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PROGRESS REPORT 2.

To the Office of Science Advisor
to the Administration,

U.S. Agency for International Development
Washington, D.C.

U.S.A.I.D. Program Title:
Seagrass Restoration in Caribbean Nearshore Areas

Grant No: DAN-5542-G-SS-2101-00

Submitted by

Department of Biological Sciences
Florida International University

Co-Sponsored by

Natural Resources Conservation Department
Government of Jamaica

July 25, 1983

Principal Investigator

A. Thorhaug, Ph.D.
Department of Biological Sciences
Florida International University

Co-Principal Investigators

Beverly Miller, Principal Director
Natural Resources Conservation Departme

Barry Jupp, Ph.D.
Consultant to FIU
Department of Botany
University of the West Indies

PROGRESS REPORT 2.

SUMMARY

The rehabilitation of seagrasses in nineteen sites damaged by industrial and urban development was attempted for the first time in any developing nation. The transfer of technology created for temperate and subtropical developed nations (United States, England, Holland, France, and Australia) was made by the transplanting of seagrass, training of Natural Resources Conservation Department (Government of Jamaica) staff, and the equipment provided to perform the work. A program to make the large scale rehabilitation of seagrass (and their fisheries nursery function) more cost-effective by utilizing unemployed fishermen as collectors of plant specimens and planters in shallow water has resulted in excellent initial results.

Successful coalescence of the seagrass at several of the badly damaged areas has resulted after seven months. Areas damaged by dredge and fill, bauxite spills, urban development, and thermal effluents can be restored and the seagrass at these test sites is growing rapidly. Nineteen test sites around the coastline of Jamaica have been transplanted in the fall and spring and are being monitored to measure the rate of survival and growth. Certain damaged areas such as continual cement tailing pollution and artifically made industrial lagoons which become quite saline appear to have far less promise for supporting seagrass restoration.

Figure 31. Front page news story from the Daily News, March 26, 1983

Jamaica DAILY NEWS

. 5 No. 189

Saturday, March 26, 1983.

Pilot seagrass project a success

FROM CARL WINT

CARTAGENA, Colombia, — A pilot project to restore the seagrasses around Jamaica's coastline has been successful Dr. Anitra Thoraug, of the Florida International University told a seminar of Caribbean and Latin American journalists here Wednesday.

Sponsored by the United States Agency for International Aid, the National Resources Conservation Department and Florida International University the 18 months project was conducted on about 17 sites representing several hundred acres of coastline.

It is the first time the restoration of seagrasses as nurseries for marine life was taking place on a successful level in the tropics.

"Already crab and shrimps, as well as fish are returning to these sites," Dr. Thoraug said. Grunt, snapper, conch, all in their young stages are returning. They will be ready for harvesting within the year.

Associated with Dr. Thoraug in the project were five officers of the Natural Resources Conservation Department, three people from the University of the West Indies, five unemployed people, five from Florida International University.

Further rehabilitation work will be done and it is anticipated that the United Nations Environment Programme will be involved. The project involved the planting of seagrasses, monitoring, equipment, training of people, analysis and recommendations.

"There is now some hope of correcting some of the mistakes we have made in the past," Dr. Thoraug said.

To ensure that there is adequate seagrasses to help attract marine life around the island's coast Dr. Thoraug said that controls will be necessary.

The project was part of Jamaica's efforts to preserve and improve the environment and will help in ensuring that Jamaica's fishermen can continue to earn a livelihood around the coast.

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Figure 32. Newspaper editorial from the Daily News, March 31, 1983

EDITORIAL

Rehabilitation of seagrass

A report last week in this newspaper dealt with the rehabilitation of seagrass on 17 sites along Jamaica's coast. That report might not have been read by some people, and no doubt others underestimated its importance.

But the fact is that while the project which ran for 18 months, involved 18 people headed by marine biologist Anitra Thorhaug, and cost under $200,000, the implications are important.

Earthscan, publicists for the International Institute for Environment and Development, claims that "the widespread seagrass meadows of the Caribbean offer economic benefits which are rarely appreciated by planners."

Seagrass thrives in shallow water, is a genuine flowering plant and is not one of the seaweeds. Seagrass is home for hundreds of species of fish, crustaceans and molluscs.

With various efforts being made to develop a shrimp and lobster industry the protection and rehabilitation of seagrass is even more important.

Marine biologists also explain that seagrass help to control erosion of beaches and shorelines. This is an aspect which bears directly on our tourist industry, a dollar earner of major proportion at this time.

They also catch particles and bind sediment thereby helping to provide the clear water upon which tourism is based, not only in Jamaica but throughout the Caribbean.

JAMAICA IS NOT the only Caribbean island rich in seagrass. There is the United States Gulf Coast, the Bahama Banks, Cuba's Southwest Coast, the Windward Islands, Mexico, Belize, Honduras, Nicaragua, Costa Rica, Panama, Colombia, and Venezuela.

Many of these countries are not yet aware of the importance of the seagrass, its economic and environmental benefits. The project in Jamaica gives this island an advantage but it will not be one which will last for long. Shortly these countries will begin to exploit this marine life, and they will do so aggressively, and to their economic benefit.

It is in our interest to ensure that the seagrass is not exposed to pollutants caused by dredging and filling, or the sudden release of oil, sewage, heated effluents, heavy metals, pesticides and fertilisers.

Heavy environmental education at all levels will be required as well as the enforcement of laws to prevent the pollution of our rivers and streams which flow into the sea.

It is our understanding that the project will continue in the months ahead. Meanwhile there is a cadre of Jamaicans who have been exposed to the rehabilitative process and no doubt others will be brought in so that Jamaica will have enough people who know what it is all about.

The current economic climate does not augur well for substantial expenditures on environmental affairs, but we believe that with a little thought and some co-operation much more can be done to enlist the support of many Jamaicans in a worthwhile effort which will redound to the health, the quality of life, the economy and the environment. In any event what is spent today will prevent us spending much more in the future.

Reports are that conservation and careful land use planning are much cheaper than rehabilitation or restoration.

DAILY NEWS

Phone: 92-63120

Printed and published by the Daily News Limited, 58 Half Way Tree Road, Kingston 10 Jamaica.

CARL W[illegible], EDITOR

Except for the Editorial [illegible] in this column the views [illegible] are not necessarily those of the publisher

Preface

In accordance with Item 1. Progress Reports, Section E. Reporting and Evaluation of the SCHEDULE for Grant No. DAN-5542-G-SS-2102-22 for the AID program titled "Seagrass Restoration in Caribbean Nearshore Areas," awarded August 31, 1982, the attached is PROGRESS REPORT 2 for the reporting period ending June 30, 1983.

As suggested in Item 1. Progress Reports, the Principal Investigator's overseas colleagues were involved in the preparation of this report by:

1. Historical research and collection of background materials in Kingston by B. Jupp, Ph.D. and NRCD staff;
2. Review and comments on the PROGRESS REPORT 2 during preparation by B. Jupp, Ph.D. in Kingston; and
3. Review and comments on the PROGRESS REPORT 2 before formal submission by B. Miller of the NRCD in Kingston.

In accordance with Section E. Reporting and Evaluation of the SCHEDULE, the Grantee is requested to submit the Financial Status Report (SF-269) as an attachment to the PROGRESS REPORT. This report, prepared by the Controller's Office of Florida International University, is attached.

Respectfully submitted,

A. Thorhaug, Ph.D.
Principal Investigator

July 25, 1983
(Four copies)

Acknowledgements

I wish to thank the Agency for International Development of the United States Department of State for supporting this grant, and the Biology Department of Florida International University and the Natural Resources Conservation Department of the Ministry of Mining, Government of Jamaica, for sponsoring this grant. The Division of Sponsored Research and the Controller's Office of Florida International University are thanked for administering the grant.

At the AID Mission in Jamaica, I wish to thank Mr. Dan Rathburn, the AID Project Officer, and his assistant, Ms. Roberta Mathis, for their cooperation and assistance during our work there. Mr. William Davis, U.S. Embassy Counselor, Information Services, is thanked for his personal interest and promotion of the project.

The Principal Director, Mrs. Beverly Miller, and staff of the Natural Resources Conservation Department are gratefully acknowledged for their cooperation, assistance and support of this project.

Lastly, I thank the field biologists from FIU, UWI, and NRCD for their work during the February and June 1983 monitoring and April 1983 planting and monitoring field trips.

Seagrass Restoration in Caribbean Nearshore Areas

PROGRESS REPORT 2.

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Note about subject headings in PROGRESS REPORT 2:

The terms "Corrected from PROGRESS REPORT 1" and "Amended to PROGRESS REPORT 1" appear following the subject headings in this report.

The term "Corrected . . . " means that the text following the heading has been changed from PROGRESS REPORT 1 to accomodate modifications in the monitoring procedure and data analysis, recoding of site names, inclusion of site characteristics pertinent to the April 1983 planting, and editorial revisions. The text under this heading therefore replaces that in PROGRESS REPORT 1.

The term "Amended . . . " means that the text following the heading is added to that in PROGRESS REPORT 1 to accomodate the April 1983 planting and editorial revisions. The text under this heading therefore is inserted into PROGRESS REPORT 1.

Seagrass Restoration in Caribbean Nearshore Areas

PROGRESS REPORT 2.

I. Introduction

A. Purpose of Grant

The research will test whether one can accelerate the re-establishment of seagrass beds destroyed by natural disasters and man-made pollution in Kingston Harbor and other sites along the coastline of Jamaica using seagrass restoration techniques developed in subtropical Florida and Texas.

B. Specific Objectives

1. To test whether shallow, tropical nearshore waters around Jamaica are capable of receiving seagrass restoration.

2. To test if successional seagrass stages (*Halodule* and/or *Syringodium* species) should be planted first (to provide ground cover and sediment stabilization) with the dominant species (*Thalassia*) planted later, or whether equal success and cost/benefit can be achieved by planting the dominant stage directly with no successional stage.

3. If the testing in Objective 1 is positive, to test whether seagrasses can be successfully restored into areas where one of the pollution impacts listed below has occurred, damaged the area, but no longer causes additional damage in the area, or where one of the pollution impacts occurs on a chronic but tolerable level:

   a. Industrial accidental spills;
   b. Land development induced impacts;
   c. Urban run-off and urban abuse.

4. To test the rate of recovery of restored versus non-restored seagrasses with associated animal communities after impact to the area has ceased.

C. Jamaica's Uses of Coastal Resources
(Submitted in PROGRESS REPORT 1)

D. Description of Jamaica's Seagrass Resources
(Submitted in PROGRESS REPORT 1)

II. Methods

As stated in PROGRESS REPORT 1, "To test the feasibility of large scale seagrass restorations in Jamaica, sixteen test sites around the coast of Jamaica were selected for planting." The number of sites, however, has been increased to nineteen to compensate in part for two sites that will not support any transplanted seagrass and in part to broaden the scope of the site characteristics tested.

Site selection, demarcation, preplanting survey, design, plant material collection, transportation, preparation, planting, monitoring, data analysis, personnel training, and equipment needed are as follows. (Previously described in PROGRESS REPORT 1. Items below reflect amendments and corrections since that report.)

A. Site Selection: No changes from PROGRESS REPORT 1.

B. Demarcation: No changes from PROGRESS REPORT 1.

C. Preplanting Survey: No changes from PROGRESS REPORT 1.

D. Experimental Design: No corrections from PROGRESS REPORT 1. Amended as follows. (Paragraph 5 - 6)

Two large test sites are transplanted with a single species of seagrass using one method of planting (Halodule plugs). They are installed to examine the success of a larger transplanting effort, to examine fisheries organisms recolonization in a larger area, and to expose the training staff to the demands of a larger scale restoration.

The large test site at Fort Augusta Causeway in Kingston is 60'x 180' (.25 acre) where 1200 planted units are installed on a 3'x 3' matrix. The second large test site at South Port Beach in Montego Bay is 60'x 120' (.17 acre) where 800 planted units are installed on a 3'x 3' matrix.

E. Plant Material Collection: No corrections from PROGRESS REPORT 1. Amended as follows (Paragraph 1, last sentence)

Ruppia maritima shoots are also collected for transplanting on one occasion.

F. Plant Transportation: No changes from PROGRESS REPORT 1.

G. Plant Preparation: No corrections from PROGRESS REPORT 1. Amended as follows (insert after first sentence):

Shoots are also attached to inert ceramic insulators or dead coral fragments found on the beach.

H. Planting: No changes from PROGRESS REPORT 1.

I. Monitoring: Corrected from PROGRESS REPORT 1 as follows:

Sampling at each site will consist of counting all the surviving planted units and measuring 33 percent of the planted units (every third plant) for length of the longest blade, number of leaf shoots per m^2, length of the primary rhizome, number of rhizomes per m^2, diameter of the plug, and the number of seeds present. Measurements are made along line transects set over the planted rows.

Physical, chemical and biological parameters noted in the Preplanting Survey (location, depth, sediment type and depth, indigenous seagrasses, dominant algae, visibility, wave energy regime and current) will be noted during monitoring. In addition, dissolved oxygen concentration, light penetration, salinity, and temperature will be measured. Underwater and surface photographs will be made of the sites.

The contemplated schedule for monitoring is:

February 7 - 18, 1983

April 4 - 24, 1983 (monitoring and additional planting)

June 7 - 22, 1983

August 22 - September 3, 1983 (monitoring and additional planting)

October 28 - November 10, 1983

January 9 - 20, 1984

April 1984.

The April 1983 additional planting consists of a spring planting at the same sites previously planted in November 1982. The April sites are adjacent, where possible, to the November sites and use similar methodology. The August planting is for collecting and planting Thalassia seeds which are in season then. The seeds will be planted in the sites laid out in April 1983.

J. Data Analysis: Corrected from PROGRESS REPORT 1 as follows.

The location of the sites is documented with photographs -- close-up and aerial. Underwater photographs will also be taken during monitoring.

The data from the monitoring will be statistically analyzed using a multi-level nested analysis of variance test for independent comparisons (Sokal and Rohlf 1981). This analysis technique will indicate significant differences among monitoring periods, sites, subsites, species, and planting techniques. An arcsine transformation will be performed on percentage data for statistical analysis (Sokal and Rohlf 1981). Means and standard deviation/ error, correlation coefficients, and least squares regression will be performed and presented where appropriate. The statistical analysis will be assisted by the SPSS Computer Program on Florida International University's Sperry Rand Univac Series 1100/80 computer.

To enter the data on the computer, the NCS 7001 System to optically scan data will be used. The NCS System provides a superior means of inputting large amounts of data to a Univac disc file. It is relatively error free and inexpensive in comparison to other means of data entry. Once entered in this way, the data can be read as card images by any program the user selects. The data are coded onto "general purpose green sheets" at the user's convenience, which when ready, are fed as a batch to the computer.

K. Training: No corrections from PROGRESS REPORT 1
Amended as follows (Paragraphs 4-7)

Management and supervisor workshops were held with NRCD personnel assigned to the project coupled with on-site assignments of management and supervision. Training in data analysis and interpretation were begun in workshop at the NRCD in June 1983.

More in depth training of fishermen occurred at the April 1983 field trip. One fisherman worked with the crew during the entire project to see the extent of techniques possible to teach to the other fishermen temporarily employed by the project. He was able to assist with logistics, plant collection, preparation, and planting. We feel very encouraged that fishermen with scuba skills and some agricultural background can be of great use for this labor intensive activity.

Several new temporarily employed fishermen joined phases of the April planting and showed skill and enthusiasm to work more if a larger project occurred. They said they were willing to help recruit and train other fishermen of their acquaintance who could work on future projects.

Older fishermen in the area were very helpful in giving oral histories of former seagrass beds which had been fishing areas prior to development impact.

U.S. A.I.D. Jamaican Seagrass Restoration Project

Co-Sponsors: Florida International University and Natural Resources Conservation Department, Kingston, Jamaica

Equipment Budget, Amended March 1983

L. Detailed List and Price of Equipment Used in Each Phase of the Seagrass Transplantation Process

Corrected and amended from PROGRESS REPORT 1 as follows:

Phase I: Site Selection, Demarkation and Preplanting Survey

Item	Number of Units	Price per Unit	Total Price
1. Site Selection			
Mask and snorkel	5	$ 25.00	$ 125.00
Weight belts	6	3.30	19.80
Swim fins	3	27.00	81.00
Lead weights (8 lb)	20	8.00	160.00
Dive knives	3	15.00	45.00
Dive boots	5	18.90	94.50
Wet suit tops	5	80.40	402.00
Dive flag	1	14.00	14.00
Regulators, Dacor 950 Pacer	6	160.00	960.00
Pressure gauge, U.S. Divers	6	39.95	239.70
Hose protectors	12	nc	nc
Scuba tanks, 80 ft^3 aluminum	6	115.00	690.00
Scuba tank backpacks	6	26.00	156.00
Buoyancy compensator devices	6	87.00	522.00
Clipboard, paper, pencil	5	2.00	10.00
Oxygen meter, YSI Model 51	1	386.40	386.40
Oxygen meter probe	1	125.60	125.60
Cable	1	68.00	68.00
Batteries	12	1.58	19.00
2. Demarkation			
Scuba dive gear (detailed in 1. Site Selection)			
Keson NR18200 200' nylon on steel measuring tape	2	73.50	147.50
Transgrid for corner ID tags on site	1 yd	13.50	13.50
#43 galvanized tubs	2	20.10	40.20
Brass clips, medium	2	2.65	5.30
Chance Keep Stake Earth Anchors	150	3.30	495.00
¼" Trap line, 1200'/box	3	21.08	63.24
A&G Polystyrene 7½" floats	275	.82	225.50
#36 orange seine twine (600'/roll)	8	7.60	60.80
Paper punches	2	1.26	2.52
Rebar	.000	nc	nc
Black markers	2	nc	nc
Propane torch and fuel	1	18.00	18.00

Equipment budget, continued

Phase I: Site Selection, Demarkation and Preplanting Survey

Item	Number of Units	Price per Unit	Total Price
3. Preplanting Survey (Equipment specified in 1. Site Selection and 2. Demarkation)			
Dive gear			
Measuring tapes			
floats and weights			
Clipboards, pencil and paper			

Phase II. Plant Collection, Transport & Preparation, and Planting

1. Plant Collection			
Dive gear			
Jacuzzi 3 hp 8M water pump	1	$ 291.00	$ 291.00
Pump hoses and connections	1	81.39	81.39
Mesh bags	12	7.35	88.20
Post hole diggers	2	25.60	51.20
Plastic bags		nc	nc
Gasoline fuel can	1	12.85	12.85
Floating shrimp baskets	2	nc	nc
2. Plant Transport and Preparation			
Captan fungicide (5 lb bag)	1	13.35	13.35
#5500 Gigantic Fish Box and Cooler	1	27.95	27.95
Dishpans	6	4.59	27.54
Garbage bags (40/box)	2	5.49	10.98
#8 scissors	2	4.98	9.96
¼" galvanized hardward cloth	25'	2.75	68.75
Wire shears	1	11.65	11.65
1/8 oz lead weights (25 lbs)	1	33.00	33.00
Duct tape roll	1	1.79	1.79
Trash can	1	5.05	5.05
3. Planting			
ear			
~~Mako Scuba tank air compressor~~	~~1~~	~~3000.00~~	~~3000.00~~
Mesh bags			
Measuring tapes			
Black top net buoys	4	49.12	196.48
Bulldog anchors (5 lb)	4	9.31	37.24
Brass clips, medium	4	2.65	10.60
Work gloves (pr)	5	2.75	13.75
Anchor pin bracelets (yd)	2	6.00	12.00

Equipment budget, continued

Major Equipment and Accessories

Item	Number of Units	Price per Unit	Total Price
1983 CG21305 3/4 Ton Chevy Van	1	$10949.00	$10949.00
Rustproofing, undercoating and polyglycoat paint	1	340.00	340.00
Air conditioning	1	450.00	450.00
Automatic transmission overhaul kit	1	125.00	125.00
Shock absorbers, spare set	1	112.00	112.00
Fuel injectors (8 per set)	1	400.00	400.00
Oil filters	6	6.00	36.00
Lightbulbs	12	1.00	12.00
Primary moisture filter	1	17.80	17.80
Secondary moisture filter	1	35.28	35.28
Air cleaner filter	1	21.00	21.00
Powerjump Battery Booster Cables	1	22.69	22.69
~~Alarm system for Van~~	~~1~~	~~150.00~~	~~150.00~~
Extra bench seat	1	150.00	150.00
Roof racks (pr)	1	35.00	35.00
13' Avon Inflatable Boat S400	1	1933.50	1933.50
Oars (pr)	1	30.00	30.00
Electic Inflator pump (DC voltage)	1	75.00	75.00
Anchor, 10 lb	1	18.27	18.27
Life cushions	4	9.00	36.00
½" polyproplyene line	100	.12	12.00
½" nylon line	50	.24	12.00
Waterproof flashlight	2	6.39	12.78
Flashlight batteries	2	3.59	7.18
Flashlight lightbulbs	4	.48	1.92
Fire extingisher	1	20.35	20.35
Brass clips, medium	4	2.65	10.60
Spring clip, galvanized	1	5.69	5.69
Boat tie downs (pr)	2	8.35	16.70
Fuel tank and line	1	64.75	64.75
25 hp Johnson Outboard Engine J25RCN, Manual, Short shaft	1	925.44	925.44

Equipment budget, continued

General Field Operations Support Equipment and Maintenance Equipment

Item	Number of Units	Price per Unit	Total Price
Brass padlocks	3	$ 7.55	$ 22.65
Master Security chains, 6'	2	20.79	41.58
Electrical connectors	2	1.15	2.30
Electrical tape	1	3.05	3.05
Stainless steel hardware	1	5.00	5.00
Duro stencils, 1" and 2"	2	1.69	3.38
Garden hose, 25'	1	5.89	5.89
Tool box	1	12.19	12.89
Tool set	1	127.85	127.85
Metal ID stamps	1	35.29	35.29
Spark plug feeler gauge and wrench	1	13.00	13.00
Outboard engine oil, case	1	59.00	59.00
Engine service manual	1	14.00	14.00
Spare propeller	1	37.35	37.35
Shear pins	12	nc	nc
OMC Triple Guard grease	1	3.05	3.05
OMC Gear Case Lube	3	6.96	20.88
Sparkplugs	4	2.40	9.60
Tire gauge	1	2.00	2.00
Shipping Container, 20'x8'x8' Ocean Freight to Kingston	1	1459.52	1459.52
Consignment fee	1	70.00	70.00
Loading and unloading container	1	300.00	300.00
Insurance on van	1	210.00	210.00
Insurance on cargo	1	225.00	225.00
Personal Equipment for Field Crew Support			
First Aid Kit	1	60.49	60.49
Rain gear (L)	3	37.50	112.50
Rain gear (XL)	2	38.50	77.00
Arctic Water Cooler	1	27.01	27.01
Insect Repellant	4	3.75	15.00
Misc. Equipment and breakage		~~4337.92~~	~~4337.92~~
		7555.92	7555.92
TOTAL		31620.00	31620.00

U.S.A.I.D. Jamaica Seagrass Restoration Project

Seagrass Restoration in Caribbean Nearshore Areas

Grant No. DAN-5542-G-SS-2102-00

Supplement to Equipment Budget submitted in October 1982

March 8, 1983

Phase I: Site Selection, Demarcation and Preplanting Survey

Item	Number of units	Price per unit	Extended total
1. Site Selection			
Mask and snorkel	2	$27.00	$ 54.00
Dive knives	3	17.00	51.00
Dive flag	1	14.00	14.00
Dive boots	3	23.90	71.70
Rocket fins	1	29.00	29.00
Wetsuit repair glue	2	3.00	6.00
Clipboards	10	1.65	16.50
2. Demarcation			
Keson NR18200 200' nylon on steel measuring tape	2	73.50	147.00
Brass clips, medium	10	2.65	26.50
Earth anchors	50	3.30	165.00
Phase II. Plant Collection, Transport and Planting			
1. Plant Collection			
Post-hole digger	2	25.60	51.20
Plastic bags	1 roll	14.00	14.00
2. Planting			
Bulldog anchors (5 lb)	6	9.31	55.86

Subtotal $701.76

Supplemental Equipment Budget, continued.

Phase III. Monitoring of Results and Documentation

Item	Number of units	Price per unit	Extended total
Oxygen meter, YSI Model 55	1	$435.00	$ 435.00
Oxygen meter probe	1	210.00	210.00
Oxygen meter probe cable	1	89.00	89.00
Oxygen meter BOD probe	1	178.00	178.00
Salinity/Temperature/ Conductivity meter, YSI Mod 33	1	440.00	440.00
SCT meter probe		120.00	120.00
SCT probe cable		nc	nc
Sediment particle size seives	1 set	200.00	200.00
Sediment seive shaker	1	50.00	50.00
IKELITE Trimcase package (underwater camera)	1	90.00	90.00
~~Less 40% discount on meters~~			~~(588.80)~~

Pending

Major Equipment and Accessories

Tires for project cargo van (replacement for worn tires) P235-75R15	4	43.33 ~~80.00~~	173.32 ~~320.00~~
Shipping ocean freight to Kingston	1	97.20	97.20
Consignment fee	1	55.00	55.00
Drayage	1	40.00	40.00
Insurance on cargo	1	44.68	44.68
		~~TOTAL~~	~~$2481.84~~

Source of funds: Misc. Equipment and Breakage Equipment Budget

III. Results

A. Sites Selected

1. Old Airport Site

a. Location: Corrected from PROGRESS REPORT 1 as follows (2nd sentence onward):

Subsite 1 is located 45 ft from shore in the middle of a large barren area adjacent to the runway. Subsite 2 is located 38 ft from shore and 59 ft south of Subsite 1. The control subplots are shown in Figure 3b. Blue paint markers were placed on the seawall to indicate the two subsite boundaries.

b. Characteristics of the Site: Corrected from PROGRESS REPORT 1 as follows:

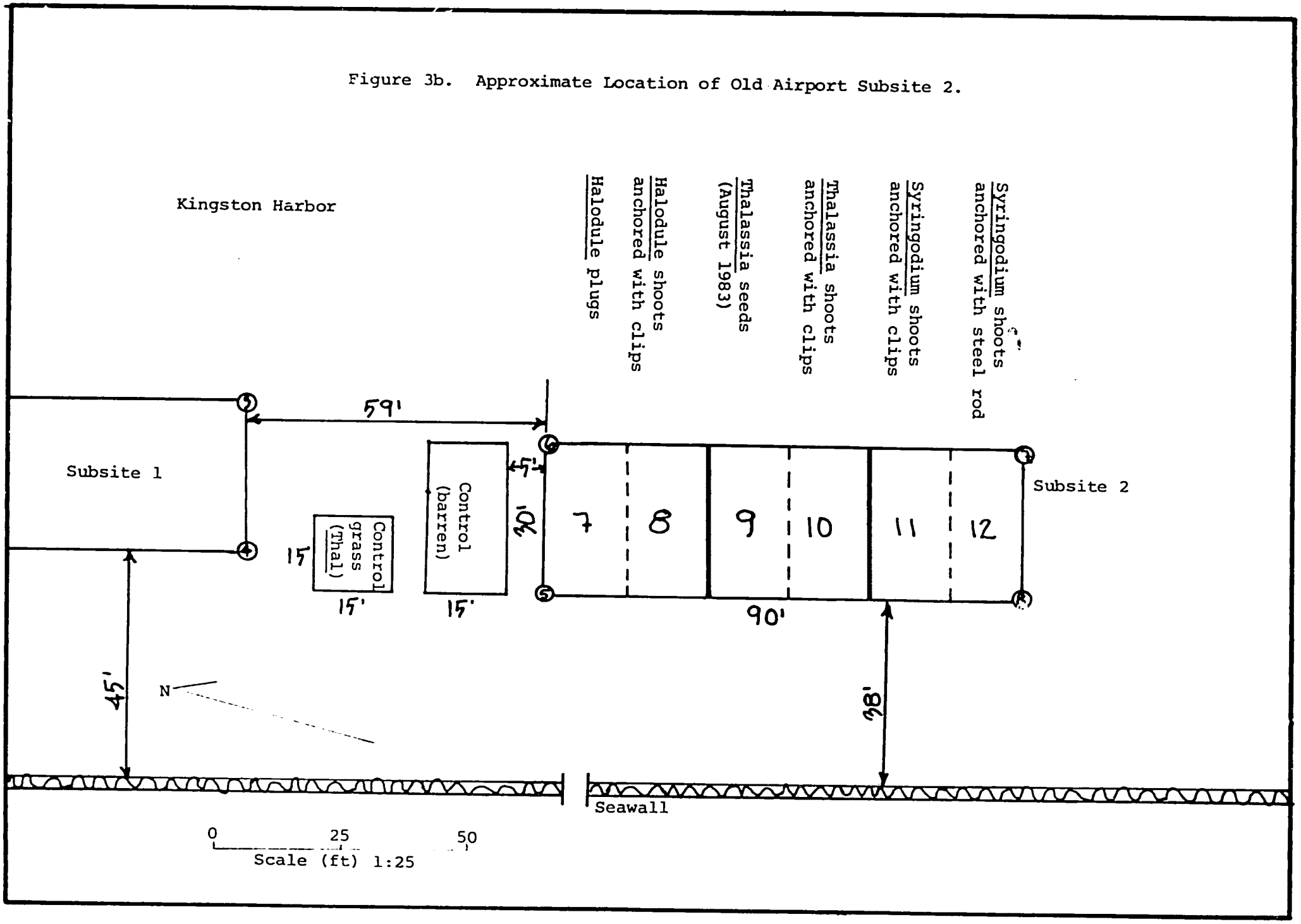
The dimensions of the two subsites are 90'x 30' each, and the long dimension was divided into 15' lengths to make six subplots 15'x 30' in each subsite. The long dimension is parallel to the seawall of the runway.

The mean low water depth at subsite 1 is approximately 6 ft. The water depth at subsite 2 is 6 ft at the southern edge, but decreases to approximately 4.5 ft at the northern edge. The sediment is coarse black sand and is more than 1.7 ft deep. The area is inhabited by Diadema (spiny sea urchin), Lytechinus variegatus (common sea urchin), pin fish, common grunts, snapper, and numerous large shrimp burrows are present. There is a 2'x 3' patch of naturally existing vegetation (Thalassia) in subplot #OA.4, a 6'x 6' patch in #OA.7, and a 6'x 4' patch in #OA.12.

c. Planting: No corrections from PROGRESS REPORT 1, Amended as follows (paragraphs 4-6):

On April 5, 1983, subsite 2 was planted by a team of biologists from NRCD, FIU, and an unemployed fisherman. Figure 3b. shows the experimental design in which the three species of seagrass were planted. Halodule plugs,6" in diameter, were planted in subplot #OA.7. 5" Halodule shoots anchored with 3" V-shaped clips were planted in #OA.8. Subplot #OA.9 was left empty for Thalassia seeds to be planted in August 1983; subplot #OA.10 was planted with 5" Thalassia shoots anchored with 6" segments of ¼" steel rod. Subplot #OA.11 was planted with 5" Syringodium shoots anchored with clips; and subplot #OA.12 was planted with 5" Syringodium shoots anchored with steel rod.

Figure 3b. Approximate Location of Old Airport Subsite 2.



All shoots and plugs were planted in a 3'x 3' matrix. 42 Halodule plugs, 50 Halodule shoots, 49 Thalassia shoots, 50 Syringodium shoots on clips, and 37 Syringodium shoots on steel rod were planted in subsite 2.

The Halodule and Thalassia plant specimens were collected from an adjacent area and the Syringodium material was collected from an area near Hellshire Beach.

2. Cement Plant

No surviving units of seagrass could be found here during the February 1983 monitoring trip. The continual slumping of fine particles from the Cement Plant landfill into the Harbor apparently smothered the plants. No further planting was attempted here.

3. Fort Augusta Causeway

a. Location: Corrected from PROGRESS REPORT 1 as follows (2nd paragraph):

Subsite 1 is located 119.5 ft seaward of a large pipe 2 ft in diameter lying along the shore of the causeway (see Figure 7.). Subsite 2 is located 172 ft seaward of the pipe, and Subsite 3 is located 209 ft seaward of the pipe (see Figure 7b.). The control subplots are also shown on Figure 7b.

b. Characteristics of the Site: Amended from PROGRESS REPORT 1 as follows (paragraph 1):

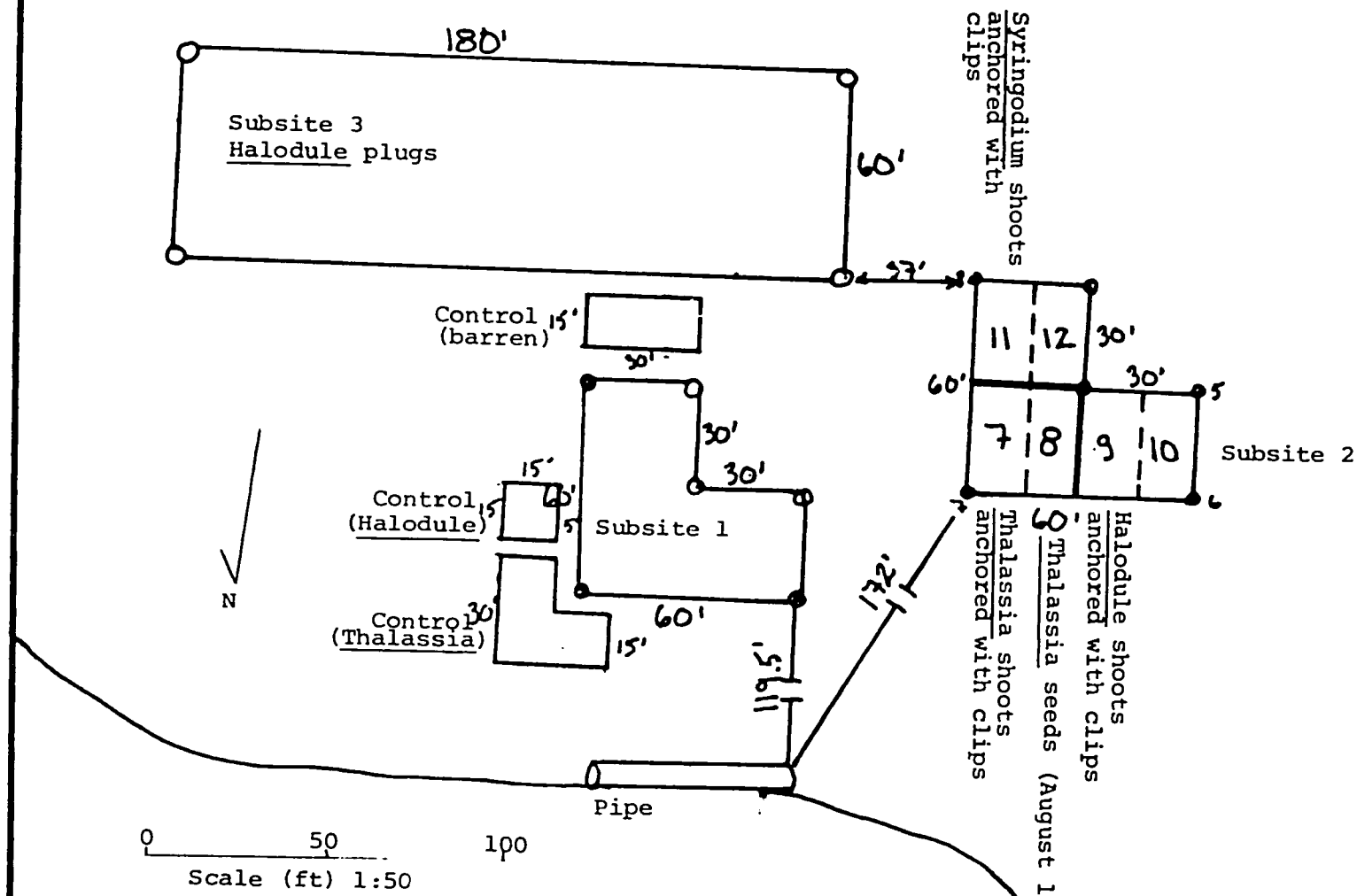
Subsite 1 as seen in Figure 7. is "L" shaped. Subsite 2 as seen in Figure 7b. is also "L" shaped. The long dimension of both subplots are 60 ft and the short dimension is 30 ft. The subplots are divided into 15'x 30' subplots. The depth of mean low water at subsite 1 is approximately 4 ft, and the depth at subsite 2 is 2 ft. The sediment is composed primarily of sand, crushed shell, and fine organic material, and is greater than 1.7 ft deep. A naturally occurring bed of Halodule 10'x 11' is in subplot #FA.1.

Subsite 3 as seen in Figure 7b. is 180'x 60.' The entire subsite was planted with one species and method, so it was not subdivided into subplots. The depth of mean low water is approximately 4 ft. The same sediment occurs here as in subsites 1 and 2.

c. Planting: Amended from PROGRESS REPORT 1 as follows (Paragraphs 3-5):

On April 6, 1983, subsite 2 was planted by a team of biologists from NRCD, FIU, and an unemployed fisherman. Figure 7b. shows the experimental design in which the three species of

Figure 7b. Approximate Location of Fort Augusta Site



seagrasses were planted. Subplot #FA.7 was planted with 5" Thalassia shoots anchored with 3" V-shaped clips, and subplot #FA.8 was left empty for Thalassia seeds to be planted in August 1983. Subplot #FA.9 was planted with 5" Halodule shoots anchored with clips, and subplot #FA.10 was left empty (Halodule plugs were planted in Subsite 3). Subplot #FA.11 was planted with 5" Syringodium shoots anchored with 3" V-shaped clips, and subplot #FA.12 was left empty. All the subplots were planted in a 3'x 3' matrix and contain 50 planting units each.

Subsite 3 was planted with Halodule plugs 6" in diameter. 1200 plugs were planted here in a 3'x 3' matrix. Total area of this subsite is .25 acre. Subsite 3 was planted on April 12, 1983 by biologists from FIU, NRCD, UWI and three unemployed fishermen.

The Halodule plugs and shoots were collected from patchy beds adjacent to the site, and the Thalassia and Syringodium shoots were collected near Hellshire Beach.

4. Hellshire Beach Site

a. Location: Corrected from PROGRESS REPORT 1 as follows:

The Hellshire Beach sites are located on the southeast end of Hellshire Bay approximately 500 ft from the point of land separating Hellshire and Half Moon Bays (Figures 8.). Subsites 1 and 2 are subdivided into nearshore (plot A) and offshore (plot B) plots. Subsite 1, plot A, is parallel to the beach and 10 ft south of a beach house standing 20 ft offshore from the beach. Subsite 1, plot B, is parallel to the beach and 170 ft seaward from the beach house. Subsite 2, plot A, is parallel to the shore and 15 ft north of the beach house. Subsite 2, plot B, is parallel to the shore and adjacent to the north end of Subsite 1, plot B. Control subplot for barren bay bottom is shown on Figure 9b. The control areas for established seagrass lie south of the area depicted on Figure 9b.

b. Characteristics of the Site: Amended from PROGRESS REPORT 1 as follows (paragraphs 1-2):

The sites shown in Figures 9. and 9b. are 90'x 15,' and they are divided into 15'x 15' subplots. Prevailing winds and long fetch make this a high energy site. Depth of Subsite 1 and 2, plots A, is 2 ft mean low water. Depth of Subsites 1 and 2, plots B, is 5 ft mean low water. The sediment is coarse and medium quartz sand and is greater than 1.7 ft deep.

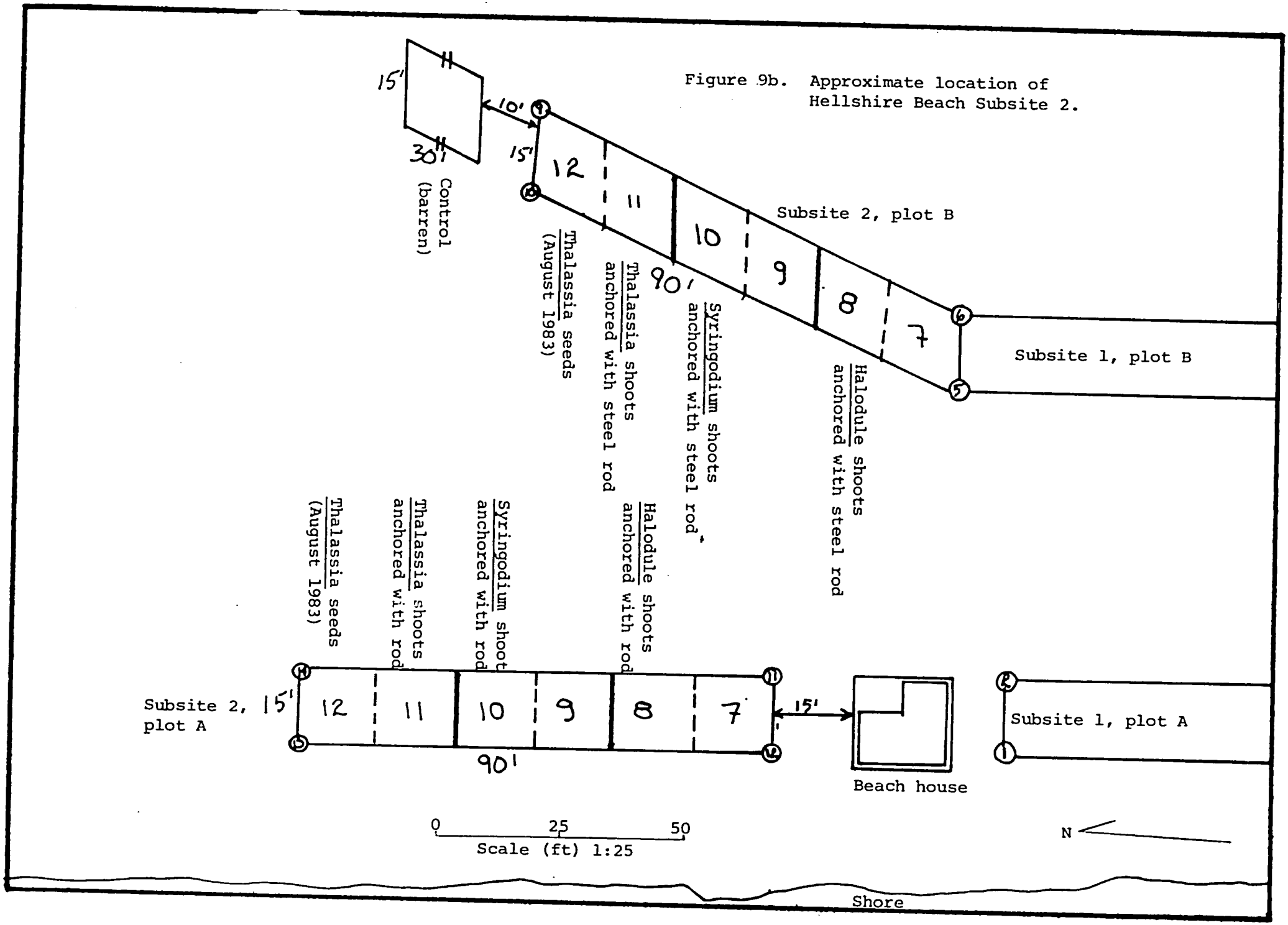


Figure 9b. Approximate location of Hellshire Beach Subsite 2.

c. Planting: Amended from PROGRESS REPORT 1 (paragraphs 3-4) as follows:

On April 7, 1983 Subsite 2 was planted by biologists from FIU, NRCD, UWI and an unemployed fisherman. Figure 9b. shows the experimental design in which the three species of seagrass were planted. All the seagrasses were anchored with 6" segments of ¼" steel rod. All the shoots were 5" in length. Halodule shoots were planted in subplots #HB.7A and #HB.7B; Syringodium shoots were planted in subplots #HB.10A and #HB.10B; Thalassia shoots were planted in subplots #HB.11A and #HB.11B; and Thalassia seeds will be planted in subplots #HB.12A and #HB.12B. All the subplots were planted in 3'x 3' matrix and each subplot contains 25 planting units each.

All the plant material was collected from seagrass beds adjacent to the site.

5. Old Harbor Power Plant Site

a. Location: Corrected from PROGRESS REPORT 1 as follows (paragraph 2):

Subsite 1 is located 119 ft from the center of a stand of red mangroves on shore. An opening in the mangrove stand is approximately even with the eastern edge of the subsite. Subsite 2 is located 65 ft east of Subsite 1 and 85 ft from the mangrove stand on shore. The control area for barren bay bottom is shown in Figure 11b, but the control areas for established grass beds are west of the area depicted in the figure.

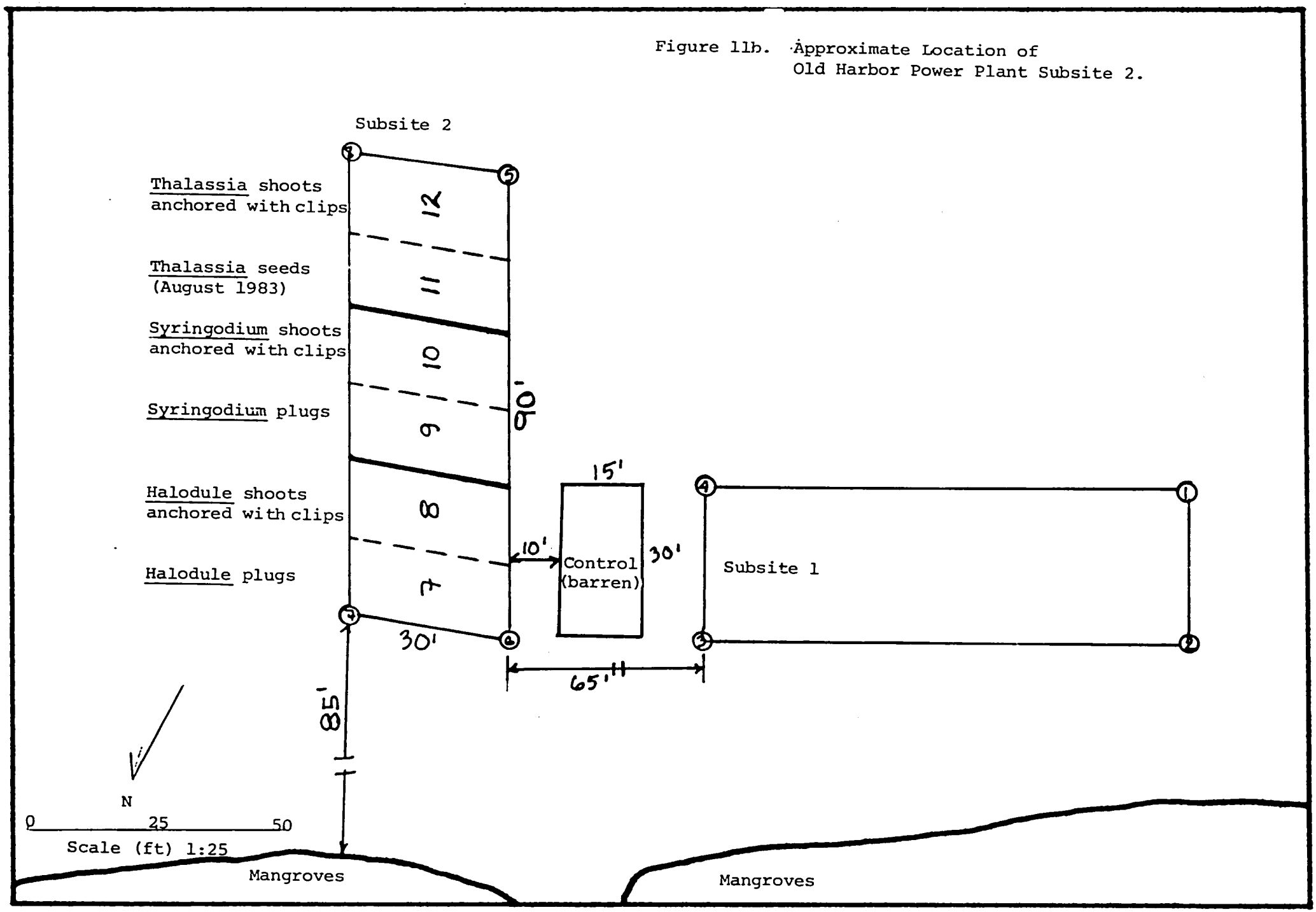
b. Characteristics of the Site: Corrected and amended from PROGRESS REPORT 1 as follows:

Subsites 1 and 2 are 90'x 30,' and the long dimensions of each subsite were divided into 15' sections to make 6 subplots in each subsite. The depth of mean low water is approximately 2.5 ft. The sediment consists of 1 inch deep compacted sand and mud overlying soft sand and mud extending more than 1.7 ft deep. Some patchy naturally occurring Halodule exists in subplots #PP.3, #PP.4, and #PP.9. Visibility was 2-3 ft, and a slow westerly current was noted.

c. Planting: Amended from PROGRESS REPORT 1 as follows (paragraphs 3-4):

On April 8, 1983, Subsite 2 was planted by a team of biologists from FIU, NRCD, and an unemployed fisherman. Figure 11b. shows the experimental design in which the three species of seagrass were planted. In subplot #PP.7 Halodule plugs 6" in diameter were planted, and in subplot #PP.8, 5" Halodule shoots anchored with 3" V-shaped clips were planted. In subplot #PP.9 Syringodium plugs 6" in diameter were planted, and in subplot #PP.10, 5" Syringodium shoots anchored with 3" V-shaped clips were planted. In subplot #PP.11 Thalassia

Figure 11b. Approximate Location of Old Harbor Power Plant Subsite 2.



seeds will be planted in August 1983, and in subplot #PP.12, 5" Thalassia shoots anchored with 3" V-shaped clips were planted. All the subplots were planted in a 3'x 3' matrix and each subplot contains 50 planting units each.

All the planting material was collected from seagrass beds near the site.

6. Port Esquivel Site

a. Location: Amended to PROGRESS REPORT 1 as follows (last sentence in 1st paragraph):

Subsite 2 is located adjacent to the eastern side of Subsite 1.

b. Characteristics of the Site: Corrected from PROGRESS REPORT 1 as follows:

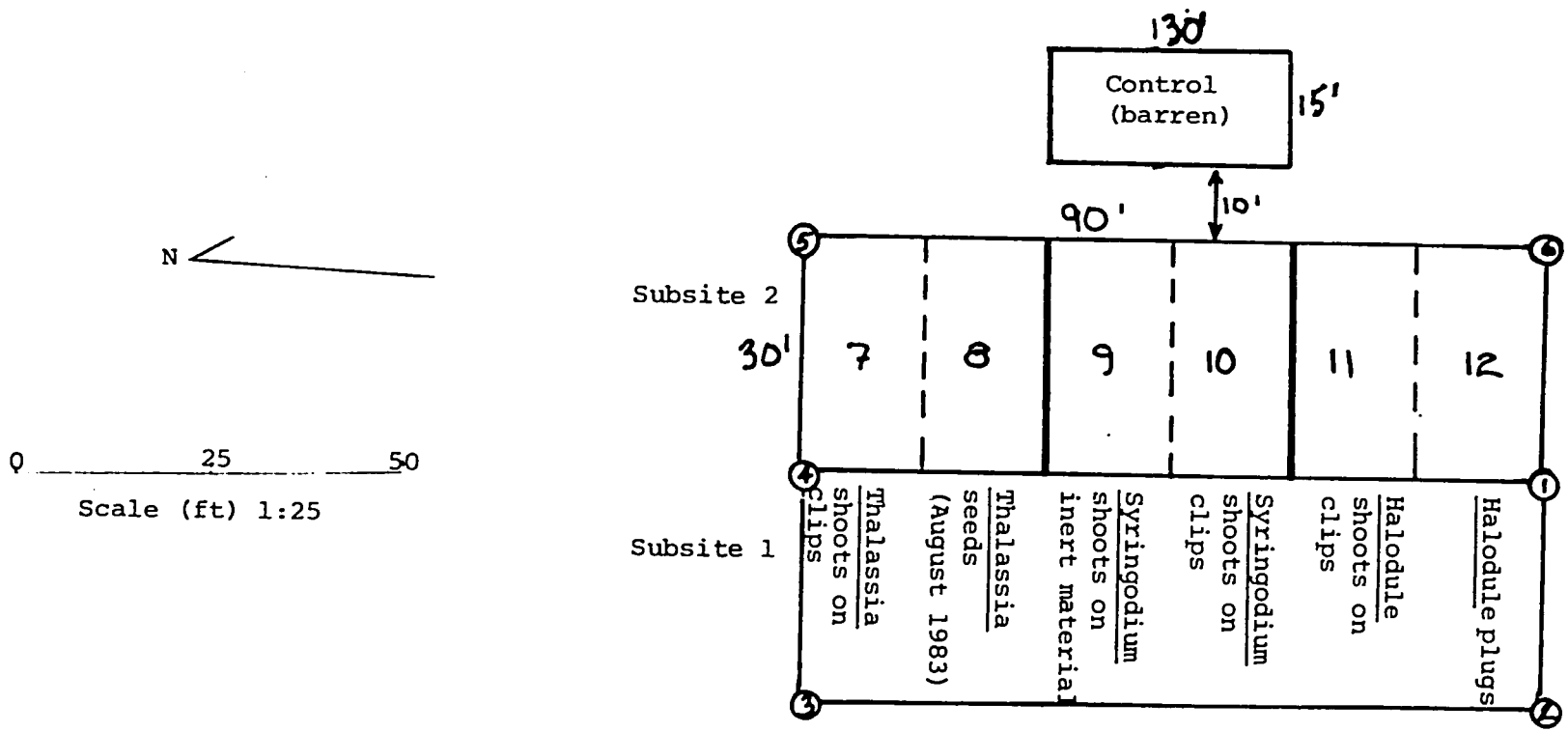
Subsites 1 and 2 are 90'x 30', and the long dimension of each subsite was divided into 15' sections to make 6 subplots in each subsite. The long dimension is parallel to shore. Subsite 1 slopes to seaward: the shoreline side is 6 ft deep mean low water, and the seaward side is 8 ft deep mean low water. Subsite 2 has a level bottom and is 8 ft deep mean low water. The sediment is composed of sand and fine mud and is 1.5 ft deep. A small number of Thalassia apical meristems poke into subplots #PE.1 and #PE.6. A large amount of the algae Gracilaria and Laurencia were found throughout the site. Visibility was approximately 8 ft in November, but was less than 1 ft in April. A slight southwesterly long-shore current was noted. (Figure 13b.)

c. Planting: Amended to PROGRESS REPORT 1 as follows (paragraphs 2-3):

On April 11, 1983 the site was planted by a team of biologists from FIU, NRCD and an unemployed fisherman. Figure 13b. shows the site layout and location of the different seagrasses. In subplot #PE.7, 5" Thalassia shoots anchored with 3" V-shaped clips were planted, and in subplot #PE.8, Thalassia seeds will be planted. In subplot #PE.9, 5" Syringodium shoots anchored on inert material were planted, and in subplot #PE.10, 5" Syringodium shoots anchored on clips were planted. In subplot #PE.11, 5" Halodule shoots anchored on clips were planted, and in subplot #PE.12, Halodule plugs 6" in diameter were planted. All the plants were installed on a 3'x 3' matrix and each subplot contain 50 planting units.

All the planting material was collected from the Old Harbor Power Plant.

Figure 13b. Approximate location of Port Esquivel Subsite 2.



7. Rocky Point Lagoon: Amended to PROGRESS REPORT 1 as follows (last sentence of paragraph 2):

Water chemistry parameters have been measured here which indicated the water was quite saline: 75.8 o/oo in April. The temperature of the water was also quite high: 33°C in April. The conditions here, therefore, are considered quite stressful to the plants.

a. Location: Corrected from PROGRESS REPORT 1 as follows:

The Rocky Point Site is in a lagoon west of the Alcoa Bauxite loading pier at Rocky Point (see Figure 14.). Subsite 1 is approximately 500 ft from the railway track servicing the the pier, and the eastern end of Subsite 1 is even with the first telephone pole west of the entrace guard station. Subsite 2 is located approximately 250 ft south of Subsite 1.

b. Characteristics of the Site: Corrected from PROGRESS REPORT 1 as follows:

Subsite 1 is 90'x 30' and Subsite 2 is 60'x 30' (see Figure 15b.). The long dimension of both subsites was divided into 15' sections to make six subplots in Subsite 1 and four subplots in Subsite 2. The depths of both subsites range from 1 ft mean low water at the eastern end to 2 ft mean low water at the western end. The site is oriented parallel to the railroad tracks. The sediment of fine sand and clay extending to more than 1.7 ft deep is covered by a ½" layer of dark black clay and a hard crust 1/8" thick. Naturally occurring Ruppia exists in subplots #RP.2 - #RP.10. Visibility was 4 - 6 ft, but reduced to zero upon disturbance. No current was noted.

c. Planting: Amended to PROGRESS REPORT 1 as follows (paragraphs 3-4):

On April 13, 1983 the Subsite 2 was planted by a team of biologists from FIU, NRCD, and an unemployed fisherman. Figure 15b. shows the experimental in which the two species of seagrass were planted. In subplot #RP.7 Halodule plugs 6" in diameter were planted, and in subplot #RP.8, 5" Halodule shoots anchored with clips were planted. In subplot #RP.9, Thalassia seeds will be planted, and in subplot #RP.10, 5" Thalassia shoots anchored with clips were planted. All the plants were installed on a 3'x 3' matrix and each subplot contains 50 planted units.

The plant material was collected from nearby adjacent seagrass beds. The control for the barren bay bottom is shown on Figure 15b. Control areas for established grassbeds were north of the railroad tracks in Colon Bay.

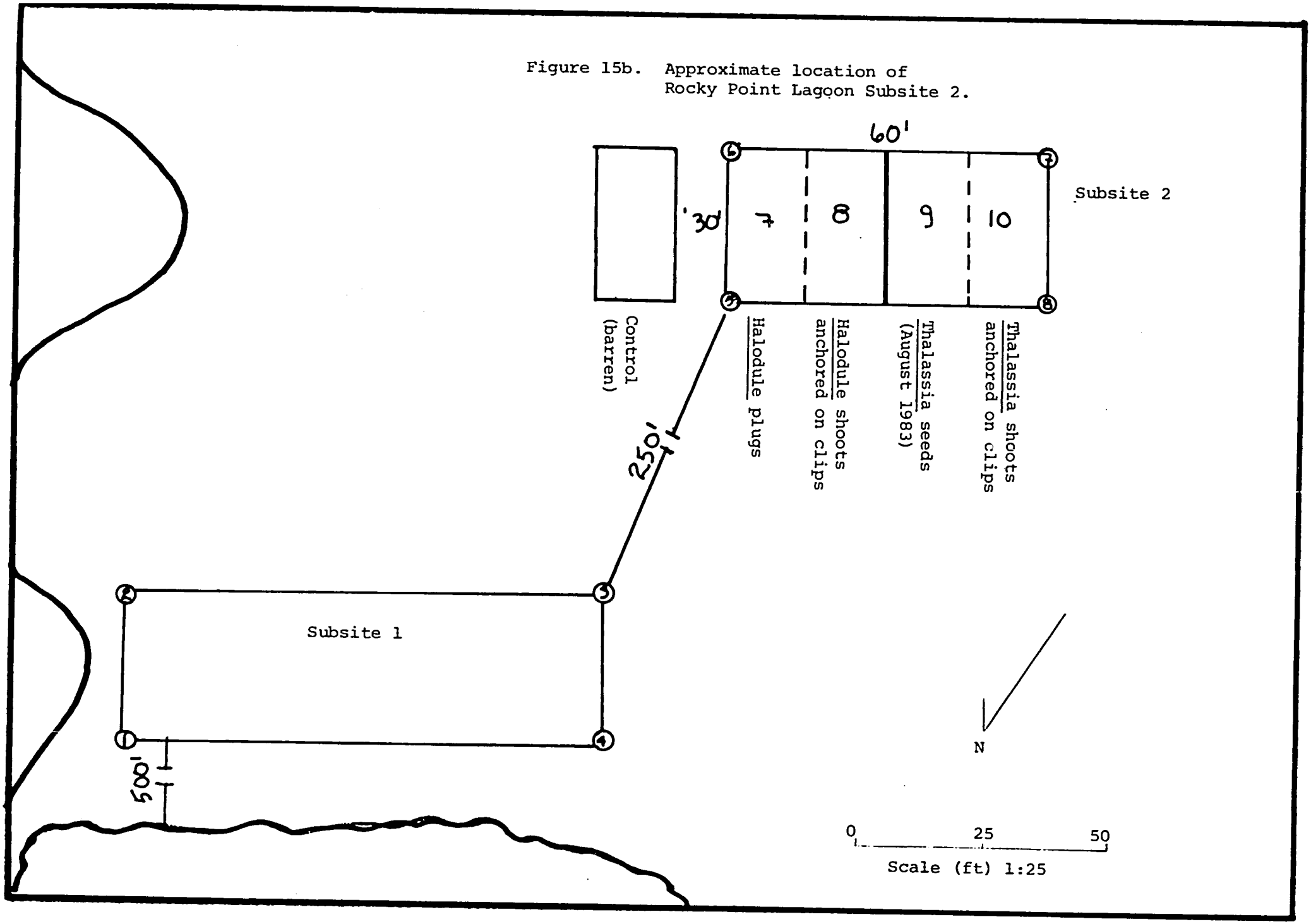


Figure 15b. Approximate location of Rocky Point Lagoon Subsite 2.

8. Rocky Point Mangrove Planting Site

b. Characteristics of the Site: Amended to PROGRESS REPORT 1 as follows (paragraph 3):

The second planting of mangroves in April 1983 are located 10 ft west of the Subsite 1 mangrove planting in subplot #RPm.2. The second planting (Subsite 2, subplot #RPm.4) is at the waterline, parallel to shore, and measures 75'x 15'.

c. Planting: Amended to PROGRESS REPORT 1 as follows (paragraph 3):

On April 13, 1983 Subsite 2 was planted by a team of biologists from FIU and NRCD. As seen in Figure 16b., Subsite 2 consists of one subplot, #RPm.4. Red mangrove propagules were planted without anchors in 5 rows of 25 plants each. A total of 125 propagules were planted in a 3'x 3' matrix. The propagules were collected from trees at the Old Harbor Power Plant.

9. Negril Point Site

c. Planting: Amended to PROGRESS REPORT 1 as follows (paragraph 3-4):

On April 22, 1983, the site was planted by biologists from FIU, NRCD, and an unemployed fisherman. No surviving plants were found on the February or April monitoring field trips at this site so the second planting was installed in the original Subsite 1. Figure 18b. shows the experimental design in which the three species of seagrass were planted. In subplot #NP.1 5" Thalassia shoots anchored with 3" V-shaped clips were planted, and in #NP.2 Thalassia seeds will be planted. In subplot #NP.3, 5" Syringodium shoots on clips were planted, and subplot #NP.4 was left empty. In subplot #NP.5, 5" Halodule shoots anchored with clips were planted, and subplot #NP.6 was left empty. All the plants were installed in a 3'x 3' matrix and each subplot contains 50 plants. The plant material was collected along the Negril Beach.

The control for barren bay bottom is shown on Figure 18b. No nearby established seagrass beds could be located for controls.

10. South Negril River Site

c. Planting: Amended to PROGRESS REPORT 1 as follows (paragraphs 3-4):

On April 22, 1983, the site was planted by biologists from FIU, NRCD, and an unemployed fisherman. No surviving plants were found on the February or April monitoring field trips at this site so the second planting was installed in the original Subsite 1.

Figure 16b. Location of Rocky Point Mangrove Subsite 2.

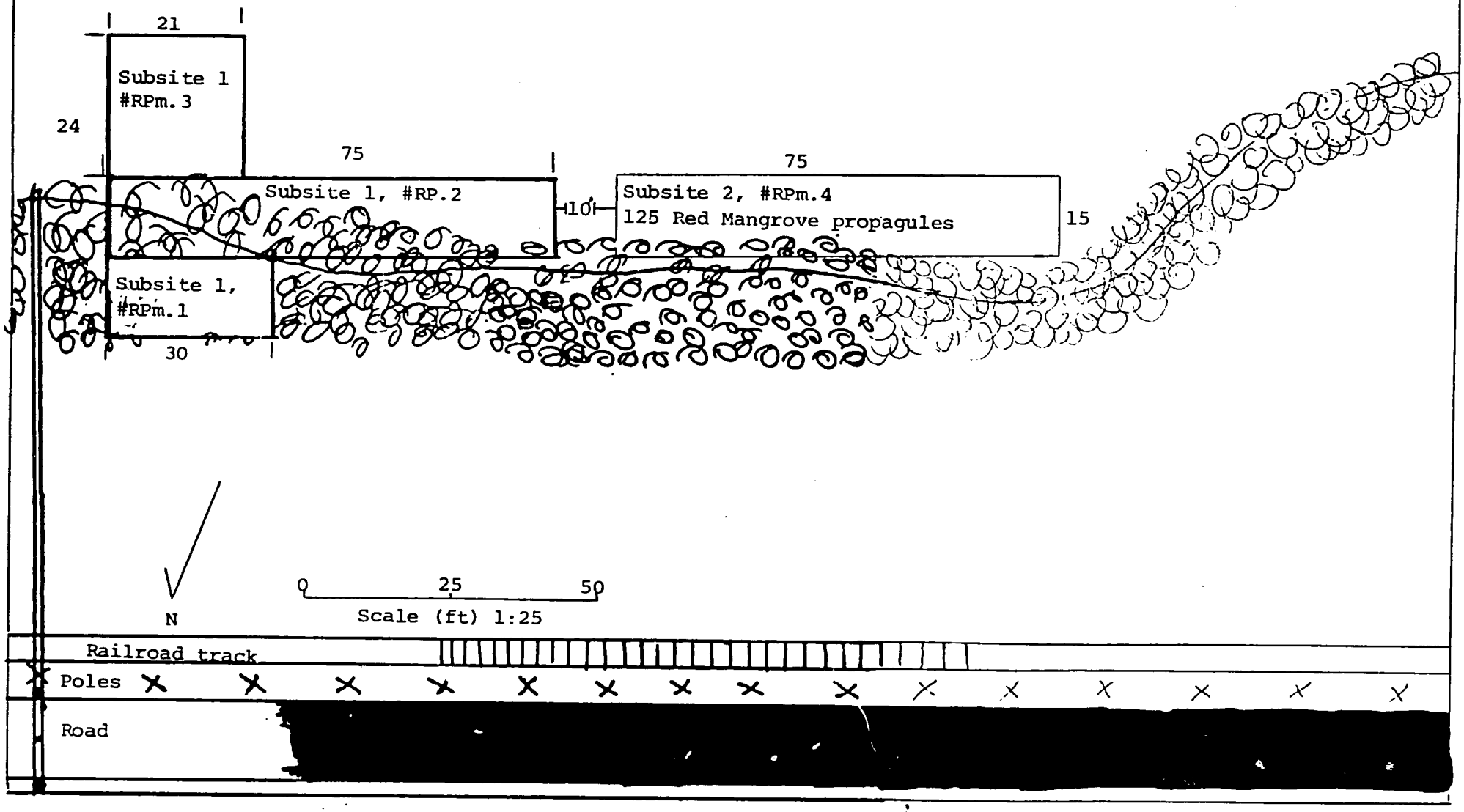


Figure 18b. Approximate location of Negril Point Subsite 2.

Figure 19b. Approximate location of South Negril River Subsite 2.

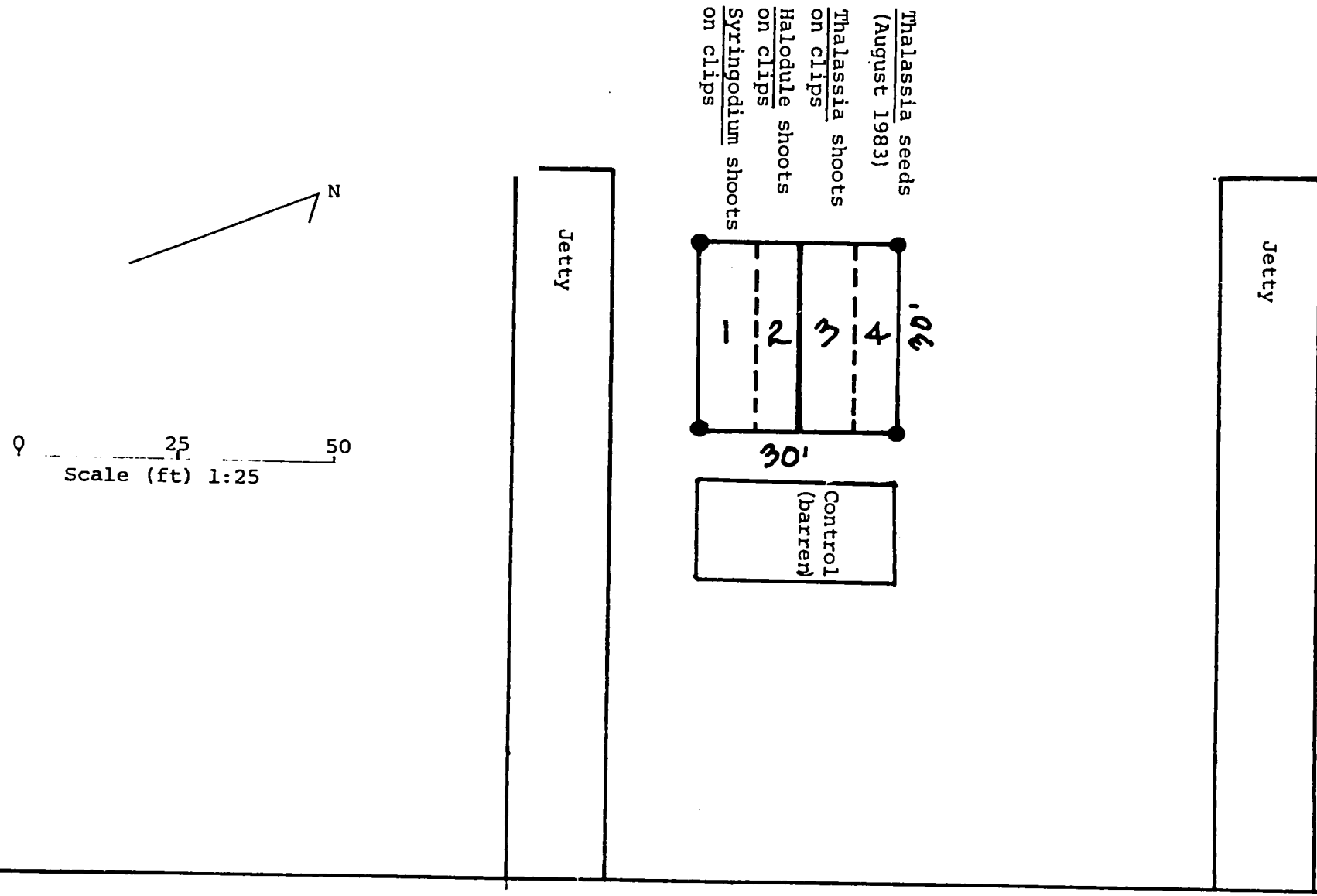


Figure 19b. shows the experimental design in which the three species of seagrass were planted. In subplot #NR.1, 5" Syringodium shoots anchored on clips were planted. In subplot #NR.2, 5" Halodule shoots anchored on clips were planted. In subplot #NR.3, 5" Thalassia shoots anchored on clips were planted, and in subplot #NR.4, Thalassia seeds will be planted. All the plants were installed on a 3'x 3' matrix and each subplot contains 20 plants.

Figure 19b. shows the control for barren bay bottom. No established beds could be located in the river for controls.

Transplants were collected from Negril Beach.

11. Montego Bay Seawinds Site: Corrected from PROGRESS REPORT 1 as follows (paragraph 2):

Measurement of water chemistry parameters show that the water quality is good at this site and normal for open ocean nearshore waters.

a. Location: Corrected from PROGRESS REPORT 1 as follows:

The Seawinds Site is located on the northwest side of the Montego Freeport approximately 300 ft southwest of the Seawinds Hotel. The northeast corner of Subsite 1 is 51 ft seaward of a blue paint mark on the stone riprap on shore. The southwest corner is 57 ft from a right angle made by the stone riprap as it turns southeast away from the sea (see Figures 20. and 21.). Subsite 2 is adjacent to the northeast side of Subsite 1 (see Figure 21b.).

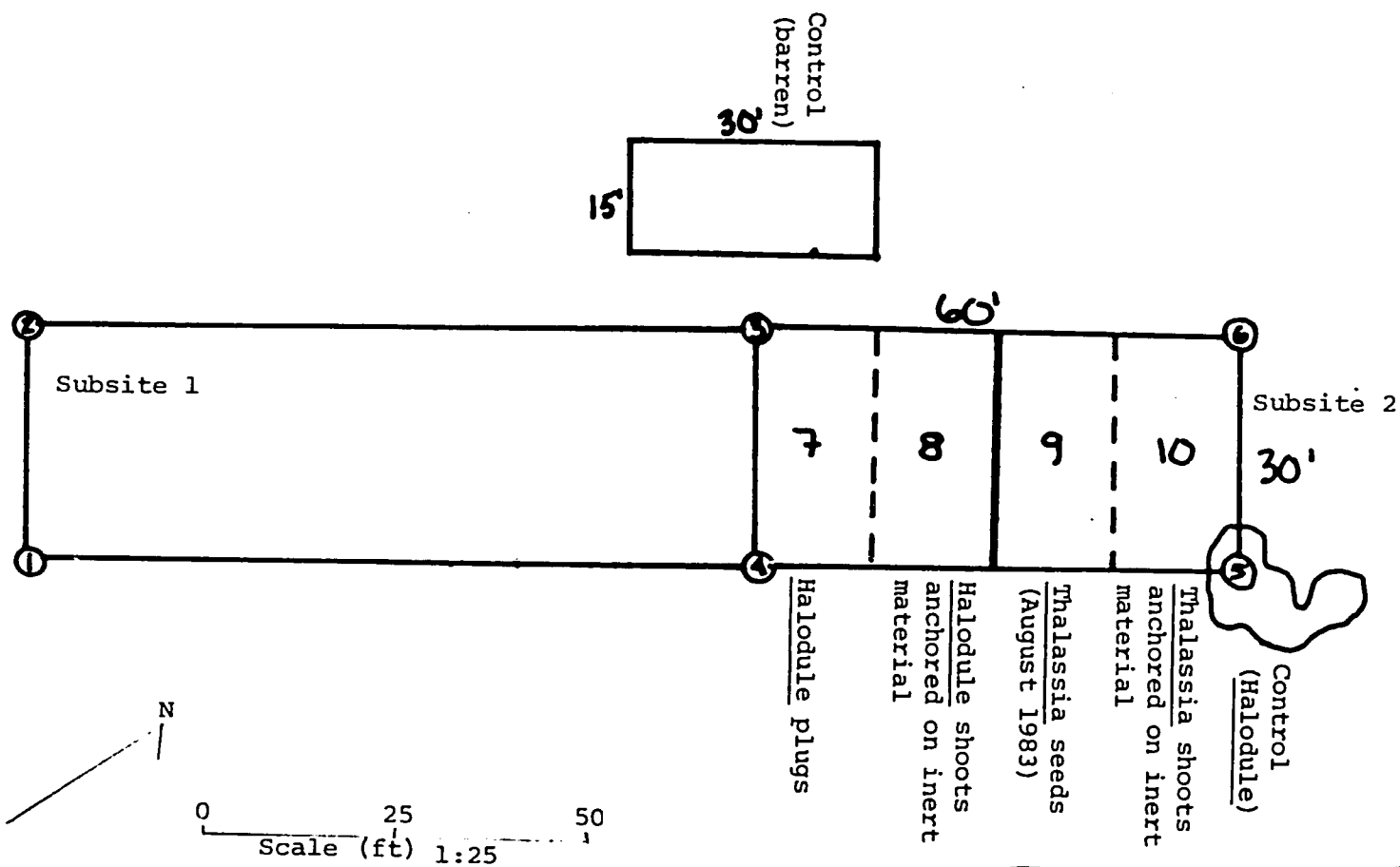
b. Characteristics of the Site: Corrected from PROGRESS REPORT 1:

Subsite 1 is 90'x 30',and Subsite 2 is 60'x 30'. The long dimension of each subsite was divided into 15' sections to make six subplots in Subsite 1 and four subplots in Subsite 2. The site slopes down to seaward: depth along the shore side is 4 ft mean low water and depth along the seaward side is 6 ft mean low water. The sediment is composed of calcareous sand and rock and varies in depth from .5 - 1.0 ft. The nearby island has been extensively filled and the surrounding bay bottom is quite unstable. Numerous Diadema were noted and removed from the site. Visibility was +25 ft and no currents were noted.

c. Planting: Amended to PROGRESS REPORT 1 as follows (paragraph 2):

On April 21, 1983 the site was planted by biologists from NRCD, FIU, and an unemployed fisherman. Figure 21b. shows the experimental design in which the two species of seagrass were planted. In subplot #SW.7 Halodule plugs 6" in diameter were planted, and in subplot #SW.8, 5" Halodule shoots anchored with inert material were planted. In subplot #SW.9 Thalassia seeds will be planted, and in subplot #SW.10, 5" Thalassia shoots anchored with inert

Figure 21b. Approximate location of Seawinds Subsite 2



material were planted. All the plants were installed on a 3'x 3' matrix and each subplot contains 50 plants.

Figure 21b. shows the control for barren bay bottom and the control area for established Halodule. The area for established Thalassia control is northwest of the area depicted on Figure 21b.

Transplants were collected from bays south of Montego Freeport.

12. Fisherman's Jetty Site

No surviving units of seagrass could be found at this site during the February or April 1983 monitoring field trips. The water chemistry parameters measured were normal for temperature, salinity, dissolved oxygen, and light penetration. No further planting, however, was attempted here.

13. Pelican Jetty Site: Corrected from PROGRESS REPORT 1 as follows (paragraph 2):

Water chemistry parameters measured here were normal for open ocean nearshore waters, however, the water was somewhat turbid.

a. Location: Corrected from PROGRESS REPORT 1 as follows:

The Pelican Jetty Site is between the northernmost and second jetty in a series of four jetties recently built along the shoreline south of the Cornick Road and Glouster Blvd. intersection in Montego Bay (see Figure 23.). The northeast corner of Subsite 1 is 52 ft from the northern jetty and 50 ft from the shoreline. Subsite 2 adjacent to the northeast side of Subsite 1 (see Figures 24. and 24b.).

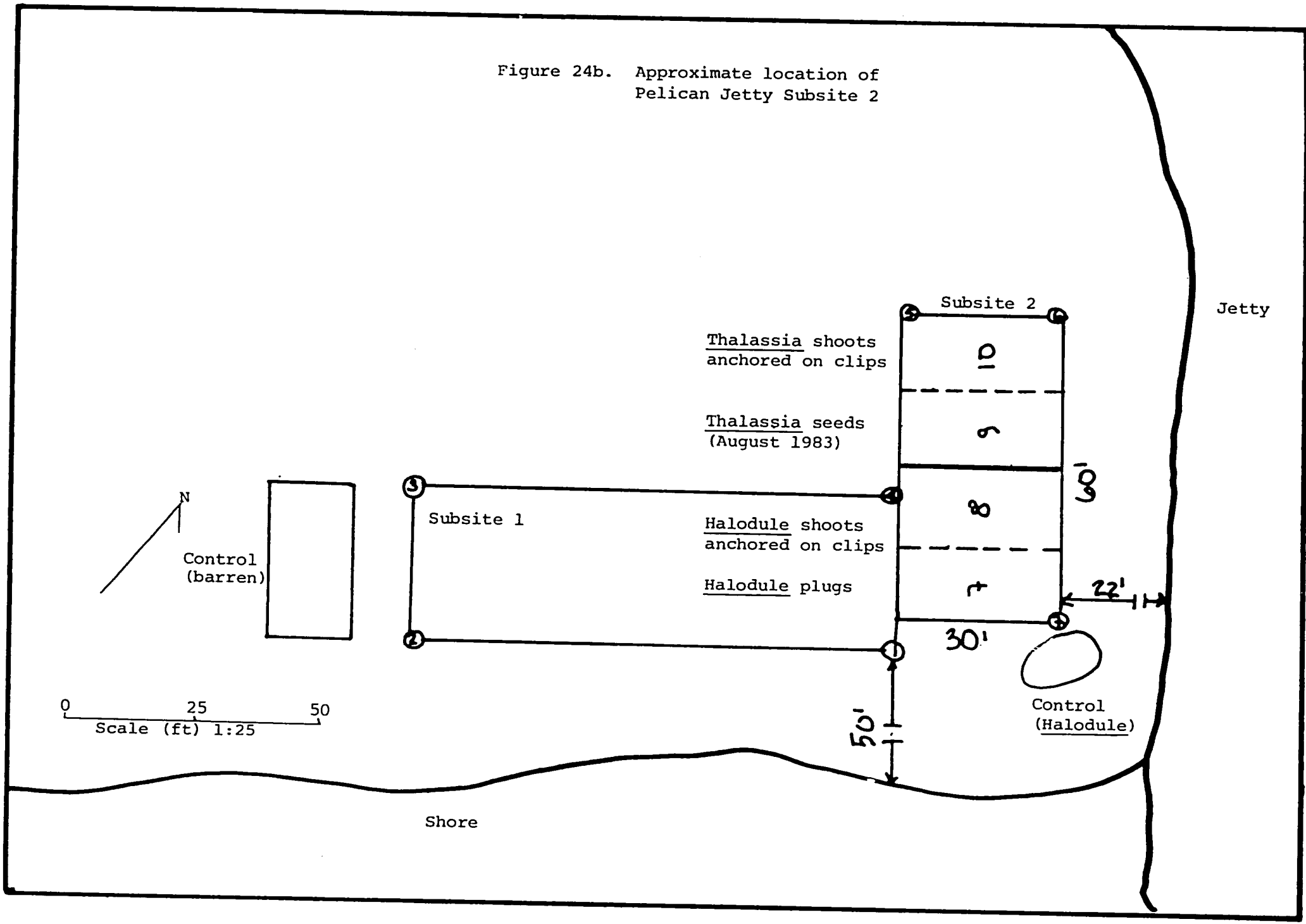
b. Characteristics of the Site: Corrected from PROGRESS REPORT 1:

Subsite 1 is 90'x 30' and Subsite 2 is 60'x 30'. The long dimension of each subsite was divided into 15' sections to make six subplots in Subsite 1 and four subplots in Subsite 2. Subsite 2 is oriented perpendicular to Subsite 1. The depth of the site increases from 4 ft mean low water at the southeast corner to 10 ft mean low water at the northwest corner of Subsite 1 and along the northern edge of Subsite 2. The sediment is composed of medium grain sand that was brought in for fill and is eroding from the beach. The depth of the sediment exceeds 1.7 ft. Many shrimp burrows were noted. Sparse Halodule is present in subplots #PJ.6 and #PJ.7. Visibility was 5 ft and not current was noted.

c. Planting: Amended to PROGRESS REPORT 1 as follows (paragraph 2):

On April 19, 1983 the site was planted by biologists from NRCD, FIU, and an unemployed fisherman. Figure 24b. shows the experimental design in which the two species of seagrass were planted.

Figure 24b. Approximate location of Pelican Jetty Subsite 2



In subplot #PJ.7, Halodule plugs 6" in diameter were planted, and in subplot #PJ.8, 5" Halodule shoots anchored with 3" V-shaped clips were planted. In subplot #PJ.9 Thalassia seeds will be planted, and in subplot #PJ.10, 5" Thalassia shoots anchored with clips were planted. All the plants were installed on a 3'x 3' matrix and each subplot contains 50 plants.

Figure 24b. shows the control for barren bay bottom and the control for established Halodule seagrass. The control area for established Thalassia is west of the area depicted in Figure 24b.

Transplants were collected from a small bay near Rose Hall.

14. Carlyle Beach Site

b. Characteristics of Site: Corrected from PROGRESS REPORT 1 as follows:

The sites as shown in Figure 25b. are 90'x 15' and the long dimension was divided into 15 ft sections to make six 15'x 15' subplots in each subsite 1A, 1B, 2A, and 2B. The depth of plot A is 6 ft mean low water and plot B is 8 ft mean low water. The sediment is composed chiefly of coarse white calcareous sand 3 - 6 inches deep at plot A and 6 - 10 inches deep at plot B. The substrate is quite rocky. Diadema were numerous at this site. The site is exposed to the open ocean and subject to occasional heavy winter storms. Visibility was +25 ft and no currents were noted.

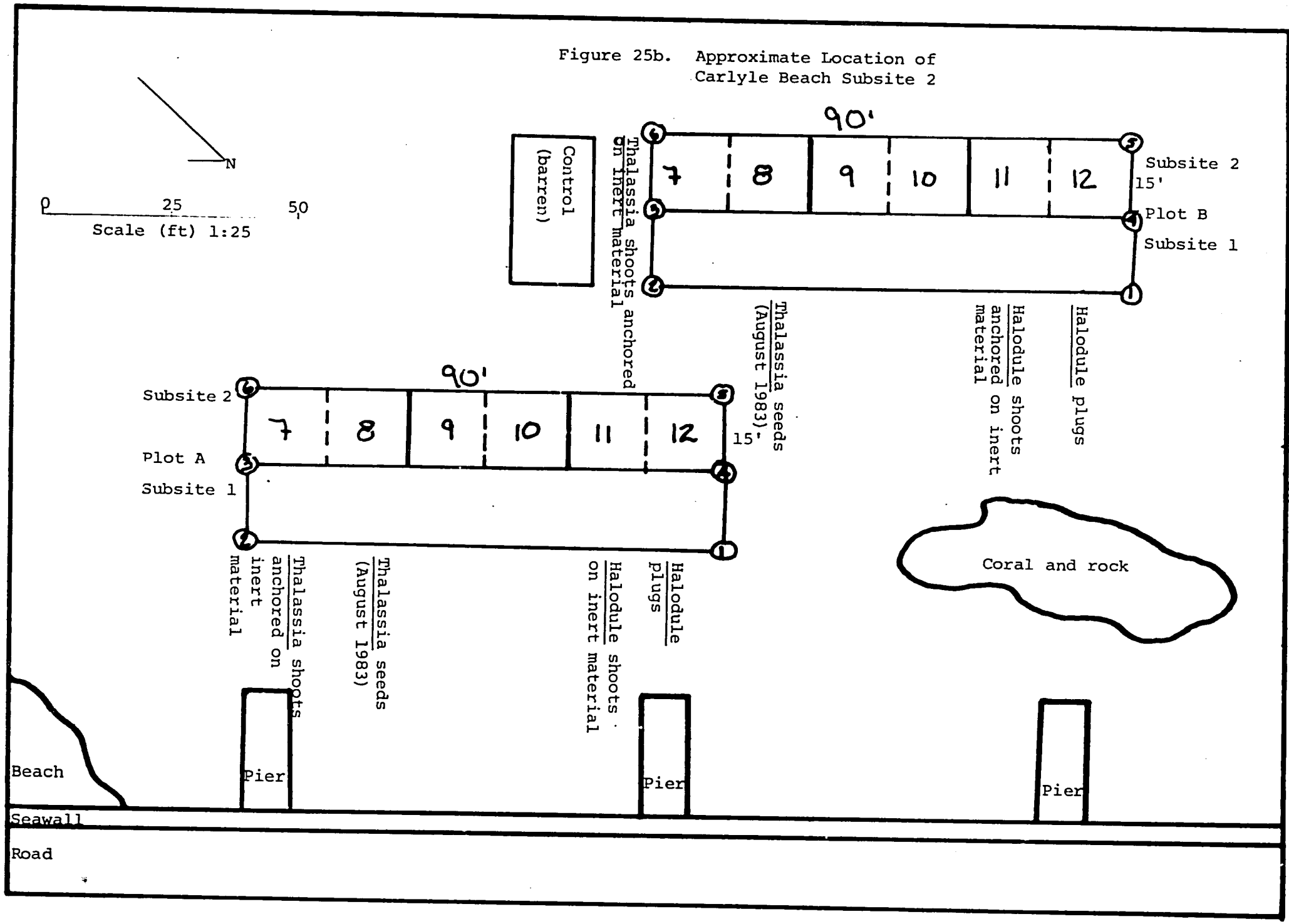
c. Planting: Amended to PROGRESS REPORT 1 as follows (paragraph 2):

On April 19, 1983 the site was planted by biologists from FIU, NRCD, and an unemployed fisherman. Figure 25b. shows the experimental design in which the two species of seagrass were planted. All the shoots were 5" in length and anchored on inert material; the plugs were 6" in diameter. In subplots #CB.7A and #CB.7B Thalassia shoots were planted, and in subplots #CB.8A and #CB.8B Thalassia seeds will be planted. Subplots #CB.9 and #CB.10 were left empty because no Syringodium could be located to transplant. Subplots #CB.11A and #CB.11B were planted with Halodule shoots, and subplots #CB.12A and CB.12B were planted with Halodule plugs. All the plants were installed on 3'x 3' matrix and each subplot contains 25 plants.

Figure 25b. shows the control area for barren bottom. Control areas for established Halodule and Thalassia are west of the area depicted in the figure.

Transplants were collected from a small bay near Rose Hall.

Figure 25b. Approximate Location of Carlyle Beach Subsite 2



15. Discovery Bay Site

a. Location: Corrected from PROGRESS REPORT 1 as follows:

The Discovery Bay Site is located approximately 800 ft east of the pier at Port Rhodes in Discovery Bay (see Figure 26). Subsite 1 is 150 ft seaward from the northern shoreline and Subsite 2 is 32.25 ft west of Subsite 1. Blue paint marks on the shoreline cliff mark the two ends of the site. The long dimension of the site is parallel to shore.

b. Characteristics of the Site: Corrected from PROGRESS REPORT 1 as follows:

Subsite 1 and 2 are 60'x 30' and the long dimension was divided into 15 ft sections to make four subplots in each subsite. The depth of water is 10 ft mean low water at both subsites. The sediment is composed chiefly of hard calcareous sand and extends more than 1.7 ft deep. There are small patches of naturally occurring Thalassia in subplots #DB.1, #DB.3, #DB.4, and #DB.5, and sparse Halodule in subplots #DB.1, #DB.2, #DB.3, #DB.4, #DB.5, and #DB.8. The animals noted present were Diadema, Lytechinus, and shrimp burrows. The site is somewhat sheltered by the outer reef and lagoon, but is subject to occasional winter storms. Visibility was +25 ft and no current was noted.

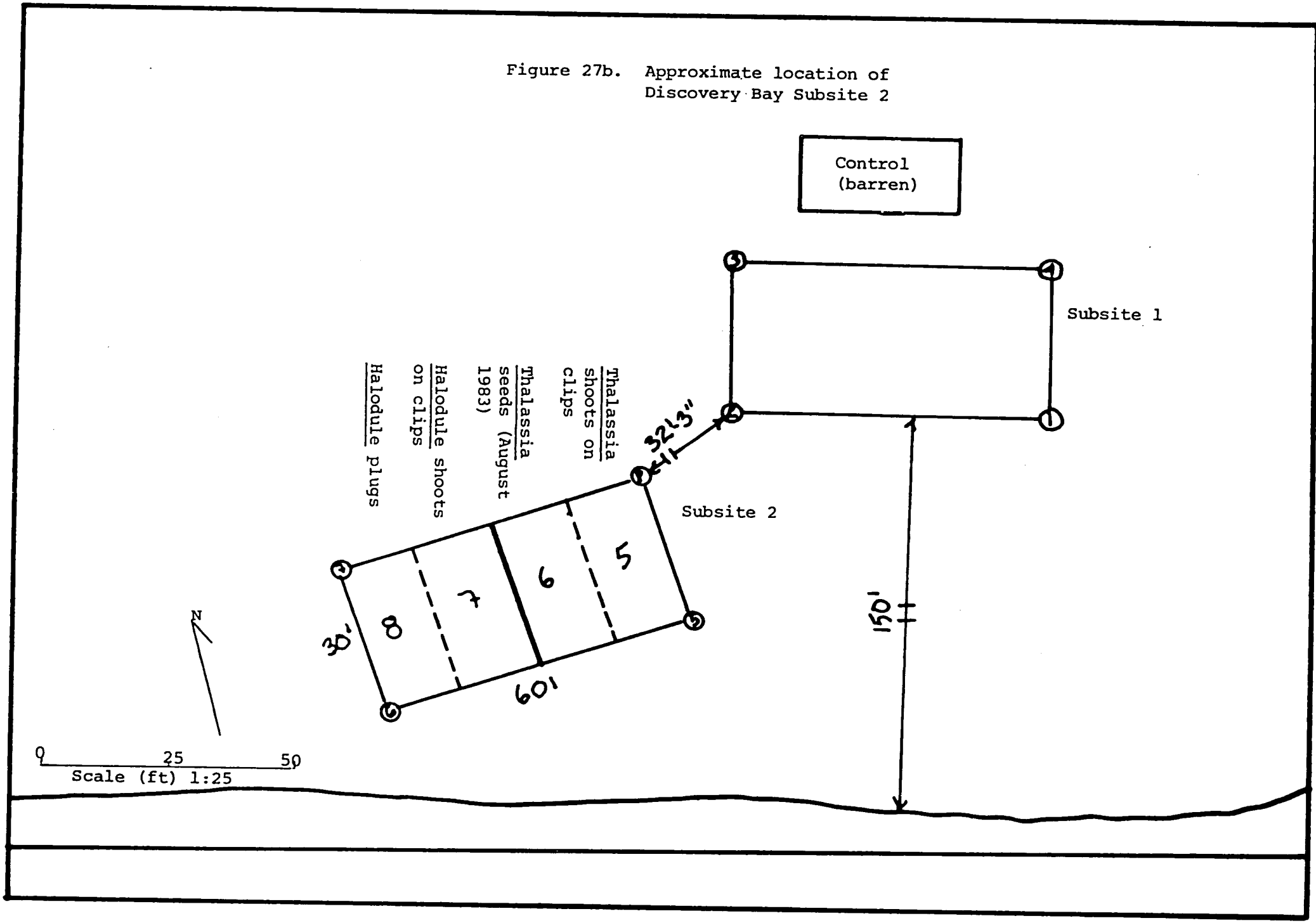
c. Planting: Amended to PROGRESS REPORT 1 (paragraph 2-3):

On April 18, 1983 the site was planted by biologists from NRCD, FIU,and an unemployed fisherman. Figure 27b. shows the experimental design in which the two species of seagrass were planted. 3" V-shaped clips were used to anchor all the 5" long shoots. In subplot #DB.5 Thalassia shoots were planted, and in subplot #DB.6 Thalassia seeds will be planted. In subplot #DB.7 Halodule shoots were planted, and in #DB.8 Halodule plugs 6" in diameter were planted. All the plants were installed on a 3'x 3' matrix and each subplot contains 50 plants.

Figure 27b. shows the control area for barren bay bottom. The control areas for Thalassia and Halodule established bed are southeast of the area depicted on the figure.

Transplants were collected from an unnamed bay along the north coast road approximately five miles from the site.

Figure 27b. Approximate location of Discovery Bay Subsite 2



16. Ocho Rios Site

The bauxite terminal at Ocho Rios damaged the area by its pier and the dredging of a ship channel which seems to have changed certain environmental conditions in the southeast corner of the bay. Dust emissions and other by-products from the loading process and ships appear to have degraded the water quality on occasions. At the east end of the bay seaward, a major fill operation appears to have occurred within the last decade and a half which resulted in dock facilities and a park. The fill and dredge probably increased the suspended particle load in the water.

The water chemistry parameters are quite similar to the Discovery Bay Site and are normal. The fresh water inflow from Dunns River decreases the temperature and salinity of the bay slightly after rains. The energy regime is quite high here.

The site was not planted in November 1982 due to bad weather. It was planted in April 1983.

a. Location

The Ocho Rios Site is located 205 ft from shore in the southwest corner of Ocho Rios Bay (see Figure 33.). The site is 165 ft east of the shoreline below a large cylindrical holding tank in the loading complex. The long dimension of the site is parallel to shore.

b. Characteristics of the Site

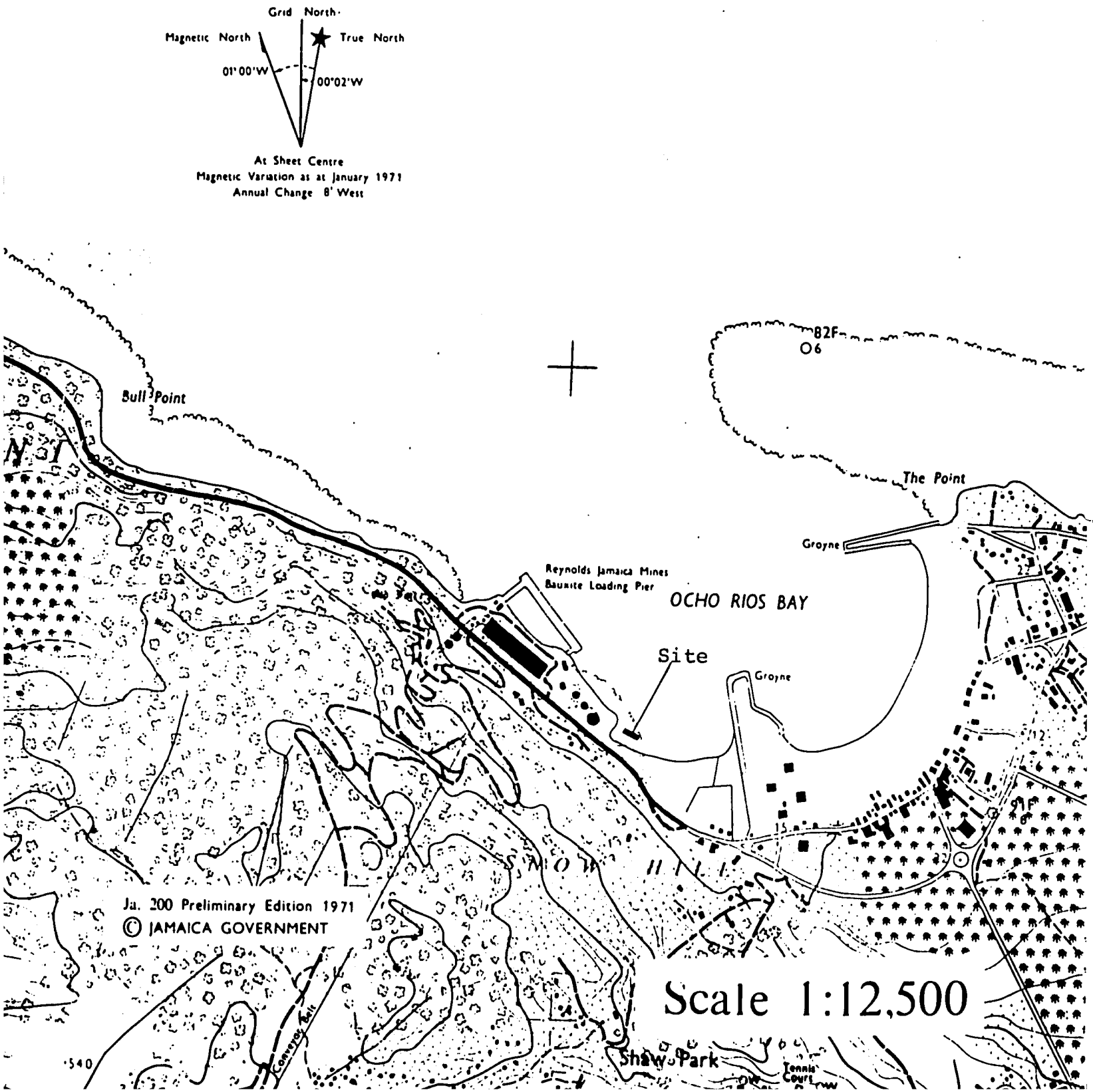
Subsite 2 is 60'x 30' (no Subsite 1 was set-up or planted). The long dimension was divided into 15 ft segments to make four subplots 15'x 30'. The depth of the site 11 ft mean low water. The sediment is fine and medium quartz sand more than 1.7 ft deep, but large rocks surround the site. Diadema are common in the area. Visibility was +25 ft and no current was noted.

c. Planting

On April 16, 1983 the site was planted by biologists from FIU and an unemployed fisherman. Figure 34. shows the experimental design in which the two seagrass species were planted. No Syringodium could be located in the area to transplant. All the shoots were anchored with inert material and all the shoots were 5" in length. In subplot #OR.1 Thalassia shoots were planted, and in subplot #OR.2 Thalassia seeds will be planted. In subplot #OR.3 Halodule shoots were planted, and in subplot #OR.4 Halodule plugs 6" in diameter were planted. All the plants were installed on a 3'x 3' matrix and each subplot contains 50 plants.

Transplant material was collected from a small bay approximately five miles west of Discovery Bay.

Figure 33. Approximate location of Ocho Rios Site



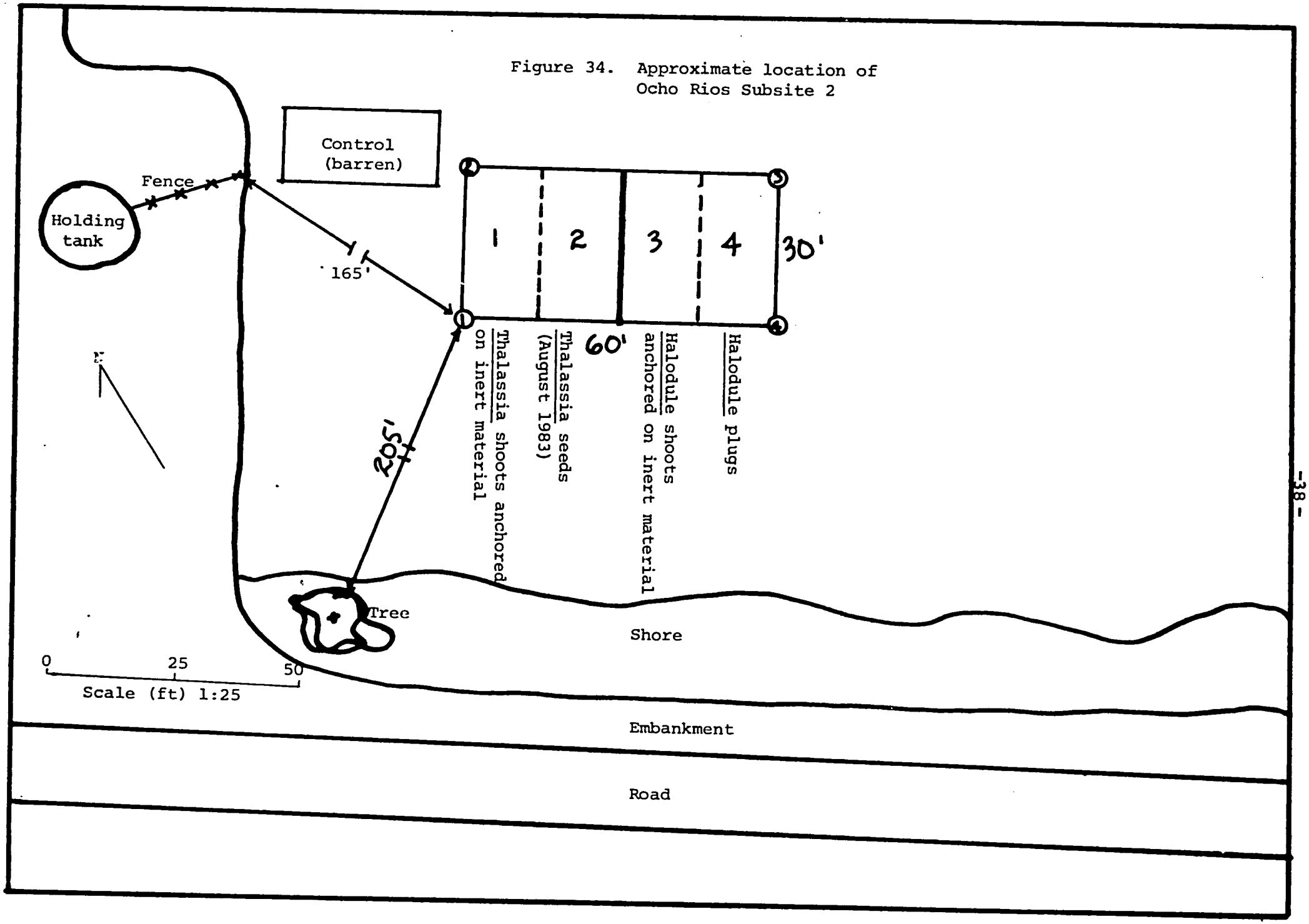


Figure 34. Approximate location of Ocho Rios Subsite 2

Figure 34 shows the control for barren bay bottom. No established seagrass beds could be located in Ocho Rios Bay for controls.

17. Yallahs Ponds (Salinas)

Yallahs Salt Ponds on the southeast coast have more than one thousand acres currently being considered as a mariculture facility by the Fisheries Department of Jamaica. We were requested by the Inland Fisheries Authority, after a meeting with the Department of Agriculture, to test this area for seagrass rehabilitation as a potential mariculture site. The pond was once used for commercial salt production.

The depth of the ponds vary from two to eleven feet. At present, no bottom vegetation lives in the ponds. A narrow beach separates the ponds from the Caribbean Sea so circulation or seawater exchange is restricted. Consequently, salinity in the ponds is quite high: 59.3 o/oo total salinity (Fenton 1981) (see Table 9.). Salinity measured 156.8 o/oo in April 1983.

The shoreline and pond bottoms are composed of sandy organic material. Beyond wind induced wave action, the ponds are fairly low energy with extensive shallow areas. The light penetration to the bottom is restricted by high plankton populations in the water column.

Since Ruppia maritima, a fourth marine seagrass species, has a high salinity tolerance, it was decided to to plant that seagrass also. Ruppia had not been previously transplanted here and is not found at any of the other sites except Rocky Point.

a. Location

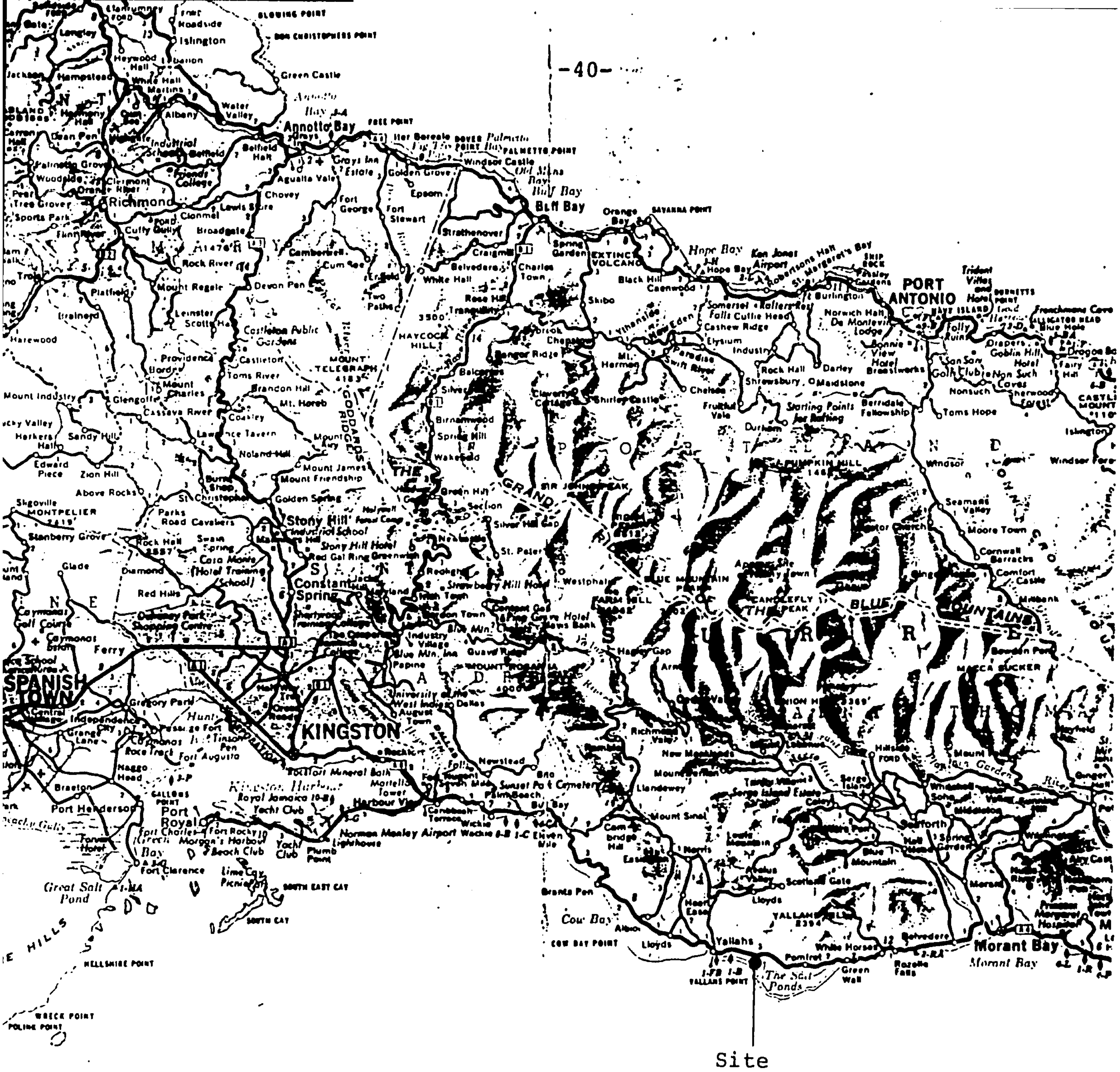
The Yallahs Pond Site is located on the south side of West Pond approximately five miles from the western edge of the pond. The site is 31.5 ft from shore and the long dimension is parallel with the shore. (See Figures 35. and 36.).

b. Characteristics of the Site

Subsite 2 is 75'x 30' (no Subsite 1 was set-up or planted). The long dimension was divided into 15 ft segments to make five subplots 15'x 30'. The depth of the site is 2 ft mean low water. The sediment is soft sand and organic material which is more than 1.7 ft deep. A hard crust overlies the soft sand underneath. No macroflora or macrofauna were noted, but the water was dense with halophylic bacteria and plankton. Visibility was less than .25 ft and no current was noted.

Table 9. Dissolved solids in water from Yallahs Salt Ponds (From Fenton 1981).

Ion	East Pond (o/oo)	West Pond (o/oo)	Seawater for Comparison (o/oo)
Na	22.157	19.787	11.081
Cl	36.423	32.731	19.460
Mg	1.179	1.173	.956
Ca	1.220	1.142	.456
SO_3	4.506	4.335	2.577
CO_3	0.081	0.073	0.000
Total	65.566	59.241	34.530



N

Figure 35. Approximate location of Yallahs Ponds Site

Elevations on map are shown in feet

Distances on map are shown in miles

One inch equals approximately 4.8 miles

Scale 0 1 2 3 4 5 10 miles

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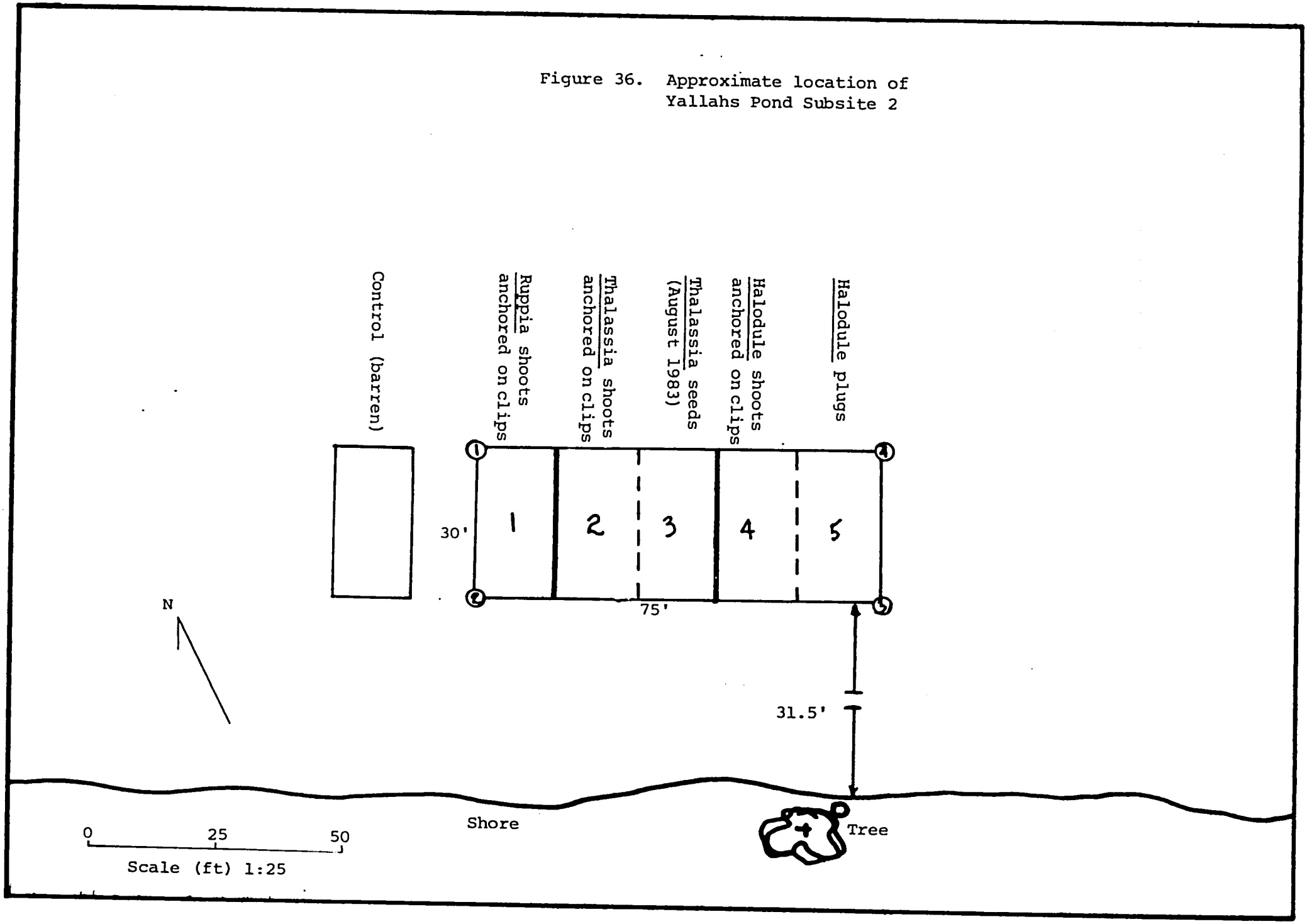
Figure 36. Approximate location of Yallahs Pond Subsite 2



c. Planting

On April 14, 1983 the site was planted by biologists from NRCD, FIU, UWI, and an unemployed fisherman. Figure 36. shows the experimental design in which the three species of seagrass were planted. All the shoots were anchored with 3" V-shaped clips and all the shoots were 5" in length. In subplot #YP.1 Ruppia shoots were planted. In subplot #YP.2 Thalassia shoots were planted, and in subplot #YP.3 Thalassia seeds will be planted. In subplot #YP.4 Halodule plugs were planted, and in subplot #YP.5 Halodule plugs 6" in diameter were planted. All the plants were installed in a 3'x 3' matrix and each subplot contains 50 plants.

Transplant material was collected from seagrass beds near the Rocky Point site.

Figure 36. shows the control area for barren pond bottom. No seagrass naturally grows in Yallahs Ponds for established bed controls.

18. Alligator Pond Site

Alligator Pond is located in the middle southwest coast near Port Kaiser aluminum facility. The area is a beach open to the Caribbean Sea. A fishing villiage is located immediately adjacent to the site. The oil spill which occurred several years ago has influenced the shoreline. Oiled sands still appear along the extensive beach. Sublittoral vegetation near the beach is minimal. A small reef structure appears to have dead coral and some live algae on it.

High energy regime of wave action from the Caribbean Sea dominates the area. The water is turbid from suspended particles caused by wave action.

a. Location

The Alligator Pond Site is located to the east of the access road to Alligator Pond and is approximately 100 yards down the beach. The site is 57 ft from the south shore and the long dimension is parallel to the shoreline. The site is west of a large spit of rocks which juts into the ocean just east of the site. (See Figures 37. and 38.).

b. Characteristics of the Site

Subsite 2 is 75'x 15' (no Subsite 1 was surveyed or planted). The long dimension was divided into 15' segments to make five subplots 15'x 15'. The depth of the site is 4 ft mean low water. The sediment is coarse dark sand more than 1.7 ft deep. Visibility was 1 ft and sea state was choppy (waves were 2 - 4 ft).

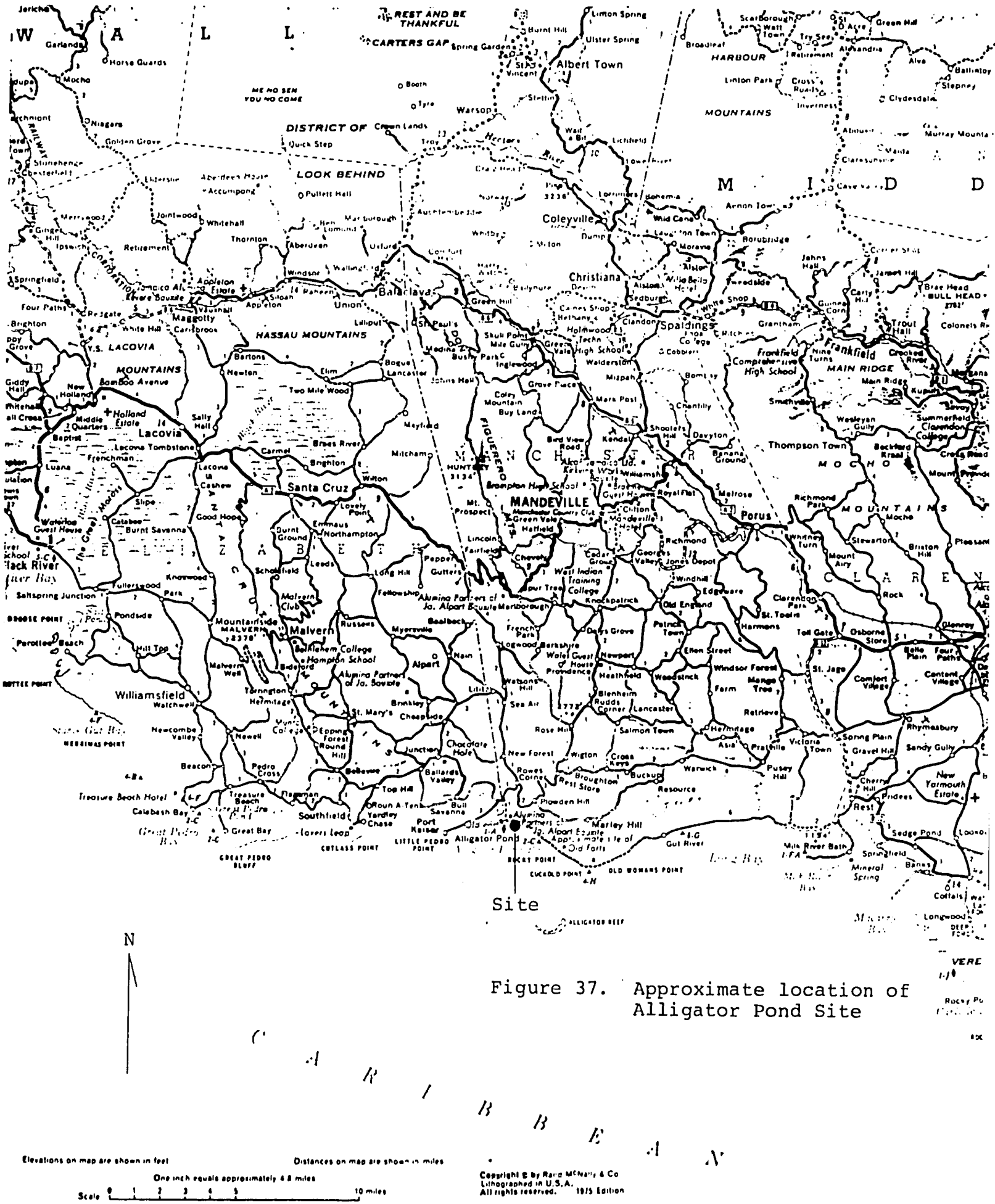


Figure 37. Approximate location of Alligator Pond Site

Elevations on map are shown in feet

Distances on map are shown in miles

One inch equals approximately 4.8 miles

Scale 0 1 2 3 4 5 10 miles

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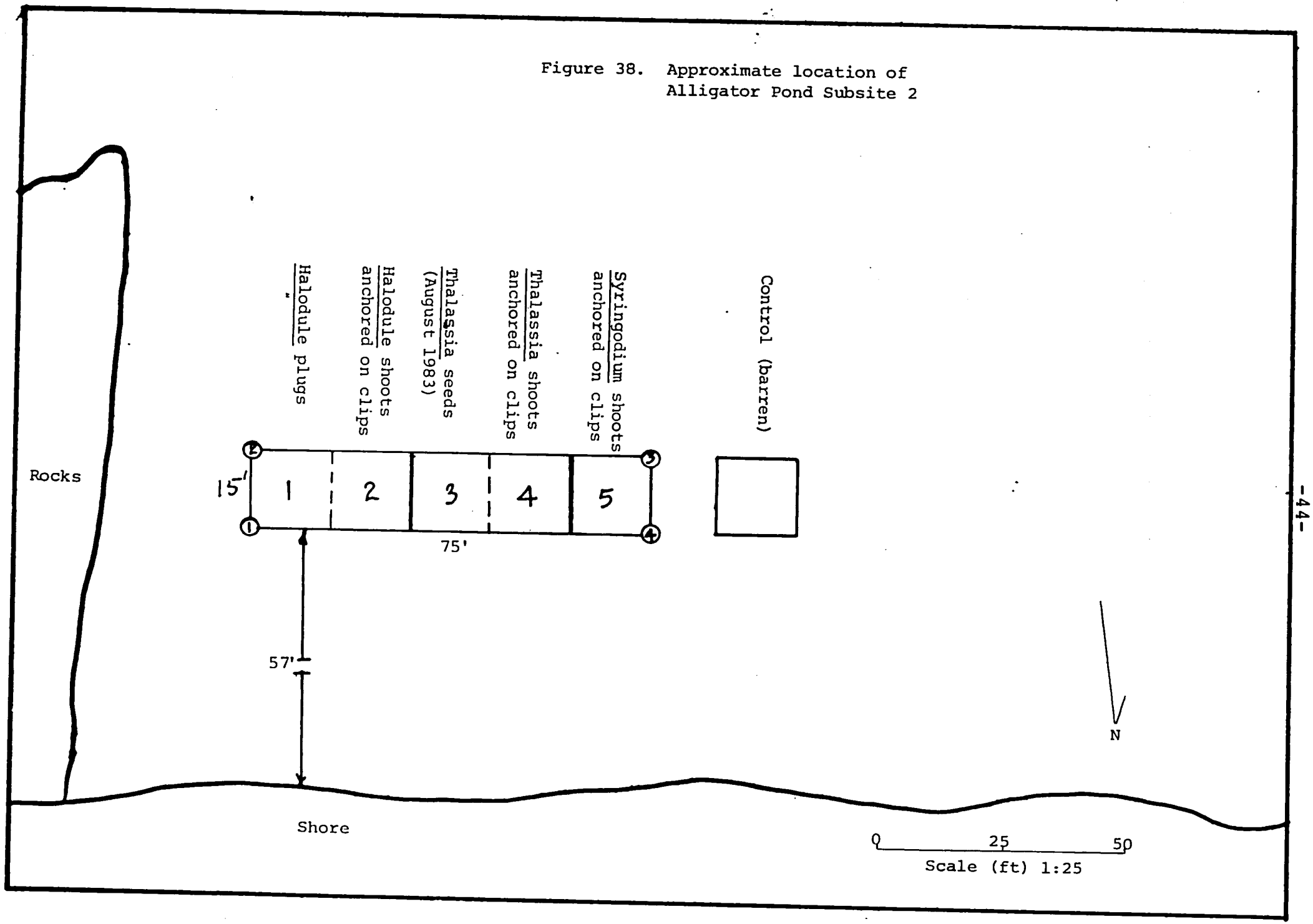
Figure 38. Approximate location of Alligator Pond Subsite 2



c. Planting

On April 15, 1983 the site was planted by biologists from FIU, NRCD, UWI, and an unemployed fisherman. Figure 38. shows the experimental design in which the three species of seagrass were planted. All shoots were anchored with 3" V-shaped clips and all the shoots were 5" in length. In subplot #AP.1 Halodule plugs 6" in diameter were planted, and in subplot #AP.2 Halodule shoots were planted. In subplot #AP.3 Thalassia seeds will be planted, and in subplot #AP.4 Thalassia shoots were planted. In subplot #AP.5 Syringodium shoots were planted. All the plants were installed in a 3'x 3' matrix and each subplot contains 25 plants.

Figure 38. shows the control for barren bottom. The sea state was too rough to locate and count control areas for established beds.

The transplants were collected from the Old Harbor Power Plant area.

19. South Port Beach Site

This area was originally a series of small mangrove islands prior to the filling of Montego Bay Freeport. The area is said by local fishermen to have been an extensive fisheries nursery and seagrass meadow. The shoreline at this site was filled with fairly coarse materials. Rock riprap was used to keep the fill in place, but some of the fill has eroded from the upland area into the sublittoral zone during the past decade. Old maps show a branch of Montego River flowing into this site, but the river has been diverted and channelized into a area north of this site. At the time of planting in April 1983, a small beach separated a freshwater drainage pond for the Pies River from the bay at the site of the former river mouth.

The site was essentially barren of bottom vegetation and animals at the planting time. The influence of the river, sewage effluent, and high turbidity from the Freeport fill and Montego Bay are evident.

This site was chosen and planted as a result of the failed planting at Fisherman's Jetty across River Bay.

a. Location

The South Port Beach Site is located approximately 1000 ft north northeast of the Esso/Shell Oil Tank Farm on Coconut Drive, Montego Bay (see Figure 39.). Subsite 2 is located 123 ft north of the end of the road behind the tank farm. Subsite 3 is adjacent to the west side of Subsite 2. The long dimensions of the subsites are parallel to shore (see Figure 40.).

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SHEET HISTORY

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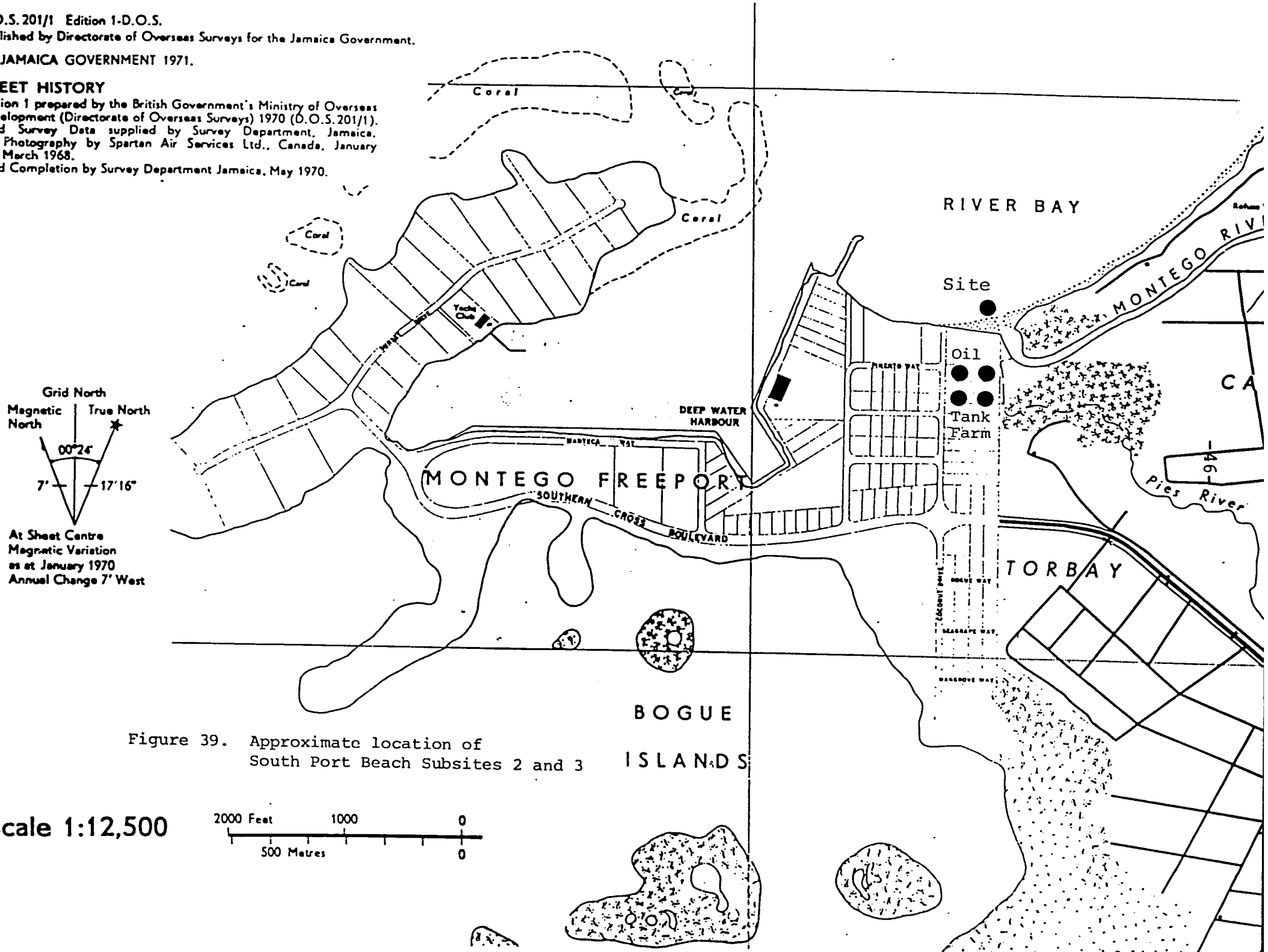
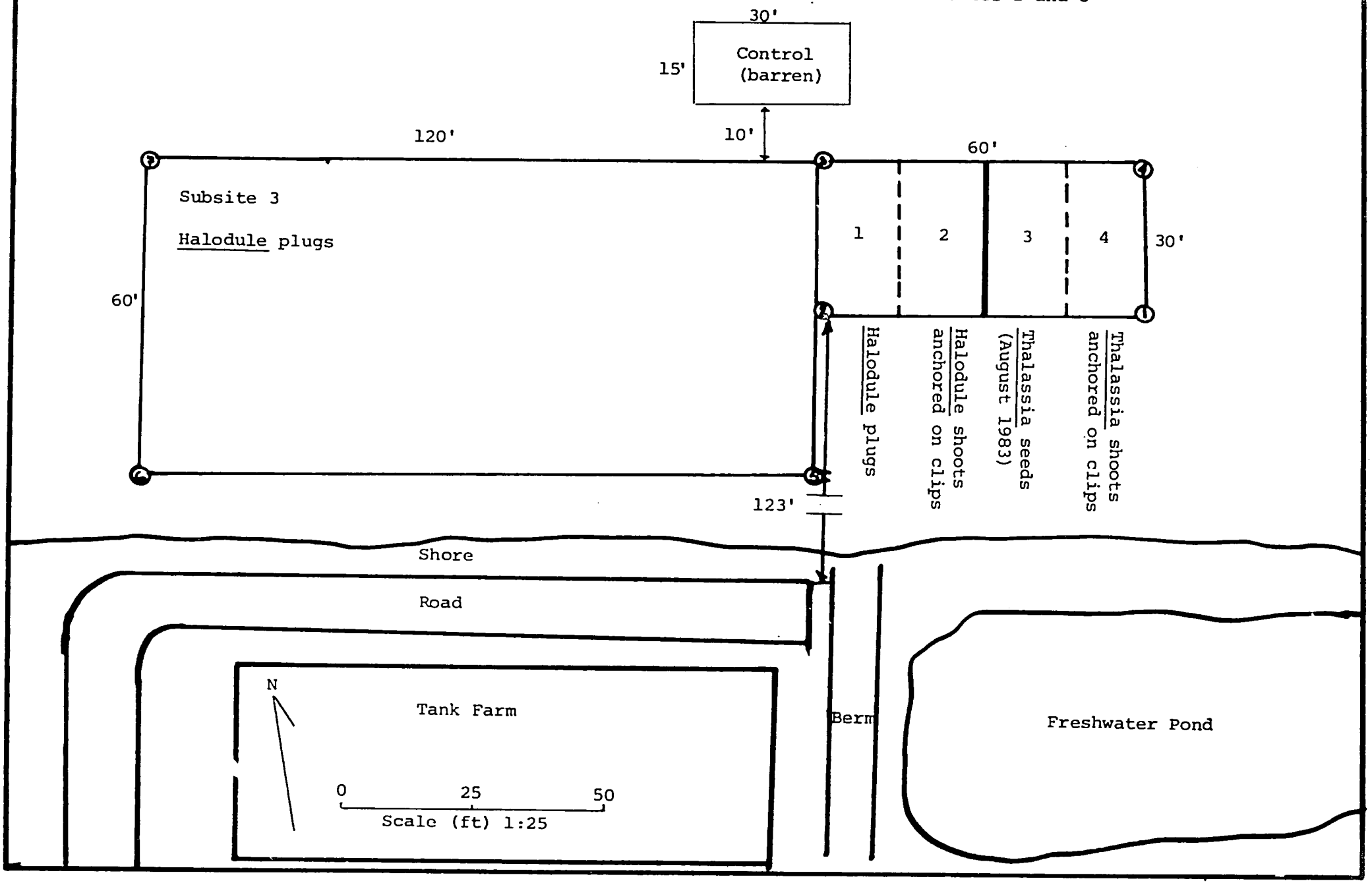


Figure 39. Approximate location of South Port Beach Subsites 2 and 3

Figure 40. Approximate Location of South Port Beach Subsites 2 and 3



b. Characteristics of the Site

Subsite 2 is 60'x 30' (no Subsite 1 was surveyed or planted). The long dimension was divided into 15' ft sections to make four subplots 15'x 30'. The depth at low mean water is 3 ft. The sediment is composed coarse brown sand and is more than 1.7 ft deep.

Subsite 3 is 120'x 60'. The entire subsite was planted with one species and one method, so it was not divided into subplots. The depth at low mean water is 3 - 4 ft. The same sediment occurs here as in Subsite 2.

c. Planting

On April 20, 1983 Subsite 2 was planted by biologists from NRCD, FIU, and an unemployed fisherman. Figure 40. shows the experimental design in which the two species of seagrass were planted. All the shoots were planted on 3" V-shaped clips and all the shoots were 5" in length. In subplot #SP.1 Halodule plugs 6" in diameter were planted, and in subplot #SP.2, Halodule shoots were planted. In subplot #SP.3 Thalassia seeds will be planted, and in subplot #SP.4 Thalassia shoots were planted. All the plants were installed on a 3'x 3' matrix and each subplot contains 50 plants.

On April 21, 1983 Subsite 3 was planted by biologists from NRCD, FIU, and an unemployed fisherman. Figure 40. shows the planting design. 800 Halodule plugs 6" in diameter were planted on a 3'x 3' matrix in this subsite. The total area of this subsite is .17 acre.

Figure 40. shows the control area for barren bay bottom. No established Thalassia or Halodule beds for controls could be located in the area.

Transplant material was collected from a small bay near Rose Hall.

B. Summary Tables of Impacts at Sites and Scientific Goals Met to Date: Corrected from PROGRESS REPORT 1 as follows:

Table 6b. summarizes the types of impacts, both natural and artificial, found at each of the eighteen seagrass restoration sites and one mangrove planting site. Oil spills and ship bilging affected 53 percent of the sites; urban runoff affected 47 percent of the sites; and industrial waste and dredge and fill affected 42 percent of the sites. Bauxite spills and river runoff affected 26 percent of the sites; erosion affected 21 percent of the sites; peat runoff affected 11 percent of the sites; and thermal effluents affected 5 percent of the sites (1 site).

Table 7b. summarizes the scientific goals met between December 1982 and June 1983. Table 7b. shows the sediment type and depth, water depth, and the number, species and anchoring method for the seagrass species planted in April 1983. This table should be helpful for gaining a general overview of the April 1983 planting and as baseline data to which the monitoring reports can be referred.

Table 6b. Impacts at 19 Test Sites

Site	Industial Waste	Dredge and Fill	Bauxite Spills	Oil Spills	Urban Runoff	River Runoff	Erosion	Peat	Thermal Effluents
Hellshire A and B					X		X		
Fort Augusta	X	X		X	X	X			
Old Airport	X	X		X	X				
Cement Factory	X			X	X				
Rocky Point	X		X	X					
Port Esquivel	X		X	X					
Power Plant									X
Discovery Bay			X	X					
Carlyle Beach	X	X			X		X		
Pelican Jetty		X			X	X			
Fishermens Jetty	X	X		X	X	X			

Table 6b. continued: Impacts at 19 Test Sites

Site	Industrial Waste	Dredge and Fill	Bauxite Spills	Oil Spills	Urban Runoff	River Runoff	Erosion	Peat	Thermal Effluents
Seawind		X			X		X		
Negril Point						X		X	
Negril River						X		X	
Rocky Point Mangrove Planting	X		X	X					
Additional Sites Planted in April 1983									
Ocho Rios		X	X	X					
Yallahs Pond									
Alligator Pond				X					
South Port Beach		X			X		X		

Table 7b. Scientific Goals Met to Date (December 1982 - June 1983)

Site (Subsite 2)	Date Planted	Sediment Type	Sediment Depth	Water Depth	# Syr. plugs	# Syr. shoots /rod	# Syr. shoots/clip
Hellshire A	April 7,'83	coarse sand	20+ inches	2 feet	0	25	0
Hellshire B	April 7,'83	coarse sand	20+ inches	5 feet	0	25	0
Fort Augusta	April 6,'83	sand and organics	20+ inches	4 feet	0	0	50
Old Airport	April 5,'83	coarse particles	20+ inches	6 feet	0	37	50
Cement factory	Terminated	fine silt	2-5 inches	3-12 feet			
Rocky Point	April 13,'83	clay crust fine silt	20+ inches	1-2 feet	0	0	0
Port Esquivel	April 11,'83	muddy sand	18 inches	6-8 feet	0	50 (inert anchor)	50
Power Plant	April 8,'83	muddy sand	20+ inches	2-3 feet	50	0	50
Discovery Bay	April 18,'83	calcareous sand	20+ inches	10 feet	0	0	0
Carlyle Beach A	April 19,'83	coarse sand	3-6 inches	6-7 feet	0	0	0
Carlyle Beach B	April 19,'83	coarse sand	6-10 inches	7-8 feet	0	0	0
Pelican Jetty	April 19,'83	coarse sand	20+ inches	4-10 feet	0	0	0
Fishermens Jetty	Terminated	black sand	20+ inches	3-6 feet			
Seawind	April 21,'83	sand	6-12 inches	4-6 feet	0	0	0
Negril Point	April 22,'83	fine mud over sand	16 inches	20 feet	0	0	50
Negril River	April 22,'83	coarse sand	20+ inches	5-6 feet	0	0	20
Rocky Point Mangrove	April 13,'83	muddy sand	20+ inches	0-2 inches			

Table 7b., continued.

Site (Subsite 2)	# Hal. plugs	# Hal. shoots/ rod	# Hal. shoots /clips	# Thal. shoots/ rod	# Thal. shoots /clips		
Hellshire A	0	25	0	25	0		
Hellshire B	0	25	0	25	0		
Fort Augusta	0	0	50	0	50		
Old Airport	42	0	50	0	49		
Cement Factory							
Rocky Point	50	0	50	0	50		
Port Esquivel	50	0	50	0	50		
Power Plant	50	0	50	0	50		
Discovery Bay	50	0	50	0	50		
Carlyle Beach A	25	25 (inert anchor)	0	25 (inert anchor)	0		
Carlyle Beach B	25	25 (inert anchor)	0	25 (inert anchor)	0		
Pelican Jetty	50	0	50	0	50		
Fishermens Jetty							
Seawind	50	50 (inert anchor)	0	50 (inert anchor)	0		
Negril Point	0	0	50	0	50		
Negril River	0	0	20	0	20		
Rocky Point Mangrove Planting	125 Red Mangrove Propagules						

Table 7b., continued.

Site (Subsite 2)	# Hal. plugs	# Hal. shoots/rod	# Hal. shoots/ clips	# Thal. shoots/ rod	# Thal. shoots/clips	# Syr. shoots/ rod	# Syr. shoots/clips
Ocho Rios	50	0	50	0	50	0	0
Yallahs Pond	50	0	50	0	50	0	(Ruppia) 50
Alligator Pond	25	0	25	0	25	0	25
South Port Beach	50	0	50	0	50	0	0

Site (Subsite 3)	# Hal. plugs	Date Planted
Fort Augusta	1200	April 12, '83
South Port Beach	800	April 20,'83

Site (Subsite 2)	Date Planted	Sediment Type	Sediment Depth	Water Depth
Ocho Rios	April 16,'83	quartz sand	+20 in	11 ft
Yallahs Pond	April 14,'83	coarse sand	+20 in	1 ft
Alligator Pond	April 15,'83	coarse sand	+20 in	4 ft
South Port Beach	April 20,'83	coarse sand	+20 in	3 ft

Training

1. NRCD personnel

NRCD training included instruction for operating all the monitoring instruments (dissolved oxygen meter, refractometer, flow meter, light meter, and sediment corers), techniques, and data management to Mr. Peter Gayle, Mr. Everton Kelly, and Ms. Barbara Chow. The detailed training of monitoring which includes relocating the test sites, measuring survival, and measuring growth was included.

Training of NRCD personnel in management and logistics of the project were stressed as training during the April 1983 planting. NRCD personnel co-directed some planting sites and solely directed two others where trainees and instructors exchanged roles to plant the site. This was followed by a management seminar with feedback from the NRCD personnel on how to improve management skills and strategies.

2. Low Technical Employment Test

Persons employed in addition to those listed in PROGRESS REPORT 1 were Mr. Grandville Block, May Pen, Kingston and Mr. Robert Higgins, Kingston.

One fisherman temporarily employed by the project during the November 1982 planting was employed for the entire April 1983 planting in order to test long term improvement of skill level on various tasks. The results were excellent. Both in ability to improve toward higher work productivity on each of the manual tasks involved in planting and in enthusiasm and energy, Mr. Donovan Henry showed a high level of performance, which would potentially make a team of Jamaican fishermen capable of restoration project (with sufficient technical management and supervision).

The background skills apparently necessary for various portions of the work are:

1. Gathering plants -- snorkeling and comfort in the water;
2. Sorting plants and attaching anchors -- agricultural background;
3. Plugging -- comfort in wading in shallow water; and
4. Planting -- scuba skills.

The ideal unemployed worker for this project has an agricultural background, has scuba dived for fish, and is energetic. This profile of person was found at many sites.

D. Public Exposure and Education

Ms. Elean Thomas, Director of Public Education for NRCD, and Mr. William Davis, Counselor, U.S. Information Services, cooperated in obtaining several excellent public exposure items for this project.

The most recent news clippings on the project are found after the title page of this report. A television special documentary, a half-hour special on our project, was filmed and directed by Ms. Pat Lazarus for the Jamaica Broadcasting Corporation.

E. Equipment Status

A supplemental shipment of planting equipment and automobile parts were sent to Kingston during the April 1983 field trip. All equipment arrived intact and undamaged. The project equipment is stored and maintained by the NRCD in Kingston. No major problems or losses have occurred, and NRCD personnel are maintianing the project equipment well.

F. Monitoring Results

The criteria for a successful restoration are a high rate of survival, satisfactory lateral expansion of rhizomes, coalescence of the grass bed, and satisfactory growth of blades compared to established grass beds in the area. The transplants are expected to grow and expand into a coalesced grass bed. The rate at which the plants do this is the primary consideration in assessing the capability of the site to support restoration. The restoration will be judged successful and the site being capable of supporting restoration based on the following conditions being met after one year:

1. 60 percent or more of the installed plants of a species survive;

2. 50 percent or more of the installed plants expand laterally (*Thalassia* is expected to expand more slowly than *Halodule* or *Syringodium*);

3. Leaf growth of the *Thalassia* seeds to 6 cm, longest blade;

4. One species remaining for the above conditions, but not the others as a result of site specific conditions favorable to only one species.

Failure at the site would be:

1. None or very few specimens of any species remaining at the site;

2. Remaining plants dying or dead;

3. No expansion of specimens.

Variability and the resulting experimental errors, as might be anticipated, are quite high in this work. The sources of the variability are the transplants which come from wild stock and do not grow as uniformly as nurseried domestic stock, the measurements of growth are made on individual plants which are quite variable, and radically different characteristics of the sites where survival ranges from 0 to 100 percent. Consequently, it is necessary to allow for a substantial amount of attrition in planning experiments and to recognize that only fairly large differences can be detected. The effects of excessive variability or heterogeneity of variances on the statistical analyses will be tested. (Woodhouse et al. 1972; Sokal and Rohlf 1981).

Appendix I contains the monitoring results from the November 1982 planting (baseline data) and the February 1983 monitoring field trip. A legend preceeds the data. The November 1982 planting is designated Period 1, and the February 1983 field trip is designated Period 2 (additional monitoring and planting trips are designated by sequential Period numbers). Period 2 is 81 days after Period 1.

The results are presented by site. The results of the monitoring for each seagrass species and planting method are presented for the site. The sites are ordered in the same sequence as Section A., Sites Selected.

The monitoring results of each seagrass species and planting method (i.e., each subplot at the site) are identified by a five-part code which is listed in the following sequence: Period #, Site (two letter abbreviation), Subsite # (identifies the November 1982 planting (1), or the April 1983 planting (2,3)) Species, and Method of planting. The dependent variables for each site are shown across the top of each results sheet. The results presented are the mean, standard deviation, and valid number of cases for each of the dependent variables.

The results presented for "Count" reflect the number of surviving transplants located during the monitoring from an original 50 installed units. If more than or fewer than 50 units were installed, the count has been weighted so it is expressed in terms of 50 installed units. No standard deviation is presented for this count because there is only one number of surviving plants per subplot (all the installed units were counted so there is no variability per subplot).

The results presented for "Blade Length," "Number of Shoots (blade groups)," "Rhizome Length," "Number of Rhizomes," and "Diameter of the Plug" reflect growth. The mean number for these variables at the time of planting was deducted from the individual measurements made in the field in order to reflect growth of the plant over time. Therefore, Period 1 data show zero growth.

The variable Blade Length is the length of the longest blade among the blades in the planted unit. Since the blades grow and die continuously, the measurement is most useful for comparing the condition of the transplanted seagrass with established beds in the area to assess the relative performance compared with the ambient conditions. The variable also relects the general health and vigor of the plant because the blades will grow as long as the physical conditions permit. (Blade length, however, is less in high wave energy areas than in calm waters simply due to physical restrictions of the environment.)

The variable Number of Shoots (blade groups) per m^2 directly indicates the density of the planted unit. The number of shoots increases as the plant grows.

The variable Rhizome Length is the length of the planted groups of rhizomes. The variable Diameter of the Plug is the diameter of the dense growth of the plug. To compare the expansion of the planted rhizomes versus the plugs, these two variables can be used. Because the planting methods are so different -- rhizomes are groups of apical meristems and rhizomes free of sediment while plugs are whole sections of the plant with the sediment intact -- the variables are not equal, but can be used as an indication of the rate of expansion of the planted unit.

The variable Number of Rhizomes indicates the number of discernable rhizomes in the planted unit. As the plant grows, lateral rhizomes are produced to increase the spread of the grass bed. The value reflects the rate of expansion of the plant.

Therefore, these dependent variables (Blade Length, Number of Shoots (blade groups), Rhizome Length, Number of Rhizomes, and Diameter of the Plug) should be interpreted in concert to gain an overall picture of the species' performance.

The variable Seeds is the number of seeds present at the monitoring from an original of two installed per unit. It applies only to the <u>Thalassia</u>.

The physical data (temperature, dissolved oxygen, salinity, current, and light penetration) is also presented for each site. This data was collected at the time of the monitoring. It will be discussed as appropriate.

Lastly, the symbol "M" appears on the results sheets when the computer program used to calculate these figures cannot do so. It cannot calculate a value if no data is available for that parameter, if it is an inappropriate parameter, or the data has already been presented once which is sufficient. The symbol appears in the Standard Deviation row when there is no variability for a measured parameter.

The following summation of the results by site is derived from the February monitoring which has been analyzed by the computer program and qualitative observations from the April and June monitoring field trips.

1. Old Airport Site

Thalassia rhizomes had the highest survival (90%). Halodule plugs survived next best (58%). The Thalassia rhizomes grew a mean of 4 $\pm$ 4 cm in length, but the plugs did not expand. Burrowing shrimp were thought to interfere with the Thalassia seeds. Growth was occurring in all subplots for the April 1983 planting which survived better than the November 1982 planting.

2. Cement Plant Site

No living plants could be located. The site was terminated.

3. Fort Augusta Site

This site had high survival for all the fall plantings except the Halodule rhizomes. Vigorous lateral growth in February preluded the total coalescence of the Halodule plugs by June. This is the most rapid coalescence of seagrass planted at three foot centers anywhere in the world to data. A larger plot 180 ft x 60 ft was planted with 1200 plugs of Halodule to test the results of a larger scale planting.

4. Hellshire Beach Site

Heavy winter wave action evidently decimated a good part of this planting, however, Syringodium rhizomes, Thalassia seeds and rhizomes on heavy anchors survived at a rate of 18%, 16% and 12%, and were growing. The spring planting had much higher survival and growth than the fall planting.

5. Old Harbor Power Plant Site

This was a successful site. 98% of the Halodule plugs and 88% of the Halodule rhizomes survived from the fall planting. 62% of the Syringodium rhizomes and 54% of the Thalassia rhizomes survived. Lateral growth of rhizomes from the Halodule was good, as was the Thalassia. The spring planting was also growing well.

6. Port Esquivel Site

This was the next most successful site for both the fall and spring plantings. 88% of the Halodule plugs survived, 60% of the Thalassia seeds and 58% of the Thalassia rhizomes survived. No surviving units of Syringodium, however, could be located. The spring planted was growing well.

7. Rocky Point Site

The salinity was quite high at this site in February (59.6 o/oo compared to 35.0 o/oo for many of the other sites). The salinity increased in April and June. The plants are present, but little growth was occurring. By June the high salinity apparently had killed a high proportion of the plants.

8. Rocky Point Mangrove Planting Site

The red mangroves propagules planted here had a 75% survival rate and 50% of the plants had two leaf pairs. No red mangrove seedlings survived. 12% of the black mangrove seedlings were surviving.

9. Negril Point Site

The survival of the fall planting was extremely low here. The spring planting survival was substantially higher.

10. Negril River Site

The survival of the fall planting was zero at this site. The spring planting survival was somewhat better.

11. Montego Bay Seawinds Site

The survival of the fall planting was poor here. 38% of the Halodule plugs and 24% of the Thalassia seeds survived, but survival was 0% for Halodule and Thalassia rhizomes. High wave energy and a rocky substrate was thought to be the cause of the poor survival. The survival from the spring planting was somewhat better.

12. Fisherman's Jetty Site

36% of the Halodule plugs and 22% of the Halodule rhizomes survived at this site. No Thalassia seeds or rhizomes survived. Survival in April at this site was 0%. The site was terminated.

13. Pelican Jetty Site

High survival of most species and methods, especially the Halodule plugs (88%), was measured here in February. Vigorous growth continued to be observed in April and June 1983. The spring planting also survived well.

14. Carlyle Beach Site

At this high wave energy site, survival was medium to poor. 22% of the Halodule rhizomes, 8% of the Thalassia seeds, and 4% of the Thalassia rhizomes survived. The spring planting had better survival.

15. Discovery Bay Site

The plants survived well at this site despite being coated with suspended bauxite dust. For Halodule, 58% of the plugs and 38% of the rhizomes survived. For Thalassia, 52% of the seeds and 38% of the rhizomes survived. Little growth was observed during the February monitoring, but the April and June monitoring looked better.

16. Ocho Rios Site

This site was not planted in November 1982 due to bad weather and rough water. The spring planting appeared to be doing well.

IV. Discussion

Specific Objective 1. has been tested, and the results are positive: shallow, tropical nearshore waters around Jamaica are capable of receiving seagrass restoration. This is the first time that a developing nation or a tropical nation has had a successful seagrass restoration.

The spring planting appears to be more cost-effective than the fall planting since the survival is higher. The survival at high wave energy sites was particularly remarkable compared to the fall planting.

The sites damaged by dredge and fill have responded well to the rehabilitation with seagrass transplants. The bauxite spill areas also appear to be highly amenable to rehabilitation as does the thermal effluent site. The most successful seagrass species to transplant appear to be Thalassia and Halodule. High salinity lagoons, unless flushed by ocean or estuarine waters, do not appear to be feasible or cost-effective for transplanting.

The very rapid formation of a complete cover of Halodule after seven months at the Fort Augusta site is noteworthy. The transplanted seagrass grew from a plug 15 cm in diameter to cover 1 yd^2 completely. This is the most rapid restoration reported in any of the world's seagrass restoration literature.

The training program of Natural Resources Conservation Department (NRCD) staff continues to progress. Training and utilization of unemployed fishermen was successful in all attempts.

Publicity in newspapers and media began to create a public awareness of seagrass beds as fisheries nurseries and as a valuable natural resource to be conserved.

V. Final Product Utilization

A. Final Product
B. Termination of Project
2. Acts of Termination
b. Papers Presented

The following paper was presented to the Island Marine Laboratories of the Caribbean meeting in accordance with the grant specifications. The paper was well received and several persons at the meeting asked for further information on the project.

Association of Island Marine Laboratories of the Caribbean Meeting
May 16-20, 1983, Miami, Florida, U.S.A.

ABSTRACT

Restoration of Seagrasses in Jamaica:
Preliminary summary of Jamaica's management of seagrass restoration

A. Thorhaug, Ph.D., Biology Department, Florida International University, Beverly Miller, Principal Director and Donovan Rose, Acting Principal Direction, Natural Resources Conservation Department, Kingston, Jamaica

The first attempt to transfer seagrass restoration technology developed in the subtropical U.S.A. to a Caribbean nation began in the fall of 1982 at twenty test sites around the coast of Jamaica. The scientific goals of the program sponsored by U.S.A.I.D. are to determine the feasibility of transplanting three species of seagrass (*Thalassia testudinum*, *Halodule wrightii*, and *Syringodium filiforme*) to damaged nearshore ocean and bay bottom. The environmental management goals are to ascertain the best and most cost-effective restoration technology for industrial and urban pollution. The test sites were located around the island and include a variety of wave energy regimes, sediment types, turbidity levels, water chemistry characteristics, and pollutants. Two methods for planting each species at each site were attempted. Two planting efforts (fall and spring) have occurred and preliminary results after three and five months for the fall planting will be discussed.

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VII. Appendices

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A. Appendix I: Monitoring Results

LEGEND

Independent variables

Period:	Date of monitoring
PER 1 :	November 1982
PER 2 :	February 1983
PER 3 :	April 1983
PER 4 :	June 1983
PER 5 :	September 1983
PER 6 :	November 1983
PER 7 :	January 1984
PER 8 :	April 1984
Site :	Two letter abbreviation of site name
Subsite:	November 1982 or April 1983 planting
SUB 1 :	November 1982
SUB 2 :	April 1983
SUB 3 :	April 1983 (large test plot)
Species:	Species of seagrass planted
SPP HAL:	*Halodule wrightii*
SPP SYR:	*Syringodium filiforme*
SPP THAL:	*Thalassia testudinum*
Method:	Method of planting
PLUG :	15 cm whole section of grass bed
SHT ROD:	12 cm long rhizomes anchored with steel rod
SHT CLIP:	12 cm long rhizomes anchored with clips
SEED :	*Thalassia* seeds
SHT INT:	12 cm long rhizomes anchored with inert material

Dependent variables

CNT:	Number of surviving plants (/50)
BL :	Blade length (cm)
SHTN:	Number of blade groups per planted unit (/m^2)
RHL:	Length of rhizome (cm)
RHN:	Number of rhizomes (/m^2)
PGD:	Diameter of the plug (cm)
S :	Number of seeds
TP :	Water temperature (^oC)
DO :	Dissolved oxygen concentration (ppm)
SAL:	Salinity (o/oo)
CUR:	Speed of current (cm/sec)
LTS:	Light energy 3 cm below the surface ($\mu E/m^2/sec$)
LTB:	Light energy 10 cm above the bottom ($\mu E/m^2/sec$)

Statistics

MEAN:	Sample mean (Σ/n)
STDEV:	Standard deviation (s)
VALIDN:	Valid number of cases (n)
M :	Cannot calculate value

PERIOD NUMBER 1
OLD AIRPORT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE OA SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE OA SUB 1 SPP HAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE OA SUB 1 SPP SYR SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE OA SUB 1 SPP SYR SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
OLD AIRPORT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE OA SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE OA SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
CEMENT PLANT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE CP SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE CP SUB 1 SPP HAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE CP SUB 1 SPP SYR SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE CP SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0

PERIOD NUMBER 1
CEMENT PLANT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE CP SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
FORT AUGUSTA

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE FA SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE FA SUB 1 SPP HAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE FA SUB 1 SPP SYR SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE FA SUB 1 SPP SYR SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
FORT AUGUSTA

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE FA SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE FA SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER. 1
HELLSHIRE BEACH

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL .0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE HB SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE HB SUB 1 SPP HAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE HB SUB 1 SPP SYR SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE HB SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0

PERIOD NUMBER 1
HELLSHIRE BEACH

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE HB SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
POWER PLANT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL C/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE PP SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE PP SUB 1 SPP HAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE PP SUB 1 SPP SYR SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE PP SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0

PERIOD NUMBER 1
POWER PLANT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE PP SUB 1 SPP THAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
PORT ESQUIVEL

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE PE SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE PE SUB 1 SPP HAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE PE SUB 1 SPP SYR SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE PE SUB 1 SPP SYR SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
PORT ESQUIVEL

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE PE SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE PE SUB 1 SPP THAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
ROCKY POINT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE RP SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE RP SUB 1 SPP HAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE RP SUB 1 SPP SYR SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE RP SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0

PERIOD NUMBER 1
ROCKY POINT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE RP SUB 1 SPP THAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
NEGRIL POINT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE NP SUB 1 SPP HAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE NP SUB 1 SPP HAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE NP SUB 1 SPP SYR SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE NP SUB 1 SPP SYR SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
NEGRIL POINT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE NP SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE NP SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
NEGRIL RIVER

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE NR SUB 1 SPP SYR SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE NR SUB 1 SPP SYR SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE NR SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE NR SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
SEAWINDS HOTEL

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE SW SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE SW SUB 1 SPP HAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE SW SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE SW SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
FISHERMANS JETTY

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE FJ SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE FJ SUB 1 SPP HAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE FJ SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE FJ SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
PELICAN JETTY

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE PJ SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE PJ SUB 1 SPP HAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE PJ SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE PJ SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
CARLYLE BEACH

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE CB SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE CB SUB 1 SPP HAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE CB SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE CB SUB 1 SPP THAL SHT ROD													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 1
DISCOVERY BAY

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 1 SITE DB SUB 1 SPP HAL PLUG													
MEAN	50	.0	0.00	.00	.00	.00	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	1	0	0	0	0	0	0	0
PER 1 SITE DB SUB 1 SPP HAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0
PER 1 SITE DB SUB 1 SPP THAL SEED													
MEAN	50	.0	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 1 SITE DB SUB 1 SPP THAL SHT CLIP													
MEAN	50	.0	0.00	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
ULD AIRPORT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS UUA	LTB UUA
PER 2 SITE UA SUB 1 SPP HAL PLUG													
MEAN	28	1	M	M	.17	.00	M	27			5.0	300	290
STDEV	M	3	M	M	.41	.00	M	M	M	M	M	M	M
VALIDN	1	6	0	0	6	6	0	1	0	1	1	1	1
PER 2 SITE UA SUB 1 SPP HAL SHT RUD													
MEAN	19	.0	0.20	.20	M	M	M	M	M	M	M	M	M
STDEV	M	.0	0.45	.45	M	M	M	M	M	M	M	M	M
VALIDN	1	5	5	5	0	0	0	0	0	0	0	0	0
PER 2 SITE UA SUB 1 SPP SYR SHT CLIP													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE UA SUB 1 SPP SYR SHT RUD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
ULD AIRPORT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE UA SUB 1 SPP THAL SEED													
MEAN	7.0	1	0.33	.00	.00	M	M	M	M	M	M	M	M
STDEV	M	2	.52	.00	.00	M	M	M	M	M	M	M	M
VALIDN	1	6	6	6	6	0	0	0	0	0	0	0	0
PER 2 SITE UA SUB 1 SPP THAL SHT RUD													
MEAN	45	2	3.13	4.1	M	M	M	M	M	M	M	M	M
STDEV	M	3	2.03	3.9	M	M	M	M	M	M	M	M	M
VALIDN	1	16	16	16	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
CEMENT PLANT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE CP SUB 1 SPP HAL PLUG													
MEAN	.00	M	M	M	M	M	M	26	6.2	35.7	2.0	270	240
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	1	1	1	1	1	1
PER 2 SITE CP SUB 1 SPP HAL SHT CLIP													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE CP SUB 1 SPP SYR SHT CLIP													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE CP SUB 1 SPP THAL SEED													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
CEMENT PLANT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE CP SUB 1 SPP THAL SHT RUD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
FORT AUGUSTA

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE FA SUB 1 SPP HAL PLUG													
MEAN	49	3	M	M	5.0	10	M	27	6.6	33.8	.00	330	330
STDEV	M	2	M	M	3.1	4.7	M	M	M	M	M	M	M
VALIDN	1	20	0	0	20	20	0	1	1	1	1	1	1
PER 2 SITE FA SUB 1 SPP HAL SHT ROD													
MEAN	5.0	.8	.75	1.5	M	M	M	M	M	M	M	M	M
STDEV	M	1	1.50	3.0	M	M	M	M	M	M	M	M	M
VALIDN	1	4	4	4	0	0	0	0	0	0	0	0	0
PER 2 SITE FA SUB 1 SPP SYR SHT CLIP													
MEAN	46	15	13.0	15	M	M	M	M	M	M	M	M	M
STDEV	M	3	8.00	11	M	M	M	M	M	M	M	M	M
VALIDN	1	18	18	18	0	0	0	0	0	0	0	0	0
PER 2 SITE FA SUB 1 SPP SYR SHT ROD													
MEAN	40	15	10.9	19	M	M	M	M	M	M	M	M	M
STDEV	M	5	6.97	14	M	M	M	M	M	M	M	M	M
VALIDN	1	14	14	14	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
FORT AUGUSTA

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE FA SUB 1 SPP THAL SEED													
MEAN	21	3	4.09	.00	M	M	2	M	M	M	M	M	M
STDEV	M	1	1.70	.00	M	M	.6	M	M	M	M	M	M
VALIDN	1	11	11	6	0	0	11	0	0	0	0	0	0
PER 2 SITE FA SUB 1 SPP THAL SHT ROD													
MEAN	39	2	2.94	7.5	M	M	M	M	M	M	M	M	M
STDEV	M	2	2.84	7.7	M	M	M	M	M	M	M	M	M
VALIDN	1	17	17	17	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
HELLSHIRE BEACH

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE HB SUB 1 SPP HAL PLUG													
MEAN	.00	M	M	M	M	M	M	27	6.1	34.8	.00	300	270
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	1	1	1	1	1	1
PER 2 SITE HB SUB 1 SPP HAL SHT ROD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE HB SUB 1 SPP SYR SHT ROD													
MEAN	9.0	.0	.83	1.2	M	M	M	M	M	M	M	M	M
STDEV	M	.0	.98	2.4	M	M	M	M	M	M	M	M	M
VALIDN	1	0	6	6	0	0	0	0	0	0	0	0	0
PER 2 SITE HB SUB 1 SPP THAL SEED													
MEAN	8.0	3	4.50	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	3	2.56	M	.00	M	5	M	M	M	M	M	M
VALIDN	1	8	8	1	4	0	8	0	0	0	0	0	0

PERIOD NUMBER 2
HELLSHIRE BEACH

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE HB SUB 1 SPP THAL SMT ROD													
MEAN	0.0	.0	1.67	4.5	M	M	M	M	M	M	M	M	M
STDEV	M	.0	1.97	2.1	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
POWER PLANT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE PP SUB 1 SPP HAL PLUG													
MEAN	49	4	M	M	9.8	16	M	30	6.6	33.9	4.0	340	310
STDEV	M	2	M	M	5.3	9.6	M	M	M	M	M	M	M
VALIDN	1	15	0	0	15	15	0	1	1	1	1	1	1
PER 2 SITE PP SUB 1 SPP HAL SHT CLIP													
MEAN	44	2	5.75	7.1	M	M	M	M	M	M	M	M	M
STDEV	M	3	8.35	11	M	M	M	M	M	M	M	M	M
VALIDN	1	16	16	16	0	0	0	0	0	0	0	0	0
PER 2 SITE PP SUB 1 SPP SYR SHT CLIP													
MEAN	31	16	6.58	11	M	M	M	M	M	M	M	M	M
STDEV	2.1	7	6.34	7.7	M	M	M	M	M	M	M	M	M
VALIDN	2	24	24	24	0	0	0	0	0	0	0	0	0
PER 2 SITE PP SUB 1 SPP THAL SEED													
MEAN	9.0	3	2.56	M	M	M	1	M	M	M	M	M	M
STDEV	M	3	2.24	M	M	M	.5	M	M	M	M	M	M
VALIDN	1	9	9	0	0	0	8	0	0	0	0	0	0

PERIOD NUMBER 2
POWER PLANT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE PP SUB 1 SPP THAL SMT CLIP													
MEAN	27	1	2.08	7.8	M	M	M	M	M	M	M	M	M
STDEV	M	2	1.08	6.5	M	M	M	M	M	M	M	M	M
VALIDN	1	12	12	12	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
PORT ESQUIVEL

PERIOD SITE SUBSITE SPECIES METHOD	CNT /SQ	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE PE SUB 1 SPP HAL PLUG													
MEAN	44	2	M	M	5.3	1.3	M	28	6.6	34.7	7.0	340	680
STDEV	M	3	M	M	3.4	2.4	M	M	M	M	M	M	M
VALIDN	1	14	0	0	14	14	0	1	1	1	1	1	1
PER 2 SITE PE SUB 1 SPP HAL SHT CLIP													
MEAN	8.0	.0	2.00	2.0	M	M	M	M	M	M	M	M	M
STDEV	M	.0	2.65	2.0	M	M	M	M	M	M	M	M	M
VALIDN	1	3	3	3	0	0	0	0	0	0	0	0	0
PER 2 SITE PE SUB 1 SPP SYR SHT CLIP													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE PE SUB 1 SPP SYR SHT ROD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
PORT ESQUIVEL

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE PE SUB 1 SPP THAL SEED '													
MEAN	30	7	1.93	1.1	M	M	2	M	M	M	M	M	M
STDEV	M	4	1.73	1.0	M	M	.5	M	M	M	M	M	M
VALIDN	1	14	14	14	0	0	10	0	0	0	0	0	0
PER 2 SITE PE SUB 1 SPP THAL SHT CLIP													
MEAN	29	4	.50	3.4	M	M	M	M	M	M	M	M	M
STDEV	M	4	.94	3.7	M	M	M	M	M	M	M	M	M
VALIDN	1	14	14	14	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
ROCKY POINT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE RP SUB 1 SPP HAL PLUG													
MEAN	46	2	M	M	12	1.7	M	30	9.2	59.6	.00	270	265
STDEV	M	2	M	M	12	2.0	M	M	M	M	M	M	M
VALIDN	1	17	0	0	17	17	0	1	1	1	1	1	1
PER 2 SITE RP SUB 1 SPP HAL SHT CLIP													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE RP SUB 1 SPP SYR SHT CLIP													
MEAN	25	9	5.11	2.8	M	M	M	M	M	M	M	M	M
STDEV	M	6	6.46	5.3	M	M	M	M	M	M	M	M	M
VALIDN	1	18	18	18	0	0	0	0	0	0	0	0	0
PER 2 SITE RP SUB 1 SPP THAL SEED													
MEAN	9.0	3	1.00	M	M	M	2	M	M	M	M	M	M
STDEV	M	3	1.07	M	M	M	.5	M	M	M	M	M	M
VALIDN	1	8	8	0	0	0	8	0	0	0	0	0	0

PERIOD NUMBER 2
ROCKY POINT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE RP SUB 1 SPP THAL SHT CLIP													
MEAN	37	.1	1.21	2.6	M	M	M	M	M	M	M	M	M
STDEV	M	.3	1.42	3.8	M	M	M	M	M	M	M	M	M
VALIDN	1	14	14	14	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
NEGRIL POINT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE NP SUB 1 SPP MAL SHT CLIP													
MEAN	1.0	.0	0.00	.00	M	M	M	28	6.2	35.7	4.0	330	230
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	0	0	0	1	1	1	1	1	1
PER 2 SITE NP SUB 1 SPP MAL SHT RUD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE NP SUB 1 SPP SYR SHT CLIP													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE NP SUB 1 SPP SYR SHT RUD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER
NEGRIL POINT

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE NP SUB 1 SPP THAL SEED													
MEAN	1.0	4	0.00	M	M	M	1	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	0	0	0	1	0	0	0	0	0	0
PER 2 SITE NP SUB 1 SPP THAL SHT ROD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER
NEGRIL RIVER

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE NR SUB 1 SPP SYR SHT CLIP													
MEAN	.00	M	M	M	M	M	M	28	6.8	32.3	3.0	335	280
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	1	1	1	1	1	1
PER 2 SITE NR SUB 1 SPP SYR SHT ROD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE NR SUB 1 SPP THAL SEED													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE NR SUB 1 SPP THAL SHT ROD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER
SEAWINDS HOTEL

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE SW SUB 1 SPP HAL PLUG													
MEAN	19	.0	M	M	3.9	6.8	M	27	6.4	35.1	7.0	340	300
STDEV	M	.0	M	M	2.0	8.8	M	M	M	M	M	M	M
VALIDN	1	11	0	0	11	11	0	1	1	1	1	1	1
PER 2 SITE SW SUB 1 SPP HAL SHT RUD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE SW SUB 1 SPP THAL SEED													
MEAN	12	3	2.00	M	M	M	2	M	M	M	M	M	M
STDEV	M	3	2.05	M	M	M	.0	M	M	M	M	M	M
VALIDN	1	7	7	0	0	0	7	0	0	0	0	0	0
PER 2 SITE SW SUB 1 SPP THAL SHT RUD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
FISHERMANS JETTY

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE FJ SUB 1 SPP HAL PLUG													
MEAN	18	2	M	M	1.2	2.0	M	27	5.3	34.2	4.0	350	300
STDEV	M	2	M	M	1.6	2.1	M	M	M	M	M	M	M
VALIDN	1	5	0	0	5	5	0	1	1	1	1	1	1
PER 2 SITE FJ SUB 1 SPP HAL SHT CLIP													
MEAN	11	4	4.25	5.9	M	M	M	M	M	M	M	M	M
STDEV	M	4	3.88	7.3	M	M	M	M	M	M	M	M	M
VALIDN	1	8	8	8	0	0	0	0	0	0	0	0	0
PER 2 SITE FJ SUB 1 SPP THAL SEED													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0
PER 2 SITE FJ SUB 1 SPP THAL SHT ROD													
MEAN	.00	M	M	M	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	0	0	0	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
PELICAN JETTY

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE PJ SUB 1 SPP HAL PLUG													
MEAN	44	3	M	M	3.2	7.8	M	27	5.2	35.5	.00	350	330
STDEV	M	2	M	M	1.8	6.8	M	M	M	M	M	M	M
VALIDN	1	19	0	0	19	19	0	1	1	1	1	1	1
PER 2 SITE PJ SUB 1 SPP HAL SHT RUD													
MEAN	18	2	11.2	14	M		M	M	M	M	M	M	M
STDEV	M	4	10.9	20	M		M	M	M	M	M	M	M
VALIDN	1	0	6	5	0		0	0	0	0	0	0	0
PER 2 SITE PJ SUB 1 SPP THAL SEED													
MEAN	22	5	2.75	M	M	M	2	M	M	M	M	M	M
STDEV	M	2	2.01	M	M	M	.5	M	M	M	M	M	M
VALIDN	1	12	12	0	0	0	12	0	0	0	0	0	0
PER 2 SITE PJ SUB 1 SPP THAL SHT RUD													
MEAN	25	.6	.82	4.1	M	M	M	M	M	M	M	M	M
STDEV	M	1	.98	3.4	M	M	M	M	M	M	M	M	M
VALIDN	1	11	11	11	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
CARLYLE BEACH

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE CB SUB 1 SPP HAL PLUG													
MEAN	7.0	.0	M	M	.00	.00	M	26	5.9	35.6	4.0	280	100
STDEV	M	.0	M	M	.00	.00	M	M	M	M	M	M	M
VALIDN	1	2	0	0	2	2	0	1	1	1	1	1	1
PER 2 SITE CB SUB 1 SPP HAL SHT ROD													
MEAN	11	.0	2.30	.90	M	M	M	M	M	M	M	M	M
STDEV	M	.0	2.79	2.2	M	M	M	M	M	M	M	M	M
VALIDN	1	10	10	10	0	0	0	0	0	0	0	0	0
PER 2 SITE CB SUB 1 SPP THAL SEED													
MEAN	4.0	6	0.00	.00	.00	M	2	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	1	0	1	0	0	0	0	0	0
PER 2 SITE CB SUB 1 SPP THAL SHT ROD													
MEAN	2.0	5	3.00	8.0	M	M	M	M	M	M	M	M	M
STDEV	M	M	M	M	M	M	M	M	M	M	M	M	M
VALIDN	1	1	1	1	0	0	0	0	0	0	0	0	0

PERIOD NUMBER 2
DISCOVERY BAY

PERIOD SITE SUBSITE SPECIES METHOD	CNT /50	BL CM	SHTN /M2	RHL CM	RHN /M2	PGD CM	S	TP C	DO PPM	SAL 0/00	CUR C/S	LTS QUA	LTB QUA
PER 2 SITE DB SUB 1 SPP HAL PLUG													
MEAN	29	.9	M	M	.44	.00	M	27	7.1	34.2	1.0	M	M
STDEV	M	2	M	M	.73	.00	M	M	M	M	M	M	M
VALIDN	1	9	0	0	9	9	0	1	1	1	1	0	0
PER 2 SITE DB SUB 1 SPP HAL SHT CLIP													
MEAN	19	.0	0.00	.20	M	M	M	M	M	M	M	M	M
STDEV	M	.0	0.00	.45	M	M	M	M	M	M	M	M	M
VALIDN	1	5	5	5	0	0	0	0	0	0	0	0	0
PER 2 SITE DB SUB 1 SPP THAL SEED													
MEAN	26	3	1.50	M	M	M	2	M	M	M	M	M	M
STDEV	M	2	1.45	M	M	M	.5	M	M	M	M	M	M
VALIDN	1	12	12	0	0	0	12	0	0	0	0	0	0
PER 2 SITE DB SUB 1 SPP THAL SHT CLIP													
MEAN	19	.8	.62	2.1	M	M	M	M	M	M	M	M	M
STDEV	M	1	.87	3.0	M	M	M	M	M	M	M	M	M
VALIDN	1	13	13	13	0	0	0	0	0	0	0	0	0

B. Appendix II: Executive Summary

The following summary was written and generally distributed in May 1983 as a mid-term synopsis of work accomplished in February and April 1983.

May 2, 1983

U.S. Agency for International Development

Seagrass Restoration in Caribbean Nearshore Areas
Grant No. DAN-5542-G-SS-2101-00

EXECUTIVE SUMMARY

Seagrass Planting and Monitoring
April 1983

The spring planting was performed by a ten person team composed of biologists from the Jamaica Natural Resources Conservation Department and Florida International University, and several temporarily employed Jamaican fishermen. This spring planting duplicated the November 1982 planting described in PROGRESS REPORT 1 to test the experimental variable of planting season. Thorhaug has previously shown that spring is the optimum planting season along subtropical U.S. coastlines. The question of whether seagrass could be successfully transplanted in tropical Jamaica all year round was the major objective for comparing the late fall-early winter planting with this spring planting. The second objective of the spring planting was to clarify if the transplant failures at some test sites were due to the characteristics of the test site or to the planting season. One final planting of Thalassia seeds will be carried out in September 1983 when the seeds are in season.

The results of the fall-early winter plantings were monitored during this spring planting. Exciting results are already apparent.

1. The transplanted seagrass along the causeway at Fort Augusta, Kingston Harbor is growing rapidly. After four months, the Halodule plugs have grown 18 $\pm$ 7 cm in diameter ($\bar{x} \pm \sigma$) and the Halodule shoots have grown 27 $\pm$ 27 cm in length. The Thalassia shoots have grown 4 $\pm$ 8 cm in length and the Thalassia seeds have produced 2 $\pm$ 2 cm long rhizomes. The Syringodium shoots have grown 57 $\pm$ 29 cm in length. The Fort Augusta site appears to be the most successful test site and will be used to compare the relative success of the other sites. It is also very similar to several test sites in Florida and comparisons among them should be interesting. Further, the Fort Augusta site

Executive Summary, Seagrass Planting and Monitoring, April 1983 Continued.

validates two hypotheses: it shows that all three species of seagrass can be successfully transplanted in Jamaica and that the three restoration methods (plugs, shoots, and seeds) work at an optimum site.

2. At the Old Harbour Power Plant test site the Halodule did appreciably better than the other two species. Since Halodule has a higher thermal tolerance, the formula for restoring power plant accidents with the thermally tolerant seagrass appears reasonable.

3. In high wave energy regime sites and sites with large sub-sediment burrowing animal communities, Thalassia on steel bar anchors was the most successful (test sites Hellshire Beach, Carlyle Beach, Seawinds, and Old Airport).

4. The sites exposed to bauxite spilled during ship loading (Port Esquivel and Discovery Bay) appear capable of being restored with Thalassia and Halodule. The transplanted Halodule and Thalassia at Port Esquivel are growing notably well.

5. The artifically created jetties and filled beaches in Montego Bay appear capable of being restored with Halodule and Thalassia. The Halodule plugs at the Pelican Jetty site looked very good.

6. No transplants of seagrass could be found at the Cement Plant site. This is probably due to the continual influx of fine silt from piles of tailing material upland from the site which results in no ability to restore this damaged habitat in the present condition.

7. At the high salinity (greater than 70 o/oo) sites, Ruppia appears best suited for transplanting rather than the other three species of seagrass (Rocky Point site).

8. The red mangrove propagules planted at the Rocky Point site had a 75 percent survival and half the plants had two leaf pairs. No red mangrove seedlings survived. 12 percent of the black mangrove seedlings were surviving.

9. No surviving seagrass transplants could be found at the Fisherman's Jetty site, and no further planting was attempted there.

10. The Negril Point and Negril River sites affected by peat and river effluent were not successful.

The spring planting was successfully completed on schedule and fulfilled all the planned objectives. Three new sites were planted: Alligator Pond near Port Kaiser, Salinas near Port Morant, and a beach in the Montego Bay Freeport area. The Ocho Rios site was successfully planted during this trip (poor weather prevented its being planted in November 1982).

Executive Summary, Seagrass Planting and Monitoring, April 1983
Continued.

Training of the NRCD biologists in techniques and management of seagrass restoration proceeded well and on schedule. At the last sites, NRCD personnel Gayle and Kelly managed and supervised the transplantation effort. Their performance was subsequently reviewed by Thorhaug and discussed among them. They agreed that their training would enable them to prepare and direct a transplantation effort well. More experience, however, would be desirable before attempting a more technically difficult or larger restoration effort.

Training of fishermen went particularly well. Fishermen skilled in Scuba diving can work on all phases of the operation. Non-Scuba skilled fishermen can collect plugs from donor beds, collect shoots from donor beds in shallow water, and prepare the seagrasses for planting. Enthusiasm was seen in this group.

Public awareness of the project was expanded by two more newspaper articles (attached). Information about the project was discussed at each site with interested persons who inquired about the work. These persons included many fishermen who quickly understood the goals of the project and the value of nearshore seagrass beds.

Lastly, the project is scheduled to be presented to the Association of Island Marine Laboratories of the Caribbean meeting, May 16-20, 1983, in Miami, Florida. The abstract of the paper is attached.

A. Thorhaug, Ph.D.
Principal Investigator

Attachments: Daily News article
Daily News editorial
A.I.M.L.C. meeting abstract

General Distribution

AT/fb

C. Appendix III: Field Trip Schedules

U.S.A.I.D. Grant
Seagrass Restoration in Caribbean Nearshore Area

Location: Coastline of Jamaica

U.S. Personnel: A. Thorhaug, Ph.D., F. Booker, G. Townsend

SCHEDULE

FEBRUARY 1983 MONITORING FIELD TRIP

Feb 7 Mon	Feb 8 Tues	Feb 9 Wed	Feb 10 Thurs	Feb 11 Fri	Feb 12 Sat	Feb 13 Sun
Old Airport & Cement Factory Terra Nova Hotel 926-2211	Fort Augusta & Hellshire Beach	Power Plant & Port Esquivel	Rocky Point	open		

Feb 14 Mon	Feb 15 Tues	Feb 16 Wed	Feb 17 Thurs	Feb 18 Fri	Feb 19 Sat	Feb 20 Sun
Discovery Bay & Ocho Rios Columbus Beach Club 972-2519	Carlyle Beach & Pelican Jetty Chatham Beach Club Montego Bay 952-4780	Fisherman's Jetty & Seawinds Hotel	Negril Point & Negril River Villas Negril 926-8501	Equipment clean-up terminate		

U.S.A.I.D. Jamaica Seagrass Restoration Project

SCHEDULE

APRIL 1983 PLANTING AND MONITORING FIELD TRIP

April 4 Monday	April 5 Tuesday	April 6 Wednesday	April 7 Thursday	April 8 Friday	April 9 Saturday
Arrive Kingston EAL #935 Terra Nova Hotel 926-2211	Old Airport Site	Fort Augusta Site	Fort Augusta 1/3 Acre Planting	Hellshire Beach	Open

April 11 Monday	April 12 Tuesday	April 13 Wednesday	April 14 Thursday	April 15 Friday	April 16 Saturday
Power Plant Site	Port Esquivel Site	Rocky Point Site	Salinas Site	Port Kaiser Site	Ocho Rios Site Columbus Beach Cottage Priory 972-2519

April 18 Monday	April 19 Tuesday	April 20 Wednesday	April 21 Thursday	April 22 Friday	April 23 Saturday
Discovery Bay Site	Carlyle Beach Site & Pelican Jetty Site Chatham Beach Club Montego Bay 952-4780	Fisherman Jetty	Fisherman Jetty 1/3 Acre Planting	Seawinds Villas Negril Negril 926-8501	Negril Riv Negril Point Sites Return to Mo Bay

April 24 Sunday
Clean-up Chatham Beach Club

General Distribution May 27, 1983

U.S.A.I.D. Grant
Seagrass Restoration in Caribbean Nearshore Areas
U.S. Personnel: A. Thorhaug, Ph.D. and F. Booker
Location: Coastline of Jamaica

REVISED SCHEDULE

JUNE 1983 MONITORING FIELD TRIP

June 6 Monday	June 7 Tuesday	June 8 Wednesday	June 9 Thursday	June 10 Friday	June 11 Saturday	June 12 Sunday
	Arrive EAL #175 5:00 pm Terra Nova Hotel 926-2211	Symposium NRCD	Fort Augusta & Hellshire Beach	Salinas & Old Airport		

June 13 Monday	June 14 Tuesday	June 15 Wednesday	June 16 Thursday	June 17 Friday	June 18 Saturday	June 19 Sunday
Port Esquivel & Power Plant	Alligator Pond & Rocky Point	Travel & Ocho Rios Columbus Beach Club Priory 972-2519	Travel & Discovery Bay Chatham Beach Club Montego Bay 952-4780	Carlyle Beach & Pelican Jetty		

June 20 Monday	June 21 Tuesday	June 22 Wednesday	June 23 Thursday
South Port Beach & Seawinds Hotel	Travel & Negril Point & Negril River Villas Negril Negril 926-8501	Travel & Clean-up Terminate Chatham Beach Club	Open

-117-

FEDERAL CASH TRANSACTIONS REPORT

(See instructions on the back. If report is for more than one grant or assistance agreement, attach completed Standard Form 272-A.)

Approved by Office of Management and Budget, No. 80-R0162

1. Federal sponsoring agency and organizational element to which this report is submitted: AGENCY FOR INTERNATIONAL DEVELOPMENT

2. RECIPIENT ORGANIZATION

Name: FLORIDA INTERNATIONAL UNIVERSTY

Number and Street: TAMIAMI TRAIL

City, State and ZIP Code: MIAMI FL 33199

3. FEDERAL EMPLOYER IDENTIFICATION NO. ▶ 1 59 600 1874 B 7

4. Federal grant or other identification number: DAN-5542-GSS-210200

5. Recipient's account number or identifying number: 231231024

6. Letter of credit number:

7. Last payment voucher number: 3405411

Give total number for this period

8. Payment Vouchers credited to your account: 6

9. Treasury checks received (*whether or not deposited*): 6

10. PERIOD COVERED BY THIS REPORT

FROM (*month, day, year*): 1/1/83

TO (*month, day year*): 6/30/83

11. STATUS OF FEDERAL CASH (*See specific instructions on the back*)	
a. Cash on hand beginning of reporting period	$ 10,885.26
b. Letter of credit withdrawals	0
c. Treasury check payments	54,249.00
d. Total receipts (*Sum of lines b and c*)	65,134.26
e. Total cash available (*Sum of lines a and d*)	65,134.26
f. Gross disbursements	74,195.67
g. Federal share of program income	0
h. Net disbursements (*Line f minus line g*)	74,195.67
i. Adjustments of prior periods	0
j. Cash on hand end of period	$ 9,061.41-

12. THE AMOUNT SHOWN ON LINE 11J, ABOVE, REPRESENTS CASH REQUIREMENTS FOR THE ENSUING *Days*	13. OTHER INFORMATION	
	a. Interest income	$
	b. Advances to subgrantees or subcontractors	$

14. REMARKS (*Attach additional sheets of plain paper, if more space is required*)

15. CERTIFICATION

I certify to the best of my knowledge and belief that this report is true in all respects and that all disbursements have been made for the purpose and conditions of the grant or agreement

AUTHORIZED CERTIFYING OFFICIAL

SIGNATURE: Nelsi Casanova

TYPED OR PRINTED NAME AND TITLE: Nelsi Casanova Fiscal Assistant II

DATE REPORT SUBMITTED: 7/15/83

TELEPHONE (*Area Code, Number, Extension*): 305 - 554-2546

THIS SPACE FOR AGENCY USE

FINANCIAL STATUS REPORT

(Follow instructions on the back)

1. FEDERAL AGENCY AND ORGANIZATIONAL ELEMENT TO WHICH REPORT IS SUBMITTED	AGENCY FOR INTERNATIONAL DEVELOPMENT
2. FEDERAL GRANT OR OTHER IDENTIFYING NUMBER	DAN-5542-G-SS-2102-00
OMB Approved No. 80-R0180	
PAGE 1 OF 1 PAGES	
3. RECIPIENT ORGANIZATION (Name and complete address, including ZIP code)	FLORIDA INTERNATIONAL UNIVERSITY TAMIAMI TRAIL MIAMI FL 33199
4. EMPLOYER IDENTIFICATION NUMBER	1 59 600 1874 B 7
5. RECIPIENT ACCOUNT NUMBER OR IDENTIFYING NUMBER	231231024
6. FINAL REPORT	☐ YES ☒ NO
7. BASIS	☒ CASH ☐ ACCRUAL
8. PROJECT/GRANT PERIOD (See instructions) FROM (Month, day, year)	9/9/82
TO (Month, day, year)	6/30/84
9. PERIOD COVERED BY THIS REPORT FROM (Month, day, year)	1/1/83
TO (Month, day, year)	6/30/83
10.	

STATUS OF FUNDS

PROGRAMS/FUNCTIONS/ACTIVITIES ▶	(a) PERSONNEL COST	(b) TRAVEL	(c) EQUIPMENT	(d) INDIRECT COST	(e)	(f)	TOTAL (g)
a. Net outlays previously reported	$ 9,071.08	$ 1,853.79	$ 25,268.31	$ 2,921.56	$	$	$ 39,114.74
b. Total outlays this report period	40,931.71	17,112.72	4,095.80	12,055.44			74,195.67
c. *Less:* Program income credits	0	0	0	0			0
d. Net outlays this report period (*Line b minus line c*)	40,931.71	17,112.72	4,095.80	12,055.44			74,195.67
e. Net outlays to date (*Line a plus line d*)	50,002.79	18,966.51	29,364.11	14,977.00			113,310.41
f. *Less:* Non-Federal share of outlays	0	0	0	0			0
g. Total Federal share of outlays (*Line e minus line f*)	50,002.79	18,966.51	29,364.11	14,977.00			113,310.41
h. Total unliquidated obligations	16,098.43	1,781.00	901.90	0			18,781.33
i. *Less:* Non-Federal share of unliquidated obligations shown on line h	0	0	0	0			0
j. Federal share of unliquidated obligations	16,098.43	1,781.00	901.90	0			18,781.33
k. Total Federal share of outlays and unliquidated obligations	66,101.22	20,747.51	30,266.01	14,977.00			132,091.74
l. Total cumulative amount of Federal funds authorized	82,917.00	26,190.00	31,620.00	18,273.00			159,000.00
m. Unobligated balance of Federal funds	16,815.78	5,442.49	1,353.99	3,296.00			26,908.26

11. INDIRECT EXPENSE

a. TYPE OF RATE (*Place "X" in appropriate box*) ☐ PROVISIONAL ☒ PREDETERMINED ☐ FINAL ☐ FIXED

b. RATE	c. BASE	d. TOTAL AMOUNT	e. FEDERAL SHARE
33.5	12,055.44	12,055.44	12,055.44

12. REMARKS: *Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation.*

13. CERTIFICATION

I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award documents.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL: Nelsi Casanova

TYPED OR PRINTED NAME AND TITLE: Nelsi Casanova Fiscal Assistant II

DATE REPORT SUBMITTED: 7/15/83

TELEPHONE (*Area code, number and extension*): 305- 554-2546

269-102

STANDARD FORM 269 (7-76)
Prescribed by Office of Management and Budget
Cir. No. A-110