east everglades
resources planning project

PROPOSED MANAGEMENT PLAN FOR THE EAST EVERGLADES
Steering Committee for the East Everglades Resources Planning Project

Allan By, Dade County Planning Department, Chairperson
Dr. Douglas Yoder, Dade County Department of Environmental Resources Management
Peter Rhoads, South Florida Water Management District
Donald Levine, Florida Department of Environmental Regulation
Dr. Gary Hendrix, Everglades National Park

Project Staff

Sam Poole, Project Director
Mike Hazell, Principal Planner
Henry Ilter, Senior Planner
Emilie Wilson, Senior Planner
Andrew Lewis, Planning Technician
Julia Pagey, Planning Technician

Citizens Advisory Committee

Susan Wilson, Chairperson
Fred Beenech
Nancy Brown
Donald C. Burgess, Jr.
Jack Campbell
Christopher Coxe
Dr. J. D. Dalton
Richard Farace
Freddy Fiskell
La Monte Graw
Henry Green
Roger Hamner
Harry Heini
Phillip Hofstetter
Laurence Cusick
Ruth Wallace
Frank Ireland
Dr. Robert Kelley
Willy Kiker
Dr. Brian Logan
Dr. Robert McMorley
Hertlyn Reed
Clemente Espinier
Raymond Rosario
Alan Thomas
Joe Torcelli
Kim Woodbury
Donald Wight
Keith Mitchell
Ed Mitchell
Tom Mitchell

Residents and Property Owners Advisory Committee

All interested property owners and/or residents
Russell Carter, Chairman
Ray Rosario, Vice Chairman
PROPOSED MANAGEMENT PLAN
FOR THE EAST EVERGLADES

Dade County Planning Department
Dade County Department of Environmental Resources Management
South Florida Water Management District
Florida Department of Environmental Regulation
Everglades National Park

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PREFACE

Recent estimates indicate that since inventory in the 1950's the United States has lost over 40 per cent of our 120 million acres of wetlands; over 40% in less than 30 years. In an earlier day and time that rather astonishing figure would have been cause for celebration. As we move into the 1980's with the increasing body of knowledge about the economic, social, and environmental values of wetlands, that loss is cause for alarm. Since the 1950's, we have begun to recognize that there are hidden and not so hidden costs in the alteration and destruction of wetlands through channelizing, dredging, and filling. Aside from the obvious cost of the destruction of wildlife and vegetation, there are numerous other costs. Listed below are a few examples.

- The flood control projects to protect the people who live in filled wetlands.
- The flood insurance program.
- The loss of life and property and the disaster relief program when floods exceed the design capacity of the flood control project (Rapid City, South Dakota, 1972, and West Virginia, Virginia, Pennsylvania and Maryland, Hurricane Agnes, 1976) or when the system fails.
- The cost of relocating wellfields due to the salt intrusion caused by drainage.
- The higher cost of road building and maintenance, and other public services in wetlands.
- The cost of water purification treatment when water cleansing wetlands are replaced by polluted run off from flooded developments.
- The loss of income by commercial trappers and fishermen due to decline in game and fish populations.
- The loss of recreational hunting and fishing use traditional in wetlands.

We have come to understand in recent times that these costs are very real and very expensive, and are borne, not by the relative few who live in low density rural developments in flood plains and wetlands, but by the taxpayer at large. Thus, the cost of wetland ownership and development is low only to the owner/developer. The real cost is heavily subsidized by taxpayers in the form of flood control and water supply projects, disaster relief, more costly public services, welfare payments to commercial fishermen and trappers, and higher food costs for fish and shellfish, to name but a few. The notion that developing wetlands and placing them on the tax rolls benefits the public treasury is simply a myth. The long term public cost mentioned above can far exceed any increase in tax revenues. It was this understanding of the real cost of wetlands development as well as the concern for the conservation of irreplaceable natural resources that created the East Everglades Resources Planning Project.

The East Everglades Project was conducted under the guidance of an inter-agency Steering Committee composed of representatives of Dade County, South Florida Water Management District, Florida Department of Environmental Regulation and Everglades National Park. The draft proposals in this plan are the result of that Committee's careful consideration of the results of two years of studies conducted by the most qualified scientists and planners available. Throughout the nearly three years of work that the Steering Committee put into the design and implementation of the study, the Committee has sought to balance the property rights and expectations of individuals against the long term economic, social, and environmental health of the south Florida region. The draft plan that follows is the Steering Committee's recommendation for realizing the most equitable balancing of those competing interests.
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INTRODUCTION

The study area for the East Everglades Resources Planning Project encompasses some 242 square miles of land in western Dade County. The area is largely undeveloped and privately owned wetland. Functionally, it is part of what remains of the once vast Everglades Basin. The study area's freshwater resources, its wildlife and its vegetation, and the impact of future development on those resources are of paramount concern to Dade County, the South Florida Water Management District, the Florida Department of Environmental Regulation, and the Everglades National Park for several reasons. One reason is that the quality, quantity, and timing of the surface water flows through the study area into Everglades National Park and on to Florida Bay are critical to the environment within the East Everglades, the Park, and the Atlantic and Gulf of Mexico fisheries that depend on the Everglades marshes for nursery grounds. A second reason is that the East Everglades serves as an important exchange area for the Biscayne Aquifer, the sole source of supply for irrigation wells and drinking water in Dade County and a major source of drinking water for the Florida Keys. Yet another reason is that the volume of freshwater in the study area is a critical factor in preventing the intrusion of saltwater along the extensive coastline shared by Dade County and the Park.

Until very recent years, there had been little pressure for development in the East Everglades. However, as Dade County's population grew, urban development expanded from the coastal ridge to the south and west and demand for residential construction and agricultural activity in the East Everglades increased markedly. As development pressure on the area mounted, it became apparent that there existed little information specific to these sensitive wetlands on which to base sound land use and water management decisions. The increased development pressure, coupled with the concern of government agencies for the long-term health of the water supply, precipitated the East Everglades Study and the preparation of a management plan for the area.

Purpose of the Study

The management needs of the area required that the Project be broad in scope and the lack of information about the area determined that an extensive data collection effort be undertaken prior to the preparation of a management plan for the area. The environmentally sensitive nature of the area recognized by the Dade County Comprehensive Development Master Plan (CDMP) gave emphasis to protecting the outstanding natural values of the area. As stated in the Plan of Study for the Project, the objective of the Project is to:

- obtain the scientific data that will provide the basis for understanding of the East Everglades ecosystems; analyze, synthesize, and project the effects of various land and water uses upon these ecosystems, such that land and water use management regulations can be prepared and implemented. The purpose of these resource use regulations will be to allow land owners maximum use of their property without jeopardizing the long term economic, social, and environmental health of the community and the region.

The CDMP and the East Everglades project plan of study recognize the high value of the natural environment and systems found in the study area, largely out of recognition of the publicly important and irreplaceable qualities of those biota and systems. For example, the public water supply is not a resource which can be economically recreated by new technologies once polluted or depleted. Further, years of study have yet to produce any hope of recreating the native ecosystems of the East Everglades once those systems have been altered by farming. The land of the East Everglades is, however, held in private ownership and subsequently, the use of such property commensurate with its natural character must be allowed. This study and the management proposals contained herein are intended to
protect the public interest from long term adverse effects of private actions in the natural wetlands systems, while preserving the rights of private property owners.

**Study Area Boundaries**

The East Everglades area is part of the Kissimmee-Okeechobee-Everglades basin of southeastern Florida. It was the study area in its regional context. The boundaries of the study area were determined by need and by jurisdictional water management considerations (see Map 2). The area is bounded on the south and west by Everglades National Park, on the north by the Tamiami Trail area, and on the east by the publicly controlled water conservation area 3B. The irregular eastern boundary begins at the junction of Tamiami Trail and Levee 31 (L-31), follows L-31 south to its junction with Canal 111 (C-111), and follows C-111 south to its junction with C-111E. The boundary then runs north along C-111E for 0.3 miles, then due east to U.S. Route I, and follows U.S. 1 in a southeasterly direction to its intersection with the boundary of Everglades National Park.

**Project Administration and Funding**

Since its inception, the East Everglades Resources Planning Project has been a cooperative effort on the part of Everglades National Park, Florida Department of Environmental Regulation, South Florida Water Management District, Dade County Department of Environmental Resources Management, and the coordinating agency, Dade County Planning Department. With technical assistance from the U.S. Geological Survey and the U.S. Environmental Protection Agency, these agencies prepared the Plan of Study and obtained a special matching grant from EPA. The special grant became available pursuant to an inter-agency agreement between the Environmental Protection Agency and the Department of the Interior which set aside a portion of the funds allocated under Section 208 of the Federal Water Pollution Control Act Amendments of 1972 for studies of areas adjacent to National Parks, such as the East Everglades, where activities having adverse impacts on Park environments might occur. The cooperating agencies have provided matching funds for the Project and, through representatives sitting as a Steering Committee, have monitored and directed the study.

**Design and Conduct of the Study**

Water quantity and quality have been a central concern in this wetlands area. A complex set of physical relationships are united around a common dependency on this medium. Because the East Everglades is relatively remote and vast, little scientific information specific to this area existed prior to this study. For planning and management purposes this absence of data permitted little more than a general and limited understanding of the dynamics of this system and its ability to tolerate the stresses of various types of development. As the study progressed, some of these intuitive preconceptions were confirmed and others were refuted. For example, there was no evidence of uncontrolled agricultural use. The anticipated degradation of water quality did not occur. Because of the results of the study, the study recommends a threefold increase in agricultural use of the East Everglades, with an accompanying water quality monitoring effort.

This Draft Management Plan is a result of a major planning effort that started almost two years ago. During this time numerous technical, economic, and social planning studies in the East Everglades have been prepared. These reports, listed in Table 1, were prepared by consultants determined by the interagency Steering Committee to be the most knowledgeable and best qualified available. Over half of the project budget was spent on data collection and interpretation. The studies were designed to focus on the type of land use and the areas within the East Everglades where that type of land use was most likely to occur. Very little effort was expended investigating uses that
### TABLE 3 - PROJECT CONSULTANTS

**Vegetation:**
1. Dr. Ken Hochstatter, Associate Professor of Botany, University of Miami
2. Dr. Taylor Alexander
3. Chuck Kilianek, Research Associate, University of Miami
4. Dr. Joan Biurde, University of Miami

**Wildlife:**
1. Dr. James Kavan, N.P.
2. Don Ross, En.P.

**Climate:**
1. Dr. Paul Ort, Agricultural Extension Service

**Water Resources:**
2. Howard Klein, " " "
3. James Schaefer, " " "
4. Abe Szilvassy, South Florida Water Management District
5. Peter Shoemaker, South Florida Water Management District
6. Ron Mireau, " " "
7. James Lane, " " "
8. James Hartwell, Consulting Professional Hydrologist
9. Dr. Jerry Steinberg - Water and Air Research, Inc.
10. Gerald Parmer - Certified Professional Geologist, Parker and Associates

**Planning:**
1. William Roberts - Wallace, Roberts, Todd,
2. Vassos Zouzis - " " "
3. Richard Collier - " " "

**Geology:**
1. Ellis Bondy, U.S.G.S.

**Topographic Mapping:**
1. Tony Jones, U.S.G.S.

**Agricultural Economics:**
1. Dr. Cary Ruthis, University of Florida

**Legal Counsel:**
1. Charles Egan, Bass, Hardie, O'Keefe, Robinson and Parsons
or significantly disrupt the balance which currently exists within the natural environment. The maintenance requirement for the above example would permit no reduction in groundwater head by draining wetland areas. The second report, "Wetland Management Practices," (WMP's) describes the limitation of land uses and activities such that the natural characteristics and values found in the East Everglades environment are preserved. Continuing the above example, one WMP would require operation of gate structures to minimize penetration of saline water into canals.

At the direction of the Steering Committee, the third interrelated task was initiated. WRT and the Dade County Planning Department prepared a draft Management Plan based on the analysis and findings of the reports on ecological relationships and best management practices. The draft plan was reviewed by the Steering Committee and technical consultants and subsequently revised in light of their comments. A revised draft was presented and reviewed by an outside technical committee composed of scholars and professionals knowledgeable about the natural environment of South Florida and land use and resource management. Based on their comments and those of the Steering Committee, the final draft which follows was prepared. In several steps during the preparation of the draft plan, competing interest for use of the same resources required that the Steering Committee exercise professional judgement in resolving conflicting objectives. For example, native plants and agriculture cannot occupy the same space. The Steering Committee determined that many of the prairie sites hydrologically suited for farming should be farmed while the higher value tree islands—although farmable—should be protected.

To summarize, the studies conducted by the project and the project maps and reports represent the most complete and most accurate body of knowledge about the East Everglades Area that exists today. Information will continue to be collected in the future to augment the information base and update, refine, and/or revise the existing information, as appropriate.

To understand the way in which this study was conducted and the conclusions herein, it is essential to recognize two basic facts. First, no amount of research and studies will produce a meaningful, scientifically based formula into which one feeds data and cranks out land uses and densities acceptable to everyone (or even most everyone). The second basic understanding is that with the limited time and money available for this particular study, it was essential to focus on the central issues of resource management in the East Everglades; that is, the most likely uses in the most likely locations. This approach was taken by the Steering Committee with the knowledge that the information gained about the existing environmental systems in the Area and the effects of certain resource uses on those systems would provide a reasonable basis for the evaluation of other unlikely or unanticipated uses.

It should be emphasized that no lawfully existing use of land will be displaced by the results of this study. This draft management proposal recommends that existing permitted uses, including homes, antenna fields, businesses and nurseries and other agricultural uses be allowed to continue.
For the purpose of this general discussion, the south Florida Region includes the area bounded by Lee County, Hendry County, Lake Okeechobee and Palm Beach County to the north, the Atlantic ocean to the east and southeast, and the Gulf of Mexico to the west and southwest (see map 1). Notable features of the region are the beaches, islands, coves, marshes, and bays along its extensive shoreline; a sub-tropical climate; vast interior wetlands including the Everglades National Park and Big Cypress Preserve; Lake Okeechobee, the largest lake totally within the boundaries of the U.S.; the proliferation of tropical and sub-tropical vegetation; intensive urban development along the east coast; huge and highly productive agricultural areas; an extensive network of drainage canals, levees, and water control structures.

The East Everglades Study Area is defined by geographical boundaries, but its ecosystems are an integral part of the entire south Florida region's agricultural, urban, and natural sub-systems. The purpose of this Chapter is to briefly describe several components of this regional system which provide the context for understanding and managing the resources and services of systems functioning in the East Everglades.

Before 1900 south Florida was a vast wilderness of bays, marshes, swamps, hammocks, pine forests, and flatlands. Each of these natural features was defined by physical and chemical conditions of the land, by climate, and by representative plants, animals, and microorganisms, which together constituted an ecosystem. Each ecosystem was dependent on nearby ecosystems for its sustenance. Freshwater runoff, for example, nourished the interior marshes and carried needed nutrients to the bays. Each of the inter-dependent ecosystems was a subsystem of the regional ecosystem. In south Florida, warm weather and abundant freshwater and sunlight over the last few thousand years allowed relatively stable and biologically productive ecosystems to develop. The waters of the region abounded with fish and other aquatic animals, and these in turn supported large numbers of reptiles, birds, and mammals.

After 1900 people began moving to south Florida and began to modify the ecosystem. Areas were drained for farming and urban development, submerged land was filled, and trees were removed. The south Florida ecosystem that had developed over thousands of years gave way to a new three-part ecosystem which incorporated an agricultural component, an urban component, and a component of the natural ecosystem that remains largely undeveloped but affected by human activities. These components are interrelated through the sustaining flow of energy and resources. Today's agricultural and urban systems rely on the remaining natural systems to provide for the commodities and services of land, water, and oxygen production and for recycling nutrients, dispersing and detoxifying pollutants, retaining biological diversity, and producing fish and wildlife. If the natural systems are reduced, the benefits they once provided must be compensated for by the expenditure of additional energy, which is often costly to the system using the benefits. For example, the anticipated water shortages occurring as a result of area-wide drainage in the East Everglades would require expensive modifications to our water supply system (such as desalination or backpumping) in order to compensate for the loss of water from the natural system.

The waters of south Florida are a key environmental factor in the region's environment. Aquatic and terrestrial systems including human social and economic activities are controlled, to some degree, by the moisture in the soil, or by the duration and depth of inundation. These factors in turn are determined by the amounts and frequency of rainfall, the infiltration capacity of the soil and underlying rock formations, and by land elevations. Coastal systems are dependent on currents, tides, waves and some freshwater runoff to circulate and transport salts, nutrients, and other essential products. The region's waters also affect other controlling environmental factors such as fire, soil, temperature, and storm systems.
Climate

South Florida's climate is a sub-tropical marine climate characterized by warm temperatures, light, persistent winds, and two seasons, — wet and dry — typical of the tropics. Although average daily temperatures range from high degrees in northern, inland areas to 82 degrees in the Keys, the climate is termed "sub-tropical" because occasional frosts do occur.

No point in south Florida is more than 70 miles from the sea, and the marine influence on the region's climate is apparent. Water bodies heat and cool more slowly than land and have a moderating effect on landward air temperatures. Because sea breezes from the Gulf of Mexico and the Atlantic Ocean are relatively cool in summer and relatively warm in winter, they reduce the high summer temperatures and raise the cold winter temperatures of inland weather systems.

The average annual rainfall throughout the region is about 54 inches per year, with above average precipitation generally occurring along the east coast, and below average levels in the Keys and along portions of the west coast. As much as 85% of the annual rainfall is usually accumulated during the wet season from May to October. Most of this rain falls as local showers that are of generally high intensity but short duration. Clear to partly cloudy skies and intense sun prevail for most of the daylight hours throughout the year.

During the wet season months, south Florida's average rainfall is greater than anywhere else in the United States. Unfortunately, this high amount of rainfall presents a misleading picture. Rainfall in any year may vary considerably from the long term average. During wet years, south Florida is the water rich land that abundant rainfall suggests. During the periodic droughts that are a part of the sub-tropical climate, water can become critically scarce. Furthermore, even during average rainfall years, water supplies are not excessive. As much as 90% of the rain that falls is returned to the atmosphere by the high evaporation rates from water bodies and transpiration by lush green plants under intense sun.

South Florida is subject to tropical storms and hurricanes. Throughout the past century, south Florida has been struck by more hurricanes than any other area of equal size in the United States. Hurricanes usually commence over warm waters in the tropics and occur most frequently during September and October. Hurricane winds, the storm surge, and the torrential rains, can have radical effects on the natural and man-made environments in south Florida.

South Florida's climate, with its warm temperatures, usually clear skies, and abundant rainfall replenishing its water supply, has been a major factor in the growth and development of its urban and agricultural systems.

Physiographic Provinces

Physiographic provinces are defined primarily by topography, surface water, and drainage patterns; closely associated distinguishing characteristics include vegetation, soils, wildlife habitats, and land use suitability. Overall, south Florida's land surface is quite low, just a few feet above sea level in most areas, and quite flat. Five general physiographic provinces have been identified in the region: the Atlantic coastal ridge, the sandy flatlands along the upper east and west coasts, the Everglades, the Big Cypress Swamp, and the mangrove and coastal glades. (see Map 3).

Atlantic Coastal Ridge

The Atlantic Coastal Ridge, with an average width of five miles, runs along the eastern shoreline and varies in elevation from 8 to 24 feet above sea level with its highest elevations occurring in the City of Miami. That an elevation as low as eight feet can be distinguished from the surrounding land surface and identified as a "ridge" is a further indication of the slight variations which constitute the region's low, flat topography.
coastal ridge is breached in many places in Dade and Broward Counties by drainage canals, most of which have been constructed through shallow sloughs known as transverse glades.

The well drained sandy soils of the coastal ridge which seldom flooded under historic natural conditions, are vegetated by native pine trees and tropical hardwood hammocks. These forests, with orchids, air plants, and many delicate ferns, were one of North America's few tropical ecosystems and an important habitat for migrating and resident wildlife, such as deer and panthers. Even though the ridge is generally well drained and accessible by water transport, it proved a preferable location for Florida's early settlers. Today the population of the region is concentrated along the ridge. Most of this province is now characterized by intense urban and suburban development.

Sandy Flatlands

The two segments of the sandy flatlands — one between the Everglades and the Atlantic coastal ridge and the other north of the Big Cypress Swamp — are generally low and poorly drained. Elevations vary from 6 feet near Miami to 20 feet near Lake Okeechobee. The flatlands were characterized by large areas of pines dotted with many small, shallow ponds. In some places numerous ponds were interconnected and served as major flow ways for transporting rainfall from the flatlands to surrounding lower wetlands. Canals and water control structures have facilitated the drainage in this province, and much of this land is now intensively farmed. Urban development is increasing in this province, especially in the eastern flatlands.

Everglades

South of Lake Okeechobee, bordered on the west by the Big Cypress and on the east by the Atlantic Coastal Ridge, lie the Everglades, a shallow depression some 40 miles wide which extends 100 miles south from Lake Okeechobee to the mangrove and coastal glades near Florida Bay. The Everglades has an almost imperceptible slope, averaging less than two inches per mile from the 14 foot elevations near Lake Okeechobee to sea level at Florida Bay. Under historic natural conditions, the Everglades was inundated seasonally, and drained slowly to the south and through the transverse glades to the east.

The central floor of this vast wetland is relatively impermeable, but the edges are underlain by highly porous limestone. Under historic conditions, water moved as surface flow down the central body of the Everglades but passed into groundwater storage on either side. The Everglades, which retained wet season water supplies for several months into the dry season, played an important role in flushing and recharging the coastal aquifers, particularly during the dry season, and in preventing the intrusion of salt water near the coast.

The fluctuating water regime is a major factor in the functioning of the Everglades ecosystem, with its numerous plant and animal species adapted to this special environment. Alligator holes, for example, serve both as a habitat for the reptiles and as a means of storing water in small pools where fish could survive as water levels receded. Aquatic birds such as Wood Storks take advantage of these fish concentrations by producing young during the dry season. Vegetation communities respond to very slight differences in elevation (see Figure 1). Aquatic plants grow in the sloughs and ponds formed by shallow depressions; sawgrass dominates the wet prairie; and willows and hardwood hammocks become established where material deposited by the slow moving water has raised the elevation above the prairie floor. Fires, natural occurrences in the Everglades were essential to the ecosystem for their role in recycling nutrients, rejuvenating dying vegetation, and stimulating plant growth.
FRESH WATER WETLANDS COMMUNITIES

FIGURE 1
The most prominent soil type in south Florida is the peat and muck of the Everglades. These are organic soils formed primarily from the accumulation of partially decomposed, saturated vegetation. Comprising more than two million acres, the Everglades is the largest tract of peat and muck in the world. The ability of the Everglades to store water is enhanced by the sponge-like action of deep peat soils and by the dense growth of sawgrass vegetation that retards surface water flow. Peat soils are sensitive to water conditions for they oxidize, or break down, rapidly upon exposure to air. These soils have been altered drastically since the turn of the century, largely as the result of drainage which has lowered water tables. Near Lake Okeechobee, where the thick peat soils are heaviest, it has been estimated that the land surface has subsided nearly six feet in 40 years. Projections indicate that 88% of the peat and muck in the Everglades will have disappeared by the year 2000.

In order to meet flood protection and water supply needs of agricultural and urban development in south Florida, the Everglades have been altered on a large scale. However, the Everglades continue to provide an essential water supply/flood control/wildlife habitat function for the region.

**Big Cypress Swamp**

The Big Cypress Swamp is a large, flat prairie that is often inundated. Most of province is less than 15 feet above sea level and slopes gently toward the Gulf of Mexico. The predominant vegetation includes short, sparse grasses, dwarf cypress trees, and thick growths of algae covering the ground surface. Dense clusters of cypress trees growing in circular depressions which dot the prairie are called "cypress domes" because of their shape above the horizon. Strands or clusters of native slash pines are found on the higher rock ridges that wind through the area.

Water standing on the land for several months of the year seeps into the ground and directly recharges the underlying aquifer. Cypress stands and domes act as water storage tanks. The trees utilize a great deal of water during their growing season, which coincides with the wet season when abundant water is available. Unlike most of south Florida's vegetation, cypress is a deciduous tree, dropping its leaves and becoming dormant during the dry winter season. With their large trunks, even the bare trees shade the ponded water in which they grow, cooling it and reducing evaporation loss.

This province provides habitat for bear, panther, deer, alligator, otter, fish, and wading birds and most of the area remains undeveloped. A substantial portion of the Big Cypress Swamp has been acquired by the federal government and is contained in the Big Cypress Preserve.

**Coastal Marsh and Mangrove**

The mangrove and coastal glades lie mostly along the Gulf and southern coasts of the peninsula. The area is characterized by tidal streams, bays, lagoons, and thousands of small islands. Freshwater seeping slowly from the Everglades and the Big Cypress flows through the dense mangroves and coastal marshes into Biscayne and Florida Bays and the southeast coast estuaries.

The circulation of seawater in south Florida's shallow, protected estuaries is sluggish and evaporation from all water bodies is high. Without the flow of freshwater, this combination could result in high concentrations of salt creating conditions hostile to many estuarine and marine organisms. Because of the freshwater inflows, a relatively stable and highly productive estuarine environment can be maintained.

The Council on Environmental Quality (1975) has observed that "...mangrove swamps in the subtropics are among the most productive environments on earth. Their output of plant materials equals that of tropical rain forests; they are twice as productive as ordinary farmland. Sheltered estuaries, rich with these nutrients support two-thirds of the commercially valuable fisheries of the U.S. Atlantic coast and the Gulf of Mexico." The coastal marshes and mangroves have a natural capacity to remove pollutants and purify air and water if they are not overloaded. Mangrove communities, with their interwoven root systems, serve to establish shorelines, prevent erosion, and protect inland
areas from damage by absorbing the first shock of storm tides and waves. Mangrove roots provide a sheltered habitat for numerous juvenile marine animals such as shrimp, mullet and various game fish.

**Water Resources**

The people of south Florida, like most living things are dependent upon the region's fresh water supplies. The water resource is a major link between the physiographic provinces and between the agricultural, urban, and natural ecosystems. Great energy has been devoted to management of the region's freshwater resources since the urban and agricultural systems emerged in south Florida.

**Surface Water**

Local rainfall is the source of all of south Florida's freshwater. Over time rainfall is removed from the land by evapotranspiration, runoff, or seepage into the ground. Evapotranspiration rates tend to be highest in undeveloped areas where accumulated water is used and transpired by plants. Runoff is highest in urban areas where impermeable paved surfaces prevent infiltration and speed runoff to stormwater drainage devices designed to remove water from the surface.

The effect of surface water on south Florida's landscape is enormous. Three of the largest physiographic provinces described above - the Everglades, the Big Cypress Swamp, and the mangrove and coastal marshes - are wetlands. Because the land slope is gentle, natural drainage is slow and rainfall accumulates in these great wetlands. In the Big Cypress, water moves through broad strands and sloughs, often miles wide and inches deep. Seasonal rainfall combined with sluggish drainage inundates as much as 90 percent of the sloughs for as long as 4 months each year. With the onset of the dry season, water remains only in the deeper ponds and sloughs, which comprise only about 10 percent of the natural areas. Free-flowing streams in well-defined channels are rare in south Florida. During the wet season, most of the surface flow forms a sheet over the land surface, a phenomenon recognized in the naming the hundred mile long and forty mile wide expanse of the Everglades a "river of grass."

In its natural state, flow in the Everglades began in the lakes of the upper Kissimmee River north of Lake Okeechobee, and slowly meandered southward through the river's floodplain into the lake. In wet years the lake overflooded its southern rim and drained southward through the sawgrass Everglades, adding to the Everglades' shallow sheet flow produced by rainfall. However, much rainfall and sheet flow were and still are converted to seepage and evapotranspiration. Major watercourses within the Everglades are the Shark River Slough, which flows through the south end of the Everglades and through the National Park, and Taylor Slough, which drains about 40 square miles, including agricultural land west of Homestead. Before development of the region, flow from the Everglades also reached the ocean through shallow sloughs called transverse glades, which cut through the Atlantic coastal ridge. Canals have been built through most of these transverse glades to provide flood protection and water supply for agricultural and urban development.

**Groundwater**

The surface and groundwater systems of the region are closely connected by the extremely porous limestone strata that underlie south Florida at or near the land surface. Figure 2 depicts the relationship of the underlying formations to each other and to the land surface in a cross-section of Dade County. The upper 3,000 feet of subsurface formation is composed chiefly of limestone, sand, clay and shells. Water from the surface filters down into these rock formations, recharging the groundwater system. Groundwater flows downstream through the rock formations toward the coast.
GENERALIZED CROSS SECTION OF DADE COUNTY (Not to Scale)
WATER MOVEMENT IN THE BISCAYNE AQUIFER

FIGURE 2
Aquifers

The water bearing rock formations, or aquifers, of south Florida are composed chiefly of limestone and are a crucial component of the groundwater system. The aquifers which are used for urban and agricultural needs are the Biscayne Aquifer underlying Dade and Broward Counties, the shallow aquifer underlying the lower Gulf Coast, and the coastal aquifer underlying Palm Beach and Martin Counties. The general characteristics of these three aquifers are similar. The Biscayne Aquifer will be the focus of discussion here, because it is a part of the freshwater system of the East Everglades Study Area.

The Biscayne Aquifer is a highly permeable wedge-shaped formation that is more than 200 feet thick in coastal Broward County and thins to a feather edge 35 to 40 miles inland. The Aquifer provides water for all municipal water supply systems from Palm Beach southward, and for agricultural irrigation in Dade and Broward counties.

Over much of its extent, the limestone of the Aquifer is covered by only a few inches of soil. In some areas, such as the rockland areas of Dade County, the rock which emerges at the land surface is the upper surface of the Aquifer. Because there are no natural impermeable formations between the Aquifer and the surface, surface water infiltrates directly into the groundwater system. This relatively rapid infiltration allows the groundwater supply to be replenished quickly by precipitation and allows the groundwater level to rise freely. The Biscayne Aquifer is about 20% porous, which means that about 20% of the total volume of the rock formation can contain water. Consequently, one inch of rainfall measured at the surface, will raise the groundwater table 3 inches. In times of heavy rainfall the aquifer simply fills up and the water table rises above the land surface. This phenomenon contributes to the seasonal foundation patterns throughout the region.

In addition to being one of the most porous aquifers in the world, the Biscayne is also one of the most productive. High yields are obtained from wells penetrating solution riddled sections of the aquifer. For example, large diameter wells in Miami's municipal system are capable of yielding 7,000 gallons per minute (10 million gallons per day) while drawing down the water table less than 10 feet under normal conditions. The direct connection between the ground and surface water systems does make the Aquifer susceptible to pollution and disruption from activities at the land surface. Many contaminants are rapidly diluted in the large volumes of water contained in the aquifer, and the porous limestone acts as a filter. However, high concentrations of pollutants can overload and incapacitate the natural cleansing action. Because of its importance to the urban and agricultural ecosystems of south Florida as well as its sensitivity to the activities of these systems, the Biscayne Aquifer has recently been designated a 'soul source' aquifer by the U.S. Environmental Protection Agency.

Water Management

Unlike the natural ecosystems of south Florida, the urban and agricultural systems cannot operate efficiently under conditions of seasonal flooding and slow drainage. Both of these systems require that water levels be maintained at least a few feet below ground surface, and that excess water be removed quickly from large land areas. Consequently, almost from the moment that Florida entered the union, efforts began to drain and reclaim its wetlands.

The effectiveness of most early efforts was limited by an incomplete understanding of the components and functions of the freshwater system and the forces acting on it. For example, in 1851 the State contracted with entrepreneur Hamilton Disston to drain areas north of Lake Okeechobee in exchange for half the land he drained. Upon completion of the project the estimates of the reclaimed land depended on whether they were made in a wet year when 50,000 acres remained dry, or in a dry year when 2,500,000 were flood free.
Many drainage canals in south Florida were completed in the 1950's, and provided rapid removal of storm water to the ocean, but because the flow to and through the canals was not controlled, they continued to drain the aquifer during dry seasons. The drought of 1943-45 brought into focus one significant problem created by uncontrolled rapid drainage of land without regard for the replenishment of the freshwater: As freshwater levels were lowered, sea water intruded into both the canals and the aquifer, and freshwater supplies were contaminated by salt. The uniqueness of the south Florida water system often required a trial and error approach to water management. The single-purpose nature (drainage) of earlier projects created problems such as salt contamination that present-day water managers are resolving. The science and art of water management in south Florida has evolved into a highly sophisticated system that benefits from much knowledge gained from past experience.

**Salt Intrusion**

A 1976 report by the U.S. Geological Survey comments:

Resident in south Florida are becoming increasingly aware that protection of fresh water supplies from contamination by sea water has high priority .... Sea water intrudes silently, persistently. In its unseen spread, it can and does contaminate domestic wells, destroy city water supplies, kill crops, and render soil unusable for agriculture. Seawater intrusion has affected south Florida's water resources chiefly in Dade and Broward Counties over the past several decades.

The fresh and salt waters of the region come into contact along the coast. When streamflow and water tables are high, sea water is prevented from moving inland; when streamflow and water levels are low, sea water moves up tidal streams and into adjacent aquifers. Uncontrolled canals constructed from inland areas to the ocean lower freshwater levels, and reduce the fresh water's opposition to the inland movement of sea water. In these conditions, the canals provide channels to convey sea water inland. Most canals now have control structures to hold a freshwater head and to thus prevent the canal from conveying salt water.

The position of the fresh/salt water contact can also be affected when large volumes of fresh water are pumped from wells in an aquifer. As the wells are pumped, ground water moves toward the pumping area. If the wells are near the coast, salt water moves toward the wells also. If an uncontrolled tidal canal is nearby, the combined effect of the pumping and the proximity of the canal causes sea water from the canal to move toward the well field. Some municipal well fields were abandoned in 1945 and in earlier Miami history for this reason. One of Miami's wellfields was threatened by salt intrusion during the 1971 drought.

Past water management experience with the salt intrusion problem has led to corrective measures such as the control structures mentioned earlier. The salt intrusion problem is a constant threat in south Florida. The inland movement of the salt front has been halted by the south Florida Water Management District, but the District is fully aware of the need to closely manage water resources to prevent further encroachment of the salt front.

**Existing Water Management System**

As mentioned earlier, much has been learned about water management since the first efforts to drain south Florida were undertaken. The first regional plan for flood control was developed by the Corps of Engineers in 1944. A regional agency, the Central and Southern Florida Flood Control District, now the South Florida Water Management District, was created to operate and maintain water supply and drainage works. Since that time, the purposes of the drainage system have been expanded to include not only regional drainage and flood control, but also development of water supplies, conservation of natural resources, and the protection of environmental quality.
The present system is a highly sophisticated network of flood gates, pumping stations, canals, levees, and impoundment areas (see Map 4). Impoundment or "conservation areas" are used to store water to supplement urban and agricultural supplies in the dry season, to retain flood waters, to serve as wildlife management areas, and serve recreation purposes. Water held in the conservation areas helps to prevent salt intrusion.

The South Florida Water Management District is meeting the expanded purposes of the water system by modifications to a network that was constructed largely for the purpose of drainage and flood control. Many of the ongoing District projects are directed at correcting problems that were created by earlier more narrowly focused projects.

For example, Everglades National Park has been affected by rapid releases of large volumes of water from the conservation areas. These releases, on occasion, drowned established alligator and bird nests and otherwise disrupted the breeding and feeding patterns of the Park's wildlife. Means of redistributing surface water flows to Everglades Park are now both in progress in the ground and under study. In Dade County, the South Dade Conveyance System is being built to enable the movement of the larger volumes of water which in order to supplement water supplies for wellfields and irrigation, for surface flow to the eastern sections of Everglades National Park, and to prevent salt intrusion along the vulnerable southeastern coast. A means of redistributing excess flows across the historic width of Shark Slough to reduce abnormal flows into Everglades National Park is being evaluated.
III
ENVIRONMENTAL CHARACTERISTICS

Introduction

Provisions for effectively managing the East Everglades are developed from an understanding of the natural features and land uses which characterize the environment and the relationships which exist among them. This understanding provides the basis from which a series of maintenance requirements is developed to ensure that the features and functional relationships are protected. These maintenance requirements in turn provide the basis for developing best management practices which are the guidelines through which land use and resource utilization in the East Everglades can be effectively regulated. The following section briefly describes the environment, ecological relationships, management objectives, maintenance requirements, and environmental constraints as they apply to each feature. The management areas derived from this analysis are presented in Chapter VI of this report.

Water

Description

Of all the environmental features found in the East Everglades water is perhaps the most essential element in the maintenance of the ecosystem. The groundwater and surface water systems are often indistinguishable from one another and operate as one unit throughout much of the year. Because of the water regimen, almost all of the study area is wetland which is inundated for some portion of the year. In an average year, approximately 48% of the area experiences a water table no lower than one foot below the ground surface for at least nine months. Approximately 89% of the area experiences similar water levels for at least 36 days of the year.

As described in the preceding chapter, the current character of the south Florida hydrologic system is affected to a large degree by operation of the canal systems and the permeable nature of the Biscayne Aquifer. The East Everglades, with the exception of the Southeast Saline Everglades, has historically become drier because of the canals and their operation. Some of the water entering the groundwater and surface water system of the East Everglades enters through seepage from the canals or through direct releases from gate structures.

The general direction of surface water movement is south and southwest. Differences in the direction and rate of surface water movement are distinguishable within the four East Everglades physiographic subareas: Northeast Shark River Slough; Rocky Glades; Taylor Slough; and Southeast Saline Everglades (C-111 area). Map 5 delineates approximate boundaries for these subareas.

The groundwater regimen in the East Everglades is determined by the properties of the shallow Biscayne Aquifer. The wedge-shaped aquifer increases from a thickness of 20 feet at the northwest corner of the Area to 35-60 feet along L-31 on the eastern boundary. The porosity of the aquifer is greatest in south Dade County due to the lower sand content found in the aquifer there. The extensive volume of water stored in the system provides the hydraulic head which inhibits the intrusion of saline water into the groundwater systems southeast and south of Homestead and Florida City. Map 6 shows the average monthly groundwater flow direction for Dade County.

Environmental Relationships

Nearly all of the natural features found in the East Everglades environment rely to some degree on the water regimen and the high quality water
found throughout most of the East Everglades. Vegetation communities possess certain characteristics because of the flooding pattern and would be replaced by very different communities if the water regimes were changed to create either wetter or drier conditions. For example, tree hammock communities experience only occasional flooding and are not adapted to saturated conditions associated with long-term flood conditions. On the other hand, wetland communities such as sawgrass marshes cannot tolerate areas which do not have standing water for at least 3-10 months each year. Organic soils such as peats exist in Northeast Shark Slough because of the saturated conditions which persist in some places throughout much of the year. Substrates such as organic soils dry out in the East Everglades as the water table drops in the dry season. Most of the diverse wildlife inhabiting the study area and adjacent areas of Everglades National Park depend on water and water-related features for habitat. For example, many wading birds commonly observed in the park and the East Everglades feed on fish and other aquatic organisms which inhabit areas of standing water in Shark Slough, Taylor Slough, and the Southeast Saline Everglades. Many human activities depend on the amount, movement, and quality of water in the hydrologic system. Of particular concern is the availability of fresh water to meet domestic and irrigation demands in Dade and Monroe Counties.

Management Objectives

Because of the importance of water to the East Everglades environment and to users, the primary focus of the management objectives is the preservation and responsible use of water resources. As stated in the objectives, water quality and quantity must be protected to (a) ensure future availability of clean water for public use, (b) protect native plant communities, and c) provide for the long-term economic, environmental, and social health of the community and the South Florida region.

To maintain water levels, it is critical that neither the amount of water entering the system be decreased nor the amount leaving the system be increased to levels that would result in adverse impacts. In addition, the amount of time the water is held in the system should not be reduced. Maintaining water level and stage duration requires that sufficient volumes be held and delivered from the canals and adjacent conservation areas. Furthermore, pumping must be limited to volumes and rates that do not significantly deplete water stored in the aquifer or above the land surface.

Because ground and surface water systems are so closely connected, maintaining surface water movement is dependent on maintaining water levels. Land alteration criteria in addition, are necessary to ensure that the current flow patterns are not disrupted. In particular, placement of structures and fill must be done in a manner that does not block or divert the overland flow of water. All excavations (e.g., ditching) should meet specifications which (1) assure that they do not alter the movement of either ground or surface waters or (2) isolate the ground and surface water systems where they normally function in concert.

The potential for providing areawide structural drainage to parts of the East Everglades has been addressed in many of the reports prepared for this plan. In each instance the probable impacts of any structural drainage in the study area have been very negative. The potential areawide impacts of structural drainage in the areas have focused primarily on the heightened potential for salinity intrusion at the coast because of the reduction in fresh water storage capability resulting from drainage. The operation of the South Dade Conveyance System, which was designed to provide water deliveries to Everglades National Park and south Dade County during the dry season, could be adversely affected by structural drainage in the East Everglades. Severe impacts on plant communities and the wildlife populations supported by these communities would occur in those areas that are provided with structural drainage and eventually in those areas that border the drained land. Finally, it may not be technically or economically feasible to provide structural drainage to the East Everglades. In a report ordered for the East Everglades Resources Planning Project by the South
Florida Water Management District entitled "Water Management Requirements for the Bone and Alternative Scenarios" (p. 19), they state:

"Structural methods (for drainage) in addition to those already available are not likely to be implemented within the present planning horizon, at least on a regional project scale. Structural measures normally considered for drainage and flood control in this type of an area are a system of primary and secondary drainage canals with or without pump stations. Water control structures are placed at strategic locations to maintain non-erodable velocities and to prevent overdrainage during normal and drought conditions. However, structures on soils encountered in the study area do not perform satisfactorily in their function of preventing overdrainage. Experience in this locale has shown that, contrary to other areas and on other soil types, desired stages cannot be maintained behind the control structures without external supplemental supplies. The extremely porous limestone underlying this area contributes to inordinately large seepage rates when cut by a system of canals. Until subsurface exploration and drainage design techniques improve sufficiently to adequately ensure that overdrainage will not result from structural flood control methods, the danger of permanent damage to the water resource is too great to recommend their utilization."

A second major water consideration in the Everglades is quality. Water quality should be maintained at levels such that surface and groundwater quality standards are not exceeded, except when natural baseline levels exceed standards. The maintenance of high quality water in the Everglades requires that the chemicals added to water through human uses be limited and monitored and that sufficient volumes of groundwater be stored in the system to inhibit saline intrusion.

Hydrologic Constraints

Practically all of the Everglades is wetland, experiencing flooding conditions which are variable in terms of frequency, duration, and intensity. As such, the wetland water regime provides many benefits to the people of Dade County and the south Florida region, and to the visitors to Everglades National Park. This water condition also constrains many of the land uses which do or may occur in the area.

The relative wetness of areas within the Everglades is shown on Maps 7, 8, and 9. Using quantifiable characteristics of the hydrologic system, these three maps depicting stage-duration have been prepared from water level duration data from twenty continuous recording wells and surface water stations for a record period 1959-78. It should be noted that the period of record used in preparing these maps is biased towards relatively low water tables because the record includes four drier than average years, one wetter than average year, and five average years. Over a long term, the stage and duration of flooding in the Everglades is likely to cover a larger area than that depicted on the maps. The maps will be revised as more information becomes available.

The maps show areas where water is expected to be at or above the ground surface, and areas where water levels lie within one foot of the ground surface for nine, three, and one month(s) of a year. The one foot depth has been mapped because the topographic map indicates average elevation. In most parts of the Everglades the land surface is highly irregular, therefore one can assume that standing water will be found on portions of a given parcel of land during times when water levels for that parcel are within one foot of the elevation indicated on the topographic map.

Flooding constrains both residential and agricultural land uses. (For flood hazard areas, see Maps 10 and 11).
MAP 8

WATER:
Stage Duration
(25% or 3 months of the time)

- Water level at or above land surface
- Water level within 1 foot of land surface
- Water level greater than 1 ft. below land surface

East Everglades Resources Planning Project

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WATER:

Stage Duration
(75% or 9 months of the time)

- Water level at or above land surface
- Water level within 1 foot of land surface
- Water level greater than 1 ft. below land surface

East Everglades Resources Planning Project
Residential land uses are severely constrained in the Study Area due to the absence of flood protection. Continued residential development increases the potential damages that will result from a flood event. In addition to potential damages, the inconvenience resulting from flooding has historically been a major factor in demands for drainage and flood protection within the South Florida Water Management District. Due to unusual climatic conditions over the last 10 years, the Everglades has not been as wet as it has in previous years. The likelihood of wetter conditions in the future combined with the perception of local residents who have moved into the area since 1970 and have not experienced the normal wet conditions strongly suggests that there are problems associated with the existing level of residential development, much less future development.

The technical infeasibility of providing flood protection in the Everglades makes continued residential development in the Area extremely unwise. Such development will create serious long-term residential flooding problems for which there is no practical solution. Furthermore, there will be a high public cost for any attempts at incremental solutions to flood protection.

Agriculture is also constrained in those areas that have saturated soil conditions during the growing season. From an agriculture perspective, the best farmland in the Everglades is that which stays dry for the longest period of time. As farmers move into fields which are flooded for longer periods, productivity may be reduced because the number of crops which can be produced in a growing season is limited by hydrologic conditions, or because the flood risk during the growing season is high (see Map 11).

Terminology

Cone of Depression — A cone or funnel-shaped profile formed in the water table as a result of pumping stress. The aerial and vertical extent of this feature is predicated on several factors including pumpage rate, permeability of the formation, and thickness of the aquifer.

Stage Duration — For a specified period of time, water level (stage) reaches or exceeds a particular elevation point.

Vegetation

Description

Nearly fifty types of vegetation communities have been identified in the Everglades through extensive field investigations. Although distinct in character, similar communities can be grouped into the following broad categories:

- Hammock Forest (tropical and broadleaf tree)
- Thicket (cocosum—willow, wax myrtle—salt bush, buttonwood, pond apple, scrub mangrove)
- Prairie (mahly, sawgrass, beardgrass)
- Marsh (sawgrass, spike rush—beak rush, maiden cane, flag—pickerel weed, cattail)
- Prairie — Tree Island Mosaic
- Disturbed (including native and exotic species)

The natural vegetation communities of the Everglades include the wet marsh and periphyton associations, the moderately dry prairies and thickets, and the elevated hammock forests. The marsh associations occur primarily in the northern and southern portions of the study area and the prairie associations dominate the central areas. Hammock forests or tree island associations and thicket communities are scattered throughout the area as pockets of woody species among the large expanses of graminoid (grassland) communities. Disturbed vegetation communities occur predominantly along the eastern border of the study area and compose only a small portion of the study area (approximately 10%). Many of the native plant communities include rare and endemic species, as well as species which have been placed on the state list of threatened or endangered species (See Table 4).
Map 10
ENVIRONMENTAL CONSTRAINTS

- Flood Hazard - Residential
- Area with No Firm Flood Projection

East Everglades Resources Planning Project
ENVIRONMENTAL CONSTRAINTS

FLOOD HAZARD: AGRICULTURE; WATER WITHIN ONE FOOT OF THE LAND SURFACE 25% (3 months) OF THE TIME
<table>
<thead>
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<th>Species</th>
<th>Status</th>
<th>Federal*</th>
<th>State</th>
<th>FCP/EPA**</th>
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<td>Shy Leaves (Asplenium pinnatifidum)</td>
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<td>Black Mangrove (Avicennia germinans)</td>
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<td>Phyllanthus americulus</td>
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<td>Shadow Orchid (Papavera axillarii var. axillarii)</td>
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<td>Red Mangrove (Phyllostachys magellanicus)</td>
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<td>Florida Key West (Pogostemon pectinatus)</td>
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<td>Narrow Beardgrass (Pratia benthamiana)</td>
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<td>Florida Tripodon (Tripeuron floridanus)</td>
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<td>Canfound’s Poison (Vanessa cardui)</td>
<td>E</td>
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</table>

* Proposed only. Smithsonian list, 1975.
** Florida Committee on Rare and Endangered Plants and Animals
  R = Rare, E = endangered, T = threatened, S = species of special concern. e = endemic.
Community character and changes which occur naturally are the result of various interrelated factors, the most important of which are climate, flooding, soils, fire, wildlife, and human use. The wetland associations are supported by an extended period of flooding, while upland associations can tolerate only brief incidents of inundation. Most species are intolerant of frost and are stressed by drought. The wettest associations are commonly found to occupy peat or marl soils, while the drier communities prefer better drained rockland. Each individual community has inherent value for certain wildlife species. The combination of communities provides habitat variety, and this variety is essential to maintenance of a diverse wildlife population. While plant communities play a significant role in (1) cycling water, nutrients, energy, and air (2) in purifying contaminated water, and (3) providing recreational opportunities, human uses often disrupt or eliminate some of these critical functions.

Beside changes resulting from human use, invasion by exotic plant species and intense fires are among the most serious current threats to the perpetuation of natural vegetation. Exotic species having significant adverse affects on native communities include Australian Pine (Casuarina sp.), Brazilian pepper (Schinus terebinthifolius), and cajuput (Melaleuca quinquenervia). Generally when natural communities are disturbed they become highly susceptible to invasion by these and other exotic species. Once established, these exotic species are nearly impossible to remove and tend to out-compete and replace indigenous species. Although natural fire is an essential element to the health and survival of many plant communities, unusually hot dry season fires that are the result of arson or carelessness can be extremely damaging to the native plant communities and their growth medium.

Management Objectives

Because vegetation is largely dependent on water, meeting objectives which protect water quantity, quality, and movement helps to ensure the occurrence of natural and landscape vegetation features. In addition, in order to retain the native vegetation, it is necessary that certain disruptive or destructive activities be regulated, particularly in those undisturbed communities which are most sensitive to human uses.

Vegetation Constraints

Many land uses require the elimination and/or alteration of plant communities. Agriculture is a total and irremovable component of native plant communities because once land in the Everglades is farmed, it will never return to the plant communities which existed prior to farming. Residential use may not, at first, have an equally extensive impact on plant communities, but if the hydrologic region is modified because of demands for drainage from new residential developments, the impact on plants would be extensive and severe.

Fire hazard is the major constraint associated with vegetation. Large segments of the marsh, prairie, and other communities in the study area are fire climax communities, i.e., they have historically relied on fire as a natural periodic occurrence that maintains the grassy vegetation that characterizes the Everglades system. Because these grass fires are an expected periodic occurrence, the locations in which the grass communities exist are considered as severe constraints to residential development. These locations are extensive and fire hazard areas are indicated on Map 13. (For distribution of vegetation communities, see Map 12).

A second land use constraint associated with vegetation is the public value that has been given to certain plant communities. Some of the plants that are found in the East Everglades have been designated as rare or endangered on various federal, state, and local lists (see Table 4). Certain plant communities have been designated by the federal government as Critical Habitat for particular rare and endangered wildlife species (see Map 14). Finally, trees have been given special protection by Dade County. Before any native tree species can be removed, a permit must be obtained from the Dade County Department of Environmental Resources Management. Hardwood hammocks have been identified in the County's Comprehensive Development Master Plan...
Map 14

CRITICAL WILDLIFE HABITATS FOR ENDANGERED SPECIES

Federal Designation: Cape Sable Sparrow
Federal Designation: American Crocodile

East Everglades Resources Planning Project
Plan as warranting special protection. Native plant communities can be protected on residential sites. At the present level of knowledge, restoration of native communities is unlikely where agriculture occurs or has occurred.

Terminology

Graminoid Community - Vegetation association dominated by grass-like species.

Exotic Species - In the broad sense, any plant species which is not native to the area. In a restricted sense, any species that degrades native habitats and biotic communities, displaces native species, or threatens human health, safety, and welfare.

Prescribed Burning - When natural wet season fires do not occur, a plant community is intentionally burned under prescribed conditions to achieve a desired result (e.g., fuel reduction, nutrient cycling, disease and pest control).

Disturbed Community - A biotic community which has been modified severely by the presence of exotic species or occurrence of unnatural conditions. Disruptions of the natural community conditions by unnatural forces include selective removal of natural species, manipulation of hydrologic conditions, fire (man-caused, non-prescribed), disruption of soil/sediment conditions, and establishment of exotic species.

Rare Species - A species which has diminished in number locally or regionally because of unbalanced competition, over collections, or loss of habitat.

Endemic Species - A species which is native to a region, environment, or habitat.

Wildlife

Description

The wildlife which occurs in the East Everglades is one of the most valuable and unique features in the study area and throughout South Florida. Approximately 350 animal species are known to occur in the study area, including 34 species of fish, 18 species of amphibians, 44 species of reptiles, 28 species of mammals, and 239 species of birds. These species depend on a large diversity of habitats offering opportunities to feed, reproduce, and seek protection. Valuable habitats occur throughout the East Everglades, however, two habitat distinctions can be made — natural habitat and disturbed areas habitat (see Map 15). Animals which utilize natural areas frequently move freely to other natural areas within the study area and to other natural areas throughout South Florida. Some of the birds utilizing parts of the East Everglades on a seasonal basis are migrating species (e.g., woodstork, spoonbill). It is well recognized, therefore, that East Everglades habitats serve an important function for local as well as regional and international wildlife populations. Moreover, species which inhabit disturbed areas of the East Everglades tend to have a more limited range than those species occupying natural areas. In general, species using disturbed habitat tend not to move into natural, undisturbed areas.

Although all wildlife is considered a valuable resource, some species have been given special distinction. For example, some species are singled out because of their recreational value. Other species have been distinguished because they have been placed on protected lists by International Conventions or Federal or State governments. A total of 33 listed species (Table 5) occur in the East Everglades including 10 endangered on the list compiled by the International Convention on Trade in Endangered Species, 6 endangered and 2 threatened species on the Federal list, 6 endangered and 4 threatened species on the state list, and 6 endangered, 7 threatened, 15 species of special concern, 1 rare and 1 status undetermined species on the Florida Committee list. Several of the nation's rarest and unique animals survive in the East Everglades. The value of a species or subspecies is inestimable, particularly when extinction occurs as it has so frequently in recent southern history (e.g., ivory bill woodpecker, Carolina parakeet).
Map 15

ENVIRONMENTAL CONSTRAINTS

- WILDLIFE HABITAT
- CRITICAL WILDLIFE HABITAT

East Everglades Resources Planning Project
<table>
<thead>
<tr>
<th>Common Name</th>
<th>International</th>
<th>Federal</th>
<th>State</th>
<th>Florida Committee</th>
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<tbody>
<tr>
<td>Everglade Kite</td>
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<tr>
<td>Peregrine Falcon</td>
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<td>Florida Panther</td>
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<td>American Crocodile</td>
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<td>Cape Sable Sparrow</td>
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<td>American Alligator</td>
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<td>Indigo Snake</td>
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<td>Wood Stork</td>
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<td>Bobcat</td>
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<tr>
<td>River Otter</td>
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</table>

E = Endangered; T = Threatened; SC = Special Concern; R = Rare; U = Status Undetermined; * = Probably Present
Environmental Relationships

Water, vegetation, and human activities are the most critical factors affecting East Everglades wildlife. Aquatic organisms rely on flooding in both wet and dry seasons as well as the non-made canals to provide habitat. Changes in the extent of standing water has direct repercussions in wildlife population size, distribution, and diversity. Similarly, terrestrial species depend directly on vegetation for food and shelter and indirectly on other environmental features such as flooding which maintain vegetation communities. Conversely, many plant species depend on wildlife for its continued success (e.g., seed distribution, pollination). Human activities in the East Everglades have been and continue to be instrumental in changing wildlife populations. Changes have occurred either through reducing the number of a particular species, as in the case of the Florida panther, or through the elimination of habitat. Loss of habitat usually occurs when land uses displace habitat or when characteristics of the plant community are modified. Historic reduction of flooding in most parts of the area has shifted habitats from those characterized by vegetation preferring wet conditions to those communities which require drier environments (e.g., sawgrass to sandy prairie). Therefore, current wildlife population in the area differ in many ways from those of the recent past. Besides habitat modifications, recreational activities (e.g., hunting, airboating) have also altered wildlife populations in the study area.

Management Objectives

Meeting management objectives which ensure the maintenance of water regime, water quality, soils, and vegetation are instrumental in meeting the objective of protecting wildlife habitat. However, management practices are also necessary to ensure that the invaluable wildlife characteristics are maintained by protecting the area and habitat which privacy. Although protection of habitat and species is critical, management practices should ensure that some land be used for recreational activities where such activities are consistent with the realization of other management objectives.

Wildlife Constraints

The objective of preserving wildlife habitat and protecting wildlife species constraints most agricultural and residential land uses, and some recreational activities. The most severe constraints are imposed in areas of federally designated critical habitat by existing federal policy administered by the U.S. Fish and Wildlife Service (see Map 14). Compatible uses vary with the nature of the habitat. Areas inhabited by potentially hazardous species such as alligators and water moccasins may be off-limits to some activities (e.g., hunting, airboating). Water conditions when flood plains for homes are attractive.

Inasmuch as all plant communities provide certain types of habitat for certain wildlife species, all native plant associations in the East Everglades have important wildlife habitat value. Consequently, any alteration of natural site conditions for human use (residential, agriculture, water supply, etc.) should be conducted in a manner that will have minimal impact on wildlife habitats and on wildlife populations. Special consideration (e.g., regulations to minimize intrusion/disturbances) must be given to those federally designated critical habitats which provide food and shelter for endangered species.

Terminology

Florida Committee Listing – Florida Committee on Rare and Endangered Biota (Kale, Layte, McDiarmid, 1978).
Soils and Sediments

Description

There are two types of substrates which occur in the East Everglades - soils and sediments. Those identified as true soils include the Everglades, Gandy, and Loxahatchee peats located primarily in the north and northwest portions of the study areas. The second soil type is the Ferrine mafs which dominate the southern and southwestern parts of the area. The mafs are composed primarily of unconsolidated, finely divided, highly calcareous sediments. The peats and mafs are the wettest substrates in the East Everglades and are typically the most poorly drained. A small deposit of Rockdale-Limestone Complex is found in the southeast corner of the East Everglades, just south of Context Road. The remainder of the study area includes a substrate known as rockland. It is composed primarily of Miami oolite or Tamiami limestone with a very thin covering of unconsolidated soil material in places. Rockland is usually better drained than peats or mafs. In general, rockland is located in the central area of the East Everglades, primarily in the eastern two-thirds. Pinnacle rock, a rare geologic formation is found in the central portions of the area occupied by rockland (see Map 16). Peat, maf, rockland, and rockdale-limestone complex account for approximately 32%, 31%, 33%, and 1% respectively, of the East Everglades area.

Environmental Relationships

Soils and sediments interact directly with vegetation, water regimen, land uses. The physical and chemical characteristics of the substrate determine which plant communities occur. Marsh, true island, and thicket communities are commonly but not exclusively associated with peat soils. Marsh also commonly occurs in areas underlain by maf soils. The vegetation communities which generally occupy the rockland include the prairie-tree island mosaic, the disturbed community.

The water regimen in the East Everglades is highly influenced by substrate characteristics, particularly drainage and permeability. The volume and rate at which water is recharged into the aquifer is largely determined by substrate characteristics and water levels. Alternatively, the substrate characteristics are directly influenced by flooding conditions. In particular, peat soils are not usually destroyed by oxidation or fire when they remain saturated.

Management Objectives

By meeting management objectives which preserve the water regimen and water quality, the objective for protecting valuable substrate features is met. To further ensure the protection of valuable substrate features and functions, it is necessary that land uses which permanently alter substrate be regulated. While some management practices have been developed to protect the natural substrate features, they also ensure the use of land by private property owners where such uses are consistent with the protection of water supplies for Bade County, the south Florida region, and Everglades National Park and the economic, environmental, and social health of the community and the south Florida region.

Soil and Sediment Constraints

Because of the physical and chemical characteristics of peat (poorly drained, acidic, fire prone), this soil offers little opportunity for traditional agricultural activity. In addition, the sensitive nature of peats, their saturation requirements and poor load bearing capacity impose severe constraints on these areas for residential use. Use of peat for residential development requires excavation and filling prior to construction.

Rockland is a suitable agricultural material that is prepared for farming by rockploving, followed by mixing the crushed rock with fine materials, and regrading. Once an area is rockploved, the substrate is permanently altered. Pinnacle rock, found predominantly in the Taylor Slough subarea, is a unique topographic feature in the East Everglades and in south Florida. As a result, special protection measures should be taken to protect and preserve pinnacle rock formations.
SOILS

- Peats (Everglades, Gandy, Loxahatchee)
- Rockland
- Perrine Marls
- Rockdale-Limestone Corplan

Map 16

East Everglades Resources Planning Project
**Terminology**

**Rockplowing** - A technique for preparing rockland for planting, in which heavy machinery is used to break up the limestone rock, mix it with finer soil material, and regrade it into elevated planting bed and troughs.

**Pinnacle Rock** - A limestone formation in which softer parts have been dissolved and eroded away by water leaving behind solution holes and the harder areas which appear as rocky points of pinnacles.

**Calcareous** - Consisting of or containing the element calcium.

**Unconsolidated** - A mixture of sediments such as sand grains which have not been arranged in a specific order or in layers by natural forces.

**Substrate** - A general term which describes ground surface conditions including soils, sediments, and exposed rock.

**Land Use**

Little of the land in the East Everglades (approximately 12%) is currently being used except for passive recreation which occurs throughout the study area. Existing land uses occur to the largest extent along the eastern limits of the study area between Northeast Shark River Slough and the Southeast Saline Everglades (C-Illl Area). Predominant land uses in the East Everglades are agriculture, residential, and recreation. (See Map 17).

Existing residential development is rural in character and makes up only a small percent (0.2%) of the study area. Many of the residential parcels include auxiliary uses such as grove crops and animal husbandry. Residential land is concentrated in the Howard and Richmond Drive areas, although small residential pockets also occur near Chekika State Recreational Area and along Tamiami Trail. Total current estimated permanent population for the East Everglades is 400 - 450 persons, with the average household size ranging from 3.5 to 4.0 persons. Only four roads near the residential area are paved. Public services in the residential areas are poor, although most homes are serviced by electric and telephone.

Agricultural development is more extensive than residential use, occupying approximately 10,000 acres or approximately fifty-five percent (55%) of the area currently in use. The area's sub-tropical climate makes parts of the East Everglades attractive for growing winter crops. Crops most commonly grown include winter vegetables, citrus and tropical fruits, tropical vegetables, and plant nursery stock. Continued demand for agricultural land in Dade County and decreasing availability of it elsewhere in the County has placed greater emphasis on utilizing land in the East Everglades. The most significant drawback to agriculture in the study area is higher flooding risks than would be found on agricultural land which is provided with drainage.

Recreational activities occur throughout the East Everglades on public and private land. Chekika State Recreation Area is the only public recreation facility. It offers a range of activities and facilities including camping, swimming, picnicking, and use of boardwalks and an interpretive walking trail. Much of the private land is used with or without the landowner’s permission for operation of off-road vehicles (ORVs), hunting, fishing, and nature appreciation. Airboats and glade buggies are the most common type of ORV's. Airboat operation occurs primarily in the Northeast Shark River Slough area by individual users and small commercial operators. Glade buggies, large rubber tire vehicles, half and full track vehicles, jeeps,
and two/three wheeled motorcycles which are commonly driven over all types of wetland marsh and rocky glades can and do have adverse impact on the environment.

Hunting and fishing occur in several locations in the study area. The most commonly hunted game includes deer, raccoon, rabbit, fox, and birds; the most commonly caught fish include panfish and black bass.

Other passive recreational activities known to occur in the study area are soaring, skydiving, and nature appreciation (e.g., birdwatching, plant identification).

Historically, some heavy commercial activities have occurred in the East Everglades. Commercial activities have included rocket engine testing, roof-trees construction, fish farming, and auto testing. The latter two continue as active uses today.

Environmental Relationships

The relationship between land uses and environmental features determines the suitability of the land to accommodate uses. The relationships of agriculture, residential, and recreation uses to water, vegetation, soils and other environmental features have been discussed throughout this chapter.

Management Objectives

Besides environmental protection, management practices provide for the use of land by private owners consistent with the protection of water supplies for Bade County and Everglades National Park and for the economic, environmental, and social health of the community and the south Florida region.

Land Use Constraints

In general, consumptive land uses such as agriculture and residential are most suitably located in areas which have already been modified. Where modified land is unavailable, the next best locations are those parcels of land which are contiguous to areas already in use. Because most recreational uses and activities do not permanently alter the land or natural features, they are generally not as locationally constrained as agriculture or residential. The only real constraint that exists among different land uses is between agriculture and residential. Residential users often consider certain aspects of high technology agriculture such as crop spraying to be undesirable. In turn, the dissection of farm land by residences is undesirable for farmers.

Terminology

Passive Recreation - Activity which requires no major alteration of land (e.g., hiking).

Active Recreation - Activity which may require land alteration and construction of facilities (e.g., camping ground).

Light Commercial - Small establishment selling novelties, boat rides, farm produce, etc.

Agricultural Development - Modifying the land to accommodate activities associated with raising for commercial purposes row and grove crops and nursery stock.
Climate

Description

The south Florida region has a sub-tropical maritime climate characterized by mild, dry winters and hot, wet summers. The region, including the Everglades, experiences an average of 33-60 inches of rainfall each year. Most of the rainfall (approximately 85% or 50 inches) comes from convection storms during the May to October rainy season. The large volume of water delivered during short, intense summer storms is not immediately absorbed by the ground and vegetation but is held in the system as floodwater until the water can absorb it. Rainfall accounts for over 90% of the total inflow of water into the Everglades.

Water is removed from the hydrologic system primarily by evaporation from free water surfaces and soils or sediments and by transpiration, a natural plant process which removes water from the ground and releases it to the air from leaf surfaces. Evapotranspiration removes about 85% or 50 inches of rain from the water system each year. This means that a surplus of only 5-10 inches of rain is available for water management in an average year.

Temperature ranges from mild during the winter months to hot during the summer. Occasionally during winter nights temperatures will drop below freezing for a brief period. Summer temperatures may on rare occasions exceed 100°F.

Environmental Relationships

Climatic conditions have a significant effect on the natural features and land uses which occur in the study area. The hydrologic system is inherently dependent on climatic factors. The amount of water in the system is almost entirely determined by the volume of water entering from precipitation and the amount leaving by evaporation and transpiration. Temperature and precipitation are major determinants of what plant species can grow and how successfully they grow. This applies to natural plant communities as well as agricultural species. The sub-tropical climate allows many crops to be grown in the Everglades which cannot be grown in winter in any other area of the continental United States. During the winter growing season, temperatures occasionally drop to or below freezing, posing a threat to crops. Although studies have shown that localized warmer and colder spots occur in Biscayne County, such conditions occur fairly uniformly throughout the County.

Many parts of the County, including parts of the Everglades, are threatened by the effects of hurricanes and other intense tropical storms. Hazards in the study area associated with intense storms often include flooding, high winds, and intrusion of saline water into the freshwater wetlands. These storm conditions impact the natural environment but have more severe and dramatic impacts on residential and agricultural land uses.

Management Objectives

Because the management objectives provide for the private use of land consistent with the objective of protecting human health, safety and welfare, it is necessary that land users be directed away from areas which pose climate-related hazards to the land users.

Climatic Constraints

The major climatic constraint is that of flooding which results from normal summer storm events and the occasional, intense hurricane and tropical storm. Flooding often constrains the use of land for many activities such as farming and can pose a danger to human users and property.
Conclusions

The individual elements, systems, and functions of the East Everglades wetland environment are a critical resource to Bade County and to the entire south Florida region. Water is perhaps the most essential component. Clean, fresh water which is stored and transported through the East Everglades helps to ensure the public water supply drawn from Bade County and Monroe County wells and the delivery of water to Everglades National Park. Water is also instrumental in maintaining the study area's natural features including native plant communities, diverse wildlife populations, and unusual soils and sediments such as pinnacle rock.

Vegetation is especially important because of the food source and shelter it provides hundreds of animal species. Many of those species are rare, endangered, or threatened and rely on the habitat for future survival. These habitats are not only critical to local animal populations, but to regional and international populations as well. Additionally, vegetation and wildlife impart certain aesthetic qualities to this vast wetland environment which may be appreciated by user groups of highly variable interests.

Because this environment operates naturally as a system, disruption of one element, especially its fresh water, is likely to have severe repercussions upon other elements of this intricate system. As a result, public and private benefits whether they be natural open space available for recreation or abundant potable water supply are permanently sacrificed.
One of the initial steps in this resource planning project was to identify the goals and objectives which the management plan should attempt to achieve. The management objectives for East Everglades Resources Planning Project listed at the end of this chapter were based on existing regulations and policies that are currently applied to the study area as well as laws, regulations and policies which are concerned with freshwater wetlands in general. Every level of government with jurisdiction in the East Everglades has developed a position concerning the public values associated with freshwater wetlands. Instead of the historic attitude which equated wetlands with wasteland, the public and the governments which represent them, have begun to understand and recognize that wetlands provide many public and private services that have considerable economic and social value. In light of this understanding, President Carter issued Executive Orders 11990 - Protection of Wetlands, and 11998 - Floodplain Management. In the statement accompanying Executive Order 11990, the President describes the inland wetlands of the Nation as "vital natural resources of critical importance. Wetlands are areas of great natural productivity, hydrological utility, and environmental diversity, providing natural flood control, improved water quality, recharge of aquifers, ... and habitat for fish and wildlife." "The unwisec use and development of wetlands will destroy many of their special qualities and important natural functions." This Presidential directive highlights the real and tangible values associated with wetlands as well as the severe and cumulative costs that have resulted from the loss of 40 percent of the Nation's wetlands since the 1950's through draining, dredging, and filling. In reference to Executive Order 11998 - Floodplain Management, President Carter indicates that unwise land development in floodplains results in "(increasing) annual losses from floods, destruction of the special qualities of these areas," and "severe threat(s) to human life, health, and property." "In order to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains (the Federal government should) avoid direct or indirect support of floodplain development wherever there is a practicable alternative."

The President's directives in fact, are a reflection of many laws, regulations, and policies that had been developed at the federal, state, regional, and local levels. As a result, rather than being drained and "reclaimed," the lasting benefits that are provided by wetland ecosystems and floodplains like the East Everglades are being protected, conserved, and managed.

Like all of our nation's freshwater wetlands, the East Everglades has its own inherent values and functions. However, the East Everglades is of particular importance as a wetland and a floodplain because of its location in the historic Everglades system from Lake Okeechobee to the estuaries of Florida Bay. These estuaries, which depend on freshwater inputs from the Everglades basin, serve a vital nursery function for the fishery resources of the south Florida region. Unfortunately, this valuable resource has declined considerably in recent years and, even though studies on the decline are incomplete, changes in the timing and volume of water deliveries to the estuaries resulting from the dramatic changes in the regional hydrologic regimen are thought to be the principal cause. Further disruption of the timing or quantity of freshwater inputs due to hydrologic alterations in the East Everglades would likely increase the severity of the regional problem.

Because zoning and land use planning are largely the concern of local government, Bade County's Comprehensive Development Master Plan provides an appropriate starting point for identifying management objectives which are appropriate to the East Everglades. The CMP placed the bulk of the East Everglades within an Environmental Sensitivity zone. The policies of the CMP which were developed by groups of Bade County citizens, include statements concerning the need to protect the quality and quantity of our freshwater resource. The CMP also addresses the need to protect "sensitive and
unique natural areas." While local governments are principally responsible for preparing local land use plans, regional, State and federal agencies are also involved in policy decision and the regulation of certain activities in freshwater wetlands. Some of these agencies include the South Florida Water Management District, the Florida Department of Environmental Regulation, the Florida Game and Freshwater Fish Commission, the Army Corps of Engineers, and the Environmental Protection Agency. The project's management objectives were derived from applicable laws, policies, and regulations that have been developed by these and other agencies and governmental bodies.

They have been reviewed and adopted by the project's Steering Committee during the planning process. Because each of these objectives is relatively narrow in scope, there are potential or inherent conflicts among them. In other words, it is impossible for each objective to be fully realized in every location in the study area. The method for resolving conflicts among objectives has been based on suitability of the land to support a particular use or achieve a particular objective. For example, extensive studies of the hydrologic regime and topographic characteristics of the East Everglades indicate that a portion of that which has never been farmed could be used for growing tropical fruits and/or winter vegetables. On the other hand, because these are undisturbed areas, they do support various types of native plants and animals. The recommendation of this management plan is to allow new farming operations in a large portion of the undisturbed area which is hydrologically suitable for farming when there are no other suitable and available farm sites elsewhere. The plan also recommends that farming operations be excluded from highly valued natural areas, such as tree islands and hammocks, even though these areas may, in some instances, be suitable for farming.

In this instance, land which was most suitable for farming was placed in an agricultural use category while certain highly valued natural features were protected.

The management objectives which have been adopted by the project's Steering Committee have been grouped into four major headings: water quantity, water quality, land use, and natural features. At the conclusion of each of the following sets of objectives, the major sources for the objectives are listed.

**Water Quantity**

A. Maintain a pattern of water periodicity and a quantity of water in the East Everglades which will insure a sufficient water supply for users in south Brevard County and the south Florida region, and prevent further salt water encroachment.

B. Maintain a pattern of water periodicity and a quantity of water in the East Everglades which will protect the biological health of the natural wetland environments within and downstream from the study area.

**Sources**

**Federal**

Safe Drinking Water Act of 1974

Federal Flood Insurance Act

Executive Orders 11988 - Floodplain Management, and 11990 - Protection of Wetlands.

Public Law 91-282 - Water Delivery to EFN.

**State**

Chapter 373, Florida Statutes - Water Resources

**County**

Chapter 9, Article III, Brevard County Code - Natural Flow of Surface Waters
Comprehensive Development Master Plan

Water Quality

A. Protect the water quality characteristics of surface and ground waters to ensure the future availability of clean water for public and private water supplies in south Bade County.

B. Protect the water quality characteristics of surface and ground waters in the East Everglades to ensure the biological health for the native flora and fauna within and downstream from the study area.

Sources

Federal

Clean Water Act of 1972

Safe Drinking Water Act of 1974

Memorandum of Agreement - Army Corps of Engineers South Florida Water Management District, and Everglades National Park - Water Quality Standards for Water Delivered to Everglades National Park.

State

Chapter 17-3, 4; Florida Administrative Code - Water Quality Standards.

Chapter 403, Florida Statutes - Water Pollution Control.

Regional

"Natural Systems", South Florida Regional Planning Council

County

Chapter 24, Bade County Code - Water Pollution Control Ordinance.

Comprehensive Development Master Plan.

Natural Features

A. Protect the existing natural wetland functions and characteristics of the East Everglades and restore functions and characteristics where practicable, in order to preserve the biological productivity, animal and plant habitat, and natural biotic diversity.

B. Protect the aesthetic value of the natural environment in the East Everglades.

C. Protect unique natural features of the East Everglades study area.

Sources

Federal

Endangered Species Act of 1972

President's Executive Order 11990 - Protection of Wetlands
Regional

"Natural Systems", South Florida Regional Planning Council

Declaration of Policy - Water Management Districts (Chapter 373.016, Florida Statutes)

County

Tree Preservation Ordinance

Comprehensive Development Master Plan

Land Use

Preserve the use of land by private property owners consistent with the protection of Dade County and Everglades National Park water supplies and the public health, safety, and welfare.

Source

Numerous Federal, State and County laws and policies.
CHAPTER V

METHODOLOGY

The purpose of this chapter is to describe the process used by the Steering Committee to prepare the study design, analyze information, and recommend a resource management plan. This process was neither rigid nor highly structured; rather, it was a method which provided for interaction among highly qualified individuals representing agencies which had jurisdiction and/or a particular interest in the East Everglades. The agency representatives that comprised the Steering Committee were exceptionally suited to the task. Like the Project, the Steering Committee was interdisciplinary with an emphasis on the scientific/technical basis for resource planning. The education and experience of the Steering Committee is as follows:

- A PhD biologist with experience in vegetation and wildlife management.
- A PhD biologist candidate with experience in water management and water management impacts on natural systems.
- A professional Planner with a Master's degree in City Planning.
- A DFA (Doctor of Public Administration) with experience in environmental resource management.
- A Resource Planner with an MS in geography/ a biologist with experience in water quality analysis (representative changed about halfway in project).

In addition to their education/professional experience background, each member of the Steering Committee has significant administrative responsibility/experience that provides a point of reference for the reasonable- ness and efficacy of the recommended plan elements. The many years of education and experience, especially south Florida related experience, represented on the Steering Committee allowed this group to guide the design and conduct of the Project with a degree of competence that would be most difficult to equal or improve upon.

This chapter is organized in a manner which reflects the chronology of events which took the Committee from the study design to the proposed land use recommendations as outlined below:

- I. Plan of Study Formulation
  - II. Data Interpretation
  - III. Evolution of the Recommended Plan
    - A. Land Use Suitability Approach
    - B. Basis for Land Use Recommendations

This outline will follow each of the major headings in the text of this chapter so that the reader will understand how each of the segments fit into the entire process.

• I. Plan of Study Formulation

The East Everglades Resources Planning Project began with the preparation of the study design based upon recommendations by the technical staff of the agencies represented on the Steering Committee, the Region IV Office of the U.S. Environmental Protection Agency, and the Miami Office of the U.S. Geological Survey. As stated earlier, limited time and money caused the Steering Committee to focus on the effects of the most likely uses in the most likely locations. By design, the Steering Committee did not spend project monies conducting studies that would duplicate other efforts or prove information already known. For example, the large public expense of providing roads, flood control, police and fire protection and other services to rural residential development of remote wetlands is well understood and no monies were expended to prove it again for the East Everglades.
Several key findings of past and ongoing studies in south Florida shaped the studies for this project. Some of these findings and the individual study designs which resulted are described below. Previous water quality investigations in South Dade agricultural areas indicated that agricultural uses posed a real threat to the quality of the ground and surface waters of the East Everglades. The groundwater below some south Dade agricultural areas had been experiencing levels of nitrate which approached and occasionally exceeded the maximum allowable limit for drinking water. This pollutant is known to cause methemoglobinemia or “blue baby syndrome” when water with high levels of nitrate is consumed by infants. In general, principal sources of nitrate are fertilizer, septic tanks, drying of muck soils, and stormwater runoff. A previous study in Dade County pointed to fertilizer and drying of muck soils as the problem in South Dade. Pesticides and other known carcinogens were suspected of being concentrated in the bottom sediments of surface waters and, potentially, in plants and animals. This phenomenon, known as biomagnification, results in progressively higher concentrations of pesticides and organic compounds in living organisms as one moves up the food chain from plants to grazing animals to meat-eating animals. Concerns were also expressed by the Steering Committee regarding the effectiveness of septic tanks in areas which are flooded during part of the year, especially when domestic water wells are located nearby. Because of each of these water quality concerns, a large portion of the project’s funds were allocated to water quality sampling and analyses.

The water quantity, or hydrologic, characteristics of the East Everglades were also thought to be an important factor in identifying environmental functions and determining the suitability of the area for various land uses. The principal hydrologic concerns were ground and surface water levels, direction and rate of flow of ground and surface water, land elevation, composition and depth of the Biscayne Aquifer, and the relationship of the water flows in the East Everglades to outside areas. Surface water levels and land elevations in these wetlands have obvious importance to land use suitability and land values. As mentioned elsewhere in this study, winter vegetable farming is feasible in areas which are flooded during the summer rainy season but dry during the winter growing season. Residential areas traditionally do not tolerate standing water for even a few days. In the ground and surface waters was also believed to be important in the transport of pollutants, the delivery of water to traditional downstream users and ecosystems, and the potential impacts of land alterations, such as roads, elevated berms, or fill pads, which could act as impoundments unless carefully designed and placed.

During the preparation of this plan of study, the Steering Committee also chose to study the plant and animal communities which are found in the study area. Prior to the study, the Department of Interior had designated several portions of the East Everglades as Critical Habitat for two endangered animal species, the American crocodile and the Cape Sable sparrow. A number of other rare animals, such as the Florida panther and Everglades kite, were either known or suspected of using the area as a source of food and/or shelter. Several rare plants were known or thought likely to occur in the area and numerous tree islands of high value for archeological as well as floral reasons were known to occur in the Everglades.

The intention of the study of plant communities was to determine which plants and plant associations were common to which set of environmental characteristics, such as depth and duration of flooding, soil types, and elevation, and how disturbances (i.e. fire, rockploving, farming, filling, and drainage) affected those plant communities. The Steering Committee was also concerned about the growing number of exotic tree species such as Australian pine, Brazilian pepper, and melaleuca, which have been displacing native plants and forming monocultures in disturbed sites. As a result, the vegetation study was also to examine disturbed sites and determine whether or not there were any feasible methods of eradicating or controlling exotics and re-establishing the native plant species.
The final biological study developed by the Steering Committee centered on the algal mat community, known as periphyton, which is found in south Florida wetlands. Previous studies had indicated that periphyton may perform numerous functions such as insulating fish eggs during the dry season and providing a food source for frogs and other organisms.

**II. Data Interpretation**

I. Plan of Study Formulation
II. Data Interpretation
III. Evolution of the Recommended Plan
   A. Land Use Suitability Approach
   B. Basis for Land Use Recommendations

The project’s environmental studies summarized in Chapter III provided the basis for determining if and how specific land uses and activities should occur in the East Everglades. It was assumed that any use of the land and its resources must be consistent with the management objectives described in Chapter IV. The method by which the environmental information prepared for this study was used to set forth a series of management practices and regulations for guiding land use in the study area is summarized below. This interpretative analysis was conducted by the study’s planning consultants, Wallace, Roberts and Todd, and presented to the Steering Committee in two reports entitled, "Ecological Relationships, Objectives, and Maintenance Requirements for the East Everglades" and "Best Management Practices for the East Everglades". These reports together with the technical studies provide the basis for the Management Plan for the East Everglades, the final product of the East Everglades Resources Planning Project.

The interpretation was conducted in four sequential steps. The four steps are summarized below together with an example which illustrates each step and shows how each step leads logically to the following step.

**Step 1: Ecological Relationship (ER)**

The technical and scientific papers describing the East Everglades environment were carefully studied to identify interactions among the elements of the natural system and the effects of man on them. Ecological relationship statements were extracted and synthesized from the papers and organized into lists based on cause and effect relationship between the following subject areas: surface water, groundwater, soils, vegetation, fire, wildlife, land use, and study sub-areas.

**Example:** Ecological Relationship Statement - A reduction in the amount of surface water which recharges the groundwater system (Apalachicola Aquifer), subsequently diminishes groundwater head and encourages saline intrusion along the salt/fresh water contact zone in the southern portion of the study area.

**Explanation:** This statement illustrates the direct effect on the groundwater (GW) system of surface water conditions (SW). The statement is listed in the report with other similar cause and effect statements under the code designation - GW/SW-9.

**Step 2: Ecological Maintenance Requirements (EMR)**

Having thoroughly described the East Everglades environment through ecological relationship statements, ecological maintenance requirements were formulated for each statement. These requirements outline "what" must be done to preserve the visibility of the ecological relationship in a manner consistent with the study's objectives.

**Example:** Ecological Maintenance Requirement Statement - Permit no diminishment of surface water flows and levels so that groundwater levels are sustained to inhibit saline intrusion.
Explanation: Any permitted land use or activity must ensure sufficient surface water supply to recharge the groundwater system. The overall project objective to be met is the protection of water quality characteristics to ensure biological health and public/private water supplies.

Step 3: Resource Management Objective (RMO)

To develop management practices for the East Everglades, the general project objectives stated in Chapter IV had to be further refined into management objectives which are resource specific. Resource management objectives were formulated for each ecological relationship. These objectives provide the reasons for establishing the maintenance requirements.

Example: Resource Management Objective - Preserve groundwater quality above established water quality standards and criteria.

Explanation: Water quality standards and criteria include any and all federal, state, county regulations. The reason for no diminishment of surface water regimen (Step 2 - Maintenance Requirement example) is to preserve the water quality above standards (Step 3 - Resource Management Objective example). By accomplishing Steps 2 and 3, contamination of the fresh water system by saline intrusion is prevented and the natural environmental conditions preserved (Step 1 - Ecological Relationship example).

Step 4: Best Management Practices (BMP's)

Having established "what" must be accomplished in land use regulation and "why", it was necessary to specify "how" regulation should be carried out, "by whom", and "where" within the study area. The "how" questions are addressed in Step 4 through formulation of a series of performance guidelines called Best Management Practices (BMP's). The BMP's are specific to the type of activities and land uses ongoing and anticipated for the East Everglades. Wherever such land uses or activities are permitted (as delineated by the final management plan) these management practices must be employed.

Example: BMP's - Rates, volumes and times of pumping in wellfields must be restricted so that groundwater head is not reduced to levels where the salt/fresh water contact zone moved inland.

Explanation: A requirement such as this calls for a coordinated effort for appropriate siting of new wells and for monitoring well withdrawals and saline encroachment.

Step 4 also includes a review of existing regulations and authority for guiding land uses and activities in the East Everglades. Specific public agencies and their responsibilities are outlined. This information is necessary to identify deficiencies in the current regulatory framework and allow recommendations to be made in the final Management Plan for resolving deficiencies. The Plan provides for improved implementation of existing laws, new regulations and their enforcement, and adoption of land use-specific BMP's.

Because BMP's were specifically designed for one type of land use or activity to meet one of the stated objectives, conflicts arose in situations where two BMP's were not mutually attainable. For example, a BMP applicable to municipal well operation aimed at meeting the objective of providing adequate public water supply may be contradictory to a BMP for well pumping where the intent is to prevent further saline intrusion. In such cases, conflicts were resolved in the Management Plan by recognizing that tradeoffs needed to be made.

The process of resolving apparent conflicts between BMP's required a four step process: 1) the establishment of values for particular wetland functions and features, 2) a determination of physical suitability for different land uses, 3) a review of development histories in other wetlands in south Florida, and 4) the designation of management areas. This decision-making process, which resulted in the land use recommendations.
contained in this draft management proposal, was performed by the Steering Committee. The preliminary recommendations were then reviewed by a group of eleven highly regarded scientists whose collective expertise included agriculture, water resource management, wildlife management, plant ecology, limnology, civil engineering, and land use planning. The comments and criticisms made by this technical review group were evaluated by the Steering Committee and, where appropriate, incorporated into subsequent drafts of the management proposals.

Following the data interpretation phase, the Steering Committee proceeded to convert this understanding into planning alternatives and land use recommendations—Draft Management Plan.

III. Evolution of the Recommended Plan

I. Plan of Study Formulation
II. Data Interpretation
III. Evolution of the Recommended Plan

A. Land Use Suitability Approach

B. Basis for Land Use Recommendations

A. Land Use Suitability Approach

In reviewing the technical studies and developing the proposed management plan, the staff and Steering Committee did not go through a process of setting up alternate plans and evaluating one against the other. Instead, the Project adopted a land use suitability approach wherein the Steering Committee strived to match the qualities of land in the East Everglades with the resource requirements of the land uses likely to occur in the area. The result of this process was a basic management concept evolving from the characteristics of the land, with an evaluation of potential alternative uses or densities within specific subareas. For example, evaluation of the project scientific/technical studies led to the designation of three management subareas based on the length of time the land was flooded and on whether the land had been previously altered. It was recognized that within the East Everglades in general, flooding and absence of flood protection made rural residential development an unsuitable land use. However within certain subareas, the relatively lower incidence of flooding during the winter farming season would permit successful farming. The Steering Committee ultimately concluded that very large lot zoning would suitably insure that agriculture would not be eventually displaced by residential use and that a caretaker house or farmhouse at a low density would neither cause significant hazard to personal safety of area residents nor create a public commitment contrary to the long term social, economic, and environmental health of the region.

The land use suitability approach was well adapted to the East Everglades situation. The seasonal flooding and no feasible flood protection conditions combine to severely constrain realistic land use opportunities. These conditions allowed the Steering Committee to focus on the impacts of the most likely land uses in the most likely locations with a problem-solving approach. Questions were formulated for the scientific/technical investigations to attempt to respond to in order to insure that the studies were properly directed. As an example, a copy of the questions directed to the vegetation consultant are included as Appendix C of this report. It should be noted that while the project investigations focused on the likely uses in the likely locations, the information collected will provide a good data base from which to evaluate other land use proposals.

The land use suitability concept was developed in the Plan of Study and guided the Steering Committee as the Project progressed from the Plan of Study to the Draft Plan. The funding of the Project in April 1978 began an initial period of intense activity to select the best consultants to conduct the field studies and to set the studies under way before the start of the summer wet season.
Once the field investigations were in progress, the Steering Committee, along with Project staff, began a process of formulating specific project objectives and investigating the existing residential, agricultural, and recreational uses of the East Everglades. A base scenario of expected growth under existing regulations and high growth residential and agricultural scenarios were prepared to assist in examining assumptions about land use impacts and water management requirements.

As the initial data from the field studies came in, the Steering Committee assessed the information for accuracy and for its relevance to Project objectives. As previously discussed, the technical and administrative expertise of the Steering Committee was particularly valuable in this role because the Committee was able to direct necessary or appropriate changes in field investigations where information suggested a modification. The redirection of nonproductive groundwater pesticide investigations to study the mineral water plume discovered to be widespread from the Groovey Ranch wells is a case in point.

After a careful review, the Steering Committee recommended the nationally recognized planning consultant firm of Wallace, Roberts and Todd for selection as a consultant to the East Everglades Project. WRT was retained by the County and began the process of organizing and interpreting the results of the various project investigations as these studies produced drafts, working papers, and intermediate reports. The Steering Committee reviewed both the studies themselves as well as the WRT interpretation. During this time, the Steering Committee reviewed and finalized the Statement of Project Goals and Objectives.

As most of the project investigations began to produce draft final and final work products, WRT prepared the detailed interpretative papers described in Section II of this chapter. These interpretative papers were taken through several iterations in workshops with the Steering Committee and the scientific/technical consultants as well. As explained in Section II, these papers attempted to maximize for each project objective without regard for conflicts in objectives or for locations of any given land use. This process was carried to the point of a clear identification of implicit conflicts among competing resource requirements for land uses.

WRT then prepared a first draft of the plan for managing the East Everglades which assigned physical location to various land uses. This assignment of location to land uses required a resolution of the conflicts between competing land uses and was based on the suitability of the land for any given use. This process was conducted within the overall context of the previously established set of management objectives. This first draft required WRT to make assumptions about the way the Steering Committee would resolve the spatially conflicting objectives and to present land use location and best management practice (BMP) concepts that took the information from the scientific/technical studies to its limit. This approach allowed the Steering Committee to consider the broadest implications of a resource management plan. Listed below are several of the more significant resource use conflicts.

- The irreversible nature of the commitment of virgin land to a farming use.
- The trade-off between long-term availability of agricultural land and residential land use.
- The permanent loss of habitat for native wildlife species when land is rockplowed for residential or farming use.
- The future commitment to provision of flood protection and other services created by build-out of the presently owned, rural residential densities in remote wetlands.

The Steering Committee and scientific/technical consultants critiqued this first draft and directed the preparation of a revised draft to be circulated for review by participating agency technical staffs and to be reviewed in the technical workshop forum mentioned in Section II of this chapter. The project staff and WRT prepared and circulated the revised draft and conducted
the technical workshop. Based on the Steering Committee evaluation of the written and oral comment from this review process, Project staff and WET prepared a Draft Management Proposal document that was circulated for public review and comment.

The Steering Committee conducted a public hearing and staff conducted workshops with the Citizens Advisory Committee and the Residents and Property Owners Advisory Committee on the Draft Management Proposal. This final Management Plan is the recommendation of the Steering Committee for the future management of the East Everglades based upon the Project investigations and upon the comments of experts, agencies, interest groups, and individuals that participated in the review process.

B. Basis for Land Use Recommendations

Two very basic facts are the key to the recommendations made in this Plan. First and foremost is the fact that the East Everglades is a wetland. It is the floodplain of the historic River of Grass. The heart of Shark River Slough flows through the East Everglades and Taylor Slough is born here. Although these natural systems have been affected by water management in the recent past, the East Everglades was a floodplain and wetland for some 10,000 years before Henry Flagler’s railroad reached Miami.

The second basic fact leading to the recommendations in this plan is that floodplains and wetlands are inappropriate locations for people to build homes. The danger to life, the public health problems, and the great public expense that inevitably accompany rural residential development of remote wetlands have combined to establish a record that is recognized at every level of governmental authority in this country. Many of the Federal, State, regional, and local regulations and policies recognizing the unsuitability of floodplains and wetlands for residential development are presented in Chapter IV of this report. Principal among these laws and policies are the President’s Executive Orders on floodplains and wetlands, and Congress’ directives for the evaluation of permit applications for filling of wetlands contained in the Federal Water Pollution Control Act and Amendments.

Having professional experience and/or a general understanding of the problems associated with the development of floodplains and wetlands, the Steering Committee recognized at an early stage in the project this buildout at existing densities would present serious problems. Moreover, as the information from the project studies began to accumulate, the Water Management District professional staff in their report titled “Hydrologic Scenarios for the East Everglades,” concluded that:

Over the past nine years, rainfall has been below the long term average for the study area. During the period 1970-1979 annual rainfall (areal weighted average) has not exceeded 60 inches per year. This is in contrast to 76.79 inches in 1969 and 69.87 inches in 1968. The long term average is about 57.5 inches.

Most of the residential development in the area has occurred since 1970. Therefore, it is likely that most of the residents of the area have not experienced the wet conditions that have occurred in the past and can be expected to occur in the future.

In addition to potential damages, the inconvenience resulting from flooding has historically been a major factor in demands for drainage and flood protection within the South Florida Water Management District. The likelihood of wetter conditions in the future, combined with the perception of local residents who have not experienced such conditions, strongly suggests that there are problems associated with the existing level of residential development, much less future development.

(underline added).
The land use recommendations presented in this Plan were based upon a preponderance of information that indicated the severe consequences of a permanent residential population at even a moderate density. The principal factors leading to the Plan's conclusions are as follows:

1. The previously discussed danger to public health, safety, and economic vitality.

2. The technical infeasibility of providing flood protection to the East Everglades.

3. The project water quality studies which concluded that while there were no significant effects from the very recent, very low density residential development in the area, a buildup to the second density would likely have serious water quality impacts. This effect would be exacerbated by the replacement of the natural system that retains and cleans flood waters by a system designed to collect and rapidly remove floodwaters from a residential area.

4. The project studies on the effects of land uses on ground and surface water quantity which concluded that the fill required for buildout at the currently permitted density would seriously impact the surface water condition. The Steering Committee further concluded that even though, from an engineering point of view, it would be possible to minimize the effect of fill for roads and houses at a one house per five acre density, the practical considerations of development cost, potential health problems, and the likelihood that residents would not tolerate the long term flooding of 80%-90% of their property, made existing permitted density unacceptable.

5. The severe effects of a buildup at existing density or even moderate densities on East Everglades and Everglades National Park wildlife populations.

6. The fire hazard to residential development from the periodic, natural fires that sweep through the Everglades.

7. The need to protect present and future water supplies for Dade and Monroe Counties and for Everglades National Park from the need to be collected in canals and dumped in the ocean because of the health and safety problems created by residential development in the East Everglades.

8. The public desire, in aesthetic as well as economic terms, to protect agriculture as a viable enterprise in Dade County. The suitability of the lower flood risk areas in the East Everglades for dry season farming and the public values mentioned above makes agriculture a sufficiently desirable use of the land to warrant the irreversible commitment of some of the East Everglades to a farming use.

With the preceding conclusions and the land use suitability approach in mind, the Steering Committee faced the task of determining what land uses should occur in which locations within the East Everglades. The final recommendations presented in this plan meet the following criteria established by the Steering Committee:

1. Should not create a hazard to East Everglades residents.
2. Should not result in a need to provide flood protection.

3. Should preserve to private property owners a reasonable, beneficial use of their land.

4. Should be a clear and unmistakable indicator of the level of public services that will be provided to the area.

5. Should not endanger the quality or quantity of water in the St. Lucie Aquifer.

6. Should not result in the conversion of agricultural land to residential use.

7. Should protect rare and endangered, as well as less recognized native wildlife and vegetation species.

For the reasons expressed earlier, the Steering Committee perceived a need to reduce the potential residential densities in the East Everglades. With respect to the objective of providing for a long term location for agriculture in Dade County, a need to both downsize and change zoning categories was recognized.

After a thorough review of the project data and the technical workshop comments, the Steering Committee concluded that a second home/hunting cabin type of use on a 40 acre site with very limited site alteration would be the most reasonable balance between the many competing public and private interests. Further comment in Advisory Committee workshops and the public hearing resulted in a revision of the exclusive agriculture zone to allow a caretaker or similar residential use, ancillary to agriculture, at a one unit per 40 acre density in the agriculture zone.

As noted previously, there exists no technique by which to project with complete precision, the cumulative, irreversible environmental impacts of various kinds and intensities of land use. Ultimately the process is a matter of judgment based upon a synthesis of experience and technical data. The final phase of the East Everglades Project wherein the Steering Committee translated the scientific/technical studies into draft plans and finally this management proposal, extended over nine months. During that time, the Steering Committee and project staff went through many careful and frequently extended deliberations in which all aspects of the competing public and private interest were considered. The Steering Committee and staff's acute awareness of and sensitivity to the interest and expectations of private property owners was reinforced on numerous occasions through advisory committee and public information meetings and continuous correspondence. The management proposals in this Final Steering Committee Plan represent this committee's recommendations for the most reasonable and equitable balancing of the long term public and private interest in the East Everglades.
VI
MANAGEMENT AREAS

A detailed analysis of the project's environmental, economic, and social findings and the management objectives for the East Everglades allowed the designation of three geographic management areas within the Study Area. The principal factors in determining management zones were existing land use and water conditions over time. In instances where water conditions over time could not be determined with sufficient accuracy, vegetation was used as an indicator of water conditions. Legal boundaries such as federally designated critical wildlife habitat were also used. Recognition of the variability of the environment within the three management areas will allow for the application of the most appropriate management practices to prevent resource degradation.

Map 18 shows the three management areas recommended for the East Everglades:

1. Area 1, Agriculture and Existing Residential Use
2. Area 2, Permanent Wetlands
3. Area 3, Seasonal Wetlands.

Management Areas 2 and 3 are further divided into subareas. A description of each Management Area and subarea is presented in this chapter.

Management Area 1: Modified Environment

Definition

This management area includes all land in the East Everglades study area which has been permanently altered by human activity. The area covers approximately 23 square miles or 14,700 acres. It is estimated that 10,600 acres are in agricultural use, including ancillary light commercial uses, 3,500 acres are vacant and 600 acres are in residential use. (See Map 19).

The central management concept for this Area should be the protection of existing agricultural and residential use and the encouragement of future agricultural activity. The East Everglades study area can accommodate a portion of the future demand for agricultural land, resulting from the displacement of farming near fast-growing urban areas such as Kendall and Homestead. This demand can be accommodated while protecting the environmental objectives of the study by allowing future agricultural activity to occur initially on land which has already been permanently altered and is suitable for agricultural use. This approach enables farmable virgin rockland in other management regions of the East Everglades to be preserved until it is needed by the agricultural sector of Dade County.

Existing residential uses should be protected in Area 1, but future residential activity should be limited to caretaker uses ancillary to agriculture at a one unit per 40 acre density. County land use policies explicitly discourage the provision of new public services in the East Everglades. Additional drainage in this Area would adversely affect valuable wetland functions in the management regions of the East Everglades and seriously threaten County and regional water supplies. In light of South Florida's history of drainage and development, it is likely that new residential uses in this subarea would ultimately generate demands for drainage and County-funded services in the area.

Land Use Suitability and Management Plan Concepts

(Specific management practices related to the plan concepts are discussed in Chapter VII.)

In general, consumptive land uses such as agriculture and residential are most suitably located in areas which have been previously modified. For the
MANAGEMENT AREAS

AREA 1. Agriculture and Existing Residential

AREA 2. Permanent Wetlands
   2A. Northeast Shark Slough
   2B. Southeast Saline Everglades

AREA 3. Seasonal Wetlands
   3A. Tree Island/Wet Prairie
   3B. Agriculture
   3C. Transition Area

East Everglades Resources Planning Project
most part, natural features have already been altered in these areas. Unlike most of the Study Area, most of Area 1 is accessible via paved roads (Richmond Drive and SW 237 Avenue), and a network of graded rock roads. The cooperatively well drained rockland of Area 1, its relatively high (compared to the rest of the Study Area) elevations, and proximity to L-31 make this an area of lesser flood risk within the East Everglades. The rockland substrate is dominated by limestone outcroppings with small pockets of fine sand or sandy loam. Rockland is prepared for agriculture by rockplowing, followed by mixing the crushed rock with fine materials, and regrading. Once an area is rockplowed, the substrate is permanently altered. Rockplowing has occurred in the rockland throughout Area 1. The characteristics of rockland make it a suitable substrate for agricultural development.

Areaswide, no further drainage should be provided, due to the adverse impact on water supply and the sensitive wetland areas of the East Everglades. Thus, existing residents and agricultural interests must be willing to accept the level of flooding which will occur in any given year under the existing water management regime in this subarea. Agriculture can accommodate the occasional floods in the area that would create disruptions, inconveniences, and some hazards for residents. Additional demands for drainage are not likely to be generated by increased agricultural use. Compared to the public service needs required by even low density residential development, agricultural's needs are minimal. Consequently, agriculture should be the primary use for vacant parcels in the area. Future residential development should occur at a maximum density of one unit per 40 acres and only if ancillary to agricultural use.

Generally, fill should be excavated only for permitted on-site uses, such as shallow water retention ditches in agricultural fields. Additionally, management objectives associated with water supply protection dictate that development should not degrade water quality or quantity beyond the standards. (See Appendix A).

Active and passive recreation should be encouraged in this subarea, consistent with the management objective which addresses private and public use of land.

Management Area 2: Permanent Wetlands (Map 20).

Definition

Management Area 2 includes all land flooded for at least nine months of a normal water year (See Map 9 and related discussion, p. 27). Most of this area covered by Forest/Thicket, Marsh (Sawgrass-Rush-Hairgrass) and Marsh (Rush-Sawgrass-Hairgrass) vegetation and nearly half of the area covered by Prairies (Narrow-leaved/Beardgrass) communities lie within Region 2.

Subarea 2A (45,400 acres) encompasses most of the Northeast Shark River Slough and Subareas 2B (25,500 acres) encompasses all of the Southeast Seline Everglades (C-111 Area) that lie within the study area boundaries. The region is about 72,000 acres in area or forty-eight percent (48%) of the study area. Area 2 includes federally designated critical habitat for the Cape Sable sparrow and American crocodile, and provides feeding grounds and habitat for wading birds, white-tailed deer, Everglades mink and most of the other wildlife species that have been found in the East Everglades. The region's plants, water regimen, and physical characteristics constitute an environment that is highly sensitive to agricultural, residential, and some recreational activity.

Land Use Suitability and Management Plan Concepts

(Specific management practices related to the plan concepts are discussed in Chapter VII.)

Water levels in Management Region 2 are the primary constraint on residential and agricultural use in the area. Most of this region is inundated
Map 20

MANAGEMENT AREA 2
PERMANENT WETLANDS

2A
Northeast Shark River Slough

2B
Southeast Saline Everglades

East Everglades Resources Planning Project
or saturated for at least nine months of the year, a condition that is not compatible with traditional development. Because the character and health of the wetlands ecosystem is largely dependent on the water regime and is quite sensitive to changes in that regime, disruption or reduction of water storage capacities or flow volumes and rates should be avoided. Human intervention activities in this sensitive region should be conducted in a manner that will minimize the disturbance or alteration of any element in the existing natural system.

Agriculture

Normally high water levels throughout the Region, together with the relatively high salinity in the Southeast Salinas Everglades, make agriculture an infeasible use of land in Area 2. In abnormally dry years, agriculture might be productive, but would severely impact the long term integrity of an environment already stressed by dry or drought conditions. Permanent alterations to the environment which can result from agricultural land use should not be risked for an activity that, in this location, is likely to be marginal, speculative, experimental, and temporary. Therefore, agriculture should not be a permitted use in Area 2.

Residential Development

Residential development of a density and character which meets criteria ensuring that water quality, water movement, fire management, natural vegetation patterns and wildlife distributions are not altered is compatible with the environmental character of Management Area 2.

Nearly all the peat soils within the Study Area are found in Northeast Shark River Slough. The presence of this soil poses additional constraints on residential development, because it must be excavated in order to assure proper placement of fill and to allow road and building structures to be secured. Localized disturbances, such as the plowing of peat above inundation levels, will result in the loss of the soil through oxidation and increased fire hazard. Excavation or on-site relocation of surface material is permitted only to the extent necessary for permitted construction.

Residential units should be developed at a density of one unit per 40 acres. Building design and construction techniques should minimize on-site disturbances. The maintenance of natural vegetation, and control of exotic vegetation should be required.

Recreation

The natural features of the area make it a valuable recreation area. Activities occurring in the region include wildlife observation, hunting, camping, and the operation of airboats and off-road vehicles. These uses should be encouraged, consistent with private property rights and the long term integrity of the recreation resource. A 1978 U.S. Department of Interior study found a strong need for recreational facilities similar to those provided at Chezika Hammock State Recreation Area, including picnicking, hiking, and freshwater swimming. Public and private investments in such facilities should be encouraged in this management area. Matching funds are available from the Federal Bureau of Outdoor Recreation to assist in the recreational development of privately owned land.

Access

Existing access to Area 2 should remain unchanged. At present, most of the Area is accessible only on foot or by the use of airboats or off-road vehicles (ORVs). Although damage to vegetation and surface contours can result from excessive use of particular types of ORVs in localized areas, overall, the Area's ecosystem can tolerate properly designed and operated airboat and ORV use. On the other hand, road construction would require the excavation of peat and much soil and require large quantities of fill material to build up the road bed to design criteria. This would disrupt natural vegetation, wildlife habi-
tacts, and alter surface water flows. Furthermore, new roads would encourage more intense use of the Area by increasing accessibility. In consideration of these factors, no new roads should be permitted in Area 2.

Management Area 3 - Seasonal Wetlands

Definition

Management Area 3 has been characterized as Seasonal Wetlands because it is wet during some portion of the year. The Area consists of all land in the East Everglades which is not contained in Management Areas 1 or 2, and includes approximately 67,300 acres. Due to the fact that this Area has a range of hydrologic characteristics, wildlife habitats, and locational considerations, it has been divided into three Subareas: 3A, 3B, and 3C. (See map 21). Hydrologic characteristics, discerned from stage duration information and existing vegetation patterns, are the primary environmental criteria used in defining the Subareas. Another important factor in defining uses in this area is the presence of Federally designated Cape Sable Sparrow habitat.

Subarea 3A: Tree Island/Wet Prairie

Management Subarea 3A (23,700 acres) is defined as all land in the East Everglades which meets at least one of the following criteria:

(1) has vegetation characterized by tree island and wet prairie communities;

(2) is flooded from 3 to 9 months during an average year

(3) is flooded less than 3 months during an average year, but is not contiguous with Management Area 1.

Subarea 3B: Agriculture

Management Subarea 3B (12,000 acres) is defined as all land in Area 3 which meets both of the following criteria:

(1) is flooded less than 3 months during an average year; and

(2) is contiguous with Management Area 1.

Subarea 3C: Transition Area

Management Subarea 3C (31,600 acres) is defined as all land remaining in Area 3 which is not included in Subarea 3A or 3B.

For much of Subarea 3C, hydrologic characteristics relative to farming can not be accurately described because topographic and hydrologic data are insufficient. The boundary for this subarea is based largely on vegetation boundaries used as an indicator of length of flooding. Because most vegetation does not immediately respond to changes in flooding, plant communities can serve as an indicator of water conditions over the long term. Further study is required to determine whether or not the land can be farmed successfully. In addition, a portion of the subarea has been designated by the Secretary of Interior as critical habitat for the Cape Sable sparrow. Federal (Corps) dredge and fill permits will be difficult to obtain in critical habitat areas.

Boundary Determinations for Subareas 3A, 3B, and 3C

The boundary between subarea 3A and Subarea 3C follows the boundary between sawgrass-rush marsh and the muddy-sawgrass (wet sandy) prairie from L-31 to the rock ridge extending out of Cockeye Park (see map 11). South of the ridge, the 3A/3C boundary follows the vegetation boundary between the muddy-sawgrass prairie and the prairie tree island mosaic until just south of Context Road, where a detailed analysis of the larger vegetation map refined the prairie-tree island mosaic line to the configuration shown.
Map 21

MANAGEMENT AREA 3
SEASONAL WETLANDS

- Subarea 3A
  Tree Island/Wet Prairie

- Subarea 3B
  Agriculture

- Subarea 3C
  Transition

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MANAGEMENT AREA 3
SEASONAL WETLANDS

Subarea 3A
Tree Island / Wet Prairie

Subarea 3B
Agriculture

Subarea 3C
Transition
The subarea 3C/3B boundary is the mshly-sawgrass/mshly-beardgrass (drier mshly) prairie boundary from L-31 to SW 136 Street. South of SW 168 Street, the 3B/3C boundary follows the Federally designated Cape Sable Sparrow habitat. Beginning just north of Context Road, the 3B/3C boundary follows the three south flooding line down to a dense cluster of tree islands in Section 13 of Township 57 south, Range 37 East.

Land Use Suitability and Management Plan Concepts

(Specific management practices related to the plan concepts are discussed in Chapter VII.)

Agriculture

To date, vegetable farming in the East Everglades has been almost exclusively limited to land which is proximate to the L3IN Canal and is flooded less than 36 days in an average year. Some of the few exceptions are fields in the western portion of the "Frog Pond" bordering L3IN, which fell into the 3 month hydroperiod. The westernmost portion of these fields have not been farmed in recent years due to the risk of excessive wetness during the growing season.

Within Management Area 3, Subarea 3A is the least suitable for development because of its flood frequencies and water stage durations, the presence of Federally designated critical wildlife habitat and regionwide environmental habitats, and certain unique natural features.

Agriculture should not be a permitted use in Management Subarea 3A. The potential for inundation during the growing season in most of this subarea is greater than in Management Subarea 3B, making the risk of crop failure and subsequent land abandonment great.

Agriculture should be a permitted use in Management Subarea 3B. In general the flood hazard does not pose an unacceptable risk to agriculture, especially for row crops produced during the dry winter season. Flood risks are somewhat greater for groves, and constraints will vary with localized conditions within Subarea 3B. All performance criteria and development standards pertaining to any land alterations or activities associated with agricultural land use in the Study Area should be followed and appropriate permits obtained.

Due to the incomplete hydrologic information and other concerns expressed earlier, Subarea 3C is designated as a transition zone where agriculture should be a conditional use. Agriculture should be permitted in Subarea 3C when all of the following conditions can be met:

1. There are no alternative locations for agriculture
2. The proposed farming site is adjacent to land currently in a farming use
3. The proposed farming site is known to be hydrologically capable of supporting farming
4. Appropriate federal permits can be obtained where critical habitat is involved.

Residential

Residential development in this seasonal wetland should be discouraged. History proves that residential development in the wetlands of Florida creates a hazard to the public health, safety, and welfare, and will very likely lead to a drainage. The residential density of 1 unit/40 acres and the management concepts developed for residential development in Area 2 should apply in Subareas 3A and 3C. In Subarea 3B, a caretaker residential use ancillary to agricultural use should be permitted at a maximum density of 1 unit/40 acres.
As in Area 2, fire poses hazards to residential development in Area 3. Large segments of the marsh and prairie vegetation communities in this area are dependent upon fire to maintain themselves. Grass fires are an expected periodic occurrence and are a natural means by which severe fires are prevented from occurring. Residences should be constructed in a manner that ensures the safety of life and property during such fires.

Recreation

The natural features of the area make it a valuable recreation area. Recreational activities occurring in the region include nature appreciation, hunting, camping, and the operation of airboats and off-road vehicles (ORVs). These uses should be encouraged, consistent with private property rights and the long-term integrity of the recreation resource. There is a strong need for recreational facilities similar to those provided at Chokika Hammock State Recreation Area. Thus, public and private investment in such facilities as discussed for Area 2 should be encouraged in this management area.
In developing the draft management plan for the Study Area, project participants progressed through a series of evaluation steps. The scientific/technical consultants collected information and reported on the baseline conditions and the effects of land use on the environment. This information was used by environmental planners to prepare a report that described the ecological relationships that existed within the Study Area and the environmental conditions necessary to maintain those relationships. (See Chapters III and V). These ecological relationships and maintenance requirements were then reviewed in light of the management objectives outlined in Chapter IV, and a set of best management practices (BMPs) was developed that allowed the protection of appropriate ecological relationships. Through workshop sessions with the Steering Committee and scientific/technical consultants, the BMPs have been refined based on the uses allowed in the management areas. The BMPs listed below and in the technical paper on BMP’s are to be used by developers and permit agencies as criteria for the appropriate design for uses permitted by the management plan. The BMPs listed below are the major criteria. More detailed discussion of BMPs are in the abovementioned technical report.

Area Wide Best Management Practices

- Additional positive drainage is not advantageous to the long-term integrity of the East Everglades and the regional water supply and should not be provided to the Study Area.

- Except for existing paved roads which provide access to Cheekles State Recreation Area (Richmond Drive and SW 237 Avenue), no public funds should be expended to maintain existing roads or build new roads in the Study Area. Official dedication of rights-of-way should be reviewed for acceptance by the Director of Dade County Public Works. Rights-of-way now held by the County should be returned to property owners, except for rights-of-way along Richmond Drive and SW 237 Avenue.

- An interagency agreement establishing procedures for public and agency review of proposed expenditures of public funds for construction of new facilities or improvements to existing facilities should be prepared by the Dade County Planning Department and entered into by Public Works, the Planning Department, and the Department of Environmental Resources Management.

- A fire management program, to be implemented by the Florida Division of Forestry should be prepared.

- The impact of existing and new agricultural or residential development on water quality should be monitored by the Dade County Department of Environmental Resources Management.

- Rock mining should not be permitted. Borrow pits and lake excavations for residential fills should be evaluated on a case-by-case basis, with appropriate consideration for cumulative impacts.

- An RV use plan for the study area should be prepared and implemented when sufficient information is available.

- New Dade County trash pick-up locations should be established in the Redland and Kendall areas to curtail refuse dumping in the East Everglades.
Where permitted, roads in the East Everglades must be designed such that they will not interrupt or divert natural sheet flow. Elevated roads must be sufficiently bridged and culverted to allow the passage of high water flows without causing significant backwater conditions. The Bade County Public Works manual on road design is incorporated herein by reference.

Tree islands characterized by native vegetation should be preserved in agricultural areas. Residential and hunting camp uses that impact tree islands are permitted only if the tree island canopy is preserved and the use does not significantly affect the wildlife habitat value of the island.

Management Area 1 (Modified Environment)

Caretaker Residential: One Dwelling Unit Per 40 Acres

Residential land use should be permitted in Management Area 1 only if ancillary to agriculture. The BMPs for this caretaker use are the same as for Area 2, except for the following:

- Housing may be constructed on fill pads not to exceed 1/2 acre in size. Applications for the construction of a small lake to obtain permitted fill should be evaluated on a case-by-case basis.

- Roads may be built on fill but should not inhibit surface water movement.

- There should be no displacement of existing lawful uses of property.

Agriculture: Groove, Row Crop and Nursery Activities

- Agricultural activities should be managed so that exotic plants will not become established. Farmers should employ all practicable methods of control, subject to County approval, which do not significantly degrade the environment. Affirmative steps should be taken to eliminate the following species: Casuarina (Casuarina spp.), Brazilian pepper (Schinus terebinthifolius), Castorbean (Ricinus communis), Colubrina (Colubrina asiatica), Aerial potato (Physocarpus pubiflora), and Bay blooming Jasmine (Cestrum diurnum).

The abandonment of farmland is discouraged because it is highly susceptible to revegetation by undesirable exotic plant species. As discussed in other segments of this plan, there is presently no cost-effective method for revegetating abandoned farmland with native plants nor is there a successful technology for eliminating exotic plants once they become established.

- Any agricultural practice which reduces infiltration rate from that of natural (or present) conditions should be compensated for by an on-site retention technique (e.g., ditch, depression). The design should ensure that collected water will percolate into the groundwater system and that no net change in infiltration rate occurs.

- After completing rockplowing and regrading activity, elevated planting beds should not inhibit surface water sheet flow.

- Farm access roads should not inhibit surface water movement. Farm roads built above grade must meet Public Works Manual criteria with regard to the passage of flood flows and sheet flow.

- A change of land use from existing farmland to any other land use should require approval by the County.
Shallow ditching for agricultural purposes should be permitted, however it should not serve as a conduit for transporting water to the extent that it adversely affects the natural hydrologic regimen.

The amount, type, and timing of agricultural chemical applications (e.g., fertilizer, pesticides) should ensure that contaminating residues are assimilated by the system and not transported beyond the agricultural field.

All solid waste not degradable by approved on-site systems should be transported to county approved dumping sites out of the study area.

Construction of structures ancillary to agricultural use such as equipment storage sheds should be allowed. The design of such structures should minimize the impact on surface water flow.

Management Area 2 (Permanent Wetlands)

Residential: One Dwelling Unit Per 40 Acres

- Only enough fill should be allowed to install an onsite wastewater disposal system. Fillings or stilts must be used to elevate structures such that the first floor elevation exceeds the 100 year flood level.

- Nonconventional onsite waste disposal systems (e.g., chemical closets, mound drainfield, waste composters) approved by the Department of Environmental Resources Management should be used where possible.

- No elevated roads should be allowed. All access to property should be by those methods currently used, i.e. airboat or ORV.

- No dredging beyond that necessary to construct an onsite wastewater disposal system should be allowed. All dredge material should be immediately transported out of the study area to a County approved dumping site. Application for the construction of a small lake to obtain the permitted fill should be evaluated on a case-by-case basis.

- Species to be used in ornamental planting should be restricted to plants which are native to this management area.

- No activity should be permitted which contaminates the water such that water quality standards (see Appendix I) are exceeded down-gradient from the residential parcel.

Recreation

- There should be no change in existing law in regard to camping and construction of hunting camps. Such uses should be designed to keep the canopy of tree island vegetation intact.

Management Area 3 (Seasonal Wetlands)

Agriculture: Grove, Row Crop, and Nursery Activities

Agriculture should be encouraged in Subarea 3B and prohibited in Subarea 3A. The BMPs for agriculture in 3B and in 3C when permitted are the same as those for Area 1, except for the following addition:

- Agricultural use should expand in accordance with best agricultural management practices. New agricultural uses should be adjacent to existing agricultural use except where unusual circumstances prevail. Such circumstances would include, but not be limited to, the following situations that might act as an unintentional limit to the orderly expansion of agriculture in Areas 3B and/or 3C:
adjacent landowners will not lease or sell their land at a reasonable market value

sustainable land is separated from land being farmed by a slough system or by critical wildlife habitat.

Residential: One Dwelling Unit Per 40 Acres

Residential land use should be permitted in Management Area 3, however in Subarea 3B, the residential use should be a caretaker function, ancillary to agriculture. The BMPs for residential use in all of Area 3 are the same as for Area 2, except for the following:

- Housing may be constructed on fill pads not to exceed 1/2 acre in size.
- Roads may be built on fill, in a manner as prescribed in Area 1.
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1 Definitions are given on Page 72.
evaluated on a case-by-case basis. If the standards and criteria by which conditional uses are approved are carefully drawn, they can ensure an equitable balancing of competing public and private interests in the context of the characteristics of a particular parcel of land. Such a procedure, which would permit flexing or tailoring of some or all of the pre-set regulations according to the characteristics of a particular parcel of land, would afford an opportunity to maximize the competing needs of the public and private sector in the Everglades. Such a procedure would also provide an opportunity for the implementation of a transfer of development rights (TDR) concept.

2. Adoption of Site Alteration Overlay Ordinance:

One method of implementing the various performance standards and best management practices proposed area-wide for the Everglades and specifically in the new zoning districts is an ordinance requiring that a developer obtain a permit for any alteration of the existing conditions on a given site. These practices and standards would be an overlay on the new zoning districts. The Dade County Commission would consider the ordinance and if approved, the Department of Building and Zoning could be responsible for administration and enforcement. Development of the overlay ordinance draft should be the joint responsibility of the Planning Department, Department of Building and Zoning, and the County Attorney's Office.

3. Transfer of Development Rights (TDRs):

The Management Proposals recommend the implementation of a TDR system for the Everglades study area. This concept recognizes that although the constitution preserves to all landowners a reasonable beneficial use of their property, some land, particularly environmentally sensitive land, should not be developed. Therefore, opportunity is made available to the landowner as an alternative to on-site construction, to transfer their development right to another more suitable parcel of land. Transferrable development rights are not compensation for restrictions imposed, but another method for use of a landowner's property. A property owner in the Everglades would be able to transfer or sell their development rights to landowners outside the Everglades in receiver sites designated by the County Commission. The Everglades landowner would sell their development rights and the transferring parcel would be preserved in perpetuity with a nominal tax value. The buyer of the development right would be able to build more residential units than allowed by zoning up to the amount of development rights purchased. The determination of the number of development rights applicable to parcels in the Everglades should be based on current zoning with associated "grandfathering". Additionally, development rights should be allocated to lands according to their realistic use potential. Lands with existing access or with lower flood risk should be given more TDR value. The Planning Department, in coordination with the County Attorney's Office should have primary responsibility for the development of the TDR concept for implementation in Dade County. Implementation could either occur within the ordinance designating the new zoning districts, referred to above, or in a separate ordinance. The use of TDRs should provide for fair and equitable method by which the key public values of the Everglades can be protected while preserving for study area landowners a reasonable opportunity to achieve their investment-backed expectations.

4. Regulation of Obstructions to Surface Water Flow:

This implementation element is currently in effect. The Department of Environmental Resources Management (DERM) regulates any activity which interrupts surface water flow under the Dade County Code (Chapter 9 [§ 9.72]). This is commonly referred to as the Class 4 Surface Water Permit. This regulatory process should continue.
5. Area of Critical County Concern Designation:

This land management technique is authorized in Section 338 of the Dade County Code and allows environmentally sensitive areas of the County to be highlighted for special consideration in land use decisions and future studies. The designation, subject to approval by the Dade County Commission, should be sought for Management Areas 2 and 3.

6. Intensive Hydrologic Study in Subarea 3C:

This study is recommended for Management Subarea 3C to determine its suitability for agricultural use based on hydrologic considerations. The study design should be developed jointly by the Planning Department, the Department of Environmental Resources Management, South Florida Water Management District and the U.S. Geological Survey.

7. Water Quality Monitoring:

This program would monitor, on a continuing basis, areas of the East Everglades immediately downgradient of development to insure that water quality criteria recommended in the Management Proposals for ground and surface waters are not violated. It should be implemented by the Department of Environmental Resources Management. If water quality problems are encountered in the future, then studies will be undertaken to determine the cause(s) and appropriate remedial action to be taken.

8. Comprehensive Development Master Plan (CDMP) Update:

The East Everglades Management Proposals may be a refinement of certain portions of the Dade County CDMP. The final recommendations may need to be incorporated into the CDMP. This consideration of updating should be performed by the Dade County Planning Department during the normal bi-annual update of the Master Plan.

9. Continuing Planning/Coordination:

The East Everglades Management Proposals should have an agency responsible for continuing planning and coordination to insure that the final Plan recommendations are implemented in a timely manner. The Dade County Planning Department has been performing this coordination role under the current project and should continue in it during the Continuing Planning Process.

10. Property Assessment Reduction for Conservation Use:

Under Section 193.501 of the Florida Statutes, environmentally endangered land may be put in a conservation use category, subject to County Commission approval, for a period of not less than 10 years. The landowner agrees not to develop the parcel during the period of the contract and as a result the tax assessment on the property is substantially reduced. The use of this law should be encouraged among property owners in Regions 2 and 3 to reduce their tax burden. The Planning Department coordinating with the Property Appraiser's Office should insure that this conservation option is implementable in the East Everglades and that landowners are fully informed about its availability.

11. Reassessment of Property Values:

Following adoption of the zoning changes contained in the proposals, the land in the study area should be reassessed according to the new use and density restrictions. This reassessment would be performed by the County Property Appraiser's Office with information applied by the County Planning Department.
12. Increased Enforcement of Firearm Regulations:

Public and private property in the East Everglades, including signs, mailboxes, and water stage recorders, is frequently destroyed by indiscriminate and wanton firearm discharge. This practice also disturbs residents and wildlife habitats. Research indicates that sufficient firearm regulations are in existence, but that enforcement is inadequate. The Management Plan recommends increased enforcement of existing firearm regulations. Resources should be allocated to the County Public Safety Department to permit more aggressive enforcement of firearm regulations in the East Everglades.

It is also recommended that a shooting range be established in the SW Dade area within or near the central portion of the East Everglades. This new range would establish a proper location for the shooting now occurring illegally in the study area. The County should actively pursue, through all possible means, the establishment of such a facility, either public or private.

13. Establishment of County Trash Collection Sites:

Visual observations in the study area have shown illegal dumping to be a problem, particularly in the Cutnet Road area. The Management Proposals recommend establishment of County maintained trash collection sites in the Redlands and Kendall areas of SW Dade. The site would be periodically serviced by the County Sanitation Department and the trash delivered to a sanitary landfill facility.

14. Public Rights-of-Way:

In past years Dade County has accepted right-of-way dedications from property owners in the East Everglades study area. These dedications are made primarily for the purpose of encouraging public road installation in the area. Existing property dedications not used to date by the County should be returned to the appropriate property owners. The return of rights-of-way should not deny reasonable access to traditional uses of improved property and should carry no tax penalty to property owners. Acceptance of future public dedications should be at the discretion of the Dade County Public Works Director. Future building permits in the Area should not require a dedicated right-of-way for issuance.

15. Development Constraint Information in Land Abstracts:

During the course of the East Everglades study, many area property owners felt that they should have been informed about the development constraints applicable to their property when they purchased it. This implementation element proposes that all land abstracts in the study area be updated to include information about development constraints. It would be carried out by the Dade County Attorney’s Office in coordination with the Planning Department.

16. Ordinance Banning Certain Exotic Plant Species:

This recommended ordinance would ban the sale, propagation, importation, and transportation in Dade County of the exotic vegetation species listed on page 74 of this proposal. It would be developed by the County Attorney’s Office in coordination with the Planning and Environmental Resources Management Departments. Input will be solicited from federal, State, and local agricultural agencies and private agricultural groups such as the Nurseryman’s Association before the ordinance is recommended to the County Commission for implementation.

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17. Recreation Facilities:

It is generally agreed that there is a strong need for recreational facilities in west Dade County. These should include any combination of swimming, camping, picnicking, and nature appreciation activities and facilities.

The Dade County Planning Department should, in coordination with the County Parks and Recreation Department investigate the various recreational programs available at the County, State, Regional and Federal levels. New recreational facilities should be sought for the Everglades area through all available programs. At the Federal level, the Department of Interior administers a program to provide funding assistance for recreational facilities on private lands. The potential for expansion of the facilities at the Chelona State Recreation Area should be discussed with the Florida Department of Natural Resources. At the Regional level, the South Florida Water Management District administers a program providing recreational facilities on selected canal rights-of-way. In Dade County, the Parks and Recreation Department should work with the Planning Department in evaluating potential for County facilities in the Everglades.

South Florida Water Management District (SFWM)

1. Water Quantity Monitoring:

This implementation element involves monitoring water levels in the Everglades in order to develop a long-term record from which to base future resource use decisions. In addition, the effects of resource use on water levels should be monitored to insure that freshwater supplies are not adversely affected by water withdrawals. The program is currently within the scope of SFWM authority, however it may require the establishment of additional water monitoring stations and the quarterly analysis of E8 water level monitoring data. The Planning Department should coordinate with the SFWM to develop the program design with the District assuming full responsibility for implementation and operation of the program.

2. Establishment of Water Management Policies:

The SFWM is responsible for water management in the Everglades as it interrelates with the regional hydrologic system. The District issues permits for water well use and drilling, consumptive use of water, and surface water management. In addition, it operates the primary regional water control system. The Management Proposals recommend that the District Governing Board reaffirm the currently implicit policy of no further structural drainage in the study area.

State of Florida

1. Regulation of Filling in Wetlands:

The Florida Department of Environmental Regulation is responsible, under Chapters 253 and 403, Florida Statutes for regulating the placement of fill in wetlands of the State. This responsibility is carried out through a joint permitting program with the Army Corps. of Engineers. The Management Proposals recommend that this regulatory activity continue.

2. Revision of Water Quality Standards:

The Florida Department of Environmental Regulation (FDER) is responsible under Chapters 17-3 and 17-4, Florida Administrative Code, for the establishment and enforcement
of water quality standards for Florida waters. The Management Proposals recommend that surface water quality standards applicable to the East Everglades be changed to conform with the standards contained in the Memorandum of Agreement between the Army Corps of Engineers, the South Florida Water Management District, and the National Park Service for the Purpose of Protecting the Quality of Water Entering Everglades National Park. This modification will require an amendment to Chapter 17-3, F.A.C.

3. Modification of the Flowing Well at the Chakika State Recreation Area:

The Florida Department of Natural Resources administers the state park and recreation system which includes the Chakika State Recreation Area. The artesian well at Chakika Recreation Area has been shown in project studies to cause water quality contamination in surface water downgradient. The Management Proposals recommend that the artesian well be plugged and capped and that a shallow well and pump be installed next to it. This should maintain the water recreation benefits at the park and solve a water quality problem in the study area.

4. Acquisition:

Acquisition in the East Everglades is recommended only as a last resort to protect the public interest and achieve proper management for sensitive areas. If acquisition is determined to be necessary in the future, then selected lands should be purchased by the State of Florida as a wildlife management area. The Department of Natural Resources (DNR) currently administers a program which manages and/or purchases private lands as wildlife management areas. In addition, DNR also administers the State Environmentally Endangered Lands Program which purchases unique lands for preservation purposes.

5. Development of Fire Management Plan: (Proposed only)

The project studies have shown that the native flora of the study area need periodic fires in order to maintain their natural successional integrity. Furthermore, these natural post-season fires are needed to reduce the danger of uncontrollable fires in the dry season. The Management Proposals recommend that the Planning Department coordinate with the Florida Division of Forestry and Everglades National Park in developing a fire management plan for Areas 2 and 3 in the East Everglades.

6. Development of Airboat and/or ORV Regulations: (Proposed only)

Excessive or improper airboat or ORV use in the study area may adversely affect vegetation and wildlife. ORVs may also cause fires by sparks from exhaust systems. These impacts are preliminary and will be re-evaluated when detailed studies in the Big Cypress area are available. The Management Proposals recommend that if the re-evaluation indicates that regulations are necessary, then the Planning Department coordinate with the Florida Game and Freshwater Fish Commission should develop a strategy to mitigate adverse impacts from airboat and/or ORV use. The strategy could range from educational workshops with hunting clubs that use the area to a requirement for spark arrester mufflers on all ORVs to a ban on certain types of ORVs in portions of the area. No new restrictions should be placed on vehicle usage without input from hunting and other recreation groups and a formal public hearing.
Federal

1. Regulation of Filling in Wetlands:

The Army Corps. of Engineers currently regulates all fill activities in the East Everglades under authority of Section 404 of Public Law 92-500. The Management Proposals recommend that this procedure continue.

2. Protection of Critical Wildlife Habitat:

The study area contains designated federal critical habitat for the Cape Sable Sparrow and the American Crocodile. The U.S. Fish and Wildlife Service, under the Endangered Species Act of 1973, is responsible for developing a Recovery Plan for endangered species and evaluating all federal actions in critical habitat areas. The actions of Federal agencies cannot adversely affect any critical habitat area unless no alternative is available. The Management Plan recommends that this procedure continue.

3. Conduct Cape Sable Sparrow Critical Habitat Study:

A portion of the critical habitat area for the Cape Sable Sparrow in the East Everglades has already been destroyed by agricultural development. Much of the remaining area is suitable for agricultural development. The Management Proposals recommend that the U.S. Fish and Wildlife Service conduct an indepth study of the current federal critical habitat designation to refine the boundaries and determine the impact of probable future development on the habitat.
Appendix A

WATER QUALITY STANDARDS

The following ground and surface water standards have been recommended by the Steering Committee for the East Everglades area. The groundwater parameters and standards are the state standards for potable groundwater (Class I-B) or the Water Quality Standards for Dade County (Chapter 24-11), whichever is more stringent. The surface water standards are either Dade County standards, State standards, or the standards contained in a Memorandum of Agreement between Everglades National Park and the South Florida Water Management District, and the Army Corps of Engineers, concerning the quality of water delivered to the Park. For each parameter, the most stringent standard has been listed below. Unless otherwise indicated, these standards are maximum allowable limits.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Standards (in mg/l unless otherwise indicated)</th>
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<tr>
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<td>Surface Water</td>
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<tr>
<td>Alkalinity</td>
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<tr>
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<tr>
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<td>Cadmium</td>
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<td>Chloride</td>
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<tr>
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<td>Color (in PCUs)</td>
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<tr>
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<tr>
<td>Methoxychlor</td>
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</table>

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Parameters | Surface Water | Groundwater
--- | --- | ---
pH | 6 - 8.5 | 6 - 8.5
Phosphate | .008 | .01
Radioactive Substances (pico-curies) | - | 5 - 15
Selenium | - | .01
Silver | 0.7 | .03
Specific Conductance (µhos/cm) | 667 | -
Total Dissolved Solids | 366 | -
Total Inorganic Carbon | 60 | -
Total Organic Carbon | 51 | -
Total F | .033 | -
Turbidity (JTU) | 11 | -
Zinc | 72 | -

Appendix B

WATER MANAGEMENT SUBPLAN FOR
PUBLIC WATER SUPPLY DEVELOPMENT

The groundwater resources of the northeast part of the East Everglades, although not fully explored, have the potential to support a relatively large wellfield for public water supply purposes. The development of such a wellfield would be consistent with the objectives of this project and management of the area.

In subsequent planning and design of such a wellfield, two factors should be given careful consideration in addition to the routine criteria used in siting and designing wellfields. First, the wetland plant communities of the Northeast Shark River Slough should be protected from long term adverse change due to municipal water supply withdrawals. Secondly, the water supply conveyance function of the primary canals must be sustained to provide water to downstream users of need, including south Dade County and Everglades National Park.

The land use proposals of the East Everglades Resources Planning Project are consistent with public water supply wellfield development.

Appendix C

Interdisciplinary Topic: Vegetation Questions

Residential Use

1. What effect has the current level of residential development had on vegetation in the East Everglades study area?

2. What are the impacts of 1/2 acre fill pads for residences and ancillary development such as roads on vegetation in NE Shark Slough, Rocky Glades, and Cilli (assume some 1 unit/1.25 acre development, some at 1 unit/2.5 acres, bulk at 1 unit/par 5 acres)?

3. What aspects of residential development (including roads) are beneficial or harmful to plant habitats?

4. What alternative methods or techniques can be employed to lessen the harmful effects or increase any beneficial impacts of residential development?
Agricultural Use

5. What effect has the current level of agricultural development had on vegetation in the study area?

6. What aspects of agricultural development (at a minimum, separate grove and row crops) are beneficial or harmful to native plant habitats?

7. What alternative methods or techniques can be employed to lessen harmful impacts or increase beneficial effects of agricultural development on vegetative species and communities?

8. What level of agricultural development (assuming current methods) can the native vegetative communities and species in the physiographic provinces near potential farmlands tolerate before their productivity and other wetland functions are detrimentally affected?

Recreation

9. How do airboats, buggies, and tracked vehicles affect vegetative communities?

10. What impact has the historical and current level of OHV use in the East Everglades had on its vegetative communities and species?

High-value Areas

11. What criteria should define high value plant habitats?

12. How does development activity, such as residential, agricultural, and recreational uses, affect high value areas?

13. What are the high value plant habitats in the East Everglades and where are they located?

Exotics

14. What aspects of land modification create favorable conditions for the invasion of various exotic species?

Other Uses

15. How will the operation of a large public wellfield in or adjacent to the north-central area near the eastern boundary of the study area impact vegetative communities in NE Shark Slough and the Rocky Glades?

16. How do current and future rock mining operations near the NE corner of the East Everglades Study area affect vegetative communities in NE Shark Slough?

Water Management

17. How have the historical and current water management practices in NE Shark Slough, Rocky Glades, C11, and surrounding areas affected the area's native vegetative communities?

18. What impact does positive drainage actions have on the flora of the East Everglades and adjacent Park areas?

19. How will possible future water management actions such as operation of the South Dade Conveyance System or changes in flow patterns from I-29 to NE Shark Slough affect the native vegetative regime?
Reclamation

20. What reclamation techniques can be applied to disturbed areas to restore native vegetation productivity?

21. What vegetative criteria should be used to determine priorities for selecting areas for reclamation in the three physiographic provinces?

22. What are the dangers to native vegetative communities in the study area and ENP from abandoned residential or agricultural lands which have been rockplowed and/or filled?

23. What areas should be considered for vegetative reclamation in NE Shark Slough, Rocky Glades, and Cl11 areas to help achieve the management objectives?

General

24. What uses (include activities associated with residential, agricultural, recreation, and canalization) and what intensity of use can the study area tolerate and still meet the management objectives associated with native vegetation in the East Everglades?