Jacksonville

WATER QUALITY ASSESSMENT IN THE JAXPORT AREA WITH ANALYSIS AND PLAN FOR THE ESTUARINE MARSH SYSTEM

FL. Dept of Community Affairs

CITY OF JACKSONVILLE

1984

CITY OF JACKSONVILLE, FLORIDA

THE HONORABLE JAKE M. GODBOLD
MAYOR

W. RAY NEWTON
DIRECTOR OF PLANNING

ACKNOWLEDGMENT

Financial assistance was provided by the Coastal Zone Management Act of 1972, as amended, administered at the federal level by the Office of Ocean and Coastal Resource Management National Oceanic Atmospheric Administration and at the state level by the Florida Department of Community Affairs Coastal Energy Impact Program.

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PREFACE

This study is in part a product of the Coastal Energy Impact Program and is centered around the future need for the City of Jacksonville to maintain and expand its place in transportation and port related industries, while protecting the coastal environmental quality of the areas adjacent to the port. There has been reason for concern over the impacts that may occur resulting from potential coastal energy activity in the vicinity of the Port of Jacksonville.

The Port of Jacksonville is unique in its location, in that it is separated from the ocean by miles of environmentally sensitive marshes and swamps. Little water quality data or general information on this specific area is available. This study is an effort to remedy that.

The study was done in basically two sections, the first analyzing non-point source pollution (N.P.S.) coming from the land and affecting the water quality in the tidal creeks adjacent to the Port of Jacksonville at Blount Island. The second part of the study was an effort to gather background information on the northeastern salt marsh adjacent to the port and design a management plan that will afford this pristine area reasonable protection from the problems associated with expanded growth expected in the near future.

Water quality and sediment sampling was done in both study areas. Future non-point source loadings for tidal creeks utilizing possible land use senarios were also done for the watershed area. Water and sediment sampling were done at numerous sites in the Duval County portion of the Nassau River-St. Johns River Estuary. The results of the analysis suggest both these areas are remarkably clean. State standards were only exceeded for certain metals at particular sample sites and sediment samples appeared to be much cleaner than had been anticipated.

Citizen participation is one of the essential ingredients in preparing a study or designing a workable management plan. Input from local citizens and various interest groups help guide staff members in understanding the various needs, circumstances and attitudes of an area. The Citizens Wetland Advisory Committee reviewed and made suggestions on various aspects of the sections in this study. Their input and ideas were invaluable.

The study areas have been organized so each section can be used separately, as well as a unit.

The first section is the analysis of the Watershed Study area with existing and future potential non-point pollutions sources being investigated. This section analyzes to some extent, the quality of water entering the port area from storm water runoff and the major source of non-point pollution. This study inventories existing land uses and problems that may occur using scenarios of future land use.

The section on estuarine analysis is basically the support or background document for the estuarine management plan. This section looks at existing land uses, zoning, the natural environment and certain potential land uses and occurrences in the area that will impact it.

The Estuarine Management Plan is the third section and is a plan for the use and protection of this environmentally sensitive estuary. The management plan discusses the duties of field and administrative personnel, other agencies with jurisdiction and ideas on protection that should be afforded the estuary.

All three of these sections are combined and inter-related, yet each section can be used as a separate informational document when needed.

This study contains basic water quality and non-point source data, the existing land uses and a plan for protecting the environmentally sensitive areas adjacent to the growing Port of Jacksonville.

WATERSHED STUDY

PLANNING DEPARTMENT

Suite 700, Florida Theatre Building, 128 East Forsyth Street
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I. WATERSHED STUDY AND ESTUARINE STUDY BACKGROUND AND PURPOSE

General Introduction

The operation of the Port of Jacksonville is dependent upon maintenance dredging of the St. Johns River. This artifical channel is presently maintained at 38 feet. Natural depth of the river is approximately 15 feet. Deepening the channel to 44 feet to accommodate larger and deeper draft vessels is under consideration.

The successful implementation of the high growth scenario as proposed by the recently completed Jaxport Master Plan (Plantec) will be facilitated by the acquisition of extended (25 year) dredging permits. Extensive water quality data is a pre-application requirement for the acquisition of dredging permits. This report presents data, interpretation and recommendations regarding water quality and non-point source pollution of selected tidal creeks proximate to the Port of Jacksonville.

The study is designed to complement and expand the environmental data base regarding the river/port, including recent water quality studies by the Florida Department of Environmental Regulations (FDER). Sampling and field analyses was conducted by the U. S. Geological Survey (USGS), Jacksonville Subdistrict Office. Major analyses were performed by the USGS Central Laboratory in Atlanta, Georgia. Materials and methods of the sampling/analyses program were in accordance with standard USGS procedures, further described in the appendix. Data review and reduction was performed by the Jacksonville USGS, Jacksonville Subdistrict Office, the City of Jacksonville Bio-Environmental Services Division (BESD) and the Jacksonville Planning Department (JPD).

Concurrent with the predescribed water/sediment quality assessment, the JPD compiled information relative to the watershed of the selected tidal creeks. This data was utilized in computer modeling of the sediment/pollution loading of the creeks.

Goals and Objectives

The major goal of this phase of the program is to develop a coordinated plan for those aspects of the Port of Jacksonville which relate primarily to water quality, environmental and recreational issues. The plan addresses the following:

a.) Pollution from non-point sources entering the river and the estuarine marshes from the port area.

b.) Protection of basic functions and characteristics of the estuarine marshes and swamps in the vicinity of the port.

The objectives for the study are to:

a.) Determine existing sedimentation rates (volume) from upstream sources adjacent to Blount Island and the coastal marshes.

b.) Determine quality of existing and future sediment loads, especially those associated with future land disturbing activities.

c.) Determine existing and potential future NPS loads and identify measures to minimize NPS impacts.

d.) Develop a management program for the protection of coastal marshes in the port area.

Citizen Participation

Citizen participation is another objective that was incorporated into the study. Local input is a valuable resource and a necessary element in completing any study that will be used in the local planning effort. Citizen participation is discussed at greater length in the Appendix.

The product of this effort is anticipated to supplement work currently underway by the Florida DER and to provide useful information in resolving the dredge disposal issue for maintenance dredging in the harbor channel. In addition, the program will enable the development of implementation tools and measures, both regulatory as well as optional incentives, for preservation and conservation of the coastal marshes and swamps in the port area.

Scope of the Study

The following outline identified the major tasks for steps of this study and provides a brief discussion on how they were accomplished.

I. Water Quality Assessment/Non-Point Source Pollution Mitigation

A. The JPD, through its consultant collected water quality data at selected locations in the tributaries to the St. John's River in the port area. Water quality parameters used in this assessment were established in consultation with the FDER.

Also, the water sampling stations were selected cooperatively with the FDER for coordination with its sampling stations Deep Water Ports Maintenance Dredging Study.

B. Inventory and analyze of generalized watershed characteristics. The JPD has collected and analyzed land use and other physical data for the watershed study area (Map); i.e. topography vegetation, soils, etc. This information plus pollution point source data (DER and Bio-Environmental Services Division), was utilized in the estimation of annual pollutant loading.

C. Conduct an evaluation of the impact of non-point source discharge on the water quality.

1. Estimate annual loading by pollutant type. Different analyses were conducted to calculate the annual loading by type of pollutant.

2. Project future pollution loading. The results of the above assessments were reviewed and evaluated. The future conditions were based

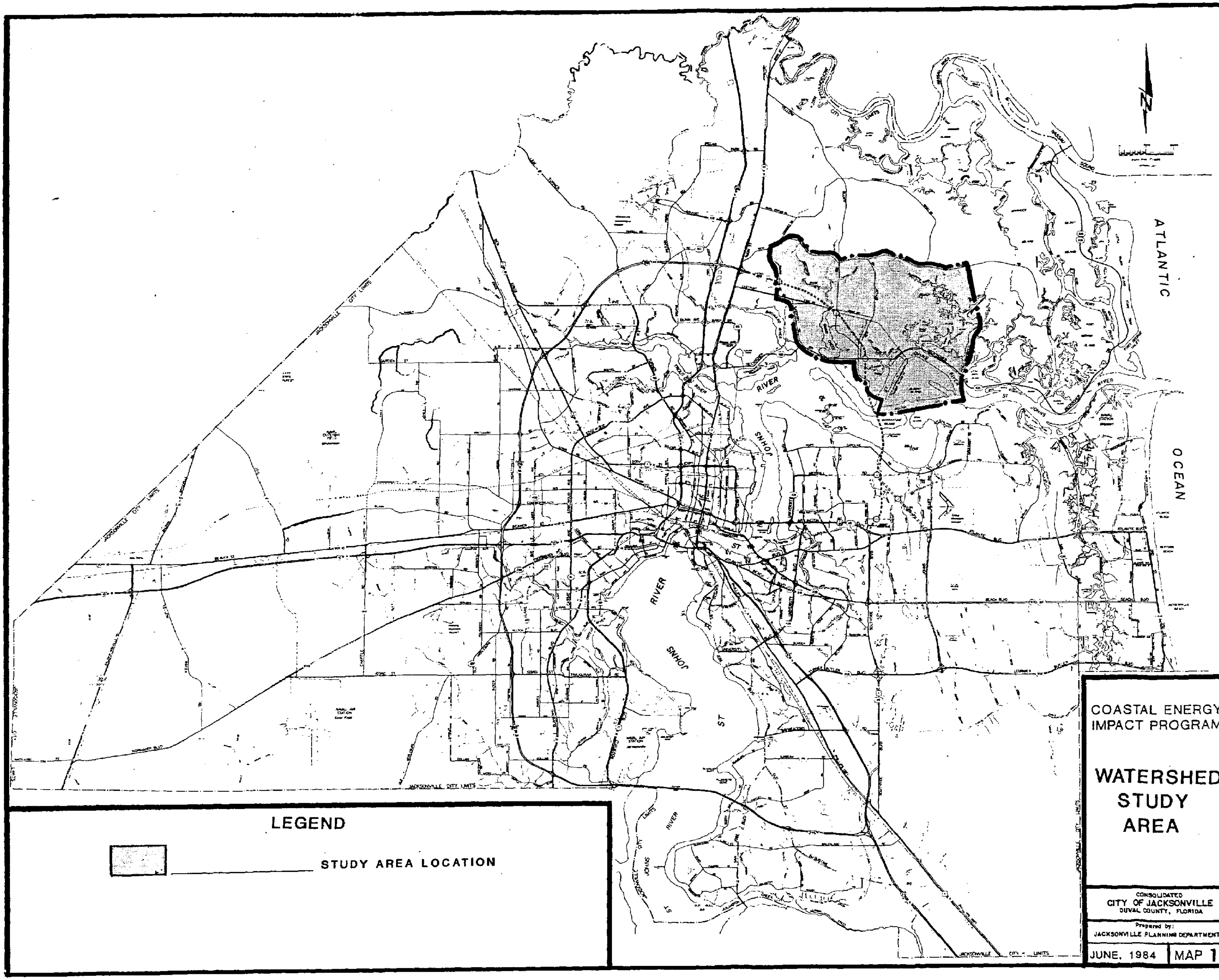
on the Land Use Plan prepared by the Planning Department staff for the watershed area. Problems areas were identified.

II. Conduct additional analyses of the estuarine marshes of the port area (Map 2). This study proposes measures to ensure preservation of significant portions of the Nassau and St. Johns Rivers estuarine ecosystems. The scope of this study includes a review and analysis of:

A. The descriptive character of the estuarine marsh system.

B. The functional characteristics of these systems.

C. Major issues and developments impacting the area.



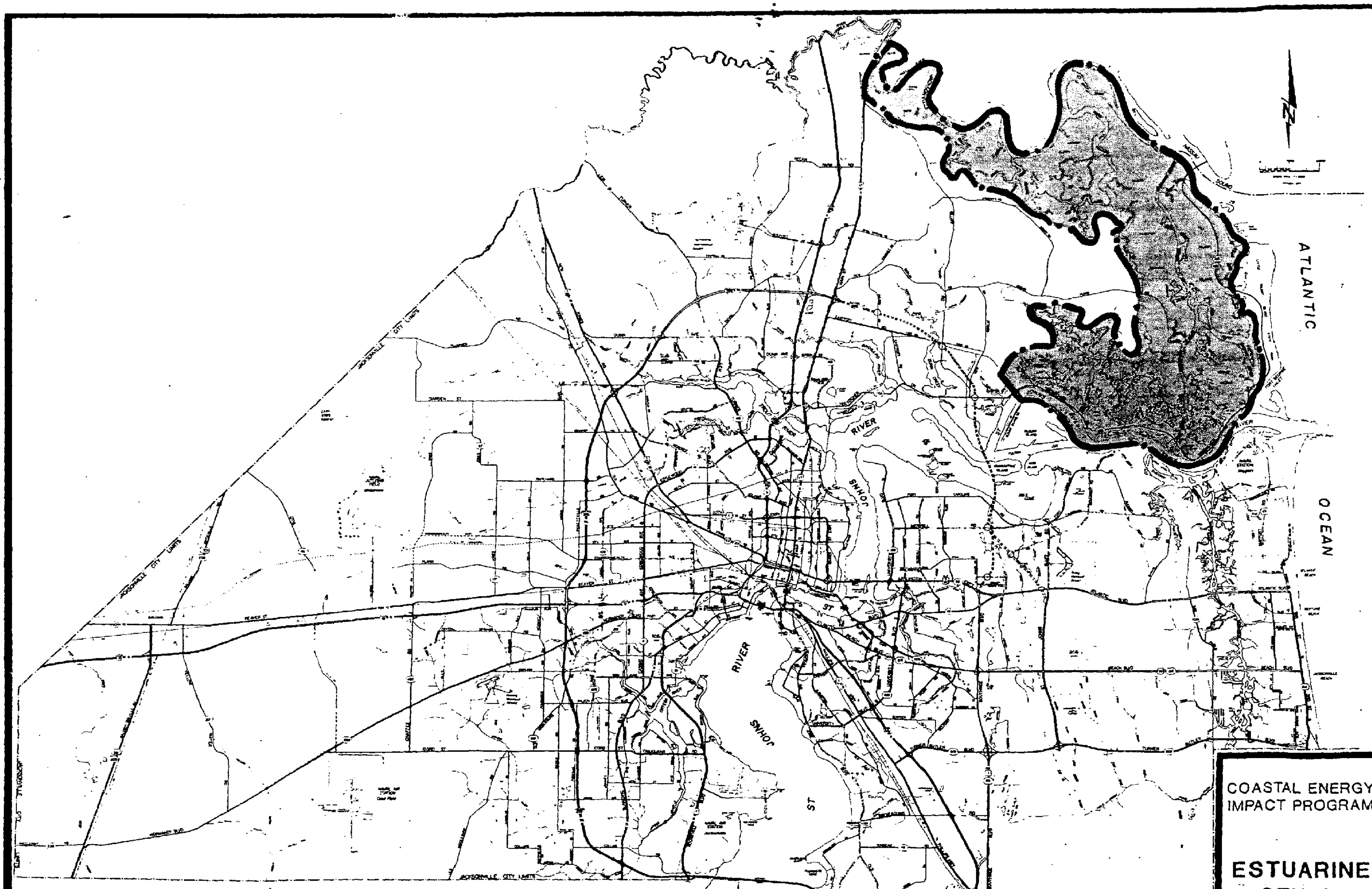
COASTAL ENERGY IMPACT PROGRAM

WATERSHED STUDY AREA

CONSOLIDATED
CITY OF JACKSONVILLE
DUVAL COUNTY, FLORIDA

Prepared by:
JACKSONVILLE PLANNING DEPARTMENT

JUNE, 1984 | MAP 1



LEGEND

STUDY AREA LOCATION

COASTAL ENERGY IMPACT PROGRAM

ESTUARINE STUDY AREA

CONSOLIDATED
CITY OF JACKSONVILLE
DUVAL COUNTY, FLORIDA

Prepared by:
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JUNE, 1984 | MAP 2

WATERSHED ANALYSIS

II. WATERSHED ANALYSIS

Introduction

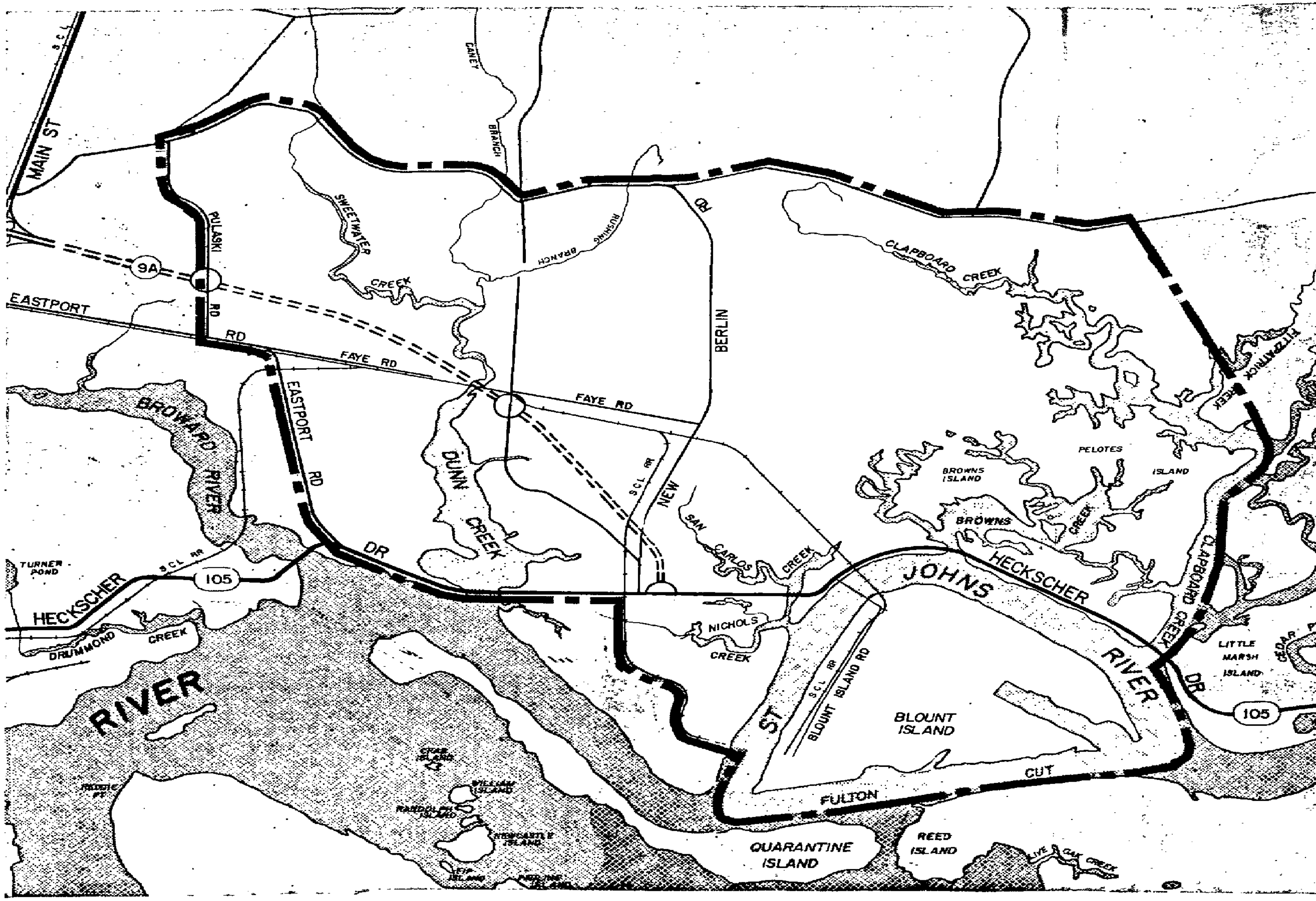
The Jacksonville Planning Department has collected data relevant to the Watershed Study area which impacts the tributaries sampled under the USGS's water quality analysis program. The following information is derived from the referenced published materials and from data obtained through staff investigations. Elements addressed to facilitate non-point pollution assessment and mitigation include: topography, soils, land cover and land use.

Study Area (Map 3)

The study area encompasses approximately 16,100 acres of tidal creeks, marshes and uplands north of the St. Johns River and including Blount Island. The southern boundary of the study area follows the St. Johns River south of Blount Island, cutting across Dames Point to Heckscher Drive. The western boundary is Eastport and Pulaski Roads; the north, New Berlin and Cedar Point Roads. The eastern limits of the study area are, roughly, Clapboard Creek.

Watershed Subbasins (Map 4)

Information in this section is derived from a 1983, USGS study - Drainage Basins of Duval County. A drainage basin consists of a major surface stream, its tributaries and the surrounding land that they drain. Drainage basins are bounded by drainage divides which are ridges or, topographically, high areas that separate adjacent stream drainage systems. Parts of Duval County have very little topographic relief and drainage divides in these areas are indistinct and low enough to be inundated during floods,



WATERSHED STUDY AREA

COASTAL ENERGY IMPACT PROGRAM

Scale: 1" : 5,000'

JUNE, 1984

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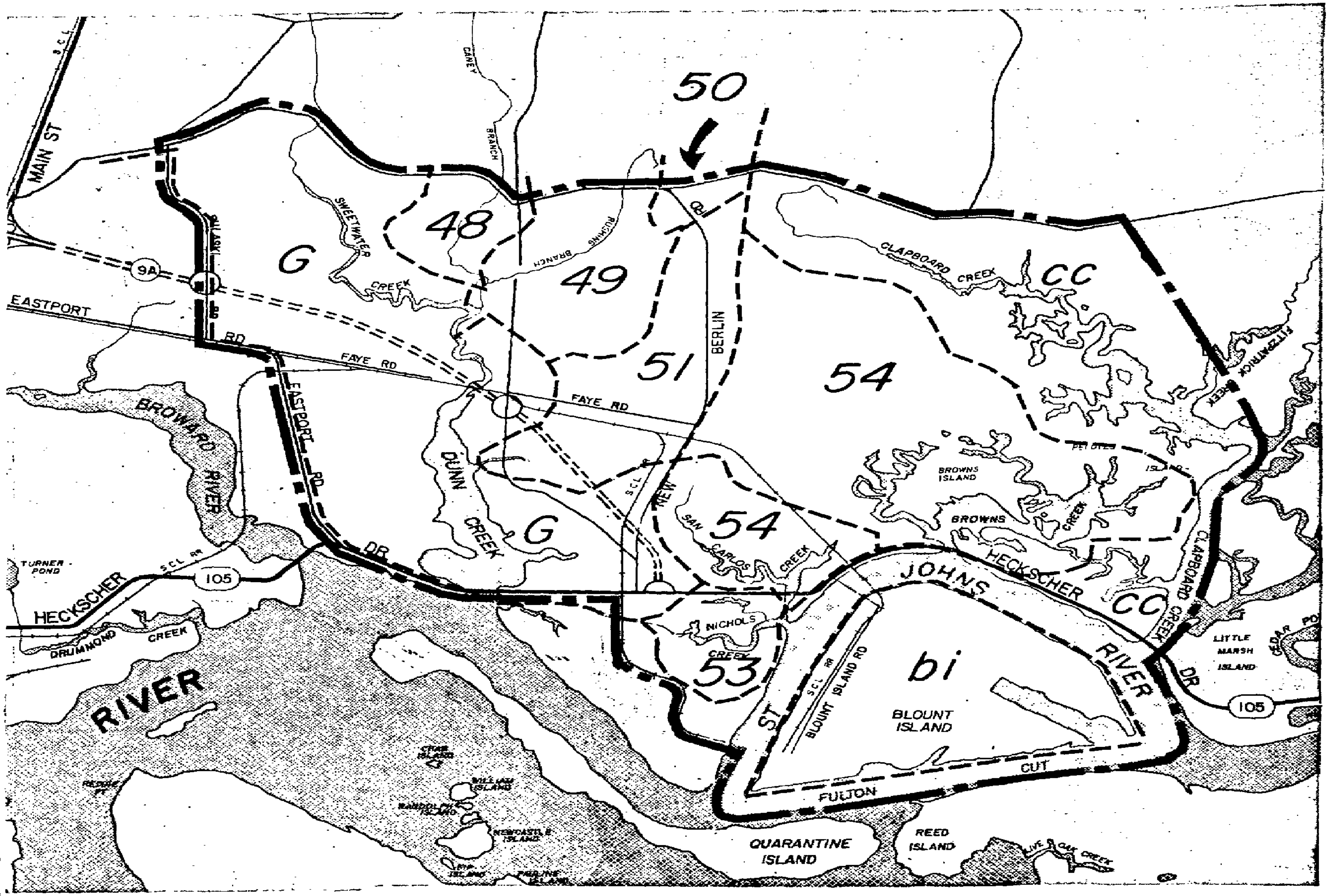
MAP 3



LEGEND	
G ____ DUNN CREEK	53 ___ NICHOLS CREEK
48 ___ CANEY BRANCH	54 ___ BROWNS CREEK
49 _ RUSHING BRANCH	54 SAN CARLOS CREEK
50 ___ SAMPLE SWAMP	cc CLAPBOARD CREEK
51 ___ TERRAPIN CREEK	bi ___ BLOUNT ISLAND

DRAINAGE SUBBASINS

WATERSHED STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

Scale: 1" : 5,000'

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MAP 4

with the result that water, occasionally, can move from one drainage system to another.

A drainage basin comprises smaller subdivisions called subbasins. Subbasins are tributary streams and the surrounding land that they drain. Basins and subbasins vary in size from many square miles to less than one square mile.

Portions of the Dunn Creek drainage basin, which is made up of five subbasins - Dunn Creek, Caney Branch, Rushing Branch, Sample Swamp and Terrapin Creek comprise the western half of the study area. Portions of another basin of the St. Johns River make up the remainder of the study area. This basin includes the two subbasins, Nickols and Browns-San Carlos Creeks and another indistinct subbasin which includes the Clapboard Creek system.

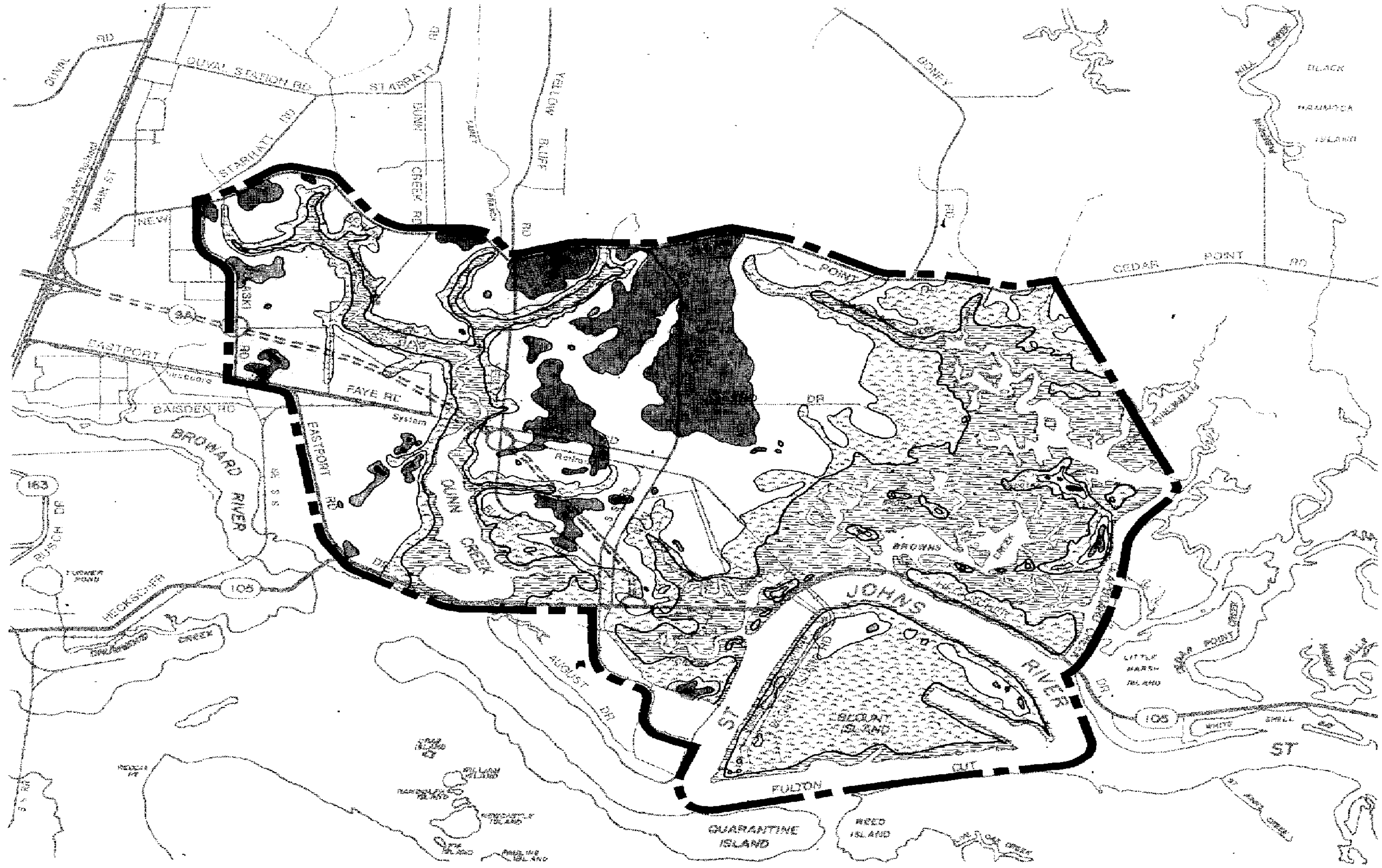
Topography (Map 5)

Most of the study area is level to gently sloping to river banks, creeks and wetlands. Large portions of the study area consist of wetlands and coastal plains. These areas seldom rise ten feet above mean sea level.

There is a general trend towards decreasing elevation from the northern and western portions of the study to the southern and eastern creeks and marshes. Elevations of twenty feet and slightly higher can be found in the vicinity of the new St. Johns River Power Park facility being constructed off of New Berlin Road. Isolated areas of thirty feet and slightly higher can be found between Dunn Creek and Eastport Road (St. Regis Paper Company) and a small area along Cedar Point Road at the northern boundary of the study area.

Generalized Soils (Map 6)

Of the 38 soil types listed as occurring in Duval County, 23 are represented in the Dunn and Clapboard Creeks Watershed Study area. These soils can be grouped into four generalized soils. Most of the northern portion of the study area is generally comprised of soils of the flatwoods, a mixture of Leon-Ridgeland-Wesconnett and Pelham-Mascott-



LEGEND

ELEVATIONS ABOVE MEAN SEA LEVEL: IN FEET

- 0 – 5
- 5 – 10
- 10 – 20
- 20 – 30
- 30 – 40

GENERALIZED TOPOGRAPHY

WATERSHED STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

0' 3,000' 6,000'
Graphic Scale

JUNE, 1984

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MAP 5

Sapelo soils. The Clapboard Creek watershed and most of the eastern portion of the study area are generally comprised of soils of the tidal marsh or Tisonia. The Dunn Creek watershed and most of the western portion of the study area are comprised of Kershaw-Ortega soils.

These generalized soil types are described briefly as follows:

Leon-Ridgeland-Wesconnett: Typical of broad areas of flatwoods interspersed with shallow depressions and large drainageways. It occurs in very large to medium-sized areas throughout the county. Nearly level, poorly drained and very poorly drained soils that are sandy throughout.

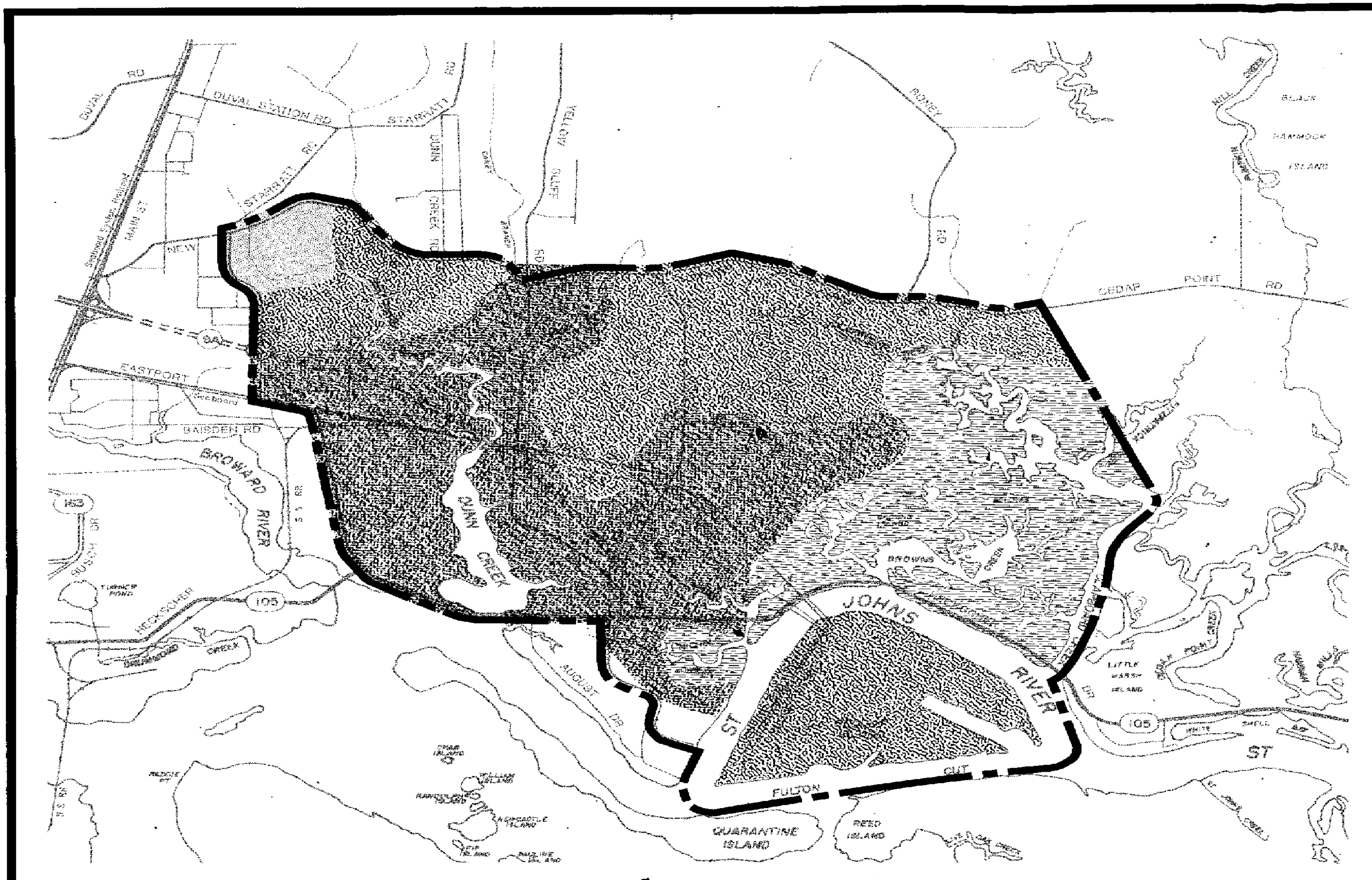
Pelham-Mascott-Sapelo: Nearly level, poorly drained soils that are sandy to a depth of 20 inches or more and loamy below. Most areas in this unit are in second growth Slash Pine, Gallberry, Sawpalmetto and Waxmyrtle.

Kershaw-Oretga: This group comprises broad, nearly level to sloping ridges interspersed with narrow, wet sloughs that generally parallel the ridges. Nearly level to sloping, excessively drained and moderately well drained soils that are sandy throughout. Located along the St. Johns River and extends inland about four miles to the north of the river and about nine miles to the south. The natural vegetation is Turkey Oak, Blackjack Oak and second growth Slash Pine and Longleaf Pine.

Tisonia: Level and nearly level, very poorly drained, saline, organic soils underlain by clayey materials. This soil type supports the tidal marsh in the county. The tidal marsh is saline in most places, but is brackish where small feeder streams enter it. Under natural conditions this soil is covered with water 6 to 12 months a year and is subject to tidal inundation twice a day.

These general soils range from well drained to very poorly drained; all are sandy with the exception of the Tisonia, which is of organic composition.

Twenty-three specific soils are represented in the study area - six dominate: Tisonia Mucky Peat, Arents, Pottsburg Fine Sand, Ortega Fine Sand, Leon Fine Sand and Kershaw Fine Sand.



LEGEND

KERSHAW - ORTEGA

LEON - RIDGELAND - WESCONNETT

PELHAM - MASCOTTE - SAPELO

TISONIA

GENERALIZED SOILS

WATERSHED STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

0' 3,000' 6,000'
Graphic Scale

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MAP 6

Land Cover (Map 7)

The predominant vegetation types of the watershed study area are Pine Flatwood, Hardwood Swamp and Salt Marsh. Substantial representations of the following communities are also found: Swamp Hammock, Coastal Hammock and Grassy Scrub. The following presents brief description of the major vegetative communities represented.

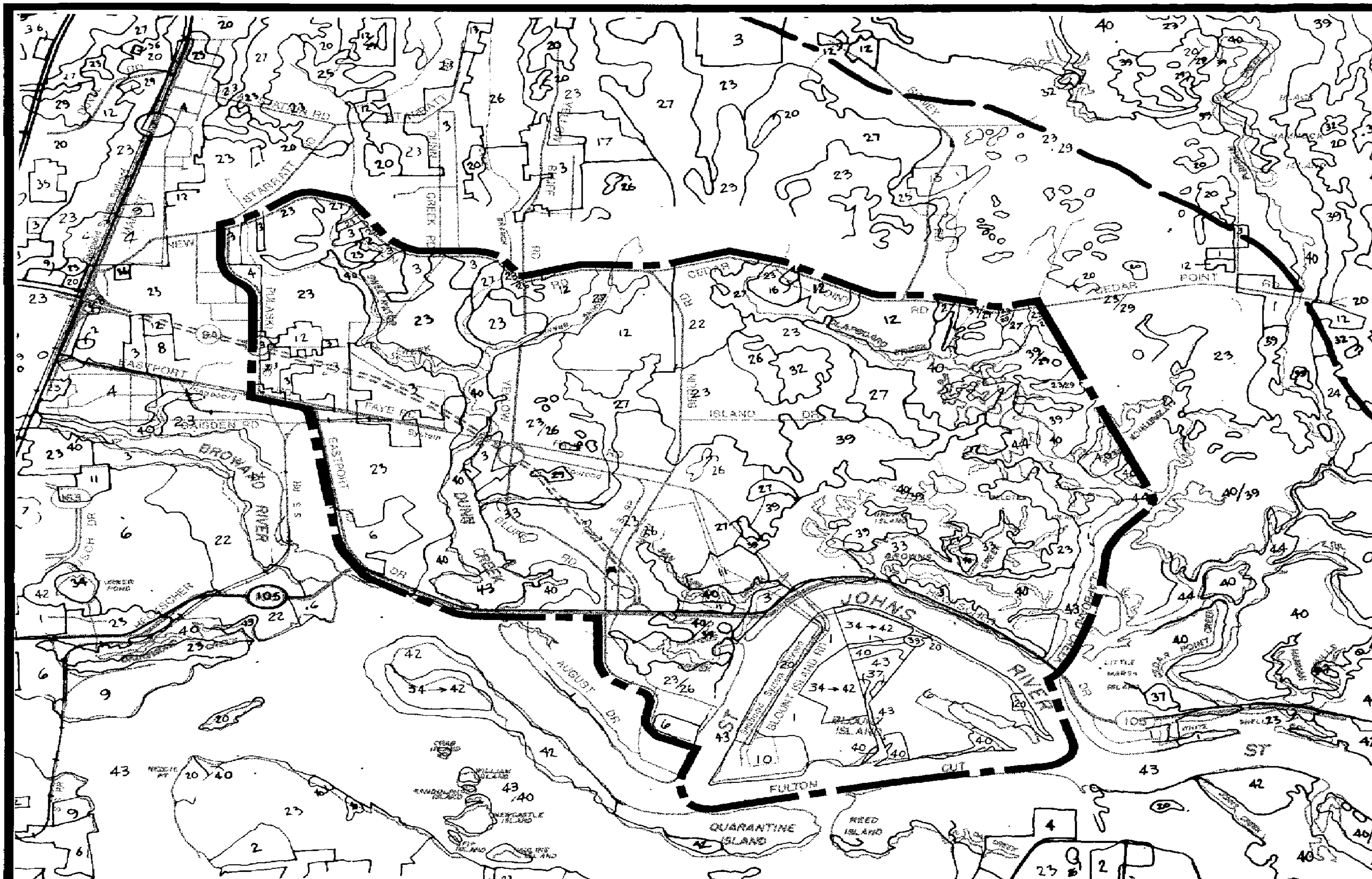
Pine Flatwood: One of the most extensive forests of Florida; dominated by pine trees and derives its name from its usual occurrence in areas of flat topography. Most of the eastern portion of the study area is comprised generally of pine flatwood.

The canopy of this area is composed primarily of Slash and Longleaf Pine. The dominant species comprising the understudy includes Inkberry, Sawpalmetto and Fetter-bush. Predominant species of the herbaceous community include Bracken Fern, Wire Grass, Beargrass, Dollar Grass and Candy Root.

Hardwood Swamp: This wetland forest is dominated by deciduous hardwood trees found in strands along drainage ways and watercourses and is influenced by seasonal flooding. Extensive areas of hardwood swamp are found along the upper reaches of the Clapboard and Dunn Creek watersheds.

Although these mixed hardwood swamps are characterized by a preponderance of deciduous tree species, they generally are not dominated by any one species. Hardwood swamps are variable with species types dependent upon the size of the waterway, its flow rate, water quality and silt turbidity characteristics. Common species in this area include Red Maple, Button Bush, Black Gum, Southern Bayberry and Pond Cypress. This community is an important wildlife habitat displaying a diversity equal to that of its flora.

Salt Marsh: Salt Marsh communities occur in coastal areas of low energy and gentle slope periodically flooded by the tides. The Salt Marsh is dominated by grasses with woody plants nearly always absent. Most of the southeastern portion of the Watershed Study area is covered by salt marsh, a brief description of this ecosystem is presented in the following section (Estuarine Study).



LEGEND

URBAN		NATURAL			
1	OPEN LAND	20	GRASSY SCRUB	34	LAKES & PONDS
3	RESIDENTIAL LOW DENSITY	23	PINE FLATWOOD		COASTAL
4	RESIDENTIAL MEDIUM DENSITY	26	SWAMP HAMMOCK	37	TIDAL FLAT
6	INDUSTRIAL	27	HARDWOOD SWAMP(RIVERINE)	39	COASTAL HAMMOCK
10	TRANSPORTATION	29	CYPRESS POND	40	SALT MARSH
11	UTILITIES & COMMUNICATIONS	32	FRESHWATER MARSH		MARINE
AGRICULTURE			OPEN WATER	42	SPOIL BANK
12	IMPROVED PASTURE	33	RIVERS & STREAMS	43	MEDIUM SALIN. PLANKTON EST.
				44	OLIGOHALINE SYSTEM

LAND COVER AND SELECTED CHARACTERISTICS

WATERSHED STUDY AREA

COASTAL ENERGY IMPACT PROGRAM

0' 3,000' 6,000'

Graphic Scale

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MAP 7

Existing Land Use (Map 8)

Table 1 shows existing land use in the Watershed Study area by drainage basins.

The study area is divided into nine watershed areas and the land uses are listed by category. These land uses include:

Residential: All residential land uses from single to multi-family to mobile homes.

The majority of the residential acreage is located in the western section of the study area and along the major transportation routes, such as New Berlin Road, Cedar Point Road and Heckscher Drive.

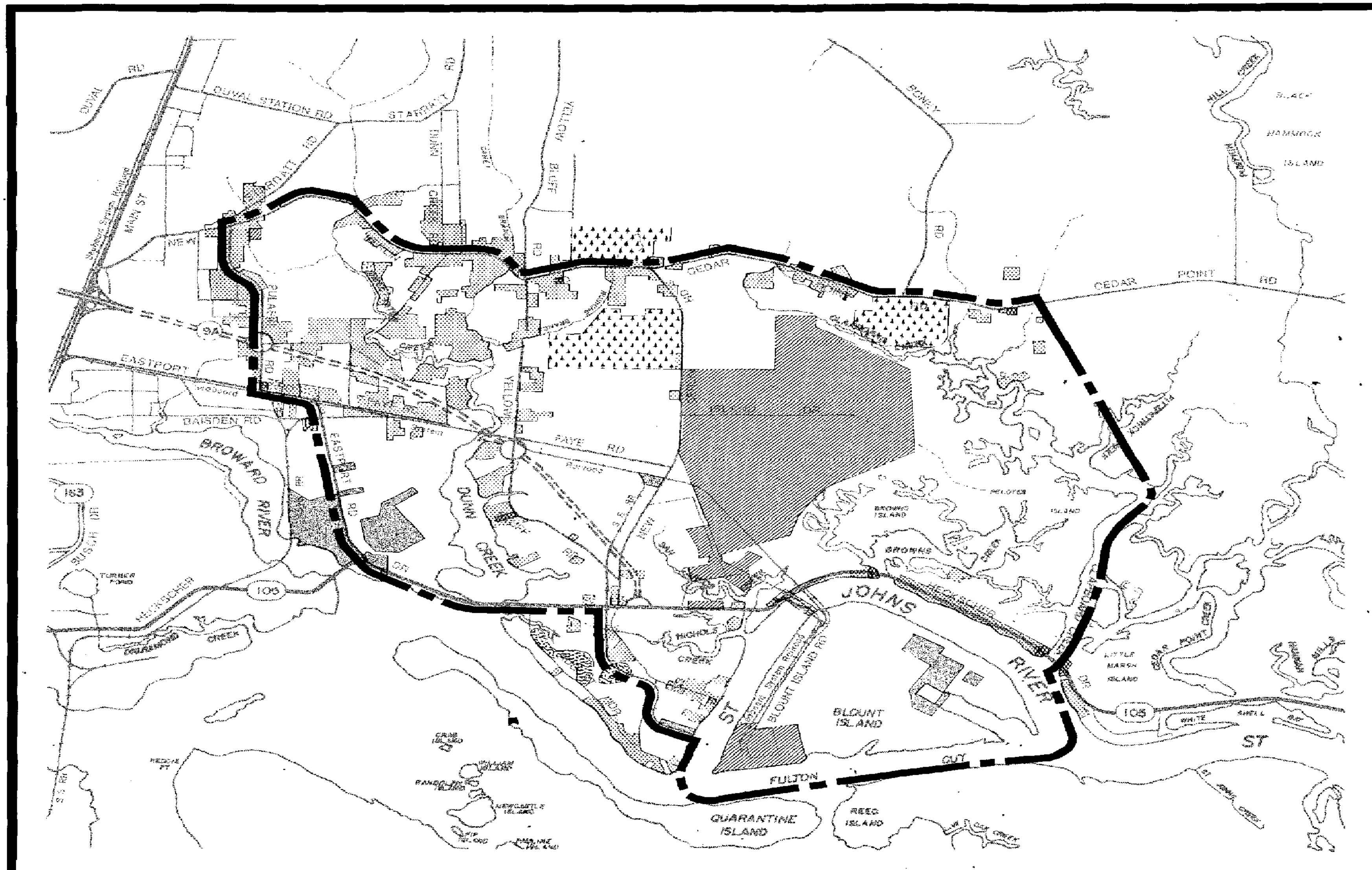
Commercial: The majority is related to retail sales and service: shops, businesses, stores, food markets, fish camps, etc. In general, the commercial land use in this area is support and neighborhood commercial.

Industrial: This category includes heavy and light industry, communications and utilities.

Industrial land that is categorized as transportation related includes land uses such as airports, railroads, truck terminals, port facilities and related use.

The communications and utilities subcategory of industrial land use represents the largest category of developed land in the study area. This is due primarily to the inclusion of the 1,656 acre JEA St. Johns River Power Park currently under construction.

This land use sub-category also includes sewage and water treatment facilities, solid waste sites and other related development. At present, the area is not served by a regional, city owned sewage treatment facility; however, there are several small, privately owned treatment plants. Offshore Power Systems and the Jacksonville Port Authority's treatment facilities are located on Blount Island. Simplex Paper Incinerators, the Allied Container Company and the Celotex Corporation each maintain water treatment facilities at their company sites. Two water treatment facilities are located at the Jacksonville Electric Authority Northside Generation Station.



LEGEND

	RESIDENTIAL
	COMMERCIAL
	INDUSTRIAL
	INSTITUTIONAL
	PARKS and RECREATION
	AGRICULTURE
	EXTRACTIVE
	COMMUNICATIONS and UTILITIES

GENERALIZED EXISTING LAND USE

WATERSHED STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

0' 3,000' 6,000'
Graphic Scale

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MAP 8

TABLE 1

Existing Land Use In the Watershed Study Area

SUBBASINS LAND USES:	48	49	50	51	53	54	"G"	Blount Island	Clapboard Creek	TOTAL
RESIDENTIAL	109.50	92.98	10.33	26.86	14.46	53.72	2414.44	47.52	57.85	2827.66
COMMERCIAL	4.13					8.26	33.63		4.13	50.15
INDUSTRIAL	2.07			8.26	12.40	1404.96	737.03	270.66	330.58	2765.96
AGRICULTURAL		177.69		109.50					183.88	471.07
PARK/OPEN SPACE	6.20							8.26		14.46
SWAMP/MARSH	61.56	144.08	8.26	162.68	152.89	1259.30	541.58	6.20	1003.97	3340.52
WATER	.42	.55		.48	37.2	334.7	417.3	1126	427.0	2343.65
UNDEVELOPED AREA	78.32	183.21	53.96	907.10	246.24	945.82	242.20	1370.85	124.95	4152.65
ROADS	6.40	4.83	3.87	10.62	5.58	17.91	55.14	12.73	7.27	124.35
RAILROADS				.92	.22	1.06	2.41	1.84		6.45
TOTAL	268.60	603.34	76.42	1226.42	468.99	4025.73	4443.73	2844.06	2139.63	16096.89 (16097.00)

Institutional: This category includes schools, churches, hospitals, etc.

Roads/Railroads: Railroads and paved roads within the study area - excluding right-of-ways.

Agricultural: Includes dairies, farmland and ranches.

Park/Open Space: Parks and sensitive areas or immediate upland from marsh or swamp area.

Swamp/Marsh: - Freshwater swamps/marshes and salt mashes.

Water: Major creeks and the St. Johns River surrounding Blount Island.

Existing Zoning (Map 9)

The Watershed Study area is primarily zoned for industrial land uses. Approximately half the area is zoned Open Rural (OR). This category functions as a type of holding zone and allows for more rural oriented land uses.

Industrially zoned land within this study area include large areas of Dames Point, areas north of Heckscher Drive to Faye Road, all of Blount Island and large areas of marsh between Browns and Clapboard Creek.

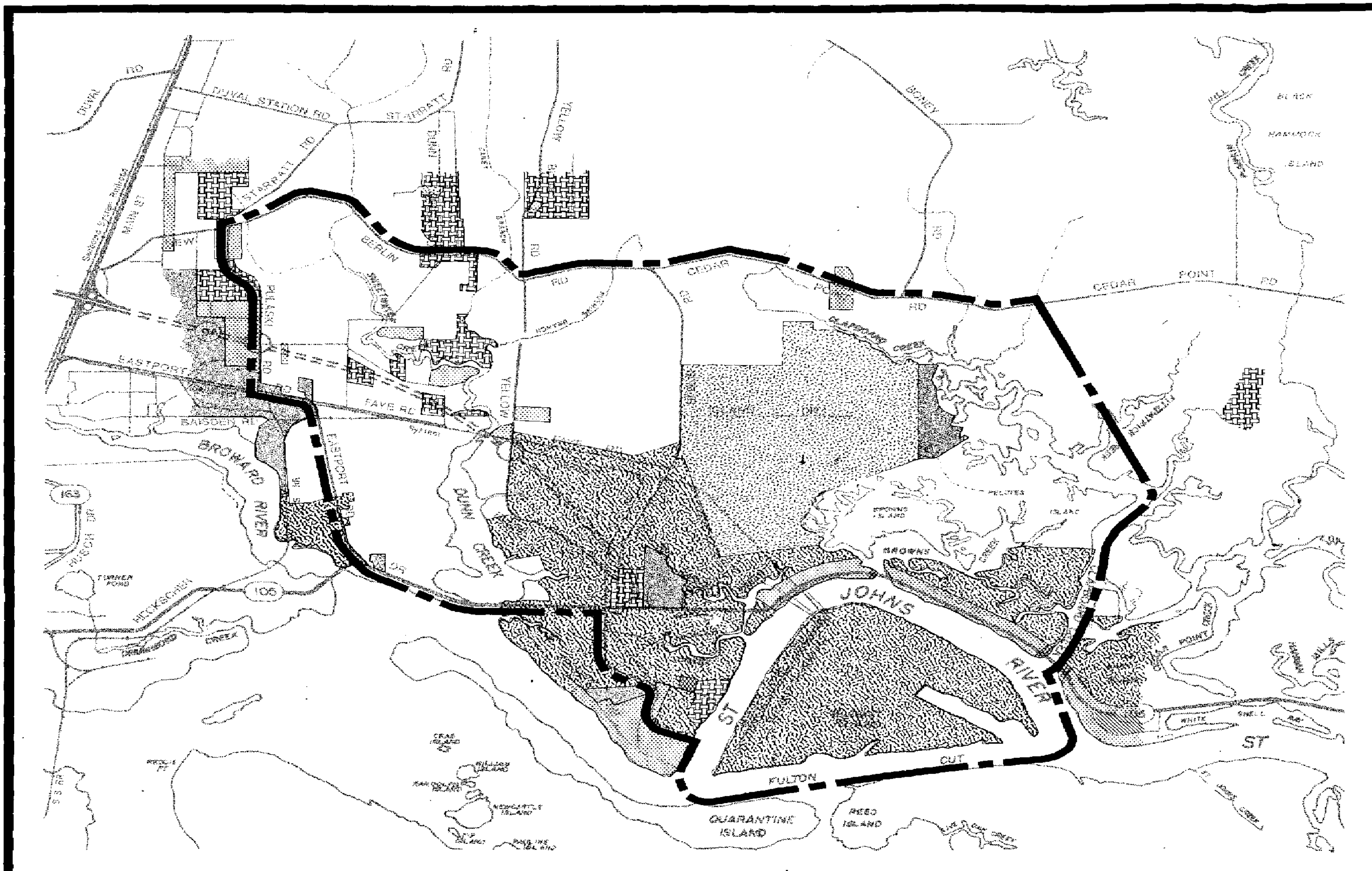
A large area east of New Berlin Road and south of Pelotes Island Road has been zoned Government Use (GU) in order to facilitate the construction of the St. Johns River Power Park and incorporate the northside power plant.

There are scattered areas of residential zoning throughout the study area, concentrated mainly at the southern end of Dames Point and along Heckscher Drive in the Blount Island area. There are also small pockets of commercial zoning throughout the area.

Major Land Use Projects in the Watershed Study Area

St. Johns River Power Park

The St. Johns River Power Park is a 1656 acre coal-fired power generating plant which will be owned and operated by the Jacksonville Electric Authority in



LEGEND

RS-A, RS-B, RS-D, RS-F, RG-A, RG-B, RG-C, RG-D	IH, IW
RMH, RM, RMOI	GU
CN, CG, CI	PUD
ILW	OR

EXISTING ZONING

WATERSHED STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

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JUNE, 1984

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MAP 9

conjuction with Florida Power and Light. The Plant is currently under construction and is expected to be completely on line by 1987. It will feature two 600 megawatt units, each of which will burn between 1.2 and 1.5 million tons of coal annually.

The facility is located in the northern part of the city off New Berlin Road adjacent to the estuarine study area and within the watershed. Accompanying the facility is a 55 acre coal unloading facility located on the south central part of Blount Island. (The acreage is leased to JEA by the Jacksonville Port Authority.)

The St. Johns River Power Park is the most extensive land use change to occur in the Watershed Study area in recent history. This area has essentially remained the same over the past several years with no major land use projects impacting the area.

This particular project has the potential to impact on the non-point source pollution in this area and should be regarded accordingly.

The environmental information document from the impact study of the power park suggest design and state-of-the-art technology should mitigate any potential environmental problems.

State Road 9A.

The extension of State Road 9A to Heckscher Drive is another development in the area that has potential for extensive impact.

The construction of State Road 9A is presently proceeding along the anticipated corridor and should supply additional access to the study area. State Road 9A will link the Northside area with I-295 and I-95. Residential and commercial density is expected to increase along interchanges within this transportation corridor. This new transportation link will also provide better available access to expanding port and industrial areas.

Dames Point Bridge

This proposed bridge is designed to complete the I-295 loop around Jacksonville and link the north and south sides of the city. The Dames Point Bridge is presently in the final stages of approval and is acknowledged as being the major future influence on this particular area. With the access should come increased potential development. Proper planning will be necessary to lessen any adverse impacts.

NON–POINT SOURCE POLLUTION

III. NON-POINT SOURCE POLLUTION

Non-point source pollution as addressed in this study is essentially stormwater runoff. Clearing, paving and other land alterations have resulted in increased runoff with the accompanying pollution from oils, greases, heavy metals, sediments, fertilizers and pesticides. Studies have shown that about half of the pollution load on our waterways is from non-point sources.

The Florida Department of Environmental Regulation (FDER) has attacked this tremendously complex problem through the implementation of their Chapter 17-25, FAC. The premise of this role is that any discharge of untreated stormwater is a potential threat to water quality.

Under Chapter 17-25, many new developments must provide a stormwater management system to ameliorate adverse impacts of untreated stormwater to adjacent waterways. These stormwater management systems often consist of detention ponds which store and filter stormwater before it is released at a relatively controlled rate. In addition to improving water quality by filtration, the systems are designed to result in less erosion by controlling the flow of the runoff.

The St. Johns River Water Management District has implemented similar stormwater management regulation, Rule 40C-4. This rule is concerned primarily with the control of water quantity and flow rather than water quality. However, the resulting management systems are often designed to comply with both the SJRWMD and the DER regulations.

The study area is currently considered undeveloped. The DER stormwater management program is presently not a significant factor regarding assessment of existing pollution loading. It may be in the future as new developments are subject to the rule.

IDENTIFICATION OF MANAGEMENT AGENCIES

IV. IDENTIFICATION OF MANAGEMENT AGENCIES

There are two primary management agencies in Duval County that are concerned with the mitigation of non-point pollution sources. They are the Department of Environmental Regulation (DER) and the St. Johns River Water Management District (SJRWMD). The Jacksonville Department of Public Works also has the potential ability to be a management agency.

Under FAC Rule 17-25, "Regulation of Stormwater Discharge", the required stormwater management systems that are considered new construction (systems built after February 1, 1982), must be permitted by DER and meet certain criteria and standards. With this stormwater discharge rule DER is attempting to reduce the amount of pollutants discharged into waters of the state.

Rule 17-25 requires permitting of all new stormwater facilities. This rule has a number of general exemptions from the permitting process such as: single family homes not part of a larger development; single family development on 10 acres or more with less than two acres of impervious surface; forestry provided the facilities are constructed and operated in accordance with silviculture best management practices; and, development that discharges into a permitted facility with adequate capacity which is maintained by a city, county or management district. An exemption may also be given to facilities that discharge into a stormwater facility which has sufficient capacity and is part of a master drainage plan adopted by a city or county. Prior written authorization from the facility owner is required.

In order to avoid a time consuming permitting process, a developer may take the option of meeting certain exemption criteria and standards required in Rule 17-25. The developer must provide notice to DER from a registered engineer, on forms provided by DER at least fourteen days prior to construction, that the stormwater discharge facility will meet all required criteria and standards. If developments provide retention or detention with filtration for the first one inch of runoff or half inch if the project is larger than one hundred acres, the development can be exempt from the permitting process.

Developers are finding that building retention or detention ponds with filtration on the project sites, as long as 17-25 specifications are followed allows their project to be exempt from permitting. The Jacksonville area is experiencing a growing number of these ponds on developments of all sizes. The intent of the ponds is to treat runoff from impervious surfaces by filtration.

DER also permits dredge and fill activities to the extent that dredge and fill activities have the potential to cause water quality degradation, Rule 17-24.28, Permits for Dredging and Filling Activities, also gives DER additional jurisdiction in relation to non-point source pollution mitigation.

The other primary management agency that mitigates non-point source pollution is the St. Johns River Water Management District (SJRWMD). Chapter 40-C-4 "Management and Storage of Surface Waters" has the affect of some non-point source mitigation. It was not the primary intent of the Water Management District to control water quality, but by requiring that permits be obtained for certain activities related to surface water management. In wetlands, they are to a certain extent, promoting mitigation of non-point source pollution.

Rule 40-C-4 requires a permit be obtained from the SJRWMD for any activity that; "drains or alters innundation of five or more contiguous acres of hydrologically sensitive area (wetlands) which has a direct hydrologic connection to a stream or water course that drains five or more square miles, an impoundment with no outfall, which is not wholly owned by the applicant and is ten acres or more in size, or a hydrologically sensitive area not wholly owned by the permit applicant." Certain criteria and standards must be met in order to obtain permits and this allows the Water Management District certain jurisdiction and management of surface waters that have the potential to impact wetlands.

At present, the Jacksonville Department of Public Works has a very limited role in non-point source mitigation. To the extent that Public Works has some jurisdiction over dredge and fill activities within the county, as well as the design of some water management systems, it can be suggested that they have the potential to be a management agency where non-point source pollution is concerned.

The Department of Public Works administers a permitting program that requires a permit for dredge and fill activities over 4,000 cubic yards. The stormwater retention rules for the city do not specifically address the problem of pollution runoff. The major concern in subdivision regulations related to stormwater is the criteria and standards for storm drainage.

WATER QUALITY ANALYSIS

V. WATER QUALITY ANALYSES

Introduction

The selection of sample sites, methodology and parameters for this study were made in consultation with the FDER to complement the FDER Deepwater Port Maintenance Dredging Study.

The parameters selected for analysis during the field program are presented in Tables 2 and 3. A brief explanation of the rationale used in parameter selections is presented below:

Ammonia, TKN and Nitrate

Nitrogen compounds such as ammonia, nitrite, nitrate and organic nitrogen (TKN) limit productivity of phytoplankton in southeastern estuaries. Nitrates typically comprise the highest concentrations of nitrogen compounds in estuarine waters while ammoniacal nitrogen is considerably less abundant. However, sediment-bound ammonia is potentially the most critical problem during dredging operations since ammonia can stimulate planktonic growth (or epiphytic algae) and, yet, be toxic to estuarine organisms.

Total Phosphorus, Phosphate and TOC

Phosphorus, phosphate and total organic carbon (TOC), like nitrogenous compounds, are essential nutrients. Although these nutrients are released during dredging, no adverse impacts to exposed estuarine biota are anticipated since nitrogen is generally the limiting nutrient to algal growth in most southeastern estuaries. Consequently, they are less critical than nitrogen released during dredging operations.

TABLE 2

SAMPLE PARAMETERS*

WATER QUALITY ANALYSIS

Inorganic Materials

Antimony	Copper	Mercury
Arsenic	Fluoride	Nickel
Cadmium	Iron	Silver
Chromium	Lead	Zinc

Organic Materials

Pesticides	Phenols
Mirex	Phenol
Toxaphane	2-Chlorophenol
DDT	2,4-dichlorophenol
Aldrin	2,4,6-triclorophenol
Chlordane	4-chloro-m-cresol
Other Chlorinated (DDE)	2,4-dinitrophenol
PCB	pentachlorophenol

General Physical-Chemical

Temperature
Salinity
pH
DO
DO (% saturation)
Turbidity
Conductivity
Ammonia
Nitrate
TKN
Phosphate
Total Phosphorous
Total Organic Carbon
BOD
Total Suspended Solids

*Parameters excluded from analysis listed in Appendix.

TABLE 3

SAMPLE PARAMETERS

SEDIMENT ANALYSIS

Inorganic Materials

Aluminum		
Antimony	Copper	Mercury
Arsenic	Fluoride	Nickel
Cadmium	Iron	Silver
Chromium	Lead	Zinc

Organic Materials

Pesticides
- Mirex
- Toxaphene
- DDT
- Aldrin
- Chlordane
- Other Chlorinated (DDE)

PCB

Oil & Grease

Phenols
- Phenol
- 2-chlorophenol
- 2,4-dichlorophenol
- 2,4,6-trichlorophenol
- 4-chloro-m-cresol
- 2,4-dinitrophenol
- pentachlorophenol

General Physical-Chemical

(Dry basis)

BOD
Nitrate
Phosphate
Specific Gravity
TKN
Total Organic Carbon
Total Phosphorous
Total Solids

Metals

Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Nickel, Silver and Zinc.

Heavy metals enter the estuarine environment from both natural weathering processes and anthropogenic sources. As fresh and brackish waters meet at the head of an estuary, various physico-chemical processes cause riverborne particulate matter to flocculate out of suspension. Thus, estuarine sediments act as a sink for heavy metals and other contaminants, reflecting the chemical composition of the drainage basin which this borders.

A commonly expressed concern with sediment bound metals is not necessarily acute toxicity to estuarine biota, but chronic effects that can occur if metals become incorporated into the estuarine food web via bio-concentration and bio-accumulation processes.

Toxic Organics: Pesticides (Aldrin, Toxaphene, DDT, Chlordane and Mirex)

These are organochlorine compounds that are somewhat refractory in the estuarine environment (the pesticides above are listed in order of decreasing toxicity to humans). Chlorinated hydrocarbons have low solubilities in natural waters and, therefore, will generally accumulate in sediments after they are introduced into estuarine waters.

Toxic Organics: PCBs and Phenols

Polychlorinated biphenyls (PCB) and phenols comprise a group of toxic compounds that have been chronically discharged into the aquatic environment.

Like chlorinated pesticides, PCBs are highly resistant to microbial degradation and can be assimilated into aquatic food webs. PCBs have low solubilities and tend to accumulate in estuarine sediments. Phenolic compounds are more labile and, therefore, more acutely toxic than chlorinated hydrocarbons.

Objectives

The objectives for the water quality study are to:

a.) Determine existing sedimentation rates (volume) from upstream sources adjacent to Blount Island.

b.) Determine quality of existing and future sediment loads, especially those associated with future land disturbing activities.

c.) Determine existing and potential future NPS loads and identify controls to minimize NPS impacts. These controls may include planning or regulatory intervention.

OVERVIEW OF NON-POINT SOURCE ANALYSIS

VI. OVERVIEW OF NON-POINT SOURCES ANALYSIS

Background and Methodology

Due to the relative scarcity of data pertaining to non-point sources within the study area, evaluation of non-point source impacts of development is a difficult proposition at best. The following computations and data treatment are generally based upon methods developed by the Engineering Division of the U. S. Soil Conservation Service. It should be kept in mind that some of these methods are still considered to be in a formative stage and provide only very generalized estimates of the effects of land use changes. They are not intended to fit all situations that may possibly arise, but they can provide information useful for planning purposes. There is still a need for more thorough understanding of the problems associated with the rapid conversion of land and for adequate technical procedures to assist planners in assessing the effects of changing land use patterns.

Water Sampling Methodology

Depth integrated water samples were collected at the four sites using the weighted bottle method as described in Brown and others, 1970. Samples of bottle material were collected by hand with an Ekman dredge type sampler. Samples were analyzed for a wide range of water quality constituents. Approximately 604 total determinations were performed on bottom material samples and 670 total determinations were performed on whole water samples.

The term "total" is used with these analyses to indicate that at least 95% of the substance present in an unfiltered sample was analyzed regardless of its physical or chemical speciation. "Total recoverable" means that the sample received mild acid digestion prior to analysis to solubilize readily dissolved substances. "Dissolved" substances are operationally defined as those that pass through a 0.45 micrometer (um) membrane filter.

Nitrogen and phosphorus species, color and turbidity were determined by the U. S. Geological Survey Water-Quality Service Unit in Ocala, Florida. All other laboratory determinations were performed by the U. S. Geological Survey National Water Quality Laboratory - Atlanta in Doraville, Georgia. Quality assurance data for determinations performed by NWQL-Atlanta can be found in Peart and others, 1983. Most of the analytical methods used for inorganic determinations are described in Skougstad and others, 1979, and Fishman and others, 1976. Organic methodology is given in Goerlitz and Brown, 1972. Additional references and copies of portions of these references are included in the Appendix.

Inventory and Analyze Non-Point Source Water Quality Data

Water quality data was collected at selected locations in the tributaries to the St. John's River in the port area.

Water sampling station locations were selected cooperatively with FDER for coordination with its sampling stations. Each sampling station location represents different types of watershed characteristics and complements the FDER study program as explained below:

- Dunn Creek - USGS has operated a water quality site on the headwaters. This site is above the point of non-reversing flow, downstream of Rushing Branch. The headwater station provided background data. This site measured contribution of non-point sources such as Sheffied Dairy.

- Drummond Creek - This watershed is adjacent to existing oil terminals and to the former municipal airport now used as an industrial park and to I-95. The watershed represents the largest developable land mass adjacent to port facilities outside of Blount Island.

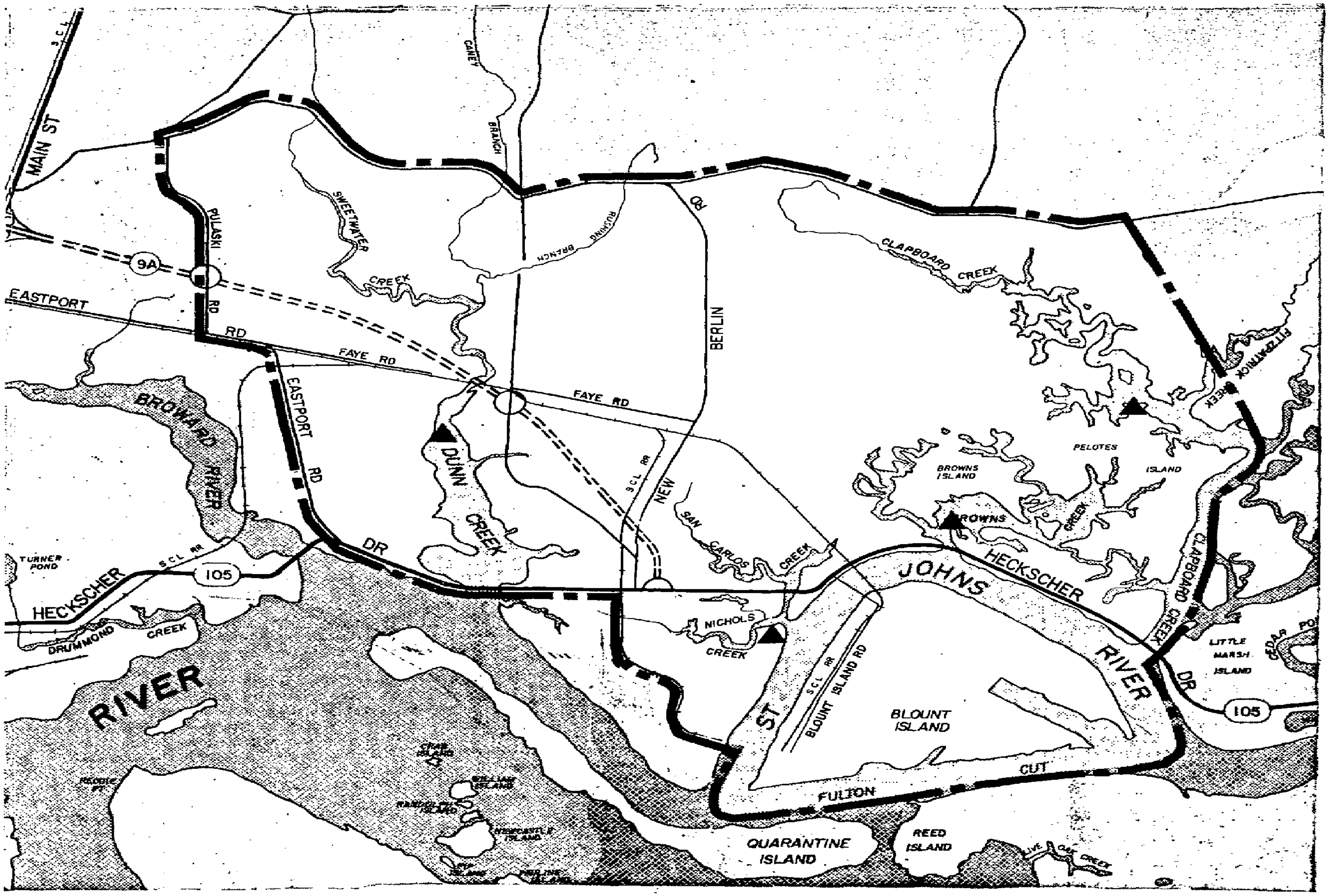
- Clapboard Creek - This watershed is typical of wetland conditions on tributaries within the port from Blount Island to the ocean. The interconnected streams and marshes represent the major natural areas and aquatic nurseries, identified as environmentally sensitive areas, and includes the only Class II waters in the county.

- Little Cedar Creek - his site is also adjacent to I-95.

New stream quality data was collected for the tributaries mentioned above. The sampling was designed to correlate sediment, suspended solids and water quality with high flow and low flow conditions. Data was collected six times during the year at approximately two month intervals.

Subbasins Within the Study Area

The total drainage (acreage) of the ten subbasins which have portions included in the study area are given in Table 4. Table 4 also gives the percentage of the entire drainage area encompassed by each respective subbasin. Table 5 gives the acreages of each subbasin within the study area and their respective percentages of the study area. Only five of the ten subbasins are fully within the study area; Terrapin Creek, Browns Creek, Nichols Creek, San Carlos Creek and Blount Island. Collectively, the areas included within the study area make up about 47 percent of the entire drainage area of the ten subbasins.



LEGEND

▲ NON-POINT SOURCE SAMPLING STATION

WATER SAMPLING SITES

WATERSHED STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

Scale:
1': 5,000'

JUNE, 1984

MAP 10

TOTAL DRAINAGE AREAS
OF BASINS IN STUDY AREA

SUBBASIN	ACRES	% OF TOTAL DRAINAGE AREA
BLOUNT ISLAND	2844.06	8.21
BROWNS CREEK	3220.58	9.31
CANEY BRANCH	2022.40	5.84
CLAPBOARD CREEK	12800.00	36.99
DUNNS CREEK	8704.00	25.15
NICHOLS CREEK	468.99	1.36
RUSHING BRANCH	972.80	2.81
SAMPLE SWAMP	1542.40	4.46
SAN CARLOS CREEK	805.15	2.33
TERRAPIN CREEK	1226.42	3.54
	34606.80	100.00

TABLE 4 TOTAL DRAINAGE AREAS OF SUBBBASINS IN STUDY AREA.

DRAINAGE AREAS WITHIN STUDY AREA

SUBBASIN	ACRES IN STUDY AREA	% OF STUDY AREA	% OF SUBBASIN IN STUDY AREA
BLOUNT ISLAND	2844.06	17.67	100.00
BROWNS CREEK	3220.58	20.01	100.00
CANEY BRANCH	268.60	1.67	13.28
CLAPBOARD CREEK	2139.63	13.29	16.72
DUNNS CREEK	4443.73	27.61	51.05
NICHOLS CREEK	468.99	2.91	100.00
RUSHING BRANCH	603.34	3.75	62.02
SAMPLE SWAMP	76.42	0.47	4.95
SAN CARLOS CREEK	805.15	5.00	100.00
TERRAPIN CREEK	1226.42	7.62	100.00
	-------	-----	
	16096.70	100.00	

TABLE 5. DRAINAGE AREAS WITHIN STUDY AREA.

Existing Land Use and Proposed Land Use Alternatives

This section presents a further analysis of the existing land use in the study area, and presents two alternative land use plans. These land use analyses are the steps necessary in the modeling assessments of sediment loading that provide indications of the amount of impervious surface and the types of pollutants associated with a particular use. Existing land use was discussed previously in this section, in detail.

Alternatives I and II were used as examples of a possible future development scenario in order to show the possibility of different sediment loadings, amounts and types of non-point source pollution associated with different land uses.

Proposed Land Use - Alternative I - (Proposed I)

Table 6 shows the proposed land use by acreage in each watershed area as suggested in the Northside Community Plan.

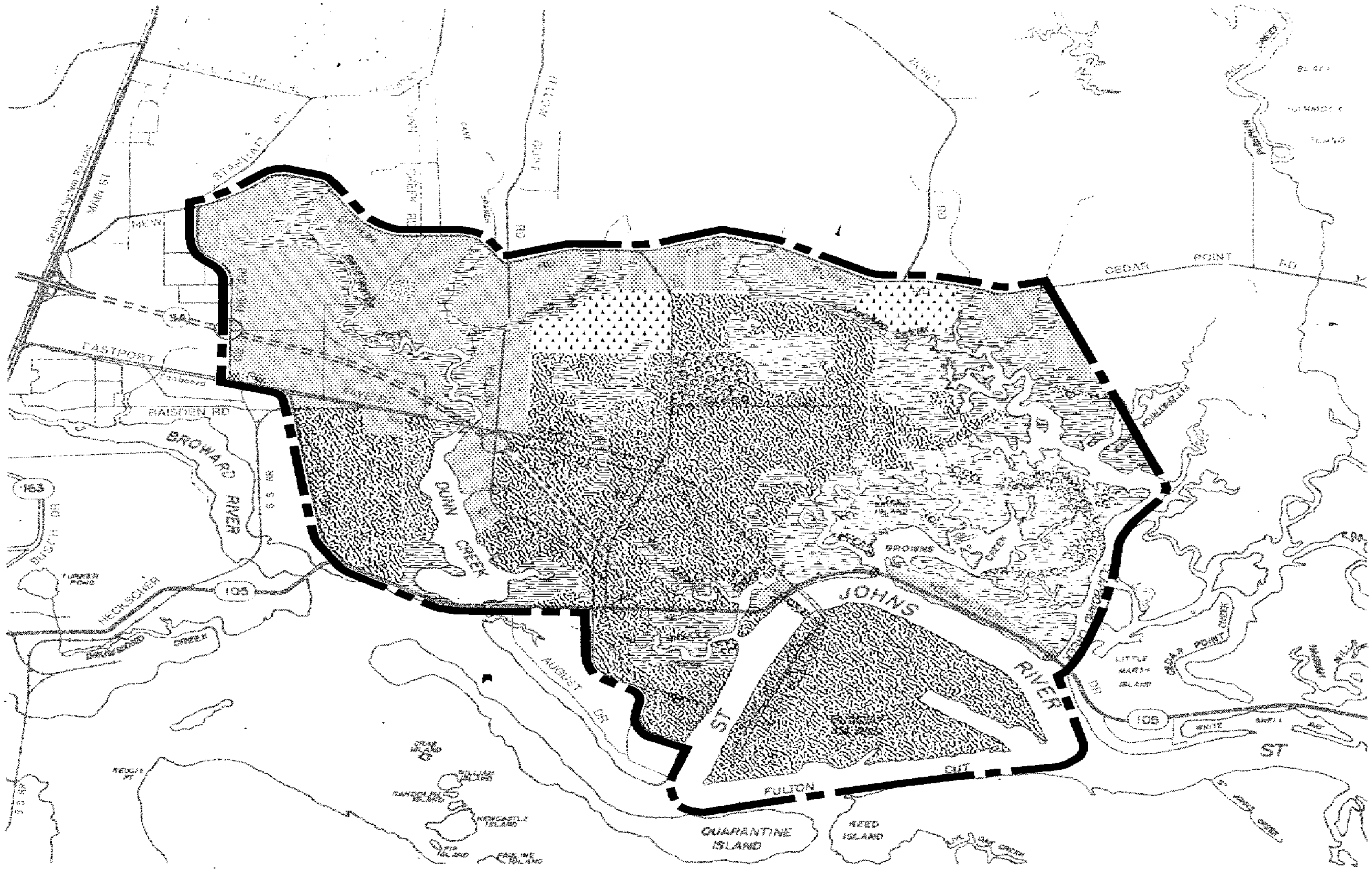
This proposed land use plan suggests large areas of industrial land use in and around Blount Island, on Dames Point and on either side of Dunns Creek. The majority of the residential land use is confined to the northwestern corner of the study area. This plan suggests no development in swamp and marsh areas within the salt marsh.

Proposed Land Use Plan - Alternative II - (Proposed II)

Table 7 shows the acreage of an alternative land use proposal.

Heckscher Drive has been dedicated as a scenic route by the Jacksonville City Council and, therefore, industrial uses have been limited along Heckscher Drive. Industrial uses have also been limited along Dunns Creek and Dames Point. Residential land use has been suggested in these areas.

Commercial land use has been suggested at the new interchanges of State Road 9-A at Eastport Road, Fay Road and Heckscher Drive. In addition, provision for open space has been made at the edge of the new coal fired power plan and the salt marsh.



LEGEND

	RESIDENTIAL
	COMMERCIAL
	INDUSTRIAL
	INSTITUTIONAL
	AGRICULTURE
	PARK / OPEN SPACE
	SWAMP / MARSH

PROPOSED LAND USE ALTERNATIVE I

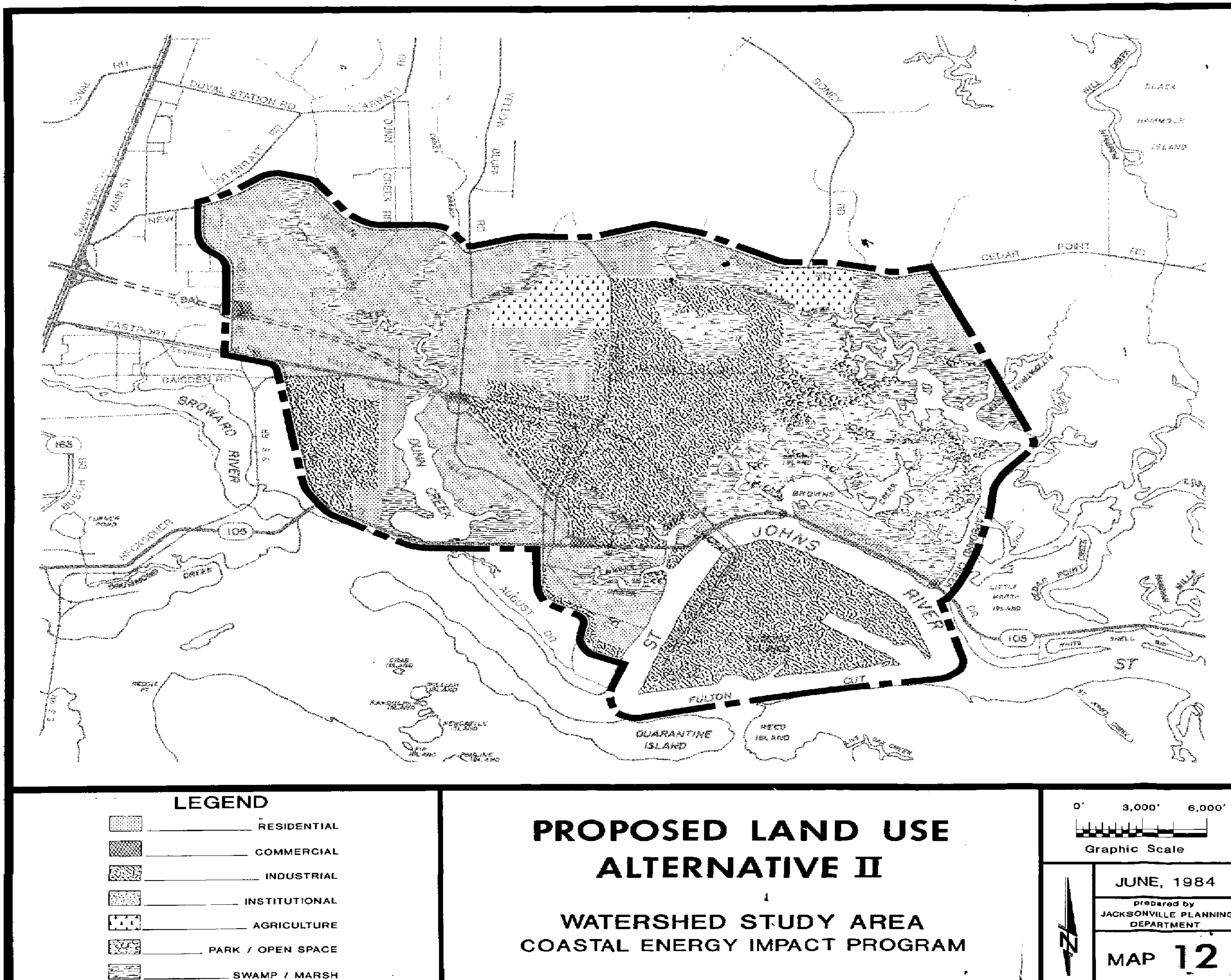
WATERSHED STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

0' 3,000' 6,000'
Graphic Scale

JUNE, 1984

prepared by
JACKSONVILLE PLANNING DEPARTMENT

MAP 11



PROPOSED LAND USE ALTERNATIVE II

WATERSHED STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

0' 3,000' 6,000'
Graphic Scale

JUNE, 1984

prepared by
JACKSONVILLE PLANNING DEPARTMENT

MAP 12

TABLE 6

Proposed Land Use Alternative I

SUBBASINS	40	49	50	51	53	54	"G"	Blount Island	Clapboard Creek	TOTAL
LAND USES:										
RESIDENTIAL	181.97	194.37	52.02	150.88	14.46	270.63	2414.44	66.11	145.34	3490.22
COMMERCIAL	4.13					8.26	33.63		4.13	50.15
INDUSTRIAL	2.07	213.00	2.07	882.11	238.92	1761.78	941.81	1611.75	270.66	5924.17
AGRICULTURAL		-0-	-0-	-0-					183.88	183.88
PARK/OPEN SPACE					6.20	348.76		8.26	82.65	445.87
SWAMP/MARSH	61.56	144.08	0.26	162.68	162.89	1259.30	541.58	6.20	1003.97	3340.52
WATER	.42	.55		.40	37.2	334.7	417.3	1126.0	427.0	2343.65
INSTITUTIONAL							18.0			18.0
ROADS - PAVED	18.45	51.34	14.07	29.35	19.10	41.24	74.56	23.9	22.0	294.01
RAILROADS				.92	.22	1.06	2.41	1.04		6.45
TOTAL	268.60	603.34	76.42	1226.42	460.99	4025.73	4443.73	2844.06	2139.63	16096.92 (16097)

TABLE 7

Proposed Land Use Alternative II

SUBBASINS	48	49	50	51	53	54	"G"	BLOUNT ISLAND	CLAPBOARD	TOTAL
LAND USES:										
RESIDENTIAL	181.74	416.00	53.91	390.69	108.08	124.09	2538.42	138.02	65.07	4016.02
COMMERCIAL					27.76	1.99	25.55		1.88	57.18
INDUSTRIAL		7.55		561.77	103.01	1659.08	796.01	1476.28	333.90	4937.60
INSTITUTIONAL							18.00			18.00
AGRICULTURE		-0-	-0-	-0-					158.70	158.70
PARK/OPEN SPACE					6.20	558.12		6.20	112.38	682.90
SWAMP/MARSH	61.56	144.08	8.26	162.68	152.89	1259.30	541.58	6.20	1003.97	3340.52
WATER	.42	.55		.48	37.2	334.70	417.30	1126.00	427.00	2343.65
ROADS	24.88	35.16	14.25	109.88	33.63	87.39	104.46	89.52	36.73	535.90
RAILROADS				.92	.22	1.06	2.41	1.84		6.45
TOTAL	268.60	603.34	76.42	1226.42	468.99	4025.73	4443.73	2844.06	2139.63	16096.92 (16097.00)*

* Rounded

Results of Land Use Alternatives by Subbasins

Tables 8 through 17 give the future land use distributions proposed by the Jacksonville Planning Department for the portions of all of the subbasins contained within the study area. Total build out is assumed. Also given are the Soil Conservation Service curve numbers (CN) for present and proposed conditions and the impervious area acreage. The curve numbers and impervious areas were estimated using procedures outlined in Chapter 2 of U. S. Soil Conservation Service Technical Release No. 55 (U. S. Soil Conservation Service, 1975). The soil-cover complex curve numbers are general indicators of the amount of direct runoff per unit of rainfall. High CN's correspond to high runoff rates and low CN's to lower rates. Hydrologic soil groups were determined from soil series and distribution information published by the Soil Conservation Service (U. S. Soil Conservation Service, 1978). The largest changes in curve number from present to proposed conditions generally occur in four subbasins entirely contained within the study area; Blount Island, Nichols Creek, San Carlos Creek and Terrapin Creek. The greatest proportion of development proposed for the study area is projected for these basins and the greater effects would be expected in them. Only minimal changes are projected for Browns Creek, Caney Branch, Clapboard Creek and Dunns Creek. Little changes in runoff volumes are expected from these areas.

Runoff - With and Without Retention

Point rainfall depths for 24 hour storms with various recurrence intervals are given in Table 18. These are taken from U. S. Army Corps of Engineers information (U. S. Army Corps of Engineers, 1980). On the basis of these figures and the previously discussed soil-cover complex curve numbers, runoff quantities in inches can be computed for each of the subbasin areas under the different land use patterns. Table 19 shows the runoff quantities computed for each subbasin with present land usage. Runoff quantities under Proposed I Conditions are given without allowance for retention storage in Table 20. The figures show that substantial increases would be expected for all of the subbasins except Browns Creek, Clapboard Creek and Dunns Creek. Table 21 shows runoff quantities computed with the assumption that the first inch of runoff from newly developed areas under Proposed I Conditions would be retained in storage. With this assumption, large increases

BLOUNT ISLAND - PROPOSED LAND USE CHANGES

LAND USE	PRESENT ACRES	PRESENT % OF BASIN	PROPOSED I ACRES	PROPOSED I % OF BASIN	PROPOSED II ACRES	PROPOSED II % OF BASIN
RESIDENTIAL	47.52	1.67	66.11	2.32	138.02	4.85
INDUSTRIAL	270.66	9.52	1611.75	56.67	1476.01	51.90
PARK/OPEN	8.26	0.29	8.26	0.29	6.20	0.22
SWAMP/MARSH	6.20	0.22	6.20	0.22	6.20	0.22
WATER	1126.00	39.59	1126.00	39.59	1126.00	39.59
UNDEVELOPED	1370.85	48.20	0.00	0.00	0.00	0.00
ROADS	12.73	0.45	23.90	0.85	89.52	3.16
RAILROADS	1.84	0.06	1.84	0.06	1.84	0.06
	2844.06	100.00	2844.06	100.00	2844.06	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	79	221.87	7.80
PROPOSED I	92	1204.19	42.34
PROPOSED II	92	1193.66	41.97

TABLE 8 BLOUNT ISLAND LAND USE CHANGES

BROWNS CREEK - PROPOSED LAND USE CHANGES

LAND USE	PRESENT ACRES	PRESENT % OF BASIN	PROPOSED I ACRES	PROPOSED I % OF BASIN	PROPOSED II ACRES	PROPOSED II % OF BASIN
RESIDENTIAL	42.98	1.33	230.94	7.17	113.35	3.52
INDUSTRIAL	1204.25	37.39	1411.07	43.81	1279.42	39.73
PARK/OPEN	0.00	0.00	348.76	10.83	558.12	17.33
SWAMP/MARSH	852.80	26.48	852.80	26.48	852.80	26.48
WATER	334.70	10.39	334.70	10.39	334.70	10.39
UNDEVELOPED	762.20	23.67	0.00	0.00	0.00	0.00
ROADS	14.33	0.45	32.99	1.03	79.14	2.46
RAILROADS	1.06	0.03	1.06	0.03	1.06	0.03
COMMERCIAL	8.26	0.26	8.26	0.26	1.99	0.06
	3220.58	100.00	3220.58	100.00	3220.58	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	75	901.31	27.99
PROPOSED I	78	1125.26	34.94
PROPOSED II	77	1036.02	32.17

TABLE 9 BROWNS CREEK LAND USE CHANGES

CANEY BRANCH - PROPOSED LAND USE CHANGES

LAND USE	PRESENT ACRES	PRESENT % OF BASIN	PROPOSED I ACRES	PROPOSED I % OF BASIN	PROPOSED II ACRES	PROPOSED II % OF BASIN
RESIDENTIAL	109.50	40.77	181.97	67.75	181.74	67.66
INDUSTRIAL	2.07	0.77	2.07	0.77	0.00	0.00
PARK/OPEN	6.20	2.31	0.00	0.00	0.00	0.00
SWAMP/MARSH	61.56	22.92	61.56	22.92	61.56	22.92
WATER	0.42	0.16	0.42	0.16	0.42	0.16
UNDEVELOPED	78.32	29.16	0.00	0.00	0.00	0.00
ROADS	6.40	2.37	18.45	6.86	24.88	9.26
RAILROADS	0.00	0.00	0.00	0.00	0.00	0.00
COMMERCIAL	4.13	1.54	4.13	1.54	0.00	0.00
	268.60	100.00	268.60	100.00	268.60	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	60	44.25	16.47
PROPOSED I	65	78.04	29.05
PROPOSED II	65	79.40	29.56

TABLE 10 CANEY BRANCH LAND USE CHANGES

CLAPBOARD CREEK- PROPOSED LAND USE CHANGES

LAND USE	PRESENT ACRES	PRESENT % OF BASIN	PROPOSED I ACRES	PROPOSED I % OF BASIN	PROPOSED II ACRES	PROPOSED II % OF BASIN
RESIDENTIAL	57.85	2.70	145.34	6.79	65.07	3.04
INDUSTRIAL	330.58	15.45	270.66	12.65	333.90	15.61
PARK/OPEN	0.00	0.00	82.65	3.86	112.38	5.25
SWAMP/MARSH	1003.97	46.92	1003.97	46.92	1003.97	46.92
WATER	427.00	19.96	427.00	19.96	427.00	19.96
UNDEVELOPED	124.95	5.84	0.00	0.00	0.00	0.00
ROADS	7.27	0.35	22.00	1.04	36.73	1.77
AGRICULTURE	183.88	8.59	183.88	8.59	158.70	7.42
COMMERCIAL	4.13	0.19	4.13	0.19	1.88	0.09
	2139.63	100.00	2139.63	100.00	2139.63	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	77	266.15	12.44
PROPOSED I	78	263.99	12.34
PROPOSED II	78	298.26	13.94

TABLE 11 CLAPBOARD CREEK LAND USE CHANGES

DUNNS CREEK - PROPOSED LAND USE CHANGES

LAND USE	PRESENT ACRES	PRESENT % OF BASIN	PROPOSED I ACRES	PROPOSED I % OF BASIN	PROPOSED II ACRES	PROPOSED II % OF BASIN
RESIDENTIAL	2414.44	54.30	2414.44	54.30	2538.42	57.10
INDUSTRIAL	737.03	16.60	941.81	21.20	796.01	17.90
INSTITUTIONAL	0.00	0.00	18.00	0.40	18.00	0.40
SWAMP/MARSH	541.58	12.20	541.58	12.20	541.58	12.20
WATER	417.30	9.40	417.30	9.40	417.30	9.40
UNDEVELOPED	242.20	5.40	0.00	0.00	0.00	0.00
ROADS	55.14	1.20	74.56	1.60	104.46	2.30
RAILROADS	2.41	0.10	2.41	0.10	2.41	0.10
COMMERCIAL	33.63	0.80	33.63	0.80	25.55	0.60
	4443.73	100.00	4443.73	100.00	4443.73	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	73	1338.72	30.13
PROPOSED I	74	1505.58	33.88
PROPOSED II	73	1460.84	32.87

TABLE 12 DUNNS CREEK LAND USE CHANGES

NICHOLS CREEK - PROPOSED LAND USE CHANGES

LAND USE	PRESENT		PROPOSED I		PROPOSED II	
	ACRES	% OF BASIN	ACRES	% OF BASIN	ACRES	% OF BASIN
RESIDENTIAL	14.46	3.08	14.46	3.08	108.08	23.04
INDUSTRIAL	12.40	2.64	238.92	50.94	103.01	21.96
PARK/OPEN	0.00	0.00	6.20	1.32	6.20	1.32
SWAMP/MARSH	159.89	32.60	159.89	32.60	159.89	32.60
WATER	37.20	7.93	37.20	7.93	37.20	7.93
UNDEVELOPED	246.24	52.50	0.00	0.00	0.00	0.00
ROADS	5.58	1.19	19.10	4.07	33.63	7.17
RAILROADS	0.22	0.06	0.22	0.06	0.22	0.06
COMMERCIAL	0.00	0.00	0.00	0.00	27.76	5.92
	468.99	100.00	468.99	100.00	468.99	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	69	18.85	4.01
PROPOSED I	84	195.47	41.70
PROPOSED II	80	163.82	34.90

TABLE 13 NICHOLS CREEK LAND USE CHANGES

RUSHING BRANCH - PROPOSED LAND USE CHANGES

LAND USE	PRESENT ACRES	PRESENT % OF BASIN	PROPOSED I ACRES	PROPOSED I % OF BASIN	PROPOSED II ACRES	PROPOSED II % OF BASIN
RESIDENTIAL	92.98	15.41	194.37	32.22	416.00	68.95
INDUSTRIAL	0.00	0.00	213.00	35.30	7.55	1.25
AGRICULTURE	177.69	29.45	0.00	0.00	0.00	0.00
SWAMP/MARSH	144.08	23.88	144.08	23.88	144.08	23.88
WATER	0.55	0.09	0.55	0.09	0.55	0.09
UNDEVELOPED	183.21	30.37	0.00	0.00	0.00	0.00
ROADS	4.83	0.80	51.34	8.51	35.16	5.83
	603.34	100.00	603.34	100.00	603.34	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	54	32.72	5.42
PROPOSED I	73	263.01	43.59
PROPOSED II	67	136.07	22.55

TABLE 14 RUSHING BRANCH LAND USE CHANGES

SAMPLE SWAMP - PROPOSED LAND USE CHANGES

LAND USE	PRESENT ACRES	PRESENT % OF BASIN	PROPOSED I ACRES	PROPOSED I % OF BASIN	PROPOSED II ACRES	PROPOSED II % OF BASIN
RESIDENTIAL	10.33	13.52	52.02	68.07	53.91	70.54
INDUSTRIAL	0.00	0.00	2.07	2.71	0.00	0.00
AGRICULTURE	0.00	0.00	0.00	0.00	0.00	0.00
SWAMP/MARSH	8.26	10.81	8.26	10.81	8.26	10.81
WATER	0.00	0.00	0.00	0.00	0.00	0.00
UNDEVELOPED	53.96	70.61	0.00	0.00	0.00	0.00
ROADS	3.87	5.06	14.07	18.41	14.25	18.65
	76.42	100.00	76.42	100.00	76.42	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	46	6.97	9.12
PROPOSED I	67	31.17	40.79
PROPOSED II	67	34.82	45.56

TABLE 15 SAMPLE SWAMP LAND USE CHANGES

SAN CARLOS CREEK - PROPOSED LAND USE CHANGES

LAND USE	PRESENT ACRES	PRESENT % OF BASIN	PROPOSED I ACRES	PROPOSED I % OF BASIN	PROPOSED II ACRES	PROPOSED II % OF BASIN
RESIDENTIAL	10.74	1.33	39.69	4.93	10.74	1.33
INDUSTRIAL	200.71	24.93	350.71	43.56	379.66	47.16
AGRICULTURE	0.00	0.00	0.00	0.00	0.00	0.00
SWAMP/MARSH	406.50	50.49	406.50	50.49	406.50	50.49
WATER	0.00	0.00	0.00	0.00	0.00	0.00
UNDEVELOPED	183.62	22.81	0.00	0.00	0.00	0.00
ROADS	3.58	0.44	8.25	1.02	8.25	1.02
	805.15	100.00	805.15	100.00	805.15	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	74	151.00	18.79
PROPOSED I	81	272.67	33.80
PROPOSED II	81	274.00	34.00

TABLE 16 SAN CARLOS CREEK LAND USE CHANGES

TERRAPIN CREEK - PROPOSED LAND USE CHANGES

LAND USE	PRESENT		PROPOSED I		PROPOSED II	
	ACRES	% OF BASIN	ACRES	% OF BASIN	ACRES	% OF BASIN
RESIDENTIAL	26.86	2.19	150.88	12.33	390.69	31.86
INDUSTRIAL	8.26	0.67	882.11	71.90	561.77	45.80
AGRICULTURE	109.50	8.93	0.00	0.00	0.00	0.00
SWAMP/MARSH	162.68	13.26	162.68	13.26	162.68	13.26
WATER	0.48	0.04	0.48	0.04	0.48	0.04
UNDEVELOPED	907.10	73.96	0.00	0.00	0.00	0.00
ROADS	10.62	0.87	29.35	2.39	109.88	8.96
RAILROADS	0.92	0.08	0.92	0.08	0.92	0.08
	1226.42	100.00	1226.42	100.00	1226.42	100.00

CONDITIONS	SCS CURVE NUMBER	IMPERVIOUS AREA, IN ACRES	% OF BASIN IMPERVIOUS
PRESENT	57	26.80	2.19
PROPOSED I	81	709.70	57.90
PROPOSED II	78	631.60	51.50

TABLE 17 TERRAPIN CREEK LAND USE CHANGES

POINT RAINFALL DEPTH - 24 HOUR STORM

EAST DUVAL COUNTY, FLORIDA

RECURRENCE INTERVAL	RAINFALL, IN INCHES
5 - YEAR	6.14
10 - YEAR	7.30
25 - YEAR	8.70
100 - YEAR	10.90
500 - YEAR	13.50

TABLE 18 POINT RAINFALL DEPTH, EAST DUVAL COUNTY, FLORIDA

RUNOFF FROM SUBBASINS IN STUDY AREA
PRESENT LAND USE

SUBBASIN	RUNOFF, IN INCHES		
	5 YR. STORM	10 YR. STORM	25 YR. STORM
BLOUNT ISLAND	3.80	4.86	6.16
BROWNS CREEK	3.40	4.41	5.68
CANEY BRANCH	2.01	2.82	3.87
CLAPBOARD CREEK	3.60	4.64	5.92
DUNNS CREEK	3.20	4.19	5.43
NICHOLS CREEK	2.82	3.76	4.95
RUSHING BRANCH	1.52	2.22	3.15
SAMPLE SWAMP	0.98	1.47	2.23
SAN CARLOS CREEK	3.30	4.31	5.56
TERRAPIN CREEK	1.76	2.51	3.51

TABLE 19 RUNOFF FROM STUDY AREA, PRESENT LAND USE

RUNOFF FROM SUBBASINS IN STUDY AREA
PROPOSED I LAND USE - NO RETENTION

SUBBASIN	RUNOFF, IN INCHES		
	5 YR. STORM	10 YR. STORM	25 YR. STORM
BLOUNT ISLAND	5.21	6.35	7.74
BROWNS CREEK	3.70	4.75	6.04
CANEY BRANCH	2.45	3.34	4.47
CLAPBOARD CREEK	3.70	4.75	6.04
DUNNS CREEK	3.30	4.31	5.56
NICHOLS CREEK	4.33	5.43	6.77
RUSHING BRANCH	3.20	4.19	5.43
SAMPLE SWAMP	2.63	3.55	4.71
SAN CARLOS CREEK	4.01	5.08	6.40
TERRAPIN CREEK	4.01	5.08	6.41

TABLE 20 RUNOFF FROM STUDY AREA, PROPOSED I LAND USE - NO RETENTION

RUNOFF FROM SUBBASINS IN STUDY AREA
PROPOSED I LAND USE - RETENTION OF
FIRST INCH OF RUNOFF FROM NEW IMPERVIOUS
AREAS

SUBBASIN	RUNOFF, IN INCHES		
	5 YR. STORM	10 YR. STORM	25 YR. STORM
BLOUNT ISLAND	4.73	5.87	7.26
BROWNS CREEK	3.46	4.51	5.80
CANEY BRANCH	2.15	3.04	4.17
CLAPBOARD CREEK	3.65	4.69	5.98
DUNNS CREEK	3.25	4.09	5.27
NICHOLS CREEK	3.86	4.96	6.29
RUSHING BRANCH	2.90	3.89	5.13
SAMPLE SWAMP	1.92	2.84	4.00
SAN CARLOS CREEK	3.79	4.86	6.18
TERRAPIN CREEK	3.20	4.26	5.59

TABLE 21 RUNOFF FROM STUDY AREA, PROPOSED I LAND USE - WITH RETENTION OF FIRST INCH OF RUNOFF FROM NEW IMPERVIOUS AREAS

would be limited to the Blount Island, Nichols Creek, Rushing Branch, Sample Swamp, San Carlos Creek and Terrapin Creek areas. Table 22 gives the runoff quantities under Proposed II Conditions without retention storage. The corresponding figures with retention of the first inch of runoff are given in Table 23. In general, runoff quantities are lower under Proposed II Conditions reflecting the smaller proportion of industrial development under that approach.

Total Runoff and Peak Discharge

The total runoff expected from the study area in acre-feet of water for the 5 year, 10 year, and 25 year storms with and without retention of the first inch of runoff from newly developed areas is given in Table 24. Without retention, the figures indicate that a roughly 18 to 22 percent increase in runoff from these magnitude storms could be expected. Increases from smaller magnitude events would be expected to be smaller percentages because abstraction would constitute a greater proportion of the total. Retention of the first inch of runoff would decrease the percentage increase from 9 to 13 percent for the large storms. The effect of retention would be greater for smaller magnitude storms because the retention storage would constitute a larger proportion of the total.

One of the noticeable effects of urbanization in rural watersheds is the increase in peak discharges from the basin due to the enhanced drainage efficiency provided by urban structures. The general magnitude of these increases can be estimated using methods outlined in U. S. Soil Conservation Service Technical Release No. 55. Because these estimates require land use input for entire basins, only those subbasins totally included within the study area were examined with respect to peak discharges. The resulting figures are given in Table 25, both with and without retention of the first inch of runoff from newly developed areas. Browns Creek is not included because no changes would be projected there due to the insignificant change in soil cover-complex curve number. The figures generally indicate that substantial increases in peak discharges would be expected from all of these subbasins in the absence of control structures. Retention storage of the first inch of runoff would lessen the increases by as much as 60 percent, however, substantial increases could still be expected. As was the case with the total runoff figures, the effect of the retention would increase with smaller storms.

RUNOFF FROM SUBBASINS IN STUDY AREA
PROPOSED II LAND USE - NO RETENTION

SUBBASIN	RUNOFF, IN INCHES 5 YR. STORM	10 YR. STORM	25 YR. STORM
BLOUNT ISLAND	5.21	6.35	7.74
BROWNS CREEK	3.60	4.64	5.92
CANEY BRANCH	2.45	3.34	4.47
CLAPBOARD CREEK	3.70	4.75	6.04
DUNNS CREEK	3.20	4.19	5.43
NICHOLS. CREEK	3.91	4.97	6.28
RUSHING BRANCH	2.63	3.55	4.71
SAMPLE SWAMP	2.63	3.55	4.71
SAN CARLOS CREEK	4.01	5.08	6.40
TERRAPIN CREEK	3.70	4.75	6.04

TABLE 22 RUNOFF FROM STUDY AREA, PROPOSED II LAND USE - NO RETENTION

RUNOFF FROM SUBBASINS IN STUDY AREA
PROPOSED II LAND USE - WITH RETENTION
OF FIRST INCH OF RUNOFF FROM NEW IMPERVIOUS
AREAS

SUBBASIN	RUNOFF, IN INCHES		
	5 YR. STORM	10 YR. STORM	25 YR. STORM
BLOUNT ISLAND	4.73	5.87	7.26
BROWNS CREEK	3.37	4.40	5.69
CANEY BRANCH	2.15	3.04	4.17
CLAPBOARD CREEK	3.65	4.69	5.98
DUNNS CREEK	3.14	4.18	5.37
NICHOLS CREEK	3.46	4.57	5.83
RUSHING BRANCH	2.33	3.25	4.41
SAMPLE SWAMP	1.92	2.84	4.00
SAN CARLOS CREEK	3.79	4.86	6.18
TERRAPIN CREEK	2.95	4.01	5.29

TABLE 23 RUNOFF FROM STUDY AREA, PROPOSED II LAND USE - WITH RETENTION OF FIRST INCH OF RUNOFF FROM NEW IMPERVOIUS AREAS

TOTAL RUNOFF FROM THE STUDY AREA
IN ACRE-FEET

LAND USE CONDITIONS	WITH RETENTION 5 YR.	10 YR.	25 YR.	NO RETENTION 5 YR.	10 YR.	25 YR.
PRESENT	4280	5590	7230	4280	5590	7230
PROPOSED I	4840	6290	7900	5220	6630	8380
PROPOSED II	4700	6120	7820	5050	6450	8170

TABLE 24 TOTAL RUNOFF FROM STUDY AREA IN ACRE FEET

PEAK DISCHARGES - NO RETENTION

SUBBASIN	PRESENT 5 YR.	PRESENT 10 YR.	PROPOSED I 5 YR	PROPOSED I 10 YR.	PROPOSED II 5 YR.	PROPOSED II 10 YR.
	PEAK DISCHARGE, IN CFS					
BLOUNT ISLAND	1220	1580	2780	3420	2780	3420
NICHOLS CREEK	90	120	250	320	200	270
SAN CARLOS CREEK	160	220	270	360	270	360
TERRAPIN CREEK	110	170	670	880	500	670

PEAK DISCHARGES - RETENTION OF FIRST INCH OF RUNOFF FROM NEWLY DEVELOPED AREAS

SUBBASIN	PRESENT 5 YR.	PRESENT 10 YR.	PROPOSED I 5 YR.	PROPOSED I 10 YR.	PROPOSED II 5 YR.	PROPOSED II 10 YR.
	PEAK DISCHARGE, IN CFS					
BLOUNT ISLAND	1220	1580	1720	2120	1720	2120
NICHOLS CREEK	90	120	180	270	140	190
SAN CARLOS CREEK	160	220	220	290	220	290
TERRAPIN CREEK	110	170	430	600	360	500

TABLE 25 PEAK DISCHARGES FROM SUBBASINS, WITH AND WITHOUT RETENTION

Estimated Annual Sediment Loss

Estimates of annual sediment losses for each of the subbasins within the study area and for the study area as a whole are given in Table 26. These estimates are based upon the Universal Soil Loss Equation. The method does not provide for quantitative estimates of the effects of retention structures and so these are not included. The figures are useful in showing the general effects of development on soil losses from the study area. As the figures show, there would be essentially no difference between the two proposed development plans with respect to soil losses. They also indicate that the estimated sediment losses could be increase by about 17 percent by development. Retention storage could reduce these losses both by trapping a portion of sediment load and by reducing peak discharges.

Estimated Average Loading Rates

Table 27 gives generalized rates of pollutant accumulation in pounds per acre per day for various land uses. These data were taken from U. S. Army Corps of Engineers figures (U. S. Army Corps of Engineers, 1980) and are comparable to rates given in Wanielista, 1978. Rates are given for only four constituents, however, these can be considered indicative of the effects of development. Other pollutant categories would be expected to follow much the same patterns exhibited by these.

Estimated average loadings for each of the subbasins in the study area under present land use are given in Table 28. Table 29 gives loading rates under Proposed I Conditions and Proposed II Conditions are shown in Table 30. The figures show that increased loading rates would be expected for almost all of the study area due to development. The lowest increases would be for the Browns Creek, Clapboard Creek and Dunns Creek basins. Substantial increases are projected for the remainder of the study area, especially Blount Island, Nichols Creek, Rushing Branch and Terrapin Creek.

Estimated total average daily loading for the entire study area is shown in Table 31. As shown, Proposed II Conditions would be expected to result in slightly lower loading rates than Proposed I Conditions, but still show a substantial increase over present conditions.

Table 32 gives average concentrations in milligrams per liter computed using the assumptions of total washoff of a six day accumulation of pollutants by a 24 hour 5 year storm

ESTIMATED ANNUAL SEDIMENT LOSS FROM UNIVERSAL
SOIL LOSS EQUATION
IN TONS PER YEAR

SUBBASIN	PRESENT	PROPOSED I	PROPOSED III
BLOUNT ISLAND	530	660	660
BROWNS CREEK	450	530	530
CANEY BRANCH	30	30	30
CLAPBOARD CREEK	620	620	620
DUNNS CREEK	2600	2900	2900
NICHOLS CREEK	60	100	100
RUSHING BRANCH	150	190	190
SAMPLE SWAMP	1	2	2
SAN CARLOS CREEK	110	130	130
TERRAPIN CREEK	220	390	390
TOTALS	4771	5552	5552

TABLE 26 ESTIMATED ANNUAL SOIL LOSSES FOR STUDY AREA.

AVERAGE POLLUTANT ACCUMULATION RATES,
IN POUNDS/ACRE/DAY

LAND USE	TOTAL SUSPENDED SOLIDS	SETTLEABLE SOLIDS	TOTAL NITROGEN	TOTAL PHOSPHORUS
RESIDENTIAL	2.00	1.000	0.0150	0.0040
COMMERCIAL	3.00	1.500	0.0300	0.0070
INDUSTRIAL	2.00	1.000	0.0500	0.0130
FOREST	0.07	0.035	0.0060	0.0003
AGRICULTURAL	1.00	0.500	0.0300	0.0060

TABLE 27. AVERAGE POLLUTANT ACCUMULATION RATES.

ESTIMATED AVERAGE LOADING RATES - PRESENT CONDITIONS, IN POUNDS/ACRE/DAY

SUBBASIN	TOTAL SOLIDS	SETTLEABLE SOLIDS	TOTAL NITROGEN	TOTAL PHOSPHORUS
BLOUNT ISLAND	0.177	0.089	0.0080	0.0015
BROWNS CREEK	0.831	0.416	0.0219	0.0051
CANEY BRANCH	0.985	0.493	0.0109	0.0022
CLAPBOARD CREEK	0.502	0.251	0.0140	0.0028
DUNNS CREEK	1.492	0.746	0.0181	0.0045
NICHOLS CREEK	0.211	0.105	0.0070	0.0008
RUSHING BRANCH	0.665	0.333	0.0146	0.0026
SAMPLE SWAMP	0.479	0.240	0.0084	0.0011
SAN CARLOS CREEK	0.590	0.295	0.0170	0.0035
TERRAPIN CREEK	0.235	0.118	0.0090	0.0010

TABLE 28 ESTIMATED AVERAGE DAILY LOADINGS - PRESENT LAND USE

ESTIMATED AVERAGE LOADING RATES - PROPOSED I CONDITIONS, IN POUNDS/ACRE/DAY

SUBBASIN	TOTAL SOLIDS	SETTLEABLE SOLIDS	TOTAL NITROGEN	TOTAL PHOSPHORUS
BLOUNT ISLAND	1.210	0.605	0.0291	0.0075
BROWNS CREEK	1.085	0.543	0.0260	0.0061
CANEY BRANCH	1.639	0.820	0.0140	0.0035
CLAPBOARD CREEK	0.547	0.273	0.0130	0.0027
DUNNS CREEK	1.594	0.797	0.0200	0.0051
NICHOLS CREEK	1.240	0.620	0.0290	0.0070
RUSHING BRANCH	1.622	0.811	0.0260	0.0065
SAMPLE SWAMP	1.984	0.992	0.0180	0.0044
SAN CARLOS CREEK	1.036	0.518	0.0260	0.0062
TERRAPIN CREEK	1.767	0.884	0.0390	0.0100

TABLE 29 ESTIMATED AVERAGE DAILY LOADINGS - PROPOSED I LAND USE

ESTIMATED AVERAGE LOADING RATES - PROPOSED II CONDITIONS, IN POUNDS/ACRE/DAY

SUBBASIN	TOTAL SOLIDS	SETTLEABLE SOLIDS	TOTAL NITROGEN	TOTAL PHOSPHORUS
BLOUNT ISLAND	1.232	0.616	0.0280	0.0072
BROWNS CREEK	0.972	0.486	0.0240	0.0056
CANEY BRANCH	1.647	0.824	0.0140	0.0034
CLAPBOARD CREEK	0.538	0.269	0.0140	0.0029
DUNNS CREEK	1.600	0.800	0.0190	0.0049
NICHOLS CREEK	1.330	0.665	0.0210	0.0050
RUSHING BRANCH	1.596	0.798	0.0140	0.0034
SAMPLE SWAMP	1.978	0.989	0.0170	0.0041
SAN CARLOS CREEK	1.036	0.518	0.0260	0.0062
TERRAPIN CREEK	1.833	0.916	0.0310	0.0080

TABLE 30 ESTIMATED AVERAGE DAILY LOADINGS - PROPOSED II LAND USE

ESTIMATED TOTAL DAILY LOADINGS ON STUDY AREA
IN POUNDS / DAY

	TOTAL SOLIDS	SETTLEABLE SOLIDS	TOTAL NITROGEN	TOTAL PHOSPHORUS
PRESENT	12,450	6,230	240	50
PROPOSED I	20,300	10,150	470	95
PROPOSED II	20,160	10,080	350	90

TABLE 31 ESTIMATED TOTAL DAILY LOADING ON STUDY AREA

CONCENTRATIONS IN MILLIGRAMS PER LITER OF 6 DAY ACCUMULATION IN RUNOFF FROM A 24 HOUR 5 YEAR STORM OVER ENTIRE STUDY AREA

	TOTAL SOLIDS	SETTLEABLE SOLIDS	TOTAL NITROGEN	TOTAL PHOSPHORUS
PRESENT	31.20	15.55	0.611	0.133
0 % REMOVAL				
PROPOSED I	44.95	22.48	1.045	0.210
PROPOSED II	45.94	22.97	0.807	0.198
60 % REMOVAL				
PROPOSED I	34.53	17.27	0.740	0.154
PROPOSED II	35.40	17.71	0.656	0.152
80 % REMOVAL				
PROPOSED I	31.05	15.55	0.641	0.136
PROPOSED II	31.88	15.98	0.606	0.136
90 % REMOVAL				
PROPOSED I	29.31	14.66	0.591	0.127
PROPOSED II	30.13	15.07	0.581	0.129

TABLE 32 ESTIMATED AVERAGE CONCENTRATION IN RUNOFF FROM 24 HOUR 5 YEAR STORM- 6 DAY ACCUMULATION

over the entire study area. Estimates are also given for various removal rates presumably by retention storage. These figures do not take many factors into account such as washoff efficiency, peak discharge increases and others and so are only very generalized averages useful for comparison purposes only. They cannot be taken as representing actual concentrations. These comparative figures show that given an 80 percent removal rate of additional load, concentrations would probably not show marked increases. While the total loading on the study area would invariably increase, the additional runoff volumes would be expected to provide sufficient dilution to keep concentrations stable.

Data Discussion

Laboratory results (Table 33) indicate iron, mercury and copper at levels in excess of state water quality standards (Table 34).

The U. S. Geological Survey, Jacksonville Subdistrict Office (consultant) and the Jacksonville Bio-Environmental Services Division have provided the following comments regarding this initial data:

> There are no existing special water quality or sediment problems indicated by the data. Iron and mercury are general problems within the county. Assessment of the mercury health risk is underway (BESD). PCB was detected in one sediment sample (Oct. '83, Dunns Creek) and is not unique in the estuary, having appeared in the St. Johns River in other studies.
>
> Data indicates that sediment is not the major source of contaminants. Contrary to expectations, the suspended particles appear to contain the greatest portion of contaminants.
>
> Data generally indicates that water in the river (tributaries) at the selected sites meets Florida Department of Environmental Regulation - Class III standards with only a few exceptions, i.e. metals.
>
> None of the organic contaminants for which analyses were performed were detected and the majority of the constituents determined seem to be easily accounted for by simple seawater dilution.

Comparison with Other Data

Recent Studies

A primary objective of this study is to complement the FDER Deepwater Ports maintenance Dredging Study.

STATION NUMBER	DATE OF SAMPLE	TIME	TEMPER-ATURE (DEG C) (00010)	AGENCY COL-LECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANA-LYZING SAMPLE (CODE NUMBER) (00028)	TUR-BID-ITY (NTU) (00076)	COLOR (PLAT-INUM-COBALT UNITS) (00080)	SPE-CIFIC CON-DUCT-ANCE (UMHOS) (00095)	OXYGEN, DIS-SOLVED (MG/L) (00300)	PH (STAND-ARD UNITS) (00400)	PH LAB (STAND-ARD UNITS) (00403)
302423081331001	83-06-20	--	--	1028	80010	9.0	70	--	--	--	7.7
	83-08-02	1300	--	1028	80010	3.2	60	--	--	--	7.7
	83-10-04	1410	--	1028	80010	--	--	22500	--	7.6	--
302423081331002	83-06-20	--	--	1028	80010	--	--	--	--	--	--
302513081315101	83-06-20	--	--	1028	80010	9.0	65	--	--	--	10.0
	83-08-03	1100	--	1028	80010	--	--	--	--	--	--
	83-10-05	1019	27.5	1028	80010	--	--	29000	5.6	7.8	--
302607081301701	83-06-20	--	--	1028	80010	9.0	60	--	--	--	7.8
	83-08-03	1300	--	1028	80010	14	60	--	--	--	7.5
	83-10-05	1100	25.0	1028	80010	--	--	33500	6.0	7.7	--
302610081350501	83-06-20	--	--	1028	80010	10	80	--	--	--	7.6
	83-08-02	1200	--	1028	80010	4.1	210	--	--	--	6.6
302610081350502	83-06-20	--	--	1028	80010	--	--	--	--	--	--

STATION NUMBER	DATE OF SAMPLE	OIL AND GREASE, TOT. IN BOT MAT GRAVI-METRIC (MG/KG) (00557)	NITRO-GEN DIS-SOLVED (MG/L AS N) (00602)	NITRO-GEN, TOT IN BOT-TOM MA-TERIAL (MG/KG AS N) (00603)	NITRO-GEN, AMMONIA DIS-SOLVED (MG/L AS N) (00608)	NITRO-GEN, AMMONIA TOTAL (MG/L AS N) (00610)	NITRO-GEN, NH4 TOTAL IN BOT. MAT. (MG/KG AS N) (00611)	NITRO-GEN, NITRITE TOTAL (MG/L AS N) (00615)	NITRO-GEN, AM-MONIA + ORGANIC DIS. (MG/L AS N) (00623)	NITRO-GEN, NH4 + ORG. SUSP. TOTAL (MG/L AS N) (00624)	NITRO-GEN, AM-MONIA + ORGANIC TOTAL (MG/L AS N) (00625)
302423081331001	83-06-20	--	--	--	.100	.110	--	.010	.40	.50	.90
	83-08-02	--	.69	--	.040	.040	--	.100	.50	.40	.90
	83-10-04	--	--	--	.070	.060	--	.060	.70	.00	.70
302423081331002	83-06-20	<1	--	--	--	--	1.6	--	--	--	--
302513081315101	83-06-20	--	--	--	.150	.100	--	.010	.50	.40	.90
	83-08-03	--	1.1	--	.030	.040	--	.120	.90	.10	1.00
	83-10-05	--	--	--	.050	.090	--	.080	.40	.20	.60
302607081301701	83-06-20	--	--	--	.120	.100	--	<.010	.40	.30	.70
	83-08-03	--	--	--	.050	.070	--	.030	.60	.40	1.00
	83-10-05	--	--	--	.050	.070	--	.020	.40	.20	.60
302610081350501	83-06-20	--	--	--	.060	.080	--	.010	.60	.30	.90
	83-08-02	--	1.6	--	.090	.090	--	.020	1.5	10	1.80
302610081350502	83-06-20	<1	--	803	--	--	6.2	--	--	--	--

STATION NUMBER	DATE OF SAMPLE	MAGNESIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	POTASSIUM, DIS-SOLVED (MG/L AS K) (00935)	POTASSIUM, TOTAL RECOVERABLE (MG/L AS K) (00937)	CHLORIDE, DIS-SOLVED (MG/L AS CL) (00940)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	FLUORIDE, DIS-SOLVED (MG/L AS F) (00950)	SILICA, DIS-SOLVED (MG/L AS SIO2) (00955)	ARSENIC DIS-SOLVED (UG/L AS AS) (01000)	ARSENIC SUS-PENDED TOTAL (UG/L AS AS) (01001)
302423081331001	83-06-20	540	4300	170	160	8300	230	.6	2.5	1	0
	83-08-02	500	4800	150	170	9000	1200	.6	1.7	1	0
	83-10-04	--	--	--	--	--	--	--	--	--	--
302423081331002	83-06-20	--	--	--	--	--	--	--	--	--	--
302513081315101	83-06-20	640	5200	190	200	10000	1400	.6	2.2	1	0
	83-08-03	--	--	--	--	--	--	--	--	--	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302607081301701	83-06-20	600	5700	210	210	11000	1600	.6	2.6	1	0
	83-08-03	650	5400	180	190	10000	1400	.6	2.9	1	0
	83-10-05	--	--	--	--	--	--	--	--	--	--
302610081350501	83-06-20	340	2500	96	97	9700	690	.3	2.5	1	0
	83-08-02	45	390	16	13	760	110	.2	6.9	1	0
302610081350502	83-06-20	--	--	--	--	--	--	--	--	--	--

PROCESS DATE 12/21/

STATION NUMBER	DATE OF SAMPLE	NITROGEN, NH4 + ORG. TOT IN BOT MAT (MG/KG AS N) (00626)	NITROGEN, NO2+NO3 TOTAL (MG/L AS N) (00630)	NITROGEN, NO2+NO3 DIS-SOLVED (MG/L AS N) (00631)	NITROGEN, NO2+NO3 TOT. IN BOT MAT (MG/KG AS N) (00633)	PHOSPHORUS, TOTAL (MG/L AS P) (00665)	PHOSPHORUS, TOTAL IN BOT. MAT. (MG/KG AS P) (00668)	PHOSPHORUS, ORTHO, DIS-SOLVED (MG/L AS P) (00671)	CARBON, ORGANIC TOTAL (MG/L AS C) (00680)	CARBON, INORG + ORGANIC TOT. IN BOT MAT (G/KG AS C) (00693)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)
302423081331001	83-06-20	--	<.10	<.10	--	.290	--	.090	13	--	170
	83-08-02	--	.20	.19	--	.120	--	.100	9.6	--	170
	83-10-04	--	.10	<.10	--	.140	--	.090	12	--	--
302423081331002	83-06-20	150	--	--	<2.0	--	66	--	--	1.7	--
302513081315101	83-06-20	--	<.10	<.10	--	.120	--	.160	12	--	190
	83-08-03	--	.20	.21	--	.130	--	.090	10	--	--
	83-10-05	--	.10	<.10	--	.120	--	.080	11	--	--
302607081301701	83-06-20	--	<.10	<.10	--	.130	--	.060	11	--	200
	83-08-03	--	<.10	<.10	--	.110	--	.040	8.3	--	190
	83-10-05	--	<.10	<.10	--	.120	--	.030	10	--	--
302610081350501	83-06-20	--	<.10	<.10	--	.190	--	.130	15	--	110
	83-08-02	--	.10	.12	--	.390	--	.270	21	--	23
302610081350502	83-06-20	800	--	--	3.0	--	90	--	--	5.5	--

PROCESS DATE 12/2

STATION NUMBER	DATE OF SAMPLE	ARSENIC TOTAL (UG/L AS AS) (01002)	ARSENIC TOTAL IN BOTTOM MATERIAL (UG/G AS AS) (01003)	BORON, DISSOLVED (UG/L AS B) (01020)	BORON, SUSPENDED RECOVERABLE (UG/L AS B) (01021)	BORON, TOTAL RECOVERABLE (UG/L AS B) (01022)	CADMIUM DISSOLVED (UG/L AS CD) (01025)	CADMIUM SUSPENDED RECOVERABLE (UG/L AS CD) (01026)	CADMIUM TOTAL RECOVERABLE (UG/L AS CD) (01027)	CADMIUM RECOV. FM BOTTOM MATERIAL (UG/G AS CD) (01028)	CHROMIUM, RECOV. FM BOTTOM MATERIAL (UG/G) (01029)
302423081331001	83-06-20	1	--	1900	100	2000	3	0	3	--	--
	83-08-02	1	--	2200	0	2200	1	0	1	--	--
	83-10-04	--	--	--	--	--	--	--	--	--	--
302423081331002	83-06-20	--	2	--	--	--	--	--	--	<1	3
302513081315101	83-06-20	1	--	2300	300	2600	2	0	2	--	--
	83-08-03	--	--	--	--	--	--	--	--	--	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302607081301701	83-06-20	1	--	2700	0	2700	1	1	2	--	--
	83-08-03	1	--	2400	0	2400	1	0	1	--	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302610081350501	83-06-20	1	--	1200	0	1200	1	1	2	--	--
	83-08-02	1	--	300	20	320	<1	--	1	--	--
302610081350502	83-06-20	--	<1	--	--	--	--	--	--	<1	2

PROCESS DATE 12/2

STATION NUMBER	DATE OF SAMPLE	CHROMIUM, DISSOLVED (UG/L AS CR) (01030)	CHROMIUM, SUSPENDED RECOV. (UG/L AS CR) (01031)	CHROMIUM, TOTAL RECOVERABLE (UG/L AS CR) (01034)	COBALT, RECOV. FM BOTTOM MATERIAL (UG/G AS CO) (01038)	COPPER, DISSOLVED (UG/L AS CU) (01040)	COPPER, SUSPENDED RECOVERABLE (UG/L AS CU) (01041)	COPPER, TOTAL RECOVERABLE (UG/L AS CU) (01042)	COPPER, RECOV. FM BOTTOM MATERIAL (UG/G AS CU) (01043)	IRON, SUSPENDED RECOVERABLE (UG/L AS FE) (01044)	IRON, TOTAL RECOVERABLE (UG/L AS FE) (01045)
302423081331001	83-06-20	<10	--	<10	--	6	1	7	--	340	510
	83-08-02	20	0	20	--	6	16	22	--	200	410
	83-10-04	--	--	--	--	--	--	--	--	--	--
302423081331002	83-06-20	--	--	--	<10	--	--	--	<1	--	--
302513081315101	83-06-20	<10	--	<10	--	3	2	5	--	310	500
	83-08-03	--	--	--	--	--	--	--	--	--	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302607081301701	83-06-20	10	0	10	--	2	3	5	--	430	620
	83-08-03	20	0	20	--	8	14	22	--	440	570
	83-10-05	--	--	--	--	--	--	--	--	--	--
302610081350501	83-06-20	10	0	10	--	5	0	5	--	420	550
	83-08-02	<10	--	10	--	4	19	23	--	240	870
302610081350502	83-06-20	--	--	--	<10	--	--	--	<1	--	--

STATION NUMBER	DATE OF SAMPLE	IRON, DIS-SOLVED (UG/L AS FE) (01046)	LEAD, DIS-SOLVED (UG/L AS PB) (01049)	LEAD, SUS-PENDED RECOV-ERABLE (UG/L AS PB) (01050)	LEAD, TOTAL RECOV-ERABLE (UG/L AS PB) (01051)	LEAD, RECOV. FM BOT-TOM MA-TERIAL (UG/G AS PB) (01052)	MANGA-NESE, RECOV. FM BOT-TOM MA-TERIAL (UG/G) (01053)	MANGA-NESE, SUS-PENDED RECOV. (UG/L AS MN) (01054)	MANGA-NESE, TOTAL RECOV-ERABLE (UG/L AS MN) (01055)	MANGA-NESE, DIS-SOLVED (UG/L AS MN) (01056)	NICKEL, DIS-SOLVED (UG/L AS NI) (01065)
302423081331001	83-06-20	170	2	2	4	--	--	10	60	50	1
	83-08-02	130	1	6	1	--	--	20	40	20	1
	83-10-04	--	--	--	--	--	--	--	--	--	--
302423081331002	83-06-20	--	--	--	--	10	4	--	--	--	--
302513081315101	83-06-20	170	1	3	4	--	--	10	60	50	1
	83-08-03	--	--	--	--	--	--	--	--	--	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302607081301701	83-06-20	190	2	1	3	--	--	20	70	50	1
	83-08-03	130	1	5	6	--	--	30	60	30	<1
	83-10-05	--	--	--	--	--	--	--	--	--	--
302610081350501	83-06-20	130	4	1	5	--	--	20	70	50	1
	83-08-02	630	1	1	8	--	--	0	40	40	<1
302610081350502	83-06-20	--	--	--	--	<10	5	--	--	--	--

PROCESS DATE 12/

STATION NUMBER	DATE OF SAMPLE	NICKEL, SUS-PENDED RECOV-ERABLE (UG/L AS NI) (01066)	NICKEL, TOTAL RECOV-ERABLE (UG/L AS NI) (01067)	NICKEL, RECOV. FM BOT-TOM MA-TERIAL (UG/G AS NI) (01068)	SILVER, DIS-SOLVED (UG/L AS AG) (01075)	SILVER, TOTAL RECOV-ERABLE (UG/L AS AG) (01077)	ZINC, DIS-SOLVED (UG/L AS ZN) (01090)	ZINC, SUS-PENDED RECOV-ERABLE (UG/L AS ZN) (01091)	ZINC, TOTAL RECOV-ERABLE (UG/L AS ZN) (01092)	ZINC, RECOV. FM BOT-TOM MA-TERIAL (UG/G AS ZN) (01093)	ALUM-INUM, TOTAL RECOV-ERABLE (UG/L AS AL) (01105)
302423081331001	83-06-20	3	4	--	<1	<1	70	0	50	--	310
	83-08-02	3	4	--	<1	<1	20	20	40	--	260
	83-10-04	--	--	--	--	--	--	--	--	--	--
302423081331002	83-06-20	--	--	<10	--	--	--	--	--	14	--
302513081315101	83-06-20	0	1	--	<1	<1	40	10	50	--	390
	83-08-03	--	--	--	--	--	--	--	--	--	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302607081301701	83-06-20	1	2	--	<1	<1	30	0	30	--	400
	83-08-03	--	3	--	<1	<1	30	10	40	--	440
	83-10-05	--	--	--	--	--	--	--	--	--	--
302610081350501	83-06-20	1	2	--	<1	<1	40	0	40	--	460
	83-08-02	--	3	--	<1	<1	30	20	50	--	440
302610081350502	83-06-20	--	--	<10	--	--	--	--	--	6	--

STATION NUMBER	DATE OF SAMPLE	ALUMINUM, DIS-SOLVED (UG/L AS AL) (01106)	ALUMINUM, SUS-PENDED RECOV. (UG/L AS AL) (01107)	IRON, RECOV. FM BOT-TOM MA-TERIAL (UG/G AS FE) (01170)	PERTHANE TOTAL (UG/L) (39034)	NAPHTHALENES, POLY-CHLOR. TOTAL (UG/L) (39250)	PCN, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39251)	ALDRIN, TOTAL (UG/L) (39330)	ALDRIN, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39333)	LINDANE TOTAL (UG/L) (39340)	LINDANE TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39343)
302423081331001	83-06-20	300	10	--	<.10	<.10	--	<.01	--	<.01	--
	83-08-02	<10	--	--	<.10	<.10	--	<.01	--	<.01	--
	83-10-04	--	--	--	--	--	--	--	--	--	--
302423081331002	83-06-20	--	--	400	--	--	<1.0	--	<.1	--	<.1
302513081315101	83-06-20	350	40	--	<.10	<.10	--	<.01	--	<.01	--
	83-08-03	--	--	--	--	--	--	--	--	--	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302607081301701	83-06-20	470	10	--	<.10	<.10	--	<.01	--	<.01	--
	83-08-03	250	190	--	<.10	<.10	--	<.01	--	<.01	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302610081350501	83-06-20	450	10	--	<.10	<.10	--	<.01	--	<.01	--
	83-08-02	20	420	--	<.10	<.10	--	<.01	--	<.01	--
302610081350502	83-06-20	--	--	940	--	--	<1.0	--	<.1	--	<.1

STATION NUMBER	DATE OF SAMPLE	CHLORDANE, TOTAL (UG/L) (39350)	CHLORDANE, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39351)	DDD, TOTAL (UG/L) (39360)	DDD, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39363)	DDE, TOTAL (UG/L) (39365)	DDE, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39368)	DDT, TOTAL (UG/L) (39370)	DDT, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39373)	DI-ELDRIN TOTAL (UG/L) (39380)	DI-ELDRIN, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39383)
302423081331001	83-06-20	<.10	--	<.01	--	<.01	--	<.01	--	<.01	--
	83-08-02	<.10	--	<.01	--	<.01	--	<.01	--	<.01	--
	83-10-04	--	--	--	--	--	--	--	--	--	--
302423081331002	83-06-20	--	<1.0	--	<.1	--	<.1	--	<.1	--	<.1
302513081315101	83-06-20	<.10	--	<.01	--	<.01	--	<.01	--	<.01	--
	83-08-03	--	--	--	--	--	--	--	--	--	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302607081301701	83-06-20	<.10	--	<.01	--	<.01	--	<.01	--	<.01	--
	83-08-03	<.10	--	<.01	--	<.01	--	<.01	--	<.01	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302610081350501	83-06-20	<.10	--	<.01	--	<.01	--	<.01	--	<.01	--
	83-08-02	<.10	--	<.01	--	<.01	--	<.01	--	<.01	--
302610081350502	83-06-20	--	<1.0	--	<.1	--	<.1	--	<.1	--	<.1

STATION NUMBER	DATE OF SAMPLE	ENDO-SULFAN, TOTAL (UG/L) (39388)	ENDO-SULFAN, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39389)	ENDRIN, TOTAL (UG/L) (39390)	ENDRIN, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39393)	TOX-APHENE, TOTAL (UG/L) (39400)	TOXA-PHENE, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39403)	HEPTA-CHLOR, TOTAL (UG/L) (39410)	HEPTA-CHLOR, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39413)	HEPTA-CHLOR EPOXIDE TOTAL (UG/L) (39420)	HEPTA-CHLOR EPOXIDE TOT. IN BOTTOM MATL. (UG/KG) (39423)
302423081331001	83-06-20	<.01	--	<.01	--	<1	--	<.01	--	<.01	--
	83-08-02	<.01	--	<.01	--	<1	--	<.01	--	<.01	--
	83-10-04	--	--	--	--	--	--	--	--	--	--
302423081331002	83-06-20	--	<.1	--	<.1	--	<10	--	<.1	--	<.1
302513081315101	83-06-20	<.01	--	<.01	--	<1	--	<.01	--	<.01	--
	83-08-03	--	--	--	--	--	--	--	--	--	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302607081301701	83-06-20	<.01	--	<.01	--	<1	--	<.01	--	<.01	--
	83-08-03	<.01	--	<.01	--	<1	--	<.01	--	<.01	--
	83-10-05	--	--	--	--	--	--	--	--	--	--
302610081350501	83-06-20	<.01	--	<.01	--	<1	--	<.01	--	<.01	--
	83-08-02	<.01	--	<.01	--	<1	--	<.01	--	<.01	--
302610081350502	83-06-20	--	<.1	--	<.1	--	<10	--	<.1	--	<.1

PROCESS DATE 12/

STATION NUMBER	DATE OF SAMPLE	METH-OXY-CHLOR, TOTAL (UG/L) (39480)	METH-OXY-CHLOR, TOT. IN BOTTOM MATL. (UG/KG) (39481)	PCB, TOTAL (UG/L) (39516)	PCB, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39519)	MIREX, TOTAL (UG/L) (39755)	MIREX, TOTAL IN BOT-TOM MA-TERIAL (UG/KG) (39758)	SOLIDS, RESIDUE AT 180 DEG. C DIS-SOLVED (MG/L) (70300)	PHOS-PHORUS TOTAL (MG/L AS PO4) (71886)	MERCURY DIS-SOLVED (UG/L AS HG) (71890)	MERCURY SUS-PENDED RECOV-ERABLE (UG/L AS HG) (71895)
302423081331001	83-06-20	<.01	--	<.10	--	<.01	--	14500	.09	<.1	--
	83-08-02	<.01	--	<.10	--	<.01	--	2300	.37	.5	.0
	83-10-04	--	--	--	--	--	--	--	.43	--	--
302423081331002	83-06-20	--	<.1	--	<1	--	<.1	--	--	--	--
302513081315101	83-06-20	<.01	--	<.10	--	<.01	--	17200	.37	<.1	--
	83-08-03	--	--	--	--	--	--	--	.40	--	--
	83-10-05	--	--	--	--	--	--	--	.37	--	--
302607081301701	83-06-20	<.01	--	<.10	--	<.01	--	20400	.40	.4	.0
	83-08-03	<.01	--	<.10	--	<.01	--	3360	.34	.5	.0
	83-10-05	--	--	--	--	--	--	--	.37	--	--
302610081350501	83-06-20	<.01	--	<.10	--	<.01	--	9200	.58	.5	.0
	83-08-02	<.01	--	<.10	--	<.01	--	1590	1.2	.2	.1
302610081350502	83-06-20	--	<.1	--	<1	--	<.1	--	--	--	--

STATION NUMBER	DATE OF SAMPLE	MERCURY TOTAL RECOV-ERABLE (UG/L AS HG) (71900)	MERCURY RECOV. FM BOT-TOM MA-TERIAL (UG/G AS HG) (71921)	PER-THANE IN BOTTOM MATERIL (UG/KG) (81886)	SPE-CIFIC CON-DUCT-ANCE LAB (UMHOS) (90095)	LAB ID NUMBER (UNITS) (99998)
302423081331001	83-06-20	<.1	--	--	21000	3180000
	83-08-02	.4	--	--	3450	3220000
	83-10-04	--	--	--	--	3290000
302423081331002	83-06-20	--	<.01	<1.00	--	3180000
302513081315101	83-06-20	<.1	--	--	25400	3180000
	83-08-03	--	--	--	--	3220000
	83-10-05	--	--	--	--	3290000
302607081301701	83-06-20	.4	--	--	27000	3180000
	83-08-03	.9	--	--	5640	3220000
	83-10-05	--	--	--	--	3290000
302610081350501	83-06-20	.5	--	--	15200	3180000
	83-08-02	.3	--	--	2510	3220000
302610081350502	83-06-20	--	<.01	<1.00	--	3180000

* **Station ID** — **Local Name**

Station ID	Local Name
302010081350501	Dunn's Creek
302423081331001	Nichol's Creek
302513081315101	Brown's Creek
302607081301701	Clapboard Creek

All stations with 02 endings are bottom samples. Some of this data has not been released from the computer system.

** U.S.G.S. Jacksonville Subdistrict

*** U.S.G.S. Laboratory, Atlanta, Ga.

Table 34

FLORIDA WATER QUALITY CRITERIA FOR CLASS III, PREDOMINANTLY MARINE WATERS

Parameter	Allowable Level
Aluminum	1.5 mg/l
Antimony	0.2 mg/l
Arsenic	0.05 mg/l
BOD	Appropriate D.O. must be maintained
Bromine	0.1 mg/l
Bromates (as bromides)	100 mg/l
Cadmium	5.0 ug/l
Chlorine (total residual)	0.01 mg/l
Chlorides	10% increase above background levels
Chromium, hexavalent: total:	0.5 mg/l in effluent 1.0 mg/l in effluent 0.05 mg/l after mixing
Coliform, fecal	200 MPN/100 ml (monthly avg.) 800 MPN/100 ml (daily max.)
Coliform, total	1000/100 ml (monthly avg.) 2400/100 ml (max.)
Copper	0.015 mg/l
Cyanide	5.0 ug/l
Detergents	0.5 mg/l
Dissolved gases	110% of saturation value at the existing atmospheric and hydrostatic pressures

Table 34 (Continued)

FLORIDA WATER QUALITY CRITERIA FOR CLASS III, PREDOMINANTLY MARINE WATERS

Parameter	Allowable Level
Dissolved oxygen	minimum, 4 mg/l; 24 hr. avg., 5 mg/l
Fluorides	5.0 mg/l
Iron	0.3 mg/l
Lead	0.05 mg/l
Mercury	0.1 ug/l
Nickel	0.1 mg/l
Nutrients	Nutrient concentrations shall not be altered so as to cause an imbalance in natural populations of aquatic flora and fauna
Oil and grease (dissolved)	5.0 mg/l
Pesticides and herbicides	Detailed in 17-3.121 FAC
pH	6.5 - 8.5, st'd units[a]
Phosphorus (elemental)	0.1 ug/l
Polychlorinated biphenyls	0.001 mg/l
Radioactive substances	
radium 226 and 228:	5 picocuries/l
gross alpha particle activity (including Ra 226, but excluding radon and uranium):	15 picocuries
Selenium	0.025 mg/l
Silver	0.05 ug/l

Table 34 (Continued)

FLORIDA WATER QUALITY CRITERIA FOR CLASS III, PREDOMINANTLY MARINE WATERS

Parameter	Allowable Level
Turbidity	50 Jackson units above background levels
Transparency	Depth of compensation point for photosynthetic activity shall not be reduced by more than 10% of natural background value
Zinc	1 mg/l

a Not to be caused to vary by more than one (1.0) unit above or below normal pH, within the stated range.

Source: Florida Administrative Code, 17-3

Results are generally consistent with the exceptions of iron and cooper; of the metals examined by the FDER in ambient waters, only mercury exceeded the state water quality standards. FDER reported mean iron determinations ranging from 0.1 to 21.0 ug/L compared with 410.0 to 870.0 ug/L recorded from the present study. FDER reported mean copper levels ranging from 0.1 - 1.4 ug/L; JPD, 5 to 23 ug/L.

A one day, 1982, FDER biological survey of the river recorded relatively high levels of copper, 84.0 - 112.0 ug/L at four sites proximate to JPD sites. Higher levels of iron, 207.0 - 258.0 ug/L, than recorded from the Deepwater Ports Study were also reported.

Envirosphere (1981) reported the following in excess of state water quality standards at river sites proximate to Browns and Nichols Creeks: aluminium, total residual chlorine, copper, total coliform, cyanide, iron, mercury, oil and grease and silver.

Historical Data

Comparisons of water quality results with historical data and other studies in general, is often misleading due to differences in sampling and analyses methodology, lack of replicate samples and other pertinent data. This situation is aggravated in the estuarine environment by tidal induced fluctuations.

The preceeding studies were conducted on the river, historical water quality data specific to the study tributaries is scant. Initial findings generally agree with USEPA STORET data in Browns, Nichols and San Carlos Creeks; copper, iron and mercury are the only parameters recorded in excess of state water quality standards. Historical data from proximate river sites recorded state standards exceeded by the following: arsenic, Cadimum Cooper, Iron, Lead, Mercury, Nickel, pH and total Chromium.

Point Source Data

Point source data is readily available from monthly reports submitted to DER and BESD, which permit point sources discharging to surface water or ground water.

There are no point sources with surface discharges within the study area.

Summary

Ambient Water Quality

Iron and mercury are the only two parameters for which water quality standards were violated. Iron flocculants may limit species populations or diversity. Mercury concentrations in fish have been documented to be below FDA limits, but an assessment of human health risk is underway.

Sediment As Pollutant Reservoir

Data indicates that sediment is generally not the major source of contaminants. Note that possible exceptions are: iron which forms flocs in salt water; and PCB which was detected in one sediment sample, but not in the water column.

Non-Point Pollutant Concentrations

Total solids concentrations less than 20 mg/l would be generally acceptable ambient conditions. Present solids concentrations (31 mg/l) would increase 50% as a result of development, without stormwater quality regulations. With enforcement of existing stormwater rules, sediment concentrations would not increase above present concentrations with <u>either</u> development proposal. The N/P nutrient ratio would double, with an expected alteration of aquatic plant life, irrespective of stormwater treatment efficiency.

Non-Point Source Mitigation

In minimizing non-point source (NPS) impacts, there are several mitigation procedures as well as local and state rules and policies that can be used in an effort to control this problem.

Non-point source pollution in most cases is determined by the amount of stormwater that runs off the land and pollutants it gathers on its way to receiving waters.

One solution in limiting non-point source pollution in this particular area is limiting the development that will occur in this area to low density. Limited density of development will reduce impervious surfaces, runoff from construction sites, traffic, and other problems associated with development and human habitation, and thereby help in the limitation of the sources of NPS pollution. This section of the city contains large areas of environmentally sensitive lands. Low density development is reasonable and is a good practical solution to NPS pollution problems in this area.

Requiring proper mitigation practices during construction will also lessen the NPS impacts. Run-off from construction sites can contribute greatly to sediment loadings and siltation of waterways. Retention of stormwater at construction sites and use of procedures to trap silt and contain erosion can mitigate these non-point source impacts. Retention of on-site run-off can help mitigate the problems caused by construction. Requirements that natural vegetation be left and the elimination of clear cutting will contribute a great deal to the mitigation of this problem.

On-site retention and filtration as required by the Department of Environmental Regulation (DER), under Rule 17-25 and recently enacted rules of the St. Johns River Water Management District (SJRWMD), Rule 40 C-4 will greatly enhance the local ability to deal with NPS problems. DER is concerned with the quality of the runoff, with the St. Johns River Water Management District being more concerned with the quantity of water being retained or diverted. Proper adherence to these rules will have positive impacts on NPS pollution problems in this area.

The recommendation for continued monitoring of local waterways, which was included in the management plan, should have positive impacts on NPS pollution problems. Monitoring will help identify increases in NPS pollution which is the first step in attempting to alleviate a problem.

The expected future development in the northeastern quadrant of the city will place added stress on the waterways and environmentally sensitive areas located there. The use of all available NPS mitigation procedures and tactics will be needed to assure the water quality in this area does not deteriorate and cause irreparable damage to the waterways, wetlands and their inhabitants.

Conclusions

The lack of adequate historic data specific to these creeks precludes an accurate discussion regarding changes in water quality. Primary observations of this initial data are:

> Water quality at the selected sites is generally high although state standards are exceeded by three metals: iron, copper and mercury. The state water quality standard for copper was not exceeded in the finalsample run, although it was in the previous runs.
>
> Iron and copper at the levels recorded pose no significant human health problem. Assessment of the mercury problem is underway.

ESTUARINE ANALYSIS

PLANNING DEPARTMENT

ALL-AMERICA CITY

Suite 700, Florida Theatre Building, 128 East Forsyth Street
Jacksonville, Florida 32202—3325 Telephone (904) 633-2272

CITY OF JACKSONVILLE, FLORIDA ®

ACKNOWLEDGMENT

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ESTUARINE ANALYSIS

I. ESTUARINE ANALYSIS

Introduction

The seaward confluences of the Nassau and St. Johns Rivers form an extensive estuarine system of predominantly salt marsh, coastal hammock and marine and brackish waters. Some of these marsh ecosystems are among the most pristine remaining on the East Coast.

The wetlands are functionally very important, currently providing:

Storm protection by acting as a buffer zone absorbing excess water.

A filtration mechanism resulting in better water quality.

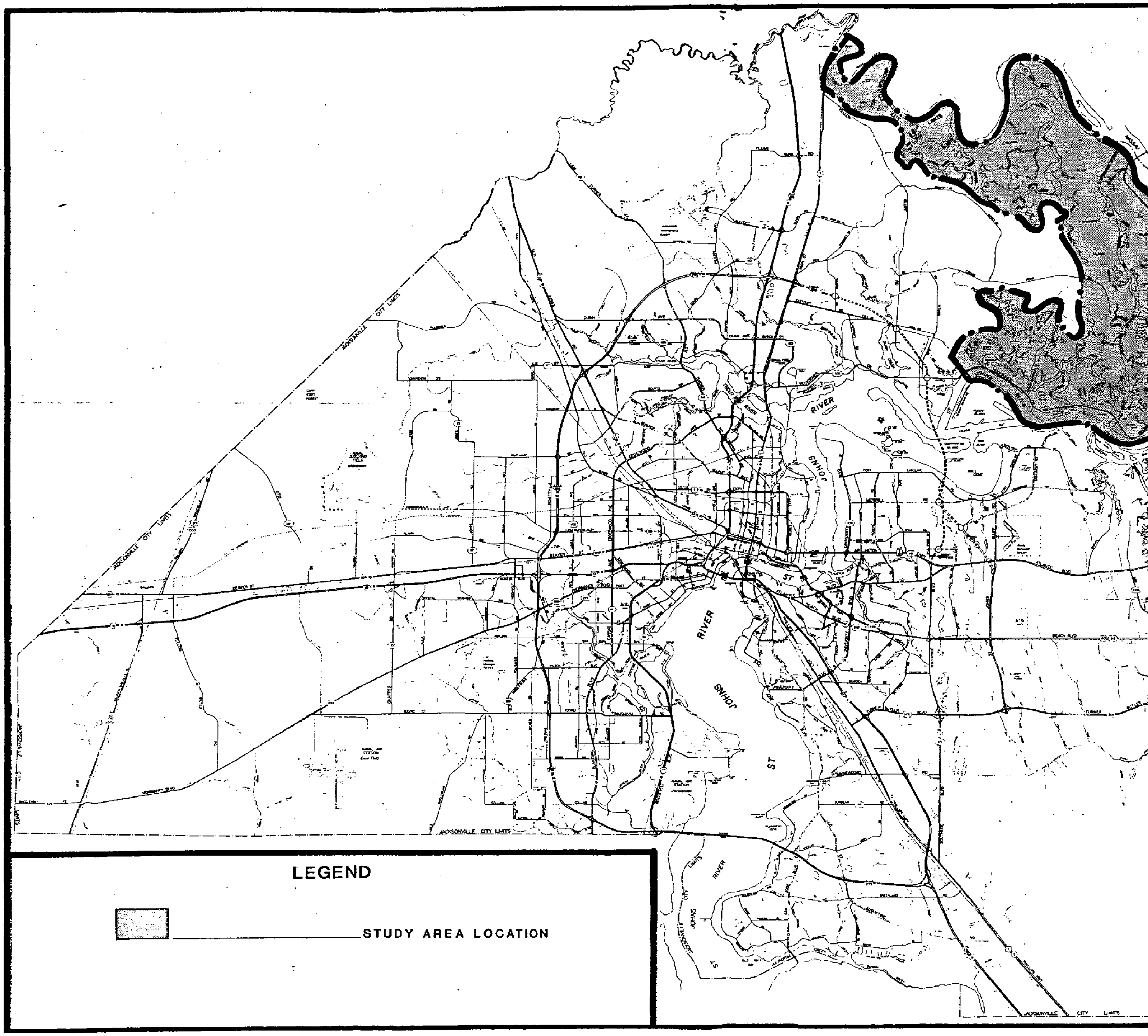
Wildlife habitat-nursery grounds for many commercially important fish and shellfish.

Recreation.

Aesthetic value, open spaces of this nature are increasingly important.

The City of Jacksonville has made efforts through comprehensive planning to ensure that the functional and aesthetic character of these wetland communities are maintained. Wetlands are also afforded limited protection through federal and state regulations. Nevertheless, development pressures associated with the anticipated general growth of the region necessitate increased local protection to prevent significant negative alternations of these systems.

This report presents data and recommendations regarding these resources. The primary objectives of the study are to address the need for preservation of the area and to provide



COASTAL ENERGY IMPACT PROGRAM

ESTUARINE STUDY AREA

CONSOLIDATED CITY OF JACKSONVILLE
DUVAL COUNTY, FLORIDA

Prepared by:
JACKSONVILLE PLANNING DEPARTMENT

JUNE, 1984 | MAP 1

an areal management plan.

Study Area - (Map 2)

Duval County lies within the South Atlantic Bight which extends along the southeastern coast of the United States between Cape Fear, North Carolina, and Cape Canaveral, Florida. This section of the southern coastal plain is characterized by extensive lagoon-marsh systems and estuaries bound at their eastern extent by barrier island complexes. The morphology of coastal island systems and the extent of the lagoon-marsh are the results of a complex interplay of physical and biological processes.

Barrier Islands associated with the Nassau-St. Johns River estuarine complex are Talbot and Little Talbot; Black Hammock Island, Ft. George Island and other smaller marsh islands are also part of the system.

The study area encompasses approximately 38,000 acres and includes most of the salt marshes of northeast Duval MAP County. The western boundary of the study area is the general western extent of the marshes from Browns Creek northward to Highway 17. The northern boundary is the Nassau River/County line; the southern, the St. Johns River. The eastern boundary of the study area is the coastline, with the exclusion of Little Talbot and Long Islands where it follows Simpsons Creek.

Little information of a descriptive nature is available concerning the area. A definite need exists for a comprehensive consolidation of available data and for expansion of the existing data base. The following information is derived from the referenced published materials and from data obtained through staff investigations.

Watershed - (Map 3)

Numerous tidal creeks comprise the watershed of the terminal reaches of the Nassau and St. Johns Rivers estuaries. Many of these creeks are interconnected, forming a maze of waterways through the salt marsh and hammock. Two major basins of the Nassau River are represented. One basin includes Deese, Samples, Edwards and Pumpkin Hill Creeks; the other, Sawpit and Simpsons Creek systems and portions of Sisters Creek (I.C.W.) and the Fort George River.

ESTUARINE STUDY AREA	Graphic Scale 1" : 10,000'
	JUNE, 1984
	prepared by JACKSONVILLE PLANNING DEPARTMENT
COASTAL ENERGY IMPACT PROGRAM	MAP 2

LEGEND

54 ______ BROWN'S CREEK
70 ______ NASSAU RIVER
71 ______ INTRACOASTAL WATERWAY
sjr ______ ST JOHN'S RIVER

DRAINAGE SUBBASINS

ESTUARINE STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

Graphic Scale
1" : 10,000'

JUNE, 1984

prepared by
JACKSONVILLE PLANNING DEPARTMENT

MAP 3

An ill-defined subbasin of the St. Johns River which includes Clapboard, Cedar Point and portions of Sisters Creek comprises most of the remainder of the study area. Browns Creek, part of another St. Johns River drainage subbasin is represented in the southwest portion of the study area.

Topography - (Map 4)

The study area is essentially flat and level; the salt marsh, comprising most of the area is predominantly at sea level or below 5 ft. in elevation, some of the insular uplands rise to 40 ft.

The majority of Pearsons Island, Black Hammock Island, Talbot Island, Fort George Island and Fanning Island are in the 10 to 20 ft. elevation..

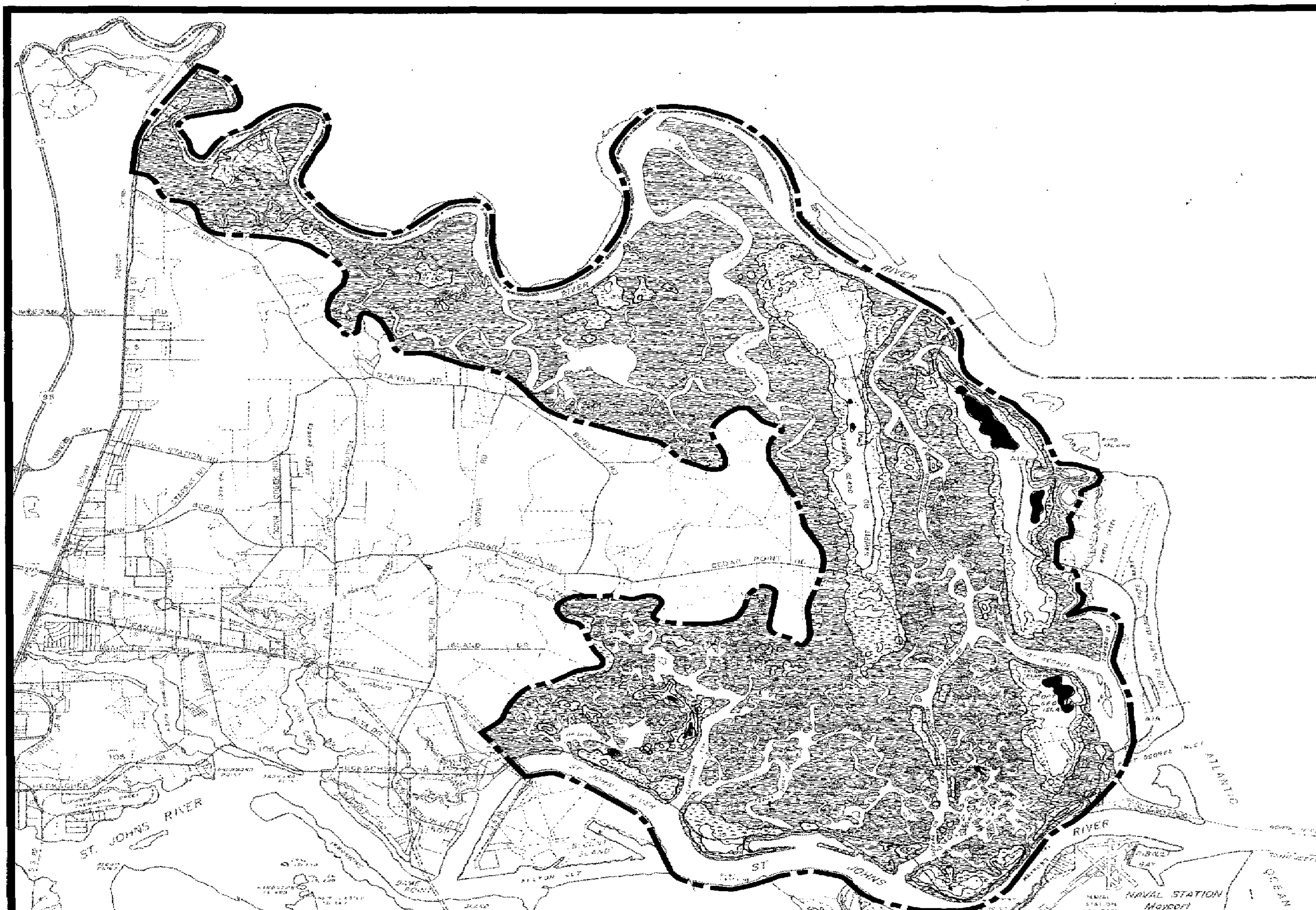
Some areas of Talbot and Ft. George Islands have elevations of 20 to 30 ft. The 30 to 40 ft. elevations are found on relatively small areas of Pelotes Island and in the northeast corner of Fort George Island.

Generalized Soils - (Map 5)

Most of the study area is composed of Tisonia soils, supporting the prevalent salt marsh. Insular uplands are mapped as being generally covered with Mandarin-Kureb and Leon-Ridgeland-Wesconnett soils.

Tisonia soil is level to nearly level, very poorly drained, saline organic soils underlain by clayey material. This soil has very low potential for planted pines or improved pasture. This very low suitability is due to excessive wetness, flooding, saline conditions and unstable surface (low strength). Potential for community development is equally low for the previously stated reasons as well as high shrink-swell potential and high corrosivity.

Mandarin-Kureb - This general soil type is made up of slightly elevated areas of flatwoods surrounded by or adjacent to broad ridges. This soil type is nearly level to moderately steep, somewhat poorly drained and excessively drained soils that are sandy throughout. These soils have medium potential for pasture because of droughty conditions and low fertility. This general soil type has high potential for community development, limited mostly be seasonal wetness, high permeability and slope.



LEGEND
ELEVATIONS ABOVE MEAN SEA LEVEL: IN FEET

- 0 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 OR MORE

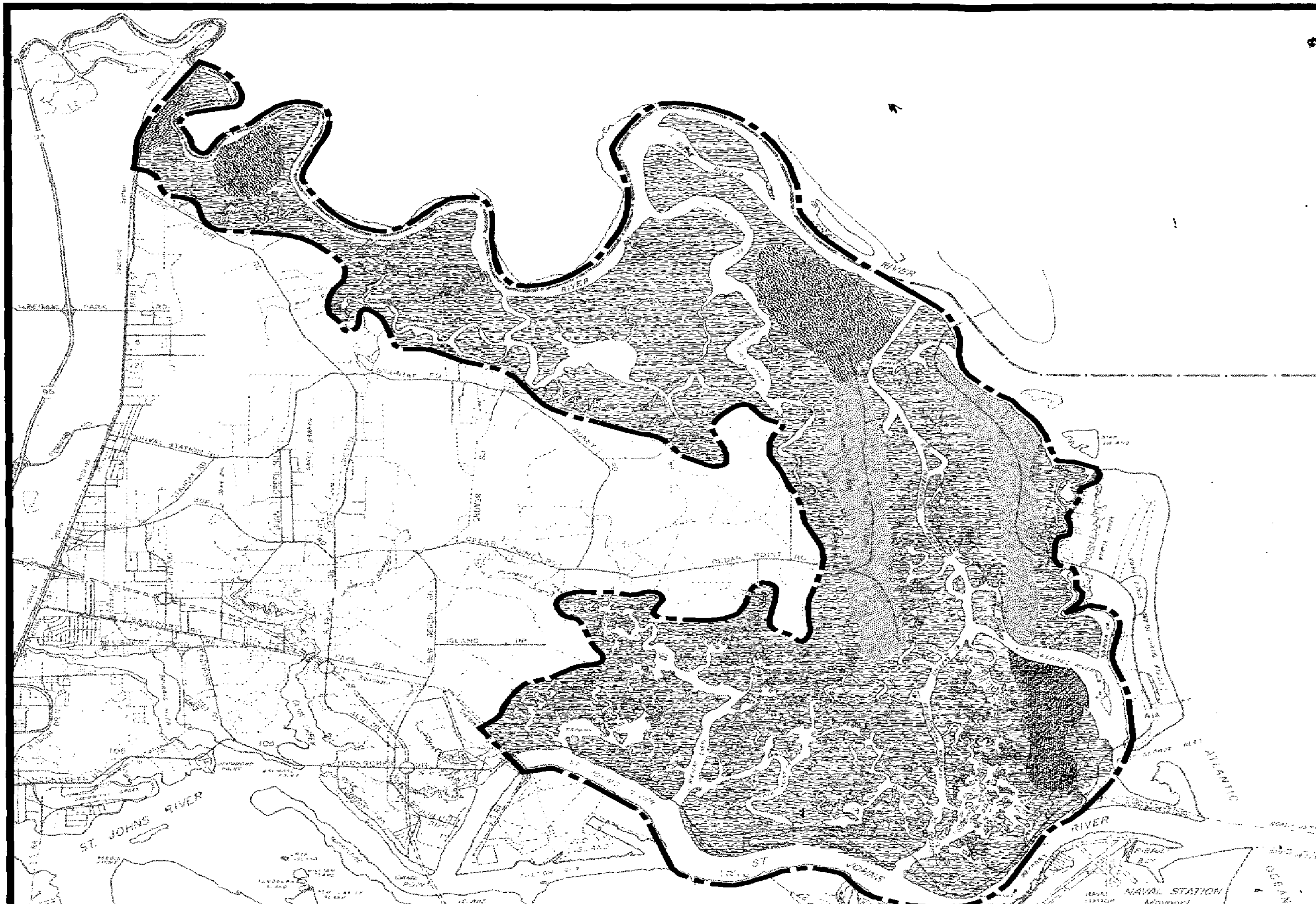
GENERALIZED TOPOGRAPHY

ESTUARINE STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

0' 3,000' 6,000' 9,000' 12,000'
Graphic Scale

JUNE, 1984
prepared by JACKSONVILLE PLANNING DEPARTMENT

MAP 4



LEGEND

KERSHAW - ORTEGA

MANDARIN - KERUB

LEON - RIDGELAND - WESCONNETT

TISONIA

GENERALIZED SOILS

ESTUARINE STUDY AREA

COASTAL ENERGY IMPACT PROGRAM

0' 3,000' 6,000' 9,000' 12,000'

Graphic Scale

JUNE, 1984

prepared by JACKSONVILLE PLANNING DEPARTMENT

MAP 5

Leon-Ridgeland-Wesconnett - This generalized soil type is made up of broad areas of flatwoods interspersed with shallow depressions and large drainage ways. This soil type is made up of soils that are nearly level, poorly drained and very poorly drained and sandy througnout. These soils have overall medium to low potential for planted pines and pasture mainly due to wetness and flooding. These soils also have a medium potential for community development, excessive wetness being the major limitation.

Specific Soils

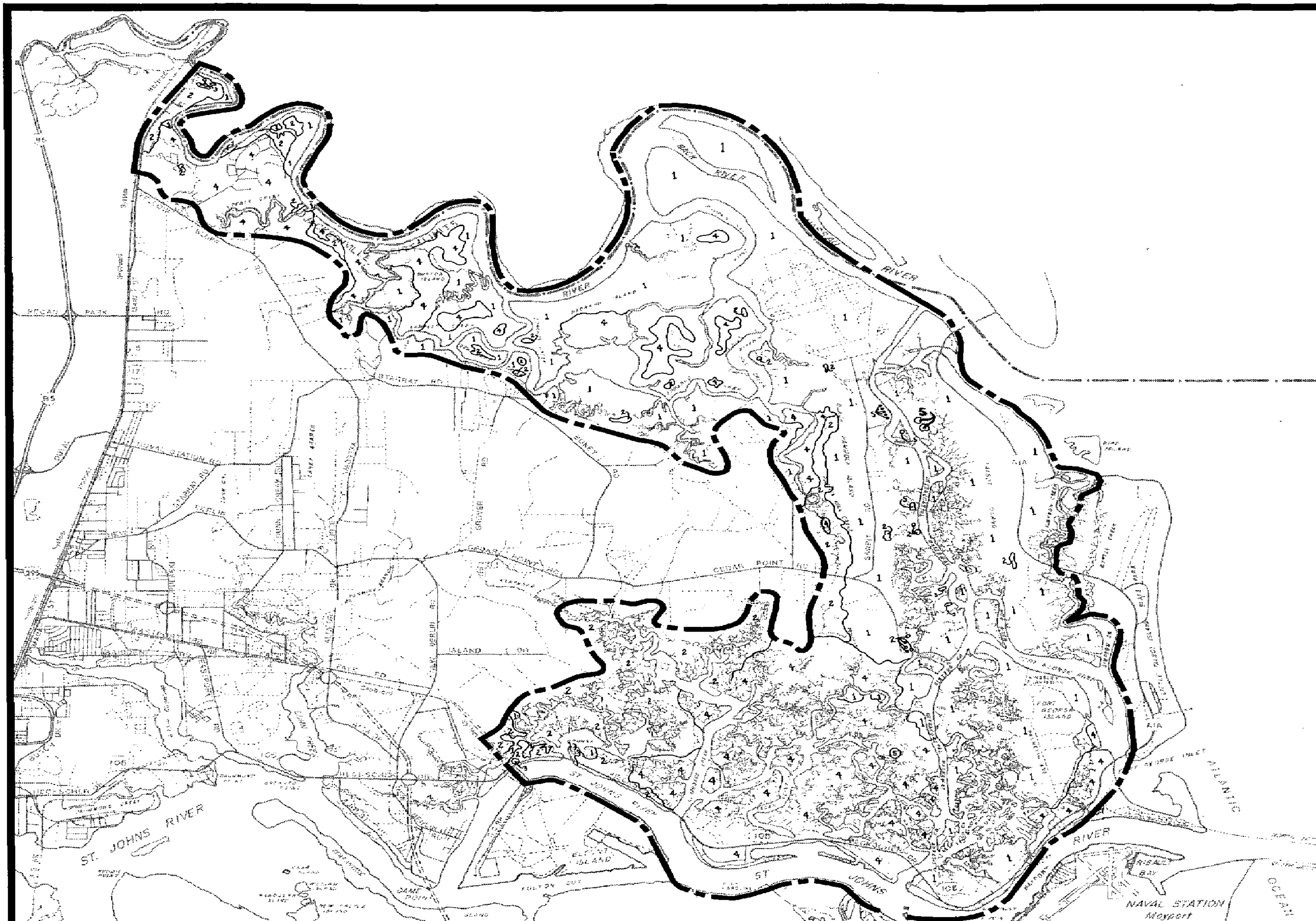
General soils are usually a composite of specific soils. The following analysis of the insular uplands is derived from the soil survey of Jacksonville; further descriptions can be found in the soil survey of Jacksonville, Duval County, Florida, part of the appendix. Specific soils in this area are:

- Pelotes Island - Kureb Soils.
- Fort George Island - Kershaw, Mandarin and Ortega Soils.
- Halfmoon Island - Leon, Lynn Haven and Mascotte Soils.
- Pearson Island - Leon, Mandarin, Mescotte, Ortega and Ridgeland Soils.
- Fort George Island - Kershaw, Ortega Soils.
- Burton Island - Lynn Haven Soils.
- Broward Island - Leon and Ridgeland.

Vegetation - (Map 6)

Most of the study area is salt marsh supported by Tisonia soils. Plant species are distributed according to several environmental factors including elevation, soil-water salinity and the frequency and depth of tidal inundations. The interaction of these factors produces distinct zonation (vegetation zones) within the salt marsh.

The zone nearest tidal creeks is typically dominated by smooth cordgrass (*Spartina alterniflora*) forming a nearly



LEGEND

1 SPARTINA ALTERNIFLORA
2 JUNCUS ROEMERIANUS
3 SPARTINA CYNOSUROIDES
4 JUNCUS - SPARTINA MIXED
5 ISOLATED HAMMOCK

VEGETATION

ESTUARINE STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

0' 3,000' 6,000' 9,000' 12,000'
Graphic Scale

JUNE, 1984
prepared by
JACKSONVILLE PLANNING DEPARTMENT

MAP 6

pure stand; Black Needle Rush (Juncus roemerianus) dominates on land that is slightly higher and less flooded than that occupied by smooth cordgrass. These communities are inundated by daily flooding at high tides. This zone is considered the deep salt marsh.

Due to the accumulations of detritus and alluvial and windborne sediments, the salt marsh will tend to become shallow marsh. In the process, salts and nutrients will further accumulate in the soil by the trapping and subsequent evaporation of flooding tidal waters. The emerging shallow marsh, like the existing shallow salt marsh, will tend to select for more salt tolerant species such as Glass Wort (Salicornia virgineca). The occasionally flooded shallow salt marsh will generally occupy regions between the regularly flooded deep marsh and freshwater wetlands or upland systems such as pine flatwoods or dune communities.

Dominate salt marsh vegetation in the study area is Black Rush and Cord Grass. Although these two grasses generally occur in relatively unbroken pure stands, subordinate species are associated with the marshes. The common shrub species recorded in this area include Groundsel-Trees and Southern-Bay-berry. Herbaceous subordinate species include Coast Bacopa, Sea Oxeye, Perennial Glasswort and Vetch.

The other major vegetation type predominate in the study area is Coastal Hammock, a climax forest dominated by broad-leaved trees. Coastal Hammock and Grassy Scrub cover much of the insular uplands such as Fort George, Little Talbot and Black Hammock Islands.

Relatively small isolated communities of Pine Flatwood, Xerric Hammock and Freshwater Marsh are also found on some of the insular uplands. Other land cover is classified as open land on Pearson Island and the northern portion of Black Hammock Island; Recreational (Golf Course), on Fort George Island; and Spoil Bank, in pockets along the Intracoastal Waterway. Additional descriptions of these vegetative communities and plant species are provided in the appendix and in the ecological assessment of the area that is included in this study.

The St. Johns Water Management District is currently conducting an intensive mapping study of the wetlands of Duval County. Special attention has been given to the salt marsh communities during the ecological survey of the tidal marsh, that has resulted in a more definitive vegetative delineation.

Wildlife

Estuarine marshes of the type found in Duval County do not display the variety of wildlife species found in freshwater wetlands such as the hardwood swamps, however, they are tremendously productive in terms of biomass. This value has long been recognized by state and federal agencies.

In a report dated August 23, 1968, regarding the Hannah Mills Creek area, the U. S. Department of the Interior, Bureau of Sport Fisheries and Wildlife, stated:

> "Tidal marsh complexes such as this rank among the most productive areas in the world. Their grasses, mud algae and phytoplankton join to produce very high levels of primary plant production. The resulting marsh nutrients pass up through the food chain to support valuable estuarine fishes and shellfishes sought by man. The tidal creeks themselves are nursery grounds for valuable species such as Mullet, Menhaden, Seatrout, Redfish, Flounder, Blue Crab and commercial shrimp. The values of the marsh thus extend far outside its bounds into nearby estuaries and influence the harvest from the adjacent sea. This area also serves wintering waterfowl and numerous wading birds, as well as the resident Clapper Rail population which is an important resource of the marsh."

The salt marshes "feed" the estuary by supplying these waters with the nutrients critical to marine life. Salt marshes are also critical habitat for the juvenile states of many marine species.

A Jacksonville Electric Authority study lists 113 species of fish from the estuarine portion of the St. Johns River. The Game and Fresh Water Fish Commission stated that there are 55 freshwater and 115 marine and estuarine species in the St. Johns River.

Functional Characteristics

These wetlands are functionally very important, currently providing:

Wildlife Habitat and Primary Productivity - These functions are briefly discussed in the preceeding section. Many studies indicate that besides the natural productivity associated with estuarine salt marshes, if intensive management systems are applied, these ecosystems can realize a far greater potential.

Climate Control - Studies have indicated that all wetlands contribute to the climate of the region. In this area their presence have a moderating influence.

Flood and Hurricane Protection - These areas function as a sponge, soaking up excess water and ameliorating the effects of drastic water volume changes associated with storms. The salt marshes act as a buffer zone between the ocean and human development, absorbing the enormous energy of storm waves and acting as a water reservoir for coastal storm waters, thus reducing further damage inland.

Maintenance of the Nitrogen and Sulfur Cycles - The continuing normal function of the biosphere depends on the chemical reduction of carbon, nitrogen and sulfur, which are incorporated into all living tissues. While carbon reduction occurs through photosynthesis in oxidizing atmosphere, completion of the cycle of the other two elements depends on microbial action in a reducing environment. Impressive evidence points to the importance of the coastal anaerobic muds to continued normal functioning of global cycles of nitrogen and sulfur.

Filtration of Pollutants and Excess Nutrients - Salt marshes and all wetlands filter pollutant-laden stormwater, ameleorating this impact to lakes and rivers. Salt marshes have a potential, realized by some municipalities, of waste assimilation; they have a tremendous capacity (free) for tertiary treatment of nutrients, especially phosphorous.

Tidal Flushing - The powerful flow of water in and out of large tidal basins tends to keep harbors and inlets "dredged". The early harbors on the southeastern coast of England were silted in when the great marshes were first diked and filled in; constant dredging and vast expenditure of national funds then became necessary to keep harbors operational. The extent of this function in the Duval County estuaries has not been calculated, but may be significant in regard to current dredging operations and spoil disposal problems associated with the maintenance of the St. Johns River shipping channel.

Education - Valuable for the on site study of a relatively pristine example of the southeast coastal salt marshes. Potential for public nature trails and university level field laboratory.

Recreation - Primarily for hunting, fishing and nature appreciation. Necessary for the maintenance of areal coastal sport fishing.

Aesthetics - Increasingly important in a computer oriented society, large areas of open space adjacent to municipalities increase the aesthetic appeal and desirability of the area.

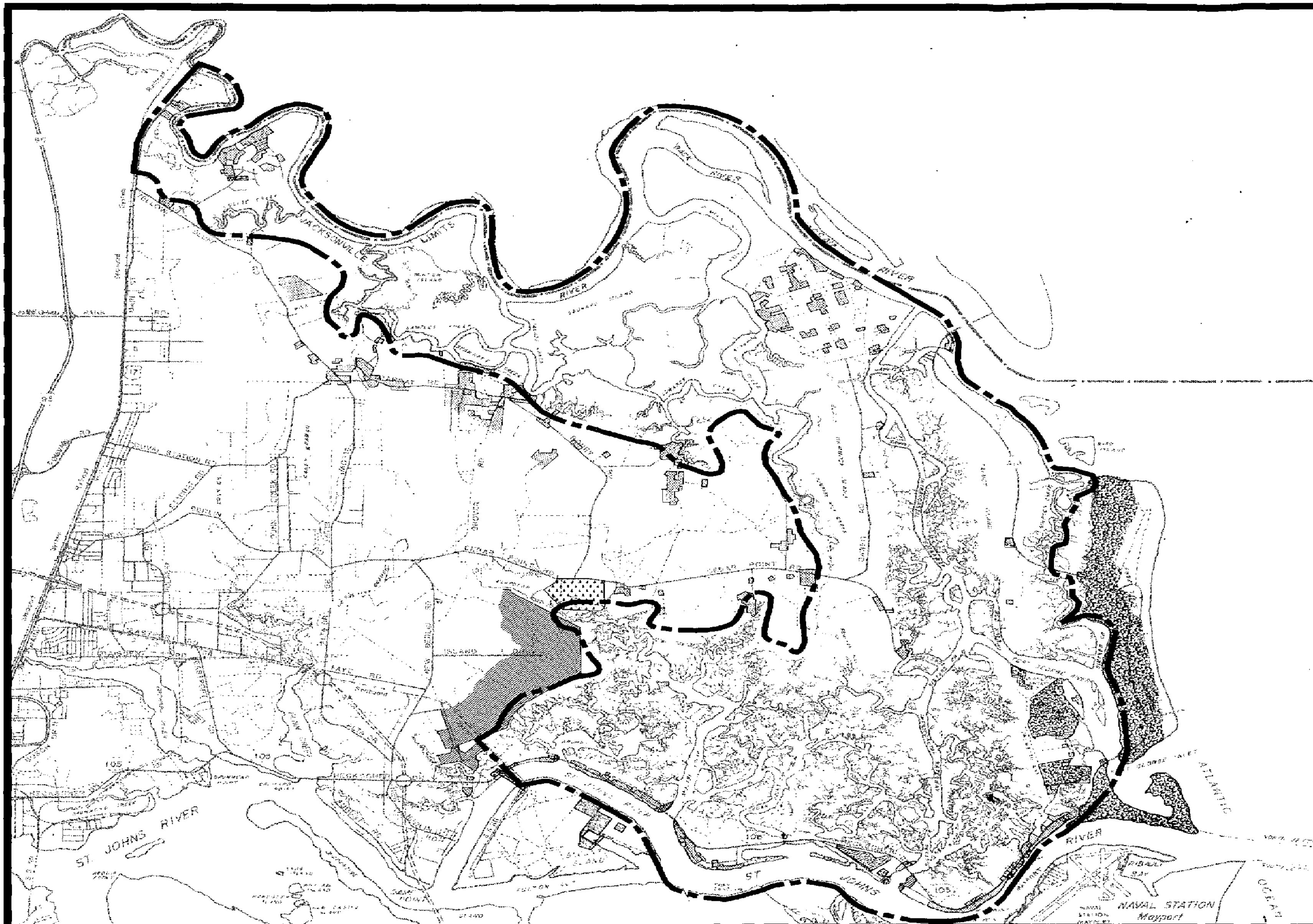
Existing Land Use - (Map 7)

The majority of the estuarine study area consists of salt marsh areas that are subject to tidal action and are usually innundated most of the year. Development potential in this area is limited to the higher, drier areas within the study area. Careful planning is necessary before development can occur, if at all.

Residential

Presently, there are approximately 650 acres developed in residential land uses in the study area. Significant residential areas are found in small pockets in the northern portion of the study area and in higher concentrations along Heckscher Drive.

Pearsons Island in the northwestern portion of the



GENERALIZED EXISTING LAND USE

ESTUARINE STUDY AREA

COASTAL ENERGY IMPACT PROGRAM

JUNE, 1984

prepared by JACKSONVILLE PLANNING DEPARTMENT

MAP 7

study area has developed into a residential community as have areas adjacent to Starrett Creek, Edwards Creek and the northern section of Black Hammock Island.

Commercial

Commercial development in the study area is currently limited to approximately 30 acres. The largest concentration is along Heckscher Drive, consisting mostly of small support businesses such as convenience stores, restaurants, fishing camps, marinas and home occupations.

Transportation

There are approximately 600 acres developed into transportation related uses in the study area. Most of this development, especially port-related railroads and trucking, has taken place adjacent to Heckscher drive near the port. The major portion of this land use consists of roads with a significant portion made up of rail lines and related facilities.

Communications and Utilities

Approximately 120 acres of the study area are utilized by communications and utilities. Power substations and other electric power facilities, package sewage treatment plants and telephone equipment and substations comprise most of this category.

Institutional

Land uses considered institutional are very limited due primarily to the relatively low population. There are approximately 20 acres of institutional land use consisting primarily of schools, fire stations, churches and government owned facilities.

Recreational

The majority of the recreational land uses in the study area consist of the state park land on Fort George and Talbot Islands and the golf course on Fort George Island. A few small scattered parks and public boat ramps make up the remainder of the approximately 1800 acres of recreational land use.

Existing Zoning - (Map 8)

The majority of the estuarine study area is zoned Open Rural (OR). This zoning category allows more rural oriented uses and dwelling units on acre plus size lots.

Residential zoning is concentrated along Heckscher Drive and can be found in isolated patches in the northern parts of the study area in the vicinity of Pearsons Island and Starrett Road.

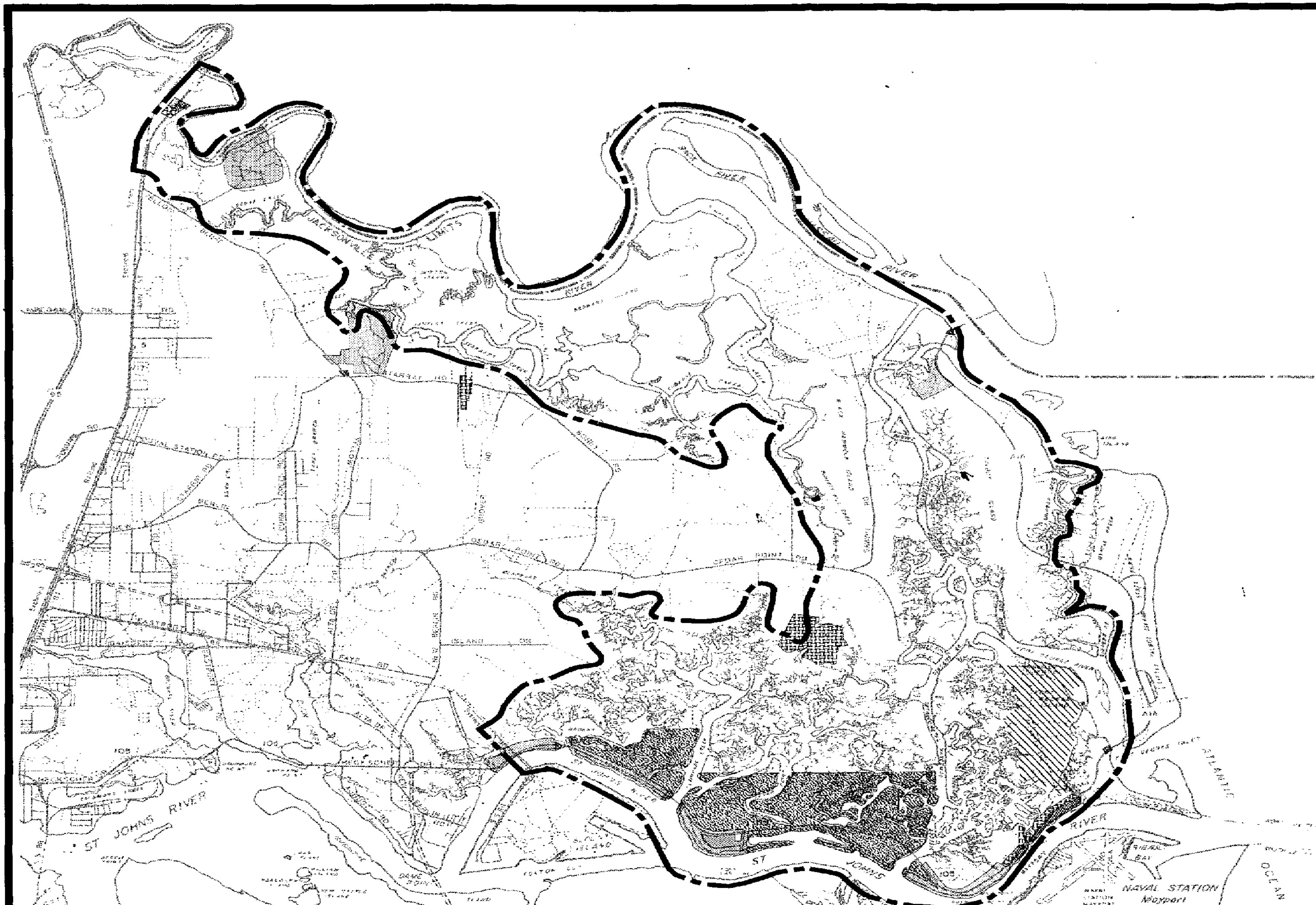
There are areas of Residential-Mobile Home, Residential-Mixed, Residential-Multiple and Office Institutional (RMH, RM and RMOI). These areas are located in isolated patches adjacent to Starrett Road, Cedar Point Road near Pumpkin Hill Creek and along the eastern reaches of Heckscher Drive.

The areas of Commercial Zoning (CI, CN, CG) are found predominantly along Heckscher Drive and in small isolated areas within the study area.

Planned Unit Development (PUD) zoning can be found adjacent to Heckscher Drive between Clapboard Creek and Sisters Creek, with a large area of PUD zoning found on Fort George Island.

The largest category of zoning in the area other than OR is industrial zoning, Industrial-Heavy (IH) and Industrial-Waterfront (IW). Large areas of marsh along and north of Heckscher Drive between Browns Creek and Sisters Creek are zoned IH and IW.

Small isolated patches of Government Use (GU) and Industrial Light Warehousing (ILW) can also be found within the study area.



LEGEND

	RS-A, RS-B, RS-D, RS-F, RG-A, RG-B, RG-C, RG-D		IH, IW
	RMH, RM, RMOI		GU
	CN, CG, CI		PUD
	ILW		OR

EXISTING ZONING

ESTUARINE STUDY AREA

COASTAL ENERGY IMPACT PROGRAM

JUNE, 1984

Prepared by JACKSONVILLE PLANNING DEPARTMENT

MAP 8

ECOLOGICAL ASSESSMENT OF THE ESTUARINE MARSH

II. ECOLOGICAL ASSESSMENT OF ESTUARINE MARSH

Introduction

Salt marsh communities are intertidal systems that occur in coastal areas of gentle slope and low wave energy. On the Atlantic coast, they develop only behind relatively sheltered inlets where the wave energy has been dissipated on the outer coast. The North Florida salt marsh is associated with broad expanses of mud flats and an extensive barrier island system. Figure 1 shows the typical barrier island profile of Northeast Florida with its associated salt marsh communities on the landward side. The North Florida - South Georgia salt marsh communities are among the most productive in the world (Odum, Copeland, and McMahan, 1974).

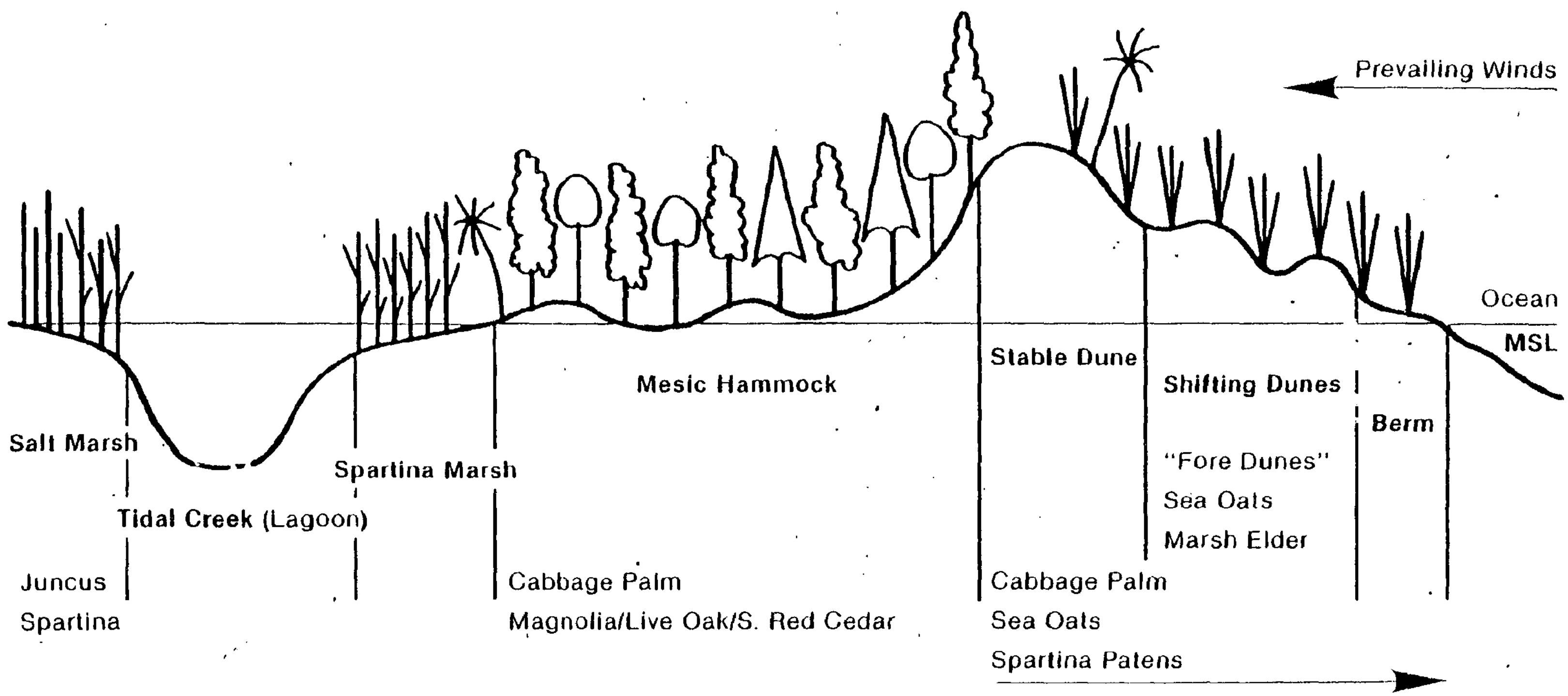
The most characteristic feature of these marshes is the broad expanse of Smooth Cordgrass (Spartina alterniflora) frequently bordered on the landward side by Black Needlerush (Juncus roemerianus). Smooth cordgrass can withstand up to 12 hours of daily tidal flooding. Thus, it occupies the zone between mean low water and mean high tide, the low marsh of Figure 2.

The zone from mean low water to mean low water spring tide is the tidal mud flat (Fig. 2). It is characterized by green algae such as Sea Lettuce (Ulva lactuca), if the sediments are sufficiently consolidated or oysters are present to provide a solid substrate for attachment of the holdfast, and by an abundance of benthic diatoms, often coloring the sands golden brown. This is a highly productive zone that provides food for mud snails (Ilyanassa obsoleta) and various species of killifish (Pomeroy and Wiegert, 1981).

The high marsh is dominated by Black Needlerush, interspersed at the lower edge with the short form of Smooth Cordgrass and at the upper edge or transition zone with a variety of salt tolerant terrestrial plants. It is generally considered a less productive zone than the low marsh (Odum, Copeland, and McMahon, 1974).

To the casual observer, a salt marsh looks like a monotonous expanse of grass and water. To the biologist or naturalist, it is a highly complex and intricately balanced ecosystem, sometimes fragile, sometimes very resilient, depending on which environmental parameter has been altered

Fig. 1. North Florida Barrier Island Profile:

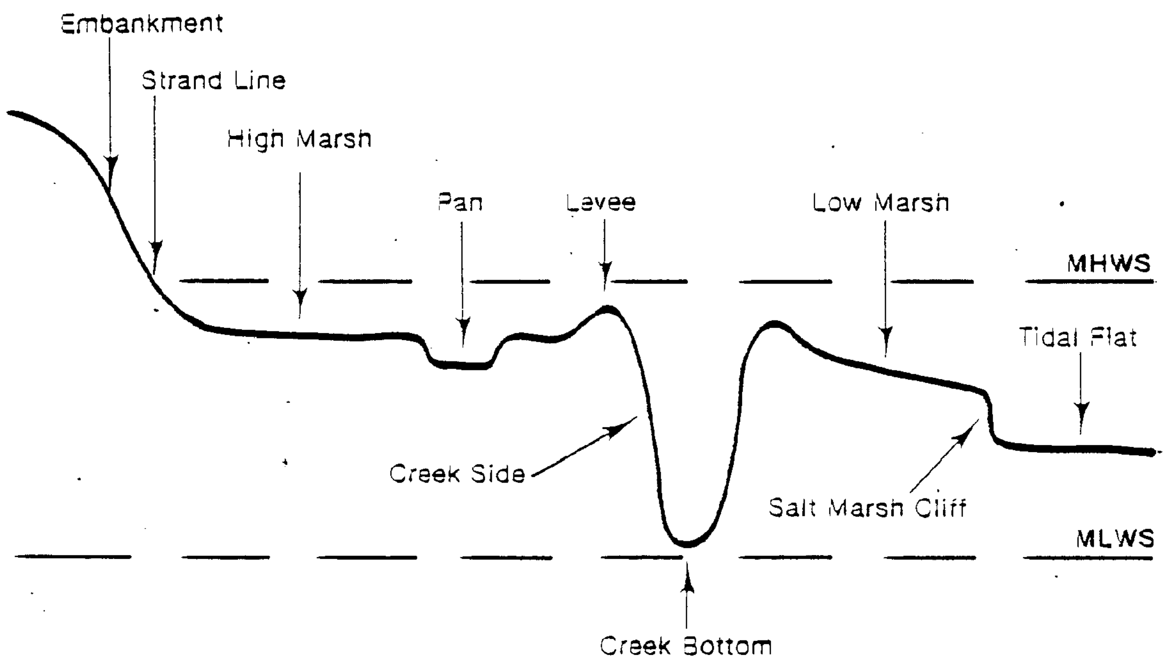


Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

Fig. 2 . Sub-Habitats of the North Florida Salt Marsh Ecosystem.

Major Kinds of Primary Producers:

1. Phytoplankton — Diatoms
2. Marsh Grass — Spartina, Juncus
3. Mud Flat Algae — Diatoms, Blue Green Algae
4. Epiphytes — Diatoms, Green Algae



Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

and for how long. The complex pattern of plant and animal distribution within the sale marsh ecosystem is based on differences in (1) elevation, (2) depth of tidal flooding, and (3) salinity. Figure 2 identifies ten sub-habitats that can be found in Northeast Florida salt marshes. All of these may be present at a given site; more frequently, however, some are missing due to topographical differences.

Salt marsh animals include a large number of terrestrial species such as insects, spiders and a few mammals that nest within the marsh, the Rice Rate and Coastal Meadow mouse. Marine species occur at the seaward edge and within the tidal creeks. These species include bass, flounder, sea trout, mullet, sea catfish, and dolphins. Typical Marsh species of birds inlcude the Clapper Rail, Marsh Wren, and the Seaside Sparrow. These species breed within the marsh and their continued survival depends on salt marsh preservation.

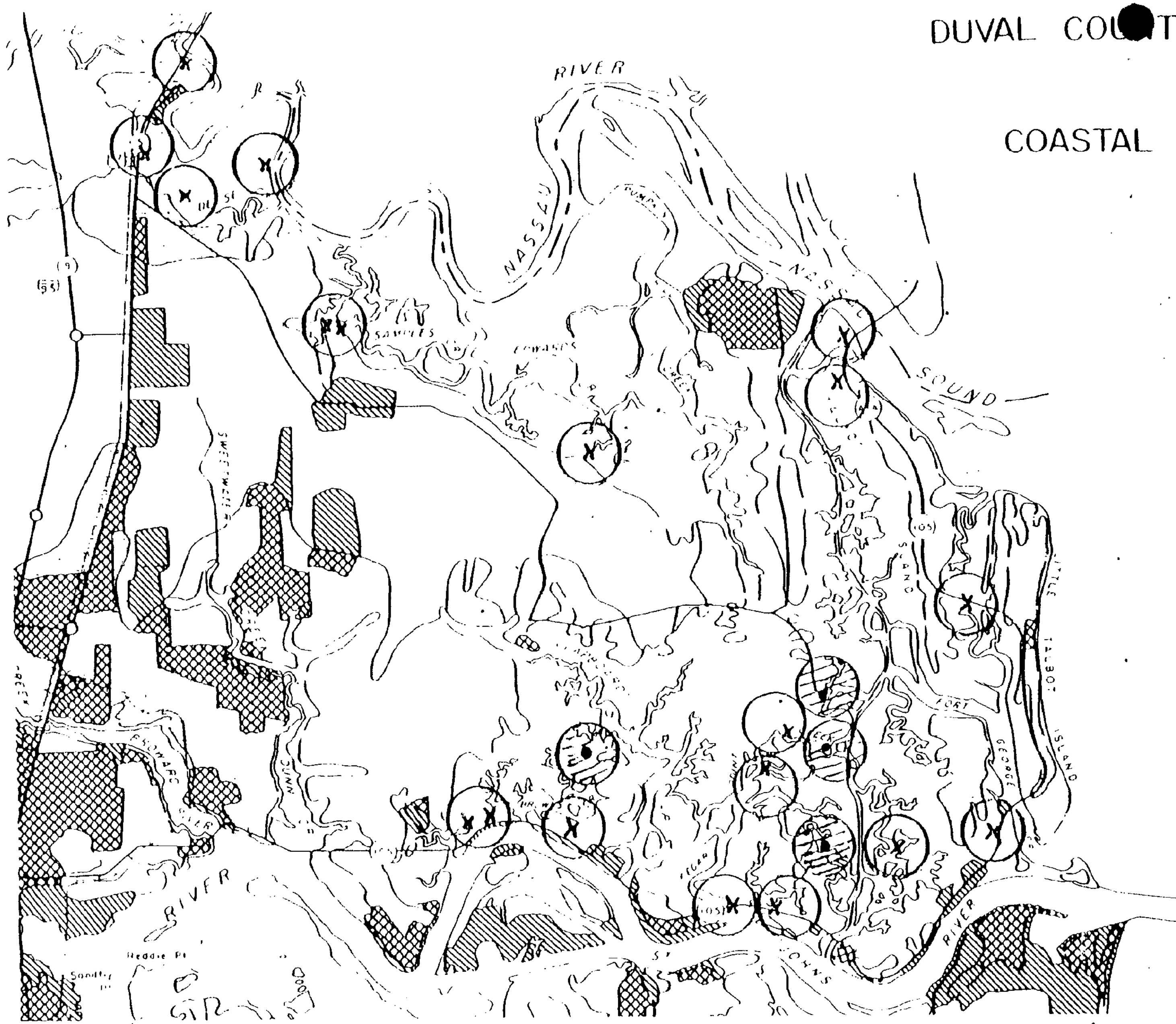
The most common marsh invertebrates include the Fiddler Crab species, Mud snails, Periwinkle snails, and Oysters. Oysters frequently reach their optimum development within the salt marsh system since the tidal flushing provides large amounts of food and the lowered salinities eliminates some of their most severe predators such as starfish and oyster drills.

Methods

Macrophytes

The locations of the sampling areas are indicated by the large circles on the map (9). Several square meter quadrats were measured within each sample location, depending on the number of different community types present at the site. All plant species within the quadrats were counted and identified to species. The average heights of smooth cordgrass types and/or black needlerush were determined for each area sampled. This was determined by measuring the height of ten randomly selected plants of each of the above species in each quadrant and taking the mean height of the sample plants. Square meter detailed vegetation maps were drawn for the four dominant saltmarsh community associations found within the study area. These sites are indicated by a shaded area within the circle in Map 9.

Vegetation transects were run at Inconstantion Creek and Horseshoe Creek from hammock dome to mean low water.



Map 9. Location of Sample Sites used in Salt Marsh Study.

Source: "The Ecological Survey of the Tidal·Marshes of the North St. Johns-South Nassau River Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

Plants falling within the transect were identified to species.

Color infrared aerial photographs supplied by the EROS Data Center were used in addition to U.S.G.S. maps and field surveys to develop a salt marsh vegetation map of the study area. Color slides of each major community association were taken using a Minolta SRT 102. These were used as an aid in plant identification and community characterization. Plant keys used in species identifications are included in the bibliography.

Plankton

Plankton tows were made in Sisters Creek and in Pumpkin Hill Creek. A No. 20 silk bolting cloth plankton net was used. Samples were preserved and counted with a Sedgewick-Rafter Counting Cell and a Hemocytometer using 100x or 400x for identification.

Annotated Animal Lists

Annotated lists of birds, fishes, mammals, and invertebrates were prepared using a combination of actual sightings and literature review.

Results

Vegetation

The plant species that were found during this study are listed in Table 1. A total of 55 species of vascular plants were identified. The dominant vascular plants were smooth Cordgrass (Spartina alterniflora) and Black needlerush (Juncus roemerianus). The low marsh, regularly flooded by tides, is characterized by pure stands of Smooth Cordgrass (Spartina alterniflora).

In the Georgia salt marshes there are typically three growth forms of smoooth Cordgrass: (1) Tall Spartina (averaging 1.3 to 2.5 meters in height) found along the creek banks, (2) Medium Spartina (.6 - 1.3 meters high) found on the top of the natural levees, and (3) Short Spartina (.3m) found back from the levees, where the surface is nearly level, and grading into the needlrush zone (Odum, Copeland, and McMahan, 1976). Based on our sample data, the tall form of Spartina is almost absent within the study area. Plants averaging 1.5 meters were found on the levee at Sisters Creek and Deep Creek. Most of the Spartina counted during this study was less than 60 cm in height, falling within the short to medium range. Plant densities and mean heights for six selected quadrats are given in Table 2.

The zonation of marsh plants typically seen during this study is shown in Fig. 3. Salt meadow hay (Spartina patens) was most abundant in the marshes along the Nassau River and its tributaries. Groundsel trees (Baccharis halimifolia) were the most abundant transition zone shrub of the study area, occurring from the Ft. George Island area to the northwestern boundary of the study area. Needlerush occurred in large pure stands in the high marshes of the central part of the study area. Table 3 lists the most frequently encountered plant species identified during this study.

Inconstantion Creek Profile

The zonation that was seen at Inconstantion Creek is diagrammed in Fig. 4. This was the area in which the largest number of Clapper Rails were sighted. In addition to Clapper Rails tracks of the following animals were identified: Marsh Rabbit, Cotton Rat, Raccoon, and White-Tailed Deer. The birds and wildlife of the area were abundant. Three large covies of quail were flushed from the

Table 1. List of Common and Scientific Names of Plants Found in the Survey of Saltmarsh and Transitional Coastal Vegetation Northeastern Duval County, Florida.

Scientific Name	Common Name	Family
Andropogon capillipes Nash	Beardgrass	Poaceae (Graminae)
Andropogon virginicus L.	Broomsedge	Poaceae
Aristida stricta michx	Wiregrass	Poaceae
Aster tenuifolius L.	Salt marsh aster	Asteraceae (Compositae)
Baccharis halimifolia L. var. angustior DC	Groundsel Silverling	Asteraceae
Batis maritima L.	Saltwort	Bataceae
Bidens pilosa L.	Beggar tick	Asteraceae
Borrichia frutescens (L.) DC.	Sea Oxeye daisy	Asteraceae
Cenchrus tribuloides L.	Sandspur	Poaceae
Cirsium horridulm Michx..	Purple thistle	Asteraceae
Cladium jamaicense	Sawgrass	Cyperaceae
Cnidoscolus stimulosus (Michx..) Engelm, and Gray	Tread softly	Euphorbiaceae
Cyperus filicinus L.	Sedge	Cyperaceae
Distichlis spicata (L.) Greene	Seashore saltgrass	Poaceae
Erythrina herbacea L.	Coral bean	Fabaceae
Galium hispidulum Michx.	Bedstraw	Rubiaceae
Hydrocotyle bonariensis Lam.	Water pennywort	Apiaceae
Ilex Cassine	Dahoon Holly	Aquifoliaceae
Ilex corriacea (Pursh) Chapm.	Gallberry Holly	Aquifoliaceae
Iva frutescens L.	Marsh elder	Asteraceae
Juncus roemerianus Scheele	Black needlerush	Juncaceae
Juncus scirpoides (Lam.)	Rush	Juncaceae
Juniperus siliciola (Small) Bailey	Southern red cedar	Cupressaceae
Limonium carolinianum (Walt.) Britt. var. angustatum (Gray) Blake)	Sea Lavender	Plumbaginaceae
Lycium carolinianum	Christmas Berry	Solanaceae
Lyonia ferruginea (Walt.) Nutt.	Staggerbush	Ericaceae
Magnolia grandiflora L. (M. foetida (L.) Sarg.)	Southern magnolia	Magnoliaceae

Myrica cerifera L.	Wax myrtle	Myricaceae
Opuntia stricta Haw.	Prickly-pear cactus	Cactaceae
Parthenocissus quinquefolia (L.)	Viriginia creeper	Vitaceae
Persea borbonia (L.) Spreng. var. borbonia	Red bay	Lauraceae
Physalis viscosa L.	Groundcherry	Solanaceae
Pinus elliottii Engelm.	Slash pine	Pinaceae
Pinus palustris Mill.	Southern long-leaf Pine	Pinaceae
Pinus taeda L.	Loblolly pine	Pinaceae
Polygala grandiflora Walt. var. grandiflora	Polygala	Polygalaceae
Prunus serotina (Ehrh.)	Black cherry	Rosaceae
Quercus virginiana Miller var. geminata Sarg.	Sand live oak	Fagaceae
Quercus hemisphaerica (Bartr.)	Laurel Oak	Fagaceae
Rubus trivialis	Dewberry	Rosaceae
Rumex pulcher L.	Fiddle dock	Polygonaceae
Sabal palmetto (Walt.) Lodd. and Schultes	Cabbage	Arecaceae (Palmae)
Salicornia virginica L.	Perennial glasswort	Chenopodiaceae
Serenoa repens (Bartr.) Small	Saw palmetto	Arecaceae
Sesuvium portulacastrum L.	Sea purslane	Aizoaceae
Smilax auriculata Walt.	Greenbrier	Smilacaceae
Smilax bona-nox	Bullbrier	Smilacaceae
Smilax laurifolia L.	Bamboo vine	Smilacaceae
Spartina alterniflora Loisel.	Smooth Cordgrass	Poaceae
Spartina cynosuroides	Big cordgrass	Poaceae
Spartina patens (Ait.) Muhl.	Marsh hay cordgrass	Poaceae
Sporobolus virginicus (L.) Kunth	Virginia dropseed	Poaceae
Suaeda linearis (Ell.) Moq.	Sea blite	Chenopodiaceae
Typha latifolia	Cattail	Typhaceae
Uniola paniculata L.	Sea oates	Poaceae

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

Table 2. PLANT DENSITIES AND MEAN HEIGHTS OF <u>SPARTINA ALTERNIFLORA</u> FOR SIX QUADRATS.

Location	Mean Height		# of Plants/M^2
Samples	levee	1.4m	38
	low marsh	34cm	528
Edwards Creek		70cm	330
Sawpit Creek	levee	60	158
	low marsh	18cm	276
Deep Creek		1.5m	60

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

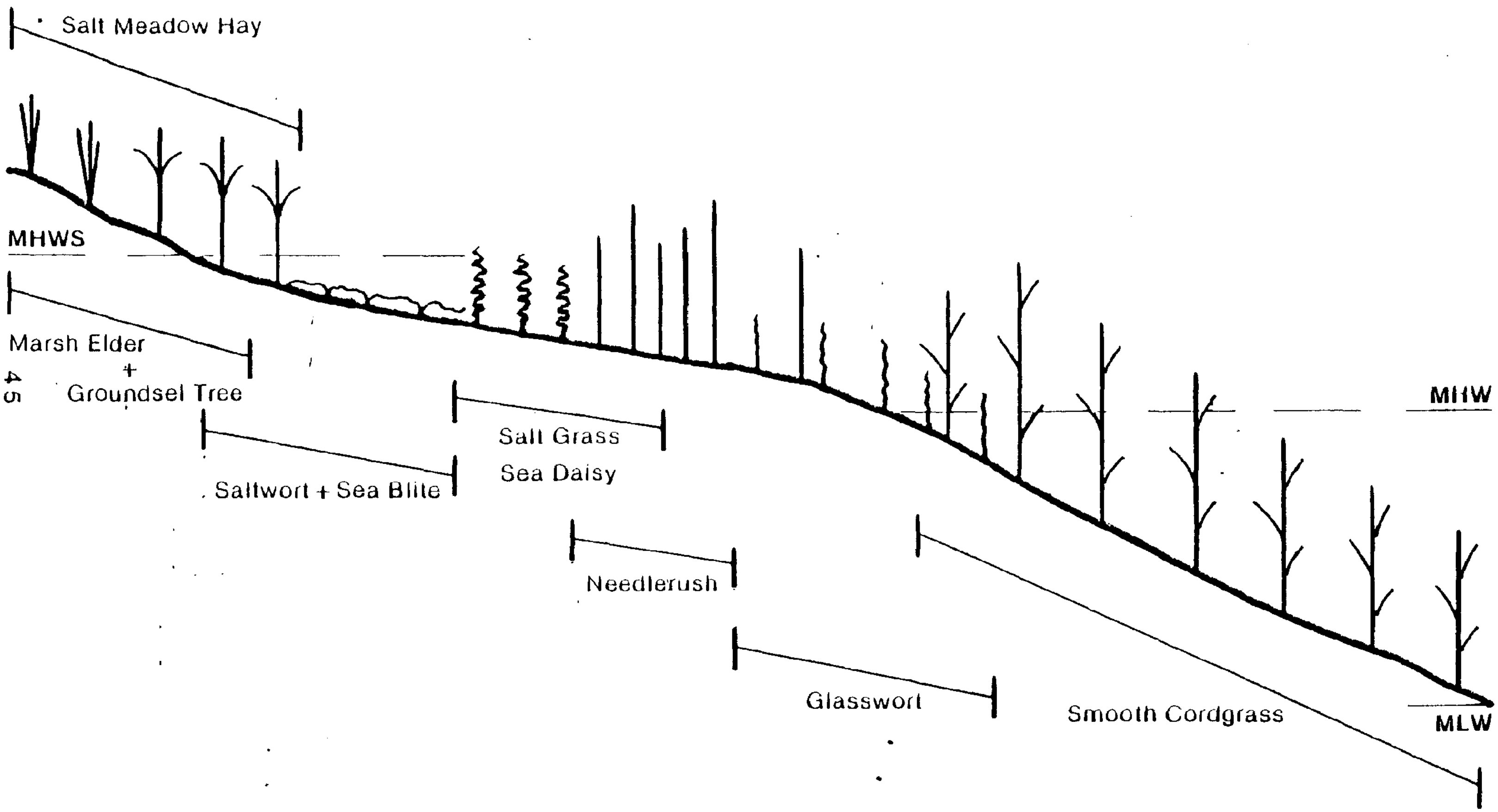


Fig. 3. Generalized Zonation of Salt Marsh Plants in North Florida.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

Table 3. TYPICAL PLANT SPECIES FOUND IN THE DUVAL COUNTY SALT MARSH

Dominant Species

Batis maritima (Saltwort)

Borrichia frutescens (Sea daisy)

Distichlis spicata (Saltgrass)

Juncus roemerianus (Black needlerush)

Spartina alterniflora (Smooth cordgrass)

Spartina patens (Marsh hay cordgrass)

Associated Species

Salicornia virginica (Glasswort)

Sesuvium portulacastrum (Sea purslane)

Spartina cynosuroides (Big cordgrass)

Suaeda linearis (Sea blight)

Typha angustifolia (Narrow-leaved cattail)

Transitional Species

Andropogon elliottii (Broomsedge)

Baccharis halimifolia (Groundsel bush)

Batis maritima (Saltwort)

Cladium jamaicense (Sawgrass)

Iva frutescens (Marsh elder)

Limonium carolinianum (Marsh lavender)

Lyonia ferruginea (Staggerbush)

Myrica cerifera (Wax myrtle)

Sabal palmetto (Cabbage palm)

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

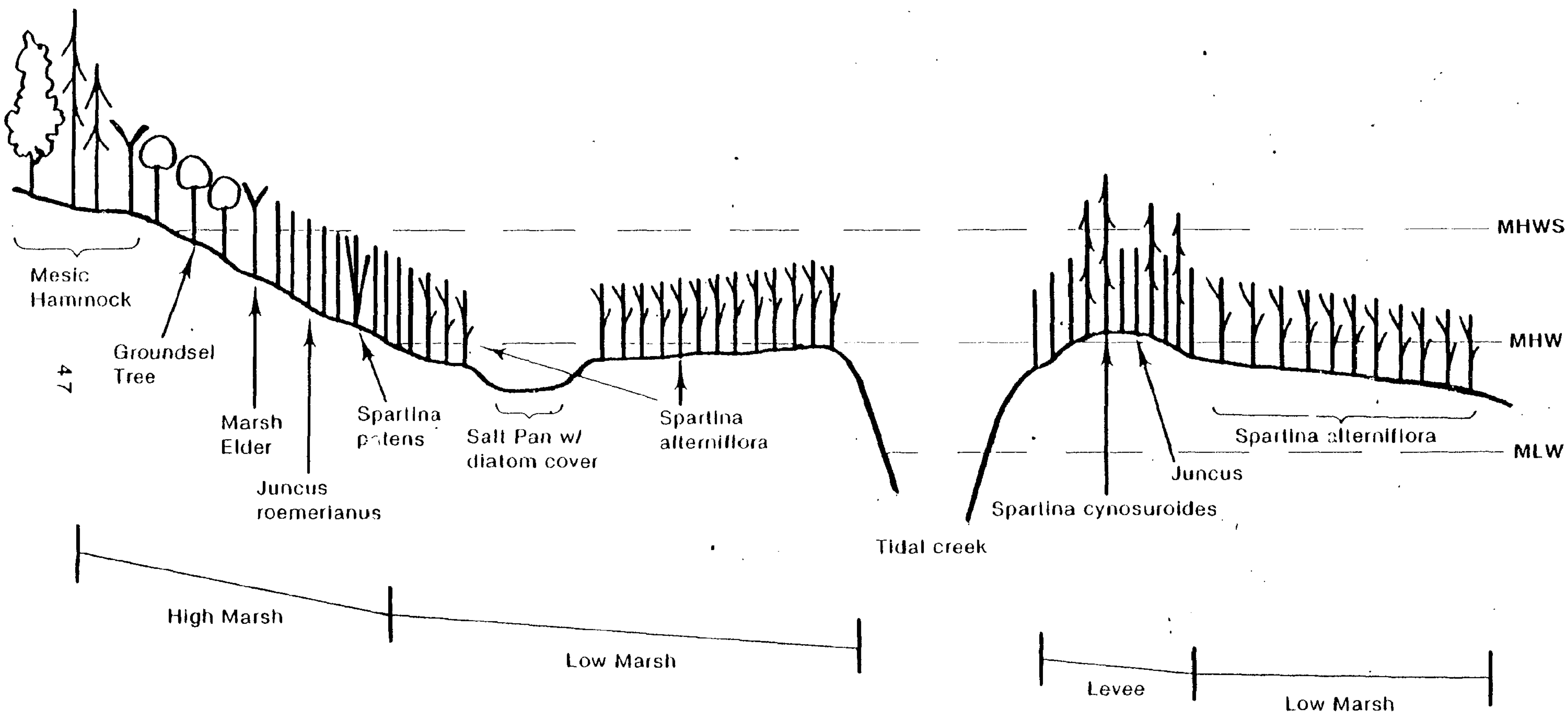


Fig. 4. Profile of Saltmarsh in Inconstantion Creek Area.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

Big Cordgrass stands during the first visit to the area. The creek banks were a golden brown due to large numbers of benthic diatoms. This was also the location of the most extensive stands of Big Cordgrass (Spartina cynosuroides).

Horseshoe Creek Profile (Black Hammock Island).

The dominant tree species of this hammock was Southern Red Cedar (Juniperus siliciola). Sea Oxeye Daisy (Borrichia frutescens) was the most abundant transition zone plant. Black Needlerush was sparsely present in widely scattered stands. The low marsh consisted of almost pure stands of Smooth Cordgrass, averaging less than 40 cm high. The low marsh was well developed in this area with extensive tidal flats containing large numbers of oyster bars, mudsnails and grapsid crabs (See Invertebrate list).

Square Meter Detailed Vegetation Maps

Square meter detailed vegetation maps were drawn for four sample locations (See Fig. 6-9). The following Community Associations are characterized by these maps: (1) Spartina marsh (2) mixed Spartina Juncus marsh (3) short Juncus marsh, (4) saline transition zone. Plant densities of the dominant species within the quadrats ranged from a high of 342 plants/m^2 for the Spartina marsh to a low of 82/m^2 for Borrichia frutescens (Sea Oxeye Daisy) in the saline transition zone.

Plankton

Plankton tows were made in Pumpkin Hill Creek (salinity 4%) and in Sisters Creek (salinity 22%). Complete Plankton lists are given in the Appendix.

Zooplankton

The most abundant zooplankton at Pumpkin Hill Creek were Cyclopoid adults. These are common fresh to brackish water Crustaceans that provide food for fish species and larger invertebrates. Calanoid adults and larval stages (nauplius) were the most abundant organisms among the zooplankton in the Sisters Creek sample. These are also Crustaceans that are an important food source for fish and invertebrates.

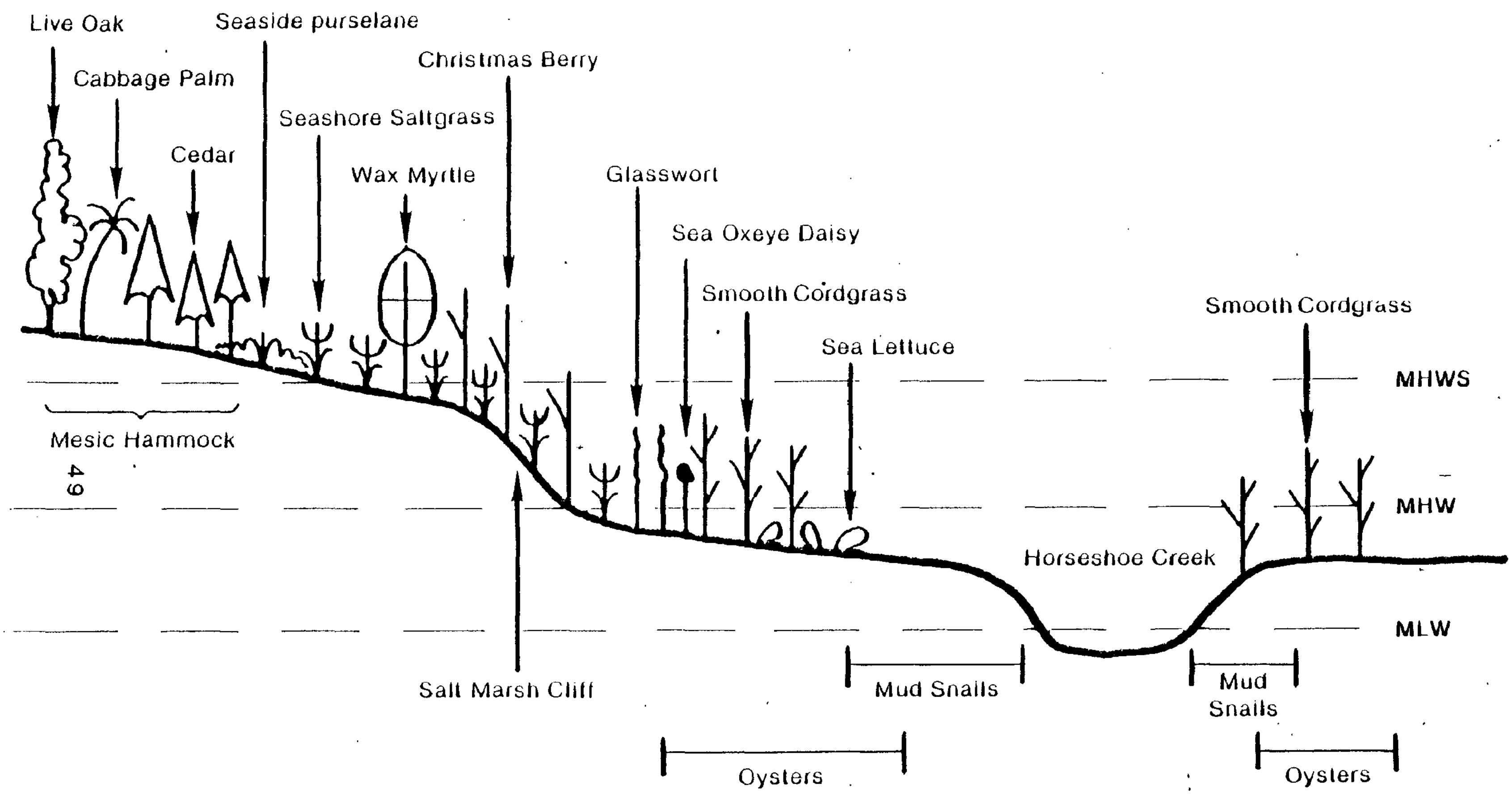
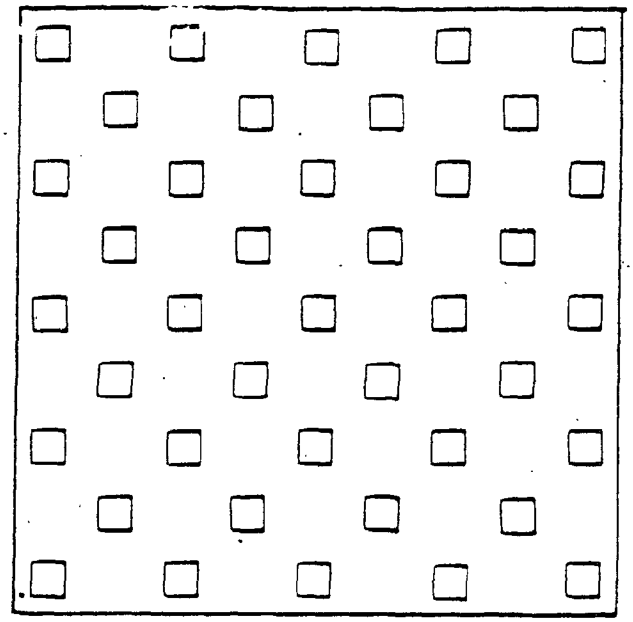


Fig. 5. **Profile of Saltmarsh in Horseshoe Creek Area (Black Hammock Island).**

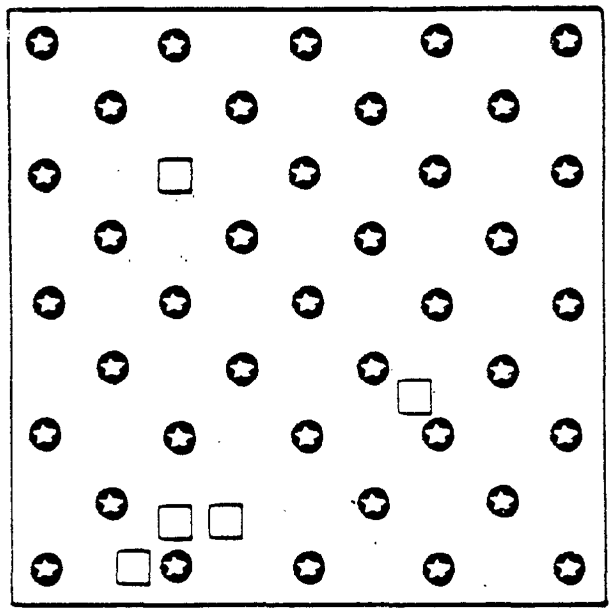
Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.



Spartina alterniflora (342)

FIG. 6. Spartina Marsh at Mouth of Cedar Point Creek near Sisters Creek, (numbers in parentheses equals total number per square meter).

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

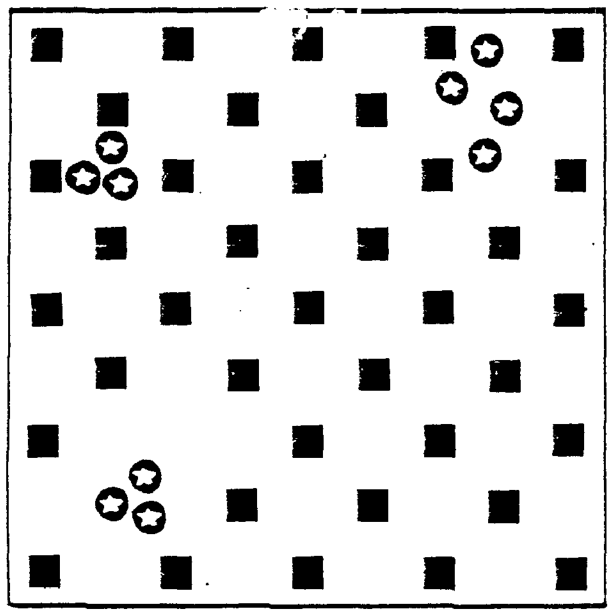


Juncus roemerianus (120)

Spartina alterniflora (51)

FIG. 7. Spartina-Juncus Marsh on Hannah Mills Creek, (number in parentheses equals total number per square meter).

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

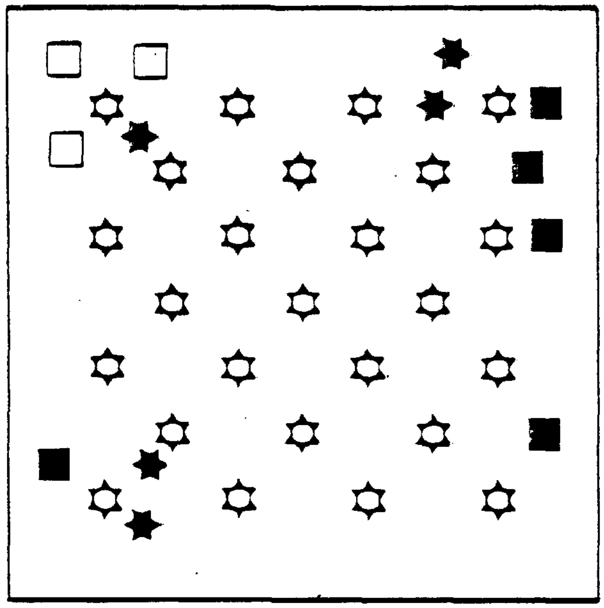


■ Juncus roemerianus (142)

✪ Salicornia virginica (1516)

FIG. 8. Short Juncus Marsh at Pelotes Island, (number in parentheses equals total number per square meter).

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.



Borrichia frutescens (82)

Salicornia virginica (7)

Spartina alterniflora (3)

Suaeda linearis (9)

FIG. 9. Transition Zone at Horseshoe Creek, (number in parentheses equals total number per square meter.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

Phytoplankton

The forms identified from the Pumpkin Hill sample were dominated by benthicdiatom genera such as Gyrosigma, Surirella, an Navicula. More species were identified from the higher salinity site at Sisters Creek. A larger number of planktonic forms were identified from this station. The bottom in this area was sandy as compared with the darker muds of the Pumpkin Hill area. This type of sandy substrate was poorer in benthic flora as compared to the organic muds of the more inland areas such as Pumpkin Hill Creek.

Annotated Animal Lists

Annotated lists for birds, fishes, mammals and reptiles (one list), and invertebrates are presented in V-VIII, attached reports. Notes on stages of the life cycle spent within the study area and endangered or threatened status are included in the reports.

Vegetation Results Summary

(1) A total of 55 species of vascular plants were identified during this study. The dominant vascular plants were smooth cordgrass (Spartina alterniflora) and black needrush (Juncus roemerianus). The low marsh, regularly flooded by tides, is characterized by pure stands of smooth cordgrass.

(2) Based on our sample data, the tall form of smooth cordgrass is almost absent within the study area. Plants averaging 1.5 meters high were found on the levee at Sisters Creek and Deep Creek. Most of the plants counted during this study were less then 60 cm high.

(3) Black needlerush occurred in large, pure stands in the high marshes of the central and southwestern part of the study area. The tallest stands occurred in the area from Pearson Island to west of Black Hammock Island.

(4) Salt meadow hay (Spartina patens) was most abundant in the marshes along the Nassau River and its tributaries.

(5) Big Cordgrass (Spartina cynosuroides) was abundant in only one area within the study. This was the Inconstation Creek location. Plants averaged 2.9 meters

high.

(6) The phytoplankton collections contained large numbers of benthic diatoms. The richest areas in terms of benthic productivity within the marsh system appeared to be from U.S. Highway 17 to the Pumpkin Hill Creek area. The poorest in terms of population densities and species diversities was the area east of the intercoastal waterway.

Birds of the Nassau River-St. Johns River Marshes

The following is a list of birds commonly sighted or known to frequent the salt marsh during migration. in the winter or for feeding. A complete list of all birds that have been sighted in or use the marsh area anytime of the year, can be found in the appendix.

Red-winged Blackbird (Agelaius phoeniceus)
Rusty Blackbird (Euphagus Carolinus)
Boat-tailed Grackle (Quiscalus major)
Common Grackle (Quiscalus quiscula)
Orchard Oriole (Icterus spurius)
Northern Oriole (Icterus galbula)
American Goldfinch (Corduel)
Wood Stork (Mycteria americana)
Green-winged Teal (ana crecca)
Mallard Duck (Anas Platyrhnchos)
Northern Pintail (Anas discors)
Northern Shoveler (Anas clypeata)
Gadwall (Anas strepera)
Ring-necked Duck (Aytha collairis)
Lisser Scaup (Autha affinis)
Hooded Merganser (Lophodytes cucullatus)
Red-brested Merganser (Mergus serrator)
Turkey Vulture (Cathartes aura)
Osprey (Pandion halictus)
Norther Harrier (Circus cyaneus)
Red-Tailed Hawk (Buteo jamaicensis)
Pied-billed Grebe (Podil ymbus podiceps)
Horned Grebe (Podiceps auritus)
Brown Pellican (Pelecanus occidentalis)
Double-crested Cormorant (Phalacrocorax auritus)
Anhinga (Anhinga anhinga)
Great Blue Heron (Ardea herodias)
Great Agret (Casmerodius abus)
Snowy Egret (Egretta thula)
Little Blue Heron (Egretta caerulea)
Tri colored Heron (Egretta tricolor)
Cattle Egret (Bubulcus ikis)
Green-backed Heron (Butorides striatus)
Black-crowned Night Heron (Nycticorax nycticroax)
White Ibis (Eudocimus albus)
American Krestrel (Falco sparverius)
Peregrine Falcon (Falco peregrinus)
Northern Bobwhite (Colinus virgini anus)
Clapper Rail (rallus longirostris)
King Rail (Rallus elegans)
American Coot (Fulica americana)

Black-bellied Plover (Pluvialis squatarola)
Wilsons Plover (Charidrius Wilsonia)
Semipalmated Plover (Charidrius semipalmatus)
American Oystercatcher (Hallmtopus palliatus)
Willet (Catoptrophorus semipalmatus)
Spotted Sandpiper (Actitus macularia)
Ruddy Turnstone (Arenaria interpres)
Sanderling (Calidris alba)
Semipalmated Sanpiper (Calidris pusilla)
Western Sandpiper (Calidris Mauri)
Least Sandpiper (Calidris minutilla)
Dunlin (Calidris alpina)
Short-billed Dowitcher (Limnodromus griseus)
Common Snipe (Gallinago, gallinago)
American Woodcock (Scolopax minor)
Laughing Gull (Larus atricilla)
Ring-billed Gull (Larus delawarensis)
Herring Gull (Larus argentatus)
Great Black-backed Gull (Larus marinus)
Gull-billed Tern (Sterna nilotica)
Casouab Tern (Sterna Caspia)
Royal Tern (Sterna Maxima)
Forester's Tern (Sterna forsteri)
Least Tern (Sterna antillarum)
Black Tern (Chidonas niger)
Black Skimmer (Rynehops Niger)
Mourning Dove (Zenaida macoura)
Yellow-billed Chuckoo
Common Barn Owl (Tyto alba)
Eastern Screech-Owl (Otus asio)
Barred Owl (Strix varia)
Common Nighthawk (Chordeiles minor)
Chuck-will's widow (Capimulgus vociferus)
Ruby-throated Hummingbird (Archilochus colubris)
Belted Kinfisher (Ceryle alcyon)
Redbellied Woodpecker (Melanerpes carolinus)
Yellow-bellied sapsucker (Sphyrapicus varius)
Downy Woodpecker (Picoides pubescens)
Downy Woodpecker (Picoides Pubescens)
Northern Flicker (Colaptes auratus)
Eastern Wood-Pewee (Contopus varens)
Eastern Phoebe (Sayornis phoebe)
Great Crested Flycatcher (Myiarchus crinitus)
Purple Martin (Progne subis)
Tree Swallow (Tachycineta bicolor)
Barn Swallow (Hirundo rustica)
Blue Jay (Cyanocitta cristata)
Fish Crow (Corvus ossifragus)
Tufted Titmouse (Parus bicolor)
Carolina Wren (Thryothorus vidovicianus)

House Wren (Troglodytes aedom)
Marsh Wren (Cistothorus platensis)
Ruby-crowned Kinglet (Regulus satrapa)
Blue-gray Gnatcatcher (Polioptila caerulea)
American Robin (Turdus migratorius)
Northern Mockingbird (Mimus polyglottos)
Brown Thrasher (Toxostoma rufum)
Cedar Waxwing (Bombycillia cedrorum)
European Starling
White-eyed Vireo (Vireo griseus)
Solitary Vireo (Vireo solitarius)
Yellow-throated Vireo (Vireo flavifrons)
Red-eyed Vireo (Vireo olivaceus)
Tennessee Warbler (Vermivora pereigrina)
Orange-crowned Warbler (Vermivora celata)
Northern Parula (Parula americana)
Black and White Warbler (Minotila voria)
American Redstart (Setophaga ruticilla)
Common Yellowthroat (Geothlypis trichas)
Summer Tanager (Piranga rubra)
Northern Cardinal (Cardinalis cardinalis)
Indigo Bunting (Passerina Cyanea)
Painted Bunting (Passeriva ciris)
Rufous-sided Towhec (Pipilo aestivalis)
Chipping Sparrow (Spizella.pusilla)
Savanna Sparrow (Passerculus sandwichensis)
Sharp-tailed Sparrow (Ammodramus caudacutus)
Seaside Sparrow (Ammodramus martimus)
Song Sparrow (Melospiza georgiana)
White-throated Sparrow (Zonotrichia albicollis)
Bobolink (Dolichonyx oryzivorus)

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

The Fish of the Nassau River-St. Johns River Marshes
Duval County, Florida

Estuarine communities are often characterized by high productivity (Phytoplankton, emergent and submergent vegetation), low species richness and diversity and high dominance. It is this productivity, the ability to capture enough energy to produce a great volume of living tissue and to pass that energy along to organisms that man finds useful, that makes an estuary so economically valuable. The commercial and sport fisheries of the area are dependent to a large extent on the quality of the salt marsh.

The commercial and sport fish that either spawn or live in the marsh for a large part of their life cycles are: Elops saurus - Lady fish; Megalops atlantica - Tarpon; Opisthonema oglinum - Threadfin herring; Brevoortia tyrannus - Atlantic mehaden; Alosa pseudoharengus - Alewife; Arius felis - Sea catfish; Bagre marinus - Gafftop catfish; Fundulus heterochtus - Mummichog; Menidia beryllina - Silverside; Mugil cephalus - stiped mullet; Mugil curema - White mullet; Chaetidipterus faber - Spadefish; Lagadon rhomboides - Pinfish; Cynoscion nebulosus - Spotted sea trout; Cynoscion regalis - weakfish; Sciaenops ocellatus - Red drum; Micropogon undulatus - Croaker; Leiostomus xanthurus - Spot; Menticirrhus saxatilis - Northern kingfish; Caranx hippos - Jack crevalle; Selene vomer - Lookdown; Trachinotus carolinus - Florida pompano; Orthopristis chrysopterus - Pigfish grunt; Paralichthys lethostigma - Southern fluke; Paralichtys dentlus - Summer flounder; Pomatomus saltatrix - Bluefish; Poronatus triacanthus - Butterfish; Scomberomorus cavalla - King mackeral. Included in the Appendix is a list of the species composition of Fish Larvae identified from Sisters Creek during two years.

Several species found in the study area are SPECIES OF SPECIAL CONCERN (See Appendix). They are Fundulus grandis - Gulf killie; Cyprinodon variegatus - Sheephead minnow and Fundulus similis - Longnose killie.

This list is divided into two parts. Part (1) is a species list of fish collected by the Marine Biology Group of the University of North Florida. An annotated list of all the species likely to occur in the study area can be found in the appendix.

Part (1) - Species list of fish collected.

Alosa pseudoharengus - Alewife
Anchoa hepsitus - Striped anchovy
Anchoa mitchilli - Bay anchovy
Brevoortia tyrannus - Atlantic menhaden
Caranx hippos - Jack crevalle
Chaetodipterus fiber - Atlantic spadefish
Chilomycterus schoepfi - Striped burrfish
Cynoscion nebulosus - Spotted seatrout
Cynoscion regalis - Weakfish
Cyprinodon variegatus - Sheephead minnow
Dorosoma cepedianum - Gizzard shad
Elops saurus - Ladyfish
Eucinostomus argenteus - Spot
Fundulus cingulatus - Banded topminnow
Fundulus confluentus - Marsh killie
Fundulus heteroclitus - Mummichog
Fundulus majalis - Stiped killie
Fundulus similis - Longnose killie
Gobionellus spp - Goby
Gobiosoma spp - Goby
Haerulon parri - sailor's choice
Hypsoblemmius hentz - carolina blenny
Lagodon rhomboides - Pinfish
Leiostomus xanthurus - Spot
Megalops atlantica - Tarpon
Menidia beryllina - Silversides
Menticirrhus saxatillis - Northern kingfish
Micropocan undalatus - Atlantic croaker
Mugil cephalus - Striped mullet
Mugil curema - White mullet
Opisthopera oglinum - Threadfin herring
Opsanus tau - Toadfish
Orthopristis chrysoptera - Pigfish
Paralichthys dentalus - Summer Flounder
Pogonias cromis - Black drum
Pomatomus saltatrix - Bluefish
Prionotus tribulus - Bighead searobin
Pronatus triacanthus - Butterfish
Scianenops ocellata - Red drum
Scomberomorous cavalla - King mackeral
Selene vomer - Lookdown
Sphaeroides maculatus - Northern puffer
Strongylura marina - Atlantic needlefish
Symphurus plagiusa - Blackcheek tongue fish
Syngathus floridae - Florida pipefish
Synodus foetens - Inshore lizardfish
Trachinotus carolinus - Florida pompano
Trichuirus lepturus - Atlantic cutlassfish
Trinectes maculatus - Hogehoker

Source: The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

An Annotated Listing of Vertebrates of the Nassau River-St. Johns River Marshes of Duval County, Florida Excluding Birds and Fish

The following includes an annotated listing of Mammals and Reptiles which reside or may reside in the salt marshes and estuaries of northeast Florida in Duval County.

The salt marsh is characterized as an area of relatively flat land which is subject to tidal inundation of salt or brackish water. In northeast Florida the cordgrass Spartina alterniflora dominates the lower regularly flooded areas of the salt marsh, and Juncus roemerianus dominates the higher and drier areas of the marsh flats. Because of the frequent and regular flooding of the marsh flat, few reptiles and mammals are permanent salt marsh residents. Many species use the salt marsh to forage for food during low tides, however.

No Amphibians and few reptiles are found in the salt marsh as regular residents. These animals are sensitive to the desiccating osmotic conditions of marine or brackish water environments, and do not survive well in waters or areas of high salinity. The few species of reptiles listed have special adaptive mechanisms which allow them to maintain the necessary osmotic balance within their body fluids.

The large majority of mammals observed in the marsh flats are actually residents of the large hammocks, islands, and areas surrounding the salt marsh. A few species are permanent residents of the flat itself, and during high tide flooding these animals take refuge in the emergent vegetation, on small hammocks, or on other patches of dry ground. Some species, like the Round-Tailed Muskrat, construct floating mats of vegetation to den in and to ride out the high tide flooding.

None of the salt marsh mammals are of major commerical importance. The American Alligator, Spotted Turtle, and the Diamondback Terrapin have all been of considerable commercial importance in the past, but are not so today because of scarcity or protection by law.

The uniqueness of the salt marsh habitat has selected for some unique mammal and reptile species. The steady disappearance of this habitat due to develpoment is threatening to eradicate many of the species which depend on the salt marsh for survival. Table 4 lists the species in the study area which are considered by the Florida Committee on Rare and Endangered Plants and Animals at risk. The manatee and alligator would probably be little affected if the salt marsh habitat was lost, but the other four species listed would suffer greatly as these are permanent salt marsh residents. Loss of the salt marsh habitat would also have a serious effect on populations of Diamondback Terrapins, as well as affecting the River Otter. The status of the River Otter is under review by the U. S. Fish and Wildlife Service.

The annotated listing of species in this report was compiled through actual field observations of individuals or evidence of their presence such as footprints or droppings. Other species were included based upon a literature review. Species listed but not actually sighted were included as indicated by their know habitat preferences and feeding habitats. Table 5 has a listing of species actually observed in the salt marshes of the study area.

A list of species known to inhabit the marsh, but not sighted, are incuded in the Appendix.

Table 4. Salt Marsh Mammal and Reptile Species included in the Florida List of Rare and Endangered Species (Prichard et.al. 1978)

Status Category*	Species Included
Endangered	*Nerodia fasciata taeniata* (Atlantic Salt Marsh Snake)
Threatened	*Trichechus manatus latirostris*
Rare	*Clemmys guttata* (Spotted Turtle)
	Mustela vison lutensis (Florida or Salt Marsh Mink)
Special Concern	*Alligator mississipiensis* (American Alligator)
	Neofiber alleni (Round-Tailed Muskrat)

*As used in the Florida List of Rare and Endangered Species, 1978.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

Table 5: Salt Marsh and Estuary Mammals Observed in the Field

Common Name	Scientific Name	Observations
Nine-Banded Armadillo	*Dasypus novenmcinctus*	1, 2
Virginia Opossum	*Didelphis virginiana*	1, 2
River Otter	*Lutra canadensis*	2
Bobcat	*Lynx rufus*	2
Round-Tailed Muskrat	*Neofiber alleni*	2
White-Tailed Deer	*Odocioleus virginianus*	1
Rice Rat	*Oryzomys palustris*	2
Raccoon	*Procyon lotor*	1, 2
Eastern Grey Squirrel	*Sciurus carolinensis*	2
Eastern Cottontail	*Sylvilagus floridanus*	2
Marsh Rabbit	*Sylvilagus palustris*	1, 2
Atlantic Bottle-nosed Dolphin	*Tursiops truncatus*	1

1 = Observed by members of U.N.F. marsh study team, 1984.
2 = Observed as reported by Fairfield Communities/Ft. George Environmental Impact Survey, 1982.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

WATER QUALITY SURVEY

III. WATER QUALITY SURVEY

Bio-Environmental Services Division (BESD) has conducted three water quality sample runs, including the Nassau River Basin and a portion of the Intracoastal Waterway (Sisters Creek area). The survey consists of eleven sample sites strategically located over approximately eighty to ninety miles of meandering salt marsh waterways. The waterways included in this survey are: Inconstantion Creek, Deese Creek, Nassau River, Sample Creek, Edwards Creek, Pumpkin Creek, Nassau River, Sample Creek, Edwards Creek, Pumpkin Hill Creek, Simpson Creek, Horseshoe Creek and Hannah Mill Creek.

The purpose of this survey was to obtain background data within the area while it remains basically undeveloped. With development rapidly approaching this area from both the north and south, further delays in obtaining water quality data might have ruined this opportunity.

Field parameters for which BESD sampled include time, temperature, dissolved oxygen, pH, conductivity, depth, tide and weather. The BESD lab analyzed water samples for total phosphorus, total suspended solids, copper and iron. Enviropact of Jacksonville, Inc. was retained to analyze water samples for total nitrogen, sulfate, total organic carbon and mercury. The Florida State Health Department ran the analysis for fecal coliform bacteria. Sediment samples will be taken in the area in the near future.

The survey was conducted during periods with tides ranging from very low to high. All field parameters were within acceptable limits; however, pH tended to run a little low (5-6) throughout the survey. The low pH is probably a normal condition in this area. The BESD Lab reports indicate slightly elevated TSS, which is probably due to plankton which was visible in heavy concentrations throughout the survey area. BESD metal analyses are not available at this time.

(INSERT: MAP 10 - SAMPLE SITES)

(INSERT: 3 PAGES - TABLES 6, 7 AND 8)

Map 10

LEGEND

● WATER QUALITY ANALYSIS SAMPLING STATION

WATER SAMPLING SITES

ESTUARINE STUDY AREA
COASTAL ENERGY IMPACT PROGRAM

Graphic Scale
1" : 10,000'

JUNE, 1984

prepared by
JACKSONVILLE PLANNING DEPARTMENT

MAP 10

Table 6. Results of Water Sample I

DATE : Feb 15 1984

PARAMETERS

LOCATION	BESD FIELD + LAB											ENVIROPACT				STATE LAB
	Time	Temp	D.O.	pH	Cond.	Tide	Depth	TP	TSS	Cu	Fe	Hg	TOC	SO_4	TN	F. Coli.
INCONSTANTION CREEK	1:25	15	9.0	6.0	6,000	outgoing	4 ft.	0.161	20	<10	610	<1	10.9	120	1.04	1600 /100 ml
NASSAU R. AT DEESE CR.	1:45	15	9.5	6.0	16,000	"	15 ft.	0.135	40	<10	610	<1	15.6	250	0.22	2400 /100 ml
DEESE CREEK	1:50	15	9.0	6.0	17,000	"	13 ft.	0.131	64	<10	460	<1	15.3	250	0.65	2400 /100 ml
SAMPLE'S CREEK	2:45	17	9.0	6.0	20,000	"	11 ft.	<0.119	42	<10	550	<1	14.8	850	0.63	1600 /100 ml
EDWARD'S CR. AT STARRETT CR.	2:30	16	9.5	6.0	22,000	out	10 ft.	0.119	40	<10	390	<1	12.8	1000	0.56	920 /100 ml
PUMPKIN HILL CR. (NORTH)	3:30	16.5	9.0	6.0	24,500	"	13 ft.	<0.119	40	<10	270	<1	12.2	1150	0.65	1600 /100 ml
EDWARD'S CR. AT PUMPKIN HILL CR.	3:07	17	8.5	6.0	25,000	"	15 ft.	0.123	44	<10	400	<1	12.1	1000	0.75	920 /100 ml
PUMPKIN HILL CR. (SOUTH)	3:15	17	8.7	6.0	24,500	"	5.5 ft.	<0.119	26	<10	550	<1	12.3	1000	0.80	> 2400 /100 ml
SIMPSON CR. AT NASSAU R.	11:25	13.5	9.6	6.0	27,500	outgoing	4 ft.	<0.119	28	<10	460	<1	3.8	1650	0.10	130 /100 ml
HORSESHOE CR.	4:08	16	10.9	6.0	33,000	incoming	1 ft.	<0.119	49	<10	290	<1	5.4	1350	0.28	1600 /100 ml
HANNAH MILL CR.	4:30	15	11.5	6.0	29,000	"	3 ft.	<0.119	55	<10	490	<1	7.1	1250	0.49	170 /100 ml

NOTE: D.O., TP, TSS, TOC, SO_4, and TN are reported in mg/l (ppm).
Cu, Fe in ug/l.
TEMPERATURE is reported in degrees centigrade.

CONDUCTIVITY is reported in uMHOS.

WEATHER: Clear / Cool

Table 7. Results of Water Sample II

DATE : March 5, 1984

PARAMETERS

LOCATION	Time	Temp	D.O.	pH	Cond.	Tide	Depth	TP	TSS	Cu	Fe	Hg	TOC	SO_4	TN	F. Coli.
	BESD FIELD + LAB											ENVIROPACT				STATE LAB
INCONSTANTION CREEK	12:40	15	8.0	5.2	310	[illegible]	8 ft.	0.206	44	<10	780	<0.001	18.4	90	1.00	1600/100 ml
NASSAU R. AT DEESE CR.	1:28	15.5	9.5	6.0	10,000	[illegible]	13 ft.	0.192	38	<10	400	"	16.2	413	0.95	540/100 ml
DEESE CREEK	1:18	15	9.2	6.0	8,000	"	13 ft.	0.175	28	<10	460	"	13.9	295	0.94	>2400/100 ml
SAMPLE'S CREEK	2:05	17	9.2	6.0	8,500	"	15 ft.	0.192	32	<10	400	"	14.9	350	0.81	>2400/100 ml
EDWARD'S CR. AT STARRETT CR.	1:45	15.5	9.5	6.5	14,000	"	>15 ft.	0.192	56	<10	320	"	13.5	850	0.95	540/100 ml
PUMPKIN HILL CR. (NORTH)	2:55	16	9.2	5.8	14,000	"	20 ft.	0.165	35	<10	290	"	13.5	800	0.90	79/100 ml
EDWARD'S CR. AT PUMPKIN HILL CR.	2:30	17.2	9.2	6.0	13,000	"	4 ft.	0.176	122	<10	330	"	12.6	850	0.94	220/100 ml
PUMPKIN HILL CR. (SOUTH)	2:40	17	9.8	5.8	17,500	"	10 ft.	0.165	90	<10	320	"	11.2	900	0.65	350/100 ml
SIMPSON CR. AT NASSAU R.	11:40	17	10.5	6.5	40,000	"	12 ft.	<0.161	71	<10	260	"	4.0	2,350	0.13	23/100 ml
HORSESHOE CR.	deleted		due	to	low	tide	-	-	-	-	-	-	-	-	-	-
HANNAH MILL CR.	3:55	15.5	9.0	6.0	—	[illegible]	5 ft.	0.165	98	<10	230	"	6.5	1,400	0.53	240/100 ml

NOTE: D.O., TP, TSS, TOC, SO_4, and TN are reported in mg/l (ppm).
Hg reported in mg/l (ppm).
TEMPERATURE is reported in degrees centigrade.

CONDUCTIVITY is reported in uMHOS.
Cu, Fe in ug/l.

WEATHER: Cool / cloudy / [illegible]

Table 8. Results of Water Sample III

DATE : May 8, 1984

PARAMETERS

LOCATION	BESD FIELD + LAB											ENVIROPACT				STATE LAB
	Time	Temp	D.O.	pH	Cond.	Tide	Depth	TP	TSS	Cu	Fe	Hg	TOC	SO_4	TN	F. Coli.
INCONSTANTION CREEK	12:50	28	5	5.5	4000	very low incoming	1 ft.	0.32	28	<10	780	<0.001	2.2	125	1.06	1600
NASSAU R. AT DEESE CR.	1:45	27	5.5	6.0	16,000	low incoming	11 ft.	0.14	28	<10	380	<0.001	19	488	.72	350
DEESE CREEK	1:30	27	5.25	5.5	15,000	"	10 ft.	0.22	55	<10	500	<.001	17	485	1.08	79
SAMPLE'S CREEK	2:09	28	6.25	6.0	20,000	"	12 ft.	0.18	48	<10	260	<.001	13	1,000	.73	49
EDWARD'S CR. AT STARRETT CR.	1:55	27	7.0	6.0	30,000	"	26 ft.	0.16	53	<10	190	<.001	11	1,150	.45	33
PUMPKIN HILL CR. (NORTH)	3:05	27	7.0	5.5	30,000	incoming high	93 ft.	0.16	45	<10	210	<.001	10	1,350	.70	<1.8
EDWARD'S CR. AT PUMPKIN HILL CR.	2:40	27	7.5	6.0	300	"	7 ft.	0.17	61	<10	<150	<.001	13	1,260	.75	33
PUMPKIN HILL CR. (SOUTH)	2:50	27.5	7.75	6.0	500	"	11 ft.	0.17	44	<10	<150	<.001	14	1,050	.75	49
SIMPSON CR. AT NASSAU R.	3:40	23	8.5	6.0	45,000	out going high	12 ft.	<0.12	63	<10	200	<.001	1.9	2,520	.83	<1.8
HORSESHOE CR.	4:30	26.5	8.0	5.5	32,000	"	3 ft.	<0.12	53	<10	280	<.001	8.1	1,350	.66	33
HANNAH MILL CR.	4:20	26.5	8.0	5.95	26,500	"	13 ft.	0.18	30	<10	170	<.001	8.2	900	1.03	79

NOTE: D.O., TP, TSS, TOC, SO_4, and TN are reported in mg/l(ppm).
Hg reported in mg/l (ppm).
TEMPERATURE is reported in degrees centigrade.

CONDUCTIVITY is reported in uMHOS.
Cu, Fe in ug/l.

WEATHER: clear and hot

Table 9. Results of Sediment Sample

DATE : June 28, 1984

PARAMETERS

LOCATION	BESD FIELD + LAB: Water Column Conditions: Time	Temp	D.O.	pH	Cond.	Tide	Depth	TP	TSS	Metals: Cu	Fe	Hg	ENVIROPACT: TOC	SO_4	TN	STATE LAB: F. Coli.
INCONSTANTION CREEK	1:10	27°	6.5	7.0	24500	high out going	5'			<1.0	5,230	<0.01				
NASSAU R. AT DEESE CR.	2:00	27.5°	6.1	7.0	41,000	out going	14'			<1.0	3,5[illegible]	<0.01				
DEESE CREEK	1:45	28°	6.4	7.0	37,500	out going	17'			<1.0	1,350	<0.01				
SAMPLE'S CREEK	2:35	28.5°	5.9	8.0	47,000	out going	6'			<1.1	3,700	<0.01				
EDWARD'S CR. AT STARRETT CR.	2:25	28°	5.6	7.5	48,000	out going	27'			<1.0	1,860	<0.01				
PUMPKIN HILL CR. (NORTH)	3:35	28.5°	5.8	7.0	49,500	out going	12'			2.6	8,610	<0.01				
EDWARD'S CR. AT PUMPKIN HILL CR.	3:10	28.5°	5.7	7.0	49000	out going	6'			5.7	2,950	<0.01				
PUMPKIN HILL CR. (SOUTH)	3:20	29.5°	6.1	7.5	59000	out going	12'			[illegible]	6,120	<0.01				
SIMPSON CR. AT NASSAU R.	12:05	27°	6.9	8.0	[illegible]	High out going	4'			<1.0	519	<0.01				
HORSESHOE CR.	11:00	27°	6.0	7.8	[illegible]	High out going	1.5'			<1.0	1,4[illegible]	<0.01				
HANNAH MILL CR.	11:20	27°	6.2	7.0	37,000	High out going	8'			<1.0	1,130	<0.01				

NOTE: Hg reported in mg/l (ppm).

TEMPERATURE is reported in degrees centigrade.

CONDUCTIVITY is reported in uMHOS.
Cu, Fe in ug/l.

WEATHER: ______

Data from Enviropact of Jacksonville indicates normal levels for TN, TOC and mercury, but reveals high levels of sulfate. There are two probable explanations for the high sulfate - one, natural; the other. industrial.

The natural cause of high sulfate could be from the oxidation of hydrogen sulfide (H_2S). In an environment with a pH of 5 (approximate levels in this area), about 99 percent of the sulfide present is in the form of H_2S (NAS, 1974). The H_2S is produced by the anaerobic decomposition of organic material embedded within the salt marsh sediment. Erosion then gradually breaks up the marsh sediments releasing the H_2S which is readily dissolved in water. In well-aerated water, the H_2S is oxidized by natural biological systems to sulfate.

From the industrial standpoint, sulfides are constituents of many industrial wastes, such as those from tanneries, paper mills, chemical plants and gasworks (EPA, 1976). These sulfides are oxidized in the same manner as those which occur naturally. Differentiation of the natural vs. industrial sulfate is beyond the scope of this survey.

Data from the Florida State Health Department indicates high fecal coliform bacteria in the more shallow creeks. This is probably due to less dilution of these creeks and is probably primarily from the animals living within the marsh and wooded areas.

MAJOR ISSUES AND DEVELOPMENTS

IV. MAJOR ISSUES AND DEVELOPMENTS

Expansion of the Port of Jacksonville - The Port of Jacksonville is the third largest petroleum port in the southeast; it is unique in that its energy facilities are spread along 24 miles of the St. Johns River from the mouth to the Main Street Bridge. The natural depth of the river is approximately 15 feet, but the current channel is designated to be maintained at 38 feet. Since the trend in energy-carring vessels is toward larger and deeper draft ships, a study is presently underway for deepening the channel to 44 feet.

All shipping traffic must enter the port through an artificially deep channel and through the adjacent sensitive tidal marshes. Major land uses and activities in the port area are heavy industries of the type that invariably result in the release of certain pollutants to the environment.

The primary potential impacts to the estuarine environment as a result of port activities are:

1. An increased pollutant load through point or non-point sources.

2. An increased demand for utilization of the proximate salt marshes for shipping facilities and/or dredge soil disposal.

Increased Pressure for Development - In addition to development directly related to port expansion, the salt marshes north of the St. Johns River are subject to general development associated with an increase in population and increased demand for coastal property. Although most of these areas are unsuitable due to soil types, water availability and other factors, the proposed development of Fort George Island reflect the potential demands on this area.

Degradation of Class II Waters - The only areas in Duval County designated as suitable for the harvesting of shellfish are found in this area. These waters have a history of being closed to harvesting due to colliform contamination. This situation is aggravated by periods of heavy rainfall and is thought to arise from septic tank contamination and or tidal transportation of pollutants from the main channel. Although the importance of this shellfish industry to Duval County is questionable, the oysters as a pollution index warn of potential water quality problems on a larger scale.

A permit is required through the Department of Public Works for some dredge and fill activity, but this regulation is aimed primarily at ensuring that a workable system is produced.

EXISTING REGULATIONS

V. EXISTING REGULATIONS

Protection of Florida's wetlands currently is afforded at several levels. Federal and state laws establish regulatory agencies which exert either direct or indirect control over wetlands. These agencies may be granted discretionary authority to administer within broad guidelines or may be rigidly governed by the legislation. Management plans cross jurisdictional lines to provide an organized program of estuarine protection. A number of tools will be used in combination to insure a comprehensive approach.

Federal Authorization

Federal Agencies

Several federal agencies are responsible for wetlands protection. These are:

- U. S. Army Corps of Engineers
- Environmental Protection Agency
- Department of the Interior
- Department of Agriculture

These agencies and their branches work together to accomplish this protection role. A description of the role of each of these agencies follows.

Army Corps of Engineers (C.O.E.)

The Corps' jurisdiction over waterways was established by the 1899 Rivers and Harbors Act, providing for control over navigable waters and intrastate waters used for interstate commerce. The 1972 Freshwater Pollution Control Act expanded this authority to include the issuance of permits for dredging/filling in the regulated waterways. The Corps evaluates permit applications to determine the levels of pollutants to be discharged during the dredging/filling operation. The Corps' authority was further expanded by the 1977 Clean Water Act which placed wetlands adjacent to regulated waterways under control of the Corps.

Environmental Protection Agency (EPA)

With authorization granted by the 1972 Freshwater Pollution Control Act, EPA issues permits which affect wetlands. It regulates air quality through the prevention of significant deterioration classification system. Treatment, disposal and storage of hazardous wastes is managed through a permitting program administered by EPA and Florida's Department of Environmental Regulation. Working with the Corps, EPA is authorized "to restrict or prohibit discharge of any dredge/fill material that may cause an unacceptable adverse impact on municipal water supplies, shellfish bed and fishery areas, wildlife, or recreational areas."(Federal Register Jl 19, '77).

Department of the Interior

The Department of the Interior's Bureau of Outdoor Recreation operates a Land and Water Conservation Fund which provides federal funds with 50% state/local match for land acquisition. The land must be used for open space or recreational purposes. The open space category includes wetlands and floodplains.

The Department of Interior is also tasked with the general administration of the Coastal Barriers Resources Act. This act restricts Federal expenditures, financial assistance, and insurance for development of undeveloped coastal barrier islands. The undeveloped coastal barrier islands along the Atlantic and Gulf Coasts are incorporated into the Coastal Barrier Resource System. Maps showing these barrier islands are distributed to the applicable states. Federal money may not be made available for construction of or purchase of infrastructure or related facilities, roads, bridges, airports, boat facilities, causeways, etc., to or on any unit of the system. Some exceptions that meet certain qualifications may be granted. The limitations imposed by this act could have major impacts on coastal development.

The Fish and Wildlife Service of the Department of the Interior, as authorized by the 1965 Land and Water Conservation Act identifies endangered species and their habitats and takes action to restore them as viable components of their ecosystem. This branch provides grant monies for protection at the local level to fish and wildlife agencies with which the Interior Secretary has a written agreement.

The Fish and Wildlife Service as well as other Federal agencies must submit an annual report on the agency's compliance with the Coastal Barriers Resources Act. One of the major objectives of this act is to limit Federal expenditures on barrier islands, thereby limiting many types of development, ultimately promoting means and measures by which long-term conservation of fish, wildlife and other natural resources may be achieved. The Fish and Wildlife Services can act as a monitoring agency for this act locally.

Department of Agriculture

The Department of Agriculture conducts a program under which wetlands agreements are renewable. The owners receive a fee for this non-use. The Agriculture Department also operates a program for the regulation or acquisition of shoreline adjacent to designated rivers. This is done under authorization of the Wild & Scenic Rivers Act of 1968 and the shoreline controls are in cooperation with the respective local governments.

Other Federal Proposals

Florida Frontier Rivers Conservation-Historic-Recreation District is a proposal made in 1982 by Florida Congressional Representative Charles E. Bennett with the intent of establishing a state/federal district similar to the Pinelands National Reserve in New Jersey. The proposed plan would have a very positive impact on Duval County if adopted. Current status - The Bill is presently pending in the House Natural Resources Committee.

There are two Presidential Executive Orders that could also have considerable influence on the protection of wetlands at the federal level. They are Presidential Executive Order 11988, "Floodplain Management" and Presidential Executive Order 11990, "Protection of

Wetlands".

The Executive Order on Floodplain Management requires federal agencies to consider the effects of any action it may take in a floodplain and that their planning programs and budget request reflect considerations of flood hazards and floodplain management. When an agency proposes activities in a floodplain, the agency should consider alternatives to avoid adverse effects and imcompatible development in the floodplains.

Designs should limit or minimize potential harm to floodplains when there is no alternative site. All new requests for authorization or funding should indicate if a proposed site will be located in a floodplain. This Executive Order requires all protective and floodproofing measures possible be used. It also requires where practicable, the elevations of structures rather than the use of fill.

The Executive Order on wetland protection, requires federal agencies when dealing with federally owned lands, to minimize the destruction, loss and degradation of wetlands. It requires each federal agency, to the extent permitted by law, to avoid undertaking or providing assistance to activities located in wetlands unless there is no reasonable alternative. At this time, all measures should be taken to minimize impacts on wetlands. All agencies requesting new authorization or new appropriations must indicate if the proposed activity will be located in wetlands and if the activity is in accord with this Executive Order. The federal government may apply restrictions to federally leased land containing wetlands, or withhold these areas from leasing totally. Agencies are required to consider factors relevant to a proposal's effect on the survival and quality of the wetlands.

State Authorization

State Laws

Florida provides a variety of legislative controls over its wetlands. Specific laws adopted by the state include:

- 1972 Environmental Land & Water Management Act
- 1972 Water Resources Act
- 1972 Land Conservation Act
- 1975 Local Government Comprehensive Planning Act
- 1975 Florida Aquatic Preserve Act of 1975
- 1977 Endangered and Threatened Species Act
- Wetland Protection Act of 1984
- Governor's Executive Order No. 81-05

These laws created regulatory agencies and established protective measures for overall environmental control. Appropriate tenets of each act are described below:

Environmental Land & Water Management Act

This first statute laid the groundwork for the state's environmental policy: "It is necessary that the state establish land and water management policies to guide and coordinate local decisions relating to growth and development." This Act provides for the designation of Areas of Critical State Concern where significant environmental impacts are anticipated.

Water Resources Act

The Water Resources Act established five regional water management districts to plan and regulate water uses, i.e., well construction, surface water management, consumptive use of water and artificial recharge.

This Act charges the management responsibilities to the Department of Environmental Regulation (DER) which channels these responsibilities to regional water management districts. The St. Johns River Water Management District serves 19 northeast Florida counties, including Jacksonville and Duval County.

Land Conservation Act

The Land Conservation Act provides that for state capital projects, the Governor and Cabinet serve as the Board of Trustees of the Internal Improvement Trust Fund to "develop and execute a comprehensive plan to conserve and protect environmentally endangered lands...".

Related to this comprehensive plan are: management plans for wetlands regulation prepared through the Florida Department of Natural Resources. Together the planning of capital projects and local management provide an overall, systematic approach to Florida's wetlands.

Local Government Comprehensive Plan Act

The 1975 Local Government Comprehensive Plan Act brought local governments into wetland protection by enabling them to control the natural resources within their jurisdiction. This control was to assist in the integration of the manmade and natural environments. Each locality incorporated elements which were specific to it as well as some mandatory elements shared by all governments.

Florida Aquatic Preserve Act

Much of the study area is included in the Nassau River - St. Johns River Marshes Aquatic Preserve. It is the intent of the Legislature that under the Florida Aquatic Preserve Act of 1975, the state owned submerged lands in areas which have exceptional biological, aesthetic and scientific value be set aside forever as aquatic preserves or sanctuaries for the benefit of future generations. The Aquatic Preserve Program could ultimately afford the Duval County Marshes a significant degree of protection; however, the effectiveness of this program is limited by the fact that the law only applies to state owned land and the real "teeth" of the program are in the design and implementation of a management plan.

Endangered and Threatened Species Act

The Endangered and Threatened Species Act of 1977 recognized Florida's importance as the location for a great variety of unique fish and wildlife. It charges the Game and Fresh Water Fish Commission with a leadership role in the protection of these species. This Act was, in part, a response to the federal legislation - the 1965 Land and Water Conservation Act - which provides for cooperation between the Fish & Wildlife Service and state/local agencies to ensure the protection of these endangered species.

1984 Wetland Protection Act

The 1984 Wetland Protection Act expands DER jurisdiction to some extent by adding numerous wetland plant species to DER's vegetative index which is used to delineate the landward extent of waters of the state. This act also allows DER, when reviewing permit requests for dredge and fill activities, to consider the impact these activities will have on wildlife including threatened and endangered species and their habitat. The act exempts sand and limerock mining from the permit requirements of the law for 10 years, requires DER to establish a permit monitoring system and data base, and designates the Florida Everglades as waters of the state, thereby giving DER jurisdiction in this area that it did not previously have.

Governor's Executive Order No. 81-105 - Barrier Island Protection

The Governor's Executive Order No. 81-105 will prohibit state funding for transportation and infrastructure in certain instances on coastal barrier islands. This Executive Order prohibits expenditure of state funds for roads, bridges and related infrastructure needs and facilities on undeveloped and partially developed coastal barrier islands and related areas of high flood hazard. The available state money for infrastructure or replacement of infrastructure will be limited by the amount of existing development on the island.

Areas in the Duval County portion of the Nassau River - Duval River Marsh will be under the jurisdiction of this Executive Order and this may have definite impacts on development in this area.

State Regulation

Several state agencies are responsible for performing management roles over wetlands areas. These agencies derive their authority from the legislative acts previously described. These agencies are:

- Department of Community Affairs
- St. Johns River Water Management District
- Department of Environmental Regulation
- Department of Natural Resources
- Northeast Florida Regional Planning Council

Their responsibilities are outlined below:

Department of Community Affairs (DCA)

The Department of Community Affairs' Bureau of Land and Water Management administers two management programs. The "Developments of Regional Impact" are large projects which would affect more than one county. The other program is "Areas of Critical State Concern", which is a designation applied to a portion of the state where a major public or private investment may affect significant resources in a geographical area.

St. Johns River Water Management District (SJRWMD)

Another state agency, the St. Johns River Water Management District, established pursuant to Florida Statutes, Ch. 373, Water Resources Act, has five primary functions:

1. Issue permits for consumptive use of water, well construction and surface water management.
2. Construct and operate water control works.
3. Engage in water resource planning.
4. Participate in technical investigations of water resources.
5. Gather water resource data.

Wetlands are regulated as they are a water storage area from which water might otherwise be diverted or removed. Any type of system which could alter the natural course of a waterway or wetlands area is regulated by the Water Management District.

Department of Environmental Regulation (DER)

One of the most important state agencies offering wetland protection is the Department of Environmental Regulations (DER). Regulation is exercised on water quality, discharge, dredging/filling, air quality (which for Duval County relates to ozone levels), stormwater discharge, solid and hazardous waste, public water systems, underground injection control, well construction and National Pollution Discharge Elimination System Water Quality Certifications. DER serves as coordinator for the water management districts. It authorizes transmission lines and power plants. Contractors involved in water related construction must obtain permits from DER.

Department of Natural Resources (DNR)

The Department of Natural Resources regulates state-owned lands, parks, recreation areas and aquatic preserves; beach and coastal land activities, and reclamation of mined lands. Much of its work is in conjunction with DER. It also prepares regional management plans for wetlands protection.

Northeast Florida Regional Planning Council (NEFRPC)

The Northeast Florida Regional Planning Council provides technical planning assistance to local governments. It works with both local and state entities to mitigate potential land water use conflicts. Lastly, the RPC conducts state intergovernmental coordination reviews (formerly known as A-95 Reviews) and reviews of Developments of Regional Impact.

Local Authorization

The City of Jacksonville's 2005 Comprehensive Plan states the city's policies regarding the importance of wetlands and flood plains. This policy discourages development of these areas and recommends efforts to facilitate state purchase of the salt marshes north of the St. Johns River. This policy is currently without the necessary regulation to augment its implementation. Most of these wetlands are zoned OR (Open Rural) and can be rezoned to accommodate almost any activity.

A permit is required through the Department of Public Works for some dredge and fill activity, but this regulation is aimed primarily at ensuring that a workable system is produced.

Comprehensive Plan

Under the 1975 "Local Government Comprehensive Plan Act", Jacksonville included wetlands protection in an element of its Comprehensive Plan. The Conservation/Coastal Zone Protection Element's goals for Sensitive Areas are:

1. "To enhance and conserve natural areas, wildlife habitats, fisheries resources, air and water quality and other renewable and non-renewable resources."
2. "To increase citizen participation in decisions affecting environmental resources.
3. "Protect the valuable functions of wetlands, estuaries and submerged lands including the territorial sea by maintaining the integrity of vegetation and hydrologic systems."

Department of Public Works

The Department of Public Works administers a permitting program for local dredge/fill activities as such activities affect wetlands: "(e) The granting of such permit and the construction to be done pursuant thereto:

(1) Will not interfere with the conservation of fish, marine and wildlife or other natural resources to such an extent as to be contrary to the public interest; and

(2) Will not result in the destruction of oyster beds, clam beds or marine productivity, including, but limited to, destruction of natural marine habitats grass flats suitable as nursery or feeding grounds for marine life, including established marine soils suitable for producing plant growth of a type useful

as nursery feeding grounds for marine life, to such extent as to be contrary to the public interest..."

The City may not grant dredge and fill permits for lands classified by the state's Department of Environmental Regulation as "environmentally significant". The activity must not damage fishing, tourism or result in irreplaceable loss of natural resources. Exceptions can be granted by the Public Works Director. "These projects must not exceed 4,000 cubic yards of material placed in or removed from the navigable waters of the State..." (City Code, Ch. 600).

The Department of Public Works also administers floodplain regulations, pursuant to City Code, Ch. 601. Several low-density uses are permitted in these flood prone areas. These uses include agricultural, recreational, supplemental residential and industrial-commercial. All other uses can be permitted under a special exception permit. These additional uses must be designed to minimize flood hazard and resist flood damage. Both the permitted and the special exception uses could impact wetlands areas.

MANAGEMENT TECHNIQUES, PLANS AND STRATEGIES

VI. MANAGEMENT TECHNIQUES, PLANS AND STRATEGIES

Techniques

There are several techniques or tools available for use when designing a management plan or wetland regulation. Several of these techniques are presently being used by other municipalities and have been used to some extent in existing management plans.

This section contains a description of available techniques, some ideas from existing management plans that are designed to protect environmentally sensitive areas and a brief look at what selected municipalities are doing in regard to wetland protection.

Permitting

Permitting authorizes a governmental agency to accept and review standardized applications; evaluate information contained therein for conformance with legally mandated requirements; and issue an approval - or permits - if the proposed work appears to meet the standards. An applicant outlines proposed work, expected results and potential impacts on the affected wetlands area. The permitting agency exercises administrative review granted to it by a local or state governing body and responds to the application as required by law. In Florida, the counties of Sarasota, Collier and Dade operate permitting programs for wetland protection.

Zoning

Zoning can be used as a single classification governing the use of a parcel of land or as an overlay regulating the physical appearance of the property. An example of the first are Dade County's Management Area classifications which are designed to permit limited development in wetland areas. Clearwater uses an overlay which permits undeveloped beach to remain in its natural state with special exception granted upon presentation of evidence relating to six mandated standards.

Tax Abatement

Tax abatement is another management tool: An individual agrees to set aside his wetlands for a specified time period in return for reduced or eliminated property taxes during that time. There is a penalty of full payment should the owner choose to develop the land during the abatement period. If the tax is eliminated, a conservation easement, a legal requirement concerning the property's appearance and condition, accompanies the property.

Transfer of Development Rights (TDR)

Transfers of Development Rights (TDR's) are another land use tool which restricts development in a wetlands or other protected area, but permits the owner of such property to use another piece of land more intensely than would otherwise be permitted. Commonly, this applies to residential dwelling units per acre. Collier County successfully uses this tool, permitting higher density residential development outside of its wetlands.

Mitigation and Restoration

Mitigation and restoration is a tool which provides for the creation of the resource which is proposed to be affected. For example, if a marsh area lies in the path of a significant development plan, the developer agrees to create a similar marsh area in another location. The new site should be able to perform the same functions as the existing marsh.

Environmental Impact Statements (EIS)

Environmental Impact Statements are studies which analyze the scope of a development project and its probable effects on an area. Dade County uses these statements as a coastal wetlands protection technique in its environmentally sensitive zoned areas. Dade County's program is administered by its Department of Environmental Resource Management, a special agency created for environmental protection. Such programs require information similar to that of a permitting operation, but with more detail and analyses.

Species Protection

Species protection provides a basis for setting aside land used as habitats, breeding or spawning grounds, or conducive to the growth of endangered plant species. In South Florida the latter condition relates to the mangrove community. This species and the area in which it grows are stringently regulated.

All of these techniques provide site specific ways of managing wetlands. Some are more suited to particular physical environments while others are more politically feasible. They can easily be used in combination to assure a reasonable solution to a complex situation. Following is a summary of the use of these tools in existing management plans throughout Florida.

Existing Management Plans

Charlotte Harbor

Two management plans have been prepared for the Charlotte Harbor area. The 1981 Charlotte Harbor Management Plan was prepared through the Department of Community Affairs Division of Local Resource Management. The expanded Charlotte Harbor Aquatic Preserves Management Plan was prepared by the Department of Natural Resources and adopted in 1983.

The 1981 Plan is a collection of goals, objectives and implementation actions. These relate to components of the Charlotte Harbor estuarine area: floodplains, stormwater runoff/drainage, wastewater, wetlands, beaches/barrier islands, water supply, land development, site alternations, dredge and fill, restoration and coastal flood plain. Regulation of these elements is designed to protect and enhance the valuable ecosystems of the estuarine area and minimize any adverse impacts upon it.

The 1983 Plan includes the four aquatic preserves of southwest Florida's Charlotte Harbor estuarine system. These preserves are located in Charlotte and Lee Counties with the cities being Cape Coral, Punta Gorda, Sanibel and Ft. Myers.

The Management Plan recognizes the area's designation as wilderness preserves and recommends the continuation of such a designation.

The Management Plan is implemented by state staff of the Bureau of Environmental Land Management (BELM). The Bureau coordinates its efforts with federal, state, regional and local agencies as required by law. It reports to the Governor and Cabinet sitting as Trustees of the Internal Improvement Trust Fund.

BELM reviews permit applications and conducts cumulative impact analyses to determine the potential effects of proposed development on Charlotte Harbor. It works with local governments to insure that their comprehensive plans or management policies are in conformance with the adopted aquative preserve plan. BELM will encourage the continued support and assistance from environmental interest groups.

Primary concerns of the management plan staff will be: monitoring the variety of uses which affect the preserve, i.e. fishing, boating, swimming; insuring that dredging is controlled and kept to a minimum; considering locational factors prior to construction of new docks and marinas; and discouraging any expansion of the existing deep water port facility.

Biscayne Bay

Another management plan used in South Florida is the 1981 Biscayne Bay Management Plan. This Plan was prepared by two metropolitan Dade County departments - Environmental Resources Management and Planning. The study area includes a portion of the Keys, the City of Miami, Biscayne National Park and the Biscayne Bay Aquatic Preserve. It is entirely within Dade County.

The major goal of the Plan is "to develop a unified, countywide management plan for the entire bay system...in a manner that will maintain or enhance...those qualities that provide the basic character and value of this resource." Because this management area encompasses such a variety of jurisdictions, the countywide approach was used. Additional benefits to this approach are a minimum of duplication and cost effectiveness.

The primary tenets of the Plan are an extensive series of guidelines relating to: freshwater discharge, stormwater runoff, sewage discharge/pathogens, solid waste disposal sites, habitat management and impacts of boating, fishing and development. Additionally, implementation strategies are identified as well as agencies responsible for implementation and potential conflicts with these strategies. The programs are based on working within existing systems rather than on the creation of new ones.

Hutchinson Island

Developed by the Hutchinson Island Resource Planning and Management Committee, this 1983 plan treats that portion of Indian River adjacent to the counties of Indian River, St. Lucie and Martin. Primary cities which have jurisdiction in the study area are Vero Beach, Ft. Pierce and Stuart. Portions of three aquatic preserves are included: Indian River - Malabar to Sebastian; Indian River - Vero Beach to Fort Pierce and Jensen Beach to Jupiter Inlet; also, the National Wildlife Refuge at Pelican Island is found within the area.

The Hutchinson Island Resource Planning and Management Plan identifies a series of "environmental resource issues" based on damages resulting from the development of the barrier island - Hutchinson. The Plan recommends a series of policies directed toward the enhancement or re-establishment of the island's ecological functions. It proposes a series of policies relating to future development within the political jurisdictions of the study area. These policies relate to: potable water and wastewater treatment, capital improvements programming and transportation.

Suwannee River

The 1981 Suwannee River Management Plan was developed by the Department of Community Affairs Division of Local Resource Management. The study area is "the 100-year floodplain of the Suwannee River including the floodplains of major tributaries, creeks and springs as well as the site of activities which significantly impact on the river's resource." This encompasses a dozen counties and several cities that border the river in the central parts of north Florida.

The overall goal of the Plan is to protect the water resources of the Suwannee River. In order to accomplish this goal, the Plan provides a series of guidelines and implementation actions. Specified jurisdictions are charged with the completion of the implementation.

The actions deal with floodplain management, water supply, stormwater/drainage management, water quality monitoring, wastewater, wetlands/estuarine protection, dredge and fill, recreation and scenic protection. An example of recommended implementation measures are those for wetlands/estuarine protection. These call for identification, monitoring and acquisition of the area.

Seminole County

The Center for Wetlands at the University of Florida prepared a Wetlands Study of Seminole County which was presented in 1983. The document is a thorough analysis of wetlands. It evaluates the question of what constitutes wetlands and provides background information on the regulation of wetlands areas at federal and state levels.

Part of this document is a management mechanism for Seminole County. The study presents a matrix to evaluate a proposed development activity with the particular type of wetland in which it may occur. It also includes a sample ordinance and amendments to Seminole County's Comprehensive Plan. The theme of the proposed legal changes is the use of performance zoning - permitting an activity under regulated circumstances.

Other Municipalities

Various techniques have been utilized by municipalities for the management of estuarine marshes and other wetlands. These include: land use controls, tax incentives, fiscal options, zoning measures and permitting.

These techniques are continually being refined and updated and are implemented with varying degrees of success. The following are examples of what other municipalities are trying.

Metro Dade

In an attempt to preserve an environmentally sensitive wetland area that lies between the westward encroachment of sprawling Miami and the Florida Everglades, Metro Dade County designated the interface area a buffer zone called an "area of critical environmental concern". Very limited activities are allowed in this area and only then with local approval.

The Metro Dade ordinance also contains an interesting statement to be placed in all property deeds of land in this critical area to the effect that all purchasers of property in this special district must be aware of the limitations imposed on the property. The deeds must also contain a disclaimer stating that no intrastructure will be provided in these protected areas by the county government.

Collier County

Also uses the designation of Special Zones in an attempt to protect environmentally sensitive wetlands and coastal areas. Collier County has "Special Treatment Overlay Districts", designed to encourage developments outside of environmentally sensitive areas. These special treatment districts use development rights transfers (TDR's) from environmentally sensitive areas to areas more amenable to higher density development. The site plan review requirements are more stringent in this special treatment district and tend to encourage the use of the available TDR's.

Hollywood, Florida

Has successfully used the special district technique in the form of the "North Beach Development District" in an effort to preserve the last undeveloped beach front property in the city. This district utilizes TDR's as a means of transferring development from the beachfront to upland areas. This transfer of development rights allows the beachfront to remain undeveloped, while expanding the density allowed on the upland property. The TDR's and density increases area designated for use only within this special North Beach Development District.

Clearwater, Florida

Utilizes "Aquatic Lands District" to restrict uses on all water bodies and submerged lands in the community. The intent is to preserve these areas in a natural state. Privately owned lands are excluded from restrictions unless they come within 30 feet of mangrove communities.

Sanibel, Florida

Utilizes zoning as a land management tool in order to protect coastal wetlands in their "Residential Planned Development" and "Open Space Zoning Regulations". Uses are restricted to single family residential and public recreation as well as other non-economic open space uses.

EVALUATE OPTIONS

VII. EVALUATE OPTIONS

A management program usually relies on the use of a combination of tools or techniques. Some of these implementation methods are directly suited to a wetlands area, while others can work well in many land use situations. An evaluation of the various options provides a comprehensive approach to the management program.

Management at State and Federal Levels Only

The most obvious option is to continue operation under the existing scheme. This places management responsibility with state and federal agencies. Most notably these are the U. S. Army Corps of Engineers, the Florida Department of Environmental Regulation (DER) and the St. Johns River Water Management District.

The Corps has jurisdiction over: 1) waters affected by tidal action; and 2) wetlands which are continguous or adjacent to those waters or which are sufficiently saturated to produce wetland vegetation. The DER regulates areas waterward of the mean high water line, in regard to dredge and fill permitting, and controls water quality in waters of the state. The water management districts' primary responsibilities are in regard to consumptive use of water, well construction, surface water management and water resources technical data.

The advantage to this system of non-local agency management is that it is already in place. These agencies are currently providing wetlands protection. The disadvantage of relying on state and federal authority is the potential for an area needing protection to lie outside the regulatory agencies' jurisdictional boundaries. These agencies' responsibilities are clearly delineated. Wetlands and their characteristics which do not meet their mandated protection criteria do not receive consideration. Recently passed wetland law and Executive Orders regarding barrier island protection, floodplain and wetland protection have expanded state and federal protection of these areas to some extent.

Land Use Tools

Permitting and zoning are well-established systems of land use control. Permitting authorizes an activity if it meets specified requirements as verified by a representative of the local governing body. Zoning allocates sections of land to particular functions. The systems are frequently used together.

Locally, the Department of Public Works issues land use related permits. Zoning is administered by the Planning and Public Works Departments. Zoning policy issues are handled through the Planning Commission and Urban Affairs Committee. Permitting and zoning could be used together to manage wetlands. New zoning classifications such as Environmental - Buffer (E-B) and Environmental - Conservation (E-C) could be used for the uplands and wetlands respectively. Permitting could be used when development was desired in either zone. The permitting and technical review could be conducted by the appropriate city agencies.

The E-B zone would permit single family residential (RS-A, RS-B, RS-D), business and professional office (CPO), neighborhood commercial (CN), and open rural (OR) uses. The OR category includes agriculture, forestry, dude ranches, riding academies, game preserves, fish hatcheries, family dwellings, foster homes and similar uses. Specific development types which would be compatible in the E-B zone could be encouraged. This would illustrate the feasibility of high quality development. Cumulative relationships of development throughout the area would be assessed.

The appropriate city agency, during the site plan review stage, would address the relationship of a new development in the E-B zone with existing developments in the area.

A special classification zoning program and overlay design zoning for the estuarine area and its immediate vicinity could be implemented. It might be designed as follows:

Designate the estuarine area E-C (Environmental-

Conservation) and stringently restrict the activities permitted within the estuarine.

Designate buffer zone in the uplands along the landward perimeters of the estuarine E-B (Environmental Buffer) and permit low impact uses in this area. The size of this zone is yet to be determined.

Overlay a DR (Design Review) zone requiring designs which will complement the character of the E-C and E-B zones. For example, the use of natural vegetation would be appropriate material for maintaining wetland/shoreline separation. Vertical bulkheading would not be appropriate.

Types of compatible land uses and developments for upland areas and the estuarine marsh should be determined.

Appropriate uses in the E-C zone are passive recreation and education/research. Proposals for these types of uses would receive authorization from the appropriate city agency. No use should be permitted which alters either the function of the salt marsh or the flow of water in the area.

Using permitting and zoning as wetland protection measures provides local control over development in these environmentally sensitive areas. Each tool is legally and politically justifiable. Financial considerations would be incremental since additional staffing and monitoring would be minimal. The program would be an adjustment of an existing system as opposed to creation of a new one.

Incentives

Less common management techniques are tax abatements and conservation easements. These are incentives. They encourage a property owner to maintain his land in its undeveloped state. Since he does not have a tax burden, he may not be pressured to gain an immediate return for his investment through development.

These measures are available currently at the state level. They apply to properties which have been identified as important wetlands. They are methods which conserve land without the cost of acquiring it.

Tax abatements and conservation easements can be easily adapted to local usage. Both operate with the use of legal documents. Neither requires an elaborate staffing program.

The state could be encouraged to expand its tax abatement program to land outside designated areas of Critical State Concern in order for local estuarine marsh land owners to participate in the program.

The option may work well for property owners who may not wish to relinquish title to their wetlands, as an acquisition program would require, tax abatement is a desirable alternative. Taxes on undeveloped wetland are low in proportion to those levied on more desirable, developable land. Yet, abatement provides an owner with an incentive to maintain his property in its undeveloped condition.

This program change would require a formal request, accompanied by a lobbying effort. This effort could be directed toward the applicable state agencies as well as toward the State Legislature. A change in state law would in all probability be required.

A weakness of using a conservation easement is that it is frequently an insufficient incentive. When compared to the potential financial return under development, the easement falls short. Its value is heightened when used in combination with other measures.

The major drawback of a tax abatement program is its effect on the local tax base. Depending upon the assessed valuation of the land and the amount of acreage affected, the program could substantially influence the tax base. This could make local fiscal planning quite difficult.

Many tax abatement programs have an established time limit for the abatement. This can serve as a drawback if the property owner chooses not to renew the abatement. Conservation of the wetland could be eliminated when the abatement expired.

Transfer of Development Rights (TDR)

Another incentive technique is transfer of development rights (TDR). This technique provides protection by permitting the owner of wetlands property to use another parcel of land more intensely than would otherwise be permitted in exchange for not developing his wetlands.

This incentive works well in localities which are developed and, therefore, have competitive and high land costs. A developer receives land of equal or greater value than that which he is forfeiting. He is permitted to use the new parcel to a potentially higher economic level.

A third incentive is land donation: giving wetland property to the government of the respective municipality in which it is located. This would require the same legal framework as that for the preceding incentive programs. A federal tax benefit would be due the property owner since the land would be classified as a charitable contribution. The donation would give the City of Jacksonville title to the property; it could set aside the land for protection purposes.

Potential problems of this program would be similar to those for the other incentives. The city could lose tax revenues. Additionally, in this case, the city would be responsible for land, probably resulting in monitoring and minor maintenance activities. Furthermore, the city could decide, at some future time, to sell the property. Its protection would not be insured.

Public Information/Education

Public education and information should be a major part of the management program. It is perhaps more of a necessity for the development of a good management plan than an option. There are various ways and techniques of disseminating information about wetlands and existing programs.

Public information about existing state programs may be provided in several ways. Support for existing state programs designed for wetlands protection can be enhanced through public awareness and education. The city, in conjunction with the Chamber of Commerce and other agencies, could provide a series of public service announcements. Printed information could be enclosed with tax statements to wetlands property owners.

The public needs to be educated to the important functions performed by wetlands and the aesthetic significance resulting from wetlands preservation. To accomplish this task requires an approach similar to the one suggested previously. It is a public information approach. However, the public is the entirety of Jacksonville's population rather than specific groups, such as property owners. Since this public is more diversified, the education approach is broader. Learning institutions such as the school systems and libraries could be encouraged to include information about wetlands. Such a subject would be particularly relevant for science classes.

Museums would be an ideal educational tool. Exhibits could illustrate plant and animal species found in wetlands, habitats, life cycles, etc. Advertising these exhibits and providing supplementary literature would be important, also.

Public television could be useful in introducing Jacksonville residents to their natural resources. An educational program series, a documentary, could be a valuable tool. Footage of the marsh lands and the uses competing for their resources would illustrate the manner in which these environmentally significant areas influence the community.

The educational theme could be continued by way of field research and education performed on site. First hand contact with these areas and their resources would provide lasting impressions of their importance. Certainly, careful guidance and monitoring would be required to avoid any potential damage to the estuary.

Establishing an on-site field laboratory in conjunction with the local universities and applicable agencies would be one way of continuing this educational theme. This laboratory could be located on publicly owned property or be utilized with the long term cooperation of a private individual. The educational facility would allow for in-depth study of the area as well as monitoring of the conditions of the marshes.

Analysis/Enhancement

This next option combines the use of a review procedure for the environmental aspects of a proposed development and the mitigation/restoration technique. It is designed to promote high quality development which will be sensitive to and compatible with the natural environment of the wetlands. It relies on predevelopment planning and is composed of several other elements.

The estuarine area should be analyzed to determine types of compatible land uses and development applicable. City agencies should do a thorough land use analysis of the area. Facilities which would be required to supplement usage as well as projected demand for these facilities would be calculated. The study would propose levels of uses for the area. Information obtained through this study would enable long range planning for the area.

Existing city departments and agencies should be utilized in reviewing the environmental aspects of a proposed development as well as the need for mitigation/restoration plans and procedures.

A program requiring preparation of an environmental review procedure for any development which will effect an estuarine marsh could be designed.

Preparation and presentation of this review procedure will provide a basis for evaluation of a proposed development's benefits/detriments to the community. Long range effects would become apparent. By assessing a development's effects prior to its initiation, adverse impacts can be minimized or eliminated, creating a cost effective approach.

The review procedure for the environmental aspects of a proposed development would consider one or more of the following categories of impacts:

- Wildlife Habitat
- Surface Water Storage
- Groundwater Recharge
- Maintenance of Water Supply
- Flora/Fauna
- Filtration of Nutrients/Pollutants - Protection of Water Quality
- Protection of Uplands from Storm Surges

The review would also consider benefits to the community and resources and infrastructure which would be required for implementation of the development. Finally, for a projected adverse impacts, proposed ways of alleviating the adversities.

Assessment could be made of the cumulative impacts of development during the review process. Each development will provide direct impacts to the property under development. It will also affect surrounding areas. Two developments on adjoining parcels of land may not appear to create any significant adverse impacts, but considered together may be incompatible with the land area. This is an important community consideration which requires attention.

Land owners/developers should be encouraged to meet with appropriate city staff early in the design phase. This meeting could eliminate any obvious negative impacts and assist the respective land owner/developer in creating a high quality development. Discussing the proposed development early in the design stage is cost effective. This early meeting strategy will provide information to developers which will enable them to use their property in a manner which will avoid mitigation/restoration requirements.

The removal and replacement of ecologically important wetland areas is the least desirable alternative. All efforts should be made by city staff to discourage this choice. It is undesirable not only from an ecological disturbance standpoint, but it is rarely cost effective.

Appropriate city agencies that are familiar with the area proposed for development could provide alternative and design suggestions, if relevant.

If the mitigation/restoration is necessary, require a 1/1 replacement and posting of a performance bond to insure completion might be required. The new wetland to be created should be designed to duplicate the ecological functions of the wetland being removed. Replacement should be monitored by the appropriate city agency.

The idea of requiring the posting of a performance bond insures that the city is covered in the event that a developer defaults at any time prior to completion of the wetland restoration process. The bond would be posted at the time of obtaining construction permits.

Policy

This option uses existing review processes. It requires a modification of existing direction given to the departments of the city involved in the review process. As a policy of the city, environmental considerations would be incorporated in the site plan review process.

It would require that potential effects on the wetlands be considered as part of the project design. Plans must include existing wetland area and its relationship to the proposed development.

To implement this program the city would either adopt a policy resolution or incorporate the policy into the Comprehensive Plan.

Maintain the Status Quo

This final option recognizes the important roles played by existing management agencies. It requires no effort on the part of the City Council. The proposal is described below:

Utilize existing management sources, providing no change in the established management program.

Management relies primarily on:

- The U. S. Army Corps of Engineers
- The Florida Department of Environmental Regulation
- The St. Johns River Water Management District
- Jacksonville Department of Public Works Wetlands Management

SELECTED OPTIONS

VIII. SELECTED OPTIONS

A comprehensive management plan requires the use of a variety of tools. The integration of various techniques into a complete unit increases the chances for success of the program.

The previous section discussed the many alternatives and variety of tools available in designing a management plan. This section will discuss the alternatives choosen.

In choosing the most applicable techniques for this particular management plan, various local conditions were taken into account.

The objective was to take the best parts of the available options and incorporate them into the plan.

Incentives

One of the options choosen was to encourage the use of state and federal laws regarding tax abatement and conservation easements. This technique encourages a property owner to maintain his land in its undeveloped state. If he does not have as heavy a tax burden, he may not be as pressured to gain immediate return for his investment through development. The state needs to be encouraged to expand its tax abatement program outside designated areas of critical state concern so more local land owners can participate in the program.

Acquisition

Acquisition of the estuarine marshes through available programs should be encouraged. This would enable a more unified management of these valuable areas. Additional acquisition would enhance protection measures not only locally, but through the Nassau River-St. Johns River

Aquatic Preserve.

Public acquisition would provide an equitable return for investment to property owners of marsh acreage. In addition to providing property owners with an equitable return, the city and state would be securing for present and future generations of residents a priceless local resource that can be used and enjoyed.

Public Information and Education

The public needs to not only be informed about existing state and federal programs dealing with tax incentives and land acquisition, they also need to be informed about state, federal and local programs for conservation and species protection. Support for existing programs designed for wetlands protection can be enhanced through public awareness. There is a need for public understanding of the important functions performed by wetlands as well as the aesthetic significance of these areas.

There are several routes local agencies can take in this educational approach to wetland protection:

> The school systems and libraries could be encouraged to include information about wetlands in their curricula and activities.
>
> Museums could be utilized as an educational tool by displaying exhibits on wetlands, plant and animal habitats and life cycles.
>
> Public television might introduce area residents to one of Jacksonvilles great natural resources through an educational series or documentary.
>
> One of the best educational uses for this area is as a living educational tool. The establishment of an on-site field laboratory in conjunction with local universities and city agencies would be a tremendous use of this invaluable resource as a teaching aid. This type of educational facility would allow for in-depth studies of this area as well as monitoring of the conditions in the marshes as a protection device.

Review Procedure Modifications

A review procedure focused on the environmental aspects of a proposed development that is likely to impact on the estuarine marsh and adjacent uplands needs to be established. This procedure would be designed to promote high quality development which will be sensitive to and compatible with the natural environment of the wetlands. It relies on predevelopment planning and on an analysis of the estuarine area to determine compatible land uses and development.

This analysis is currently being done to some extent through the vegetative mapping of the area by the St. Johns River Water Management District and through studies of water quality and ecosystem analysis in this study. A determination of uses for this area will need to be made, with uses considered detrimental being discouraged.

This review procedure can be established through existing permitting processes and site review procedures utilizing city agencies already involved in this process.

This type of review and corresponding modification of the procedure will go a long way in establishing reasonable protection for the estuarine area without creating additional legal or bureaucratic stumbling blocks. Land owners and developers that meet with city staff early in the design stage could eliminate negative impacts on this area while promoting high quality development.

Mitigation and Restoration

Mitigation and restoration procedures for development that will unavoidably impact or damage the estuarine marsh should be established. If the procedures outlined previously (site plan review modification) are followed, this will help provide developers with information that will avoid the need for mitigation and restoration in most instances. Removal and replacement of ecologically important wetlands areas is the least desirable alternative. It is not only undesirable from an ecological standpoint, but it is rarely cost effective.

If restoration is necessary, a required replacement ratio could be devised and possibly a performance bond required to insure completion. The new wetlands required to be created should duplicate the ecological function of the area removed. These restoration and mitigation procedures could be monitored by appropriate existing city agencies.

These techniques and alternatives will be incorporated and used to shape the estaurine management plan.

MANAGEMENT PLAN

PLANNING DEPARTMENT

ALL-AMERICA CITY Suite 700, Florida Theatre Building, 128 East Forsyth Street
Jacksonville, Florida 32202—3325 Telephone (904) 633-2272

CITY OF JACKSONVILLE, FLORIDA

ACKNOWLEDGMENT

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INTRODUCTION

I. INTRODUCTION

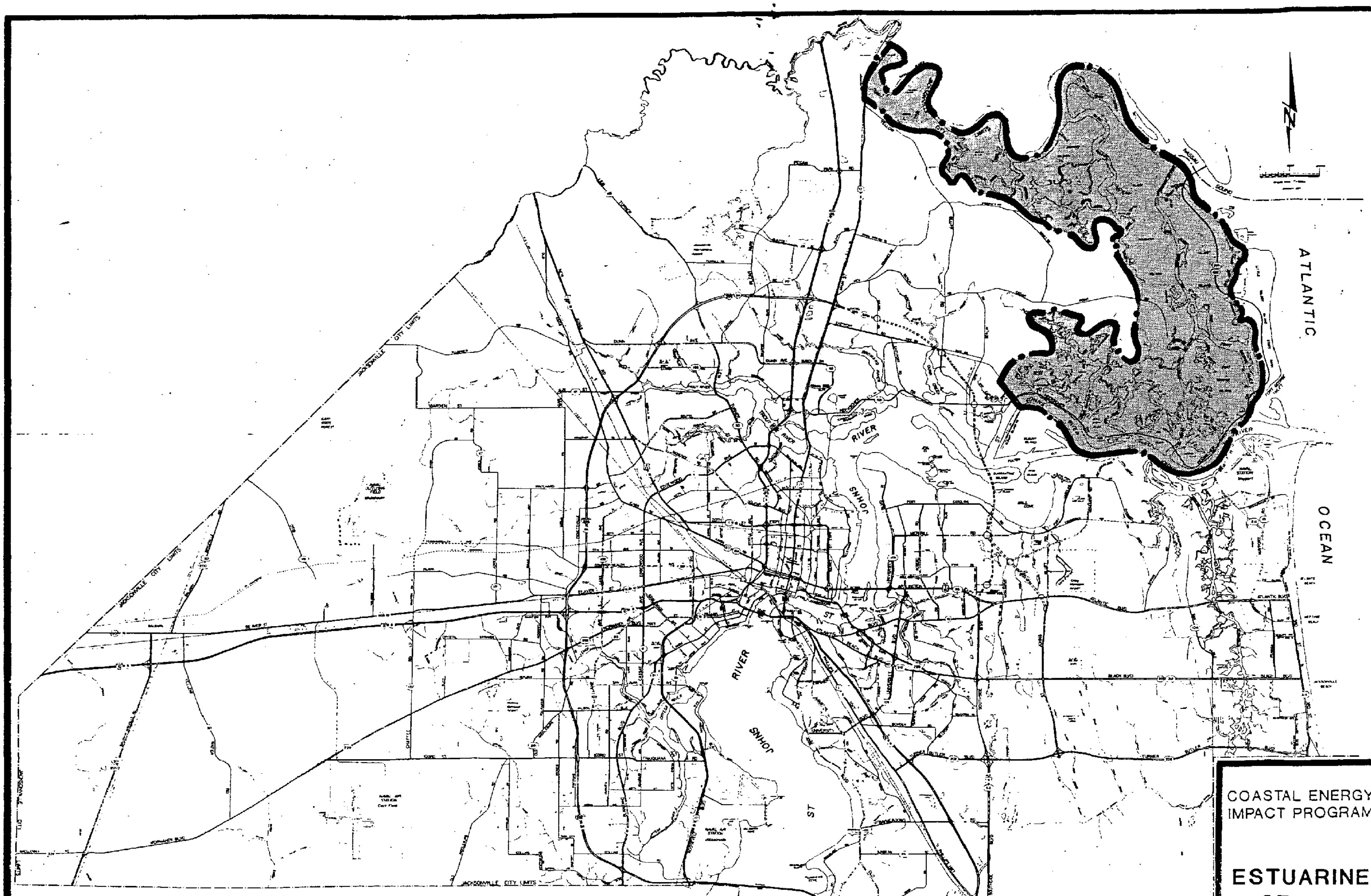
The portion of the Nassau River-St. Johns River marsh that is in Duval County consists of approximately 38,000 acres of tidal marshes and hammock islands. At present, this estuary is still considered rather pristine.

An estuary is generally defined as a semi-enclosed coastal body of water where freshwater from one or more streams mixes with seawater. This area supports predominantly salt tolerant vegetation.

The majority of this estuarine area is also within the boundaries of the Nassau River-St. Johns River Aquatic Preserve. Only a small portion of the study area west of Clapboard Creek, including Browns Creek, to the Mean High Water Spring (MHWS) at the edge of the marsh near the new coal fired Power Park, is not within the preserve. Little Talbot Island has also been excluded from the study area, mainly because it is a State Park and considered adequately protected. (See map.)

The boundaries of the unprotected estuarine marsh in Duval County can be easily delineated by creeks and tidal marsh areas. The study area is bounded on the north by the Nassau River, to the west by watershed boundaries that follow the marsh vegetation down past Mink Creek, Samples Creek and Edwards Creek. The boundary follows Pumpkin Hill Creek to the marshes edge south of Cedar Point Road and along the edge of the new coal fired Power Park, to the St. Johns River. The estuarine marsh is bordered on the south by the St. Johns River, to the east by a line running along the edge and including Ft. George Island, continuing along the edge of Little Talbot Island north along Simpson Creek and along the northern shore of Big Talbot Island to the Nassau River.

It is hoped that this plan will be acceptable at the



LEGEND

STUDY AREA LOCATION

COASTAL ENERGY IMPACT PROGRAM

ESTUARINE STUDY AREA

CONSOLIDATED
CITY OF JACKSONVILLE
DUVAL COUNTY, FLORIDA

Prepared by:
JACKSONVILLE PLANNING DEPARTMENT

JUNE, 1984 | MAP 1

state level and eventually be the basis for the management of the entire Aquatic Preserve.

This management plan includes the only ecological survey of the Duval County portion of the Nassau River-St. Johns River marsh. Vegetation species, plankton analysis, fish and wildlife species, as well as vegetative mapping of the area are included. Resource management is discussed with on site management objectives, administrative management objectives and a management implementation network, as well as program needs all being identified.

An effort has been made to make this plan comprehensive, workable and a viable tool to protect one of the last pristine estuarine ecosystems on Florida's East Coast.

GOALS, OBJECTIVES AND STRATEGIES

II. GOALS, OBJECTIVES AND STRATEGIES

The major goals, objectives and strategies of this section highlight the basic thrust of the management effort.

The management plan for the estuarine marsh is designed to fulfill these goals and objectives as completely as possible.

<u>Goal:</u> Maintain the functional, environmental and aesthetic integrity of the estuarine marsh system.

<u>Objective:</u> To protect the valuable services estuarine marshes provide. These may include: wildlife habitat, erosion control, propagation of marine species.

<u>Strategy:</u> Encourage state acquisition of valuable estuarine marshes within Jacksonville. This would enable more unified management of the estuarine area. The City could establish a lobbying effort to encourage state acquisition under the existing state plans to acquire environmentally sensitive areas.

<u>Strategy:</u> The same type of lobbying effort should be established to encourage DNR to assist in the implementation of the management plan developed for the Nassau River-St. Johns River marsh.

DNR should be encouraged to assist with on-site staff requirements and funding. DNR should also be encouraged to adopt a similar management plan for the entire Nassau River-St. Johns River Aquatic Preserve.

Strategy: Property owned by the City within the estuarine marsh should remain in City ownership. Unless there is an overriding public need for the use of the land.

Objective: Maintain the present water quality as required by state water quality standards.

Strategy: Initiate an on-going water quality monitoring effort in the estuarine area. Selected water sampling sites within the estuarine area can be incorporated into the existing monitoring routine.

Objective: Promote public information about existing state and local programs such as land acquisition, conservation efforts, species protection, tax abatements and conservation easements. Support of these programs that help in the protection of wetlands can be enhanced through public awareness.

Strategy: The City, Chamber of Commerce and St. Johns River Water Management District and other agencies can provide a series of public service announcements. Information may also be included in mailings such as tax statements to owners of wetland property.

The public school system can be utilized by City agencies to promote wetland awareness.

Local libraries and museums can promote exhibits on marsh systems. Often the State Department of Natural Resources has educational aids for this purpose.

Goal: To optimize compatible use of the estuarine marsh and adjacent uplands.

Objective: Prohibit adverse impacts from development in and adjacent to estuarine marshes.

Strategy: If a wetlands management plan is to be successful, it must be accompanied by an uplands mangement plan that takes into consideration all of the watershed area that drains into the estuary. The management plan goal should be to maintain the pre-development volume and quality of upland flow into the tidal estuary.

Strategy: Require post development runoff be maintained at predevelopment rates. During the site review process adherence to the DER and SJRWMD stormwater management criteria should be established. No development and design should be approved by any City agency that does not fully adhere to required stormwater management. Channelization of stormwater should be discouraged.

Strategy: Establish mitigation and restoration procedures for development that will unavoidably impact on or damage the estuarine marsh.

Strategy: Develop a management staff using existing personnel (whenever possible) for implementation of the estuarine management plan. Assistance from applicable state agencies may also be pursued.

Strategy: Establish a review procedure for the environmental aspects of a proposed development that is likely to impact on the estuarine marsh and adjacent upland areas. This can be established through existing permitting processes utilizing city agencies presently handling this procedure.

An example of information that could be addressed in the design plan regarding environmental aspects might be; the amount of vegetation expected to be removed, the set back distance from the marsh, establishing mitigation procedures, if needed, cumulative impact, etc.

Strategy: Modify the site plan review process and/or the subdivision regulation to require that environmental considerations be as important a consideration in the review of site plans as proper drainage, lot size requirements and required easements for streets and right-of-ways. Site plans should include details showing how the development will impact or avoid impacting the estuarine area.

Develop a list of practices that are regarded as detrimental to the estuarine area, are contrary to this plan's primary goal and should not be considered acceptable uses within the estuarine marsh.

The estuarine management staff will review and comment on development plans that may impact on the estuarine marsh system.

<u>Objective:</u> Analyze the estuarine marshes and the adjacent uplands to determine types of compatible land uses and development.

<u>Strategy:</u> Establish on-site field laboratory within the salt marshes for educational purposes. This field laboratory could be established in conjunction with the University of North Florida, Jacksonville University, city agencies and DER. If suitable city owned property is not available, encourage the donation of more suitable property by landowners within the area.

<u>Objective:</u> Fulfill the goal of compatible uses in the estuarine marsh by the provision of public access to suitable marsh areas and the waterways within the marsh.

<u>Strategy:</u> Public facilities including but not limited to boatramps, picnic areas, and scenic overlooks should be properly sited, designed and constructed so there is minimal impact on the estuarine system.

EXISTING MANAGEMENT AUTHORITY

III. EXISTING MANAGEMENT AUTHORITY

State Authority

The majority of the estuarine area or Nassau River-St. Johns River marsh (estuarine marsh) is within the boundaries of the state Nassau-Duval Aquatic Preserve. Therefore, a large portion of this study area is under the rules and management authority of the state, i.e., the Trustees of the Internal Improvement Trust Fund (The Governor and Cabinet) and their agents, The Division of Environmental Lands Management within DNR (The Department of Natural Resources), and parts of other state agencies having some jurisdiction in this area. It is, therefore, necessary to understand the state authority in the estuarine area in order to fully realize the need for local management.

Chapter 258, F. S., clearly establishes the proprietary management overview role of the Governor and Cabinet, sitting as the Trustees of the Internal Improvement Trust Fund. Throughout this legislation, the Trustees of the Internal Improvement Trust Fund are variously referred to as the "Trustees" or the "Board". Furthermore, all management responsibilities assigned to the Trustees by this legislation may be fulfilled directly by the Governor and Cabinet or indirectly via staff or agents of the Trustees, pursuant to delegations of authority, management agreements, or other legal mechanisms. All subsequent references to the Board or Trustees should, therefore, be presumed to potentially include staff and designated agents, in addition to the Governor and Cabinet.

The primary authorities available to staff in implementing management directives affecting aquatic preserves are found in Chapters 258 and 253, Florida Statutes. These authorities stipulate a lead responsibility for the Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund. Acting as "agents" for the Trustees, the staff of the Bureau of Environmental Land Management (BELM) is able to review all requests for uses of or directly affecting state-owned sovereignty submerged lands within aquatic preserves. The review and subsequent staff comments are primarily geared toward the environmental consequences of any proposed use of state-owned submerged land. The review is conducted within the confines of the criteria contained in the "maintenance" provisions for aquatic preserves in Chapter 258, Florida Statutes.

Formal review comments are provided to the Department of Natural Resources, Division of State Lands by the Bureau of Environmental Land Management for inclusion in the comments and recommendations accompanying agenda items for Trustees consideration. This mechanism allows the Governor and Cabinet, sitting as owners of the land, to evaluate public interest and project merits within the context of environmental impact upon the preserve.

Chapters 16Q-21 and 16Q20, Florida Administrative Code, are two administrative rules directly applicable to the Department of Natural Resources/Trustee's actions regarding allowable uses of submerged lands, in general, and aquatic preserves specifically. Chapter 16Q21, F.A.C., controls activities conducted on sovereignty submerged lands, and is predicated upon the provisions of Sections 253.03 and 253.12, F. S. The stated intent of this administrative rule is:

> "(1) To aid in fulfilling the trust and fiduciary responsibilities of the Boards of Trustees of the Internal Improvement Trust Fund for the administration, management and disposition of sovereignty lands;
>
> (2) To insure maximum benefit and use of sovereignty lands for all the citizens of Florida;
>
> (3) To manage, protect, and enhance sovereignty lands so that the public may continue to enjoy traditional uses including, but not limited to, navigation, fishing, and swimming;
>
> (4) To manage and provide maximum protection for all sovereignty lands, especially those important to public drinking water supply, shellfish harvesting, public recreation, and fish and wildlife propagation and management;
>
> (5) To insure that all public and private

activities on sovereignty lands which generate revenues or exclude traditional public uses provide just compensation for such privileges; and,

(6) To aid in the implementation of the State Lands Management Plan."

Chapter 16Q-20, F.A.C. addresses the aquatic preserves and derives its authority from Sections 258.35, 258.36, 258.37, and 258.38, F. S. The intent of this rule in contained in Section 16Q-20.01, F.A.C., which states:

(1) All sovereignty lands within a preserve shall be managed primarily for the maintenance of essentially natural conditions, the propagation of fish and wildlife, and public recreation, including hunting and fishing where deemed appropriate by the board and the managing agency.

(2) The aquatic preserves which are described in Sections 258.39, 258.391 and 258.392, F. S., and in 16Q-20.02, F.A.C., were established for the purpose of being preserved in an essentially natural or existing condition so that their aesthetic, biological and scientific values may endure for the enjoyment of future generations.

(3) The preserves shall be administered and managed in accordance with the following goals:

(a) To preserve, protect, and enhance these exceptional areas of sovereignty submerged lands by reasonable regulation of human activity within the preserves through the development and implementation of a comprehensive management program;

(b) To protect and enhance the waters of the preserves so that the public may continue to enjoy the traditional recreational uses of those waters such as swimming, boating, and fishing;

(c) To coordinate with federal, state, and local agencies to aid in carrying out the intent of the Legislature in creating the preserves;

(d) To use applicable federal, state, and local management programs, which are compatible with the intent and provisions of the act and these rules, to assist in managing the preserves;

(e) To encourage the protection, enhancement or restoration of the biological, aesthetic, or scientific values of the preserves, including but not limited to the modification of existing man made conditions toward their natural condition, and discourage activities which would degrade the aesthetic, biological, or scientific values, or the quality, or utility of a preserve, when reviewing applications, or when developing and implementing management plans for the preserve;

(f) To preserve, promote, and utilize indigenous life forms and habitats, including but not limited to: sponges, soft coral, hard corals, submerged grasses, mangroves, salt water marshes, fresh water marshes, mud flats, estuarine, aquatic and marine mammals, birds, shellfish and mollusks;

(g) To acquire additional title interests in lands wherever such acquisitions would serve to protect or enhance the geological, aesthetic, or scientific values of the preserves;

(h) To maintain those beneficial hydrologic and biologic functions, the benefits of which accrue to the public at large.

The State Lands Management Plan, adopted on March 17, 1981, by the Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund, contains specific policies affecting aquatic preserves and their resources. In addition to basic restatement of Legislatively established management policies, the Plan also establishes policies concerning spoil islands, submerged land leases, "Outstanding Native Florida Landscapes", unique natural features, submerged grassbeds, archaeological and historical resources, and endangered species. All of these issues provide management guidance to the aquatic preserve program.

Other Department of Natural Resources management authorities applicable to aquatic preserves include fisheries and marine mammal management and protection, and beach and shore preservation programs outlined in Chapters 370 and 161, F. S. Land acquisition programs conducted under the Environmentally Endangered Lands authorities of Chapter 259 259, F. S., or the Conservation and Recreation Lands Program authorized by Chapter 253, F. S., will enhance the protection of the natural resources of the aquatic preserves. The public acquisition of the adjacent upland properties enable their management in a manner compatible with the goals and objectives of the aquatic preserve management program.

Chapter 403, F. S., is an important adjunct to Chapters 253 and 258, F. S. This governs, in part, the state's regulatory programs affecting water quality. The Department of Environmental Regulation, through a permitting and certification process, administers this program.

Section 253.77, F. S., requires that all state regulatory agencies, such as the Department of Environmental Regulation, have evidence of approval of the requested use from the Trustees, prior to issuing permits for projects utilizing state owned land. This statutory directive provides an avenue for staff comments on potential environmental impacts of projects in aquatic preserves through the Department of Environmental Regulation permitting process. Additionally, the Department of Environmental Regulation has designated, by administrative rule, a series of waterbodies with stringent use criteria called "Outstanding Florida Waters" (OFW). The inclusion of all aquatic preserve waters within this classification greatly enhances the protective provisions of Chapter 258, F. S. As the designated "306" Coastal Zone Management Agency, the Department of Environmental Regulation also provides a source of funding for data collection and planning in these areas, as well as being the state agency responsible for implementing the "federal consistency" provisions of the federal Coastal Zone Management Act.

The Department of Environmental Regulation's administrative rules of primary significance to the aquatic preserve management program include Chapters 17-3 and 17-4, Florida Administrative Code. Both rules are based upon the authorities contained in Chapter 403, F. S. Chapter 17-3, F. A. C., addresses water quality standards and establishes the category of "Outstanding Florida Waters", while Chapter

17-4, F. A. C., addresses permit requirements.

In December, 1982, a Memorandum of Understanding (MOU) between the Department of Environmental Regulation, the Department of Natural Resources, and the U. S. Army Corps of Engineers was executed. This MOU clearly establishes a process whereby the proprietary concerns of the Trustees, under the auspices of Chapter 253, F. S., can be integrated into the Department of Environmental Regulation/Corps of Engineers joint permit processing system.

Other opportunities for environmental review and input into activities potentially affecting aquatic preserves are afforded by the Department of Community Affairs, and the Department of State, Division of Archives, History, and Records Management. The Executive Office of the Governor also provides a mechanism for public input into federal projects via the State Clearinghouse process.

The Department of Community Affairs is statutorily responsible for administering the "Development of Regional Impact" (DRI), and "Areas of Critical State Concern Legislative Program". The DRI program, authorized by Section 380.06, F. S., was established by the Legislature to provide a review and monitoring procedure for those development projects potentially affecting more than one county. The Areas of Critical State Concern program is mandated by Section 380.05, F. S. This program is intended to protect regional or state wide resources from poorly conceived development through the state regulation of development activities.

The Department of Community Affairs is also the designated Coastal Zone Management "308" Agency, and, as such, is responsible for discharging the "Coastal Energy Impact Program (C.E.I.P.)". This program will be very important to Florida's aquatic preserve program should oil and gas be discovered in commercial quantities on the Florida Outer Continental Shelf.

Chapter 267, F. S., establishes the state policy regarding preservation and management of Florida's archaeological and historical resources. This responsibility is legislatively assigned to the Department of State, Division of Archives, History and Records Management, which holds title to those cultural resources located on state owned lands. This also applies to sovereignty submerged lands, including aquatic preserves.

The Department of Health and Rehabilitative Services, under their public mandate, administer two programs directly affecting the aquatic preserve management program. These programs are (1) septic tank regulation, usually administered by county Health Departments and (2) arthropod (mosquito) control programs, usually implemented through local mosquito control districts. Each of these programs holds the potential of creating significant impacts upon the aquatic preserves. Establishment of close working relationships between the aquatic preserve staff and the Department of Health and Rehabilitative Services will be a necessary element of the aquatic preserves management program.

Each of these referenced programs currently provide some effective means of protecting aquatic preserves and their ecologically sensitive resources.

Local Authority

Locally, management authority for environmental concerns rest mainly with the Environmental Protection Board and to some extent Bio-Environmental Services Division (BESD) who serves as their staff.

BESD has general responsibility administration and operation of mosquito control services and for the enforcement of air and water pollution laws.

The Environmental Protection Board is tasked with promoting rules and regulations reasonably necessary for implementing the intent, enforcement, administration and interpretation of City Ordinances regarding effective and continuing control and regulation of environmental health within the city.

They are also currently used as a variance Board for appeals by various entities that request relief from local pollution laws that are more stringent than the states. The Board could be utilized as an appeals board for persons having a conflict with the recommendations of the estuarine management staff over allowable uses of the estuarine area.

EXISTING RESOURCES

IV. EXISTING RESOURCES

Introduction

Salt marsh communities are intertidal systems that occur in coastal areas of gentle slope and low wave energy. On the Atlantic coast, they develop only behind relatively sheltered inlets where the wave energy has been dissipated on the outer coast. The North Florida salt marsh is associated with broad expanses of mud flats and an extensive barrier island system. Figure 1 shows the typical barrier island profile of Northeast Florida with its associated salt marsh communities on the landward side. The North Florida - South Georgia salt marsh communities are among the most productive in the world (Odum, Copeland, and McMahan, 1974).

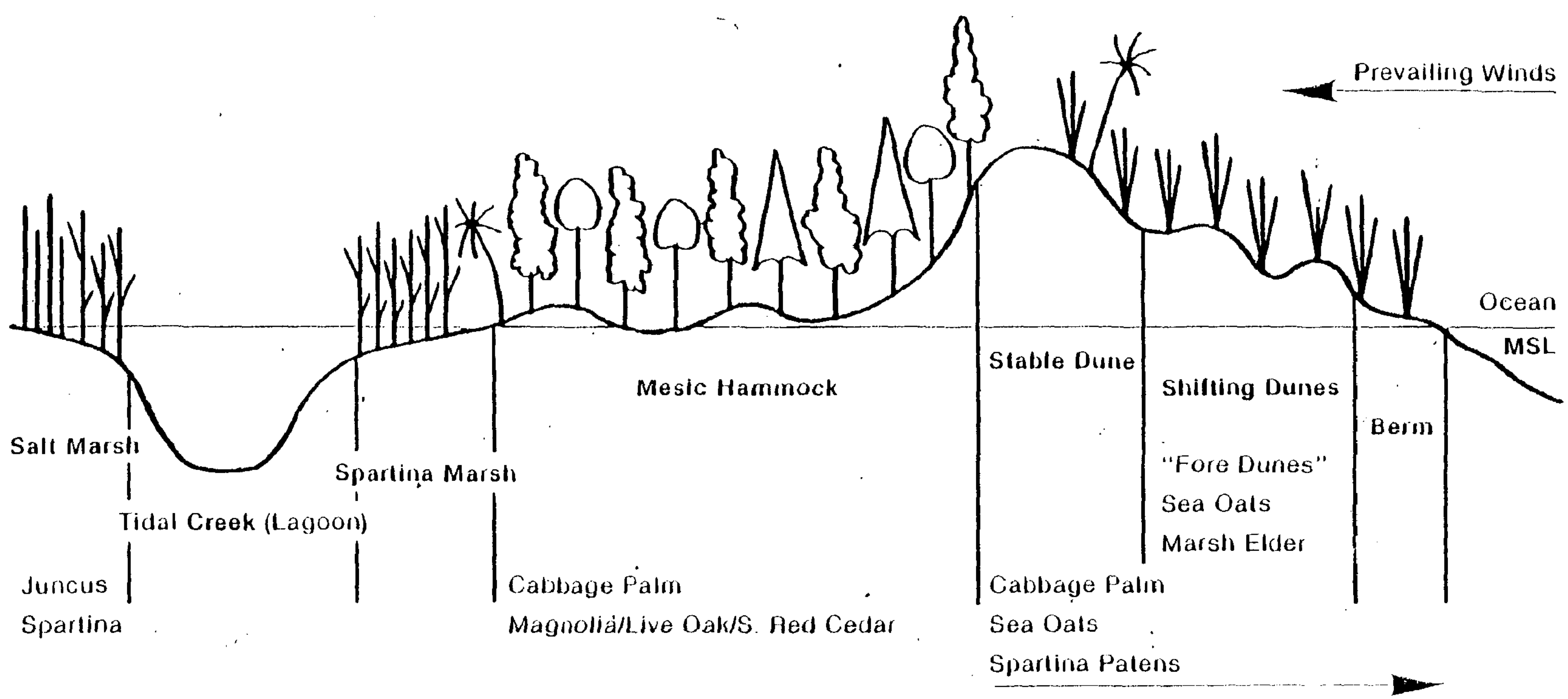
The most characteristic feature of these marshes is the broad expanse of Smooth Cordgrass (*Spartina alterniflora*) frequently bordered on the landward side by Black Needlerush (Juncus roemerianus). Smooth cordgrass can withstand up to 12 hours of daily tidal flooding. Thus, it occupies the zone between mean low water and mean high tide, the low marsh of Figure 2.

The zone from mean low water to mean low water spring tide is the tidal mud flat (Fig. 2). It is characterized by green algae such as Sea Lettuce (*Ulva lactuca*), if the sediments are sufficiently consolidated or oysters are present to provide a solid substrate for attachment of the holdfast, and by an abundance of benthic diatoms, often coloring the sands golden brown. This is a highly productive zone that provides food for mud snails (Ilyanassa obsoleta) and various species of killifish (Pomeroy and Wiegert, 1981).

The high marsh is dominated by Black Needlerush, interspersed at the lower edge with the short form of Smooth Cordgrass and at the upper edge or transition zone with a variety of salt tolerant terrestrial plants. It is generally considered a less productive zone than the low marsh (Odum, Copeland, and McMahon, 1974).

To the casual observer, a salt marsh looks like a monotonous expanse of grass and water. To the biologist or naturalist, it is a highly complex and intricately balanced ecosystem, sometimes fragile, sometimes very resilient, depending on which environmental parameter has been altered

Fig. 1. North Florida Barrier Island Profile:

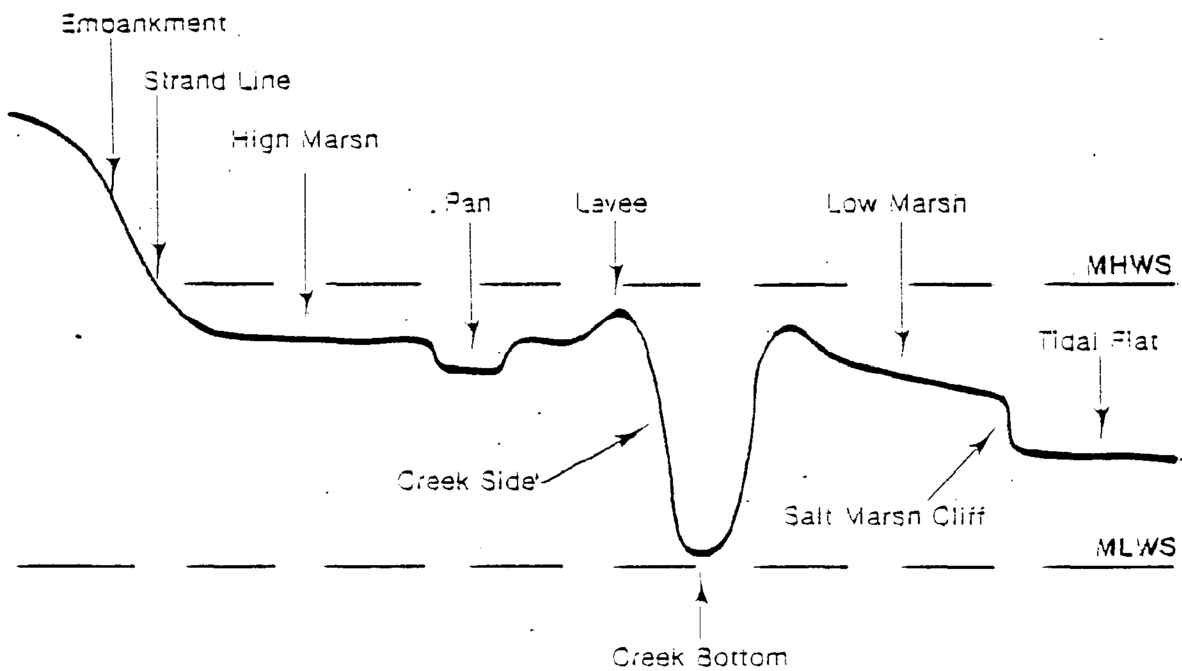


Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

Fig. 2 . Sub-Habitats of the North Florida Salt Marsh Ecosystem.

Major Kinds of Primary Producers:

1. Phytoplankton — Diatoms
2. Marsh Grass — Spartina, Juncus
3. Mud Flat Algae — Diatoms, Blue Green Algae
4. Epiphytes — Diatoms, Green Algae



Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

and for how long. The complex pattern of plant and animal distribution within the sale marsh ecosystem is based on differences in (1) elevation, (2) depth of tidal flooding, and (3) salinity. Figure 2 identifies ten sub-habitats that can be found in Northeast Florida salt marshes. All of these may be present at a given site; more frequently, however, some are missing due to topographical differences.

Salt marsh animals include a large number of terrestrial species such as insects, spiders and a few mammals that nest within the marsh, the Rice Rate and Coastal Meadow mouse. Marine species occur at the seaward edge and within the tidal creeks. These species include bass, flounder, sea trout, mullet, sea catfish, and dolphins. Typical Marsh species of birds inlcude the Clapper Rail, Marsh Wren, and the Seaside Sparrow. These species breed within the marsh and their continued survival depends on salt marsh preservation.

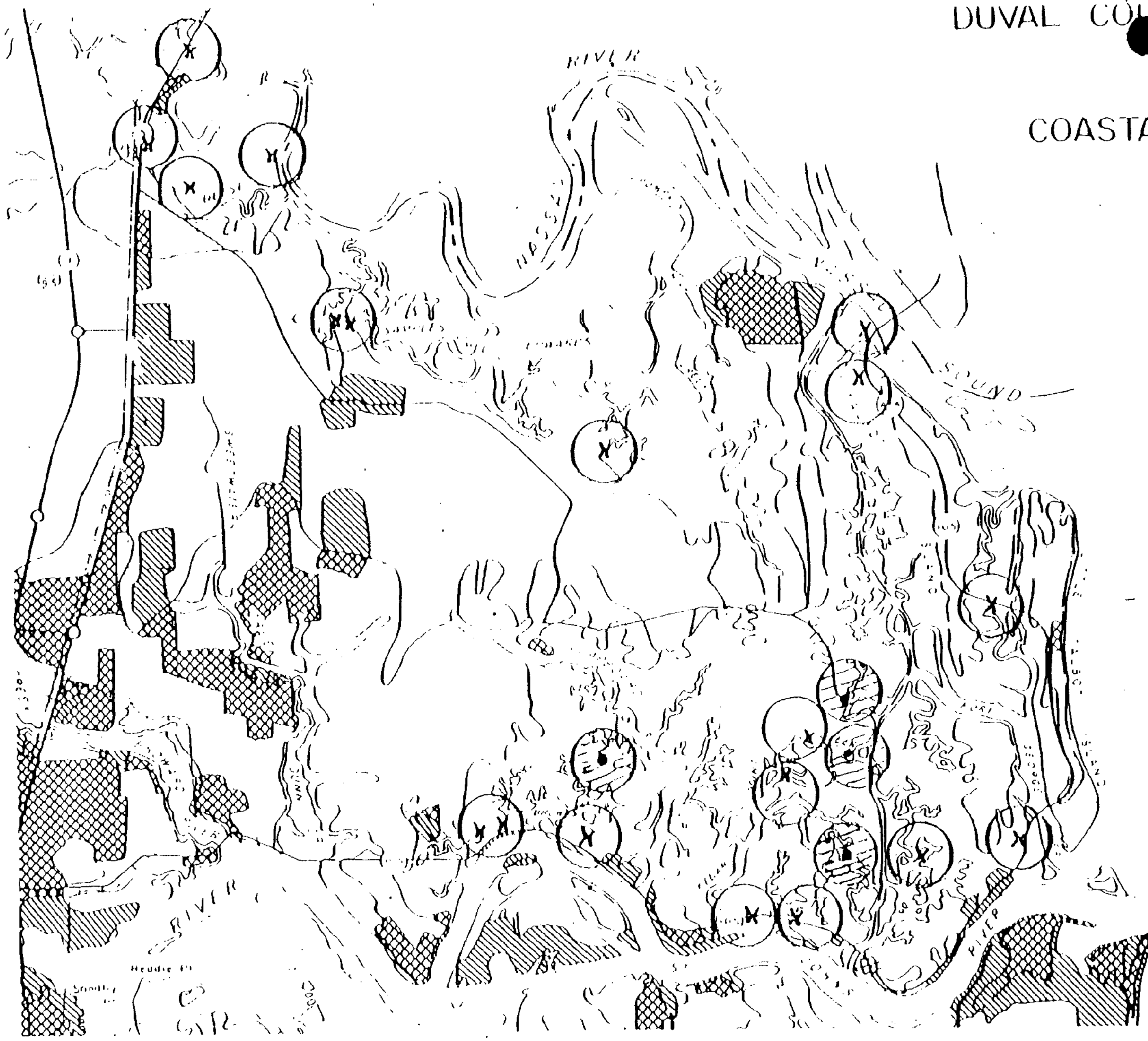
The most common marsh invertebrates include the Fiddler Crab species, Mud snails, Periwinkle snails, and Oysters. Oysters frequently reach their optimum development within the salt marsh system since the tidal flushing provides large amounts of food and the lowered salinities eliminates some of their most severe predators such as starfish and oyster drills.

Methods

Macrophytes

The locations of the sampling areas are indicated by the large circles on the map (9). Several square meter quadrats were measured within each sample location, depending on the number of different community types present at the site. All plant species within the quadrats were counted and identified to species. The average heights of smooth cordgrass types and/or black needlerush were determined for each area sampled. This was determined by measuring the height of ten randomly selected plants of each of the above species in each quadrant and taking the mean height of the sample plants. Square meter detailed vegetation maps were drawn for the four dominant saltmarsh community associations found within the study area. These sites are indicated by a shaded area within the circle in Map 9.

Vegetation transects were run at Inconstantion Creek and Horseshoe Creek from hammock dome to mean low water.



Map 2. Location of Sample Sites used in Salt Marsh Study.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area," by Dr. Carol DeMort, University of North Florida, Dep rtment of Natural Sciences, April 1984.

Plants falling within the transect were identified to species.

Color infrared aerial photographs supplied by the EROS Data Center were used in addition to U.S.G.S. maps and field surveys to develop a salt m[illegible] vegetation map of the study area. Color slides of each major community association were taken using a Minolta SRT 102. These were used as an aid in plant identification and community characterization. Plant keys used in species identifications are included in the bibliography.

Plankton

Plankton tows were made in Sisters Creek and in Pumpkin Hill Creek. A No. 20 silk bolting cloth plankton net was used. Samples were preserved and counted with a Sedgewick-Rafter Counting Cell and a Hemocytometer using 100x or 400x for identification.

Annotated Animal Lists

Annotated lists of birds, fishes, mammals, and invertebrates were prepared using a combination of actual sightings and literature review.

Results

Vegetation

The plant species that were found during this study are listed in Table 1. A total of 55 species of vascular plants were identified. The dominant vascular plants were smooth Cordgrass (Spartina alterniflora) and Black needlerush (Juncus roemerianus). The low marsh, regularly flooded by tides, is characterized by pure stands of Smooth Cordgrass (Spartina alterniflora).

In the Georgia salt marshes there are typically three growth forms of smoooth Cordgrass: (1) Tall Spartina (averaging 1.3 to 2.5 meters in height) found along the creek banks, (2) Medium Spartina (.6 - 1.3 meters high) found on the top of the natural levees, and (3) Short Spartina (.3m) found back from the levees, where the surface is nearly level, and grading into the needlrush zone (Odum, Copeland, and McMahan, 1976). Based on our sample data, the tall form of Spartina is almost absent within the study area. Plants averaging 1.5 meters were found on the levee at Sisters Creek and Deep Creek. Most of the Spartina counted during this study was less than 60 cm in height, falling within the short to medium range. Plant densities and mean heights for six selected quadrats are given in Table 2.

The zonation of marsh plants typically seen during this study is shown in Fig. 3. Salt meadow hay (Spartina patens) was most abundant in the marshes along the Nassau River and its tributaries. Groundsel trees (Baccharis halimifolia) were the most abundant transition zone shrub of the study area, occurring from the Ft. George Island area to the northwestern boundary of the study area. Needlerush occurred in large pure stands in the high marshes of the central part of the study area. Table 3 lists the most frequently encountered plant species identified during this study.

Inconstantion Creek Profile

The zonation that was seen at Inconstantion Creek is diagrammed in Fig. 4. This was the area in which the largest number of Clapper Rails were sighted. In addition to Clapper Rails tracks of the following animals were identified: Marsh Rabbit, Cotton Rat, Raccoon, and White-Tailed Deer. The birds and wildlife of the area were abundant. Three large covies of quail were flushed from the

Table 1. List of Common and Scientific Names of Plants Found in the Survey of Saltmarsh and Transitional Coastal Vegetation of Northeastern Duval County, Florida.

Scientific Name	Common Name	Family
Andropogon capillipes Nash	Beardgrass	Poaceae (Graminae)
Andropogon virginicus L.	Broomsedge	Poaceae
Aristida stricta michx	Wiregrass	Poaceae
Aster tenuifolius L.	Salt marsh aster	Asteraceae (Compositae)
Baccharis halimifolia L. var. angustior DC	Groundsel Silverling	Asteraceae
Batis maritima L.	Saltwort	Bataceae
Bidens pilosa L.	Beggar tick	Asteraceae
Borrichia frutescens (L.) DC.	Sea Oxeye daisy	Asteraceae
Cenchrus tribuloides L.	Sandspur	Poaceae
Cirsium horridulm Michx.	Purple thistle	Asteraceae
Cladium jamaicense	Sawgrass	Cyperaceae
Cnidoscolus stimulosus (Michx.) Engelm, and Gray	Tread softly	Euphorbiaceae
Cyperus filicinus L.	Sedge	Cyperaceae
Distichlis spicata (L.) Greene	Seashore saltgrass	Poaceae
Erythrina herbacea L.	Coral bean	Fabaceae
Galium hispidulum Michx.	Bedstraw	Rubiaceae
Hydrocotyle bonariensis Lam.	Water pennywort	Apiaceae
Ilex Cassine	Dahoon Holly	Aquifoliaceae
Ilex corriacea (Pursh) Chapm.	Gallberry Holly	Aquifoliaceae
Iva frutescens L.	Marsh elder	Asteraceae
Juncus roemerianus Scheele	Black needlerush	Juncaceae
Juncus scirpoides (Lam.)	Rush	Juncaceae
Juniperus siliciola (Small) Bailey	Southern red cedar	Cupressaceae
Limonium carolinianum (Walt.) Britt. var. angustatum (Gray) Blake)	Sea Lavender	Plumbaginaceae
Lycium carolinianum	Christmas Berry	Solanaceae
Lyonia ferruginea (Walt.) Nutt.	Staggerbush	Ericaceae
Magnolia grandiflora L. (M. foetida (L.) Sarg.)	Southern magnolia	Magnoliaceae

Myrica cerifera L.	Wax myrtle	Myricaceae
Opuntia stricta Haw.	Prickly-pear cactus	Cactaceae
Parthenocissus quinquefolia (L.)	Viriginia creeper	Vitaceae
Persea borbonia (L.) Spreng. var. borboni	Red bay	Lauraceae
Physalis viscosa L.	Groundcherry	Solanaceae
Pinus elliottii Engelm.	Slash pine	Pinaceae
Pinus palustris Mill.	Southern long-leaf Pine	Pinaceae
Pinus taeda L.	Loblolly pine	Pinaceae
Polygala grandiflora Walt. var. grandiflora	Polygala	Polygalaceae
Prunus serotina (Ehrh.)	Black cherry	Rosaceae
Quercus virginiana Miller var. geminata Sarg.	Sand live oak	Fagaceae
Quercus hemisphaerica (Bartr.)	Laurel Oak	Fagaceae
Rubus trivialis	Dewberry	Rosaceae
Rumex pulcher L.	Fiddle dock	Polygonaceae
Sabal palmetto (Walt.) Lodd. and Schultes	Cabbage	Arecaceae (Palmae)
Salicornia virginica L.	Perennial glasswort	Chenopodiaceae
Serenoa repens (Bartr.) Small	Saw palmetto	Arecaceae
Sesuvium portulacastrum L.	Sea purslane	Aizoaceae
Smilax auriculata Walt.	Greenbrier	Smilacaceae
Smilax bona-nox	Bullbrier	Smilacaceae
Smilax laurifolia L.	Bamboo vine	Smilacaceae
Spartina alterniflora Loisel.	Smooth Cordgrass	Poaceae
Spartina cynosuroides	Big cordgrass	Poaceae
Spartina patens (Ait.) Muhl.	Marsh hay cordgrass	Poaceae
Sporobolus virginicus (L.) Kunth	Virginia dropseed	Poaceae
Suaeda linearis (Ell.) Moq.	Sea blite	Chenopodiaceae
Typha latifolia	Cattail	Typhaceae
Uniola paniculata L.	Sea oates	Poaceae

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

Table 2. PLANT DENSITIES AND MEAN HEIGHTS OF SPARTINA ALTERNIFLORA FOR SIX QUADRATS.

Location	Mean Height		# of Plants/M^2
Samples	levee	1.4m	38
	low marsh	34cm	528
Edwards Creek		70cm	330
Sawpit Creek	levee	60	158
	low marsh	18cm	276
Deep Creek		1.5m	60

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

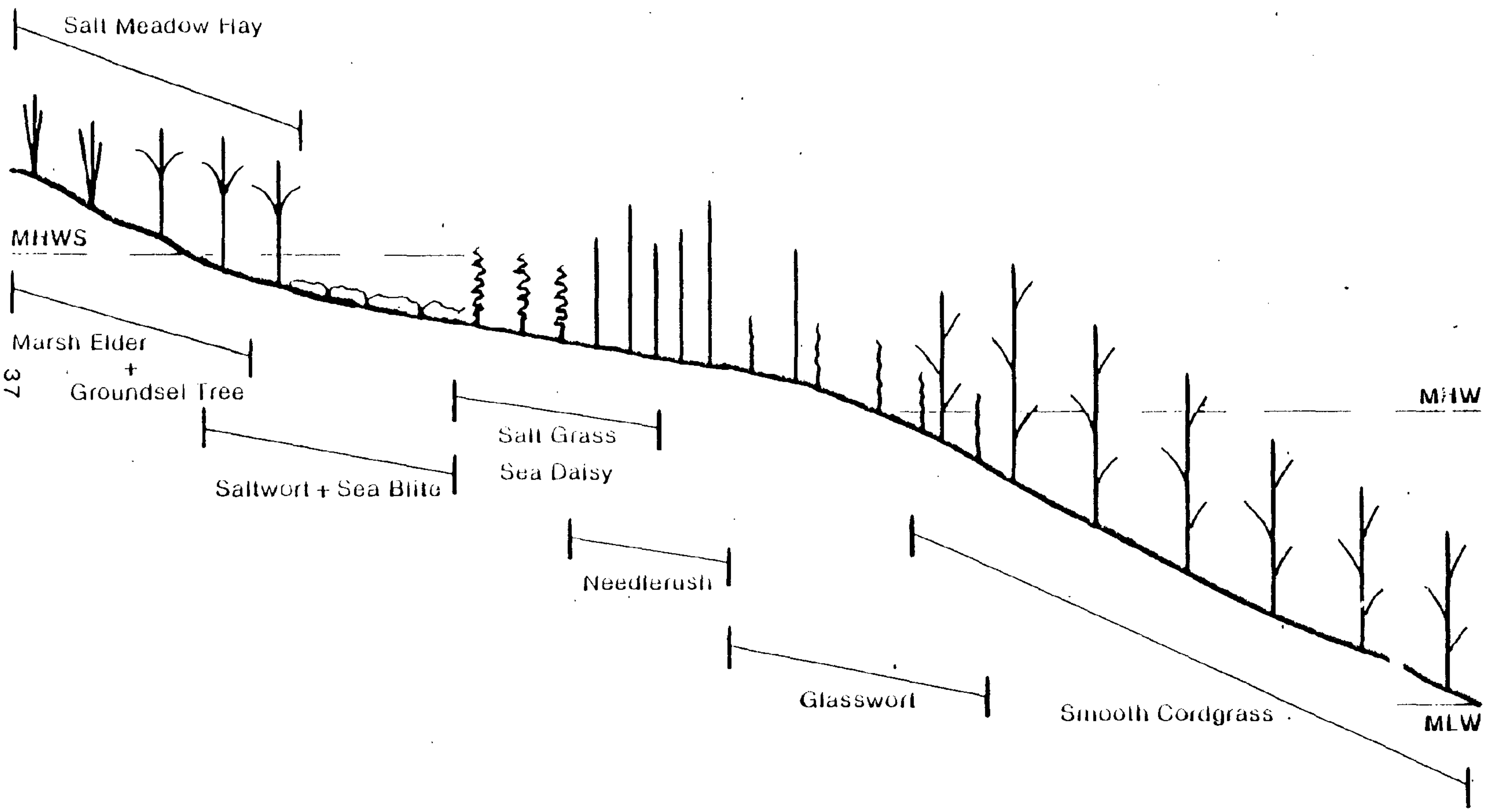


Fig. 3. Generalized Zonation of Salt Marsh Plants in North Florida.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

Table 3. TYPICAL PLANT SPECIES FOUND IN THE DUVAL COUNTY SALT MARSH

Dominant Species

Batis maritima (Saltwort)

Borrichia frutescens (Sea daisy)

Distichlis spicata (Saltgrass)

Juncus roemerianus (Black needlerush)

Spartina alterniflora (Smooth cordgrass)

Spartina patens (Marsh hay cordgrass)

Associated Species

Salicornia virginica (Glasswort)

Sesuvium portulacastrum (Sea purslane)

Spartina cynosuroides (Big cordgrass)

Suaeda linearis (Sea blight)

Typha angustifolia (Narrow-leaved cattail)

Transitional Species

Andropogon elliottii (Broomsedge)

Baccharis halimifolia (Groundsel bush)

Batis maritima (Saltwort)

Cladium jamaicense (Sawgrass)

Iva frutescens (Marsh elder)

Limonium carolinianum (Marsh lavender)

Lyonia ferruginea (Staggerbush)

Myrica cerifera (Wax myrtle)

Sabal palmetto (Cabbage palm)

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

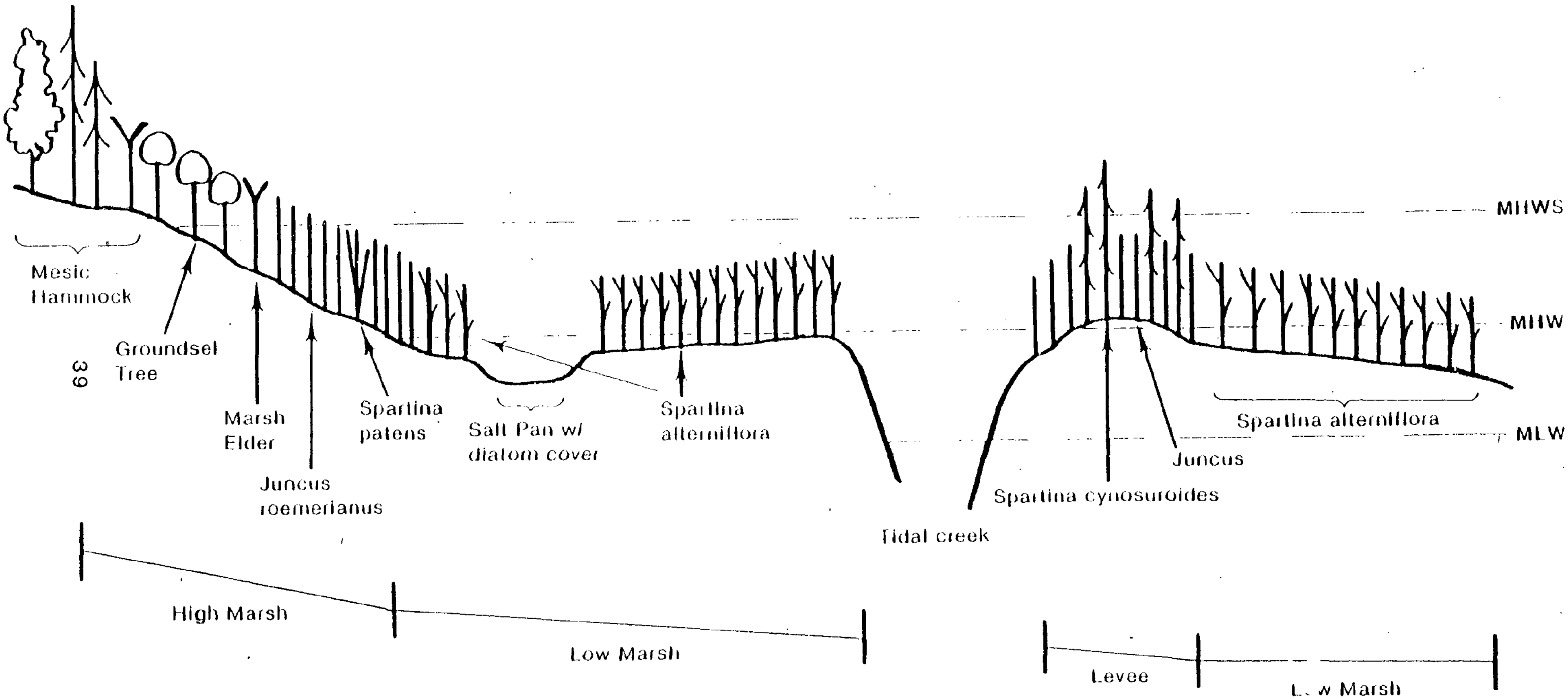


Fig. 4. Profile of Saltmarsh in Inconstantion Creek Area.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

Big Cordgrass stands during the first visit to the area. The creek banks were a golden brown due to large numbers of benthic diatoms. This was also the location of the most extensive stands of Big Cordgrass (Spartina cynosuroides).

Horseshoe Creek Profile (Black Hammock Island).

The dominant tree species of this hammock was Southern Red Cedar (Juniperus siliciola). Sea Oxeye Daisy (Borrichia frutescens) was the most abundant transition zone plant. Black Needlerush was sparsely present in widely scattered stands. The low marsh consisted of almost pure stands of Smooth Cordgrass, averaging less than 40 cm high. The low marsh was well developed in this area with extensive tidal flats containing large numbers of oyster bars, mudsnails and grapsid crabs (See Invertebrate list).

Square Meter Detailed Vegetation Maps

Square meter detailed vegetation maps were drawn for four sample locations (See Fig. 6-9). The following Community Associations are characterized by these maps: (1) Spartina marsh (2) mixed Spartina Juncus marsh (3) short Juncus marsh, (4) saline transition zone. Plant densities of the dominant species within the quadrats ranged from a high of 342 plants/m^2 for the Spartina marsh to a low of 82/m^2 for Borrichia frutescens (Sea Oxeye Daisy) in the saline transition zone.

Plankton

Plankton tows were made in Pumpkin Hill Creek (salinity 4%) and in Sisters Creek (salinity 22%). Complete Plankton lists are given in the Appendix.

Zooplankton

The most abundant zooplankton at Pumpkin Hill Creek were Cyclopoid adults. These are common fresh to brackish water Crustaceans that provide food for fish species and larger invertebrates. Calanoid adults and larval stages (nauplius) were the most abundant organisms among the zooplankton in the Sisters Creek sample. These are also Crustaceans that are an important food source for fish and invertebrates.

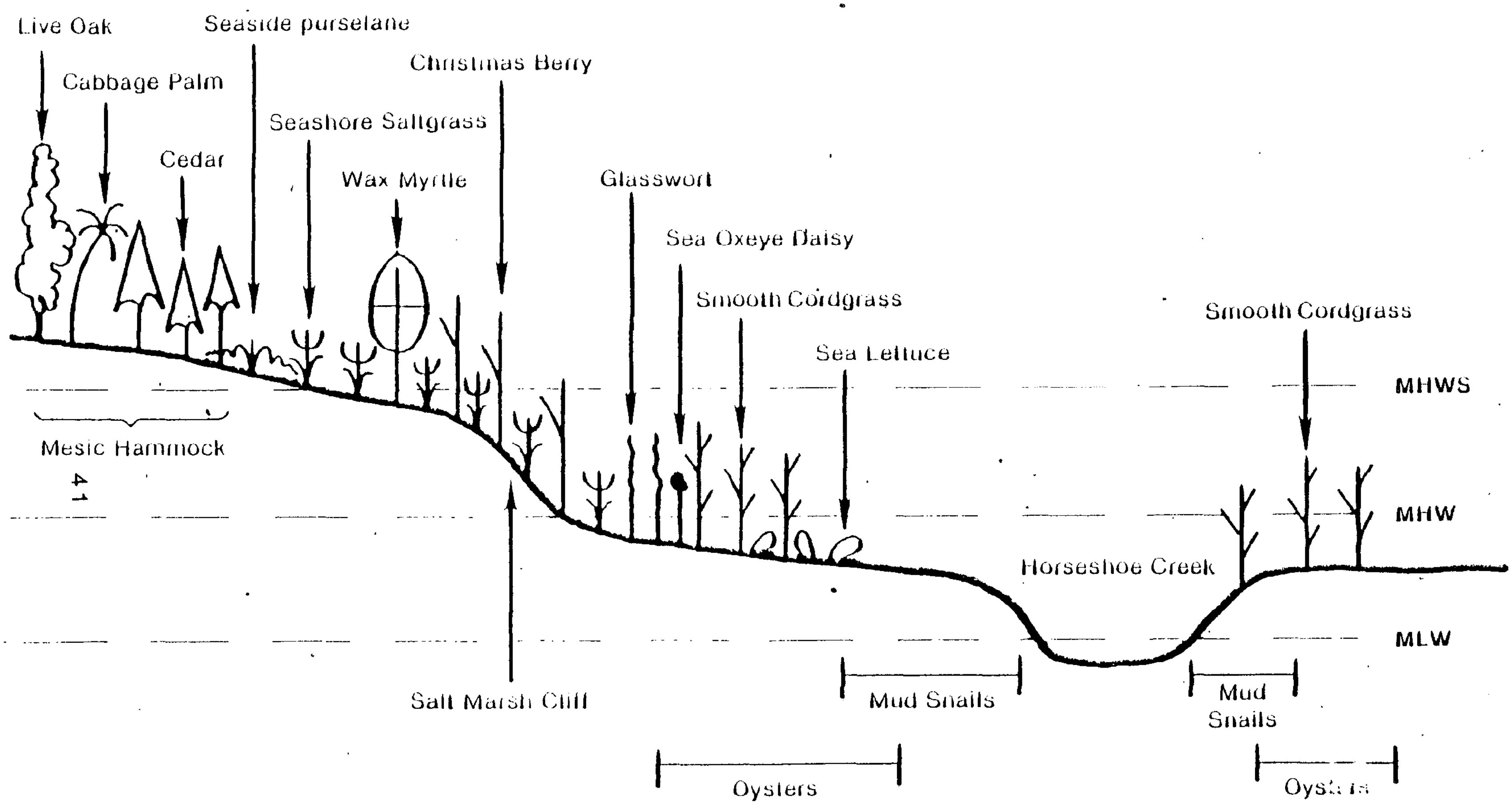


Fig. 5. Profile of Saltmarsh in Horseshoe Creek Area (Black Hammock Island).

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

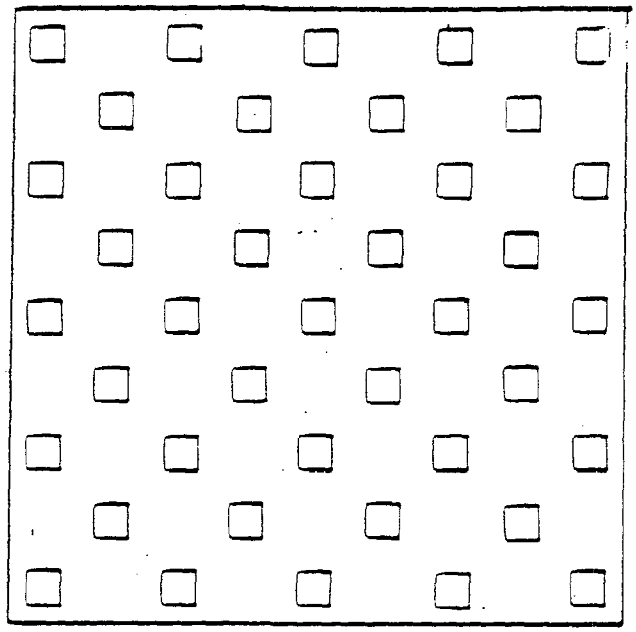


FIG. 6. Spartina Marsh at Mouth of Cedar Point Creek near Sisters Creek, (numbers in parentheses equals total number per square meter).

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

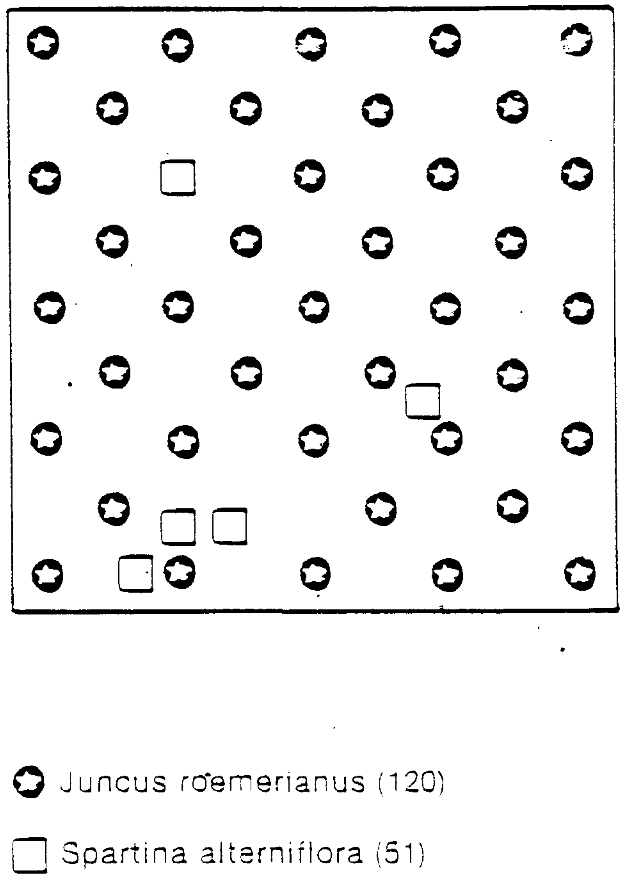
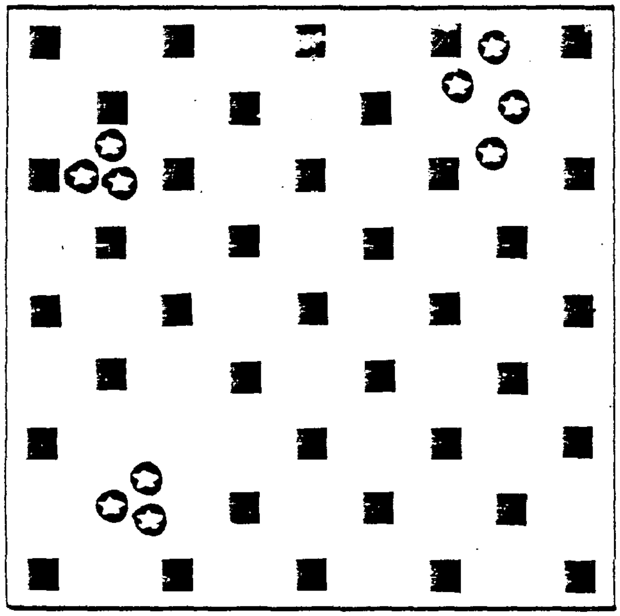


FIG. 7. Spartina-Juncus Marsh on Hannah Mills Creek, (number in parentheses equals total number per square meter).

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.



■ Juncus roemerianus (142)

✪ Salicornia virginica (1516)

FIG. 8. Short Juncus Marsh at Pelotes Island, (number in parentheses equals total number per square meter).

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

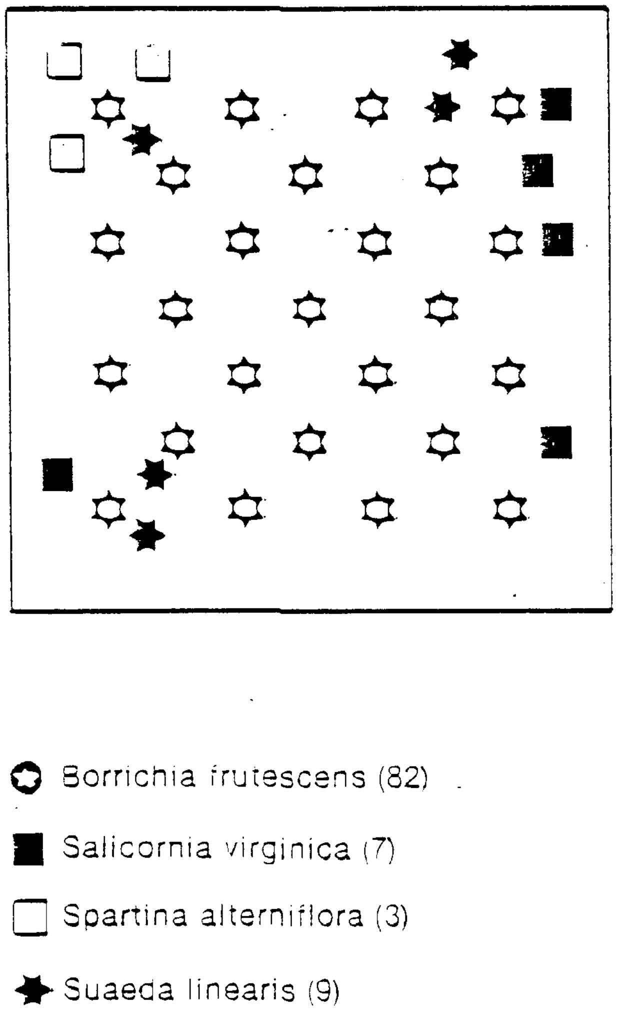


FIG. 9. Transition Zone at Horseshoe Creek, (number in parentheses equals total number per square meter.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Jonns-South Nassau River County Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

Phytoplankton

The forms identified from the Pumpkin Hill sample were dominated by benthicdiatom genera such as *Gyrosigma*, *Surirella*, an *Navicula*. More species were identified from the higher salinity site at Sisters Creek. A larger number of planktonic forms were identified from this station. The bottom in this area was sandy as compared with the darker muds of the Pumpkin Hill area. This type of sandy substrate was poorer in benthic flora as compared to the organic muds of the more inland areas such as Pumpkin Hill Creek.

Annotated Animal Lists

Annotated lists for birds, fishes, mammals and reptiles (one list), and invertebrates are presented in V-VIII, attached reports. Notes on stages of the life cycle spent within the study area and endangered or threatened status are included in the reports.

Vegetation Results Summary

(1) A total of 55 species of vascular plants were identified during this study. The dominant vascular plants were smooth cordgrass (Spartina alterniflora) and black needrush (Juncus roemerianus). The low marsh, regularly flooded by tides, is characterized by pure stands of smooth cordgrass.

(2) Based on our sample data, the tall form of smooth cordgrass is almost absent within the study area. Plants averaging 1.5 meters high were found on the levee at Sisters Creek and Deep Creek. Most of the plants counted during this study were less then 60 cm high.

(3) Black needlerush occurred in large, pure stands in the high marshes of the central and southwestern part of the study area. The tallest stands occurred in the area from Pearson Island to west of Black Hammock Island.

(4) Salt meadow hay (Spartina patens) was most abundant in the marshes along the Nassau River and its tributaries.

(5) Big Cordgrass (Spartina cynosuroides) was abundant in only one area within the study. This was the Inconstation Creek location. Plants averaged 2.9 meters high.

(6) The phytoplankton collections contained large numbers of benthic diatoms. The richest areas in terms of benthic productivity within the marsh system appeared to be from U.S. Highway 17 to the Pumpkin Hill Creek area. The poorest in terms of population densities and species diversities was the area east of the intercoastal waterway.

Birds of the Nassau River-St. Johns River Marshes

The following is a list of birds commonly sighted or known to frequent the salt marsh during migration, in the winter or for feeding. A complete list of all birds that have been sighted in or use the marsh area anytime of the year, can be found in the appendix.

Red-winged Blackbird (Agelaius phoeniceus)
Rusty Blackbird (Euphagus Carolinus)
Boat-tailed Grackle (Quiscalus major)
Common Grackle (Quiscalus quiscula)
Orchard Oriole (Icterus spurius)
Northern Oriole (Icterus galbula)
American Goldfinch (Corduel)
Wood Stork (Mycteria americana)
Green-winged Teal (ana crecca)
Mallard Duck (Anas Platyrhnchos)
Northern Pintail (Anas discors)
Northern Shoveler (Anas clypeata)
Gadwall (Anas strepera)
Ring-necked Duck (Aytha collairis)
Lisser Scaup (Autha affinis)
Hooded Merganser (Lophodytes cucullatus)
Red-brested Merganser (Mergus serrator)
Turkey Vulture (Cathartes aura)
Osprey (Pandion halictus)
Norther Harrier (Circus cyaneus)
Red-Tailed Hawk (Buteo jamaicensis)
Pied-billed Grebe (Podil ymbus podiceps)
Horned Grebe (Podiceps auritus)
Brown Pellican (Pelecanus occidentalis)
Double-crested Cormorant (Phalacrocorax auritus)
Anhinga (Anhinga anhinga)
Great Blue Heron (Ardea herodias)
Great Agret (Casmerodius abus)
Snowy Egret (Egretta thula)
Little Blue Heron (Egretta caerulea)
Tri colored Heron (Egretta tricolor)
Cattle Egret (Bubulcus ikis)
Green-backed Heron (Butorides striatus)
Black-crowned Night Heron (Nycticorax nycticroax)
White Ibis (Eudocimus albus)
American Krestrel (Falco sparverius)
Peregrine Falcon (Falco peregrinus)
Northern Bobwhite (Colinus virgini anus)
Clapper Rail (rallus longirostris)
King Rail (Rallus elegans)
American Coot (Fulica americana)

Black-bellied Plover (Pluvialis squatarola)
Wilsons Plover (Charidrius Wilsonia)
Semipalmated Plover (Charidrius semipalmatus)
American Oystercatcher (Hallmtopus palliatus)
Willet (Catoptrophorus semipalmatus)
Spotted Sandpiper (Actitus macularia)
Ruddy Turnstone (Arenaria interpres)
Sanderling (Calidris alba)
Semipalmated Sanpiper (Calidris pusilla)
Western Sandpiper (Calidris Mauri)
Least Sandpiper (Calidris minutilla)
Dunlin (Calidris alpina)
Short-billed Dowitcher (Limnodromus griseus)
Common Snipe (Gallinago, gallinago)
American Woodcock (Scolopax minor)
Laughing Gull (Larus atricilla)
Ring-billed Gull (Larus delawarensis)
Herring Gull (Larus argentatus)
Great Black-backed Gull (Larus marinus)
Gull-billed Tern (Sterna nilotica)
Casouab Tern (Sterna Caspia)
Royal Tern (Sterna Maxima)
Forester's Tern (Sterna forsteri)
Least Tern (Sterna antillarum)
Black Tern (Chidonas niger)
Black Skimmer (Rynehops Niger)
Mourning Dove (Zenaida macoura)
Yellow-billed Chuckoo
Common Barn Owl (Tyto alba)
Eastern Screech-Owl (Otus asio)
Barred Owl (Strix varia)
Common Nighthawk (Chordeiles minor)
Chuck-will's widow (Capimulgus vociferus)
Ruby-throated Hummingbird (Archilochus colubris)
Belted Kinfisher (Ceryle alcyon)
Redbellied Woodpecker (Melanerpes carolinus)
Yellow-bellied sapsucker (Sphyrapicus varius)
Downy Woodpecker (Picoides pubescens)
Downy Woodpecker (Picoides Pubescens)
Northern Flicker (Colaptes auratus)
Eastern Wood-Pewee (Contopus varens)
Eastern Phoebe (Sayornis phoebe)
Great Crested Flycatcher (Myiarchus crinitus)
Purple Martin (Progne subis)
Tree Swallow (Tachycineta bicolor)
Barn Swallow (Hirundo rustica)
Blue Jay (Cyanocitta cristata)
Fish Crow (Corvus ossifragus)
Tufted Titmouse (Parus bicolor)
Carolina Wren (Thryothorus vidovicianus)

House Wren (Troglodytes aedom)
Marsh Wren (Cistothorus platensis)
Ruby-crowned Kinglet (Regulus satrapa)
Blue-gray Gnatcatcher (Polioptila caerulea)
American Robin (Turdus migratorius)
Northern Mockingbird (Mimus polyglottos)
Brown Thrasher (Toxostoma rufum)
Cedar Waxwing (Bombycillia cedrorum)
European Starling
White-eyed Vireo (Vireo griseus)
Solitary Vireo (Vireo solitarius)
Yellow-throated Vireo (Vireo flavifrons)
Red-eyed Vireo (Vireo olivaceus)
Tennessee Warbler (Vermivora pereigrina)
Orange-crowned Warbler (Vermivora celata)
Northern Parula (Parula americana)
Black and White Warbler (Minotila voria)
American Redstart (Setophaga ruticilla)
Common Yellowthroat (Geothlypis trichas)
Summer Tanager (Piranga rubra)
Northern Cardinal (Cardinalis cardinalis)
Indigo Bunting (Passerina Cyanea)
Painted Bunting (Passeriva ciris)
Rufous-sided Towhec (Pipilo aestivalis)
Chipping Sparrow (Spizella pusilla)
Savanna Sparrow (Passerculus sandwichensis)
Sharp-tailed Sparrow (Ammodramus caudacutus)
Seaside Sparrow (Ammodramus martimus)
Song Sparrow (Melospiza georgiana)
White-throated Sparrow (Zonotrichia albicollis)
Bobolink (Dolichonyx oryzivorus)

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

The Fish of the Nassau River-St. Johns River Marshes Duval County, Florida

Estuarine communities are often characterized by hign productivity (Phytoplankton, emergent and submergent vegetation), low species richness and diversity and high dominance. It is this productivity, the ability to capture enough energy to produce a great volume of living tissue and to pass that energy along to organisms that man finds useful, that makes an estuary so economically valuable. The commercial and sport fisheries of the area are dependent to a large extent on the quality of the salt marsh.

The commercial and sport fish that either spawn or live in the marsh for a large part of their life cycles are: *Elops saurus* - Lady fish; *Megalops atlantica* - Tarpon; *Opisthonema oglinum* - Threadfin herring; *Brevoortia tyrannus* - Atlantic mehaden; *Alosa pseudoharengus* - Alewife; *Arius felis* - Sea catfish; *Bagre marinus* - Gafftop catfish; *Fundulus heterochtus* - Mummichog; *Menidia beryllina* - Silverside; *Mugil cephalus* - stiped mullet; *Mugil curema* - White mullet; *Chaetidipterus faber* - Spadefish; *Lagadon rhomboides* - Pinfish; *Cynoscion nebulosus* - Spotted sea trout; *Cynoscion regalis* - weakfish; *Sciaenops ocellatus* - Red drum; *Micropogon undulatus* - Croaker; *Leiostomus xanthurus* - Spot; *Menticirrhus saxatilis* - Northern kingfish; *Caranx hippos* - Jack crevalle; *Selene vomer* - Lookdown; *Trachinotus carolinus* - Florida pompano; *Orthopristis chrysopterus* - Pigfish grunt; *Paralichthys lethostigma* - Southern fluke; *Paralichtys dentlus* - Summer flounder; *Pomatomus saltatrix* - Bluefish; *Poronatus triacanthus* - Butterfish; *Scomberomorus cavalla* - King mackeral. Included in the Appendix is a list of the species composition of Fish Larvae identified from Sisters Creek during two years.

Several species found in the study area are SPECIES OF SPECIAL CONCERN (See Appendix). They are *Fundulus grandis* - Gulf killie; *Cyprinodon variegatus* - Sheephead minnow and *Fundulus similis* - Longnose killie.

This list is divided into two parts. Part (1) is a species list of fish collected by the Marine Biology Group of the University of North Florida. An annotated list of all the species likely to occur in the study area can be found in the appendix.

Part (1) - Species list of fish collected.

Alosa pseudoharengus - Alewife
Anchoa hepsitus - Striped anchovy
Anchoa mitchilli - Bay anchovy
Brevoortia tyrannus - Atlantic menhaden
Caranx hippos - Jack crevalle
Chaetodipterus fiber - Atlantic spadefish
Chilomycterus schoepfi - Striped burrfish
Cynoscion nebulosus - Spotted seatrout
Cynoscion regalis - Weakfish
Cyprinodon variegatus - Sheephead minnow
Dorosoma cepedianum - Gizzard shad
Elops saurus - Ladyfish
Eucinostomus argenteus - Spot
Fundulus cingulatus - Banded topminnow
Fundulus confluentus - Marsh killie
Fundulus heteroclitus - Mummichog
Fundulus majalis - Stiped killie
Fundulus similis - Longnose killie
Gobionellus spp - Goby
Gobiosoma spp - Goby
Haemulon parri - sailor's choice
Hypsoblemmius hentz - carolina blenny
Lagodon rhomboides - Pinfish
Leiostomus xanthurus - Spot
Megalops atlantica - Tarpon
Menidia beryllina - Silversides
Menticirrhus saxatillis - Northern kingfish
Micropogan undalatus - Atlantic croaker
Mugil cephalus - Striped mullet
Mugil curema - White mullet
Opisthopera oglinum - Threadfin herring
Opsanus tau - Toadfish
Orthopristis chrysoptera - Pigfish
Paralicthys dentalus - Summer Flounder
Pogonias cromis - Black drum
Pomatomus saltatrix - Bluefish
Prionotus tribulus - Bighead searobin
Pronatus triacanthus - Butterfish
Scianenops ocellata - Red drum
Scomberomorous cavalla - King mackeral
Selene vomer - Lookdown
Sphaeroides maculatus - Northern puffer
Strongylura marina - Atlantic needlefish
Symphurus plagiusa - Blackcheek tongue fish
Syngathus floridae - Florida pipefish
Synodus foetens - Inshore lizardfish
Trachinotus carolinus - Florida pompano
Trichuirus lepturus - Atlantic cutlassfish
Trinectes maculatus - Hogchoker

Source: The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area," by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April, 1984.

An Annotated Listing of Vertebrates of the Nassau River-St. Johns River Marshes of Duval County, Florida Excluding Birds and Fish

The following includes an annotated listing of Mammals and Reptiles which reside or may reside in the salt marshes and estuaries of northeast Florida in Duval County.

The salt marsh is characterized as an area of relatively flat land which is subject to tidal inundation of salt or brackish water. In northeast Florida the cordgrass Spartina alterniflora dominates the lower regularly flooded areas of hte salt marsh, and Juncus roemerianus dominates the higher and drier areas of the marsh flats. Because of the frequent and regular flooding of the marsh flat, few reptiles and mammals are permanent salt marsh residents. Many species use the salt marsh to forage for food during low tides, however.

No Amphibians and few reptiles are found in the salt marsh as regular residents. These animals are sensitive to the desiccating osmotic conditions of marine or brackish water environments, and do not survive well in waters or areas of high salinity. The few species of reptiles listed have special adaptive mechanisms which allow them to maintain the necessary osmotic balance within their body fluids.

The large majority of mammals observed in the marsh flats are actually residents of the large hammocks, islands, and areas surrounding the salt marsh. A few species are permanent residents of the flat itself, and during high tide flooding these animals take refuge in the emergent vegetation, on small hammocks, or on other patches of dry ground. Some species, like the Round-Tailed Muskrat, construct floating mats of vegetation to den in and to ride out the high tide flooding.

None of the salt marsh mammals are of major commerical importance. The American Alligator, Spotted Turtle, and the Diamondback Terrapin have all been of considerable commercial importance in the past, but are not so today because of scarcity or protection by law.

The uniqueness of the salt marsh habitat has selected for some unique mammal and reptile species. The steady disappearance of this habitat due to develpoment is threatening to eradicate many of the species which depend on the salt marsh for survival. Table 4 lists the species in the study area which are considered by the Florida Committee on Rare and Endangered Plants and Animals at risk. The manatee and alligator would probably be little affected if the salt marsh habitat was lost, but the other four species listed would suffer greatly as these are permanent salt marsh residents. Loss of the salt marsh habitat would also have a serious effect on populations of Diamondback Terrapins, as well as affecting the River Otter. The status of the River Otter is under review by the U. S. Fish and Wildlife Service.

The annotated lsiting of species in this report was compiled through actual field observations of individuals or evidence of their presence such as footprints or droppings. Other species were included based upon a literature review. Species listed but not actually sighted were included as indicated by their know habitat preferences and feeding habitats. Table 5 has a listing of species actually observed in the salt marshes of the study area.

A list of species known to inhabit the marsh, but not sighted, are incuded in the Appendix.

Table 4. Salt Marsh Mammal and Reptile Species included in the Florida List of Rare and Endangered Species (Prichard et.al. 1978)

Status Category*	Species Included
Endangered	*Nerodia fasciata taeniata* (Atlantic Salt Marsh Snake)
Threatened	*Trichechus manatus latirostris*
Rare	*Clemmys guttata* (Spotted Turtle)
	Mustela vison lutensis (Florida or Salt Marsh Mink)
Special Concern	*Alligator mississipiensis* (American Alligator)
	Neofiber alleni (Round-Tailed Muskrat)

*As used in the Florida List of Rare and Endangered Species, 1978.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

Table 5: Salt Marsh and Estuary Mammals Observed in the Field

Common Name	Scientific Name	Observations
Nine-Banded Armadillo	*Dasypus novenmcinctus*	1, 2
Virginia Opossum	*Didelphis virginiana*	1, 2
River Otter	*Lutra canadensis*	2
Bobcat	*Lynx rufus*	2
Round-Tailed Muskrat	*Neofiber alleni*	2
White-Tailed Deer	*Odocioleus virginianus*	1
Rice Rat	*Oryzomys palustris*	2
Raccoon	*Procyon lotor*	1, 2
Eastern Grey Squirrel	*Sciurus carolinensis*	2
Eastern Cottontail	*Sylvilagus floridanus*	2
Marsh Rabbit	*Sylvilagus palustris*	1, 2
Atlantic Bottle-nosed Dolphin	*Tursiops truncatus*	1

1 = Observed by members of U.N.F. marsh study team, 1984.
2 = Observed as reported by Fairfield Communities/Ft. George Environmental Impact Survey, 1982.

Source: "The Ecological Survey of the Tidal Marshes of the North St. Johns-South Nassau River Study Area", by Dr. Carol DeMort, University of North Florida, Department of Natural Sciences, April 1984.

IDENTIFICATION OF NEEDS

V. IDENTIFICATION OF NEEDS

This section of the management plan will address the various internal program needs that are expected to be identified during management activities. Meeting these needs will correct or generally relieve some stress on the estuary or the personnel involved in the management of the estuarine marsh. These needs may, in some cases, require legislative or administrative rule changes or acquisition of critical areas by the state.

The need to identify problem areas and adjust the management plan in a manner that will positively address these problems and management needs is an essential element of any good management program. Both field personnel and administrative staff will continually monitor the management plan implementation process and specifically identify observed program needs and problems. The areas to be monitored include, but are not limited to:

Acquisition of Additional Property
Legislative Needs
Boundary Problems
Administrative Rule Changes
Data Needs
Resource Protection Capabilities and
Enforcement Capabilities
Funding, Staffing Needs and Potential
Sources of Funding

The administrative staff will annually develop an implementation status report that will contain a summary of identified management needs and suggested measures to be taken in meeting these needs.

Acquisition of Additional Property

There are areas within and upland of the estuarine marsh area that are in public ownership or under the jurisdiction of various local, state and federal agencies. Formal management agreements, memorandums of understanding, etc., will be needed to ensure the compatible management of these areas.

Other areas within or adjacent to the estuarine marsh that are in private ownership should be closely examined to determine the advisability of bringing them into public ownership. The acquisition of these lands might act as a buffer to critical resources, prevent development of sensitive areas, allow the restoration of areas adversely affected by previous development or allow removal of disrupting uses within the estuary. The field personnel, during normal management activities, should be aware of significant upland areas and areas within the estuarine marsh which if developed, would compromise the integrity of the estuary. The field personnel will keep a running record of these areas and will help prioritize these areas for possible public acquisition.

Several owners of private land located within the estuarine marsh have expressed their willingness to sell their holdings to the State of Florida. All efforts should be made in order to obtain funding for acquisition of these areas.

Boundary Problems

The Nassau River-St. Johns River marsh follows the general boundaries of the Nassau River-St. Johns River Aquatic Preserve. The boundaries of the Aquatic Preserve are often artificial delineations of natural systems. There are many areas in the Nassau River-St. Johns River Preserve that are unsurveyed. Exact boundaries are surveyed when a request for a permitted use comes into the central office and jurisdiction or ownership of the exact area needs to be established.

The boundaries of the aquatic preserve needs to be expanded to include the marsh area east of Clapboard Creek to the edge of the marsh at the boundaries of the new power park. This includes the Brown Creek and Pelotes Island areas. This would put all of the Nassau River-St. Johns River marsh under Aquatic Preserve jurisdiction and afford better protection to the area. Field personnel in their normal activities should be sensitive to the possible need for boundary modifications.

Legislative Needs

Management needs could conceivably involve changes in the legislation pertaining to estuarine aquatic preserves or other statutes upon which estuarine management is based. These changes may include boundary realignments or the strenthening of certain management authorities.

Administrative Rule Changes

Administrative rules are statements addressing the organization, procedures and practices used in the implementation of estuarine management plans and policies. This process includes identifying problems within the federal, state and local agencies that affect the management of estuaries.

Data/Information Needs

The field personnel and administrative staff will note data needs and promote research or other means to fulfill them. Data needs in the near future could possibly be supplied by such ongoing projects as the monitoring laboratory that is to be established by agreement between personnel from the University of North Florida, University of Florida, city agencies and possibly DER.

There is very little base data that has been gathered on the Nassau River-St. Johns River estuarine marsh area. There is a need for continual monitoring in order to properly assess the present and future state of the marsh. Past data on water quality, plant and animal communities, etc., is needed for comparison. Any other agencies or organizations that undertake research in the marsh should interface with field personnel and administrative staff in regular exchanges of information.

Resource Protection and Enforcement Capabilities

At present, there is a very low level of protection enforcement in the marsh. This stems partially from the lack of authority, as well as l--k of manpower. These needs might require additional enforcement support from local government or other state agencies including tactical and logistical support. These needs may, also, involve additional equipment or vehicles.

The management staff will become familiar with the capabilities of both Department of Natural Resource's staff and the other agencies with enforcement responsibilities in the estuary. Annually, staff should fully assess the effectiveness of the protective and enforcement capabilities of these combined agencies.

Funding and Staff Needs

The funding for a management plan for the estuarine marsh will very likely have to come from several sources. The legislation creating the Nassau River-St. Johns River Aquatic Preserve made no designation for funding. Therefore, there are no personnel from state agencies presently assigned to the preserve that could be incorporated into the local management plan.

There are presently personnel assigned to Little Talbot Island State Park and Fort Clinch State Park that may possibly be utilized as field personnel in the beginning stages of plan implementation.

The Bureau of Environmental Lands Management is not only the agent for the Board of Trustees of the Internal Trust Fund, but they are, also, responsible for management of the state reserve system. In the Charlotte Harbor Aquatic Preserve Plan, personnel from the adjoining state reserves have been utilized as staff/field personnel within the preserve. The same technique could be used in the estuarine marsh area by utilizing personnel from the Nassau Reserve. The major problem being that there is presently no funding for personnel for the reserve. A major lobbying effort should be made at the state level for funding for staff in the Nassau Reserve. These personnel could then be utilized as field personnel in the estuary.

However, in order for the management program proposed in this plan to function and succeed, the program may have to have its own funding and staffing. The workload required by this program is too much for an existing staff to handle in addition to their obligations to the state reserves. Funding and staffing needs are critically important to the success of the program.

Personnel from existing city agencies might possibly be utilized as management and administrative staff. Because of the already existing workload, it is possible that some staff positions may need to be added. Laboratory facilities at existing city agencies may be utilized where needed. It is, also, feasible that facilities at the proposed monitoring laboratory shared by the University of North Florida, Jacksonville University and other city agencies could be utilized.

ESTUARINE RESOURCE MANAGEMENT PLAN

VI. ESTUARINE RESOURCE MANAGEMENT PLAN

Introduction

The main objective of this management plan is to maintain the functional and environmental integrity of the estuarine marsh system so it may benefit and be enjoyed by generations to come. This part of the Management Plan addresses policies and procedures both on-site and administratively.

A desirable approach to on-site management would involve DNR personnel in conjunction with city staff. Agreement with DNR on the use of personnel from Little Talbot and Fort Clinch will have to be arranged. The Charotte Harbor preserve uses personnel from adjacent reserves. This may also be a possibility in the Nassau River-St. Johns River Marsh/Estuarine Management Plan. Personnel from the Nassau River-St. Johns River marsh reserve could be utilized as field personnel. The immediate problem is arranging funding for personnel in the reserve, and then utilizing them part-time as field representatives within the marsh.

The administrative role in the estuarine marsh will be a cooperative effort between the Department of Natural Resources, including the Division of Parks and Recreation and the Environmental Lands Management Division, Division of State Lands personnel at the state level and existing city agencies at the local level.

On Site Management Proposals

Field Personnel

Field personnel will deal mainly with monitoring activities within the estuarine marsh. They will be aware of plant and animal communities and the changes that occur within these communities, any need for mitigation and restoration or additional protection of these resources. They will also be aware of changes in geological features, archaeological and historical sites, and water resources. Field personnel will need to be aware of changes in geological features that could denote problems within the estuary. They should also monitor any disturbance to, or discovery of any archaeological or historical sites.

Plant Communities

Plant communities within the estuarine habitat perform vital functions necessary to the health and productivity of the estuarine system. They stabilize physical features in the face of currents, tides, winds, and waves. They produce much of the decayed matter that forms the basis for major chains that include the estuarine fish, bird and other animal populations. They provide protective habitats for spawning and developing marine species, and roosting and nesting habitat for water birds. They filter nutrients and pollutants from upland runoff and in many cases buffer upland areas from storm waves and winds.

The main objective of field personnel in regard to the plant communities is to identify areas of damage and (primarily due to human activity) to devise plans for mitigation and where needed restoration.

Field personnel will, in coordination with DER, COE and other agencies, help monitor any restoration or mitigation requirements imposed on projects and activities.

Field personnel need to be familiar with the plant species within the estuary and be aware of rare and endangered species as well as where they are located.

Protection of Plant Communities

Field personnel will comment and make recommendations on all design plans for uses in and adjacent to the estuarine marsh. They will also comment on applications for use of state sovereign lands per agreement with state officials.

Field personnel will not recommend for approval any proposal that: advocates the unnecessary clearing of native vegetation or the shading of native vegetation to the extent as to cause death of a significant part of the vegetative community.

By agreement with the Bureau of Environmental Land Management, field personnel will be notified of applications for uses of submerged state lands within the aquatic preserve. Field personnel will inspect the site and assess potential impacts on the estuary and make recommendations to Bureau of Environmental Lands Management.

Identification of Research Needs and Coordination with Other Researchers

Field personnel will identify research needs as they relate to the plant communities within the estuarine marsh. Special consideration will be given to development of a data base on plant communities and ways to manage vegetative communities that are under stress because of degraded environmental conditions.

Field personnel will be aware of other research projects in the estuary and offer assistance whenever possible.

Animals

The estuarine system is rich in marine species as well as birds and mammals.

The estuarine marshes are invaluable for their function as nursery and breeding areas for large numbers of valuable commercial and game fish. The estuary is utilized by an extensive list of birds that nest, feed or use the area as a resting place during migration. Large numbers of mammals feed within the marsh with small numbers actually living there. The marsh is also home to hundreds of marine and estuarine vertebrates and invertebrates.

The main objective of field personnel in regard to animal life within the estuarine marsh will be the maintenance of habitat and life style in the most natural condition possible.

Field personnel will need to familiarize themselves with major, threatened and endangered species in the estuary. They should be familiar with the habitats of these animals and the current condition of these habitats. The familiarization process will include the location, number, season of siting, weather conditions and any other factors necessary to build a working knowledge of the animal species, and their interaction and occurrence in the estuarine area.

Endangered Species

Field personnel will need to become familiar with the guidelines of the Florida Game and Fresh Water Fish Commission, U. S. Fish and Wildlife Service, Department of Natural Resource's Division of Marine Resources, National Marine Fisheries and any other applicable agencies and non government organizations involved in the management of endangered species. The guidelines from these agencies will be used to help develope guidelines to deal with each endangered species and their critical habitats within the estuarine marsh.

Protection

Field personnel must be aware of changes in animal activities as well as numbers of animals within the estuarine system. This includes monitoring animal species for changes due to natural causes or encroachment of human uses in the estuary. Field personnel will comment on and make recommendations on all design plans in regard to their impact on animal life in and adjacent to the estuarine area.

By agreement with the Bureau of Environmental Lands Management field personnel will be notified of applications for uses of submerged land within the aquatic preserve area. Field personnel will inspect the site and assess potential impacts in regard to animal life and make recommendations to the Bureau.

Identify Research Needs and Coordination With Other Researchers

Field personnel will identify research needs as they relate to animal life. Special consideration will be given to development of a data base for animals unique to the estuary and endangered species. Special consideration should also be given to developing ways of managing animal species under stress because of environmental degradation.

Geologic Features

Field personnel will be aware of changes in natural geologic features, whether they are caused by humans or nature. They need to be aware of these changes and how they affect the geologic features in the estuarine marsh in order to better enable them to review applications for uses of state owned land as well as design plans for local uses. The main objective of the management of these natural features is to allow the naturally dynamic system to operate without man's influence or interference.

Field personnel should also be involved with review of project proposals under other agencies such as U.S. Army Corp of Engineers, DER, or the St. Johns River Water Management District (SJRWMD). Field personnel should review these projects in regard to their impact on the estuarine marsh.

Archaeological Sites and Historic Sites

The management policy followed is generally recommended by the Division of Archives, History and Records Management

(DAHRM) in the Florida Department of State.

Field personnel will be aware of and coordinate with other agencies as well as the DAHRM in order to prevent any unauthorized disturbance of archeological or historical sites.

Field personnel will notify DAHRM when activities or proposed activities have potential to impact on archaeological or historical sites. In the course of management activities or because of potential development, it is determined that valuable historic or archaeological sites will be damaged or destroyed DAHRM will be notified and may require salvage or measures to mitigate the impact of proposed activities on sites.

Field personnel will note suspected sites for future DAHRM information and pay particular attention to preventing on site disturbance by unauthorized "looters." Any discovery of unauthorized destruction of these of these sites will be reported to DAHRM, DNR and any other applicable agency.

Water Resources:

Without a doubt, the most critical aspect of estuarine management is responsible management of water resources for the protection of human health and recreation, as well as for the protection of the plant and animal communities. Changes in the hydrologic regime of the estuary have the potential to cause irreparable damage to the entire system.

The successful management of water resources within the estuarine area depends heavily on the Department of Environmental Regulation (DER) charged with protection of water quality and the St. Johns River Water Management District (SJRWMD) responsible for water quantity.

The main objective of field personnel within the estuary will be to see that the naturally high water quality is maintained and to ensure the natural seasonal fluctuations of fresh water into the estuary. Existing city agencies will have the ability to do water sampling and testing and should coordinate information with all other agencies.

Cooperation with Other Agencies

The field personnel should be aware of all other agencies and private organizations, as well as their jurisdiction and areas of analysis within the estuary. At present, very little water analysis is taking place in the estuarine. Agencies and organizations that may operate within the estuarine marsh are:

United States Geological Survey - USGS - Not active in estuary at present.

Department of Environmental Regulation - DER- Not active in estuary at present - have monitoring stations in the St. Johns River.

St. Johns River Water Management District - SJRWMD Not active in estuary at present.

Fairfield Properties - Must do year long water quality study as part of development order for Ft. George Project.

Department of Natural Resources - Active in State Parks (Talbot Island), etc.

Field personnel will not only be aware of other agencies doing studies in the estuarine marsh, they should also cooperate by lending assistance whenever possible. They should promote coordination among agencies involved in monitoring programs during the planning and monitoring stages of the program. Field personnel can monitor water quality in the estuary by reviewing data compiled by other agencies working in the area.

Review of Permits and Lease Applications

Field personnel will review sovereign land lease applications in the aquatic preserve as per agreement with DNR. They should also comment on and make recommendations on any design plans for activities in or adjacent to the estuarine marsh. By agreement with the Northeast Florida Regional Planning Council (NEFRPC) they should supply comments and recommendations for Developments of Regional Impact (DRI) that have the potential to impact on the estuarine marsh. By agreement with DER and COE, field personnel should review and comment on applications for activities within the estuary that must be processed through these agencies.

The basic objective is to have field personnel aware of proposed activities in the estuary and to have their observations and comments considered by other agencies that have jurisdiction over activities in the estuarine marsh.

Cumulative Impact Analysis

Cumulative impacts are the sum total of major and minor changes or effects upon a natural system. Taken singularly, these effects may not constitute a notable change in the condition of the natural system, but as these single changes or uses accumulate, there combined impact equals a substantive environmental disturbance or degradation of the natural system.

The review of proposed uses in the estuarine marsh by cumulative impact analysis requires a thorough knowledge of the natural system and the various interactions and dynamics within that system. This estuarine management program will initiate development of a cumulative impact analysis.

The availability of on-site staff who are familiar with the distinctive characteristics of this estuarine system, coupled with their ability to access Landsat imagery, SJRWMD land use mapping, and other data sources, are the key to development of a successful cumulative impact analysis program. As cumulative impacts are identified for specific areas and/or resources. They will become an integral part of the project analysis and decision making process.

Illegal Encroachments

Field personnel will be involved in the identification of, reporting of, and monitoring of remedial action of any illegal encroachments into the estuarine marsh and the aquatic preserve.

Encroachment applies to all unauthorized placement of structures or other illegal uses in the estuarine marsh and aquatic preserve. These encroachments may, also, include illegal extensions or uses in addition to approved uses, such as dock extensions, construction of boat houses, extending an approved channel.

After field identification of suspected encroachment, field personnel will notify the Bureau of Environmental Land Management if the activity is on stated owned land, verify the title of the land and research the possibility of the activity being approved by the state. If the encroachment is not under the jurisdiction of the aquatic preserve, the field personnel will check with administrative personnel and have them check with DER, COE, SJRWMD, and other city agencies to see if the activity has been authorized by these or other applicable agencies. Action for verified illegal encroachment will be developed by the agencies specifically involved. Field personnel will assist in this process, as necessary, with evaluations, recommendations or other needed support activities. Final action will be monitored by field personnel to the extent agreed upon by the agencies involved and decided on a case by case basis.

Administrative Proposals

The administrative role is generally interpreted within the context of coordinating activities with field personnel and other agencies with jurisdiction in the estuarine marsh. This coordination aspect is important to all aspects of the estuarine management program, including project review, evaluation and development, interagency contact initiation, administrative rule development, contractual services and conflict resolution, as well as arrangements for funding and routine support.

The administrative proposals are an essential part of the Estuarine Marsh Management Plan.

The first recommendation is to ensure a comprehensive, coordinated review and evaluation of proposed activities within the estuary that have the potential to impact on the environmental integrity and natural function of the estuarine marsh.

Second, the administrative personnel will coordinate the interagency arrangements and agreements necessary to be certain the field personnel and administrative staff review projects under jurisdiction of various agencies, if it appears these projects may impact on the estuarine marsh. The administrative staff can be the link between the field personnel and other state, local, regional and federal agencies.

In conducting environmental evaluations, administrative staff, in coordination with field personnel, will rely on current available data such as mapping, Landsat imagery, and other information from various agencies. If the proposed activity is generally of negligible environmental concern, then the project review will, in most instances, be conducted within the office, utilizing the available generalized environmental data. Field personnel will need to conduct more detailed and on site environmental assessments if preliminary project review determines there may be a significant impact on the environmental integrity and natural function of the estuarine marsh. Field personnel aided by administrative staff will establish communication links with various regulatory and management agencies in order to obtain advanced notice of projects that have the potential to impact on the estuary.

Identification of Activities

One of the major aspects of the review and evaluation programs of the estuarine management staff will be to identify proposed activities that are generally or specifically considered detrimental to the estuarine area and, therefore, should not be allowed. The following are considered detrimental to the environmental integrity and natural function of the estuarine marsh system. The majority of these activities are presently regulated to some extent by existing state and federal agencies and it is recommended that they not be approved by staff in regard to projects or activities within the estuarine marsh:

- Bulkheading is not recommended as an approved use within the estuarine marsh, since it destroys natural vegetation and habitat, alters circulation within the estuary and interferes with tidal flux and flushing.

  Bulkheading should only be approved when the proposed project is clearly within the public interest and no reasonable alternative is available. Public interest is defined as demonstrable environmental, social, and economic benefits that would accrue to the public at large as a result of a proposed action and which would clearly exceed all demonstrable environmental, social and economic cost.

- Destruction of natural vegetation should be discouraged. Natural vegetation supplies habitat, a source of food, protection against erosion, storm and wave action buffers and other invaluable functions. A buffer of natural vegetation between the marsh and upland areas should be maintained.

- Dredging and filling is not recommended for approval within the estuarine marsh system. Removal of marsh by either dredging or filling is the primary way in which the natural function of the area is destroyed. Proposed activities within the marsh must be designed where no dredge and fill activities are required.

The exceptions to this are:

- Minimal dredging required for public navigational channels, or

- Other such alterations of physical conditions as may, in the opinion of the management staff, be necessary to enhance the quality or utility of the estuary or the public health in general.

- Projects that are deemed to be of overriding public interest or benefit. (Example: Utility line crossings.)

- Piers and docks as allowed by traditional riparian rights should be designed so dredge or fill activity is unnecessary, natural vegetation is not removed, and shading of natural vegetation that will cause death and damage is kept to a minimum.

- Marinas are generally not considered a desirable use within the estuarine marsh system. Destruction of native vegetation and habitat, dredging and filling, turbidity, increased traffic, disturbance to wildlife are general by-products of marinas and are not in keeping with the preservation of the environmental integrity and natural function of this area. Because of the delicate nature of this area, certain criteria should be met when considering the siting of a marina within this system. Marinas should not be sited in tidal creeks with low natural flushing rates. This type of siting can result in the build-up of heavy metals and hydrocarbons from marina-related boat activities within the tidal creek system. If a marina is to be located within the estuarine area, it should not be sited in an area that will require the excavation of man-made canals or dredging and filling of tidal wetlands. Marinas should not be sited in areas where wildlife would be unduly disturbed. Proper siting, design and mitigation measures should be used in planning marinas.

- Solid fill roads are not compatible with best management practices within the estuarine marsh. When allowed, roads and bridges should be designed so they do not alter the natural water flow or interfere more than minimally with the natural hydrologic regime of the area. The road or bridge must also be clearly in the public interest and have no other reasonable alternative available.

- Drilling for gas, oil and excavation of minerals are considered incompatible uses within the estuary. They are contrary to the maintenance of the environmental integrity and natural function of the estuarine system and should not be an approved use in this area.

- The practice of discharging waste, effluents and non-permitted effluents into the estuarine marsh system is considered contrary to maintaining the environmental integrity and natural function of the system and should not be considered an approved use in this area.

Appeals

Applicants who desire to appeal the recommendations of the management staff will do so before the appropriate city agency at a time and place designated by them.

Coordination with Interest Groups

One of the most important jobs of the management staff is to establish a mutually beneficial communications linkage with other interest groups concerned with the estuarine area. The administrative staff will assist on site personnel with establishing a working relationship not only with other governmental agencies active in the estuary, but other special interest groups and concerned individuals that are interested in an exchange of knowledge.

MANAGEMENT IMPLEMENTATION

VII. MANAGEMENT IMPLEMENTATION

Implementation Network

There are various different government agencies and programs, non-governmental entities, interest groups and individuals that the management staff must be aware of and maintain a working relationship with in order to do the best job possible in regard to the estuarine area.

Federal Agencies

There are federal government agencies that have property interest, potential wildlife management programs, barrier island protection policies, potential research, construction and regulation programs within the estuary. The object of the local management staff will be to complement and assist in these various activities whenever possible. The local management staff will also review federal activities in regard to their potential impact on the estuarine marsh.

The various agencies that local management staff may eventually deal with on the federal level are:

United States Fish and Wildlife Service - USFWS

This agency is part of the U. S. Department of Interior. This federal agency reviews dredge and fill requests and other federal level permitting in regard to wildlife and are concerned with endangered species and bird rookeries.

Bureau of Land Management

The management staff will be familiar with this federal agency because of land holdings the federal government has within the estuarine marsh.

U. S. Corp of Engineers - COE

The U. S. Corp of Engineers is charged with providing technical guidance and planning assistance for the nation's waterways. The COE is involved with DER in the dredge and fill permitting process, technical oversight of channel and pass maintenance, evaluating requests for new channels, passes and public works projects. The local management staff will review proposed activities by the COE for conformance with the goals and objectives of the estuarine management plan.

U. S. Geological Survey - USGS

The USGS is under the Department of Interior and is responsible for performing surveys, investigations and research activities pertaining to topography, geology, mineral and water resources. USGS publishes and distributes data relative to these activities. This information may be very useful in management of the estuary.

Environmental Protection Agency - EPA

The EPA, in cooperation with state and local governments is the federal agency responsible for control and abatement of environmental pollution. DER is the agency responsible for handling these programs at the state level, especially when there is no functional federal program operating. Management staff will assist EPA whenever possible in planning field activities, especially where both agencies have common goals and interest.

U. S. Coast Guard

The U. S. Coast Guard is the federal agency involved in boating safety, search and rescue when necessary and review of permits for structures that might conflict with navigational uses. Through agreements on exchange of information, the management staff will also review permits the Coast Guard may be evaluating for potential impacts on the estuarine system.

State Agencies

There are many state agencies that have programs which affect or have the potential to affect the resources or regulate activities within the estuarine marsh.

Department of Natural Resources - DNR

The Nassau River-St. Johns River Aquatic Preserve, of which the estuarine area is a part, is associated with several land management programs within the Department of Natural Resources.

The Department of Environmental Land Management has the responsibility of overseeing and developing management plans for all the state aquatic preserves. The Division of State Lands reviews applications for use of state lands and related issues. The Division of Resource Management is responsible for various programs that might affect the estuarine. Among them is the marine mammals protection program. The Division of Marine Resources monitors conditions for shellfish harvesting, as well as permitting for the collection of certain marine species. The management staff will become familiar with these programs at the state level and assist these agencies, as well as incorporate their knowledge into management of the estuarine marsh.

The Florida Game and Fresh Water Fish Commission (GFWFC) reviews projects which may have potential impacts on local fish and wildlife habitat as necessary.The field personnel will use the GFWFC's assistance in their review process, when possible, and in developing fish and wildlife management for the estuarine marsh. The GFWFC has enforcement officers and the field personnel will interact with these officers where there are common goals. The GFWFC is, also, the state coordinator of the Endangered Species in Florida. The field personnel and administrative staff will work with GFWFC personnel in developing program needs in this area. At present, the GFWFC are not conducting more than routine monitoring within the estuarine areas.

Department of Environmental Regulation - DER

The Department of Environmental Regulation is responsible for regulating air and water quality. The DER is, also, the local contact for the initiation of dredge and fill applications in conjunction with the COE and DNR. With respect to water quality and dredge and fill regulation the DER is possibly one of the most important agencies to the management of the estuary. The water quality is the most important factor to the health of the estuarine complex and dredge and fill activities are one of the most potentially destructive activities within the marsh. With the new wetland legislation enacted in 1984, DER jurisdiction is enhanced by the expansion of the vegetative index and the ability to consider wildlife habitat in decisions, and to some extent by the new state policies on barrier island protection. The DER also regulates other forms of pollution such as air, noise and hazardous waste, which may be important in the future to the estuarine area.

The management staff will become familiar with the water quality, dredge and fill and other regulatory programs that are important to the estuarine area. The field personnel should develop a close working relationship with DER staff and become familiar with DER field activities and programs that are in common with objectives of the estuarine marsh management program. The management staff should open the most efficient line of communication with the local offices to receive the permit applications from DER as soon as possible to improve the response time within the review process.

The DER, Office of Coastal Management, is charged with coordinating activities related to Coastal Management in the state and reviewing federal actions for consistency with the State Coastal Management Program, Section 380.20, F. S. The management staff will maintain a close relationship with the Office of Coastal Management for assistance in the review of federal actions, data and research needs, and other program support.

Department of Community Affairs - DCA

The Department of Community Affairs is responsible for reviewing Developments of Regional Impact (DRI) and for Areas of Critical State Concern (ACSC). DRI's are major developments that have impacts on a scale which is greater than a county level and requires a regional review from neighboring local governments and state agencies. Both the administrative staff and field personnel of the estuarine management program will be involved in reviewing DRI's. The field personnel should receive notice of a DRI through the state and local administrative staff and will proceed with the field review. The administrative staff will coordinate the field review findings and work with the other state agencies in Tallahassee in the review of the DRI.

The ACSC program is intended to protect the areas of the state where unsuitable land development would endanger resources of regional or state-wide significance. When an area is identified as a possible ACSC, a Resource Planning and Management Program (RPMP) is established. The RPMP evaluates the resources and the local government's land development practices. After this evaluation is complete, the RPMP committee makes recommendations to the local governments on how their land development practices could be improved to ensure an orderly and well-planned growth that would protect the critical resources.

If these modifications are not made to the RPMP Committee's approval, those areas of local government that are not in conformance could be designated an ACSC or the entire area may be designated an ACSC by the Legislature. Under an ACSC designation, the local governments are required to notify DCA of any application for a development permit. The entire land development process will require the state's oversight until that local government modifies its land development practices to conform to the ACSC requirements.

Department of Transportation - DOT

The DOT has a regional office in Lake City and the resident engineer, by agreement, will notify the field personnel of anticipated projects having possible impacts on the estuarine system and its major tributaries. The field personnel and administrative staff will review any major highway or bridge projects that may be proposed for the area.

Department of State

The Division of Archives, History and Records Management (DAHRM) in the Department of State will have a close working relationship with the field personnel and administrative staff in the protection of archaeological and historical sites. The field personnel will be directed by DAHRM in any activities or management policy needs for these sites.

Regional

Northeast Florida Regional Planning Council

The Northeast Florida Regional Planning Council (NEFRPC) serves seven counties, including Baker, Clay, Duval, Flagler, Nassau, Putnam and St. Johns.

Among its duties, the NEFRPC aids local governments with planning expertise; is the regional representative for the Development of Regional Impact (DRI) review process; serves as a regional clearing house for state and federal projects and programs; and, conveys information from the local governments to the state and federal levels. The management staff will become familiar with the various projects, programs and data sources that the NEFRPC has within its administration that may effect or prove useful to the management of the estuarine.

The DRI review of projects which affect the estuarine marsh will be handled by the administrative staff in coordination with the field personnel.

Water Management District

On a regional level, the estuarine management staff will be dealing with the St. Johns River Water Management District (SJRWMD). This district includes all or parts of 19 counties ranging from Nassau County to the north, Alachua and Marion Counties to the west and Indian River and Okeechobee Counties to the south. The eastern boundary is the Atlantic Ocean.

The water management district administers permitting programs for the local consumptive use of water, stormwater discharges and dredge and fill type activities. This includes the withdrawal and use of water from rivers, streams and wells.

The SJRWMD, under Rules Chapter 40-C4, Management and Storage of Surface Waters, addresses the destruction of certain hydrologically sensative areas (wetlands). The field personnel will become familiar with the review and permitting procedures as they might apply to the water supply of the Nassau River-St. Johns River estuarine complex. The water management districts are, also, involved in various studies on water supply and other related research that may be of use in the estuarine management program.

Local Government

This section will address the relationship of the estuarine management program to the various local government agencies, special districts and their programs. The local governments are the incorporated cities and counties that surround the estuary.

The majority of the Nassau River-St. Johns River estuary is within the consolidated Jacksonville-Duval County limits. This should simplify implementation of management plans, since staff does not have to deal with several government entities.

Nassau County to the north of Duval County contains the northern most reaches of the estuarine marsh. Nassau County, also, contains the northern section of the Nassau River-St. Johns River Aquatic Preserve. The management staff will be the local liaison for the estuarine marsh to these local government entities. The field personnel will be available to these local entities to assist them, if necessary, in modifying their policies and practices to conform to the objectives of the estuarine management plan.

Relationship to Local Management Plans

The local governments are required by the Local Government Comprehensive Planning Act of 1975 (LGCPA), (Section 163.3161. F. S.) to have a comprehensive management plan with elements relating to the different governmental functions (i.e. housing, physical facilities, conservation, land use and coastal zone protection). These plans, in effect, are long-range plans for the orderly and balanced development of the city or county. The comprehensive plans guide local zoning policies and practices toward a future as set out in the plan. No development was to be permitted that did not conform to the local government's comprehensive plan.

The aim of the management staff, with respect to these local government comprehensive plans, is to have their plans be consistent with the estuarine management plans. The management staff will become familiar with each of the above plans and how they support or are in conflict with the objectives of good estuarine management. The staff will assist local planning officials in having their plans meet these objectives.

This management plan was designed with the goals, objectives and policies of the 2005 Comprehensive Plan for Jacksonville/Duval County in mind.

One of the major goals of the 2005 Plan in regard to protecting environmentally sensitive areas is to enhance and conserve natural areas. One of the major objectives in fulfilling this goal is to protect the valuable function of wetlands and estuaries by maintaining the integrity of the vegetation and hydrologic regime of these areas. The Management Plan has incorporated this goal of protection.

Presently the 2005 Plan is undergoing the required update. Once incorporated in the local comprehensive plan, the management plan will be used as a guide in making decisions regarding policies and activities in the estuary.

Relation to Local Development Codes

The local zoning and development codes (e.g., building codes) provide the major local regulation as to what an owner can do on a particular parcel of property. The zoning prescribes the allowable uses and the intensity of those uses. These uses along the estuarine marsh can potentially have a profound effect on the estuary. The field personnel will become familiar with the local zoning and its potential effects on the nearby estuarine marsh. The management staff will assist local planning and zoning officials in identifying areas where changes in zoning would better conform to the objectives of estuarine management. The management staff might, also, offer to assist local planning and zoning officials in the review of proposed subdivisions upland of the estuarine marsh.

Local Policies and Practices

Management staff will help suggest policies and work with local governments so as to coordinate local government policies and the management of the estuarine area. Management staff will also identify any local government practice that has potential to endanger the overall integrity of the estuarine marsh. The management staff will work with the Public Works Department and the Planning Department in regard to overall plan/subdivision design in accordance with local regulations.

Other Agencies and Groups

The management staff will also deal with numerous entities and organizations of a non governmental nature that have an interest in the estuarine area.

This may include, but not be limited to, groups like the Sierra Club, Audubon Society, fishing and sports groups like the Organized Fisherman of Florida, Universities that use the area for educational purposes such as the University of North Florida or Jacksonville University and also organized property owners and development interest concerned with the area.

The relationship of these groups to estuarine management might include the coordination of activities such as scientific research, environmental education, management of rookeries or other natural area, or numerous other possible activities. A worthwhile estuarine management process will depend on the continued support and help of these interest groups. The management staff will be active in communicating the estuarine management process and activities to the various groups and consulting with them for assistance in their areas of expertise.

Scientific Researcn

The management staff should serve as the area coordinator of scientific research in the estuarine marsh. Scientific research and any other type of research or testing within the estuarine marsh, should require the clearance of both the field personnel and the administrative staff before these activities can proceed. Certain activities could be detrimental to the resources of the estuary and should be carefully reviewed before allowing them to occur. Factors including location, type and time of year, should be carefully reviewed for possible disturbance or affect of the research on the other resources of the marsh. The management staff will be aware of the possibility of working with other government agencies, colleges, universities, research foundations and government programs to fill the data needs of the estuarine system. The management staff will assist in the selection of possible test sites and other research needs within the estuarine marsh.

Permanent monitoring activities will be developed in order to collect data and observe the changes in the estuarine area. An agreement between city agencies, University of North Florida and Jacksonville University should be reached in regard to a permanent monitoring laboratory to be established and used to monitor water quality, tidal flow, plant and animal communities and gather other information necessary to properly maintain the natural functions of the estuarine system.

Environmental Education

The estuarine marsh should be used to enhance environmental educational programs at every opportunity. The goal of maintaining the estuarine marsh for the benefit of future generations can begin to be realized through the use of the marsh areas for environmental education. Knowledge of the resources in the estuary and its values are a major factor in the continued protection of the estuarine system in the future.

The field personnel will, through their normal activities in the marsh, select good examples of habitats and resources within these aquatic environments for use during educational group tours. This might possibly include the development of an environmental educational boat tour through the estuary. These activities should, also, include the eventual development of a brochure outlining the major points of management in the estuarine marsh. These brochures could then be circulated to the various user groups.

The field personnel should also prepare programs on the estuarine marsh for presentation to interested groups of all ages on the values of management activities. These types of presentations are, also, useful in explaining the management of the estuary to government units and private interest groups. The education of the public on estuarine management is the key to the success and future of the area.

The monitoring lab set up in conjunction with the University of North Florida, Jacksonville University and city agencies will double as an educational facility for both universities. Educational programs can be developed that can be presented to local schools, the public, business groups and other groups requesting more information on the estuarine marshes.

ACCEPTABLE USES IN ESTUARINE MARSH

VIII. ACCEPTABLE USES IN THE ESTUARINE MARSH

Public Uses

The estuarine area, although a relatively delicate ecosystem, can and should be available for certain public uses. Public uses refers to persons without riparian (ownership of upland areas) rights, basically the general public.

Active Uses

Active uses refers to such things as fishing, hunting, shellfishing, etc., that remove resources from the estuarine area. The management of these uses will include monitoring and general observation of the effects of the resource use of the estuary.

Field personnel will periodically assess the impacts of these uses on the estuarine area. Protection of the estuarine resources from unlawful or overuse, would be another aspect of estuarine management. The legality of the uses allowed in the estuarine marsh will have to be controlled by local and state laws and ordinances. Any uses allowed in the estuarine area will need to be monitored by field personnel for their impact on the estuarine resources (i.e., bird rookeries, oyster beds, archaeological sites, etc.)

Passive Uses

There are other uses within the estuarine marsh referred to as passive uses that do not remove any resources from the area. These uses might include, but are not limited to, such things as swimming, boating, bird watching, educational activities and the like. These uses are not generally controlled by law. The guiding principle in relation to these activities becoming a problem will be whether or not they cause disruption of estuarine resources, i.e., disturbing rookeries, destruction of oyster beds, excessive damage or removal of plants. In the event of severe disruption, management staff will have to become involved and make recommendations for mitigation.

Private Non-Commercial Uses

The next type of uses to be considered are private, non-commercial uses derived from riparian rights such as docks or piers. This right of ingress, egress, boating, swimming, fishing and other incidental uses that normally allows for the placement of certain structures such as docks within the estuarine area. This right, however, can only be exercised with proper planning and design and does not include approval of activities that destroy or damage areas of environmental significance.

As was stated earlier, under the section on administrative objectives, bulkheading is contrary to the main objective of the estuarine marsh management which is to maintain the integrity and natural function of the marsh. Leaving natural vegetation will accomplish the erosion control that concerns upland owners while maintaining valuable shoreline habitat. Bulkhead should only be approved in the estuary when it can be clearly shown to be in the overriding interest of the public at large.

Dredge and fill activities are also contrary to the stated objectives of the estuarine marsh. Exemptions are made for maintenance of existing navigation channels and what activity is required for new navigation channels. Again, overriding public interest where public benefit exceeds public loss, is a requirement. The activity should be water dependent. Mitigation and equal restoration of despoiled wetlands is required.

Docks and piers, when allowed, will be located and designed so they cause the least amount of destruction or displacement of resources within the estuary. Docks should be designed so they require no dredging or filling.

Commercial Uses

There are a variety of commercial uses that may possibly occur within the estuarine marsh, such as utility crossings, commercial fishing and types of fishing or boating for hire. These uses will be considered individually.

Future proposals for utility crossings should be designed so the estuary is crossed by the least destructive method at the least vulnerable point. Increased or additional use of existing crossings are preferred. Field personnel can assist in suggesting the best environmentally sound locations possible for this type of activity. Crossings should be limited to open water areas to minimize impacts on vegetation.

Management of commercial fishing activities is not really within the scope of responsibility of field personnel. Field personnel will monitor these activities and assess their affects on the estuary only in conjunction with the Division of Marine Resources and as part of a cooperative effort with that division. The field personnel will also notify the applicable authority in the event of illegal activities (Chapter 370 F. S. or by special act). The field personnel, along with other agencies' and divisions' programs and studies, will monitor fishing activities within the estuary with respect to the need to manage access of boats in certain areas, prevention of habitat destruction and other needs of the estuarine marsh as they are associated with commercial fishing activities.

Marinas are not considered a compatible commercial use within the estuarine marsh system. Destruction of native vegetation and habitat, dredging and filling, oil and gas discharge, increased traffic and turbidity, interruption to natural tidal flows and flushing, increased erosion (through increased wake), are generally by-products of marinas and are not in keeping with the overall objectives of estuarine management which are to maintain the environmental integrity and natural function of the area.

Port facility expansion into the estuarine marsh is not presently seen as a viable alternative for commercial port needs. The port facility study, known as the Jaxport Comprehensive Planning Element, done by Plantec Corporation for the City of Jacksonville, states: "in terms of land availability, a major conclusion of the Jaxport Master Plan is that needed port expansion to the year 2005 can be accommodated within existing or improved port owned properties." This study sees the environmentally sensitive areas near Blount Island as undevelopable. The study concludes that there are enought available sites for port development and expansion into the estuarine marsh area is not necessary.

Other commercial uses will require a review by all applicable local and state agencies to assess their impact on the estuarine marsh and to consider the best location for the activity compatible with existing resources within the estuary.