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A study plan of sediment nutrient exchange rates in Hillsborough Bay, Florida

City of Tampa Department of Sanitary Sewers

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A Study Plan of Sediment Nutrient Exchange
Rates in Hillsborough Bay, Florida.

Submitted

to

Florida Department of Environmental Regulations
March 31, 1986

by

City of Tampa
Department of Sanitary Sewers
Bay Study Group

Introduction

The City of Tampa is planning a study of sediment nutrient exchange rates in Hillsborough Bay, Florida. The study will supply the FDER Water Quality Analysis Section with information to refine the mathematical modeling of Hillsborough Bay for wasteload allocation.

The initial effort, Phase I, will produce a map of Hillsborough Bay identifying areas of "sandy" and "muddy" sediments, and to estimate the areal coverage of these sediment types.

The secondary effort, Phase II, will estimate seasonal nutrient exchange rates for "sandy" and "muddy" sediments at a minimum of two locations in Hillsborough Bay.

The seasonal estimates of sediment nutrient exchange rates, in conjunction with knowledge of sediment distributions and areal coverage, will greatly improve the estimate of total nutrient exchange from the sediments of Hillsborough Bay.

Phase I

Surface Sediment Composition and Areal Coverage

Surface sediment types in Hillsborough Bay will be distinguished by using depth recorder tracings taken during 29 transects (Figure 1). Sediment samples from 19 locations throughout the bay will be analyzed for particle size to confirm interpretations of the depth recorder tracings.

Sediment types discriminated by the depth recorder will be analyzed in the laboratory for grain size, carbon, nitrogen and phosphorous composition (Figure 2). Particles retained on an ASTM number 230 sieve (63 μm) will be defined as "sand" and those passing through will be called "mud". Surface sediments containing \leq 50% "sand" will be "mud" for mapping purposes. The Department of Marine Science at the University of South Florida will determine sediment grain size, total carbon and total nitrogen. Grain size analysis will follow standard sieve and pipette methods (Folk 1965). Total carbon and total nitrogen will be determined using a Carlo-Erba model 1106 elemental analyzer and reported as percent by weight. Total phosphorous (Std. Methods 14 ed., Method 425F) will be measured by the City of Tampa chemistry laboratory.

The output of this effort will yield the approximate boundaries and percent coverage of "mud" in the surface sediments of Hillsborough Bay.

Figure 1. Twenty-nine sediment transects and 19 sediment sample stations in Hillsborough Bay.

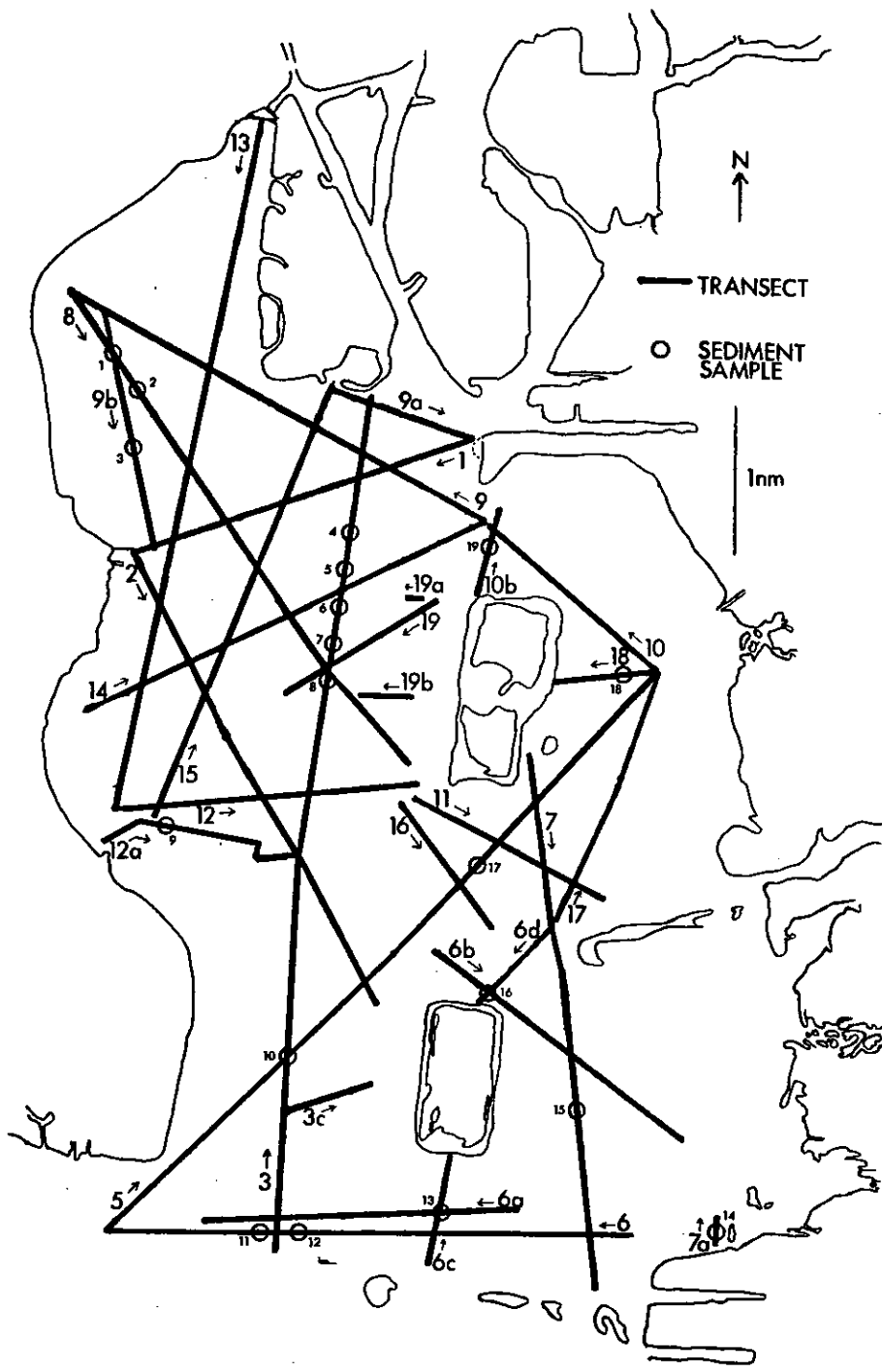
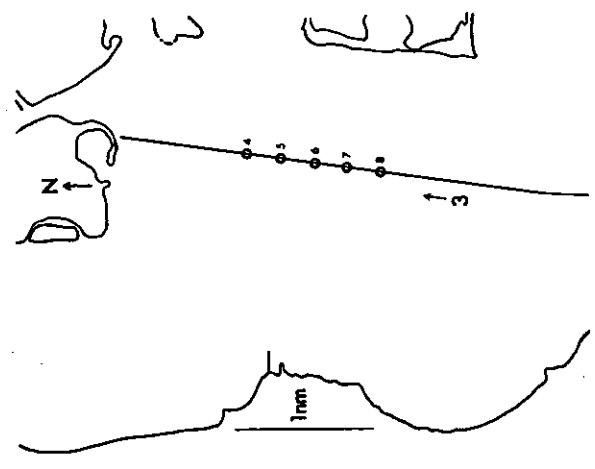
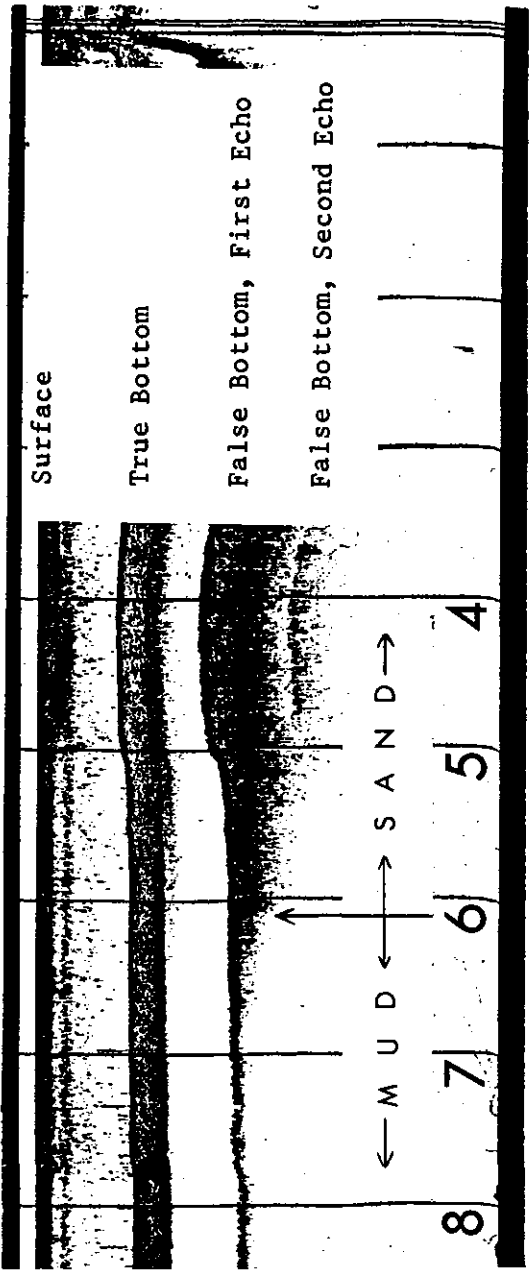


Figure 2. Depth recorder tracing from five sediment sample locations along transect 3 in central Hillsborough Bay.



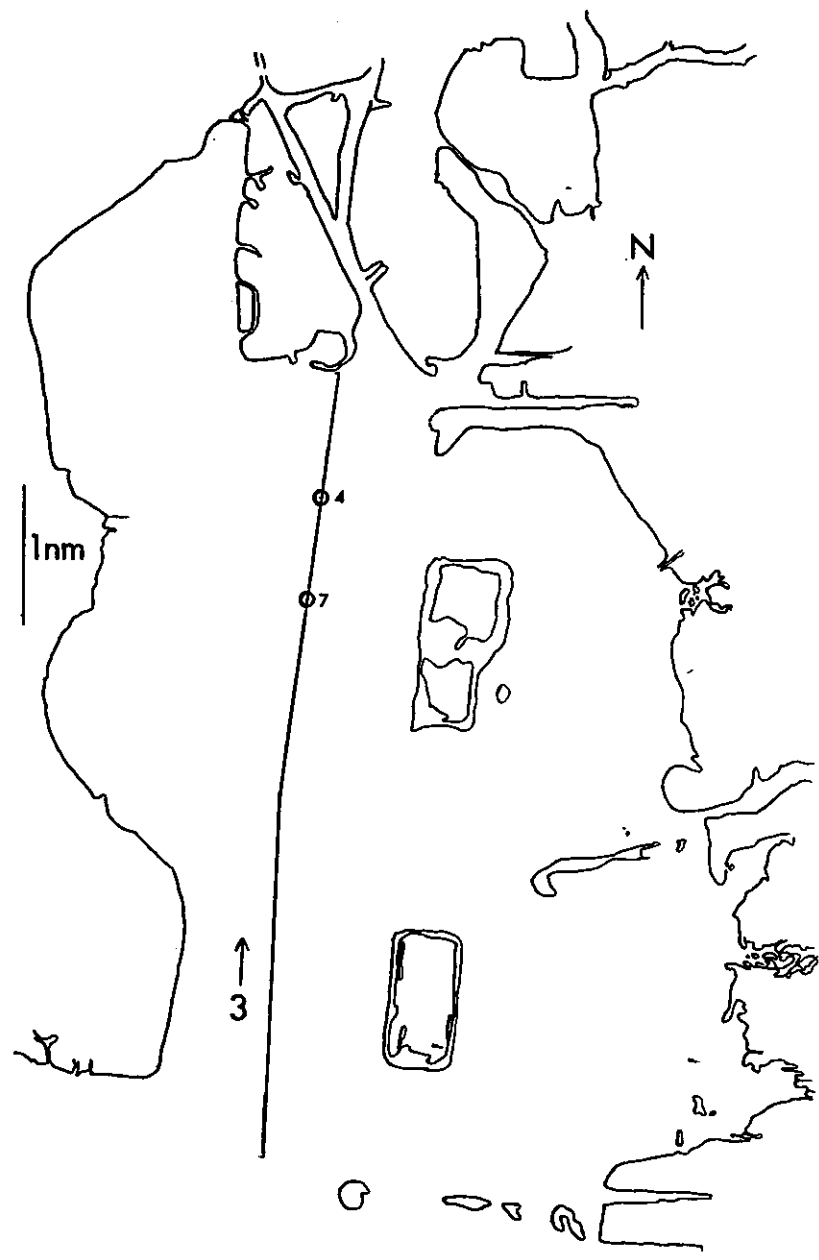
Phase II

Seasonal Sediment Nutrient Exchange

Seasonal nutrient exchange rates for "sandy" and "muddy" sediments will be measured at a minimum of two locations in Hillsborough Bay. At least one dry/cold (December, January, February) and one wet/warm (July, August, September) measurement will be made for the two sediment types. Additional sampling during other seasons may be performed. Sediment oxygen demand (SOD) rates will also be estimated since they can be easily incorporated along with the nutrient exchange rate experiments.

In-situ SOD chambers will be set in Hillsborough Bay by SCUBA divers in sandy sediments at station 4 and in muddy sediments at station 7 (Figure 3). The in-situ SOD chambers, and the field procedures employed, will be the same as described by Murphy and Hicks (1985). All chambers will be allowed to incubate for six hours from 1030 to 1630 hours. Dissolved oxygen (DO) will be measured every 15 minutes using DO probes (YSI model 5739) calibrated by Winkler titrations (Strickland and Parsons 1968) of seawater. DO probes will be calibrated before incubations start, and will be checked for calibration immediately following the incubation period. Water samples (500ml) for nutrient analyses will be taken from each chamber initially and every two hours thereafter during incubations. Surface and bottom water samples will be collected by Niskin bottle casts for ambient nutrient levels at the start and end of the incubation period. Nutrient samples will be placed on ice and transported to the City of Tampa Bay Study laboratory without delay. Within 1½ hours of the collection time, each sample will be split into a filtered (0.4 µm Nuclepore, 7 psi) and non-filtered fraction, acidified (2ml concentrated H₂SO₄ per liter of sample), and stored on ice.

Figure 3. Sediment nutrient exchange sampling locations in Hillsborough Bay.



Concentrations of total phosphorous (unfiltered), $\text{PO}_4\text{-P}$, TKN (unfiltered), $\text{NO}_2\text{-N}+\text{NO}_3\text{-N}$ and $\text{NH}_3\text{-N}$ will be measured by the Hillsborough County Environmental Protection Commission (H.C.E.P.C) to ensure compatibility with available water quality data for Tampa Bay.

The output of this effort will provide seasonal sediment nutrient exchange rates for "muddy" and "sandy" sediments in Hillsborough Bay.

Interim Reporting Dates for the
Nutrient Exchange Study

Phase I

Report of surface sediment distribution March 31, 1986

Phase II

Results from winter nutrient exchange sampling May 31, 1986

Results from summer nutrient exchange sampling September 30, 1986

References

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