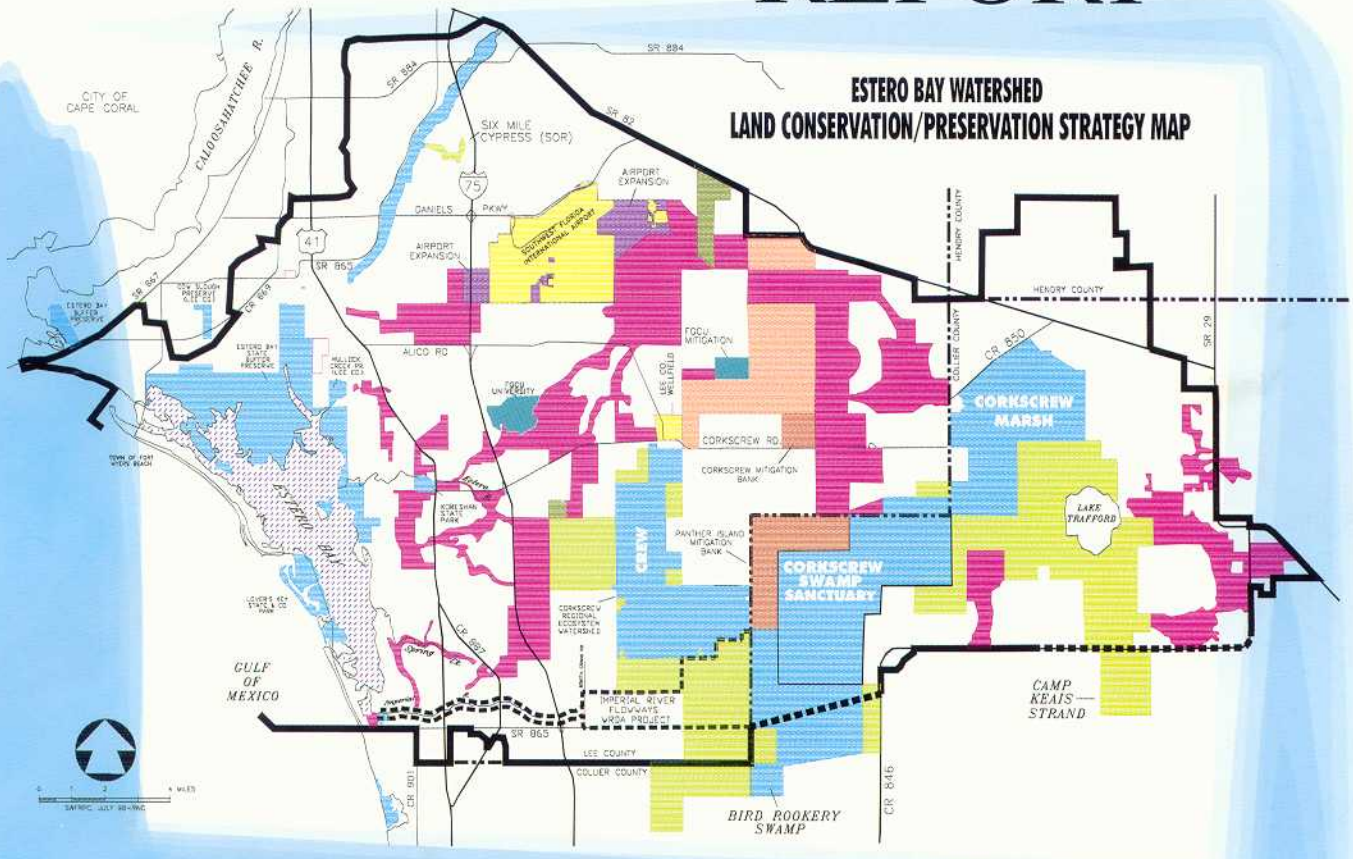
Estero Bay
Agency on Bay Management

STATE OF THE BAY REPORT



Prepared by **THE ESTERO BAY AGENCY FOR BAY MANAGEMENT**

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PREFACE

This "State of the Bay Report" was written as a collective effort of the Estero Bay Agency for Bay Management (ABM). The ABM was established as a result of the settlement agreement for the completion of environmental resource permitting by the South Florida Water Management District for the Florida Gulf Coast University. Upon completion of the Arnold Committee study process, the Southwest Florida Regional Planning Council was charged with establishing and providing support for the ABM.

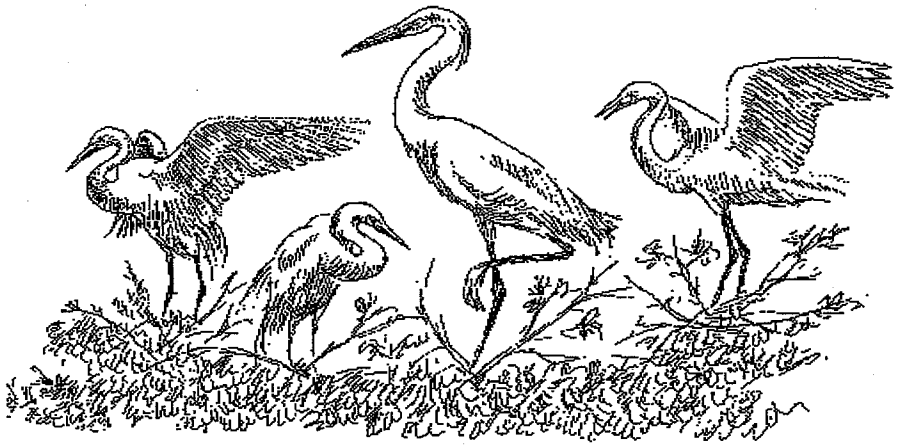
The ABM is a non-regulatory, proactive rather than reactive, advisory body whose directive is to make recommendations for the management of Estero Bay and its watershed. It is charged with collecting and maintaining data concerning the Estero Bay and watershed, and with making the data available to the public.

Document Audience

The "State of the Bay Report" has been written to inform the general public on issues surrounding the Estero Bay and its watershed. As you read this report, a basic working knowledge of the Bay will be helpful; however, we have strived to publish a document uncomplicated enough so that the most inexperienced individuals will understand the magnitude of the issues and the importance of management today.

Acknowledgements

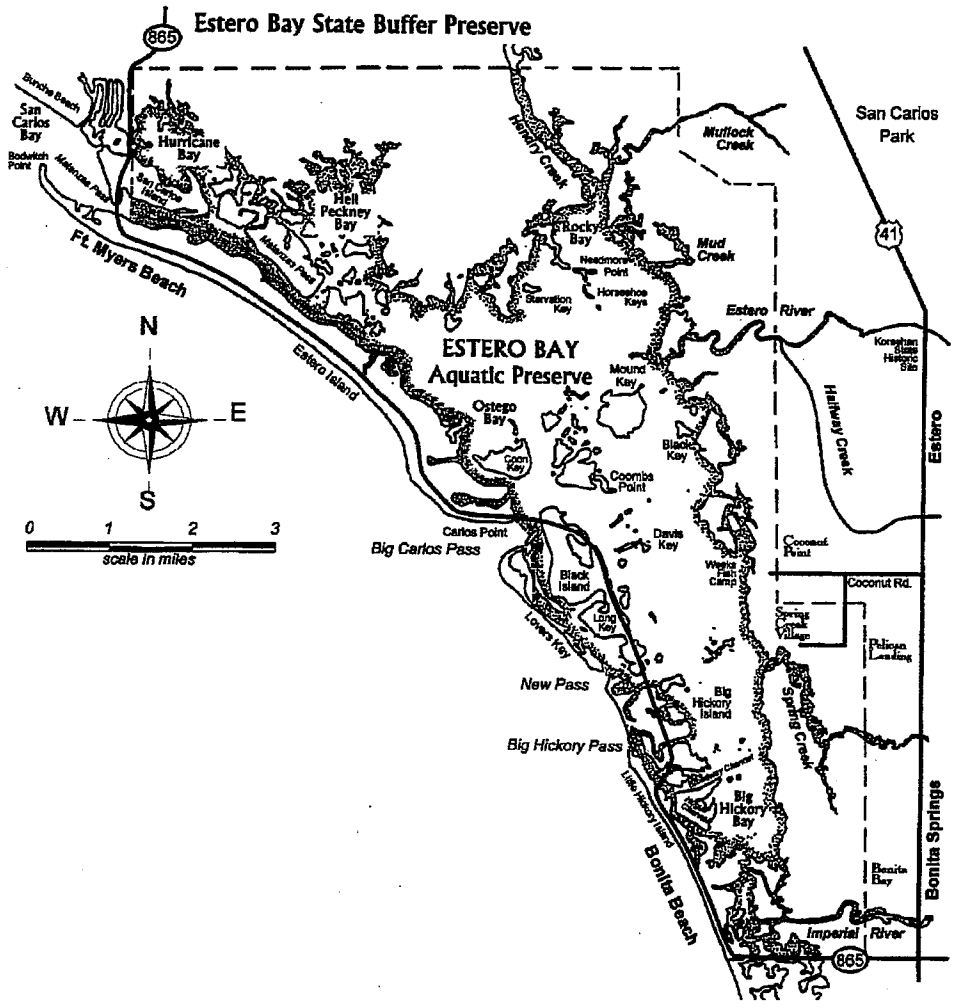
This report was written by many volunteers. Their names are (without attribution for sections) Robert Baker, David Burr, David Ceilley, Dennis Church, David Crawford, Wayne Daltry, Kim Dryden, Harry Gottlieb, Bill Hammond, Tracy Hayden, Tim Jones, Calvin Lloyd, Ellen Peterson, Ben Pratt, Jacque Rippe, Heather Stafford, Fran Stallings, and Chris Stratton. Laura Miller was responsible for the editing. The South Florida Water Management District provided financial and technical help throughout the project.



THE BAY: AN OVERVIEW

Since the drainage of the watershed directly affects the quality and character of the water in Estero Bay, the "State of the Bay Report" examines information and issues concerning both the Bay and its watershed.

Estero Bay is a long, narrow and very shallow body of water, with its northwestern border beginning at Bowditch Point on Estero Island, and reaching as far as Bonita Beach on the south. Estero Island, Black Island, Long Key, Lover's Key and Big Hickory Island are the barrier islands that separate the bay from the Gulf of Mexico. Four outlets give access to the Gulf of Mexico: (from north to south) Matanzas Pass, Big Carlos Pass, New Pass, and Big Hickory Pass. The surface water area is approximately 15 square miles. Water circulation is dominated by tidal currents, but storms, winds, and large volumes of fresh water runoff can cause variations in the circulation pattern. The watershed of the bay includes central and southern Lee County and parts of northern Collier and western Hendry Counties. The principal fresh water inflows come from Hendry Creek, Mullock Creek, Estero River, Spring Creek and the Imperial River. Prominent among the islands in Estero Bay is Mound Key, which has the highest elevation in western Lee County.



Estero Island is intensely developed, with the Town of Fort Myers Beach the center of the tourism and recreational industries in the area. In recent years there has been talk of developing

ecotourism as a way to attract more visitors. The Town of Fort Myers Beach has considered the possibility of an "Ecotourism Trail" with stops at the Mound House, an historic house on Estero Island; the Matanzas Nature Preserve; and Mound Key, thought by archaeologists to have been the capital of the king of the Calusa Indians, who once ruled over much of Southwest Florida. Further, a viable commercial shrimp and fishing industry is located at the north end of the bay on San Carlos Island. Marinas and boat ramps provide access to the rivers and the bay for recreation and fishing. The rest of the bay shoreline, relatively undeveloped until recently, now appears to be more and more attractive to developers of large upscale communities and resort hotels. The bay is largely lined with mangroves, although there are mobile home courts, trailer courts, and private residences located on the rivers, creeks, and canals that flow into the bay. Citizen action in 1998 and 1999 has had some success in stopping the development of a large subdivision at the mouth of the Estero River.

The flora and fauna of the bay and its watershed are varied and abundant; the area includes many species that are listed on the state and federal threatened and endangered species lists. Among them are the West Indian manatee, loggerhead sea turtle, Florida panther, bald eagle, big cypress fox squirrel, red-cockaded woodpecker, and snowy plover. There are five rookery and/or roosting islands in the bay. Thousands of birds such as brown pelicans, frigate birds, herons, egrets, cormorants, and ibises use these places for nesting or roosting. The great white heron nests on one of the mangrove islands, believed to be the northernmost nesting site for this rare bird.

The mangrove-lined shores and islands with wading birds in the shallow waters, shorebirds foraging on exposed mudflats and oyster bars, bobbing crab pot markers, the white wake of pleasure boats skimming through the water, osprey diving into the fish-laden bay, bottlenose dolphins breaking the water surface, a swirl of water from manatees feeding in the seagrass beds, and the return of the pelicans, herons and egrets to the rookery and roosting islands at sunset paint a picture of a resource with great value. On closer examination the waters on which the wildlife swim and forage and on which humans boat are under the stress of human developments and activities. Seagrass beds are shrinking and are being replaced by algae; near dawn dissolved oxygen levels in the water are below the Florida Department of Environmental Protection's acceptable level of less than 4 milligrams per liter (<4.0 mg/L) and heavy metal concentrations are increasing in the tributaries due to storm water runoff of urban areas. Freshwater inflows profoundly influence many living resources in the bay and its tributaries. Domestic and development sources do appear to significantly influence the salinity gradients and nutrient loading of the rivers and creeks.

In view of the shrinkage of the seagrass beds, nutrient loading, the sub-standard dissolved oxygen levels and the fast-paced development around the bay, tourism, Lee County's primary industry, and commercial fishing, along with the great bio-diversity of the bay, would seem to be in jeopardy.

GEOLOGY: THE FORMATION OF ESTERO BAY

Relatively small degrees of change in the polar icecaps determine the existence of Estero Bay. When the ice caps shrink, the bay, along with the barrier islands, disappears and becomes a part of an enlarged Gulf of Mexico--as has happened in the past. When the ice caps grow, the bay becomes salt marshland or freshwater swamp--as has also happened in the past.

The basic geologic strata of the Florida peninsula formed in the Southern Hemisphere, and continental drift caused Florida to migrate across the equator well before the surface geology that forms the basic surficial rocks of the bay and its watershed was created. In fact, Estero Bay's geologic formation was shaped primarily during the Pleistocene Era while Florida assumed its current position.

Estero Bay formed its current general physical dimensions at the end of the last Ice Age, 100,000 years ago. The islands giving the bay its outer form were not then recognizable as they are now. At that time the upper bay was one of several mouths of the Caloosahatchee River. Even at the time of the Vikings, a mere 1000 years ago, the islands were more shifting spit than fixture. As late as 1953, Lover's Key was just coming into existence. The barrier islands continue to shift today.

Over the last two decades the dimensions of the Estero Bay have changed little, with the exception of pass formation. The major changes that have been occurring have been in the dimensions of the watershed. The watershed naturally shrank due to changes in the mouth of the Caloosahatchee River, then grew with the construction of the Ten-Mile Canal, and with various transportation or agricultural drainage works occurring over the last two decades.

HISTORY

The Native Americans

It can be surmised that there was human (Homo sapiens) habitation, within organized societies, of southwestern Florida starting as early as 10,000 years before the birth of Christ. Societal change, either peaceful or not, resulted in four distinct cultural periods, with the last, the Mississippian, clearly being introduced through migration from the north. This last native culture was dominant in Florida for approximately 400 years before the arrival of the Spaniards. There is a question whether the southern part of the state was more dominated by the Mississippian culture or by contacts with Central and South American civilizations, with which contact existed through marine trade.

The local representative Native American culture at the time of Columbus was the Calusa, with a tribal area covering most of Southwest Florida. Population estimates vary, but local student Dr. Robin Brown estimates that the natural ecology maintained a native Calusa population of up to 40,000 at the time of Columbus. A Native American population of this size was not again achieved for the same area until after World War I.

Ponce De Leon was the first recorded Spanish explorer who was likely to have come to the Estero Bay environs; it is thought he died of wounds received over a dispute about cultural differences. Such differences led to the complete disappearance of the known Calusa peoples over a 250-year period, as disease killed tens of thousands, and slavery, indenture, or conversion led to the transfer of the remaining population to Cuba or other lands.

Southern Florida became lightly repopulated through migration of the southern Cree, who likely intermarried or absorbed very small numbers of remnant native peoples, and became known as "Seminoles," through the latter part of the eighteenth and early nineteenth centuries. A series of wars led to the Seminoles residing in southwestern Florida, including family groups in the Estero basin. This habitation ended with the Third Seminole War, and the survivors fled to the Everglades.

Statehood Period

The early "American" settlements in Estero Bay watershed were after the Civil War, and were isolated pods created by land-hungry pioneers, or by visionaries in pursuit of dreams. Cyrus Teague (a.k.a. Koresh) is the best remembered of these, because he founded a society based on scientific investigation that led to unique social principles. The Koresh settlement on the banks of the Estero River was the final site of his discipline; the location is now a state historical park.

Post World War One

By the 1920 Census, Bonita Springs and Estero were named and settled farming and fishing villages, as was Bayview (a.k.a. Crescent Beach, now the Town of Fort Myers Beach). The creation of the Tamiami Trail in the late 1920s opened up most of the Estero Bay coastal watershed, becoming motor court and trailer park destinations, and the construction of a toll bridge to Estero Island (54 cents in 1921) inspired further development of the island. The coastal component of the basin endured the same boom and bust phenomenon Florida enjoyed during the 1920s, with its own promoters engaged in the same land sales puffery not significantly exaggerated by the Marx Brothers in the movie *Coconuts*. World War II brought the area out of the depression, and Fort Myers Beach was a rest and recreation site for trainees at the military bases, Page Field and Buckingham Field, only briefly discomfited by the 1944 hurricane.

Post World War Two

The post World War II boom came to the Estero Basin late, but with the same results. Large amounts of land were committed to urban purposes, but without commitments to urban infrastructure. Septic systems and wells gave way grudgingly to centralized water and sewage systems, with improved health standards. (However, septic systems continue to this day to fight ferocious holding actions.) The population either grew around or bypassed the older villages, creating new named communities, and increasing the intensity. Fort Myers and Bonita Beaches went condo and into the skies. San Carlos Island and San Carlos Park became intensely developed.

Recent Environmental Involvement

Early environmental activism in southwestern Florida began around Estero Bay. Estero Bay became the state's first aquatic preserve in the 1960s. The Estero Bay shoreline became the site of the most ferocious land use battle in the history of Lee County, which set Florida and National environmental law through the court systems. This case concerned The Estuaries, a 1976 proposal for 26,000 units on 4000 wetland acres. The environmentalists won the battle, and to this day the area in question remains in its natural state.

Activism in the latter parts of the 1970s led to a request that Estero Bay be included within an Area of Critical State Concern. Although that designation was not granted, the area became part of the state's first Resource Planning and Management Committee, resulting in a plan approved by the Governor and Cabinet in 1981. That plan had certain requirements which, for Estero Bay, led to the designation of many of the bay's tributaries as "Outstanding Florida Waters" by the mid 1980s.

However, the Governor's plan did not address development directly, except for shoreline use, and for stormwater management. Consequently, concern continues as more and more of the uplands surrounding the Bay continue to be zoned at higher and higher densities.

MODIFYING HYDROLOGY

"Water is the common enemy" was a slogan of the turn-of-the-twentieth-century Florida Legislature. With that philosophy, and with statutory support, drainage districts were established throughout southern Florida. The primary or sole purpose of these districts was to excavate ditches and canals in order to drain off surface waters and to lower groundwater tables. Land transportation activities also promoted extensive drainage, with the Florida Department of Transportation being the largest manager of storm water within Florida. Today, after years of such practices, the topographic relief within the basin is so slight that in order to use the land for any intensive agricultural use, as well as for virtually any urban or domestic use, the water regime needs further management by land managers.

Drainage activity took place within the Estero watershed throughout the 20th century; by 1970, the drainage patterns of the basin had been largely altered to what they are today. There are now ten recognizable subbasins within the Estero watershed. They are: the Barrier Islands, Hendry Creek, Ten Mile Canal/Six Mile Slough/Mullock Creek, Estero River/Halfway Creek, Spring Creek, Imperial River, Leitner Creek, Oak Creek, Corkscrew Swamp and Lake Trafford. Information regarding 1970 conditions are taken from the report by Johnson Engineering, Inc., to the Lee County Board of County Commissioners. Post 1970 information is taken from the 1990 Lee County Interim Water Management Plan. Additional information comes from the 1999

Estero Bay and Watershed Assessment prepared for the South Florida Water Management District. A map of the watershed can be found as the first entry in Appendix I.

The Barrier Islands

The Barrier Islands Basin includes 24 ½ square miles in the southern portion of Lee County and drains the barrier islands into Estero Bay and the Estero Bay Aquatic Preserve to the east and the Gulf of Mexico to the west. A portion of the islands themselves is included in the Estero Bay State Buffer Preserve. Estero Island lies north of Big Carlos Pass and includes the town of Fort Myers Beach. South of the pass are several small islands, including Black Island, Long Key and Big Hickory Island, separated by New Pass and Big Hickory Pass. Bonita Beach is located along the southern portion of the islands where they are nearly connected to the mainland. County Road 865 (Bonita Beach Road, which becomes Estero Boulevard on Estero Island) travels to and from the mainland the entire length of the islands.

Hendry Creek

The watershed of Hendry Creek in 1970 was 17 square miles, and is the same general size today. Its primary early land uses were flower growing with some residential; now the dominant land uses are the highly urbanized commercial districts along Daniels Parkway and US 41. Lakes Park receives a significant portion of the drainage of this basin. North of Gladiolus Drive, the Creek has been partially channelized due to the old Iona Drainage District works, but south of Gladiolus Drive, it is in a natural condition.

Ten Mile Canal/Six Mile Cypress Strand/Mullock Creek

The Ten Mile Canal basin was constructed to intercept the flows from the east so that the land west of the canal could be used for urban and suburban use, and in 1970 it was approximately 53 square miles in size, beginning within the city limits of Fort Myers. Approximately 42 square miles of this basin comprised the largely undeveloped Six Mile Cypress basin. Ten Mile Canal flows into Mullock Creek, which discharges into Estero Bay.

The 1990 study changed the dimensions of these watersheds. Six Mile Cypress watershed is now considered 55 square miles in size, and has become partially urbanized. The Ten Mile Canal watershed has grown to 68 square miles, with 55 belonging to Six Mile Cypress. Including the Mullock Creek watershed, which is still the receiving body, the entire subbasin is approximately 78 square miles in size.

Estero River/Halfway Creek

The Estero River basin was approximately 60 square miles in size in 1970. Largely an undeveloped basin at that time, with US 41 being a two-lane road, this watershed has undergone the most recognizable change of all the subbasins, what with the subsequent construction of I-75,

the expansion of US 41, and the resultant access for new development (including the new Florida Gulf Coast University).

Development has altered the dimensions of the Estero River basin; the watershed is now estimated to be 69 square miles in size. The rock mining that has taken place within this subbasin has also altered the nature of drainage.

Halfway Creek was not separately identified in the 1970 study, but by 1990 alteration of its watershed had made its boundaries largely artificial; its current size of 10 square miles is a remnant of that which existed prior to the reconstruction of US 41 and the construction of I-75.

Spring Creek

Spring Creek's watershed in 1970 was (and still is) approximately 10 square miles, with the greater part of that coming from canals connecting to its eastern portion. Its watershed was largely undeveloped in 1970, except for agricultural purposes and for US 41, then a two-lane road curving eastward into Bonita Springs. Beginning in the 1980s, two large developments, Bonita Bay and Pelican Landing, began building residential golf course communities west of U.S. 41 and on each side of Spring Creek down to the bay. By the 1990s, urbanization had begun filling the eastern portions of the watershed.

Imperial River

The Imperial River is the second largest of the watersheds, with an areal extent in 1970 of 103 square miles. By then, the northern part of the watershed had been severed by State Road 82, and its drainage subsumed in the East County Water Control District. With the community of Bonita Springs existing along the River, and canalization having occurred for agricultural cultivation and for waterfront homes, portions of the basin had been significantly altered. The realignment of US 41 and the construction of I-75 increased development trends in this basin.

Development since 1970 has altered the size of this subbasin. Estimated to be 92 square miles in 1990, the development and lack of land management that has occurred to the east has caused the size of this and the Estero subbasin to be much larger during periods of heavy rainfall.

Leitner Creek

A tributary for the Imperial River, Leitner Creek had in 1970 a watershed of 8 square miles that had largely been canalized for agricultural activity. Since then, the basin has undergone further conversion to agriculture uses, as well as to urban functions. These changes have reduced the Creek's watershed to 2 square miles.

Oak Creek

A tributary to the Imperial River, the Creek's watershed in 1970 was 14 square miles, half in Collier County. In 1970 it was classified as largely a residential watershed, with extensive alteration; since then conversion to intensive uses has largely been completed. These changes have effectively withdrawn most of Collier County's lands from this watershed, reducing its size to 4 square miles.

Corkscrew Swamp

By far the largest of the watersheds, the Corkscrew Swamp Watershed includes 143 square miles in Lee and Collier Counties, west of the town of Immokalee. Land use in the Corkscrew Swamp Basin includes approximately 47% of developed lands and 53% of natural/undeveloped lands. Agriculture is the largest developed land use in the basin and pasture lands include nearly 19%; tree crops account for 19%. Urban land use comprises only 3% of the total.

A major feature of this basin is the Corkscrew Swamp. A large portion of the basin is included in the Corkscrew Regional Ecosystem Watershed (CREW) lands and most of the natural areas are under consideration for public ownership under Save Our Rivers (SOR) and CREW Trust programs.

Lake Trafford

The Lake Trafford Basin includes 18 square miles in the Estero Bay Watershed in Lee and Collier Counies and is associated with Lake Trafford in the far eastern portion of the watershed, just west of the town of Immokalee, with the Camp Keais Strand to the south. The basin is bounded by S.R. 82 to the north, S.R. 29 to the east and south C.R. 846 to the east and south, and by Corkscrew Swamp to the west and northwest.

Land use in the Lake Trafford Basin includes 45% developed lands, with agriculture as the primary developed land use, making up 31%. Residential areas comprise 11% of the overall land use, predominantly low density and medium density residential. Undeveloped lands make up 67% of the basin and are primarily wetlands.

LAND USE IN THE ESTERO BAY WATERSHED

1900 to 1995

Land uses in the Estero Bay drainage basin have changed significantly over the past century. Spanning three counties, the watershed covers all of southern Lee County, the northwestern portion of Collier County and the southwestern tip of Hendry County and includes the Flint Pen Strand, the Corkscrew Swamp Sanctuary and Lake Trafford. The most dramatic of these changes in the land uses have dealt mainly with the reduction in wetlands, the increases and then the

decreases in agricultural areas, and the continued increasing of urbanization in a six- to eight-mile-wide corridor between the Bay on the west and I-75 to the east.

In 1900, only a small portion of the lands in the basin had been impacted by modern man. Other than small communities on the shores of the Estero and Imperial Rivers, the land in the watershed remained undeveloped and was used mostly as open range for cattle ranching, timbering and hunting. The entire area was viewed by those not living here as a hot, swampy land that was unfit for human habitation. A benefit coming from this point of view was that the uplands and wetlands remained and functioned together, balancing the storm water runoff and nutrient loading entering the bay system, thereby keeping the bay healthy and viable and retaining the majority of the native habitats, keeping the basin's wildlife plentiful.

Following World War II, many of the servicemen who had trained on bases throughout south Florida and had experienced the region's environment either immediately returned to the area with their families after the war or, after working in other areas of the country, began retiring to this area. This trend invited a population influx beginning in the 1960s and 1970s. This population increase caused land uses in the western corridor of the basin, which included the San Carlos Park, Estero, San Carlos Estates, Estero Bay Shores / Spring Creek Village, Bonita Springs, Bonita Beach and Immokalee communities, to grow. Additionally, agricultural demands for a growing population increased the demand for agricultural land uses.

These increases in human activities on the land substantially changed the basin's land use patterns. The changes to the storm water runoff and nutrient loading patterns into the bay, as well as those which reduced the wilderness habitat necessary for the large variety of plants and animals in the basin, substantially impacted the bay and the natural upland areas in the basin. In response to these land use changes not only in the basin but throughout Florida, the state, regional and local governments adopted plans to provide guidance for future land use changes. Because of the governmental regulatory activities, the development reviews increased and land uses were limited via the comprehensive plans. As a result, the major wetland systems in the basin remained, even though somewhat reduced in size, and development densities allowed in the center of the basin were reduced.

During the 1980s, the influx of population increase had not abated. Demand for the southwest Florida lifestyle, the livability of the environment, the increased use of air conditioning and the control of mosquitoes, which in a large part has been due to the ongoing development, kept the land use conversions growing. In the mid 1980s, the growth-impacted counties containing the basin amended their comprehensive plans in an attempt to control the location and intensity of urban land use changes. The comprehensive plans attempted to force the urban growth to take place mostly in the western portion of the basin (located near US 41 and the railroads) while protecting the major wetlands systems existing in the eastern part of the basin. The result is that south of State Road 82 and east of I-75 the greater part of the wetland system that was present in 1900 is now mostly identified. For a time it looked as though the area was being regulated through the United States Army Corps of Engineers (USACOE), the South Florida Water Management District (SFWMD), and county regulations.

Recent events, however, have led many to wonder how safe the future of the area is in reality. The siting of Florida Gulf Coast University, Florida's newest higher education facility, led to serious opposition, because of the possible threat to Lee County's domestic water supply. The formation of the Estero Bay Agency for Bay Management was a direct result of that opposition. Within the past two years much residential and commercial development has been approved for the area, including two Developments of Regional Impact (DRIs). The Southwest Florida International Airport is planning expansion, and only recently a developer has announced plans for a shopping mall to be twice the size of Edison Mall, Lee County's largest mall. The Metropolitan Planning Organization (MPO) has also for some time been looking into the possibility of new roads in the area.

In 1997, the general land use pattern in the basin seemed relatively set with urbanized land use patterns located in the western developed corridor, the areas around the university, Bonita Springs and western Immokalee; the major wetland and associated upland systems were firmly set in the center and eastern parts of the basin, with the mining and agricultural uses located on the boundaries and between the large wetland systems. The change at this time would appear to be the implementation of increased governmental acquisition and management of sensitive lands around the wetland systems that remain. This will be difficult with the increased agricultural and mining interest in the area. However, the continued public support for the acquisition of sensitive lands for preservation is being addressed via the CREW Trust and other like programs. In 1997 the voters of Lee County demonstrated their concern for preservation by voting for Conservation 2020, a plan for citizens to tax themselves in order to set up a fund for purchase of sensitive lands from willing sellers.

The three maps of the Estero Bay Drainage Basin which are located in Appendix I graphically portray in a generalized fashion the changes in land uses that have taken place within the Estero Bay drainage basin during the past century. The information shown is an interpretation of the land uses as they existed c. 1900, c. 1970 and in 1997. As the various map legends indicate, human activity has created an ever-increasing diversification of land covers and thereby has created ever more complicated classification systems to identify these uses. The 1997 map reflects the most detailed categorization and has added the most recent land use classifications associated with large scale master planned communities. It should be noted that these maps are prepared at a regional scale with generic information available from public sources, and as such, should not be construed to be site specific determinations as to exact boundaries of the various land uses in the basin.

It should also be noted that there is a volume of "deferred" development within the basin. Deferred development is that which has received some or all of its local, regional, state or federal approvals for development, but has not yet finished the development for which it is approved. The larger of these developments are known as DRIs. These are depicted on the map titled "DRI Activity and Estero Bay Watershed," also located in Appendix I.

Transportation

Transportation makes the basin's lands accessible. The first "permanent" transportation works were the railroad to Naples and the Tamiami Trail, neither of which was completed until well after World War I. Since then, the construction of SR 82, I-75, and SR 865 (Estero Boulevard) have acted to provide access to most of the land in the basin which has undergone urbanization or significant alteration for intensive agriculture. Rapid growth in the area and heavy demands for improved transportation facilities in other parts of Florida have made it impossible for the local, state and federal governments to keep up with the needs, particularly during the winter season when northern visitors swell the population.

The relocation of the major airport of Lee County from Page Field to the International Airport site has also inspired additional urbanization. Although basin development restrictions were a condition of the relocation, "density" restrictions in land use have been replaced by "intensity" restrictions on water discharge.

Power transmission lines have also served as a form of transportation, thereby acting to increase development of the basin. Originally, power was available to only the major inhabited areas, which meant that the greatest part of the basin had no power provider. The Rural Electrification Act, which inspired rural electric cooperatives, led to the provision of service to additional parts of the basin, and the competition led the region's major power company to provide service to the rest of the basin.

Water transportation has become the lesser important transportation mode for the basin. It should be recognized, though, that the basin's relatively undeveloped state was due to the shallow bay waters that were only accessible for land use through the few marginally deeper riverbeds. Now the major water transportation use in the basin is for recreation, and then for shallow draft craft.

Agriculture: Cattle, Row Crops and Citrus

Southwest Florida has historically been blessed with mild temperatures and adequate rainfall, though seasonal, which provide for almost yearlong growing conditions. The soils of this area are of a sandy type with very low fertility levels, the exception being the heavy muck soils around Lake Okeechobee.

Cattle ranching is probably the oldest facet of Southwest Florida's agriculture. At first cattle grazed the entire area unhampered by any fencing and requiring little supervision other than roundups and cattle drives to market. More recently cattle ranching has become more sophisticated, with planted grass and selected breeds that deal well with our climate.

Row crop farmers are attracted to South Florida mainly because of the mild winter temperatures. This industry has made phenomenal growth in the past few years, having the advantage of being able to grow vegetables in the winter, which is the off-season to most of the continental United States. The advent of refrigerated transportation has greatly advanced the growth of this

industry. Global economics and international trade have somewhat impacted the row crops the last few years. Sugar cane growing, mostly on the heavy muck soils around Lake Okeechobee, has long been one of the biggest suppliers of revenue in the entire area of South Florida.

Citrus has been grown on the banks of the Caloosahatchee River for many years. However, the large plantings in this area of Florida are relatively recent, following the devastating freezes in central Florida starting some 30 years ago. This has been the fastest growing agricultural enterprise in Southwest Florida in the past few years, with processing plants and fresh fruit packing facilities being built in this area. Due to the plantings of the last decade this southwest segment of Florida will be the largest citrus growing area in Florida.

Global economics have had a great effect on both vegetable and citrus industries. Availability of labor is always a concern, and the adoption of the North American Free Trade Act (NAFTA) has, according to some sources in agriculture, had a deleterious effect because cheaper labor in Mexico, Central America and South America makes it possible for those areas to produce less expensive fruits and vegetables.

Mining

Earth moving has been a necessary side effect of settlement in the Estero basin, with fairly few sites that have natural drainage that would allow any intense level of habitation. Mining, though, is a fairly recent addition to the basin, with two major sites occurring. One of these sites is at the intersection of U.S. 41 and Gladiolus, an area which is now closed to mining and serves as Lakes Park. The other is a series of mines, east of I-75 between Alico and Corkscrew roads, which are for the extraction of limerock. Extraction is expected to continue for the next several decades.

FLORIDA'S FIRST AQUATIC PRESERVE: Preserving the Bay

As necessity is the mother of invention, so dredge and fill is the mother of the aquatic preserve system. The filling of Boca Ciega Bay in Pinellas County, for example, served to demonstrate that, without special recognition, Florida's natural marine resources are in peril. To say the least, Florida's normal stewardship in the 1950s and 1960s was uninformed.

This recognition was particularly evident in Lee County, with concerns from the intense development of Estero Island and San Carlos Island, indicating to residents that development of the area around the Bay itself was a matter of time. Activism, and the support of a local legislator, led to the upper reaches of Estero Bay becoming the state's first aquatic preserve in December, 1966, two years before the formal creation of the Florida Aquatic Preserve System.

Early designation, and legislation strengthening the authority of the Trustees of the Internal Improvement Trust Fund, reduced the threat of the filling of the state-owned submerged lands. However, not all bottom-land, nor all saltwater wetlands, were (or are) in ownership of the state. The establishment of "meander" lines, as opposed to determination of mean high tide lines, resulted in large portions of bay bottom and salt water vegetation going into private ownership. Consequently, it has taken further legislation to reduce the threat of development of the Bay itself.

The first major change was the authorization in the new Florida Constitution (of 1968) that the state could conserve and protect natural resources. Next, in 1972, came a bundle of environmental land and water resource management laws. 1975 saw the passage of the Local Government Comprehensive Planning Act.

These laws resulted in action: the denial of the development proposal known as The Estuaries; the establishment of the Charlotte Harbor Resource and Management Plan adopted by the governor in 1981; the expansion of Estero Bay aquatic preserve designation to include the southern portion of the Bay in 1983; the approval of the Estero Bay Aquatic Preserve Management plan (the state's first aquatic preserve plan) in 1983; and the declaration that Estero Bay is a State Wilderness area, also in 1983.

There has been a deliberate, if not sustained, effort to preserve the wetlands around Estero Bay. This effort began with Lee County environmental groups which used political activism and private dollars to promote acquisition, or at least conservation. This effort began after the shoreline alteration went into full swing on Estero and San Carlos Islands. The effort has been successful, with new developments recognizing the value in employing setbacks and conservation easements on their own property, as well as supporting some efforts to have the public buy undeveloped uplands of neighboring parcels.

Estero Bay Aquatic Preserve (Extracts of FDEP Estero Bay Aquatic Preserve Plan)

Both the Estero Bay Aquatic Preserve and the Estero Bay State Buffer Preserve (land to remain in preservation and that buffers the bay from impacts from inland development) are managed from a field office at the northwest entrance to Estero Bay.

This Florida Department of Environmental Protection (FDEP) field office is responsible for resource management, research and monitoring, and education in these preserves. Aquatic preserves are exceptional coastal areas whose inshore waters and state-owned submerged lands have been set aside by the Florida Legislature for the purpose of "being preserved in their essentially natural or existing condition so their aesthetic, biological, and scientific values may endure for the enjoyment of future generations." Specific state rules apply to protection of the aquatic preserve. These can be found in Section 258 of the Florida Statutes and Chapters 18-20 of the Florida Administrative Code (F.A.C.) The State Buffer Preserve rules are spelled out in chapters 18-23 of the F.A.C.

Resource management of these special areas includes exotic pest plan control, prescribed fire, and land acquisition. Research and monitoring include water quality and anchorage monitoring. Education and public outreach are made up of speaker/slide presentations, public workshops and exhibits. A primitive trail system within the Buffer Preserve with a primary public access point at the south end of Winkler Road provides for hiking, nature observation, and similar activities. Opportunities exist for participating in a Citizen Support Organization, a volunteer water quality monitoring program, and other volunteer resource activities. DEP publications and educational materials are distributed through this office upon request.

EDUCATION: Who Is Doing What?

Knowledge about Estero Bay and its watershed has until recently been largely oral history, not significantly different from the method of distributing information during the time of the Calusas. With the establishment of the Environmental Education program within the Lee County School system, the Calusa Nature Center, the Ostego Bay Foundation, the environmental programs of Lee County Parks Department and State Park System, associated programs at Edison Community College and Florida Gulf Coast University, the Corkscrew Regional Ecosystem Watershed (CREW) Trust, the Estero Bay Marine Resources Task Force and the Estero Bay Buddies, there are numerous programs regarding our natural environment.

Lee County Environmental Education Program, Lee County School System

Founded by a high-school biology teacher who is now on the faculty at Florida Gulf Coast University, the Environmental Education Program (EEP), the first of its kind in the United States, integrates classroom work with field trips to natural and altered sites so that students achieve an understanding of the interrelatedness of the built and natural environments. The Six-Mile Cypress Swamp Nature Preserve, founded as a result of the environmental concern and political savvy of high school students, serves as a lasting monument to the work of this group of students. Under siege in times of tight school district budgets, the EEC has so far managed to survive.

The Calusa Nature Center and Planetarium

Located at the intersection of Ortiz Avenue and Colonial Boulevard, the Center provides educational programs and walking tours regarding upland habitat, flora, and fauna. It also provides programs regarding the Calusas, and early settlement activities.

The Ostego Bay Foundation

A fairly new organization, the Ostego Bay Foundaion (OBF) focuses on shoreline and bay educational and research programs, particularly in the upper reaches of Estero Bay.

Lee Parks Department

The nature studies of the Parks Department focus on field trips to sites under county management, including the "dreaded swamp swim" at Six-Mile Cypress. There are also interpretive sites at various locations under county management.

State Parks

These facilities are in both counties. The Koreshan and Mound Key State Historical/Archaeological sites are owned by FDEP (Division of Parks) in Estero Bay and in the Lee watershed. Development is encroaching upon the boundaries of the Koreshan site, and Mound Key is divided between public and private owners, although environmentalists have had some success in persuading owners to sell sites for public ownership.

Wiggins Pass State Recreation Area and Barefoot Beach are two open space tracts on either side of Wiggins Pass in Collier County. These sites are maintained by FDEP.

Edison Community College and Florida Gulf Coast University

Being the region's centers for higher education, both institutions offer courses that provide a good grounding in the natural environment, including life and earth sciences. Part of the mission statement for the Florida Gulf Coast University (FGCU) includes a strong commitment to environmental education. It has the rare distinction of requiring a course in Environmental Education in its General Education program.

Corkscrew Regional Ecosystem Watershed Trust

Established at the turn of the 1990s, CREW has as its initial mission the acquisition of the wetland areas in the upper reaches of the Imperial watershed, Flint Pen Strand, as well as similar properties that interrelate to Corkscrew Swamp. Since its founding, the Trust has acquired over 14,000 acres, and has expanded its interests to include wetland upper reaches of the lower Estero Bay watershed. It provides trails and interpretive sites on the upland portions of its holdings.

The Conservancy of Southwest Florida

The Conservancy of Southwest Florida conducts a range of environmental education programs to improve the public's understanding of Southwest Florida's native ecosystems. At the Conservancy's two centers, the public can participate in naturalist-led trail walks, boat trips, and excursions, and visit the conservancy's museum of natural history. The Conservancy's school and summer camp programs reach thousands of children each year. Its lecture programs keep the public informed on key environmental issues facing Southwest Florida.

"Ding Darling" National Wildlife Refuge

The centerpiece of the U.S. Fish and Wildlife Service's system of wildlife refuges in southwest Florida, the "Ding Darling" refuge is named for the noted cartoonist of the post-Theodore Roosevelt conservation era. The Service's administrative and educational offices for the Estero watershed are located at this site, which is on Sanibel Island.

Estero Bay Marine Resources Task Force

Founded in 1998 by the Town of Fort Myers Beach, this group concerns itself with regulating activities on the Bay so that the best concerns of the environment, recreational boaters and the shrimping industry can be balanced.

Estero Bay Buddies

This volunteer group, started in 1999, is the newest of all the organizations which concern themselves with the health of the Bay. Its leaders concentrate on recruiting citizens who are activists and are concerned with preserving the health of Estero Bay.

OUTDOOR ACTIVITY ON ESTERO BAY

Tourism and Recreation

Tourism is Lee County's number one industry. In 1996, tourist expenditures impacted the County's economy at a rate exceeding $1.2 billion, with 1,715,090 visitors enjoying a stay here. Most of these visitors came from the Northeast U.S. (26.5%) and the Midwest U.S. (34.8%) with smaller but nearly equal numbers coming from Florida (11.6%) and Europe (12.5%). The top five reasons for choosing Lee County were warm weather; non-commercialized beaches; relaxation; white sand beaches with shelling; and sunning on the beach. The majority of these visitors (67.8%) used air transportation to reach our area.

Airports have increased in importance for tourism due largely to the gradual decrease in total time for vacation stays over the years. Lee County has two airports--Southwest Florida International Airport (commercial aviation) and Page Field (general aviation). Southwest Florida International Airport, located off Interstate 75, is the 57th busiest airport in the United States. This airport was designated as a Foreign Trade Zone in 1996 and a $900 million, 20-year expansion is planned that will double the size of the airport and add a second runway and midfield terminal. Page Field, located off U.S. 41, is one of the busiest general aviation airports in the United States. It serves both business and recreational flyers. These airports handled 4,099,188 passengers and 19,556,628 pounds of cargo in 1995.

Eco-tourism appears to be a growing part of the area's attraction for visitors. However no figures are yet available to demonstrate the actual size of this industry. Other marine-related local industries include charter fishing; boat manufacturing; marinas; fishing-supply stores; beachwear, shell, diving and surfing shops; and other similar activities.

Recreation (a form of tourism but for residents) within Estero Bay and its watershed comes in many varieties. Residents and visitors can enjoy the more passive types of recreation such as nature appreciation, hiking and bird watching at the Corkscrew Regional Ecosystem Watershed (CREW), the Six-Mile Cypress Slough Preserve, the Estero Bay State Buffer Preserve, Bowditch Point and the Matansas Pass Preserve on Fort Myers Beach, to mention a few. Several Parks are destinations for others. These include Lovers Key State Recreation Area, Koreshan State Historic Site and Lakes Park.

Access and Boating

Access to Estero Bay also comes in many forms. Canoeing down the Estero River from the Koreshan State Historic Site or further inland is one popular way. There are also "eco-tours" offered from several coastal locations. Dolphin and manatee observation, birding, shelling and historical/archaeological perspectives are the subjects of these eco-tours.

If you want to rent a boat to access the bay, there are many marinas from which to choose. Or you can launch your own boat from the area's public boat ramps, including the Imperial River, Carl Johnson Park and Punta Rassa to the northwest.

Recreational Fishing

One of the great attractions offered in Lee County has for a long time been sport fishing on Estero Bay. In addition to exciting fishing for snook, redfish, sea trout, tarpon and other species, the bay has a superb natural beauty, supplemented by birds, dolphins and manatees.

Over the last several decades, there has been a noticeable decline in the overall quality of fishing. It has been more difficult for professional guides and amateurs alike to have a successful fishing day in Estero Bay. The problem is further exacerbated by the red tide which plagues the west coast of Florida from time to time, killing fish and making life difficult for those with breathing problems.

Generally, the decline in fishing quality appears to be related to increased development and boat traffic on and near the bay, with the result that water quality has deteriorated. Proposed massive new developments on and near the bay's eastern shore, with corresponding increases in boat traffic, threaten the bay's future. It is likely to become overwhelmed.

Personal watercraft (jet skis) and recreational fishing are incompatible in a relatively confined area such as Estero Bay. The tranquility of the fisherman is shattered, and the noise cannot help but frighten the fish and other wildlife, to say nothing of the damage to seagrass beds. Further decline in the quality of Estero Bay sports fishing would be a blow to the local tourist industry and to the quality of life of local residents.

Hunting

Hunting has through time become less popular than it once was in the study area, but it still continues. Private lands in the study area are utilized for hunting white-tailed deer, wild hog, raccoon, gray squirrel, wild turkey, bobwhite quail, American coot, wood duck, ring-necked duck, mottled duck (Florida duck), green-winged teal, blue-winged teal, mourning dove, naturalized dove species, and common snipe. Hunting methods include use of shotgun, rifle, or bow and styles include still hunt, tree stand hunt, walking hunt, horseback hunt or the use of outdoor recreational vehicles (ORVs). Dogs, including bird and trail dogs, are used in some areas.

Part of the study area (northern and western Collier County west of Corkscrew National Audubon Sanctuary) was part of a 350,000-acre Collier Wildlife Management Area managed by the Game and Fresh Water Commission in the early 1950s. Game kill data from 1952 to 1957 indicated that 392 deer, 2,586 turkey, 5,518 quail, 744 fox squirrels, 1,290 gray squirrels, 487 dove, 290 ducks, 29 snipe, and 3 bears were harvested during this time period. Another wildlife management area, the Lee Management Area, was located further north and west (south of S.R. 82 and including most of the Alico lands and the Estero area) and was managed for public hunting by the Game and Fresh Water Fish Commission (now called the Florida Fish and Wildlife Conservation Commission) under agreement with private landowners until the late 1960s. Both of these Management Areas have been terminated through the expiration of the management agreements, and the division of land into more and more ownerships.

MATANZAS HARBOR: The Bay's Most Active Waterway

Early History

Matanzas Harbor is a natural shallow water harbor in Lee County. It is the site of one of the older settlements of the study area, and was once partly owned by the Koreshans, who were among the island's first developers. The Harbor became a reliably accessible fishing port after maintenance dredging of Matanzas Pass was authorized in 1960. Reflecting this use, records in 1956 listed 280 shrimp boats using the facilities at Fort Myers Beach. That year shrimp boats delivered 3,800 tons of shrimp. By 1960, waterborne commerce consisted principally of diesel fuel, fish, shrimp and ice, with tanker barges delivering the fuel. The commercial facilities included two shrimp and several fish packinghouses, fuel and ice distribution points, and two marine railways. Blocks of ice came from Fort Myers to Fort Myers Beach for crushing on site to load on commercial boats harvesting fish and shrimp. Much of the land development,

construction of an ice plant, and diesel fuel terminal were for the support of the shrimp and fishing activity.

The local fleet required a supply of fuel and ice in order to operate. From 1963 to 1966, the delivery of ice averaged about 18,000 short tons and fuel increased from 2,300 to 13,400 short tons. The shrimp harvest increased from 1,294 to 1,713 short tons. The need for vessel facilities was strong during this period, enabling the justification for a channel extension and construction of a turning basin in Matanzas Pass in 1968. Prospects for continued commercial growth were good.

In 1980, the Coast Guard established a search and rescue station, which is reportedly the fourth busiest station in the United States. The station handles over 600 search and rescue missions a year including Cuban refugees' interdiction and drug enforcement duty. The station covers a coastline of about 60 miles from Sarasota Beach to Cape Romano.

Current Use

The National Marine Fisheries Service (NMFS) fish-landing statistics indicate an average of about 2,740 short tons a year from 1990 through 1994 for Fort Myers Beach. The NMFS reports the value for that average annual tonnage at about $8.7 million, making Fort Myers Beach landings the second most valuable in Florida. Nationally, the United States Department of Commerce consistently ranks Fort Myers Beach as one of the top 100 major ports in the United States in terms of commercial fishing.

Data from the field for 1993 showed the delivery of 14,000 tons of fuel, a slight increase over fuel figures reported in 1966. The fuel is primarily for the commercial shrimp fleet of approximately 80 boats. The approximately 62 live-aboard, 44 sightseeing boats, 916 power/sailboats, 2 charter

boats and 50 other fishing vessels docked or moored in the area also use fuel. This shows the diverse use of Matanzas Pass and is a reflection of the county's significant economic and population growth. That growth was an attraction that resulted in the start of charter boat operations. The operators of those two boats reported a total operating expenditure of $13 million for salaries, food, beverage, fuel and other expenses for 1993.

Facilities have prospered along the waterfront. The oil terminal has been expanded to handle the wholesale sale of propane and recently invested $300,000 in the upgrading of its ice manufacturing plant to handle a greater demand from shrimpers. Matanzas Harbor supports four shrimp packinghouses, several fish packing facilities, two marina railways and nine marinas.

POPULATION

The 1970 Census established census tracts for Lee County, as the 1980 Census did for Collier. The Census, through its tract system, enables some historical population trends to be developed because the "count" boundaries remain

comparable through time. Estimates have been extracted from the zones established in 1970, and updated, and they are included in Table 1.

TABLE 1
POPULATION GROWTH
1970-1990

	1970	1980	1990
Estero Basin	18,433	30,902	77,697

The table indicates that the watershed population has increased by 331% over the 20-year period indicated.

It should be noted that this is a "resident" population, made up of those who consider their residence their primary homestead for voting and census purposes. The functional population is much higher, and includes transients, tourists, and seasonal residents, who commonly occupy hotels, mobile home or recreational vehicle parks, seasonal apartments, or condominiums. During the winter season, the Beach population more than doubles, and the overall coastal population increases by approximately 30%.

There have been population forecasts for the Estero Basin as part of other planning efforts. The most compatible of these between Lee and Collier Counties is the Metropolitan Planning Organization (MPO) forecasts. MPOs use "traffic analysis zones," which are subsets of Census tracts. For the MPO plans for the year 2020, the base year for 1990 was used, with data updated to 1993-1994, when the plans began, and performed forecasts at 10-year intervals. These estimates are included in Table 2.

TABLE 2
POPULATION FORECASTS
2000-2020

	2000	2010	2020
Estero Basin	155,610	233,916	281,406

(Note: the forecasts include the Cocohatchee basin, whereas the current estimates do not.)

WATER QUANTITY, QUALITY AND TIMING

"Everything that grows needs water" is a appropriate slogan. Water quality, quantity and timing all play a significant part in the lives of the inhabitants and their environment. Tourism, agriculture, estuarine and fresh water wetland flora and fauna, including humans, are dependent on water in the right amount, the right quality and at the right time. There are only small creeks and rivers flowing into Estero Bay providing the fresh water. This condition makes Estero Bay extremely sensitive to changes in upland drainage, which affect the quantity, quality and seasonality of fresh water influx. Much of the area is also subject to flooding during periods of heavy rainfall. With increased development and loss of wetlands, the surface water will flow unhindered to the bay, which is sensitive to large amounts of fresh water. Therefore, it is very important to balance the water quality, quantity and timing.

Water Quantity: Streamflow and Groundwater

There are ten watersheds, counting the minor ones, that provide water to the bay. Some of the watersheds are relatively undeveloped while one such as Ten Mile Canal/Mullock Creek is the drainage path for portions of the city of Fort Myers. Water control structures to slow drainage and contaminant retention are present on the major rivers, but lacking on the major creeks. Surges of fresh water can reduce salinity, increase turbidity and carry nutrients that have detrimental effects on seagrass beds and the spawning and nursery habitats of many fish species. Streamflow volumes vary widely based on the rainfall, which since 1970 has been as low as 32 inches (1987) to as high as 80 inches (1995). Not only can the yearly amounts vary greatly, but within the watershed there can be variations; for example, the average annual rainfall from 1940 to 1991 was 53.65 inches, but in 1997 Page Field recorded 70.89 inches while at Bonita Springs the figure was 51.59 inches. Monthly precipitation levels are the highest from June to September, and lowest in November and into the winter and early spring months.

Water inflows to the bay from ground water are unknown. With active mining, agricultural operations and the extraction of groundwater for domestic supplies (25 million gallons per day from the various aquifers for public water supplies) there may be no consistent groundwater inflows remaining in the estuary. Of the various aquifers, the Surficial aquifer, which includes the water table aquifer and the Lower Tamiami aquifer, is an important source for potable water, agriculture and landscaping. The demand is increasing and the draw down during the dry season when the seasonal residents are present is causing a long-term deficit that is not replenished during the wet season, leading, perhaps, to a serious water shortage in the future.

Water Quality

Industry, commercial fishing, urban growth, marinas, road runoff, septic systems, agricultural practices and pleasure boats influence the water quality. Water quality can be measured in terms of physical, chemical or biological parameters. Water quality information for the bay is available from varied sources and at varied times, but only since 1991 has information been available on the tributaries. Seagrass beds are an indicator of water quality, because turbidity and algae blooms (due to the nutrient load) govern the penetration of sunlight. Studies of seagrass bed areas show

a marked decline from historical and recent records. Dissolved oxygen concentration or per cent saturation of oxygen in the water indicates the suitability of the waters for oxygen-requiring species. The Florida Department of Environmental Protection has established a state standard of 4 mg/Liter. Levels above 5 mg/L allow animals and plants to grow and reproduce. Data collected by Estero Bay Marine Laboratory and others shows that the dissolved oxygen levels are often below the standard in the central part of the bay, Estero River, and Ten-mile Canal. These indicators clearly show that the bay and at least two of the freshwater sources are under stress and that the biocommunity and ecosystem are threatened.

Timing

The characteristics of the water in the bay and its tributaries are in a continued state of flux due to daily and seasonal rainfall and tidal influences. The timing of the inflows (hydroperiod) affects the bay's capacity to function optimally as a nursery for marine species. The absence of hydroperiod data is a serious gap in the analysis of the State of the Bay. Due to manmade alterations in the watershed, surface water modeling may be the only way to develop a water management plan that will restore and preserve the bay's marine environment and to identify the most critical sources or activities that impact the bay. The cumulative effects of control structures in canals, rivers, and creeks; wetland loss; projected land use; and water demand need to be parameters in the model.

WILDLIFE AND HABITAT

Estuarine Life: Fish

The brackish waters of the Estero Bay estuary have been cleansed and refreshed by tidal action daily for at least the last five thousand years. The constant rhythm of salt and fresh water mixing and swirling over rich sediments and marine plant beds creates ideal fish habitats in the tidal creeks and inshore shallows of the estuary.

If most of the public, even those of us who regularly use the Bay for recreation, were asked to name the fish living here we would probably answer by naming the most important of Florida's sport fish. Snook, redflsh, sea trout, pompano and permit, tarpon, jacks and drum would surely all get mentioned. If pressed farther, most could add mullet, catfish, perhaps sharks and maybe "baitfish." A typical list would probably total a dozen or so species.

In fact, estuarine fish research in neighboring bays has documented over 200 species of fish in our local waters. These include such endangered species as Gulfcoast sturgeon and smalltooth sawfish, juveniles of major offshore fisheries and young of a number of important shark species. One sign of a productive, stable and healthy ecosystem is a broad diversity of wildlife dependent on clean, renewable resources.

Mammals

Estuarine bays offer diverse habitats that can support a wide variety of mammal species. The waters of Estero Bay are home for some of

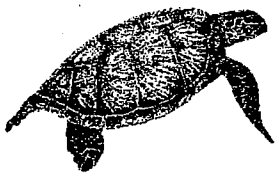
the most well known of Florida's aquatic mammals, as well as some of the largest, such as the West Indian Manatee and Bottle-nosed Dolphin. Manatees are not really abundant anywhere, but choice estuarine bay habitats like Estero offer year- round accommodations for many. A resident dolphin pod numbers about three dozen animals, based on records of local observers.

Raccoons, river otter and marsh rabbits live on the tideline boundary, between the aquatic and upland habitats. On the dry side of the habitat scale, the uplands of Estero Bay State Buffer Preserve provide excellent habitat for white-tail deer, bobcat, wild hog and even Florida black bear.

The pine flatwoods, hammocks and high marsh habitats are also the preferred range for Florida's smaller furred fauna, ranging from the listed Big Cypress Fox Squirrel, Cotton and Silver Rice Rat, on down to Short-tailed and Least Shrews, weighing in at less than an ounce each. Even the treetops offer good places for mammals to live: at least four species of bats make their home in the Estero Bay forests.

Amphibians and Reptiles

It will take a keen eye to observe this class of wildlife in the Estero Bay environs, but they are here in abundance. Frogs and toads, known collectively as the anurans, are represented by about fifteen species in all non-salty habitats. Reptiles are even better represented. About eighteen different snakes serve as both predator and prey in the area. Eight lizard types and a dozen or so kinds of turtles occupy nearly all fresh wetland habitats, with the handsome Ornato Terrapin inhabiting the mangrove creeks. The drier upland woods and scrub areas are home to gopher tortoises and Florida box turtles, some of whom have likely lived in our flatwoods for more than a century.



Sea turtles of three species use this part of the Florida coastline for nesting and feeding, mostly during the May to October nesting season. They ply the inshore bays and creeks during the summer months, waiting for nightfall, the right tide and an increasingly rare commodity these days: an isolated stretch of beach for digging a nest pit.

Alligators are not common within the Estero Bay estuarine system mostly because they do not tolerate brackish water well for extended periods. They will, however, travel up and down the freshwater creeks with the tide shoulder, and the summer's push of fresh rainwater into the Bay will allow them more time farther downstream. Wherever they occur they serve the role of top predator and preeminent scavenger. American crocodiles are finding their way back into this corner of their former range, too. Sightings of this unique and still highly endangered giant lizard are being reported again after several decades of near complete extirpation.

Invertebrates

This class of wildlife contains what are, arguably, the most important and influential groups of wildlife of the Estero Bay region. No other assemblage has the enormous economic impact or the

potential to make the area inhospitable to humans. That is because this wide class of wildlife ranges from crustaceans such as crabs and shrimp, vital to local economies and estuarine food webs, to the insects, including mosquitoes, biting flies and agricultural pests, to the mollusks whose shells give our beaches such charm.

As noted previously, the shrimping fleet for the southern Gulf of Mexico largely operates out of San Carlos Island, located at Matanzas Pass, the southernmost big service port in the eastern Gulf. Its economic influence is considerable, supporting many jobs and companion businesses, causing local governments to take serious notice of port construction requests and estuarine management policies that, naturally, favor the industry. But, harvesting operations of this scale, with the modern efficiency required for profitability, have the ability to make actual measurable changes in shrimp and crab populations on a Gulf-wide scale that can have significant ecological effects up and down the food chain.

Estuaries are the nurseries of shrimp, crabs and dozens of small to microscopic crustacean species that live in the water and sediments. They, in turn, are vital to the food webs of other estuarine residents. One challenge constantly faced by local authorities is maintaining a balance between sound commercial shrimp harvest and the requirements of a healthy estuary.

First-time visitors to the area are often amused at learning that local elections include races for the office of "mosquito commissioner." Truth is, "mosquito control plans" have considerable influence on population densities. It is also a fact that, without these plans, the burgeoning mosquito population can cause serious health threats, and modern life as we know it would be much less comfortable. The tools of this trade, largely chemical controls and wetland-manipulation strategies, can, and will, have considerable implications for managing ecologically vital public wetlands in the future.

On the lighter side, the invertebrate wildlife of Estero Bay includes a delightful assortment of sea stars and sand dollars, a myriad of bizarre polychaete worms, spiny urchins, diaphanous jellyfish and just plain pretty beach shells. More than 150 species of shelled mollusks alone populate the inshore waters. Part of the charm of "going to the beach" involves the unexpected discovery of the beautiful symmetry and diversity found in estuarine invertebrates. This diversity goes part-and-parcel with a healthy ecosystem. To many of our important tourists/guests there is a crucial link between the appeal of a living, vital coastline and their willingness to return.

Seagrasses

The large dark patches of pattern and color on the bay bottom are mostly beds of rooted marine plants that we collectively call "seagrasses" due to their long, narrow leaves. These plants are key to maintaining the productivity and diversity, the very health, of our coastal bays.

These plants are not algae but actually produce small flowers and seeds, although most of their reproduction is by root spreading. Five species are native to Estero Bay and can be found in patches

measuring a few square feet up to acres in size and in water depths from about six feet to areas awash at spring low tides. All provide stability to otherwise loose sediments (important erosion control), have leaf structures supported in the water column (making cover for fish and other animals), provide a solid surface on which to attach (needed by zoophytic and epiphytic animals and plants), are a direct source of food to many species (such as sea turtles and manatees) and are a vital source of organic detritus (decaying leaves, stems and roots that help recycle nutrients and provide important food chain origins).

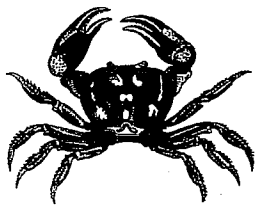
They go by colorful names such as turtle grass, eel grass and manatee grass. The beds often border channels used by boaters, channels that are often hard to see in the shallow bay waters. Running aground on the grass beds, or worse, gouging a propeller scar and cutting the rootlike rhizomes by which these plants replicate, cause damage that can take years to heal. These are the gardens of the estuary providing beauty, sustenance and true vitality to the bay ecosystem.

Human activities are largely responsible for the loss of seagrass beds. The critical reduction in light penetration due to increased water turbidity and nutrients can only be reversed by efforts to improve the management of surface water runoff and reduction of pollutants. Other factors in the reduction of seagrass beds can include such natural phenomena as prolonged low winter temperatures. Long term salinity stress and low levels of dissolved oxygen near dawn also contribute to seagrass loss.

Tidal Flats To Open Waters

Shifting sands, slick black mud and crushed shells do not seem at all hospitable for wildlife but these harsh and dynamic conditions of the tidal flats are home for many. The active beach face is a rich, percolating cauldron of highly oxygenated water, decaying plant parts and an abundance of open space, providing habitat for a whole realm of animals called the interstitial community. It comes complete with prey, predators and scavengers represented by members of the crustaceans, mollusks, fish, segmented worms and even bird families that specialize in exploiting this habitat. Lots of productivity here, but on these shifting sediments nobody has a permanent residence for long.

Looking out across the open expanse of bay waters, one might imagine a vast, wet desert devoid of life except for the occasional fish. But, as we have seen elsewhere in the estuary, looks can be deceiving. Found in the water column, the vertical range of water between the bottom and the surface is a community of free-ranging plants and animals called the *plankton.* Usually quite small, drifting where currents take them, they are an astounding array of algae, juvenile shrimps and crabs, young vallgers of many mollusks, hatchling fish, diatoms--the list goes on for hundreds of species. Some specialize as estuarine plankton; some are visiting by way of currents from offshore. In aggregate they amount to the meat and potatoes in a rich, brackish broth forming nutritious estuarine soup. And, yes, there are those who depend on this soup for sustenance: the filter feeders. Dozens and dozens of mollusks, tunicates, sponges, tube worms and many other species have digestive systems designed as power filters to dine on this tide *de jour.*



Upland Life: Neotropical Migrants

Neotropical migrants are birds that migrate between North America and South America, the West Indies and islands near South America. Some of these birds, such as the least tern, swallow-tailed kite and the chuck-will's widow, breed in North America and spend their non-breeding period primarily south of the United States. Other birds, such as the cedar waxwing and American goldfinch, breed in and winter extensively in North America, although some populations winter south of the United States. A small group of birds, including the mangrove cuckoo and black-whiskered vireo, breed only on the Florida peninsula within the United States, and leave Florida during the non-breeding season. Florida is important to many of these bird species because of its geographic position between North and South America and close to the West Indies. Migratory birds must "refuel" after what may be an extended non-stop flight across the Gulf of Mexico. Preservation of habitat, especially forested areas on and near the Florida coastline, may be critical to some birds which use the mid-Atlantic and central flyways between the two continents.

Birds are great travelers. As masters of the air they not only can avoid their predators, reach new food sources and find cover more easily, but they can relocate over distance when conditions don't suit them. They cover long distances and see more of the world than most of us ever will in the process.

If we consider our backyards or perhaps the Estero Bay forests as the places where those small birds live we will be only half right. For half or more of the year most of the small passerine, or perching birds, travel to and from our backyards to tropical savannas and rainforests to spend the winter months.

Think about this feat for a moment. This one-to-two ounce bundle of down and fluff must fuel up, navigate over hundreds of miles of open water, avoid predators and find the same patch of forest or brush in a land a continent away. We used to believe small birds could not possibly make such bold treks and must hitchhike on the backs of large birds. We now know through bird leg band studies that most of the small warblers, vireos, flycatchers and thrushes (to name a few) make these skillful journeys twice each year for the half-dozen or so years of their lives. Our backyards--and preserves--are just their part-time address in a life filled with true travel adventure.

Wide-Ranging Species

To understand the sense of scale needed to successfully manage wildlife and natural resources one must consider habits, behavior and necessities of the species being managed. If the objective were only to manage habitat for mice, then preserve lands could be measured in square yards. However, public resource managers have the obligation to provide viable habitat for the wide diversity of plants and animals of the native system.

Likewise, connection of coastal areas to interior watersheds, and the preservation of those interior habitats, is crucial to some wildlife species. Many wading birds in South Florida forage in freshwater habitats during the wet and drawdown season but may concentrate foraging or nesting activities in saltwater wetlands during droughts or on a seasonal basis. Many wading bird species migrate to and from different regions of South Florida and to other parts of Florida and the United States. Some species must negotiate a vast terrain to access a variety of food resources on a seasonal basis. The Florida black bear uses a variety of habitats, including mangroves, but may travel to specific locations to feed on palmetto berries in the fall. The Florida sandhill crane requires freshwater marshes and shallow ponds to roost and nest, but leaves wetland areas by mid-summer in South Florida to spend most of the year in drier habitats in a home range that may exceed 450 acres for adults and 4 to 5.3 times more acres for subadults. The male Florida panther occupies an average home range of 135,850 acres. Migratory shorebirds may use much of the Florida coastline when migrating between continents.

Wide-ranging species in the watershed include large and medium-sized land mammals, raptors, ducks, migratory songbirds, and shorebirds. Florida black bear, for instance, must range over a territory of 50 square miles or more to find food and shelter that meet their needs. Bobcats may need 10 to 12 square miles, manatees travel hundreds of miles in a season, peregrine falcons and roseate terns travel continent-spanning migration routes and even shrimp need protected access to the Gulf for successful rearing and reproduction. All of these considerations together will tell us what the size our preserves, and our thinking, must be.

With this in mind, it becomes much clearer why one nest tree does not make an eagle preserve or that one sheltered bay is not a coastal management system. But places like Estero Bay can be a part, like a link in a chain, of an interconnected series of preserves, a part of a coastal corridor of vital habitats that can adequately serve and protect these valuable resources.

Shore Birds

"Shorebirds will be where shorebirds can be," said a wise man once. He was talking about habitat in a roundabout way. The implication is that wildlife (in this case the cadre of sandpiper species, plovers, curlews and such) will find and exploit good food and cover resources when and wherever they can be found. And that food is mostly the formerly mentioned invertebrates like crabs and the small baitfish of the estuary. Some three dozen species of shorebirds use Estero Bay for a feeding and/or breeding site, all with just a slight twist of appetite and abilities so that direct competition is avoided. Several of these birds, such as the endangered piping plover and threatened snowy plover, least tern and black skimmer, can easily be found here.

Many species, particularly species that over-winter or migrate through the watershed in spring, must compete with people for access to beaches at high tide and feeding areas at low tide.

Important shore bird areas in the watershed include the Estero Critical Wildlife Area (CWA), managed by the Fish and Wildlife Conservation Commission on Ft. Myers Beach; all beaches, particularly at inlets; wide sand and tidal mud flats throughout Estero Bay; saltterns in Estero Bay and interior to mangrove fringes in the watershed; and many freshwater wetlands that are utilized by such species as the solitary sandpiper, yellowlegs, black-necked stilt, and dowitchers.

Coastal Scrub

Xeric oak scrub and scrubby flatwoods are found almost exclusively in Florida, on the highest coastal dunes or paleodunes with deep, well-drained soils, and have distinct vegetation types which include four scrub oak species and several endemic plants with restricted ranges. Well-drained soils and high elevation insure xeric conditions that favor drought and fire tolerant plants. The animals that are endemic to xeric scrubs in the watershed include the threatened Florida scrub jay and scrub lizard. Endemic plants include the endangered Curtiss's milkweed.

The remaining xeric oak scrubs within the watershed are restricted to areas along the perimeter of the Estero Bay/River system in Lee County, including Chapel Ridge scrub and part of Koreshan State Park; some undeveloped areas that are contiguous to the Cocohatchee River system in Collier county; and remnants of scrubs in developments adjacent to the Imperial River. Some minute scrub areas are located in the eastern portion of the watershed in the Gator Slough area and in conjunction with the Immokalee Rise. The Chapel Ridge scrub until recently was the largest and only contiguous scrub system left in Lee County. This ridge has been greatly reduced in size in the past five years by development and is under tremendous development pressure. An endemic scrub species, the Florida scrub jay, has not been documented in the Chapel Ridge scrub since 1993.

Wetland Life

The Estero Bay watershed includes many freshwater wetlands that are necessary to support the life history of most of the fish and wildlife species in the region. These wetland types include cypress and mixed swamp forests or strands, dwarf cypress strands, hydric pine flatwoods, mixed pine/cypress forests, shrub swamps, popash and willow heads, pond apple sloughs, wet prairies, and isolated ponds or freshwater marshes. Regional freshwater systems in the watershed include the Corkscrew Swamp, Bird Rookery Swamp, Six Mile Cypress Strand, and the Cocohatchee, Imperial, and Estero Rivers. Cypress and willow heads provide nesting and foraging locations for wading birds. River systems provide year-round refuge for fish, amphibian and turtle species. Isolated or temporary ponds provide breeding sites for a wide range of amphibians and reptiles, as well as foraging sites for wading birds, small mammals, and reptiles.

Fish

Thirty-eight species of freshwater fish and five exotic fish species were documented in 1993 as using the Immokalee rise. Forty-seven species of freshwater fish and seven exotic freshwater fish

species are identified in southern Florida in 1874. Common species include the Florida and longnose gars, American eels, pickerels, bowfin, shiners, catfish, sunfish, largemouth bass, bluegill, black crappie, sailfin molly, and many species of killifish. Non-native species include the walking catfish, oscar, Jack Dempsey, jewelfish, black acara, and spotted and blue tilapias.

Mammals

Twenty-six mammal species, including naturalized and nuisance species such as the black and Norway rats, house mouse, and wild hog, were documented as using the Immokalee Rise area in 1993. Lesser-known mammals identified in the study include the short-tailed and least shrews, marsh rabbit, rice rat, and spotted skunk. This list did not include the coyote, which is expanding its range south through the state and has been documented in Hendry and Collier counties and the West Indian manatee or whale species that use coastal waters.

Thirty-four species of land mammals have been identified or projected to be found in the Caloosahatchee/Big Cypress watershed. In addition, rare species such as the Everglades mink, long-tailed weasel, several bat species, southern flying squirrel, and round-tailed muskrat may be present in the watershed.

Reptiles and Amphibians

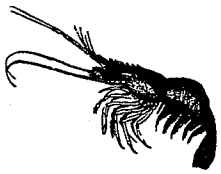
Twenty species of amphibians and two exotic amphibians (Cuban treefrog and greenhouse frog) were documented as using the Immokalee rise area in1993. Toads, frogs, treefrogs, amphinuma, sirens, and one species of newt and salamander have been documented.

Forty-six species of reptiles and two exotic reptiles (brown anole and the Indo-Pacific gecko) were documented as using the Immokalee Rise area in 1993. The American alligator, turtles, the gopher tortoise, glass lizards, the six-lined racerunner, skinks, and twenty-seven species of snakes have been identified.

Sixty-seven species of reptiles and amphibians have been found in the Big Cypress watershed. In addition, coastal species such as the American crocodile, the Florida scrub lizard, the diamondback terrapin, and five species of sea turtles, including the loggerhead sea turtle, have been identified in the area.

Invertebrates

Very little information is available on the freshwater and land invertebrates of the Estero Bay watershed with the exception of some insect species (mosquitoes, butterflies, damselflies), apple snails, and crayfish. More information is available on marine and estuarine invertebrates. Invertebrates include those species that are pelagic (floating in the water column) or benthic (bottom-dwelling) in wetlands and water bodies (fresh and salt), as well as some land invertebrates. Common groups of invertebrate species in the watershed include crabs, clams, snails, scallops, amphipods, isopods, shrimp, crayfish, spiders, scorpions, millipedes, mayflies, dragonflies,



damselflies, grasshoppers, roaches, lice, beetles, butterflies, moths, flies, mosquitoes, ants, bees and wasps.

Wading Birds and Rookeries

Wading birds that utilize the Estero Bay watershed for foraging and nesting include the white ibis, tri-colored heron, little blue heron, snowy egret, limpkin, great blue heron, green heron, great egret, black-crowned night heron, yellow-crowned night heron, American bittern, least bittern and cattle egret. The cattle egret is generally considered to be an unwanted, naturalized exotic from Africa that often dominates wading bird rookeries to the detriment of other species. Roseate spoonbills, reddish egrets, and glossy ibis also forage in the bay area. Double-crested cormorants and anhingas, although considered "waterbirds," are also frequently found in wading bird colonies or rookeries.

Florida's wading bird populations are so fragmented that large colonies are very scarce, and small "ephemeral" colonies have become more abundant. The data compiled on rookeries in Florida indicate that there is an overall decline in most wading bird species. There has been a dramatic decline in populations of white ibis, snowy egret, tri-colored herons, and wood storks. Wetlands within 15 km of nesting wading bird colonies are described as core foraging areas by the Fish and Wildlife Conservation Commission. Most of the wetlands within the Estero Bay watershed are located within 15 km of the seven wading bird colonies identified in Lee County by GFC atlas between 1976 and 1989. Four of these wading bird colonies are located in Estero Bay.

ISSUES OF SPECIAL CONCERN

Ten Mile Canal

The Ten Mile Canal was excavated in or about 1920 to intercept sheetflow from 10 square miles of the 70 square miles of the Six-Mile Cypress basin in order to, in concert with that slough, channel the combined waters south to Mullock Creek and Estero Bay. This opened lands west of the canal to farming. As the economic climate changed, residential, commercial, industrial and institutional development replaced the gladiolus farms. This new development has come into conflict with the realities of the basin's natural features.

Basin topography slopes from northeast to southwest at approximately one foot per mile. Six-Mile Cypress (actually eight miles in length), is the largest cypress strand in Lee County because the topography and rainfall produce standing wetlands. Normal rainfall during the year averages 54 inches, with the greatest concentration occurring from June through September. It should be noted that 1924 recorded 72 inches, with standing water in the basin averaging 13 inches above ground. (A one-year design storm anticipates standing water about 2.5 inches above ground.) In October 1924, peak flow in the canal was 2533 cubic feet per second (cfs) where the Tamiami weir now stands. During very dry years, no flow was recorded.

A straight-line ditch without control structures, Ten Mile Canal in 1974 was either dry or overflowing, depending upon the season. In 1975, based upon Johnson Engineering's recommendations, Lee County undertook a flood mitigation project to widen and deepen the canal and provide three water control structures, the largest passing 2500 cfs. Concurrently, four structures were installed in Six-Mile Cypress to regulate levels and this tributary's outflows. Operative and largely complete in 1977, rock encounters resulting in increased costs delayed total completion but did not preclude functioning as intended. The canal now holds water year round with the attendant groundwater storage bonus and no flooding episode experience.

Areas Built Prior to 1975

The Water Resources Act, passed in 1972, broadened the authority and responsibilities of the Flood Control District, charging them with the control and regulation of ground and surface water supplies and their use. The rules and criteria for regulating development as it pertains to surface and ground water went into effect in 1975. The rules and regulations apply to new development only. Therefore, any project built prior to 1975 does not have to meet SFWMD criteria pertaining to water quality and quantity unless major changes are made to the existing development.

Outstanding Florida Waters

The five freshwater tributaries directly discharging into Estero Bay are Hendry Creek, including Big Bayou; Mullock Creek, including Mud Creek; Estero River, including Halfway Creek; Spring Creek, including both south and north branches; and the Imperial River, including both Oak and Leitner Creeks.

As these tributaries exist today, probably their most outstanding aspect is that they have had a large number of dedicated people who spent five long years in the eighties gathering information, including physical surveys of all the flora and fauna found in their environs. This included extensive bird sightings, a butterfly list and geological surveys of the banks. An economic study was done. Several public hearings were held by the Department of Environmental Regulation and, over the strenuous objections of a number of people, the designation of Outstanding Florida Waters was bestowed on the tributaries.

Environmentally Sensitive Lands

Habitats within the watershed that are termed "environmentally sensitive" but may in fact be critical to the survival of individual fish and wildlife species, ecosystem health, recreational or commercial resources, or water supply include:

Estuaries (inter-tidal areas including mangroves, mud and sand flats, saltterns, grassbeds, and marshes) – these areas support the critical food and nursery resources for most of the marine ecosystem and support a wide prey base for land-based wildlife resources.

Beaches and Coastal Strand – these areas support migrating shorebirds and neotropical migrants, buffer inland areas from storms, and provide perhaps Florida's greatest recreational asset.

Riverine Systems – rivers and creeks convey fresh water to the Gulf of Mexico, supporting estuarine productivity, provide riparian corridors to many wildlife species, as well as recreational opportunities for boating.

Interior Wetlands (cypress and mixed swamp forests, hydric flatwoods, mixed pine/cypress strands, fresh water marshes, shrub swamps, and wet prairies) – wetlands are critical to ecosystem function and preserve water resources. In the watershed, forested wetlands are particularly important to wide-ranging land mammals such as the black bear. Isolated wetlands and sheet flow wetlands are critical to a number of fish, amphibian, and reptile species that are dependent upon wetlands for breeding and foraging. Shrub swamp and willow head wetlands are critical to nesting wading birds. The drawdown of these wetlands during the dry season is one of the most important features of the South Florida environment.

Rare habitats (xeric oak scrub, tropical hammock, coastal strand) – these areas are often the only refuge of some endemic plant and animal species. The preservation of these areas increases the biodiversity of the region and offers a greater diversity of resources for evolving species. These habitats have aesthetic value to many people and may hold commercial value as sources of new medicine or reservoirs of plant and animal genetic resources.

Uplands (pine flatwoods, oak hammocks, palmetto prairies) – development in the watershed may have elevated some upland habitats that were historically common to rare status. Total reduction in acres or disturbance due to habitat fragmentation can be equally devastating to those plant and animal species that utilize upland habitats. These habitats are critical to many listed animal species and to birds and wide-ranging mammals. These areas may protect the best groundwater resources. Sustainable management of upland resources can be of commercial benefit to industries such as forestry, and recreational interests such as hunting.

Listed Species

The following are those wildlife species that are listed by the state (Florida Fish and Wildlife Conservation Commission) and federal (U.S. Fish and Wildlife Service) governments that are documented in the Estero Bay watershed.

BIRDS

Wood Stork
Snail Kite
Arctic Peregrine Falcon
Florida Scrub Jay
Red-Cockaded Woodpecker
Least Tern
Audubon's Crested Caracara

Bald Eagle
Piping Plover
Southeastern American Kestrel
Florida Sandhill Crane
Snowy Plover
Black Skimmer
White Ibis
Tri-Colored Heron
Little Blue Heron
Snowy Egret
Limpkin
Roseate Spoonbill
Burrowing Owl
Mangrove Cuckoo

MAMMALS

West Indian Manatee
Florida Panther
Florida Mastiff Bat
Big Cypress Fox Squirrel
Florida Black Bear
Sherman's Short-Tailed Shrew

AMPHIBIANS

Florida Gopher Frog

REPTILES

American Crocodile
Eastern Indigo Snake
Loggerhead Sea Turtle
Gopher Tortoise
American Alligator

FISH

Snook

Exotic Animals and Plants

Some exotic animals and plants are doing very well here in south Florida. So well, in fact, our landscape when viewed from certain angles seems to be dominated by them. And, what's more, the costs are mounting.

Exotics, non-indigenous, non-native, and alien species are terms that describe plants or animals that are not native to an area, yet may persist, thrive, harm and displace native species (FDEP, 1994). South Florida is particularly susceptible to these types of invasion because of human disturbance factors and the state's similarity to an island ecosystem. In the Estero Bay watershed, invasive exotic plant species include melaleuca, Brazilian pepper, downy rose myrtle, water hyacinth, hydrilla, torpedo grass, rosary pea, water lettuce, tropical soda apple, cogan grass and natal grass. Exotic, destructive, or nuisance animal species include the wild hog, fire ant, walking catfish, oscar, Jack Dempsey, various tilapias, Cuban tree frog, various anoles, nine-banded armadillo, Norway rat, black rat, house mouse, coyote, feral house cat, muscovy duck, rock dove, Eurasian collared dove, and house sparrow.

As a protected and thoughtfully managed area, Estero Bay represents a place where we can see native Florida wildlife and wildlands as they have matured over time in the Florida environment. An important goal is to minimize exotic intrusions and foster a native environment. Think of Estero Bay as a reference for what fits the Lee coast landscape without needing a repair kit. Management of this place, and the system of which it is a part, is dedicated to preserving native Florida.

The Summer of 1995

During the summer of 1995, much of Lee County became inundated with floodwaters for extended periods of time. In the southern part of the county approximately 1000 residents from the Bonita Springs area were evacuated for a period of approximately six weeks. Following this event, in early October 1995, Hurricane Opal added an additional six to seven inches of rainfall to this already saturated watershed.

Historical sheet flow was north to south. When the region's ground became saturated with summer rainfall, water traveled over land, blending watersheds as the flow continued in a southerly direction. Now as stormwater gathers from eastern Lee County, part of Hendry County and Collier County (an overall basin of approximately 350 square miles) the rivers and creeks have not been maintained so that water can be released at different locations along the route. The water continues to flow southwest, pond against I-75, and stack-up in the Imperial River and Estero River watersheds.

As a result of the flooding several projects have been undertaken. These will not alleviate the flooding entirely, but they are designed to lessen the severity. The first is an overall look at this large watershed with the South Lee County Watershed Study. This one-year study obtained necessary background data and developed hydrologic and hydraulic models of the study area; assessed the ecological value of the study area and identified target hydrologic parameters for

restored conditions; applied the models developed to evaluate the performance of existing water management facilities in the study area; identified existing problems; developed and assessed alternate facilities and systems. Public forums were held to generate a recommended plan for implementing a preferred alternative. The preliminary report was issued in February of 1998; the study was expanded to add Camp Keais Strand, and the final report was issued in May of 1998.

The other projects, recommended in the Summer 1995 reconnaissance study which are going forward, are cleaning and snagging of the Imperial River, Estero River, Oak Creek and Leitner Creek. These consist of removal of fallen debris and exotic vegetation. No dredging is proposed for these projects. Another project is the replacement of the Kehl Canal Weir. The existing temporary weir will be replaced with an operable weir and the berms will be connected upstream of Bonita Grande Drive to allow controlled release of water downstream and eliminate bypass of uncontrolled flow.

Another constriction, the Imperial Bonita Estates Bridge, will be replaced. The bridge significantly constricts the Imperial River flow during a flood event. This bridge needs to be reconstructed to the proper size to allow floodwaters to flow unrestricted in the river channel. The IBE Bridge is 44 feet long, while upstream where I-75 crosses over the river, the opening is 300 feet long. The IBE constriction was demonstrated by the overflow of water around the north and south bridge abutments. The water eventually turned back into the river channel before reaching the Matheson Street Bridge, downstream.

The last major component of the Bonita springs area is the purchase of land east of I-75 that lies within the low-lying areas. The Corkscrew Regional Ecosystem Watershed Trust (CREW) is actively purchasing land within their boundaries and the South Florida Water Management District (SFWMD) has applied for Federal funds (Critical Restoration Projects) to purchase approximately 4,670 acres.

Offshore Oil Drilling

The interest in drilling offshore Southwest Florida targets formations geophysicists believe may be a continuation of the Yucatan Reef Complex off Mexico. Geophysical exploration conducted to date off Southwest Florida is extremely encouraging with a high potential for heavy crude production. No matter how attractive the geophysical analysis, the only way to determine for sure if hydrocarbons are present in commercially producible quantities is to drill exploratory wells. One, two or even ten wells may not be enough to determine the extent of hydrocarbons present and to delineate a reservoir. In some cases thirty or forty wells have been required to properly identify and delineate a field. At this time approximately 15 wells have been drilled offshore from the Tampa area south to Marco Island.

The greatest threat to the ecological resources of Southwest Florida would occur with the discovery of major deposits of crude oil and large-scale production. The threat would be greatest during early production phases due to the lack of an infrastructure (pipelines) for transport of the oil to shore. In mature fields near shore, pipelines are normally constructed to transport the hydrocarbons to a collection point where they may be processed and/or sent on to some other

location. Tankers or offshore storage facilities pose a greater danger of a major oil spill than do pipelines.

The potential problem of offshore oil drilling to Southwest Florida would be that in the early phases of production it would be necessary to store large quantities of crude oil offshore, either surface and/or subsurface. When a sufficient volume was produced and in storage, it would be offloaded into tankers for transport to processing facilities. An accident could occur during normal operations, or, more likely, during a hurricane or other unusual circumstance. In this scenario a large quantity of crude oil could be washed ashore and cause extremely serious impacts to our estuarine systems.

Southwest Florida is highly vulnerable to damage from an oil spill. Our coastal systems are very wide, in some cases several miles or more, as opposed to a high rocky coast where the zone may be only a few hundred feet wide. If the crude came in on a high tide or under storm surge conditions the oil could be deposited completely across the estuarine zone to the uplands. The thick vegetation, especially the convoluted root systems of the mangroves, could trap and hold a thick layer of oil. Even though bacteria would break down the oil more rapidly than in colder locations, the results of such a spill could be disastrous and the impacts could last for many years.

The quest to drill off Florida will continue because it would set a precedent if a state succeeded in preventing exploitation of a resource in or beneath offshore waters under Federal jurisdiction. Also oil companies have already paid for the right to drill and some have made large investments on this basis.

Use of the Waters of the Bay

Estero Bay is in part a victim of its own success. Early on, environmentalists began the battle to keep Estero Bay clean and free from pollution. They could point to Tampa Bay and Sarasota Bay, with the overuse of industrialization and development, as examples of what not to do. They could also see that, in the sixties and seventies, Fort Myers Beach was growing far too fast and with little control over the proliferation of new condos. Luckily for Estero Bay, the early efforts were successful enough to make the area suitable for recreation. The bad news is that the bay became very popular with boaters, many of whom were not sensitive to the delicate balance of nature.

The high quality of the bay water is also due, in part, to action on the part of Lee County environmental organizations to have the Estero Bay tributaries declared "Outstanding Florida Waters," assuring that they would not become mixing bowls to dilute pollution. The designation also resulted, in large part, from a recommendation to Vicki Tschinkel, who was at the time Secretary of the Florida Department of Environmental Regulations, from the original Charlotte Harbor Resource Planning and Management Committee. Consequently, the waters are safe for

fishing, boating and swimming. Parts of them are also used for commercial navigation, pointing up the need for coordinated anchorage management programs.

Finally, part of the bay is used as a stormwater sump; this use has been curtailed for new development; existing development will require retrofit.

Waterfront and Shoreline Development

Fort Myers Beach is one of the older developed communities in Lee County, as is San Carlos Island, which is on the northern approaches to Fort Myers Beach. These communities were developed in the 1920s to the 1960s, with the southern part of Fort Myers Beach undergoing intensive development in the mid 1970s. Bonita Beach is also one of the older communities, and was originally largely single family homes. Its most intensive period of development began in the early to mid 1970s and continues to the present time. Bonita Springs equals Fort Myers Beach in the original age of development, and it received a major boost with the completion of the Tamiami Trail in the mid 1920s. Its growth became redirected with the relocation of US 41 and the completion of I-75.

All three communities have gone through a period of development that saw land owners attempt the alteration and hardening of shorelines by building such structures as seawalls, docks and rock jetties; efforts have been made at Fort Myers Beach to harden its Gulf Beach shoreline, and residents and businesses of Fort Myers Beach and San Carlos Island have hardened portions of their Estero Bay shorelines. Bonita Springs owners have attempted to harden the Imperial River shoreline.

The nature of development that has inspired these efforts has been primarily residential--originally for single family, and then for multifamily use. There has since been some commercial replacement of some original residential use; also, the high demand for seafood has led to the creation of commercial fishing operations, notably shrimping, and this development has led to the creation of commercial dock districts in the northern part of the bay on both sides of Matanzas Pass.

Another method of hardening was through dredging locally available material (such as bay bottom) and filling in shore-fringing wetlands and bay bottom. This resulted in the immediate loss of the environmental value of the wetlands, and also resulted in storm water pollution of parts of the bay since rainfall was immediately flushed into the bay.

Current development practices have ended dredging, filling, and immediate storm water discharge. There have been increased requirements for buffering, shoreline protection, and storm water retention and detention. Setbacks have also been marketable to the development industry *if* there is also an increase in building heights and clustering, so that the preserved view is available

to more buyers. This new development practice is now commonplace for all parts of the near bay uplands that were not originally developed, or were not placed into preserves.

Backbay Flushing

Several hydrographic studies had been done in the past regarding water flow patterns in Estero Bay. More recently, the SFWMD conducted modeling studies of the Imperial and Estero River tributaries. Hydrologic flows are dynamic and depend on a variety of factors; however, there are typical flow patterns that are observed. Waters from Hendry Creek, Mullock Creek, and the Estero River appear to flow towards Big Carlos Pass, while Spring Creek waters typically flow north then west to New Pass, and the Imperial River flows northward through Fishtrap Bay and Hogue Channel to Big Hickory Pass. Matanzas Pass, commonly considered part of Estero Bay, is the body of water northwest of the Bay, from the Gulf southeastward to Julies Island. The major tidal influence is from the northwest, with minor exchanges with the main body of Estero Bay. Previous studies indicate that the residency of waters from the tributaries is at least several days. Therefore, water quality in the Bay is directly linked to the quality, quantity, and timing of the tributary discharges.

Changes in Hydrodynamics/The Impacts of Causeways

The Estero Bay system, including its inlets, is very dynamic. The inlets (also known as "passes") are key components in maintaining the delicate balance of the Bay's ecosystem. Water quality is maintained through exchange of waters with the Gulf. The transport of eggs, larvae, and juvenile marine fish and shellfish between the bay and the Gulf are also dependent on the presence of the inlets. Therefore, the health of the Bay is directly linked to the number, location, and dimensions of its passes. Inlets are naturally subject to shoaling, erosion, shifting, opening, and closing in accordance with normal coastal processes. However, coastal development brings with it a demand to artificially stabilize the passes in order to protect upland properties, maintain static navigational channels, etc. Channel dredging and beach renourishment projects are methods which attempt to stabilize the footprints of the existing inlets. Major construction projects may cause inadvertent shifts in typical pass dynamics. It is possible that the construction of the Sanibel Causeway in the early 1960s had an impact on Estero Bay by changing flow patterns between it and San Carlos Bay to the north through Matanzas Pass, although this has never been confirmed. During the same time period as the construction of the Sanibel Causeway, the Estero Boulevard Causeway was built, connecting Fort Myers Beach with Bonita Beach. The Estero Boulevard Causeway caused the filling of at least seven minor passes or cuts with the Estero Bay system, which influenced tidal exchange. Hawk Channel was one of these, and was artificially opened by Lee County in the early 1990s in an attempt to re-establish some of the historic flows and improve water quality in the Bay. Anecdotal evidence indicates that water clarity, areal extent and health of the bay's seagrass beds, and abundance of fish and shellfish, have declined drastically since the 1960s. For example, there were thriving scallop populations in both San Carlos and Estero Bays at that time. Today, scallops are extremely rare in these waters. The construction of the causeways, as well as upland development, filling of wetlands and surface waters, and increases in pollutant loading in stormwater runoff, are likely contributors to declining water quality and marine resources in Estero Bay.

MANAGEMENT INITIATIVES: GROUPS AND ORGANIZATIONS

There are a number of public entities with direct or indirect management missions within the Estero Bay watershed. The general breadth and depth of these organizations is described in the *Base Program Analysis* of the Charlotte Harbor National Estuary, which encompasses the Lee County portions of the Estero Bay watershed. Specific organizations, however, have immediate short-term influences upon the Bay and its watershed. These include (in no particular order):

1. The South Florida Ecosystem Restoration Task Force. Established in 1993 to coordinate interrelated federal programs and foster communication and cooperation in ecosystem restoration efforts, the Task Force has the goal of achieving restoration, preservation and protection of the ecosystem while promoting a sustainable South Florida. It presently consists of 7 federal agencies, 2 state, 1 regional (SFWMD), 2 local governments, and 2 tribal governments.

2. The Governor's Commission for a Sustainable South Florida . Created in 1994 by the late Governor Lawton Chiles, this group completed 14 reports in its 5-year term. Of note, its "Initial Report" focused 110 recommendations on making South Florida sustainable. Numerous other reports focused on the U.S. Army Corps of Engineer's "Restudy" as well as technical water issues, energy, quality communities, and full cost accounting. A "Southwest Issues Group" was established by this Commission to examine applicability of these and other recommendations to the Southwest portion of the State. The Commission was the officially recognized advisory body ("stake holders") to the South Florida Ecosystem Restoration Task Force. The Commission expired on June 30, 1999.

3. The Governor's Commission for the Everglades. Established by Governor Jeb Bush in June 1999 to follow in the footsteps of the previous Governor's Commission, its purpose is to continue to serve as the advisory body to the South Florida Ecosystem Restoration Task Force. Its other charges were to evaluate the U.S. Army Corps of Engineer's Restudy implementation progression; review and evaluate Lake Okeechobee water quality; evaluate the region's overall water conservation efficiency; and recommend actions for integrating the needs of farm worker, low income and rural communities with Everglades restoration; develop a demonstrable benefit/cost analysis for a Restudy-related issue in a rural area; restore, manage and protect natural resources of the Everglades; enhance sustainable and environmentally compatible development to sustain the regional economy and a healthy Everglades system; create sustainable agriculture programs; and allocate natural resources to support natural and human systems. To date (October 1999) the Commission membership has not yet been announced. An initial meeting is tentatively scheduled for late November 1999.

4. Conservation 2020. An initiative endorsed by Lee County voters in 1996, Conservation 2020 is a property-tax-supported environmental land acquisition program administered by the Lee County Commission, with a 15-member steering committee making recommendations on the priority of purchase over the next seven years.

5. Preservation 2000. Established by the Florida Legislature, this is an environmental funding source for acquisition programs such as the state agencies combined Conservation and Recreational Lands (CARL) program, the Save Our Rivers (SOR) initiative of the Florida Department of Environmental Protection and the Water Management Districts, and the acquisition programs of DCA and GFWFC. P-2000 and the related programs have been requested to fund some of the sensitive land purchases in the basin. In the spring of 1999, as P-2000 was about to expire, the State Legislature established Florida Forever, a new program to take its place. Florida Forever will have available three billion dollars per year for preservation.

6. Charlotte Harbor National Estuary Project. An EPA-funded special three-year planning, four- year implementation effort, this is the nation's only (primarily) preservation project and it encompasses the Lee County portion of the basin. The ABM is effectively serving as a sub basin effort within the NEP. The NEP also has a strong education element.

7. Ecosystem Management Areas. The Florida Department of Environmental Protection (FDEP) has determined that there are discrete ecosystem management areas in southwestern Florida, with Estero Bay watershed being one such. FDEP sponsors *ad hoc* assemblages of public agency staffs within such areas to address particular problems that have a permit facet. Legislation directing such processes was enacted during the 1997 Legislature.

8. Estero Bay Watershed Assessment. Sponsored by the South Florida Water Management District, the Estero Bay Assessment will define water quality and fresh water quantity objectives or pollutant load reduction goals (PLRGs) for the bay and develop tools to evaluate the effects of watershed management techniques on the bay. The Estero Bay Assessment involves the application of a logical protocol for designing study and management plans to identify the types of pollutants and their impacts on estuarine environments. It will result in a comprehensive Estero Bay Research Plan, based upon management goals for the estuary.

The Estero Bay Watershed Assessment will develop land and water management strategies to achieve the water quality and quantity objectives for the bay. The Watershed Assessment will characterize the watershed and provide the tools to evaluate existing conditions and predict the effectiveness of various management scenarios on meeting the goals for the bay developed in Phase I of the Bay Assessment. Estero Bay Watershed Assessment activities involve: physical description of major features and current management practices, identification of water trends, identification and ranking of potential pollution problem areas, development and compilation of input data for a watershed model to evaluate management scenarios, and recommendations of basin-specific management strategies to achieve water quality improvements.

9. The Central and Southern Flood Control District Restudy. The Restudy is under the sponsorship of the U.S. Army Corps of Engineers. The 1948 historical objectives for the C&SF Project were to:

- reduce flood damages and enhance land-use throughout the region
- control ground water levels for agriculture
- store excess floodwater for beneficial use
- reduce salt water intrusion into coastal wellfields
- preserve fish and wildlife
- enhance navigation
- provide recreational opportunities

To meet these objectives, the C&SF Project sacrificed a significant portion of the Everglades. The Kissimmee River Basin was drained. Lake Okeechobee was diked to prevent uncontrolled discharges from the lake. The Everglades Agricultural Area was drained and ground water levels managed to reduce flood damages. The flooding risk was also reduced in the lower East Coast to allow for urban and suburban development and intensified agriculture. Central portions of the Everglades were diked to create areas for which water could be stored for human needs in the lower East Coast and for deliveries to Everglades National Park. While some fish and wildlife value was expected to remain in the water conservation areas, the only natural area intended to be preserved in pristine condition was the Everglades National Park.

The purpose of the restudy (approved through the Federal 1996 Water Resources Development Act) is to review how well the C&SF project is functioning and determine what modifications may be needed to achieve the new set of objectives which are:

-increase the total spatial extent of natural areas
-improve habitat and functional quality
-improve native plant and animal species abundance and diversity
-improve availability of fresh water (agricultural/municipal and industrial)
-reduce flood damages (agricultural/urban)
-provide recreational and navigation opportunities
-protect cultural and archeological resources and values

The Restudy planning objectives were developed as the result of public participation and scientific knowledge of South Florida. Through workshops conducted during the Reconnaissance phase of the Restudy and the subsequent technical evaluations, it is evident that the C&SF Project must continue to provide the valuable services originally intended. Therefore, many of the economic and social objectives are similar to those of the original C&SF Project. However, unlike the original set of objectives for the C&SF Project, the Restudy includes objectives that recognize the importance of the natural system.

10. Big Cypress Basin Watershed Plan. Sponsored by the Big Cypress Basin Board, a subdivision of the SFWMD, the Big Cypress Watershed Plan will develop a guide map for future capital project construction and operation of the water management facilities in the Big Cypress Basin. It is proposed that the objective will be met by: (1) conducting a comprehensive evaluation of the surface and groundwater flow characteristics of the western Collier County Region as a singular watershed; and (2) developing a regional hydrologic-

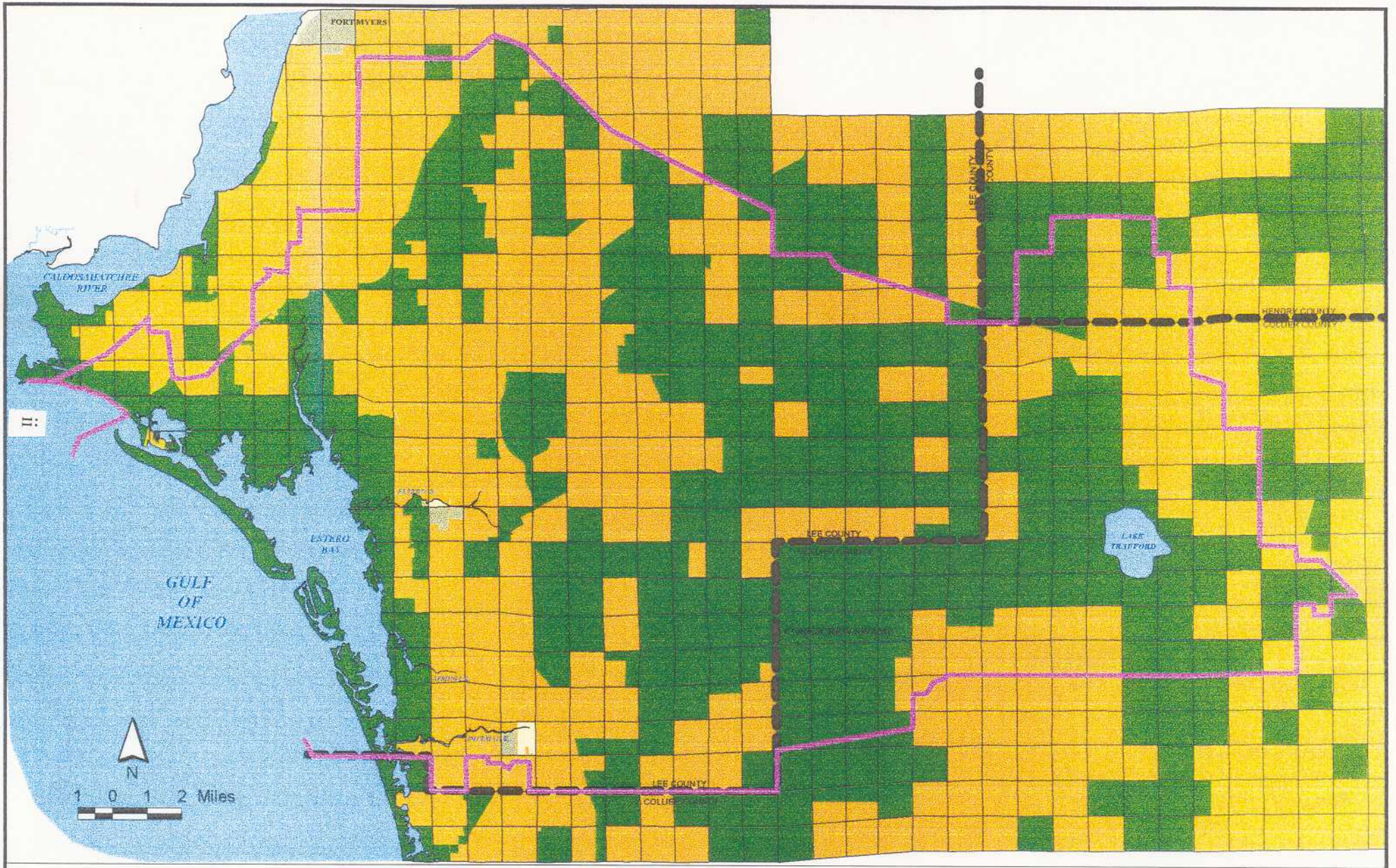
future capital project construction and operation of the water management facilities in the Big Cypress Basin. It is proposed that the objective will be met by: (1) conducting a comprehensive evaluation of the surface and groundwater flow characteristics of the western Collier County Region as a singular watershed; and (2) developing a regional hydrologic-hydraulic routing model as a tool for evaluating alternatives for improved water management strategies. The basic premise of the study will incorporate the time history of data and information on surface hydrology, hydraulics of the canal network and general land-use at various spatial scales, and integrate the dynamic processes that have influenced the overall hydrology and ecology of the Big Cypress Basin region. The model will help to evaluate alternative strategies for effective management of water and related land resources in an effort to achieve the following goals:

-maintain or improve levels of flood protection in the developed and developing areas consistent with Collier County Comprehensive Plan
-restore historic surface water flow characteristics on conservation and public lands
-improve water retention and aquifer recharge potential
-reduce threats of saltwater intrusion
-reduce excessive freshwater discharge impacts on downstream estuaries
-provide basis for off-site opportunities
-enhance natural system functions and values on publicly owned and conservation lands.

11. Environmental Impact Study. In 1997, with encouragement from citizens' groups, the Jacksonville District of the U.S. Army Corps of Engineers began an Environmental Impact Study (EIS) of parts of Lee and Collier Counties. The Study is intended to help the COE in making decisions when permit applications come before them concerning the stewardship of wetlands. In the information-gathering stage, they had help from the Alternatives Development Group, made up of people from diverse backgrounds, including proponents of development, agriculture and conservation. They also received help and advice from members of federal, state and local governments. At various stages of the Study's development, citizen input was solicited at public meetings. In the future, when the COE makes decisions on permitting in the study area, they will be considering the cumulative impact of the project in question.

Appendix I

Maps



Estero Bay Drainage Basin c. 1900

Legend

- Basin Boundary
- Section Line
- County Line
- Water

Land Use 1900

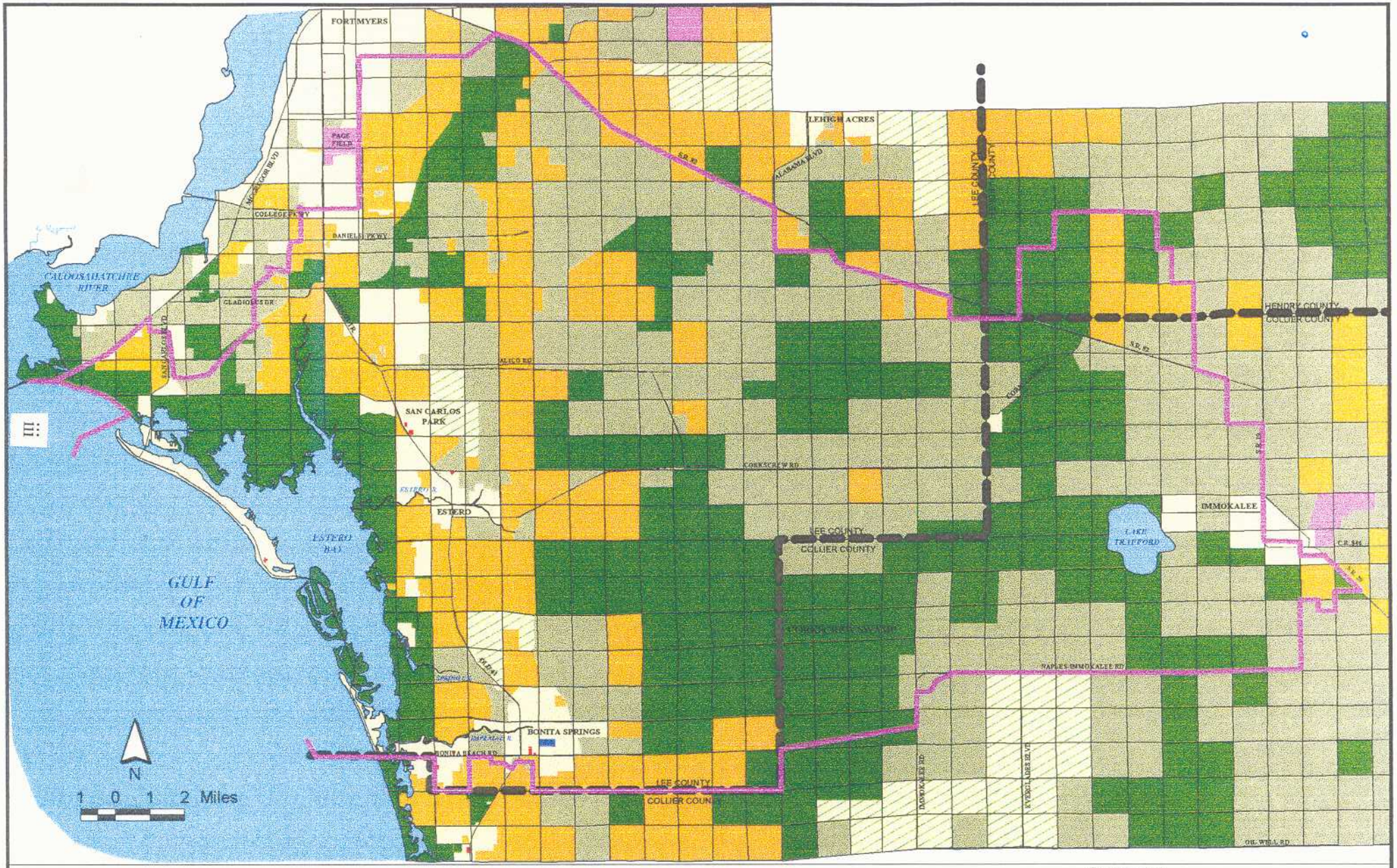
- Agricultural Uses
- Existing Settelment
- Wetlands
- Uplands

Sources:

c.1997: Nov. 1996 REDI Book Aerials, Lee Co. PUD Map.
c.1970 and c.1900: Based on 1997 map, additional data from "Vegatation & Landuse...", map. Center for Wetlands: UF, Gainsville, FL. Hendry Co. information taken from landuse imagery provided by Fl. Game & FW Fish Comm.

WILSON MILLER

Prepared by Wilson Miller GIS, July 1997



Estero Bay Drainage Basin c. 1970

Legend

- Basin Boundary
- Section Line
- County Line
- Roads

Land Use 1970

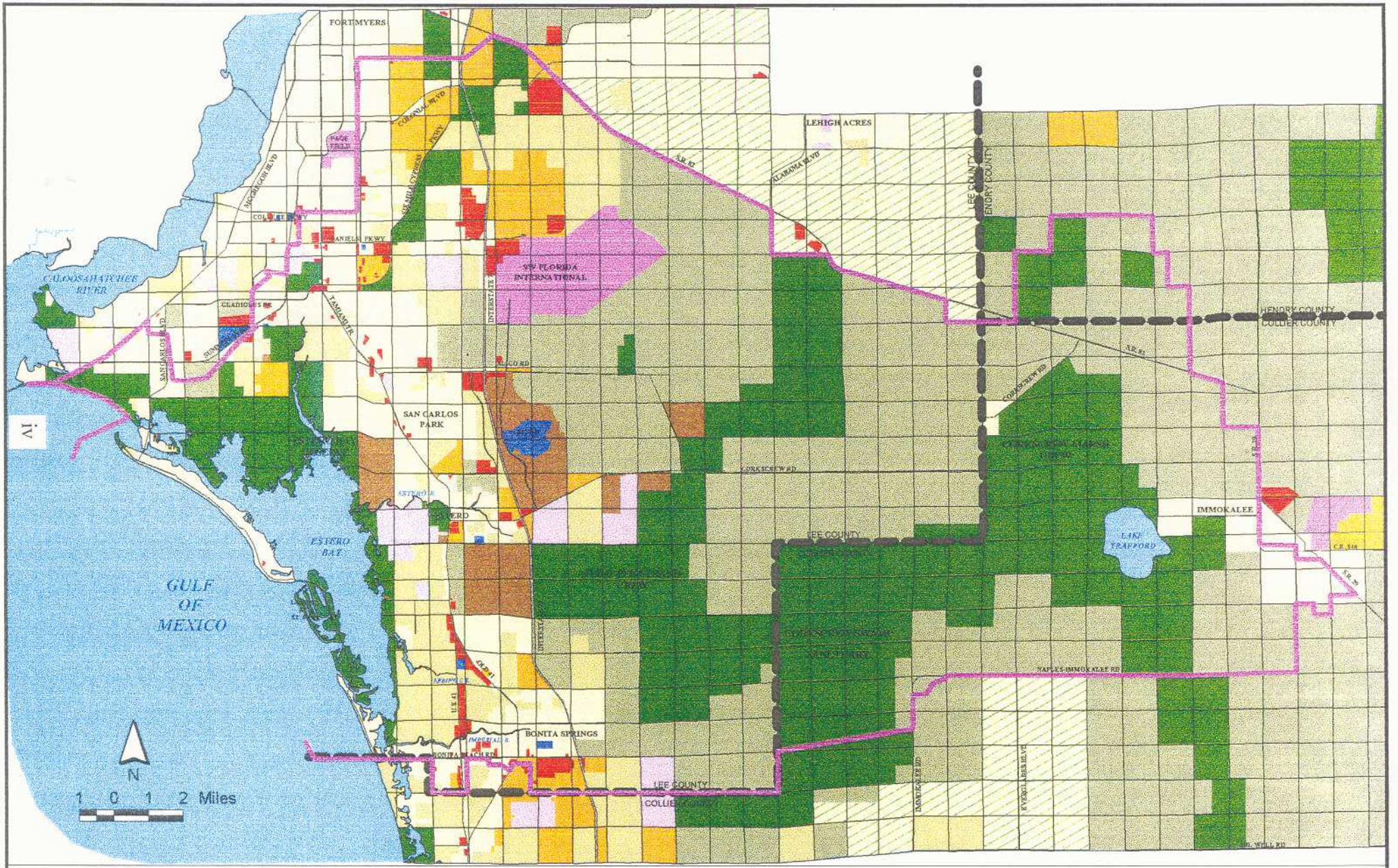
- Airport
- Agricultural and Mining
- Urban Landuse, Small Vacant Tracts
- Disturbed Land (Platted Subdivision)
- Commercial and Industrial
- Schools, Churches, Hospitals
- Wetlands, Parks & Preserves
- Upland, Large Vacant Tracts

Sources:

c.1997: Nov. 1996 REDI Book Aerials, Lee Co. PUD Map.
c.1970 and c.1900: Based on 1997 map, additional data from "Vegatation & Landuse...", map. Center for Wetlands: UF, Gainsville, FL. Hendry Co. information taken from landuse imagery provided by Fl. Game & FW Fish Comm.

WILSON MILLER

Prepared by Wilson Miller GIS, July 1997



iv

Estero Bay Drainage Basin c. 1997

Legend

- Basin Boundary
- Section Line
- County Line
- Airports
- Agricultural and Mining
- Urban Landuse, Small Vacant Tracts
- Disturbed Land (Platted Subdivision)
- Approved Planned Development
- Existing Planned Development
- Proposed Planned Development
- Commercial and Industrial
- Schools, Churches, Hospitals
- Parks & Preserves, Wetlands
- Large Vacant Upland Tracts

Sources:

c.1997: Nov. 1996 REDI Book Aerials, Lee Co. PUD Map.
c.1970 and c.1900: Based on 1997 map, additional data from "Vegatation & Landuse...", map. Center for Wetlands: UF, Gainsville, FL. Hendry Co. information taken from landuse imagery provided by Fl. Game & FW Fish Comm.

WILSON MILLER

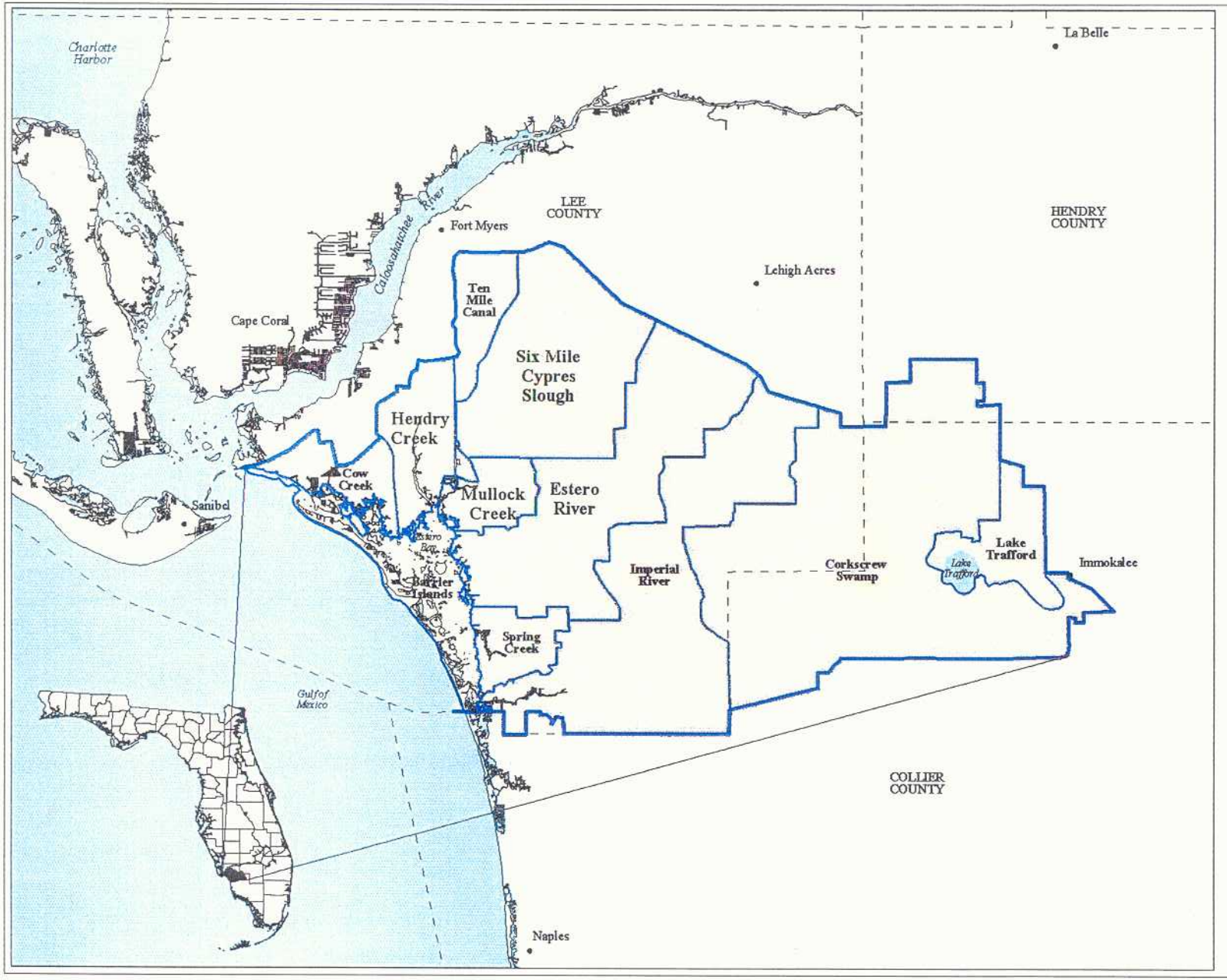
Prepared by Wilson Miller GIS, July 1997

Plate 1-1

Estero Bay and Watershed Assessment Plan

ESTERO BAY WATERSHED

Basin Locations



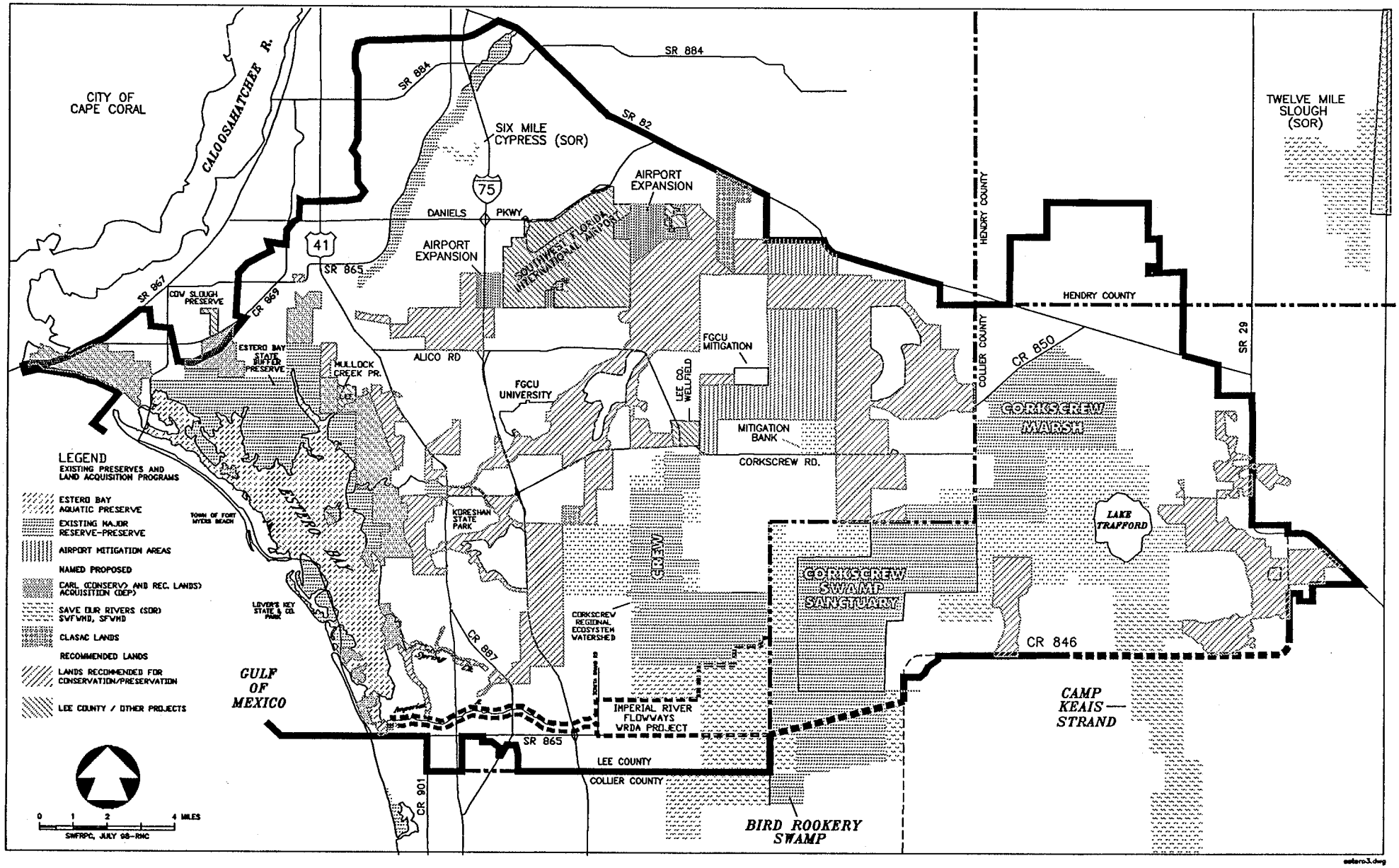
County Boundary
Roads
Primary Basin Boundary
Secondary Basin Boundary

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

N
W E
S

1 0 1 2 3 4 5 Miles

PBS&J No. 10315.30 reference apr monitor 10/20/98



ADOPTED JULY 13, 1998 BY THE ESTERO BAY AGENCY ON BAY MANAGEMENT

ESTERO BAY WATERSHED

LAND CONSERVATION/PRESERVATION STRATEGY MAP

Appendix II

Principles of the Estero Bay Agency for Bay Management

Principles of the Estero Bay Agency on Bay Management

The Estero Bay Agency on Bay Management (ABM) is a non-regulatory body whose directive is to make comments and recommendations for the management of Estero Bay and its watershed. The waters of Estero Bay provide a tremendous resource for local residents and tourists who enjoy fishing and appreciate the local vegetation and wildlife. It is also important to note that Estero Bay is Florida's first aquatic preserve. Due to the forthcoming increase in population density on and near the shores of Estero Bay and its watershed and the attendant increase in boat traffic, the Estero Bay Agency on Bay Management has adopted the following guiding principles. These principles are an attempt by the ABM to make strong and clear recommendations for the preservation and restoration of this rare and unique ecosystem. The ABM realizes that some situations within the Estero Bay Watershed may not allow the strict adherence to these principles, however, the ABM recommends that they be utilized wherever and whenever possible.

Water Courses

General

- Non-structural approaches versus structural approaches will be used for water resource management solutions.
- No further channelization of remaining natural watercourses will occur.
- A better balance of ecological needs versus water flow will be used for water resource management decisions.
- Establish and restore the historic basin flood plains to the maximum extent possible.
- Compliance and enforcement of existing environmental regulations will be a top priority for regulatory agencies.

Vegetation

- Natural, native vegetation versus non-native invasive vegetation within flowways and natural systems will be retained to the greatest extent possible.
- Physical removal of invasive vegetation versus widespread chemical treatment will be utilized for control.
- Limited application of herbicides that rapidly degrade may be used on a case-by-case basis, under the supervision of certified personnel, for control of nuisance and invasive non-native vegetation and to maintain native plant communities.
- Promote, whenever possible, the active and aggressive removal of invasive non-native plants from all common areas, conservation easements, preserves and natural areas within the Estero Bay watershed.

Physiographic

The ancient relief of the upper tributary reaches will be maintained by:

- Preserving vegetation that provide the characteristic riparian habitat and canopy.
- Retaining the relic natural features of the tributary bank contours.
- Reconnecting historic natural flowways that have been diverted or severed.
- No further channelization.
- No further dredging.

New Construction

- New setback criteria will be developed and implemented along watercourses to provide construction setbacks to the maximum extent possible. These setback criteria will be based on the best available scientific data.
- Construction within tributary flood plains shall be avoided wherever possible.
- For construction that must occur within flood plains, utilize techniques that do not adversely impact the capacity of the floodplain (e.g. pilings to raise living floor elevations versus fill).
- Utilize non-polluting construction materials (e.g. concrete pilings versus treated wood) within flood plains.

Hazardous Materials

- Specifically placed larvicides and biological controls are the preferred methods for mosquito control. Adulticides should only be used in compliance with Section 388.011(1) Florida Statutes.

Agriculture and Urban

- Old surface water management (SWM) systems built before current regulations will be retrofitted, using best available management practices, to meet current SWM standards.
- Permitting must address cumulative impacts to the water storage capacity of the watershed.
- Grants or incentives should be provided for retrofitting old surface water management systems that are not effectively managing water volume or flow, or removing nutrients and other pollutants.

Roadways

- All future roadways to be located in the floodplain within the Estero Bay watershed will be designed and constructed to not impede flows from a 25-year, 3 day, storm event.

Boating

- No special accommodations will be made for boats (e.g. no cutting of overstory vegetation, no removal of oxbows, no dredging or filling except for permitted maintenance of navigation channels).

Public Notice

- Activities in the watershed by any regulatory agency shall provide the opportunity for public participation.

Uplands, Headwaters and Isolated Wetlands

General

- Lands identified as critical for listed species shall be targeted for public purchase and managed to maintain their environmental value.
- The Lee County Conservation Land Acquisition and Stewardship Advisory Committee will

consider priorities for land purchases adopted by the "Arnold Committee" and the ABM.

- The Lee County Conservation Land Acquisition and Stewardship Advisory Committee will use proactive approaches to investigate the willingness of landowners to be voluntary sellers, as specified in the requirements of the ordinance that established the land acquisition program.
- Tax incentives should be created so that landowners may continue land use practices that maintain ecologically important habitat.
- Adequate staff at Property Appraisers' Offices within the watershed will be provided to review the high number of applications and strictly enforce the rules for bona fide agricultural tax exemptions.
- The minimum time period for re-zoning of agricultural land should be increased from three years to ten years to reduce the speculative clearing of agricultural land for "higher use" which results in the loss of natural habitat and the loss of tax revenue.
- Regulations within the existing "Notice of Clearing" process by Lee County will be developed that require wildlife surveys, habitat assessments, and a development plan for the agricultural operations so that critical habitats for state and federal listed species can be preserved.
- Conservation easements will be used as an option to protect critical habitats.
- Legislation should be implemented that provides inheritance tax, real estate tax and estate tax relief for agriculture landowners and their heirs, who will maintain their land in agriculture.
- Legislation should be implemented that provides inheritance tax, real estate tax and estate tax relief for landowners and their heirs, who provide permanent conservation easements on their property.
- All re-zoning requests within the Estero Bay watershed will be critically evaluated to ensure protection of water quality, rare and unique habitats, listed wildlife, and ecosystem functions.
- Variances from environmental regulations and deviations from development standards will be the exception, not the rule.
- Environmental protection and long-term quality of life will not suffer based on short-term economic impacts or political pressures.
- Zoning resolutions that are required as a part of the approval for re-zoning must be tracked for future compliance and enforcement.
- Additional staff will be hired to assist in the compliance and enforcement of zoning resolutions related to environmental issues.
- The ABM will be cognizant of the "big picture" and to the concept of "ecosystem management" and sustainable development.
- Agency staffing will keep pace with increased demand on services, especially environmental protection issues. Trained and experienced wildlife biologists and environmental scientists will be hired to ensure adequate development review.
- Programs such as the "Keep It Clean" and "Florida Yards and Neighborhoods" programs should be promoted, to minimize inputs of stormwater pollutants into the bay.
- Compliance and enforcement of existing environmental regulations will be a top priority for regulatory agencies.
- The Inheritance Tax will be repealed, so as to encourage the retention of agricultural lands.

Vegetation

- Natural, native vegetation within natural systems will be retained to the greatest extent possible.
- Physical removal of invasive vegetation will be utilized for control rather than widespread chemical treatment.
- Limited application of herbicides that rapidly degrade may be used, according to the product label, on a case by case basis for the control of nuisance and invasive non-native vegetation

and to maintain native plant communities.
- Promote, whenever possible, the active and aggressive removal of invasive non-native plants from all common areas, conservation easements, preserves and natural areas within the Estero Bay watershed.

Physiographic

Consideration will be given to the ancient relief of the watershed by:

- Preserving vegetation that provide the characteristic habitat and canopy.
- Retaining the relic natural features.
- Reconnecting historic natural flowways that have been diverted or severed.

New Construction

- Construction within flood plains shall be avoided wherever possible.
- For construction that must occur within flood plains, utilize techniques that do not adversely impact the capacity of the floodplain (e.g. use of pilings to raise living floor elevations versus use of fill).
- Utilize non-polluting construction materials (e.g. concrete pilings versus treated wood) within flood plains.

Hazardous Materials

- Specifically placed larvicides and biological controls are the preferred methods for mosquito control. Adulticides should only be used in compliance with Section 388.011(1) Florida Statutes.

Agriculture and Urban

- Old surface water management (SWM) systems built before current regulations will be retrofitted, using best available management practices, to meet current SWM standards.
- Permitting must address cumulative impacts to the water storage capacity of the watershed.
- Grants or incentives should be provided for retrofitting old surface water management systems that are not effectively managing water volume or flow, or removing nutrients and other pollutants.

Roadways

- All future roadways to be located in the floodplain within the Estero Bay watershed will be designed and constructed to not impede flows from a 25-year, 3 day, storm event.

Public Notice

- Activities in the watershed by any regulatory agency shall provide the opportunity for public participation.

Bay Waters

Water Quality

- Regulatory agencies will continue to support "Best Management Practices."
- Operation of overloaded and outdated package wastewater treatment plants will be discontinued.
- All urbanization will be served by centralized sewage systems.
- There should be uniform application of water quality protection measures by regulatory agencies. A holistic management scheme should be implemented that takes into consideration ecological impacts of regulated activities.
- Compliance and enforcement of existing regulations are needed to protect water quality and biological integrity.
- There shall be no discharge of hazardous materials into Estero Bay.
- Surface water management systems in new developments will be required to utilize state-of-the-art best management practices.
- Grants or incentives should be provided for retrofitting old systems that are not effectively removing nutrients and other pollutants from urban and agricultural stormwater systems.
- The State of Florida will actively investigate and prosecute water quality violators.
- Retrofitting existing shorelines hardened with vertical seawalls to sloping limerock revetments or native, salt tolerant vegetation, should be encouraged wherever possible.
- Compliance and enforcement of existing environmental regulations will be a top priority for regulatory agencies.

Habitat Alteration

- Construction within Estero Bay waters shall be avoided wherever possible.
- For construction that must occur within Estero Bay waters as proven necessary for the health, safety and welfare of the natural resources of Estero Bay and of the people in the watershed, utilize techniques that do not adversely impact Estero Bay waters

New Construction

- New construction projects should utilize best management practices to minimize negative impacts to the bay to the greatest extent possible; and in addition, the project as a whole, including mitigation, should be necessary to protect the public health, safety, or welfare, or the property of others, and should improve the current condition and relative value of functions being performed by the areas affected by the project.
- Utilize non-polluting construction materials (e.g. concrete pilings versus treated wood).

Wildlife

- A manatee protection plan will be adopted to reduce the number of boat-related manatee mortalities and that respects the rights of other users of the bay; to achieve a sustainable manatee population (the goal of the Marine Mammal Protection Act, the Endangered Species Act and other pertinent legislation); to protect manatee habitat; to promote boating safety; and to increase public awareness of the need to protect manatees and their environment.
- Efforts by wildlife protection agencies will be accelerated to reduce other non-boat related manatee mortalities.
- Maintain and improve the overall ecology of the bay and its watershed.

- Wildlife resources such as rookeries, sea grass beds and fisheries are under increasing threat from human activity. Greater efforts are required by regulatory and other agencies and groups to insure the sustained productivity of these resources.

Recreation

- Regulatory agencies will make special effort to maintain the bay as a major natural resource for fishing and appreciation of vegetation and wildlife.

Public Notice

- Activities in Estero Bay by any regulatory agency shall provide the opportunity for public participation.

Appendix III

Entities Represented in the Estero Bay Agency for Bay Management

ENTITIES REPRESENTED IN THE ESTERO BAY AGENCY FOR BAY MANAGEMENT

Bonita Bay Properties, Inc.
Calusa Group of the Sierra Club
Citizens Association of Bonita Beach
Coastal Engineering, Inc.
Collier County Commission
Conservancy of Southwest Florida
Cooperative Producers, Inc.
Council of Civic Associations
Corkscrew Regional Ecosystem Watershed (CREW) Trust
DCA-Division of Resource Planning and Management
Economic Development Council of Lee County, Inc.
Environmental Council of Southwest Florida
Estero Bay Aquatic and State Buffer
Estero Bay Tours
Florida Department of Transportation, District 1
Florida Game and Fresh Water Fish Commission
Florida Gulf Coast University, College of Arts and Sciences
Florida Real Estate Consultants
Fort Myers Beach Chamber of Commerce
Fort Myers Beach Civic Association
Fort Myers Beach Town Council
Fort Myers Planning Department
Harper Brothers, Inc.
League of Women Voters of Lee County
Lee County Mosquito Control District
Lee County Planning Division
Ostego Bay Foundation
Property Owners Association of North Collier County
Responsible Growth Management Coalition
Sanibel-Captiva Conservation Foundation
South Florida Water Management District, Ft. Myers Service Center
Southwest Florida Marine Trades Association
Southwest Florida Research and Education Center
START
State Legislature, 75th District
Sustainable Southwest Florida
Trico Shrimp Company
United States Army Corps of Engineers
U.S. Fish and Wildlife Service
USDA, National Resource Conservation Service
USEPA, Region 4
Vanasse and Daylor, LLP
West Coast Inland Navigation District

To our readers:

Thank you for taking an interest in Estero Bay. The Estero Bay Agency for Bay Management is committed to do everything possible to protect the health of this beautiful and precious resource. If you have found this report to be informative and meaningful, we would be glad to hear from you. Or if you have suggestions about how we can make future reports more useful to you, please let us know. Send your remarks and questions to:

David Y. Burr, Planning Director
Southwest Florida Regional Planning Council
4980 Bayline Drive, 4th Floor
Nort Fort Myers, FL 33917-3909
(941) 656-7720