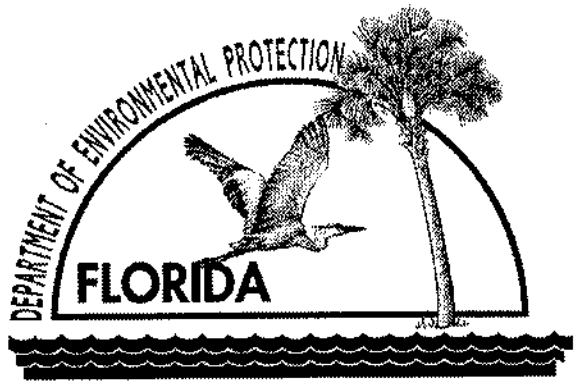


Biological Assessment of

Potash Corporation of Saskatchewan

(formerly Occidental Chemical Corporation)

Hamilton County

NPDES #FL0000655

Sampled November 1997

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

August 1998

Biology Section

Division of Administrative and Technical Services

Comprehensive Quality Assurance Plan No. 870346G

Department of Environmental Protection
Results of Fifth Year Inspections

Discharger: Potash Corporation of Saskatchewan
County: Hamilton
NPDES Number: FL0000655
State Permit Expiration Date: 5/28/2002

Toxics Sampling Inspection (XSI)

Date Sampled: 17 November 1997

Results: No pesticides or organic pollutants were detected in the effluent. Effluent metals complied with Class III water quality standards.

Compliance Biomonitoring Inspection (CBI)

Date Sampled: 17 November 1997

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

Impact Bioassessment Inspection (IBI)

Date Sampled: 10 November 1997

Results: The periphyton community at test site 1 did not appear to be negatively affected by the discharge. However, the phytoplankton at test site 1 (and test site 2 to a far lesser degree) exhibited symptoms of cultural eutrophication. Algal density at test site 1 was approximately two orders of magnitude higher than the control site, and chlorophyll *a* at test site 1 (28.7 µg/L) was higher than the values found in 90% of other Florida streams. This is interpreted to be a violation of Rule 62-302.530(48)(b) FAC, imbalances of aquatic flora or fauna. Several measures of macroinvertebrate community health indicated degradation associated with the Swift Creek discharge. The Shannon-Weaver Diversity Index decreased from 3.6 at the control site to 2.6 at test site 1 (a 28% reduction) which is a violation of the biological integrity criterion (Rule 62.302.530(11) FAC). Consistent with previous biological assessments in Swift Creek, pollution sensitive mayflies were virtually eliminated at test site 1.

Water Quality Inspection (WQI)

Date Sampled: 17 November 1997

Results: Fecal and total coliforms complied with Class III water quality standards at all sites. Extreme nutrient enrichment was observed at test site 1 (Swift Creek), where the phosphorus and nitrogen concentrations were greater than those found in 90% to 95% of other Florida streams. The AGP at test site 1 (65.5 mg dry wt/L) greatly exceeded the 5 mg dry wt/L "problem threshold" for freshwater systems. AGP at test site 2 (Hunter Creek = 7.5 mg dry wt/L) somewhat exceeded the "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 Potash Corporation of Saskatchewan (PCS) - Suwannee River Chemical Complex (formerly Occidental Chemical Corporation) operates two large phosphate mining and fertilizer manufacturing complexes in Hamilton County, Florida, near the town of White Springs (see maps in Appendix). The company mines phosphate rock and produces liquid and granular fertilizers, and animal feeds.

The subject of this investigation, the Suwannee River Chemical Complex, includes a process-water treatment area, gypsum stacks, cooling ponds, and associated process-water recirculation systems with 4.32 MGD (design capacity) emergency wastewater treatment facility. This facility provides for two-stage pH adjustment (with settling) and a contaminated non-process water retention system. Treated (double limed) process water and contaminated process water is discharged into the Class III Swift Creek (at in-stream sampling point 001) and eventually enters the Suwannee River, which is designated as an Outstanding Florida Water. Discharge of the treated process water occurs during extreme rainfall events.

The Suwannee River Mine consists of mining and beneficiation operations which include a phosphatic-clays settling system with recirculation to the mine's hydraulic system. Excess mining waters are accumulated primarily from rainfall events and discharged into Swift Creek and the Class III Hunter Creek (in-stream sampling point 002) which also flows into the Suwannee River.

Permit limits for outfall 001-4 (combined discharge from outfalls 001-2, 001-7, 001-8, 001-9, and 001-17) to Swift Creek and outfall 002-2 to Hunter Creek are listed in the Facility Summary in theAppendix. Limits for the individual outfalls that combine to form outfall 001-4 are also included. Past monthly operating reports list the following violation:. in October and December, 1996, as well as in March and April, 1997, there were violations of chronic freshwater toxicity standards. There were also pH limit violations in January, March, and May, 1997, attributed to swamp drainage into the system. This conclusion was supported by evaluation of pH results from upstream samples.

PCS has been conducting quarterly biological integrity sampling since the end of 1992. The Shannon-Weaver Index data indicate the sites have consistently been above the minimum standard (75% of background).

Methods

The focus of this investigation was to evaluate the discharger's effects on the receiving waters. A comparison of biological community health was made between a control site (located in Deep Creek, 30 to 50 meters east of Old River Road), test site 1 (the sampling point in Swift Creek specified by the permit, downstream of the mine), and test site 2 (located in Hunter Creek, 65 to 100 meters upstream of the bridge on County Road 135) (see maps in Appendix). Conditions at test site 1 represent the combined influences of the Suwannee River Chemical Complex and the Suwannee River Mine. Water from this location is considered to be "effluent" as well as "test site 1" samples. Test site 2 samples include runoff from the Suwannee River Mine. A habitat assessment was performed *in situ* to establish comparability between sites. Supplemental physical/chemical data were also collected at the effluent and study sites. The effluent was analyzed for metals and for organic constituents (base-neutral and acid extractables). Additionally, nutrient analyses were performed on the samples from control and test sites. Effluent nutrient samples were not collected. All water chemistry and effluent samples were collected on November 17, 1997. Methods used for all chemical analyses are on file at the DEP Central Chemistry Laboratory in Tallahassee.

Acute toxicity bioassays, using the water flea, *Ceriodaphnia dubia,* and the fish, *Cyprinella leedsi,* as test organisms, were performed on an effluent sample. Benthic macroinvertebrate communities were evaluated at control and test sites. Invertebrates were collected from multiple substrates (*e.g.*, snags, leaf packs, vegetation) on November 10, 1997, by using discrete dip-net sweeps. Additional invertebrate collections were accomplished on the same day using Hester-Dendy multiplate samplers, which had been incubated for 28 days. Periphyton were sampled on November 10, 1997, at control and test sites by collecting glass microscope slides that had been incubated in a standard periphytometer for 28 days. Periphyton racks and Hester-Dendy samplers were vandalized at test site 2. Chlorophyll *a* was determined for periphyton communities. Bacterial populations were analyzed for total and fecal coliforms following the methods of APHA. Algal Growth Potential (AGP) tests, used *Selenastrum capricornutum* as the test organism.

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.

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.

The Florida Index: Some organisms become rare or absent as the intensity or duration of disturbance increases. 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.

Ephemeroptera/Plecoptera/Trichoptera (EPT) Index: This index 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 control conditions, may indicate degradation.

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

Functional Feeding Groups: 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 (SCI): The SCI is a composite macroinvertebrate metric (Barbour *et al.* 1996) developed for Florida. The SCI assigns points to a variety of parameters, depending on how closely each parameter approaches an expected control condition (see SCI calculation table in Appendix).

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

The following personnel were involved in this investigation: Tim McKelvey and Pat O'Connor (DEP Northeast District) and Lyn Burton, Jennifer Eichelberger, Ken Espy, Marshall Faircloth, Russel Frydenborg, Joy Jackson, Scott Lashbrook, Elizabeth Miller, Urania Quintana, Johnny Richardson, Lisa Tamburello, David Whiting, Vicki Whiting, and Steve Wolfe (DEP Central Biology Laboratory in Tallahassee). The report was reviewed by the Point Source Studies Review Committee, consisting of Wayne Magley, Jan Mandrup-Poulsen, and Michael Tanski, as well as District representatives.

Results and Discussion

The habitat quality was "optimal" at all three study sites, with 143 points at the control site, 135 points at test site 1, and 127 points at test site 2 (see Habitat Assessment Field Data Sheets in Appendix). These scores indicated that each site had adequate in-stream substrate and water velocity for macroinvertebrate success.

Dissolved-oxygen concentrations at the control site and test site 2 were similar (8.9 mg/L and 8.6 mg/L, respectively), and somewhat lower at test site 1 (6.8 mg/L) (Table 1). Water at the control site was very acidic (3.8 SU), but at or near neutral at both test sites (7.0 SU and 7.2 SU). The conductivity was much higher at test site 1 (447 µmhos/cm) than at the control site (85 µmhos/cm), or test site 2 (191µmhos/cm). The temperature was lower at the control site (12.3°C) than either test site 1 (17.7°C), or test site 2 (15.2°C). The turbidity increased from 1.1 NTU at the control site, to 6.3 NTU at test site 1, and 12.1 NTU at test site 2.

No organic constituents were detected in the effluent.

Aluminum, iron, copper, lead, and cadmium were detected in the effluent at levels that complied with Class III water quality standards (Table 1).

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

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

Potash Corporatin of Saskatchewan	Effluent Limits	Effluent Sample (11/17/97)	Con-trol	Test Site 1 (11/10/97)	Test Site 2 (11/10/97)
Organic Constituents (µg/L)					
None detected					
Metals (µg/L)					
Aluminum	≤ 1500 **	232	-	-	-
Arsenic	≤ 50 **	40 U	-	-	-
Cadmium	≤ 1.5 ** c	0.03 I	-	-	-
Chromium	≤ 281.1 ** c	10 U	-	-	-
Copper	≤ 16.3 ** c	0.7 I	-	-	-
Iron	≤ 1,000 **	88	-	-	-
Lead	≤ 5.1 ** c	0.2 I	-	-	-
Mercury	≤ 0.012 **	0.10 U	-	-	-
Nickel	≤ 216.3 ** c	7 U	-	-	-
Selenium	≤ 5.0 **	50 U	-	-	-
Silver	≤ 0.07 **	0.05 U	-	-	-
Zinc	≤ 145.5 ** c	10 U	-	-	-
Nutrients (mg/L)					
Ortho-phosphate		-	0.12	1.7	0.12
Total phosphorus	105 *	-	0.15	2.0	0.18
Ammonia	Report	1.47	0.023 A	1.1	0.023
Unionized ammonia	Report	0.0037			
Nitrate+Nitrite		-	0.005 I	0.93	0.069
TKN		-	1.0	2.1	0.70
Total Nitrogen	Report	-	1.005	3.03	0.77
Total Fluoride	75 *	-	-	-	-
General Phys-Chem Parameters					
Habitat Assessment		-	143	135	127
D.O. (mg/L)	≤ 5.0 *	7.5	8.9	6.8	8.6
pH (SU)	5.0-9.5 *	6.9	3.8	7.0	7.2
Conductivity (µmhos/cm)	≤ 1275.0 *	422	85	447	191
Temperature (°C)		15.4	12.3	17.7	15.2
Tot. Suspended Solids (mg/L)	150	-	-	-	-
Flow (MGD)	Report	-	-	-	-
Turbidity (NTU)	31.0 *		1.1	6.3	12.1
Hardness (mg $CaCO_3$)	-	145.3	-	-	-
AGP (mg dry wt/L)	-	-	0.3	65.5	7.5
Toxicity					
Bioassay Fish	Non toxic	-	-	-	-
Bioassay Invertebrate	Non toxic	-	-	-	-
Microbiology (# organisms/100 mL)					
Fecal Coliforms	-	-	110	87	450
Total Coliforms	-	-	490	370	700 A

* Permit limit - Reflects one-time grab event
** Class III water quality standard
c - Value is calculated based on hardness
A - Value reported is the mean of two or more determination
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

Fecal and total coliform counts complied with Class III water quality standards (Table 1).

Although somewhat improved from past FDEP inspections (FDEP 1995), extreme nutrient enrichment was nevertheless detected in Swift Creek (Test Site 1) (Table 1). While total phosphorus concentrations at the control site and test site 2 were similar (0.15 mg/L and 0.18 mg/L, respectively), total phosphorus was significantly higher at test site 1 (2.0 mg/L). Similarly, the ortho-phosphate concentration at test site 1 (1.7 mg/L) was significantly higher than the control site or test site 2 (both were 0.12 mg/L). The nitrate+nitrite concentration increased from 0.005 mg/L at the control site to 0.93 mg/L at test site 1 and 0.069 mg/L at test site 2. Ammonia was 0.023 mg/L at both the control site and test site 2, but increased substantially at test site 1 (1.1 mg/L). TKN at test site 1 (2.1 mg/L) was again higher than either the control site (1.0 mg/L) or test site 2 (0.70 mg/L). All of the nutrient concentrations at test site 1 were greater than those found in 90% to 95% of other Florida streams (see *Typical Values for Selected Parameters in Florida Waters* in Appendix).

The Algal Growth Potential (AGP) at test site 2 (7.5 mg dry wt/L) was somewhat higher than the 5 mg dry wt/L "problem threshold" (Raschke and Schultz 1987), while AGP at test site 1 was extremely elevated (65.5 mg dry wt/L). AGP at the control site was typical for unenriched streams (0.3 mg dry wt/L).

The periphyton racks were vandalized at test site 2, therefore comparisons will only be made between the control site and test site 1 (Swift Creek). Most measures of periphyton community health did not indicate any degradation at test site 1 (Table 2). Taxa richness, diversity, and algal density were similar at both sites. The high percentage of difference in chlorophyll *a* between the two sites is an artifact of the small values being compared. While periphyton chlorophyll *a* at test site 1 was below the detection limit, the chlorophyll value of the control site 1 was slightly higher at 0.57 µg/L. Apparently, factors such as water velocity or light penetration helped delay the near-field effects of the excessive nutrients in Swift Creek. This does not preclude the possibility of eutrophication from occurring further downstream in the Suwannee River.

In contrast to the periphyton results, the phytoplankton data showed some large differences between the control site and test site 1 (Figure 1). Phytoplankton was depauperate at the control site, as would be expected of a swiftly flowing stream (velocity here was 1 m/s). In comparison to both test sites, the control site had low taxa richness, algal density, and diversity. Algal density at test site 2 (486 cells/mL) was higher than the control site (88 cells/mL). Algal density at test site 1 (6,026 cell/mL) was approximately two orders of magnitude higher than the control site, and chlorophyll *a* at test site 1 (28.7 µg/L) was higher than the values found in 90% of other Florida streams. This is interpreted as a violation of Rule 62-302.530(48)(b) FAC, imbalances of aquatic flora or fauna.

Several measures of macroinvertebrate community health indicated degradation associated with the Swift Creek discharge. The Shannon-Weaver Diversity Index decreased from 3.6 at the control site to 2.6 at test site 1 (a 28% reduction) which is a violation of the biological integrity criterion (Rule 62.302.530(11) FAC).

Consistent with previous biological assessments in Swift Creek (FDEP 1995), pollution-sensitive mayflies were virtually eliminated at test site 1. .Test site 1 was dominated by the pollution-tolerant midge, *Polypedilum convictum* group (56% of the total community), and test site 2 was dominated by the equally tolerant amphipod, *Hyalella azteca* (with a 34% contribution). The SCI score at the control site (31 points) placed it in the "excellent" category, while SCI scores at test site 1 (25 points) and test site 2 (23 points) were "good" (see SCI worksheet in Appendix).

Conclusions

Water at the control site was very acidic (3.8 SU) but, at or near neutral at both test sites.

No organic constituents were detected in the effluent sample. Metals in the effluent complied with Class III water quality standards. The effluent was not acutely toxic to the fish, *Cyprinella leedsi*, or the water flea, *Ceriodaphnia dubia*. Total and fecal coliforms complied with Class III water quality standards.

Although somewhat improved from past FDEP inspections extreme nutrient enrichment was nevertheless detected in Swift Creek (Test Site 1), where both phosphorus and nitrogen concentrations were greater than those found in 90% to 95% of other Florida streams. The AGP at test site 1 (65.5 mg dry wt/L) reflected the high

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

Potash Corporation of Saskatchewan	Control	Test Site 1	Test Site 2
Macroinvertebrate Qualitative			
Number of Taxa	29	34	21
Florida Index	21	16	6
SCI	31	25	23
EPT Index	10	5	6
% Dominant Taxon	21	32	32
Community Composition			
% Amphipoda	1	14	35
% Coleoptera	10	9	29
% Diptera	22	64	11
% Ephemeroptera	26	1	12
% Odonata	1	1	1
% Oligochaeta	0.0	4	0.0
% Trichoptera	36	5	10
% Other	5	2	2
Functional Feeding Groups			
% Burrowing Deposit Feeders	0.0	4	0.0
% Predators/Carnivores	12	15	3
% Scavengers	2	0.0	2
% Shredders	15	28	17
% Scrapers	17	6	20
% Surface Deposit Feeders	30	36	40
% Suspension Feeders	21	10	15
% Unknown	3	1	3
Macroinvertebrate Hester-Dendy			
Number of Taxa	33	31	-
Shannon-Weaver Diversity	3.6	2.6	-
Florida Index	19	12	-
EPT Index	7	7	
% Dominant taxa	39	57	
Community Composition			
% Amphipoda	1	2	-
% Coleoptera	3	3	-
% Diptera	40	79	-
% Ephemeroptera	39	0.0	-
% Odonata	1	0.0	-
% Oligochaeta	0.0	1	-
% Trichoptera	15	15	-
Functional Feeding Groups			
% Predators	12	4	-
% Shredders	7	32	-
% Scrapers	22	2	-
% Surface Deposit Feeders	38	38	-
% Suspension Feeders	20	20	-
% Unknown	1	4	-

levels of nutrients present and greatly exceeded the 5 mg dry wt/L "problem threshold" for freshwater systems. AGP at test site 2 (7.5 mg dry wt/L) somewhat exceeded the "problem threshold". As the water in Swift Creek (test site 1) is composed primarily of PCS effluent (consistent with FDEP biological assessments in 1992 and 1995), it is apparent the facility is the major source of these nutrients.

The periphyton community at test site 1 did not appear negatively affected by the discharge. However, the phytoplankton at test site 1 (and test site 2 to a far lesser degree) exhibited symptoms of cultural eutrophication. Algal density at test site 1 was approximately two orders of magnitude higher than the control site, and chlorophyll *a* at test site 1 (28.7 µg/L) was higher than the values found in 90% of other Florida streams. This is interpreted as a violation of Rule 62-302.530(48)(b) FAC, imbalances of aquatic flora or fauna.

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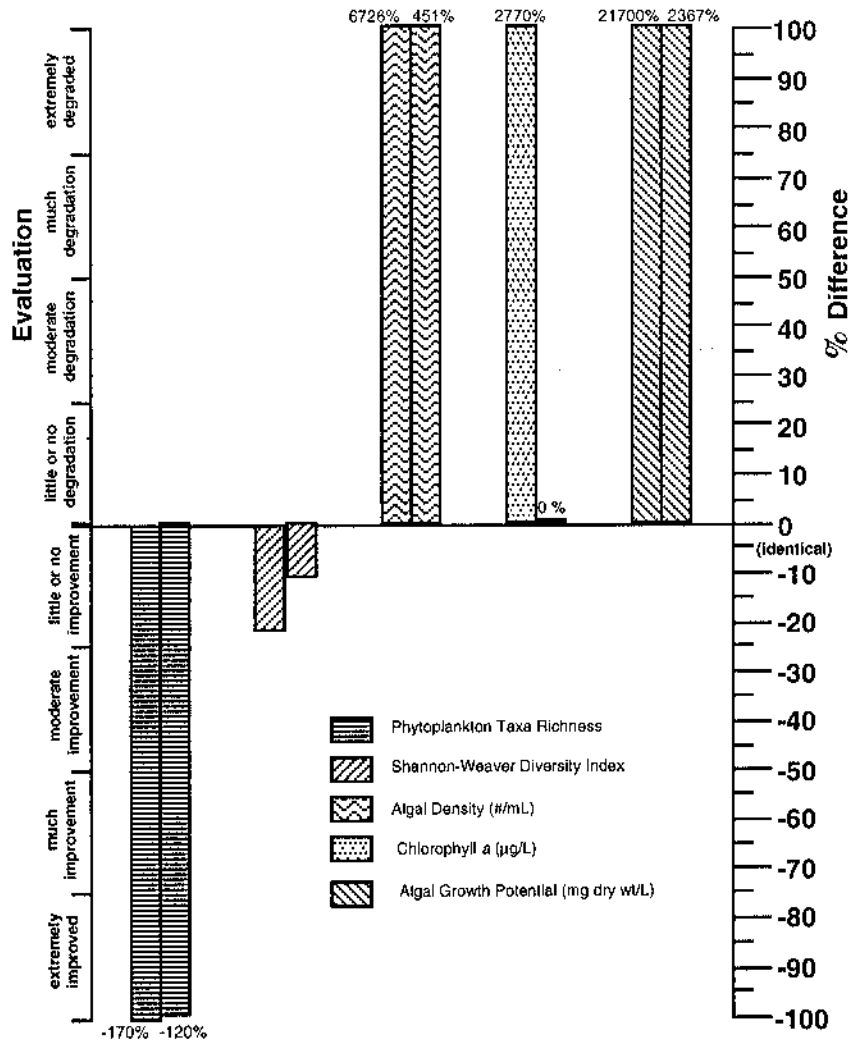


Figure 1. Effect of discharge on the phytoplankton community.

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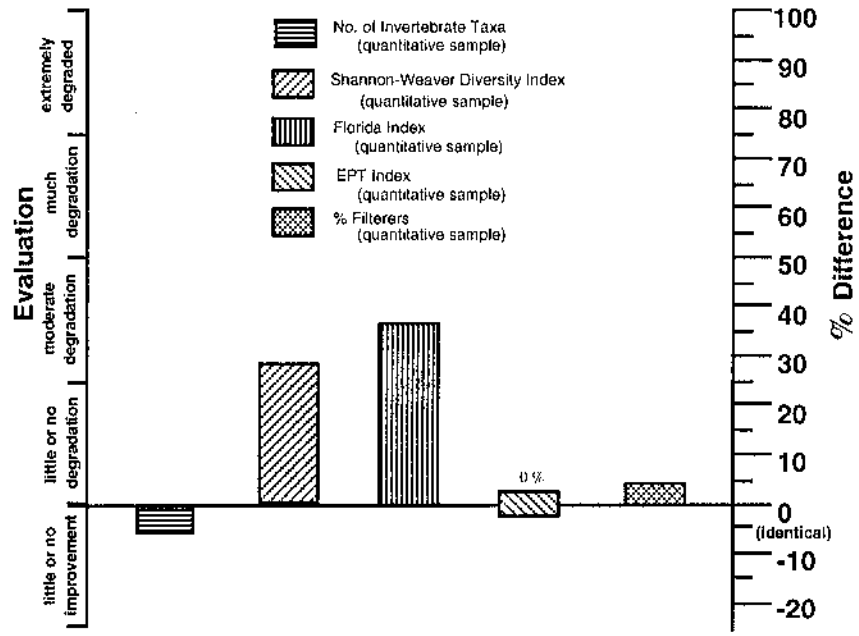


Figure 2. Effect of discharge on the macroinvertebrate community.

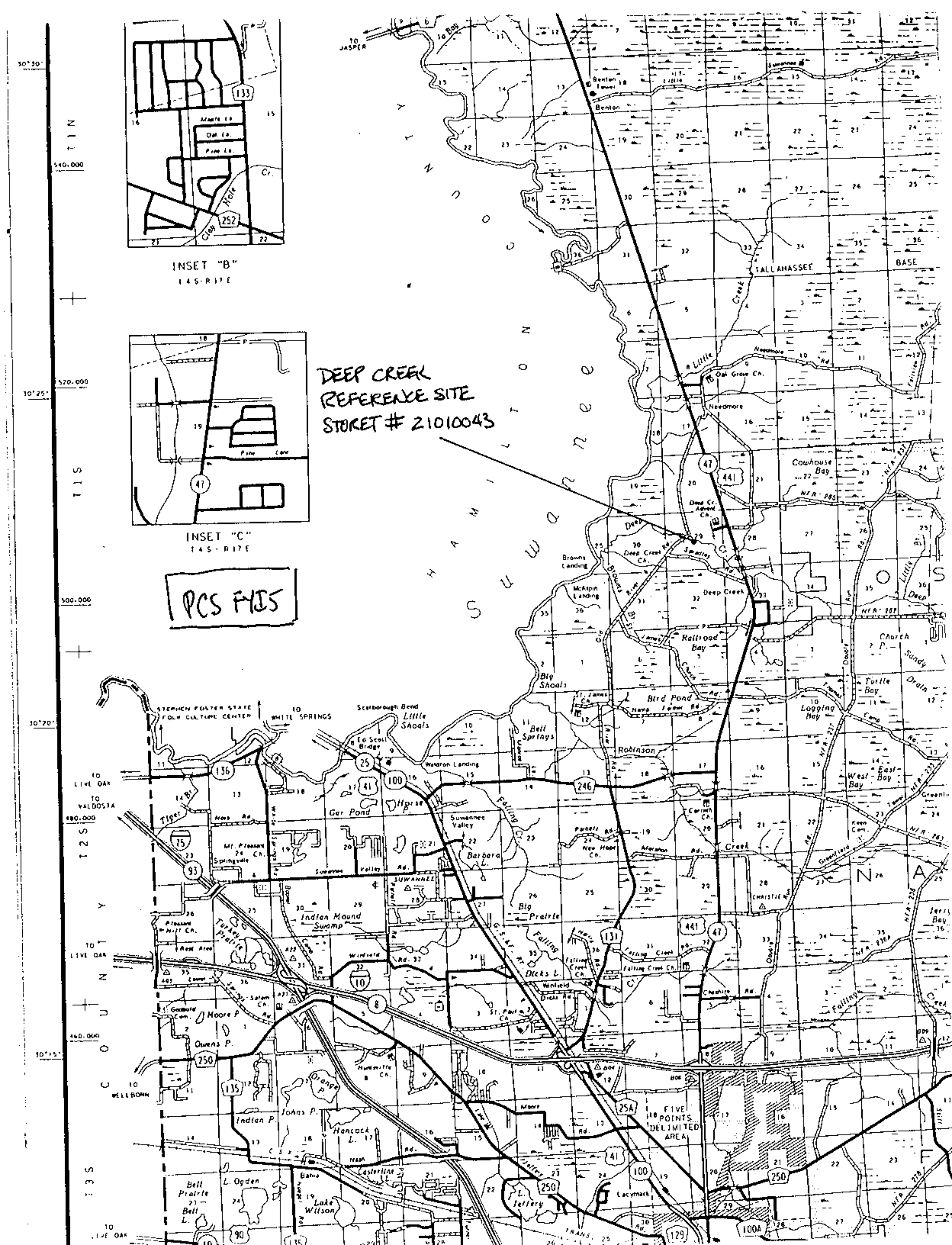
Typical Values for Selected Parameters in Florida Waters

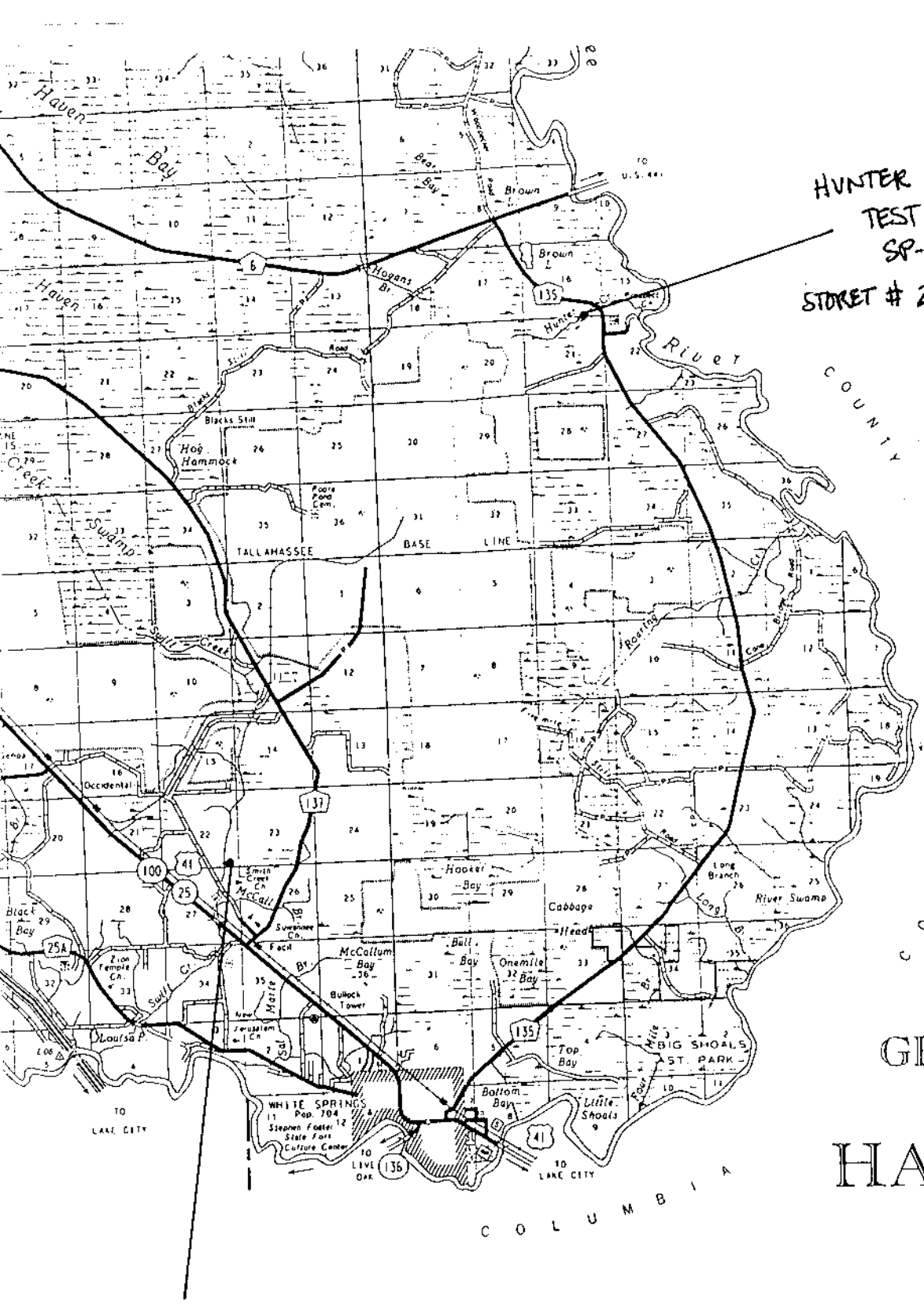
Adapted from Joe Hand, FDER, personal communication, 1991
(data was collected between 1980 and 1989)

Percentile Distribution

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

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


DEEP CREEK
REFERENCE SITE
STORET # 21010043
PCS FY15
INSET "B"
INSET "C"
HAMILTON
Suwannee
COLUMBIA
Deep Creek
TALLAHASSEE
Needmore
Benton
Robinson
Big Shoals
Little Shoals
STEPHEN FOSTER STATE FOLK CULTURE CENTER
WHITE SPRINGS
FIVE POINTS DELIMITED AREA
TO JASPER
TO LIVE OAK
TO VALDOSTA
TO WELLBORN



GENERAL HIGH

HAMILTON

FLORID

SWIFT CREEK
TEST SITE SP-001
STORET # 21020040

PCS FYIS

PREPARED BY THE
STATE TOPOGRAPHIC
FOR THE
DIVISION OF TRANSPORTATI
STATE OF FLOR
DEPARTMENT OF TRANS
IN COOPERATION WITH
U.S. DEPARTMENT OF TR
FEDERAL HIGHWAY ADMIN

02°56'36"
00°47'30"

SCALE

SCALE FOR INSETS

State of Florida
Department of Environmental Protection
Facility Summary

Facility Name: Potash Corporation of Saskatchewan (PCS) - Suwannee River Mine	**Prepared By:** Teresa Valdespino **Date:** 11/7/97

Location: (See Attached Map)	**County:** 24 - Hamilton	**District:** Northeast

Federal Permit No.: FL0000655 **Expiration Date:** 5/28/02	**State GMS #:** 3124P00081 **State Expiration Date:** 5/28/02	**Facility Type:** Industrial

Function of Facility: Mining activities producing phosphatic fertilizers, superphosphoric acid and associated by-products.

Description of treatment process: The Suwannee River Chemical Complex consists of a process water treatment area, gypsum stacks, cooling ponds and associated process water recirculation systems with 4.32 MGD (design) emergency wastewater treatment facility providing two-stage pH adjustment and settling, and a contaminated non-process water retention system. Discharge of treated (double limed) process water and contaminated process water is through outfalls 001-17, 001-8 and to 001-4 Swift Creek (in-stream sampling point 001). Discharge of treated process water occurs infrequently from extreme rainfall events.

The Suwannee River Mine consists of mining and beneficiation operations which include a phosphatic clays settling system with recirculation to the mine's hydraulic system. Excess mining waters are accumulated primarily from rainfall events and discharged through 001-7 to Swift Creek and through outfall 002-2 to Hunter Creek (in-stream sampling point 002).

Receiving Waters: Swift Creek and Hunter Creek to the Suwannee River (OFW)	**Classification**: Class III, fresh water
Design Flow: rainfall dependent	**Actual Mean Flow: (From DMR's of February 1996 to September 1997)**
(Design Flow reported is for the outfall structures,)	10.94 MGD Monthly Average to Swift Creek 6.32 MGD Monthly Average to Hunters Creek

Discharge is: Continuous Intermittent Seasonal **Rainfall Dependent*** Other

Facility Mixing Zone Details: none

Description of outfalls:	
001-2, 001-17	Contaminated Non-Process Water, Clean Water Ditch at Chemical Plant, Cooling Tower Blowdown, Pump Seal Water and Condensate
001-6, 001-7	(Altman Bay Canal including west diversion ditch when used) Beneficiation Process, Mine De-Watering and STP Effluent
001-9	Rerouted flow from 001-7 during high flow periods
001-8	Treated Process Water from miming and beneficiation of phosphate rock, Contaminated Non-Process Water, stormwater and treated sanitary wastewater.
001-4	Combined discharge from 001-2, 001-17, 001-7, 001-8, 001-9 to Swift Creek
002-2	(Spillway 33) Mining effluent to Hunter Creek
001	Instream Sampling point, Swift Creek
002	Instream Sampling point, Hunter Creek at CR 135 Bridge

Effluent Limits:			
Parameter	**1-Day Max**	**30-Day Average**	**Comments**
001-2			
Flow	Report (MGD)	Report (MGD)	Continuous at 001-2, Daily at 001-17
Total Phosphorus as P	105 (mg/l)	35 (mg/l)	24-hr composite
Total Fluoride	75 (mg/l)	25 (mg/l)	24-hour composite
pH	6.0 - 9.5 (SU)	6.0 - 9.5 (SU)	Report min and max
Total Nitrogen as N	Report (mg/l and lbs/d)	Report (mg/l and lbs/d)	
001-17			
Flow	Report (MGD)	Report (MGD)	Continuous at 001-2, Daily at 001-17
Total Phosphorus as P	105 (mg/l)	35 (mg/l)	24-hr composite
Total Fluoride	75 (mg/l)	25 (mg/l)	24-hour composite
pH	--	--	Report min and max
001-7, 001-9 and 002-2			
Flow	Report	Report	Continuous
Total Non-Volatile Non-Filterable Residue	25 (mg/l)	12 (mg/l)	24-hour composite
Total Non-Filterable Residue	60 (mg/l)	30 (mg/l)	24-hour composite
Total Phosphorus as P	5 (mg/l)	3 (mg/l)	24-hour composite
pH	6.0 - 9.0 (SU)	6.0 - 9.0 (SU)	Report min and max
Turbidity	Report	--	Grab Sample
001-8			
Flow	Report (MGD)	Report (MGD)	Continuous
Total Phosphorus as P	105 (mg/l)	35 (mg/l)	24-hour composite
Total Fluoride	75 (mg/l)	25 (mg/l)	24-hour composite
Total Suspended Solids	150 (mg/l)	50 (mg/l)	24-hour composite
Gross Alpha	15 (pCi/l)	--	24-hour composite
Radium 226 & 228	5 (pCi/l)	--	Analyze if Gross Alpha is greater than 5 pCi/l
Turbidity	Report (NTU)	--	
001-4			
pH	5.0 - 9.5 (SU)	5.0 - 9.5 (SU)	Report min and max
001-6			
Flow	Report (MGD)	Report (MGD)	Continuous
TSS	150 (mg/l)	50 (mg/l)	24-hour composite
Total Phosphorus as P	105 (mg/l)	35 (mg/l)	24-hour composite
pH	6.0 - 9.5 (SU)	6.0 - 9.5 (SU)	Report min and max
Turbidity	Report (NTU)	--	24-hour composite
Fluoride	75 (mg/l)	25 (mg/l)	24-hour composite

Effluent Limits, cont.:			
Parameter	**1-Day Max**	**30-Day Average**	**Comments**
001			
Flow	Report	Report	Calculated
TSS	Report	--	24-hour composite
Dissolved Oxygen	5.0 (mg/l) minimum	5.0 (mg/l) minimum	Report minimum
Fluoride	10.0 (mg/l)	--	24-hour composite
Un-ionized Ammonia	0.02 (mg/l)	--	Calculated
Ionized Ammonia	Report(mg/l)	--	Calculated
Total Ammonia	*Report (mg/l)*	--	*Grab*
Specific Conductivity	1275.0 (umhos/cm)	--	24-hour composite
pH	6.0 - 8.5 (SU)	6.0 - 8.5 (SU)	Report min and max
Temperature	Report (deg C)	--	Grab
Turbidity	31.0 (NTU)	--	Grab
Radium 226 & 228	5.0 (pCi/l)	--	24-hour composite
Gross Alpha	15.0 (pCi/l)	--	24-hour composite
Total Phosphorus	Report (mg/l and lbs/d)	Report (mg/l and lbs/d)	24-hour composite
TKN	Report (mg/l)	Report (mg/l)	24-hour composite
Total Nitrogen	Report (mg/l and lbs/d)	Report (mg/l and lbs/d)	24-hour composite
Biological Integrity	Report		Quarterly
Chronic Toxicity	NOEC>100%	--	
002			
Flow	Report	Report	Calculated
TSS	Report	--	24-hour composite
Dissolved Oxygen	5.0 (mg/l) minimum	5.0 (mg/l) minimum	Report minimum
Fluoride	10.0 (mg/l)	--	24-hour composite
Un-ionized Ammonia	0.02 (mg/l)	--	Calculated
Ionized Ammonia	Report(mg/l)	--	Calculated
Total Ammonia	Report (mg/l)	--	Grab
Temperature	Report (deg C)	--	Grab
Turbidity	31.0 (NTU)	--	Grab
pH	6.0 - 8.5 (SU)	6.0 - 8.5 (SU)	Report min and max
Total Phosphorus	Report (mg/l and lbs/d)	Report (mg/l and lbs/d)	24-hour composite
TKN	Report (mg/l)	Report (mg/l)	24-hour composite
Total Nitrogen	Report (mg/l and lbs/d)	Report (mg/l and lbs/d)	24-hour composite
Biological Integrity	Report	--	Quarterly

List permit violations (MOR data) and plant upsets that occurred at the plant within the past year:

- Failing Chronic Freshwater Toxicities in 10/96, 12/96, 3/97 and 4/97 (<100% Effluent).
- Below pH limits in 1/97, 3/97 and 5/97, although these were attributed to swamp drainage into their system and was demonstrated by evaluating results from upstream samples.

Describe previous impact bioassessments, WQBEL's, and previous or current enforcement actions: A biological assessment was conducted by August 15, 1994 by the Department during the last fifth-year inspection.

PCS has been conducting quarterly biological integrity sampling since the end of 1992. Their Shannon-Weaver index data indicates that the sites have consistently achieved results above the minimum standard (75% of background).

Additional Information: none.

PCS FY15

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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

SUBMITTING AGENCY CODE: 8031 / SUBMITTING AGENCY NAME: NED	STORET STATION NUMBER: 21010043	DATE (M/D/Y): 11-10-97	TIME: 1030	RECEIVING BODY OF WATER: DEEP CREEK

REMARKS: water level up some HP deployed	COUNTY: COLUMBIA	LOCATION: JUST EAST (100 - 150 FT) OF BRIDGE ON OLD RIVER ROAD.	FIELD ID/NAME: REFERENCE SITE

RIPARIAN ZONE/STREAM FEATURES

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

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
20	60	10	10				

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

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

Width of riparian vegetation (m) on least buffered side: 18mt

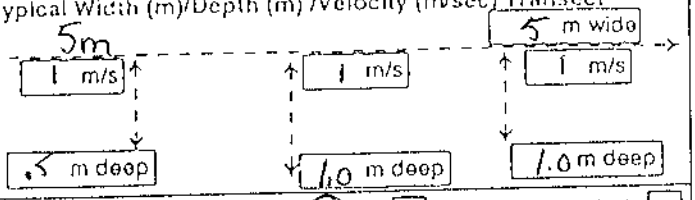
List & map dominant vegetation on back

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

Artificially Impounded ☐ yes

High Water Mark: 2m (m above normal water level) + 1m (or more depth in m) = 3m (m above bed)

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



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

SEDIMENT/SUBSTRATE

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

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

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

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)	20	5	dipnet	Sand + other	20	5	dipnet
Leaf Packs or Mats	20	5	dipnet	Mud/Muck/Silt			
Aquatic Vegetation				Other: (clay)			
Rock or Shell Rubble				Other:			
Undercut banks/Roots	40	5	dipnet				

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):	TURB		Secchi (m):
Top	0							1.0
Mid-depth	.5	12.3	3.81	8.92	.85	1.1		
Bottom	1.0							

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): Very Tannic: ☑ Green (algae): ☐ Clear: ☐ Other: ☐

Weather Conditions/Notes: Cool, 60-70°F, Clear Sunny.

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

SAMPLING TEAM: Tim McKelvey Pat O'Connor

SIGNATURE:

DATE: 11-10-97

Tim

PCS FY15

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (experimental 10-15-97)

SUBMITTING AGENCY CODE: 8037 / SUBMITTING AGENCY NAME: NED	STORET STATION NUMBER: 210100 93	DATE (M/D/Y): 11-6-97	RECEIVING BODY OF WATER: DEEP CREEK

REMARKS:	COUNTY: COLUMBIA	LOCATION: JUST EAST (100-150 FT) OF BRIDGE ON OLD RIVER ROAD	FIELD ID/NAME: REFERENCE SITE

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Primary Habitat Components Substrate Diversity [20]	Four or more productive habitats present (snags, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock). 20 19 18 17 16	Three productive habitats present. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	Two productive habitats present. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	One or less productive habitat. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Substrate Availability [20]	Greater than 30% productive habitat present at site. 20 19 18 17 16	16% to 30% productive habitat, by aerial extent. 15 14 13 12 11	6% to 15 % productive habitat 10 9 8 7 6	Less than 5% productive habitat. 5 4 3 2 1
Water Velocity [18]	Max. observed at typical transect: >0.25 m/sec. but < 1 m/sec 20 19 (18) 17 16	Max. observed at typical transect: 0.1 to 0.25 m/sec 15 14 13 12 11	Max. observed at typical transect: 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed at typical transect <0.05 m/sec, or spate occurring; > 1 m/sec 5 4 3 2 1
Habitat Smothering [15]	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
Primary Score [73]				
Secondary Habitat Components Artificial Channelization [20]	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
Bank Stability [10]	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 [20]	Over 80% of riparian surfaces consist of native plants, including trees, understory shrubs, or non-woody macrophytes. Normal, expected plant community for given sunlight & habitat conditions. 20 19 18 17 16	50% to 80% of riparian zone is vegetated, and/or one class of plants normally expected for the sunlight & habitat conditions is not represented. Some disruption in community evident. 15 14 13 12 11	25% to 50% of riparian zone is vegetated, and/or one or two expected 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 and/or 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
Secondary Score [70]				

TOTAL SCORE [143]

ANALYSIS DATE: 11-18-97	ANALYST: McKelvey / O'Connor	SIGNATURE: Ann McKelvey

PCS FYI5

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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

SUBMITTING AGENCY CODE: 8051 / SUBMITTING AGENCY NAME: NED	STORET STATION NUMBER: 21020040	DATE (M/D/Y): 11-10-97	TIME: 1500	RECEIVING BODY OF WATER: SWIFT CREEK

REMARKS: Biology sampling only.	COUNTY: HAMILTON	LOCATION: permit specified sampling point on Swift Creek, downstream of mine.	FIELD ID/NAME: TEST SITE SP-001

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
100							

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

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

Width of riparian vegetation (m) on least buffered side: 60+

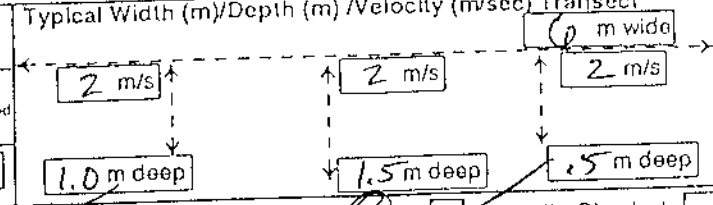
List & map dominant vegetation on back

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

Artificially Impounded ☐ yes

High Water Mark: 1 (m above present water level) + 1.5 (stream depth in m) = 2.5 (m above bed)

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



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

SEDIMENT/SUBSTRATE

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

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

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

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)	15	5	dynet	Sand	70	5	dynet
Leaf Packs or Mats	10	5	"	Mud/Muck/Silt			
Aquatic Vegetation				Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots	5	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):	TURB.		Secchi (m):
Top								0.6
Mid-depth	.75	17.64	7.02	6.82	447	6.3		
Bottom	1.5							

System Type : Stream: ☑ (1st order / 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:
Cool & Sunny, Clear Skies,
70°F

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

SAMPLING TEAM: Tmi McKelvey / Pat O'Connor

SIGNATURE: Tmi McKelvey

DATE: 11-10-97

PCS FY15

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-96)

SUBMITTING AGENCY CODE: 8031 / SUBMITTING AGENCY NAME:	STORET STATION NUMBER: 21020063	DATE (M/D/Y): 11-10-97	TIME 1300	RECEIVING BODY OF WATER: HUNTER CREEK

REMARKS: Biology Samples only.	COUNTY: HAMILTON	LOCATION: UPSTREAM OF BRIDGE ON C.R. 135. (200-300FT)	FIELD ID/NAME: TEST SITE SP-002

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
40	20	10	30				

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

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

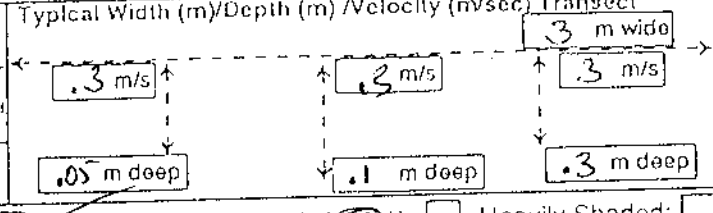
Width of riparian vegetation (m) on least buffered side: 18m+ — List & map dominant vegetation on back

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

Artificially Impounded ☐ yes

High Water Mark: 1.0 (m above present water level) + .3 (present depth in m) = 1.3 (m above bed)

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



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

SEDIMENT/SUBSTRATE

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

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

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

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)	10	4		Sand	70	4	
Leaf Packs or Mats	5	4		Mud/Muck/Silt			
Aquatic Vegetation	0			Other:			
Rock or Shell Rubble	5	4		Other:			
Undercut banks/Roots	0.0	4		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):	TURB.		Secchi (m):
Top	0							.157
Mid-depth	.15	15.15	7.24	8.64	191	12.1		
Bottom	.3							

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): slightly Tannic: ☑ Green (algae): ☐ Clear: ☐ Other: ☐

Weather Conditions/Notes:

Cool, Clear skies, Sunny
60-70°F

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

SAMPLING TEAM: Tim McKelvey / Pat O'Connor

SIGNATURE: Tim McKelvey

DATE: 11-10-97

Tim

PCS FMIS

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (experimental 10-15-97)

SUBMITTING AGENCY CODE: 5031 / SUBMITTING AGENCY NAME: NED	STORET STATION NUMBER: 21020063	DATE (M/D/Y): 11-10-97	RECEIVING BODY OF WATER: HUNTER CREEK
REMARKS: Biology samples only.	COUNTY: HAMILTON	LOCATION: UPSTREAM (200-300 FT) OF BRIDGE ON C.R. 135	FIELD ID/NAME: TEST SITE SP-002

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Primary Habitat Components Substrate Diversity [14]	Four or more productive habitats present (snags, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock). 20 19 18 17 16	Three productive habitats present. Adequate habitat. Some substrates may be new fall (fresh leaves or snags) 15 (14) 13 12 11	Two productive habitats present. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	One or less productive habitat. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Substrate Availability [15]	Greater than 30% productive habitat present at site. 20 19 18 17 16	16% to 30% productive habitat, by aerial extent. (15) 14 13 12 11	6% to 15 % productive habitat 10 9 8 7 6	Less than 5% productive habitat. 5 4 3 2 1
Water Velocity [18]	Max. observed at typical transect: >0.25 m/sec. but < 1 m/sec 20 19 (18) 17 16	Max. observed at typical transect: 0.1 to 0.25 m/sec 15 14 13 12 11	Max. observed at typical transect: 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed at typical transect <0.05 m/sec, or spate occurring; > 1 m/sec 5 4 3 2 1
Habitat Smothering [10]	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
Primary Score [57]				
Secondary Habitat Components Artificial Channelization [20]	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
Bank Stability [15]	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 [15]	Over 80% of riparian surfaces consist of native plants, including trees, understory shrubs, or non-woody macrophytes. Normal, expected plant community for given sunlight & habitat conditions. 20 19 18 17 16	50% to 80% of riparian zone is vegetated, and/or one class of plants normally expected for the sunlight & habitat conditions is not represented. Some disruption in community evident. (15) 14 13 12 11	25% to 50% of riparian zone is vegetated, and/or one or two expected 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 and/or 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
Secondary Score [70]				

127 TOTAL SCORE

ANALYSIS DATE: 11-10-97	ANALYST: Tim McKelvey / Pat O'Connor	SIGNATURE: Tim McKelvey

Tim

PCS PYI5

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (experimental 10-15-97)

SUBMITTING AGENCY CODE: 8031 / SUBMITTING AGENCY NAME: NED	STORET STATION NUMBER: 21020040	DATE (M/D/Y): 11-18-97	RECEIVING BODY OF WATER: SWIFT CREEK
REMARKS: Biology sampling only.	COUNTY: HAMILTON	LOCATION: permit specified sampling point on Swift Creek, downstream of mine	FIELD ID/NAME: TEST SITE SP-001

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Primary Habitat Components Substrate Diversity [15]	Four or more productive habitats present (snags, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock). 20 19 18 17 16	Three productive habitats present. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	Two productive habitats present. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	One or less productive habitat. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Substrate Availability [15]	Greater than 30% productive habitat present at site. 20 19 18 17 16	16% to 30% productive habitat, by aerial extent. 15 14 13 12 11	6% to 15 % productive habitat 10 9 8 7 6	Less than 5% productive habitat. 5 4 3 2 1
Water Velocity [20]	Max. observed at typical transect: >0.25 m/sec. but < 1 m/sec 20 19 18 17 16	Max. observed at typical transect: 0.1 to 0.25 m/sec 15 14 13 12 11	Max. observed at typical transect: 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed at typical transect <0.05 m/sec, or spate occurring; > 1 m/sec 5 4 3 2 1
Habitat Smothering [10]	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
Primary Score [60]				
Secondary Habitat Components Artificial Channelization [20]	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
Bank Stability [15]	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 [20]	Over 80% of riparian surfaces consist of native plants, including trees, understory shrubs, or non-woody macrophytes. Normal, expected plant community for given sunlight & habitat conditions. 20 19 18 17 16	50% to 80% of riparian zone is vegetated, and/or one class of plants normally expected for the sunlight & habitat conditions is not represented. Some disruption in community evident. 15 14 13 12 11	25% to 50% of riparian zone is vegetated, and/or one or two expected 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 and/or 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
Secondary Score [75]				

135 TOTAL SCORE

ANALYSIS DATE: 11-18-97	ANALYST: Tim McKelvey / Pat O'Connor	SIGNATURE: Tim McKelvey

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: PCS-Phosphate - Swift creek
County:
Contact / District: Pat O'Connor / Northeast
NPDES Permit #: FL0000655
LIMS Sample #: 200732 LIMS Job #: 97-NOV-18-09
sample log: 11/5/97 dw

Sample Collection: Date 11-17-97 Time 1230
Test Beginning: Date 11-18-97 Time 1405
Test Ending: Date 11-20-97 Time 1410
Organism Batch #: 46 Diluent Batch #: 51
Organism Age: <24hour
Test Organism: Ceriodaphnia dubia

Test Type: Screening / Definitive
Static / Static Renewal / Flow-through
Temperature range: room 24.0-25.0 °C
incubator 24.4-25.4°C
Test Number: 1 of 2
Remarks: D = dead, M = missing

Instrument Calibrations:	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	23.5 @ 23.6	8.4 @ 24.0 °C	105.1 @ 103.6 MF wrote in wrong space 994 ~~105~~ MF 11-18-97 @ 1005 @ 24.6 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	24.0 @ 24.0	8.3 @ 24.9 °C	105.1 @ 103.6 988 @ 1005 @ 24.6 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	22.1 @ 22.2	8.2 @ 25.1 °C	104.3 @ 103.2 987 @ 1005 @ 25.0 °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	A	5	5	5	8.1		8.3	24.2		25.0	7.3		6.9	170		190
Control B	B	5	5	5			8.3			25.0			6.9			190
Control C	C	5	5	5			8.3			25.0			7.0			190
Control D	D	5	5	5			8.3			25.1			6.9			190
100% A	A	5	5	5	7.3		8.2	24.4		24.7	7.3		7.0	400		445
100% B	B	5	5	5			8.2			24.6			7.0			465
100% C	C	5	5	5			8.2			24.6			7.1			450
100% D	D	5	5	5			8.2			24.6			7.0			460
Measured/Loaded by:		MF	KS	MF	MF		MF	MF		MF	MF		MF	MF		MF
Recorded by:		MF	KS	MF	MF		ND	MF		ND	MF		ND	MF		ND

Investigators' Signatures
Marshall Faircloth
Ken Johnson
Mark Cook

Water Quality Parameters verified by MF

	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	MF/ND
Alkalinity (mg/L as $CaCO_3$):		70	60	Hach	ND
Hardness (mg/L as $CaCO_3$):		80	140	Hach	ND
Total ammonia (mg/L as N):		<0.017	1.47	orion	MF

Ammonia Meter #98136 Meter Slope: -60.0
Ammonia Blank: <0.017
Control Salinity: 0 ppt
Sample Salinity: 0 ppt

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: PCS-Phosphate Swift Creek
County:
Contact / District: Pat O'Connor / Northeast
NPDES Permit #: FL0000655
LIMS Sample #: 200732 **LIMS Job #:** 97-NOV-18-09
sample log: 11/19/97 DW
Test Type: Screening | Definitive
Static | Static Renewal | Flow-through
Temperature range: room 24.0-25.0°C
incubator 24.5-26.6°
Test Number: 2 of 2
Remarks: D = dead, M = missing

Sample Collection: Date 11-17-97 Time 1230
Test Beginning: Date 11-18-97 Time 1420
Test Ending: Date 11-20-97 Time 1410
Organism Batch #: 88 **Diluent Batch #:** well H2O
Organism Age: 12 days
Test Organism: Cyprinella leedsi

Instrument Calibrations:

	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	23.5 @ 23.6	8.4 @ 24.0 °C	105.1 @ 103.6 994 @ 1005 @ 24.6 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	24.0 @ 24.0	8.3 @ 24.9 °C	105.7 @ 103.6 968 @ 1005 @ 23.6 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	22.1 @ 22.2	8.2 @ 25.1 °C	104.3 @ 103.2 987 @ 1005 @ 25.0 °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	B1	5	5	5	7.9	8.3	8.3	25.0	24.4	24.7	6.9	7.3	6.8	255	260	265
Control B	B2	5	5	5	7.9	8.3	8.3	25.1	24.6	25.0	6.9	7.2	6.8	255	260	265
Control C	B3	5	5	5	7.9	8.3	8.4	25.1	24.5	24.8	6.9	7.1	6.8	255	260	265
Control D	B4	5	5	5	7.9	8.3	8.4	25.1	24.6	24.7	6.9	7.1	6.8	255	260	260
100% A	B5	5	5	5	7.3	7.9	8.1	24.9	24.6	24.5	6.8	7.1	7.1	415	415	420
100% B	B6	5	5	5	7.3	7.9	8.0	24.7	24.8	24.8	6.8	7.2	7.1	415	420	425
100% C	B7	5	5	5	7.3	7.8	8.0	24.8	24.7	24.8	6.8	7.1	7.0	415	420	430
100% D	B8	5	5	5	7.3	7.8	8.0	24.8	24.6	25.1	6.7	7.0	6.9	415	420	435
Measured/Loaded by:		MF	KJ	ND	MF	KJ	MF	MF	KJ	MF	MF	KJ	MF	MF	KJ	MF
Recorded by:		KJ	KJ	ND	MF	KJ	ND	MF	KJ	ND	MF	KJ	ND	MF	KJ	ND

Investigators' Signatures
Marshall Faircloth
Kerri Johnson
Nick Lamb

Water Quality Parameters verified by MF

	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	MF/ND
Alkalinity (mg/L as $CaCO_3$):	120		60	Hach	ND
Hardness (mg/L as $CaCO_3$):	130		140	Hach	ND
Total ammonia (mg/L as N):	<0.017		1.47	orion	MF

Ammonia Meter #98136 Ammonia Meter Slope: -60.0 Ammonia Blank: <0.017 Control Salinity: 0 ppt Sample Salinity: 0 ppt

reviewer

Control Site

Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	Value	5	3	1	Score
Total Number of Taxa	29	≥27	26-14	<14	5
EPT Index	10	≥6	5-3	<3	5
# Chironomid Taxa	7	≥9	8-5	<5	3
% Contribution of Dominant Taxon	21	≤25	26-62	>62	5
% Diptera	22	-	≤60	>60	3
Florida Index	21	≥13	12-7	<7	5
% Suspension feeders/Filterers	21	≥13	12-7	<7	5
Total Score		**Panhandle**			31
Interpretation of Scores		**Excellent**			27-33
		Good			21-26
		Poor			14-20
		Severely Degraded			7-13

Winter Index Period: Stream Condition Index (SCI) for Florida Panhandle (April 1996)

Test Site 1

Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	Value	5	3	1	Score
Total Number of Taxa	34	≥27	26-14	<14	5
EPT Index	5	≥6	5-3	<3	3
# Chironomid Taxa	14	≥9	8-5	<5	5
% Contribution of Dominant Taxon	32	≤25	26-62	>62	3
% Diptera	64	-	≤60	>60	1
Florida Index	16	≥13	12-7	<7	5
% Suspension feeders/Filterers	10	≥13	12-7	<7	3
Total Score		**Panhandle**			25
Interpretation of Scores		**Excellent**			27-33
		Good			21-26
		Poor			14-20
		Severely Degraded			7-13

Winter Index Period: Stream Condition Index (SCI) for Florida Panhandle (April 1996)

Test Site 2

Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	Value	5	3	1	Score
Total Number of Taxa	21	≥27	26-14	<14	3
EPT Index	6	≥6	5-3	<3	5
# Chironomid Taxa	7	≥9	8-5	<5	3
% Contribution of Dominant Taxon	32	≤25	26-62	>62	3
% Diptera	11	-	≤60	>60	3
Florida Index	6	≥13	12-7	<7	1
% Suspension feeders/Filterers	15	≥13	12-7	<7	5
Total Score		**Panhandle**			**23**
Interpretation of Scores		**Excellent**			27-33
		Good			21-26
		Poor			14-20
		Severely Degraded			7-13

Winter Index Period: Stream Condition Index (SCI) for Florida Panhandle (April 1996)

Periphyton taxa list and densities (#/cm^2) for Potash Corporation of Saskatchewan, collected via glass microscope slides in Deep Creek and Swift Creek on November 10, 1997.

	Control Site	Test Site 1
Bacillariophyceae		
Achnanthes exigua	365	–
Achnanthes hungarica	–	194
Achnanthes lanceolata dubia	244	–
Cocconeis placentula	–	324
Cyclotella sp.	–	906
Cyclotella stelligera	–	65
Cymbella lunata	–	65
Cymbella minuta	122	–
Eunotia curvata	122	–
Eunotia pectinalis	244	–
Eunotia sp.	1706	–
Eunotia tautoniensis	122	–
Frustulia rhomboides capitata	731	–
Frustulia sp.	487	–
Gomphonema parvulum	122	65
Melosira sp.	609	259
Navicula bicephala	122	–
Navicula capitata	122	65
Navicula confervacea	1827	259
Navicula exigua	122	–
Navicula laevissima	122	–
Navicula lanceolata	122	–
Navicula minima	244	–
Navicula pseudoscutiformis	122	–
Navicula pupula	122	–
Navicula viridula	–	65
Nitzschia palea	122	583
Pinnularia interrupta	122	–
Pinnularia obscura	122	–
Pinnularia sp.	244	–
Stauroneis anceps	–	65
Pennales	487	65
Chlorophyceae		
Ankistrodesmus sp.	–	65
Characium sp.	244	–
Chlamydomonas sp.	–	583
Chlorococcum sp.	–	453
Coelastrum sp.	–	129
Crucigenia sp.	–	65
Dictyosphaerium sp.	–	65

Golenkinia sp.	–	324
Microthamnion sp.	122	–
Mougeotia sp.	365	–
Oocystis sp.	–	388
Scenedesmus sp.	–	1489
Selenastrum sp.	–	518
Tetraedron sp.	–	712
Ulothrix sp.	365	–
Undetermined Chlorophyceae	609	324
Cyanophyceae		
Anabaena sp.	122	–
Aphanocapsa sp.	–	129
Aphanothece sp.	122	–
Chroococcus sp.	–	65
Dactylococcopsis sp.	–	647
Gloeocapsa sp.	–	259
Lyngbya sp.	–	65
Merismopedia sp.	–	129
Spirulina sp.	122	–

Phytoplankton taxa list and densities (#/mL) for Potash Corporation of Saskatchewan, collected via subsurface grabs in Deep Creek, Swift Creek, and Hunter Creek on 10 November, 1997.

	Control Site	Test Site 1	Test Site 2
Bacillariophyceae			
Melosira sp.	–	173	–
Cyclotella sp.	–	269	–
Synedra sp.	–	19	–
Eunotia sp.	–	19	–
Achnanthes sp.	–	–	3
Cocconeis sp.	–	–	9
Navicula sp.	3	38	6
Navicula capitata	–	–	3
Capartogramma crucicula	–	–	3
Cymbella sp.	–	–	3
Gomphonema sp.	–	–	3
Nitzschia sp.	–	77	177
Pennales	15	–	12
Chlorophyceae			
Chlamydomonas sp.	–	1977	9
Pandorina sp.	–	19	–
Tetraedron sp.	–	77	9
Oocystis sp.	–	230	–
Ankistrodesmus sp.	–	58	3
Kirchneriella sp.	–	173	3
Pediastrum sp.	–	38	–
Actinastrum sp.	–	38	–
Scenedesmus sp.	–	1363	64
Crucigenia sp.	–	211	12
Selenastrum sp.	–	77	–
Coelastrum sp.	–	19	–
Dictyosphaerium sp.	–	19	–
Golenkinia sp.	–	–	6
Gloeocystis sp.	3	58	3
Undetermined chlorophyceae	9	–	9
Chrysophyceae			
Dinobryon sp.	–	–	6
Mallomonas sp.	–	19	–
Synura sp.	3	–	–
Cryptophyceae			
Cryptomonas sp.	6	345	9
Cyanophyceae			
Aphanocapsa sp.	–	96	–
Aphanothece sp.	6	–	–
Chroococcus sp.	–	211	–
Rhabdoderma sp.	35	–	–

Dactylococcopsis sp.	6	345	95
Oscillatoria sp.	3	19	43
Euglenophyceae			
Phacus sp.	–	38	–

Benthic macroinvertebrate taxa list for Potash Corporation of Saskatchewan, collected via 20 discrete dip net sweeps in Deep Creek, Swift Creek and Hunter Creek on November, 1997. Densities, in number/m^2, represent the mean of three replicates.

	Control Site	Test Site 1	Test Site 2
Amphipoda			
Crangonyx sp.	1	–	–
Hyalella azteca	–	25	34
Undetermined Amphipoda	–	–	3
Coleoptera			
Cyphon sp.	1	1	–
Dubiraphia sp.	–	2	1
Microcylloepus pusillus	6	9	–
Microcylloepus sp.	–	–	29
Neoporus sp.	–	1	–
Stenelmis sp.	2	–	–
Undetermined Chrysomelidae	1	–	–
Undetermined Elmidae	–	3	–
Decapoda			
Cambarus sp.	–	–	1
Diptera			
Chironomus sp.	1	–	–
Clinotanypus sp.	–	–	1
Cricotopus bicinctus	1	–	–
Cryptochironomus sp.	–	9	–
Hemerodromia sp.	8	–	–
Palpomyia/Bezzia grp.	–	4	1
Parachironomus carinatus	–	1	–
Paralauterborniella nigrohalterale	–	2	–
Parametriocnemus sp.	–	–	1
Pentaneura inconspicua	–	7	–
Polypedilum convictum grp.	1	56	1
Polypedilum illinoense grp.	–	1	–
Polypedilum scalaenum grp.	–	12	1
Probezzia sp.	–	2	–
Rheotanytarsus distinctissimus grp.	–	4	–
Rheotanytarsus exiguus grp.	–	10	5
Stempellinella sp.	–	–	1
Stenochironomus sp.	4	–	1
Tanytarsus sp.	–	1	–
Thienemanniella sp.	–	1	–
Thienemanniella sp. A Epler	–	1	–
Thienemanniella xena	–	1	–
Tribelos jucundus	1	–	–
Tribelos sp.	1	–	–

Undetermined Chironomidae	2	1	–
Undetermined Simuliidae	3	–	–
Ephemeroptera			
Caenis sp.	–	1	–
Labiobaetis sp.	–	–	7
Stenonema smithae	21	–	–
Undetermined Baetidae	5	1	5
Undetermined Heptageniidae	–	–	1
Gastropoda			
Undetermined Ancylidae	–	2	–
Hemiptera			
Ranatra sp.	1	–	–
Hirudinea			
Mooreobdella microstoma	–	1	–
Isopoda			
Caecidotea sp.	2	–	–
Odonata			
Calopteryx sp.	1	–	–
Progomphus sp.	1	–	–
Undetermined Coenagrionidae	–	2	1
Oligochaeta			
Dero vaga	–	2	–
Eclipidrilus sp.	–	1	–
Limnodrilus hoffmeisteri	–	2	–
Undetermined Enchytraeidae	–	1	–
Undetermined Ancylidae	–	2	–
Pelecypoda			
Undetermined Sphaeriidae	–	–	1
Trichoptera			
Cheumatopsyche sp.	15	–	6
Chimarra sp.	1	–	–
Hydropsyche sp.	2	3	–
Hydroptila sp.	–	1	–
Nectopsyche pavida	2	–	–
Nectopsyche sp.	4	–	–
Oecetis georgia	7	–	–
Oecetis sp.	–	5	–
Orthotrichia sp.	–	–	2
Triaenodes sp.	4	–	–
Undetermined Hydropsychidae	–	–	3
Undetermined Polycentropodidae	1	–	–
Trombidiformes			
Mideopsis sp.	1	–	–

Benthic macroinvertebrate taxa list for Potash Corporation of Saskatchewan, collected via Hester Dendy samples in Deep Creek and Swift Creek on November, 1997. Densities, in number/m^2, represent the mean of three replicates.

	Control Site	Test Site 1
Amphipoda		
Crangonyx sp.	5	–
Hyalella azteca	–	93
Coleoptera		
Microcylloepus pusillus	11	101
Microcylloepus sp.	–	19
Stenelmis sp.	3	11
Undetermined Elmidae	–	5
Diptera		
Ablabesmyia rhamphe grp.	–	11
Conchapelopia sp.	5	–
Dicrotendipes modestus	–	13
Helopelopia sp.	5	–
Hemerodromia sp.	34	29
Labrundinia sp.	3	–
Nanocladius sp.	–	13
Pentaneura inconspicua	–	151
Polypedilum convictum grp.	32	2648
Polypedilum fallax	21	–
Polypedilum illinoense grp.	3	–
Polypedilum scalaenum grp.	3	204
Rheocricotopus robacki	3	–
Rheotanytarsus distinctissimus grp.	3	11
Rheotanytarsus exiguus grp.	–	228
Rheotanytarsus sp.	3	13
Simulium sp.	11	–
Tanytarsus sp.	5	–
Tanytarsus sp. L Epler	3	–
Tanytarsus sp. M Epler	3	–
Tanytarsus sp. S Epler	19	–
Thienemanniella similis	–	114
Thienemanniella sp.	3	–
Thienemanniella sp. A Epler	8	–
Thienemanniella xena	–	29
Thienemannimyia grp.	13	–
Tribelos fuscicornis	3	–
Undetermined Chironomidae	3	193
Undetermined Empididae	–	5
Undetermined Orthocladiinae	3	–
Ephemeroptera		
Paraleptophlebia volitans	3	–

Stenonema smithae	180	–
Undetermined Baetidae	–	21
Gastropoda		
Laevapex sp.	–	3
Megaloptera		
Corydalus sp.	3	11
Pelecypoda		
Corbicula fluminea	–	8
Odonata		
Argia sp.	5	–
Undetermined Coenagrionidae	–	3
Oligochaeta		
Dero vaga	–	3
Trichoptera		
Cernotina sp.	3	–
Cheumatopsyche sp.	42	61
Chimarra sp.	11	–
Cyrnellus fraternus	–	37
Hydropsyche sp.	–	516
Lype diversa	8	–
Undetermined Hydropsychidae	8	63
Undetermined Polycentropodidae	–	13
Undetermined Trichoptera	–	3

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

1 Transaction Code	2	3 NPDES NUMBER	11	12 YR/MO/DA	17	18 Insp Type	19 Inspector	20 Fac Type
N	5	FL0000655		971110		X	S	2

Remarks

21 66

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

1 Transaction Code	2	3 NPDES NUMBER	11	12 YR/MO/DA	17	18 Insp Type	19 Inspector	20 Fac Type
N	5	FL0000655		971110		B	S	2

Remarks

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