed; 0.05 to 0.1 m/sec **8-15 points**	Max. observed; <0.05 m/sec, or spate occurring; > 2 m/sec **0-7 points**
Artificial Channel/ Flow Alteration 15	No artificial channelization. Little activity (impervious surface) in watershed which would cause scouring during spates. **12-15 points**	—	—	Artificially channelized, or scouring present during spates because of excess impervious surface in watershed. **0-3 points**
Bank Stability 10	Stable. No evidence of erosion or bank failure. Little potential for future problems. **9-10 points**	Moderately stable. Infrequent or small areas of erosion, mostly healed over. **6-8 points**	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. **3-5 points**	Unstable. Many raw, eroded areas. Obvious bank sloughing. **0-2 points**
Riparian Zone Vegetation Quality 9	Over 80% of streambank surfaces consist of native plants, classified as: bottomland hardwoods, understory shrubs, or non-woody macrophytes. **9-10 points**	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. **6-8 points**	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. **3-5 points**	Less than 25% of streambank surfaces are vegetated. Poor plant community (e.g. grass monoculture) present. **0-2 points**

Adjustments		TOTAL SCORE
5	Add 5 points if cross-sectional area of flow is estimated to be greater than one square meter during periods of normal flow.	84

COMMENTS:

ANALYSIS DATE:	ANALYST:	SIGNATURE:
11/22/93	Fiscano	Pat Fiscano

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: CF Mining Corp
Location:
County: Hardee
Contact/District: Jim Snitzer / SW
NPDES Permit #: FL00 40177 Outfall #: 003

Sample Collection: Date 11/01/93 Time 1100
Test Beginning: Date 11/02/93 Time 1430
Test Ending: Date 11/04/93 Time 1430
Organism Batch #: 117 Diluent Batch #: 29
Organism Age: <24hrs.
Test Organism: Ceriodaphnia dubia

93 NOV 02 20
65338

Test Type: Screening | Definitive
Static | Static Renewal | Flow-through

Test Number: 1 of 2

Remarks:

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	22.1 @ 22.2	8.5 @ 23.2	975 @ 1,000 9360 @ 10,000 @ 23.1 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	22.7 @ 22.8	8.5 @ 22.8	980 @ 1,000 9420 @ 10,000 @ 23.4°C
48 hr	7.0 @ 7.0 9.0 @ 9.0	23.6 @ 23.7	8.4 @ 23.8	990 @ 1,000 9580 @ 10,000 @ 24.0°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
Control	A	5	5	5	7.9		8.1	21.6		23.4	8.0		9.0	150		160
Control	B	5	5	5			8.1			23.4			9.0			175
Control	C	5	5	5			8.1			23.3			9.0			180
Control	D	5	5	5			8.1			23.1			9.2			190
100%	A	5	5	5	7.3		8.4	21.6		23.3	8.1		9.2	260		270
100%	B	5	5	5			8.4			23.3			9.3			255
100%	C	5	5	5			8.4			23.2			9.4			300
100%	D	5	5	5			8.5			23.1			9.4			320
Measured/Loaded by:		MF	TM	TM	TM		TM	TM		TM	TM		TM	TM		TM
Recorded by:		MF	TM	TM	TR		TR	TR		TR	TR		TR	TR		TR

Investigators' Signatures

Tina Mikulsky
Robin C. Rader
Marshall Faircloth

Reviewer

form updated 7/8/93

	Salt Water/ (Well Water)	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2:			not	measured	
Lab Total Residual Cl2:	<0.03	<0.03	<0.03	0.02-1.00	TM
Alkalinity:	125	70	105	Hach	TR
Hardness:	120	80	110	Hach	TR
Total Ammonia:	<0.017	<0.017	<0.017	colorimetric	MF

Ammonia Meter #98136 Ammonia Meter Slope: -54.0 Ammonia Blank: <0.017 Control Salinity: 0 ppt Sample Salinity: 0 ppt

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: CF Mining Corp
Location:
County: Hardee
Contact/District: Jim Snitzer 1500
NPDES Permit #: FL00 40177 Outfall #: 003
93 NW 02 20 65328

Sample Collection: Date 11/01/93 Time 1100
Test Beginning: Date 11/02/93 Time 1430
Test Ending: Date 11/04/93 Time 1430
Organism Batch #: 46 Diluent Batch #: well
Organism Age: 9 days old
Test Organism: Cyprinella leedsi

Test Type: (Screening) | Definitive
(Static) | Static Renewal | Flow-through
Test Number: 2 of 2
Remarks:

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	22.1 @ 22.2	8.5 @ 23.2	975 @ 1,000 9360 @ 10,000 @ 23.1 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	22.7 @ 22.8	8.5 @ 23.8	980 @ 1,000 9430 @ 10,000 @ 23.4 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	23.6 @ 23.7	8.4 @ 23.8	990 @ 1,000 9580 @ 10,000 @ 24.0 °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
Control A	87	5	5	5	7.7	7.8	8.2	23.1	22.7	23.3	7.8	6.9	8.0	240	315	320
Control B	23	5	5	5	7.6	7.8	8.2			23.2	7.8	6.9	8.9	240	330	335
100% A	3660	5	5	5	7.2	7.6	8.0	23.1	22.6	23.1	8.1	7.6	8.8	295	350	355
100% B	888	5	5	5	7.2	7.6	8.0			23.2	8.1	7.6	8.6	290	375	380
Measured/Loaded by:		TM	TM	TM	TM	MF	TM	TM	MF	TM	TM	MF	TM	TM	MF	TM
Recorded by:		TR	TM	TM	TR	TM	TR	TR	TM	TR	TR	TM	TR	TR	TM	TR

Investigators' Signatures

Tina M. Kubale
Robin C. Rader
Marshall Faircloth

Reviewer

Water Quality Parameters	Salt Water/ Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2:			not	measured	
Lab Total Residual Cl2:	<0.03	<0.03	<0.03	DR-100	TM
Alkalinity:	125	N/A	105	Hach	TR
Hardness:	120	N/A	110	Hach	TR
Total Ammonia:	<0.017	N/A	<0.017	Orion	MF

Ammonia Meter #98136 Ammonia Meter Slope: -54.0 Ammonia Blank: <0.017

Control Salinity: 0 ppt

Sample Salinity: 0 ppt

form updated 7/8/93

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 Phosphorus	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-Phosphorus	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-Phosphorus	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

CF MINING REFERENCE SITE (DIP NET DATA)

Calculation and Interpretation of the Stream Invertebrate Index for Florida (SIIF) (Draft Version 1994)								
Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	**Panhandle (65, 75a)**				**Peninsula (75b, c, d)**			
	5	3	1	Score	5	3	1	Score
Number of Taxa	≥ 31	16–30	0–15		≥ 27	14–26	0–13	5
EPT Index	≥ 7	4–6	0–3			≥ 4	0–3	3
% Contribution of Dominant Taxon		≤ 20	> 20			≤ 37	> 37	3
Florida Index	≥ 18	9–17	0–8		≥ 7	4–6	0–3	5
% Diptera		≤ 38	> 38			≤ 32	> 32	1
% Suspension feeders/ Collector-Filterers	≥ 12	7–11	0–6		≥ 8	4–7	0–3	5
% Shredders		≥ 10	0–9			≥ 13	0–12	3
% Crustacean/Mollusks (Peninsula only)	–	–	–			≥ 16	0–15	1
# Crustacean/Mollusks (Peninsula only)	–	–	–			≥ 4	0–3	1
Total Score	**Panhandle**				**Peninsula**			29
Interpretation of Score	**No Impairment**			29-23	**No Impairment**			33-27
	Moderate Impairment			22-15	**Moderate Impairment**			26-17
	Severe Degradation			14-7	**Severe Degradation**			16-9

CF MINING TEST SITE (DIP NET DATA)

Calculation and Interpretation of the Stream Invertebrate Index for Florida (SIIF) (Draft Version 1994)								
Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	**Panhandle (65, 75a)**				**Peninsula (75b, c, d)**			
	5	3	1	Score	5	3	1	Score
Number of Taxa	≥ 31	16–30	0–15		≥ 27	14–26	0–13	5
EPT Index	≥ 7	4–6	0–3			≥ 4	0–3	3
% Contribution of Dominant Taxon		≤ 20	> 20			≤ 37	> 37	3
Florida Index	≥ 18	9–17	0–8		≥ 7	4–6	0–3	5
% Diptera		≤ 38	> 38			≤ 32	> 32	1
% Suspension feeders/ Collector-Filterers	≥ 12	7–11	0–6		≥ 8	4–7	0–3	5
% Shredders		≥ 10	0–9			≥ 13	0–12	1
% Crustacean/Mollusks (Peninsula only)	–	–	–			≥ 16	0–15	3
# Crustacean/Mollusks (Peninsula only)	–	–	–			≥ 4	0–3	3
Total Score	**Panhandle**				**Peninsula**			29
Interpretation of Score	**No Impairment**			29-23	**No Impairment**			33-27
	Moderate Impairment			22-15	**Moderate Impairment**			26-17
	Severe Degradation			14-7	**Severe Degradation**			16-9

Benthic macroinvertebrate taxa list for CF Industries, collected via 20 discrete dip net sweeps in Payne Creek, on 22 November, 1993.

	Reference Site	Test Site
Acarina		
Atractides sp.	48	–
Mideopsis sp.	24	–
Sperchon sp.	24	–
Undetermined Acarina sp.	24	–
Amphipoda		
Hyalella azteca	–	120
Coleoptera		
Dubiraphia sp.	384	792
Microcylloepus pusillus	912	–
Stenelmis sp.	–	120
Undetermined Dryopidae	48	24
Decapoda		
Palaemonetes paludosus	–	72
Procambarus sp.	48	48
Diptera		
Ablabesmyia mallochi	48	24
Cladotanytarsus sp.	–	72
Coelotanypus sp.	–	24
Corynoneura sp.	96	–
Cryptotendipes sp.	–	24
Labrundinia pilosella	–	24
Labrundinia sp.	–	24
Nanocladius sp.	–	24
Palpomyia grp. sp.	24	24
Parachironomus hirtalatus	–	24
Pentaneura inconspicua	72	–
Polypedilum convictum grp.	1992	216
Polypedilum halterale grp.	–	288
Polypedilum illinoense	96	120
Polypedilum scalaenum grp.	–	24
Rheotanytarsus distinctissimus grp.	–	48
Rheotanytarsus exiguus grp.	48	–
Simulium sp.	–	48
Stenochironomus sp.	72	48
Stelechomyia perpulchra	24	–
Tanytarsus sp. A (Epler)	24	96
Tanytarsus sp. D (Epler)	24	–
Tanytarsus sp.	48	–
Tanytarsus sp. L (Epler)	72	72
Tanytarsus sp. S (Epler)	96	24
Undetermined dipteran pupae	168	–
Ephemeroptera		
Acerpenna pygmaeus	288	96

Caenis sp.	72	–
Stenacron floridense	24	24
Gastropoda		
Hebetancyclus excentricus	–	24
Laevapex sp.	–	24
Planorbella duryi	–	24
Viviparus sp.	–	24
Undetermined Ancylidae sp.	144	24
Hemiptera		
Undetermined Hemiptera sp.	–	24
Hirudinea		
Batracobdella phalera	24	–
Odonata		
Argia sp.	–	24
Enallagma cardenium	–	48
Hetaerina titia	–	24
Ischnura sp.	24	–
Undetermined Coenagriidae	48	24
Oligochaeta		
Aulodrilus pigueti	–	48
Dero trifida	48	48
Limnodrilus hoffmeisteri	–	48
Undetermined Enchytraeidae	24	24
Pelecypoda		
Corbicula manilensis	–	168
Sphaerium or *Musculium* sp.	336	192
Platyhelminthes		
Dugesia sp.	–	24
Trichoptera		
Cheumatopsyche sp.	288	72
Neotrichia sp.	360	–
Oecetis cinerascens	96	–
Oecetis sp.	–	24
Polycentropus sp.	48	–
Undetermined Trichoptera pupa	24	24
Total	6264	3480

Benthic macroinvertebrate taxa list for CF Industries, collected via Hester-Dendy artificial substrates in Payne Creek, on 22 November, 1993. Densities, in number/m^2, represent the mean of three replicates.

	Reference Site	Test Site
Acarina		
Atractides sp.	2	1
Sperchon sp.	2	–
Undetermined Acarina sp.	–	1
Amphipoda		
Hyalella azteca	–	11
Coleoptera		
Dineutus sp.	1	–
Dubiraphia sp.	–	1
Gyrinus sp.	1	–
Macronychus glabratus	–	5
Microcylloepus pusillus	16	32
Stenelmis hungerfordi	5	2
Stenelmis sp.	11	7
Diptera		
Ablabesmyia rhamphe grp.	–	1
Asheum beckae	–	3
Atrichopogon sp.	6	–
Cladotanytarsus sp.	–	10
Corynoneura sp.	18	21
Cryptotendipes sp.	–	5
Hemerodromia sp.	14	7
Palpomyia grp. sp.	3	–
Pentaneura inconspicua	41	58
Polypedilum convictum grp.	555	639
Polypedilum fallax grp.	–	1
Polypedilum illinoense	–	5
Polypedilum scalaenum grp.	7	3
Rheocricotopus robacki	3	–
Rheotanytarsus distinctissimus grp.	29	30
Rheotanytarsus exiguus grp.	165	119
Simulium sp.	–	18
Stelechomyia perpulchra	–	5
Stempellinella sp.	2	–
Tanytarsus sp. E (Epler)	–	1
Tanytarsus sp. A (Epler)	16	18
Tanytarsus sp. C (Epler)	–	1
Tanytarsus sp.	–	1
Tanytarsus sp. G (Epler)	–	1
Tanytarsus sp. L (Epler)	6	10
Tanytarsus sp. S (Epler)	7	4
Tanytarsus sp. T (Epler)	–	1
Thienemanniella sp.	15	6

Tribelos fuscicorne	–	6
Tribelos jucundum	4	3
Undetermined Chironomidae sp.	17	17
Undetermined dipteran pupae	42	60
Ephemeroptera		
Acerpenna pygmaeus	78	64
Caenis sp.	5	14
Stenonema exiguum	3	2
Stenacron interpunctatum	–	1
Gastropoda		
Amnicola dalli johnsoni	1	–
Hebetancyclus excentricus	7	10
Micromenetus dilatatus	1	–
Physella sp.	1	–
Planorbella duryi	–	4
Viviparus georgianus	1	1
Undetermined Ancylidae sp.	–	13
Megaloptera		
Corydalus cornutus	3	4
Odonata		
Argia sp.	–	2
Enallagma cardenium	–	2
Hetaerina titia	–	1
Ischnura hastata	–	1
Ischnura ramburii	–	1
Ischnura sp.	1	2
Undetermined Coenagriidae	1	–
Oligochaeta		
Tubifex tubifex	–	1
Trichoptera		
Cernotina sp.	6	1
Cheumatopsyche sp.	92	256
Cyrnellus fraternus	3	3
Hydropsyche sp.	1	16
Neotrichia sp.	23	39
Neureclipsis sp.	–	11
Nyctiophalax sp.	15	15
Oecetis sp.	–	7
Orthotrichia sp.	5	–
Polycentropus sp.	–	3
Undetermined Trichoptera pupa	2	3
Total	1237	1591

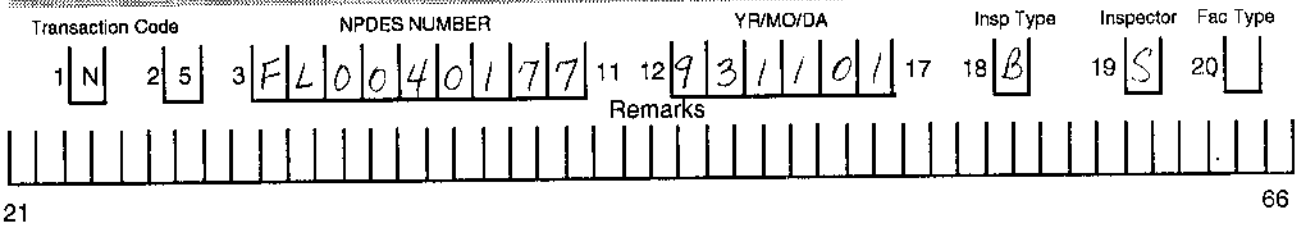
Phytoplankton taxa list and densities (#/mL) for CF Industries, collected via subsurface grabs in Payne Creek, on 22 November, 1993.

	Reference Site	Test Site
Diatoms		
Achnanthes sp.	73	70
Cocconeis sp.	146	–
Gyrosigma sp.	–	70
Navicula sp.	73	141
Nitzschia sp.	146	211
Chlorophyta		
Ankistrodesmus sp.	73	985
Closterium sp.	73	–
Cosmarium sp.	146	141
Crucigenia sp.	73	–
Dictyosphaerium sp.	–	70
Gloeocystis sp.	730	1196
Golenkinia sp.	219	–
Kirchneriella sp.	292	704
Oocystis sp.	292	–
Pediastrum sp.	–	70
Scenedesmus sp.	1607	3377
Tetraedron sp.	–	563
Unknown chlorophyte flagellate	–	70
Cyanophyta		
Anabaena sp.	–	141
Anabaenopsis sp.	292	633
Aphanocapsa sp.	73	211
Aphanothece sp.	–	70
Chroococcus sp.	3433	1407
Dactylococcopsis sp.	73	704
Gloeocapsa sp.	73	70
Lyngbya contorta	365	352
Lyngbya sp.	–	492
Merismopedia sp.	146	1477
Microcystis sp.	146	633
Oscillatoria sp.	–	211
Euglenophyta		
Euglena sp.	73	–
Trachelomonas sp.	–	141
Pyrrhophyta		
Peridinium sp.	73	–
Total	8690	14210

Periphyton taxa list and densities (#/mm^2) for CF Industries, collected via glass microscope slides in Payne Creek, on 22 November, 1993.

	Reference Site	Test Site
Diatoms		
Achnanthes exigua	22	133
Achnanthes hustedtii	–	675
Achnanthes lanceolata	57	–
Achnanthes lanceolata v. *apiculata*	–	204
Achnanthes lanceolata v. *dubia*	–	595
Bacillaria paradoxa	7	9
Cocconeis placentula	1482	1714
Eunotia pectinalis	–	9
Melosira sp.	7	–
Navicula cryptocephala	7	–
Navicula exigua	7	–
Navicula hungarica	7	–
Navicula minima	–	311
Navicula pupula	–	62
Navicula radiosa	–	9
Nitzschia amphibia	43	36
Chlorophyta		
Scenedesmus sp.	7	–
Stigeocolonium sp.	–	36
Cyanophyta		
Aphanothece sp.	–	9
Chroococcus sp.	22	98
Total	1668	3900

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



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

