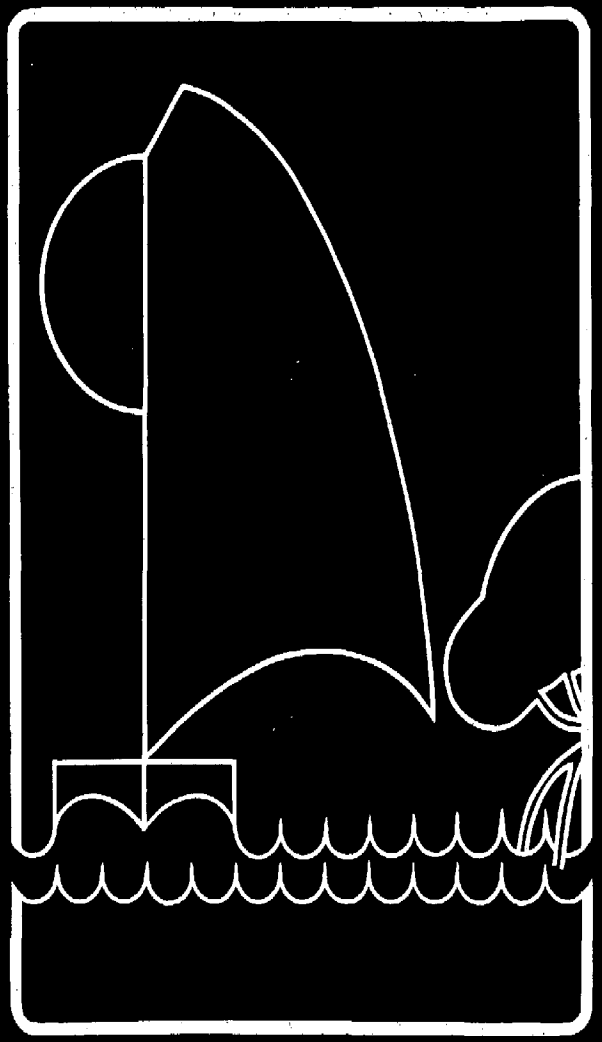

BISCAYNE BAY MANAGEMENT PLAN

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BISCAYNE BAY

MANAGEMENT PLAN

PREPARED JOINTLY BY THE

METROPOLITAN DADE COUNTY ENVIRONMENTAL RESOURCES MANAGEMENT DEPARTMENT

AND

METROPOLITAN DADE COUNTY PLANNING DEPARTMENT

909 S.E. 1 AVENUE

MIAMI, FLORIDA 33131

MARCH 1981

PREFACE

Over the past several years, many meetings have been held by the University of Miami Sea Grant Program, Dade County, the Greater Miami Chamber of Commerce, and the State of Florida to discuss Bay issues and problems. Participants at those meetings have stressed that past uses of the Bay and shoreline have resulted in many problems such as habitat destruction, water pollution, and lack of public access. There has also been a general concensus that the first step toward solving many of the Bay's most pressing problems should be the development of a comprehensive Management Plan to guide the Bay's future and resolution of the current fragmented, overlapping maze of jurisdictional controls over the Bay and adjacent shoreline.

In recognition of the problems and opportunities related to the Bay, the Board of County Commissioners declared Biscayne Bay an "Aquatic Park and Conservation Area" and empowered the County Manager to develop a management plan for that area. To initiate that process, the County appropriated $50,000 in November 1978.

Planning Process

The Biscayne Bay Management Planning Project was undertaken jointly by the Dade County Planning and Environmental Resources Management Departments (DERM). In April 1979 the County Manager appointed a Policy Advisory Committee to oversee the general scope and direction of the Bay project. Members of this Committee were:

Mr. Parker Thomson, Attorney, Chairman
Mr. Paul Andre, The Marine Council
Mr. Lester Freeman, Greater Miami Chamber of Commerce
Mr. Robert E. Tallon, Group Vice President, Florida Power and Light
Mrs. Alice C. Wainwright, Attorney

Two additional Committees have been appointed. A Scientific/Technical Committee was selected from local university faculties, federal and state agencies to review work products for scientific accuracy and to provide technical input into the Bay Planning Process. A Local Government Liaison Committee composed of representatives from each of the shoreline municipalities was appointed to keep those municipalities thoroughly advised of work on this project and to insure that the implications of all planning alternatives were thoroughly evaluated.

The planning process consisted of six steps: identification of the management boundary, adoption of goals and objectives, identification of major Bay planning concerns, development of preliminary Bay Management Guidelines, distribution of the Draft Preliminary Bay Management Plan and identification of existing and potential implementation programs and activities.

Management Boundary

For planning purposes the study boundary included all lands that directly drain into the waters of Biscayne Bay. The management boundary begins at the northern Dade County line and runs south along Ocean Boulevard (State Road AlA) to Collins Avenue, then west along 63rd Street to the most southerly extension of Alton Road at Jefferson Avenue. From that point the line proceeds east along Biscayne Street to the eastern mean high water line of Miami Beach and then south across Government Cut to the eastern mean high water line of Fisher Island then south and east along the mean high water line to Norris Cut. The boundary line then proceeds south across Norris Cut to the eastern mean high water line of Virginia Key and then south across Bear Cut to a point just north of the most northern parking lot on the east side of Crandon Boulevard and 2325 feet east of Crandon Boulevard. The line then runs west to Crandon Boulevard and north along the Boulevard to the northern boundary of Cape Florida State Park. The boundary line then follows the northern Park boundary line to the eastern mean high water line of Key Biscayne, and then south to the southern tip of Key Biscayne. From that point the line extends southward along the eastern mean high water lines of Soldier Key, the Ragged Keys, Sands Key, Elliott Key and Old Rhodes Key to Broad Creek and then west along the southern boundary line of Biscayne National Park to the western mean high water line of Biscayne Bay in Section 23, Township 58 south, Range 40 east. The line then proceeds northward along section lines and Bayward of the Florida Power and Light Company Turkey Point Plant as detailed in the Legal Description and extends along the eastern boundary of Levee 31 E to Old Cutler Road. The Boundary then follows Old Cutler Road northward to LeJeune Road, then northward to West Ingraham Terrace and east to Ingraham Highway; and northeast and north to Douglas Road and Main Highway. From that point the Boundary runs northeast to McFarlane Road and along McFarlane Road to South Bayshore Drive, then northeast along South Bayshore Drive to South Miami Avenue and northeasterly and northerly along Biscayne Boulevard (State Road No. 5) to the northern Dade County line.

Goal and Objectives

In order to initiate the process of goal and objectives formulation, staff summarized goal statements contained in publications from several conferences and symposia held on Biscayne Bay since 1970. Those goal and objective statements were reviewed during public workshops and by the Policy, Scientific/Technical, and Local Government Committees and revised accordingly. In November 1979, the Policy Committee approved the revised goal and objectives and recommended that they be placed before the County Comission for adoption as the first element of the Biscayne Bay Management Plan. The following goal and objectives were adopted by the County Commission on December 18, 1979.

> The primary goal of this planning project is to develop a unified, County-wide management plan for the entire Bay system, including its adjacent wetlands, embayments and contiguous developed shorelands in a manner that will maintain or enhance where necessary, those physical, chemical, biological and aesthetic qualities that provide the basic character and value of this resource.
>
> In order to effectively realize this primary goal, the following program objectives shall be achieved:
>
> - to address and resolve the jurisdictional issues relating to Biscayne Bay in order to provide long-term management capability;

- to provide a wide array of water oriented opportunities at the water's edge, consistent with the primary goal;

- to enhance physical and visual access thereby increasing the potential for environmentally sound utilization and attractiveness of Biscayne Bay for the public at large;

- to identify and maintain, or enhance where necessary, those biological communities that are essential to the long-term viability of Biscayne Bay;

- to optimize the quality and quantity of marine life;

- to maintain, or enhance where necessary, water quality that permits safe water contact recreation and propagation of fish and wildlife;

- to provide protection for endangered, threatened or rare species of plants and animals that exist within the waters of Biscayne Bay or the adjacent coastal wetlands;

- to avoid irreversible or irretrievable commitments of the Bay's resources;

- to seek funding for activities which are necessary to achieve the primary goal;

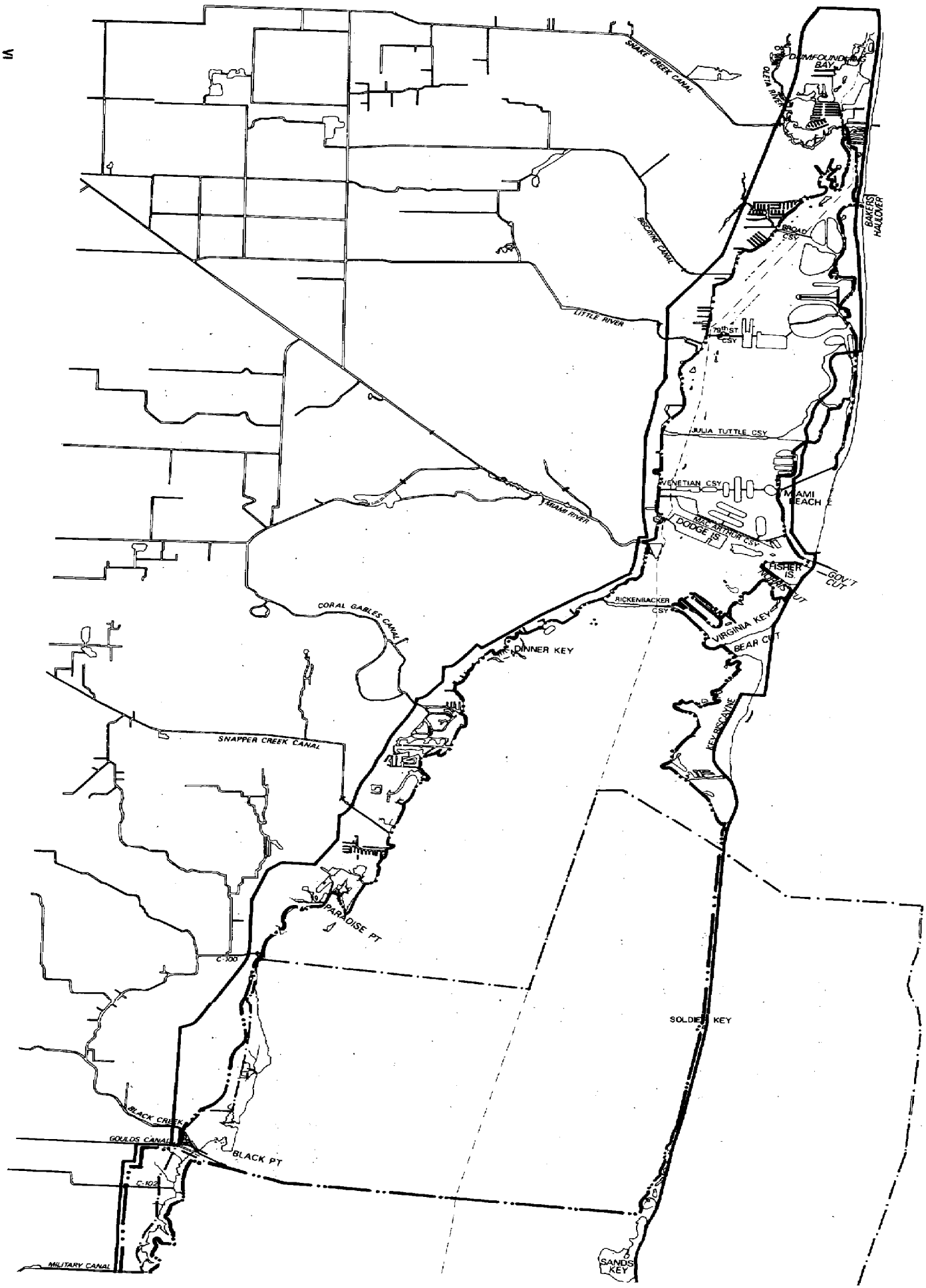
- to promote water transportation and enhance the Bay's contribution to the economic health of the community through marina development and other appropriate measures consistent with the primary goal; and

- to provide continuing monitoring of the Bay in order to assemble an adequate data base for Bay management.

Minor amendments to the goal and program objectives are included in the Bay Management Program Section of Chapter III.

Major Bay Management Concerns

During the course of many meetings and workshops with Bay user groups, numerous Bay-related concerns and issues were identified. These have been grouped under three major headings: Environmental, User-Related and Management Concerns. Environmental concerns include canal discharges and stormwater runoff, water clarity, recreational and developmental user impacts, and habitat management. Included under the heading of User-Related Concerns are conflicts among various user groups, the need for more marine oriented recreational facilities, the need to improve physical and visual access to the Bay, and the persistent problem of trash and litter along some areas of the Bay shoreline. Management Concerns relate primarily to the necessity for a less duplicative, more locally accountable Bay Management Program, and the need to resolve the problems of fragmented and overlapping jurisdictions.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BISCAYNE CANAL
LITTLE RIVER
MIAMI RIVER
CORAL GABLES CANAL
SNAPPER CREEK CANAL
BLACK CREEK
GOULDS CANAL
MILITARY CANAL
C-100
C-102
BLACK PT
PARADISE PT
DINNER KEY
RICKENBACKER CSY
VIRGINIA KEY
BEAR CUT
KEY BISCAYNE
SOLDIER KEY
SANDS KEY
FISHER IS
GOVT CUT
NORTH CUT
DODGE IS
MACARTHUR CSY
VENETIAN CSY
MIAMI BEACH
JULIA TUTTLE CSY
79th ST CSY
BROAD CSY
BAKERS HAULOVER
DUMFOUNDLING BAY
OLETA RIVER

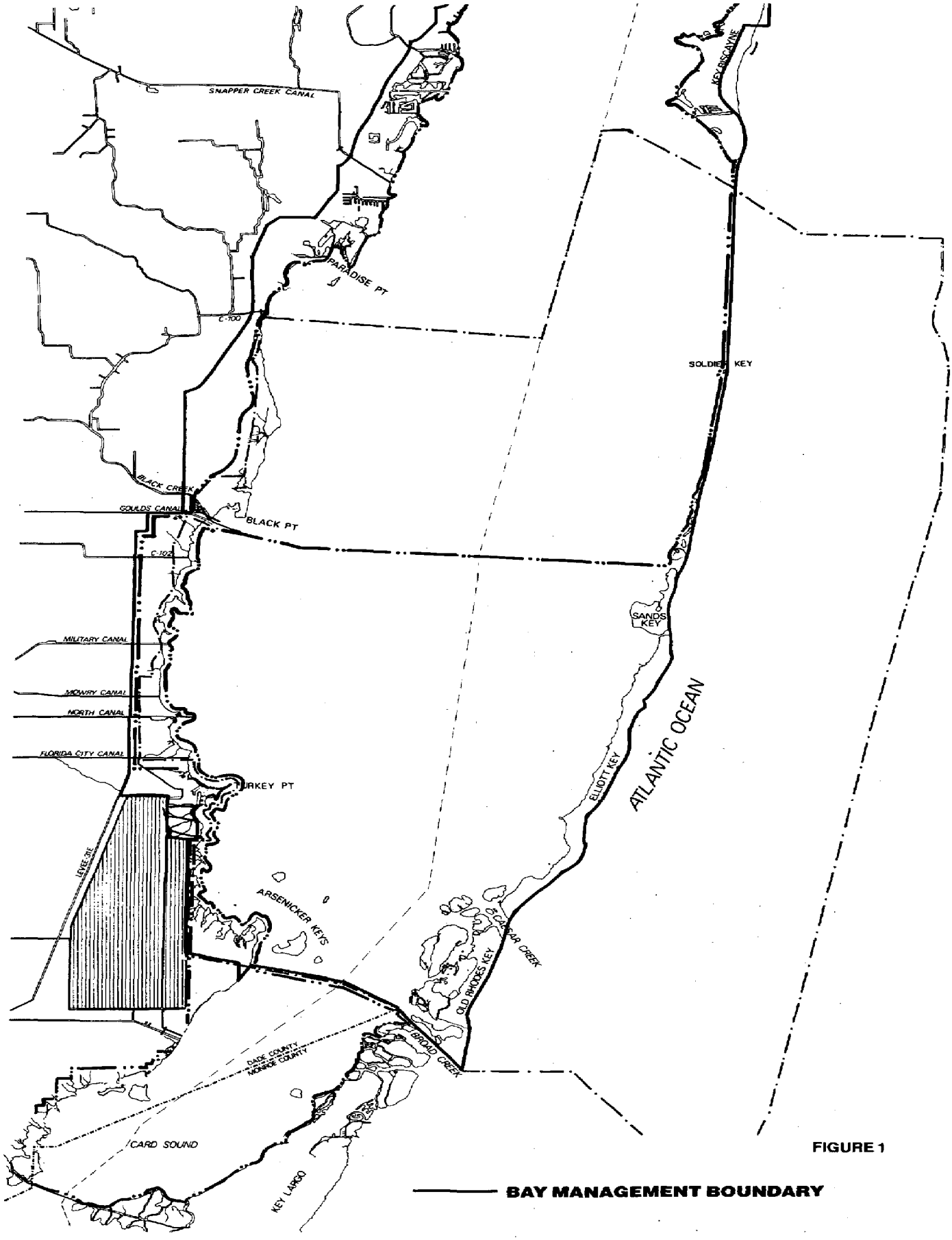

FIGURE 1

BAY MANAGEMENT BOUNDARY

BISCAYNE NATIONAL PARK BOUNDARY

APPROXIMATE BISCAYNE BAY AQUATIC PRESERVE BOUNDARY (CHAPTER 16Q-18, FLA. ADMIN. CODE)

Development of Guidelines and Draft Preliminary Bay Management Plan

Using the goal and program objectives and the Bay-related concerns as points of departure, staff assembled data on the natural systems within the Bay and shoreline area, and the major uses and users of the Bay and shoreline. Information has also been compiled on the regulations and jurisdictions which control those uses and users.

In response to the concerns raised by the various user groups and others identified by staff during the course of assembling background data, staff drafted preliminary management guidelines which were subsequently reviewed by many interested groups and the project advisory committees. Once a degree of concensus was reached about the general content of the guidelines, staff expanded the draft to include relevant information about each area of concern and the documented or potential impacts on the natural systems or utility of Biscayne Bay. That document titled the Draft Preliminary Management Plan for Biscayne Bay was released for public review and comment.

Staff met with various project committees and interested groups to discuss the draft and receive suggestions regarding potential implementation methods. During the first week of September 1980, public workshops were held to receive recommendations and comments from members of the public on the draft and on potential implementation strategies.

Subsequently, staff redrafted the Preliminary Bay Management Plan based upon recommendations received at meetings and public hearings; plus data and recommendations generated as part of the Urban Waterfront and Bay Enhancement Programs (see below). The third chapter, Bay Management Recommendations, outlines implementation programs for each section of guidelines. For each existing or proposed implementation program, a course of action is recommended, responsible agencies or community based resource groups are identified, and wherever possible, potential sources of funding are noted.

Purpose of the Bay Management Plan

This plan is intended to serve five basic purposes: (1) to define the scope of concerns and programs that should be addressed within a comprehensive, coordinated approach to Bay Management, (2) to recommend programs and actions that should be undertaken in order to move towards comprehensive and coordinated management of Biscayne Bay, (3) to identify a coordinating committee structure to oversee the scope and direction of programs that are recommended, (4) to identify those agencies and community based groups that have responsibility for implementing certain management programs, and (5) to identify sources of funding or community based resources that can be utilized to achieve a coordinated approach to Bay management.

Relationship to Other Bay Management Activities

Since the beginning of this project in 1979, a number of Bay Management activities have been initiated at the federal, state and local level which must be carefully coordinated with this management planning effort. Major activities that should be noted are the creation of the Biscayne National Park, the adoption of rules governing the Biscayne Bay Aquatic Preserve, the appropriation of over one million dollars by the state legislature for Bay Restoration and Enhancement Activities, and the receipt of Coastal Zone Management funds to improve public access along the Urban Bay Waterfront.

Biscayne National Park

With the recent passage of Federal enabling legislation most of the Bay region from Coral Gables and Key Biscayne south has become a National Park (see Figure 1). While much of this area has been a National Monument for more than a decade, this expansion represents a significant step towards protecting a large area of unique natural beauty for posterity. Not only is this enactment consistent with many of the objectives of the Bay Management Program, this designation can be viewed as effectively implementating a strategy to achieve the Bay Management objectives relating to protection of the marine life and qualities of that area.

Since excellent cooperation exists between National Park and County staffs, few if any, coordination problems are foreseen. However, since the Bay should be viewed as an holistic, interrelated system, it will be necessary not only to maintain the present working relationship, but also to insure that the Park is represented on all appropriate Bay Management committees or interagency structures.

Biscayne Bay Aquatic Preserve Rules

As adopted by the Governor and Cabinet in February 1980, the rules for the Biscayne Bay Aquatic Preserve have the potential to interface directly with this Bay Management Plan. The rules were written in anticipation of a management plan, and many sections refer specifically to a need for consistency with "management plans when developed for the Preserve." The rules also specify that the management plan for the Preserve shall be prepared by the Florida Department of Natural Resources or by other public or private entities in cooperation with the Department. This permissive language clearly leaves the option open for future adoption of the County Bay Management Plan as the management plan for that portion of the Aquatic Preserve that is within Dade County.

However, in order to keep the potential relationship between the Aquatic Preserve rules and the County Bay Management Plan in perspective, it is important to note that the boundary of the Preserve extends only to the mean high water line and includes lands within Monroe County (see Figure 1). It should also be understood that the Preserve rules apply to those portions of the rules that are administered by the Department of Natural Resources, most importantly relating to the sale, transfer or lease of State owned lands and to permits for all coastal construction activities that are reviewed by the Department of Environmental Regulation on the basis of existing statutory language in the Aquatic Preserve Act. In sum, the Bay Management Guidelines are consistent with both the intent and the language of the Biscayne Bay Aquatic Preserve Rules; however, they are both more comprehensive in scope and applicable over a more broadly defined geographical area than the Aquatic Preserve Rules.

Biscayne Bay Restoration and Enhancement Project

Concurrent with the Bay Management Planning activities, the staffs of DERM and Planning have been involved in initiating a series of Bay restoration and enhancement projects. During the 1978 and 1979 Legislative sessions, over one million dollars were appropriated specifically for improvement of Biscayne Bay, largely through the efforts and leadership of Senator Robert McKnight.

First Year Restoration and Enhancement Activities. Pursuant to the Biscayne Bay Aquatic Preserve and Water Resources and Preservation Acts the Florida legislature appropriated $125,000 to undertake a demonstration Bay restoration and enhancement project.

In November 1978, the County initiated an intensive effort to identify restoration and enhancement activities and sites. At the outset of the project, the Florida Department of Environmental Regulation specified that two important criteria for first year activities would be public useability and visibility.

Initially, all publicly owned parcels of land bordering north Biscayne Bay were evaluated from the standpoint of use, size, location, accessibility, and shoreline characteristics. After the preliminary screening, submerged lands adjacent to the sites with the greatest potential for restoration and enhancement activities were surveyed for specific projects (e.g., artificial reefs, riprap, seagrass planting, mangrove planting), and for the presence of existing submerged habitats. Based upon these site analyses and project selection criteria, a combination reef and pier project at Pelican Harbor off the 79th Street Causeway was selected as the first year restoration and enhancement activity. This reef/pier project was completed in September 1980.

Second Year Restoration and Enhancement Activities. Upon appropriation by the State Legislature of $950,000 for improvement of Biscayne Bay for the biennial cycle 1979-1981 and as part of the first year activities, County staff began selecting potential improvement activities for Biscayne Bay. In June 1979, the project selection criteria were prioritized by the members of the Scientific/Technical Committee, and a list of potential Bay improvement activities was compiled, after an intensive two month review and comment period.

The final list of prioritized restoration and enhancement projects was endorsed by the Policy Advisory Committee in November and approved by the Board of County Commissioners in December 1979. It includes:

	Rank
Improve Public Awareness	1
Improve Access	2
Identify Areas that Need Stabilization or Wave Energy Abatement	3
Obtain Baseline Data on Fisheries and Fisheries Pathology	4
Monitor Existing Mitigation/Restoration Efforts	5
Develop Fisheries Management Program	6
Obtain Baseline Water Chemistry	6
Obtain Baseline Circulation Data	6
Stabilize Shorelines	7
Map Benthic Community	8
Riprap Public Areas	9
Identify Sources of Turbidity	10
Obtain Baseline Data on Water Epidemiology and Pathology	11
Plant Mangroves	12
Install Artificial Reefs	13
Plant Seagrass	14
Fill Deep Holes	15
Redistribute Circulation	16
Remove Fine Bottom Sediments	17

In May 1980 an agreement was signed between Dade County and the Florida Department of Environmental Regulation (DER) which made available to the County $350,000 for the implementation of the Bay restoration and enhancement activities. In June 1980 an agreement modification was requested by Dade County which would extend the contract termination date from December 1980 to December 1981 and would make available to the County the 1980-81 appropriation of $600,000.

The agreement signed in May 1980 requires the County to prepare an objective and scope of work statement for each prioritized restoration and enhancement activity as well as perform associated activities to implement the activities. The State (DER) will review and approve the activities at various stages. Several of the restoration and enhancement activities are being done by DERM staff and are presently underway. Because of the magnitude of the project and the complexity of the Biscayne Bay system the County anticipates that restoration and enhancement activities will be ongoing through 1989.

Urban Waterfront Project

The Urban Waterfront and the Bay Restoration and Enhancement Projects will work together to initiate implementation strategies for a number of the program objectives of the Bay Management Plan. In this way progress can be made toward implementation as rapidly as possible, under the umbrella of the Bay Management Plan. Specifically, the Urban Waterfront Project is a program to optimize public access to the Bay through the development of policies, design guidelines and plans for specific portions of northern and central Biscayne Bay. It is intended to achieve the following objectives:

(1) to define the urban waterfront of Biscayne Bay, Dade County, Florida, its visual qualities, uses and extent;

(2) to develop a framework for making decisions about Bay/shoreline uses that will optimize public access,

(3) to develop implementation tools to optimize visual and physical access,

(4) to accomplish these tasks within the context of total Bay planning in order that these products may become an integral part of the Biscayne Bay Management Plan.

Land use, socio-economic and visual elements on the urban waterfront have been mapped. Based upon field work and data in the Property Appraiser's files, existing development patterns were described both in terms of ownership patterns, zoning, densities and structures and economically in terms of land, building, and taxation values plus other key market factors. Using these data, key indicators of change in character of the urban waterfront were identified and used to determine areas of the shoreline that are likely to undergo transition.

In undertaking this project staff has asked the administrative and professional members of the Local Government Liaison Committee to review and comment on the guidelines and criteria developed to optimize public access to the urban waterfront. Working with that Committee, staff is evaluating feasible implementation tools to achieve the stated objectives including modifications of private development and direct public investment. Opportunity sites including public rights-of-way, easements, sources of public-private land transfers and potential sources of public funds are being evaluated. Some specific project and program recommendations generated as a result of the Urban Waterfront Project are included within the implementation section on Physical and Visual Access in Chapter III.

In terms of trends in shoreline uses and opportunities to enjoy the benefits of the Bay, this project plays a key part in the larger Bay Management effort. Products from the Urban Waterfront Project have been used in making recommendations regarding the analyses, policies, and intergovernmental structures necessary to enter the implementation phase of the Bay Management Program. When finalized, the Urban Waterfront Project will become Technical Supplement II of the Bay Management Plan.

ACKNOWLEDGMENTS

Sincere appreciation is extended to members of the Biscayne Bay Policy Committee, the Local Government Liaison Committee, and the Scientific and Technical representatives for valuable and generous service rendered to the community. The Policy Committee established the scope and direction for this project; and all the groups assisted by reviewing preliminary drafts, and offering suggestions for corrections, improvements and additions.

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Paul and Thomson Law Firm

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and the City of Miami Waterfront Board

Mr. Lester Freeman, Executive Vice President
Greater Miami Chamber of Commerce

Mr. Robert Tallon, Group Vice President
Florida Power and Light Company

Ms. Alice Wainwright
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Commander D. Addison, Coast Guard Boating Safety Division
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Mr. Joe Carroll, U.S. Fish and Wildlife Service
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Mr. Mark Proctor, State Department of Natural Resources
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Mr. Richard Aiken, Manager, City of Surfside
Ms. Lucia Allen, Attorney's Office, Miami Beach
Mr. Frank Aymonin, Director, Miami Beach Public Works Department
Ms. Clara Baldwin, Deputy Town Clerk, Town of Golden Beach
Mr. Richard Bassell, Planning Department, North Miami Beach
Mr. Fred Bowen, Manager, North Bay Village
Mr. Lawrence Casey, Manager, City of North Miami
Mr. Donald W. Cather, Director, City of Miami Public Works Department
Mr. Bob David, Former Director, Planning Department, City of Miami Beach
Mr. Gene DeMarie, Manager, City of North Miami Beach
Mr. William Fagan, City of Coral Gables
Mr. Warren Feld, Code Enforcement Division, City of Miami Beach
Mr. J. Martin Gainer, Manager, City of Coral Gables
Mr. Lowell P. Garrett, Planning Department, City of Coral Gables
Mr. Cesar Gomez, Former Director of Planning, North Miami
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Mr. Joseph Grasse, Former Manager, City of Miami
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Mr. Jud Kurlancheek, Department of Economic Development, City of Miami Beach
Mr. John P. Little, Jr., City of Coral Gables
Mr. James Lynch, Leisure Services, City of Miami
Ms. Chris Macey, Park and Recreation Department, City of Miami
Mr. Joseph McManus, Planning Department, City of Miami
Mr. Fred W. Maley, Manager, Village of Bal Harbor
Mr. Anthony Nales, Manager, Town of Bay Harbor Island
Mr. Jack Neustadt, Town of Golden Beach
Mr. John Phillips, Parks and Recreation Department, City of Miami Beach
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Mr. Jack Pyms, Islandia
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Mr. Cecil Rash, Bay Harbor Islands
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Mr. Joseph Rice, Planning Consultant, Bal Harbour/Bay Harbor Islands
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Ms. Kitty Roedel, Downtown Development Authority
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Mr. John Wood, City of Miami Beach
Ms. Mildred Young, Clerk, City of Islandia
Mr. Harold Zombeck, Planning Department, City of North Miami Beach

TECHNICAL SUPPLEMENT*

APPENDICES

*Available upon request

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INTRODUCTION

The Bay Management Plan is divided into the following three chapters:

I. Natural Systems of the Biscayne Bay Area
II. Uses of the Bay and Water-Related Uses of the Shoreline
III. Bay Management Recommendations

Chapter I is essentially an update and summary of the information contained in the coastal chapter of the revised Comprehensive Development Master Plan (1978). This chapter includes an overview of the Bay area, discussion of the Bay's natural systems and a description of Bay and shoreline biota. Appendices for this chapter include: a description of water quality; representative wildlife of the coastal region; and endangered, threatened or rare plants and animals found in the Bay or adjacent wetland habitats.

Chapter II includes a description of in-Bay uses ranging from recreational uses to submerged utility corridors, water dependent shoreline uses such as the Port of Miami and marinas and an overview of the predominant uses of the Bay shoreline. Whenever data are available, these uses have been described quantitatively. This material includes appendices on marina facilities and marine businesses in Dade County.

Chapter III contains the Management Guidelines, which have been reviewed and revised pursuant to comments received from the Scientific-Technical and Local Government Liaison Committees, as well as comments received from many organizations and individuals. The guidelines have been grouped under three major headings: Bay Management Program; Environmental Concerns; and Major Bay User-Related Concerns. The major subheadings under Environmental Guidelines are:

Freshwater Delivery/Storm Water Runoff
Sewage Discharge/Pathogens
Solid Waste Disposal Sites
Boating/Fishing and Other Recreational Impacts
Development Impacts
Habitat Management

The User-Related guidelines are grouped as follows:

User Conflicts
Physical and Visual Access
Public Awareness and Environmental Education
Other User Concerns (trash and litter)

Included with each of the groups of guidelines are implementation strategies and techniques along with recommended courses of action.

CHAPTER I

NATURAL SYSTEMS OF THE BISCAYNE BAY AREA

Biscayne Bay is a natural system which has been affected by man-induced activities. Dredge and fill, channelization, cuts to the ocean and landside activities to control flooding and prevent saltwater intrusion have all played a part in creating the Bay as it is known today. Equally important have been hurricanes and subtle long-term geologic events. Even as known today, it is a system that is continually evolving.

Overview of the Bay Area

In broad terms, the shoreline adjacent to the Bay north of Rickenbacker Causeway has been almost totally developed. Over forty percent of this area has been either dredged or filled. A few years ago, this area was declared a "biological desert," an example of a mistreated, misunderstood natural resource. Today, with the cessation of some of the most abusive activities such as direct raw sewage discharges, this water body is showing signs of recovery.

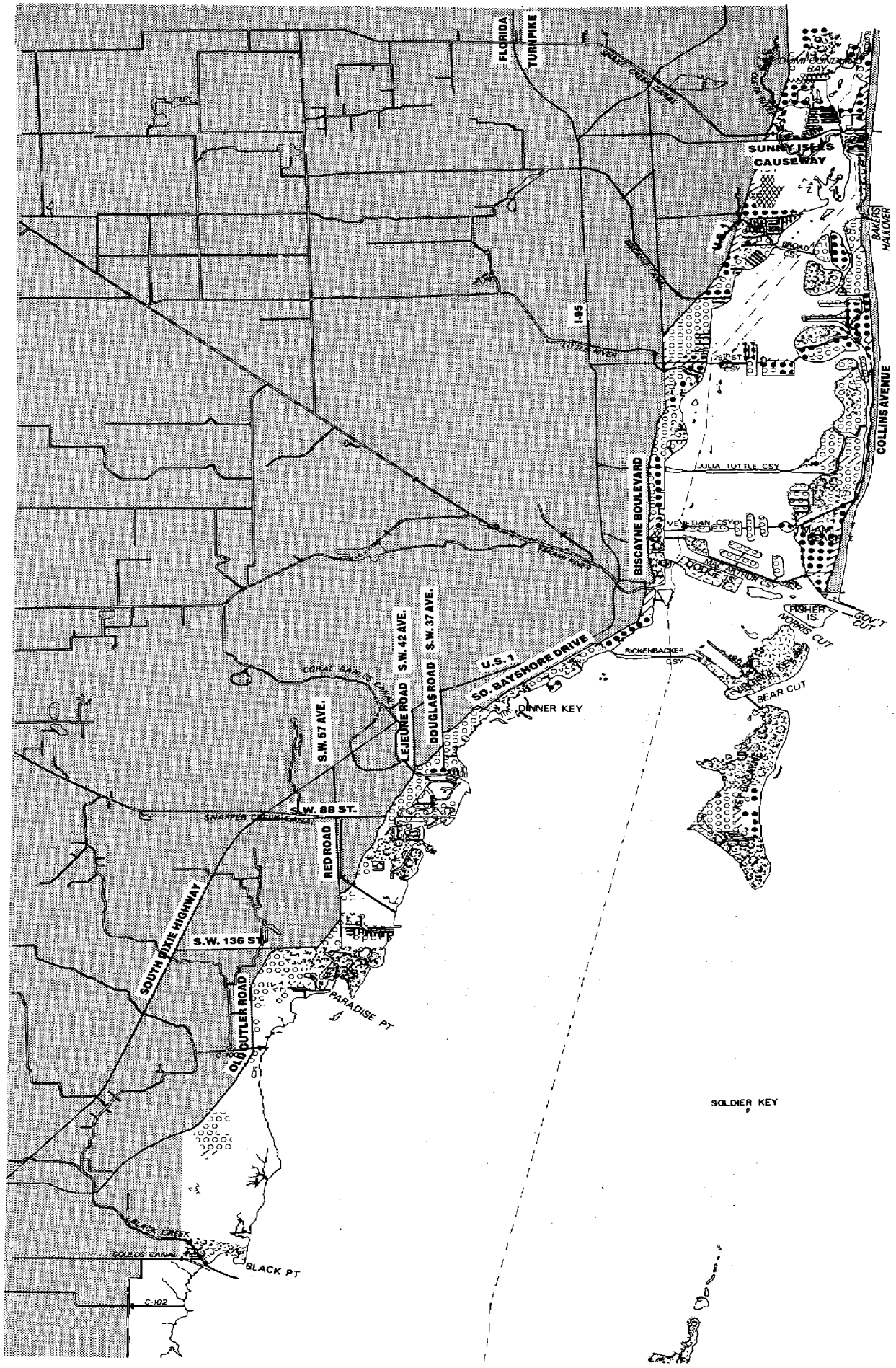
The Bay from Rickenbacker Causeway south to the Coral Gables southern city limit is frequently referred to as the mid- or central Bay area. This is a transition zone from the heavily urbanized northern basins to the almost undeveloped south Bay area. This is also the only area where Bay waters can freely exchange with Ocean waters. A large portion of this area, including the islands and shoals north from Sands Key to the channel just south of Key Biscayne, has been incorporation within the recently authorized Biscayne National Park.

While salinities in the Bay area south of the Coral Gables southern city limit have been affected by the lowering of ground water levels and canal discharges, this region of the Bay has remained relatively undisturbed. The diverse biological communities within this area support more than a thousand marine plants and animals. It should be noted that south Bay has recently been declared a National Park.

North Bay Region

Residential and governmental uses (e.g., Florida International University, the Port of Miami) dominate large areas of the north Bay region, however, the character of individual sub-basins, as defined and bounded by the Causeways, varies substantially from area to area. Depending upon the mix of activities and shoreline treatment, each sub-basin takes on its own distinct identity. Figure 2 shows the predominant land uses along the Bay shoreline.

Dumbfoundling Bay Area. The northern embayments of Maule and Little Maule Lakes and Dumbfoundling Bay were historically shallow marshes and estuarine areas where freshwater flowed and slowly mixed with more salty, tidal waters. Today these embayments are almost totally dredged and bulkheaded (see Figure 3). A narrow passage of the Intracoastal Waterway (ICW) connects Dumbfoundling Bay to northern Biscayne Bay.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I-95
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VENETIAN CSY
MACARTHUR CSY
DODGE IS
FISHER IS
GOVT CUT
NORRIS CUT
BISCAYNE BOULEVARD
S.W. 42 AVE.
S.W. 37 AVE.
U.S. 1
SO. BAYSHORE DRIVE
RICKENBACKER CSY
VIRGINIA KEY
BEAR CUT
DINNER KEY
CORAL REEF ST. CANAL
S.W. 57 AVE.
LEJEUNE ROAD
DOUGLAS ROAD
S.W. 88 ST.
SNAPPER CREEK CANAL
RED ROAD
SOUTH DIXIE HIGHWAY
S.W. 136 ST.
OLD CUTLER ROAD
PARADISE PT
SOLDIER KEY
BLACK CREEK
BLACK PT
C-102

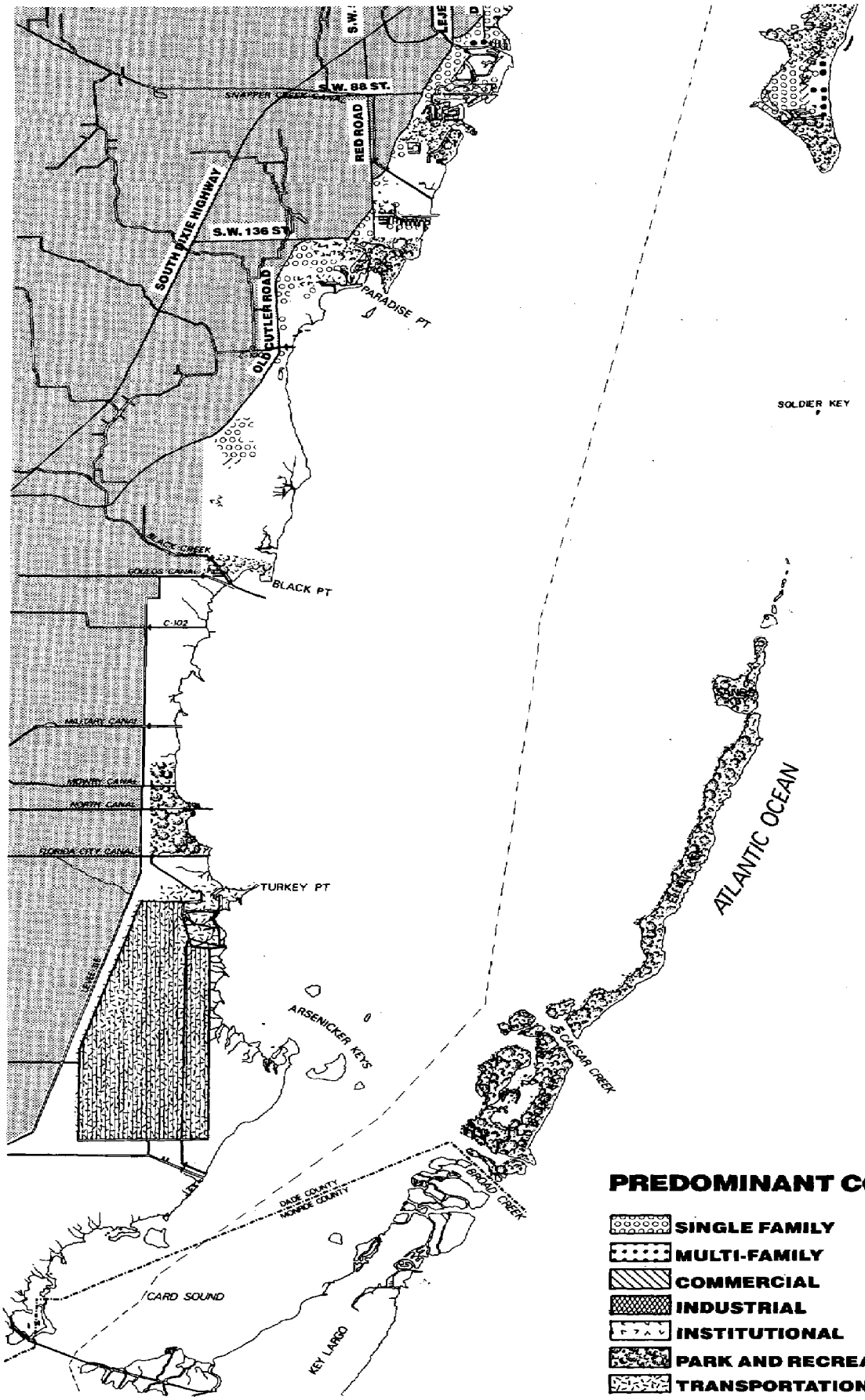
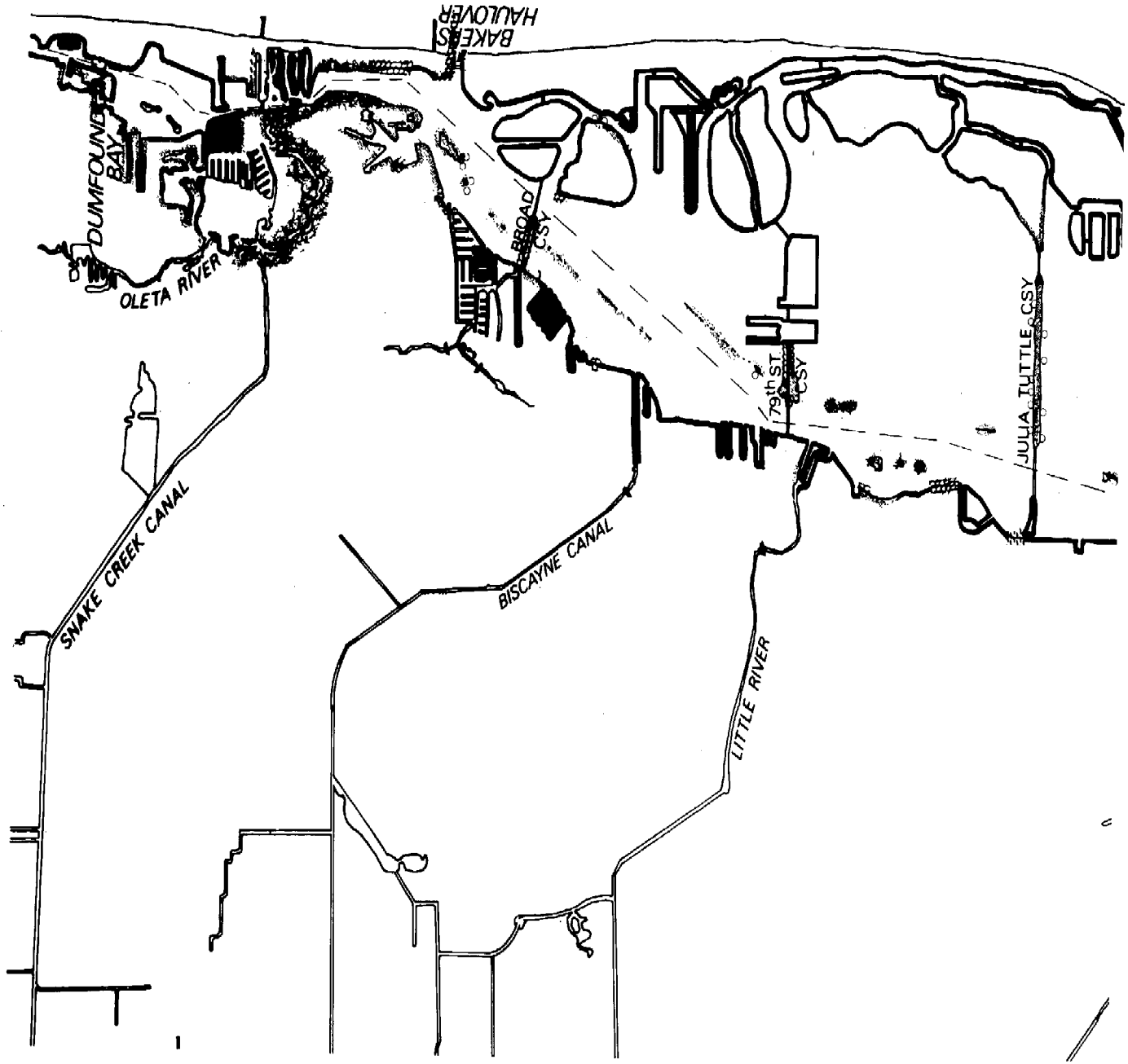


FIGURE 2

PREDOMINANT COASTAL LAND USES

- SINGLE FAMILY
- MULTI-FAMILY
- COMMERCIAL
- INDUSTRIAL
- INSTITUTIONAL
- PARK AND RECREATION
- TRANSPORTATION AND UTILITIES
- UNDEVELOPED/VACANT

SOURCE: DADE COUNTY PLANNING DEPARTMENT


BAKERS HAULOVER
DUMFOUNDING BAY
OLETA RIVER
BROAD CSY
79th ST CSY
JULIA TUTTLE CSY
SNAKE CREEK CANAL
BISCAYNE CANAL
LITTLE RIVER

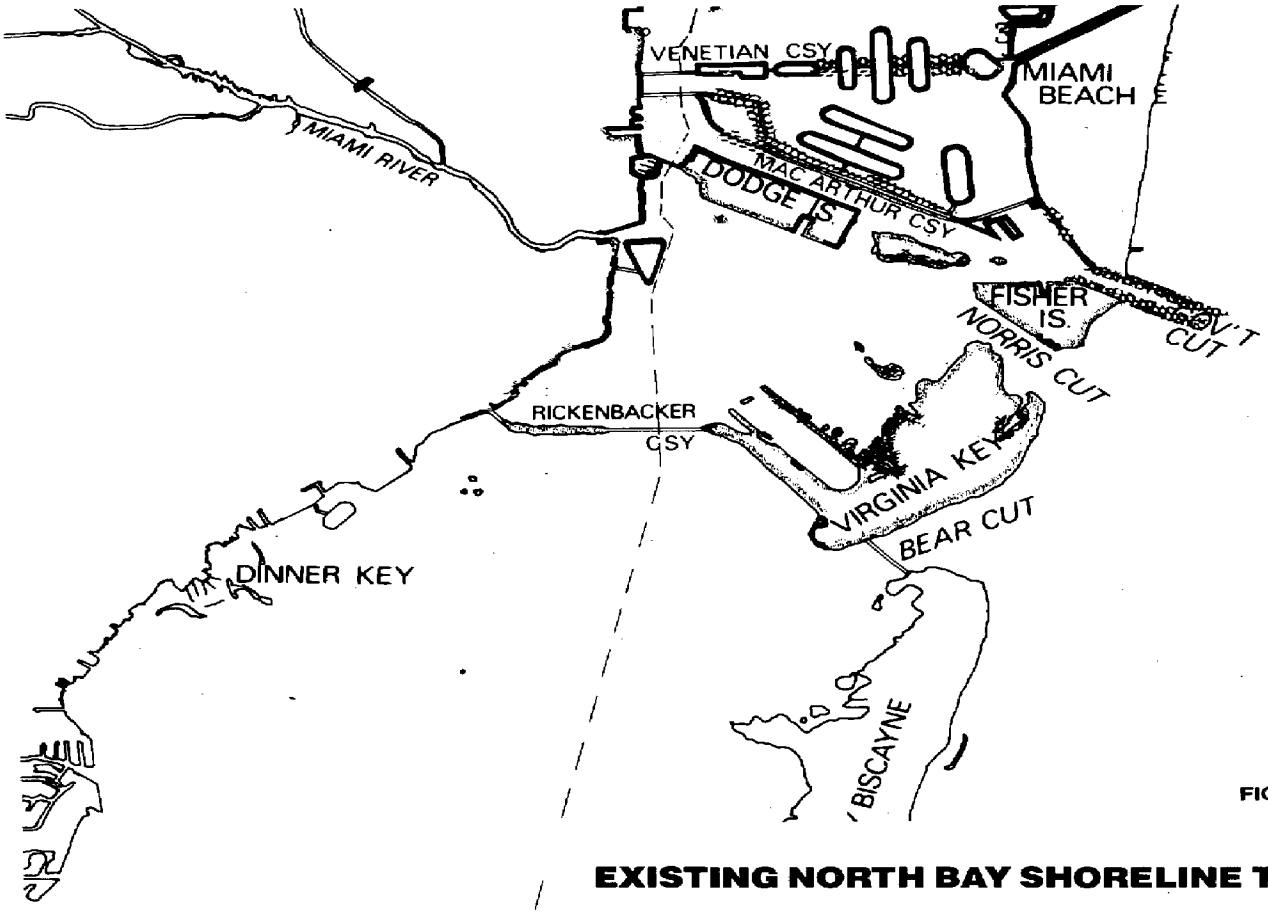


FIGURE 3

EXISTING NORTH BAY SHORELINE TREATMENT

- VERTICAL BULKHEADING
- CONSOLIDATED , SLOPING INTERTIDAL (CEMENT BAGS AND POURED CONCRETE)
- UNCONSOLIDATED , SLOPING INTERTIDAL (BEACHES AND SOIL)
- RIPRAP
- MANGROVE
- SPARSE MANGROVE

SOURCES: PETER HARLEM
DADE COUNTY PLANNING DEPARTMENT

From the Broward County line south to Sunny Isles Causeway, the shoreline land use is high density residential development interspersed with large parcels of vacant land and land under development. The nearly two square mile area east of US 1 from the County line south to the northern boundary of the City of North Miami Beach is zoned for approximately 30,000 dwelling units. Currently, about 8,000 have either been, or are being, constructed.

One unique feature of this region is the industrial zone located on the western shoreline of Dumbfoundling Bay between NE 187 and 183 Streets. While no new industrial development has moved into this area in recent years, this remains one of the few active, marine oriented industrial locations in Dade County.

Immediately south of Maule and Little Maule Lakes are Interama and the Oleta River State Recreation Area. Developed land uses in this area are almost exclusively institutional (FIU, Munisport Dump and North Dade Regional Sewage Treatment Plant).

Across Dumbfoundling Bay and the ICW, more than 60 percent of the shoreline from Golden Beach south to Haulover Park is also intensely developed with high rise condominiums and apartments. Haulover Park stretches for more than a mile along the ICW and the Ocean affording space for a variety of activities such as boat launching, charter fishing and boat tours. At the southern tip of the Park, Haulover Cut provides the only access to the Ocean north of Government Cut.

North Biscayne Bay. The Bay from Sunny Isles Causeway to Rickenbacker Causeway is commonly referred to as "north Bay." Bordered on the east by the barrier islands of Miami Beach and Virginia Key and on the west by developed shorelines from the Miami central business district north, this waterbody is, in reality, a 23 square mile aquatic urban park.

In north Bay, water depths vary substantially from area to area. Borrow areas that have been dredged to depths of more than twenty feet are not uncommon along causeways and islands. However, where dredging has not occurred, large areas with water depths of less than two or three feet are found (see Figure 4).

Interama to 79 Street Causeway. The Bay shoreline in this area is almost exclusively devoted to single family homes with vertical bulkheads. In scattered locations, the shoreline horizon is broken by taller buildings at, or just inland from, the shoreline. Similarly, on the Miami Beach side, single family residences line most of the shore from Indian Creek Village to the Venetian Causeway. To the north, the towns of Surfside and Bay Harbor Islands present contrasting shoreline images of single family and higher intensity uses in close proximity.

In contrast to the general conformity of shoreline development, each of the Causeways is unique. The low landscaped fill island along Broad Causeway provides wide, water-level vistas of the Bay, but direct physical access is discouraged by the presence of a gas station, trash transfer station, and lack of parking. The 79 Street Causeway is largely characterized by the commercial, amusement and residential development of North Bay Village. However, at Pelican Harbor on the westerly end of the Causeway, a large open County park provides an area where people can launch boats, fish or view the Bay. Throughout this segment of the Bay, numerous spoil islands, which are remnants of former dredging activities, provide a variety of recreational uses from bird watching to picnicking.

79 Street to the MacArthur Causeway. On the mainland from 79 Street south to the Julia Tuttle Causeway, the shoreline is almost completely devoted to low density single family homes with a small pocket of medium density development in the vicinity of Legion Park. In this region two large City of Miami parks and a number of smaller public green areas blend with the relatively well vegetated shoreline. Here, as in the area to the north, the spoil islands are frequently used by boaters for picnicking, wading and water skiing. While these parks afford some Bay access, they are not primarily water oriented parks.

MacArthur to Rickenbacker Causeway. This is the working section of the Bay. The 300 acre Port of Miami which handles approximately 1 million passengers and 1 1/2 million tons of freight annually, the Belcher Oil Company, Chalk's Plane Base, several large marinas and the entrance to the commercial and industrial activities which take place along the Miami River are located here. The River, which can be viewed as an extension of the Bay, provides safe harbor for a major component of the local fishing fleet, houseboats, the Miami Shipyard and many other marine-related construction or repair facilities. These water dependent uses are discussed in Chapter II.

The most intensive Bay shoreline development in Dade County is also located in this area. The development that is slated for the Ball Point and Southeast Bank properties will not only change the entire downtown Miami image, but it will also dramatically add to the urbanized Bay shoreline.

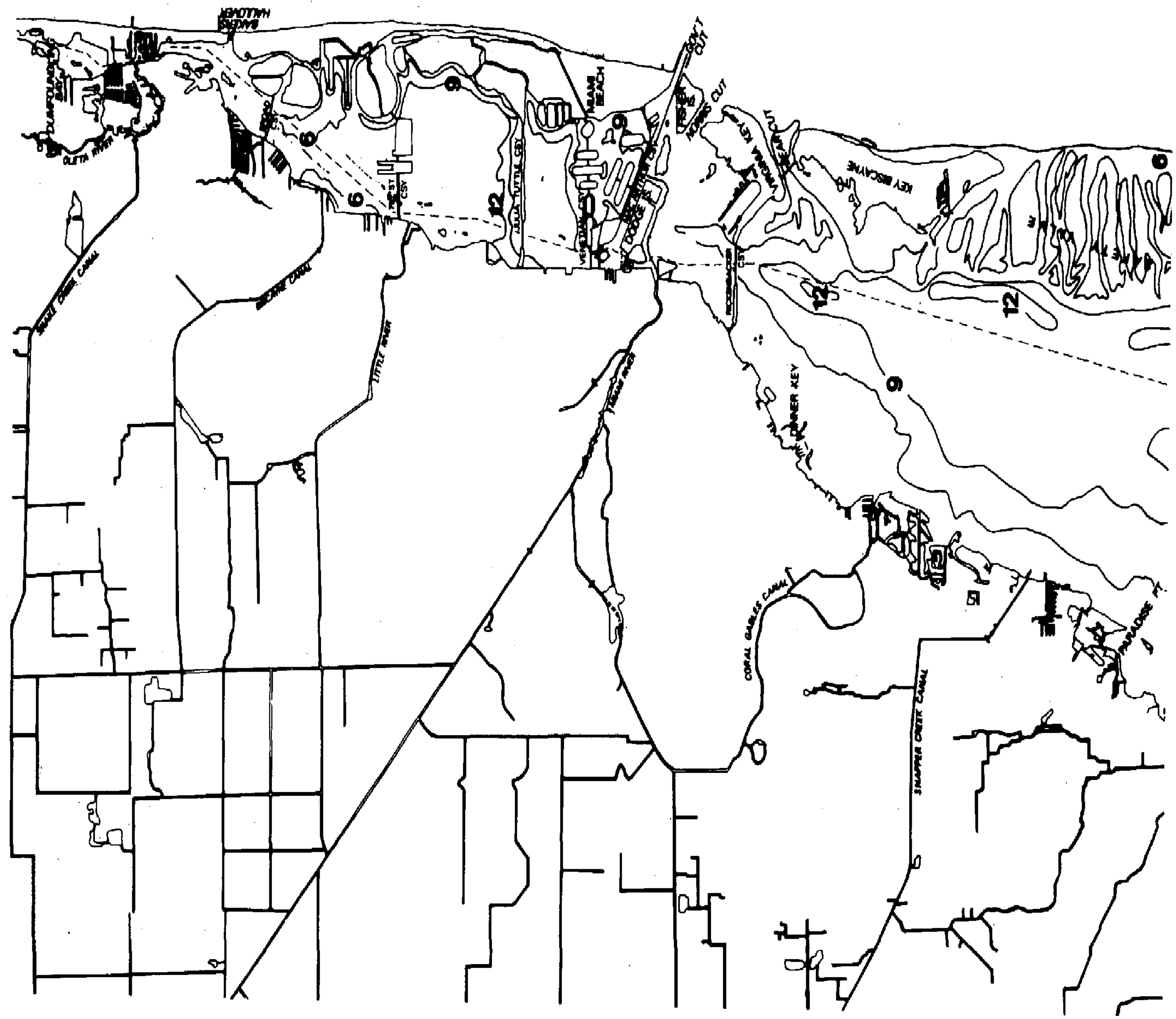
Mid-Bay Region

The mid-Bay area, from the Rickenbacker Causeway south to the Coral Gables city limit differs qualitatively and quantitatively from north Bay. Here the Bay reaches its maximum width of ten miles and its maximum natural depth of 13 feet. There is free exchange with Ocean waters over the nine mile system of shoals which extend south from Key Biscayne to the upper Keys.

In the mid-Bay area the mainland shoreline rises sharply from a shallow submerged platform to the Atlantic Coastal Ridge immediately inland from shore. Although the shoreline from the Rickenbacker Causeway to the Coral Gables city limit is developed, residential estate and open space uses predominate. Prominent high rise structures in Coconut Grove and at the end of the Gables Waterway, present sharp contrasts to an otherwise low, landscaped or vegetated shoreline. In this region Dinner Key provides docking and moorage for many pleasure and fishing boats. Toward the northeast, the apartments and hotels of Key Biscayne rise sharply above the low, green island. To the east lie the flats of the upper Safety Valve and the unique structures of Stiltsville.

South Bay Region

South of Coral Gables the character of the Bay changes once again. In south Bay, egress to the offshore areas and water circulation are again restricted by the presence of islands with few tidal inlets. As in central or mid-Bay, there is a shallow ledge adjacent to the western shoreline, where water depths register less than six feet at low tide. However, in this area the submerged ledge extends more than three or four miles from shore and generally supports a lush growth of marine plants. In addition, the mainland shoreline itself rises much more gradually than in the central or northern Bay regions. South of Black Point, most of the shoreland registers elevations of only one or two feet above mean sea level for a mile or more inland from shore.


BAKERS HAULOVER
OLETA RIVER
SNAKE CREEK CANAL
LITTLE RIVER
JULIA TUTTLE CSY
MIAMI BEACH
GOV'T CUT
NORRIS CUT
VIRGINIA KEY
BEAR CUT
KEY BISCAYNE
DINNER KEY
CORAL GABLES CANAL
SNAPPER CREEK CANAL
PARADISE PT.
6
9
12

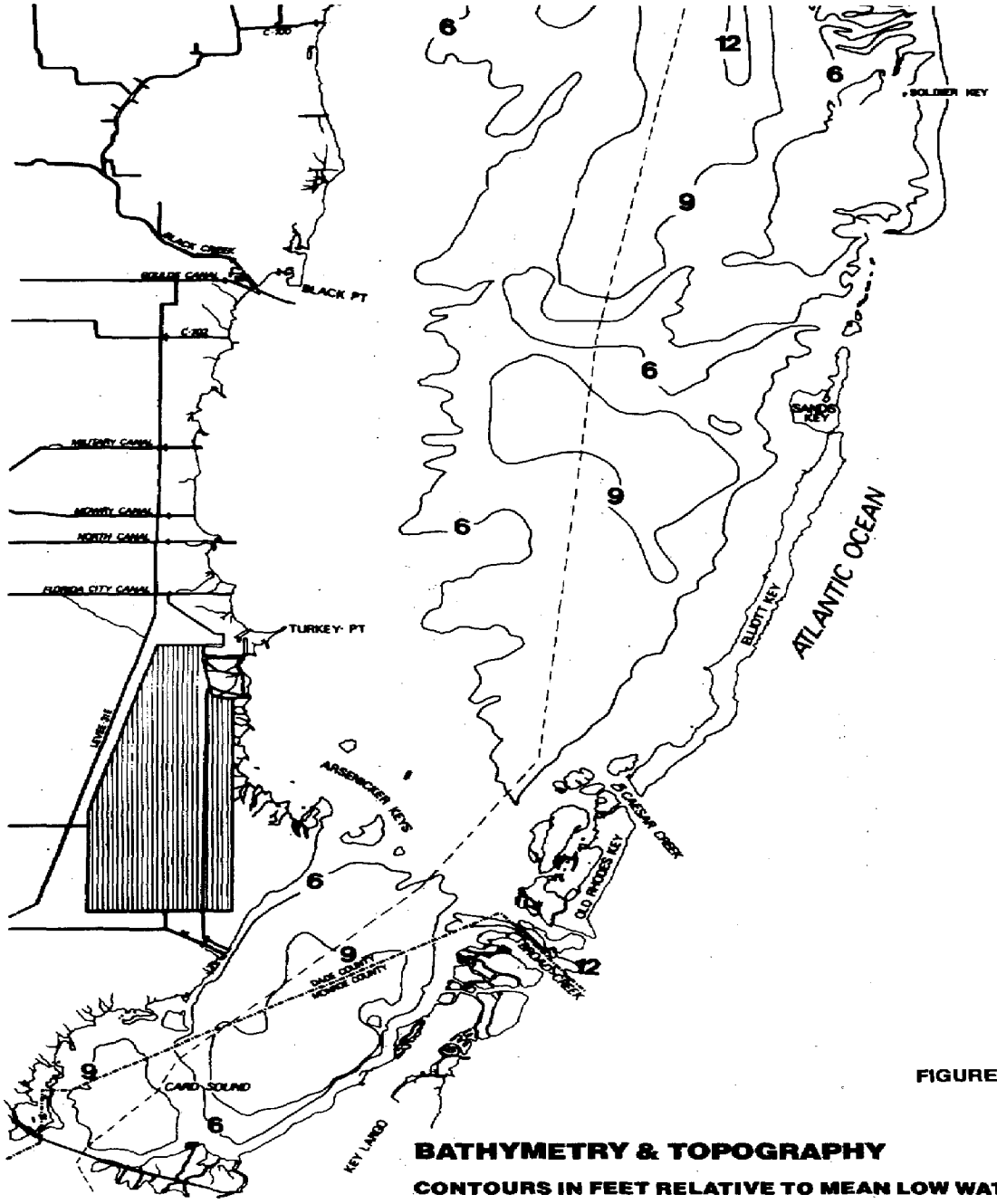


FIGURE 4

BATHYMETRY & TOPOGRAPHY

CONTOURS IN FEET RELATIVE TO MEAN LOW WATER

SOURCE: WETLANDS DEMONSTRATION PROJECT, 1977

From Coral Gables south, only two man-made features, the stacks of the Cutler and Turkey Point Power Plants stand out against mangrove coastline. County parks and Biscayne National Park provide opportunities for water related activities, as well as passive recreation. In addition, there are numerous informal access points primarily at canal outlets and road ends that are used by local fishermen and boaters.

Barrier Islands and Keys

The barrier islands of Key Biscayne, Virginia Key, Miami Beach and the northern Florida Keys form the eastern boundary of Biscayne Bay and its adjacent embayments. The upper Keys are composed of ancient coral reefs. Most emerge only a few feet above the high water mark and are fringed with mangroves and rocky shorelines.

North of the Keys the ancient reef tract is submerged beneath the shallow waters of the Bay-Ocean interface and is overlain alternately by bands of sandy mud and grass flats. This extensive system of shoals and channels is known collectively as the "Safety Valve." Farther north, the ancient reef tract is covered with sand deposits which form the sedimentary barrier islands of Key Biscayne, Virginia Key and Miami Beach.

Unlike the relatively remote islands of the upper Keys, the barrier islands have been subjected to the increasing pressures of urbanization. Geologically, the barrier islands of Miami Beach, Key Biscayne, and Virginia Key are narrow, offshore sandbars. However, the natural features of these islands have been significantly and permanently altered by dredging, filling, and development.

In their natural state, barrier islands are constantly shifting with the forces of wind, tides and storms. In spring and summer when wave energy is relatively low, sand tends to accumulate on the beach slope. With the arrival of stormy fall and winter weather, the trend is reversed and sand is eroded from the beach and deposited in nearshore sand bars. Sand bar formation is important in the overall scheme of beach processes because the location and height of the bar determines where waves break as they approach the beach. As a sand bar builds up, waves tend to break farther offshore, thereby approaching the beach with diminishing energy. Ultimately, the sand bar accumulation causes waves to break far enough from the beach to reduce or reverse the trend of erosion.

The transformation of the barrier islands, from shifting sandbars with transient dune vegetation and mangrove swamps to urbanized islands, has been well documented. Today each of these islands possesses a distinct character and provides unique contributions to the Dade County community as well as to the entire country.

Geological History

The ridges which enclose Biscayne Bay were formed about 100,000 years ago when the seas were approximately 25 feet higher than at present. On the mainland, tiny limestone spheres settled out of the turbulent waters and formed the oolitic limerock of the Atlantic Coastal Ridge. Along the eastern borders, sheltered back reefs formed the Keys and the submerged base structure for the barrier islands that would become Miami Beach, Key Biscayne and Virginia Key. During subsequent decades, the ridge and reef structures were alternately exposed and submerged, causing continual geological sculpturing, erosion and hardening.

About 6,000 years ago with the advent of the most recent rise in sea level, the Biscayne basin began to fill with water, first within the deeper areas near Key Biscayne and, later, to the south and east. About 4,000 years ago the northern basin was finally enclosed as sand from the mid-Atlantic coast drifted south and accumulated on the ancient submerged reefs. By 2,000 years ago the seas had invaded all of Biscayne Bay except the shallow shelf along the western border.

Sedimentary Processes. As the seas rose, five dynamic processes of sedimentation and erosion were continually occurring in Biscayne Bay. In addition to the longshore drift of sands onto the barrier islands, sands of more local and recent origin were deposited throughout the western half of north Bay and along exposed sections of the western bay shoreline as far south as Black Point. Deep tidal bars of calcareous sand and mud were deposited and continually reworked by tidal action to form the Safety Valve and Featherbed Banks. Mangroves moved westward across the Bay in response to the rising sea level. A thin veneer of calcareous sand was deposited over the limerock basin throughout the central region of the Bay.

Unlike other coastal lagoons along the Atlantic or Gulf Coasts, Biscayne Bay is not a drowned river valley with a shifting sand substrate. Rather, these sedimentary processes are controlled by the rigid topography of the basin, the availability of sediment, and wind driven circulation, primarily during periods of winter cold fronts and hurricanes. Here the confined limerock basin not only defines where sedimentation can occur, but also limits the amount of available sedimentary material. Except for the limited drift of sand from the Appalachian mountain region onto the barrier islands, all of the Bay's sediments are produced by organisms living within the Bay itself (Wanless, 1976).

External Factors Which Control the Bay Ecosystem

In addition to man-induced changes and geological processes there are a few key external factors or forcing functions which drive or inhibit the physical or biological activities within the Bay's natural systems. In the most basic terms these may be grouped under the general headings of climate and hydrology, tides and circulation, and the influx of nutrients or chemicals.

Climate and Hydrology

Each of the climatic elements of sunlight, temperature, wind and rainfall has a distinct and direct influence upon the Bay area. Climate together with geological processes has shaped the Bay and shoreline, influenced drainage patterns and ultimately the character of the total Bay system.

Sunlight and Temperature. The climate of the Bay area is strongly influenced by its geographical location. Due to its proximity to the equator, this area receives intense sunlight during 66 percent of the daylight hours. While the attendant thermal effects are moderated by the presence of the Gulf Stream and southeast tradewinds, this intensity of sunlight is a primary factor in the Bay environment and maintaining the balance of plants and animals that exist in this sub-tropical lagoon.

Bay temperatures average 66.2°F in the winter (minumum 48°F) and 87°F in summer (95°F maximum). The shallow Bay waters often exhibit 5.4°F day-night variations and passages of winter cold fronts can cause 18°F drops in ambient temperatures.

Temperature exerts both a "push" and a "pull" force on the Bay system. With moderate increases, accelerated respiration and productivity and cycling of material through the system are observed. However, when temperatures increase significantly above background, the system is stressed until it ultimately ceases to function. Optimal temperatures for maintaining species diversity and maximum biomass are between 62°F and 82°F in Biscayne Bay. At temperatures between 82°F and 92°F, 50 percent of the organisms are killed, and between 95° and 98°F, 75 percent of the organisms die (Bader, and Roessler, 1972).

Wind, Tropical Storms and Hurricanes. From April through September, prevailing winds over Dade County are generally from the east or southeast. These daytime onshore winds frequently shift during the night to westerly offshore breezes. During the winter months the easterly wind pattern is often interrupted by the passage of cold fronts with winds and severe weather activity from the north.

Periods of calm winds of less than 5 knots (less than 6 mph) occur about 25 percent of the time in Dade County and winds of less than 10 knots (11.5 mph) are recorded over 60 percent of the time. Average wind speeds along the coast are two times stronger than velocities measured inland. High winds of short duration are generally associated with the occurrence of local thunder storms or the passage of cold fronts. In contrast, sustained high winds are most often associated with tropical storms or hurricanes.

By definition, tropical cyclones include tropical storms (storms with winds from 38 mph to 73 mph), hurricanes (storms with winds from 74 mph to 123 mph), and great hurricanes (with winds over 124 mph). Hurricanes usually commence over warm waters in the tropics and contain low-pressure centers with surrounding counterclockwise winds. Hurricanes affecting Dade County develop in the Atlantic Ocean, the Gulf of Mexico, and the Caribbean Sea during the summer and fall months. Severe storms occur most frequently during September and October; these usually develop in the eastern Atlantic.

Throughout the past century, south Florida has been struck by more hurricanes than any other area of equal size in the United States. South Florida also has more of the great hurricanes per unit length of coastline than any other area of the country. During the period of 1886 to 1970, tropical storms with sustained winds over 38 mph occurred on the average of every 5 years. Storms of hurricane strength occurred every 6 years. Great hurricanes occurred on an average of once every 14 years (Gentry, 1974).

Hurricanes and tropical storms have significantly affected both the Bay shoreline and submerged communities. Wind, lightning and storm surges associated with the Great Miami Hurricane of 1929 defoliated most of the taller mangroves on Key Biscayne and Virginia Key. The little known hurricane of 1929 produced even more significant damage in some of the Bay's mangrove forests.

In addition to the direct destruction of coastal forest trees, hurricanes and tropical storms have also caused severe erosion along barrier and spoil islands in the Bay system. The 1929 hurricane eroded about 200 feet on either side of Baker's Haulover. A large amount of that sand flowed into the Bay and was deposited as a large fan-shaped delta.

Hurricanes have also brought about many changes in the submerged communities. The 1926 hurricane recontoured submerged plant communities in the area from Melloy Channel just north of MacArthur Causeway to a portion of the Safety Valve region at the southern end of Key Biscayne. Damage to the Safety Valve area was even more significant after the passage of the 1929 storm. Other probable

damage to Bay bottom communities has been documented through careful inspection of old aerial photos (Harlem 1979). One striking example is a large denuded area north of the Venetian Causeway that most likely resulted from the passage of the 1935 "Yankee Hurricane."

Rainfall and Hydrology. Rainfall and upland hydrological patterns influence salinity within the Bay system. In broad terms, the south Florida area receives more rain during the five month period from June to October than any other region of the continental United States. Approximately 70 percent of the total annual rainfall is received during that five month period. However, in the Bay region as in other parts of the County, rainfall varies markedly from area to area of the Bay as well as seasonally and annually. Over many years, average yearly rainfall in the Homestead area was 18 inches greater than the average annual rainfall at Miami Beach.

Historically, during the rainy season freshwater flowed into the Bay through broad natural sloughs or drainage ways and via overland runoff and groundwater seepage. In this way, fresh and sea water slowly mixed and a region of mildly salty or brackish water was maintained throughout many months of the year. The creation of canals and levees to reduce flooding not only accelerated the rate of flood water removal from uplands and interior wetlands, but also sharply reduced the length of time during which freshwater flows into the Bay and decreased the total amount of freshwater flowing into the Bay by about 20 percent (Buchanan and Klein, 1976).

At present, most of north Biscayne Bay and extreme south Bay registers salinities as great as, or greater than, seawater throughout much of the year. However, in the area from Miami River south to Turkey Point nearshore salinities continue to reflect changes in rainfall, groundwater seepage and canal outflows during the rainy season. The measurable dilution of seawater along the western shoreline causes the formation of a east-west salinity gradient which, during the rainy season increases from brackish to full strength seawater proceeding from the land toward the ocean. A reverse pattern predominates during the dry season, when salt concentrations higher than those found in normal seawater are recorded along the western shoreline. These gradients are important because many kinds of fish and shell fish are adapted to areas of lowered salinity, especially during their juvenile stages.

Tides and Circulation

Exchange processes between the Ocean and Bay and within the basins of Dumbfoundling Bay, Biscayne Bay and Card Sound are driven primarily by wind driven currents. Tides in the area are semi-diurnal ranging from about two feet in northern Biscayne Bay to one foot in south Biscayne Bay. In a series of tidal lagoons with several interconnected basins such as Dumbfoundling Bay and Biscayne Bay, tidal movement is generally between basins rather than through the Ocean-Bay inlets.

Tidal patterns alone within Biscayne Bay produce conditions where flushing or exchange with Ocean waters is extremely slow. However, wind driven currents can substantially reduce flushing time. While the moderate southeast summer winds assist basic tidal motions, the shifting of winds to northerly directions and the increase in wind speeds associated with the passage of winter cold fronts allow waters which are normally held along the western shoreline to be transported into the eastern section of the basin where they can be discharged out through the ocean inlets. In this manner, the flushing time may be reduced from over a year to a period of one to three months (Lee and Rooth, 1975).

Inflows of Chemical and Other Nutrients into the Bay

Water quality in Biscayne Bay and adjacent embayments is controlled by the flux of chemicals into and through the system. These chemicals flow into the bays via canals, surface and ground water seepage, storm drain discharges, rainfall and ocean tides. All except rainfall and tides are influenced directly or indirectly by upland water management practices.

At present, three agencies are collecting water quality data on a regular basis in Biscayne Bay. The National Park Service collects samples at 26 stations in south Biscayne Bay. The Florida Department of Environmental Regulation monitors one station in north Biscayne Bay and one in south Biscayne Bay. The Dade County Department of Environmental Resources Management (DERM) monitors 48 stations in Biscayne Bay.

In the fall of 1978, Dade DERM conducted an intensive six week study of 25 stations in north Biscayne Bay. In general, that assessment indicated that Bay waters from Rickenbacker Causeway north generally meet EPA criteria, and State and County Class III water quality standards for recreational uses. With the exception of stations near the mouth of the Miami River, the entire body of water in north Biscayne Bay appeared to be well oxygenated at mid-depth.

The highest turbidity levels were observed at the mouth of the Little River Canal, where readings were five times the average values recorded at a mid-Bay location one mile east of Gables-by-the-Sea. In contrast, average turbidity values in Dumbfoundling Bay were lower than the mid-Bay readings. The six canals which drain into north Biscayne Bay contribute colored water to it. Color in water results primarily from the decomposition of naturally occurring organic matter. Colored water limits light penetration and generally reduces aquatic plant growth.

In general, nutrient concentrations were found to be relatively low in north Biscayne Bay. However, the average nitrogen concentrations for the six week period examined was four times the concentrations found at the background station off Gables-by-the-Sea. Potential sources of nitrogen include septic tank drainfields, stormwater runoff which may contain fertilizers, animal wastes, automobile exhausts and losses from natural mineralization processes.

The average phosphate-phosphorus concentrations in north Bay were two times the central Bay background values. The total phosphorus concentration for the Dumbfoundling Bay stations was significantly higher than all other stations in north Biscayne Bay and three times the mid-Bay background level. Phosphorus as phosphate is one of the major nutrients required for plant nutrition and is essential for life. In excess of a critical concentration, phosphates stimulate plant growth. Phosphates enter waterways from several different sources. Varying amounts drain into watercourses in stormwater runoff. Tree leaves as well as atmospheric fallout are also contributing sources. The elevated phosphate-phosphorus readings in the Dumbfoundling Bay area may be attributable to urban runoff discharges into this confined area.

The number of coliform bacteria found in north Biscayne Bay is generally low. When data showing extremes in variation were minimized by using a geometric mean, it was seen that only the Miami River contributed water to north Biscayne Bay which was in violation of the Dade County standard. The River's total coliform bacteria zone of influence was restricted to one station in the Claughton Island Channel. Only stations around the Miami River exceeded the fecal coliform criterion established by the U.S. Environmental Protection Agency.

Sediments at two of four stations sampled contained detectable quantities of pesticides. Concentrations of DDT in the sediment at the mouth of the Miami River were higher than those found in central Florida agricultural soils.

Comparative data for south Bay are presently limited to information obtained during an intensive study done for FP&L from 1970-72, DER sampling at one station east of Turkey Point, National Park Service data and DERM data for 23 stations in central and south Biscayne Bay and Card Sound.

During the past few years dissolved nutrient (nitrate, phosphate and ammonium ions) data have shown some interesting trends in the Bay area south of Black Point. The highest concentrations and the widest range of nutrients were observed in the flood control canals and at the stations located just off these canals. East-west transects reveal heavier nutrient levels along the western shore. The highest levels of phosphate and nitrate were observed north of Homestead Bayfront Park. These data clearly show the influence of the flood control canals. At stations south of Homestead Bayfront Park the source of this nutrient loading is the exchange with mangrove fringe forest.

It should also be noted that although the same east-west trends for nitrate and phosphate are observed for background ammonia concentrations, an inverse north-south relationship appears to exist along the western shoreline. North of Homestead Bayfront Park, where the area is strongly influenced by the flood control canals, the mean ammonia loading is less than half the value recorded to the south. This indicates that the southwestern area of lower Biscayne Bay is a region where metals are more tightly bound to sediments than in other areas of the south Bay. Comparative data recorded since 1970 plus details on the current DERM Bay Monitoring program are given in Appendix I.

Plant Communities of the Biscayne Bay System

The amount of light, photoperiod, temperature, salinity and sediment depth are major factors which control plant growth in coastal systems. Plants capture the sun's energy and use it to form organic compounds which are in turn used by the entire coastal system. All of the forcing functions discussed previously play vital roles in this conversion process. Temperature and salinity control the distribution of organisms and affect the rates of chemical reactions among the biota, water column and sediments. Hydrologic flows, plus tidal and wind driven currents, influence the rate on which chemicals are introduced into, or are removed from the Bay systems.

Sunlight is the principal driving mechanism of the photosynthetic process and is essential to plant growth. Hence, the amount of sunlight penetration through the water column strongly influences plant distribution and system viability. In the shallow Bay system, the amount of light available to bottom dwelling and suspended plants is controlled by the clarity of the water column. Light penetration may be limited by drainage of suspended solids from upland sources, dredged materials, or by blooms of tiny plants which live in the water column.

Bottom conditions are also very important in determining makeup of Bay communities. Very small changes in sediment depth influence bottom community distributions. In general, areas with more than 4-6 inches (10-15 cm.) of sediment are dominated by marine grasses and algae wherever light conditions are adequate.

Submerged Plant Communities

In north Biscayne Bay, wherever light penetration is sufficient, extensive communities of Cuban shoalweed and manatee grass are found frequently in association with algae. In other areas soft-bottom communities predominate. The fauna of these communities generally consists of animals such as molluscs, worms, crustaceans and other invertebrate groups which dwell within or on the sediments.

In addition to the better known bottom communities, it is thought that much of the primary productivity in north Bay stems from tiny plants called phytoplankton that live suspended in the water column. Unlike the larger attached plants, these minute one-celled organisms mature, live and die within a period of days. Thus they have the capacity to recycle nutrients rapidly through the ecosystem. Sometimes they grow excessively and the waters become murky and turbid, but at other times the presence of these tiny organisms is very beneficial as they provide a rich nutrient source for the other plants and animals within the Bay system.

In central and southern Biscayne Bay where light penetration is not a limiting factor, turtle grass communities cover approximately 30 percent of the Bay bottom. Here the major limiting factor is sediment depth. A minimum of 3-4 inches of sediment is required to sustain seagrass growth and 9 inches or more is necessary to support vigorous growth. Since the turtle grass community is considered one of the most diverse and productive marine communities in the world, this sediment-grass association is of extreme importance.

Turtle grass is frequently associated with Cuban shoalweed and manatee grass. In locations such as at canal outlets where there are wide salinity variations, shoalweed often replaces turtle grass as the dominant species. Along most of the western shoreline, turtle grass dominates down to the six or eight foot depth. In some areas dense turtle grass beds extend offshore for more than a mile or two. In other areas, growth is restricted to patches of deep sediment surrounded by sand or rock. To the east, below the eight foot contour, manatee grass becomes increasingly more abundant and may replace turtle grass at greater depths.

Once established, seagrasses affect sedimentation. The roots may extend more than 2 feet below the sediment surface thus binding and stabilizing sediments. Even during periods of high wave action the grass blades create a layer of semi-motionless water over the bottom in which fine sediment can settle out. The sediment trapping ability is proportional to the density of the blades and contributes appreciably to the maintenance of water clarity. In addition, seagrasses function as a major link in the cycling of elements through the ecosystem, absorbing them from the sediments, storing basic chemical elements and converting them into useable organic substances.

A few organisms feed directly upon marine grasses, and the blades also provide protection and shelter to numerous animal species especially during nursery stages. The blades also provide a substrate for the attachment of many small plants and animals which in turn are food for even smaller crustaceans, molluscs and fish. Over 250 species of fish inhabit the grass flats at some time during their life cycle and more than 200 invertebrate species have been recorded in grass flats within Biscayne National Park. Notable species include shrimp, spiny lobster, mullet, snappers, grunts, sea trout, bonefish and permit (Voss, et al., 1969).

Depending upon environmental variations, different species of animals dominate the grass communities. Near the western shore, where salinities are most variable, hermit crabs, mud crabs, shrimp, and certain molluscs are dominant. In the mid-Bay region sediment cover is sparse and turtle grass is largely replaced by red, green, and brown algae, sponges and alcyonarians (sea whips, sea fans, and sea feathers). This association becomes increasingly common toward the eastern shoreline of the Bay. Along the fringe islands where constant ocean salinities are found, sponges, sea urchins, and corals dominate (Thorhaug and Roessler, 1977). Stone crabs, spiny lobsters and many other invertebrates are frequent residents of the rocky holes and crevices throughout this region.

Shoreline Plant Communities

Proceeding from the submerged marine environment to the undisturbed mainland shorelines of the Bay, the dominant vegetative communities are mangrove forests with salt marshes and hammocks. The mangrove communities provide numerous contributions to the Bay systems. Coastal mangroves bear the brunt of storm tides, protecting the shoreline from severe storm erosion. The extensive prop root system produces a baffling effect which dissipates wave energy and reduces tidal currents. The resulting deposition of suspended silt is thought to build land and enhance water clarity. The maze of prop roots also provides a surface for the attachment of marine organisms and protection for juvenile fishes from predators. The penetration of the mangrove roots into shoreline mud is basic to the mineral cycling necessary for maintaining the high primary productivity of the marine community.

The export of mangrove detritus -- minute particles of decomposing plant material -- is of vital importance to the continued functioning of coastal ecosystems. As fragments of marine grasses and mangrove leaves or twigs drift in the warm shallow coastal waters, they are mechanically and chemically broken into smaller particles by colonies of bacteria, fungi or protozoa. The small particles are, in turn, colonized by succeeding colonies; thus the relative concentration of protein and the caloric value of the particles is enhanced, and they become increasingly more valuable as food sources. The detrital particles, plus associated bacteria, fungi and protozoa are fed upon by detritus feeders (e.g., amphipods, mysids, copepods, shrimp and some small or juvenile fish species). The small animals eat the associated bacteria, fungi, and protozoa, and excrete the indigestible cellulose portion which then becomes substrate for a subsequent assemblage of microorganisms, and the process is repeated.

The detritus feeders are eaten by predators (e.g., carnivorous worms, snails, and numerous juvenile fish), which are, in turn, eaten by larger predators such as snappers, barracuda, sharks, and various marsh and shore birds (e.g., egrets, herons). Each of these higher level consumers contributes waste and decay materials which are acted upon by bacteria and fungi to become part of subsequent detrital food chains.

In sum, the mangrove communities create a dynamic system responsive to natural perturbations. The vigor of mangrove growth is sensitive to alterations in drainage patterns, tidal inundation, overland runoff and water quality characteristics. Changes in any of these factors may result in alterations in rates of leaf fall, changes in species distributions or changes in the rates and kinds of exported material to surrounding bays. Acting together, these mangrove communities form a regional system where the quality of waters and ecosystem vitality are maximized.

Salt Marsh Communities

Inland from the mangrove forest, and covering much of the region southeast of Homestead, communities of halophytes, salt or brackish water plants, predominate. Plants typical of these salt marsh communities include saltgrass, black rush, cord grass, glasswort, sea blite, saltwort, sea purslane, and sea side daisy.

While much of the vegetation grows in the marls, small regions of peat accumulations support mangrove and buttonwood tree islands. Due to modification of freshwater runoff patterns and the rising sea level, this region serves as an ecotone, or transition zone, from fresh to salt tolerant species. With heavy precipitation the ecotone may shift toward land, while intense storm tides may cause a shift toward the Bay or Card Sound. The functions of saltmarsh plants are similar to those of mangroves. Additionally, as discussed in the following section, mangrove forests, salt marshes and coastal hammocks provide habitat for numerous endangered, threatened or rare plants and animals (see Appendices II and III).

Wildlife of the Bay and Shoreline

Wildlife areas and bird rookeries are among the most conspicuous natural features of the Bay area (See Figure 5). Large rookeries of herons, egrets and white ibises are found at Bird Key and other spoil islands in north Biscayne Bay and in Greynolds Park. Virginia Key, the Arsenicker Keys, Black Point, and Chapman Field are important rookery areas in central and southern Biscayne Bay. In particular, the Arsenickers and the nearby mangrove fringe forest provide habitat for many rare or threatened species, including reddish egrets, magnificent frigatebirds and pelicans.

The relationships between rookery sites and feeding or resting sites is little known. However, since herons and egrets use a number of different foraging strategies to search for a wide variety of fish species, virtually all of the Bay shoreline areas including mangroves, tidal creeks, causeways and tidal flats are utilized by these species.

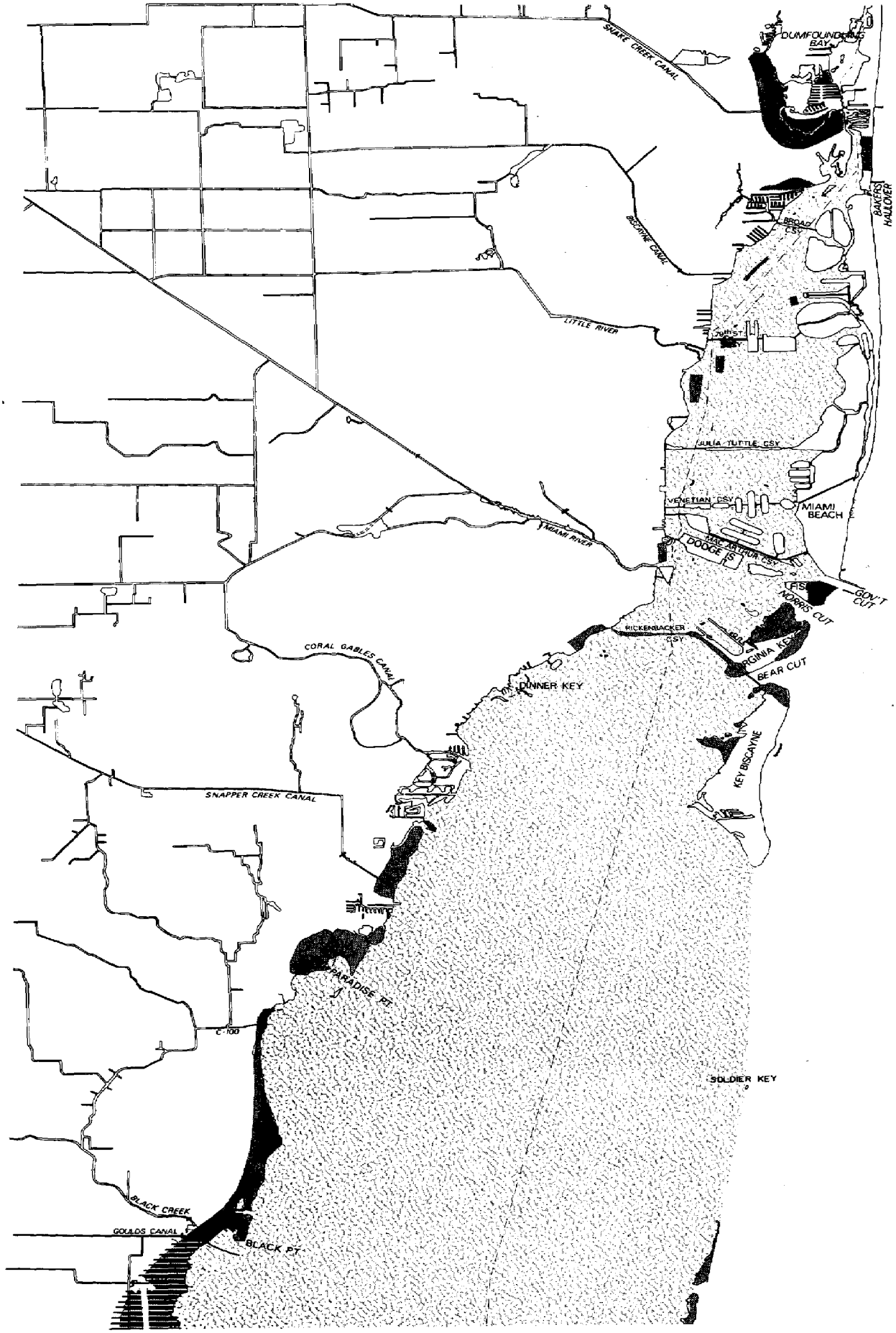
While less dramatic than nesting sites, locations used for feeding or resting are also important to wildlife species survival. Since many birds selectively utilize differing regions of the coastal zone for feeding, resting or nesting, their life cycles tend to re-emphasize the importance of viewing the coastal zone as a whole system, rather than as a series of separate areas.

Other endangered and threatened animals of the coastal zone such as the manatee and American crocodile merit special mention. Biscayne Bay north of Key Biscayne and all adjoining water bodies north to and including Maule Lake are designated critical habitat for the Florida manatee by the U.S. Fish and Wildlife Service. While manatees are seen throughout the Bay during most of the year, they appear to concentrate in the protected channels at Chapman Field and Black Point, south of Key Biscayne and at Dinner Key. It is apparent therefore, that the designated critical habitat does not include some vital areas.

Since the turn of the century, the historical crocodile habitat gradually has been eliminated from much of Dade County owing to shoreline development. Documented occurrences of the American Crocodile in Dade County and northern Monroe County currently are limited to the undeveloped mangrove shoreline and canals from Black Point to Flamingo and northern Key Largo, and occasionally to islands within Biscayne National Park. Significant populations of these animals occur in the Turkey Point cooling canal system and adjacent canals. A representative listing of the animals that inhabit Bay or shoreline communities during all or part of their life cycles is given in Appendix IV.

It can be seen from the preceding discussion that the Bay system is dependent upon the viability of, and interrelationships among, all of the Bay and shoreline communities. Each provides an array of values and services which in sum make the Biscayne Bay System a unique natural resource of national significance. Changes, by whatever means, in the physical or chemical characteristics of these communities will produce corresponding changes in the structure and functioning of their living components. These, in turn, will affect the quality, viability and utility of the entire Bay region.

The utility of this region is discussed in the following chapter on the "Uses and Users of the Bay and Shoreline." In Chapter III major environmental and user concerns about maintaining and improving many of the Bay's natural and developed characteristics are presented together with recommendations regarding the guidelines and implementation programs that should be followed to address those concerns.


SNAKE CREEK CANAL
DUMFOUNDLING BAY
BAKERS HAULOVER
BROAD C.SY
BISCAYNE CANAL
LITTLE RIVER
JULIA TUTTLE CSY
VENETIAN CSY
MIAMI BEACH
MIAMI RIVER
DODGE IS
MAC ARTHUR CSY
FIS
GOV'T CUT
NORRIS CUT
RICKENBACKER CSY
VIRGINIA KEY
BEAR CUT
CORAL GABLES CANAL
DINNER KEY
KEY BISCAYNE
SNAPPER CREEK CANAL
PARADISE PT
C-100
SOLDIER KEY
BLACK CREEK
GOULDS CANAL
BLACK PT

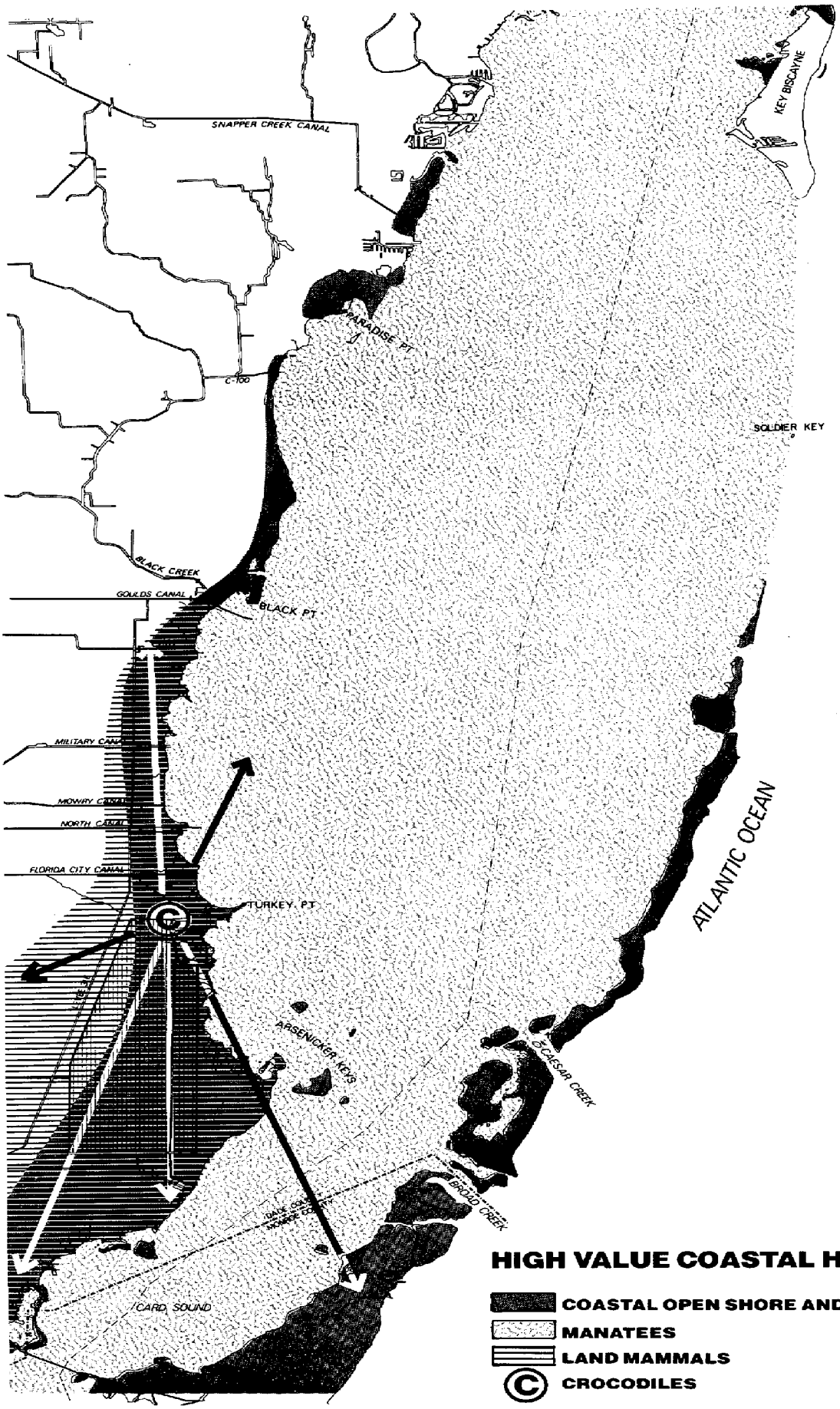


FIGURE 5

HIGH VALUE COASTAL HABITAT AREAS

- COASTAL OPEN SHORE AND MANGROVE BIRDS
- MANATEES
- LAND MAMMALS
- CROCODILES

SOURCES: ABRAMSON, KUSHLAN, OGDEN, TILMANT, OWRE, 197

CHAPTER II

USES OF THE BAY AND WATER-RELATED USES OF THE SHORELINE

Use of Biscayne Bay for water related activities occurs in three general areas: the water itself; the water-land interface; and the shorelands that are visually or physically tied to the Bay. It is impossible to segregate the uses of one area from those of another area because of the interdependency of the three areas. Uses of the Bay waters generally depend on the quality and accessibility of the waterbody, while the uses along the shoreline are frequently water oriented, but not necessarily water dependent. By analyzing the uses that occur along the water's edge, one may approach the Bay as an interrelated system.

Major In-Bay Uses

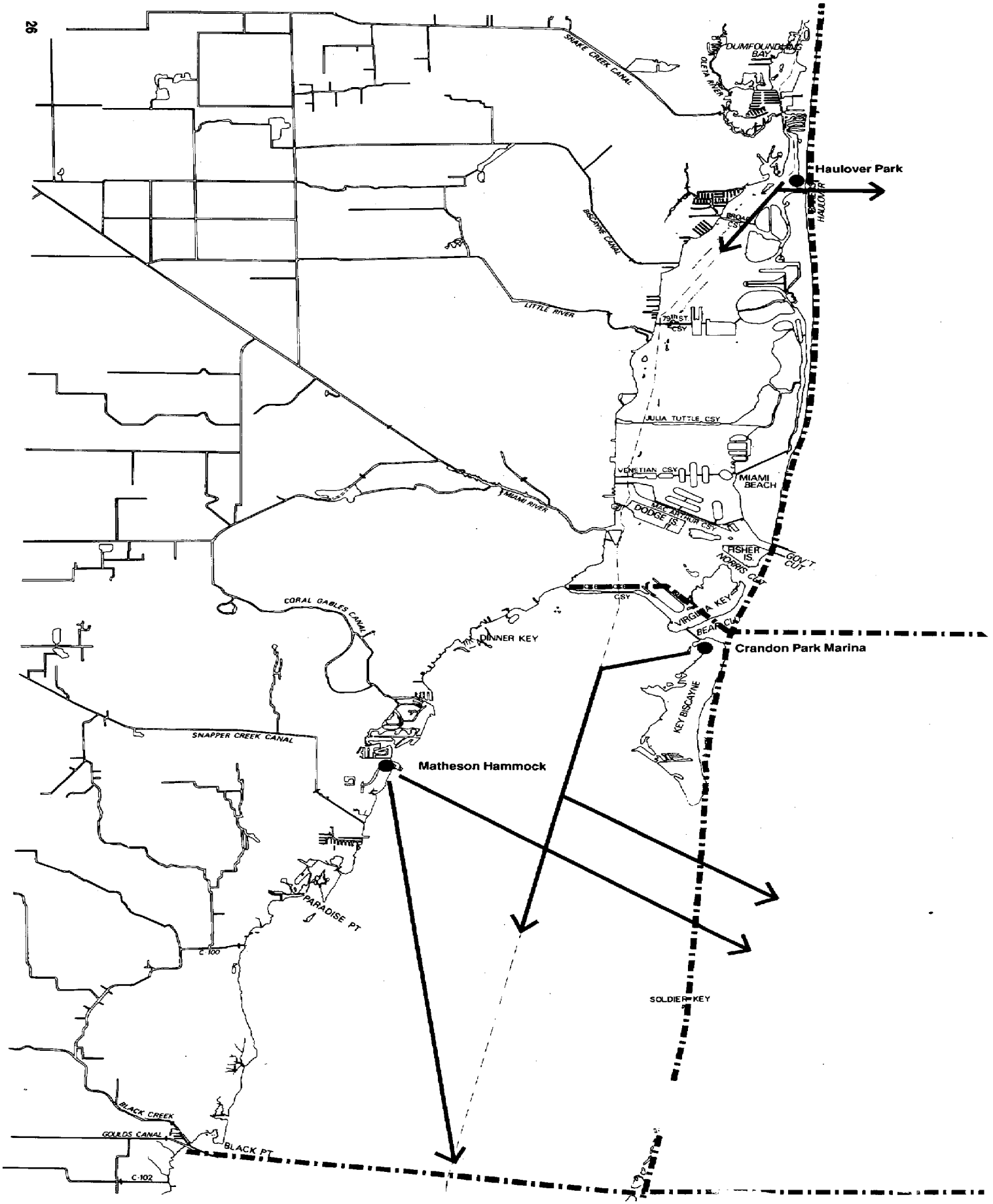
Many of the most important uses of the water column are recreational in nature. These include boating and associated uses such as water-skiing, skin and SCUBA diving, spearfishing, sportfishing, swimming, collecting and viewing.

Recreational Boating

In 1975-1976, there were over a quarter-million recreational boating trips made from Dade County, three-quarters of which were made within Biscayne Bay (Austin, et. al. 1977). A survey conducted by the Dade County Parks and Recreation Department (1979) revealed a higher percentage of younger, Latin boaters than shown in the Austin survey. Overall, only a small portion of Dade County's boat owners may be considered as "active boaters," with about 80 percent of all owners using their boats less than three times a month. Use rate at marinas of as low as 10 percent have been observed even during the more favorable summer months.

As might be expected, the boater's choice of recreational area depends upon both the choice of activity and the launching facility used (Austin, et. al. 1977). Cruising and water contact sports are usually conducted within the Bay, especially during the winter months when ocean waters tend to be rough; line fishermen are more likely to choose the offshore reefs and Gulf Stream regions.

A 1976 user survey conducted by the Biscayne National Monument (now Biscayne National Park) established a strong relationship between place of access to the water and the location and intensity of the recreational activity. While only 36 percent of the Monument visitors launched from southern Biscayne Bay, they comprised 54 percent of the fishermen. A similar situation was observed with sailboaters from Coconut Grove. They comprised about 32 percent of the sailboaters, whereas the total number of visitors from the Grove represented less than 8 percent of the total. It also appears that boats which originated from private slips and Miami marinas were more likely to restrict their activities to cruising. There is also a strong relationship between launching sites and destination (see Figure 6).


SNAKE CREEK CANAL
DUMFOUNDLING BAY
OLETA RIVER
Haulover Park
HAULOVER
BISCAYNE CANAL
LITTLE RIVER
79th ST. CSY
JULIA TUTTLE CSY
VENETIAN CSY
MIAMI BEACH
MIAMI RIVER
DODGE IS.
MACARTHUR CSY
FISHER IS.
GOVT CUT
NORRIS CUT
CSY
VIRGINIA KEY
BEACH CLUB
CORAL GABLES CANAL
DINNER KEY
Crandon Park Marina
KEY BISCAYNE
SNAPPER CREEK CANAL
Matheson Hammock
PARADISE PT
C-100
SOLDIER KEY
BLACK CREEK
GOULDS CANAL
BLACK PT.
C-102

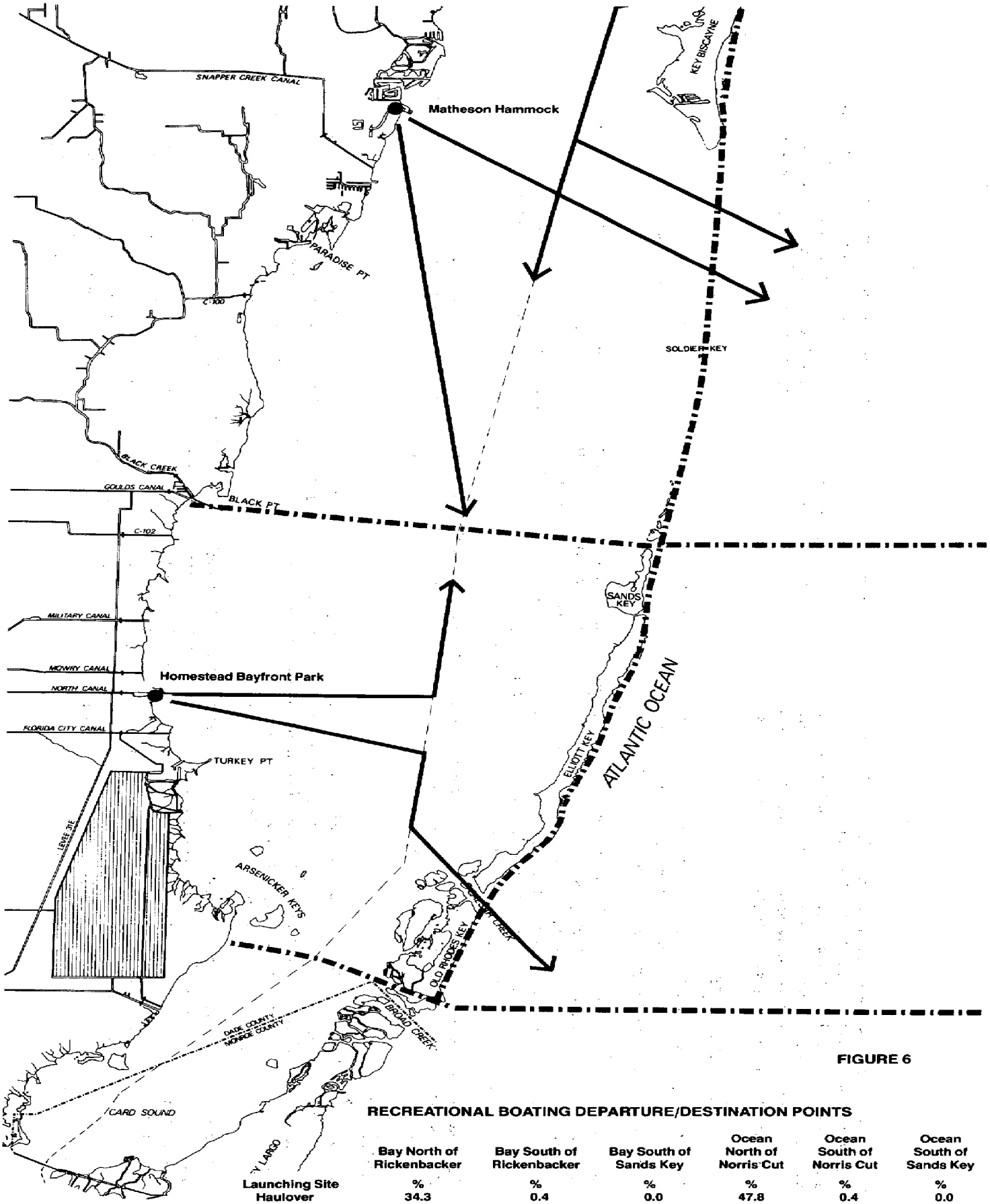


FIGURE 6

RECREATIONAL BOATING DEPARTURE/DESTINATION POINTS

Launching Site	Bay North of Rickenbacker	Bay South of Rickenbacker	Bay South of Sands Key	Ocean North of Norris Cut	Ocean South of Norris Cut	Ocean South of Sands Key
	%	%	%	%	%	%
Haulover	34.3	0.4	0.0	47.8	0.4	0.0
Crandon	3.7	41.7	3.0	4.1	37.9	2.1
Matheson	0.7	48.7	6.8	0.8	29.6	1.7
Homestead	0.0	0.6	51.1	0.0	0.6	35.2

Source: Austin et. al, 1977

The Austin study also revealed a strong relationship between launching site and place of residence. For example, over 95 percent of the people who launched their boats at Haulover Park lived north of Flagler Street, while almost 75 percent of the people who launched at Matheson Hammock Park lived south of Flagler Street. The use of boats in the Bay is also influenced by other factors, such as bridge and causeway locations, water depths, and the nature and location of launch and docking facilities. In northern Biscayne Bay, for example, there are many miles of bulkheaded waterways and numerous berths for large boats; it is not surprising, therefore, that the boating activity most frequently done in north Bay is cruising.

Boating Related Activities

The intensity of all boating related activities varies according to such factors as season of the year, day of the week, weather, accessibility, and income of the boat owner. Over 40 percent of all recreational boating activities occur during the summer weekends, with fall being the period of least activity (see Table 1).

The Austin survey determined that 57 percent of the boating done in north Bay is for cruising, with about 20 percent each for line fishing and water-skiing. Swimming is limited by the lack of beaches and turbid, unappealing water. Water-skiing, which requires long stretches of water free from boating debris, is popular in sheltered areas along the western Miami Beach shoreline north of Venetian Causeway, around Palm and Hibiscus Islands, the Rickenbacker Causeway, the Marine Stadium, and the western shores of Key Biscayne. South of the Rickenbacker Causeway to the Featherbed Bank, the Bay is heavily used for sailing and power boating, with activities being almost equally divided between cruising and line fishing.

The area in and around the Biscayne National Monument (now Biscayne National Park) is popular for a variety of boating uses because of the sheltered environment afforded by this location. The 1976 user survey indicated that 38 percent of all visitors engaged in line fishing, 4 percent in spearfishing, and 21 percent in diving, snorkeling, and water-skiing.

Sportfishing

Sportfishing occurs throughout the Bay, depending on season, tides, migratory patterns, and temperature. Small fish are generally in good supply in north Bay, with trout, ladyfish, jack, and occasional pompano being caught in the grassbeds near the Causeways. Government Cut and Haulover Cut are also prime fishing spots, although Haulover Cut cannot be fished from the water because of dangerous currents. Anglers casting from shore often catch bluefish, snook, and tarpon. Government Cut fishermen often catch snook and tarpon at night during the summer months (Hardee, J. 1978).

South Bay fishermen often catch Spanish mackerel and bluefish from fall through spring south of the Rickenbacker Causeway drawbridge, and from the Cutler Power Plant to the Turkey Point Power Plant. Bonefish are caught south of Key Biscayne in the flats, off the Rickenbacker Causeway, near Norris and Bear Cuts and along Cutter Bank in south Bay. Bluefish may be found along the Cape Florida Channel and its neighboring sand bars, and in the Safety Valve. Table 2 indicates the relative abundance and seasonality of the fish most frequently landed by sport fishermen in 1979. Data compiled by the Biscayne National Monument (Park) staff from 1976-1979 support the general finding that the fishes most frequently caught in the Bay are grunts and snappers. None of the data presently available give an adequate picture of how many people fish the Bay. Except for one study done in the early 1960's data are entirely lacking on stationary fishing.

Commercial Fishing

In 1976, Dade County ranked 7th out of the 18 counties in Florida with commercial fish landings, with a total catch valued at $3 million. Between 1972 and 1976, however, fish landings in Dade County declined substantially. Fish landings are highest in January through March, while shellfish landings are high in March and from August through December (see Figure 7). However, it should be noted that a large percentage of the fish included in these figures were caught offshore and not in the Bay.

A recent survey estimated that of 306 active commercial fishermen in Dade County in 1977-1978, less than 100 handled over 5,000 pounds of fish and shellfish per year (Mathis, et al. 1979). Most commercial fishermen dock at Black Point, Dinner Key, and along the banks of the Miami River, which is also the location of most of the fish processing and shipping terminals. About one-third of the commercial fishermen travel less than ten miles to their normal fishing areas, while slightly over 40 percent travel 11 to 25 miles. However, the number who fish primarily or exclusively in the Bay is not known.

Commercial mullet fishing, while occurring throughout the Bay, is regularly pursued by less than a dozen fishermen. Mullet are caught with either roller or gill nets.

Shrimping is a relatively stable year-round industry, although there are large seasonal fluctuations in the size of the shrimp and in overall populations. Data gathered by the Biscayne National Monument showed that the total catch for the winter of 1978 was about 20,000 pounds, and for the summer of 1979, only 2,000 pounds (Tilmant, J. and D. Robbins, 1978-79). The number of shrimp harvested has remained relatively constant over the past 20 years, even though the number of shrimpers has increased. This would seem to imply that the intensity of shrimp harvesting has not yet reached the point where it is affecting the shrimp population adversely but it may also be that the fishermen are taking smaller shrimp now than they did a decade ago. There is no legal limit on the number of shrimp that may be taken, only on their size. Prime areas for commercial shrimping are near the grass beds of Black Point and in the Dinner Key area, where about 50 shrimp trawlers work during the lucrative winter months.

Tropical fish collecting is done within the Bay concomitant to shrimping when there is a demand. Species most frequently sought are the sea horses which are caught over clear bottom areas. Two-eyed butterfly fish and small angel fish occasionally come up with the shrimp nets.

Although parts of the Bay south of the northern boundary of the Biscayne National Park have been used by commercial and sport lobstermen, almost all parts of the Bay as well as Card Sound, have been abandoned by commercial lobstermen since 1978 for economic reasons, as these areas serve primarily as nursery areas for juvenile lobsters. Also, the taking of lobsters in these areas is now prohibited by Florida law.

Two varieties of crabs, the blue crab and the stone crab, are sought in Biscayne Bay. About 10 to 15 active commercial blue-crabbers harvest crabs in south Bay near Homestead and Turkey Point, as well as in north Bay near Interama and the Oleta River. The 50 to 75 commercial stone-crabbers who work the Bay from 36 Street to Black Point are limited to a five-month season and in the size of the crabs that can be taken.

TABLE 1

1975-76 RECREATIONAL BOATING TRIPS IN BISCAYNE BAY

ACTIVITY	WINTER	SPRING	SUMMER	FALL	ANNUAL TRIPS IN BAY	% Of Bay Trips	TOTAL ANNUAL TRIPS	*% of Total Trips
Cruising	13809	23214	35373	11024	83430	49	89478	34.4
Swim/Ski	2655	5022	16260	2460	26397	15	29028	11.2
Linefish	10464	14061	13056	7860	45441	27	117111	45.0
Dive/Spearfishing	237	885	6093	921	8136	5	15819	6.1
Other (hand fishing, commercial fishing, business related)	630	2388	3478	1215	7711	4	8556	3.3
	27795	45570	74260	23490	171115	100	259992	100.0

*Includes trips to offshore reef and Gulfstream areas.

Source: Austin 1977

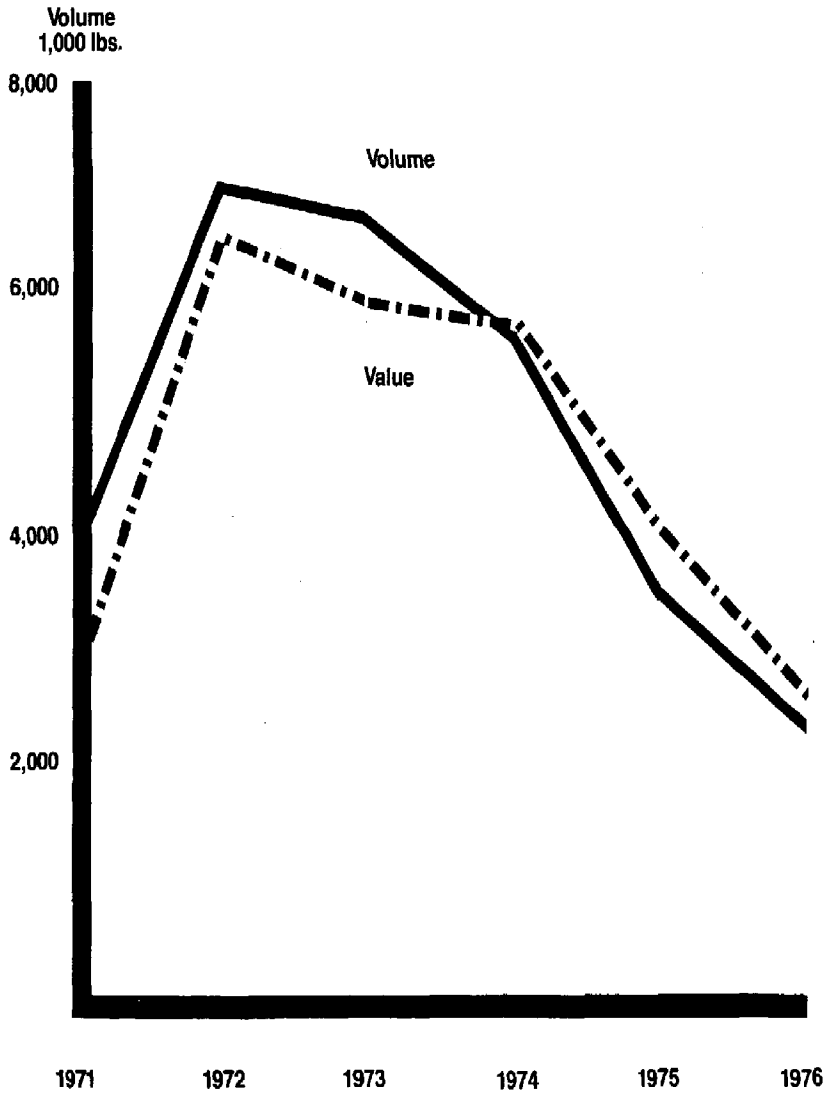
TABLE 2

FISH LANDINGS IN BISCAYNE BAY, 1979

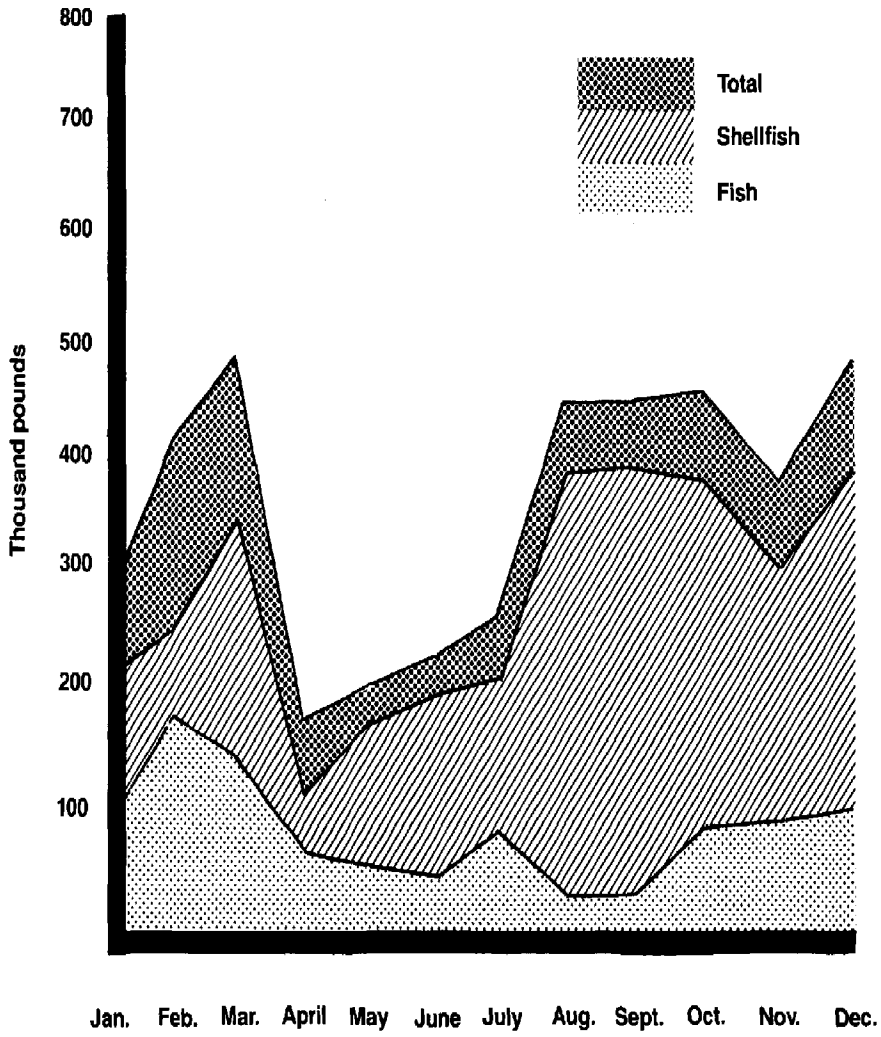
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
Fish Landed In Biscayne Bay	Snapper sp. (36%) Grunt (29%) Sand Perch (11%) Pinfish (4%) Trout sp. (3%) Other (17%)	Grunt (35%) Snapper sp. (25%) Pinfish (8%) Sand Perch (7%) Jack sp. (7%) Other (18%)	Grunt (32%) Snapper sp. (25%) Grouper sp. (9%) Sand Perch (6%) Trout sp. (5%) Other (23%)	Grunt (34%) Snapper sp. (19%) Sand Perch (9%) Grouper sp. (7%) Other (23%)	Grunt (50%) Snapper sp. (22%) Grouper sp. (7%) Porgy (4%) Sand Perch (3%) Other (14%)	Grunt (31%) Snapper sp. (20%) Bonefish (7%) Trout sp. (3%) Porgy (3%) Other (36%)	Grunt (43%) Snapper sp. (35%) Barracuda (6%) Grouper sp. (3%) Other (13%)	Grunt (51%) Snapper sp. (31%) Trout sp. (4%) Bonefish (3%) Barracuda (3%) Other (8%)	Grunt (64%) Snapper sp. (17%) Barracuda (5%) Jack sp. (3%) Other (11%)	Grunt 48%) Snapper sp. (19%) Bluerunner (12%) Sand Perch (4%) Other (17%)	Grunt (32%) Snapper sp. (27%) Bluerunner (10%) Mackerel sp. (8%) Other (23%)
Total # Fish Recorded from Biscayne Bay	324	575	845	1585	828	974	1127	1492	1482	1659	916
Total # Fish/ Angler Hour	1.02 fish/hr	0.90 fish/hr	0.87 fish/hr	0.89 fish/hr	0.58 fish/hr	0.89 fish/hr	0.76 fish/hr	0.83 fish/hr	1.24 fish/hr	1.12 fish/hr	1.26 fish/hr

SOURCE: DADE MARINE INSTITUTE SURVEY, 1979.

FIGURE 7
COMMERCIAL FISH LANDINGS IN DADE COUNTY



—Volume and value of seafood landings, Dade County, 1971-1976.



—Average monthly landings of fish and shellfish, Dade County, 1971-1976.

Source: Florida Agricultural Market Research Center—1979 in Mathis, et. al., 1979

The oldest commercial activity in Biscayne Bay is the harvesting of sponges, where high-quality sponges have been harvested since the middle of the 19th century. An 1896 publication entitled "Notes on Biscayne Bay" describes sponges found in Biscayne Bay as being of "a finer quality and faster growing than those found in the ocean reefs..." Most sponges in Biscayne Bay are harvested south of Black Point by using a series of hooks dragged along the bottom. Diving for sponges is illegal. Although there is no limit on the number of sponges that can be taken, there is a five-inch diameter minimum size for sponges that can be taken.

The sponge resources of southern Biscayne Bay are likely to remain healthy, aided in part by the development of synthetic sponge material which has lessened the demand for natural sponges. Sponging activity in Biscayne Bay has had annual cycles of harvesting intensity with the fall being the highest and summer the lowest. The annual harvest of sponges in Biscayne Bay constitutes approximately ten percent of the stock of marketable sponges.

Although most commercial fishing for foodstuffs occurs outside the Bay, a few of these fishermen do catch grouper, grunts, snappers, and jacks within the Bay. Both drift fishing and bottom fishing techniques are used, depending on the depth to which the line is to be dropped.

Commercial Sport Fishing

There are over 200 commercial sport fishing boats operating out of Biscayne Bay, the majority of which use the Bay only for access to the offshore reefs and the Gulf Stream. Many of these boats operate only during the months of the winter tourist season. Major docking facilities are located at Miamarina, Haulover Park, the Castaways Motel Docks, and several smaller docks on the west side of Collins Avenue. Crandon Park Marina, Dinner Key, and a few private docks round out the major facilities available for commercial sport fishing. Of the 52 charter boats in Dade County in 1976, 47 made over eleven thousand trips, yielding a gross return of more than $1,700,000 (Gentle, 1977).

Living Facilities

There are 800-900 houseboats and liveaboards in Biscayne Bay and its adjacent tributaries at any given time. Houseboats are floating houses permanently or temporarily moored, usually at docks or bulkheads, while liveaboards are boats which are used primarily as permanent places of residence. Permanent houseboats and liveaboards maintain dockage year round, while transient houseboats and liveaboards generally come into Dade County from the outside and stay in the Bay for only a day or so. Transient houseboats may be rented for brief excursions down the Bay or into adjacent waters. Major concentrations of houseboats are found in North Bay Village, along Indian Creek, and in the Little River and Miami River. Liveaboard dockage is provided in several areas, with Miamarina and Dinner Key having a combined total of 250 wet slips.

There are a number of stilt houses located in the Safety Valve south of Key Biscayne. These existing structures have been issued "campsite leases" by the Florida Department of Natural Resources. These leases will expire in 1999 and no new leases are being issued.

Utility Corridors

Submerged bottom lands are currently used as utility corridors for telephone, sewer, and power lines from the mainland to the filled and barrier islands. Florida Power and Light has cross-Bay cables in six locations. Information on telephone cables is not available. Sewer lines cross the Bay from Interama to the ocean outfall; from the downtown area to Virginia Key; and from Fisher Island to Virginia Key. Water lines run to the barrier and filled islands along the seven Causeways that cross the Bay.

Past Uses of Bay Waters and Submerged Lands

In the past, the Bay has been routinely used as receiving waters for poor quality water and other undesirable materials discharged from upland areas and canals. The Bay itself has also been filled extensively to create new land. Although the Bay still receives stormwater runoff and canal discharges, the dumping of untreated wastes from sewage and industrial plants has been virtually eliminated, and filling is allowed only under the most rigidly controlled circumstances. Dredging for fill, a common practice until the late 1960's, has been curtailed, and today the cases in which dredging is permitted are severely limited.

Water Dependent Uses of the Shoreline

There are a number of land uses that depend on the Bay for their existence and frequently require a landside base directly at the water's edge. Many commercial, recreational, or navigation and shipping activities are also either water dependent or substantially water oriented. While power plants are not always water dependent, two existing plants along the shoreline are Bay dependent. Both Turkey Point and the soon to be activated Cutler Plant depend on fuel which is delivered by barge. The Cutler Plant depends on Bay water for cooling water.

Commercial-Recreational Uses

Two commercial tour boat companies, Nikko Sightseeing Tours and the Island Queen, offer cruise trips within the Bay. Between these two operators, attractions such as the Seaquarium, Viscaya, bird feeding areas and general views of the urban waterfront are provided to a large number of residents and tourists.

Outside of charter fishing boats, there are limited opportunities to rent boats in Biscayne Bay (see Appendix V). Sailboat rentals are concentrated in the Dinner Key region, and limited power boat rentals are available in north Dade. Boat rentals in south Dade are generally confined to trailerable boats.

The Seaquarium is a privately-owned and operated tourist attraction featuring performing porpoises, whales, and dolphins. Over 1 million visitors a year come to this attraction. The Seaquarium recycles 14 million gallons of water a day from the Bay. The water returned to the Bay is of comparable quality to the water taken into the Seaquarium.

The Marine Stadium is operated by the City of Miami Parks and Recreation Department. The stadium contains a track that can be extended from 1 3/4 miles to 3 miles. Many events are held at the stadium, including powerboat races, water-skiing, boat shows, aqua-shows and concerts. Access to the stadium is from the Rickenbacker Causeway.

Stationary Fishing

In spite of extensive waterfront development, there are still some areas along the Bay shoreline that provide good stationary fishing, the best being bridges, canal outlets, and the Haulover Inlet. Although there is no shortage of bridges in Dade County, many spans are not open to the public. The most notable bridges that are open to the public are Rickenbacker, Bear Cut, and the MacArthur Causeway. Spans not open to the public include the Venetian and Julia Tuttle Causeways.

Marinas and Launching Facilities

There are 79 public and private marinas located along the shoreline of Biscayne Bay and its tributaries (see Figure 8 and Appendix VI). More than half are commercial facilities which provide 1,719 wet and 2,042 dry slips, respectively; however, about 65 of these are used exclusively for repair services only and are not available for general boat storage. The twelve publicly owned marinas operated by the County and the City of Miami provide 1,762 wet and 471 dry slips, plus 12 boat ramps and three hoists. In addition, there are numerous private clubs, apartment and condominium docks which bring the total number of slips located along the Bay or its tributaries to 5,285 wet and 2,857 dry berths, respectively. As of March 1980, over 5,000 wet and dry slips have been identified as either proposed or under construction (see Figure 9) along Biscayne Bay.

In addition to these larger facilities, an estimated 3,600 wet berths are located along the embayments from Broad Causeway northward. A 1977 aerial survey revealed that two-thirds of the 2,200 bulkheaded and 1,400 of the non-bulkheaded slips were vacant. The wet berth sites in this North Bay area could, in the event of a hurricane, provide protection from wind and wave action. Except for the 240 wet berths potentially available at Interama, the remainder are located at private residences (Connell, Metcalf and Eddy, 1978).

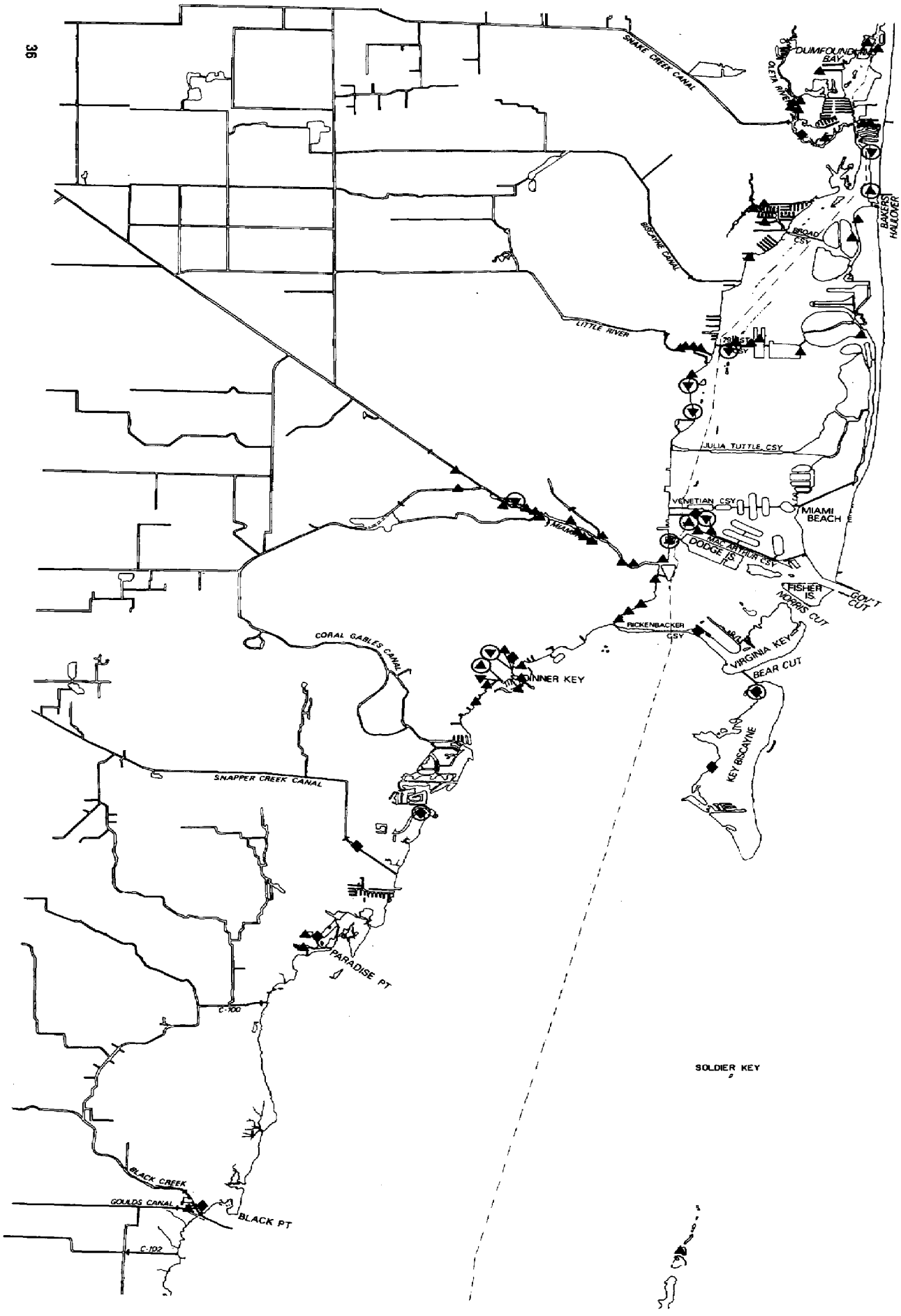
The Miami River and Coral Gables Waterway have, in the past, provided havens of refuge for boats during hurricanes. These two areas are currently, and will in the future, be inadequate in serving the boating population with hurricane refuge (Connell, Metcalf & Eddy, 1978). A hurricane evacuation program for boats does not yet exist.

The Port of Miami

The major water port in Dade County is the Port of Miami located on Dodge Island. Other local shipping terminals include facilities on the Miami River, an oil terminal on Fisher Island and the MacArthur Causeway, the Miami Herald dock, the TMT trailer ferry dock, and the FEC terminal on Biscayne Boulevard. Altogether, these facilities provide over 30,000 linear feet of berthing space and more than 40 acres of covered and 141 acres of open storage (Cloverdale and Colpitts, 1978).

The Port of Miami is accessible by all major modes of transportation. The major rail line leading to the port crosses Biscayne Boulevard, and for this reason, rail service is only allowed during nighttime hours. Major roads leading to the Port include US 1 and I-95. The Government Cut shipping channel provides direct access to the Ocean and to the Intracoastal Waterway.

The Port of Miami is operated by the Dade County Seaport Department. The "Port of Miami: Update of Master Development Plan" shows that facilities completed or under construction include 12,700 feet of berthage used by cargo, passenger and research vessels;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BROAD CSY
BISCAYNE CANAL
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JULIA TUTTLE CSY
VENETIAN CSY
MIAMI BEACH
MACARTHUR CSY
DODGE IS
FISHER IS
MORRIS CUT
GOV'T CUT
PICKENBACKER CSY
CORAL GABLES CANAL
INNER KEY
VIRGINIA KEY
BEAR CUT
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SOLDIER KEY
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GOULDS CANAL
BLACK PT
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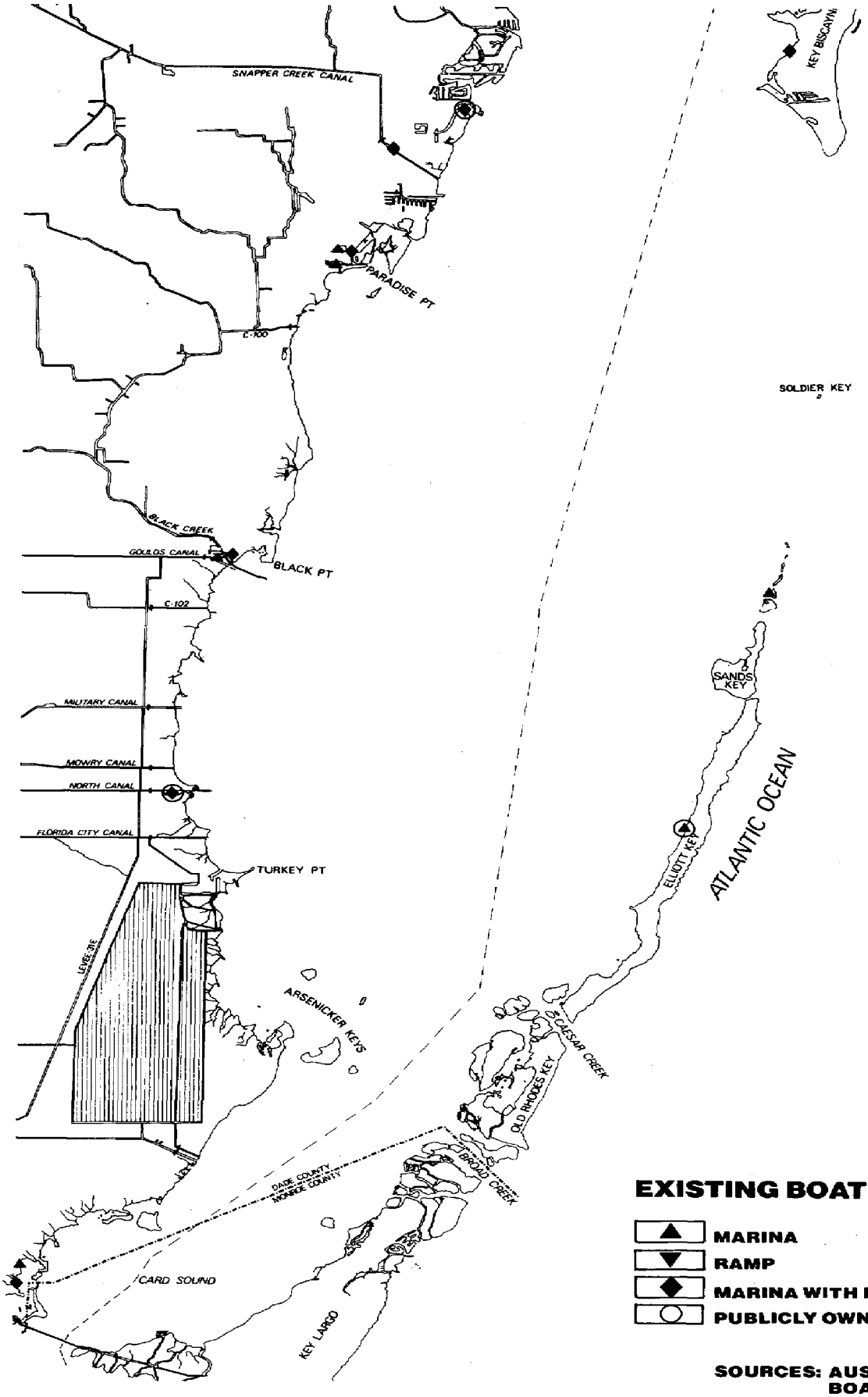
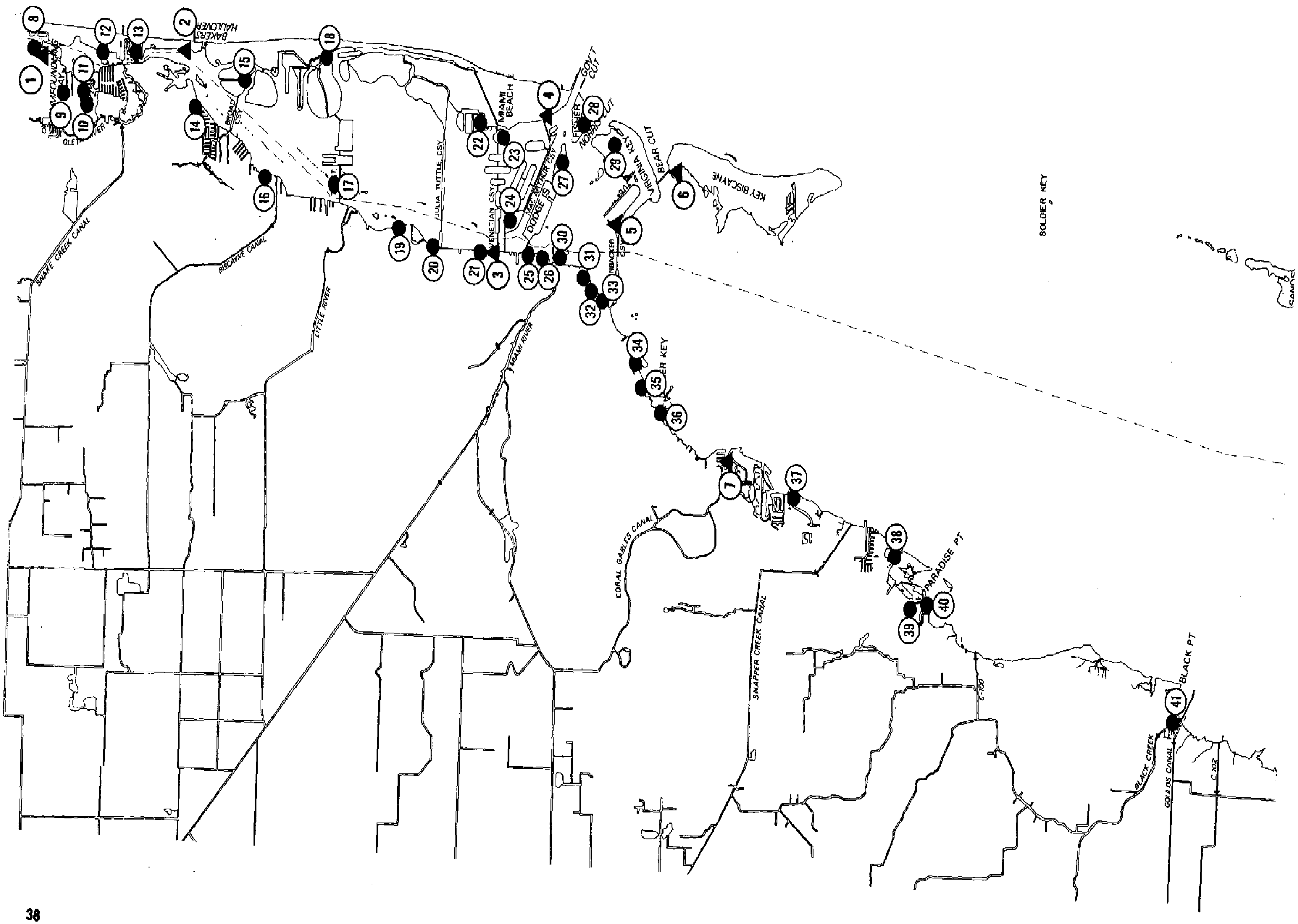


FIGURE 8

EXISTING BOATING FACILITIES

- MARINA
- RAMP
- MARINA WITH RAMP
- PUBLICLY OWNED FACILITY

SOURCES: AUSTIN, ET. AL., 1977
BOATING ALMANAC, 1979
WATERWAY GUIDE, 1979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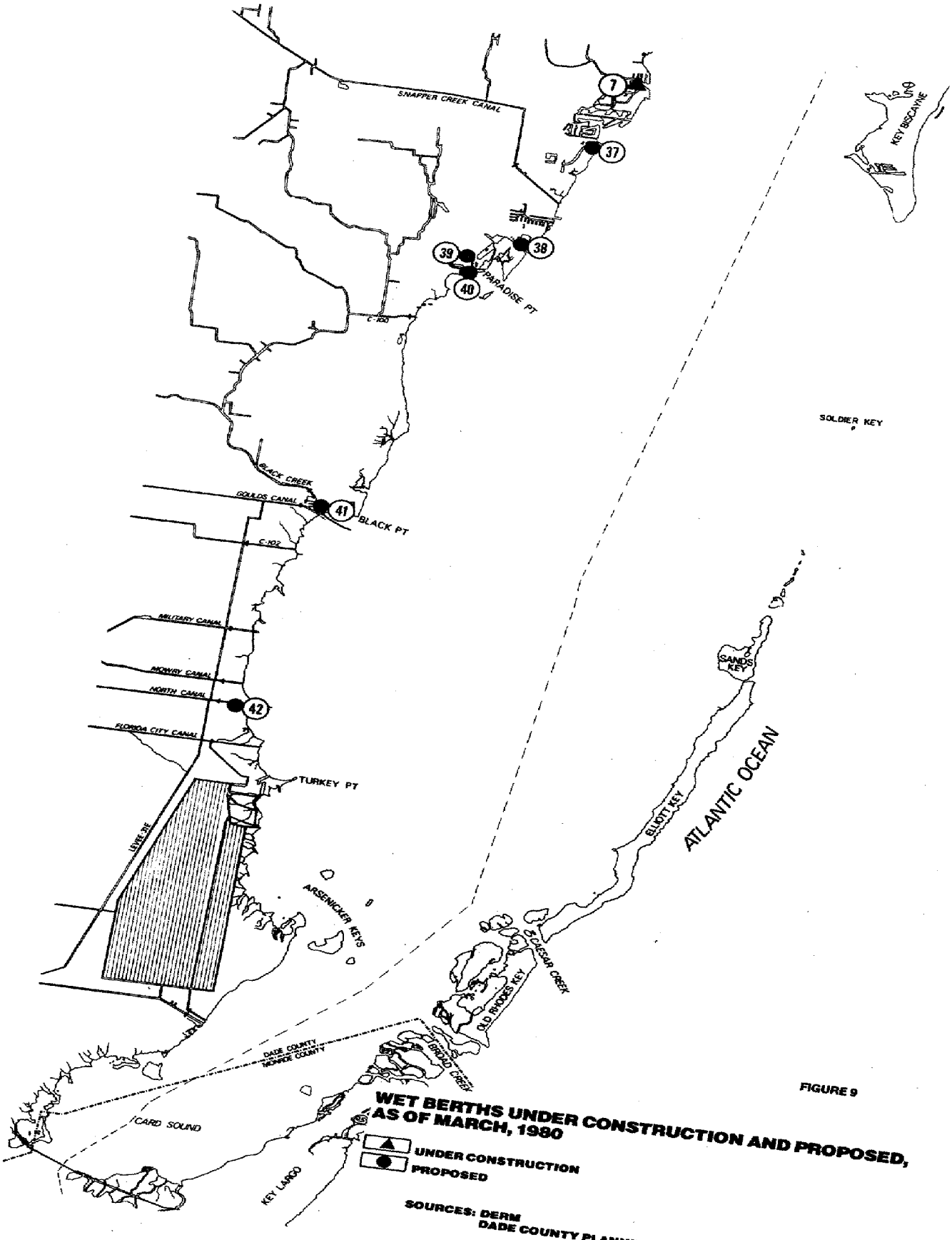


FIGURE 9

WET BERTHS UNDER CONSTRUCTION AND PROPOSED, AS OF MARCH, 1980

▲ UNDER CONSTRUCTION
● PROPOSED

SOURCES: DERM
DADE COUNTY PLANNING DEPARTMENT

Key: Figure 9 Wet Berths Under Construction and Proposed, as of March 1980

Berths Under Construction[1]

1.	Aventura/Turberry Isles (Edon Yacht)		93 wet slips
2.	Haulover Park		29 wet slips
3.	Omni Marina (Plaza Venetia)		200 wet slips
4.	South Beach		430 wet slips
			400 dry slips
5.	Marina Biscayne		77 wet slips
6.	Crandon Park Marina (additional)		99 wet slips
7.	Cocoplum		197 wet slips

Proposed* Berths[1,2]

8.	Aventura/Turnberry Isle (Expansion)		69 wet slips
9.	Marina del Rey (partial permitting)		150 wet slips
			500 dry slips
10.	Davies Project		25 wet slips
11.	Admiral's Port		19 wet slips
12.	Plaza of the Americas		63 wet slips
13.	Poinciana Isle	(large)	7 wet slips
		(medium)	10 wet slips
		(small)	100 wet slips
14.	Keystone Point		100 dry slips
15.	9350 Realty Corp.		7 wet slips
16.	Quayside	(permitted)	34 wet slips
		(additional)	19 wet slips
			25 on davits
17.	Pelican Harbor		272 wet slips
			400 dry slips
		(Phase II)	172 wet slips
18.	City of Miami Beach (Sailboat Marina)		# unknown
19.	Morningside Park		35 wet slips
			100 dry slips
20.	Magnolia - Stearns Parks		120 wet slips
21.	Pace Park		200 wet slips
			160 dry slips
			50 moorings
22.	Purdy Avenue		192 wet slips
23.	Nine Island Avenue Association		35 wet slips
24.	Watson Island		151 wet slips
25.	Miamarina		122 wet slips
			50 moorings
26.	Bayfront Park (temporary tie-ups along proposed bulkhead)		# unknown
27.	Port Expansion		
28.	Fisher Island		80 wet slips
29.	Virginia Key		380 wet slips
30.	Brickell Key (Claughton Island)		97 wet slips
31.	Vizcaya North		72 wet slips
32.	Brickell Marina (Villa Regina)		49 wet slips
33.	Grand View		41 wet slips
34.	Grove Isle		98 wet slips
35.	L'Hermitage		20 wet slips
36.	Dinner Key - Phase I & II		# unknown
37.	Matheson Hammock		99 wet slip expansion
38.	Chapman Field		492 wet slips
39.	Coral Reef Yacht Club		27 wet slip expansion
40.	Royal Palm Yacht Club		75 wet slips
41.	Black Point		354 wet slips/
			300 dry slips
42.	Homestead Bayfront Park - Phase I		265 wet slips
	Phase II		375 wet slips/
			360 dry slips

[1] Dade County Department of Environmental Resources Management

[2] Greenleaf/Telesca, "Comprehensive Marina Development Study," Miami, Florida, February, 1979.

*These proposed facilities figures include projects for which no permits have been sought. These proposed figures do not reflect recommendations of this project.

storage, administrative, maintenance, parking, and transportation facilities. The present range of berths is as follows: passenger ships, 8-9; break-bulk cargo, 6-10; roll-on/roll-off cargo, 5-8; and lift-on/lift-off cargo 2-3. Extensive improvements are currently being made to the Port of Miami to improve its capacity and accessibility. Work is being scheduled in several phases between now and the year 2000. For the first two phases, which are scheduled to be completed in 1986, an estimated $79.7 million will be spent on such improvements as widening and deepening the main ship channel; extending the Port to Lummus Island; additional cargo and passenger facility construction; and enlargement of the turning basin.

Additional Marine Freight Terminals

There are 35 additional marine freight shipping terminals in the Port of Miami Area (see Figure 10). These include the Belcher Oil Company dock located on Fisher Island and another dock also operated by Belcher Oil on the MacArthur Causeway. Other terminals located on this Causeway include the U.S. Coast Guard station; the Albury and Company Terminals, which are used for receipt and shipment of general and containerized cargo, and the Florida Power and Light dock which is used for mooring a research vessel and receiving plant equipment.

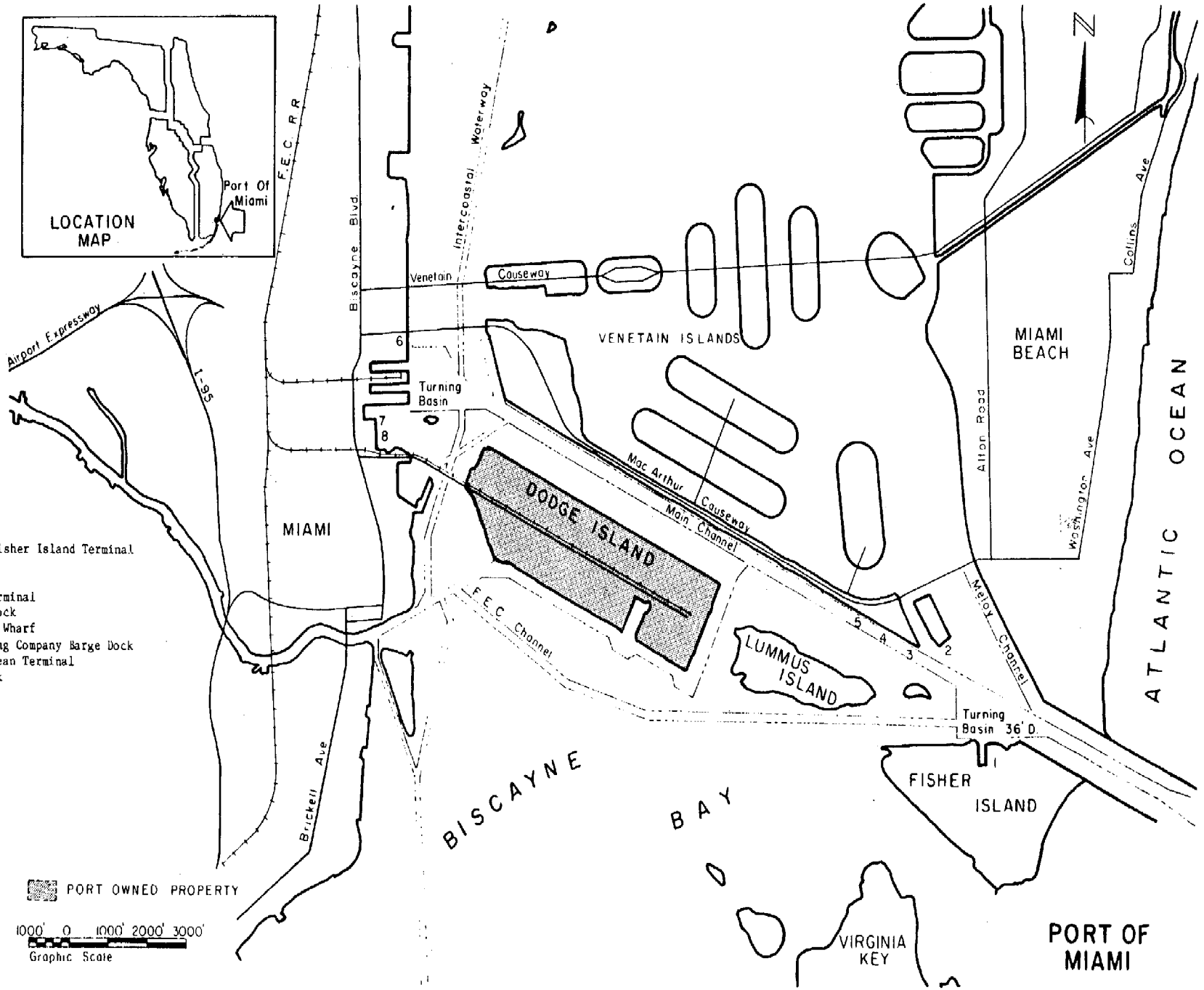
On the west side of the Bay in the downtown area are the Miami Herald dock which provides for direct delivery of large rolls of newsprint to the Herald's storage room, the Florida East Coast and T.M.T. terminals, both of which are owned by the F.E.C. Railroad. These two facilities handle roll-on/roll-off trailers, automobiles, and machinery. A rail connection is provided between these terminals and other F.E.C. rail lines.

The terminals on the banks of the Miami River are used only for shallow draft vessels due to nine foot water depth. Among the uses accommodated at these facilities are seafood terminals, general cargo, containers and roll-on/roll-off cargo, and sand and aggregates. Five terminals on the river have transit sheds totaling 66,230 square feet of covered storage. Several of the terminals use space for mooring boats and floating equipment, and for fueling small boats. Repair facilities are included in several dockyards (see Appendix V).

Ship repair facilities are located on the Miami River, but drydock facilities are limited to 700 ton lifts. Nine marine repair and machine shop companies in the area have equipment and personnel to make major repairs to vessels at berth. Ten diesel tugs and towboats serve the Miami Harbor and the Miami River. Other marine related businesses in Dade County are covered in Appendix V.

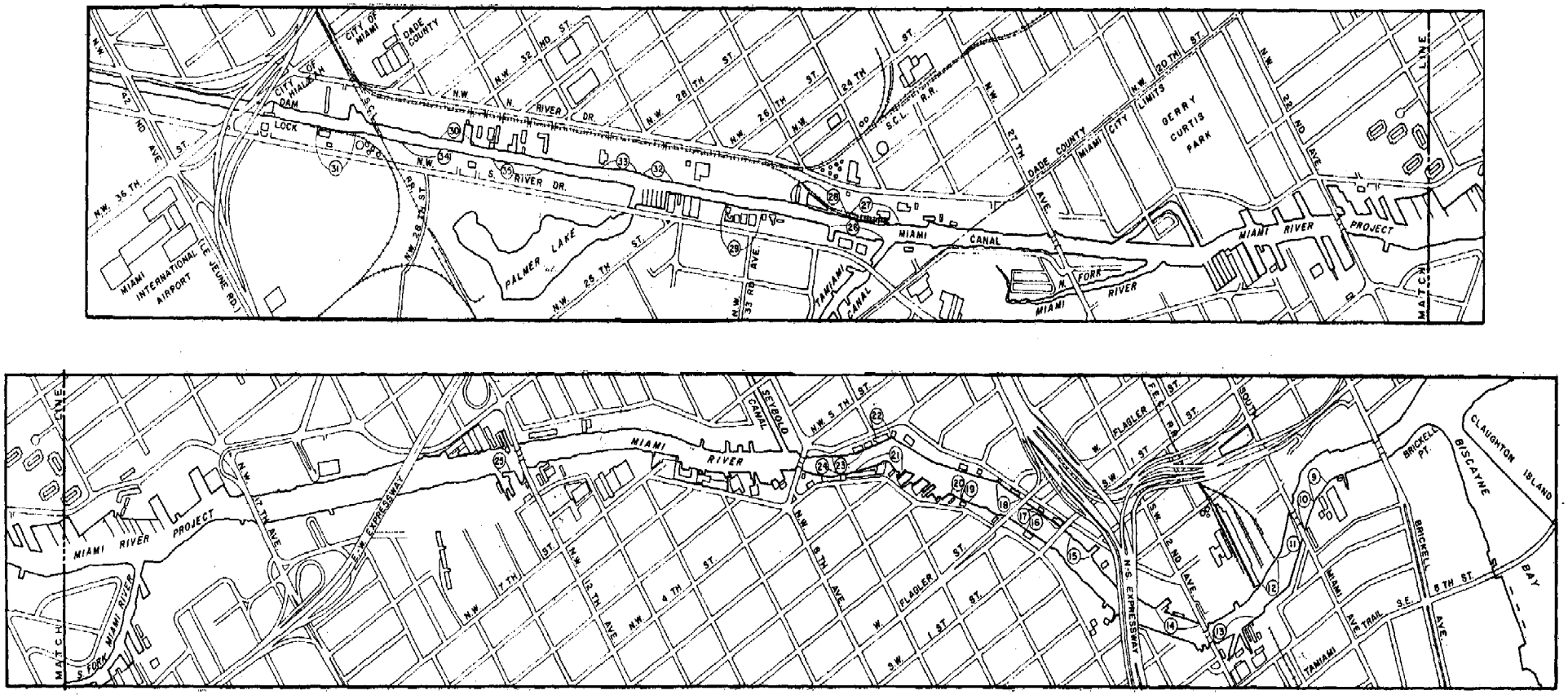
In summary, it is apparent from an examination of current conditions in and around Biscayne Bay that a series of complex relationships exists among the Bay and its various users. Some of the uses of the Bay, such as power boat cruising and line fishing, generally complement each other, while other uses, such as water-skiing and swimming/diving or pleasure boating and shipping may potentially be in conflict. Each user of the Bay, either through the passage of time, or the enactment of specific laws and regulations, has accrued certain "rights" with respect to the Bay

In the following chapter, guidelines are recommended relative to the impacts that various Bay or shoreline uses have on the continued health, accessibility and utility of the Bay. In addition, guidelines are proposed to minimize potential user conflicts and to establish a unified program for management of the Bay system.



1 Belcher Oil Company Fisher Island Terminal Dock and Slip
2 U.S. Coast Guard Base
3 Albury and Company Terminal
4 Belcher Oil Company Dock
5 Florida Power & Light Wharf
6 Miami Herald Publishing Company Barge Dock
7 Florida East Coast Ocean Terminal
8 TMT Trailer Ferry Dock

FIGURE 10



PORT OF MIAMI

EXISTING FACILITIES IN
MIAMI RIVER AND MIAMI CANAL

1000' 500' 0' 1000' 2000'

N

9	Cayman Marine Wharf (Pioneer Shipping, Inc.)
10	Atlantic Marine Industries
11	Allright Auto Parks
12	Victoria Caribbean Shipping
13	Miami Shipyards Wharf
14	Miami Marine Services
15	East Coast Fisheries
16	Florida Carib Fishery
17	East Coast Fisheries Main Wharf
18	Atco Marine
19	Two Friends Fish Company
20	W. G. Kreidt Dock
21	National Fisheries
22	Better Bait Company
23	REJ Investments
24	Superior Fish Company
25	Merrill-Stevens South Yard No. 1
26	Bernuth Marine Shipping
27	Shaw Lipscomb & Union Amsco
28	Antillean Marine Shipping
29	Trans-Caribbean Terminal
30	Desrocher Towing Company
31	Texaco Dock
32	Pioneer Shipping, Inc. (new site)
33	Aimco Scrap Iron
34	Melvin Shipping Service
35	Ship 'n Shore Marine Terminals

FIGURE 10

CHAPTER III

BAY MANAGEMENT RECOMMENDATIONS

In the preceeding chapters, background information on the Bay's resources and uses was presented. The general level of knowledge described provides the starting point for the Bay Management programs that are discussed in this chapter. The preparation of this overview has also highlighted several areas where additional data will be required for Bay Management.

In this chapter major environmental, user-related and management concerns are discussed. For each area of concern, guidelines are recommended stating what this management program should do to address that particular area of concern. Following the general adopted guidelines, existing and potential implementation methods are identified and a recommended course of action is outlined.

Because all of the problems and issues facing Bay Management are tied to the need for a comprehensive approach to Bay Management, the proposed Bay Management Program structure and initial management recommendations will be presented prior to the discussion of the individual issues and recommended programs.

Bay Management Program

From a management standpoint, Biscayne Bay may be best described as navigable waters of the United States overlying mostly Federal and private, as well as sovereign lands of the State of Florida. It is bordered by thirteen municipalities and Dade County. Authority to regulate any function within the Bay system is split among and within the various levels of government (see Appendix IX). While regulatory agencies have substantial authority over specific functions or problems in the Bay or along the shoreline, each must operate within the scope of its enabling legislation, thus creating a complex and highly fragmented approach to Bay management.

Complexity in jurisdictional control over resource utilization and management and coastal construction has in the past held off any viable management planning for the Bay area. However, the basic tenet of this management planning process is that a comprehensive management program for Biscayne Bay must coordinate the many aspects of Bay Management in order to ultimately achieve a unified, approach to the management of Biscayne Bay. As an initial step toward this end, the County Commission adopted the following goal and program objectives as the first element of the Bay Management Plan (R-1610-79):

Primary Goal. The primary goal of this planning project is to develop a unified, Countywide management plan for the entire bay system, including its adjacent wetlands, embayments and contiguous developed shorelands in a manner that will maintain or enhance where necessary, those physical, chemical, biological and aesthetic qualities that provide the basic character and value of this resource.

Program Objectives. In order to realize this primary goal, the following program objectives shall be achieved:

- to address and resolve the jurisdictional issues relating to Biscayne Bay in order to provide long-term management capability;

- to provide a wide array of water oriented opportunities at the water's edge, consistent with the primary goal;

- to enhance physical and visual access thereby increasing the potential for environmentally sound utilization and attractiveness of Biscayne Bay for the public at large;

- to identify and maintain, or enhance where necessary, those biological communities that are essential to the long-term viability of Biscayne Bay;

- to optimize the quality and quantity of marine life;

- to maintain, or enhance where necessary, water quality that permits safe water contact recreation and propagation of fish and wildlife;

- to provide protection for endangered, threatened or rare species of plants and animals that exist within the waters of Biscayne Bay or the adjacent coastal wetlands;

- to avoid irreversible or irretrievable commitments of the Bay's resources;

- to seek funding for activities which are necessary to achieve the primary goal;

- to promote water transportation and enhance the Bay's contribution to the economic health of the community through marina development and other appropriate measures consistent with the primary goal; and

- to provide continuing monitoring of the Bay in order to assemble an adequate data base for Bay management.

In order to begin a judicious and logical procedure for accomplishing the primary goal and objectives of the Bay Management Program, the following Bay Management guidelines are adopted:

- Dade County should pursue delegation of portions of Federal and State permitting and regulatory authority over resource planning and management and coastal construction in order to establish a coordinated Bay Management program.

- The County shall seek all appropriate legislative and administrative changes that are necessary to create a coordinated, unified countywide Bay Management Program.

- Baseline data should be obtained on a routine basis and used to improve Bay management capability.

- A centralized research library, including all relevant Bay-related physical, biochemical and socio-economic information should be created and utilized to assess all future impacts on the Bay.

It is a basic premise of this Management Plan that Dade County, the only local governmental entity which encompasses the entire Bay system, is most capable of coordinating the implementation programs which are recommended in this Management Plan. To accomplish this the County must create an administrative mechanism to bring many diverse elements and participants together into a cohesive, coordinated Bay Management program. In doing this the County should seek a mechanism which is: (1) capable of addressing multi-jurisdictional issues; (2) is least duplicative and (3) is most cost effective.

In order to achieve the maximum degree of coordination among the Federal, State and local authorities which have major jurisdictional controls over Biscayne Bay, primarily the U.S. Corps of Engineers, the National Park Service, the Florida Department of Environmental Regulation, the Florida Department of Natural Resources, Dade County and the twelve municipalities which border the Bay, the following Bay Management approach is recommended:

(1) That a Committee of the County Commission be established by ordinance to oversee the continual progress on the several programs and actions that are proposed as the elements of the Bay Management Program.

(2) That the Committee shall be composed of 13 members of whom 9 shall be appointed by the Board of County Commissioners, as follows:

3 members of the Board of County Commissioners;
2 members recommended for appointment by the Dade League of Cities; and
4 members from the Dade County community appointed by the Dade County Manager.

Except as specified below for the initial appointments, those members appointed by the Board of County Commissioners shall serve for a term of 2 years. The remaining 4 members shall be the District Engineer of the U.S. Army Corps of Engineers, the Superintendent of the Biscayne National Park, the Secretary of the Florida Department of Environmental Regulation, and the Executive Director of the Florida Department of Natural Resources. Members shall serve without compensation, but shall be entitled to be reimbursed for necessary expenses incurred in the performance of their official duties, upon approval by the County Manager.

In order to ensure continuity of membership on the Biscayne Bay Management Committee, the terms of membership on the Committee shall initially be as follows: One member of the Board of County Commissioners, one member recommended for appointment by the Dade League of Cities and two members recommended for appointment from the Dade County community by the Dade County Manager shall serve for a period of 1 year. At the end of that one year period, successors to memberships shall be appointed for a period of 2 years. The County Manager shall designate a member of his staff to serve as Executive Secretary to the Committee. Additional staff support shall be provided by the Department of Environmental Resources Management and Planning Department upon approval of the County Manager. The process of appointment and other requirements of Ordinance 80-136 shall be followed.

(3) That the Committee shall hold a minimum of two publicly advertised meetings per year to review progress on the Bay Management Plan and to make policy decisions regarding programs and actions that are specified within this Plan.

(4) That the Dade County Planning Department be designated as having primary responsibility for monitoring progress on the Bay Management Planning programs and updating the implementation schedule annually and that a budget of $75,000 per year be allocated for that purpose.

(5) That adequate resources be allocated for the specific program tasks to be provided by the Dade Environmental Resources Management, Park and Recreation, Public Works and Building and Zoning Departments.

(6) That the Committee shall be empowered to appoint sub-committees or task forces to address specific Bay-related issues.

(7) That following public hearing, the Committee be empowered to add programs to those that are identified in this Plan or to refine program elements identified in this Plan, based upon increased and improved baseline data.

(8) That the Board of County Commissioners be designated as the Bay Management Committee until such time as the Committee has been appointed and is able to function as described in the ordinance which establishes the Committee.

In addition to overseeing progress on all of the programs that are discussed under the environmental and user-related sections of this chapter, the following are recommended as immediate or short term actions to be taken by the Board of County Commissioners to implement the Bay Management Plan:

(1) That the Board of County Commissioners adopt the Biscayne Bay Management Boundary as shown in Figure 1 and outlined in the Legal Description as defining that area within which the implementation programs described in this Plan shall apply, except as specified in (8) on Page 49 and (1) on Page 76.

(2) That in adopting this Plan, the Board of County Commissioners refine the primary goal to read as follows:

> "The primary goal of this Plan is to provide a unified management system for the entire Bay that will, upon implementation, effectively maintain and enhance those physical, chemical, biological and aesthetic qualities that provide the basic character and values of this resource."

(3) That Dade County in conjunction with Monroe County seek to enter into Resource Management Agreement(s) with the Division of State Lands of the Florida Department of Natural Resources to prepare and implement the Management Plan for the Biscayne Bay Aquatic Preserve.

target date - 6 months from adoption of this Plan

(4) That the County seek strong support from the Dade Delegation to the Florida Legislature to obtain the following during the 1981 Legislative session:

(a) Continued funding for the Biscayne Bay Restoration and Enhancement Program through an appropriation of 3.5 million dollars for the fiscal years 1981-83.

(b) Funding through the Department of Natural Resources for the preparation and development of the Management Plan for the Biscayne Bay Aquatic Preserve.

(c) Amendment of the statutory language contained in Chapter 370.102 F.S. which limits the regulation of fisheries to the state to permit County regulation in counties which have a fisheries management program approved by the Department.

(d) Amendment to the statutory language contained in Chapter 253.124 F.S. to read that all applications for filling permits in Home Rule Charter Counties must be approved by the County.

(5) That the County Attorney's Office review other legislative changes that may be required to implement this Plan.

target date - 6 months

(6) That Dade County seek the appropriate interagency agreements with the Corps of Engineers to obtain the administrative authority of a Corps General Permit for certain coastal construction activities such as the permitting of small docks and seawalls.

target date - 1 year

(7) That Dade County seek delegation from the Florida Department of Environmental Regulation for regulation of certain coastal construction activities within this County.

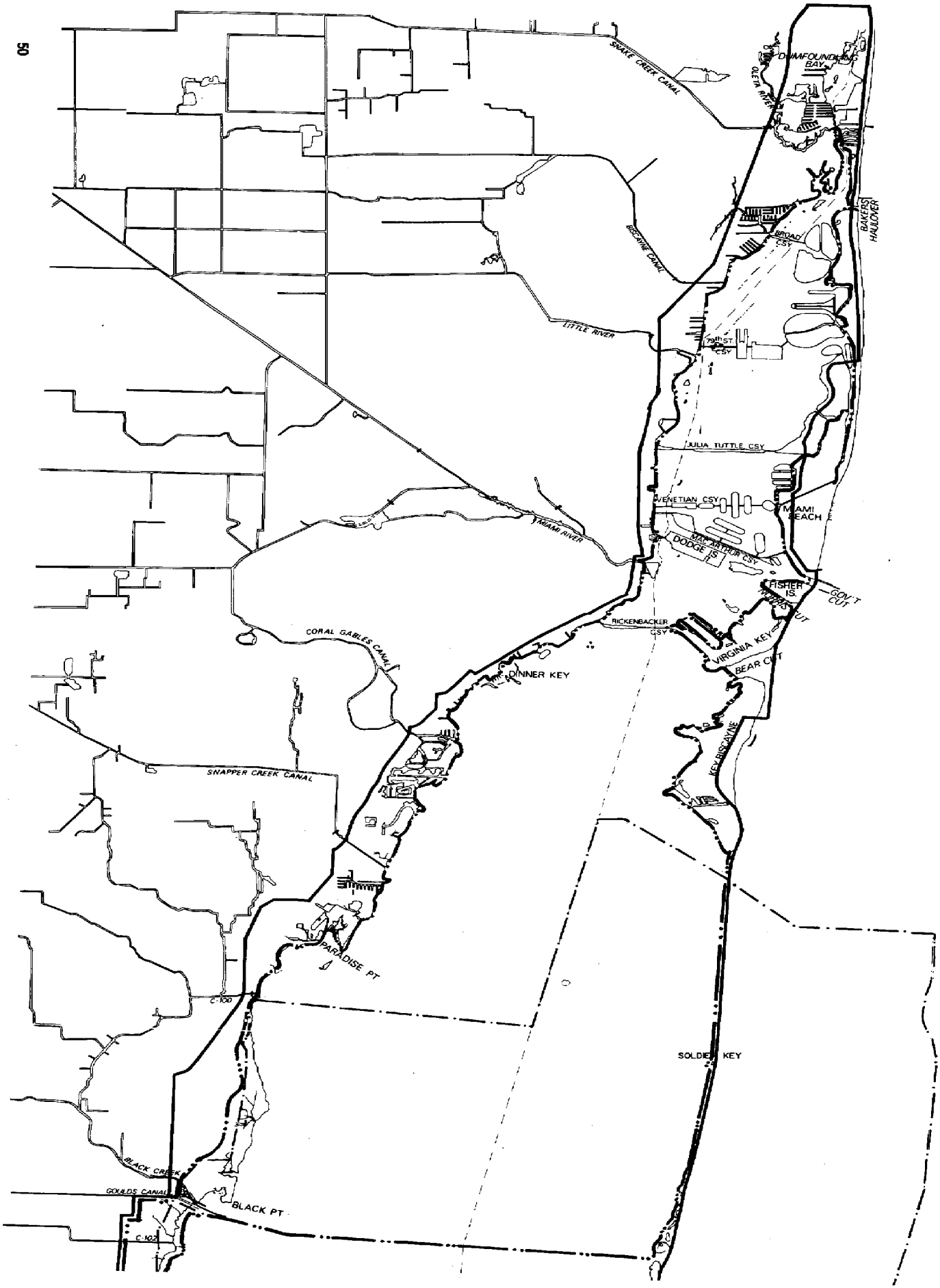
target date - 1 1/2 years

(8) That the County should amend Chapter 33 of the Dade County Code to give the Development Impact Committee (DIC) the authority to review all proposed public and private bayfront developments (excluding single family and duplex, or as specified in the ordinance of adoption) within a boundary defined by the closest parallel existing public roadway to the Bay where such exists or otherwise by the Bay Management Boundary as shown in Figure 1 and defined in the Legal Description. That the required review will not become effective until review criteria are developed (as specified in (9) on Page 52 and (3) on Page 77).

a. All developments (excluding single family and duplex, or as specified in the ordinance of adoption) within the boundary specified in (8) and all planning studies within the Bay Management Boundary shall be reviewed by the DIC within a specified time frame.

b. Following DIC review, the Board of County Commissioners shall forward its recommendations to the appropriate municipality for its consideration and action.

c. For this review only, the DIC shall be expanded to include representatives from all appropriate agencies and the cities in which the development under review is proposed. Also, staff from cities adjacent to a proposed development action will be included in the review process.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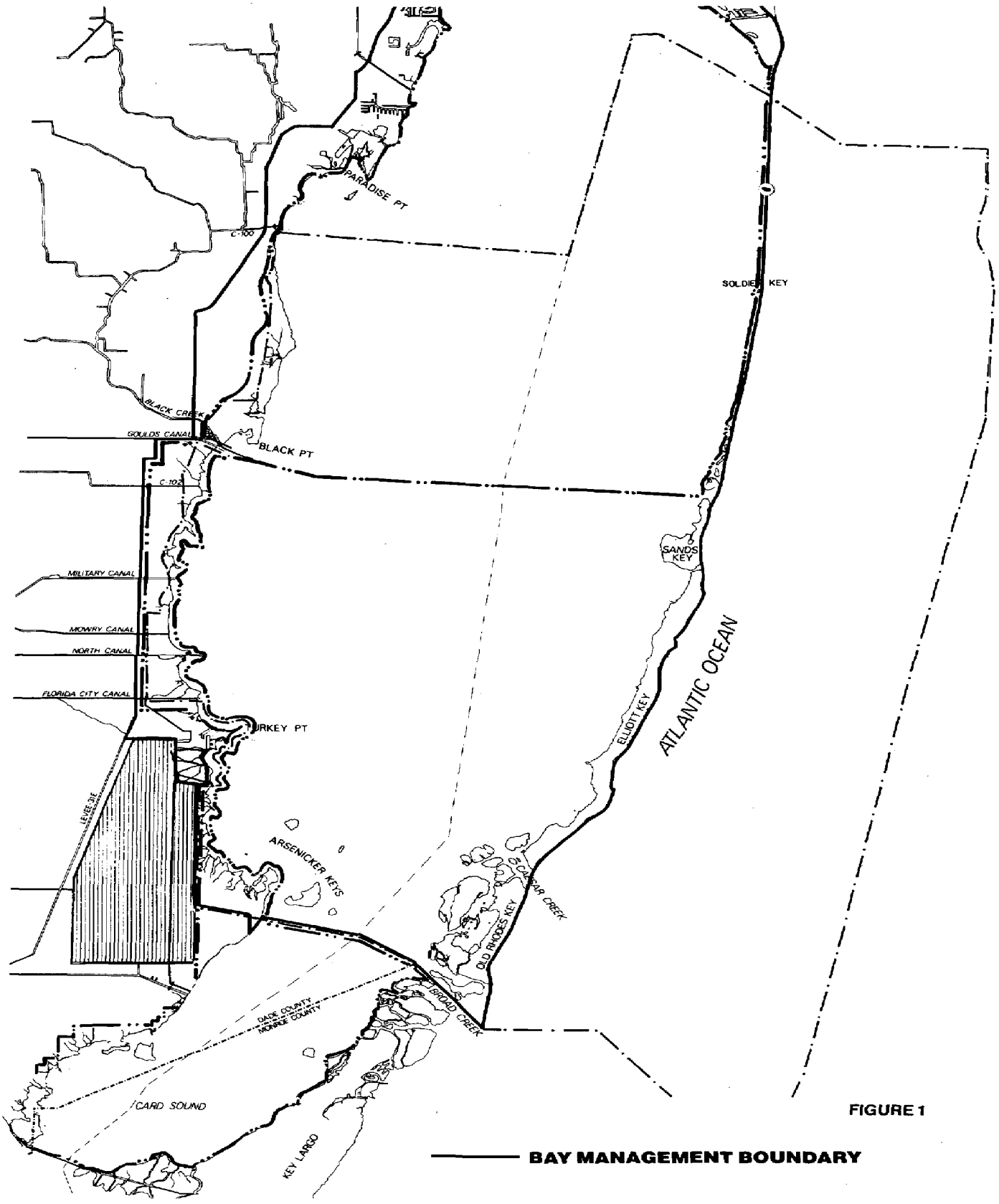


FIGURE 1

BAY MANAGEMENT BOUNDARY

BISCAYNE NATIONAL PARK BOUNDARY

APPROXIMATE BISCAYNE BAY AQUATIC PRESERVE BOUNDARY (CHAPTER 16Q-18, FLA. ADMIN. CODE)

d. A certain minimum number of the DIC membership will be required to have expertise in landscape architecture, architecture and environmental planning.

e. In addition to design criteria and objectives that are included within the recommendations under "Visual and Physical Access" (see Page 95), the following objectives shall be applied in this DIC site review process.

- That development or redevelopment be compatible with the natural, physical, and socio-economic characteristics of the area.

- That development adjacent to Biscayne National Park shall respect and preserve the natural and visual qualities of the Park.

- That development within the shoreline area north of Biscayne National Park shall be done in a manner that will enhance and be enhanced by the recreational, aesthetic, and visual qualities of the Bay and adjacent northern embayments.

- That development along the Bay shoreline shall be reviewed as a total site plan including both in-water and upland improvements.

- That development shall be reviewed in the context of existing and proposed developments within the Bay Management Boundary encompassed by a radius of two miles.

target date for adoption of ordinance - 2 months from adoption of Plan

(9) That the County in conjunction with the Bay shoreline communities develop review criteria to apply to all uses more intensive than single family or duplex or as specified in the ordinance of adoption within the boundary specified in (8) Page 49.

target date - 1 year

(10) That the County approve a supplemental budget of $100,000 for Bay Management Activities for fiscal year 1981.

target date - immediate

(11) That the County initiate a "Decade of the Bay" bond program to supplement state and federal funds in order to achieve the multiple objectives of this Management Program.

(12) That implementation of this DIC review process shall provide for an application process fee that is adequate to cover the costs of processing.

Environmental Concerns

In this section more than 65 guidelines are presented under eight major headings: Freshwater Discharge, Stormwater Runoff, Sewage Discharge/ Pathogens, Solid Waste Disposal Sites, Boating Impacts, Fishing Impacts, Development Impacts and Habitat Management. Taken together these guidelines are statements of intent regarding the initial steps toward implementing the seven following program objectives:

- to identify and maintain, or enhance where necessary, those biological communities that are essential to the long-term viability of Biscayne Bay;
- to optimize the quality and quantity of marine life;
- to maintain, or enhance where necessary, water quality that permits safe water contact recreation and propagation of fish and wildlife;
- to provide protection for endangered, threatened or rare species of plants and animals that exist within the waters of Biscayne Bay or the adjacent coastal wetlands;
- to avoid irreversible or irretrievable commitments of the Bay's resources;
- to seek funding for activities which are necessary to achieve the primary goal;
- to provide continuing monitoring of the Bay in order to assemble an adequate data base for Bay management.

Following the guideline statements, the implementation process is taken further to explore existing and potential implementation programs. For each program identified, potential impediments to implementation, major agency or group responsibilities and possible sources of funds are identified to the extent that they are presently known.

In several instances it will be noted that a single guideline can be implemented by a number of implementation programs. This format stresses the use of existing laws and programs to achieve guideline implementation rather than the creation of new programs.

Fresh Water Delivery Schedule

Water management and delivery practices impact salinity regimes in the Bay. With construction of the canal drainage systems, fresh water flows into the Bay have been substantially affected in quality, quantity and time. The timing of delivery has changed from natural wet season flows through low drainage ways and prolonged dry-season groundwater seepage to regulated pulse discharges and decreased ground water flows. It has been reported by commercial fishermen that this has necessitated an increase in fishing time and territory to achieve the same size catch.

Background. Buchanan and Klein (1976) have described the effects of water management on fresh water discharge to Biscayne Bay as follows:

> Prior to development in southeast Florida, fresh-water discharge to Biscayne Bay consisted of flow through natural drainageways, overland flow, and coastal underseepage from the Biscayne aquifer. Through the years, the characteristics of the fresh-water flow have changed from natural, sporadic, short bursts of rainy-season flow through the low drainageways and prolonged dry-season coastal underseepage, to regulated discharge through drainage canals and decreased periods of coastal underseepage.
>
> The fresh-water flow to Biscayne Bay has been significantly reduced in quantity and in time, due to extensive flood and water-control measures and water-management practices instituted after the extensive flooding of 1947. By the end of 1962, surface flows could be fully controlled in the Everglades by a system of levees and canals, water-conservation areas, pumps, and flow regulation structures. Thus, since 1953 annual fresh water flow to Biscayne Bay has been reduced by about 20 percent and the duration of storm water runoff has also been reduced. Flood control measures in south Dade County have altered the pattern of fresh-water flow to the Bay. Ground-water levels recession rates in south Dade County are twice as rapid as they were before the implementation of flood control measures there. This means that the Bay receives fresh-water runoff for only about half as long after a storm as it did previously.

Effects on the Bay. The lowering of the fresh water table and the almost complete control of water flow into the Bay has had significant effects on salinity regimes in the Biscayne Bay system. The Coast and Geodetic Survey Navigation Chart No. 166, published in 1896, showed the location of "fresh water" springs in the Bay nearly 3/4 of a mile from shore. Mariners and spongers obtained fresh water by lowering kegs into the springs, without having to set foot on land. In 1964, a study determined that the water discharging from the aquifer at the shoreline was no longer completely fresh, but contained 1-2 parts/thousand salt water (Kohout and Kolipinski, 1964).

Presently, most of north Biscayne Bay, Card and Barnes Sounds register salinities as great as, or greater than, sea water throughout most of the year. However, in the nearshore regions of central and southern Biscayne Bay salinities continue to reflect changes in rainfall, groundwater seepage and canal outflows during the rainy season. The measureable dilution of sea water along the western shoreline causes the formation of a rainy season east-west salinity gradient which increases from brackish to full strength sea water proceeding from the land toward the ocean. The reverse pattern predominates during the dry season, when salt concentrations higher than those found in normal sea water are recorded along the western shoreline (Lee and Rooth, 1975).

These greatly reduced conditions of fresh water inflow have been sufficient to induce conditions of biological zonation, especially among sea grasses, snails and certain shrimps. Many juvenile marine fishes and invertebrates are adapted to the lower nearshore salinities for protection from larger predators which are incapable of living in extremely brackish conditions. Thus, the maintenance of lowered salinities and the summer east-west salinity gradient is a major factor in preserving the Bay's role as a nursery ground for many marine organisms that are important to both the commercial and sport fisheries.

In addition to the effects brought about as a result of fresh water decline, the timing of fresh water delivery has also affected certain animal populations. According to local shrimpers, "pulse" fresh water discharges can cause disease conditions among shrimp populations that are significant enough to render the shrimp unsalable.

In determining whether any changes could or should be made to the fresh water delivery schedule to Biscayne Bay a number of facts must be kept clearly in mind: The South Florida Water Management District currently must balance many competing demands in determining water delivery rates, including flood control, aquifer recharge, maintenance of a fresh water head to stem salt water intrusion and guaranteed inflows into Everglades National Park. Therefore, the first question that must be addressed is whether the freshwater delivery system can be altered to obtain a more optimal delivery schedule for the Bay. If the answer is affirmative, then it will be necessary to determine what constitutes an optimal schedule for the Bay. In order to seek a commitment from the South Florida Water Management District to evaluate the impacts of the present water delivery system and to establish protection of the Bay's ecological and biological functions as an objective of that delivery system, the following guidelines are adopted:

1. The upland discharge schedule (i.e., timing and amount of canal outflows) should achieve the following multiple objectives of water management: water conservation, flood control, environmental protection and protection of the Bay's estuarine and biological functions.

2. The effects on the Bay should be taken into consideration when evaluating any action that would change the total amount, seasonality and distribution of freshwater discharged annually to the Bay.

Agency Responsibilities. Currently the agencies with primary responsibility for freshwater discharge into the Bay are the South Florida Water Management District (SFWMD) and the U.S. Army Corps of Engineers (COE). However, neither of these agencies presently has any ongoing program to implement these guidelines. It is recognized that these guidelines relate to a very long term commitment and that their full or even partial achievement will come only as a result of an extremely difficult balancing of the many competing demands that are made on the freshwater delivery system throughout south Florida. It is also understood that there are a number of very important studies or projects currently under way that will also determine to a large extent the degree to which these guidelines may be achievable. Five of the more important activities are: COE study of the entire water management system, a study that is being conducted by Everglades National Park to determine optimal water delivery schedules for the Park, studies of Conservation Area 3-A and the Biscayne Aquifer and the location of the Miami-Dade wellfields in the East Everglades. None of these studies or projects will attempt to address the impact of the freshwater delivery system on the Bay.

In addition to these ongoing programs, a request for federal funding has been made by the Department of Environmental Resources Management (DERM) for an Army Corps of Engineers Survey Review. The proposed survey will provide a coordinated and comprehensive review of all federally authorized projects affecting Biscayne Bay to determine their combined impact on the biological characteristics and water quality of the Bay. The Corps of Engineers as lead federal agency, in cooperation with the Federal Department of

Transportation, will review projects such as the Intracoastal Waterway, Government Cut, Bakers Haulover Inlet, the Central and Southern Flood Control Project, and causeway construction to determine whether these and other existing federally authorized projects are having a detrimental impact upon those physical, chemical, biological and aesthetic qualities that comprise the basic character and value of Biscayne Bay. The Survey Review will address, but not be limited to, the effects of dredging and filling on circulation patterns and the flushing of problem areas, the effect of Intracoastal Waterway spoil islands on water quality, and the effects of modified freshwater inputs to Biscayne Bay on biological communities and water quality. Based upon these determinations the study will recommend solutions and propose measures to alleviate any problems associated with the aforementioned projects.

The program that is outlined below will address three basic questions: (1) What are the present impacts of the rate and timing of freshwater delivery on Biscayne Bay? (2) What would constitute an 'optimal' discharge to the Bay? and (3) With a better understanding of the competing demands on the water management system as a result of the studies mentioned above, what flexibility will SFWMD have in altering its discharge rates or amounts? To begin the long term process of obtaining answers to these questions the following courses of action are proposed:

(1) The County should continue to work with members of the Dade delegation to the U.S. Congress to obtain a Corps of Engineers review of the impacts of all past and present federal projects which have impacted Biscayne Bay, including the water management system and canal, causeway and levee construction.

target date to initiate study - 1982

(2) The County should seek technical and financial assistance from the South Florida Water Management District to determine the current impacts of the freshwater delivery schedule on Biscayne Bay.

target date - immediate

(3) The County should seek increased technical and financial assistance from Biscayne National Park to determine the current impacts of the freshwater delivery system on Biscayne Bay.

target date - immediate

(4) The County, Corps of Engineers, South Florida Water Management District, and Biscayne National Park should determine the "optimal discharge" of freshwater to Biscayne Bay.

target date - 1 year to develop the Plan of Study

Storm Water Runoff

Past practices of drainage have created an extensive drainage network of pipes which allow the direct discharge of runoff from the land to the Bay and its tributaries. This form of drainage serves the purpose of flood protection but affords almost no water quality enhancement prior to discharge to the receiving water. The nutrients, metals, suspended solids and bacteria which are channelled to the Bay after a storm may be equated to the discharges from hundreds of sewage treatment plants periodically flushing secondarily treated effluent into the Bay.

Background. In the early 1970's public concern about the effects of direct discharge of untreated sewage into canals and the Bay resulted in serious efforts to reduce water pollution. During the past decade direct discharge of sewage into the Bay and inland canals has been substantially decreased and the remaining discharges are subjected to tertiary treatment prior to release into surface waters.

Subsequent to the County's initial efforts to reduce sewage discharges, the 208 Water Quality Management Program began to address the problems associated with stormwater runoff. Coincidental with Dade County's efforts, the U.S. Geological Survey produced a series of studies which were aimed at quantifying the pollutant loading associated with various land uses (U.S.G.S., 1978 and 1979). The U.S. Geological Survey work corroborated the findings by Dade County with regard to the seriousness of storm water disposal problems.

Effects on the Bay. There are thousands of storm water outfalls draining into the Bay. The majority drain paved areas into Biscayne Bay north of Rickenbacker Causeway. Although outfalls which contribute significant amounts of nitrogen, phosphate, suspended solids, biological oxygen demand and total coliform bacteria have been identified, little is known about the extent of the effects that these outfalls have on the Bay. However, studies in the canal systems in Broward and Dade County have revealed that 70 percent of the bacterial loading and 50 percent of the suspended solids from single family and commercial areas and transportation corridors are directly attributable to storm water discharges after a heavy rainfall (U.S. Geological Survey, 1978).

Based upon the findings and recommendations of the Urban 208 Water Quality Management Program the following Bay Management guidelines are adopted:

1. Stormwater retention facilities should be designed to provide maximum reduction in pollutant load. Retention, diffusion, and soakage systems should be used to achieve release of water which meets all applicable State and local standards and creates minimal environmental impacts.

2. When existing positive storm water outfall systems are replaced or relocated, on-site retention systems should be utilized to the fullest extent feasible.

3. Environmentally detrimental storm water outfalls should be replaced with seepage or other on-site retention systems.

4. A street cleaning program should be instituted until replacement of stormwater outfalls can be accomplished.

5. Landward of the mangrove zone, all development or site alteration should be done in a manner which will achieve the benefits inherent in overland sheet flow and reduce pollutant loads into the coastal mangrove forest. (See related guidelines in Development Impacts section.)

Agency Responsibilities. Agencies with primary program responsibilities for implementing the stormwater discharge guidelines are Dade DERM, Dade Public Works (in unincorporated areas) and municipal public works departments. With recent modifications to Chapter 24 of the Dade County Code, DERM has permitting jurisdiction over all new outfalls to Biscayne Bay. Under the Urban 208 Water Quality Management Program, Dade DERM is involved in a long term effort to improve water quality through design, replacement or relocation programs for stormwater outfalls. Among the efforts that have direct applicability for Bay Management are the stormwater outfall study which has identified the location and size of all outfalls which flow into the Bay, and the street cleaning program which could provide a workable short-term implementation strategy.

The following are recommended courses of action:

(1) DERM should finalize stormwater runoff design criteria and include standards for stormwater retention in the DERM operational manual.

target date - 6 months

(2) DERM should identify the most detrimental outfalls based upon:

(a) pollutant loading - target date - 6 months
(b) benthic habitats - target date - 6 months
(c) existing or proposed uses - target date - 1 year

(3) DERM should determine the cost to modify the outfalls that are identified as most environmentally detrimental.

target date - 6 months after completion of #2

(4) The County should adopt an ordinance to mandate a timely phasing out of the most environmentally detrimental outfalls.

target date - 6 months after completion of #2

(5) The County should include in its Decade of the Bay bond program funds to assist in the modification of the outfalls identified in #2.

target date - 1 year after adoption of plan

(6) The County should initiate the modification of at least 10 percent of the outfalls identified in #2 per year.

target date - 6 months after adoption of ordinance specified in #4

(7) As an interim measure the County should adopt an ordinance based upon the 208 guidelines, to mandate a street cleaning program in all areas which drain into the Bay or its tributaries.

target date - 6 months from adoption of this plan

Water Clarity

The water clarity of Biscayne Bay varies with the seasons, weather conditions and is affected by both natural and man-induced influences. The amount of sunlight reaching the bottom dwelling (benthic) flora and fauna of the Bay is dependent upon the clarity of the water column. Water clarity is primarily affected by the turbidity and color of the water. Color reduces light penetration and is due to humic materials from the soil such as tannins, humic acid and humates. Turbidity is caused by the presence of suspended particulate matter and plankton in the water column.

Background. Many early settlers reported that the Bay bottom could be easily observed from a boat at any point in the Bay. However with intensive development and steady population increases, a decline in Bay water clarity was observed due to factors such as the discharge of raw sewage, the dredging of boat channels and the extensive dredging and filling that occured throughout north Biscayne Bay.

Although the direct discharge of untreated or poorly treated sewage has been curtailed throughout Dade County (see following section on sewage discharges and pathogens), the accumulated organic ooze from former discharges and material from extensive construction activities has resulted in a fine silt-like sediment on the Bay bottom in much of the area from Rickenbacker Causeway north. This material not only buried Bay bottom communities, but even more detrimentally, periodic resuspension of this unconsolidated sediment by wave action has resulted in persistent adverse effects on water clarity.

Excavation of large areas of previously shallow Bay bottom in north Biscayne Bay to obtain fill for the creation of additional land in and around the Bay has left deep holes that are beyond the photic (light) zone. Consequently, aquatic vegetation, which serves to consolidate sediments and provides food and shelter for higher forms of marine life, is not able to live in these deep areas. However, these deep holes may provide some positive values to the Bay system as areas of shelter for fish and shellfish.

When the Intracoastal Waterway (ICW) and other channels were dredged in Biscayne Bay, spoil material was frequently deposited beside the channel, forming a series of islands. These islands have been largely overgrown by exotic tree species such as Australian pine whose root systems are not able to hold the fill as well as native mangrove species. In addition, no efforts were made to stabilize these shorelines. As a result, these islands tend to erode on the side that receives wave and wake action and build up on the opposite side. This constant erosion and accretion probably contributes to the turbidity in the Bay.

When the uplands adjacent to both north Biscayne Bay and the northern portion of south Biscayne Bay were developed, the shoreline was straightened and vertical bulkheads were used to prevent erosion and bank undercutting. Unfortunately, these vertical seawalls reflect waves and boat wakes rather than attenuating their energy as does a sloping rubble or natural shoreline. This wave wake reflection results in continual re-suspension of the fine bottom sediments, thereby aggravating long-term turbidity problems.

Effects of Turbidity. In other water bodies the following adverse effects have been documented as a result of high turbidity levels. It is expected that the turbidity levels in northern Biscayne Bay are creating similar negative impacts, as follows:

- Reduction of light penetration leading to decreased long term plant productivity, a reduction in the base of the estuarine food web, and eventual reduction in fin and shellfish populations.

- Abrasive damage to aquatic organisms, particularly to the gills of fish by erosion of gill filaments.

- Destruction of filterfeeding organisms such as clams and oysters due to blockage of filter mechanisms.

- Direct destruction of bottom communities, including hard corals, through suffocation.

- Reduction of dissolved oxygen in the water column due to the oxygen demand of the suspended particles.

- Prevention of successful development of fish eggs and attachment of larval invertebrates. When the small particles settle, they form a very soft, poorly consolidated sediment. Numerous forms of marine organisms will not recolonize a bottom with even a thin layer of such sediment due to bottom preferences of their larval forms. If young bottom dwelling organisms or eggs settle and sink into this soft sediment, they may suffocate due to a lack of oxygen.

- Modification of the natural fish movements and migration.

In order to reduce the turbidity levels and improve water clarity in Biscayne Bay, the following guidelines are adopted:

1. During coastal construction, measures should be taken to insure that turbidity levels do not exceed background levels or levels which could be harmful to the surrounding environment. Prior to removal of turbidity curtains, accumulations of fine silt should be either removed or stabilized.

2. All fill, including spoil islands, which has been, or is, placed adjacent to or within Biscayne Bay and is causing a turbidity problem should be stabilized.

3. Developed uplands directly bordering Biscayne Bay should be bermed, sloped or graded to maximize filtration and minimize pulse discharges of direct unfiltered runoff into the Bay.

4. When bulkheads or other shore protection structures are constructed, physical barriers which will intercept direct overland runoff should be used.

5. Whenever possible, sloping riprap should be placed along bulkheads to minimize resuspension of bottom sediments, absorb wave energy and increase intertidal habitats.

6. There should be no further dredging or filling in Biscayne Bay except for the following: (a) minimum dredging and spoiling for public navigation projects or public necessity, (b) an alteration of physical conditions as may be necessary to enhance the quality or utility of the Bay, (c) minimum dredging and filling as may be authorized for creation and maintenance of marinas, piers, docks and their attendant navigational channels, (d) minimum dredging and filling that is necessary for the purpose of eliminating conditions hazardous to public health or for purpose of eliminating stagnant waters, (e) minimum dredging or filling as may be required to enhance the biological, chemical or physical characteristics of Bay waters, or waters of adjacent embayments or tributaries.

7. Beach renourishment and channel dredging projects should be designed to minimize the potential for suspended material from entering Biscayne Bay.

8. Unstabilized areas that cause turbidity should be stabilized through riprapping and/or the use of natural vegetation or other environmentally acceptable methods.

9. The nutrient levels of the Bay should not be exceeded to the extent where phytoplankton population levels impair the aesthetic or biological qualities of the resource.

10. Natural conditions that trap sediments, filter water and decrease wave energy should be preserved or established.

11. No structure or activity should be permitted to hinder the regular exchange of Bay and ocean waters.

12. Navigational channels should be located, marked and designed, and constructed in a manner which protects vital habitat areas and minimizes the potential for erosion. Channel dimensions including slope, lengths, and depths, should be sized to have minimal environmental impact or modified to eliminate existing negative impacts.

13. Dredging operations which interfere with fish migration, disturb fish breeding, or create poor water quality conditions should be suspended.

14. Wherever possible, dredging and filling should be conducted in a manner which will maintain or improve aerobic conditions and light penetration.

15. The removal of water from construction sites (de-watering) should be done in a manner that will not increase turbidity of Bay waters on a short- or long-term basis.

Agency Responsibilities. There are a number of agencies involved in programs that can be used to implement certain of the Water Clarity guidelines. The Army Corps of Engineers (COE), Florida Department of Environmental Regulation (DER) and Dade County Environmental Resources Management (DERM) are all involved in coastal construction permitting; dredge and fill; stabilization of unconsolidated sediments; flushing of Bay waters; and, along with the Coast Guard, navigational channel alignments. Beach renourishment

is a Corps of Engineers program sponsored and monitored by DERM. The EPA, Florida DER, South Florida Water Management District (SFWMD), DERM and the Biscayne National Park (within its boundaries) have major responsibilities for enforcing water quality standards. Fish migration and breeding is the prime responsibility of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. In addition to these existing water management, coastal construction and habitat management programs, potential implementation programs include the COE Survey Review and fresh water discharge impact study discussed previously. The Biscayne Bay Enhancement Program through riprapping unconsolidated areas, stabilization of areas causing turbidity and fisheries monitoring and management will provide a means to implement many of the water clarity guidelines.

High costs and long-term time frames for many of these programs could create problems. It is also recommended that there is the need for circulation and fisheries studies prior to undertaking turbidity abatement activities.

The following are recommended as short- and long-term courses of action for the implementation of the Water Clarity guidelines:

(1) As part of the Bay Restoration and Enhancement Program, areas that are causing continual turbidity problems should be identified and control measures should be proposed.

target date - 6 months to initiate study

(2) A corrective program to modify the areas identified in #1 utilizing the proposed control methods should be initiated.

target date - 6 months after completion of #1

(3) Sea Grant or other appropriate funds should be sought by members of the scientific community to determine levels of turbidity that are harmful to the environment. Recommended revisions to the present turbidity standard should be proposed based upon those findings.

target date - 1 year to initiate study

(4) Standards and criteria relating to overland runoff, coastal construction, de-watering operations and mitigation of negative impacts should be developed, revised subsequent to public hearings and included with the DERM operational manual.

target date - 6 months

(5) The County should develop a riprap stock pile where appropriate material from public or private projects could be made available at a minimal cost to individuals and governmental agencies for the purpose of riprapping bulkheads along the Bay shoreline.

target date - 6 months

(6) As part of the Corps Survey Review (discussed under the Freshwater Delivery section) the Corps should do a cost/benefit evaluation on placing a breakwater on the north jetty of Haulover Cut. As part of this program, channel areas where turbidity can be decreased through adequate marking, channel re-alignment, alternate spoiling sites, or better maintenance dredging should be identified. The County should request the Coast Guard involvement in a channel marking or re-alignment program.

target date - upon completion of the Corps of Engineers Survey Review

(7) The Bay Management Committee should determine the feasibility of charging a "Bay User Fee" for all commercial users of the Bay who follow regular, specified routes and cause documented increases in turbidity.

target date - 6 months

Sewage Discharge/Pathogens

Although the discharge of raw sewage to Biscayne Bay from local sewage plant outfalls has been stopped through environmental regulations, sewage discharges from liveaboard vessels remains a problem in parts of Biscayne Bay. In addition, evidence concerning septic tank drainfield systems indicates that pathogens and nutrients can seep into the Bay if drainfields are located too close to the Bay or its tributaries.

Background. Prior to 1956, Biscayne Bay was a heavily polluted waterbody. Over 30 million gallons of raw sewage were discharged into north Biscayne Bay daily. When the Virginia Key sewage treatment plant was brought into operation in late 1956, this major pollution loading from domestic and industrial wastes was eliminated. Subsequently, all known combined stormwater and sanitary sewer systems which had overflow pipes to the Miami River or the Bay were phased out and treatment of remaining discharge into other surface waters was substantially upgraded. There remained, however, a substantial sewage discharge into the Miami River and the Bay from liveaboard vessels and tidal inflow from ocean outfalls. The problem of tidal inflows from ocean outfalls has been addressed through extension of outfall lines and creation of a regional sewage treatment system.

A survey conducted by the Environmental Resources Management Department staff in early 1974 revealed approximately 910 liveaboard vessels in Dade County that were calculated to be discharging approximately 150,000 gallons of wastewater per day into the Bay and its tributaries. Although Federal Coast Guard Regulations required all vessels with an on-board toilet to install an approved marine sanitation device (treatment system or holding tank) by January 30, 1980, it is suspected that a large percentage of boat owners are not in compliance at this time.

At the present time, few marinas in Dade County have operational sewage pumpout stations and none has direct sewage connections at liveaboard slips. Most new marinas are now required to install a permanent sewage pumpout station. If liveaboards are allowed, direct sewage connections are required at each liveaboard slip in new marinas.

Effects on the Bay. The following adverse effects have been found to result from the discharge or seepage of sewage and pathogens into tidal waterbodies. It is expected that the discharge or seepage of sewage and pathogens into Biscayne Bay from the sources discussed above has similar effects in Biscayne Bay.

- A potential health hazard exists to persons engaged in water contact sports, such as swimming and water-skiing in the vicinity of marinas or boat docking facilities which contain liveaboard vessels not in compliance with U.S. Coast Guard Marine Sanitation Regulations.

- Increased levels of nutrients such as phosphorus or nitrogen can cause dramatic short-term increases in the growth of marine plants, particularly phytoplankton, which are microscopic plants suspended in the water column. This increase in the amount of phytoplankton can result in increased turbidity levels, decreased light penetration, and ultimately a decline in the system's productivity.

- Bottom feeding fish and benthic invertebrates, such as shellfish, which live in or feed in areas receiving sewage/pathogens concentrate pathogens in their tissues possibly creating a health hazard if eaten.

- Bottom feeding fish exhibit a higher incidence of external disorders such as fin and scale diseases than do fishes that live and feed primarily in the water column.

In order to eliminate the discharge of sewage and pathogens to Biscayne Bay, the following guidelines are adopted:

1. The discharge of wastewater, toxic and hazardous substances from liveaboards, e.g. boats which are utilized as legal residences into the Bay and its tributaries should be prohibited.

2. Marinas should provide wastewater pumpout facilities at each liveaboard slip and conveniently located, operational pump out facilities that are available to the general boating public.

3. All new marinas shall provide direct wastewater pumpout connections at each liveaboard slip and require tenants to hook-up. Liveaboards should be prohibited in offshore mooring areas where sewage collection is not available unless operable holding tanks meeting all requirements are on the boat.

4. All sewage discharges to Biscayne Bay and the upland canal system shall continue to be prohibited.

5. All septic tank drain fields and package treatment plants within the Biscayne Bay Management Boundary should be phased out as expeditiously as possible.

6. Combined stormwater and sanitary sewer systems shall continue to be prohibited.

7. Programs should be developed to control emergency sewage overflows.

Agency Responsibilities. There are three existing programs that can be used to implement guidelines on wastewater discharge from vessels: The Marine Sanitation Device Regulation program which is under the sole jurisdiction of the U.S. Coast Guard, Coastal Construction permitting procedures which are administered by the Corps of Engineers, Florida DER, Dade DERM and municipalities, and administrative programs relating to the presence of liveaboards and pumpout facilities at both public and private marinas.

The Marine Sanitation Device Law has been in effect since January 1980. Only those vessels that the Coast Guard boards in open water for safety checks or inspections are currently being checked for compliance with the marine sanitation regulations. Since most liveaboard vessels rarely leave their landbased slips, they are generally not subject to these inspections. The Coast Guard generally prefers an educational approach to enforcement of Marine Sanitation Device regulations. Through existing coastal construction permitting procedures, pumpout facilities and direct wastewater connections can be required at all new marinas. However, in existing facilities, the need for functional, conveniently located pumpout facilities and dockside hookups for all liveaboards, is not adequately addressed under existing administrative procedures. To address this problem, the following courses of action are recommended:

(1) That the Coast Guard be asked to enforce the Marine Sanitation Device laws in all anchorage areas with liveaboard moorages.
target date - immediate

(2) That the County adopt an ordinance stipulating that all marinas which provide liveaboard facilities be required to provide dockside pumpout at each slip and that pumpout facilities for the general boating public be required at all marinas and all private marinas with more than 25 slips by the year 1985.
target date - 1 year

The major responsibility for regulating discharges into upland canals, septic tank drain field and package plant permitting and operational procedures is given to the DERM through the authority of Chapter 24 of the Dade County Code. Therefore, the major responsibility for implementing the Sewage Discharge/Pathogen guidelines (numbers 4-7) also resides in DERM. In order to make those programs more explicit the following actions are recommended:

(1) That a special taxing district be established for all neighborhoods or developments which presently utilize septic tanks or package treatment plants within the Bay Management Boundary.
target date - 1 year

(2) That 201 funds be utilized on a priority basis to sewer those areas within the Bay Management Boundary which are presently unsewered or serviced by package treatment plants.
target date - 2 years

(3) That criteria for reviewing and approving sewage treatment plant emergency procedures be specified in the DERM manual.
target date - 6 months

Solid Waste Disposal Sites

Until recently, the most common solid waste disposal methods in Dade County were dumps and incinerators. These methods were not only economically desirable due to relatively low capital and operating costs but they were also the only proven methods available. All types of wastes including dead animals, waste sludge, toxic chemicals and pathological and pathogenic materials were accepted at disposal sites. At the dumps, these materials were generally placed in excavated pits where the probability of polluting the underlying groundwater was relatively high.

As rainwater percolates through discarded waste, it can carry with it relatively high concentrations of metals or other chemical compounds plus bacterial contaminants. The mix of contaminants varies from site to site depending upon the composition of the waste materials, salinity and other chemical characteristics of the underlying groundwater, and the chemical makeup of the soil or rock material. However, in many instances, the groundwater downgradient, or downstream in the gravitational flow of the water, contains levels of sodium, chloride and ammonia that are significantly higher than the levels recorded upgradient from the dump site.

Due to the close proximity of many older dump and landfill sites to the Bay, the amount of filtration of the contaminated waste water, or leachate from these dump sites is minimal before reaching the Bay. Furthermore, very little is known about how leachates affect or are affected by the saline Bay environment.

The potential threats posed by dump and landfill leachates and toxic substances to both freshwater supplies and marine life have resulted in a redesign in landfill concepts and a close examination of alternative solid waste disposal methods. Many improperly designed landfills and dumps have been closed in Dade County. Other sites are being closely monitored. If required, they will be closed and the leachate will be collected and treated. More sophisticated and environmentally desirable forms of disposal such as resource recovery, sanitary landfills, and high temperature incineration are presently under construction.

While there are no proposals to construct any additional landfills at this time, if such facilities are required in the future, they will have to be in full compliance with State and County laws and the following guidelines:

1. Sanitary landfills and other facilities for the disposal of solid waste should be constructed and located in a manner which will not impact the waters of Biscayne Bay or its adjacent wetlands.

2. At sanitary landfills, groundwater should be protected through the use of an impervious natural or artificial liner underlying the entire landfill facility.

3. A leachate collection and disposal system should be required between the waste material and the impervious liner to intercept percolated leachate.

4. Surface water runoff from sanitary landfills should be collected and treated, if necessary.

5. The landfill facility should have no waste deposited below the minimum Dade County flood level criteria or contain an approved perimeter berm for flood protection.

6. A continuing groundwater monitoring program should be required at all landfill sites to detect any pollutant migration.

7. Only domestic, non-toxic and non-pathogenic wastes should be deposited at new solid waste and fill sites. Disposal of any other materials would have to be approved by Florida Department of Environmental Regulation and Department of Environmental Resources Management on a case by case basis.

On former dump and landfill sites the following guideline shall apply:

Development on old dump and landfill sites should be located and done in a manner to minimize the impacts of leachates on the Bay or adjacent wetlands. Disturbance of old waste materials should be prohibited unless the old waste material is being removed from the site to protect underlying groundwater and adjacent surface waters.

Agency Responsibilities. The major existing programs which will be used to implement guidelines 1-7 are the 404 and 402 permitting programs which are authorized by the Federal Clean Water Act, the state solid waste permitting program under Chapter 17-7 of the Florida Administrative Code and under Chapter 24 of the Dade County Code. The primary agency involvement lies with the Corps of Engineers and EPA at the Federal level, Florida DER at the State level and Dade DERM locally. Guidelines 1-7 can be implemented through these existing programs; however, one alteration in Florida Administrative Code language is recommended:

> That the County adopt a resolution requesting the Environmental Regulatory Board of the Florida Department of Environmental Regulation to amend Chapter 17.7 of the F.A.C. to require that all solid waste material be deposited at or above specified County floor level criteria in any County which has adopted such criteria, or contained in an approved perimeter berm for flood protection.

The guideline regarding development on old landfill sites can be partially implemented through existing planning and zoning whenever construction is proposed for old landfill sites that are located within coastal wetland areas as defined by Federal Code, Chapter 17.4 of the Florida Administrative Code and Chapter 24 of the Dade County Code. All of the Coastal Construction programs that are administered by the Corps of Engineers, Florida DER, Dade DERM and municipalities also are applicable. These programs were discussed previously under "Water Quality." The potential also exists for implementing this guideline through the proposed DIC development review process that is discussed under the section on Development Impacts (see pp. 76-7).

Boating Impacts

While there are no quantitative data to assess the degree of impact that present boating and maintenance activities have on the Bay, long term Bay observers and users stress that certain activities (e.g. those that have potentially negative impacts on water quality and marine communities) should be carefully monitored as part of the Bay Management Program. Additional boating impacts that relate more directly to user conflicts and needs are discussed in the second section of this chapter under the general headings of "User Conflicts" and "Physical and Visual Access."

Effects on the Bay. In many instances boat maintenance operations, particularly scraping and painting, are done over or partially in water. In other locations the residues from these operations are flushed directly into the Bay. Thus, heavy metals such as lead, zinc, mercury, chromium, copper and iron may settle on the Bay bottom where they can be ingested by bottom feeding fishes and concentrated in their tissues. Other maintenance and repair operations release liquid paint, oil and grease into Bay waters.

Other negative impacts on Bay water quality result from the presence of approximately fifty derelict vessels which have been identified by the Dade County Public Works Department along the shore of Biscayne Bay and its tributaries. In many instances, these are not only aesthetically unappealing and potential navigation hazards, but they also release pollutants (e.g. oil and grease, heavy metals) into Bay waters.

In addition to the negative impacts that boats or boating maintenance operations may have on water quality, boating operations frequently aggravate turbidity problems. In many locations vertical bulkheads reflect boat wakes. The problem can be particularly severe where a boat channel is close to the bulkhead or where waves are continually reflected between bulkheads, around causeways and bridges. In some areas continual wave scouring has undermined bulkheads necessitating costly repairs and aggravating local turbidity problems through persistent re-suspension of shoreline and bottom materials (see related discussion under "Water Clarity").

Boating practices may also negatively impact submerged communities and shoal areas. While boats are generally run aground due to poor boat handling, even experienced boaters can run aground in the poorly marked, shallow areas of the Bay. Operating boats in areas of insufficient depth is not only potentially dangerous for boaters and boats, it can also cause considerable damage to bottom communities. The frequency of this phenomenon is unknown; however, an examination of aerial photographs reveals that it is widespread and that the scars may remain visible for years after the initial damage is done.

Careless boat handling is also the cause of manatee injuries and deaths. Many manatees show scars from being sliced by propellers. There have also been instances where manatees were killed by being crushed between a vessel hull and the bottom.

While it will be necessary to quantify the extent of these impacts in order to take appropriate corrective actions, the following are seen as general guidelines which will, over time, minimize the negative impacts of boating operations on the Bay.

1. The discharge or runoff of heavy metal residues, oil and grease, or other pollutants from boat construction and maintenance operations and facilities to the Bay or its adjacent canal and river systems should be minimized.

2. Derelict vessels that are aesthetically unappealing, hazards to navigation, or that release pollutants into Bay waters should continue to be removed from the Bay and its tributaries as quickly as possible.

3. To lessen the impact of boat wakes and wave action along the Bay shoreline, public shoreline areas should be stabilized whenever possible. Wave attenuating stabilization should generally be required along all new or repaired vertical bulkheads and encouraged for existing private bulkheads or unconsolidated shorelines.

4. Wherever possible, no wake zones should be established and enforced in areas where dangerous conditions are caused by wake reflection, where erosion is a persistent problem or where wakes have been identified as having adverse environmental impacts.

Agency Responsibilities. Existing programs which may potentially be used or extended to implement guidelines 1-4 are found in the water quality management programs administered by EPA, Florida DER and Dade DERM. These programs were reviewed under the previous sections on sewage discharges and water clarity. Additionally, the derelict removal programs administered by the Corps of Engineers, Florida Department of Natural Resources, and Dade County Public Works will be the primary mechanisms for implementing guideline #2 regarding derelict vessels.

Several existing programs including Coastal Construction permitting and the Bay Restoration and Enhancement Program could also be used to implement guidelines 3 and 4 which relate to the impact of boat wakes. These programs have also been discussed in the previous sections of sewage discharges and water clarity, and they will also be referred to extensively in the following sections of development impacts and habitat management. In the section on boating conflicts (see pp. 81-87) existing boating laws and enforcement problems are discussed in some detail so that discussion will not be repeated here.

Problems identified with the implementation of these four guidelines are as diverse as the guidelines themselves. The basic problems with derelict vessel removal stem from the need to notify the owner of said vessel prior to removal, and the existence of limited equipment to accomplish the job of removing more than 100 vessels that are currently abandoned in the Bay or its tributaries. With regard to the negative impacts on water quality stemming from boat construction and maintenance operations, the major problem stems from the need for monitoring and therefore the need for additional inspection staff. Another aspect of this problem may be that much of the public does not know how, or where to report a violation or that these activities may be potentially quite damaging to the Bay. Recommendations on public awareness and education are found beginning on page 100.

The problems associated with lessening the impacts of boat wakes are also extremely complex. The establishment of no wake or minimum wake zones is the least costly implementation method, but achievement would require substantially more enforcement capability than currently exists in the combined local marine patrols. In some locations such as along the Intercoastal Waterway, no wake zones are simply not feasible. On the other hand, stabilization techniques such as riprapping are costly, and will not be achieved quickly along the more than ninety miles of bulkheaded shoreline which line the urbanized portions of Biscayne Bay.

With the knowledge that these problems are significant and not easily nor quickly solved, the following courses of action are recommended:

(1) That DERM reinstate its "spot check" program of all marine construction and maintenance facilities.

target date - immediate

(2) That all marinas be required to initiate an on-site retention and yard maintenance program.

target date - 1 year

(3) That Dade County continue and expand its derelict vessel removal program.

target date - immediate

(4) That wherever erosion or turbidity problems are identified as part of the Bay Restoration and Enhancement Program (see Water Clarity section) the feasibility of creating a "no wake zone" be evaluated by the Boating Task Force (see recommendation #6 on page 86) and a recommendation made to the Bay Management Committee within three months of the requested evaluation.

target date - 1 1/2 years

(see related recommendations on pages 85-87)

Fishing Impacts

Biscayne Bay is used for both sport and commercial fishing. As growing demands are placed on this fishery by increasing numbers of people, concern for its long-term health and continued productivity must also grow.

Concerns related to sport and commercial fishing, the nature and use of the resource and the opinions of various user groups are discussed below. Certain issues that relate more to general environmental considerations (i.e., water quality, turbidity, habitat management) are not repeated here even though it is recognized that they may have considerable impact on the fishery resources of the Bay. Also, concerns that relate more directly to user conflicts and requirements are discussed in the sections titled "User Conflicts" and "Physical and Visual Access."

Effects on the Bay. In discussions with fishermen and boaters who use Biscayne Bay, three different areas of concern were expressed relating to commercial shrimping:

- The trawls used by commercial shrimpers destroy sea-grass beds and other benthic communities; and
- Commercial shrimping impacts fish populations; and
- Shrimping with trawl nets by unlicensed individuals is depleting the shrimp population in Biscayne Bay, thereby reducing the population of fish which depend on shrimp as a food source.

According to some of the area's sport fishermen, and commercial shrimpers, commercial shrimp trawls do negligible damage to sea grass beds. However, shrimping with trawl nets by unlicensed individuals has increasingly become recognized as a problem during the last few years. Even though boats are not commercially licensed boats, they often bring in commercial sized loads that are obviously in excess of personal needs. Both sport and commercial fishermen feel that the growing number of unlicensed shrimpers is stressing the shrimp population.

It is not certain whether any or all of the shrimp that leave the Bay on ebb tide are going to spawn. If it is determined that these shrimp are going to spawn, then it will be necessary to take steps to protect the breeding stock. At the present time, these shrimp runs are the most popular time for shrimping.

An additional area of concern which falls under the general topic of declining fish populations is the potentially negative impact of netting across the finger channels of the Safety Valve. Commercial sport fishing guides state that fish netters have caused serious declines in sportfish (pompano, bonefish, snapper, etc.) in the finger channels south of Cape Florida. However, the Florida Marine Patrol does not believe this to be a major problem since they receive relatively few complaints on this issue. Sport fishermen counter that there are few complaints because the netting goes on at night and is rarely reported. This exchange brings out at least two separate issues (1) there is clearly disagreement over the severity of netting violations and their potential impact, and (2) many people do not know where or how to report violations (for recommendations related to this second point see "Public Awareness" section).

Commercial fishermen emphasize that specific local bag, equipment or area limits would be inequitable because the differences in the laws from area to area would tend to create a competitive advantage for one area's commercial fishermen over another's. Many sport fishermen and environmentalists counter that differences between areas require site specific regulations which are more sensitive to the pressures and capacities of individual resources than statewide regulations.

The lack of concensus regarding fishing laws underscores the need for comprehensive baseline data on the impact of current fishing practices on Biscayne Bay. In the interim, the following general guidelines shall apply:

1. Commercial and recreational shrimping and fishing should be managed in a manner which will not adversely impact benthic communities, deplete fishery resources, or degrade water quality.

2. Recreational and existing commercial fishing in the Bay and its tributaries should be allowed unless it is determined that they are adversely impacting the long-term viability of the population of the species sought or other components of the Bay's ecosystem. New commercial activities should not be permitted until it is determined that they will not adversely impact the fisheries resources or benthic communities of the Bay.

3. The use of nets other than hand-held dip or landing nets should be prohibited across finger channels.

4. The Bay should be managed to promote the growth and development of healthy shellfish and fin fish populations, and if necessary, efforts should be made to restock with appropriate species.

Agency Responsibilities. The four general guidelines relating to the impact of fishery practices on benthic communities, the fishery resource or on water quality can partially be implemented through existing programs including enforcement of state fishing laws by the Florida Department of Natural Resources Marine Patrol and continued fishery monitoring programs under the auspices of the National Park Service staff at both Everglades and Biscayne National Parks. The U.S. Fish and Wildlife Service and the NOAA National Marine Fisheries Service Laboratory on Virginia Key could also potentially be involved at least to the extent of providing technical assistance.

The problems associated with current enforcement programs relate primarily to lack of enforcement and adequate laws. In managing commercial shrimping Florida Statutes require the permitting of commercial shrimpers, specify catch size and handling requirements and require the licensing of retail and wholesale food dealers. However, there are no specific limitations on catch size or equipment that may be used by the recreational shrimper. The determination of whether an individual is shrimping for commercial purposes without a permit is open to judgment. Enforcement officers base their determination on the reasonableness of the size of the catch on board and the kind and size of equipment being used. Despite legal prohibitions, the selling of shrimp by noncommercial shrimpers to uninformed or unconcerned individuals does occur and goes largely undetected.

Since the repeal of Dade's fishing acts in 1975, there have been no laws which specifically relate to this fishery except a single subparagraph in the Biscayne Bay Aquatic Preserve Act which states "Fishing involving the use of seines or nets is prohibited, except when the fishing is for shrimp or mullet and such fishing is otherwise permitted by state law or rule promulgated by the Department of Natural Resources."

Laws pertaining to saltwater fishing are enforced by officers of the Dade County Public Safety Department Marine Patrol, Florida Marine Patrol, and Biscayne National Park. These agencies rely heavily on voluntary compliance with regulations rather than on issuing citations for violations. Educating and informing the public in order to achieve cooperation and compliance is an important component of enforcement efforts. The number of enforcement officers is inadequate to minimize violations especially during shrimp runs and other periods of high use.

Additional problems with implementation of these fishing guidelines stem primarily from the lack of data on the impact of fishing practices on the Bay resources. Current data are limited to information on the lobster, sponge, and shrimp fisheries within Biscayne National Park.

Therefore, prior to making a comprehensive set of recommendations regarding the adequacy of fishing laws for Biscayne Bay, it will be essential to obtain a much better understanding of the fishery resource and the users of that resource. Toward that end the following programs and actions are recommended:

(1) As part of the Biscayne Bay Restoration and Enhancement Program, data should be obtained on the relative abundance of fish and shellfish species and their roles in the Bay ecosystem, fish pathology and the extent of commercial and sport fisheries in the Bay. Technical, staff or financial assistance should be sought from the Florida Department of Natural Resources, the National Park Service, Fish and Wildlife Service, the NOAA National Marine Fisheries Service, or Florida Sea Grant.

target date - 6 months to initiate study

(2) The Biscayne Bay Management Committee should establish a Fisheries Management Task Force to review existing fishing laws and recommend necessary changes in the Florida Statutes or administrative Rules governing saltwater fisheries or the federal laws and regulations governing saltwater fishing in Biscayne National Park.

target date - 1 month for establishment of Task Force - 3 months for initial recommendations to Bay Committee

(3) Based upon information from the fisheries monitoring program, the Fisheries Management Task Force should recommend additional changes that may be required in state fishing laws as they pertain to Biscayne Bay.

target date - 3 years

(4) As an interim measure, south Florida fishing clubs, the Dade County Sea Grant Marine Advisor and the Florida League of Anglers should be encouraged to establish a "Don't Take What You Can't Eat" campaign for Biscayne Bay.

target date - immediate

Development Impacts

Miami and its neighboring communities have grown phenomenally over the past 80 years and the impact on the environment in the northern Biscayne Bay area, at least, has been equally phenomenal. When Miami was founded in 1896 several thousand people were already living here. From that point on the growth has continued to where there are now over 1.5 million permanent residents. Fueled by an expanding national population and economy, and especially by increasing affluence, communications, trade, and advertising, the small communities of the 1890's were soon overwhelmed by the expansion of the metropolis.

Effects on the Bay Environment. The effects on the natural environment of Biscayne Bay were immediate and pervasive. The tiny channels in the northern Bay were abandoned - temporarily as it later turned out. With an eye towards stimulating trade and tourism, the Florida East Coast Railroad dredged a basin north of the Miami River (and in the River itself), and cut a channel to the sea by way of Cape Florida. With expanding trade still in mind, Government Cut was created in 1905 through the small natural southern peninsular tip of Miami Beach. At the same time Fisher Island, was built in an area that previously had been a very shallow bank.

Mangroves were cleared, and the areas filled in and bulkheaded along the previous vegetated "coastline." Artificial islands created by dredging surrounding bottom lands began to appear by 1919 in the middle of northern Biscayne Bay. Baker's Haulover Cut was dug in 1923-24. By 1926, plans had been drawn up to extend the "Venetian Isles" up the middle of the upper Bay. These plans were never fully realized, but their relics still remain in the Bay. Several causeways were constructed across the Bay, and more communities were created on slightly raised mangrove islands north of Miami Beach. Key Biscayne, already modified by both natural and human events in the 19th century, was the scene of agricultural, then partial urban, development. The southern tip, threatened by rapid erosion, was also bulkheaded and filled in to a considerable extent.

Since 1887 approximately 20 percent of the Bay north of Bear Cut has been filled, and roughly another 20 percent dredged, to accommodate the urbanization of the region (Harlem, 1979). Along the Atlantic side of the barrier island complex, from the northern tip of Biscayne Bay to the southern end of Key Biscayne, the shore length has undergone some accretion or erosion since 1887.

On the mainland, downtown Miami grew, and Bayfront Park was created by filling in east of the existing natural shoreline. Other modifications took place almost everywhere along the coast where the shoreline was developed.

Alteration of the landscape itself has, of course, been almost total within the urbanized area. The original pine and hammock vegetation has been largely replaced by various urban land uses, including parks. One inadvertent change has come as the result of the introduction of the "Australian Pine" (Casuarina) in the early 1900's; it now is rapidly replacing other types of vegetation over much of the remaining open spaces.

Current Review Procedures. Within the current review procedures, individual projects and sometimes individual phases of a project are reviewed independently of one another. No criteria or guidelines are presently available to address the cumulative impacts of development activities on the Bay system.

Several workshops on Biscayne Bay have emphasized the need for guidelines and criteria to ensure that future development is compatible with the Bay's natural features. Additionally, many people have emphasized the need to evaluate the cumulative impacts, both positive and negative, for new projects. Information contained in Appendix VII indicates the extent of proposed development along the Bay shoreline and serves to underscore the need for a comprehensive review of the cumulative impacts for all new projects.

Therefore, the following guidelines, as they relate to developmental impacts, are adopted:

1. Coastal construction should be compatible with the Bay's natural features, such as, but not limited to, mangrove habitats, seagrass beds and hard bottom communities, and should be conducted in a manner which will protect, enhance and be sensitive to the qualities, values and processes of existing natural habitats within and adjacent to Biscayne Bay.

2. The County shall seek to make the review and permitting process for all shoreline projects and activities as consistent, comprehensive and efficient as possible.

3. The County shall establish a standardized procedure for any mitigation activities to be undertaken within Biscayne Bay, its adjacent embayments or tributaries. These shall include criteria relative to when and how mitigation will be done and a specified method for public participation in this process.

4. Wherever permissible, development within, or access to viable coastal habitats should be achieved in a manner which has minimum impact on those habitats and other natural shoreline characteristics. (See related guidelines under Habitat Management.)

5. The County shall establish minimum standards relative to all Bay shoreline construction and utilization.

6. All new development or redevelopment along the Bay shoreline should be located, scaled and designed so that the building or facility and accompanying landscape features are oriented toward the Bay. (See related guidelines under Physical and Visual Access.)

7. Marinas should be located and sized in a manner which is compatible with adjacent land and in-Bay uses and nearshore environments. Such facilities should be tailored to accommodate types of craft that can operate compatibly in the environs.

8. Siting of new marinas and docking facilities should avoid use of shoreline areas containing viable submerged communities and near-shore areas of inadequate navigational depths. Such facilities should not negatively impact existing water quality.

9. Channel or basin designs should maximize flushing and circulation. Design of new channels and basins should imitate natural circulation patterns and configurations as closely as possible and maintain or enhance light penetration to the bottom.

10. Areas designated as appropriate for boating facilities should be developed to their potential provided that safe navigation and use of the area is maintained. (See Physical and Visual Access section for additional guidelines relating to marina facilities.)

11. Shoreline dependent commercial and industrial activities should be maintained, and appropriate, environmentally compatible new areas reserved for such activities. Existing operations should be upgraded where necessary to meet applicable water quality and other environmental standards.

12. During the assessment of development along the Bay shoreline or over Bay waters, cumulative impacts, both positive and negative, for the public in general and the immediate and adjacent environment should be evaluated.

13. The total impact from the many individual development or user activities along the Bay shoreline should not be allowed to negatively affect the Bay's biological, chemical or aesthetic qualities.

14. Facilities in or over Bay waters and its tributaries should only be constructed if their development and use are water-dependent (see glossary) and in the public interest, as defined by Florida statutes or the Florida Administrative Code.

15. Where extensive development is appropriate and compatible with the Bay's natural features, sites should be developed to the optimum extent feasible.

16. Shoreline park development and usage should be compatible with adjacent land and in-Bay uses and offshore submerged communities. (See Physical and Visual Access section for additional guidelines relating to shoreline parks.)

17. New construction should be designed and sited to withstand hurricane winds and storm surge.

Agency Responsibilities. The major existing programs which can be used in part to implement the development guidelines are the Federal, State and local coastal construction permitting processes (see the Water Clarity section) and zoning, planning and development impact reviews. These programs potentially provide the basis for addressing all the development guidelines except numbers 12 and 13 which relate to cumulative impacts and number 17 which addresses the need for building construction to withstand the force of hurricane storm surge tides.

The major problems that arise from relying totally on coastal construction permitting and zoning are that these programs are basically negative, situation oriented and fragmented. They do not, as presently constituted approach development in a comprehensive coordinated or cumulative manner. Moreover, local plans that have been developed as a result of the Local Government Planning Act or 1974 are usually too general and oriented toward status quo to be of much assistance in guiding future shoreline development.

At present the Dade County Development Impact Committee (DIC) process cannot address many important issues or projects because of high threshold determinations and the fact that the process is triggered by zoning actions alone. The problems associated with these high thresholds are also inherent in the Development of Regional Impact process. In making the following program recommendations it is recognized that the DIC review process has been operational for years in Dade County and that precedent for the proposed changes can also be found in the Development of Regional Impact processes:

(1) That the County amend Chapter 33 of the Dade County Code to give the Development Impact Committee (DIC) the authority to review all proposed public and private bayfront developments (excluding single family and duplex, or as specified in the ordinance of adoption) within a boundary defined by the closest parallel existing public roadway to the Bay where such exists or otherwise by the Bay Management Boundary as defined by the adopting ordinance. That the required review would not become effective until review criteria are developed (as specified in (9) on Page 52 and (3) on Page 77).

a. All developments (excluding single family and duplex, or as specified in the ordinance of adoption) within the boundary specified in (1) and all planning studies within the Bay Management Boundary shall be reviewed by the DIC within a specified time frame.

b. Following DIC review, the Board of County Commissioners shall forward its recommendations to the appropriate municipality for its consideration and action.

c. For this review only, the DIC shall be expanded to include representatives from all appropriate agencies and the cities in which the development under review is proposed. Also, staff from cities adjacent to a proposed development action will be included in the review process.

d. A certain minimum number of the DIC membership will be required to have expertise in landscape architecture, architecture and environmental planning.

e. In addition to design criteria and objectives that are included within the recommendations under "Visual and Physical Access" (see Page 95), the following objectives shall be applied in the site review DIC process:

- That development or redevelopment be compatible with the natural, physical, and socio-economic characteristics of the area.

- That development adjacent to Biscayne National Park shall respect and preserve the natural and visual qualities of the Park.

- That development within the shoreline area north of Biscayne National Park shall be done in a manner that will enhance and be enhanced by the recreational, aesthetic, and visual qualities of the Bay and adjacent northern embayments.

- That development along the Bay shoreline shall be reviewed as a total site plan including both in-water and upland improvements.

- That development shall be reviewed in the context of existing and proposed developments within the Bay Management Boundary encompassed by a radius of two miles.

target date for adoption of ordinance - 2 months from adoption of Plan

(2) That the County, in conjunction with the Bay shoreline municipalities, review all zoning within the Bay Management Boundary for consistency with the Goal and Objectives of the Bay Management Plan.

target date for recommendations to Bay Management Committee - 9 months

(3) That the County in conjunction with the Bay shoreline communities develop review criteria to apply to all uses more intensive than single family or duplex or within the boundary specified in (8) Page 49 and (1) on Page 76.

target date - 1 year

(4) That the County seek revisions in the South Florida Building Code or appropriate local ordinances to insure hurricane protection standards that meet Florida Department of Natural Resource requirements for local administration of the Coastal Construction Control Line.

target date - 1 year

(5) That the County develop a cumulative impact review process to be included in Chapters 24 and 33 or other appropriate sections of the Dade County Code. That the initial process (Phase 1) be developed for water related developments based on, but not limited, to the following: water depths, benthic habitats, aesthetic impacts, existing and projected shoreline uses and human safety. Based upon experience obtained in developing the initial process, an expanded cumulative impact process should be developed for all development or re-development within the Bay Management Boundary.

target date - 6 months to develop Plan of study for Phase 1

Habitat Management

Three types of mangroves -- red, black, and white -- inhabit the low tidal coasts along eastern and southern Dade County. Historically, in northern Biscayne Bay there was a band of mangroves which probably extended several hundred yards in width along the low contours of the Dade County coast; in south Bay the mangrove band broadened to 2-3 miles in some locations. Today the northern half of Biscayne Bay has only scattered mangrove forest remnants in the vicinities of East Greynolds Park, the Interama site, Coral Gables Waterway, Snapper Creek Canal, and Matheson Hammock. South of Black Point, the band of mangroves is interrupted only by the Turkey Point Power Plant and Homestead Bayfront Park.

Mangrove Communities. Mangrove forests are dynamic biotic communities in terms of environmental function and productivity. Mangrove ecosystems intercept and filter surface water run-off, thereby preventing large scale nutrient losses to the open sea; a by-product of this filtering action is the maintenance of water quality. Their complex root structure serves in the accumulation of organic and inorganic materials. The systems also act as mechanical energy buffers to strong winds and storm tides, thus preventing periodic devastations of the coastline.

Mangrove detritus -- minute particles of decomposing plant material -- is of vital importance to the continued functioning of coastal ecosystems. As fragments of mangrove leaves or twigs drift in the warm shallow coastal waters, they are mechanically and chemically broken into smaller particles by colonies of bacteria, fungi or protozoa. In this way, the relative concentration of protein and

the caloric value of the particles is increased, and they become increasingly more valuable as food sources. The detrital particles, plus associated bacteria, fungi and protozoa are fed upon by detritus feeders (e.g., amphipods, mysids, copepods, shrimp, and some larval or juvenile fish species). These small animals eat the associated bacteria, fungi, and protozoa, and excrete the indigestible cellulose portion which then becomes substrate for a subsequent assemblage of microorganisms, and the process is repeated.

The detritus feeders are eaten by predators (e.g., carnivorous worms, snails, and numerous juvenile fish), which are, in turn, consumed by larger predators such as crabs, snappers, tarpon, snook, and many other species actively sought by sport and commercial fishermen.

Mammals such as racoon, squirrel and bobcat frequent mangrove forests. Endangered species including the crocodile, manatee, bald eagle, roseate spoonbill and osprey depend on mangroves for feeding and breeding habitats, and many other aquatic birds use mangroves for roosting and nesting (see Figure 5 and Appendices III and IV).

Salt Marsh Communities. Inland from the mangrove forest, and covering much of the region south of Turkey Point between Card Sound Road and the Bay, communities of salt or brackish water plants predominate. Plants typical of these salt marsh communities include saltgrass, black rush, cord grass, glasswort, sea blite, saltwort, sea purslane and sea side daisy. While much of the vegetation grows in the marls, small regions of peat accumulations support mangrove and buttonwood tree islands. Due to modification of freshwater runoff patterns and the rising sea level, this region serves as an ecotone, or transition zone, from fresh to salt tolerant species and provides a valuable feeding area for many birds. By intercepting freshwater sheet flow, absorbing nutrients, adding detrital matter to the waters and maintaining wildlife habitat, the salt marsh community provides functions similar to the coastal mangrove forest community.

Submerged Habitats. Within the Bay itself the most important biotic community is that of the marine grasses and associated algae. The grass community is composed of turtle grass, Cuban shoal weed, and manatee grass. Grass beds of varying densities occur throughout the Bay depending upon the clarity and depth of water, physical and chemical consistency and thickness of the sediment deposit. The deeply penetrating root and rhizome system plays an important role in nutrient recycling as well as aiding in water clarity by accumulating and stabilizing sediments. The grasses and algae provide habitat for early stages of many commercially important species. Some of the more conspicuous species inhabiting this area are grunts, gobies, snapper, mussels, oysters, mud crabs and snapping shrimp.

Areas of shallow silt deposits support what can be considered a suborder of the above community. In these areas the grass beds are sparse and algae predominate. These communities are generally found just seaward from the coastal sediment fringe in the south Bay and support large populations of mojarras, pinfish, shrimp and a wide variety of molluscs.

On the hard sandy bottom areas of south Biscayne Bay, a less productive zone exists. Here the grass and algal beds are confined to pockets of sediment. Sponges, corals and sea fans attach themselves to the hard bottom, and creatures of the offshore coral reefs such as crabs and starfish may frequently be seen. This is a beautiful though less productive zone as most of the enrichment is gained from adjacent grass beds, mangrove detritus, and plankton or small algae which remain suspended in the water column.

Importance of Coastal and Submerged Habitats to Biscayne Bay. The productivity of Biscayne Bay south of Rickenbacker Causeway is primarily dependent upon the viability of two major types of vegetative communities: the shoreline mangrove community and the marine grass beds with their associated algae. These communities support a detritus-based ecosystem of high productivity. Their value to man is realized in terms of water clarity and an abundance of lower order species which attract large populations of game fishes.

While the diverse subtidal and intertidal habitats of south Biscayne Bay have remained relatively unaltered, much of north Biscayne Bay has been heavily impacted by urban development. There, in addition to the better known bottom communities, it is thought that much of the primary productivity stems from tiny plants called phytoplankton that live suspended in the water column. Unlike the larger attached plants, these minute one-celled organisms mature, live and die within a period of days, and thus they have the capacity to recycle nutrients rapidly through the system. Sometimes they grow excessively and the waters become murky and turbid, but at other times the presence of these tiny organisms is very beneficial as they provide a rich nutrient source for the other plants and animals within the Bay system. To assure that the remaining natural resources of Biscayne Bay and its adjacent wetlands are used wisely, a habitat management strategy must be devised. As an initial step in the development of a management program the following guidelines are adopted:

1. Rookeries, nesting, roosting, feeding and nursery areas should be protected.

2. Unique or environmentally sensitive habitats and areas frequented by endangered, threatened, or rare species should be selectively posted and uses of those areas should be limited to activities that will not adversely impact those areas.

3. All feasible means should be sought to acquire the coastal mangrove fringe forest, or at a minimum, the development rights within that area.

4. The natural communities of Biscayne Bay and its adjacent natural shoreline should be managed to provide adequate feeding and breeding areas for the diverse population of animals that presently inhabit those areas.

5. Collecting of flora and fauna from all submerged and coastal upland areas of the Bay region should be regulated and a program to reintroduce native and acceptable non-native species and remove exotics should be established, wherever feasible.

Agency Responsibilities. With regard to habitat management, implementation capability resides among numerous programs at the federal, state and local level. The U.S. Fish and Wildlife Service and National Park Service of the Department of Interior, N.O.A.A. of the Department of Commerce, the Florida Department of Natural Resources, state, county and municipal parks, marine patrols and public safety programs have roles to play in implementing these habitat management guidelines. One mechanism of note with regard to endangered or threatened species is the development of "recovery plans" for individual species. Such plans have been prepared for the Brown Pelican and American Crocodile. Private groups and individuals also play a significant role in habitat management and species protection. Notable efforts are ongoing through the work of the Wildlife Rescue Team, the Audubon Society, the Miami Seaquarium and other privately operated shelters for injured birds.

Primary programs for land acquisition such as the Land and Water Conservation Fund are administered by the Department of the Interior and the Florida Department of Natural Resources. The Florida Trustees of the Internal Improvement Fund (the Governor and Cabinet) administer the State Conservation and Recreation Land Trust Fund. Private groups such as the Nature Conservancy and the Trust for Public Lands have also played significant roles in acquiring unique or environmentally sensitive lands in Dade County.

At present there is little emphasis on minimizing collection of plants and animals or of reintroducing those plants and animals that have become rare in certain native habitats such as coastal hammocks. However, there are a number of agencies and community based groups such as local nurserymen, the Native Plant Workshop, environmental and youth service groups that could conceivably play a major role in such programs.

Recommended Actions:

(1) Federal, State and local park personnel, DERM staff and volunteers from local conservation or environmental groups should identify both publically and privately owned sites that should be designated as "Environmentally Sensitive" or "Environmental Education" areas. Known nesting, roosting, feeding areas or nursery grounds should be given high priority in such designation.

target date - 6 months

(2) County and municipal park naturalists and other field personnel should be authorized to issue citations to enforce "no collecting" laws in all publicly owned "Environmentally Sensitive" or "Environmental Education" areas such as the "Bear Cut Environmental Education and Conservation Area" and other areas as designated.

target date - immediate

(3) A cooperative program aimed at the propagation and reintroduction of native plant materials should be undertaken by local nurserymen, the Dade Urban Forester, Biscayne National Park personnel and volunteer groups such as the Native Plant Workshop.

target date - 3 months to initiate program

(4) Local nurserymen should be asked to initiate a cooperative program aimed at propagating native plant materials and informing the public about their use, through periodic advertising campaigns and sales.

target date - immediate

(5) The County and municipal nursery programs should increase their propagation of native plant materials and eliminate propagation of undesirable exotics, particularly Melaleuca. Landscaping of all public parks within the Bay shoreline area should be preferentially done with appropriate native plant materials.

target date - immediate

(6) Concurrent with #4, a selective program of removing certain exotic plants, particularly Australian pine, Melaleuca, and Brazilian pepper should be initiated in all metropolitan and regional parks.

target date - 6 months

(7) The sale, propagation, importation, and transportation of Melaleuca, Australian Pine and Brazilian pepper should be banned. Input should be solicited from federal, State, and local agencies and private groups such as the Nurseryman's Association before legislation banning these species is recommended for implementation.

target date - 6 months for recommendation to Bay Management Committee

Major Bay User-Related Concerns

The guidelines and implementation strategies discussed in this section address six of the Bay Management objectives that were adopted as the first element of the Bay Management Plan in December 1979:

- to provide a wide array of water oriented opportunities at the water's edge, consistent with the primary goal;
- to enhance physical and visual access thereby increasing the potential for environmentally sound utilization and attractiveness of Biscayne Bay for the public at large;
- to avoid irreversible or irretrievable commitments of the Bay's resources;
- to seek funding for activities which are necessary to achieve the primary goal;
- to promote water transportation and enhance the Bay's contribution to the economic health of the community through marina development and other appropriate measures consistent with the primary goal; and
- to provide continuing monitoring of the Bay in order to assemble an adequate data base for Bay management.

In this section the guidelines and recommended implementation programs and actions are grouped as follows: User Conflicts, Trash and Litter, Physical and Visual Access, and Public Awareness and Environmental Education.

User Conflicts

While there are no quantitative data on user conflicts within Biscayne Bay, many Bay users have expressed concern over potential and real conflicts among certain Bay uses and users. Snorkeling, SCUBA diving and water-skiing are frequently in conflict with each other and with other fishing and boating activities. Conflicts also exist among the three principal fishing groups: commercial, recreational from boats and recreational from land.

As discussed previously, both sport and commercial fishermen have emphasized that the growing number of unlicensed shrimpers has stressed the shrimp population. Additionally, during shrimp runs, trouble is frequently reported among individuals who hang drift nets from bridges, boaters and traditional dip netters. Boaters must avoid the drift nets, and dip netters are often precluded from using limited bridge space by a few drift netters.

As pleasure boating activity grows, so does the frequency of problems and conflicts which boaters experience. An inexperienced or careless boat operator can aggravate many user conflicts and cause problems even in a relatively uncrowded space. Within narrow channels or intersections they can create very serious problems. The renowned Columbus Day Regatta, which attracts about 1,500

boats to Elliot Key, illustrates the navigational problems and conflicts that heavy boating activity can generate. These include frequent or extended bridge openings, boats running aground in shallow areas, boats becoming immobilized when they wrap lobster or crab trap lines around their props, and boats colliding or having "near misses" with other boats or ships in the Government Cut shipping channel.

Bridge openings required by sailboats and vessels with high superstructure cause considerable frustration and traffic problems along the causeways. The problems that exist along Rickenbacker Causeway are widely recognized. The problems experienced along other roadways and bridges particularly the Miami River and Venetian Causeways are frustrating to boaters and residents, and costly to shipping interests.

Many boaters are unprepared for the maze of trap buoys that one encounters within the Bay. All too frequently, boaters wrap a trap line around their prop, causing damage to their outdrive or propeller shaft and making it nearly impossible for the commercial fisherman to locate and retrieve his trap.

Recent statistics point out the growing severity of boating hazard problems. In 1979 Florida led the nation in boating fatalities. A total of 111 people died in pleasure boating accidents in Florida in 1979, a 29 percent increase over the previous year's total. In most states less than 10 percent of the boating fatalities result from collisions; in Florida nearly one third of the victims die from injuries such as fractures and propellor cuts.

The following guidelines are adopted as initial steps toward resolving the user conflicts discussed above:

1. The shrimp fishery in Biscayne Bay should be managed to minimize conflicts among the three principal shrimping groups (e.g., commercial, recreational from boats and recreational from land).

2. The use of fishing nets from bridges shall be done in a manner which does not interfere with navigation. Fishing nets across channels should be prohibited.

3. An adequate buffer zone should be established around bridges and causeways where netting from boats shall be prohibited.

4. Water-skiing, swimming, snorkeling or SCUBA diving should be prohibited under or adjacent to bridges and piers where fishing is allowed or within major navigational channels, except for authorized bridge repair work.

5. To avoid user conflicts, appropriate areas should be designated within the Bay where uses such as water-skiing, skin diving, small boat launching, sailing and swimming will be encouraged.

6. Trap lines and associated buoys should be prohibited in designated recreational areas and navigational channels or corridors.

7. Traditional uses of the cuts and creeks for fishing and diving should be maintained wherever possible. Boating through these areas should be done in a manner which will minimize hazards or conflicts with these traditional uses.

8. In navigable areas where chronic shoaling occurs, the causes of the shoaling should be determined. Such areas should be clearly marked and maintenance dredged regularly, or alternative routes should be established.

9. Pleasure boating and skin diving in the Government Cut Shipping Channel should be done in a manner which will minimize hazards and conflicts with commercial shipping activities.

10. Adequate security and public safety should be provided along the Bay shoreline.

11. Boat owners should be required to have insurance, complete a boating safety course, or pass an equivalency test for certification. Minimum age limits should be established for all boat operations. These requirements should be established statewide.

12. A person who is cited for operating a boat in an unsafe manner should, at a minimum, be required to complete a certified boating safety course.

13. Facilities for berthing and launching of sailboats or vessels with high superstructure or antennae should be encouraged at environmentally suitable locations where bridge openings will be minimized.

14. Hurricane protection and evacuation plans should be prepared for all public and private marinas and made available to all marina users.

Agency Responsibilities. Most of the conflicts addressed in guidelines 1-3 and 6 are the subject of existing laws and regulation. In managing commercial shrimping, the Florida Statutes require the permitting of commercial shrimpers, establish catch size and handling requirements, and require the licensing of retail and wholesale food dealers.

The use of nets and fish traps in the Bay is limited under the rules for the Biscayne Aquatic Preserve, which prohibit the use of fish traps and the use of seines or nets except for catching shrimp or mullet. Traps and nets that are allowed in the Bay may not be placed in such a manner as to interfere with navigation. Under State law it is unlawful to secure a frame, trawl, or trap net to state road bridges, or to use more than one such net while fishing from a state road bridge. Within the Biscayne Aquatic Preserve, a 1,000 foot buffer zone around bridges is established within which net fishing from boats is prohibited.

The effectiveness of some laws is limited by their narrow scope. For example, restrictions on the attachment of nets to bridges are applicable only to state bridges and cannot be enforced on county bridges.

In practice, it is difficult to interpret or enforce some regulations to the letter. For example, without markers, the limits of the 1,000 foot buffer zone around bridges (where net fishing from boats is prohibited) cannot readily be ascertained by anyone in the water. Enforcement of certain laws is hampered by lack of specificity. There are no specific limitations on catch size or equipment that may be used by the recreational shrimper. The determination of whether an individual is shrimping for commercial purposes without a permit is therefore open to judgement. Enforcement officers base their determination on the reasonableness of the size of the catch on board and the kind and size of equipment being used. Despite legal prohibitions, the selling of shrimp by noncommercial shrimpers to uninformed or unconcerned individuals goes largely undetected.

Laws pertaining to saltwater fishing are enforced by officers of the Dade County Public Safety Department Marine Patrol, Florida Marine Patrol, and Biscayne National Park. These agencies rely heavily on obtaining voluntary compliance with regulations rather than on issuing citations for violations. Educating and informing the public in order to achieve cooperation and compliance is an important component of enforcement efforts. The number of enforcement officers is inadequate to minimize violations and resolve user conflicts, especially during shrimp runs and other periods of high use.

Although the State reserves the right to regulate saltwater fisheries, where user conflicts within Biscayne Bay are of concern, it is appropriate for the County Commission to propose changes to these laws and regulations to the Department of Natural Resources and the Dade Legislative Delegation.

Recommended Actions and Programs:

(1) Provide for the application of prohibitions regarding the securing of nets to bridges and limiting the number of nets used while fishing from bridges to all bridges within Dade County.

target date - immediate

(2) Limit the size of trawl nets that may be used by noncommercial shrimpers in Biscayne Bay. This provision should be subject to a three year sunset provision with revisions made at that time consistent with findings of the Fisheries Resource Management Study.

target date - immediate

(3) See page 72 for additional programs relating to the Bay fishery.

Conflicting and incompatible activities in Bay waters addressed in guidelines 4, 7, 9, 10, 11 can potentially be implemented in part through existing federal, State and local laws.

Reckless or negligent operation of a vessel is unlawful under state, federal and county law. Boating regulations can be enforced by the U.S. Coast Guard, Florida Marine Patrol, and the Dade County and municipal Marine Patrols. However, these regulations are quite general in nature and include few specific prohibitions, a situation which can inhibit enforcement as well as operator awareness of

unsafe practices. Limited staff resources have made it difficult for these enforcement agencies to establish and maintain a regular and consistent presence on the Bay. Most recently, Dade County Public Safety Department has substantially reduced the number of officers assigned to Marine Patrol.

Under Florida law, the State, and in certain circumstances the County, in coordination with the Army Corps of Engineers can establish restricted areas in water where safety or navigational hazards exist. The National Park Service also has the authority to establish use areas within its jurisdiction. However, except for fishing regulations, the various recreational uses of the Bay are presently limited only by physical characteristics such as shoreline configuration or bottom depth, and the existing built environment.

Although state and federal laws require that a report be filed by anyone involved in a boating accident, boat operators frequently do not know what agency to contact or how to do so. There exists no mechanism for citizens to report other problems, such as nuisances, unsafe boat handling, violations of fishing or collection restrictions, littering, or use conflicts.

With regard to guidelines 11-15, boating safety and navigational practices are taught by the Coast Guard Auxilliary and the U.S. Power Squadrons. Although these are voluntary programs recognized for providing excellent training, they reach only a fraction of the boaters who use local waters. While guideline 10 could probably be accomplished through these existing mechanisms, the implementation of guideline 11 would require a substantially new program. Currently no mechanisms exist to implement guidelines 13 or 14.

Recommended Programs and Actions:

(1) The County should seek funds from Sea Grant or other appropriate entity to conduct a survey of Bay use to ascertain the present attraction of shoreline and water related activities, impediments to use and desired opportunities for additional Bay access. This information should be used in conjunction with data generated as a result of the Bay Restoration and Enhancement and Urban Waterfront Projects to reduce user conflicts and improve public access.

target date - 3 months for initiation of study

(2) By resolution, the County Commission should request the Coast Guard to provide a preliminary analysis of accident reports and citations issued within Biscayne Bay from 1978 to the present. The analysis should include an assessment of time, location, and causes of accidents, occurrence patterns where discernible, and recommendations for preventing accidents and reducing violations.

target date - 6 months

(3) The County Commission should direct the Public Safety Department to provide a preliminary analysis of reported drownings, injuries, rescues, and other security and safety problems in Biscayne Bay and its tributaries.

target date - 3 months

(4) The County Commission should request that the Florida Department of Natural Resources and Florida Legislature appropriate additional funds to augment the present Florida Marine Patrol enforcement staff. The County should also appropriate funds to increase the Dade Marine Patrol force.

target date - immediate

(5) Based upon the findings in #2 and 3 above and the recommendations from the Safety and Use Conflict Task Force (see #6 below), the County should make supplemental requests and appropriations to achieve increased Marine Patrol enforcement.

target date - 1 year

(6) The Bay Management Committee shall appoint a task force to study user conflicts and safety hazards relating to recreational boating in Biscayne Bay. The Task Force shall be composed of representatives including but not limited to the following: Florida Department of Natural Resources, Dade County Public Safety Department, U.S. Coast Guard, Biscayne National Park, Dade Parks and Recreation Department, Florida Intracoastal Waterway Commission, Sea Grant Marine Advisor, the Army Corps of Engineers, and appropriate user groups. The task force shall make recommendations for action to be taken by the appropriate state, local, or federal agencies with regard to the following items:

a. Navigational and recreational safety regulations for Biscayne Bay and the Intracoastal Waterway.

b. Coordination of enforcement and emergency services including the preparation of a marine hurricane evacuation plan.

c. Methods to minimize conflicts between recreational boats in transit and other recreational activities such as fishing, diving and skiing and commercial shipping.

d. Minimum requirements for boat operators, such as age, licensing, and insurance.

e. Improved education and training opportunities for boaters.

f. Penalties for violation of safety and navigation regulations.

g. Marking of navigation hazards, such as areas subject to shoaling, commercial shipping lanes, and dangerously high traffic areas.

target date for Task Force recommendations to Bay Management Committee - 1 year

(7) Designation of the following use restrictions should be given priority consideration by the Bay Management Committee:

a. Prohibition of water skiing, swimming, and diving in specified major navigation channels, such as Government Cut, where these activities pose a hazard to navigation.

b. Restriction on boat speed and wakes in creeks, canals and channels under County jurisdiction, in order to accommodate without hazard fishing, diving and through traffic in these areas.

Where information gathered in recommendations 2, 3 and 7 substantiates that use restrictions are necessary in specific areas to eliminate safety hazards and mitigate conflicts, the Bay Management committee should recommend to the County Commission that restricted area designations be established for the proposed restrictions. By resolution, the Commission should request the Department of Natural Resources to designate the restricted areas and to conduct an investigation as required by Florida law.

target date for Bay Management Committee review - 1 year

(8) See Page 69 for additional programs related to Boating Impacts.

Trash and Litter

Some areas of the Bay shoreline are unsightly, chronic debris collecting locations. If allowed to remain over time, degradation of accumulated debris can cause noxious odors and locally decreased oxgyen levels. Currently there are two County cleanup boats. One works in the Miami River, the other in the Bay. One boat working to cleanup the Bay, however, may not be adequate.

The following guidelines are adopted as an integral part of the Bay Management Program:

1. Chronic debris-collecting areas along the Bay shoreline should be identified and the County and residential, commercial or industrial shoreline users should allocate sufficient resources to keep Biscayne Bay and the shoreline free of debris.

2. Developed shoreline areas which are (a) recognized chronic debris collection points, (b) offensive to surrrounding areas and (c) degrading existing water quality should be modified to eliminate those problems. Proposed shoreline configurations in developed areas which would create additional debris collection points should not be permitted.

3. There should be adequate trash receptacles, aesthetically pleasing 'no littering' signs and better trash collection at all facilities used by the public along Biscayne Bay.

4. With the assistance of various marine oriented organizations, a cleanup campaign for Biscayne Bay should be established.

Agency and Community Responsibilities. Existing County ordinances and state laws provide the means for implementing most of these guidelines. The Dade County Code makes it unlawful to litter within the County. Litter enforcement officers can be appointed by the Park and Recreation Department to enforce this ordinance. Trash receptables are provided on spoil islands throughout the Bay north of MacArthur Causeway. Trash is collected bi-weekly by the Public Works Department from those islands.

The City of Miami Code stipulates that shoreline homeowners are responsible for keeping their individual shoreline areas clean. The accumulation of litter on private property can be declared a public nuisance and the owner required to rectify the situation. However, in most cases the Public Works Department relies on citizen complaints to locate property where the accumulation of trash has become a nuisance. Because it is often difficult to trace debris observed along the Bay shoreline to a landward street address, official action is frequently impeded.

Recommended Programs and Actions:

1. County and municipal Park and Recreation and Public Works Departments should assess the need and the cost for additional trash receptacles and increased collection schedules in public areas fronting on the Bay.

   target date - 3 months

2. By ordinance, the County Commission should require all businesses fronting on the water to maintain adequate trash receptacles. Facilities which accommodate boats should be required to provide one trash receptacle for every 50 feet of dock.

   target date - 3 months

3. The County Commission and City Commissions of municipalities fronting on the Bay should declare a week to be devoted to Bay cleanup, with activities coordinated by the Bay Restoration and Enhancement Program.

   target date - immediate

4. Cleanup activities should involve youth groups; yacht and sailing clubs; racing and diving associations; civic and environmental groups; private business, particularly those associated with fishing and water recreation; and business associations including chambers of commerce.

   target date - 3 months

5. Implementation strategies related to shoreline modifications are included under Development Impacts (see pp. 76-77).

Physical and Visual Access

Background. The lack of physical and visual access to the bayshore is a major concern; especially in the north Bay and northern south Bay areas. Much of north Bay's 90 linear miles of shoreline is developed residentially, except for downtown Miami, the Port of Miami and the Interama Tract. The same is true in the northern portion of south Bay along the mainland, from the Rickenbacker Causeway south to Gables-by-the-Sea. Within these areas only a very limited amount of Bay shoreline is accessible to the general public. These include parks, public and semi-private marinas, causeways and several privately owned sites traditionally used by the public (see Figure 11).

Buildings, both large and small are frequently situated right at the water's edge, with minimal regard for scale, water orientation, visual access or shoreline treatment. Rarely is a sensitive transition between the buildings and the Bay established. In many

instances fenced-in swimming pools, tennis courts and parking lots are located directly on the shore. The buildings, and their associated uses create an impenetrable barrier that eliminates the possibility of access, not only from the immediate building and neighborhood, but from a much larger surrounding area as well.

The present configuration of single-family neighborhoods also walls off the Bay, preventing public physical and visual access. During the past few years there have been significant changes in shoreline development, which has had an effect on both physical and visual access to the Bay. Single family areas are being replaced by high-rise condominiums and apartment houses, compounding access problems. While many condominiums and apartments provide direct Bay access for renters through private marina facilities, residents not renting slip space are restricted, in many cases, from these bayside facilities and Bay access.

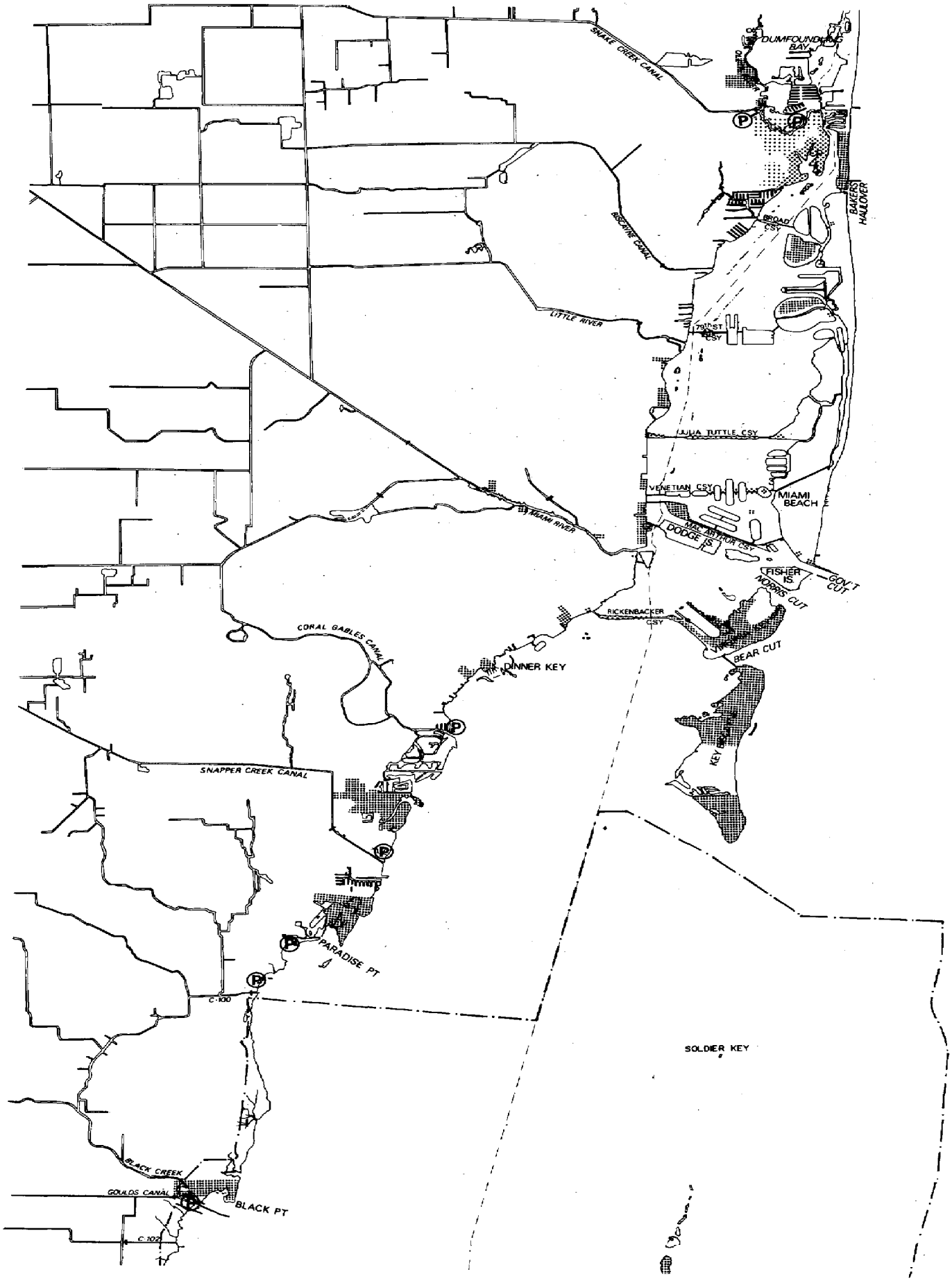
Except for the causeways, there is only a minimal amount of roadway which fronts the Bay. In some instances, such as downtown Miami, major north/south arterials near the Bay act as barriers preventing physical access to Bayshore parks. Visual access of the Bay from vehicles takes place almost entirely from causeways, which offer superb views of the Bay and surrounding city skylines. This is one of the most striking characteristics of the area, and could be used to much greater advantage. Of the six causeways across the Bay, only the Rickenbacker is open for direct public access to the water. The Julia Tuttle is fenced, prohibiting public use. Other causeways provide good visual access, but little else, since prohibitive signs discourage public use. Many streets run to the water's edge but are presently unutilized as Bay access points because guard rails, trash, limited parking and prohibitive signs discourage use.

Physical and visual access limitations are not only landside phenomena. The shoreline treatment of developed sites acts as a visual constraint to boaters as well. Physical access to the shoreline is also constrained; except for public and private marinas, few commercial shoreline facilities such as restaurants or bazaars, cater to the boating public.

South of Gables-by-the-Sea most of the Bay shoreline is bordered by a coastal mangrove forest. The expansion of the Biscayne National Monument into Biscayne National Park includes much of the band of coastal mangroves from Chapman Field south to Turkey Point. In spite of the fact that most of this shoreline is presently privately owned and generally inaccessible, certain areas along canal rights-of-way and street ends have been traditionally used for public access.

Shoreline Facilities. Shoreline parks potentially provide physical and visual access to the Bay. While some Bay shoreline parks provide boat ramps and marine related facilities, most do not take maximum advantage of their Bayfront location. At these parks a diversity of water dependent activities could be provided compatible with adjacent land use, in-Bay uses and offshore submerged communities.

There is substantial concern among members of the boating and marine community regarding the need for berthing, launching and repair facilities. Background material on existing facilities is presented in Technical Supplement Appendix VI and Figure 8. In 1979, the Dade County Planning Department published a document titled "Projections of Dade County Boat Registrations, Berthing Requirements and Related Data to the Year 2000." This document was essentially a refinement of projections that had previously been prepared for the County by the consulting firm Connell, Metcalf, and Eddy (1977).


SNAKE CREEK CANAL
DUMFOUNDLING BAY
BAKERS HAULOVER
BROAD CSY
BISCAYNE CANAL
LITTLE RIVER
79TH ST CSY
JULIA TUTTLE CSY
VENETIAN CSY
MIAMI BEACH
MACARTHUR CSY
DODGE IS
FISHER IS
GOVT CUT
MIAMI RIVER
RICKENBACKER CSY
NORRIS CUT
CORAL GABLES CANAL
DINNER KEY
BEAR CUT
KEY BISCAYNE
SNAPPER CREEK CANAL
PARADISE PT
C-100
SOLDIER KEY
BLACK CREEK
GOULDS CANAL
BLACK PT
C-102

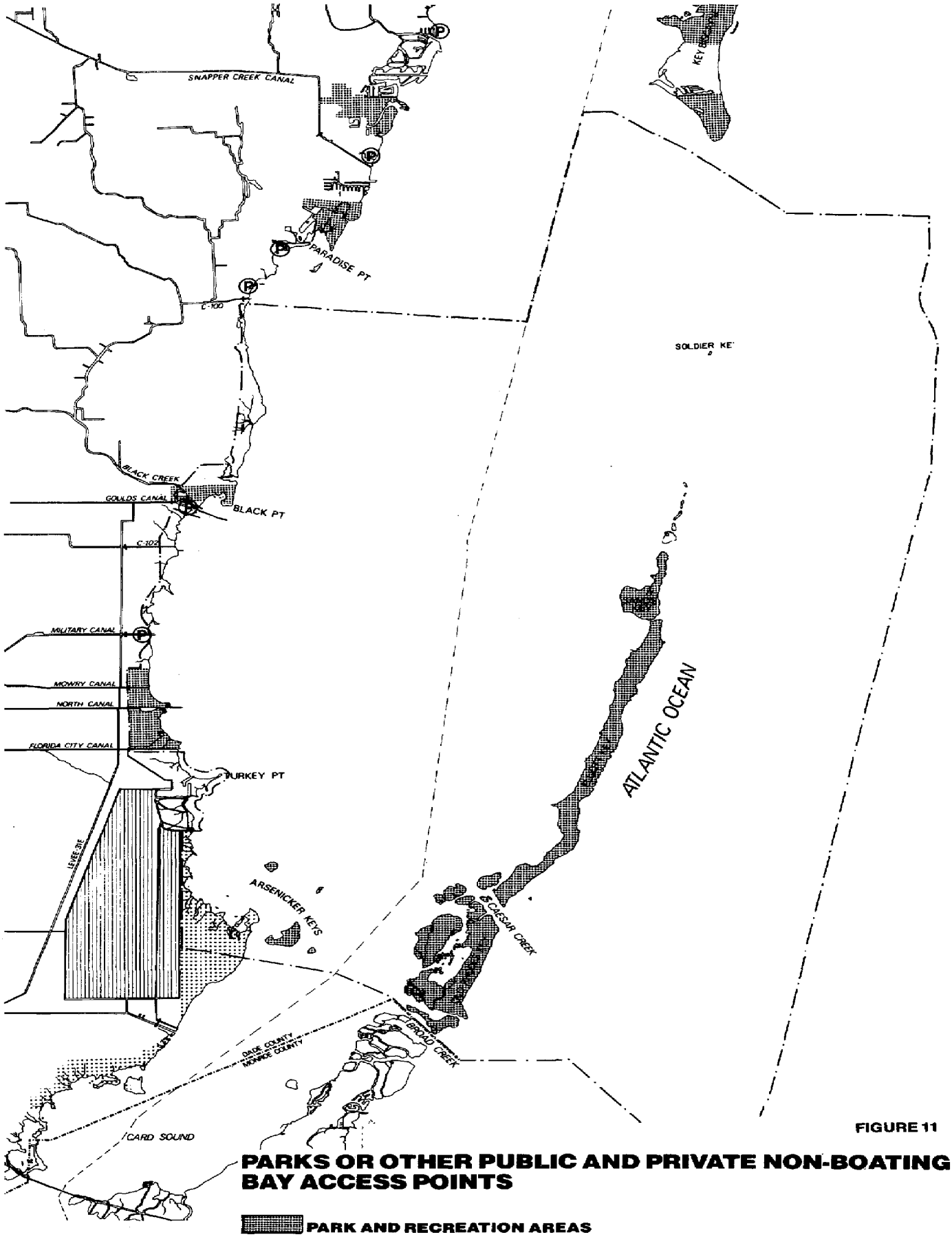


FIGURE 11

PARKS OR OTHER PUBLIC AND PRIVATE NON-BOATING BAY ACCESS POINTS

- PARK AND RECREATION AREAS
- OTHER PUBLIC ACCESS POINTS
- (P) PRIVATE LAND COMMONLY USED FOR PUBLIC ACCESS
- PRESERVES AND WILDERNESS AREAS
- BISCAYNE NATIONAL PARK

Both studies show considerable growth potential for boating and consequently berthing facility demand in Dade County. There is agreement also that the bulk of new berthing demand will be concentrated south of Rickenbacker Causeway. However, the Planning Department's projections of aggregate boat registrations and berthing requirements are lower than the consultant's for all projection periods. These differences are relatively minor for the immediate planning horizon, but become larger for more distant years. Specifically, the Planning Department's projections expressed as percentages of the consultant's projections are:

Planning Department's Projections
as a Percent of Connell Metcalf and Eddy Projections

Year	Pleasure Boat Registrations	Total Berthing Requirements
1982	92.3	90.8
1987	91.8	81.7
1997	87.7	68.7

The general conformity of the projections for the near term provides a common basis for short range planning. The progressive divergence of the projections over time cautions against inflexible commitment, and advises continuous monitoring. In view of the refinements incorporated in the Planning Department's projections it is thought that these form a more realistic set of planning projections. These findings are summarized in Technical Supplement Appendix VIII.

Comprehensive planning to provide marine facilities in the Bay must also take many factors other than berthing requirements into consideration. These include the nature of the shoreline and offshore conditions, the need for dredging or filling, landside accessibility and impacts on traffic, allocation of public resources, need for hurricane shelter and the cumulative impacts that may be potentially realized if a substantial number of the facilities that are currently proposed are constructed.

In order to initiate a coordinated approach to improving both physical and visual access along the Bay shoreline, the following guidelines are adopted:

1. A wide range of public water oriented opportunities which would enable large numbers of people to see and use the Bay should be provided at the water's edge along Biscayne Bay and the adjacent embayments within Dade County. Site selection should be based upon environmental and social as well as economic considerations.

2. Traditional public Bay area uses that provide public access (e.g. stationary shoreline fishing, wading, viewing, boating) should be given high priority when developmental changes are considered for the Bay or shoreline.

3. Public access to the Bay should be made more readily available to all segments of Dade's population through coordination with transportation networks such as bike trails, bus routes, "park and ride" facilities, walkways and vehicular routes. Consideration should be given to establishing a commuter and tourist waterborne transportation system which would interconnect major origin and destination points along the Bay.

4. Causeways, road rights-of-way and canal easements at the shoreline should be used to provide physical as well as visual public access to the Bay.

5. In presently developed areas, public shoreline access should be obtained through the extension of boardwalks, docks or piers from the existing public right-of-way in appropriate locations, based upon water and land use considerations.

6. Non-water dependent or incompatible uses of the shoreline (e.g., garages, trash pick-up areas, warehouses, auto gas stations) should be located as far back from the water's edge as necessary to minimize their adverse visual effects or reduce their negative impacts on the Bay's natural resources. (See recommended implementation programs 1-3 on pp. 76-7 in the Development Impact Section.)

7. Bayfront zoning categories should provide developers with the flexibility to preserve and enhance the visual and aesthetic qualities of the developed Bay shoreline. Design review by professional staff should be an integral part of Bayfront zoning procedures. (See recommended implementation programs 1-3 on pp. 76-7 in the Development Impact Section.)

8. Visual penetrations should be required of all new buildings fronting the Bay. Side setbacks, penetrations through the building, elimination of part of the ground floor or other appropriate methods should be encouraged to provide visual public access to the Bay. The use of earthen berms or mounds along the shoreline should be limited to the extent required to achieve water quality and management objectives. (See recommended implementation programs 1-3 on pp. 76-7 in the Development Impact Section.)

9. Mixed use developments that provide multi-use opportunities of the Bayfront should be encouraged. Uses that encourage public access in private developments such as restaurants and shops should be incorporated in new developments and redevelopments along the Bay. (See recommended implementation programs 1-3 on pp. 76-7 in the Development Impact Section.)

10. Historical places along the Bayfront should be retained and incorporated into new development and redevelopment.

11. The County should coordinate the development of a regional marina system including adequate facilities for repair and hauling of boats, wet and dry berths, and boat ramps and hoists with attendant parking.

12. The mix and number of facilities at individual marinas should be determined by factors, including but not limited to, access to the ocean and the Intracoastal Waterway, and nature of the surrounding region.

13. New marinas located close to existing residential developments should be designed and sized so that their expected sound levels are compatible with existing ambient sound levels measured at the perimeter of the landside extent of the marina property.

14. Major emphasis should be placed upon providing ramp and hoist access with associated parking at convenient and appropriate locations throughout the County.

15. Boat rental facilities should be provided within existing parks and marinas wherever they would be compatible with adjacent land and in-Bay uses plus offshore submerged conditions. Particular emphasis should be placed on small boats that can be made available at a reasonable cost.

16. Shoreline parks should take maximum advantage of their Bayfront location, and provide a diversity of water dependent or environmentally compatible public uses to attract the public to the shoreline. All public facilities should provide public access through the use of walkways, piers and fishing areas, wherever feasible.

17. Commercial development utilizing the shoreline should provide docking for transient boats and, where feasible, public access to the shoreline.

Agency Responsibility. The major responsibility for providing physical and visual access to the Bay has traditionally fallen to Federal, State, and local Parks Departments plus planning and zoning departments. Recently, however, many other agencies or authorities have become increasingly interested in the need to enhance the public's physical and visual access along the nation's waterfronts. A major goal of the Federal Coastal Zone Management Planning activities is to increase public access to the nation's shoreline. Locally, coastal zone funds have been made available to Dade County to look specifically at the Urban Waterfront of Biscayne Bay and to identify projects and programs to increase public access. Recommendations for implementation generated by that project are presented below.

In addition to Coastal Zone Management, other Federal programs have the potential to provide technical and financial assistance to localities that want to improve public shoreline access. The Heritage Conservation and Recreation Service of the Department of Interior provides financial assistance to states or their political subdivisions for acquisition and development of outdoor recreation areas and facilities for the general public. Under its Urban Park and Recreation Program, this service also provides project grants for demonstrating innovative means to enhance park and recreational opportunities.

Other agencies that are, or could be, involved in the provision of public access along the Bay shoreline are the South Florida Water Management District (SFWMD), the Department of Transportation (DOT), Public Works and the Downtown Development Authority. Finally, the Biscayne Bay Restoration and Enhancement Program which has been discussed previously is oriented not only towards restoring or improving the Bay, but also toward making the Bay more available and usable for the public. It is anticipated that more than eight million dollars will be requested from the Florida Legislature for improvement of public access along the Bay shoreline during the next decade. Against the background of this continuing involvement with public access the following actions are recommended to improve public visual and physical access to Biscayne Bay:

(1) That the following objectives and criteria be used in reviewing all developments (more intensive than single family or duplex or as specified by ordinance of adoption) within the boundary described in (8) on Page 49 and (1) on Page 76. The recommended implementation procedure would be the proposed changes in Chapter 33 of the Dade County Code which were discussed previously under the Development Impact section.

Review Criteria for Publicly Held Bayfront Lands

1. Where feasible the design of bayfront parks should include multiple uses which would encourage a wide array of public access opportunities.

2. The design of bayfront parks should include uses which are compatible with the natural, physical and socio-economic conditions of the area.

3. Uses that permit personal interaction with the Bay and shoreline should be preferentially located in shoreline parks.

In addition the following design factors should be considered when evaluating development on publicly owned land on the Bayfront:

1. Design. The development and redevelopment of shoreline parks should be designed to orient both physically and programmatically to the Bay.

2. Shoreline Treatment. The transition from water to land should be softened by the use of boulders as revetments, wood structures, and native plant material.

3. Landscape. Structures and landscaping should be used to focus views towards the Bay. High branching trees should be used in areas where there may be a view through to the Bay from the closest access road. Existing native vegetation should be retained and shaded sitting areas along the Bay should be incorporated in all public bayfront areas where appropriate.

4. Linear Access. Sites which have long Bayfront frontages should be designed with linear pedestrian paths linking together various appropriate uses, such as fishing piers, gazebos, and private uses such as shops and restaurants. Where potential hazards, such as industrial developments, may exist, viewing towers or elevated walkways could be provided.

5. Public Access. All bayfront public parks should be clearly marked and furnished with directional signs placed in strategic locations on the nearest major arterial roads.

6. Local Access. Access to public bayfront facilities should be enhanced for local residents by the provision of paved surfaces for pedestrians and bicycles, and through the provision of pedestrian-operated street crossing signals in appropriate locations.

7. Integration of Circulation Systems. The linkage of circulation systems to the park such as bike trails, bus routes and walkways should be provided.

8. Visual Access to Bay. Where possible, public parks should be designed to provide visual access from adjacent roadway(s) to the Bay.

Review Criteria for Privately Held Bayfront Lands

The following review criteria are divided into design considerations for the urbanized bayfront (north of the Biscayne National Park boundaries) and the non-urbanized bayfront (fronting on the National Park boundary):

Urbanized Bayfront. All new development and redevelopment projects along the Bay should be designed to respect the Bayfront environment and to optimize public physical and visual access to the Bay. In accordance, the following design factors should be considered in evaluating all privately developed urbanized Bayfront sites.

1. Public Spaces - Public spaces provided by private developers should be located in areas facing the Bay either on grade or above grade. Sites which have long bayfront frontages should be developed with linear pedestrian paths and minimum building setbacks of 50 feet. Where potential hazards, such as in industrial developments may exist, viewing towers or elevated public walkways could be provided.

2. Mixed Uses - Mixed use development should be encouraged on bayfront sites where such uses will not severely impact adjacent areas.

3. Visual Penetration - The walling of the Bay by buildings should be minimized by providing visual breaks between buildings, by providing penetrations through buildings or by raising the buildings above grade and by segments of no more than 75 percent of any lot to be covered by buildings or structures.

4. Definition of Public and Private Spaces - Site and architectural design solutions should clearly define public and private areas.

5. Transitional Elements - Building design should be related to the Bay by providing transitional design elements such as walkways, level changes, plazas, landscape, piers, docks or other transitional devices.

6. Shoreline Treatment - The transition from water to land should be softened by the use of boulders as revetments, wood structures, or native plant material.

7. Landscape - Structures and landscape should be used to focus views towards the Bay. High branching trees should be used in areas where there may be a view through to the Bay. Existing native vegetation and shaded sitting areas along the Bay should be incorporated in all bayfront development.

8. Historical Buildings - New buildings should be designed to be sympathetic to earlier historical buildings that are to be retained. Where historical structures exist on a site, such structures should be sensitively integrated into the new project.

9. Roof Decks - Roof decks, public and private, should be developed as passive recreation areas overlooking the Bay.

10. Air Movement - Buildings should be arranged in a manner that allows air movement to circulate through the development. Tall, wide buildings that create off-site wind shadows should be discouraged.

11. Buffers - Buffering elements that provide a logical transition to adjoining, existing or permitted uses should be provided.

12. Incompatible Uses - Incompatible uses such as parking lots and service areas and active recreation uses such as tennis courts and other similar court games that do not benefit by the bayfront location should be located in areas not fronting on the Bay.

Non-Urbanized Bayfront. Modification of on-site and adjacent off-site natural systems both in the short term (during construction), and long term (after completion of construction) should be minimized to the fullest extent possible. In accordance, the following criteria should be considered in evaluating all private developments in nonurbanized Bayfront sites:

1. Plans for development should indicate specific techniques used to preserve natural functions.

2. The physical scale of structures should preserve the natural visual quality of South Bay as perceived from both bayside and landside.

3. Limited public access to the Bayfront should be provided through the use of raised boardwalks and other similar structural devices that minimize disruption of the Bay-edge ecosystem and are compatible with any management plans that are developed for Biscayne National Park.

(2) That the second proposed implementation tool is the development of a model bayfront "PUD" ordinance for adoption by the County and by the municipalities that front on the Bay. The purpose of the ordinance would be to "free-up" certain individual zoning regulations, thereby providing the flexibility to create design solutions that respect the unique bayfront environment. Also development bonuses would be given in exchange for preservation of historical architecture and for design solutions that provide public visual and physical access to the bayfront. Methods whereby mixed use development could be utilized would also be included. (See Development Impact Section for related recommended actions.)

target date - 6 months

(3) That the County working with the appropriate local and state agencies shall seek to implement the specific public access project proposals that have been identified as part of the Urban Waterfront project:

a. That the State of Florida Department of Transportation, Department of Natural Resources and the Department of Environmental Regulation work together with the County Public Works, Parks and Recreation, Environmental Resources Management and Planning Departments to open Julia Tuttle Causeway for public use, and that all appropriate federal, state and local funding be sought to accomplish this project.

target date - 1-2 years

b. That the City of Miami and Dade County submit a joint demonstration proposal to the Office of Coastal Management or other appropriate agency to optimize physical and visual access opportunities in the Edgewater Area of the city between Biscayne Boulevard and the Bay from 15 Street northward to the Julia Tuttle Causeway.

target date - 6 months

c. That the County coordinate with the City of Miami to develop limited environmentally sensitive public access through the mangrove forest on Virginia Key to be used as an environmental education area.

target date - 6 months

d. That the County seek coastal zone or other appropriate funding to implement projects identified by the Urban Waterfront and Biscayne Bay Restoration and Enhancement Programs. Projects to be done include: development of appropriate street ends as mini-park and fishing areas, making accessible spoil island-picnic areas and constructing shoreline improvements such as board walks, piers or ramps in areas where in water enhancement and restoration activities are undertaken.

target date - 6 months

(4) That the final report of the Urban Waterfront Project be reviewed by the Bay Management Committee as a Technical Supplement to the Bay Management Plan and that recommendations from that project in addition to those included in (3) be included within the scope of the Bay Management Program upon approval of the Bay Management Committee.

target date - immediate

Public Awareness and Environmental Education

Planning for sharing community resources is a central element of the Bay Management Plan. This plan as a whole recognizes that the protection of the environment is a shared responsibility between the public and private sectors. Because Biscayne Bay is a large, diverse, and vital resource bordering on a metropolitan area, the community identified concerns cannot be adequately addressed by the governmental jurisdictions exercising authority alone; the use of citizen based resources for assistance in meeting these needs is necessary. Moreover, the nature of information distribution in general and the provision of education services in particular requires a multi-faceted comprehensive approach, which is beyond the scope of any one public institution.

This section's programs are categorized as either requiring increased public awareness or improved environmental education. As a first step toward developing a comprehensive public awareness and environmental education program for Biscayne Bay, the following guideline is adopted:

1. Public education programs developed in shoreline parks, schools and as part of other appropriate forums should seek to inform the public about a wide spectrum of Bay related issues and opportunities including the environmental, economic, recreational and aesthetic values of the resource as well as the potential conflicts among user groups and jurisdictional controls over the Bay resource. This information should include but not be limited to:

   - Improve awareness regarding functioning of habitats and organisms within and adjacent to Biscayne Bay.
   - Increase public awareness of endangered species that frequent the Bay and adjacent shoreline.
   - Discourage the public from collecting live plant or animal materials.
   - Inform the public that visibility in north Bay waters is often affected by the discharge of natural, organically colored waters from the canals in north Dade County.
   - Educate the public to recognize the symptoms of fish diseases.
   - Increase public understanding of the historical and archeological values of the Bay.
   - Improve awareness regarding the economic, commercial and recreational opportunities the Bay provides.
   - Keep the public informed about Bay related activities, user conflicts and impacts on the Bay.
   - Educate the public about hazards and the need for safety practices.

- Inform the public regarding the problems associated with littering.

- Improve public understanding about the principal Bay-related jurisdictions, their powers and responsibilities.

Public Awareness Program. There are a number of existing community resources which can implement this guideline.

They are:

The Biscayne Bay Restoration and Enhancement Program within DERM, Municipal and County Parks and Recreation Departments, public information offices and environmental education programs, Biscayne National Park, information and educational services, and a consortium of citizen based groups whose interests actively include the use and appreciation of the Bay.

Numerous agencies currently contribute resources for informational and educational services. The principal support agencies are:

The Florida Department of Natural Resources Public Information Office; United States Coast Guard; Dade County Public School System; Metro Dade County Economic and Community Development, Planning, and Park and Recreation Departments; Miami-Dade Community College, University of Miami and Florida International University.

The program to increase public awareness of identified Bay concerns will: use a multi-media approach, including graphic and written materials; avoid scientific and technical terms; have a young adult reading level; offer key materials in Spanish; and use community media. The principal agency involved in developing the public information package will be the Metro Dade County Department of Environmental Resources Management, through its continuing Biscayne Bay Restoration and Enhancement Program.

Increasing public awareness regarding the uses and resource value of the Bay has been identified as the top priority element of the Bay Restoration and Enhancement Project. As the result of a community participatory planning process, the following vehicles are planned to further public awareness:

(1) Publication of a periodic newsletter to include Bay activities, project events and program status reports. This newsletter will be received by all major community groups and interested citizens.

(2) Development of a media plan to establish contact with the mass media, Latin, and Black community media.

(3) Preparation of two informational publications titled "Who Governs Biscayne Bay?" and "Recreational and Access Opportunities." Others will be prepared as the need arises.

(4) Development of public service announcements on community identified Bay concerns.

(5) Establishment of a continuing series of public meetings on Bay issues and programs.

(6) Establishment of a speaker's bureau including a list of potential public speakers and their expertise as related to the Bay.

(7) Utilization of the Planning Department Information Center and the County's Citizen Information number as primary sources of information about the Bay. The public will be encouraged to use the Citizen Information Number to report boat accidents, navigation hazards, nuisances, complaints and problems relating to Bay use.

(8) Request that the Department of Natural Resources include appropriate information material in its annual mailing of boat registrations to all boat owners in Dade County. The request should be initiated by resolution of the County Commission.

Environmental Education Program. Materials will describe the Bay plant and animal life, their support systems, and detail the interdependence of Bay sub-systems with the entire Bay ecosystem. A multi-media approach will be used stressing citizen instruction and the distribution of specific learning materials. An environmental educational plan for Dade County will be developed. All materials will be shared among community based groups to foster information and education services. The following programs can be utilized to implement this Environmental Education Program:

> Biscayne Bay Restoration and Enhancement Program; Municipal and County Parks and Recreation Departments, Public Information Offices and Environmental Education Programs; Biscayne National Park, Information and Educational Services; a consortium of citizen based groups, whose interests actively include the use and appreciation of the Bay; Dade County Public and Private School Systems; Miami Dade Community College, Florida International University and the University of Miami; Metro Dade Department of Economic and Community Development; Dade Heritage Trust Program; and the Dade County Public Library System.

Presently, the Dade County and the City of Miami Parks and Recreation Departments, the Dade County School System and the Biscayne National Park each have environmental education programs and environmental specialists. Regularly scheduled guided walking tours are provided in both Miami and County Parks. At the Dade County Public Elementary School environmental education program on Key Biscayne, an environmental education specialist instructs grade school age children on ecosystems and environmental issues. Biscayne National Park has a visitor center on Elliot Key and plans an educational center for Adams Key. An environmental education specialist conducts the environmental education program.

In order to augment existing community based resources for environmental education the following actions are recommended:

(1) That trained volunteers and support material from community based groups be used to expand existing environmental education programs.

target date - 6 months

(2) That informational signs and educational exhibits about the Bay be placed at appropriate shoreline parks or other publicly owned shoreline facilities.

target date - 1 year

(3) That nature centers and interpretive walks be incorporated within the scope of all appropriate Bay shoreline parks.

target date - 1 year for design and plan of study

(4) That a centralized library and learning center for environmental affairs be included within the Metro Dade library system.

target date - 1 year for feasibility study and recommendations

GLOSSARY

Benthic Communities - Associations of plants and animals which live in or are attached to the Bay or ocean floor.

Berth - A place where a boat may be secured to a fixed or floating structure and left unattended.

Bulkhead - A structure or partition which retains or prevents sliding of the land, or secondarily protects the upland against damage from wave action.

Canal - An artificial watercourse cut through a land area for such uses as drainage, water supply, and navigation.

Central Bay Area (Mid Bay Area) - Includes that portion of south Biscayne Bay lying between the Rickenbacker Causeway and the southern Coral Gables city limit.

Coastal High Flood Hazard District (or Area) - Areas along the shorelines of coastal waters which are susceptible to flooding with wave action or flooding by a storm surge. These areas are delineated on Flood Hazard Boundary Maps prepared by the Federal Flood Insurance Administration by a "V," for flooding with velocity.

Coastal Water - The waters of the State or County where either tidal influence exists or where saline water occurs.

Community - The assemblage of organisms living in a given area.

Development - An application for zoning or rezoning through district boundary change, site or plot use approvals, special exception, special permit, unusual use, variances and other comparable County or municipal procedures subject to the vested rights of the developer as set forth in 2-114 (d) of the Dade County Code.

Endangered Species - Any plant or animal that is in imminent danger of becoming extinct or extirpated throughout a major portion of its range (see Appendices I and II for additional clarification).

Estuary - Any coastal body of water and associated wetlands strongly affected by tidal action and within which seawater is mixed (and usually measurably diluted) with fresh water.

Extirpate - Eradicate from a given area.

Heavy Metals - Metals which are considered highly dense in relation to their size, i.e., lead, copper, iron, and mercury. Most are toxic substances which can interfere with metabolic activities in humans.

Hydrology - The branch of science dealing with the distribution, characteristics, and effects of the waters of the earth.

Hydroperiod - That portion of the annual hydrological cycle during which water is at or on the soil surface. In estuaries, the hydroperiod is the annual period during which surface runoff from the land measurably dilutes seawater.

Leachate - Liquid which has seeped through materials, thereby accumulating some of those materials and transporting them to groundwater. Most commonly associated with rainwater which soaks through landfill (dump) sites.

Mean High Water - The average height of all high tides during a 19 year cycle.

Non-Point Source of Pollution - Generalized discharge of waste into a surface or ground water body whose source cannot be specifically located. Nonpoint source pollution includes stormwater run-off; run-off from construction activity; pesticides, herbicides and fertilizers used in agricultural activities and in lawns and gardens.

North Biscayne Bay - Includes that portion of Biscayne Bay lying north of Rickenbacker Causeway and extending northward to the Sunny Isles Causeway.

Nutrient - Any matter that, taken into a living organism, serves to sustain its existence by promoting growth and providing energy. Nitrogen and phosphorus are common plant nutrients.

Outfall - The point at which a collection pipe discharges stormwater or wastewater effluent to a receiving water body.

Photic Zone - That portion of the water column in a water body through which light can penetrate. The depth of the photic zone depends upon factors such as the amount of suspended materials present in the water column.

Point-Source Pollution - Discharge of degraded water through a discernable, confined or discrete conveyance, including, but not limited to, pipes, ditches, channels, tunnels, conduits or wells.

Positive Drainage - The practice of draining lands or roadways directly into the nearest waterbody via pipes or other continuous conduits.

Primary Canal - A major system for conveying water from one point to another. These canals are used primarily for drainage and conveyance of water supplies and are connected directly to the bay or ocean.

Pumpout Station - A facility for removal of sanitary wastes from a boat's holding tank or head.

Riprap - A layer, facing or protective mound of stones randomly placed to prevent erosion, scour or sloughing of a structure or embankment. At a minimum it should be limerock boulders of at least one foot in diameter placed at a 1:2 slope, i.e., 1 foot in vertical drop for every 2 feet horizontally, or flatter.

Road - Any artificially created paved or unpaved path or way on public or private property intended or used for the passage of vehicles, the elevation of which is higher than the natural ground upon, or adjacent to which it is located.

Safety Valve - The nine mile long network of channels and shoals which are located between the Cape Florida Channel and the Ragged Keys.

Sediment - The accumulation of solids which settle out of a solution. These solids form a layer on the bottoms of water bodies.

Shoal (verb) - To become shallow gradually.
Shoal (noun) - A detached elevation of the sea bottom composed of any material except rock or coral, and which may endanger surface navigation.

Shoreline - The immediate interface of land and a surface water body.

Shoreline Dependent - A use or activity which can be carried out only at shoreline locations because the use requires access to the water body for such reasons as water-borne transportation or recreation.

Shoreline Related - Uses which are not necessarily dependent upon direct access to a water body, but which provide goods or services that are directly associated with shoreline or water dependent uses, and which, if not located adjacent to the water, would result in public loss of quality in the goods or services offered.

Site Alteration; Alteration; or Altered - Destruction, displacement, removal or alteration including, but not limited to, removal of, or damage to, soils, vegetation, wildlife, and water resources by burning, filling, ditching, dredging, draining, excavation, earth moving, water containment and changes in the natural flow regime or the effects of such actions.

South Biscayne Bay - Includes that portion of Biscayne Bay lying south of Rickenbacker Causeway and extending southward to the county line in Card Sound.

Species of Special Concern - a designation used in Florida for species that are not now rare statewide, but that warrant special attention.

Turbidity - A cloudy appearance in water caused by suspended particles.

Water Dependent - A use or activity which can be carried out only on, in, or adjacent to water areas because the use requires access to the water body for waterborne transportation, recreation, energy production or source of water.

Water Related - Uses which are not directly dependent upon access to a water body, but which provide goods or services that are directly associated with water-dependent land or waterway use, and which, if not located adjacent to water, would result in a public loss of quality in the goods or services offered. Except as necessary for water dependent or other water related uses or facilities, residences, parking lots, spoil and dump sites, roads and highways, restaurants, businesses, factories, and trailer parks are not generally considered dependent on or related to water location needs.

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LEGAL DESCRIPTION
BISCAYNE BAY MANAGEMENT BOUNDARY

Begin at the point of intersection of the North Dade County line with the centerline of Biscayne Boulevard (State Road No. 5) thence run easterly along the north Dade County line to the centerline of Ocean Boulevard (State Road AlA); thence run southerly along the centerline of Ocean Boulevard and Collins Avenue to the centerline of 63rd Street (Miami Beach); thence run westerly along the centerline of 63rd Street to the centerline of Alton Road; thence run southerly along the centerline of Alton Road and its southerly extension along Jefferson Avenue to the centerline of Biscayne Street; thence run easterline along the centerline of Biscayne Street and its easterly extension to the easterly Mean High Water Line of Miami Beach; thence run southerly along the easterly Mean High Water Line of Miami Beach to Government Cut; thence run southerly across Government Cut to the easterly Mean High Water Line of Fisher Island; thence run southerly along the easterly Mean High Water Line of Fisher Island to Norris Cut; thence run southwesterly across Norris Cut to the easterly Mean High Water Line of Virginia Key; thence run southerly and southwesterly along the easterly Mean High Water Line of Virginia Key to the south line of Section 16, Township 54 south, Range 42 east; thence southerly across Bear Cut to the south line of Section 21, Township 54 south, Range 42 east; thence southerly for a distance of 2,250 feet to a point 2,325 feet east of the centerline of Crandon Boulevard; thence westerly to the centerline of Crandon Boulevard; thence run southerly along the centerline of Crandon Boulevard to the northerly boundary of Cape Florida State Park; thence run easterly along said northerly boundary to the easterly Mean High Water Line of Key Biscayne; thence run southerly along said easterly Mean High Water Line of Key Biscayne to a point east of Cape Florida Lighthouse near the southerly tip of Key Biscayne, thence run southerly along straight lines connecting the most easterly points of the easterly Mean High Water Lines of Soldier Key, the Ragged Keys, and Sands Key to the easterly Mean High Water Line of Elliott Key; thence run southerly and southwesterly along the easterly Mean High Water Line of Elliott Key; thence run southwesterly to the easterly Mean High Water Line of Old Rhodes Key; thence run southwesterly along the easterly Mean High Water Line of Old Rhodes Key to the southerly tip of Old Rhodes Key; thence run due southwest to the centerline of Broad Creek; thence run northwesterly along the centerline of Broad Creek and along the southerly boundary line of Biscayne National Monument and its westerly extension to the Mean High Water Line on the western shore of Biscayne Bay in Section 23, Township 58 south, Range 40 east; thence run southwesterly along said Mean High Water Line to its intersection with the west line of said Section 23; thence run north along the west line of said Section 23 to the southeast corner of the north one-half of Section 22, Township 58 south, Range 40 east; thence run west along the south line of the north one-half of said Section 22 to the west line of said Section 22, thence run northerly along the west line of Section 22, 15, 10, and 3, Township 58 south, Range 40 east to the southwest corner of Section 34, Township 57 south, Range 40 east, thence run easterly along the south line of said Section 34 for 1,670.00 feet to a point, thence run northerly parallel with the west line of said Section 34 for 1,720.00 feet, thence deflect left 35 degrees, and run northwesterly 1,500.00 feet to a point, thence run northerly parallel with the west line of said Section 34 for 820.00 feet to a point, thence deflect right 45 degrees, 00 minutes and run approximately 1,450 feet to a point located 1,800.00 feet east of the west line and 650.00 feet south of the north line of said Section 34, thence run northerly parallel with the west line of said Section 34 to the north line of said Section 34, thence continue northerly parallel with the west line of Section 27, Township 57 south, Range 40 east to a point located 1,550.00 feet north of the south line of said Section 27 and 1,800.00 feet east of the west line of said Section 27, thence deflect left approximately 43 degrees, 00 minutes and run northwesterly to a point located 2,300.00 feet north of the south line of said Section 27 and 1,150.00 feet east of the west line of said Section 27, thence run westerly 2,300.00 feet north of and parallel to the south lines of Sections 27 and 28, Township 57 south, Range 40 east to a point located northeast of 100.00 feet as measured 90 degrees, 00 minutes from the centerline of the extension of the Palm Drive access road to the FPL Turkey Point Power Plant, thence run northwesterly parallel with and 100.00 feet northeasterly of the centerline of said Palm Drive access road to the north line of said Section 28, thence run westerly along the north lines of

Sections 28, thence run westerly along the north lines of Sections 28 and 29, Township 57 south, Range 40 east to the eastern boundary of Levee 31E, thence run northerly along Levee 31E to the centerline of Old Cutler Road; thence run northeasterly and northerly along the centerline of Old Cutler Road to the centerline of LeJeune Road; thence run northerly along the centerline of LeJeune Road to the centerline of West Ingraham Terrace; thence run easterly along the centerline of West Ingraham Terrace to the centerline of Ingraham Highway; thence run northeasterly along the centerline of Ingraham Highway to the centerline of Douglas Road; thence run northerly along the centerline of Douglas Road to the centerline of Main Highway; thence run northeasterly along the centerline of Main Highway to the centerline of McFarlane Road; thence run southeasterly along the centerline of McFarlane Road to the centerline of South Bayshore Drive; thence run northeasterly along the centerline of South Bayshore Drive and South Miami Avenue to the centerline of State Road No. 5; thence run northeasterly and northerly along the centerline of State Road No. 5 to the point of beginning.

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