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KISSIMMEE RIVER BASIN
WATER QUALITY MODEL STUDY

SUBMITTED TO

CENTRAL & SOUTHERN FLOOD
CONTROL DISTRICT

BY

CIVIL ENGINEERING DEPARTMENT
UNIVERSITY OF MIAMI

July 1973

Thomas D. Waite

Dr. Thomas D. Waite
Assistant Professor of Civil Engineering

H. Halprenstien

for Howard Halprenstien
Dean
School of Engineering & Environmental Design

UNIVERSITY OF MIAMI
BY *Eugene L. Curren*
EUGENE L. CURREN
VICE PRESIDENT

Mr. Howard R. Cottrell
Treasurer

PROPOSAL

BACKGROUND

The Kissimmee-Okeechobee River Basin is located in South-Central Florida extending from the Lake Kissimmee Region down to Lake Okeechobee. It forms the upstream portion of the everglades water system which has large human population centers as downstream users. Concern has been expressed lately with regard to water quality in Lake Okeechobee-The Water System's Nucleus. Attention has been drawn to the channelized Kissimmee River which constitutes the primary inflow to Lake Okeechobee. The existing Kissimmee canal was dredged on the basis of flood control, but the resultant water quality is now being questioned.

NEED FOR STUDY

It has become apparent that a balancing of several systems within the Kissimmee-Okeechobee basin is now required. The existing system of flood control will have to be modified to include water quality measures which will coincidentally affect wildlife habitat. Parameters which influence the basin must be defined, isolated and quantified. The effects of altering these parameters must be simulated with models, and a simulation of both the hydrology and water quality must be conducted. A valuable tool for decision making will thus evolve.

PROPOSED STUDY

The proposed study would create a working model which interfaces the hydrology and water quality aspects of the Kissimmee River Basin. Existing hydraulic-hydrology models would be utilized as a skeleton for the addition of the important water quality parameters in the system. The result will generate a comprehensive model which can relate hydraulic loadings and environmental perturbations.

Phase I

- (a) Collection and assimilation of water quality data taken on the Kissimmee River and Lake Okeechobee by various agencies.
- (b) Familiarization with hydraulic models of the Kissimmee River Basin used by F.C.D.
- (c) Evaluation of the river basin models currently in use e.g. Potomac River system, Ohio River Basin etc.

Phase II

- (a) Evaluation of critical water quality parameters in the Kissimmee Basin.
 - 1) Organic Loading
 - 2) Macro-Nutrients
 - 3) Micro-Nutrients
 - 4) Trace metals
 - 5) Refractory Compounds
 - 6) Temperature, salinity
- (b) Determination of most reliable environmental indicators.
 - 1) Dissolved Oxygen
 - 2) Plant Productivity
 - 3) Fish Productivity
 - 4) Turbidity
 - 5) Bacteriological Indicators
 - 6) Chemical Constituents

- (c) Write mass balances on conservative parameters using preconstructed hydraulic loadings.
 - 1) Phosphate
 - 2) Nitrate
 - 3) Ammonia
 - 4) Nitrite
 - 5) Calcium
 - 6) Trace metals
 - 7) Refractory compounds
 - 8) Light
- (d) Compare the above components for magnitude of perturbation and sensitivity.
 - 1) Evaluation at various hydraulic loading rates
 - 2) Comparison with known values
- (e) Combine selected components with hydrology model. Create computer program to simulate the model.

Phase III

- (a) Test model with collected data from Kissimmee River and Lake Okeechobee.
- (b) Use model to predict resultant water quality due to modifications in the Kissimmee River Basin.

The Kissimmee River situation is unique, hence most of the classical river basin models will not simulate the system with any accuracy. Channelization has caused large hydraulic and water quality changes which must be modeled to assure correct water management.

Our study will include an evaluation of biological and chemical methods of element movement. Biological uptake of the macro-nutrients i.e. nitrogen and phosphorus will be simulated in several ways to achieve best fit of observed data. Recent work on kinetics of trace metal movement will also be incorporated to allow for the management of certain metals. Bacteriological break_{down} rates of refractory compounds i.e. pesticides, hydrocarbons etc. will be evaluated for possible use in the model.

The resultant hydrology-water quality interfaced model should offer a means for evaluating river restoration alternatives. Proposed changes to the topography of the river basin could be plugged into the model and a prediction of resultant flow and water quality could be made.

STUDY TIME TABLE

Phase I- September 1, 1973 - February 28, 1974

Phase II- March 1, 1974 - October 31, 1974

Phase III- November 1, 1974 - February 28, 1975

KISSIMMEE RIVER BASIN
WATER QUALITY MODEL STUDY

BUDGET
(1½ years)

Graduate Student

Tuition - 30 crs. x 100	\$3,000.
Stipend - \$244.44/mo x 18	4,400.
Fees	50.
Travel*	750.
Lab Supplies	500.
Computer Time-Univac 1106	1,000.
Total Direct Costs	9,700.
Indirect Costs - 20% of Total Direct Costs	x 1,940.
Total	<u>\$11,640.</u>
	<u>- 1,200</u>
	<u>\$10,440</u>

*10 trips to Kissimmee & F.C.D.
@ 500 mi. roundtrip
@ 15¢/mi.

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PETER CHARLES ROSENDAHL
Engineer

Personal:

Born: March 6, 1944, Teaneck, New Jersey

Education:

University of Miami, Environmental Engineering Doctorate Program,
presently in program

University of Miami, Ocean Engineering, Master of Science, 1972
Humble Oil and Refining Company, Petroleum Engineer, Company
schools both in Production and Reservoir Engineering, 1971
Newark College of Engineering, Mechanical Engineering, Bachelor
of Science, 1967

Awards and Honors:

Tau Beta Pi - National Engineering Honor Society
Pi Tau Sigma - National Mechanical Engineering Honor Society
Epsilon Tau Lambda - Adult Honorary Academic Society
U. S. Sea Grant Fellowship, 1970-1971

Professional Experience:

The Center for Urban and Regional Studies, Division of Applied Ecology,
University of Miami, Intern, 1971 to date
Rosenstiel School of Marine and Atmospheric Science, Miami, Florida,
Ocean Engineer, Summer of 1971
Humble Oil and Refining Company, Kingsville, Texas, Project Engineer,
Petroleum Production Engineer, 1967-1970
Humble Oil and Refining Company, Kingsville, Texas, Project Engineer,
Petroleum Reservoir Engineering, 1967-1969
Kodak, Rochester, New York, Design Engineer, Summer of 1966

Publications:

Heat Transfer in Open Channels by Swirl Flow. Department of Mechanical
Engineering, University of Miami (Topic deals with thermal
pollution)

Affiliations:

Boy Scouts (Scoutmaster, 1969-1971)
Toastmasters (President, 1970)
American Society of Mechanical Engineers
Environmental Alliance of Dade County
Newark College of Engineering Rod and Gun Club

RESUME

Name: Thomas Dee Waite

Address: 9250 S. W. 81 Avenue, So. Miami, Florida

Born: April 23, 1944, Watertown, New York

Education:

B.S.C.E.	Northeastern University,	1967
M.S.C.E.	Northeastern University,	1969
S.M.	Harvard University,	1971
Ph.D.	Harvard University,	1972

Experience:

Teaching

Northeastern University, Teaching Assistant,
Civil Engineering, 1967-1968

Northeastern University, Instructor,
Civil Engineering, 1968-1969

Harvard University, Teaching Assistant
Environmental Sciences, 1970-1972

University of Miami, Assistant Professor
Civil Engineering, 1972-Present.

Research

Massachusetts Institute of Technology, Soil Mechanics
Division, Laboratory Technician, Cooperative Work
Assignment 1963-1967.

Helsinki Water Protection Laboratory, Helsinki,
Finland, Research Engineer, 6/71-9/71.

Consulting

Robert Charles Assoc., East Boston, Massachusetts,
Sewer Design and Layout, 6/69-9/69.

Eco-Control, Cambridge, Massachusetts, Board of
Directors, and Vice President of Engineering, 1970-1972;
Vice President 1970-Present.

Consulting cont.

Broward County Air and Water Pollution Control Board
Expert Testimony (1972)

General Development Corporation
Canal Water Quality Study (1973)

Research Grants, Contracts:

<u>Agency</u>	<u>Title</u>	<u>Position</u>	<u>Dates</u>	<u>Amount</u>
E.P.A.	Advanced Wastewater Plant Operator Training	Co-P.I.	1972	\$ 6,000
E.P.A.	Multidisciplinary Air Pollution Technician Training Program	Co-P.I.	1972	25,000
Dade Co. U. Miami Dept. of Interior	Water Quality Restora- tion of Canals After Ceasation of Sewage Discharges	P.I.	1973- 1974	94,000
N.S.F.	Lake Osceola Study	P.I.	1973	2,400
Dept. In- terior Water Re- sources	Bacteria and Macrophyte Interactions in Fresh and Estuarine Waters (Submitted)	P.I.	1973- 1975	131,000
N.S.F.	Variables Affecting Nutrient Transport by Roots of Various sub- merged hydrophytes (Submitted)	P.I.	1973	17,000
E.P.A.	Graduate Student Training Grant (Submitted)	(Admini- strator)	1973- 1974	167,000

Publications:

- 1) Waite, T. and C. Gregory, (1969) Notes on the Growth of Ulva as a function of ammonia nitrogen. Phytologia Vol. 18, No. 2.

Publications cont.

- 2) Waite, T. and C. Gregory, (1969) Parameters affecting the growth of Ulva latissima in a polluted estuary. Proc. 2nd Annual North Eastern Regional Anti-pollution Conference, University of Rhode Island.
- 3) Waite, T. and R. Mitchell, (1972) the role of benthic plants in marine eutrophication
Journal American Society of Civil Engineering, Sanitary Engineering Division, Vol. 98, No. SA5
- 4) Waite, T. and R. Mitchell, (1972) The effects of nutrient fertilization on the benthic alga Ulva lactuca
Botanica Marina, Vol XV pg. #151-156.
- 5) Waite, T. A study of the microfloral symbiosis of the alga Ulva lactuca. Report to NSF, Marine Ecology Course, Marine Biological Laboratory, Woods Hole, Mass.
- 6) Waite, T., L. Spielman, R. Mitchell, (1972) Growth rate determinations of Ulva in continuous culture
Environmental Science and Technology, Vol. 6, No. 12. pgs. 1096-1101
- 7) Waite, T. and R. Mitchell, (1972) Some symbiotic and antagonistic relationships between Ulva and its associated microflora. Biol. Bulletin.
(Submitted for publication)

Honors and

Awards:

PHI SIGMA, Honorary Biological Research Society, 1969
USPHS Fellowship 1970
EPA Fellowship 1971-1972
New England Water Works Scholarship Award 1971

Professional

Societies:

American Society of Civil Engineers
New England Water Works Association
Harvard Engineering Society

RECEIVED JUN 11 1974

UNIVERSITY OF MIAMI
CORAL GABLES, FLORIDA 33124

SPONSORED PROGRAM FISCAL MANAGEMENT
P. O. BOX 248153

June 4, 1974
Invoice No. 4

TO: Central and Southern Florida Flood Control District
P.O. Box V
West Palm Beach, Florida 33402

FROM: University of Miami
P.O. Box 248153
Coral Gables, Florida 33124

RE: Kissimmee River Basin - Water Quality Model Study
Ctr. & So. Fla. Flood District 4KRA22
Principal Investigator: Dr. Thomas Waite
Period: 11/1/73 - 2/28/75 Account No. Y 8421

Payment Due Per Terms of Contract:


FOR THE PERIOD OF: May 1, 1974 THRU July 31, 1974

Three (3) months @ \$ 1,696.50 \$ 1,696.50

TOTAL DUE UNIVERSITY \$ 1,696.50

UNIVERSITY OF MIAMI

"I certify that the above bill is correct and just and that payment thereof has not been received."


(Mrs.) Alma Watkins,
Grants & Contracts Administrator
(305) 284-4711

AW/dc

Approved for Payment
6-30-74
Bill To. Brown

ME0-1015
303-290
303-90-J275

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UNIVERSITY OF MIAMI
CORAL GABLES, FLORIDA 33124

JAN 23 1974

RESEARCH ACCOUNTING
P. O. BOX 8153

CENTRAL & SOUTHERN FLORIDA
FLOOD CONTROL DISTRICT
January 21, 1973
Invoice No. 2

TO: Central and Southern Florida Flood Control District
P. O. Box V
West Palm Beach, Florida 33402

FROM: University of Miami
P. O. Box 248153
Coral Gables, Florida 33124

RE: Kissimmee River Basin - Water Quality Model Study
Ctr. & So. Fla. Flood District 4KRA22
Principal Investigator: Dr. Thomas D. Waite
Period: 11/1/73 - 1/31/74 Account No. Y3421

Payment Due Per Terms of Contract :

FOR THE PERIOD OF: November 1, 1973 THRU January 31, 1974

Three (3) Months @ \$ <u>1,696.50</u>	\$ <u>1,696.50</u>
	<i>565.50</i>	
TOTAL DUE UNIVERSITY		\$ <u>1,696.50</u>
		=====

UNIVERSITY OF MIAMI

"I certify that the above bill is correct and just and that payment thereof has not been received."

Alma Watkins

(MRS.) ALMA WATKINS
Grants & Contracts Administrator
(305) 284-4711

1-25-75
Budget Code 303-290
Cost # 90-5-275

ME0-1015

pw 1/21/74