Coastal Zone
Information
Center

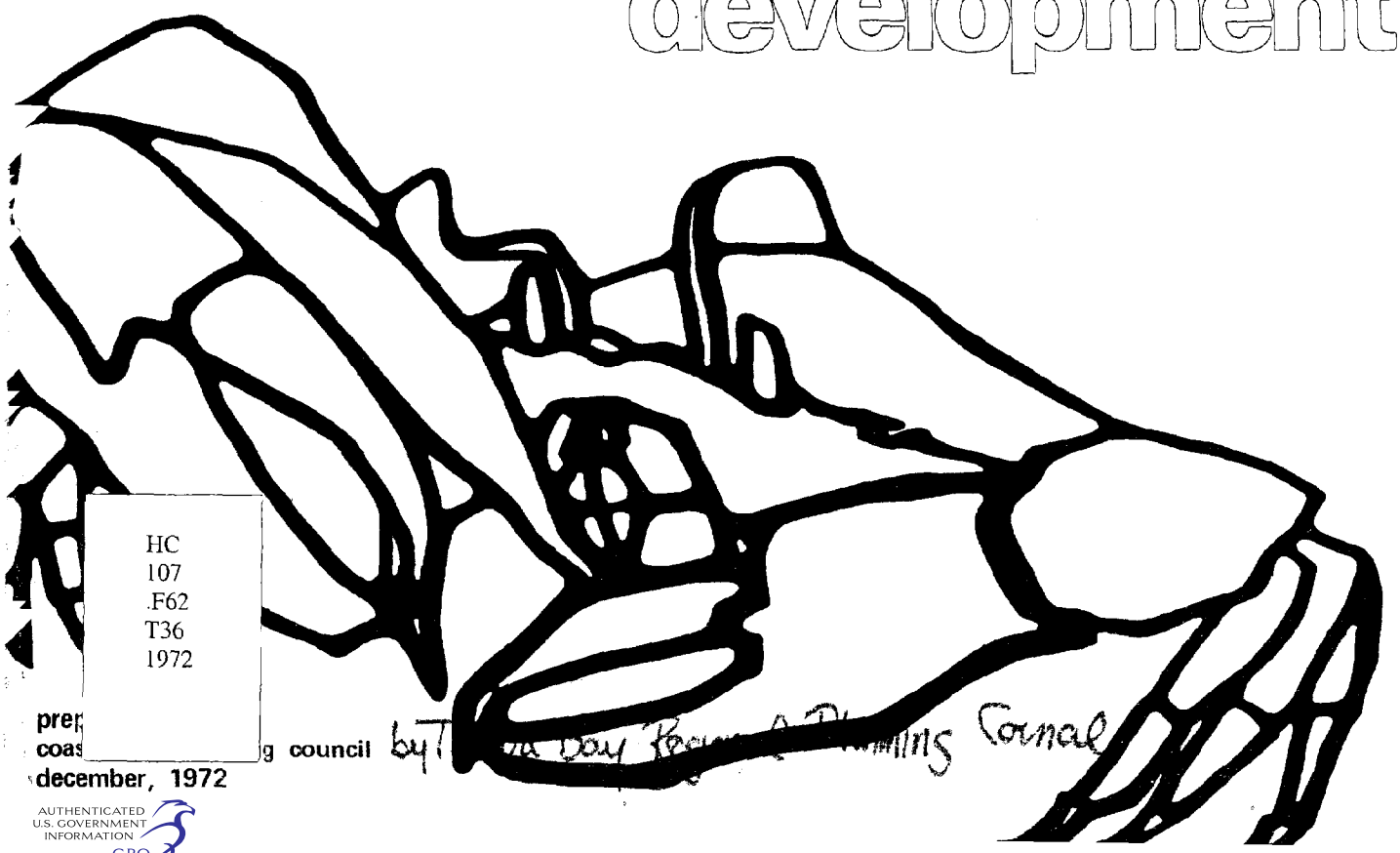
JUN 27 1973

COASTAL ZONE
INFORMATION CENTER

Florida. Coastal Coordinating Council.
HC107.F62T36 1972

tampa bay region preliminary

environmental assessment of development

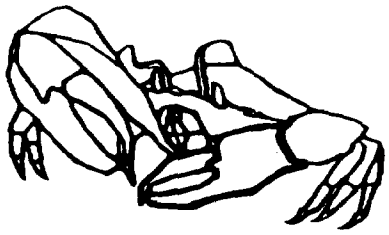


HC
107
.F62
T36
1972

prep
coas g council by T a Bay Region & Planning Council
december, 1972

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

00970



Tampa Bay Region Preliminary

ENVIRONMENTAL ASSESSMENT OF DEVELOPMENT:

A Preliminary Investigation of the Use of the Natural Resources in the Tampa Bay Region as a Basis for Future Development Policy

Prepared For

FLORIDA COASTAL COORDINATING COUNCIL
CONTRACT NO. CCC08–72

PREPARED BY

Tampa Bay Regional Planning Council Staff
Norman H. Thompson, Jr., Executive Director

S. Randall Lankford, Jr., Project Manager

December, 1972

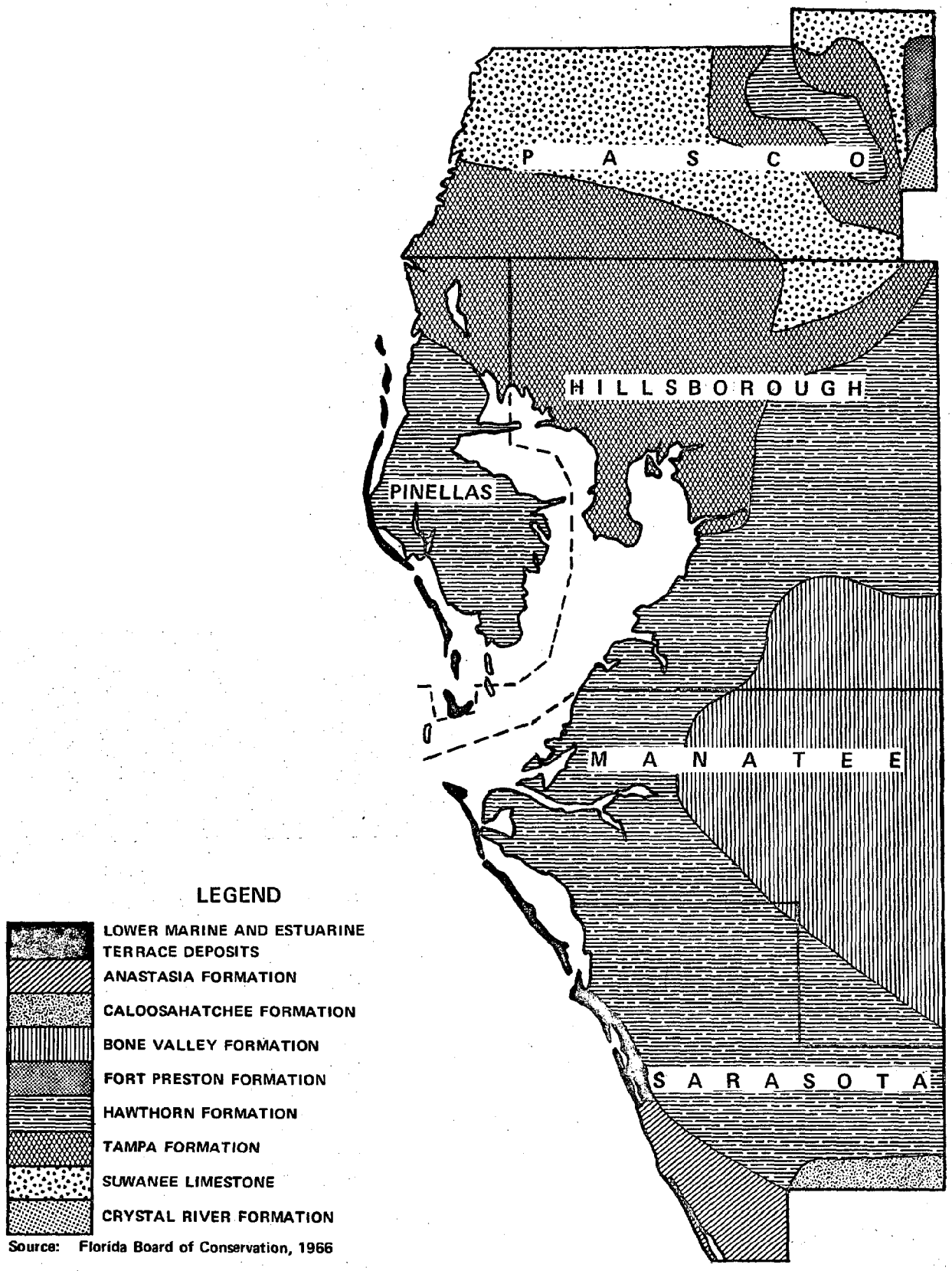
US Department of Commerce
NOAA Coastal Services Center Library
2234 South Hobson Avenue
Charleston, SC 29405-2413

ACKNOWLEDGMENT

This report is the result of the efforts of many men and women within the state and region, whose time and efforts have made it possible. Although the list of contributors is long, special appreciation is offered to Mr. Steven Peacock and Mr. Robert Dubois. Their efforts into areas, largely untapped in the region, in zoological and economic data assimilation support this report.

Many state and local agencies have provided invaluable assistance. Major among these is the Coastal Coordinating Council, without whose guidance and assistance or concern for the environment this research would not have started. This report is a staff effort contracted to the Regional Council staff for the purpose of validating the Coastal Coordinating Council concepts and techniques for regional planning application.

ERRATA SHEET



Source: Florida Board of Conservation, 1966

FIGURE 2.2: REGIONAL GEOLOGICAL FORMATIONS

ERRATA SHEET

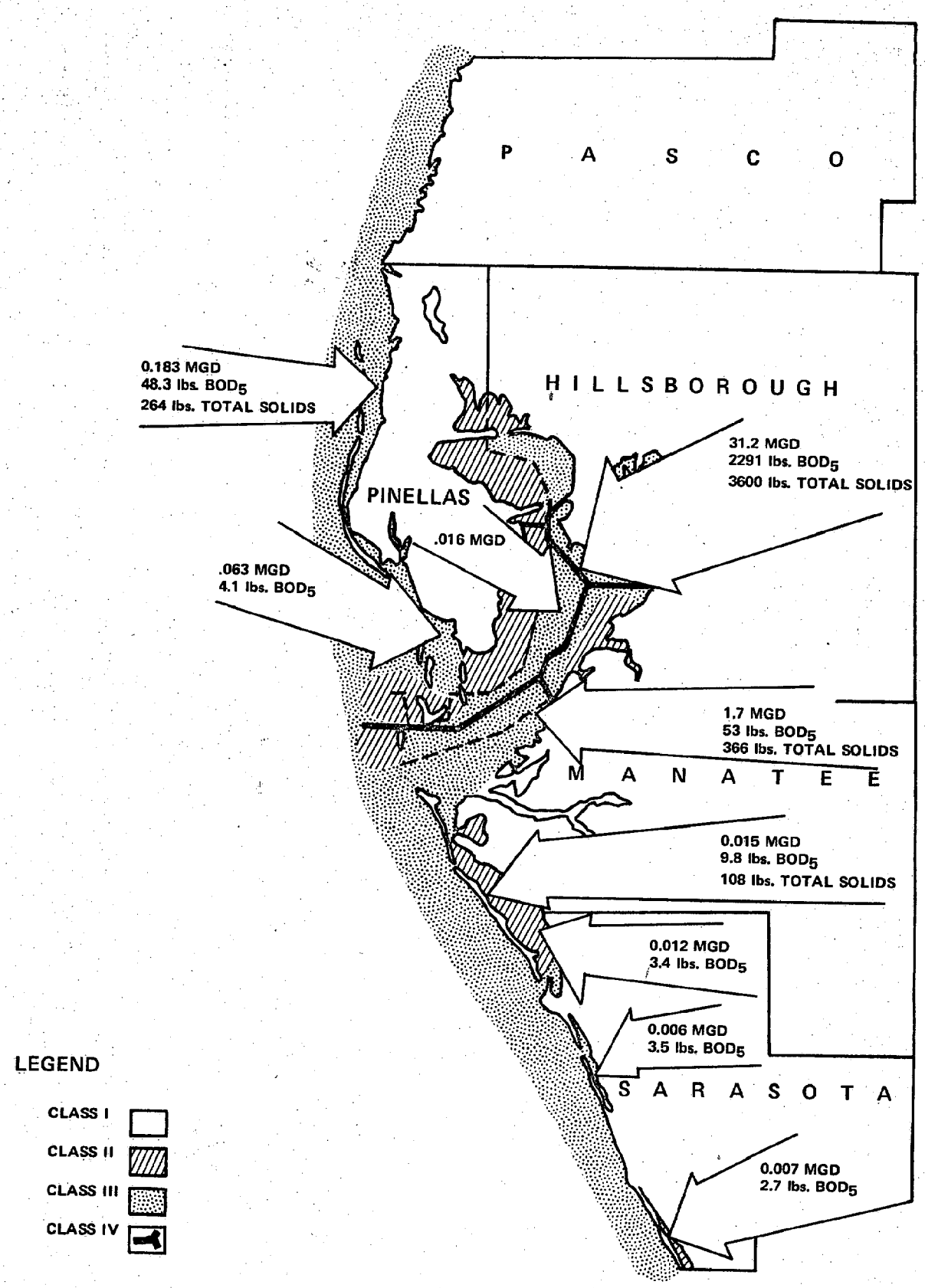


FIGURE 3.1: EFFLUENT WASTE INTO SURFACE WATERS

ABSTRACT

The purpose of this study was to determine if resource management concepts proposed by the Florida Coastal Coordinating Council could assess development suitability and impact for regional planning purposes. The presentation is directed toward assessing environmental degradation as an adjunct to land development in one of Florida's fastest growing areas. This degradation is presented as a conflict between the existing resource base and the climax use of the land area.

The process of analyzing the resource conflicts starts with a survey indicating the extent and status of valued resources in the region and the areas of present conflicts. Using techniques of market growth analysis, a projection of anticipated future resource conflicts is presented and the impact discussed on a county by county basis.

With these conflicts analyzed and potential problem areas identified, a set of land development guidelines was evolved to minimize the conflict impact. The guidelines address the areas of priority set up in the Coastal Coordinating Council concepts.

The overall review of salient resource features and a description of the integral processes of the region's environmental systems are presented on an item by item basis. The review includes the first region wide wildlife habitat mapping analysis published in the region.

Overlaying this description of natural systems, an overview of the various aspects of urban systems is presented. The overview includes reviews and projections of land development, population trends and economic conditions.

The methods and techniques presented in this study when refined will serve as planning and administrative tools that will help protect valued natural resources from degradation and also encourage sound economic growth.

TABLE OF CONTENTS

TITLE PAGE 1
ACKNOWLEDGMENT 2
ABSTRACT 3
TABLE OF CONTENTS 4
LIST OF TABLES, CHARTS AND MAPS 5
INTRODUCTION 7

CHAPTER I: Research Summary 8
Natural Resource Assessment 9
PRESERVATION AREAS 9
CONSERVATION AREAS 10
DEVELOPMENT CONFLICTS 10
Present Conflicts 11
Development Suitability Analysis 12
Economic Effect of Preserving the Land 12
RECOMMENDED GUIDELINES FOR CONFLICT MINIMIZATION 12
Statement of Priorities 13
Priority One 14
Priority Two 14
Priority Three 15
County Environmental Synopses 18
PASCO COUNTY 18
PINELLAS COUNTY 20
HILLSBOROUGH COUNTY 33
MANATEE COUNTY 36
SARASOTA COUNTY 42

CHAPTER II: Resource Inventory 50
CLIMATE 50
LAND AND WATER RESOURCES 50
PHYSIOGRAPHY 50
MINERALS 52
WILDLIFE 53
COMMERCIAL FOREST 54
RESOURCE ECONOMICS 55

CHAPTER III: Land Development Assessment 57
DEVELOPMENT REVIEW 57
POPULATION REVIEW 57
ECONOMIC REVIEW 57
DEVELOPMENT/RESOURCE PROBLEMS 58
Waste Discharge 58
Water Runoff 60
Dredging 60
Estuarine 60
Land Development 61
Salt Water Encroachment 62

APPENDICES
I WILDLIFE HABITAT DEFINITIONS 63
II COMMERCIAL FORESTRY DEFINITIONS 66
III ENVIRONMENTAL PLAN PROCEDURES 67
IV HISTORICAL AND ARCHEOLOGICAL SITES 70
V GLOSSARY 74

BIBLIOGRAPHIES
I ECONOMIC 78
II LAND PLANNING 78
III WASTE DISCHARGE 80

TABLES

1.1 Preservation Categories, Tampa Bay Region . . . 9
1.2 Conservation Categories, Tampa Bay Region . . . 10
1.3 Extent of Land Development, August, 1972 . . . 10
1.4 Extent of Projected Land Development, 1975 . . . 11
1.5 Land Development Projections to 1975 . . . 11
1.6 Preservation Conflicts . . . 11
1.7 Conservation Conflicts . . . 11
1.8 Aggregate Increases for Period 1972–1975 . . . 12
1.9 Projected Aggregate Development Increases, Tampa Bay Region, 1972–1975 . . . 12
1.10 Land Suitable for Development, Tampa Bay Region, 1972 . . . 12
1.11 Preservation Areas, Pasco County, 1972 . . . 19
1.12 Conservation Areas, Pasco County, 1972 . . . 19
1.13 Development Conflicts, Pasco County, 1972 . . . 19
1.14 Land Suitable for Development, Pasco County, 1972 . . . 19
1.15 Future Development Conflicts, 1972–1975 . . . 20
1.16 Future Development Conflicts by Zone, 1972–1975 . . . 20
1.17 Aggregate Development Increases, Pasco County, 1972–1975 . . . 20
1.18 Preservation Areas, Pinellas County . . . 25
1.19 Conservation Areas, Pinellas County, 1972 . . . 25
1.20 Development Conflicts, Pinellas County, 1972 . . . 25
1.21 Land Suitable for Development, Pinellas County, 1972 . . . 25
1.22 Future Development Conflict, Pinellas County, 1972–1975 . . . 29
1.23 Future Development Conflicts by Zone, 1972–1975 . . . 29
1.24 Aggregate Development Increases, Pinellas County, 1972–1975 . . . 29
1.25 Selected Pinellas County Wildlife Species Facing Habitat Modifications . . . 29
1.26 Preservation Areas, Hillsborough County, 1972 . . . 33
1.27 Conservation Areas, Hillsborough County, 1972 . . . 33
1.28 Development Conflicts, Hillsborough County, 1972 . . . 33
1.29 Land Suitable for Development, Hillsborough County, 1972 . . . 35
1.30 Future Development Conflicts, Hillsborough County, 1972–1975 . . . 35
1.31 Future Development Conflicts by Zone, Hillsborough County, 1972–1975 . . . 35
1.32 Aggregate Development Increases, Hillsborough County, 1972–1975 . . . 35
1.33 Selected Hillsborough County Wildlife Species Facing Habitat Modifications . . . 36
1.34 Preservation Areas, Manatee County, 1972 . . . 36
1.35 Conservation Areas, Manatee County, 1972 . . . 40
1.36 Development Conflicts, Manatee County, 1972 . . . 40
1.37 Land Suitable for Development, Manatee County, 1972 . . . 40
1.38 Future Development Conflicts, Manatee County, 1972–1975 . . . 40
1.39 Future Development Conflicts by Zone, Manatee County, 1972–1975 . . . 42
1.40 Aggregate Development Increases, Manatee County, 1972–1975 . . . 42
1.41 Selected Manatee County Wildlife Species Facing Habitat Modifications . . . 42
1.42 Preservation Areas, Sarasota County, 1972 . . . 44
1.43 Conservation Areas, Sarasota County, 1972 . . . 44
1.44 Development Conflicts, Sarasota County, 1972 . . . 44
1.45 Land Suitable for Development, Sarasota County, 1972 . . . 44
1.46 Future Development Conflicts, Sarasota County, 1972–1975 . . . 48
1.47 Future Development Conflicts by Area, Sarasota County, 1972–1975 . . . 48
1.48 Aggregate Development Conflicts, Sarasota County, 1972–1975 . . . 48

2.1 Geologic Formations of the Tampa Bay Region . . . 50
2.2 Selected Wildlife Habitats in the Tampa Bay Region . . . 53
2.3 Species of Concern and Their Status in the Tampa Bay Region . . . 54
2.4 Area of Commercial Forest Land, by Forest-type Group and County, 1970 . . . 54
2.5 Net Annual Growth of Sawtimber and Growing Stock on Commercial Forest Land, by Species Group and County, 1969 and Annual Removals of Sawtimber and Growing Stock on Commercial Forest Land, by Species Group and County, 1969 . . . 56

TABLES (continued)

2.6 Treatment Needs of Commercial Forestland, Per Cent of County Totals 56
2.7 Treatment Needs of Forestland Grazed, Per Cent of Total 56

3.1 Population History by County, 1960–1972 58
3.2 Comparison of Total Industrial Effluent Flows with Municipal System Effluent Flows in the Tampa Bay Region (Million Gallons Per Day) 59
3.3 Per Cent of Total Waste Flow Discharged into the Tampa Bay Region by Industries 59
3.4 Comparison of Total Industrial and Municipal System BOD_5 Effluent in the Tampa Bay Region 60
3.5 Per Cent of Total Pounds of BOD_5 Discharged into the Tampa Bay Region by Industries 60
4.1 Land Use, 1972, in Acres Per Capita or Acres Per Employee 68
4.2 Land Use Projections by Population and Economic Activity by Acreage, 1975 69

FIGURES

1.1 Preservation Zoning, Pasco County, 1972 21
1.2 Conservation Zoning, Pasco County, 1972 22
1.3 Composite Development, Pasco County, 1972 23
1.4 Wildlife Habitat, Pasco County, 1972 24
1.5 Preservation Zoning, Pinellas County, 1972 26
1.6 Conservation Zoning, Pinellas County, 1972 27
1.7 Composite Development, Pinellas County, 1972 28
1.8 Wildlife Habitat, Pinellas County, 1972 30
1.9 Preservation Zoning, Hillsborough County, 1972 31
1.10 Conservation Zoning, Hillsborough County, 1972 32
1.11 Composite Development, Hillsborough County, 1972 34
1.12 Wildlife Habitat, Hillsborough County, 1972 37
1.13 Preservation Zoning, Manatee County, 1972 38
1.14 Conservation Zoning, Manatee County, 1972 39
1.15 Composite Development, Manatee County, 1972 41
1.16 Wildlife Habitat, Manatee County, 1972 43
1.17 Preservation Zoning, Sarasota County, 1972 45
1.18 Conservation Zoning, Sarasota County, 1972 46
1.19 Composite Development, Sarasota County, 1972 47
1.20 Wildlife Habitat, Sarasota County, 1972 49

2.1 Regional Mineral Resources 51
2.2 Regional Geological Formations . . . . . errata sheet

3.1 Effluent Waste Into Surface Waters . . . . . errata sheet

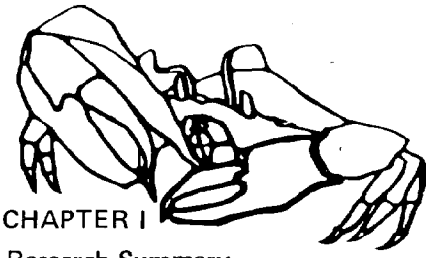
INTRODUCTION

In order to end the needless destruction of the natural resources in the Tampa Bay Region, new and vital methods for environmental assessment are required. This report is an attempt to demonstrate that such methods are available and need only be applied to start turning the tide on environmental degradation.

In 1970, a state law was passed to create the Florida Coastal Coordinating Council. This was a major step toward environmental management. This year, 1972, the Florida Legislature passed the *Land Conservation Act* and the Florida *Land and Water Management Act,* further steps toward protecting the quality of the environment. These recent acts call for sweeping action that must be supported by valid, practical methods for environmental assessment. Although much work remains in the development of a completely refined method, much of the groundwork is available.

The purpose of this report is to test and validate methods for regional natural resource management. Central to the evolution of the study are concepts and methods developed by the Florida Coastal Coordinating Council (CCC). This report tests these concepts and methods by applying them to the entire five county Tampa Bay Region, in addition to the region's Coastal Zone. Combined with these were growth and development market analysis methods. These marketing methods were employed to provide the contrasting picture of potential land development. The use of these two methodologies (the CCC's and the market analysis) supplies a valid and consistent basis for relating many environmentally significant questions. The following questions are addressed: **how can areas of natural resource importance be determined; what is their current status, and finally, what danger do these areas face?** In validating the methods, these three questions for the Tampa Bay Region are answered.

In answering the questions the report identifies potential large scale resource degradation problems and proposes guidelines for averting these problems. The approach is relatively new for it attempts to determine the type and degree of use that the various areas of the region can withstand without degradation of its basic resources. It is particularly important that county and municipal governments recognize this as a basis from which to develop their own performance standards for local development.



CHAPTER I

Research Summary

"One boat on a wild stream creates an idyllic sense of discovering the unspoiled, raising the question of how can numbers of people enjoy this without destroying attractive qualities?" This question, posed by the Florida Conservation Foundation, unfortunately has no answer at present. More frustrating is the fact that present planning methods will never yield an answer! Degradation of the resource base and planning for environmental quality are in general topics that planners have traditionally avoided. One of the major problems facing the Tampa Bay Region concerns future degradation of the resource base and although economic growth is cited as the main culprit in environmental degradation, in reality, it is the lack of planning and the **inadequate recognition of environmental values** that have given rise to the degraded condition.

New and realistic policies are desperately needed which seek a proper balance between continued growth and maintaining a quality environment. To derive these policies sound methods of assessment are required or governments shall proceed from microcrisis to microcrisis until a major system collapse occurs. Some researchers suggest that a collapse is the only process that will expand awareness enough to implement corrective measures, but no responsible urban management should allow this to happen.

Methods are available today that could avert resource use conflicts, but they are for the most part, ignored. This investigation has proved the methods tested are valid, significant steps toward averting environmental degradation and should not be ignored. Other methods, such as economic analysis, are also ignored. Thoroughly detailed economic investigations are directed at optimum uses of resources and should not be confused with the inadequate, but standard, economic analyses common to planning today.

The graphic nature of this report and the underlying concepts that form the presentation offers a simple, clear, concise picture of environmental problems in the region. This research, when viewed as a starting point or baseline validated the following:

- **The research methods can define environmentally "safe" development limits for a range of development alternatives. The conversion of these baseline findings into easily reviewed performance standards for development is the next, and probably simplest, step for the proper local managers. These measures, when related to municipal capital planning of support services, can define optimum limits for growth and development.**
- **These methods can chart the course and location of environmental degradation once the baseline is determined. Based on the environmental indicators or categories, gross changes in the environment are identifible. With continued refinement of the method, sophisticated environmental management is possible.**
- **The indicators or categories chosen define a priority system for resource values that is comprehensive enough to form a point of reference for local environmental goals from community to community; the preservation category is the highest value, the conservation category is the next highest value and suitable development areas are the lowest priority.**

The use of the environmental method in the region identified the following significant points as a basis for developing an environmental management program in the region.

1. **Almost 170,000 acres of preservation land areas are left in the region and much of this area is currently in peril.**
2. **Over 709,000 acres of conservation land areas exist in the region and vast stretches of this land face development pressures today.**
3. **Over 108,000 acres of land resources currently are developed in a manner which results in resource conflicts.**
4. **The anticipated growth of the region will convert from 16,000 to 22,000 acres each year into urban use. Although almost 1,200,000 acres of land are vacant that are suitable for development without special restriction, the development conflicts will continue to increase at a rate of 12.1 per cent per annum, or about six acres out of every ten that are developed will generate resource conflicts.**

Pinellas County, as the smallest county in the region, has the greatest share of conflict areas - approximately half of the region's cumulative total of development conflicts. Projections of the county's growth indicate that Pinellas will maintain this share without a strong effort to protect its resources. Hillsborough, the largest and most industrial county in the region claims about one-fourth of the cumulative total. Sarasota and Manatee counties almost evenly split 20 per cent leaving Pasco County with five per cent of the total.

Analysis of the projected conflicts indicates that both Pasco and Hillsborough will decrease their proportion of the conflict areas by 1975. This reduction is a natural process, however, because the more accessible land for development is in less environmentally sensitive areas. Manatee and Sarasota counties show a rapidly increasing potential for resource conflicts that will require stringent development management to prevent environmental problems.

The major increase in conflicts from development occurs in the preservation areas in every county. Only by preparing and implementing guidelines for development, as suggested in this report, can the impact of such development be reduced. The second and third order effects from this development can be even more costly to local governments and to the environment than is now anticipated. A direction for environmental management is found in the general development impact discussion for each county. These points are discussed only to reinforce the management mechanisms now existing in each county.

5. **Based on the priority statement and on the analysis of resource conflicts, a set of preliminary environmental development guidelines was generated. Although it was not the intent of this research to develop performance standards, the guidelines lend themselves to this application readily and some suggestions for standards are contained in the guidelines.**

Environmentally significant resources were inventoried and the consequences of man-made problems were surveyed. In every case, inadequate attention to environmental values lies at the crux of the problems. This is perhaps disconcerting when cast against the anticipated construction for the future. Only detailed research aimed at developing environmental assessment methods for each county will avert the continuing degradation of the region. This report tests an approach to accomplishing this end.

TABLE 1.1: PRESERVATION CATEGORIES, TAMPA BAY REGION

CATEGORY	EXTENT
Beaches	1,926 acres
Mangrove	14,620 acres
Aquatic Grass	45,915 acres
Freshwater Swamps	139,107 acres
Coastal Marshes	8,316 acres
Class II Waters	126,855 acres
Total	336,739 acres
Net Land	163,969 acres

Natural Resource Assessment

This analysis validates the hypothesis that the region's natural resource base can be used as a foundation for development policies. Using an inventory approach, highly valued resources are identified. The priorities for protecting these resources are based on the importance of preserving areas that are sensitive to urban encroachment. A glossary is presented in the appendicies to clarify any definitional problems that may arise from these resource area terms.

From the analysis of these sensitive areas, a preliminary framework for guidelines was developed. These guidelines, if expended through more in-depth research, will allow municipal and county policymakers to exert better control over the quality of the environment in the region. The methods presented can determine **holding capacities** for urbanization and thus define limits for growth when local goals and objectives are defined for the quality of the environment. The methods, when refined, can determine fiscal planning approaches that will protect the quality of the environment.

Looking first at the preservation and conservation areas (areas needing protection from **any** development and areas where development should procede with caution) in the region the report then analyzes these resources in terms of present and future growth trends. The analysis provides a record of future resource degradation from 1972 to 1975.

Based on this analysis, guidelines for land development were prepared that minimize the effects of future development on the region.

PRESERVATION AREAS

Preservation areas were identified that represent some of the region's most valued natural resources. Extensive research and field work indicates that these areas are of prime importance to retain the very character of the region. These resources and their extent are summarized for the region in Table 1.1.

The 164,000 acres or 256.2 square miles of land reflected in the table represents seven per cent of the region's land area and only five-tenths of one per cent (0.5%) of Florida's total land area.

At present, the entire 1,926 acres of sandy beaches are in active recreational use and beach nourishment operations in Pinellas County are well under way. The existing mangrove areas in the region support a significant sport fishing industry as well as certain well-documented ecological functions. Anticipated use of the mangrove areas in the region indicates a reduction in forestation estimated at closs to 50 per cent in the coming decade.

Aquatic grasses were surveyed by air in both the spring and summer of 1972 and the figures given represent a maximum area of grass beds at this time. These beds also are expected to decline as land development impact continues as discussed in Chapter III, Development/Resource Problems. However, over the long run, extensive reduction of these beds is not expected as initial adverse effects settle out and some beds reestablish.

An important factor in the reestablishment of grass beds is the minimization of water turbidity. If this is not controlled, reestablishment potential is reduced.

The grass beds support an active sport fishing industry, and serve as an important link in the ecological food chain. The beds are commonly dominated by turtle grass and are one of the most productive habitats known. Cuban shoal weed and manatee grass are also commonly found in the region.

Freshwater swamps in the region still face the peril of destruction from land development. Those areas closest to urbanization and the coastline face the greatest threat. During the course of this study, a significant area of swamp in northern Pinellas County in the Lake Tarpon area underwent alteration. A swamp's prime value and use is both hydrological and ecological. The benefits to man from preservation of these areas relate to water supply protection, the sport fishing and hunting industry, and the unique aesthetic values of the areas.

Coastal marshes at present face development pressures in only southern Pasco County. These areas also play a key role in sustaining the region's ecosystem and thus the sport fishing and hunting industries.

Protection and enhancement of the Class II water areas (water approved for shellfish harvesting) within the region are particularly important for biological production. Although there are 126,855 acres of Class II water surface in the region, less than half of these are open for shellfishing. The future urban development presented in this study indicates that water runoff is a potential problem in the Sarasota and Manatee county Class II waters. This can be circumvented and is mentioned only to identify a potential water degradation source.

CONSERVATION AREAS

These areas, while important, are not absolutely critical to maintaining the ecological integrity of the region. They provide buffers for preservation areas and require special precautions when being converted to other uses. The precautions are needed to avoid direct or indirect consequences harmful to public health, safety and welfare. Table 1.2 summarizes the extent of lands in this category.

The 709,740 acres, or 1,109 square miles of land reflected in the table, represents 31 per cent of the region's land area and only two per cent of Florida's total land areas.

The hurricane flood zone is undergoing the majority of intensive land use changes throughout the region. The critical nature of the development in this zone is reflected in the fact that it represents only ten per cent of the region but a majority of new construction. The river flood plains in the coastal zone are also undergoing major development. The effect of this development in both flood hazard areas is easily seen, especially with the attendant denuding of stream and coastal margins.

The parks in the region, although extensive and well used, are a large reservoir of untapped recreational resources. A surprising percentage of the park land owned is not developed for human use. In many cases these lands are desirable for wildlife purposes, but many areas that can offer excellent recreational values have not reached their potential.

Marginal lands within the region offer too much of a diversified pattern for discussion on a regional basis beyond general observations. For the most part, marginal lands in the coastal zone are, or will be, at some stage in the development process in the next three to five years. However, there are definetely exceptions within each locale. Development in these areas is a product of local economics and subject to the vagaries of the market.

DEVELOPMENT CONFLICTS

The Tampa Bay Region encompasses 2,255,910 acres, including 37,005 acres of water. The extent of the various land uses are shown in Table 1.3.

TABLE 1.3: EXTENT OF LAND DEVELOPMENT, (August, 1972)

CATEGORY	TOTAL AREA (ACRES)	% TOTAL REGION	DEVELOPED AREA %
URBAN			
Residential	163,038	7.22	55.48
Commercial	18,776	.83	6.39
Industrial	12,498	.55	4.25
Transportation and Utilities	15,075	.66	5.13
Public and Semi-Public	19,197	.85	6.53
Recreation and Open Space	65,235	2.89	22.20
Total Urban	293,819	13.02	100%
NON-URBAN			
Agriculture and Mining	676,425	29.98	
Vacant and Open Range	1,248,661	55.35	
Total Non-Urban	1,925,086	85.33	
Inland Water Total	37,005	1.64	
Regional Totals	2,255,910	100%	

TABLE 1.2: CONSERVATION CATEGORIES, TAMPA BAY REGION

CATEGORY	EXTENT
Hurricane Flood Zone	225,679 acres
River Flood Plains	36,175 acres
Parks	53,164 acres
Marginal Land	394,702 acres
Total Land	709,738 acres

Forty-three per cent of the total area within the region is currently distributed among the various land use activities shown (urban, agriculture, and mining) in Table 1.3. By computing the acreage of uses as a function of the current population and employment activity, we can develop unique cardinal base ratios for each land use category as shown by example in Appendix III, Environmental Plan Procedures.

TABLE 1.4: EXTENT OF PROJECTED LAND DEVELOPMENT, 1975

CATEGORY	TOTAL AREA (ACRES)	% TOTAL REGION	DEVELOPED AREA %
URBAN			
Residential	208,806	9.26	57.98
Commercial	24,420	1.08	6.78
Industrial	15,156	0.67	4.21
Transportation and Utilities	16,174	0.72	4.49
Public and Semi-Public	24,423	1.08	6.78
Recreation and Open Space	71,166	3.15	19.76
Total Urban	360,145	15.96	100%
NON-URBAN			
Agriculture and Mining	759,886	33.68	
Vacant and Open Range	1,098,874	48.71	
Total Non-Urban	1,858,760	82.39	
Total Inland Water	37,005	1.64	
Regional Totals	2,255,910	100%	

TABLE 1.5: LAND DEVELOPMENT PROJECTIONS TO 1975

AREA	INCREASE IN ACRES
Pasco County	4,817
Pinellas County	27,151
Hillsborough County	23,332
Manatee County	4,965
Sarasota County	6,061
Regional Increase	66,326

The denominators of these ratios are expressed in terms common to the measurement of population growth and economic activity such as acres per capita or acres per employee in terms of land use densities. From this point, extrapolation of the base ratio for each land use category produces the projected land use data. A more detailed explanation of the methodology used is found in Appendix III, Environmental Plan Procedures.

The final projected acres for each land use category are predicted on the assumption that land use densities in each category remain constant, and are shown in Table 1.4. To measure the impact of alternate land management policies upon projected land use, a corresponding adjustment of the base ratio is required.

TABLE 1.6: PRESERVATION CONFLICTS

	ACREAGE
Increase in Conflicts, 1975	4,141
Present Conflict, 1972	4,194
Total Conflict Areas, 1975	9,500
Increase for the Period, 1972-75	98.7%

The net increase in total developed urban acreage is 66,326 acres or 22.57 per cent per year for the three year period 1972-1975. Although as an aggregate total this seems extreme, it is greater than the trend analysis carried out by the Florida Division of Forestry and less than a previous Tampa Bay Regional Planning Council analysis. The allocation of this acreage is shown in Table 1.5.

Present Conflicts

The preservation category is defined as areas that should be protected from any further development, except in cases of overriding public interest. The conservation category is defined as areas (both land and water) that should be developed with extreme caution. In zoning terminology, this would mean low gross density development with special guidelines. When these two categories are used in conjunction with existing problems and trends, areas that are endangered can be identified.

The following presentation is limited to a discussion of the regional conflicts that are generated from the market growth analysis. A more detailed discussion is presented in each county synopsis. The conflicts of major concern are those generated in the preservation areas. Of this category, the most extensive conflicts take place in those areas identified on the Series One, Preservation Maps in the Atlas. The areas of affected grass beds are generalized from coastal construction activity. The category showing the least encroachment is that of Selected Coastal Marshes. Table 1.6 summarizes the projected aggregate development growth for the preservation area based on the estimates of growth and its allocation:

TABLE 1.7: CONSERVATION CONFLICTS

	ACREAGE
Increase in Conflicts	33,682
Present Conflict Area	108,459
Total Conflict Areas, 1975	144,099
Increase for the Period	31.1%

The conservation conflicts are by far the most extensive, however, they are of lower priority than the preservation conflicts. The conservation area has large conflict areas which are estimated to increase an additional 31.1 per cent by 1975, this category approaches directly those development areas that potentially

TABLE 1.8: AGGREGATE INCREASES FOR PERIOD, 1972-1975

	ACREAGE
Increase in Developed Land	66,326
Increase in Conflicts	37,823
Conflict to Development Ratio	.57

TABLE 1.9: PROJECTED AGGREGATE DEVELOPMENT INCREASE, TAMPA BAY REGION, 1972–1975

CATEGORY	1972 ACREAGE	1975 ACREAGE	INCREASE
Total Developed Land and Increase	293,819	360,145	22.57 %
Total Conflict Areas and Increase	112,653	153,599	36.35 %
Conflicts to Total Development	38.34 %	42.65 %	

endanger life and property from flood hazard. Table 1.7 summarizes the aggregate development growth for the conservation zone based on estimates of growth and its allocation:

In total, the intensive land development estimated to take place in the region will place a severe stress on the environmental resources addressed in this report. On the aggregate, for every ten acres developed in the three year period, almost six acres will be in conflict with the criteria of the Coastal Coordinating Council. The vast majority will be conservation conflicts. Table 1.8 summarizes the estimated effects of land development in preservation and conservation areas:

Research indicates that the coming period, 1972-1975 is most crucial in terms of land development and the environment. Considering the total development in the region, this three year increase in development will cause a 42.65 per cent increase in resource conflicts for the period. Overall development conflicts will increase 36.35 per cent in the region, these comparisons are shown in Table 1.9:

The effect of these conflict problems are most noticable on the pro-ecological side of the environmental debate. The alteration of habitat on land and water will have both short and long term effects. The short term effects are primarily water based, but even here long term alteration will have a consequence. Long term alteration will result primarily from overland runoff and water turbidity problems. These effects are discussed in more detail in the county synopses.

Development Suitability Analysis

The following land availability calculations estimate the land suitable for development in the Tampa Bay Region. The preservation category includes areas of aquatic grass beds, and Class II waters. By reducing the preservation total (both land and water) by these water areas, a preservation land total results. For both preservation and conservation categories, the net amount results from reducing the land total by the existing conflicts total for a net available amount. This preservation land is removed from the availability total due to the need to protect these lands for environmental reasons.

TABLE 1.10: LAND SUITABLE FOR DEVELOPMENT, TAMPA BAY REGION, 1972

DESCRIPTION	ACRES
Undeveloped Area	1,962,019
Inland Water Area	(37,005)
Undeveloped Land Area	1,925,014
Net Preservation Land	(157,849)
Gross Developable Land	1,767,165
Net Conservation Land	(601,261)
Net Land Suitable for Development Without Special Restrictions	1,165,904

The reduction results in gross developable acres available. However, this gross total includes lands that should carry special development restrictions, as well as lands that need fewer environmental safeguards. To determine total land that requires no special development guidelines, the gross total is reduced by the amount of net conservation land that exists. The results are net land suitable for development without special restrictions, shown in Table 1.10.

Economic Effect of Preserving the Land

The amount of land in the preservation category that has been listed amounts to 163,969 acres. This is a significant percentage of the total (2,255,910 acres), approximately 7.3 per cent of the region, significant enough to generate a discussion on preservation and its economic impact. The question addressed is what effect would the removal of all the preservation land in the coastal zone have on the regional economy?

The supply of land is of course fixed and the amount of vacant land available is reduced with every development. Further, as the supply decreases, there is a price movement upwards and additionally a corresponding shift to an increase in demand as land consumers realize the scarcity situation.

The effect of removing this land from availability encourages the normal market situation. The effects of the chain of events that occurs is also interesting in the land development sense. The greatest demand pressure for land is from the increasing population, largely from in-migration of retirees or persons on fixed incomes. With the demand pressures these people generate, the price of land increases. This brings a general increase in the cost of development. This development cost applies to both commercial and retail properties. As the fixed development costs in these sectors increase, the amount of overhead cost per product increases. The businessman maintains a reasonable margin on the products he sells for his livelihood, therefore, prices increase. As this spiral increases, the labor pool moves into the more lucrative job markets. There is then an adjustment in incomes, particularly if the product sales are limited to the local market. This highly simplistic example mirrors the current trends in the Tampa Bay Region. However, those on fixed incomes are inadvertently pricing themselves out of the market. Add to

this the problem of discouraging industrial development from speculative land costs and the relatively low unemployment (indicating a small available supply to tap), and diversification of the population base is discouraged.

These trends lead to the financial push for high density development for more efficient capital resource use. Intensive use of resources is the only thing that can force costs to remain in line, relative to national costs. This is primarily due to an upward spiral in land costs resulting from the demand pressures of in-migration.

Another effect of this encouragement of the normal market process is that it may help stabilize growth. As land development costs and the costs of attendant services continue to rise, the market becomes less and less attractive. The long run effect of the process results in an easing of demand. This less intensive demand is the result of a very long run process, however, and its effect in relation to this study is negligible.

The effect of restrictions on methods of development as suggested by development guidelines has an effect similar to the preservation discussion. However, these effects will appear far more slowly and over a longer time span.

One may conclude from this simplistic discussion that land zoning policies that are environmentally responsive may be achieved by using gross density figures for zoning decisions. The gross density approach associated with Planned Unit Developments (PUD) allows for a maximization of efficiency in land use and can be environmentally responsive. This approach would make current densities more attractive. For example, using the gross density approach, assume that a developer has a ten acre site he can develop. He develops a portion of his land intensely and has maintained the overall gross density. In effect, he has preserved a large natural open space. To use this approach, however, will require more informed and environmentally responsive development than is now evident in the region.

RECOMMENDED GUIDELINES FOR CONFLICT MINIMIZATION

The Florida Environmental Land and Water Management Act of 1972, is concerned with the environmental effects of land development and urban support systems. The potential for successful land and water management is greatest in those areas as yet undeveloped. As was pointed out in the Tampa Bay Regional Planning Council's Shoreline Resource Development Study, *once thousands of people have made an area their home, the cost of corrective change is prohibitive. Furthermore, without drastic action the likelihood of such change being considered is almost nil.* The above emphasis is also found in Section five of the act. The areas of critical state concern are described and the burden of keeping them undeveloped or developing them within specific guidelines is placed on the various local governments.

Section six of the act is concerned with developments of regional impact. This section is perhaps more comprehensive from the development standpoint, whereas Section five is more concerned with environmentally endangered lands.

This report is focused on research that can develop operational techniques for Section five of the act, and is limited to physical environmental issues in the delineation of critical environmental areas.

The study emphasis is on environmental constraints on growth and development in the Tampa Bay Region and is consistent with the intent of the 1972 act.

However, even within this limited framework, there are a multitude of operational problems that must be overcome. Major among these are: **what indicators can demonstrate than an area is environmentally endangered by future development; where are areas that are feasible to preserve; which methods are technically and professionally feasible and defendable, how is local support and advice useful and finally, when is this the best time to solicit this advice?** Local public input is advisable to help generate interest and support for pending environmental programs. However, the details of strategic public involvement must proceed carefully to allay confusion or frustration and subsequent distrust.

The criteria for the indicators were developed from work with natural resources, ecological communities, aesthetics soil suitability mechanics and development potential. This integrative approach can offer the most comprehensive method of systematically identifying and cataloging a wide variety of information inputs, and this is a key factor in clarifying many operational problems. Standardization of these criteria is the most professionally defensible method of gathering and analyzing the data in an objective sense.

To avoid potential conflicts, a set of guidelines for development in certain areas is needed. These guidelines will not completely prevent conflicts, but they will allow the protection of the significant resource factors in each site condition.

Precedents for environmental safeguards were set by the *National Environmental Policy Act,* the *Clean Air Act,* and more recently by the *National Coastal Zone Management Act of 1972.* Therefore, a set of guidelines for development standards to protect regionally significant natural resources rests on reasonably firm ground.

Statement of Priorities

The guidelines presented relate to the Tampa Bay Region, already identified as an area with intense stresses and problems. These guidelines are presented only on a regional basis and are limited to the restricted development areas shown in the Series Three Maps in the Atlas. Further, these guidelines pertain to those areas previously identified in the future conflict analysis.

The most stringent restrictions and the highest priority for protection should fall on those areas depicted on the Series One, Preservation Maps in the Atlas. Those categories identified in the conflict analysis and discussed here include: **Marine Grass Beds, Selected Coastal Mangrove, Selected Coastal Marsh, Selected Freshwater Swamps and Marshes, Class II Water Areas and Beaches and Dunes.** These areas within the region's preservation classification will bear the brunt of the anticipated development conflicts. Therefore, the six classifications should have the highest priority in guidelines for development.

The next priority item for guideline discussion are the conservation conflicts. The conflict problems are greatest in the flood hazard areas and on marginal lands. The preliminary guideline recommendations are limited to these two categories.

The final set of priorities relate to development in general, and are discussed as generic development types. The discussion is not exhaustive but relates to significant development concerns within the region.

Priority One: Preservation Guidelines

Marine Grass Beds, Marsh, Mangrove Areas, and Class II Water

Those shoal areas within the terrestial euphotic zone are a major source of marine productivity. The preservation and enhancement of these areas are important factors in this regard, and further up the food chain they support extensive terrestial wildlife groups and sport industries.

Guidelines

a. Grass beds should remain undisturbed. The only exception allowed is where overriding public interest is **proven.**
b. Upland and coastal margin construction activity should be buffered from the area of influence on the grass beds. This activity can adversely affect water quality, particularly creating water turbidity. Turbidity decreases the production capabilities of the beds by interrupting the photosynthetic processes. The existing performance standards for turbidity should be enforced for upland construction activity to prevent degradation of adjacent waters. A buffer should control overland runoff siltation through berms, dams or dikes to be determined from natural site conditions.

   Runoff into the adjoining water body during and after project completion should not exceed the previous amount of natural runoff, with limitations set on runoff content, i.e., suspended solids, etc.
c. If marine activity, docks, wharfs, etc., and increased pleasure boating are anticipated, existing grass beds and coastal margins (border areas where land and water meet) should be buffered from these areas. The activity should be limited to protected areas and such areas should not interrupt or degrade the existing natural tidal flow.
d. The issuance of environmental protection performance bonds should be investigated for these areas. This is a common practice for the protection of capital resources and should be investigated as a requirement for natural resource protection.
e. In the case of vegetation in the coastal margin, development should be limited to the extent that the character and function of this vegetation remains intact. Distinctive vegetation features should be both buffered and preserved. Marsh and mangrove areas should be placed off-limits to development that would significantly alter their character.
f. Where removal or destruction of grasses or vegetation is anticipated, a program of reseeding or reforestation should be required as a part of the review process.

Freshwater Swamps and Marshes

Guidelines

a. The requirements for protection and preservation as noted in the first set of guidelines should be utilized where the protective measures of marine areas apply to freshwater areas.
b. The protection of surface water through drainage into and out of the swamp proper must be controlled and buffered in a site undergoing development. This protection is needed to minimize adverse effects on surrounding vegetation and wildlife by the impact of unnatural water system changes.
c. The encouragement of using gross density limitations rather than the more common net or lot densities should be stressed. The use of gross density zoning allows more efficient use of the available land through more open space areas, centralization of facilities and services and minimum impact on the natural conditions of the site.

Three categories, **Grass Beds, Mangrove and Marsh Areas,** are facing the most extensive alteration throughout the region. The plight of swamp regimes is just emerging, and if the projection technique used in the conflict analysis were extended to 1980, the conflict with swamp development might become more evident.

Beaches and Dunes

These areas, in addition to being very important recreational resources, constitute natural shoreline protection features. Under Chapter 161.053, F.S., all construction seaward of the coastal construction setback line (50 feet inland from Mean High Water (MHW) unless otherwise established through consideration of natural beach processes) must receive a permit from the Bureau of Beaches and Shores. Local governments through their building permit systems, have the most effective means of detection violations and should assure that projects within their areas of jurisdiction abide by the setback law.

Guidelines

a. No new construction should be allowed that would threaten the stability of either the primary dunes or the beach itself. All construction should be restricted to areas landward of the primary dune line.
b. In areas where dunes are being eroded, local governments should encourage and support dune stabilization projects, preferably utilizing vegetation as the stabilizing medium. Local governments should pursue programs that will guarantee adequate public access to the beaches. Motorized vehicles should be prohibited from operating on primary dunes except in emergency.

Priority Two: Conservation Guidelines

Development restriction is reflected in the Series Two, Conservation Maps. Again the guideline discussion is limited to areas that reflect extensive conflicts for the future.

The Hurricane and River Flood Zones

Guidelines

a. The construction requirements of the National Flood Insurance Program should be adapted into a state-recognized building code. The Southern Building Code now recognized in Florida sets very lenient minimum construction standards; a more responsive code for the state should be developed.
b. Vegetation is particularly important in these areas. Vegetation acts as a natural buffer for both drainage and flood impact on human settlement. Minimization of ground cover removal as well as the overstory protection now afforded in tree ordinances should be emphasized. The adoption of regional tree ordinances would also enable better protection for areas either not having or unable to enforce tree ordinances.
c. Based on drainage basin patterns, development taking place in the flood plain areas should include statements on the adequacy of support systems (storm and septic sewers, transportation routes and public facilities) to preclude external problems on the surrounding areas.

d. Any development in the hurricane flood zone which would unnecessarily jeopardize human life or economic welfare of the area should be discouraged, unless properly protected.

e. All residential construction in the hurricane flood zone should have ground-floor elevations above the level subject to flooding or flood proofed by the statistical 100-year hurricane.

f. All construction in the hurricane flood zone should be storm proof and flood proof against a statistical 100-year storm.

g. All high intensity development in the hurricane flood zone should be serviced by central sewer systems. Septic tanks should not be allowed in residential subdivisions or other high intensity use areas of the hurricane flood zone. Sewage treatment plants, industrial holding ponds or other potential pollution facilities should not be constructed in the hurricane flood zone. If alternate locations inland are not available, special hurricane flooding precautions should be taken in the design and construction of the facility.

Marginal Lands

Guidelines

a. By definition (see Glossary) marginal lands are typified by poor drainage, susceptability to flooding and soils having low permeability, high water table and/or low bearing strength. Although many of these restraints are checked prior to construction to safeguard the building, the restraint on flooding susceptability is often checked superficially. Hence, another occasion where a state building code would be useful. The requirement of a general soils report in addition to engineering test borings would bring surrounding factors into play.

b. The vegetation requirements of guideline b under *The Hurricane and River Flood Zones* are recommended to protect the natural balance of factors associated with soil environmental groups with marginal capabilities.

c. Because of the wide range of problems associated with intensive development of marginal lands, policies of local government should specify extreme caution and very careful site planning before intensive development takes place.

d. Development that does occur in marginal lands should utilize central sewage collection and treatment facilities.

e. Special care should be taken to minimize environmental impact of landscape modification in marginal lands.

Priority Three: Urbanization Guidelines

The scope of these urban development guidelines is limited to generic development types.

Ports and Water-Related Industry

Ports and water related industries are basic activities upon which many other segments of the economy depend. Efficiency and economy usually dictate that the various secondary industries dependent upon primary industries should locate close to them. This restraint reduces the cost to the public of added services such as roads and reduces product cost.

Unfortunately, Tampa's ports have been hampered by unfavorable physical conditions and encroachment of urban activities into adjacent areas. These factors make port and industrial expansion, modernization of facilities, or introduction of new industries extremely difficult. As a result, the port faces the unpleasant task of overcoming physical restrictions on development as well as serious conflicts with urban activities. In some cases facilities may be relocated to more favorable areas where expansions and better efficiency are possible as is desired in the planning and development of Port Manatee.

It has become evident that the ports, if they are to remain competitive with other ports having more favorable physical conditions, should explore alternatives to traditional methods of cargo trans-shipment. It must be realized, that dredging and filling to some degree is absolutely necessary for efficient port operation. But this should not be the only alternative considered for enlarging and improving port operations.

Guidelines

a. Some dredging and filling will be necessary to provide for port expansion, but any permitted fill or dredging should be in accord with an overall port development plan designed to minimize any harmful effects.

b. Land identified for water-related industry should be used by industries specifically requiring waterfront sites. Industries linked to them but not requiring waterfront should be located away from the shoreline.

c. To reduce shoreline pressure that will develop for industries not requiring waterfront sites, freeways and railroads in upland locations should be encouraged, with sites near these transportation links reserved for industries requiring the combination of rail and freeway.

Transportation

Construction of transportation routes and utilities generally anticipates projected needs for the foreseeable future, and, direct ecological effects are now being considered although this has not been the case in many past projects. But it is apparent to many that consideration of **direct** effects by themselves, is not enough. Second and third order effects must also be considered.

Realizing this, it becomes evident that in many cases properly analyzed and planned projects can be an effective tool for guiding future development toward more favorable end products. This can ultimately reduce undesirable second and third order consequences such as pollution from development, flooding problems, high maintenance costs for local government and long-term destruction of natural resources.

Guidelines

a. Major highways, freeways and railways should be located inland from the shore, except in port and heavy industrial areas.

b. All new transportation construction should attempt to avoid wetlands.

c. In cases where wetlands cannot be avoided, bridging should be used to the maximum degree possible rather than filling to create road beds. The facility should be designed in a manner that does not invite additional filling of the waterfront for other purposes.

d. Highway corridor analysis in undeveloped areas should consider suitability of the adjacent land for urbanization. Routing should be designed to guide growth into favorable areas and away from ecologically sensitive areas. In cases where this is not possible, access should be strictly limited.

e. Structures over water should be designed to allow free flow of water and not cause excessive shoaling, and provide adequate clearance for commer-

cial and pleasure boats.

f. Maximum care should be taken to prevent concentrated runoff from roadways from entering adjacent water bodies. Storm sewers, ditches, or other drainage systems should not empty directly into open water. Holding basins should be created to allow settling of suspended matter and gradual release to open water. All slopes and road cuts should be stabilized by vegetation or other means as soon as possible in the construction of the facility to prevent unnecessary erosion.
g. Catwalks and fishing platforms should be constructed on new bridges, where appropriate, to provide recreational use of these structures.
h. All transportation and utilities construction that involves wetlands or navigable waters should have state approval.
i. Maximum retention of natural vegetation should be attempted with all transportation and utilities projects.
j. Underground utilities placement should be encouraged.

Removal of Natural Vegetation

Natural vegetation serves several important functions in the region. Among these are the following: provision of habitat for various important animal and bird species; air purification; noise reduction; retardation of runoff and retention of soil moisture; prevention of shoreline erosion; buffering of storm surges; prevention of wind erosion; utilization of excess nutrients; and filtration of sediments and pollutants which may endanger water quality in adjacent areas. This guideline refers to those areas not covered in the Priority One and Two Guidelines. Thus, it is apparent that worthless vegetation that poses a hinderance to development may actually be serving a more important function in preserving environmental quality.

The importance of preventing unnecessary ground clearing cannot be overstressed, particularly in shoreline areas and on slopes. Retention of as much natural vegetation as possible will aid considerably in protecting water quality, marine productivity, and living conditions in the coastal zone.

Guidelines

a. Development should preserve as permanent open space, buffer zones of natural vegetation on slopes and along the shoreline.
b. In areas where temporary removal of vegetation is necessary during construction, replanting should be carried out as soon as feasible.
c. Landscaping around developments should utilize, where possible, native species that are adapted to soil, water, and temperature conditions of the area. This allows ground cover without introduction of fertilizers, pesticides and other potentially harmful materials that are often necessary for survival of non-indigenous plants. Many times native plants can be salvaged before development occurs and later used for landscaping.

Wetlands Development

The values associated with Florida's wetlands have only recently been recognized by the public. But there is now a concensus among agencies involved in resource use management that these areas are one or our most valuable resources. There is also a concensus among these agencies as to wetlands sensitivity to alteration particularly by drainage. Activities that have little effect in other locations have a wide range of effects in wetlands areas.

Guidelines

a. Wetlands should be avoided by all development if possible.
b. Any development that does occur in wetlands areas should take special care to avoid unnecessary ecological or hydrological damage to the area.

Residential Development

Residential development has probably had more impact on the region's landscape than has any other single type of development. The prospect of continued rapid population increase, primarily from in-migration, suggests that this situation will continue. With new residents come demands for services such as schools, police and fire protection, water supplies, sewage treatment, electricity, road maintenance, etc. New residents arrive expecting to have these services already available, but in rapidly growing areas, this is seldom the case. The result is often deficit spending to provide the services, rapidly increasing taxes, and/or an absence of adequate facilities and services. This can create a situation where effective planning is stymied, resulting in unnecessary destruction of natural resources, hodge-podge development, and general degradation of living conditions in this area.

The answer to this problem is not a halt to all further residential development, but rather to allow only development that is well planned and in accordance with local government's ability to provide and maintain necessary services.

This demands that residential development be allowed only in those areas where physical conditions will not present future maintenance problems from flooding, inadequate septic tank functioning, shoreline erosion, etc. It also demands that timing of development be in phase with expansion of sewer and water facilities, building of new roads and schools, increased police and fire protection, recreational facilities, etc. The common practice of allowing **leap frog** subdivision development will thus have to be changed to one permitting only orderly, timed development in areas where services can be provided. Unless this is done, the long-term consequences are clear: urban blight, slums, higher taxes, inadequate services, and environmental degradation.

Guidelines

a. Residential subdivisions should not be permitted in areas where local government will inherit unnecessary maintenance problems from the developer.
b. The costs for roads, sidewalks, water and sewer lines, and storm sewers within residential subdivisions should be borne by the developer. Project acceptance by local government should occur only if rigid construction standards are met.
c. Local governments should develop long-range plans for guiding residential subdivision development into areas suitable for development.
d. Subdivision regulations should be performance oriented rather than means oriented if possible to allow flexibility in the techniques used to achieve desired goals of local government.
e. Residential subdivisions should be planned in accordance with natural characteristics of the land rather than simply laying out a grid pattern that ignores slope, elevation, drainage patterns, natural vegetation, and accessibility.

f. Maximum retention of green areas and open space should be encouraged, with density and setbacks being controlled by utilization of the **planned unit development** concept, where possible.
g. Runoff from streets and yards should be carefully controlled to prevent flooding in adjacent areas or pollution of water bodies. Catchment basins should be constructed at storm sewer outfalls to prevent silt and other pollutants from entering water areas.

Solid Waste Disposal - Sanitary Landfill Sites

Solid waste problems in the region, especially in the coastal zone, are becoming increasingly complex. Each person in Florida now generates about five pounds of solid waste per day. By 1990, it is anticipated that the per capita generation of solid waste could reach up to 12 pounds a day, more than double the present amount. If present trends continue, by the year 2000 generation of solid waste in Florida's coastal zone will exceed 75,000 tons per day or over 27 million tons per year. This would cover a road 25 feet wide from Tallahassee to Miami to a height of 50 feet!

The problems associated with disposal of such massive quantities of material are compounded by concentration in a relatively small portion of the state's land area and the increasing scarcity of suitable disposal sites. If we are to prevent water pollution, habitat destruction, health problems, loss of aesthetics, and depressed real estate values and unnecessary public expense brought about by improper solid waste management, it is mandatory that long-range solid waste management programs are implemented.

Guidelines

a. Every municipality and county government should conduct a coordinated solid waste management program.
b. All open dumps should be closed, converted to sanitary landfill operations or employ other approved methods of disposal.
c. Selection and operation of sanitary landfills should be in accordance with a long-term plan.
d. Appropriate agencies of local government should utilize the available talents and assistance offered by the Solid Waste Planning Section of the Florida Department of Pollution Control.
e. Proposed developments, especially in the coastal zone, should be analyzed carefully by local governments to determine their impact on existing solid waste management programs.
f. New techniques of solid waste disposal are constantly under investigation. Incineration, separation and recycling, grinding, development of new equipment for landfill use - all of these are under investigation and some are actually being successfully used. Many of the new techniques are too expensive for widespread utilization, and many have not yet been approved by health authorities. Responsible governmental bodies trying to deal with solid waste disposal should always keep aware of new technology in the field, but should contact the Solid Waste Planning Section of the Department of Pollution Control for their approval before making any purchase or adopting any new techniques.

Forest Management Practices

Timber production is an extensive land use, with very low profit per unit of production and long time periods required for realization of profits. For this reason, modern timber management has tended toward utilization of faster growing species of trees with more trees per acre. The practice of clear-cutting and replanting of solid stands of single species trees has become widespread and ecological and aesthetic values have, in some cases, been threatened.

Florida's recently enacted *Greenbelt Law,* offering tax advantages to agricultured land in and around urban areas, relieves some of the pressure for realizing maximum possible profits from forest lands and makes such practices as selective cutting and multiple use more attractive to timber interests. There are certain other techniques that can be employed to lessen the harmful effects of timber production and harvesting, and these should be used as much as possible.

Guidelines

a. Because vegetation diversity is the key to having productive animal habitat, selected areas of swamp, hardwoods, or other low value timberland should be kept undisturbed as often as possible.
b. Drainage corridors and streams should not be interrupted by tree planting or logging operations.
c. Clear-cutting should not be employed in areas adjacent to water bodies.
d. Any trees felled into streams or other bodies should be removed before logging operations are completed.
e. Clear-cutting should not be employed on slopes where erosion may be induced.
f. Replanting should occur as rapidly as possible after logging operations have been completed.
g. Where important game animal habitats exist, selective cutting and sustained yield techniques should be employed as much as possible.
h. Controlled burning in compliance with pollution control regulations is encouraged to prevent fire hazard buildup and to facilitate growth of annual plants as food for game birds and animals.

Amenities, Aesthetics and Design

Amenities and aesthetics include almost all characteristics of natural and man-made components of the landscape. (*Landscape* encompasses land, streams, estuaries, and bays; offshore waters of the Gulf of Mexico or Atlantic Ocean, and air and sky quality). While aesthetics refer primarily to scenic or perceived qualities and amenities involve the use of components of the landscape for recreation, recreational access, property enhancement, and other environmental benefits, the two terms are closely allied and should be considered integral for management purposes. From the point of view of environmental quality, amenities and aesthetics can be interpreted to mean qualities than enhance man's esteem of an area.

With growing public concern for environmental quality, it can be safely stated that public esteem of the amenities and aesthetics of any particular area may potentially enhance or downgrade social and economic well-being within the area.

A comprehensive assessment of the coastal and inland landscape, its biotic and non-biotic resources, and the activities which man may arrange among them is a necessary step toward long-term resource management and securing maximum public benefits, many of which are very difficult to quantify in absolute terms.

Techniques are now available for making a systematic assessment of the relative aesthetic values of various components of a given area's landscape. Also

available are techniques for maximizing aesthetic values in the development of an area. Research into this topic indicates that many landscape components of high aesthetic value also have very high ecological value and very low development suitability. Many other aesthetically valuable areas are also well suited to development if proper design techniques are utilized. The often complementary nature of aesthetic and ecological values gives additional support to the concept of trying to maximize the public benefits of development through careful analysis of, and design in accordance with, physical characteristics of the landscape.

Guidelines

a. The identification and assessment of aesthetic and amenity values and the formulation of plans for maximizing these values should be a viable part of local planning programs.
b. Maximum efforts should be made to provide, enhance, and preserve scenic views of the water. Vista points should be included in local plans.
c. Proposed development should be restricted from blocking scenic views unless there is an overriding public interest.
d. To maximize the attractiveness of a setting for dwellings, development should display principles of good design. Subdivision layouts should be developed in proper relation to existing and other proposed developments, the topography, surface water, vegetation cover, and other natural features. Compatibility of appearance as well as compatibility of use is desirable; this means harmony, not necessarily uniformity.
e. To conserve natural landscape, the cluster development or planned unit development is advantageous. Such development should be used to preserve certain open space, especially along the shoreline, by legal means that will guarantee its remaining open space in perpetuity.
f. All but the smallest waterfront subdivision should be required by local authorities to provide pedestrian access to the water. Such access should be wide enough to permit hedges or other landscaping on both sides, for both privacy and aesthetic appeal.
g. The placing of utilities underground has definite aesthetic benefits and should be encouraged.
h. Secondary or collector road construction through forested areas should preserve as many trees along the right-of-way as possible.
i. Building heights along the waterfront should be restricted to prevent development from creating concrete barriers to the waterfront. Construction of condominiums and other high-rise structures should be restricted to areas away from the shoreline.
j. The indiscriminate use of off-premise commercial advertising signs and billboards which create a negative aesthetic effect should be prevented.

County Environmental Synopses

This summary section provides a more detailed look at each individual county. The observations and approach for the counties are similar to those used for the regional evaluation. A short economic synopsis for the county is presented touching on the highlights that define the particular character of the county. Following this, the environmental descriptions of each county are presented including the description of preservation and conservation areas, the present conflict areas, the unrestricted land development suitability analysis for 1972, and finally a projection of the potential growth for the 1972–1975 period. The growth analysis is presented in the light of what future conflicts or critical environmental areas are anticipated. The conflicts are analyzed for the 1972–1975 period only, and also as a cumulative total of development to date.

Finally, a general assessment of what the impact of this growth will have on the physical environmental factors is addressed. This discussion is limited to environmental degradation trend analysis for each county and will highlight major modifications of the existing regime.

In selecting those historical and/or archeological sites which are included in the preservation areas, several criteria were considered:

1. **The site is of major historical consequence.**
2. **The site is designated in the *National Register of Historic Places.***
3. **The site is of major archeological significance.**
4. **The site is currently undisturbed by surrounding development.**
5. **The chance for preservation of the site is feasible or already underway.**

A site is not included if it is currently in a predominately developed area or is partially destroyed. Any site which is not substantial enough to warrant preservation for cultural, historical or recreational purposes is not included. The listing of sites, by county, is found in Appendix IV, Historical and Archeological Sites.

PASCO COUNTY ENVIRONMENTAL SYNOPSIS

Pasco County is the fastest growing county in the region and the county's primary growth is localized in the coastal zone. Industrial expansion is almost nonexistent. Primarily an agrarian economy prior to 1960, a major change took place at that time that gives Pasco a pre-eminence as the most rapidly growing county in the state. The change was a movement to a retiree market evidenced by the county having the oldest median age in the region in 1970, while having the fourth oldest median age of the counties in 1960.

The large influx of older people and persons on fixed incomes with minimal mobility makes the coastal zone in Pasco County a financially captive market. The result of this activity mirrors the regional land market price description. The market conditions in themselves may slow development in the coastal zone through cost increases.

Preservation Areas

At present, the preservation category remains reasonably intact in Pasco County with a total of 80,879 acres of preservation area, including land and water. This includes 69,503 acres of land area, which encompasses 14 per cent of the county and over 42 per cent of the total preservation land areas of the region. The Pasco County beach area is below the minimum reporting size for this report.

Table 1.11 summarizes the preservation areas shown in Figure 1.1 and on Series One, Preservation Map of Pasco County.

Conservation Areas

The conservation areas in Pasco County encompass 187,757 acres. This amounts to 38 per cent of the county and almost 27 per cent of the region's total conservation areas. The majority, 79 per cent of conservation land, is in the marginal land category. As shown in Figure 1.2 and Series Two, Conservation Map

TABLE 1.11: PRESERVATION AREAS, PASCO COUNTY, 1972

CATEGORY	ACREAGE
Beaches	Negligible
Freshwater Swamps	65,048
Aquatic Grasses	11,376
Coastal Mangrove	600
Coastal Marshes	3,855
Class II Waters	0
Total	80,879
Total Land Area Only	69,503
Historical/Archeological Sites	6

TABLE 1.12: CONSERVATION AREAS, PASCO COUNTY, 1972

CATEGORY	ACREAGE
Flood Zone	25,645
River Flood Plains	5,056
Parks	7,496
Marginal Land	149,560
Total	187,757

in the Atlas, the majority of this area is in southern Pasco. These soils are all nearly level, poorly to very poorly drained that are either sandy or sand over clay on broad flats and narrow upland ridges interspersed with swamps and sloughs.

Table 1.12 summarizes the data shown in the Conservation Maps, Figure 1.2 or Series Two, Conservation Map in the Atlas.

Conflict Areas

The totals for each zone are based on natural conditions prior to development. The development that has taken place encroaches on areas within each category. Table 1.13 summarizes these development conflicts for each category; they are shown in Figure 1.3 and in Series Three, Map 11 in the Atlas.

TABLE 1.13: DEVELOPMENT CONFLICTS, PASCO COUNTY, 1972

	ACREAGE
Preservation Conflict	468
Conservation Conflict	4,392
Total Conflict Acreage	4,860

TABLE 1.14: LAND SUITABLE FOR DEVELOPMENT, PASCO COUNTY, 1972

CATEGORY	ACREAGE
Undeveloped Area	464,451
Inland Water Area	(12,537)
Undeveloped Land Area	451,914
Net Preservation Land	(69,503)
Gross Developable Land	382,411
Net Conservation Land	(183,365)
Net Land Suitable for Development Without Special Restrictions	199,046

Suitability Analysis

This county conflict acreage amounts to 16 per cent of the county's developed land, but only four per cent of the total regional environmental conflict areas. The areas remaining that are suitable for development in gross acreage are summarized in Table 1.14 and their extent is shown in Figure 1.3 and in the Series Three, Composite Development Map 11. As explained in the regional analysis, the total area is reduced by various restrictions and results in making the total area available for development without special restrictions.

Projection

Although close to 39 per cent of the undeveloped land in the county is suitable for development, most of the development that is anticipated will create some conflicts. The market growth calculations for Pasco County indicate an additional 4,817 acres will be altered for development through 1975.

The allocation of this acreage when applied to the U.S. Bureau of the Census' Minor Civil Divisions (MCD's) indicates approximately 2,423 acres of this addition will generate environmental conflicts of varying degrees. The analysis indicates that almost one out of every two acres developed will generate environmental conflicts or become areas of critical environmental concern.

The following calculations for each zone are the basis of Table 1.16 which is based solely on the estimated growth potential for the county through 1975, and the allocations by MCD's. By far, the conservation conflicts show the greatest increase.

This analysis further indicates that the anticipated changes will increase developed land in the county by 16 per cent and simultaneously increase the total conflicts by 50 per cent. This data is summarized in Table 1.17.

General Impact Analysis

The effects of these conflicts can be assessed only in general trends at this stage. Site analysis is still the only definitive approach, but as an overall indicator certain tentative conclusions may be drawn.

If the general trend of development that Pasco County has shown continues, the major problems anticipated are human rather than environmental for the study period.

TABLE 1.15: FUTURE DEVELOPMENT CONFLICTS, 1972–1975

	ACREAGE
Increase in Developed Land	4,817
Increase in Conflicts	2,423
Conflict to Development Ratio	.503

TABLE 1.16: FUTURE DEVELOPMENT CONFLICTS BY ZONE, 1972–1975

	ACREAGE
PRESERVATION AREAS	
Increase in Conflicts	404
Present Conflict Area	468
Total	872
Increase for the Period	86.3%
CONSERVATION AREAS	
Increase in Conflicts	2,019
Present Conflict Areas	4,392
Total	6,411
Increase for the Period	45.9%

TABLE 1.17: AGGREGATE DEVELOPMENT INCREASES, PASCO COUNTY, 1972–1975

CATEGORY	1972 ACREAGE	1975 ACREAGE	INCREASE
Total Developed Land	29,629	34,336	16.26%
Total Conflict Areas	4,860	7,283	49.86%

1972, Conflict Areas Occur in 16.4% of the Developed Areas
1975, Conflict Areas Occur in 21.1% of the Developed Areas

The habitat, ground cover and wildlife modifications will occur in the pine flatwood areas. The extent of these areas is shown in Figure 1.14 and in the Series Four, Map 16 in the Atlas. For forestry and wildlife values, these areas are lower priority locales. The exception, and a high priority area, is the potential for development in hardwood forest areas in close proximity to urbanizing centers. This habitat is also prime for the Florida indigo snake, one of the region's endangered species.

In general, the majority of development is anticipated inland from the coastline, minimizing marine dredge and fill problems. However, dredge and fill problems related to swamp forest groups are expected to increase. If the approach is applied to a longer projection period, the problem may become more evident. Should swamp dredge and fill increase, it could encroach on the habitats of three endangered species and two species whose exact status is presently not certain. The endangered species are the southern bald eagle, the Florida panther and possibly the American alligator. The species of undetermined status includes the American osprey and the wood ibis.

Although the development is not anticipated on the coastline, it is anticipated in the hurricane flood zone. Of all counties in the region, Pasco is the most critical in this problem. Pasco County does not have flood protection ordinances. As mentioned, the primary problems of development anticipated in Pasco County concern protection of life and property.

PINELLAS COUNTY ENVIRONMENTAL SYNOPSIS

Pinellas is the smallest and most densely populated county in the region. In growth rate, the county ranks third in the region. The trend toward service related industries for tourism and retirees is well established. Presently based on a retiree market, the Pinellas economy is moving toward diversification. While having the oldest median population in 1960 in the region, the county is becoming slightly younger and now ranks fourth in the region in maximum median age.

Pinellas County leads the region in tourist-related employment, as well as in retail trade. Employment in the medical and health services of Pinellas County is greater than the combined total employment in that category for the remainder of the region, indicating the well established retiree market.

To counter the rise in land and development costs, the Pinellas developer has started to intensify development. Typified by a sprawl of single family development in a relatively small land area, the move to higher density development was a logical necessity in order to avoid pressures for residential construction that would price the developer out of his market. The inability of the tax structure and needed support systems to keep up with the development demand has placed Pinellas County in a most perilous environmental situation.

Preservation Areas

The county contains a total of 88,323 acres of land and water in the preservation category. The lands, 12,193 acres, that remain today represent seven per cent of the county and seven per cent of the preservation land area left in the region. This total includes 11,375 acres of land area alone. Table 1.18 summarizes the preservation sub-categories shown in Figure 1.5 and in the Series One, Map 2 in the Atlas.

Conservation Areas

The conservation areas encompass 135,749 acres in Pinellas County. This is 77 per cent of the county and 19 per cent of the regional conservation area. The vast majority of this, 52 per cent, is in marginal lands. This land is nearly level, moderate to very poor drainage on broad flats with lakes, streams, ponds and swamps. The land is typified by low rid-

FIGURE 1.1
SERIES I
PRESERVATION ZONING MAP
PASCO COUNTY

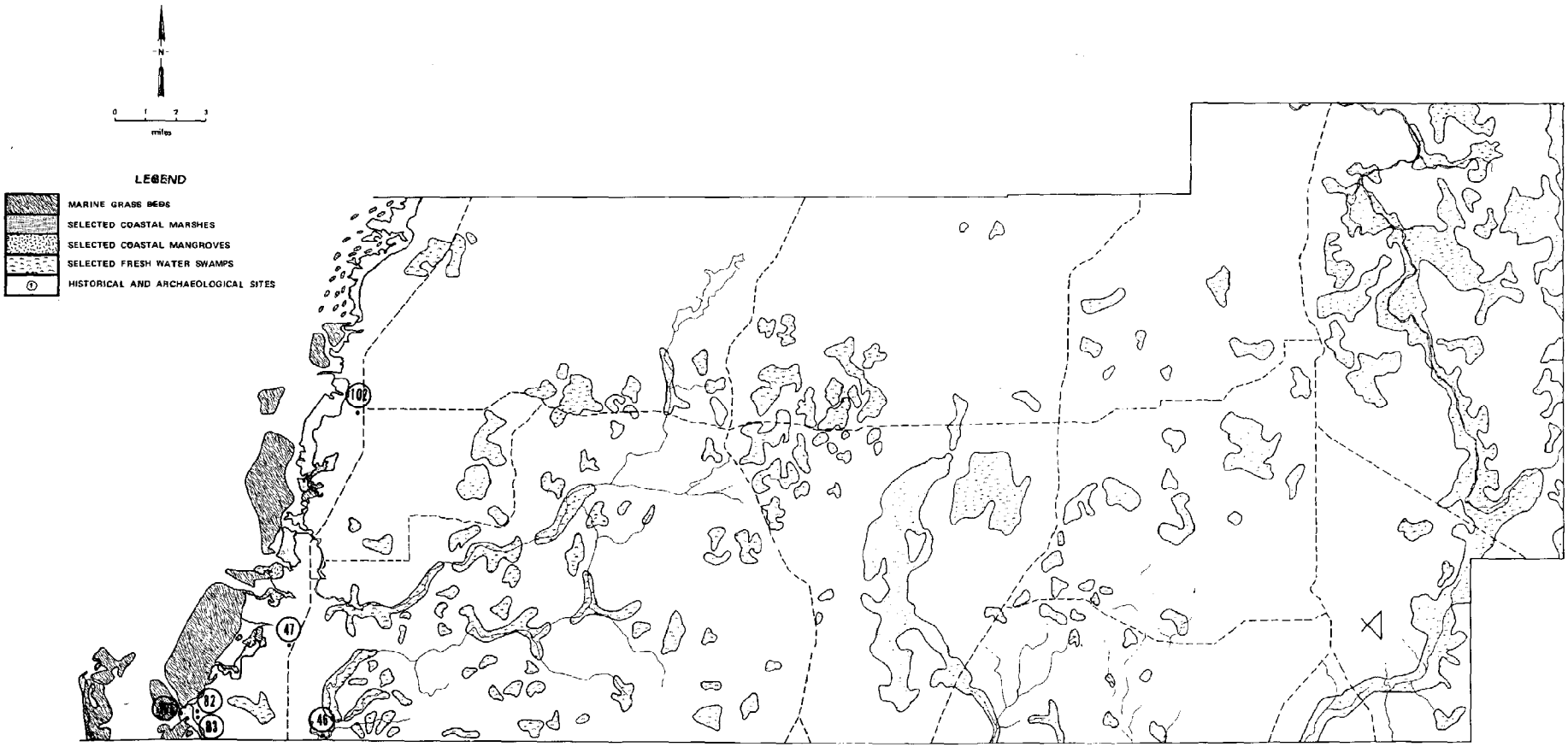


FIGURE 1.2
SERIES II
CONSERVATION ZONING MAP
PASCO COUNTY

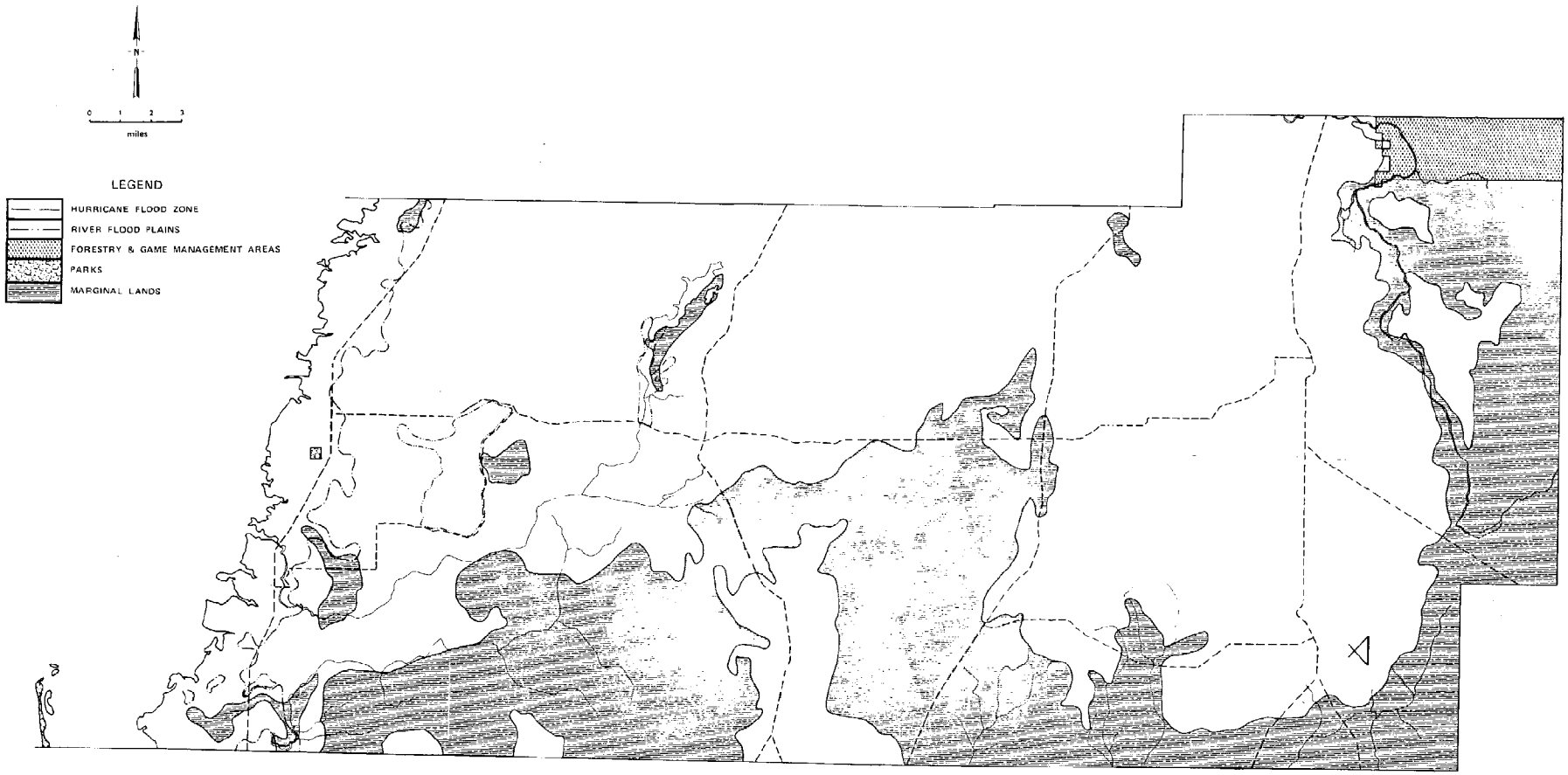


FIGURE 1.3
SERIES III
COMPOSITE DEVELOPMENT MAP
PASCO COUNTY

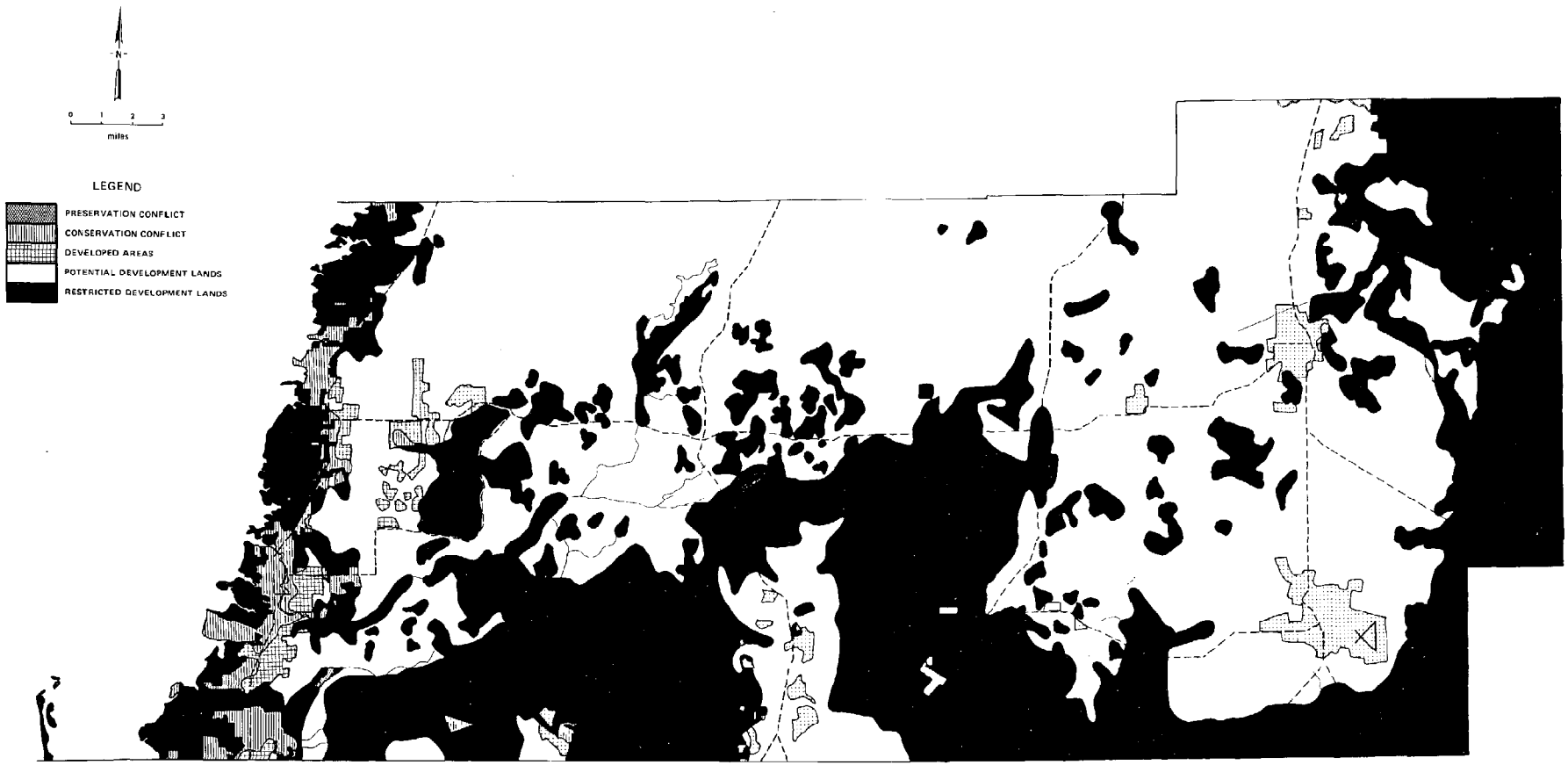


FIGURE 1.4
SERIES IV
WILDLIFE/VEGETATION ASSOCIATION MAP
PASCO COUNTY

ges with poorly defined drainageways.

Table 1.19 summarizes the conservation areas shown in Figure 1.6 and Series Two, Map 7 in the Atlas.

Conflict Areas

The totals for each category are based on natural conditions prior to development. The development that has taken place encroaches on areas within each zone. Table 1.20 summarizes these development conflicts for each category and they are shown in Figure 1.7 and in the Series Three, Map 12 in the Atlas.

Suitability Analysis

This county conflict acreage amounts to over 87 per cent of the developed land in the county and 57 per cent of the region's environmental conflicts. The areas remaining that are suitable for development, in gross acreage are summarized in Table 1.21 and their extent is shown in Figure 1.7 and in the Series Three, Composite Development Map 12. As explained in the regional analysis, the total area is reduced by various restrictions and results in the total area available for development without special restrictions.

Only 15 per cent of the county that is undeveloped is suitable for development without special restrictions. With the current development demand, this indicates that future development conflicts are a certainty.

Projection

The market growth calculations for Pinellas County indicate an additional 27,151 acres will be altered for development through 1975. The allocation of this acreage applied to the U.S. Bureau of the Census' Minor Civil Divisions (MCD's) indicates approximately 24,407 acres of this addition will generate environmental conflicts of varying degrees. This indicates that for every ten acres developed, 8.9 acres will generate conflicts, or become areas of critical environmental concern. Table 1.22 summarizes this data.

The following calculations show that the major areas of future conflicts are in the conservation zone. However, the greatest change is in the preservation zone and this emphasizes the need for special construction requirements; the data is shown in Table 1.23.

TABLE 1.18: PRESERVATION AREAS, PINELLAS COUNTY

CATEGORY	ACREAGE
Beaches	818
Freshwater Swamps	6,857
Aquatic Grasses	13,750
Coastal Mangrove	4,455
Coastal Marshes	63
Class II Waters	62,380
Total	88,323
Total Land Area Only	12,193
Historical/Archeological Sites	31

TABLE 1.19: CONSERVATION AREAS, PINELLAS COUNTY, 1972

CATEGORY	ACREAGE
Flood Zone	59,425
River Flood Plains	None
Parks	5,901
Marginal Land	70,468
Total	135,749

TABLE 1.20: DEVELOPMENT CONFLICTS, PINELLAS COUNTY, 1972

	ACREAGE
Preservation Conflict	0
Conservation Conflict	64,982
Total Conflict Acreage	64,982

TABLE 1.21: LAND SUITABLE FOR DEVELOPMENT, PINELLAS COUNTY, 1972

CATEGORY	ACREAGE
Undeveloped Area	101,512
Inland Water Area	(3,729)
Undeveloped Land Area	97,783
Net Preservation Land	(11,375)
Gross Developable Land	86,408
Net Conservation Land	(70,812)
Net Land Suitable for Development Without Special Restrictions	15,596

FIGURE 1.5
SERIES I
PRESERVATION ZONING MAP
PINELLAS COUNTY

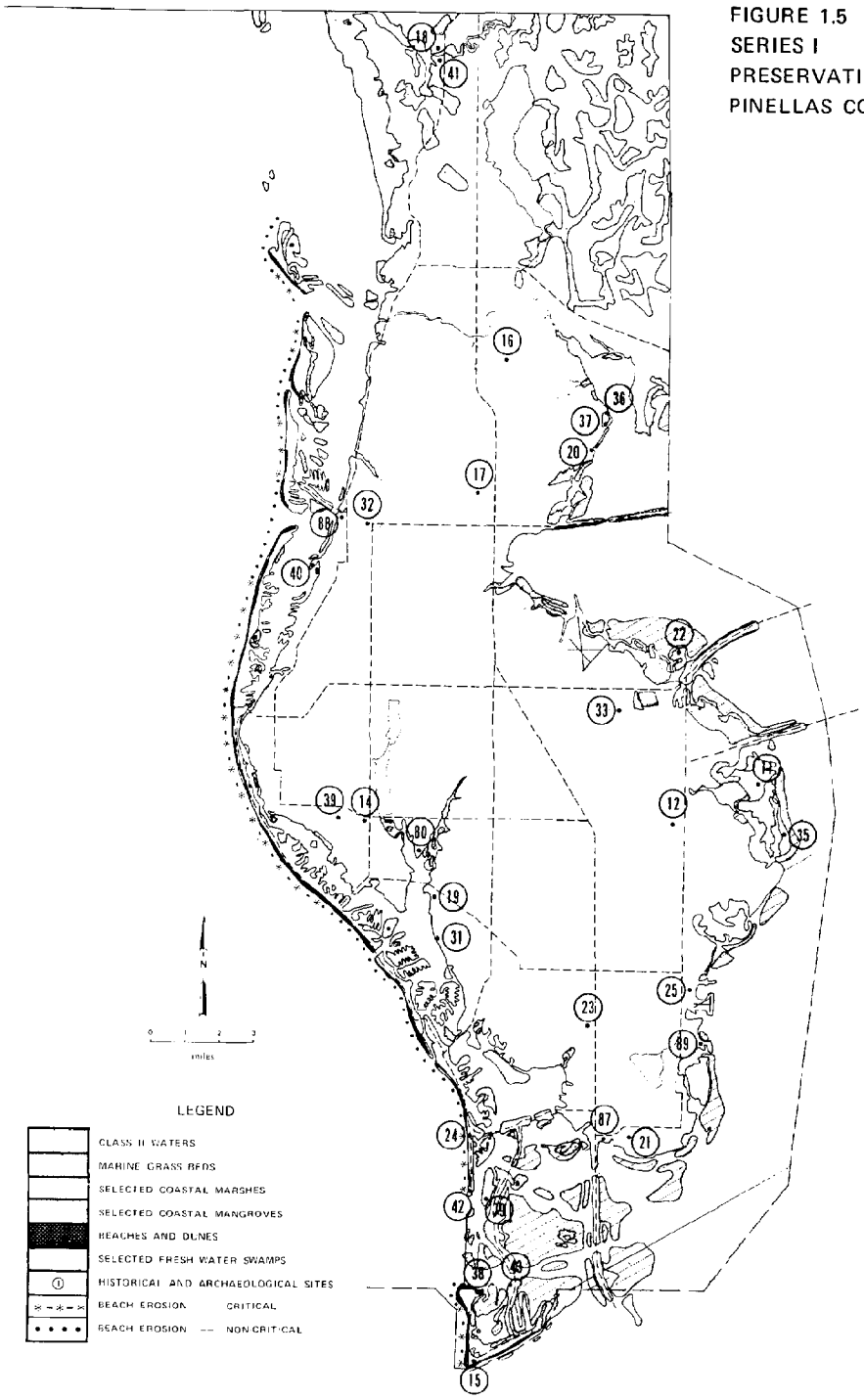
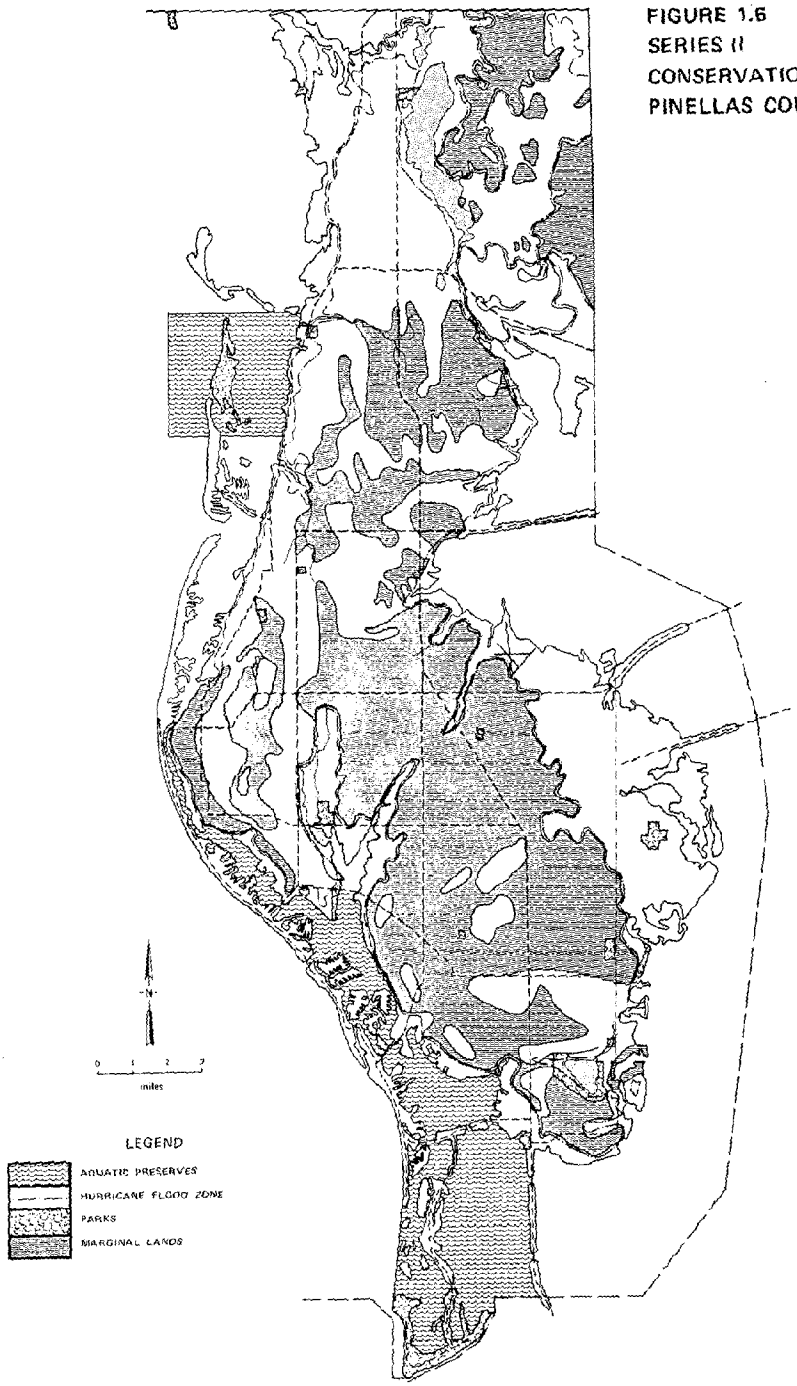


FIGURE 1.6
SERIES II
CONSERVATION ZONING MAP
PINELLAS COUNTY



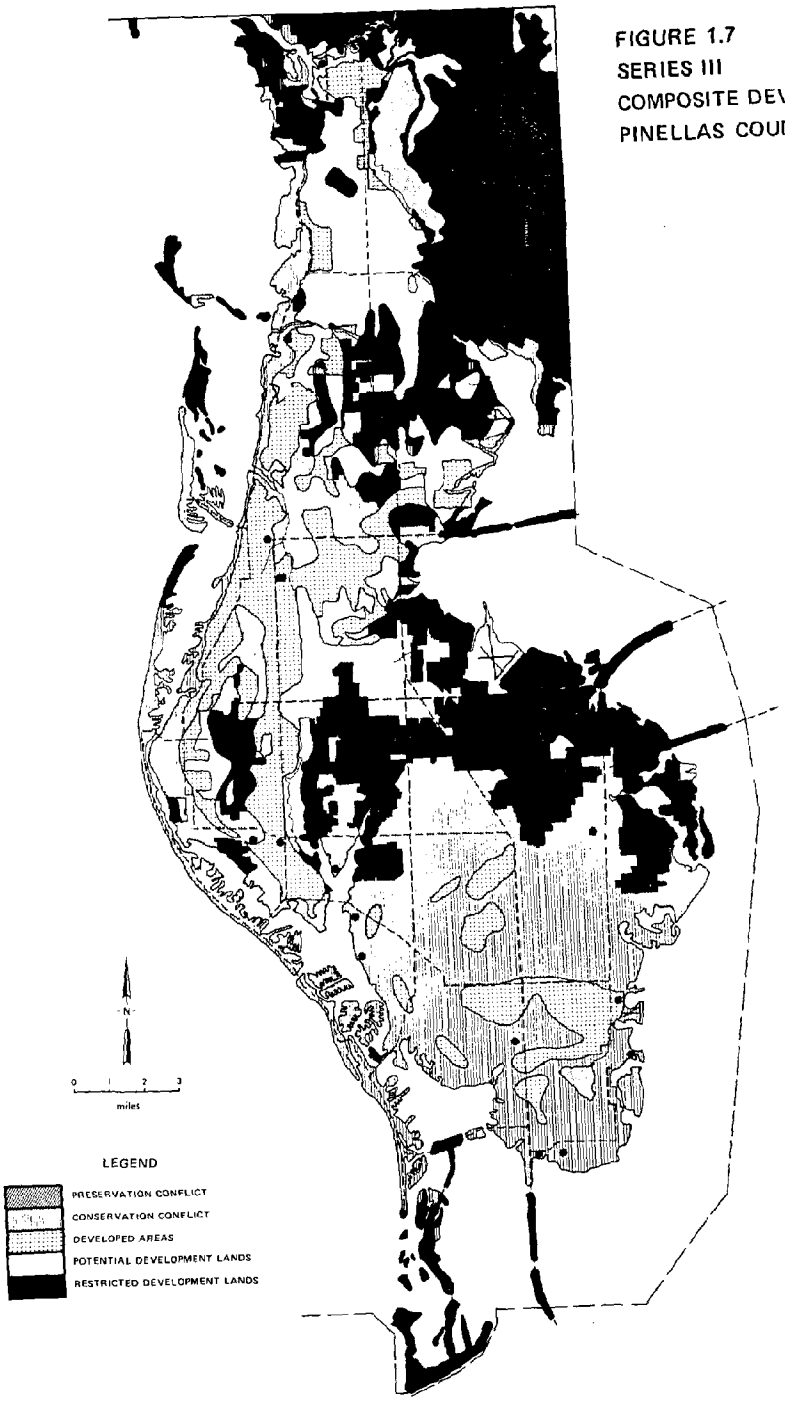


FIGURE 1.7
SERIES III
COMPOSITE DEVELOPMENT MAP
PINELLAS COUNTY

This analysis further indicates that the anticipated changes will increase developed land in the county by 35.9 per cent and simultaneously increase the total conflicts by 37.6 per cent. This data is summarized in Table 1.24.

General Impact Analysis

The effects of conflicts can be assessed only in general terms at this stage. The discussion is limited to overall environmental trends and observations throughout the county.

The habitat, ground cover, and wildlife modifications will occur in all habitats left in the county. This includes swamp forest, mangroves, sand pine, pine and oak, pine flatwoods, and the coastal strand. The extent of these areas is shown in Figure 1.8 and in the Series Four, Map 17 in the Atlas. The wildlife modifications can potentially affect three endangered species and two rare species of wildlife. The following table, Table 1.25 lists the species and their present status that can be affected. While the wildlife list is not exhaustive, it does indicate the major species of concern indigenous to the region.

The forestry and wildlife values involved are areas of high to medium priority. Furthermore, the vast majority of future development in Pinellas County should take place with special environmental restrictions on the development. This will allow development, but minimize the conflicts that are created. The special restriction areas are shown in Series Three, Map 12, Pinellas County.

Drainage alteration and flood problems are also anticipated unless careful design procedures are followed. The talent and technology to avert these problems exists. The question is, will it be used?

TABLE 1.22: FUTURE DEVELOPMENT CONFLICT, PINELLAS COUNTY, 1972–1975

	ACREAGE
Increase in Developed Land	27,151
Increase in Conflicts	24,407
Conflict to Development Ratio	.899

TABLE 1.23: FUTURE DEVELOPMENT CONFLICTS BY ZONE, 1972–1975 PINELLAS COUNTY

	ACREAGE
PRESERVATION ZONES	
Increase in Conflicts	1,460
Present Conflict Area	0
Total	1,460
Increase for the Period	1460%
CONSERVATION ZONES	
Increase in Conflicts	22,947
Present Conflict Area	64,982
Total	87,929
Increase for the Period	35.3%

TABLE 1.24: AGGREGATE DEVELOPMENT INCREASES, PINELLAS COUNTY, 1972–1975

CATEGORY	1972 ACREAGE	1975 ACREAGE	INCREASE
Total Developed Land	75,628	102,779	35.9%
Total Conflict Areas	64,982	89,389	37.6%

1972, Conflict Areas Occur in 85.9% of the Developed Area
1975, Conflict Areas Occur in 87.0% of the Developed Area

TABLE 1.25: SELECTED PINELLAS COUNTY WILDLIFE SPECIES FACING HABITAT MODIFICATIONS

BIRDS	STATUS
Eastern Brown Pelican	Endangered
Florida Great White Heron	Rare
Southern Bald Eagle	Endangered
Red-Cockaded Woodpecker	Rare
Eastern Reddish Egret	Peripheral
Roseate Spoonbill	Peripheral
Short-tailed Hawk	Peripheral
Florida Mangrove Cuckoo	Peripheral
Black-Whiskered Vireo	Peripheral
Wood Ibis	Undetermined
American Osprey	Undetermined
REPTILES	
Florida Indigo Snake	Endangered

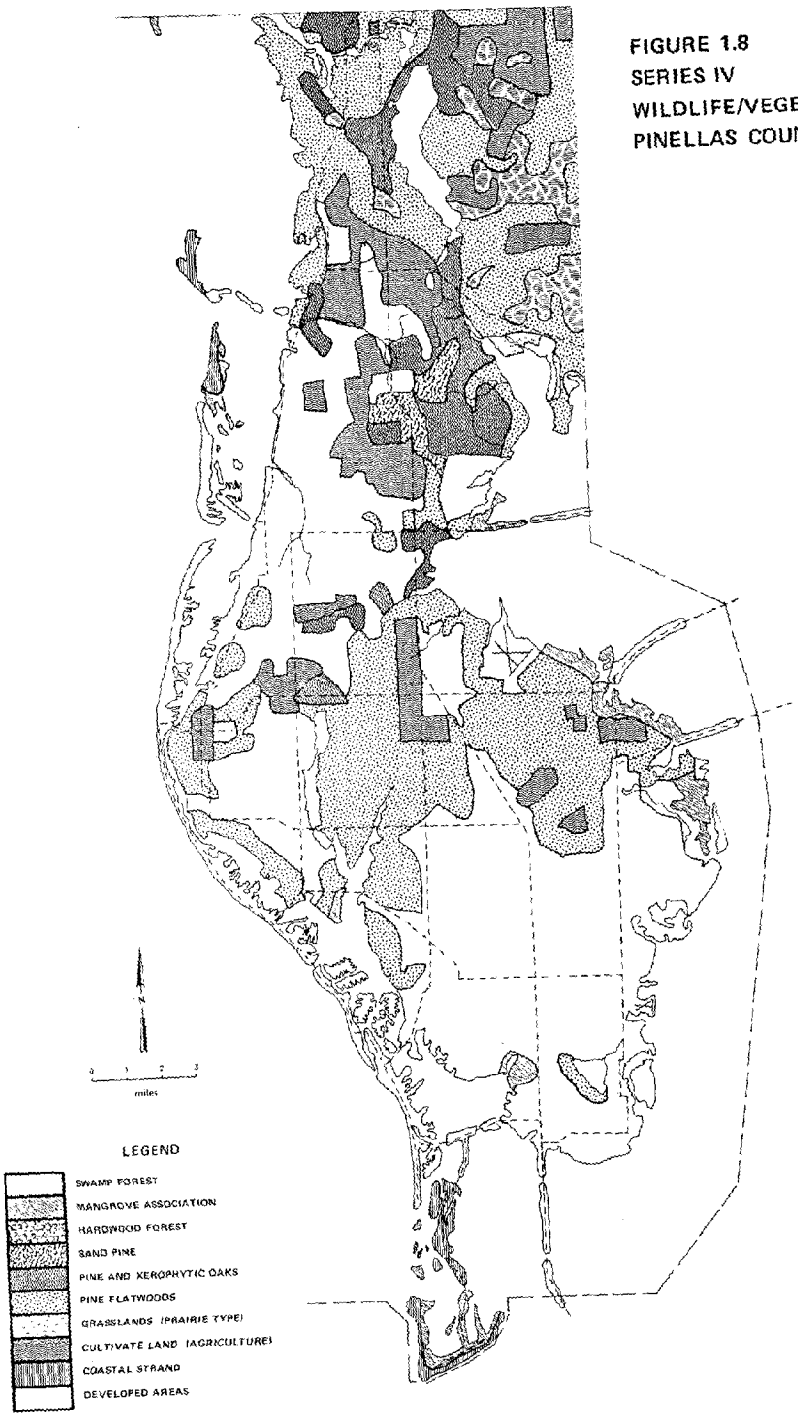


FIGURE 1.8
SERIES IV
WILDLIFE/VEGETATION ASSOCIATION MAP
PINELLAS COUNTY

FIGURE 1.9
SERIES I
PRESERVATION ZONING MAP
HILLSBOROUGH COUNTY

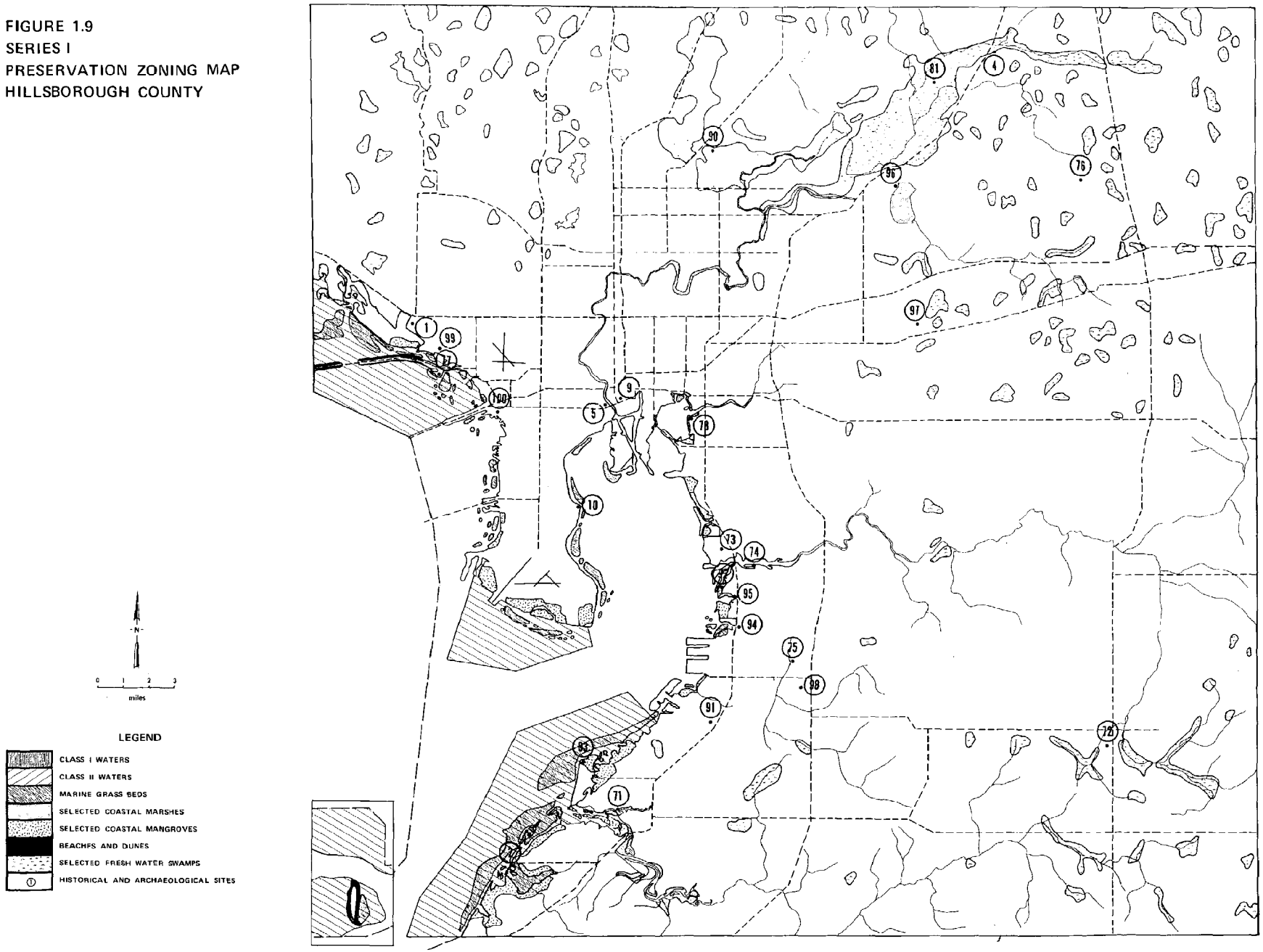
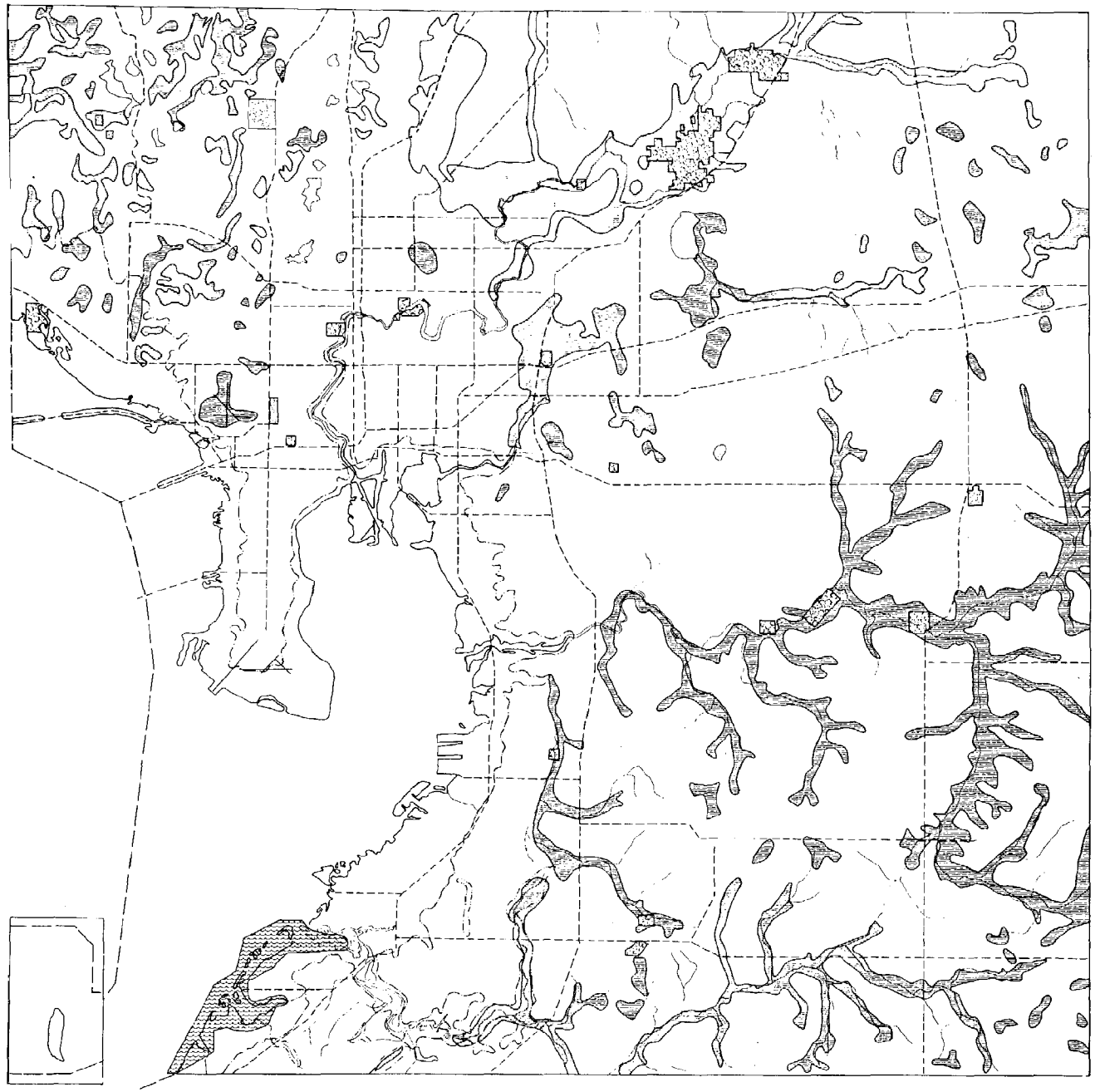
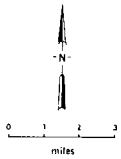


FIGURE 1.10
SERIES II
CONSERVATION ZONING MAP
HILLSBOROUGH COUNTY





LEGEND

- AQUATIC PRESERVES
- HURRICANE FLOOD ZONE
- RIVER FLOOD PLAINS
- PARKS
- MARGINAL LANDS

HILLSBOROUGH COUNTY ENVIRONMENTAL SYNOPSIS

Hillsborough is the largest county in the region and exhibits the most stable growth rate, as well as the most balanced one. It is the only county in the region to enjoy a natural increase, which accounts for 45 per cent of its annual population growth. Hillsborough's median age has been and still is the lowest in the region. Today, the county comes closest to matching state and national age trends which makes it unique in the region.

The diversification of the economic base is due primarily to the industrial orientation of the county. Hillsborough County remains the regional manufacturing center, with total manufacturing employment at 31,666, and the Port of Tampa as a major transportation hub. Wholesale trade in Hillsborough County is greater than the combined wholesale trade activity of the other counties in the region. Construction has grown at one of the most stable rates in the region. This may result from the county's apparent lack of desire to court the retiree market.

Preservation Areas

The size of the county is reflected throughout the environmental planning categories. The county contains 49,528 acres of land and water areas in the preservation area, with 42,376 acres in land alone. The land area is six per cent of the county area and over one-fourth of the total preservation area in the region. Table 1.26 summarizes the extent of the preservation areas and they are shown in Figure 1.9, and in Series One, Map 3 in the Atlas.

TABLE 1.26: PRESERVATION AREAS, HILLSBOROUGH COUNTY, 1972

CATEGORY	ACREAGE
Beaches	273
Mangroves	4,540
Coastal Marshes	2,835
Aquatic Grasses	7,425
Freshwater Swamps	34,728
Class III Waters	46,140
Total	95,941
Total Land	42,376
Historical/Archeological Sites	26

TABLE 1.27: CONSERVATION AREAS, HILLSBOROUGH COUNTY, 1972

CATEGORY	ACREAGE
Flood Zone	65,392
River Flood Plains	4,006
Parks	8,240
Marginal Land	78,110
Total	155,748

TABLE 1.28: DEVELOPMENT CONFLICTS, HILLSBOROUGH COUNTY, 1972

	ACREAGE
Preservation Conflict	3,114
Conservation Conflict	28,278
Total Conflict Acreage	31,392

Conservation Areas

In the conservation category, there are 155,748 acres in Hillsborough County. This is almost 23 per cent of the county and 22 per cent of the regional conservation category. Slightly over 50 per cent of this total is marginal land. This land is nearly level to gently sloping with moderately to very poorly drained soils. The topography is characterized by broad flats and coastal plain uplands to low ridges and poorly defined drainageways. Table 1.27 summarizes the extent of the conservation areas shown in Figure 1.10 and Series Two, Map 8 in the Atlas.

Conflict Areas

The totals for both zones are based on natural conditions prior to development. The development that has taken place encroaches on areas within each zone. Table 1.28 summarizes these development conflicts for each category and they are shown in Figure 1.11 and in the Series Three, Map 13 in the Atlas.

Suitability Analysis

The county conflict acreage amounts to only 28 per cent of the total present environmental conflicts. The increase reflects the fact that although the county is the most extensive in the region, development is intensively confined to the greater Tampa area. The concentration is noticable in that 31 per cent of the developed land in the county is in conflict areas.

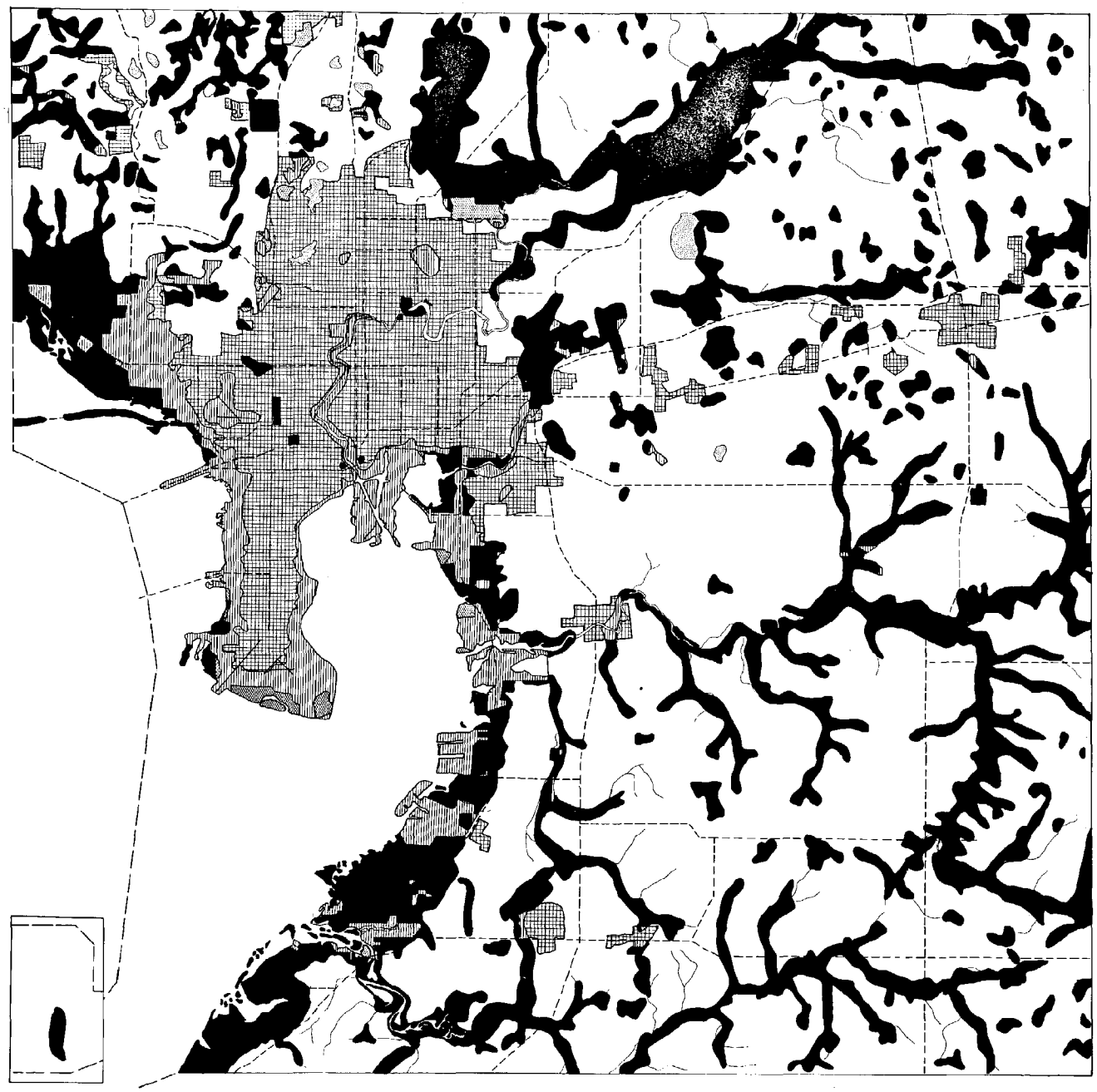
The areas remaining that are suitable for development are summarized in Table 1.29 and the Series Three, Map 13 in the Atlas. As explained in the regional analysis, the total area is reduced by various restrictions, and results in the land available for development without special restrictions.

Projection

Almost 70 per cent of the undeveloped land in the county is suitable for development without special restrictions. Although this is a major area, development trends indicate that conflicts must be anticipated.

The market growth calculations for Hillsborough County indicate an additional 23,332 acres will be altered for development through 1975. The allocation of this development when applied to U.S. Bureau of the Census' Minor Civil Divisions (MCD's) indicates approximately 4,888 acres of this addition will generate environmental conflicts of varying de-

FIGURE 1.11
SERIES III
COMPOSITE DEVELOPMENT MAP
HILLSBOROUGH COUNTY



LEGEND

- PRESERVATION CONFLICT
- CONSERVATION CONFLICT
- DEVELOPED AREAS
- POTENTIAL DEVELOPMENT LANDS
- RESTRICTED DEVELOPMENT LANDS

TABLE 1.29: LAND SUITABLE FOR DEVELOPMENT, HILLSBOROUGH COUNTY, 1972

CATEGORY	ACREAGE
Undeveloped Area	584,256
Inland Water Area	(10,086)
Undeveloped Land Area	574,170
Net Preservation Land	(38,989)
Gross Developable Land	535,181
Net Conservation Land	(127,470)
Net Land Suitable for Development Without Special Restrictions	407,711

TABLE 1.30: FUTURE DEVELOPMENT CONFLICTS, HILLSBOROUGH COUNTY, 1972–1975

	ACREAGE
Increase in Developed Land	23,332
Increase in Conflicts	4,888
Conflict to Development Ratio	.210

TABLE 1.31: FUTURE DEVELOPMENT CONFLICTS BY ZONE, HILLSBOROUGH COUNTY, 1972–1975

	ACREAGE
PRESERVATION ZONES	
Increase in Conflicts	1,395
Present Conflict Area	3,114
Total	4,509
Increase for the Period	44.8 %
CONSERVATION ZONES	
Increase in Conflicts	3,493
Present Conflict Area	28,278
Total	31,771
Increase for the Period	12.4 %

TABLE 1.32: AGGREGATE DEVELOPMENT INCREASES, HILLSBOROUGH COUNTY, 1972–1975

CATEGORY	1972 ACREAGE	1975 ACREAGE	INCREASE
Total Developed Land	100,234	123,566	23.3%
Total Conflict Areas	31,392	36,280	15.6%

1972, Conflict Areas Occur In 31.3% of the Developed Areas.
1975, Conflict Areas Occur in 29.4% of the Developed Areas.

grees. The analysis indicates that for every ten acres of development, two acres will generate conflicts, or become areas of critical environmental concern. This data is summarized in Table 1.30.

The following calculations show that the major areas of conflicts are in the conservation category. However, the greatest change is in the preservation category, emphasizing the need for special construction and development requirements.

This analysis further indicates that the anticipated changes will increase developed land in the county by 23.3 per cent and simultaneously increase development conflicts by 15.6 per cent. This analysis is summarized in Table 1.32.

General Impact Analysis

The effects of these conflicts can be assessed only in general terms at this stage. The discussion is limited to overall environmental trends and observations within the coastal zone.

The habitat, ground cover, and wildlife modifications will occur primarily in the swamp forest, mangrove, pine flatwoods and pine and oak habitats. The extent of these areas is shown in Figure 1.12 and in the Series Four, Map 18 in the Atlas.

The wildlife potentially indigenous to these habitats include three endangered and one rare species. Table 1.33 lists the species, and their present status, that can be affected. While the list is not exhaustive it indicates the major species of concern.

The forestry and wildlife values involved are within areas of high to medium priority. This indicates the need to officially formulate and adopt special environmental restrictions on development to insure conflicts are minimized. These special restriction areas as defined in this report are shown in Figure 1.11 and the Series Three, Map 13, Hillsborough County.

Much of the area in the Hillsborough coastal zone is subject to adverse alteration of drainage and this problem is naturally compounded in the flood zones. However, based largely on the county's size, topography and concentrated development patterns, the overall effect of development during the study period is much less severe than other counties in the region.

TABLE 1.33: SELECTED HILLSBOROUGH COUNTY WILDLIFE SPECIES FACING HABITAT MODIFICATIONS

	STATUS
MAMMALS	
Florida Panther	Endangered
BIRDS	
Eastern Brown Pelican	Endangered
Florida Great White Heron	Rare
Southern Bald Eagle	Endangered
Eastern Reddish Egret	Peripheral
Roseate Spoonbill	Peripheral
Short-Tailed Hawk	Peripheral
Florida Mangrove Cuckoo	Peripheral
Black-Whiskered Vireo	Peripheral
Wood Ibis	Undetermined
American Osprey	Undetermined
REPTILES	
Florida Indigo Snake	Endangered

MANATEE COUNTY ENVIRONMENTAL SYNOPSIS

Manatee County is the fourth most rapidly growing county in the region and with an average annual growth rate of 4.4 per cent ranks fourth in the total population. The economic activity in the county is diversified, but limited in scale. While per capita income has grown at a respectable rate, overall economic activity is still well below the regional average. A significant increase in construction activity is attributed largely to the current Port Manatee expansion program. However, the county has steadily been growing in residential construction activity and a stable diversified growth trend seems indicated in the Manatee County coastal zone.

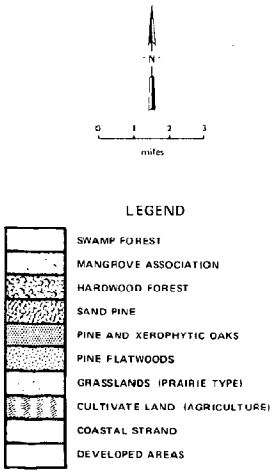
Preservation Areas

Manatee County has extensive preservation areas relative to its size. The preservation area in Manatee encompasses 43,303 acres including 14,469 acres of land. The preservation land represents nine per cent of the county and 26 per cent of the region's preservation lands. Table 1.34 summarizes the preservation areas in Manatee County and its extent is shown in Figure 1.13 and Series One, Map 4 in the Atlas.

TABLE 1.34: PRESERVATION AREAS, MANATEE COUNTY, 1972

CATEGORY	ACREAGE
Beach	262
Mangrove	3,385
Aquatic Grasses	10,934
Freshwater Swamps	9,259
Coastal Marshes	1,563
Class II Waters	17,900
Total	43,303
Total Land	14,469
Historical/Archeological Sites	20

FIGURE 1.12
SERIES IV
WILDLIFE/VEGETATION
ASSOCIATION MAP
HILLSBOROUGH COUNTY



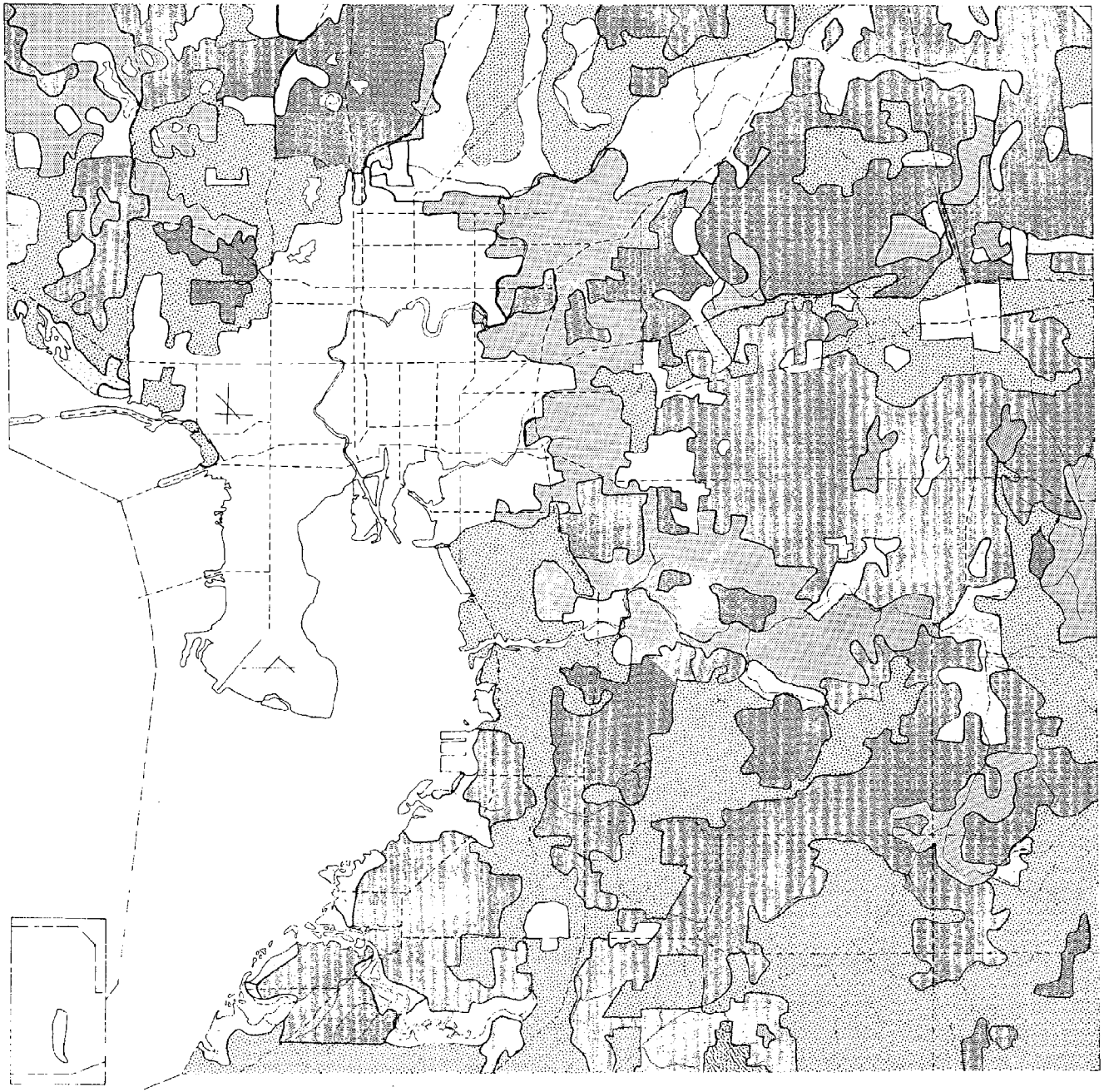


FIGURE 1.13
SERIES I
PRESERVATION ZONING MAP
MANATEE COUNTY

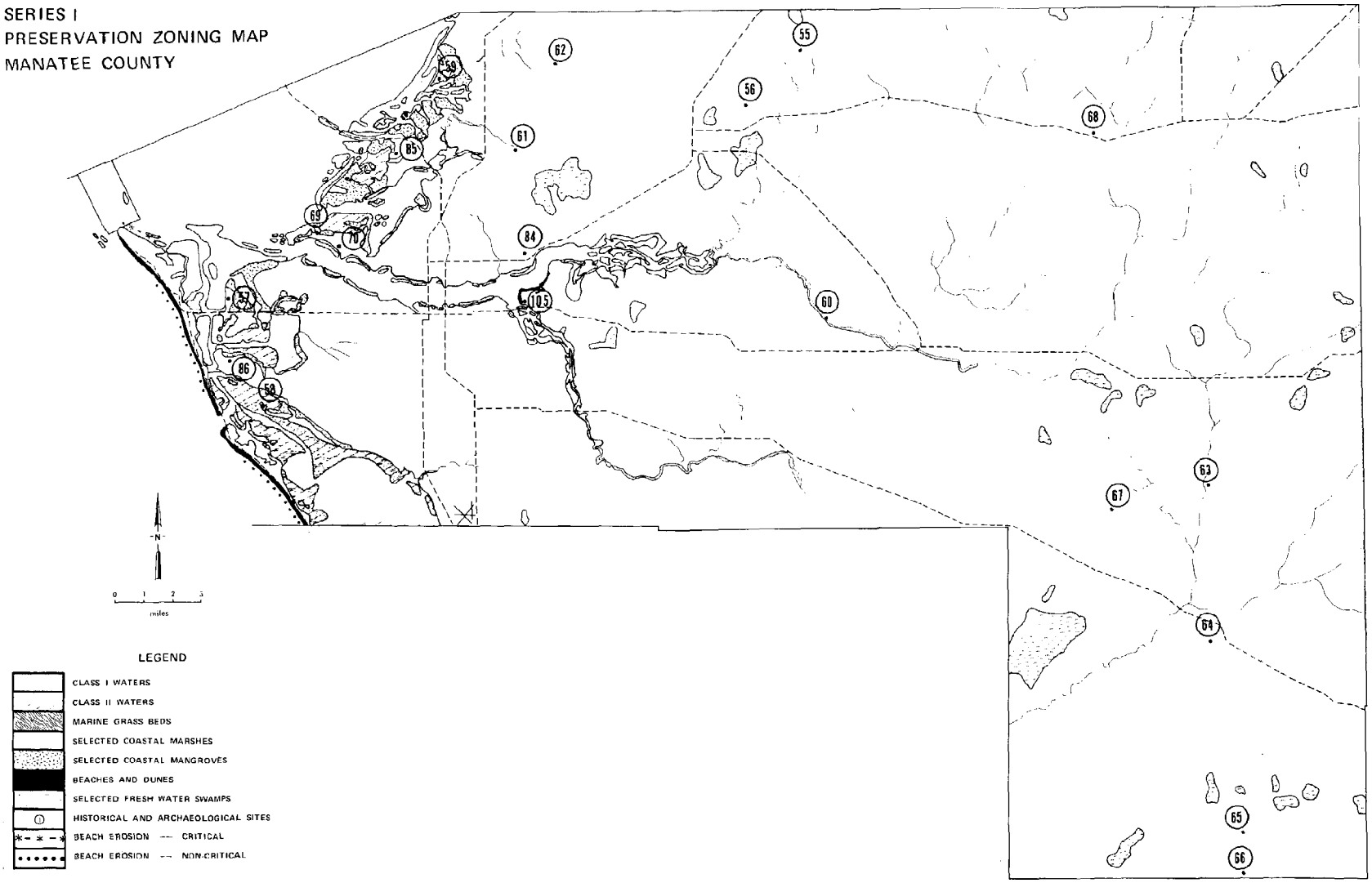


FIGURE 1.14
SERIES II
CONSERVATION ZONING MAP
MANATEE COUNTY

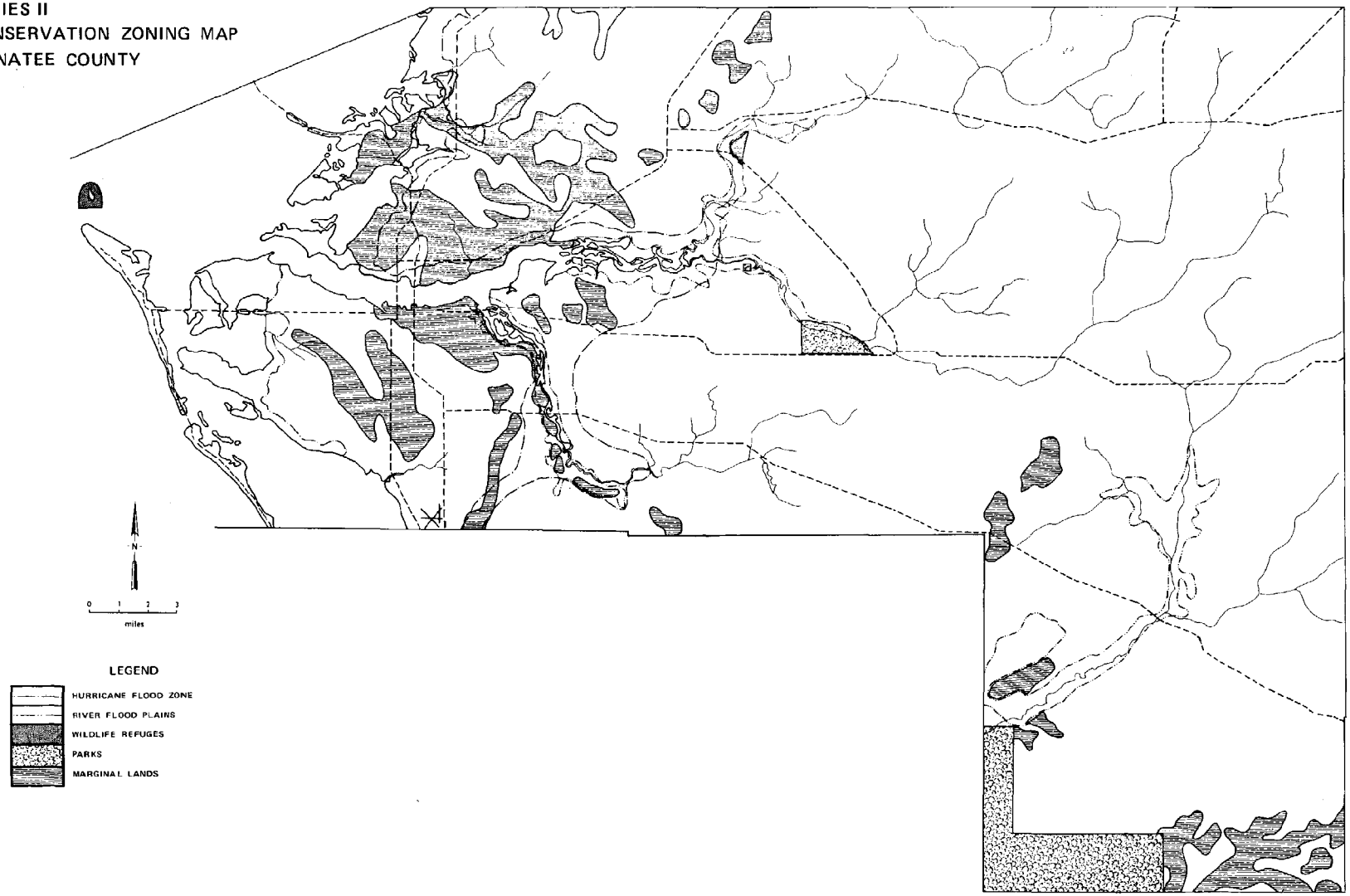


TABLE 1.35: CONSERVATION AREAS, MANATEE COUNTY, 1972

CATEGORY	ACREAGE
Flood Zone	47,305
River Flood Plains	18,360
Parks	10,994
Marginal Land	37,404
Total	114,063

TABLE 1.36: DEVELOPMENT CONFLICTS, MANATEE COUNTY, 1972

	ACREAGE
Preservation Conflict	198
Conservation Conflict	10,044
Total Conflict Acreage	10,242

TABLE 1.37: LAND SUITABLE FOR DEVELOPMENT, MANATEE COUNTY, 1972

CATEGORY	ACREAGE
Undeveloped Area	467,864
Inland Water Area	(8,972)
Undeveloped Land Area	458,892
Net Preservation Land	(14,009)
Gross Developable Land	444,883
Net Conservation Land	(104,019)
Net Land Suitable for Development Without Special Restrictions	340,864

TABLE 1.38: FUTURE DEVELOPMENT CONFLICTS, MANATEE COUNTY, 1972–1975

CATEGORY	ACREAGE
Increase in Developed Land	4,965
Increase in Conflicts	4,446
Conflict to Development Ratio	.895

Conservation Areas

In the conservation areas, Manatee County encompasses 114,063 acres or 23 per cent of the county and 16 per cent of the regional zone. Marginal land represents one-third of the category. This land is nearly level to gently sloping with poor to excessively drained soils. Mostly sandy, the topography is typified by broad flats and moderately high ridges. Much of this land is freshwater swamps, coastal mangrove and marsh, subject to inundation. Table 1.35 summarizes the conservation areas shown in Figure 1.14 and Series Two, Map 9 in the Atlas.

Conflict Areas

The zoning totals are based on natural conditions prior to development. Development has encroached into these areas, however, and Table 1.36 summarizes the conflicts shown in Figure 1.15 and Series Three, Map 14 in the Atlas.

The Manatee County conflict areas amount to almost one-third of the county's developed areas. This reflects the fact that almost all development is concentrated in the coastal zone and localized in the Bradenton-Palmetto area.

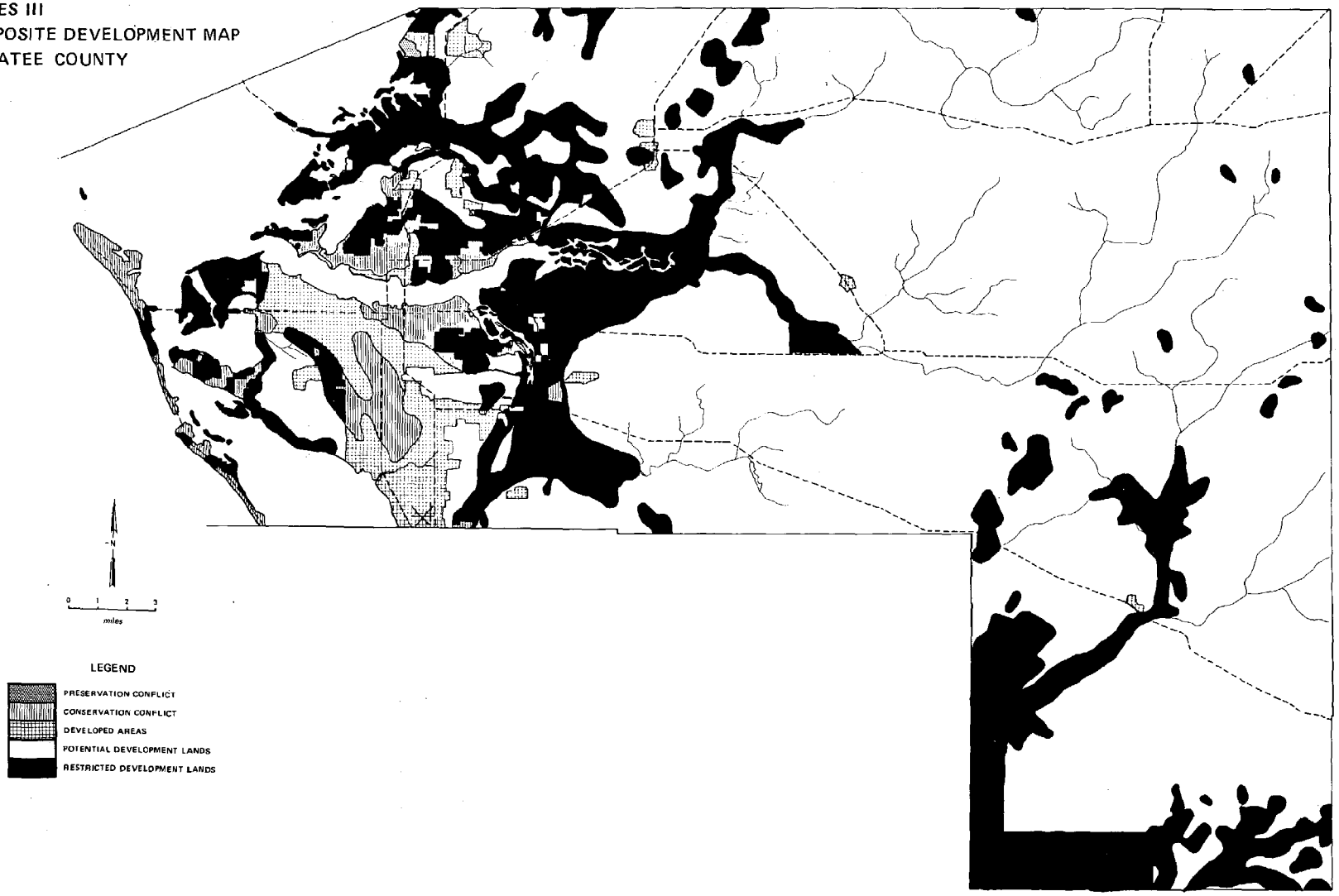
Only a relatively small portion of Manatee County is developed. The remaining areas suitable for development are summarized in Table 1.37 and their extent shown in Figure 1.15 and the Series Three, Map 14 in the Atlas. As explained in the regional analysis, the total area is reduced by various restrictions and results in the land available for development without special restrictions.

Projection

Although this 340,864 acres is almost three-fourths of the undeveloped land left in the county, the centralized development patterns indicate development conflicts should be anticipated.

The market growth calculations indicate an additional 4,965 acres will be altered for development through 1975. The allocation of this development applied to the U.S. Bureau of the Census' Minor Civil Divisions (MCD's) indicates approximately 4,446 acres of this addition will generate environmental conflicts of varying degrees. The analysis indicates that for every ten acres developed, almost nine will generate conflicts, or become areas of critical environmental concern. This data is summarized in Table 1.39.

FIGURE 1.15
SERIES III
COMPOSITE DEVELOPMENT MAP
MANATEE COUNTY



The following calculations show that the major source of conflicts is in the conservation category. However, the greatest change is in the preservation category. This emphasizes the need for special construction and development requirements.

This analysis further indicates, that anticipated changes will increase developed land in the county by 14.4 per cent and simultaneously increase development conflicts by 43.4 per cent. This analysis is summarized in Table 1.40.

General Impact Analysis

The effects of these conflicts can be assessed only in general terms at this stage. The discussion is limited to the overall environmental trends within the coastal zone.

The habitat, ground cover, and wildlife modifications will occur primarily in the mangrove, prairie type grasslands and the coastal strand association. The extent of this area is shown in Figure 1.16 and in the Series Four, Map 19 in the Atlas. In Manatee County, this affects bird populations primarily, and potentially includes one endangered and three rare species. Table 1.41 lists the species and their present status. While the list is not exhaustive, it indicates the major species of concern.

The major areas of development either lie in or adjacent to flood zone areas. In addition, the development anticipated in Manatee County suggests overland runoff drainage alterations in pattern, content and volume. These runoff characteristics should be closely watched to avert water degradation. Should this take place, significant changes in the local marine ecology may take place. This will reinforce the direct efforts of habitat modifications by altering the food chain in the area.

Manatee County should place particular emphasis on special environmental development restrictions.

SARASOTA COUNTY ENVIRONMENTAL SYNOPSIS

Sarasota County is the second fastest growing county in the region in total population. The county has shown the most uniform annual rate of growth, with a consistent average annual increase of 5.7 per cent. Economic activity, as indicated by employment, is concentrated in retail trade and selected services, with a minor proportion of economic activity devoted to manufacturing and agricul-

TABLE 1.39: FUTURE DEVELOPMENT CONFLICTS BY ZONE, MANATEE COUNTY, 1972–1975

	ACREAGE
PRESERVATION ZONES	
Increase in Conflicts	353
Present Conflict Area	198
Total	551
Increase for the Period	178%
CONSERVATION ZONES	
Increase in Conflicts	4,093
Present Conflict Area	10,044
Total	14,137
Increase for the Period	40.8%

TABLE 1.40: AGGREGATE DEVELOPMENT INCREASES, MANATEE COUNTY, 1972–1975

CATEGORY	1972 ACREAGE	1975 ACREAGE	INCREASE
Total Developed Land	34,536	39,501	14.4%
Total Conflict Areas	10,242	14,688	43.4%

1972, Conflict Areas Occur in 29.7% of the Developed Areas
1975, Conflict Areas Occur in 37.2% of the Developed Areas

TABLE 1.41: SELECTED MANATEE COUNTY WILDLIFE SPECIES FACING HABITAT MODIFICATIONS

	STATUS
BIRDS	
Eastern Brown Pelican	Endangered
Florida Great White Heron	Rare
Florida Sandbill Crane	Rare
Red-Cockaded Woodpecker	Rare
Eastern Reddish Egret	Peripheral
Roseate Spoonbill	Peripheral
Florida Mangrove Cuckoo	Peripheral
Black-Whiskered Vireo	Peripheral
Florida Burrowing Owl	Undetermined
Florida Grasshopper Sparrow	Undetermined

FIGURE 1.16
SERIES IV
WILDLIFE/VEGETATION ASSOCIATION MAP
MANATEE COUNTY

ture. However, per capita income in the county exceeds that of any other county in the region. The retiree orientation found in Sarasota County is evidenced by the increasing median age of the county. Sarasota is now second only to Pasco County in the oldest median age in the region. Development is localized in the coastal zone, but there is no longer a significant concentration. Development has spread south from Sarasota and north from Venice into an almost continuous band of coastal development.

Preservation Areas

The county has extensive unaltered preservation areas relative to its size. This is probably the result of the county's development patterns. The preservation category in Sarasota County encompasses 27,293 acres with 25,428 acres of land area. The land area represents six per cent of the county and almost 16 per cent of the region's conservation areas. Table 1.42 summarizes the preservation area categories; the extent of this area is shown in Figure 1.17 and in Series One, Map 5 in the Atlas.

Conservation Areas

In the conservation category, Sarasota County encompasses 114,063 acres or almost 29 per cent of the county and 16 per cent of the region's conservation zone. Marginal land represents slightly over half of this zone. This land is nearly level with poorly drained soils. Sandy throughout, the topography is characterized by broad flats with poorly defined drainageways and depressions. Table 1.43 summarizes the conservation area shown in Figure 1.18 and Series Two, Map 10 in the Atlas.

Conflict Areas

The category totals are based on natural conditions prior to development. Development has encroached into these zones, however, and Table 1.44 summarizes the conflicts shown in Figure 1.19 and Series Three, Map 15 in the Atlas.

These Sarasota County conflict totals amount to only two per cent of the developed area in the county and only one per cent of the conflict area in the region.

Although relatively little of Sarasota County is developed, 13.5 per cent, the remaining areas suitable for development are summarized in Table 1.45 and their extent shown in Figure 1.19 and the Series Three, Map 15 in the Atlas. As explained in the regional analysis, the total

TABLE 1.42: PRESERVATION AREAS, SARASOTA COUNTY, 1972

CATEGORY	ACREAGE
Beaches	573
Mangrove	1,640
Aquatic Grasses	1,430
Freshwater Swamps	23,215
Class II Waters	435
Total	27,293
Total Land	25,428
Historical/Archeological Sites	9

TABLE 1.43: CONSERVATION AREAS, SARASOTA COUNTY, 1972

CATEGORY	ACREAGE
Flood Zone	27,912
River Flood Plains	8,753
Parks	20,533
Marginal Land	59,160
Total	116,358

TABLE 1.44: DEVELOPMENT CONFLICTS, SARASOTA COUNTY, 1972

	ACREAGE
Preservation Conflict	414
Conservation Conflict	763
Total Conflict Acreage	1,177

TABLE 1.45: LAND SUITABLE FOR DEVELOPMENT, SARASOTA COUNTY, 1972

CATEGORY	ACREAGE
Undeveloped Area	344,008
Inland Water Area	(1,681)
Undeveloped Land Area	342,327
Net Preservation Land	(24,441)
Gross Developable Land	317,886
Net Conservation Land	(115,595)
Net Land Suitable for Development Without Special Restrictions	202,291

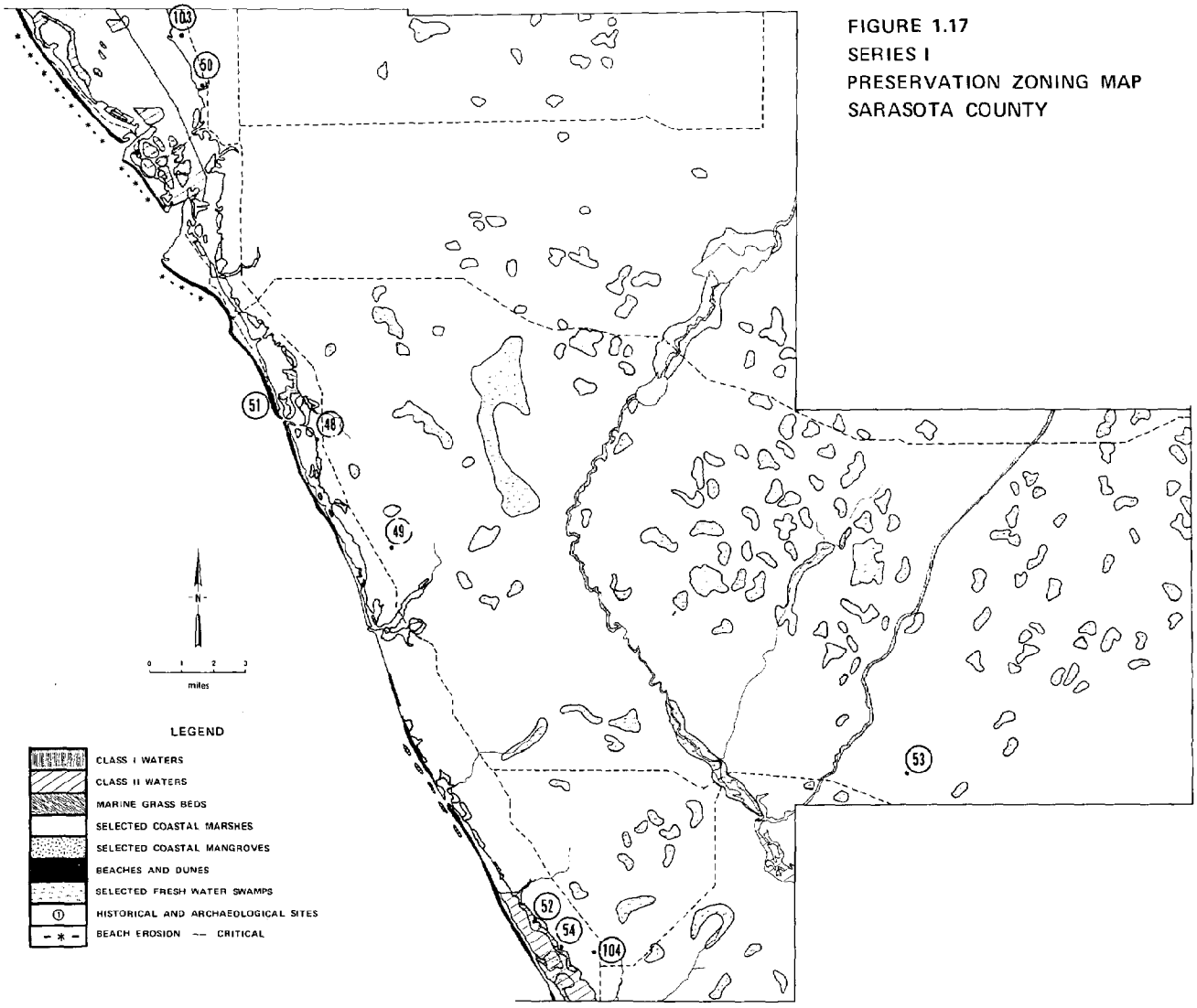


FIGURE 1.17
SERIES I
PRESERVATION ZONING MAP
SARASOTA COUNTY

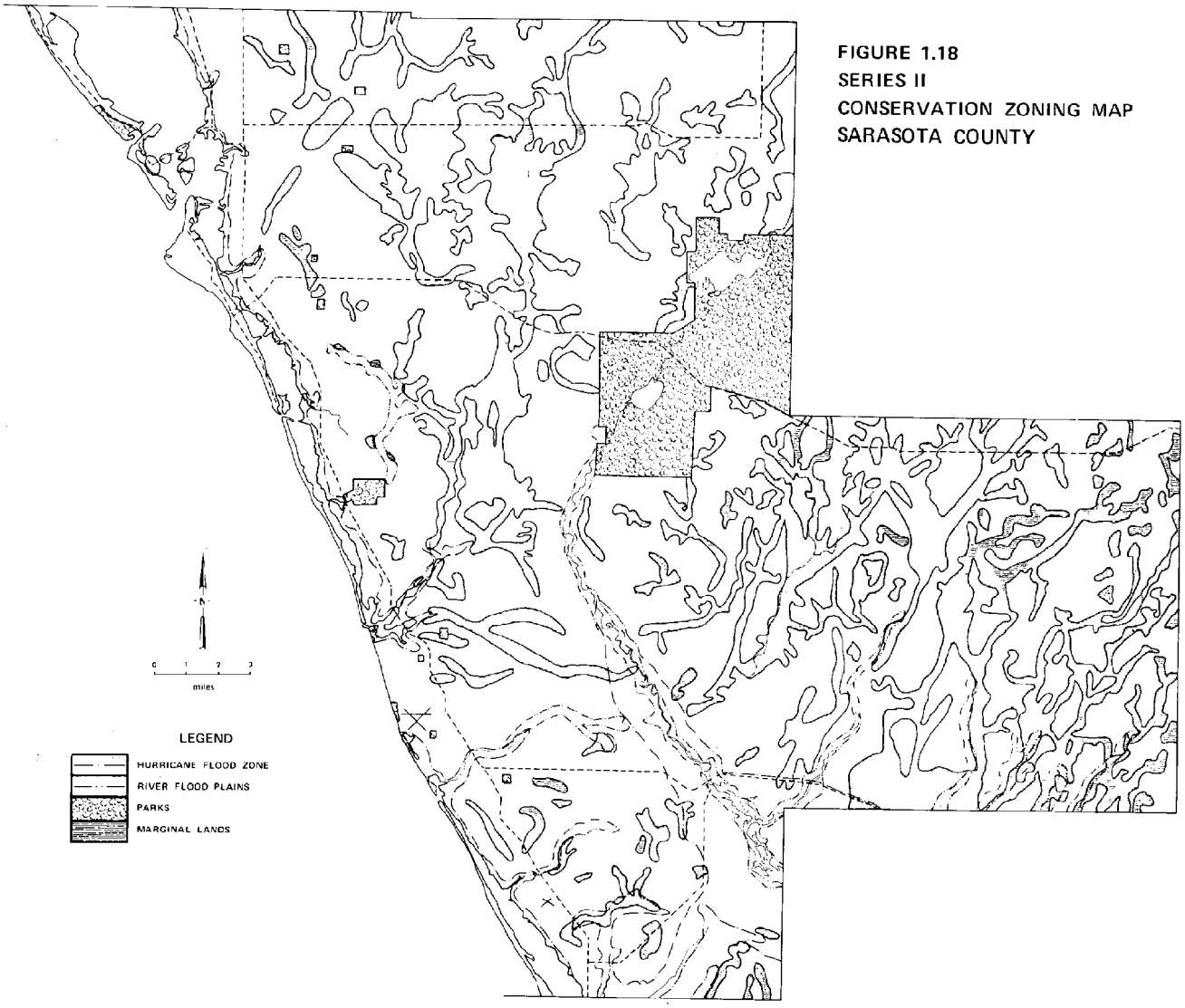


FIGURE 1.18
SERIES II
CONSERVATION ZONING MAP
SARASOTA COUNTY

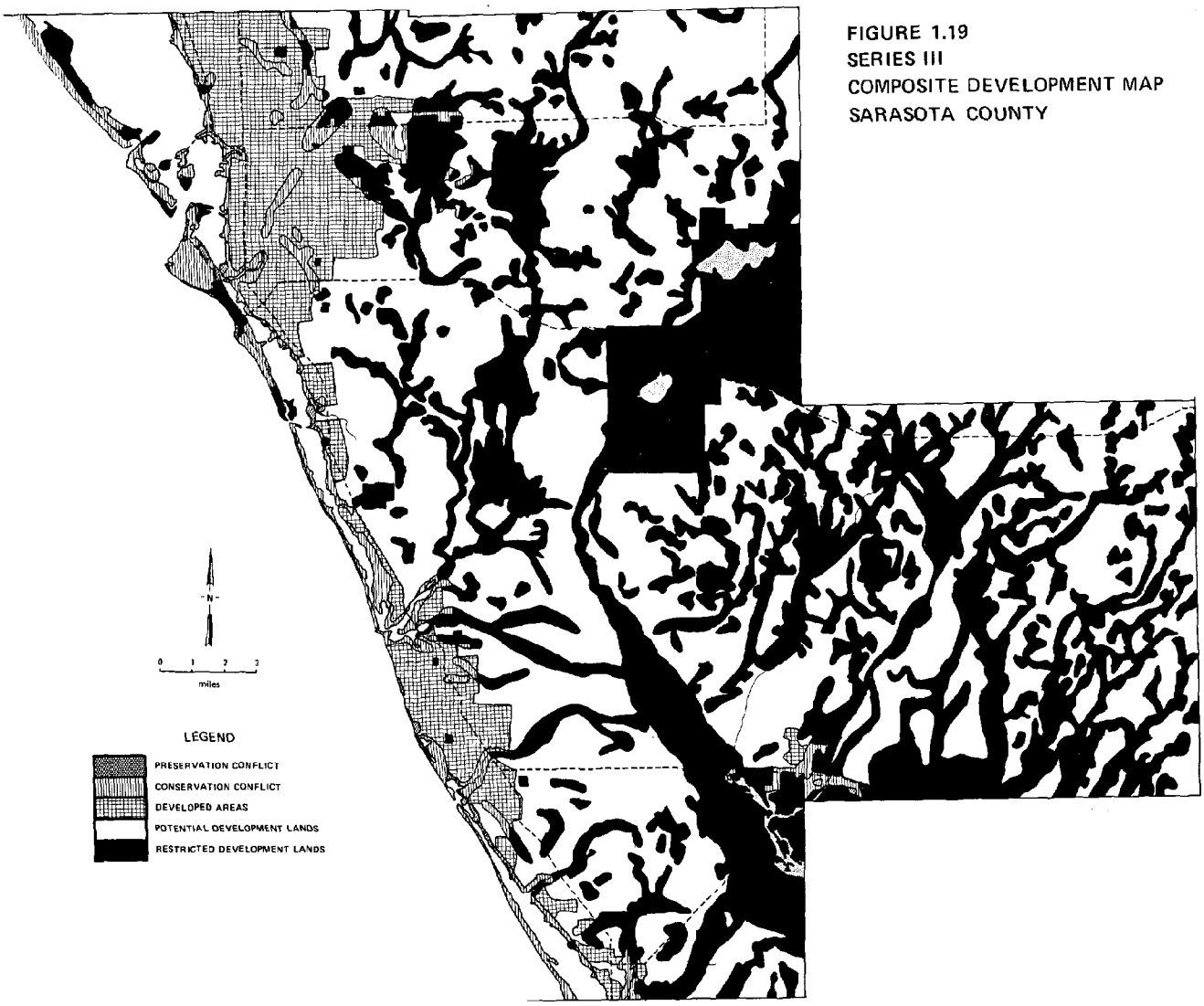


FIGURE 1.19
SERIES III
COMPOSITE DEVELOPMENT MAP
SARASOTA COUNTY

area is reduced by various restrictions and results in the land available for development without special restrictions.

Future Conflict Analysis

Although the 202,291 acres is close to 60 per cent of the undeveloped land left in the county, the coastal development pattern of Sarasota County indicates that future development conflicts should be anticipated.

The market growth calculations indicate an additional 6,061 acres will be altered by development through 1975. The allocation of this development applied to the U.S. Bureau of the Census' Minor Civil Divisions (MCD's) indicates approximately 1,659 acres of this addition will generate environmental conflicts of varying degrees. This indicates that for every ten acres developed, 2.7 acres will generate conflicts or become areas of critical environmental concern. This data is summarized in Table 1.46.

The following calculations show that the major source of conflicts is in the conservation zone. Sarasota is the only county in this report that does not indicate a greater change in the preservation conflicts than in the conservation conflicts.

This analysis further indicates that the anticipated changes will increase the developed land by 6.3 per cent and simultaneously increase development conflicts 82.6 per cent. This analysis is summarized in Table 1.48.

General Impact Analysis

The effects of these conflicts can be assessed only in general terms at this stage. The discussion is limited to the overall environmental trends within the coastal zone.

The habitat, ground cover and wildlife modifications will occur primarily in the coastal strand and the pine and xerophytic oak associations. The extent of these areas is shown in Figure 1.20 or Series Four, Map 20 in the Atlas. This is anticipated to have little significance, for development is expected primarily to intensify in areas that are predominately urbanized at the present. The only potential exception anticipated may come in pine flatwood areas.

The alterations of drainage patterns and the content thereof is fairly set from previous alteration of the land. The only concern is the protection of marine resources in the local bays. For the study period, the value of the marine resources do not face significant impairment.

TABLE 1.46: FUTURE DEVELOPMENT CONFLICTS, SARASOTA COUNTY, 1972–1975

CATEGORY	ACREAGE
Increase in Developed Land	6,061
Increase in Conflicts	1,659
Conflict to Development Ratio	.274

TABLE 1.47: FUTURE DEVELOPMENT CONFLICTS BY AREA, SARASOTA COUNTY, 1972–1975

	ACREAGE
PRESERVATION ZONES	
Increase in Conflicts	529
Present Conflict Area	414
Total	923
Increase for the Period	127.8%
CONSERVATION ZONES	
Increase in Conflicts	1,130
Present Conflict Area	763
Total	1,893
Increase for the Period	148.1%

TABLE 1.48: AGGREGATE DEVELOPMENT CONFLICTS, SARASOTA COUNTY, 1972–1975

CATEGORY	1972 ACREAGE	1975 ACREAGE	INCREASE
Total Developed Land	53,792	59,853	11.3%
Total Conflict Areas	1,177	2,836	140.9%

1972, Conflict Areas Occur in 2.2% of the Developed Areas
1975, Conflict Areas Occur in 4.7% of the Developed Areas

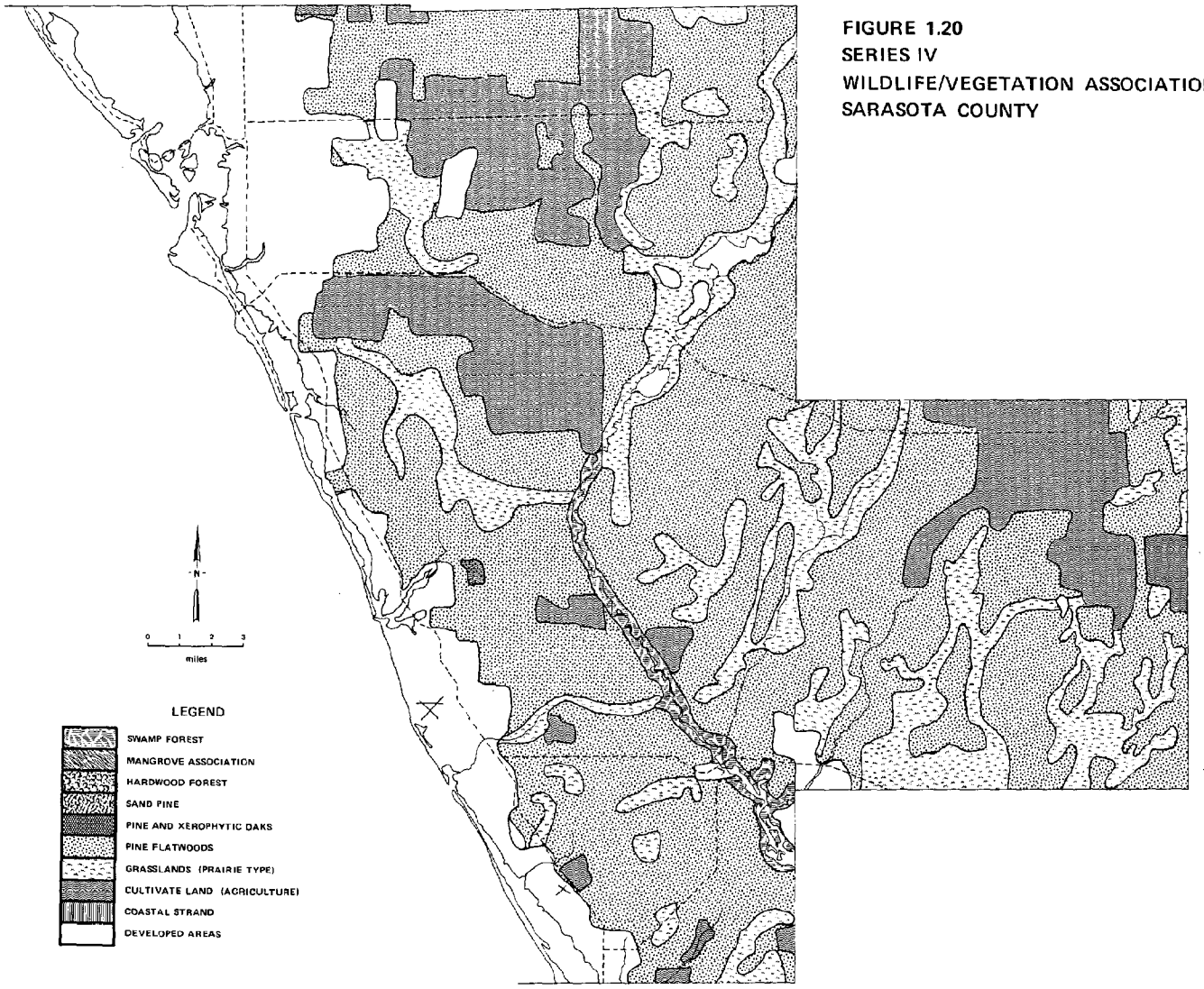
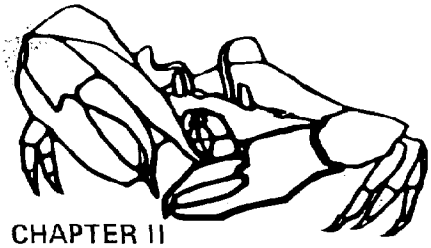


FIGURE 1.20
SERIES IV
WILDLIFE/VEGETATION ASSOCIATION MAP
SARASOTA COUNTY



CHAPTER II

Resource Inventory

The purpose of this chapter is to identify major elements of the region's resource base, including a resource inventory, existent and potential problems and finally a discussion of resource economics. Those items that have been well documented in other publications are lightly described, unless they play a major role in the development of the region.

CLIMATE

The climate of the Tampa Bay Region is characterized by long, warm and relatively humid summers and mild, relatively dry winters. Annual total rainfall averages between 50 and 55 inches throughout the area, but is quite unevenly distributed during the year. Generally more than one-half the total annual rainfall occurs during the four summer months, June through September. The period from April to late May is quite dry, with the summer shower season starting at the end of this drought period. More recent trends indicate the drought period now extends into mid-June.

Tropical storms tend to occur in the summer and fall months and bring copious rain to local areas. The short heavy storms delivering up to nine inches of rain in a 24 hour period are typical of this period for the entire region. The longer storms (four to seven days) occur more frequently inland from Tampa Bay proper. Abnormally high rainfall is expected about once every 25 years, on the average.

The region has been quite fortunate relative to hurricane activity and with the exception of recent damage from Agnes passing far out in the Gulf of Mexico, no activity of significance has occurred since the early sixties. However, the probability of a hurricane hitting the region in any given year is approximately one in twenty. Recent computer simulation tests of hurricane impact indicate a direct attack, angling into Tampa Bay could create extensive flooding throughout the entire coastal lowland portion of the region.

LAND AND WATER RESOURCES

Geology

The geological formations in the region represent all but the Paleocene Epoch of the Cenozoic Era. The calendar age of this era is estimated at about 50 million years.

Of particular interest are the geological constraints these formations place on the groundwater. Over most of the area, water is confined to the artesian aquifer by impervious sediments of the Miocene Hawthorn Formation. This formation not only confines the water in areas where flowing wells are possible, but it also restricts recharge.

In the northern part of the region, the limestones and dolomites of the artesian aquifer are exposed at the ground surface or they are covered by unconsolidated porous sands. In this area artesian leakage and springs are present that sustain the flow of water in surface streams which cross the exposed rocks to the coast. This leakage is present except where the cover of sand is thick and the rainfall is sufficient to maintain shallow groundwater tables at elevations higher than the artesian head. In such cases, large quantities of rainfall are absorbed by the porous sand and the water becomes a part of the artesian system by flowing from the sand body into the underlying rock. This relationship is better expressed in Table 2.1, as it relates to Figure 2.1. The table describes the superficial formations and their composition and the figure demonstrates their disposition throughout the region.

PHYSIOGRAPHY

The Tampa Bay Region lies within two of the five natural physiographic regions of Florida, these regions are the coastal lowlands and the central highlands. The elevations range between sea level in the west and 200 feet in the east and include a diversity of land forms, from low, nearly level plains to rolling hills. The land forms include numerous intermittent ponds, swamps and marshes, as well as many lakes and streams.

The soil conditions in these topographic formations are relatively complex. The complexity is the result of the geological formations, the rise and fall of the seas over time and a variety of other climatic conditions.

Along the coast, thick beds of sands occur which are excessively drained. These soils occur on nearly level to steep

TABLE 2.1: GEOLOGIC FORMATIONS OF THE TAMPA BAY REGION

SERIES	FORMATION	DESCRIPTION
Recent	Lower Marine and Estuarine Terrace Deposits	Freshwater Alluviums, marls, peats, muds and marine sediments along coastline
Pleistocene	Anastasis Formation	Coquinoid limestone, sand and clay
	Calosahatchee Formation	Shell hash limestone and clay
Miocene	Bone Valley Formation	Phosphatic boulders and pebbles and phosphatic, sandy clay
	Fort Preston Formation	Gray, white thinly laminated sands
Upper Part of Floridan Aquifer	Hawthorn Formation	Sands, clay, marls, sandy limestones, all phosphiritic
	Tampa Formation	Sandy, chalky limestone
Oligocene Floridan Aquifer	Suwanee Limestone	Thin bedded, soft highly fossiliferous limestone (some dolomite)
Eocene Floridan Aquifer	Crystal River Formation	High calcium limestone

sandhills, knolls and ridges. Areas of Pasco and Hillsborough counties have soils which are dominately alkaline sands. Ocala and Hawthorn Formations outcrop in the area and the soils have developed from marine terrace sands overlying finer sediment on limestone which are probably the result of the weathering of sandy limestone.

Phosphatic and loamy sands also occur in Hillsborough County. This is the result of the major geological formations outcropping in the area, as shown in Figure 2.1. This area is well to moderately, well-drained, nearly level, gently sloping to rolling, with elevations ranging from less than 40 feet to more than 200 feet above present mean sea level.

The soils occurring principally in the coastal lowlands are dominately acidic sand and are somewhat poorly drained. The older geological formations are covered for the most part by beds of sand and clays that form the parent material from which these soils are derived.

There are a number of peat, muck and freshwater swamp areas within the region. Because of intermingling of soil materials, the dense vegetation and the wetness of the land, the soil types are not distinguished. However, these areas serve as water reservoirs and provide abundant food and shelter for wildlife.

The last group in the region is the tidal marsh-coastal beach-coastal dune group. This association consists of nearly level saltwater marsh, coastal beach and undulating to sloping coastal dunes. The marsh soils are not mapped due to their inaccessibility and it is impractical to make separations of the coastal dunes and beach soils. However, these soils are of great importance to the increasing recreational needs of the region. Water covers slightly less than 200,000 acres of the land with more than 151,000 acres of saltwater in bays and inlets and 49,000 acres in freshwater areas of which 37,000 acres are in well defined lakes and rivers.

The region is drained by six major river basins; feeding the groundwater systems in these basins is the Floridan Aquifer, one of the most productive aquifers in the United States. It is the source of almost all the groundwater used in the region and of some of the largest freshwater springs in the world.

The aquifer is composed of more than 1,000 feet of limestone and dolomite and consists of several geologic formations which more or less function as a single hydrologic unit. The thickness of the aquifer and its depth below the surface differ throughout the basin. In the northern part, the aquifer is either on or relatively near the surface. And in the southern part of the region, it is several hundred feet deep.

Shallow aquifers overlie the Floridan Aquifer throughout most of the area and include the surficial sands and generally the upper part of the Hawthorn Formation. Generally, only small quantities of water are obtained from the shallow aquifers.

Potentiometric surface studies indicate groundwater has shown a major drop in head-pressure in two areas. The changes are most obvious in lower Sarasota and eastern Hillsborough counties. In the former, the increased water use for agricultural purposes caused the potentiometric drop. However, the efficiency of the irrigation methods has been increased and the depletion is expected to correct itself in time. The Hillsborough County low was created in the past by high water consumption in both phosphate mining and citrus operations. However, the phosphate industry has increased the efficiency of their water use and at the same time has been curtailing operations in the area. Some activity is expected further south in large phosphate land holdings in Manatee County, but the effect of this movement is not detectable at present. The only other decline of the potentiometric surface is in the well field areas of Pinellas and Hillsborough counties.

Several areas of the region appear as prime natural recharge areas, based on analysis of the potentiometric surface topographic maps and soil conditions. These areas exist in northeastern Pasco County and west central Hillsborough County. Exact location of the bounds of these areas is not possible at this time.

There are four freshwater sources of surface water in the region based on the Florida Water Classification System of Class I Waters. These include the Hillsborough River in Hillsborough County, the Manatee River in Manatee County and Myakka River and the Big Slough in Sarasota County.

Extensive areas of Class II waters (salt water with shellfishing capabilities) exist in the region, although less than 50 per cent of the bay system's waters are designated Class II and only a small percentage of these are open for shellfishing.

MINERALS

The principal mineral resources of the region are phosphates, limestone, and sands of various types and quality. Figure 2.2 indicates the disposition of these minerals and any current mining that is taking place.

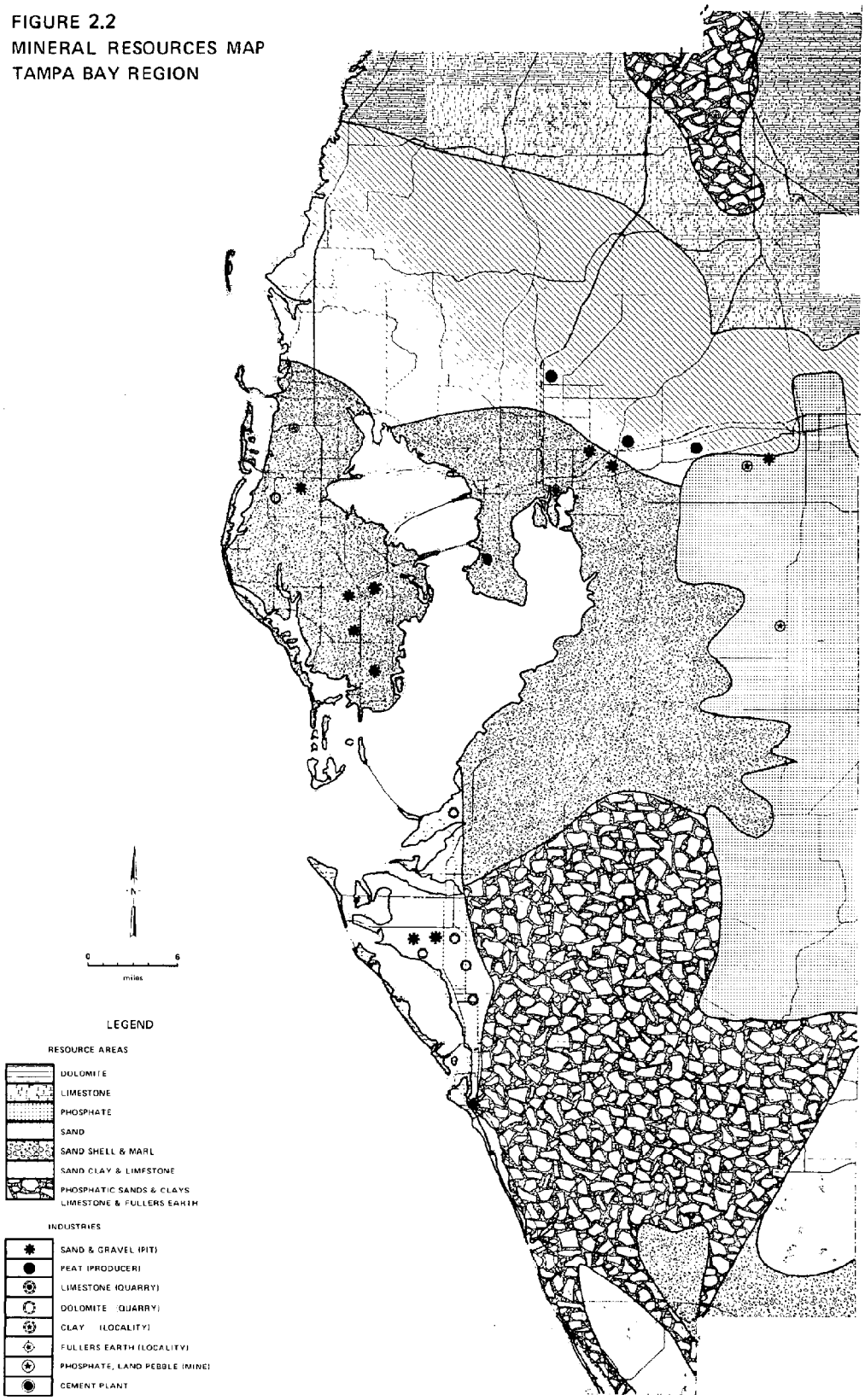
Phosphate deposits occur in the lower part of the Bone Valley Formation. The overburden averages about 24 feet and the matrix is about 16 feet thick. The mining of the matrix, either as pebbles or sand sized grains, is done with open pit methods.

Historically, Florida produces about 70 per cent of our domestic phosphate and supplies 30 per cent of the world's needs. While Florida is a major producer, it has only ten per cent of the world's phosphate reserves. The high grade deposits in Hillsborough County are being depleted, and mining is moving south into Manatee County where lower grade deposits are available. Land use conflicts are also depleting the reserves available for mining. This is unfortunately true of all mineral resources. There are instances where phosphate values are lost for highway construction: an interstate highway now covers an area containing 275,000 tons of phosphate rock; this mineral is lost to production as local reserves dwindle.

Currently, phosphate operations take place in only two areas of the region, Hillsborough and Manatee counties. There is no phosphate mining in Hillsborough County at present and indications are there may be none for at least ten years.

Mining has the least flexible land requirements of any of the major users of land. Agricultural, community and industrial development can be accommodated in almost any area, but mining is naturally limited to the specific area in which the resource is found. In order to reserve phosphate land for future mining, the companies have had to either purchase or option extensive tracts of land. In the past, this meant taking the land out of active use. However, within the past decade all of the phosphate companies have practiced active land management programs on their properties. Since 1961, the industry has accel-

FIGURE 2.2
MINERAL RESOURCES MAP
TAMPA BAY REGION



erated a program of land reclamation. The companies should be encouraged to make lands held in reserve available for other uses before mining and to reclaim previously mined lands in areas needed to expand.

Limestone and dolomite both occur in thick deposits throughout the region. Both have similar uses, but limestone is more abundant and is mined more extensively than dolomite. Because rock use hinges on the physical and chemical character of the product, which is widely variable, only portions of the extensive limestone deposits are valuable as an economic mineral resource.

Limestone and dolomite are mined as either dimensional or crushed stone. Dimensional stone is generally used for decorative purposes. Blocks or slabs are cut into shapes suitable for utilization in buildings or construction. Crushed stone is used for concrete aggregate, road base material, agricultural purposes and other miscellaneous uses. All of the limestone quarries in the state are of the open pit variety. Most limestone mining in or around the Tampa Bay Region has been done in Hernando County. Some mining for dimensional dolomite has been done in Manatee County, and limestone mining on a smaller scale has been taking place in Pinellas County.

Potential mining for limestone or dolomite could take place in the resource areas shown in Figure 2.2. Whether mining in these areas is feasible hinges on the quality of the stone and its proximity to land surface. The closer the stone to land surface, the lower the excavation costs.

The final resource mentioned, sand, covers most of the region. However, sand as used here, refers to silica or quartz grains, the size of which largely determines their economic value. Primary economic sands include concrete sands, plaster sands, mortar sands and glass sands. To meet specification for these uses, sands must be of a certain purity and grain size. Sands in the Tampa Bay Region are generally too fine to be used as concrete sands, but some pure sands exist which may have value as glass sands.

Strip mining is the common method for extracting sand deposits. Coarse sand deposits are fairly well distributed in the central (Lake Wales) ridge east of the Tampa Bay Region and are a source of concrete sands for the region.

For 1970, the state's sand and gravel output was $12.5 million, or about a dollar a ton. Because sand, like most construction materials, is a low unit-value resource, the transportation costs of bringing the product to the area of need are significant. For this reason, identifying and developing deposits near urban areas is of particular importance, and the urgency of extracting mineral deposits prior to land development is again indicated.

There are no productive oil fields in the region at the present time and the closest known oil pools, with any economic importance are to the south in Collier and Hendry counties. However, offshore state leases have been let and geophysical permits for exploration work in the Gulf of Mexico issued.

A further example of mineral resources and land use conflicts is the case of high quality clay deposits in northern Pinellas County. Excavation of the clay has been delayed and due to residential land development, the land costs render excavation economically unfeasible. Although mining in this area would have punctured the impervious mantle of the Hawthorn Formation and allowed a prime site for groundwater recharge, the project is now unfeasible.

WILDLIFE

The terrestial wildlife found in the Tampa Bay Region covers a wide range of species. However, it is not the intent of this report to provide a complete or extensive listing of these species, but rather to define a representative range. The approach taken to define this range is by habitat groups. The habitats are shown in the Series Four Section of the Atlas and presented in the environmental synopsis of each county, with a discussion of the impacts of development.

The habitats indicate areas where certain species may be expected. The home ranges of these representative species may extend into several of the habitat groups, but remain in the indicated habitat the majority of the time. The habitats inventoried are listed below in Table 2.2 and a detailed explanation of these habitats and the representative species found in them are given in Appendix I.

TABLE 2.2: SELECTED WILDLIFE HABITATS IN THE TAMPA BAY REGION

1. **Swamp Forest**
2. **Mangrove Association**
3. **Hardwood Association**
4. **Sand Pine Habitat**
5. **Pine and Xerophytic Oak Habitat**
6. **Pine Flatwoods**
7. **Grassland of Prairie Type**
8. **Cultivated Land**
9. **Coastal Strand**
10. **Developed Areas**

TABLE 2.3: SPECIES OF CONCERN AND THEIR STATUS IN THE TAMPA BAY REGION

	STATUS
MAMMALS	
Florida Panther	Endangered
Florida Manatee (Sea Cow)	Endangered
BIRDS	
Eastern Brown Pelican	Endangered
Florida Great White Heron	Rare
Southern Bald Eagle	Endangered
Florida Sandbill Crane	Rare
Red-Cockaded Woodpecker	Rare
Eastern Reddish Egret	Peripheral
Roseate Spoonbill	Peripheral
Short-tailed Hawk	Peripheral
Florida Mangrove Cuckoo	Peripheral
Black-Whiskered Vireo	Peripheral
Wood Ibis	Undetermined
American Osprey	Undetermined
Florida Burrowing Owl	Undetermined
Florida Grasshopper Sparrow	Undetermined
REPTILES	
American Alligator	Endangered
Green Turtle	Peripheral
American Crocodile	Peripheral
Florida Indigo Snake	Endangered

The region supports some twenty species of wildlife that are of concern. Included within this group are five species designated on the Department of the Interior's endangered list, three on the rare list, seven on the peripheral list and four whose status is not determined. These species all utilize habitats found in the region and all have been recently sighted. These species are listed above in Table 2.3.

In addition to this list, other species, especially those requiring extensive areas for their biological routines, or which are closely tied to a specific food item, are no longer found locally. These species, whose population is stable in other areas, are therefore not included on the Department of the Interior's rare and endangered species list, but have been lost from the Tampa Bay Region.

COMMERCIAL FOREST

The region contained 513,271 acres of commercial forestland in 1970. Assuming the same rate of land use change in the region, this is a 9,800 acre drop in acreage from a little over 611,000 acres ten years ago. About 7,000 acres have been planted to trees during the same period. The current 513,000 acres is broken down into

stream margins
56,000 acres
flatwoods
229,000 acres
sandhills
118,000 acres
swamp
14,000 acres
miscellaneous
96,000 acres

as shown in Table 2.4.

In general, removals exceed growth in softwood, in the sawtimber size classes and on the upland sites that support these stands. Growth exceeds removals in the bottomland hardwood stands, where young stands are increasing in volume rapidly. Hardwood growing stock is growing 30 to 40 times faster than it is being removed. Consequently, the heaviest volumes of growing stock are in the bottomland hardwood types. Ecologically, these hardwoods are the least marketable on today's lumber market. The

TABLE 2.4: AREA OF COMMERCIAL FOREST LAND, BY FOREST-TYPE GROUP AND COUNTY, 1970

COUNTY	ALL TYPE GROUPS	FOREST–TYPE GROUPS (In Thousands of Acres)					
		LONGLEAF-SLASH PINE	LOBLOLLY-SHORTLEAF PINE	OAK PINE	OAK HICKORY	OAK-GUM-CYPRESS	ELM-ASH-COTTONWOOD
Hillsborough	150.4	29.9	5.5	8.2	29.9	74.2	2.7
Manatee	66.5	29.4	11.3	------	3.7	22.1	----
Pasco	178.7	42.0	-------	5.8	52.4	78.5	-----
Pinellas	41.2	18.9	3.7	------	------	18.6	----
Sarasota	76.5	59.8	3.3	-------	------	13.4	-----
Totals	513.3	180.0	23.8	14.0	86.0	206.8	2.7

SOURCE: Forest Service, U.S. Department of Agriculture, Resource Bulletin SE-17, September, 1970

heaviest removals are coming from farmer owned forestland. (See Table 2.5.) Publicly-owned forestlands are growing at their **maximum** capability although the statistics show there are undesirable components in the stand that should be weeded out so that the growth will be emphasized in desirable (marketable) growing stock.

Miscellaneous forests on private and farming land, on the other hand, are growing at only half their capability. These lands now average an annual net growth of 28 cubic feet per acre and could, under intensive management, grow 53 cubic feet per acre. It is unrealistic to assume that this can be brought about on all **500 + thousand acres** or that it is even desirable with current demands for alternative land uses. But the fact is that simple management practices and public policies that give incentive to the timber grower can produce substantial gains in economic value and simultaneously produce amenity values that are needed.

RESOURCE ECONOMICS

The Land

Undeveloped land in the region still exists in major tracts. In fact, over 85 per cent or 1,925,086 acres of the region are classified as non-urban areas. This classification includes vacant and open range land, agriculture, and mining properties. Mining is included in this aggregation for there are only 26 active operations in the region of which 13 are either in or bordering on urban areas.

Although these figures appear to discount a land problem in the region when discussed in aggregate, they distort the critical nature of land development in the region. This is particularly true from the environmental perspective, considering the location of existing development, annual rate of land development, and particularly, the amount of land unsuitable for development.

Land values over the region have appreciated in a range from insignificant to 18 per cent per annum. As expected, the changes in appreciation are greater as one moves from east to west with the greatest values on the coast near and in urbanized areas. The diminishing supply of land in the coastal zone and the continual increasing demand for this land, provides a favorable situation for large and small investors and may result in both development returns and capital gains on real property.

Accounting for variations over time, an adjusted figure of approximately 9,000 acres a year, or four tenths of one per cent per annum, is converted by development. This use is primarily for residential purposes, with over 55 per cent of the developed land in the residential use category. The residential growth market in the region is a key factor in land development in the region, and the coastal zone bears the brunt of this land conversion.

The problem of development suitability or capabilities for various sites is the most significant factor facing the quality of continued development and the environment. For the region, removal of lands that should be preserved or developed only within certain restrictions reduces the gross acreage available by only 14 per cent. However, the location problem and the coastal zone are again the focus of major development activity.

The residential demand for this land is one side of the approach taken in this study. The approach combines environmental land analysis and residential development market analysis. The analysis of these two factors enables the subsequent use of large area environmental assessment on a limited basis.

Minerals

The value of the mineral industry, by product, in the region is difficult to accurately ascertain. Reporting methods and the sparcity of the firms in the industry often precludes the revealing of financial data in order to protect the individual company's position.

The last reporting period, 1967, from which aggregate totals of dollar value are obtainable, lists only two counties in the region. This data indicates that revenues from mineral production in these two counties is falling. In 1967, Hillsborough County reported $24,345,220, an 8.2 per cent drop from the previous year. This value is derived from production of cement, phosphate rock, oystershell, sand and gravel and peat.

Reporting from the same period, Pinellas County shows a value of $517,500; the decline in Pinellas from 1966 represents a 10.8 per cent fall. The county production was from oystershell and sand and gravel.

Wildlife

Wildlife values in both terrestial and aquatic habitats have been declining with increasing urban encroachment and degradation of the waters. Although revenues from hunting and fishing indicate increasing growth in various sport industries, one can question if this merely represents increased costs rather than increased sport value as the supply of wildlife of sport variety declines.

Whatever the result, values are increasing and in 1970, an estimated 197,661 hunters existed in the region and the Florida Game and Freshwater Fish Commission (GFC) estimates a typical hunter spends $91.98 a year. This amounts to $181,808 in 1970 and $201,807 in 1972. There were also approximately 684,113 resident fisherman in 1970 and based on the GFC estimates of $79.49 in expenditures per annum per fisherman, this brings expenditures in 1970 to $543,801 and $603,619 in 1972. This of course does not indicate the real value of wildlife, but does indicate the relative worth that is generated from fishing and hunting in the region.

Commercial Forestry

The difference between **commercial forest** and **non-commercial forest** is that the acreage of commercial forest is producing or capable of producing crops of industrial wood, while the non-commercial acreage is generally not capable of producing industrial wood because of adverse site conditions. Today, the percentage of total land area meeting this definition is waning.

Although commercial forestry production is decreasing in the region, adequate treatment can raise the productivity of the remaining forest lands. To indicate what is possible with an active improvement program, consider the following example.

For each 100,000 acres of miscellaneous private and farming forestland that is improved to maximum capacity, there would be an increase in annual growth of some 29,400 cords of wood worth $200,000 in stumpage to the owners on todays market. This would also provide $1,272,000 in payroll value and add $4,977,000 in wholesale manufacturing value to the economy. If these volume increases were valued for wood products

TABLE 2.5: NET ANNUAL GROWTH OF SAWTIMBER AND GROWING STOCK ON COMMERCIAL FOREST LAND, BY SPECIES GROUP AND COUNTY 1969 AND ANNUAL REMOVALS OF SAWTIMBER AND GROWING STOCK ON COMMERCIAL FOREST LAND, BY SPECIES GROUP AND COUNTY, 1969

COUNTY	Sawtimber					Growing Stock				
	ALL SPECIES	PINE	OTHER SOFTWOOD	SOFT HARDWOOD	HARD HARDWOOD	ALL SPECIES	PINE	OTHER SOFTWOOD	SOFT HARDWOOD	HARD HARDWOOD
	Million Board Feet					Million Cubic Feet				
Hillsborough	20.6 (18.2)	5.2 (3.0)	6.7 (10.7)	4.2 (2.0)	4.5 (2.5)	4.9 (4.8)	1.1 (0.7)	1.7 (2.8)	1.2 (0.7)	0.9 (0.6)
Manatee	4.8 (7.5)	2.1 (7.5)	-------- (------)	2.1 (------)	0.6 (------)	1.2 (1.8)	0.6 (1.8)	-------- (------)	0.4 (------)	0.2 (------)
Pasco	21.2 (17.0)	6.1 (2.1)	6.4 (14.2)	4.5 (0.6)	4.2 (------)	6.2 (4.0)	2.0 (0.6)	1.7 (3.1)	1.2 (0.3)	1.3 (------)
Pinellas	2.1 (7.1)	7.0 (5.2)	0.8 (1.9)	0.2 (------)	0.1 (------)	1.0 (1.7)	0.7 (1.2)	0.2 (0.5)	0.1 (------)	------- (------)
Sarasota	6.1 (6.0)	5.8 (6.0)	-------- (------)	0.2 (------)	0.1 (------)	1.8 (1.4)	1.6 (1.4)	-------- (------)	0.1 (------)	0.1 (------)
TOTALS	54.8 (55.8)	20.2 (23.8)	13.9 (26.9)	11.2 (2.6)	9.5 (2.5)	15.1 (13.7)	6.0 (5.7)	3.6 (6.4)	3.0 (1.0)	2.5 (0.6)
Net Change	(1.0)	(3.6)	(13.0)	8.6	7.0	1.4	0.3	(2.8)	2.0	1.9

SOURCE: Forest Service, U. S. Department of Agriculture
Resource Bulletin SE-17, September, 1970

as they are currently consumed in the industry (39 per cent goes into logs, 60 per cent into pulpwood and one per cent into other products), the stumpage would increase to $225,000. Improvements of this magnitude could probably be brought about with an expenditure of $20 to $40 per acre.

TABLE 2.6: TREATMENT NEEDS OF COMMERCIAL FORESTLAND, PER CENT OF COUNTY TOTALS

COUNTY	TREATMENT ADEQUATE	ESTABLISHMENT AND REINFORCEMENT	TIMBER STAND IMPROVEMENT
Pasco	38%	35%	27%
Pinellas	45%	37%	18%
Manatee	9%	89%	2%
Sarasota	17%	79%	4%

SOURCE: Florida Department of Agriculture, Division of Forestry

TABLE 2.7: TREATMENT NEEDS OF FORESTLAND GRAZED, PER CENT OF TOTAL

COUNTY	TREATMENT ADEQUATE	NEED TO IMPROVE FORAGE	NEED TO REDUCE OR ELIMINATE GRAZING
Pasco	14%	83%	3%
Hillsborough	15%	82%	3%
Pinellas	----None Reported----		
Manatee	10%	60%	30%
Sarasota	10%	90%	

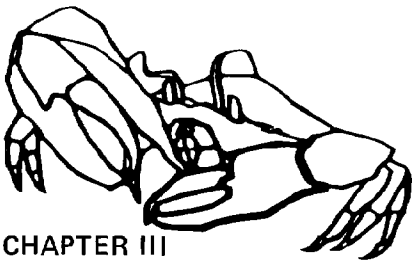
SOURCE: Florida Department of Agriculture, Division of Forestry

The total for forestry production, mentioned earlier, is approximately 500,000 acres. Tables 2.6 and 2.7 indicate the various treatment needs of this total in each county. The county totals are found by referring back to Table 2.5.

Current ad valorem taxes are a serious deterrent to long term forest management. More realistic values are needed. At current rates of forestland valuation, as recommended in the woodland section of the *Tax Assessor's Guide*, the woodland owner who owns average pine land and practices intensive forest management is unable to earn six per cent interest on his investment. There is no incentive under this tax level to practice forestry. The tax level encourages rapid turnover of forestland based on gain to be expected from land value appreciation and encourages owners to over-cut timber in order to pay the tax bill.

Lands that are ecologically important, such as long stream margins in swamps and water recharge areas, need to be maintained in forest cover and probably under some form of controlled use. Consideration should be given to public incentive payment to private owners for devoting forestland to this use.

At current rates of forestland attrition, 2032 appears to be the year when all private forestland will disappear in the region. More public acquisition of forestland is needed if any significant reserve of forestland for public use is expected.



CHAPTER III

Land Development Assessment

The rapid growth and development of the Tampa Bay area is a fact which cannot be ignored. Statistical evidence of this rapid growth is abundant. For example, total population has tripled since 1950 and new construction records are established nearly every month. With such growth, data becomes obsolete in a matter of months, or in some areas, days. However, the data presented herein is the most accurate data available as of August, 1972. It is the intent of this section to provide a current inventory and analysis of development activity within the region; to identify current development patterns and trends which will have a major influence in shaping the region's future land use; to determine the limitations and potential for development of existing vacant land within the region; and to provide a data base for projecting land use needs.

DEVELOPMENT REVIEW

Historically, all the region's major cities had been established by 1930. This settlement was reinforced by the constantly improving and expanding interregional transportation system. The original settlement pattern and transport system expansion are the major influences on the region's current development pattern. The development pattern as it exists today also illustrates the historical and current importance of the region's shoreline areas.

The initial settlements were established along the shoreline areas, and road networks soon connected these early communities; little development occurred between city centers until the 1950's. It was during the fifties, when tourists and retirees came into the region in large numbers, that proximity to the shoreline areas offered new advantages. These advantages included sport fishing rather than fishing for subsistence, water sports and recreation rather than transportation, and home sites rather than commercial agriculture. These changes in the economic importance of the shoreline areas did not occur overnight, but took place over a period of years. There is, however, little argument against the fact that this change in shoreline desirability was complete by 1950.

Prior to 1950, most new development occurred within, or very near, existing cities and towns. After 1950, the move to the suburbs began here, as it did in other areas in the nation. An improved internal transportation system had much to do with this move to the suburbs or urban expansion. This expansion of the road and highways network opened many areas to development for the first time.

It must be noted at this point, that these same factors, increased tourism and retirement, an expanding transportation system, and more recently, industrial expansion, are continuing to directly influence development and encourage urban sprawl.

The region's coastal orientation is obvious from the fact that 82 per cent of the developed land in the region is in the coastal zone. The land development pattern in the region has recently undergone a change from a nodal concept to a linear pattern of metropolitan development. This has been a natural change and in some areas the transformation is not yet complete. The previous nodal concept was centered around the many small cities in the region. The land use pattern around each city was separated by natural greenbelts or undeveloped areas from other cities. These cities, or nodes, were connected by highway arterials which were to become the basis for the transformation from the nodal pattern to the linear pattern which exists today.

This linear pattern emerged as each of the nodes expanded and eventually grew together to form an almost continuous strip of development from Hudson in Pasco County to Englewood in Sarasota County. This strip along the Gulf coast, broken only by Tampa Bay, is centered on U.S. Alternate 19 and U.S. 19 in Pinellas and Pasco counties and U.S. 301 and U.S. 41 in Sarasota and Manatee counties.

POPULATION REVIEW

This developmental pattern is a result of regional population growth patterns. Starting with a total of 955,301 inhabitants in 1960, the five county Tampa Bay Region population mushroomed to just under 1.5 million in 1972. This change reflects a 5.2 per cent average annual rate of growth. The net inmigration of new citizens into the region accounts for 100 per cent of population growth in all but one of the five counties. This unusual growth pattern is caused by a negative natural population increase in those counties, which reflects the high proportion of inhabitants past childbearing age.

It is interesting to note that there has been a sharp upturn in regional population in the past two years. The average annual growth rate from 1970 to 1972 is almost 50 per cent above the growth rate for the preceding ten year period. Pinellas County, with its prime location between Tampa Bay to the east and the Gulf of Mexico to the west, has the third largest county growth rate in the region. Across Tampa Bay, Hillsborough County exhibits the most stable growth rate, as well as the most balanced one. It is the only county in the region to enjoy a positive natural increase, which accounts for 45 per cent of its annual population growth. Pasco County has the distinction of being the region's most rapidly growing area, with a total population increase of 171.8 per cent between 1960 and 1972. Its annual rate of growth is triple that of the region as a whole. Manatee County, with an average annual growth rate of 4.4 per cent ranks just ahead of Pasco County in total population. Sarasota County, southernmost in the region, has shown the most uniform annual rate of growth, with a consistent average annual increase of 5.7 per cent.

Preliminary figures from a Tampa Bay Regional Planning Council population study indicate continued population increase, but at a slightly decreasing rate. That study estimates total regional population in 1975 at 1,617,400 representing a net population increase of 164,410 inhabitants.

ECONOMIC TRENDS REVIEW

The analysis of growth trends and the future projections of growth potential is based on social and physical trend analysis. Due to the nature of this study, financial capabilities and the capital market are assumed to remain constant. The analysis presented below summarizes the various factors investigated and is on an aggregate regional basis to assess the potential growth. The detailed market analysis is precluded from this report be-

TABLE 3.1: POPULATION HISTORY BY COUNTY, 1960–1972

COUNTY	1960	1970	1972	% CHANGE	AVERAGE CHANGE/YEAR
Pinellas	374,665	522,324	609,901	+ 62.8%	+ 5.2%
Hillsborough	397,788	490,265	508,600	+ 27.9%	+ 2.3%
Pasco	36,785	75,955	100,000	+ 171.8%	+ 14.3%
Manatee	69,168	97,115	105,507	+ 52.5%	+ 4.4%
Sarasota	76,895	120,413	128,952	+ 67.7%	+ 5.6%
Region	955,301	1,306,077	1,452,990	+ 52.1%	+ 4.3%

cause the total effect on the resource base is the problem addressed. The analysis of population trends presented earlier, forms the general point of reference of the following synopsis.

Employment in the region increased 51 per cent during the 1965 to 1971 period. However, the great majority of this increase took place in the first four years of this period. The annual increase for the last year slowed to 4.4 per cent against an overall annual rate of 8.5 per cent. Throughout this rapid growth period, the overall composition of employment and economic activity has not fluctuated significantly, although certain sectors of the economy have shown spectacular rates of growth.

Also during this period, per capita personal incomes have increased slightly faster than the nation as a whole. While increases for all the states amounted to a 43 per cent increase during the period, the per capita income of both Florida and the region increased 53 per cent. Analysis of the 1950-1970 period indicates income growth for the region is increasing at a slower rate. Analysis also indicates the change in rate for the region has a heavy bias in the 1965-1971 period.

New construction starts in the region have broken all previous records for the 1965-1971 period. The valuation of permits has increased 285 per cent for the period, while the number of units increased 1382 per cent. A factor in new construction is the availability of sewage and water connections. However, availability, as a factor, is indeterminate at present, due to the policies of the State Department of Pollution Control.

Add to these summaries the changing composition of land developers in the region and future development appears inevitable. Syndicated and publicly held corporations are entering the region. Such capital resources enable development of large tracts of prime land (with high unit cost) in the coastal areas. This is necessary with the high capital requirements of fast growing areas because land costs play an increasing role in total cost of development.

These factors all play a significant part in the increased importance of land development in the region.

Over the next eight years, regional per capita income should continue to increase at least at its current rate, and there appears to be a trend toward equalization of per capita income among the individual counties. Overall economic activity in the region should grow at a healthy pace, although it appears to be doing so at a decreasing rate.

As the region becomes more urbanized, agricultural activity will tend to become more concentrated, making up a decreasing percentage of total employment. The marked decline of fisheries appears almost certain to continue. Construction activity in the region is likely to continue its current expansion, although population projections tend to indicate a decreased rate of growth.

Because of its strategic location as a distribution center, the Tampa Bay Region should maintain a strong manufacturing base. Current port expansion programs in both Hillsborough and Manatee counties will tend to make the region even more attractive to new industry. The port expansion will reinforce the already strong wholesale trade sector of the economy.

Retail trade, spurred by an increasing population, promises to remain in close proximity to manufacturing as the largest sector of economic activity.

Tourist oriented businesses will be subject to upward pressure by the continuing increase of tourist activity throughout Florida. However, the growth rate in this sector of the economy should decrease, as urbanization of the region renders other less developed areas of the state more attractive to tourists. This trend should not have any noticable effect prior to 1980. However, a tourist trend analysis for the last five years, on a state-wide basis, indicates this phenomenon does occur. The trend analysis of southeast Florida is especially indicative of this pattern.

DEVELOPMENT/RESOURCE PROBLEMS

The research has identified six problem areas that intensify the conflict problems in the region. All of these areas are environmental management problems that were generated in the past, but the full effect of the problems is becoming evident today. Only with new approaches can the problems of today and of the future be alleviated.

The problems discussed herein are as follows:

1. **Waste Discharge**
2. **Water Runoff**
3. **Dredging**
4. **Estuarine**
5. **Land Development**
6. **Salt Water Intrusion**

Waste Discharge

The discussion of domestic and industrial waste discharged into surface waters is presented as a regional overview. This information presents an up-to-date summary of point source discharge conditions in the region.

Domestic Waste

Total domestic wastewater average daily flows (ADF) to treatment facilities in the region are estimated at 127 MGD (million gallons per day) at the present time. An additional 8.7 MGD is discharged into municipal systems by industrial users. Of the total 127 MGD, 95 per cent or 121.2 MGD are discharged directly into surface waters of the region, such as lakes, ponds, canals, rivers, streams or bays. The remaining five per cent or 5.8 MGD are disposed of by evaporation-

percolation ponds, drainfields or irrigation.

If we utilize the data obtained from the governmental and franchised systems in the Tampa Bay area, we find a total flow of 115.9 MGD (by deducting the industrial users of sewer systems from a population of 964,500 people for a per capita flow of about 120 gpcd.) Using this figure and the 1970 census data for the area, at 1,400,000 persons plus a daily tourist population of 250,000 persons, the estimated total domestic waste production would amount to approximately 198 MGD. Consequently, 127 MGD of the 198 MGD or 64 per cent of the region's domestic waste flow is treated in some type of treatment facility, while the remaining 36 per cent or 71 MGD is accounted for by individual septic tank systems or unreported small systems.

Governmental wastewater treatment facilities include those owned and operated by federal, state, county or city governments as opposed to franchised or private treatment facilities. At this point in time, there are 49 governmental treatment systems within the area defined by this study, which account for approximately 109.4 MGD or 86 per cent of the total estimated domestic waste flow to treatment facilities of the region. Of this total, 108.0 MGD or 98.5 + per cent of treated wastewater is discharged directly into surface waters of the region, while 1.4 MGD or less than 1.5 per cent is disposed through irrigation or evaporation-percolation ponds.

These systems serve an estimated 904,700 persons, or approximately 65 per cent of the area's population. It is assumed that this percentage holds true when including heavy tourist populations since many hotels, motels and vacation residences are connected to the municipal systems.

Private facilities total approximately 405 plants with an ADF of approximately 11.1 MGD or nine per cent of the total estimated domestic waste flow to treatment facilities of the region. However, the number of plants amounts to 84 per cent of the total amount for the region. Of this total, approximately 6.4 MGD or 57 per cent of the flow is discharged directly into surface waters of the region. These systems serve an estimated 92,500 people, (derived by combing the total flow above with the per capita flow of 120 gpcd derived earlier).

Industrial Waste Disposal

There is sufficient technology available to treat all of the industrial waste presently produced, including radioactive material. What is of concern is not the **how to treat it,** but that effluent **is treated** before discharge.

Aside from the toxic heavy metals and corrosive chemicals that can be changed to insoluable salts and neutral solutions, and after settling, the effluent can be discharged into the surrounding waters. Even the organics are amenable to treatment. However, as recycling techniques are developed and improved, more industries are utilizing total retention and recovery.

The waste loads of all the industries discharging into receiving waters described in this report, are presented as total waste loads discharged into the Tampa Bay Region in Table 3.2. In order to determine the extent of pollution from industries in the Tampa Bay Region, the total flows reported were compared with the total effluent discharged from municipal waste water systems.

From Table 3.3 we can estimate the per cent of total flow discharged into the region by industries.

TABLE 3.2: COMPARISON OF TOTAL INDUSTRIAL EFFLUENT FLOWS WITH MUNICIPAL SYSTEM EFFLUENT FLOWS IN THE TAMPA BAY REGION
(MILLION GALLONS PER DAY)

	INDUSTRY	MUNICIPAL SYSTEMS	TOTAL
Tampa Bay	32.9	61.2	94.1
Boca Ciega Bay	0.063	25.2	25.3
St. Joseph's Sound	0.183	6.3	6.5
Sarasota Bay	0.027	8.3	8.327
Donna Bay	.006	-------	.006
Lemon Bay	.007	0.2	0.207

SOURCE: Tampa Bay Regional Planning Council

TABLE 3.3: PER CENT OF TOTAL WASTE FLOW DISCHARGED INTO THE TAMPA BAY REGION BY INDUSTRIES

Tampa Bay	34.96%
Boca Ciega Bay	0.25%
St. Joseph's Sound	2.82%
Sarasota Bay	0.32%
Donna Bay	100.00%
Lemon Bay	3.38%

The comparison to total pounds of BOD_5, discharged into the Tampa Bay Region is presented in Table 3.4.

Water Runoff

Rural runoff effects, other than dairy farming, are indeterminate at present. The only conclusions that can be drawn are suppositions based on fertilizer and pesticide use. With approximately 676,425 acres or 30 per cent of the total acreage in agricultural use, and major expenditures being made for fertilizer chemicals and pesticides, it is assumed a major toxic and nutrient source can be traced to overland runoff from agricultural areas. Beyond this, no major effect is noticable in rural areas until urban development takes place. The effect of urban development is discussed below.

Dredging

Channel dredging is another major source of adverse biological affect on the bay system. This is due primarily to alteration of habitat and increased water turbidity. These conclusions are well documented and mentioned here only to indicate degrees of effect.

Commercial channel dredging and maintenance are not presently a major factor in the region. Because of their location and age, commercial channels in the bay system are carefully controlled and effects from their maintenance is negligible. A side effect of increased water traffic is that it constantly stirs up silt which remains in suspension for a considerable period of time.

The major problem is the widespread small scale channel dredging usually conducted by land developers. The direct marine habitat alteration is significant and steep channel slopes that result often make the possibility of reestablishing local habitats slight.

Another effect from the general trend of channel dredging for land development is the disruption of water flow patterns. Improper design and planning of the channel often creates almost stagnant waters with an accompanying deterioration of water quality in the channel system. Greater attention to the engineering and planning review stages of land development projects is needed to stop such problems. The technical ability to avoid those problems exists, and there is a need to insure that it is used.

TABLE 3.4: COMPARISON OF TOTAL INDUSTRIAL AND MUNICIPAL SYSTEM BOD_5 EFFLUENT IN THE TAMPA BAY REGION

	INDUSTRY	MUNICIPAL SYSTEMS	TOTAL
Tampa Bay	2296.	57594.	59890.
Boca Ciege Bay	4.	8261.	8265.
St. Joseph's Sound	48.	673.	721.
Sarasota Bay	13.	976.	989.
Donna Bay	185.	----------	185.
Lemon Bay	0.27	18.48	18.75

SOURCE: Tampa Bay Regional Planning Council

TABLE 3.5: PER CENT OF TOTAL POUNDS OF BOD_5 DISCHARGED INTO THE TAMPA BAY REGION BY INDUSTRIES

Tampa Bay	3.83%
Boca Ciega Bay	0.05%
St. Joseph's Sound	6.66%
Sarasota Bay	1.33%
Donna Bay	100.00%
Lemon Bay	1.44%

Estuarine

Another major water quality problem in the region concerns Hillsborough Bay. Alteration in and around Hillsborough Bay has caused a significant degradation of estuarine areas and the Bay proper. The following conclusions best describe the problems associated with Hillsborough Bay.

Obnoxious odors along the western shore of Hillsborough Bay are the result of the death and decay of the marine algae, **Gracilaria**. There are two odors: a nauseating vegetable odor from **Gracilaria** deposited on beaches and shorelines and an intense hydrogen sulfide odor occurring predominately along the upper western shore as a result of anaerobic decay of **Gracilaria** in shallow waters. The immediate causative agent in the death and decay of the benthic algae is freshwater from the Hillsborough River. Poor flushing along the western shore tends to keep the chloride concentration reduced thereby accelerating the death process. Dissolved oxygen is used up during the decay of the **Gracilaria** and hydrogen sulfide is produced.

Waste discharges from point sources, although they do not produce the odor problem directly, are a significant factor in the problem. **Gracilaria** are tolerant to degraded water quality while other types are less adaptive. Waste effluents and excessive nutrient concentrations create the water quality conditions whereby **Gracilaria** can flourish at the expense of a number of other plant species that would produce a healthy diversified ecosystem if water quality were improved. Therefore, the contribution of nutrients and organic wastes to Hillsborough Bay is the indirect cause of the obnoxious odors along the western shore of Hillsborough Bay.

The excessive growth of phytoplankton in the Bay is primarily the result of the extremely high concentrations of total nitrogen in the Bay. The causes of these concentrations are the effluences from the phosphate processing plants on the Alafia River, the Tampa sewage treatment plant, U.S. Phosphoric Products Company, the Nitram Chemical Company and also water hyacinth control practices. Because of the excessive phosphate concentrations, it is concluded that the biological plant system is limited by available nitrogen. A high percentage reduction of available nitrogen as well as phosphorous, is necessary to limit the

growth of aquatic vegetation.

Low dissolved oxygen in Hillsborough Bay is primarily the result of the discharge of inadequately treated effluent from the City of Tampa's sewage treatment plant. There is also a substantial demand on the oxygen resources of the Bay from organic benthic material which accounts for the low dissolved oxygen values at the deeper levels. The principal sources of these benthic deposits are the inflow of solids from the Hillsborough and Alafia Rivers, the discharge of the Tampa sewage treatment plant and the settling of phytoplankton and other organisms.

Land Development

Land development discussions are limited to the area of the coastal lowlands. The reason for doing so is based on the following conclusions:

1. **The coastal zone in the Tampa Bay Region almost completely encompasses the coastal lowlands.**
2. **The combined effects of geomorphological events in the lowlands create potential development hazards that do not exist in central highlands, i.e., slope and drainage problems, rare and endangered animal habitat problems, flood and hurricane danger, land use conflicts and a full range of estuarine ecological problems.**
3. **The lowlands and particularly the coastal zone in the region are undergoing some of the most significant development alterations in the state, with 82 per cent of the region's developed land in the coastal zone.**
4. **The demand for the recreational and subtropical amenities has increased proportionally with the rise in living standards, incomes and mobility trends.**

The increase in the development in the region is widely recognized, and the pressure for development is centralized in the coastal lowlands where physical constraints on development are greatest. The range of these environmental factors must necessarily be limited to an operationally acceptable few. There is a set of actions on local natural regimes that trace a perceptible path in the course of any development. Four of these regimes are discussed here. They are discussed from the perspective of environmental impact and are of course general in nature.

The four impact items are:

1. **Ground Cover Modification**
2. **Habitat Modifications**
3. **Alteration of Drainage Patterns and Water Table**
4. **Wildlife Modifications**

The first and most obvious alteration of any land parcel is ground cover modification. This single act generates the other three changes, therefore, all four will be considered as a single interdependent regime for the regional overview.

Denuding a site for building construction has repercussions far beyond the site itself. The destruction of wildlife habitat particularly in coastal areas can upset an obvious, but delicate, balance between local plants, animals and land forms. Several large developments in the region have seen the value of mangrove forestation on their properties, but too late. The stabilizing effect of mangrove on the coastline (or ground cover in any area) is dramatic and the lack of planning and design ability that calls for their removal is financially unwise.

The cost of mangrove removal multiplies quickly as efforts to halt the land erosion begin. This erosion is a double edged proposition since the forestation protects the land mass from shore erosion as well as erosion from overland runoff. This proposition holds true for any vegetation/land form group that is subject to variable water conditions, i.e., stream and river margins as well as large water bodies.

Estimates indicate that runoff, drainage problems and flood potential exist on close to a 1:5 ratio comparing natural to urban conditions, i.e., urban conditions tend to produce five times the runoff volume (Leopold, 1968). The ratio is based on increase in runoff due to the increase in impervious land surface accompanying development, and a reasonable storm sewer system within the area. In the lowland area of the region, good storm drainage sewers are difficult (at times economically impossible) to engineer due to low elevations and flat topography.

In the stream and river areas, as well as man-made channels, this is particularly evident. As the volume of runoff from a storm increases, the size of flood peak also increases. Runoff volume also affects low flows because in any series of storms the larger the percentage of direct runoff, the smaller the amount of water available for soil moisture replenishment and for ground water storage. An increase in total runoff from a given series of storms as a result of imperviousness, results in decreased ground water recharge and decreased low flows. Thus, increased imperviousness has the effect of increasing flood peaks during storm periods.

The principal effect of land use on sediment comes from the exposure of the soil to storm runoff. This occurs mainly when bare ground is exposed during construction. It is well known that sediment production is sensitive to land slope. Sediment yield from urban areas tends to be larger than in unurbanized areas even if there are only small and widely scattered units of unprotected soil in the urban area. In aggregate, these scattered bare areas are sufficient to yield considerable sediment.

Land use in all forms affects water quality. Agricultural use results in an increase of nutrients in stream water from both the excretion products of farm animals and from commercial fertilizers. A change from agricultural use to residential use, as in urbanization, tends to reduce these types of nutrients, but this tendency is counteracted by the widely scattered pollutants of the city, such as oil and gasoline products, which are carried through the storm sewers to the streams. The net result is generally an adverse effect on water quality. This effect can be measured by the balance and variety of organic life, by quantities of dissolved material, and by the bacterial level. Unfortunately, data describing quality factors from urban versus non-urbanized areas are particularly lacking.

Finally, the amenity value of the hydrologic environment is especially affected by three factors. The first factor is the stability of the stream channel itself. A channel, which is gradually enlarged owing to increased floods caused by urbanization, tends to have unstable and unvegetated banks, scoured or muddy channel beds, and unusual debris accumulations. These all tend to decrease the amenity value of a stream.

The second factor is the accumulation of artifacts of civilization in the channel and on the flood plain; beer cans, oil drums, bits of lumber, concrete, wire - the whole gamut of rubbish of an urban area. Though this may not importantly affect the hydrologic function of the channel, it becomes a detriment of what

is termed the hydrologic amenity.

The third factor is the change brought on by the disruption of balance in the stream biota. The addition of nutrients promotes the growth of plankton and algae. A clear stream, then, may change to one in which rocks are covered with slime, turbidity increases, and odors develop. As a result of increased turbidity and reduced oxygen content, desirable game fish give way to less desirable species. Although lack of quantitative objective data on the balance of stream biota is often a handicap to any meaningful and complete evaluation of the effects or urbanization, qualitative observations tend to confirm these conclusions.

The basic data available for analyzing the effect of urbanization on sediment yield, though sparse, has been summarized to some extent in the literature. Especially valuable is the report by Wolman (in Leopold, 1968) who summarized not only the data obtained from sediment sampling stations in streams in eastern United States, but also studied the sediment yield from building construction activities. Sediment yields from urbanized or developing areas ranged from 1,000 to more than 100,000 tons per square mile per year.

It should be recognized that sediment yield per square mile decreases with increasing drainage areas, but nevertheless, it is apparent that unurbanized drainage basins yield 200 to 500 tons per square mile per year, on the average. When building sites are denuded for construction, excavations are made, and dirt is piled without cover or protection near the site, the sediment movement in a rill or stream channel is very large in terms of tons per year immediately downhill from the construction site. If the channel contains little water except during storms (an ephemeral stream), there is no chance for dilution and during storm flow the sediment movement is great. If the construction debris gets into perennial channels, or for other reasons is distributed along a channel or dispersed over a wide area, the dilution lowers the yield per square mile per year.

For very small areas, construction denudes the natural cover and exposes the soil beneath. The tonnage of sediment derived by erosion from an acre of ground water construction in developments and highways may exceed 20,000 to 40,000 times the amount eroded from farms and woodlands in an equivalent period of time. In small urbanizing, developed or industrial areas investigations indicate that the sediment yield is 10 to 100 times larger than that of rural areas.

Salt Water Encroachment

All counties in the region are subject to salt water encroachment problems. However, the problems of Pinellas and Hillsborough counties are mainly man-made while in Pasco, Manatee and Sarasota counties the problems are a function of coastal physiography.

The latter three counties have soil and estuary conditions that correlate closely with the 250 ppm or greater isocholor line used to indicate the boundaries of salt water encroachment. The line cannot be properly established from published data in Hillsborough and Pinellas counties. However, the intensive draw down from the well field areas to supply water to the rapidly growing urban areas in these two counties must have an influence on the present 250 ppm isocholor.

Interviews with private well drilling companies indicated that the actual 250 ppm isocholor line is significantly landward of the published line. Only proper water resource management will alleviate this problem.

APPENDIX I

Wildlife Habitat Definitions

1. SWAMP FOREST

Swamp forest habitats are found in low, usually flooded grounds and are of two types: The cypress swamp and the bay tree swamp. In the cypress swamp, the dominate vegetation is typically bald and pond cypress and various hardwood species such as red maples and water ash. The bay tree swamp is dominated by bay trees such as red and sweet bay. The cypress swamp has a large seasonal water level fluctuation versus a more stable water level found in the bay swamps.

Both forest types are usually high mixed formation often bordering lakes and rivers and intimately associated with the water supply of an area. Swamp forests form thick conglomerates of vegetation, sometimes called hammocks, when isolated within another vegetation type.

Swamp forests are especially important to wildlife because they act as areas of protection and are often inaccessible to "off-the-road" vehicles. The forests act as sanctuaries and breeding grounds for species of animals that have a low tolerance for human contact. Many species of birds make their homes in this suitable habitat, including the pileated woodpecker, barred owl, limpkin, red-shouldered hawk, wood duck, white ibis and the wood ibis. Mammals often found in this vegetation type include raccoons, oppossum and marsh rabbits. When the habitat is located near lakes or rivers, it may be the home for bald eagles, ospreys and alligators.

2. MANGROVE ASSOCIATION

The mangrove associations are well-defined habitats bordering much of the coast of the Tampa Bay Region. Typical vegetation includes red, black and white mangrove trees, as well as many maritime species of vegetation. These tidal areas vary from saline to brackish and often extended far inland forming a tropical mangrove swamp habitat.

Diagnostic wildlife of this habitat includes such birds as the gray kingbird, black-whiskered vireo, and mangrove cuckoo. Many species of wading birds such as the common egret, reddish egret, louisiana heron, and the great blue heron are found in this habitat because of the abundance of marine life which serve as a food source for the birds. The habitat is also a suitable breeding ground for such birds as the green heron, roseatte spoonbill and brown pelican. Other wildlife native of the area, may include raccoons, marsh rabbits, diamond backed terapins and mangrove water snakes.

Like the swamp forests, mangrove areas often act as sanctuaries for many species of animals that may not normally be found in other areas. This is especially true for highly mobile species such as birds, which use mangrove habitats during migration.

3. HARDWOOD FOREST

The hardwood forest habitats are true forests with a dense overstory of trees. These forest types are of several different varieties and are also called hammocks. Dominate trees include cabbage palm, slash pine, magnolia, hickory, maple, as well as several species of oak. Usually a heavy undergrowth of shrubs and vines grow with the grasses in the small, scattered openings where sun penetrates the dense canopy.

The hardwood forests are important to wildlife species because of their suitability for food production and cover. Wildlife species may include deer, turkey, squirrel, quail and dove. The hardwood forest areas are also utilized by many small woodpeckers, and passerine birds including white-eyed vireo, parula warbler and tufted titmouse, and by many species of migratory birds that are not native to this area.

4. SAND PINE HABITAT

The sand pine habitat is a less, well-defined association of vegetation, but is usually characterized and dominated by many sand pines. Depending on the soil characteristics and the amount of water, varying numbers of myrtle oak, chapman's oak, scrub hickory, paw paw, and rosemary can be found in the sand pine habitat. These species often are present in thick masses of vegetation three to six feet tall in the more open areas. In some of the areas, the sand pine forms a rather-thick canopy and the forest floor is open and sandy.

On all levels of the sand pine habitat, the soils are sandy and are usually very dry. The limited amount of food and available water often limits wildlife to a large extent. Typical bird species of this habitat are rufous-sided towhee, blue jay, brown thrasher, hairy woodpecker and dawny woodpecker.

A few quail and dove also utilize the area for cover. Mammals of the area may include gray fox and skunks.

5. PINE AND XEROPHYTIC OAK HABITAT

The pine and xerophytic oak habitat is found on uplands with deep, well drained soils and may be highly diverse in both plant and animal species. Major trees of these areas include longleaf pine, slash pine, turkey oak, and blueback oak. Runner oak is the dominate plant in the scrub layer and the ground is usually covered with native grasses and wildlife food sources. The forest type may vary to a larger degree in composition than the other habitats, ranging from areas of mainly pines to areas of mainly oaks with the median habitat containing both vegetation types and wildlife.

Species of birds common to these areas include red-headed woodpecker, quail, great horned owl, dove, blue jay, and summer tanager. Other species including several hawks and woodpeckers also utilize this habitat. Mammals of these areas often include red and gray fox, fox squirrel, skunk, oppossum and occasionally deer.

6. PINE FLATWOODS

The pine flatwoods are an extensive habitat type, found on relative level areas with poorly drained sandy soils. The vegetation has a typical two layered look: the overstory being composed of varying densities of slash and longleaf pines and the understory being composed of saw palmetto grasses and a few herbs. The poor drainage of the soil often results in small hardwood hammocks, cypress stands, marshes and prairies being scattered throughout this association.

7. GRASSLANDS OF PRAIRIE TYPE

Included in this habitat description are sand ponds, sloughs, fresh water shallow marshes, and natural prairies. These habitat types are in effect natural prairies or open, treeless grasslands ranging from very small to several square miles.

The dominate vegetation of the area, includes various species of grasses such as maidencane, paspolams, theehawn and various legumes. In the wetter areas such plants as nutgrass, cutgrass, and sawgrass are dominate. These areas vary in their availability of surface water ranging from prairie areas that never have standing water, to the fresh water marshes that even during drought will usually retain some standing water.

The habitat produces a wide variety of food for various species of wildlife, but because of the lack of cover, few actually breed there. Species found in these areas may include sandbill cranes, burrowing owls, marsh hawks, meadow larks and quail. Mammals will include various species of field mice, rabbits and deer if cover is available nearby.

8. CULTIVATED LANDS

In the Tampa Bay Region the two major forms of cultivated lands are improved pasture and citrus groves. However, in the southern counties a considerable amount of cultivated lands are devoted to vegetable crops. The improved pasture areas offer much the same wildlife possibilities as the grasslands of prairie habitat. The wildlife in the other cultivated lands is dependent on the nature of the remaining natural vegetation and the extent and type of maintenance practices that the particular cultivated crop requires.

9. COASTAL STRAND

The coastal strand habitat is another tropical association found along the coastal shore. The vegetation includes many pioneer herbs, grasses and shrubs of wide distribution. The plants are characteristic of dune formations and sandy soils above the high tide mark, and they include sea purslane, glasswort, sea oats and sea grapes. Farther inland the strand community often grades into a beach hammock which supports cabbage palm, live oak, red cedar and australian pine. Also included in this category are the salt water marsh habitats found along low lying coastal areas of the region. These salt marsh habitats are dominated by various sedges and grasses that are tolerant to the effects of the tides.

Besides the well documented contribution to the marine life by these salt marshes acting as nurseries for numerous marine species, this habitat also has an abundance of other wildlife. The salt water marshes are used as feeding grounds for most, if not all local species of wading birds such as herons, egrets and ibis. This habitat is also important to both resident and wintering species of shorebirds and some ducks. Raptors found in this habitat will include ospreys, marsh hawk, and wintering short-eared owls. Other raptor species such as bald eagles and peregrine falcons, both endangered species, are sometimes found feeding in this important habitat type.

Mammals found in these areas will include raccoons, aquatic rats and marsh rabbits. Occasionally otters and manatees in deeper canals, are also seen. Reptile species typically include diamond backed terrapins, and various types of non-poisonous snakes.

10. DEVELOPED AREAS

These areas include residential areas, cities, and large transportation facilities. Mature residential areas, containing a variety of large trees and shrubs or ornamentals, offer to a limited degree a type of wildlife habitat, utilized by a variety of small animals with a high tolerance for human contact. The other developed areas offer little, if any, habitat and wildlife for all practical purposes can be considered significantly reduced.

APPENDIX II

Commercial Forestry Definitions

1. COMMERCIAL FOREST LAND

Treatment Adequate – This records commercial and non-commercial forestland that is adequately treated in the opinion of Division of Forestry personnel.

Establishment and Reinforcement – For commercial forest, this is the area producing less than its potential because of inadequate stocking. The area can be satisfactorily stocked by planting natural or artificial seeding with or without site preparation. For non-commercial forest, this is the acreage of all non-stocked and poorly stocked land on which increases in tree stocking would improve the non-timber benefits both on-site and off.

Timber Stand Improvement – For commercial forest only. This includes all acreage on which timber stand improvement is biologically feasible, even though application may not be practical because of costs and/or the variability of management objectives. It is assumed that cutting to release crop trees or potential crop trees will result in increased growth and/or quality of the remaining trees in the stand.

2. FOREST LAND GRAZED

This is the total acreage of commercial and non-commercial forest lands which are grazed by domestic livestock. This acreage is included in the total estimate of commercial and non-commercial forest as listed in Table 1.12. The columns are explained as follows:

Treatment Adequate – This is the commercial and non-commercial forest land grazed that is adequately treated.

Needs to Improve Forage – This is commercial and/or non-commercial forest acreage grazed that, under good farm management, should be treated to improve forage by removal or reduction of timber and brush cover and other practices.

Grazing Reduction or Elimination – Commercial and/or non-commercial forest land on which grazing should be reduced or eliminated. Under good farm management, this will protect the land against soil deterioration or to improve the cover. Primary treatment would include weeding, eradication or undesirable components and planting. These practices could be coupled with an incentive rental and loan program to provide landowner incentives and furnish capital funds to be paid back by the owner at harvest time.* Amenity values of scenic beauty, outdoor recreation and watershed protection are probably just as important. In order for private ownership to provide these public benefits, incentives or controls be provided for, we recommend toward the incentives approach.

The Conservation Needs Inventory – Updated in 1967 lists the principle forest treatment needs by county in the Regional Planning Council area.

* *Funds for this incentive contingent on implementation of Forest Incentives Act of 1972 in the U.S. Congress.*

APPENDIX III

Environmental Plan Procedures

The zoning categories, definition and philosophy of the Florida Coastal Coordinating Council (CCC) are used without alteration. To compile the data into composite zoning plans which consider both environmental and developmental considerations, the following procedures were followed.

MAPPING PROCEDURES

The study area was designated as the entire Tampa Bay Region as delineated by the Tampa Bay Regional Planning Council. Florida Department of Transportation (DOT) county highway maps were chosen for base work maps.

The CCC had already completed preliminary investigations for the region. This material was transferred to DOT base maps to serve as the nucleus of the mapping procedure. Once mapped, this information was then checked and updated by recent aerial photographs of the study area. A final flyover check of the marine grass beds, coastal marshes, coastal mangroves, and beach and dunes was made in order to provide the greatest degree of accuracy possible.

Fresh water swamps were mapped by comparing aerial photographs with the soil surveys of each county, after consultation with the United States Geological Survey (USGS) in Tampa. It was determined that these wetlands were important not only as wildlife habitats, but aid in the preservation of the waning water supply of the area by maintaining potentiometric head pressure and soil saturation levels.

Historical and archeological sites were mapped in consultation with the Florida Division of Archives, History and Record Management, Florida Historical Society, regional historical societies, and professors of archeology and anthropology, at the University of South Florida.

Beach erosion conditions were mapped from information supplied by the United States Army, Corps of Engineers.

Water classifications were mapped in accordance with the *Florida Water Classifications* of the Florida State Department of Pollution Control.

Categories I, II and IV were actually mapped, while Class III waters were not indicated. Class III waters are by definition all waters not otherwise included in Classes I, II and IV.

Maps of aquatic preserves were transferred from maps provided by the Florida Board of Trustees of the Internal Improvement Trust Fund through the CCC.

Hurricane flood zone mapping presented special problems. The line mapped is an approximation of the statistical 100 year flood line which is the basis of the federally financed flood insurance program. Because of this, it was desired that the flood line be mapped as accurately as possible. Both the USGS and the National Oceanographic and Atmospheric Administration have participated in this type of mapping. The USGS maps were made readily available.

The primary sources for mapping of the park land were the parks and open space plans for the respective counties. Where it was felt necessary, this information was updated by personally contacting local sources. Due to the limits of a regional study, only those parks over forty acres were mapped.

The mapping of marginal land proved to be particularly difficult. However, in a joint meeting of all the district conservationists and soil scientists, followed by meetings with the individual county conservationists these problems were overcome.

Aquifer recharge areas were identified for the region. Potentiometric maps and topographic maps were compared. Those areas where the potentiometric surface was lower than the earth's surface were delineated. In these areas, it can be assumed that there is a greater potential for ground water percolation than in other areas. These areas were then overlaid with soil maps. Those areas where a low potentiometric surface coincided with high, permeable, sandy soils were then delineated as aquifer recharge areas.

Mineral resources were mapped from state and local maps showing the resources of the region.

The final mapping task was to develop generalized wildlife habitat maps of the region. This was done in order to be able to recognize those areas which serve as the habitats of endangered species and should be set aside for preservation. The process of which was followed was to obtain from the Soil Conservation Service maps showing climax vegetation groups based upon soil type. Then in consultation with zoologists, the wildlife groups associated with various vegetation associations were determined. These associations were compared with current land use maps and aerial photographs to determine those areas where the actual climax vegetation associations still exist. The result is a generalized map of wildlife habitats.

DEVELOPMENT PROJECTIONS

The projected acreage to be altered for development is based on the preliminary Tampa Bay Regional Planning Council's *Population Study.*

Data on developed acres per capita were used as a base line for projection in all land use categories listed except the commercial and industrial categories. These two categories were developed using employment trend analysis and projected on commercial and industrial acreage per employee. This was carried out for each county. The following table identifies the acres per capita (A/C) or acres per employee (A/E) that were derived for the developed areas.

TABLE 4.1: LAND USE, 1972 IN ACRES PER CAPITA (A/C) OR ACRES PER EMPLOYEE (A/E)

	CATEGORY	ACRES
1.	Residential	0.1291/C
2.	Tourist Commercial	0.3273/E
3.	Retail Service	0.1239/E
4.	Industry	0.0930/E
5.	Transportation and Utilities	0.0144/C
6.	Recreation and Open Space	0.0440/C
7.	Public and Semi-Public	0.0090/C

The following aggregation presents these totals for the region for 1975. Categories two (2) and three (3) were combined for the commercial figure shown in the analysis section.

TABLE 4.2: LAND USE PROJECTIONS BY POPULATION AND ECONOMIC ACTIVITY BY ACREAGE, 1975

	CATEGORY	ACREAGE
1.	Residential	208,806
2.	Tourist Commercial	4,735
3.	Retail Service	19,685
4.	Industry	15,156
5.	Transportation and Utilities	16,174
6.	Recreation and Open Space	71,166
7.	Public and Semi-Public	24,423
8.	Total Urban Occupied Areas	360,145

The population projections were analyzed by Minor Civil Divisions (MCD) in each county or a total of 46 sub-divisions in the region. This analysis was then checked by local planning organizations to arrive at a favorable concensus on population allocations. From this point, local interviews with planners, developers and real estate professionals were carried out to determine areas with the highest probability for development in the next three years. These areas were then checked against the preservation and conservation maps, Series One and Two, to determine future conflicts. These areas were then measured by the dot-grid matrix method to determine the figures used in the conflict analysis.

APPENDIX IV

Historical and Archeological Sites

METHODOLOGY

In selecting those historical and/or archeological sites which are included in this section of the study, several criterion were considered:

1. **The site is of major historical consequence.**
2. **The site is designated in the** *National Register of Historic Places.*
3. **The site is of major archeological significance.**
4. **The site is currently undisturbed by surrounding development.**
5. **The chance for preservation of the site is feasible or already underway.**

A site is not included if it is currently in a predominately developed area or is partially destroyed. Any site which is not substantial enough to warrant preservation for cultural, historical or recreational purposes is not included. The counties are listed from North to South and the numbered items correspond to the number items on the Series One Maps, Preservation Zones.

PASCO COUNTY

* **No. 46** Arrowhead
Flint Area

* **No. 47** Cemetery Site
Lithic Workshop (Elfers)

* **No. 82** Old Spanish Well
Watering place for early ships

* **No. 83** Anclote Mound

* **No. 101** Lithic Workshop
Mouth of Anclote River

* **No. 102** Lithic Workshop

PINELLAS COUNTY

* **No. 11** Weedon Island
Indian Village Complex (N end) dating 300 AD - 1400 AD

* **No. 12** Fossil Park
Named for fossils - 650 new species found -
dating to Pliocene Age

No. 14 Seminole Methodist Church

No. 15 Fort Desoto Park - 1898
Only fort in U.S. activated during four major U.S. wars

No. 16 Sylvan Abbey Cemetery
Clearwater
Oldest Pinellas County Cemetery

No. 17 McMullen Cabin
Built - 1952
Example of early pioneer building and architecture

No. 18 Sponge Exchange, Tarpon Springs
Early 1900's - Industry

* **No. 19** Abercrombie Park
Site of location and landing of Panfilo de Narvarz - 1528

No. 20 Espirta Santo Springs, Safety Harbor
Original Fountain of Perpetual Youth, sought by
Ponce de Leon and discovered by Hernando Desoto in May, 1539

* **No. 21** Hirrihigua Mound
Serpentine Drive and 20th Street South
Temple Mound

PINELLAS COUNTY (cont.)

*	No. 22	Big Island Mound Pre-historic Archaelogical Site
	No. 23	St. Bartholomew's Episcopal Church Oldest Church in Pinellas County, 1889
	No. 24	Don Cesar Hotel Built in 1928 - 325 Bedroom Luxury Hotel
	No. 25	Detroit Hotel Built in 1888 - First Hotel in St. Petersburg
*	No. 31	Jungle Prada Site Middens and Cemetery
	No. 32	First Pinellas County Courthouse
*	No. 33	Arnaldi Hammock 4' - 8'
*	No. 35	Ross Island Mounds
	No. 36	Odet Phillippi Estate Phillippi Park Safety Harbor
*	No. 37	Safety Harbor Mounds Phillippi Park Temple and Burial Mounds
*	No. 38	Arrowhead Park Midden Mullet Key
*	No. 39	Oakhurst Burial Mound Oakhurst Road
	No. 40	Bellview Biltmore
	No. 41	St. Michael's Shrine Hope Street, Tarpon Springs
	No. 42	Oldest Beach Church - 1913 Pass-A-Grille Beach Community Church
*	No. 43	Tierra Verde Mound Indian Burial Mound - 1500 AD
*	No. 79	Pine Key Mound Burial Mound
*	No. 80	Long Bayou Temple, Burial
*	No. 87	Canton Street Site Indian Village
*	No. 88	Bayview Site U.S. 19 East and North of Gulf to Bay
	No. 89	Miranda Home Oakdale Street - Off Fourth Street South near 23rd Avenue

HILLSBOROUGH COUNTY

* No. 1 Dirsler Circle
Tampa Mound and Tropical Jungle

* No. 2 Coachroach Key
Indian Mound
One of the largest still in tact

No. 4 Fort Alabama – 1/2 mile East of
Highway 301 - Hillsborough River

No. 5 Tampa Bay Hotel - University of Tampa
Social and Cultural Center of early Tampa
Opened 1891

No. 9 First Church Building in Tampa
Built in 1851 -1891

No. 10 Ballast Point
Small park with fishing pier

* No. 71 Thomas
Sand Mound, shell midden

* No. 72 Picnic Mound
12 miles East of Riverview and Picnic

* No. 73 Mill Point I
Midden

* No. 74 Shell Bluff
Burial Mound - Near Alafia Mouth

* No. 75 Lincoln Mound (3)
Bullfrog Creek

* No. 76 Sand Burial Mound
Plant City

* No. 77 Rocky Point
Shell Midden Mound

* No. 78 Palm River Midden

No. 81 Ft. Foster
Second Seminole War Fort

* No. 90 Buck Island

* No. 91 Mill Point

* No. 92 Bullfrog Creek Midden

* No. 93 Shell Point Midden

* No. 94 The Kitchen Sites

* No. 95 Gardenville Midden

* No. 96 Thonotasassa Site

* No. 97 Unnamed Site
Lithic Materials

* No. 98 Unnamed Site
Sand Mound

* No. 99 Shell Midden - North
of Rocky Point Peninsula

* No. 100 Fish Creek Site

MANATEE COUNTY

* No. 55 Parrish Mound (2)
Sand Burial Mound

* No. 56 Parrish Mound "3" (2)

* No. 57 Perico Island (2)

* No. 58 Cow Point
Shell Mound, 2 Burial Mounds (3)

* No. 59 Harbor Key
Temple Mound
Sand Burial, Sand Middens

* No. 60 Unnamed
Sand Burial Mound

* No. 61 Unnamed Burial Mound

* No. 62 Unnamed
Earthwork - Sand Ridge
(Gillette)

* No. 63 Unnamed Burial Mound

* No. 64 Cemetery, Unnamed

* No. 65 Large Sand Mound and Small Mounds

* No. 66 Sarasota - Manatee (Line Site)
Oblongs and Mound

* No. 67 Ogleby Creek Site
Oblong Sand Mound

MANATEE COUNTY (cont.)

*	No. 68	Burial Mound 15 Miles East of Parrish
*	No. 69	Shell Midden - (Snead Isle) Crescent Shaped
*	No. 70	Horton Site Snead Island
	No. 84	Robert Gamble House Ellenton - U.S. 301
*	No. 85	Madeira Bickel Mound Terra Ceia Island
	No. 86	Cortez 1880 Fishing Village
	No. 105	Braden Castle Three Miles East of Bradenton At Confluence of Manatee and Braden River

SARASOTA COUNTY

*	No. 48	Osprey - Shell Middens Little Sarasota Bay
*	No. 49	Pool Hammock Northeast of Laurel Village
*	No. 50	Whitaker Estate Mound 60' Diameter - 10' High
*	No. 51	Midnight Pass (Bird Key) Shell Midden
*	No. 52	Lemon Bay Unnamed Shell Midden
*	No. 53	Little Salt Spring Spring Burial Site
*	No. 54	Paulsen Point Shell Midden
	No. 103	John and Mable Ringling Estate
*	No. 104	Englewood Site Major Indian Village Complex

* Indicates Archeological Sites

APPENDIX V
GLOSSARY

PRESERVATION AREAS

Preservation areas are recommended to be protected from any further development except in extreme cases of overriding public interest. The preservation concept includes consideration of ecologically sensitive flora and fauna, as well as, fragile topographic features such as beaches, marshes, and dunes. Included are important historical and archeological sites and any unique environmental features peculiar to the region such as selected springs, caves, waterfalls, and reefs. The estuarine water areas included are classified for shellfish propagation (Class II). This is the state's most stringent coastal water classification.

Preservation of the areas would offer enhanced aesthetic values, recreational opportunities, sustained biological productivity, and substantial protection to coastal residents and visitors.

Class I Waters

These are surface waters that are used as a potable source of public water supplies or withdrawn for treatment as such.

Class II Waters

These are coastal waters which have the capability of supporting shellfish harvesting.

Marine Grass Beds

These are shallow water areas containing extensive amounts of submerged vegetation. These areas are very important to maintenance of marine productivity.

Selected Coastal Marshes

These are marsh systems having an extent of at least forty acres. Such areas are valuable habitat for numerous species of birds and terrestrial animals, and those marshes influenced by tidal action are considered critical to the maintenance of our marine fisheries. Included in this category are **high** marsh areas generally considered as being above Mean High Water (MHW). Such areas of lesser extent than forty acres are also recommended to be preserved, but due to scale difficulties are not shown.

Selected Coastal Mangroves

These are shore-fringing stands of red, black and/or white mangroves having regional significance. Although it is generally held that red mangroves are the most important and occupy that area between MHW and Mean Low Water (MLW), the three types are often intermixed, making identification of distinct zones within stands very difficult. Similar in function to tidal marshes, these areas are vital to regional marine productivity and offers protection from potential erosion and flooding.

Gulf and Atlantic Beaches and Dunes

This refers to all beaches and dune systems fronting on the open Gulf of Mexico. These areas, in addition to being very important recreational resources, constitute natural shoreline protection features. Under Chapter 161.053, F.S., all construction seaward of the coastal construction setback line (50 feet inland from MHW unless otherwise established through consideration of natural beach processes) must

receive a permit from the Bureau of Beaches and Shores. Local governments through their building permit systems, have the most effective means of detecting violations and should assure that projects within their areas of jurisdiction abide by the setback law.

Estuarine Beaches

These are recreation-quality beaches not exposed to the open Gulf of Mexico or Atlantic Ocean. Although they are not as extensive or as attractive as open ocean or gulf beaches, they are important recreational resources that are subject to similar natural forces and development pressures. The state coastal construction setback law does not apply to estuarine beaches.

Selected Fresh Water Swamps and Marshes

These are areas having a high water table, predominantly internal drainage, and supporting extensive stands of water-tolerant vegetation. Such areas are unsuitable for intensive land uses without major alteration. They are usually of great ecological importance and serve as natural retaining mechanisms for surface water storage.

Because of the ecological significance of these areas, their value for hydrologic purposes, and their intrinsic unsuitability for intensive development, they should be preserved in essentially their natural state. The state and federal governments presently have limited authority to ensure this, except in wildlife refuges, state and national parks, state wilderness areas, areas subject to flowage easements, or other areas in public ownership. The majority of Florida's fresh water swamps and marshes are in private ownership, with very few controls on their use.

Historical and Archeological Sites

These are areas of outstanding historical or archeological significance designated by either the federal government or the Florida Division of Archives and History. Florida's rich and colorful history has endowed the state with a valuable assortment of such areas, and although it is state policy to protect them, many important sites are in private ownership. In such areas the state is often powerless to prevent their destruction by private interests and must rely solely on local governments to protect the public interest.

CONSERVATION AREAS

Conservation areas are the lands and waters within the coastal zone that are not absolutely critical to regional ecological integrity (except certain wildlife refuges). However, because of their physical character or present use, they provide **buffer zones** for preservation areas and represent retention to use options for future generations. These areas also require special precautions when being converted to development in order to avoid direct or indirect consequences harmful to the public health, safety and welfare.

Class III Waters

These are all coastal waters not otherwise specifically classified by the State Department of Pollution Control. Included are bays, rivers, lakes, estuaries and open waters of the territorial sea. The primary requirement for these waters is that they be maintained at a quality sufficient to allow body contact water sports and propagation of fish and wildlife. Within this classification, however, is the **special stream classification** mentioned earlier. These streams are considered as **unique environmental features,** and are zoned as preservation areas in the state coastal zone plan.

Aquatic Preserves

These are state protected coastal areas having exceptionally high biological, aesthetic, educational and/or scientific value. Such areas are established by the state after public hearings at the local level.

Hurricane Flood Zone

This encompasses lands seaward of the 100 year flood line including keys and islands, that is, the area subject to flooding by hurricane driven tides on a statistical probability of once every 100 years. It should be kept in mind that this frequency prediction represents an average that may occur several times within a short time span or may delay for a considerable period. Most of the heavily populated and rapidly growing cities of South Florida have been very fortunate in the last three decades and have not been subjected to devastating hurricanes. Unfortunately, this has caused a false sense of security in many areas, thus setting the stage for natural disasters on a massive scale. Hurricane driven tides are accompanied by severe wave action and are potentially far more destructive than rising water associated with poor drainage. For this reason, development in the hurricane flood zone should recognize the hazards and use proper construction techniques.

It should be recognized that the National Flood Insurance Program utilizes the 100 year flood line as a basis for granting flood insurance. To qualify for insurance under this program, all new residential construction must have ground floor elevations above the 100 year flood stage. Other uses have the option of either making ground floor elevations above this level or flood proofing buildings to that height.

River Flood Plans

These are lands lying along drainage corridors (rivers and streams) that are subject to flooding on a regular basis. These areas usually contain mixed alluvial, poorly drained soils and natural vegetation that is adapted to fluctuating water levels. The vegetation is especially important in that it provides diversity to the landscape, serves as vital habitat for numerous species of birds and animals, and performs very significant ecological functions for the waters that flow through the drainage corridors.

Development in flood plains is usually very expensive, both initially and in terms of continuing maintenance costs. In spite of steadily increased expenditures on flood control structures, national losses due to floods continue to rise at an alarming rate. It is ironic that the most important factor contributing to this situation is persistent invasion of the flood plains by those land users most likely to suffer large financial losses from floods. Any development in flood plains that does not actually require access to waterfront is likely to become an unnecessary financial burden to local, state and/or federal government and should be subject to very strict regulation.

Wildlife Refuges

These are areas specifically set aside for the protection of wildlife. Such areas may be subject to multiple use, as in the case of state parks, all of which are game refuges. Newly enacted legislation (SB 187) allows the state to lease lands for 50 years of more for use as wildlife sanctuaries. It also provides tax relief on those lands.

Parks and Recreation Areas

These are areas devoted to outdoor recreational activities of various types. This may include historical and archeological sites, game refuges or unique environmental features. It is impossible for state government to meet all outdoor recreation needs of residents and tourists, therefore, local governments and private owners must be relied upon to satisfy a large portion of the needs. As urbanization intensifies,

this situation becomes increasingly critical, emphasizing the wisdom of providing development controls that will prevent degradation of recreation areas.

The recently enacted "greenbelt law" (H3772) provides a mechanism for encouraging retention of privately owned parks and recreation areas. By offering tax incentives in accordance with this law, municipal and county governments can aid the state.

Marginal Lands

Marginal lands are those areas that require major alterations before they are suitable for intensive development and are not classified as other conservation items. Examples of limitations are poor drainage, susceptability to flooding, and soils having low permeability, high water table, and/or low bearing strength. There are varying degrees of marginality, and most of the limitations may be adequately overcome by technology. Generally speaking, however, intensive development of areas having moderate to severe limitations involves excessive modification of the landscape, large initial expenditure of funds, a high maintenance cost, and presents continuing problems for local government. In addition, intensive development of marginal lands can generally be anticipated to have significant ecological impact unless very careful planning precedes development.

ECONOMIC BIBLIOGRAPHY

Area Statistics: Selected Services, 1967, U.S. Department of Commerce, Bureau of the Census

County Business Patterns, 1962, 1965, 1970, 1971, U.S. Department of Commerce, Bureau of the Census

Employment Covered Under the Workman's Compensation Act, 1960, 1965, Florida Industrial Commission

Economic Growth and Development, Hillsborough County, Hillsborough County Planning Commission, Tampa, Florida, August, 1972

The Economic Impact of the Tampa Port, Dr. M. S. Heidingsfeld, College of Business Administration, University of South Florida, September, 1968

Florida Statistical Abstract, 1967, 1968, 1969, 1970, 1971

Initial Development of Port Manatee, James C. Buckley, Inc., New York, New York, 1966

Local Government Finances, 1967, 1970, U.S. Department of Commerce, Bureau of the Census

Population and Land Use, Tampa Bay Regional Planning Council, (unpublished)

Population Projections, Tampa Bay Regional Planning Council, (unpublished)

LAND PLANNING BIBLIOGRAPHY

Barada, W. etal, *Report of Investigation of the Environmental Effects of Private Waterfront Canals,* Prepared for State of Florida, Board of Trustees of the Internal Improvement Trust Fund, Tallahassee, Florida, February, 1972

Coastal Coordinating Council, Draft of "Guidelines for Development Activities in Florida's Coastal Zone", unpublished working paper

Coastal Zone Management in Florida, 1971, Florida Coastal Coordinating Council, Tallahassee, Florida, 1971

Conservation Foundation Letter, "The Conservation Foundation", Washington, D.C.

Dartelli, L. J., et al eds., **Soil Surveys and Land Use Planning,** Soil Science Society of America and American Society of Agranomy, 1966

Escarosa: A Preliminary Study of Coastal Zone Management Problems and Opportunities in Escambia and Santa Rosa Counties, Florida Coastal Coordinating Council, Tallahassee, 1971

Flawn, P. T. , **Environmental Geology: Conservation, Land Use Planning and Resource Management,** Harper and Row, New York, 1970

Florida Legislature, *The Florida Environmental Land and Water Management Act of 1972,* (SB 629), Tallahassee, Florida, 1972

Florida Legislature, *The Florida Water Resources Act of 1972,* (HB 4060), Tallahassee, Florida, 1972

Florida Statistical Abstract, Bureau of Economic and Business Research, College of Business Administration, University of Florida, Gainesville

"Florida Tourist Study", Florida Department of Commerce, Tallahassee, Florida

Florida Trend, Volumes 13-14, 1971, inclusive

Florida Trend, April, 1972, Volume 14, Number 12

"Forest Statistics for Central Florida, 1970," U.S.D.A. Forest Service Bulletin SE-17, Southeastern Forest Experiment Station, Ashville, North Carolina, September, 1970

Hills, G.A., *The Classification and Evaluation of Land for Multiple Uses,* Forestry Chronicle, June, 1966, (pp. 1-25) (reprint available)

Hills, G.A., *Regional Site Research,* Forestry Chronicle, 1960, December, 1960, (pp. 401-423) (reprint available)

Interim Waste Water Treatment Plan Through 1980, Tampa Bay Regional Planning Council, March, 1972

Kiplinger Florida Letter, op. cit.

Kiplinger Florida Letter, 1971, 1972, inclusive

Lacate, Douglas S., *A Review of Land Type Classifications and Mapping,* Land Economics, August, 1961, (pp. 275–277)

Land Use Conflicts and Phosphate Mining in Florida, Sweeny, J.W., Bureau of Geology, Information Circular 72, State of Florida, Department of Natural Resources, Tallahassee, see 1971

Leapold, B.L., et al, *A Procedure for Evaluating Environmental Impact,* U.S. Geological Survey, Washington, D.C.

Leapold, L.B., *Hydrology for Urban Land Planning - A Guidebook on Hydrologic Effects of Urban Land Use,* Geological Survey Circular 554, Washington, D.C. 1968

Lewis, Philip H., **The Outdoor Recreation Plan,** (Wisconsin Development Series) Madison: Wisconsin Department of Resource Development, 1969

McHarg, Ian L., **Design with Nature,** Doubleday/Natural History Press, Doubleday and Company, Inc., Garden City, New Jersey, 1971

McHarg, Ian L. and Wallace, David A., *Plan for the Valley vs. Spectre of Uncontrolled Growth,* Landscape Architecture Quarterly, April, 1965, (pp. 179-181)

McQuigg, J.L., *The Economic Value of Florida's Estuarine Areas,* unpublished lecture presented at the Pine Job Environmental Sciences Center, West Palm Beach, 1971

National Estuary Study, U.S. Department of the Interior, Fish and Wildlife Service, G.P.O., Washington, D.C., January, 1970

National Goals Research Staff, *Toward Balanced Growth: Quality and Quantity,* Washington, D.C., U.S.G.P.O., 1970

The National Shoreline Study, Volumes 1-3, U.S. Army Corps of Engineers, Washington, D.C., 1971

Newsletter, *Florida Coastal Coordinating Council,* Department of Natural Resources, Tallahassee, Florida, Volume I

Outdoor Recreation Resources Review Report, Volumes 1-23, Outdoor Recreation Resources Review Commission Staff, G.P.O., Washington, D.C.

"Population Trends, A Regional Fact Sheet", in-house research report, Tampa Bay Regional Planning Council

Preliminary "Population Study, Tampa Bay Region", unpublished working paper, Tampa Bay Regional Planning Council

Preliminary "Land Use Study, Tampa Bay Region", unpublished working paper, Tampa Bay Regional Planning Council

"A Red Flag Charrette", Seminar Sponsored by the Florida Association of the American Institute of Architects, March 5, 1972, Gainesville, Florida

Science and Environment, Report to the Commission on Marine Science, Engineering and Resources, G.P.O., Washington, D.C., 1969

Shoreline Analysis of the City of Sarasota, Smally, Welford and Nalven Consulting Engineers, Tampa Bay Regional Planning Council, Publication, 1970

Shoreline Resource Development: A Preliminary Report on Coastal Planning and Land Management for the Tampa Bay Region, Tampa Bay Regional Planning Council, April, 1972

Soil Survey Manual, Agriculture Handbook, 18, U.S. Department of Agriculture, G.P.O. Washington, D.C.

Soil Survey, Pasco, Pinellas, Hillsborough, Manatee and Sarasota, Florida, U.S. Department of Agriculture, Soil Conservation Service, G.P.O., Washington, D.C.

Taylor, J.L. and C.H. Saloman, *Some Effects of Dredging and Coastal Development in Boca Ciega Bay, Florida,* Fishery Bulletin, Volume 67, Number 2, 1968

Thompson, S.H., *Estuaries: An Action Program to Save Them,* from Gulf and Caribbean Fisheries Institute Proceedings, 1967

U.S. Legislature, 92nd Congress, *The Coastal Zone Management Bill,* (S582), Washington, D.C., 1972

WASTE DISCHARGE BIBLIOGRAPHY

Department of Pollution Control, Winter Haven, Florida

Department of Pollution Control, Southwest Region, Punta Gorda, Florida

Department of the Army, Jacksonville District Office Corps of Engineers

Environmental Protection Commission, Hillsborough County

Environmental Engineering Section, Manatee County Health Department

Environmental Engineering Section, Pasco County Health Department

Environmental Engineering Section, Pinellas County Health Department

Environmental Engineering Section, Sarasota County Health Department

Engineering Standard, *Animal Waste Treatment Lagoons,* Florida, April, 1970

Florida Board of Conservation (DNR), *Florida Land and Water Resources, Southwest Florida,* 1966

FWPCA - *Problems and Management of Water Quality in Hillsborough Bay, Florida,* December, 1969

Project Manasota 88, Report of an Environmental Health Study, Manatee and Sarasota Counties, 1966-68

TBRPC, *Comprehensive Plan for Water and Sanitary Sewer Systems in the Counties of Hillsborough, Manatee, Pinellas and Sarasota,* October, 1968

TBRPC, *Interim Wastewater Treatment Plan Through 1980,* March, 1972

TBRPC, *Inventory and Analysis of Existing Water, Sewer and Solid Wastes Systems,* November, 1967

Bill Ruff Cover

TAMPA BAY REGIONAL PLANNING COUNCIL
3151 THIRD AVENUE NORTH, SUITE 540, ST. PETERSBURG, FLORIDA 33713

NOAA COASTAL SERVICES CENTER LIBRARY
3 6668 14104 0842

COASTAL ZONE
INFORMATION CENTER