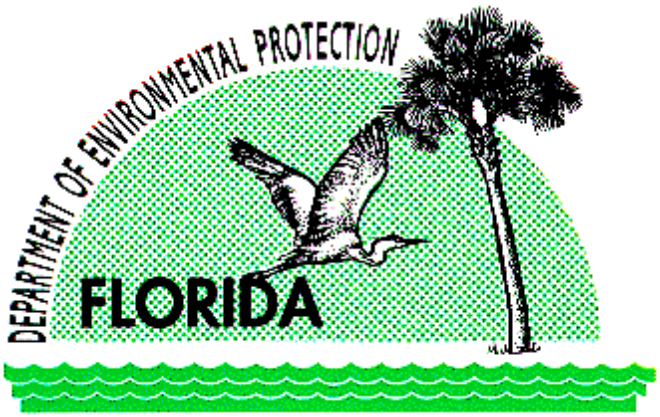


Biological Reconnaissance of

RCRA Open Burn Site at Primex

Wakulla County

Sampled December 1997

March 1998

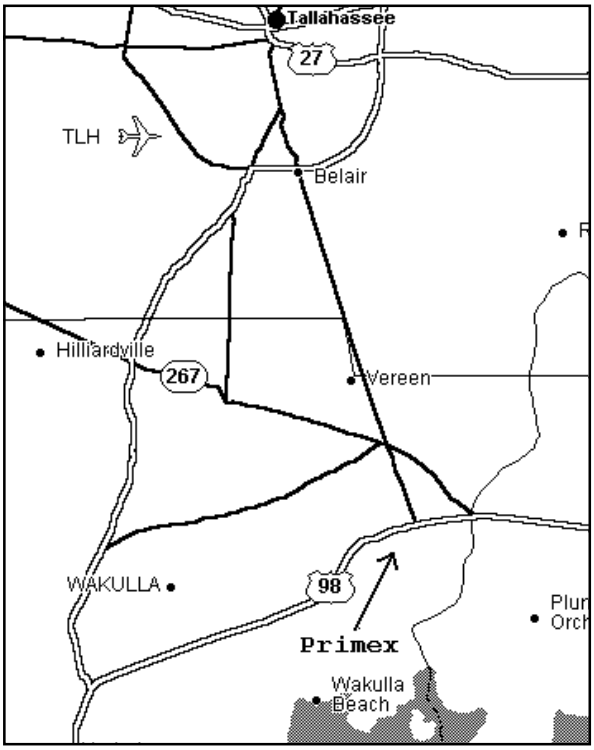
Bureau of Laboratories
Division of Administrative and Technical Services

Comprehensive Quality Assurance Plan No. 870346G

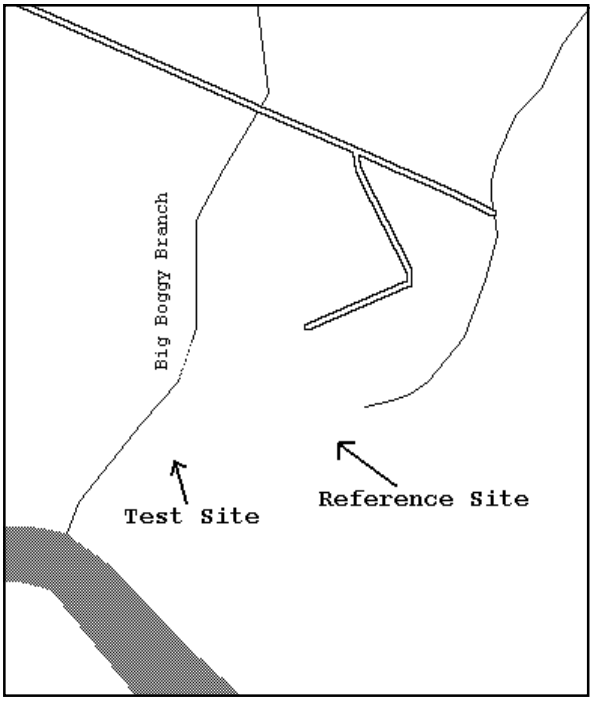
Biological Reconnaisance of an Open Burn Site at Primex

Executive Summary

Department staff conducted an ecological study at Primex (formally Olin Corporation) to determine potential adverse effects on the surrounding marsh area. Benthic macroinvertebrate and algal community health at the Primex test site was comparable to the reference marsh. Measures such as invertebrate taxa richness, the Florida Index, the ETO Index, and % dominant taxon were generally similar, or slightly better at the test site, compared with the reference site. Phytoplankton chlorophyll *a* and density were very low at both sites. Although ammonia was elevated at the test site, the tidally controlled water residence time was apparently of short enough duration to preclude algal blooms from occurring at the test site. The ammonia appeared to be delivered to the site from Big Boggy Branch, which receives the facility's industrial effluent. In summary, leachate or runoff from the Primex open burn/ detonation area did not appear to have any negative effect on the adjacent wetland's biological community.



Map 1: Overview of Area



Map 2: Closeup of Sampling Area

Introduction

Primex (formally Olin Corporation) is located in Wakulla County, Florida (see map in Appendix). The facility, which manufactures explosives, treats a number of hazardous waste by-products (nitrocellulose, nitroglycerin, bulk propellant, etc.) at open burn/open detonation areas located on site. The focus of this particular study was an elevated open burn/detonation area, which was used historically but is now inactive and has been "capped" with concrete.

The burn area was constructed in an area of poorly drained, often inundated soils (a cypress/sweetbay swamp). Material to form the burn site and its access road was dredged from the surrounding area, creating a ditch around the perimeter of both. This ditch collects runoff or leachate from the burn site. Water in the ditch discharges to an adjacent, rather extensive marsh, which flows to Boggy Branch, and thence to the Wakulla River, during the outgoing tide. During an incoming tide, the ditch surrounding the burn site receives a mixture of water from the Wakulla River and Boggy Branch.

Big Boggy Branch runs roughly north to south through this swampy area and is approximately 150 m to the west of the burning ground. Big Boggy Branch, which also receives Primex's treated industrial wastewater, empties into the Wakulla River about 600 m southwest of the burning ground (see maps). The confluence of the Wakulla River and Big Boggy Branch is one mile upstream of the St. Marks River, which flows approximately six miles south into Apalachee Bay (see maps in Appendix).

Due to its proximity to Wakulla River wetlands, there was concern that leachate from the burn site could potentially have adverse effects on adjacent biological communities. The Florida Department of Environmental Protection (FDEP) Bureau of Laboratories was asked by the FDEP Hazardous Waste Regulation Section to perform a biological assessment in the potentially affected marsh.

Methods

The focus of this investigation was to determine if the leachate from the open burn area was adversely affecting the biota in the adjacent marsh associated with the Wakulla River. A comparison of the wetland biological community health was made between a marsh reference site and a marsh test site. The reference site was located approximately 300 meters east of the burn site, where First Branch, a sluggish, second order, blackwater stream enters the marsh. The test site was within 50 meters from the burn area. (see maps in Appendix). A habitat assessment was performed in situ to establish comparability between sites. Supplemental physical/chemical and nutrient data were also collected at the study sites. Turbidity, color, ammonia, nitrate-nitrite, total Kjeldahl nitrogen (TKN) and total phosphorus were also measured.

Benthic macroinvertebrate communities were evaluated at the reference and test site. Invertebrates were collected from multiple substrates (including, snags, leaf packs, vegetation) using twenty discrete dip net sweeps.

Table 1: Chemistry Data For Primex RCRA

	Reference Site	Test Site
Nutrients (mg/L)		
Total phosphorus	0.026	0.022
Ammonia	0.018 I	1.1
Nitrate+Nitrite	0.004 U	0.23
TKN	0.92	1.9
General Phys-Chem Parameters		
Habitat Assessment	111	113
D.O. (mg/L)	5.7	6.6
pH (SU)	7.1	7.2
Conductivity (µmhos/cm)	1000	1050
Temperature (°C)	9.1	8.8

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

Phytoplankton was sampled at both reference and test sites via a subsurface grab. Chlorophyll a was also determined for phytoplankton communities (Ross 1990).

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:

Habitat Assessment: Seven attributes known to have potential effects on the freshwater biota were evaluated and scored, with twenty points possible 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); Sub-optimal (70-104 points); Marginal (35-69 points); and Poor (0-34 points).

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.

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. The macroinvertebrate component of the Lake Condition Index (Hulbert 1990) was employed to assess the lentic sites sampled in this survey, since there is a degree of morphological similarity between a lake littoral zone and a marsh. Species sensitivity data from other sources, such as Hudson et al. (1990), Lenat (1993), Farrell

Table 2: Biological Data For Primex RCRA

	Reference Site	Test Site
Macroinvertebrate Qualitative		
Number of Taxa	28	34
Florida Index	3	7
Lake Condition Index	4	6
ETO Index	2	3
% Dominant Taxon	21	22.8
Community Composition		
% Amphipoda	10.5	42.7
% Isopoda	21	12.3
% Diptera	21.9	24.6
% Ephemeroptera	7.6	2.3
% Odonata	1.9	3.5
% Oligochaeta	18.1	9.4
% Trichoptera	1	0
% Other	18	5.4
Functional Feeding Groups		
% Predators	11.9	19.3
% Burrowing Deposit Feeders	15.2	9.4
% Surface Deposit Feeders	21	30.1
% Suspension Feeders	1	0.9
% Scrapers	4.8	2.9
% Shredders	12.9	5.9
Phytoplankton Algae		
Number of Taxa	13	23
Shannon-Weaver Diversity	3.1	3.7
Chlorophyll a (µg/L)	1 U	1 U
Algal Density (#/mL)	154.9	425.7
% Blue-green	0	4.4
% Green	36	24.3
% Diatoms	46	43.4

(1992), Chang et al. (1992), and Whitmore (1989), are used as appropriate.

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

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

Algal biomass: High algal biomass (algal density or chlorophyll a) implies nutrient stress.

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 following personnel were involved in this investigation: Russel Frydenborg, Tom Frick, Rebecca Northup, and Scott Lashbrook (FDEP Bureau of Laboratories). Taxanomic identification and chemical analysis were conducted by the DEP Central Laboratories' Biology and Chemistry Sections, respectively.

Results and Discussion

The study sites were situated in a tidally influenced sawgrass marsh near the confluence of Big Boggy Branch and the Wakulla River (see maps in Appendix).

Although a ditch had been dredged surrounding the burn site, the actual test site was established in the natural marsh area adjacent to the burn site. Vegetation at both sites consisted primarily of sawgrass (*Cladium* sp.), with scattered occurrences of such

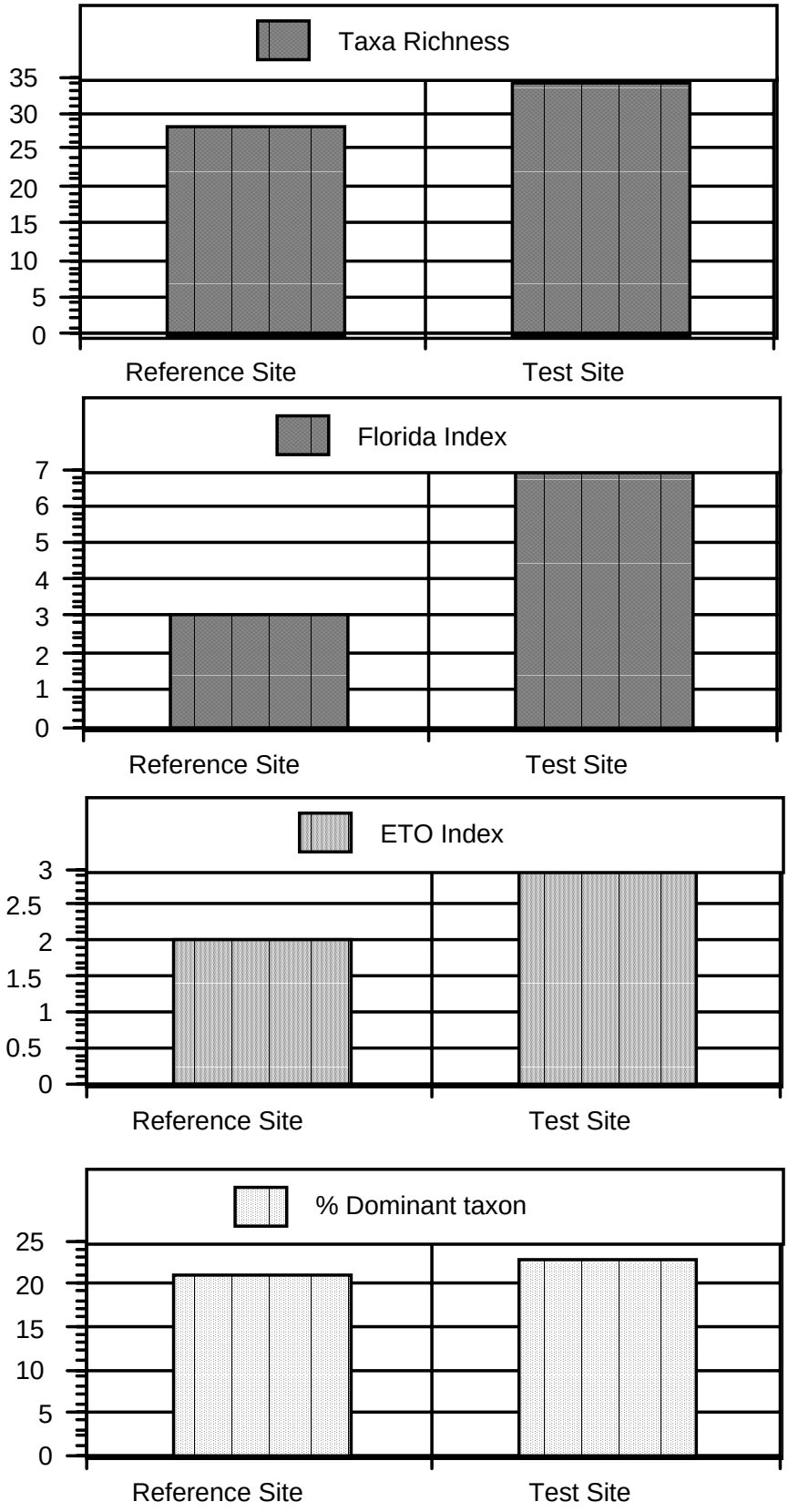


Figure 1: Selected Macroinvertebrate Matrics

plants as cypress (*Taxodium* sp.), wax myrtle (*Myrica cerifera*), sweetbay (*Magnolia virginiana*), and *Ludwigia carolina*.

There was no significant difference in habitat quality between the reference site and the test site. It should be noted these habitat assessments were based on stream criteria and are not completely applicable to wetland systems. However, both sites scored in the optimal category for all habitat parameters, except for water velocity and habitat smothering. Water velocity was sluggish at both sites, being controlled by the tides. Muck and silt deposition was very prevalent at the reference and test sites alike. These observations are normal and characteristic of such wetland systems. The test and reference sites had virtually identical substrates (mostly sawgrass and some woody debris) for macroinvertebrate colonization. Sediment at both the reference and test sites was organic mud/muck with an anaerobic odor, and the water at both sites was clear and tannic.

Dissolved oxygen complied with Class III water quality standards at both sites, ranging from 5.7 mg/L at reference site to 6.6 mg/L at the test site. The specific conductance was slightly higher at the test site (1050 µhmos/cm) than at the reference site (1000 µhmos/cm). It should be noted that specific conductance at both sites increased as one approached the Wakulla River. Areas with similar conductivity regimes were sampled. Water temperature (8.8° C to 9.1° C) and pH (7.1 SU to 7.2 SU) were similar at both sites (see Table 1).

Ammonia was significantly elevated at the test site (1.1 mg/L), where concentrations exceeded those found in 95% of other Florida streams or estuaries (see Table 1 and Typical Water Quality Values in Appendix). Results from a concurrent Fifth Year Bioassessment of the Primex discharge site indicate ammonia in the facility's industrial effluent at 12 mg/L and in Big Boggy Branch, downstream of the discharge, at 3.0 mg/L. The ammonia present in the marsh near the burn site was probably transported to the area from Big Boggy Branch during the incoming tide. The ammonia probably did not originate from the burn site itself. Unionized ammonia at the test site was calculated to be 0.004 mg/L, which complied with the Class III limit of 0.02 mg/L. Nitrate-nitrite levels were somewhat elevated at the test site (0.23 mg/L, greater than the levels found in approximately 70% of other Florida streams). In contrast, nutrients were low or undetected at the marsh reference site.

Qualitative measures of benthic macroinvertebrate community health indicated no adverse effects associated with the open burn area.

The macroinvertebrate taxa richness at the test site was 34, representing a slight increase over the reference site, which had 28 taxa (Figure 1). The benthic population at the test site con-

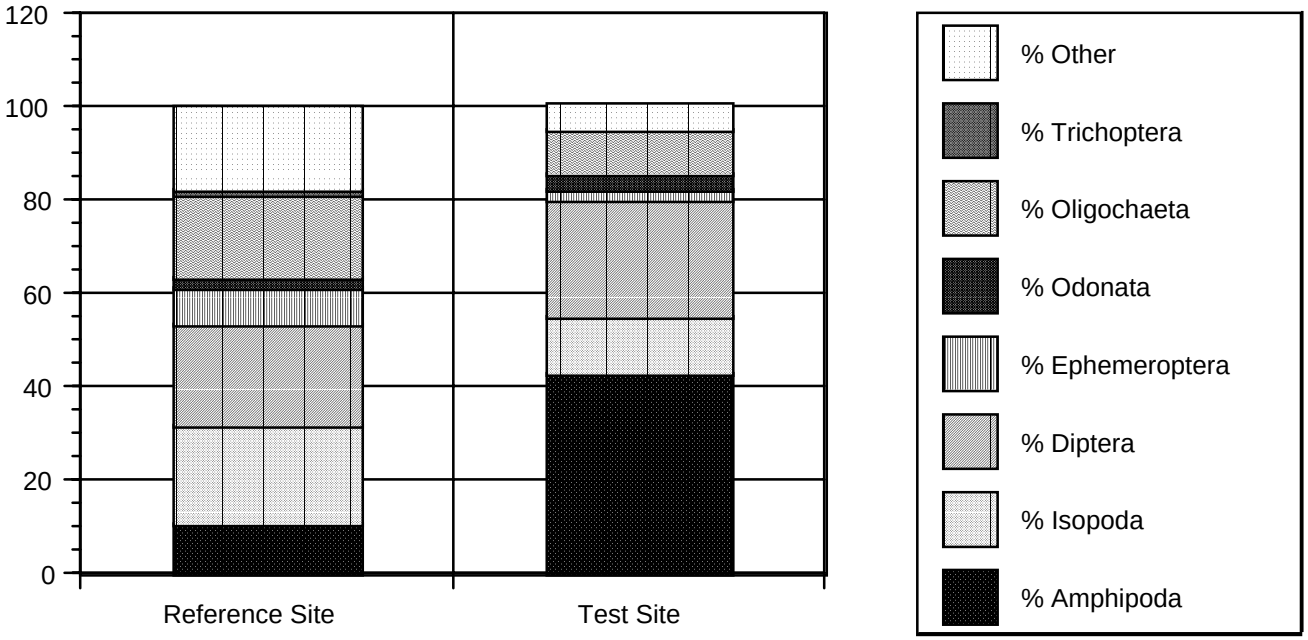


Figure 1: Selected Macroinvertebrate Matrics

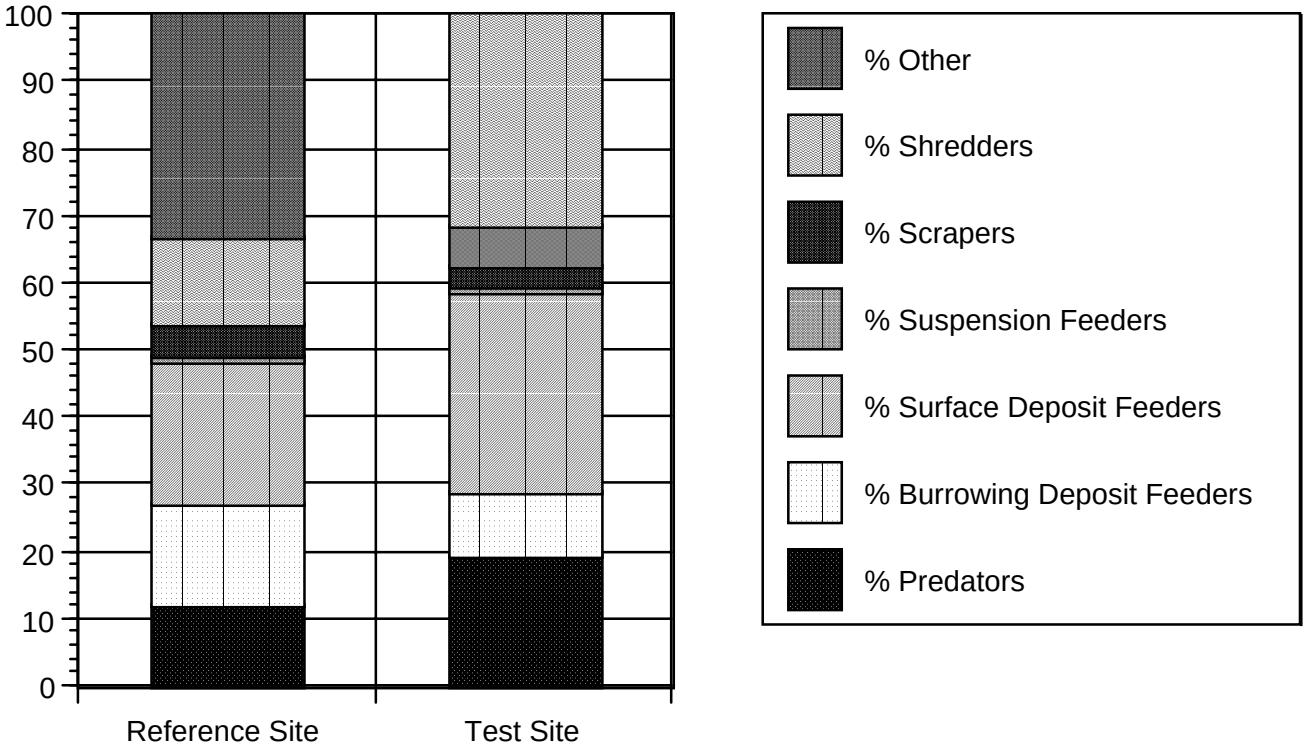


Figure 3: Macroinvertebrate Percent Functional Feeding Groups

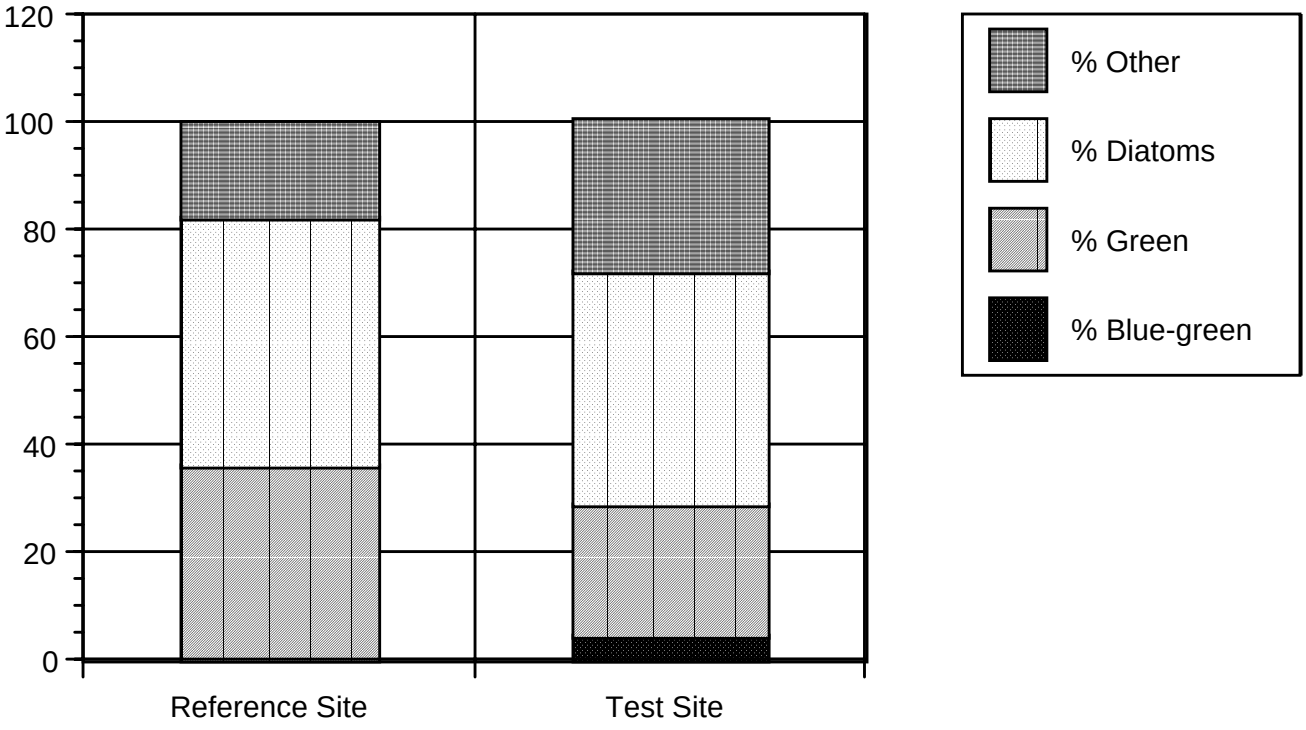


Figure 4: Algal Community Composition

sisted primarily of amphipods, dipterans, and isopods, with oligochaetes, ephemeropterans, and trichopterans also represented. Isopods, dipterans, amphipods, oligochaetes, ephemeropterans, and odonates were present at the reference site (Figure 2). The Florida Index at the test site (7) was roughly twice that of the reference site (3). Similarly, the invertebrate component of the Lake Condition Index at the test site (6) was higher than that found at the reference site (4) (Appendix). Two ETO taxa were found at the reference site, while the ETO Index at the test site was 3.

Above-surface deposit feeders, predators, and below-surface deposit feeders were most numerous at the test and reference sites alike, followed by shredders, scrapers, and suspension feeders (Figure 3). The dominant taxon at the test site was *Crangonyx* sp., which made up 22.8% of the total community. *Caecidotea* sp. was the most numerous taxon at the reference site (21% of the total), as well as being the second most common invertebrate found at the test site. A complete list of taxa is shown in the Appendix.

The phytoplankton assemblage at the test site was comparable to that of the reference marsh site. Diatoms were most numerous at both sites, followed by chlorophytes (Figure 4). Chlorophyll a was undetected at both sites, and algal density was low (less than 500 units/mL) as well (Figure 5). Taxa richness and diversity was higher at the test site than the reference site. Taxa common to both sites included the diatoms, *Nitzschia* sp. and *Navicula* sp., and unidentified chlorophytes. Although ammonia was elevated at the test site, tidally controlled water residence time was apparently of short enough duration to preclude algal blooms from occurring at the test site.

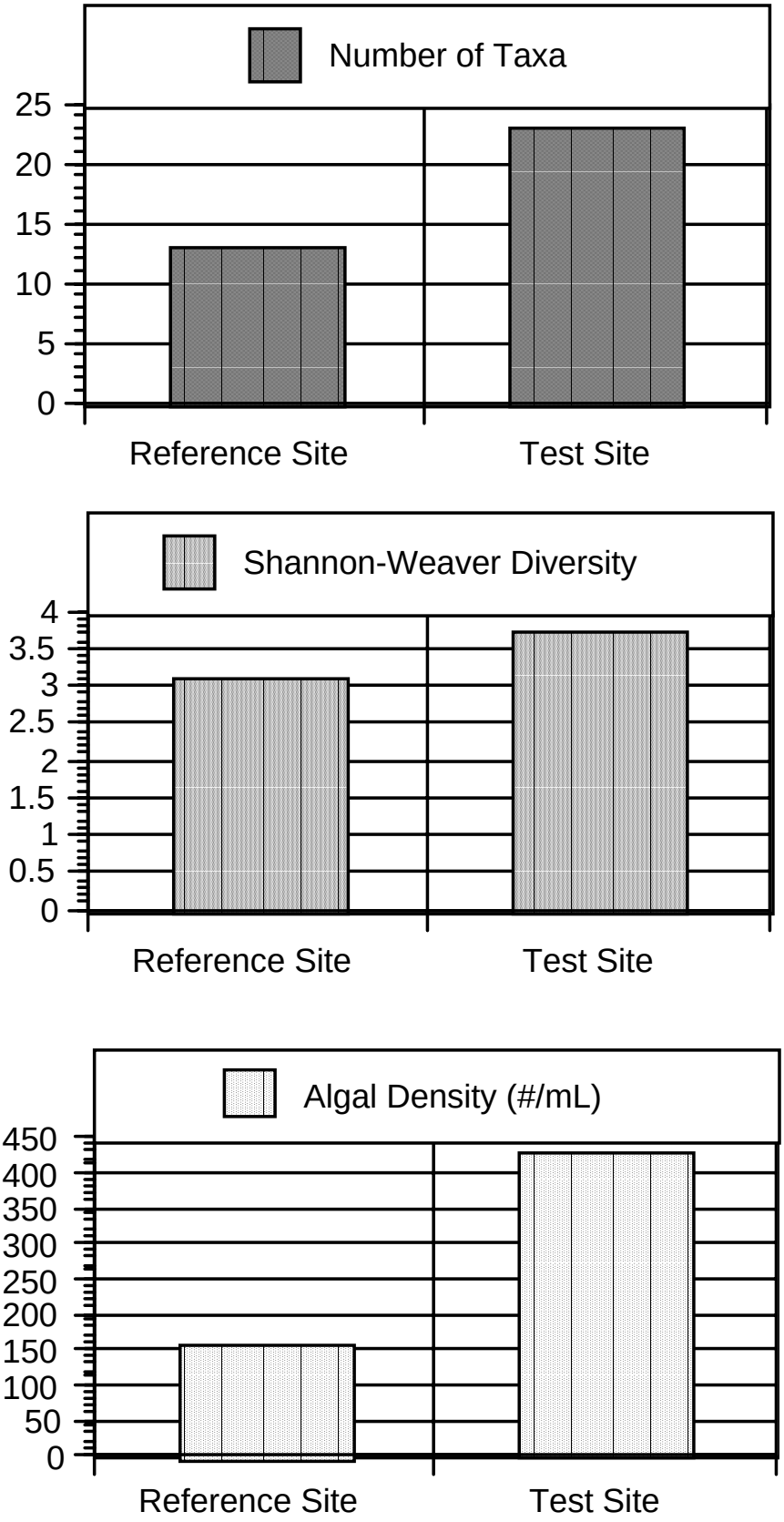


Figure 5: Selected Algal Metrics

Conclusions

Benthic macroinvertebrate and algal community health at the Primex test site was comparable to the reference marsh. Measures such as invertebrate taxa richness, the Florida Index, the ETO Index, and % dominant taxon were generally similar, or slightly better at the test site, compared with the reference site. Phytoplankton chlorophyll a and density was very low at both sites. Although ammonia was elevated at the test site, the tidally controlled water residence time was apparently of short enough duration to preclude algal blooms from occurring at the test site. The ammonia appeared to be delivered to the site from Big Boggy Branch, which receives the facility's industrial effluent. In summary, leachate or runoff from the Primex open burn/ detonation area did not appear to have any negative effect on the adjacent wetland's biological community.

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