

Biological Assessment of

St. Marks Refining Company

Wakulla County

NPDES #FL0035220

Sampled January 1996

June 1996

Biology Section
Division of Administrative and Technical Services

Comprehensive Quality Assurance Plan No. 870346G

Department of Environmental Protection
Results of Fifth Year Inspections

Discharger: St. Marks Refinery
County: Wakulla
NPDES Number: FL0035220
State Permit Expiration Date: 30 September 1996

Toxics Sampling Inspection (XSI)

Date Sampled: 22 January 1996

Results: No metals were detected in the effluent or at the test site at levels exceeding Class III standards. Bromodichloromethane (0.75 µg/L) and chloroform (2.7 µg/L) were detected in the effluent at less than acutely toxic concentrations.

Compliance Biomonitoring Inspection (CBI)

Date Sampled: 22 January 1996

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

Impact Bioassessment Inspection (IBI)

Date Sampled: 22 January 1996

Results: Quantitative (Hester-Dendy) measures of benthic macroinvertebrate community health indicated that Rattlesnake Branch was already stressed for reasons other than the discharge (*e.g.*, poor habitat, stormwater inputs, elevated conductivities). The Stream Condition Index (SCI), ranked the Rattlesnake Branch reference site (with 17 SCI points) in the "poor" category, and the test site (with 21 SCI points) in the lowest range of the "good" category. These results also suggest that the discharge was not exacerbating the already disturbed conditions in Rattlesnake Branch. Phytoplankton algal density and chlorophyll *a* were very low at both the Rattlesnake Branch reference site and the test site, corresponding to the AGPs. The Moriah Creek phytoplankton population was generally similar to that of Rattlesnake Branch.

Water Quality Inspection (WQI)

Date Sampled: 22 January 1996

Results: Fecal coliform bacteria violations were observed at both the Rattlesnake Branch reference site (4,700 organisms/100 mL) and the Rattlesnake Branch test site (3,700 organisms/100 mL) (Rule 62-302.530(6) FAC). Total coliform violations were also found at the Rattlesnake Branch reference site (7,700 organisms/100 mL) and the Rattlesnake Branch test site (5,600 organisms/100 mL) (Rule 62-302.530(7) FAC). The effluent, with relatively low fecal and total coliforms, was not responsible for the violations. Other sources of bacterial contamination to Rattlesnake Branch should be investigated. Nutrient concentrations were generally low in the effluent and at all receiving water stations. The algal growth potential was very low (less than 1 mg dry wt/L) in the effluent sample, and at all three receiving water stations, indicating no potential eutrophication problems.

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 St. Marks Refining Company, located in Wakulla County, Florida, was originally designed as a 20,000 barrel per day crude oil refinery (see maps in Appendix). Formerly known as Seminole Refining, the facility was sold in 1992, with the previous owners responsible for the cleanup of contaminated soil and groundwater. Presently, the facility is serving as a storage and distribution operation only, and does not discharge process wastewater. Contaminated stormwater is collected in four unlined impoundments, which seep into groundwater and have a surface water discharge to the Class III Rattlesnake Branch, a tributary of the St. Marks River. The facility was not discharging during the time of this survey.

Permit limits for the effluent include: flow (0.43 MGD), pH (6.0 to 8.5 SU), BOD (200.7 lbs/day maximum and 106.7 lbs/day as a monthly average) and TSS (141 lbs/day maximum and 90 lbs/day as a monthly average), COD (1,033.5 lbs/ day maximum and 534 lbs/day as a monthly average), sulfide (1.34 lbs/ day maximum and 0.6 lbs/day as a monthly average), unionized ammonia (0.02 mg/l maximum at the effluent), phenol (see Rule 63-302.530(53)(b) FAC), and temperature (no more than 5 °F over ambient).

The facility has a mixing zone for oil and grease, arsenic, cadmium, iron, lead, and zinc. Originating at the point of discharge, the mixing zone includes 340 feet of drainage ditch and 1,020 feet of Rattlesnake Branch, and extends to the point where Rattlesnake

Major characteristics of community structure of control and test sites.

	Moriah Ck. Ref. Site	Rattle snake Br. Ref. Site	Rattle snake Br. Test Site
Macroinvertebrate Qualitative			
Number of Taxa	29	21	25
Florida Index	5	6	9
SCI	21	17	21
EPT Index	1	0	0
% Contribution of Dominant Taxon	27.8	29.9	22.1
% Oligochaeta	5.2	7.1	2.3
% Diptera	20.0	31.0	40.5
% Ephemeroptera	27.8	0	0
% Amphipoda	14.8	5.4	5.3
% Isopoda	0.9	43.5	28.2
% Gastropoda	8.7	2.2	14.5
% Coleoptera	11.3	0	0
% Other	11.3	10.8	9.2
% Predators	9.6	4.4	7.3
% Above Surface Deposit Feeders	40.9	19.6	21.8
% Below Surface Deposit Feeders	2.6	6.5	2.3
% Suspension Feeders	9.6	7.9	3.1
% Scrapers	20.0	2.2	14.5
% Shredders	9.6	11.1	14.5
% Scavengers	0.4	32.1	26.3
Macroinvertebrate Hester-Dendy			
Number of Taxa	12	7	7
Florida Index	1	1	1
Shannon-Weaver Diversity	3.2	1.8	1.5
EPT Index	2	0	0
% Coleopterea	4.6	0	0
% Ephemeroptera	18.2	0	0
% Diptera	18.2	9.7	19.5
% Amphipoda	4.6	9.7	72.2
% Isopoda	45.4	61.3	2.8
% Gastropoda	9.1	19.4	2.8
% Other	0	0	2.7
% Predators	0	0	2.8
% Above Surface Deposit Feeders	18.2	8.1	44.4
% Below Surface Deposit Feeders	0	0	0
% Suspension Feeders	4.6	3.2	1.4
% Scrapers	15.9	19.4	2.8
% Shredders	2.3	4.8	43.1
% Scavengers	34.1	62.9	1.4
Phytoplankton Algae			
Number of Taxa	6	10	15
Shannon-Weaver Diversity	2.3	2.0	3.7
Algal Density (#/mL)	216	362	284
Chlorophyll a (µg/L)	2.20 U	2.20 U	1.98 U
% Blue-green	4.8	5.6	14.8
% Green	14.3	63.9	40.7
% Diatoms	61.9	22.2	14.8
% Other	19.0	8.3	29.7
Algal Growth Potential (mg dry wt/l)	0.3	0.3	0.6

Branch meets the St. Marks River. Permit limits for parameters taken at the edge of the mixing zone include oil and grease (maximum of 5 mg/L), iron (maximum of 1.0 mg/L), arsenic (maximum of 50 µg/L), as well as hardness-based Class III standards for cadmium, lead, and zinc.

In response to an August, 1995, spill of #6 fuel oil, a DEP inspection determined that the facility's operation and maintenance was unsatisfactory due to leaking tanks, resulting in contaminated soil. Previous sampling showed that soil and groundwater at the site were contaminated with polynuclear aromatic hydrocarbons, total recoverable petroleum hydrocarbons, phenol, VOA's, methyl ter-butyl ether (MTBE), and benzene-toluene-ethelbenzene-xylene (BTEX). The remediation of this previous contamination is the responsibility of the former owner, Seminole Refining Corp., and is covered in Consent Order 84-0199.

Methods

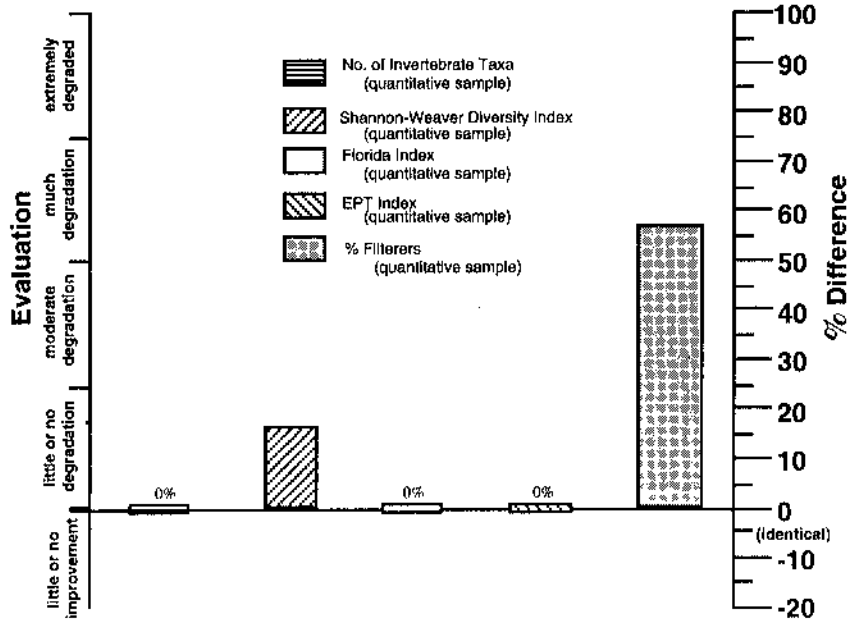
The focus of this investigation was to determine the discharger's effects on the receiving waters. A comparison of biological community health was made between a reference site (located in Rattlesnake Branch, upstream of the discharge) and a test site (located in Rattlesnake Branch, downstream of the discharge). Another reference site was established in Moriah Creek, located roughly 1.5 miles Northwest of the discharge, to assess potential stormwater effects on the Rattlesnake Branch reference site.

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 and the test site were analyzed for metals and for organic constituents (base neutral and acid extractables, and pesticide extractables). Additionally, nutrient analyses were performed on the effluent, the reference site, and the test sites. Methods used for all chemical analyses are on file at the Tallahassee DEP Chemistry Laboratory.

Benthic macroinvertebrate communities were evaluated at the reference and test sites. Invertebrates were collected from multiple substrates (*e.g.*, snags, leaf packs, vegetation) using 20 discrete dip net sweeps. Hester-Dendy artificial substrates, which were incubated for 28 days (Ross 1990), were deployed. Periphyton was sampled by incubating glass microscope slides in a standard periphytometer for 28 days (Ross 1990), but the periphytometers were lost at the test site. Consequently, phytoplankton population data, sampled via subsurface grabs, will be presented instead. Chlorophyll *a* was also determined for phytoplankton 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 to determine the effects of a discharge. These are briefly discussed here.



Effect of discharge on the benthic macroinvertebrate community.

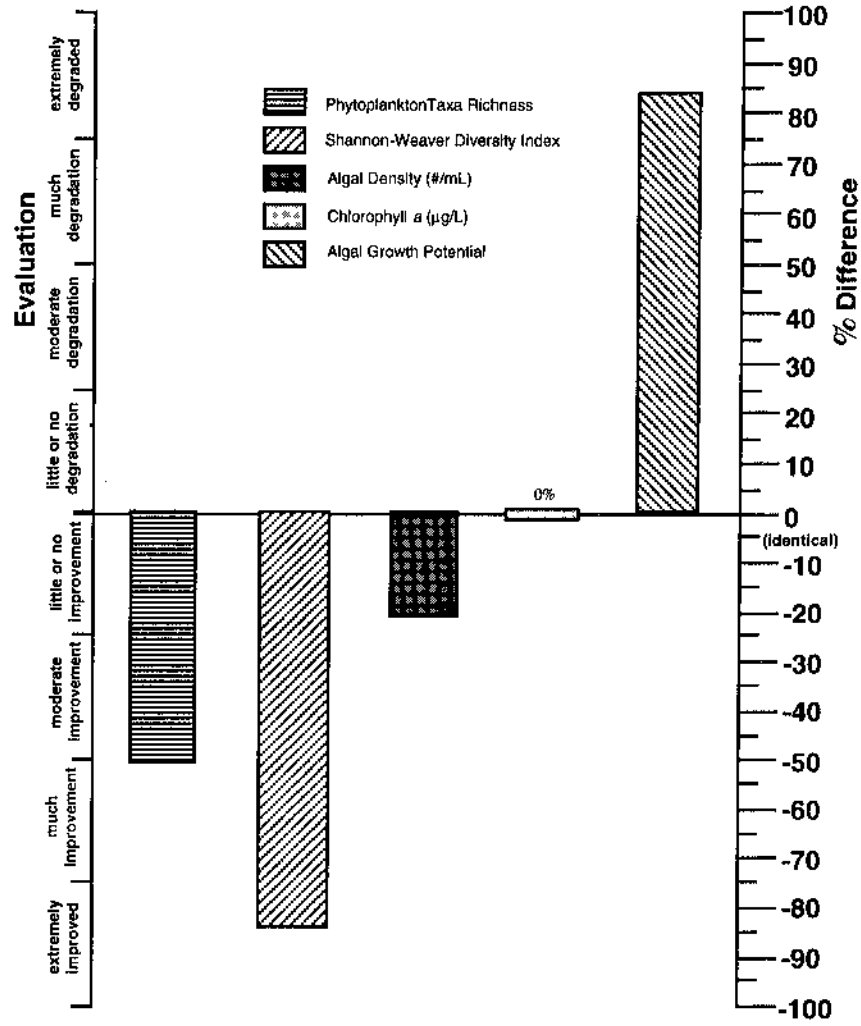
Taxa richness: Stress tends to reduce the number of different types of organisms present in a system, although moderate nutrient enrichment may sometimes be correlated with increased algal taxa richness.

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. Excessive numerical dominance of a single type of organism (a high % contribution of the dominant taxon) is a related measure which is also associated with disturbance.

Numbers of pollution sensitive taxa: Some organisms become rare or absent as the intensity or duration of disturbance increases. For example, 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. Species sensitivity data from other sources, such as Hudson *et al.* (1990), Hulbert (1990), Lenat (1993), Farrell (1992), Chang *et al.* (1992), and Whitmore (1989), are used as appropriate.

Ephemeroptera/Plecoptera/Trichoptera Index: This is the sum of the number of EPT taxa present. Higher EPT values are associated with healthier systems.

Community structure: Substantial shifts in proportions of major groups of organisms, compared to reference conditions, may indicate degradation. In marine systems, an increase in the % tubificid oligochaetes, a decrease in the % pelecypods, and a decrease in the number of polychaete taxa are all considered indicators of disturbance (Engel *et al.* 1994).



Effect of discharge on the algal community.

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.

Trophic composition/feeding guilds: Disturbance can shift the feeding strategies of invertebrates. In Florida, for example, pollution may be responsible for reducing the numbers of filter-feeders (FDEP 1994) and shredders (EA Engineering 1994).

The Stream Condition Index for Florida (SCI) is a composite macroinvertebrate metric (EA Engineering 1994). The SCI assigns points to a variety of parameters, depending on how closely each parameter approaches an expected reference condition (see SCI calculation table in Appendix).

Seven attributes known to have potential effects on the stream biota were evaluated and scored, with 20 possible points for each factor. Based on the sum of these individual scores, overall habitat quality is assigned to one of four categories: Optimal (105-140 points); Subop-

timal (70-104 points); Marginal (35-69 points); and Poor (0-34 points).

For graphical purposes, the percent differences between the reference and test sites involving the number of taxa, the diversity index, the Florida Index, the EPT Index, and the % filter-feeders are measured as the reference site minus test site divided by the reference site. The percent differences between sites involving algal density, 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: Glenn Butts (DEP Northwest District) and Lyn Burton-Hupp, Russel Frydenborg, Joy Jackson, Kathleen Lurding, Elizabeth Miller, Urania Quintana, Bart Richard, Todd Space, Lisa Tamburello, Vicki Whiting, and Greg Wynn (Tallahassee Biology Laboratory). 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

Habitat quality was suboptimal at both the Moriah Creek reference site (with 97 points) and at the Rattlesnake Branch reference site (83 points). Habitat quality declined into the marginal range at the Rattlesnake Branch test site (with 60 points). Water velocity, which was very slow (ranging from 0.02 to 0.07 m/s) at all three sites, was one factor responsible for low habitat assessment scores. In-stream substrates were fairly limited at all three stations, but especially at the test site, which scored only 2 points for available substrate. All three sites had evidence of previous artificial channelization and present bank instability. Riparian zone buffer width and vegetation quality were reduced at the Rattlesnake Branch reference and test sites.

There were some differences in the physical/chemical measurements between the reference and test sites. Dissolved oxygen was 8.2 mg/L at the Moriah Creek reference site, 9.0 mg/L at the Rattlesnake Branch reference site, and 8.4 mg/L at the test site. The temperature at the Moriah Creek reference site (9.4 °C) was higher than that found at the Rattlesnake Branch reference site (5.8 °C) or the test site (8.0 °C). Specific conductance varied from 380 µmhos/cm at the Moriah Creek reference site, to 900 µmhos/cm at the Rattlesnake Branch reference site, to 1,000 µmhos/cm at the test site. Higher conductivity in Rattlesnake Branch may be the result of occasional tidal exchange. Rattlesnake Branch is located near a more estuarine portion of the St. Marks River than is Moriah Creek. The pH at all three sites (7.7 SU at Moriah Creek, 8.1 at the Rattlesnake Branch reference site, and 7.7 SU at the test site) indicated slightly alkaline conditions.

Bromodichloromethane (0.75 µg/L) and chloroform (2.7 µg/L) were detected in the effluent. These concentrations are less than acutely toxic levels.

The full strength effluent sample was not acutely toxic to the invertebrate, *Ceriodaphnia dubia,* or to the fish, *Cyprinella leedsi* (Appendix).

Metals found above minimum detection limits included iron (119 µg/L) in the effluent, and cadmium (0.12 µg/L), copper (less than 10 µg/L), and iron 75 µg/L) at the test site. All metals concentrations complied with Class III water quality standards.

Fecal coliform bacteria violations were observed at both the Rattlesnake Branch reference site (4,700 organisms/100 mL) and the Rattlesnake Branch test site (3,700 organisms/100 mL) (Rule 62-302.530(6) FAC). The effluent, with 2 organisms/100 mL, did not appear to be the source of the fecal coliform contamination. Water at the Moriah Creek reference site contained 470 fecal organisms/100 mL (indicating compliance with the Class III fecal coliform standard). Total coliform violations were found at both the Rattlesnake Branch reference site (7,700 organisms/100 mL) and the Rattlesnake Branch test site (5,600 organisms/100 mL) (Rule 62-302.530(7) FAC). Total coliforms in the effluent (240 organisms/100 mL) and at the Moriah Creek reference site (720 organisms/100 mL) complied with Class III water quality standards.

Nutrient concentrations were generally low in the effluent and at all receiving water stations (see Chemistry Summary Table).

The algal growth potential (AGP) results agreed with the nutrient results. AGP was very low (less than 1 mg dry wt/L) in the effluent sample, and at all three receiving water stations, indicating no potential eutrophication problems.

Quantitative measures of benthic macroinvertebrate community health indicated that there was little effect from the discharge on the receiving water biota, which already appeared stressed. The Figure on p. 2 indicates the degree of difference between the invertebrate populations of the Rattlesnake Branch reference site and the test site. Larger differences (that is, higher percent-

ages) correspond with greater degrees of degradation. Negative values mean the test site is better than the reference.

In the Hester-Dendy samples, taxa richness, with 7 taxa at both the Rattlesnake Branch reference and test sites, was very low (less than that found in approximately 88% of other Florida streams). Similarly, Florida Index scores of only one point at the reference and test sites alike, indicated stressed conditions. Shannon-Weaver diversity values (1.8 at the reference site and 1.5 at the Rattlesnake Branch test site) were also depressed. The EPT Index was abnormally low (zero) at both sites. Note that with the exception of a slight decrease in the % filter feeders (from 3.4% at the reference site to 1.4% at the test site) there was little difference between the Rattlesnake Branch reference and test sites with regard to these measures of community health. This suggests the stream was already stressed for reasons other than the discharge (*e.g.*, poor habitat, stormwater inputs, elevated conductivity). The adjacent Moriah Creek reference site fared somewhat better than both Rattlesnake Branch sites. The EPT Index there was 2, while the Shannon-Weaver diversity was 3.2.

Qualitative (dip net) measures of the invertebrate community generally coincided with the Hester-Dendy results. The Stream Condition Index (SCI), which summarizes seven different measures of stream biological health, ranked the Rattlesnake Branch reference site (with 17 SCI points) in the "poor" category, and the test site (with 21 SCI points) in the lowest range of the "good" category. These results also suggest the discharge was certainly not exacerbating the already disturbed conditions in Rattlesnake Branch.

The Figure on p. 3 represents changes in the phytoplankton algal community. As was noted with the macroinvertebrates, larger differences (that is, higher percentages) correspond with greater degrees of degradation. Both phytoplankton (free-water) and periphyton (attached) algal populations were sampled for this bioassessment. Since the periphytometers were lost at the test site, the phytoplankton data will be used. Phytoplankton taxa richness and diversity were lower at the Rattlesnake Branch reference site (10 taxa, diversity of 2.0) compared with the test site (with 15 taxa and a diversity of 3.7). Algal density and chlorophyll *a* were very low at both the Rattlesnake Branch reference site and the test site, corresponding to the AGPs. The Moriah Creek phytoplankton population was generally similar to that of Rattlesnake Branch.

Conclusions

Bromodichloromethane (0.75 µg/L) and chloroform (2.7 µg/L) were detected in the effluent at less than acutely toxic concentrations.

The full strength effluent sample was not acutely toxic to the invertebrate, *Ceriodaphnia dubia,* or to the fish, *Cyprinella leedsi.*

No metals were found in the effluent or at the test site at levels exceeding Class III water quality standards.

Fecal coliform bacteria violations were observed at both the Rattlesnake Branch reference site (4,700 organisms/100 mL) and the Rattlesnake Branch test site (3,700 organisms/100 mL) (Rule 62-302.530(6) FAC). Total coliform violations were also found at the Rattlesnake Branch reference site (7,700 organisms/100 mL) and the Rattlesnake Branch test site (5,600 organisms/100 mL) (Rule 62-302.530(7) FAC). The effluent, with relatively low fecal and total coliforms, was not responsible for the violations. Other sources of bacterial contamination to Rattlesnake Branch should be investigated.

Nutrient concentrations were generally low in the effluent and at all receiving water stations.

The algal growth potential was very low (less than 1 mg dry wt/L) in the effluent sample, and at all three receiving water stations, indicating no potential eutrophication problems.

Quantitative (Hester-Dendy) measures of benthic macroinvertebrate community health indicated that Rattlesnake Branch was already stressed for reasons other than the discharge (*e.g.*, poor habitat, stormwater inputs, elevated conductivities). The Stream Condition Index (SCI), ranked the Rattlesnake Branch reference site (with 17 SCI points) in the "poor" category, and the test site (with 21 SCI points) in the lowest range of the "good" category. These results also suggest that the discharge was not exacerbating the already disturbed conditions in Rattlesnake Branch.

Phytoplankton algal density and chlorophyll *a* were very low at both the Rattlesnake Branch reference site and the test site, corresponding to the AGPs. The Moriah Creek phytoplankton population was generally similar to that of Rattlesnake Branch.

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Chemistry summary table for St. Marks Refining Co	Effluent	Moriah Ck. Reference Site	Rattlesnake Br. Reference Site	Rattlesnake Br. Test Site
Organic Constituents (ug/L)				
Bromodichloromethane	0.75 I			
Oil and Grease (mg/L)	1.0 U		1.0 U	1.0 U
Chloroform	2.7			
Metals (ug/L)				
Aluminum	100 U			100 U
Arsenic	10 U			10 U
Cadmium	0.080 U			0.12 I
Copper	3 U			10 K
Chromium	10 U			10 U
Iron	119			75
Lead	10 U			10 U
Mercury	0.10 U			0.10 U
Nickel	4 U			4 U
Selenium	30 U			30 U
Silver	0.5 U			0.050 U
Zinc	10 U			10 U
Nutrients (mg/L)				
Ortho-phosphate	0.020 U	0.020 U	0.020 U	0.020 U
Total phosphorus	0.015 U	0.015 U	0.018 I	0.030 I
Ammonia	0.020 U	0.020 U	0.020 U	0.076
Nitrate+Nitrite	0.028 I	0.020 U	0.020 U	0.020 U
TKN	0.49	0.18	0.37	0.43
General Phys-Chem Parameters				
Habitat Assessment		97	83	60
D.O. (mg/L)	9.0	8.2	9.0	8.4
pH (SU)	8.1	7.7	8.1	7.7
Specific Conductance (µmhos/cm)	520	380	900	1,000
Temperature (°C)		9.4	5.8	8.0
Total Suspended Solids (mg/L)	2 U			
Biological Oxygen Demand, 5 day (mg/L)	1.75 A			
COD (mg/L)	26			
Sulfate (mg SO4/L)	14 A			
Hardness (mg CaCO3)	197.5			
Algal Growth Potential (mg dry wt/L)	0.4	0.3	0.3	0.6
Toxicity				
Bioassay Fish	Not Toxic			
Bioassay Invertebrate	Not Toxic			
Microbiological Communities (org/100 mL)				
Fecal Coliform	2	470	4,700	3,700
Total Coliform	240	720	7,700	5,600
Escherichia coli	1 K	400	4,300	3,300

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

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

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


Spring
Brewer Spring
Newport
Lookout Tower
St Marks NWR Work Center
Sand Pit
Substation
MORIAH CK. REFERENCE SITE
Moriah Creek
FORBES PURCHASE
SEABOARD
Branch
River
St Marks
Strickland Landing
RATTLESNAKE REFERENCE SITE
TEST SITE
DISCHARGE
St Marks
St Marks Cem
Pier
Gaging Station
BM 4.5
BM 4.0
BM 3.9
BM 3.6
BM 6.0
BM 3.3
BM 2.0
22
23
24
25
26
27
30
31
34
35
36
6
21
11
98
30
363
267
59
1.6
1.5
6.5
4.5

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

FACILITY SUMMARY

Facility Name: St. Marks (Seminole) Refining Co.*		**Date Summary Prepared :** 1/8/96
Location (attach detailed map): 400 Port Leon Drive St. Marks, FL 32433	**County** Wakulla	**District** Northwest
Federal Permit # and expiration date: # FL0035220 10/31/99	**State GMS # and State expiration date:** #1065P02700 9/30/96	**Facility Type:** (Industrial) Municipal Federal Agricultural Other (list):

Function of facility: The St. Marks Refining Co. is designed as a 20,000 barrel per day crude oil refinery. At the present time, St. Marks Refinery is serving as a storage and distribution facility only. Currently, it has no process water to discharge.

Description of treatment process:

Treatment and disposal of stormwater and of contaminated non-contact river water. Treatment is provided by four surface impoundments with discharge to the ground water and to class III waters of the St. Marks River.

Receiving waters: Ditch to Rattlesnake Branch to St.Marks River	**Classification:** I II (III)	
Design Flow: 0.43MGD	**Mean Flow:** none	**Flow during survey:** no flow

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

therefore, the best time to sample is: No discharge

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

The facility has a mixing zone for oils & grease, arsenic, cadmium, iron, lead, and zinc. The mixing zone includes 340 feet of the drainage ditch and1,020 feet of the mosquito ditch originating at the Point of Discharge of the effluent to the point where the mosquito ditch meets the St. Marks River.

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

Parameter		Limit (units)
Flow	Daily	0.43MGD
BOD5	Twice/month	106.7 lbs/day monthly avg 200.7 lbs/day max
TSS	Twice/month	90 lbs/day monthly avg 141 lbs/day max
COD	Twice/month	534 lbs/day monthly avg 1033.5 lbs/day max
Sulfide	Twice/month	0.60 lbs/day monthly avg 1.34 lbs/day max
pH	Twice/month	6.0-8.5 or within one unit of the background
Temperature	Daily	No more than 5°F > ambient
Ammonia(unionized)	One/month	0.02 mg/l

Cadmium	One/month	
Phenols	One/month	Rule 17-302.510 (5)(m)
Oils & Grease	One/month	-
Iron	One/month	-

Permit Limits, Continued

Lead	One/month	-
Arsenic	One/month	-
Zinc	One/month	-

The following parameters will be monitored at the edge of the mixing zone:

Oil & Grease	One/month	5 mg/l
Iron	One/month	1.0 mg/l
Arsenic	One/month	50 ug/l
Cadmium	One/month	**
Lead	One/month	**
Zinc	One/month	**

**limitation dependent upon hardness. See Rule 17-302.560, F.A.C.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

FACILITY SUMMARY

(Facility)

Description of permitted outfall(s):

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

No permit violations due to no flow.

8/25/95: Over filling of TK-21 with No.6 oil causing a spill of less than 500 gallons of product. Spill was contained and cleaned up with no effects to surface waters. Contaminated soil was removed.

9/29/95: Inspection of the site addressed the spill on 8/25/95 and determined the facility to have unsatisfactory Operation & Maintenance due to leaking tanks and contaminated soil.

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

Consent Order 84-0199 (Seminole Refining Corp): Consent order was written to address groundwater and soil contamination at the site. "Upon the sale of the property, Seminole Refining Corp. will remain solely liable for the assessment and cleanup of any contamination existing on the property on the date of closing."

Some of the site contaminates include: Oils & Grease (Polynuclear Aromatic Hydrocarbons, Total Recoverable Petroleum Hydrocarbons), Phenol, VOA's, Methyl Ter-Buryl Ether(MTBE), and Benzene Toluene Ethelbenzene Xylene (BTEX). Monitoring Well contaminates are not provided due to the unavailability of the Contamination Assessment Report as well as other documents.

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

Additional information:

*The Seminole Refining Corp. sold the refinery to St.Marks Refining in 1992. Seminole Refining Corp. is responsible for the cleanup of existing soils and groundwater contamination at the site (Consent Order 84-0199).

Staff contributing to this review (signature):

	(Biologist)
	(Inspector)
	(Engineer)
Lisa Kelley Co-op	(Other)
	( )
	( )

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 5)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		4/22/14	1150	Morrison Creek

REMARKS:	LOCATION:	FIELD ID/NAME:
	Morrison Creek	Reference site

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
80				10		10	

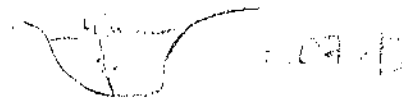
Local Watershed Erosion (check box): None ☐ Slight ☐ Moderate ☑ Heavy ☐

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

Width of riparian vegetation (m) on least buffered side: 20 m

List & map dominant vegetation on back

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect (draw cross-section & provide at least 3 velocity & depth values)



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

Artificially Impounded ☐ yes

High Water Mark (m above bed): 1.5

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)	3	3		Sand	20	2	
Leaf Packs or Mats	15	5		Mud/Muck/Silt	50		
Aquatic Vegetation		5		Other:			
Rock or Shell Rubble				Other:			
Undercut Banks/Roots	9	5		*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	D.S	9.4	7.72	0.15	38			
Mid-depth								
Bottom								

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:

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

SAMPLING TEAM:	SIGNATURE:	DATE:
LT, BR		4/22/14

.4 m Lip

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (v2)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		12/18/95	Moriah Creek

REMARKS:	LOCATION:	FIELD ID/NAME:
MORIAH Reference Site	Newport cut #4	REFERENCE Moriah Creek

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Bottom Substrate/ Available Cover [10]	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs (partially decayed), undercut banks, rubble, or other stable habitat. 20 19 18 17 16	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat, frequently disturbed or removed. (10) 9 8 7 6	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious, substrates unstable. 5 4 3 2 1
Water Velocity [6]	Max. observed: >0.25 m/sec. but < 2 m/sec 20 19 18 17 16	Max. observed; 0.1 to 0.25 m/sec 15 14 13 12 11	Max. observed; 0.05 to 0.1 m/sec 10 9 8 7 (6)	Max. observed; <0.05 m/sec, or spate occurring; > 2 m/sec 5 4 3 2 1
Artificial Channelization [9]	No artificial channelization or dredging. Stream with normal, sinuous pattern 20 19 18 17 16	May have been channelized in the past (>20 yrs), but mostly recovered, fairly good sinuous pattern 15 14 13 12 11	Channelized, somewhat recovered, but > 80% of area affected 10 (9) 8 7 6	Artificially channelized, box-cut banks, straight, instream habitat highly altered 5 4 3 2 1
Deposition [20]	Less than 20% of habitats affected by sand or silt accumulation (20) 19 18 17 16	20%-50% of habitats affected by sand or silt accumulation 15 14 13 12 11	Smothering of 50%-80% of habitats with sand or silt, pools shallow, frequent sediment movement 10 9 8 7 6	Smothering of >80% of habitats with sand or silt, a severe problem, pools absent 5 4 3 2 1
Bank Stability [13]	Stable. No evidence of erosion or bank failure. Little potential for future problems. 20 19 18 17 16	Moderately stable. Infrequent or small areas of erosion, mostly healed over. 15 14 (13) 12 11	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. 10 9 8 7 6	Unstable. Many (60%-80%) raw, eroded areas. Obvious bank sloughing. 5 4 3 2 1
Riparian Buffer Zone Width [20]	Width of native vegetation (least buffered side) greater than 18 m (20) 19 18 17 16	Width of native vegetation (least buffered side) 12 m to 18 m 15 14 13 12 11	Width of native vegetation 6 to 12 m, human activities still close to system 10 9 8 7 6	Less than 6 m of native buffer zone due to intensive human activities 5 4 3 2 1
Riparian Zone Vegetation Quality [19]	Over 80% of streambank surfaces consist of native plants, including trees understory shrubs, or non-woody macrophytes. Plants growing naturally. 20 (19) 18 17 16	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. Some disruption in community evident. 15 14 13 12 11	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. Patches of bare soil or closely cropped vegetation, disruption obvious. 10 9 8 7 6	Less than 25% of streambank surfaces are vegetated. Poor plant community (*e.g.* grass monoculture or exotics) present. Vegetation removed to stubble height of 2 inches or less. 5 4 3 2 1

[ ] Add **5 points** if cross-sectional area of flow is estimated to be > one square meter during periods of normal flow.

Comments

[97] **TOTAL SCORE**

ANALYSIS DATE:	ANALYST:	SIGNATURE:
	VW, LT	

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 5)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		1/22/14	9:47	Rattlesnake Branch

REMARKS:	LOCATION:	FIELD ID/NAME:
RATTLESNAKE Reference	Behind St. Mark's Refinery	Rattlesnake Ref

RIPARIAN ZONE/INSTREAM FEATURES

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

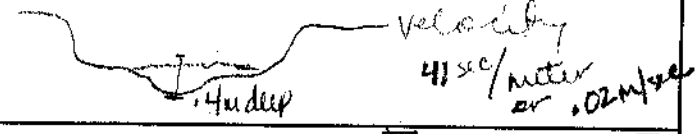
Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
40%	5%			5%	5%	45%	

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

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

Width of riparian vegetation (m) on least buffered side:	List & map dominant vegetation on back
20m	

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect (draw cross-section & provide at least 3 velocity & depth values)



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

Artificially Impounded ☐ yes

High Water Mark (m above bed): .7m

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)	10	6 ✓		Sand	30	1 ✓	
Leaf Packs or Mats	20	8 ✓		Mud/Muck/Silt	65	1 ✓	
Aquatic Vegetation	1	1 ✓		Other:			
Rock or Shell Rubble				Other:			
Undercut Banks/Roots	2	3		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		5.8	8.12	9.0	900			
Mid-depth								
Bottom								

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: cold, clear | When picked up HD black oil sheen was seen

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

SAMPLING TEAM:	SIGNATURE:	DATE:
VW, TS	Vicki Wintz	1/22/14

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (v2)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		12/29/95	Rattlesnake Branch above POD

REMARKS:	LOCATION:	FIELD ID/NAME:
St. Mark's above POD RATTLESNAKE REFERENCE	Inland St. Marks Refinery	REFERENCE Rattlesnake Brch

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Bottom Substrate/ Available Cover [10]	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs (partially decayed), undercut banks, rubble, or other stable habitat. 20 19 18 17 16	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat, frequently disturbed or removed. (10) 9 8 7 6	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious, substrates unstable. 5 4 3 2 1
Water Velocity [1]	Max. observed: >0.25 m/sec. but < 2 m/sec 20 19 18 17 16	Max. observed; 0.1 to 0.25 m/sec 15 14 13 12 11	Max. observed; 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed; <0.05 m/sec, or spate occurring; > 2 m/sec 5 4 3 2 (1)
Artificial Channelization [15]	No artificial channelization or dredging. Stream with normal, sinuous pattern 20 19 18 17 16	May have been channelized in the past (>20 yrs), but mostly recovered, fairly good sinuous pattern (15) 14 13 12 11	Channelized, somewhat recovered, but > 80% of area affected 10 9 8 7 6	Artificially channelized, box-cut banks, straight, instream habitat highly altered 5 4 3 2 1
Deposition [20]	Less than 20% of habitats affected by sand or silt accumulation (20) 19 18 17 16	20%-50% of habitats affected by sand or silt accumulation 15 14 13 12 11	Smothering of 50%-80% of habitats with sand or silt, pools shallow, frequent sediment movement 10 9 8 7 6	Smothering of >80% of habitats with sand or silt, a severe problem, pools absent 5 4 3 2 1
Bank Stability [14]	Stable. No evidence of erosion or bank failure. Little potential for future problems. 20 19 18 17 16	Moderately stable. Infrequent or small areas of erosion, mostly healed over. 15 (14) 13 12 11	Moderately unstable. Moderate areas of erosion, high erosion potential during floods 10 9 8 7 6	Unstable. Many (60%-80%) raw, eroded areas. Obvious bank sloughing. 5 4 3 2 1
Riparian Buffer Zone Width [13]	Width of native vegetation (least buffered side) greater than 18 m 20 19 18 17 16	Width of native vegetation (least buffered side) 12 m to 18 m 15 14 (13) 12 11	Width of native vegetation 6 to 12 m, human activities still close to system 10 9 8 7 6	Less than 6 m of native buffer zone due to intensive human activities 5 4 3 2 1
Riparian Zone Vegetation Quality [10]	Over 80% of streambank surfaces consist of native plants, including trees understory shrubs, or non-woody macrophytes. Plants growing naturally. 20 19 18 17 16	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. Some disruption in community evident. 15 14 13 12 11	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. Patches of bare soil or closely cropped vegetation, disruption obvious. (10) 9 8 7 6	Less than 25% of streambank surfaces are vegetated. Poor plant community (*e.g.* grass monoculture or exotics) present. Vegetation removed to stubble height of 2 inches or less. 5 4 3 2 1

[ ] Add 5 points if cross-sectional area of flow is estimated to be > one square meter during periods of normal flow.

[43] **TOTAL SCORE**

Comments: low tide

ANALYSIS DATE:	ANALYST:	SIGNATURE:
12/29/95	VW, LB	Vicki Whiting

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 5)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y): 7/23/96	TIME: 1015	RECEIVING BODY OF WATER: Rattlesnake Bend

REMARKS: below POD TEST SITE	LOCATION: St Marks Refuge	FIELD ID/NAME: Test Station C

RIPARIAN ZONE/INSTREAM FEATURES

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

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

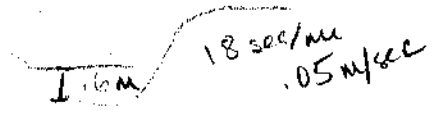
Local Watershed Erosion (check box): None ☐ Slight ☐ Moderate ☑ Heavy ☐

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

Width of riparian vegetation (m) on least buffered side: 8m

List & map dominant vegetation on back

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect (draw cross-section & provide at least 3 velocity & depth values)



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

Artificially Impounded ☐ yes

High Water Mark (m above bed): 3m

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)		6		Sand			
Leaf Packs or Mats	5	11		Mud/Muck/Silt	5	2	
Aquatic Vegetation				Other:			
Rock or Shell Rubble				Other:			
Undercut Banks/Roots	5	2		*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	0.6	28	7.68	8.35	1000			
Mid-depth								
Bottom								

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:

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

SAMPLING TEAM:	SIGNATURE:	DATE:
ET, BR		

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (v2)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		12/18/95	Rattlesnake Branch

REMARKS:	LOCATION:	FIELD ID/NAME:
Test Site	Below plant	TEST Rattlesnake Branch

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Bottom Substrate/ Available Cover [2]	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs (partially decayed), undercut banks, rubble, or other stable habitat. 20 19 18 17 16	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious, substrates unstable. 5 4 3 (2) 1
Water Velocity [1]	Max. observed: >0.25 m/sec. but < 2 m/sec 20 19 18 17 16	Max. observed; 0.1 to 0.25 m/sec 15 14 13 12 11	Max. observed; 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed; <0.05 m/sec, or spate occurring; > 2 m/sec 5 4 3 2 (1)
Artificial Channelization [8]	No artificial channelization or dredging. Stream with normal, sinuous pattern 20 19 18 17 16	May have been channelized in the past (>20 yrs), but mostly recovered, fairly good sinuous pattern 15 14 13 12 11	Channelized, somewhat recovered, but > 80% of area affected 10 9 (8) 7 6	Artificially channelized, box-cut banks, straight, instream habitat highly altered 5 4 3 2 1
Deposition [18]	Less than 20% of habitats affected by sand or silt accumulation 20 19 (18) 17 16	20%-50% of habitats affected by sand or silt accumulation 15 14 13 12 11	Smothering of 50%-80% of habitats with sand or silt, pools shallow, frequent sediment movement 10 9 8 7 6	Smothering of >80% of habitats with sand or silt, a severe problem, pools absent 5 4 3 2 1
Bank Stability [12]	Stable. No evidence of erosion or bank failure. Little potential for future problems. 20 19 18 17 16	Moderately stable. Infrequent or small areas of erosion, mostly healed over. 15 14 (13) 12 11	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. 10 9 8 7 6	Unstable. Many (60%-80%) raw, eroded areas. Obvious bank sloughing. 5 4 3 2 1
Riparian Buffer Zone Width [10]	Width of native vegetation (least buffered side) greater than 18 m 20 19 18 17 16	Width of native vegetation (least buffered side) 12 m to 18 m 15 14 13 12 11	Width of native vegetation 6 to 12 m, human activities still close to system (10) 9 8 7 6	Less than 6 m of native buffer zone due to intensive human activities 5 4 3 2 1
Riparian Zone Vegetation Quality [8]	Over 80% of streambank surfaces consist of native plants, including trees understory shrubs, or non-woody macrophytes. Plants growing naturally. 20 19 18 17 16	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. Some disruption in community evident. 15 14 13 12 11	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. Patches of bare soil or closely cropped vegetation, disruption obvious. 10 9 (8) 7 6	Less than 25% of streambank surfaces are vegetated. Poor plant community (*e.g.* grass monoculture or exotics) present. Vegetation removed to stubble height of 2 inches or less. 5 4 3 2 1

[ ] Add 5 **points** if cross-sectional area of flow is estimated to be > one square meter during periods of normal flow.

Comments

[60] **TOTAL SCORE**

ANALYSIS DATE:	ANALYST:	SIGNATURE:
	VW, LT	

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: St. Marks Refinery
County: Wakulla
Contact / District: Ricki Whiting / Biology Staff
NPDES Permit #: FL00
LIMS Sample #: 122641 LIMS Job #: 96-JAN-23-08

Sample Collection: Date 1-22-96 Time 1135
Test Beginning: Date 1-23-96 Time 1030
Test Ending: Date 1-25-96 Time 1030
Organism Batch #: 5 Diluent Batch #: 3
Organism Age: < 24 hours
Test Organism: Ceriodaphnia dubia

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	21.8 @ 21.7	8.1 @ 25.8 °C	107.2 @ 106.2 1024 @ 1025 @ 24.9 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.1 @ 23.2	8.1 @ 26.0 °C	1078 @ 106.2 1027 @ 1025 @ 24.9 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	20.7 @ 20.7	8.2 @ 24.7 °C	107.2 @ 106.2 1023 @ 1025 @ 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
Control A	A	5	5	5	8.2		8.3	23.10		24.7	8.0		8.0	165		185
Control B	B	5	5	5			8.3			24.7			7.9			195
Control C	C	5	5	5			8.3			24.6			7.9			195
Control D	D	5	5	5			8.3			24.5			8.0			190
100% A	A	5	5	5	8.1		8.3	24.2		24.5	9.0		8.0	490		435
100% B	B	5	5	5			8.3			24.5			7.9			460
100% C	C	5	5	5			8.3			24.5			8.0			455
100% D	D	5	5	5			8.3			24.4			8.1			460
Measured/Loaded by:		TM	MF	TM	MF		JLS	MF		JLS	MF		JLS	MF		JLS
Recorded by:		MF	MF	TM	TM		TM	TM		TM	TM		TM	TM		TM

Investigators' Signatures
Marshall Faircloth
Tina Mitchell
[illegible]
Robin C. Kaler
Jennifer Sancapini

reviewer

form updated 5/05/95

	Salt Water / Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			—	—	—
Lab Total Residual Cl2 (mg/L):	—	<0.03	<0.03	DR100	TM
Alkalinity (mg/L as $CaCO_3$):	—	70	140	Hach	TR
Hardness (mg/L as $CaCO_3$):	—	80	90	Hach	TR
Total ammonia (mg/L as N):	—	<0.017	<0.017	Orion	JN

Ammonia Meter #98136 Ammonia Meter Slope: -58.4 Ammonia Blank: <0.017 Control Salinity: 0 ppt Sample Salinity: 0 ppt

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: St. Marks Refinery
County: Wakulla
Contact / District: Vicki Whiting / Biology STAFF
NPDES Permit #: FL00
LIMS Sample #: 127641 (sample log 1-30-96) LIMS Job #: 96-JAN-23-08

Sample Collection: Date 1-22-96 Time 1135
Test Beginning: Date 1-23-96 Time 1030
Test Ending: Date 1-25-96 Time 1030
Organism Batch #: #443 Diluent Batch #: uncl
Organism Age: 12 days
5 *wrong # control mf 1/23/96
Test Organism: C. ludsi (Cyprinella lutrensis)

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	21.8 @ 21.7	8.1 @ 25.8 °C	1022 @ 1062 1024 @ 1025 @ 24.9 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.1 @ 23.2	8.1 @ 26.0 °C	1078 @ 1062 1027 @ 1025 @ 24.9 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	20.7 @ 20.7	8.2 @ 24.7 °C	1072 @ 1062 1023 @ 1023 @ 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
Control A	G1	5	5	5	7.8	8.3	8.4	24.8	23.8	23.0	7.7	7.8	8.1	255	250	250
Control B	G2	5	5	5	7.8	8.3	8.4	24.8	23.7	23.0	7.7	7.8	8.1	255	250	250
Control C	G3	5	5	5	7.8	8.3	8.4	24.8	23.6	22.9	7.6	7.8	8.1	255	250	250
Control D	G4	5	5	5	7.8	8.3	8.4	24.9	23.6	23.2	7.6	7.7	8.1	255	250	250
100% A	G5	5	5	5	8.1	8.4	8.3	24.7	23.6	23.1	8.9	7.8	8.1	520	500	485
100% B	G6	5	5	5	8.1	8.4	8.3	24.7	23.6	23.0	9.0	7.8	8.1	520	500	480
100% C	G7	5	5	5	8.1	8.4	8.3	24.7	23.6	23.0	9.0	7.8	8.2	520	500	485
100% D	G8	5	5	5	8.1	8.4	8.3	24.8	23.6	23.1	9.0	7.9	8.1	520	500	485
Measured/Loaded by:		TM	MF	TM	MF	MF	JS	MF	MF	JS	MF	MF	JS	MF	MF	JS
Recorded by:		MF	MF	TM	TM	MF	MF	TM	MF	MF	TM	MF	MF	TM	MF	TM

Investigators' Signatures
Marshall Faircloth
Tina McKeller
[illegible]
[illegible]
Jennifer Sparapani

reviewer

form updated 5/05/95

Water Quality Parameters	Salt Water: Well Water / 20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):		—	—	—
Lab Total Residual Cl2 (mg/L):	<0.03 / —	<0.03	DR-100	TM
Alkalinity (mg/L as $CaCO_3$):	125 / —	190	Hach	TR
Hardness (mg/L as $CaCO_3$):	140 / —	90	Hach	TR
Total ammonia (mg/L as N):	<0.017 / —	<0.017	Orion	JN

Ammonia Meter #98136 Ammonia Meter Slope: -58.4 Ammonia Blank: <0.017 Control Salinity: 0 ppt Sample Salinity: 0 ppt

RATTLESNAKE REFERENCE SITE

Winter Index Period: Stream Condition Index for Florida (SCI) (1996) Version 3

Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	Value	Panhandle (65, 75a)				Peninsula (75b, c, d)				Northeast (75e & f)			
		5	3	1	Score	5	3	1	Score	5	3	1	Score
Total Number of Taxa	21	≥26	25-13	<13	3	≥ 27	26-14	<14		≥18	17-9	<9	
EPT Index	0	≥6	5-3	<3	1	≥ 4	3-2	<2		-	≥3	<3	
# Chironomid Taxa	8	≥9	8-5	<5	3	≥9	8-5	<5		≥5	4-3	<3	
% Contribution of Dominant Taxon	29.7	≤25	26-62	>62	3	≤30	31-65	>65		≤44	45-72	>72	
% Diptera	31	-	≤60	>60	3	-	≤52	>52		-	≤67	>67	
Florida Index	6	≥ 13	12-7	<7	1	≥10	9-5	<5		≥ 6	5-3	<3	
% Suspension feeders/Filterers	7.9	≥ 13	12-7	<7	3	≥15	14-8	<8		≥ 32	31-16	<16	
Total Score		Panhandle			17	Peninsula				Northeast			
Interpretation of Score		Excellent			27-33	Excellent			27-33	Excellent			26-31
		Good			21-26	Good			21-26	Good			20-25
		Poor			14-20	Poor			14-20	Poor			14-19
		Severely Degraded			7-13	Severely Degraded			7-13	Severely Degraded			7-13

RATTLESNAKE TEST SITE

Winter Index Period: Stream Condition Index for Florida (SCI) (1996) Version 3

Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	Value	Panhandle (65, 75a)				Peninsula (75b, c, d)				Northeast (75e & f)			
		5	3	1	Score	5	3	1	Score	5	3	1	Score
Total Number of Taxa	25	≥26	25-13	<13	3	≥ 27	26-14	<14		≥18	17-9	<9	
EPT Index	0	≥6	5-3	<3	1	≥ 4	3-2	<2		-	≥3	<3	
# Chironomid Taxa	13	≥9	8-5	<5	5	≥9	8-5	<5		≥5	4-3	<3	
% Contribution of Dominant Taxon	22.1	≤25	26-62	>62	5	≤30	31-65	>65		≤44	45-72	>72	
% Diptera	42.5	-	≤60	>60	3	-	≤52	>52		-	≤67	>67	
Florida Index	9	≥ 13	12-7	<7	3	≥10	9-5	<5		≥ 6	5-3	<3	
% Suspension feeders/Filterers	3.1	≥ 13	12-7	<7	1	≥15	14-8	<8		≥ 32	31-16	<16	
Total Score		Panhandle			21	Peninsula				Northeast			
Interpretation of Score		Excellent			27-33	Excellent			27-33	Excellent			26-31
		Good			21-26	Good			21-26	Good			20-25
		Poor			14-20	Poor			14-20	Poor			14-19
		Severely Degraded			7-13	Severely Degraded			7-13	Severely Degraded			7-13

MORIAH REFERENCE SITE

Winter Index Period: Stream Condition Index for Florida (SCI) (1996) Version 3													
Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	Value	**Panhandle (65, 75a)**				**Peninsula (75b, c, d)**				**Northeast (75e & f)**			
		5	3	1	Score	5	3	1	Score	5	3	1	Score
Total Number of Taxa	29	≥26	25-13	<13	5	≥ 27	26-14	<14		≥18	17-9	<9	
EPT Index	1	≥6	5-3	<3	1	≥ 4	3-2	<2		-	≥3	<3	
# Chironomid Taxa	13	≥9	8-5	<5	5	≥9	8-5	<5		≥5	4-3	<3	
% Contribution of Dominant Taxon	27.8	≤25	26-62	>62	3	≤30	31-65	>65		≤44	45-72	>72	
% Diptera	20	-	≤60	>60	3	-	≤52	>52		-	≤67	>67	
Florida Index	5	≥ 13	12-7	<7	1	≥10	9-5	<5		≥ 6	5-3	<3	
% Suspension feeders/Filterers	9.6	≥ 13	12-7	<7	3	≥15	14-8	<8		≥ 32	31-16	<16	
Total Score		**Panhandle**			21	**Peninsula**				**Northeast**			
Interpretation of Score		**Excellent**			**27-33**	**Excellent**			**27-33**	**Excellent**			**26-31**
		Good			**21-26**	**Good**			**21-26**	**Good**			**20-25**
		Poor			**14-20**	**Poor**			**14-20**	**Poor**			**14-19**
		Severely Degraded			**7-13**	**Severely Degraded**			**7-13**	**Severely Degraded**			**7-13**

Winter Index Period: Stream Condition Index for Florida (SCI) (1996) Version 3													
Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	Value	**Panhandle (65, 75a)**				**Peninsula (75b, c, d)**				**Northeast (75e & f)**			
		5	3	1	Score	5	3	1	Score	5	3	1	Score
Total Number of Taxa		≥26	25-13	<13		≥ 27	26-14	<14		≥18	17-9	<9	
EPT Index		≥6	5-3	<3		≥ 4	3-2	<2		-	≥3	<3	
# Chironomid Taxa		≥9	8-5	<5		≥9	8-5	<5		≥5	4-3	<3	
% Contribution of Dominant Taxon		≤25	26-62	>62		≤30	31-65	>65		≤44	45-72	>72	
% Diptera		-	≤60	>60		-	≤52	>52		-	≤67	>67	
Florida Index		≥ 13	12-7	<7		≥10	9-5	<5		≥ 6	5-3	<3	
% Suspension feeders/Filterers		≥ 13	12-7	<7		≥15	14-8	<8		≥ 32	31-16	<16	
Total Score		**Panhandle**				**Peninsula**				**Northeast**			
Interpretation of Score		**Excellent**			**27-33**	**Excellent**			**27-33**	**Excellent**			**26-31**
		Good			**21-26**	**Good**			**21-26**	**Good**			**20-25**
		Poor			**14-20**	**Poor**			**14-20**	**Poor**			**14-19**
		Severely Degraded			**7-13**	**Severely Degraded**			**7-13**	**Severely Degraded**			**7-13**

Benthic macroinverebrate taxa list for St. Marks Refining, collected via Hester-Dendy artificial substrates on 22 January, 1996. Densities, in number/m^2 represent the mean of three replicates.

	Moriah Creek Reference Site	Rattlesnake Branch Reference Site	Rattlesnake Branch Test Site
Gastropoda			
Amnicola dalli johnsoni	3	–	–
Micromenetus dilatatus	3	–	–
Neritina reclivata	–	16	3
Isopoda			
Caecidotea sp.	13	50	–
Lirceus sp.	13	–	–
Sphaeroma terebrans	–	–	3
Amphipoda			
Gammarus sp.	–	3	–
Hyalella azteca	3	5	69
Ephemeroptera			
Caenis sp.	3	–	–
Stenacron interpunctatum	8	–	–
Odonata			
Ischnura posita	–	–	3
Coleoptera			
Macronychus glabratus	3	–	–
Chironomidae			
Dicrotendipes simpsoni	–	–	3
Microtendipes pedellus grp.	3	–	–
Polypedilum illinoense grp	–	–	13
Polypedilum trigonum	–	3	–
Tanytarsus sp. C Epler	3	3	–
Tanytarsus sp. D Epler	–	3	–
Tanytarsus sp. T Epler	3	–	–
Undetermined Chironomidae	3	–	3

Benthic macroinvertebrate taxa list for St. Marks Refinery, collected via 20 discrete dipnet sweeps, on 22 January, 1996.

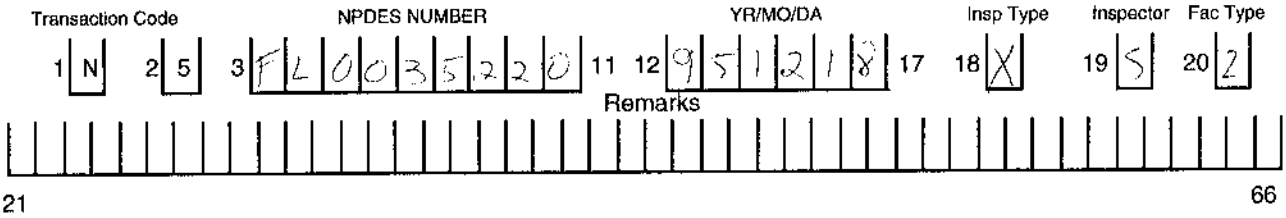
	Moriah Creek Reference Site	Rattlesnake Branch Reference Site	Rattlesnake Branch Test Site
Polychaeta			
Streblospio benedicti	–	–	4
Oligochaeta			
Aulodrilus pigueti	1	1	1
Haber speciosus	1	1	–
Limnodrilus hoffmeisteri	2	11	1
Nais communis	–	–	1
Hirudinea			
Desserobdella phalera	2	–	–
Gastropoda			
Laevapex sp.	1	–	–
Littoridinops sp.	–	–	1
Neritina reclivata	2	4	17
Undetermined Hydrobiidae	7	–	1
Pelecypoda			
Corbicula fluminea	–	1	–
Undetermined Pisidiidae	7	9	–
Acarina			
Atractides sp.	1	–	–
Oribatei sp.	1	–	–
Piona sp.	–	2	–
Isopoda			
Caecidotea sp.	–	55	29
Lirceus sp.	1	–	–
Uromunna reynoldsi	–	25	8
Amphipoda			
Crangonyx sp.	–	1	2
Gammarus sp.	–	8	5
Hyalella azteca	17	1	–
Decapoda			
Palaemonetes paludosus	–	–	6
Collembola			
Isotomurus sp.	–	8	–
Ephemeroptera			
Caenis sp.	32	–	–
Odonata			
Ischnura sp.	–	–	1
Undetermined Coenagrionidae	–	–	1
Undetermined Odonata	4	–	–
Coleoptera			
Dubiraphia sp.	6	–	–
Hydroporus sp.	5	–	–
Undetermined Elmidae	2	–	–

Diptera			
Ablabesmyia rhamphe grp.	–	1	–
Chironomus sp.	–	1	4
Clinotanypus sp.	–	–	2
Coelotanypus sp.	1	–	–
Corynoneura sp.	1	–	–
Dicrotendipes lobus	–	–	1
Microtendipes pedellus grp.	5	–	–
Monopelopia boliekae	–	–	1
Nanocladius distinctus	1	–	1
Palpomyia/Bezzia grp.	–	2	1
Parametriocnemus sp.	1	1	3
Paratanytarsus sp. B Epler	1	–	–
Polypedilum sp.	–	2	1
Polypedilum halterale grp.	–	9	7
Polypedilum illinoense grp.	1	28	24
Polypedilum trigonum	1	–	–
Polypedilum tritum	–	–	1
Procladius sp.	–	3	2
Stenochironomus sp.	3	–	–
Stictochironomus devinctus	–	–	1
Tanytarsus sp.	–	–	2
Tanytarsus sp. G Epler	1	9	–
Tanytarsus sp. L Epler	1	–	–
Tanytarsus sp. T Epler	5	–	1
Tribelos jucundus	1	–	–
Undetermined Chironomidae	–	1	1

Phytoplankton taxa list for St. Marks Refinery, collected via water bottle grab samples, on 22 January, 1996.

	Moriah Creek Reference Site	Rattlesnake Branch Reference Site	Rattlesnake Branch Test Site
Cyanophyceae			
Anabaena sp.	–	10	–
Dactylococcopsis sp.	–	–	11
Lyngbya sp.	–	–	21
Oscillatoria sp.	10	10	11
Chrysophyceae			
Centritractis sp.	–	–	11
Bacillariophyceae			
Cyclotella sp.	–	–	11
Gyrosigma sp.	–	10	–
Navicula sp.	10	20	11
Nitzschia sp.	51	40	11
Surirella sp.	–	10	11
Synedra sp.	41	–	–
Pennales	31	–	–
Chlorophyceae			
Ankistrodesmus sp.	–	–	11
Chlamydomonas sp.	–	50	21
Chlorococcum sp.	–	–	11
Cosmarium sp.	–	–	11
Chlamydomonadaceae	–	–	11
Chlorophyceae	31	181	53
Euglenophyceae			
Euglena sp.	–	10	21
Trachelomonas sp.	–	10	–
Dinophyceae			
Gymnodinium sp.	–	–	42
Cryptophyceae			
Cryptomonas sp.	41	10	11

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)

