# DOCUMENTING THE ECONOMIC IMPORTANCE OF TAMPA BAY

FINAL REPORT

March 1986

Tampa Bay Regional Planning Council
9455 Koger Boulevard
St. Petersburg, Florida 33702
(813) 577-5151

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# DOCUMENTING THE ECONOMIC IMPORTANCE OF TAMPA BAY

A Report to the Tampa Bay Regional Planning Council

and Agency on Bay Management

Financial assistance for this study was provided by a Coastal Management Grant from the Florida Department of Environmental Regulation.

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# EXECUTIVE SUMMARY

The Tampa Bay estuarine system is, both directly and indirectly, a vitally important economic asset to the Tampa Bay region. Directly, the presence of Tampa Bay makes possible the port facilities of Tampa, St. Petersburg and Manatee County; ship building and repair firms; commercial and recreational fishing industries; and other marina facilities. Indirectly, the mere presence of the bay attracts industries and businesses, waterfront residential developments, and a myriad of related support industries, and commercial and recreational activities. There is strong evidence that the presence of Tampa Bay has contributed significantly to the rapid growth rate of the region's population and economic base over the past 50 years, and yet, the value of Tampa Bay as a natural resource and cultural amenity has never been fully documented or quantified.

In 1982, the Tampa Bay Regional Planning Council (TBRPC) established the Tampa Bay Management Study Committee. The Committee was charged with the task of identifying critical bay management problems and evaluating potential solutions for those problems. There were 42 issues identified by the Committee, contained in the final Tampa Bay Management Study. Issue number 17 was entitled Documenting the Economic Importance of Tampa Bay. The intent of Issue 17 was to document the overall economic benefits of Tampa Bay to the region.

In 1983, TBRPC established the Tampa Bay Management Steering Committee, which in turn gave rise to the Tampa Bay Management Study Commission, established by the 1984 Florida Legislature. the culmination of the Commission's efforts was a comprehensive study entitled The Future of Tampa Bay, which contained a detailed management strategy for Tampa Bay. The Commission built upon the accomplishments of the previous Study Committee, and the 42 issues identified originally were researched further.

In October 1984, TBRPC obtained a Coastal Management Grant from the Florida Department of Environmental Regulation, to initiate a study with the objective of documenting the importance of the Tampa Bay estuarine system to the economic base of the region (Issue 17), in its static, or present, condition.

A summary of the economic benefits derived from various uses and attributes of Tampa Bay is as follows:

## Benefits of Tampa Bay to Shipping and Water-borne Commerce

- Tampa Bay, as a body of water, provides a surface on which transportation can take place. It is estimated that, in 1984, shippers and cosignees that engaged in commerce on bhe bay, via the Port of Tampa, realized an annual savings in transportation related costs of approximately $281 million.

Benefits of Tampa Bay to Sanitary and Electric Services

- Tampa Bay serves as a receiving water body for discharges of treated wastewater from municipal sewage treatment plants. As such, the following has been determined:

  - The costs associated with the alternatives of gulf outfall ($123.5 million), spray irrigation ($164.3 million) and deep-well injection ($1 billion), exceed the present costs associated with the advanced wastewater treatment (AWT) and discharge to Hillsborough Bay, at the City of Tampa's Hookers Point Sewage Treatment Plant.

  - The costs associated with the alternative of secondary treatment and spray irrigation represent an additional $14 million beyond the costs associated with the present AWT and discharge to Channel A, at Hillsborough County's River Oaks Sewage Treatment Plant.

  - In general terms, the cost of wastewater reuse for all seven sewage treatment plants located in north Pinellas County, represents an additional $41 to $48 million beyond the costs associated with secondary treatment levels and surface water disposal.

- Tampa Bay serves as a source of condensor cooling water and as a site for disposal of waste heat, from steam electric power plants located on its shores. As such, the following has been determined:

  - The costs of a closed-cycle cooling system represents an additional $40.5 million beyond the cost associated with the conventional once-through cooling system, presently employed at the Tampa Electric Company, Big Bend Unit IV facility.

  - In general terms, the costs associated with the alternatives of dilution pumps ($12.5 million), "helper" cooling towers ($22.8 million), and off-stream mechanical craft cooling towers ($50 million), exceed the cost associated with the once-through cooling system, presently employed at the Florida Power Corporation, P.L. Bartow Plant.

Benefits of Tampa Bay to Commercial Fishing

- In 1984, approximately 1,952 commercial fishermen plied their trade in Hillsborough, manatee and Pinellas Counties, landing a total of 22.1 million pounds of finfish and shellfish, valued at $19.5 million.

Benefits of Tampa Bay to Waterfront Property Owners

- It was determined that the most valuable attribute or benefit, provided by Tampa Bay, to owners of single-family residential waterfront homes was the water view, followed by the ability to navigate a boat in water close to the home.

Benefits of Tampa Bay to Water-Oriented Recreational Activities

- In 1984, the retail sales reported for motorboats, yachts and marine accessories in Pinellas, Hillsborough and Manatee Counties, was approximately $184 million.

- The total economic value of recreational fishing in the Tampa Bay region is estimated to be $197 million (in 1983 dollars).

- The total annual economic value of saltwater beach activities and boat ramp use, in the Tampa Bay region, is estimated to be $23 million (in 1983 dollars).

Ecological Services of Tampa Bay

- In general terms, Tampa Bay continues to perform the various natural functions indicative of all estuaries, however, its ability to "function naturally" has been stressed by 100 solid years of competing uses.

CHAPTER 1

## A. INTRODUCTION

Tampa Bay is the largest open water estuary in the State of Florida, with over 1.6 million people living in the three counties bordering its shores.(1) This population represents a 45 percent increase since 1970. Once the state's most diverse and productive estuarine ecosystem, rapid urban and industrial development have significantly changed the character and ecology of Tampa Bay. For example, recent studies have indicated that 44 percent of the original 25,000 acres of mangrove forests and salt marshes have been destroyed, and 81 percent of the original 76,500 acres of seagrasses have disappeared. This habitat loss has resulted in declining populations of economically important fish and shellfish including a complete collapse of such fisheries as scallops and oysters, and major declines of bait shrimp, spotted seatrout and red drum.

Now the second largest population center in the State of Florida, this rapid urbanization has, however, enhanced the economic benefits of the Tampa Bay area in other ways both for the state, and for the nation as a whole. The Port of Tampa has become the nation's seventh largest port in terms of tonnage transported, and is the third largest U.S. port in terms of foreign exports. Over six million tourists are drawn to the bay area's beaches and waters annually. Tampa Bay is a major aesthetic and recreational amenity, supporting a multitude of water dependent commercial enterprises including a burgeoning boat building industry, waterfront homes, restaurants, hotels and office buildings, an expanding complex of public and private marinas, and numerous recreational activities.

Nevertheless, over the past few years it has become painfully clear to bay area municipal and county governments that the additions of homes and businesses, and accompanying people, dramatically increase the needs of local governments to provide water, new sewage treatment plants, electrical power plants and highways. Because growth and development rarely pay for themselves in the short-term, local governments will increasingly struggle to finance the needs of a surging population. The subsequent strain on the environment has been, and will continue to be, well documented in the adverse impacts on the ecology of Tampa Bay.

Tampa Bay constitutes the central geographic feature most responsible for, both historically and at present, shipping, industrial development, and aesthetic and recreational values that encompass the overall attractiveness of the region to population influx. However, without proper management, and the maintenance of balance between all public and private uses, Tampa Bay is threatening to become a major liability rather than the area's main asset.

Currently, the management of Tampa Bay is fragmented amongst a multitude of federal, state and regional regulatory agencies, as well as 17 local governments bordering the bay (see Figure 1-1). Management is accomplished through the uncoordinated implementation of various monitoring, permitting and regulatory programs. Under the existing management framework, jurisdictions are often overlapping, interests are often conflicting, and no one agency has overview authority for the bay, or manages it as a holistic natural resource. As a result, the management of Tampa Bay has been both wasteful and ineffectual. For these reasons, the Tampa Bay Management Study Commission was created to examine the opportunities for, and the constraints against, developing a unified, comprehensive management strategy for Tampa Bay.

## B. HISTORY OF THE TAMPA BAY MANAGEMENT STUDY COMMISSION

In 1968, a conference sponsored by the University of South Florida recommended that no reduction of present bay bottom area or mean bay dimensions below mean high water, and no modification of present bay bottom be allowed, except for the maintenance dredging of existing navigation channels. The group also recommended that limits to municipal wastewater discharges, as well as the establishment of a baywide management committee were necessary. No actions were taken regarding the first conclusion, but a local act of the 1972 Florida Legislature, which was later repealed in 1981, did implement stringent limits on acceptable sewage treatment plant effluent discharges.

In response to growing public concern about the environmental degradation of Tampa Bay, the Legislature passed a local act in 1970 creating the Tampa Bay Conservation and Development Commission. This Commission was to consist of ten members composed entirely of local legislators and other elected officials. The Commission was empowered to undertake studies to ascertain the public interest in Tampa Bay, and to determine the effects of further dredging and filling on navigation, and fish and wildlife resources in the bay. Unfortunately, the Tampa Bay Conservation and Development Commission never convened and the act expired.

In 1982 the first symposium on Tampa Bay was held at the University of South Florida. The Tampa Bay Area Scientific Information Symposium (BASIS) lasted four days and involved topical presentations by 50, invited speakers. Major conclusions of the Symposium were that (1) Tampa Bay should be comprehended and managed, as a single ecological system; (2) the bay is remarkably resistant to environmental challenges; (3) a clear pattern of decline is evident in some measures of ecological condition; and, (4) the management needs of Tampa Bay are relatively clear and, if implemented in a comprehensive and baywide basis, would result in tangible improvements to the bay and its usefulness to people.

It was further concluded that, at the present time, state and federal regulatory agencies, local governments surrounding the bay, and an array of industries and user groups generally carry out their respective activities independently. The effect of bay

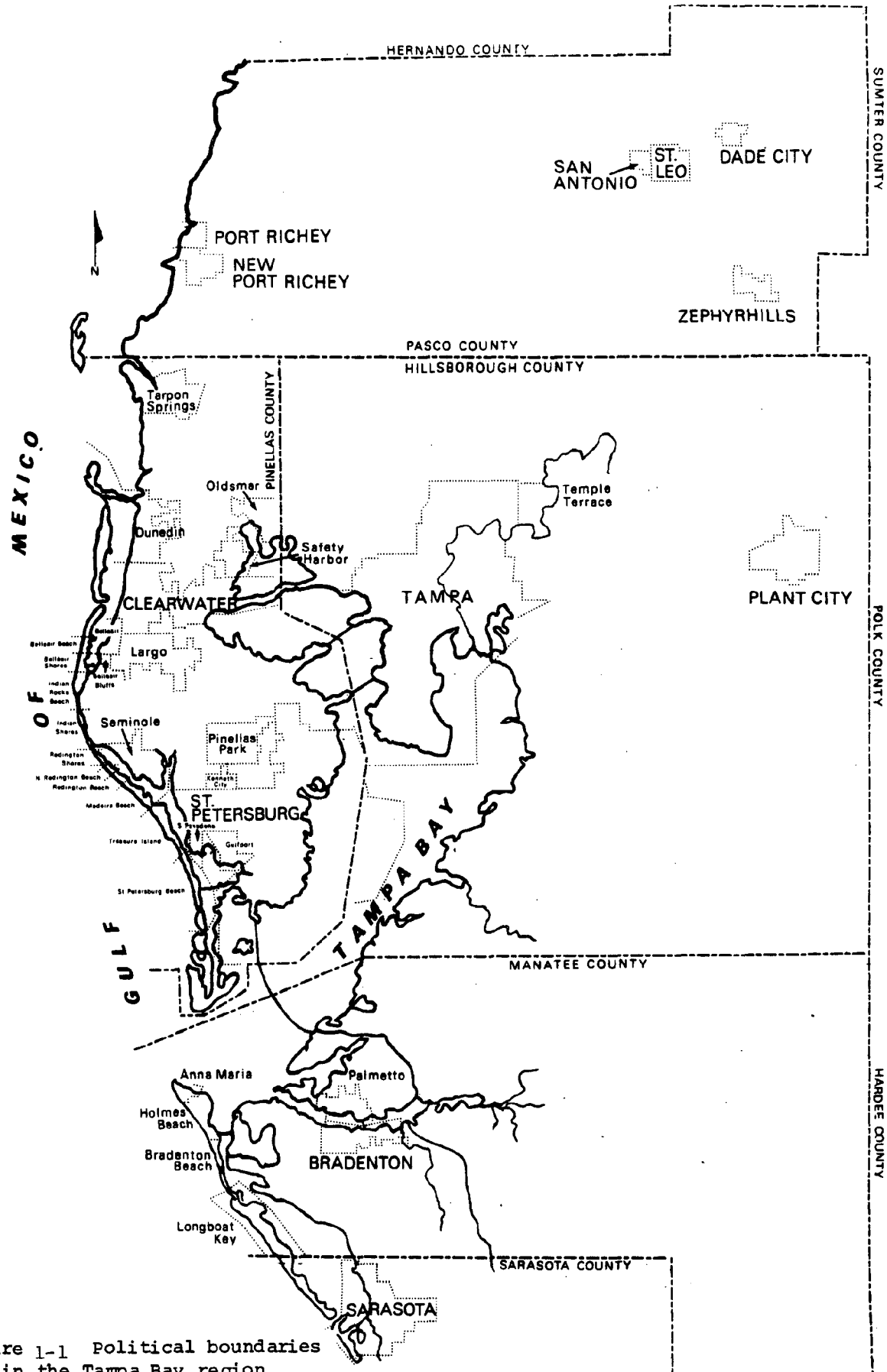



Figure 1-1 Political boundaries within the Tampa Bay region.

management by a multitude of overlaping and often conflicting interests and jurisdictions had thus contributed to a number of environmental and growth management problems in the bay area.

In partial recognition of these problems, BASIS organizers suggested that the Tampa Bay Regional Planning Council (TBRPC) initiate a comprehensive planning study of Tampa Bay from a variety of viewpoints. On May 10, 1982, a motion was passed by the Council to establish the Tampa Bay Management Study Committee. The Committee was charged with the task of identifying critical bay management problems and evaluating potential solutions for those problems. In December 1982, a grant was received from the Florida Department of Environmental Regulation (FDER), through the federal Coastal Zone Management program, to help support Committee activities for one year and to develop a management plan for Tampa Bay.

The Tampa Bay Management Study Committee was composed of representatives from local, regional, state and federal agencies, the academic community and commercial, industrial, recreational and environmental interests. Initially, five subcommittees were formed to specifically address ecological, industrial, institutional, economic and recreational aspects of Tampa Bay. The planning process consisted of five steps: 1) identification of the management boundary; 2) adoption of goals and objectives; 3) identification of major bay management issues; 4) development of bay management guidelines and performance standards; and, 5) identification of existing and potential implementation programs and strategies. In December, 1983, grant funds for this effort expired and the final Tampa Bay Management Study document was published.

Because of the large number and complex nature of the issues affecting Tampa Bay, the Tampa Bay Study Committee could not reach a consensus regarding a recommended strategy to direct a coordinated approach to the management of the bay. As a result, the Committee recommended, and the Council approved, the interim establishment of a 15 to 20 member Tampa Bay Management Steering Committee in October, 1983. The composition of this Committee provided for effective representation from a wide range of Tampa Bay's business, environmental and industrial interests as well as from the local regulatory agencies having jurisdiction over the bay.

During its six-month tenure, the Steering Committee concentrated primarily on a comprehensive survey and review of all entities having management responsibility for Tampa Bay with the objective of documenting all major jurisdictional gaps and overlaps. As a result of this effort, an existing authorities matrix was developed.

Through the efforts of local legislators and key members of the Tampa Bay Management Steering Committee, a special legislative act was introduced and passed during the 1984 session of the Florida Legislature creating the Tampa Bay Management Study Commission, in recognition of the need for a more credible and structured forum within which to proceed. The Commission was to be composed of essentially the same membership as the Steering Committee, and was

to retain many of the members of its predecessor as an adjunct Technical Advisory Committee.

The Commission was granted a one-year mandate to complete the following tasks:

1. Develop a recommended Bay Management Plan and make a formal recommendation to the Tampa Bay Regional Planning Council 30 days prior to the 1985 session of the Florida Legislature.

2. Prepare a preliminary three-to-five year legislative work program to address priority bay management issues in conjunction with ongoing efforts by Congress, the U.S. Fish and Wildlife Service, state agencies, port authorities and other regulatory entities, for submittal prior to the 1985 legislative session.

3. Seek new sources of funding, as well as assist in coordinating existing funded efforts, to implement studies or actions addressing priority bay management issues. Such funding was not to be limited to only funding efforts of the Council, but also essential work by other public and private groups.

4. Monitor proposals falling under the review responsiblities of the Council for compliance with the recommended Bay Mangement Plan.

5. Make specific recommendations to the Council regarding bay management issues that may be identified during the lifetime of the Commission.

In conjunction with these efforts, the Tampa Bay Regional Planning Council procurred a second FDER Coastal Zone Management grant in October, 1984 to support the activities of the Commission. During its one-year tenure, the Commission provided technical commentary and made specific recommendations to the Council, the Florida Department of Environmental Regulation and the U.S. Army Corps of Engineers, regarding two major bay management issues - the Tampa Bay wasteload allocation study, and the proposed deepening of the Alafia River and Big Bend navigation channels.

The culmination of the Commission's efforts was a comprehensive study entitled The Future of Tampa Bay.(2) This study, representing a comprehensive management strategy for Tampa Bay, was presented to the Florida Legislature prior to the 1985 session.

## C. PLANNING PROCESS

During the meetings from July, 1982 to March, 1983, the various subcommittees of the Tampa Bay Management Study Committee defined a management boundary system and identified local and regional issues, including many site specific concerns, related to the comprehensive management of Tampa Bay.

A two-fold definition was developed to delineate a proposed management boundary for the Tampa Bay estuarine system. It was unanimously acknowledged that the Tampa Bay estuary could never be comprehensively managed without determining and controlling the impacts of those activities occurring upstream from, or adjacent to, the estuary.

The Tampa Bay estuary includes a connected group of estuaries and second order embayments; its seaward limit is arbitrarily given as a line connecting the barrier beaches of Boca Ciega Bay and Anna Maria Sound; its upstream limit is approximately at the transition of shoreline vegetation from tidal to freshwater forms; and its upland limit is that line above which terrestrial land-forms and vegetation occur. The estuary has a total area of about 398 square miles including all intertidal wetlands. Figure 1-2 depicts the defined management boundaries of Tampa Bay proper. Further, the zones of Tampa Bay proper as defined by Lewis and Whitman (3) are also recognized as the official subdivisions of the bay (see Figure 1-3).

The Tampa Bay watershed includes the uplands and freshwaters contained within the combined watersheds of all rivers and tributaries which flow into Tampa Bay. The watershed has a total area of about 2200 square miles. A summary list of general environmental concerns and management issues was approved at the March 22, 1983, Committee meeting and is shown in Table 1-1.

The major effort of the Committee following the preparation of this list was to further identify and focus upon specific bay management problems. Through the subcommittee meetings a total of 42 specific issues were identified. At the August 30, 1983 Committee meeting the final issues list was approved in priority ranking, as shown in Table 1-2.

The task of the Tampa Bay Management Study Commission was to build upon the accomplishments of the previous committee. The 42 specific bay management issues were reviewed by two subcommittees to determine additional information or research needs and to develop specific recommendations and strategies for rectifying the identified problems. The Science/Engineering Subcommittee reviewed those issues which were more technical in nature and would require particular technical expertise to recommend solutions. The Planning/Management Subcommittee reviewed those issues requiring essentially administrative or political solutions.

In the process of their reviews, the two subcommittees developed a series of issue briefs, one for each identified bay management problem, following a specific format which included the following: issue analysis; identification of relevant laws and statutes; specific bay management objectives and recommendations; work elements; and long-term management alternatives. These issue briefs are contained in the final report, The Future of Tampa Bay.(4)

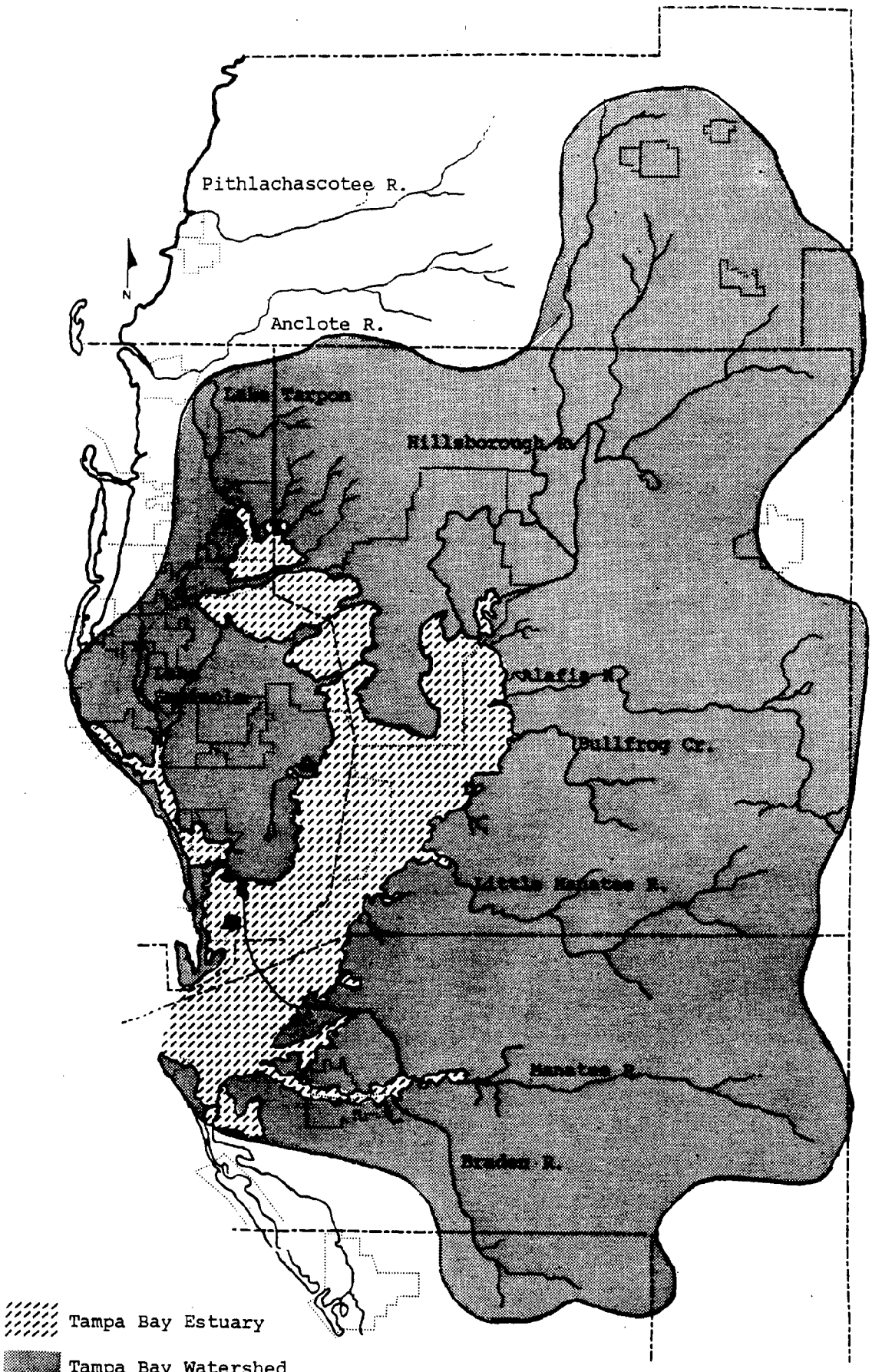



Figure 1-2 Management boundaries of Tampa Bay proper.

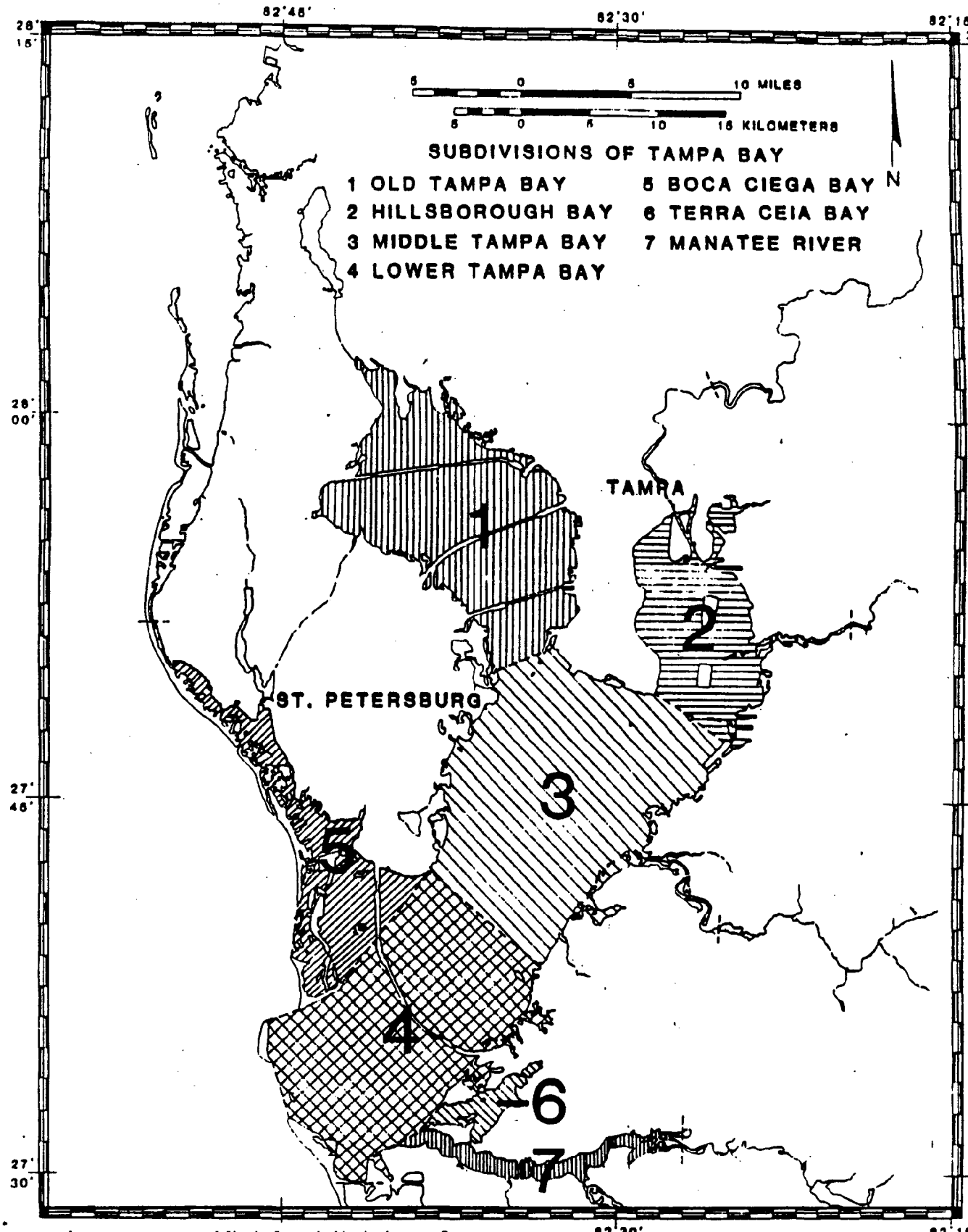



Figure 1-3 Official subdivision of Tampa Bay proper (Lewis and Whitman, 1982).

Table 1-1 List of major concerns and management issues identified by the Subcommittees.

Environmental Concerns:

- Development and Growth
- Industrial, Municipal and Transportation Impacts on Tampa Bay
- Impacts from Changes to Tidal Creeks
- Declining Visual Quality
- Decline in Harvestable Resources
- Habitat Loss and Restoration
- Changes in Bay Circulation
- Loss of Resources Based Recreational Opportunities
- Changes to Species Composition and Community Structure (Excessive Blooms, Mass Mortalities, Reduced Diversity, etc.)
- Loss of Assimilative Capacity
- Long Term Changes in Salinity Patterns
- Changes in Hydrography
- Contamination of Life Forms

Management Issues:

- Intergovernmental Coordination and Jurisdictional Control over Tampa Bay
- Public Participation and Education
- User Conficts and Limits on Activities
- Ownership of Submerged Lands
- Bay Management Alternatives and Implementation Measures
- Public/Visual Access and Shoreline Recreation Facilities
- Funding
- Value of Tampa Bay for Commerce
- Controls on Industry
- Water Quality Management and Violations of Standards
- Wildlife Management
- Management and Acquisition of Public Lands

Table 1-2 Tampa Bay Study Committee Numerical Priority List

1. Funding
2. Loss of Seagrass in Tampa Bay
3. Non-Point Source Discharges Entering Tampa Bay
4. Spoil Disposal and Management of Spoil Islands
5. Hazardous Waste Disposal and Management
6. Enforcement
7. Control of Septage Waste
8. Aquatic Preserves
9. Seagrass, Marsh and Mangrove Habitat Creation
10. Municipal and Industrial Discharges
11. Stronger State Wetlands Regulation
12. Study and Management of Tidal Creeks and Rivers
13. Wasteload Allocation for Tampa Bay
14. Assessment of Fishery Stocks in Tampa Bay
15. Gypsum Decommissioning, Hillsborough County
16. Commercial & Sport Fishing Regulation
*17. Documenting the Economic Importance of Tampa Bay
18. Public Education
19. Urban Waterfront Development and Public Access
20. Load Relief for Major Sewage Treatment Plants
21. Water Quality Improvement for Recreational Uses
22. Stormwater Detention Requirements for Redevelopment
23. Review of Rules and Regulations
24. McKay Bay Management Plan
25. Shellfish Classification
26. Power Plant Entrainment
27. Hendry Fill Restoration Project
28. Contingency Planning for Post-Hurricane Acquisition of Habitat
29. Mitigation Banking
30. Management of Bower Tract and Adjacent Wetlands
31. Management of Passage Key
32. Management and Restoration of Shorelines in Boca Ciega Bay
33. Improvements to Bridge Facilities Crossing Tampa Bay
34. Channel A Restoration
35. Water Quality Improvements Using Tidal Gates and Pumps
36. User Conflicts and Limits on Activities
37. Marina Siting Policy
38. Construction of New Skyway Bridge Pier Protection System
39. Extension of 49th Street (St. Petersburg) Across Tampa Bay
40. Sailboat Launching
41. Odor
42. Manatee River Derelict Train Trestle, Manatee County

## D. DEVELOPMENT OF THE ISSUE

Issue 17, entitled "Documenting the Economic Importance of Tampa Bay" was initially identified by the Tampa Bay Management Study Committee and later elaborated upon by the Study Commission. The major recommendation concerning this issue was to obtain funding to undertake a specific natural resource economic study of Tampa Bay. In October 1984, the Tampa Bay Regional Planning Council (TBRPC) obtained Federal Coastal Management funds to initiate a study with the objective of documenting the importance of the Tampa Bay estuarine system to the economic base of the region, in its static condition. With this overall objective, the following tasks were to be completed:

- An export driven economic base model will be developed for the determined study area around Tampa Bay. Export and local service industries will be identified and export multipliers calculated, based on employment data and using primarily the location quotient approach. The economic base model will enable quantification of the short-run impact of various exogenous "shocks" experienced by the study area, such as an influx of new business or tourism.

- Using various methods of economic analysis including opportunity cost calculations, surveys and regression analysis, the net economic benefits derived from various attributes and uses of the bay will be quantified. These attributes and uses include the following:

    1. aesthetic contributions - values of waterfront amenities and benefits to residents and tourists;

    2. water-based recreation - swimming, fishing, boating;

    3. commercial fishing;

    4. shipping, water-borne commerce and transportation;

    5. public and private utilities including municipal sewage treatment services and electric power generating facilities; and

    6. ecological services.

The Tampa Bay estuarine system is, both directly and indirectly, a vitally important economic asset to the numerous municipalities surrounding the bay. Examples of economic entities which are dependent upon the direct utilization of Tampa Bay include; the port facilities of Tampa, St. Petersburg and Manatee County; the ship building and repair firms, and other marina facilities located around Tampa Bay; and the commercial and recreational fishing industries. Indirectly, the mere presence of the bay attracts industries and businesses as well as water-oriented residential developments, restaurants, and a myriad of related support industries and commercial and recreational activities. The rapid growth

rate of the Tampa Bay region's population and business sector over the past 30 years suggests that, historically, the Tampa Bay estuary has contributed significantly to the economic growth and diversity of the region. And yet, the value of Tampa Bay as a natural resource and cultural amenity to the overall economic base of the region has never been documented or quantified.

The environmental quality of Tampa Bay is, intuitively, an important component in the decision making processes of the majority of individuals and industries considering locating and/or operating in the Tampa Bay area. The value of the estuary as a regional economic resource is, however, viewed by various industries and individuals from many different, and often conflicting, perspectives. For example, industries relying upon the availability of a source of water-borne transport may perceive Tampa Bay's value in the same sense that land-based industries would value railroad frontage in determining location decisions. For other firms, industries and even local governments, Tampa Bay is considered to be a convenient receptacle for the inexpensive disposal of treated industrial and urban wastes, or available waterfront space for further development. But for those industries dependent upon the harvest of living resources, or the availability of bay-oriented recreational opportunities, the value of Tampa Bay is perceived to be intimately tied to its ecological health.

The Federal Water Pollution Control Act (Clean Water Act) amendments of 1972 mandated that, wherever possible, water quality is to be suitable for the protection and propagation of fish and wildlife, and to provide for recreation in and on all waters by July 1983. Further, the Act required that all point source pollutant discharges are to be controlled or eliminated by 1985. Local implementation of this Act over the past decade has generally resulted in an overall improvement in the water quality of Tampa Bay. (However, no analyses have ever been attempted to document the impacts of this improvement from an economic analysis perspective on the overall economic framework of the area, or to describe available alternatives in achieving an economic/environmental balance in light of the continuing requirements of the Clean Water Act, as well as other relevant federal and state environmental legislation.)

This document represents the culmination of all study efforts and analyses, aimed at addressing issue number 17, as described in The Future of Tampa Bay.

## E. FOOTNOTES

1. Chapter 1 is condensed from a discussion of Tampa Bay and the Tampa Bay Management Study Commission, presented in The Future of Tampa Bay, Tampa Bay Regional Planning Council, 1985.

2. Ibid.

3. Lewis, R. R. and R. E. Whitman. A New Geographic Description of the Boundries and Subdivisions of Tampa Bay, BASIS proceedings, 1982.

4. Ibid. The Future of Tampa Bay.

CHAPTER 2

## A. LITERATURE REVIEW

The purpose of the study, "Documenting the Economic Importance of Tampa Bay", is to analyze the present importance of Tampa Bay - a natural resource - to the economic base of the region, in its static condition. A survey of literature focused on locating previous studies that had successfully analyzed the economic impact of estuarine areas and net economic benefits accruing to relatively small regions. The methods outlined below, that emerged from this search, represent an effort to combine the best of analytical techniques with data that was available from other studies, and that which could be generated within the resource constraints of the present study.

### 1. Economic Base Model

The economic base model used in the present study was chosen over the econometric and input-output models for the following reasons: it lends itself to a forecast period of one to four years; it utilizes aggregative variables such as total employment and income for small regions, where exports are a significant proportion of total regional activity; and it does not require a major research budget.(1)

Funding constraints prevented experimentation with alternative techniques, such as minimum requirements (2) and econometric approaches. A recent comparison of alternative methods concluded that the location quotient approach underestimates the gross basic activity even with data on the four-digit Standard Industrial Classification (SIC) level, however, combining it with the assignment approach may be a pragmatic step in the direction of accuracy.(3) In any case, it compares favorably with using minimum requirements in the case of the present study because minimum requirements in one-half of the sunbelt cities were found lower than location quotients, reflecting insensitivity to trade and services.(4)

### 2. Shipping and Water-Borne Commerce

The principal approach adopted here was to equate benefits to the cost savings made possible by the availability of water-borne transportation. The structure of exports and imports into the Tampa Bay ports was analyzed with a view to determining the next best alternative mode of transportation for each. Alternatives considered include railroad and truck transportation. Published data was utilized on the private cost of commodity shipments by the alternative modes. The principal study used here was the Economic Impact Assessment of the Port of Tampa, performed for the Tampa Port Authority and completed in 1979.(5)

3. Public Utilities and Municipal Sewage Treatment Services

Many major (public and private) industries derive benefits from locating on Tampa Bay, rather than further inland. Ready accessibility to bay water for discharge of treated effluent from municipal sewage treatment plants, cooling water for electric power generating plants and water-borne transportation are benefits studied by the alternative cost method. The principle sources of information used here are the Central Hillsborough County-Tampa 201 Facility Plan, U.S. Environmental Protection Agency (EPA) Final Environmental Impact Statement for the Tampa Electric Company Big Bend Unit 4, and the Florida Power Corporation Cooling Water Report for the Paul L. Bartow Plant.

4. Commercial Fishing

Economic impact studies of commercial fishing in Florida and the Tampa Bay region were readily available through the Florida Sea Grant College, University of Florida. Fish and shellfish landing trends (6), along with value and volume data (7), were updated using primarily information received from the National Marine Fisheries Service (8).

5. Aesthetic Valuation

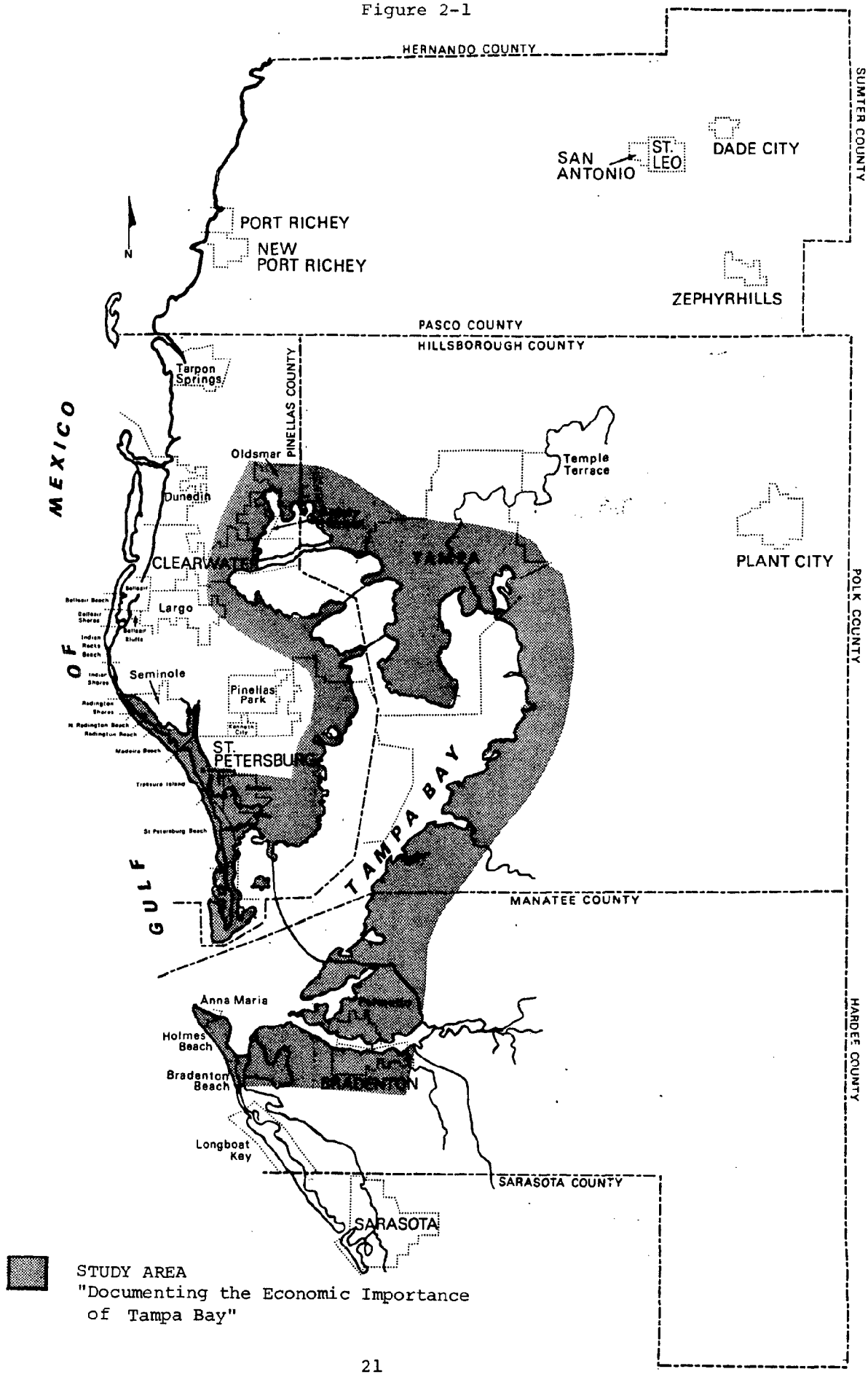
The present study uses, as its base, a model of determination of residential property values developed for Pinellas County. (9) The model was expanded to apply to single-family structures within the study area, with emphasis on neighborhood conditions, local public schools, travel time to the job location, water views, water quality, and recreational benefits. The benefits accruing to property owners, from these neighborhood and environmental amenities, are generalized for the study area as a whole, based on the number of single-family structures.

## B. STUDY AREA

The defined study area for this economic study principally includes Hillsborough, Manatee and Pinellas Counties, in that Tampa Bay is bordered by all three counties. It was assumed apriori that most, if not all, of the economic impact resulting from the presence of Tampa Bay would occur in the counties and municipalities that border the bay.

Initially, it was decided that the study area would be defined by census tracts, with proximity to Tampa Bay, in each of the three counties. However, because the economic base model required explicit employment data, necessitating business and industry address locations, it was decided that the study area be defined and identified by U.S. Postal Service zip code zones that have geographic proximity to Tampa Bay. A total of 65 zip code zones were selected and included the following: 28 zones in Hillsborough County; 12 zones in Manatee County; and 25 zones in Pinellas County. Figure 2-1 approximates the study area, based upon the zip code zones

Figure 2-1




STUDY AREA
"Documenting the Economic Importance of Tampa Bay"

shown in Figure 2-2.

## C. POPULATION ANALYSIS

As illustrated in Table 2-1, the populations of Hillsborough, Manatee and Pinellas Counties have experienced explosive growth over the past two and one-half decades. Between 1960 and 1980, Hillsborough County has had a population increase of approximately 63 percent; Manatee County 114 percent; and Pinellas County 94 percent. Based upon the projections shown in Table 2-1, between 1980 and 2000, Hillsborough County will have an additional population increase of 22 percent; Manatee County 33 percent; and Pinellas County 25 percent.

In 1980, the total population of Hillsborough, Manatee and Pinellas Counties was 1,523,933. It is estimated that the 1980 population of the study area is 710,152 persons, or 47 percent of the total population of the three counties.

The study area includes the City of Tampa, the county seat of Hillsborough County and the largest city located in the Tampa Bay region. Tampa serves as the legal and financial center of Florida's west coast, as well as the hub of manufacturing and distribution. Also included in the study area are the cities of Palmetto and Bradenton, the latter of which is Manatee County's largest city and also serves as the county seat. Pinellas County's largest city, St. Petersburg, is also included in the study area, as well as portions of eastern Clearwater.

Figure 2-2

TAMPA BAY ECONOMIC STUDY TARGET AREA ZIP CODES

| PINELLAS | HILLSBOROUGH | MANATEE |
|---|---|---|
| 33504 | 33570 | 33501 |
| 33519 | 33586 | 33505 |
| 33520 | 33601 | 33506 |
| 33557 | 33602 | 33508 |
| 33572 | 33603 | 33509 |
| 33701 | 33604 | 33510 |
| 33702 | 33605 | 33522 |
| 33703 | 33606 | 33529 |
| 33704 | 33607 | 33532 |
| 33705 | 33608 | 33561 |
| 33706 | 33609 | 33564 |
| 33707 | 33610 | 33591 |
| 33708 | 33611 | |
| 33711 | 33614 | |
| 33712 | 33615 | |
| 33715 | 33616 | |
| 33731 | 33619 | |
| 33732 | 33621 | |
| 33733 | 33629 | |
| 33736 | 33673 | |
| 33737 | 33674 | |
| 33738 | 33675 | |
| 33739 | 33677 | |
| 33740 | 33679 | |
| 33741 | 33680 | |
| | 33681 | |
| | 33686 | |
| | 33690 | |

TABLE 2-1
POPULATION -- HILLSBOROUGH, MANATEE, AND PINELLAS COUNTIES

| Year | Hillsborough | Manatee | Pinellas | Totals |
|---|---|---|---|---|
| 1960 | 397,788 | 69,168 | 374,785 | 841,741 |
| 1970 | 490,265 | 97,115 | 522,329 | 1,109,709 |
| 1980 | 646,960 | 148,442 | 728,531 | 1,523,933 |
| Projected | | | | |
| 1985 | 700,100 | 169,700 | 796,000 | 1,665,800 |
| 1990 | 752,900 | 189,300 | 859,300 | 1,801,500 |
| 2000 | 856,200 | 226,000 | 1,003,100 | 2,085,300 |

Source: 1980 U.S. Census and Population Studies Research, College of Business, University of Florida

D. FOOTNOTES

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# CHAPTER 3
# ECONOMIC IMPACT ANALYSIS

## A. THE SHAPING OF THE TAMPA BAY REGION'S ECONOMIC BASE

### Introduction

Hillsborough County historian Ernest Robinson stated in 1928, "That of all Tampa's attractions to businessmen and investors, the greatest is her port; of all Hillsborough County's attractions, the greatest is her convenient available port on Tampa Bay, and that neither county nor city would have experienced the growth and prosperity which they now enjoy were Hillsborough County an inland county."(1) Robinson goes on to describe Tampa as a city made to fit an opportunity. A short review of the history of Tampa's growth and development, and that of the region surrounding it, makes clear that the Region took advantage of certain opportunities.

### Early Settlement

Tampa Bay, thought to provide the best natural harbor on the gulf coast of peninsular Florida, became the object of government attention soon after the United States' acquisition of Florida in 1821. A U.S. military outpost was established at the juinction of the Hillsborough Bay and River in 1824. The Hillsborough River was one of three rivers leading into Tampa Bay which was navigable by large vessels.

Settlers began moving into the area, utilizing adjacent land for agriculture and livestock. The farm and fishing village that grew up outside of the Fort Brooke military reservation became known by the Indian name of Tampa. (2)

Tampa soon became the trade center for the scattered population in the area. The territory around Tampa furnished excellent pasturage, and by the mid-1830s there was a thriving cattle industry. Shipment of cattle was one factor in the early development of Tampa's port, as cattlemen were busy supplying the Cuban market. (3)

An influx of new settlers over the years also contributed to the growth and prosperity of Hillsborough County. Florida became a state in 1845 and, ten years later, Tampa became an incorporated town.

Although the Tampa Bay area was still prospering toward the end of the Civil War, it was obvious that the town of Tampa lacked both railroad connections and adequate harbor channel and berthing facilities. (4) Fort Brooke, now a 256-square mile military reservation, remained the sole reason for the town's existence. However, in 1885, after an enthusiastic Board of Trade was organized, it was

decided that Tampa should develop into a great city. (5) This development of Tampa, from a faded military outpost to a productive metropolis, began with the expansion of the railroad system and solicitation of federal aid to make Tampa a viable port city. Railroads connected to active ports were desirable, as together they would lead to further growth and expansion.

**Cigars, Fishing and Phosphate**

The expansion of the railroad line into Tampa, and the port, was an indication to the rest of Florida, and the nation, that certain entrepreneurs were confident of Tampa's future. Railroad expansion provided better facilities for the transportation of citrus, cattle, cigars, fish and other agricultural products.

The migration of the cigar industry into Tampa began in 1886, when Vincente Martinez Ybor transferred his facilities and workers from Key West, Florida, after many months of labor trouble. The almost immediate economic success of the cigar industry launched a chain reaction of business developments, which included the establishment of banking institutions to handle the transactions and financial arrangements of the cigar manufacturers.(6) Economic success within the industry also meant an increase in employment, which triggered land improvements, real estate development and various public works projects.

Railroad expansion actually spurred Florida's and the Tampa Bay areas's fishing industry. The waters of Tampa Bay had long been fished to provide for local markets. Mullet and pompano were the most important of a wide range of food fish taken in great abundance from Tampa Bay. Rail transportaion and refrigeration by ice provided the means of satisfying the growing demands for fish and oysters in the northern and western areas of the U.S.

A great demand for phosphate fertilizer developed in this nation around 1875. Land pebble deposits of phosphate were discovered in the Tampa Bay area in 1885, however, no effective attempt was made to exploit the deposits until 1888. The discovery of phosphate dramatically changed the future of Tampa and its port due to its proximity to the most productive mines and its ample and accessible harbor. The railway system which existed when the phosphate boom started enabled Tampa to draw from the mines being opened in the vicinity. In the meantime, harbor improvements begun in 1879 made Tampa accessible to vessels drawing twenty feet of water, and the stage was set for the major expansion of the phosphate trade.

The development of Tampa as a major seaport perhaps got its greatest impetus with the chaos and confusion of the Spanish-American War of 1898. As the United States became involved, Tampa became a focal point, as some 30,000 troops were brought in and readied for shipment to Cuba to wage war. Tampa was a natural concentration point, primarily because it was the nearest mainland port to Cuba, having both rail and water facilities. (7)

St. Petersburg

Agriculture remained the major industry in and around St. Petersburg through the late 1800s. St. Petersburg became a more viable port city with the expansion of the railroad into the city and, in 1888, the construction of a railroad pier to facilitate freight loading and unloading.(8) The pier extended one-half mile into the waters of Tampa Bay, to a point where the the water was twelve-feet deep. St. Petersburg, however, never became a rival port with Tampa, for as Tampa grew as an industrial community, St. Petersburg developed into a tourist town. As transportation into and out of St. Petersburg improved through the early 1900s, tourism slowly began to have a greater influence on the local economy. The "omnipresent" healthy climate attracted the tourists, and the industry slowly developed many sustaining and supporting services and trade establishments to serve both the tourists and area residents. St. Petersburg's resort atmosphere, the Tampa Bay and Gulf beaches, and available residential land gradually attracted retirees and others to settle premanently.

Early 1900s

Further action came on the development of an even deeper-water port at Tampa, in 1905, when Congress appropriated funds to finance the dredging of a twenty-foot channel. This was heralded as the beginning of Tampa's great port development. With the completion of the deepening project, Tampa was able to take advantage of its favorable location with regard to the islands of the Caribbean and parts of Central and South America.(9) The port improvements enabled more tonnage to be handled, and soon Tampa began to capture a large amount of foreign and intracoastal trade. So much traffic began using the port through the early 1900s, that an expansion of Tampa's port facilities was necessary soon after the completion of the original deep-water channel.

During World War I, Tampa became a tremendous shipbuilding center for the U.S. military effort, turning out warships and merchant vessels to be utilized during the campaign. It was an activity that would be repeated two decades later.

Prior to WWI, and beyond, there were but sketchy contacts between Tampa and St. Petersburg, even though the communities lay only twenty miles apart across the waters of Tampa Bay. Few area residents were interested in a tiresome 165-mile trip by train between Tampa and St. Petersburg or an all-day round trip by boat. The construction of the Gandy Bridge during the 1920s linked Tampa to St. Petersburg and the Gulf beaches, and actually triggered St. Petersburg boom, both in the form of tourism and permanent residents.

On the eve of World War II, Tampa's search for a new identity and new direction came to an end as the threat of war literally changed the economic scene. Shipbuilding, troop training and defense spending, in general, provided much needed relief to a battered urban economy. The impact of thousands of soldiers during the war

years and the construction of MacDill Field, a million-dollar complex that helped maintain the nation's B-17 and B-29 Fleets, cannot be overestimated.(10) In addition, the wartime economy lured thousands of civilians to the Tampa Bay area. Employment at the Tampa shipyards reached 16,000, and the payroll soon exceeded $750,000 a week, surpassing that of the cigar industry.

Post-War Development

Tampa's kinetic energy, the product of local, regional and national forces, began manifesting itself in a variety of economic forms. The most important factors in the postwar Tampa economic boom included massive federal appropriations for defense and urban renewal; the development of a diversified economic base; the maintenance of a strong agribusiness sector; the emergence of the area as an important transportation and distribution center; the continuing real estate and construction booms; the maturation and promotion of a tourist/leisure society; and the urban renaissance of downtown Tampa.(11)

In the Spring of 1945, with shipbuilding winding down and the port again looking rundown and neglected, the Tampa Chamber of Commerce pushed for an entity to oversee the Port of Tampa. A local bill, proposed to the Hillsborough County legislative delegation, called for creation of a port authority. The bill required a referendum to gain voters approval in Tampa and the western end of the county. The port plan was endorsed by an overwhelming majority, and thus the Port Authority came into being.(12) One of the major projects facing the five-member Port Authority was the deepening (again) of the 45-miles of ship channels connecting Tampa's harbor with the Gulf of Mexico. Eventually, Congress came through with the money needed to dredge the channels.

In addition to harbor dredging, the Federal government stimulated metropolitan Tampa Bay's growth with appropriations for highways, two interstate expressways and a new international airport.

One of the most important postwar developments in the Tampa Bay area was the coming of the shrimp industry. With the discovery of new shrimp beds off of the coast of Mexico and near the Dry Tortugas, shrimp boat operators who had previously fished off the east coast of Florida needed a large and well equipped port on the lower west coast. Tampa was chosen as the home base for a shrimp fleet which, by the end of 1952, included more than 100 boats. Shrimp boat building and repair yards, as well as shrimp processing firms, were established in response to the needs of the new industry.(13)

Lured by omnipresent sunshine, aggressive promotion, a low tax base, and ample industrial parklands, over eight hundred new businesses have located in Tampa since WWII. The 1970s brought a turnaround as new money stimulated the development of downtown Tampa; while during the 1980s, Tampa's undergoing an urban renais-

sance in which scarcely a week passes without the unveiling of still another skyscraper or financial tower to alter the skyline. (14)

Summary

The geographic location of Tampa has been an important factor in the development of the city and region. Tampa Bay, the largest bay on the Gulf coast of peninsular Florida, also provides the best natural harbor on the west coast of Florida.

The groundwork for making Tampa a major seaport was completed, during the decades prior to the Spanish-American War, due in large measure to the efforts of a few individuals who developed and expanded the railroad transportation system to Tampa and its port. By tying the State of Florida to the rest of the country, the railroads broadened the scope of commercial activity in such a way and to such an extent that the seaports of Florida (Tampa included) were no longer gateways and outlets for Florida alone, but for the country at large.

Tampa's sea connections with other parts of the United States, and with other nations, have depended largely upon improvements in the channel approaches through the harbor and upon development of adequate terminal facilities. It was not until the first major harbor development project was completed in 1908, that straightened and deepened the natural shallow harbor, that Tampa's standing as the leading commercial center of the Florida west coast was significantly strengthened. Successive dredgings were necessary in order for the port to handle increasingly larger ships, while adequate terminal facilities kept pace, in order to handle the larger scale imports and exports. Tampa Bay's history intertwines with that of the railroad, the development of the port, the phosphate industry and early twentieth century technology.

## B. ECONOMIC IMPACT ANALYSIS

There are two basic ingredients to economic impact analysis: an estimate of the exogenous or differential stimulus that serves as the direct impact, and a model of the regional economy that will produce estimates of the indirect effects.(15) (The term "indirect effects" is used here in a very general sense and includes induced effects where appropriate. The term "exogenous" refers to external influences, i.e., influences from outside the local economy or study area.) Methodological innovations, resulting from research efforts in recent years, have produced a variety of models that resist categorization.(16) Economic base multipliers are estimated with econometric techniques, input-output models are treated as econometric models, and hybrid models are constructed that may combine elements of economic base, econometric and input-output models.

## C. ECONOMIC BASE MODELS - GENERAL

As noted earlier in Chapter 2, the economic base model was chosen to be used in this study, over the alternatives of econometric and input-output models, for the following reasons: it lends itself to a forecast period of one to four years; it utilizes aggregative variables such as total employment and income for small regions, where exports are a significant proportion of total regional activity; and it does not require a major research budget.

To analyze a regional or local economy it is necessary to identify its economic base. The economic base model dichotomizes economic activity in a region into export (exogenous)industries and local service (import) industries.(17) Economic models view the local economy much like a household with a single wage earner. Household income and standard of living can only increase with increases in wages earned by the head. The counterpart to the single wage earner in the economic base model is the export industry. Business and industry within the local economy that cause funds to "flow in" are considered export or exogenous industries. These are firms that sell their products to businesses and households outside the boundaries of the local economy. Tourism facilities and federal and state government are considered to be part of the export industry since they are responsible for money inflows. Local service industries, by contrast, sell their outputs only within the local economy.(18)

Without new "injections" of funds into the local economy, the economy will be stagnant, since local service industries can only respond to changes in local economic conditions. External changes that result in an increase of export activity cause increases in payroll and employment in the export industries, which are then transmitted to the local service sector. Further, the inflow of money causes activity in local services to change by a multiple of the original stimulus as the new influx of funds is spent and respent in the local economy. Re-circulation continues until the leakages in the system, like imports, savings and taxes, exhaust the amount of the initial influx. Similar, though opposite, effects occur in the case of a decrease in export activity.(19)

The chosen economic base model can be characterized as a highly simplified general equilibrium model of a local economy. It assumes that the economy is initially in equilibrium and describes a new equilibrium position after the exogenous change has been transmitted through the system. Prices, wages and technology are assumed constant, supply is perfectly elastic, and no changes are allowed for in the distribution of income or resources.(20)

As a theory of regional growth, economic base models emphasize the "openness" of regional economies; that is, regional trade is considered to be the primary impetus for growth. The high degree of interrelatedness between the local economy and "the rest of the world" is based soley on a demand orientation. Exogenous changes in demand for exports determine regional income and employment changes. In reality, export sales are not the only activity that

responds to exogenous forces, even in the short run. Omission of these other exogenous influences from the model suggests that economic base studies are appropriate primarily for smaller regional economies where exports represent a larger proportion of total regional activity.(21)

The economic base model ignores the supply side of the local economy, implicitly assuming that supply is perfectly elastic. This neglect of supply does not appear to be a serious defect if the region itself is small, relative to the size of the economy. Given the degree of openness of a local economy and the migrational propensity of labor, an elastic supply would not be an unrealistic assumption. Capacity constraints will present problems to the degree that the local infrastructure is not capable of supporting the expansion. If energy, water, transportation facilities, and land for expansion are all at full capacity prior to an increase in demand for exports, then prices would increase rather than the quantity supplied expand.(22)

## D. LOCATION QUOTIENTS

To make the economic base model operational, it is necessary to determine how much of the region's total employment is devoted to export activities. A problem exists in that most goods produced in the local economy are typically sold in both local and non-local markets. A number of indirect methods are available to approximate this allocation, and one such method is location quotients.(23)

Employment is the most frequently used unit of measurement for the economic base model. Using employment as the unit of measurement is advantageous because the data are available on a disaggregated basis for the larger local economies. Employment data were obtained for the study area, by three-digit SIC (Standard Industrial Classification), for 1984, from three sources: U.S. Department of Labor, Bureau of Labor Statistics; Florida Department of Labor and Employment Security, Division of Unemployment Compensation; and Contacts Influential Inc., Marketing Information Services, Tampa.

Location quotients compare the concentration of industry employment in a particular region with that of the nation, adjusted for foreign exports. A region that has a greater percentage of its employment concentrated in an industry than does the nation must be producing for export outside the region, since it has more than the average employment required to satisfy its domestic needs.

The location quotient is the ratio of an industry's share of the economic activity (of the economy being studied) to that industry's share of another economy.(24) Assuming that the study area is a region (R) of a nation (N), and that employment (E) is the measure of economic activity, the location quotient for industry "I" may be expressed using the equation shown in Figure 3-1.

If the location quotient for an industry (LQI) is greater than one, it is assumed that the region exports the products of that industry.(25) By contrast, if the location quotient is less than one,

FIGURE 3-1
LOCATION QUOTIENT FORMULA

$$LQI = \frac{EIR}{EIN} \Big/ \frac{ER}{EN}$$

LQI - Location Quotient for industry "I"
R - Region (study area)
N - Nation
E - Employment
I - Industry

FIGURE 3-2
EXPORT EMPLOYMENT FORMULA

$$XIR = \left[\frac{EIR}{EIN} - \frac{ER}{EN}\right] EIN$$

XIR - Export (exogenous) employment for industry "I" within the region (study area)
EIR - Employment Industry Region
EIN - Employment Industry Nation
ER - Employment Region
EN - Employment Nation

it is assumed that the region is not satisfying its domestic requirements and must import the products of that industry.

Location quotients compare the given region to an "average" region of the nation. If a region's industry displays a location quotient greater than one, its export-related employment (XIR) can be calculated using the equation shown in Figure 3-2, relying on the following assumptions (26):

1. Consumer tastes and preferences are the same throughout the nation, implying that per capita consumption, in particular, is identical. (Although per capita income is often a poor proxy for per capita consumption, it is worth pointing out that the per capita income in the Tampa-St. Petersburg MSA is very close to the national average, so this assumption does not appear grossly unreasonable).

2. Production functions for each industry are identical in every region.

3. Local demand is satisfied by local production. (To reduce the distortions caused by "cross-hauling," all primary employment data were collected on the basis of three-digit SIC industries, which represents substantial disaggregation compared to many other studies.)

4. Every region completely satisfies its own domestic needs.

## E. THE MULTIPLIER CONCEPT

Economic theory dictates that the rate of growth of a region is determined by its function as an "exporter" outside the region. (27) Sales outside the region channel outside dollars into the region and trigger chain reactions of additional economic activity within the region.

The first activity associated with an outside sale is the direct impact, and the jobs provided because of the sale, and the income generated in the industry. These direct impacts then produce additional economic impacts or indirect impacts. These indirect impacts come in the form of goods and services provided to the export industry by other businesses in the region. Both the direct and indirect impacts then produce additional impacts. This is called "induced" activity and results from spending of employees who earn income in jobs provided in either direct or indirect businesses. These impacts occur in local retail stores, banks, and any other places the wage earner spends his income.(28)

The total impact of an industry results from the simultaneous action of direct, indirect, and induced impacts. Each additional dollar of sales by the basic industry causes a new round of impacts throughout the region. The process of each dollar being respent and causing new impacts is not infinite. At each round of the spending process, some dollars leak out of the regional economy in the form of savings, taxes, profits to stockholders outside the

region, and as payments for goods and services imported from outside the region. The total respending process associated with each additional dollar of sales is called the "multiplier" effect. The multiplier for a particular basic industry is a measure of the total economic activity associated with the initial increase in export sales outside the region. The multiplier will vary with the size of the region and the industry. The more complex the export industry in regard to its demands on other industries for goods and services, the larger the multiplier. The multiplier effect also works in reverse. A decrease in export sales will cause a chain reaction of decreases in economic activity.(29) Most economic multipliers are determined using input-output analysis, econometric techniques, or elements of the economic base. Multipliers generated from these mathematical techniques are usually output, income, and employment multipliers.

## F. EMPLOYMENT MULTIPLIER

The location quotient multipliers calculated using the equation shown in Figure 3-1, are employment multipliers. A single employment multiplier, for the study area, is derived from the location quotients by estimating export employment for all industries with location quotients greater than one, summing that employment for all industries, and dividing the sum into the total employment of the region.(30) To the extent that a region imports products from an industry which it also exports, the location quotient will underestimate exports, thereby over-estimating the multiplier.(31)

Once the multiplier has been calculated, the impact on total activity of an anticipated change in export activity can be estimated by multiplying that change times the multiplier.(32)

## G. STUDY AREA ECONOMIC BASE MODEL

The results of the economic base model used to analyze the study area's economic activity are illustrated in Appendix A, and summarized in Appendix B. The model utilizes employment data as the unit of measurement in dividing the study area's economic activity into export and import (local service) sectors. The 1984 employment data is presented on a disaggregated basis (three-digit SIC) thereby diminishing the problem in the use of location quotients often referred to as "product-mix" or "crosshauling".(33)

The location quotients presented here are employment multipliers. As noted previously, if the location quotient for an industry is greater than one, it is assumed that the study area exports the products of that industry, whereas, if the location quotient is less than one, it is assumed that the study area imports the products of that industry.

The overall employment multiplier, for the study area, has been calculated at 2.62. This figure is derived from the location quotients, by calculating the export employment for all of the study area's industries with location quotients greater than one

(as shown), summing that employment, and dividing the sum into the total employment of the study area. The multiplier of 2.62 was calculated assigning all public administration to the export (exogenous) sector. (Other industries can be assigned to the exogenous sector in toto, e.g. fertilizer mineral mining, hotel, tourist court and motel employment, reducing the multiplier further.)

## H. DISCUSSION

Upon review of the data presented in Appendix A and Appendix B, it is evident that there are numerous export industries within the study area that cause funds to flow in, or in more generic terminology, industries that "drive the local economy." By contrast, there are numerous local service industries identified. The products or services associated with these industries must be imported into the study area because domestic consumption is not being satisfied. Before analyzing the export and import industries which currently serve as the economic base of the study area, it is interesting to note the industries that were historically important in the development of the Tampa Bay Region are still important today.

As noted earlier in this chapter, the industries of primary importance in the development of Tampa, and eventually the region, include (in no particular order) the following: agriculture and livestock; national security; citrus; cigars and fishing; railroad; phosphate; boat building and repair; tourism and general port activities. The importance of geographic proximity to Tampa Bay for most of these industries is evident, e.g. fishing, boat building and port activities necessitate immediate proximity to Tampa Bay.

The economic base model, utilizing 1984 employment data, illustrates the static economic activity within the study area, and in doing so reveals the following export industries: crop services, including citrus grove preparation (SIC 072); commercial fishing (SIC 091); fertilizer mineral mining, including phosphate rock (SIC 147); cigars (SIC 212); boat building and repair (SIC 373); local water transportation and associated services (SIC 445-46); boat dealers (SIC 555); eating and drinking places (SIC 581); and hotels and motels (SIC 701).

The economic base model identifies these industries as being key components of the study area's exogenous sector. In addition to the aforementioned industries, there are still other export industries whose proximity to Tampa Bay is essential. These industries include residential building construction (SIC 152); electric services (SIC 491); and sanitary services (SIC 495). These industries, along with port activities and commercial fishing, are analyzed further in succeeding chapters.

Local service industries identified through the economic base model, by major group (MG), include the following: manufacturing or processing of food products (MG 20); apparel manufacturing (MG 23); manufacturing of furniture and fixtures (MG 25); manufacturing

of machinery (MG 35-36); and security, commodity and life insurance establishments (MG 62-63).

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## CHAPTER 4

## BENEFITS OF TAMPA BAY TO SHIPPING AND WATER-BORNE COMMERCE

### A. PORT OF TAMPA

The Port of Tampa has served as a vital transportation link for the West Central Florida region since the early nineteenth century (please see discussion in Chapter 2). The port evolved initially as a gateway for agricultural products flowing to and from Cuba. (1) Improvements to the natural harbor began with the discovery of phosphate in the region and the first Congressional authorization in the 1880s. During the past 100 years, channel dimensions have repeatedly been enlarged, the size of ships calling on the port have increased, and the annual tonnage transiting the port has increased from one million tons in 1920 to 50 million tons in 1980. (2) In the fiscal year 1984-85, the Port of Tampa registered 48,856,924 net tons, making it Florida's number one port.(3)

Part of the port's overall strength is the variety of terminals operating throughout the port and the diversity of cargoes handled through these facilities.(4) Sixteen terminals in Tampa handle inbound and outbound phosphate, fertilizer and related chemical products. In addition, eight terminals handle dry bulk products other than phosphate or phosphate-related chemicals. The primary products handled through these terminals are grain, feed, salt, cement, gypsum and coal.

Eight general cargo terminals are operated in Tampa handling a variety of general cargoes including steel products, bananas, linerboard and citrus products. Three specialized general cargo terminals operate in Tampa handling products that require specialized facilities or facilities developed to serve a particular plant. Eighteen liquid bulk terminals are located in Tampa, almost all of which handle petroleum products, and liquid sulphur.

### B. BOOZ, ALLEN & HAMILTON REPORT

During 1978, the transportation consulting firm of Booz, Allen & Hamilton, (Bethesda, Maryland) was retained by the Tampa Port Authority to perform a marketing and economic impact assessment of the Port of Tampa. The principal objective of the study was to determine the role that the Port of Tampa had in the economy of the City of Tampa, Hillsborough County, and other adjacent counties.

The primary direct impact of the port was estimated at approximately $200 million per year. This figure represents a measure of the revenues that flow from the principal port users, e.g. shippers and waterborne carriers. The total direct impact, which represents both the primary direct and the respending of the primary flow of revenue through the local economy, was estimated at approximately $500 million per year. (This figure reflects the use of a multiplier of 2.5. It should be noted that this multiplier is virtually identical with the overall multiplier for the study area, generated

from the economic base model. Please see discussion in Chapter 3). During the fiscal year 1983-84, close to 48 million tons of cargo were handled at the Port of Tampa, making Tampa the seventh largest port in the United States in terms of total tonnage. Table 4-1 identifies the tonnage handled (selected categories) at the port during 1978 and 1984.

## C. ECONOMIC IMPACT OF THE PORT OF TAMPA

As noted previously, in 1978, the total direct primary impact of the Port of Tampa was estimated at approximately $200 million per year. One of the methods employed to estimate the primary direct impact associated with activity at the port involved an analysis of a sample of representative ship/barge calls at the port.(5)

Table 4-2 provides a summary of the direct primary impact associated with each ton of the major commodities, handled by ship and barge, for 1978 and 1984. The table also identifies the total annual tonnage of each major commodity, and estimates of the total direct primary impacts during 1978 and 1984. (The total direct primary impact estimates result from multiplying the impact per ton times the total tonnage.)

The table and figures indicate that for 1984, on the average, each ton of cargo contributed $6.42 in direct primary benefits to the local economy. The handling of approximately 45.7 million tons during 1984 contributed approximately $294 million in direct benefits to the port.

## D. NET BENEFIT OF THE PORT OF TAMPA

It is generally recognized that there are net economic benefits (consumer surplus) associated with a port such as Tampa. These benefits primarily accrue to the shippers and receivers who use the Port of Tampa. These accruals, over the long run, are in turn passed on to the consumer of the item which may be received or to the owners and employees of firms who ship through the port.

While these benefits could be concentrated in the same geographic area as are the direct benefits, that is Tampa, Hillsborough and Pinellas Counties, they may also be realized in areas further removed from the port area.

One method of estimating net economic benefits relates the cost of operation in question to the next best alternative method of accomplishing the same. This was the method of transportation savings used in the 1978, Booz, Allen & Hamilton Report and updated here.

In the Booz, Allen & Hamilton report (1979) the transportation savings were estimated by making an assumption that the Port of Tampa was not available to shippers and receivers, and thus making it necessary to use an alternative port, such as Jacksonville.

TABLE 4-1
ESTIMATED TOTAL TONNAGE HANDLED
AT THE PORT OF TAMPA
DURING FY 1978 AND FY 1984
(SELECTED CATEGORIES,
IN THOUSANDS OF SHORT TONS)

| Category | Total: 1978[1] | | Total: 1984[2] | |
|---|---|---|---|---|
| Phosphate | 24,006 | 50% | 23,610 | 52.0% |
| Other Dry Bulk | 5,689 | 12 | 4,192[3] | 9.0 |
| Petroleum Products | 12,109 | 25 | 10,630 | 23.0 |
| Other Liquid Bulk | 5,027 | 10 | 6,203[4] | 13.5 |
| General Cargo | 1,401 | 3 | 1,118[5] | 2.5 |
| Total | 48,232 | 100% | 45,753 | 100% |

1 Booz, Allen & Hamilton Report

2 Tampa Port Authority, 1984 Annual Report

3 Coal and Aragonite Only

4 Includes Sulphur (Liquid), Ammonia (Anhydrous) and Phosphoric Acid

5 Includes Steel Products, Bananas, Meat & Poultry, and other General Cargo

TABLE 4-2
DIRECT PRIMARY IMPACT OF THE PORT OF TAMPA
BY MAJOR COMMODITY GROUP 1978 AND 1984
(DOLLARS AND TONS IN THOUSANDS)

| 1978[1] | | | | | 1984 | | | |
|---|---|---|---|---|---|---|---|---|
| Vessel Type | Commodity Group | Direct Primary Impact Per Ton (In Dollars) | Total Tonnage | Total Impact | Commodity Group | Direct Primary Impact Per Ton (In Dollars)[2] | Total Tonnage | Total Impact |
| Ship | Phosphate | $ 3.17 | 15,205 | $ 48,200 | Phosphate | $ 5.11 | 23,610 | $120,647 |
| Barge | Phosphate | 3.31 | 8,801 | 29,131 | | | | |
| Ship | Other Dry Bulk | 1.53 | 2,500 | 3,825 | Other Dry Bulk | 2.56 | 4,192 | 10,731 |
| Barge | Other Dry Bulk | 1.72 | 3,189 | 5,485 | | | | |
| Ship | Petroleum | 4.17 | 5,270 | 21,976 | Petroleum | 6.49 | 10,630 | 68,988 |
| Barge | Petroleum | 4.06 | 6,839 | 27,766 | | | | |
| Ship | Other Liquid Bulk | 3.87 | 1,298 | 5,023 | Other Liquid Bulk | 6.02 | 6,203 | 37,342 |
| Barge | Other Liquid Bulk | 3.76 | 3,729 | 12,118 | | | | |
| Ship | Steel Products | 19.30 | 367 | 7,083 | Steel Products | 30.49 | 307 | 9,360 |
| Ship | Bananas | 36.28 | 134 | 4,862 | Bananas | 57.32 | 228 | 13,068 |
| Ship | Meat & Poultry | 31.06 | 31 | 963 | Meat & Poultry | 49.07 | 19 | 932 |
| Ship | Other General Cargo | 41.23 | 869 | 35,829 | Other Gen. Cargo | 65.14 | 564 | 36,738 |
| Total | | $ 4.19 | 48,232 | $202,261 | Total | $ 6.50 | 45,753 | $297,806 |

[1]Ibid.,Booz, Allen & Hamilton

[2]Includes the following: Dockage and sheddage fees; wharfage; stevedore expenses; terminal and handling charges; agents fees and commissions; tug and pilot expenses; harbormaster fees; fresh water charges; crew spending; inland transportation expenses; and other vessel disbursements. The dollar impacts per ton for [illegible]4, were calculated by adjusting the 1978 figures for [illegible]

Table 4-3 illustrates the comparison of transportation savings associated with the Port of Tampa in 1978 and 1984. (The net economic transportation benefits result from multiplying the total tonnage handled for each commodity group times the transportation savings estimates. The 1978 estimates were adjusted for inflation using the producer price index, to derive the 1984 savings estimates.)

The assumptions used include the following:

- It would cost an additional $6.14 per ton to ship phosphate to Jacksonville or Palm Beach by rail.

- It would cost approximately 3.2 cents per gallon to distribute petroleum products from Jacksonville overland to the Tampa area, in lieu of water-borne receipt, and then distribution from the Port of Tampa.

- Other liquid bulk items, and principally sulphur, would incur additional charges of $5/ton, if routed by truck via Jacksonville or Palm Beach.

- General cargo is a heterogeneous commodity group and thus, it is difficult to explicitly estimate a premium for the additional inland transportation requirement to or from Jacksonville, the closest (major) general cargo port. For the purpose of this analysis, an 8.65 cents per ton mile was used as rule-of-thumb. The 1.1 million tons of general cargo was therefore assessed a total transportation premium of $12.0 million for the average additional inland haul of 125 miles.

- Other dry bulk commodities consist primarily of coal and aragonite.

  - It is estimated that a rail shipment of coal from eastern Kentucky to the Tampa area would cost approximately $1.22 per ton more than a barge movement via Cairo, Illinois to Tampa.

  - The aragonite transportation premium assumes a rail haul from Miami to the Tampa area. The cost of this movement is estimated at $6.12 per ton.

Overall, the transportation premium associated with other dry bulk commodities would be approximately $8.2 million if the water-borne shipment to Tampa was not available to the major receivers of these products.

The total transportation savings, hence benefits, associated with the handling of the products that currently use the Port of Tampa, is estimated at approximately $281 million.

TABLE 4-3
INDIRECT TRANSPORTATION IMPACT ASSOCIATED
WITH THE PORT OF TAMPA
(IN MILLIONS OF DOLLARS)

| Commodity Group | 1978 Transportation Savings [1] | 1984 Transportation Savings |
|---|---|---|
| Phosphate | $ 78.0 | $ 144.9 [2] |
| Petroleum Products | 60.0 | 85.0 [3] |
| Other Liquid Bulk | 20.1 | 31.2 [4] |
| General Cargo | 8.8 | 12.0 [5] |
| Other Dry Bulk | 6.8 | 8.2 [6] |
| Total | $ 173.7 | $ 281.3 |

[1] Ibid., Booz, Allen & Hamilton

[2] Producer Price Index (PPI) = 89% Source: U.S. Department of Labor, Bureau of Labor Statistics

[3] Ibid. PPI = 62.6%

[4] Reflects a cost increase of 26%. Source: Ryder/PIE. Nationwide Inc.

[5] PPI = 73% Source: U.S. Department of Labor, Bureau of Labor Statistics

[6] Ibid. PPI = 75%

E. FOOTNOTES

1. Fehring, William K., "History of the Port of Tampa," proceeding from the Tampa Bay Area Scientific Information Symposium (BASIS), Tampa, Florida, May 1982.

2. Ibid.

3. Port of Tampa, Florida, Fiscal Year Cargo Report, October 1, 1984 - September 30, 1985.

4. Tampa Port Handbook, 1985-86.

5. Economic Assessment of the Port of Tampa, for the Tampa Port Authority, by the Transportation Consulting Division of Booz, Allen & Hamilton. (EDA Project Number 04-06-01533, March 1979.)

# CHAPTER 5
# BENEFITS OF TAMPA BAY TO SANITARY AND ELECTRIC SERVICES

## A. INTRODUCTION

Currently, Tampa Bay is used as a receiving water body for treated wastewater and industrial effluent discharges. It also serves as an ideal site for electric power generating plants, due in part to the need for large quantities of cooling water. The economic base model, presented in Chapter 3, identifies both sanitary services (SIC 495) and electric services (SIC 491) as part of the exogenous sector. The geographic proximity of these two industries to Tampa Bay results in several economic benefits, which are outlined within this chapter. Case studies are presented for both Hillsborough and Pinellas Counties, involving sanitary and electric services.

In September 1984, the Florida Department of Environmental Regulation presented a draft of the Tampa Bay 205(j) Water Quality Impact Study. The Tampa Bay estuarine system was studied for the purpose of considering water quality impacts of point and nonpoint source discharges to the Bay.(1) The study was completed as a cooperative effort between various agencies and with a number of contractors. Dissolved oxygen (DO) and nutrient concentrations in Tampa Bay were studied as parameters to define nutrient or chlorophyll a target concentrations in Tampa Bay and to consider the impacts of point and non-point sources relative to the targets.

When finalized, the Tampa Bay Water Quality Impact Study may play a critical role regarding future point and non-point source discharges to the Tampa Bay estuary.

## B. WASTEWATER DISPOSAL

Tampa Bay is presently experiencing a number of water quality problems. In particular, there is a periodic depletion of the dissolved oxygen (DO) resources and associated fish kills. There has been a disappearance of grassbeds in the area. Seasonal algal blooms are also encountered. Taken together, these problems appear to be associated with nutrient enrichment of the bay system. Therefore, the primary concern in the study of Tampa Bay Water Quality Impact Study was the nutrient load from point and non-point sources (2).

Municipal and industrial wastewaters enter Tampa Bay directly or via its tributaries at over 188 points around the Bay.(3) Hillsborough Bay receives the heaviest loadings of both municipal and industrial wastes, while Old Tampa Bay receives substantial loadings of predominatly municipal wastes. Relatively smaller amounts of municipal and industrial wastes are discharged into the middle and lower segments of Tampa Bay proper, however, Boca Ciega Bay has been severely impacted by municipal discharges.

In 1972, the Florida State Legislature passed what was known as the Wilson-Grizzle Bill (Section 403.086(1)(b), Florida Statutes). This bill stipulated that no domestic wastewater disposal facility constructed after 1972, could discharge any waste into Old Tampa Bay, Tampa Bay, Hillsborough Bay, Boca Ciega Bay, St. Joseph Sound, Clearwater Bay, Sarasota Bay, Little Sarasota Bay, Roberts Bay, Lemon Bay, or Punta Gorda Bay, in addition to any bay, bayou or sound "tributary thereto" without providing at least advanced wastewater treatment (AWT). In essence, the area covered by the bill included all saline coastal bodies of water from the Anclote Keys south to Charlotte Harbor.

Advanced wastewater treatment, as defined in the Florida Administrative Code, Chapter 17-6, limited the annual average effluent concentration to 5 milligrams per liter (mg/l) of 5 day biochemical oxygen demand (BOD5) and total suspended solids; 3 mg/l total nitrogen; and 1 mg/l total phosphorus. This requirement was not based on site-specific water quality determinations, but was made in an attempt to reverse what was perceived by many to be deteriorating water quality in the area. No relief mechanism was provided other than a statutory variance.

In 1980, the Legislature modified the Wilson-Grizzle Bill such that the FDER could grant relief for facilities if the applicant initiated a request for such relief and then demonstrated that AWT was not required to protect water quality. The modified Wilson-Grizzle Bill also expanded the "affected area" to include all freshwater tributaries which flow into the original Wilson-Grizzle area. This area was defined hydrologically as the Peace River and Tampa Bay Basins.

In July 1981, the Legislature repealed the statute requiring AWT for domestic wastewater treatment facilities constructed after 1972. The statute was replaced with a mandate requiring the Department to specify wasteload allocations on a case-by-case basis for domestic point sources. Also required was a survey on the overall impact of existing non-point sources discharging into the waters of the original Wilson-Grizzle area.

In 1982, the surface waters of Tampa Bay received domestic effluent from 49 permitted sources which included facilities with design treatment capacities ranging from 10,000 to 60 million gallons per day.(4) Domestic point sources in 1984 discharged 71.01 billion gallons of effluent to Tampa Bay and its associated tributaries as compared to 61.75 billion gallons in 1982, a 15% increase in total annual flow. This increase can generally be attributed to rapid population growth, higher than average rainfall and associated infiltration problems with collection systems.

There are currently 23 industries which are permitted to discharge directly into Tampa Bay waters according to Department of Environmental Regulation National Pollutant Discharge Elimination System (NPDES) permit files. In addition, there are 116 industries which are permitted to discharge into the tributaries of Tampa Bay.(5)

It is difficult to predict future trends as many unknown factors will come into play. As local governments move toward the implementation of approved 201 Facility Plans, fewer plants will discharge directly to surface waters of the bay. Alternative effluent disposal practices such as deep-well injection, spray irrigation and percolation ponds will become more commonplace. In addition, the level of treatment in regional plants will continue to improve. However, counteracting these positive actions is an increasing trend toward the construction of numerous small (<0.1 MGD capacity) "package plants" in developments not served by existing sewer systems. This trend will result in an overall increase in the number of point source discharges to be monitored, and an overall decrease in level of treatment.

PL 92-500 Planning Processes

Public Law 92-500, known as the Federal Water Pollution Control Act Amendments of 1972, was enacted by the ninety-second Congress of the United States of America on October 18, 1972. The stated objective of this act is to "restore and maintain the chemical, physical and biological integrity of the Nation's waters." The national goals and policies established by PL 92-500 include the following: "...it is the National Policy that areawide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each State..."

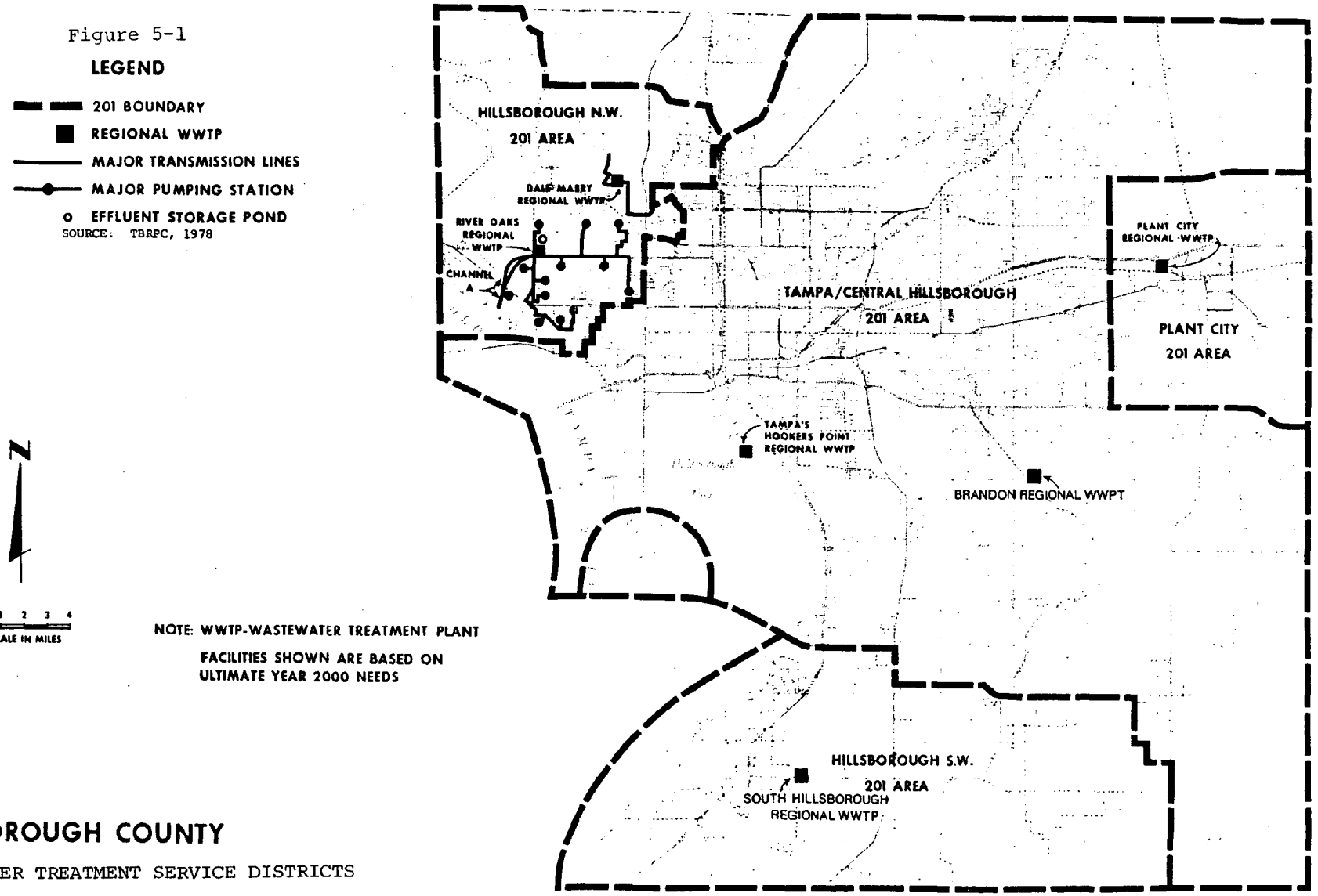
In keeping with this policy, PL 92-500 expanded existing and created new planning processes to be carried out by the States. Plans required to be prepared under this act are: Section 303(e) - Basin Plans; Section 208 - Areawide Waste Treatment Management Plans; and Section 201 - Facility Plans.

The 201 Facility Plan is concerned primarily with developing a specific project, or projects, for the collection, treatment and disposal of wastewaters generated in the 201 Planning Area. It is specific in that it includes the treatment and disposal of wastewaters generated in the 201 Planning Area. It is also specific in that it includes the treatment plant sites, sizes, types of processes, methods of effluent and sludge disposal, interceptor sewer routings and other steps necessary for constructing the project.

1. Hillsborough County

Hillsborough County contains four wastewater treatment service districts: Hillsborough Northwest, Plant City, Central Hillsborough-Tampa and Hillsborough Southwest (see Figure 5-1). Hillsborough Northwest also treats wastewater from a small area in the neighboring Pasco County. The wastewater treatment - disposal systems of the Central Hillsborough-Tampa and Hillsborough Northwest areas are examined here.

Figure 5-1




## HILLSBOROUGH COUNTY

WASTEWATER TREATMENT SERVICE DISTRICTS

a. Central Hillsborough-Tampa

The preponderance of the wastewater originating within the Central Hillsborough County - Tampa 201 Planning Area is conveyed to and treated at the Hookers Point Sewage Treatment Plant, operated by the City of Tampa. Hookers Point is an Advanced Wastewater Treatment (AWT) Facility with a current design capacity of 60 MGD. Effluent disposal is by discharge to Hillsborough Bay.

Alternatives

Presently, the Hookers Point facility disposes of approximately 50.3 MGD sewage effluent by discharge to Hillsborough Bay. Alternatives, considered within the 201 Facility Plan, for treatment and disposal of effluent, are summarized as follows:

Secondary Effluent: Treat effluent to secondary levels and dispose by deep-well injection, spray irrigation or by deep-water outfall in the Gulf of Mexico.

Advanced Waste Treatment (AWT) Effluent: AWT treatment and disposal by discharge to Hillsborough Bay with potential reuse of all or part of the effluent.

Costs

Preliminary estimated comparative costs for the secondary treatment alternatives and disposal options are summarized in Table 5-1, which includes 1979 dollar estimates and 1984 dollar estimates.

The preliminary estimated costs for the Advanced Waste Treatment of effluent alternative, with disposal by discharge to Hillsborough Bay, are summarized in Table 5-2.

The Selected Alternative

The selected alternative for the Tampa Service Area - the preferred alternative - comprises expansion and improvements to the wastewater collection systems and the Hookers Point AWT plant, with disposal by discharge of treated wastewater to Hillsborough Bay.(6) The selected alternative was the AWT series treatment with packed towers, with the facilities for the removal of phosphorus. The Hookers Point facility continues to be expanded to provide capacity for current and estimated (future) wastewater quantities, through the year 2000. New and improved facilities at Hookers Point include units for methane generation and energy recovery, and improvements to some of the original process units. This preferred alternative (AWT), with discharge to Hillsborough Bay, is the most cost effective and environmentally sound, as required to meet water quality standards.(7)

TABLE 5-1
SECONDARY TREATMENT ALTERNATIVES AND DISPOSAL OPTIONS

| | Alternative Project | See Figure | Preliminary Estimated Comparative Costs[1] Thousand Dollars (1979) | | Estimated Comparative Costs Thousand Dollars (1984)[3] | |
|---|---|---|---|---|---|---|
| | | | (Capital) | (EAC[2]) | (Capital) | (EAC) |
| S-1 | Spray Irrigation (no crop recovery) | 5-2 | $ 297,864 | $ 28,574 | $ 378,287 | $ 36,288 |
| S-1 | Spray Irrigation (crop recovery) | 5-2 | 297,864 | 19,905 | 378,287 | 25,279 |
| S-2 | Gulf Outfall (Route No. 1) | 5-3 | 203,932 | 18,648 | 258,993 | 23,682 |
| S-2 | Gulf Outfall (Route No. 2) | 5-3 | 187,033 | 17,277 | 237,532 | 21,942 |
| S-3 | Deep Well Injection | 5-4 | 886,783 | 86,074 | 1,126,214 | 109,314 |

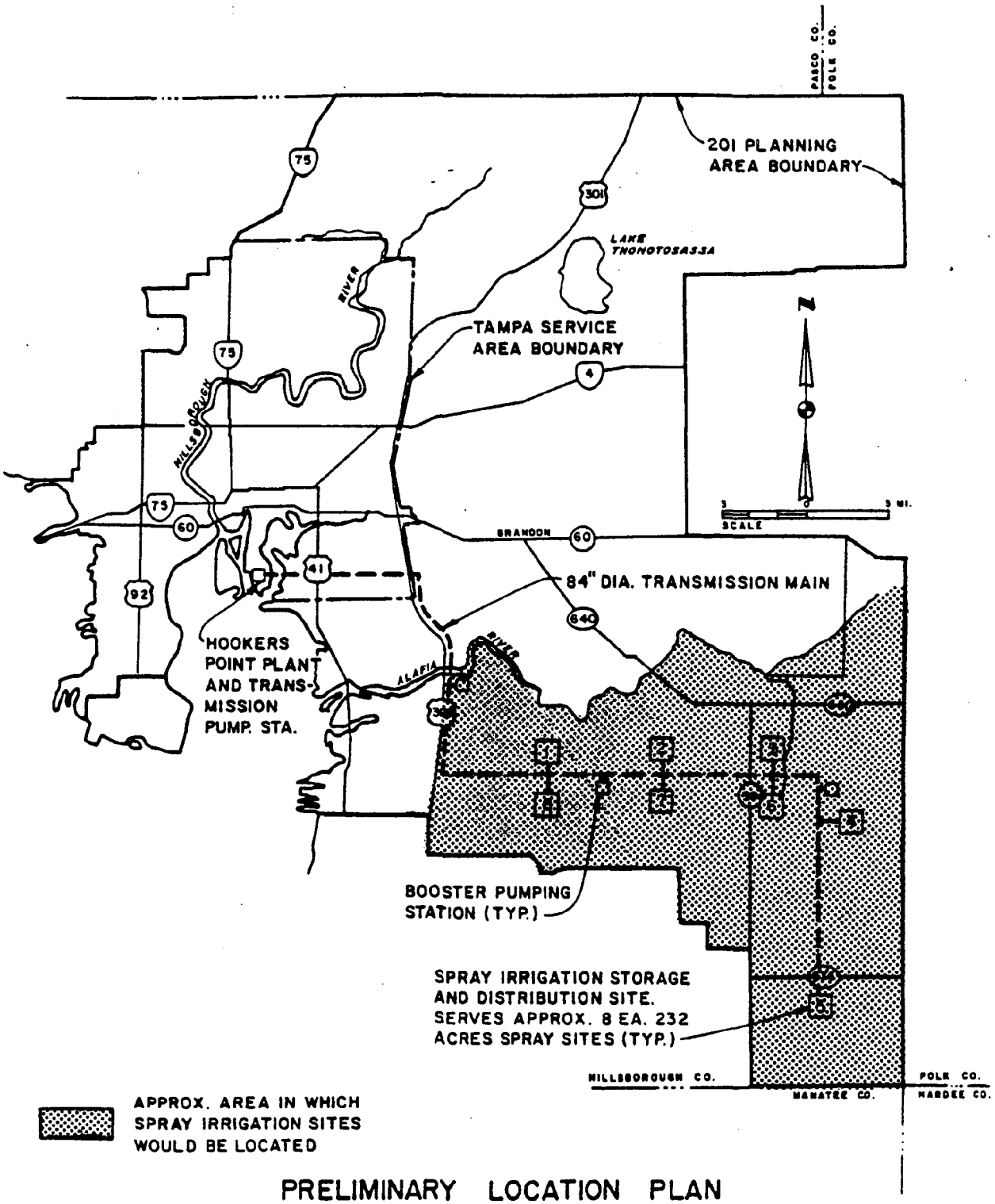
[1] Source: Central Hillsborough County - Tampa 201 Facilities Plan
[2] Equivalent Annual Cost
[3] U.S. Department of Commerce, Composite (Construction) Cost Index, 1985 Adjustment for Inflation (+27%)

**TABLE 5-2**
**ADVANCED WASTE TREATMENT ALTERNATIVE**

| Alternative Project | See Figure | Thousand Dollars (1979) (Capital) | (EAC) |
|---|---|---|---|
| Series Treatment w/packed towers (w/o P-rem) [1] | 5 - 5 | $ 66,897 | $ 15,792 |
| *Series Treatment w/packed towers (w/P-rem) [2] | 5 - 5 | 67,723 | 17,448 |

[1] Without facilities for removal of phosphorus
[2] With facilities for removal of phosphorus
* Selected Alternative

Figure 5-2

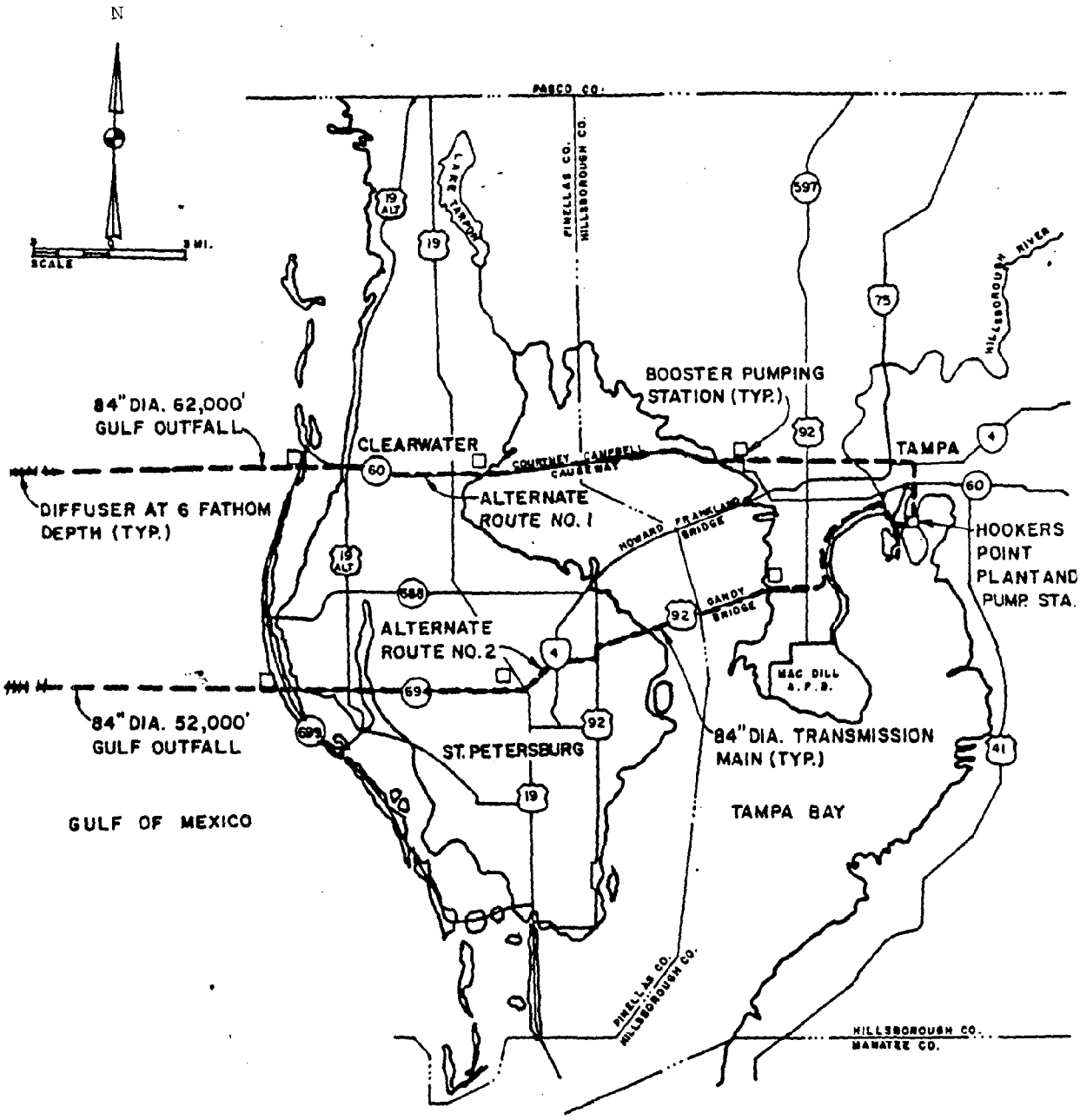



# PRELIMINARY LOCATION PLAN
# ALTERNATE S-1, SPRAY IRRIGATION
# SECONDARY TREATMENT

SMITH AND GILLESPIE
GREELEY AND HANSEN
ENGINEERS

CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
EPA NO. C12063401.0

Figure 5-3

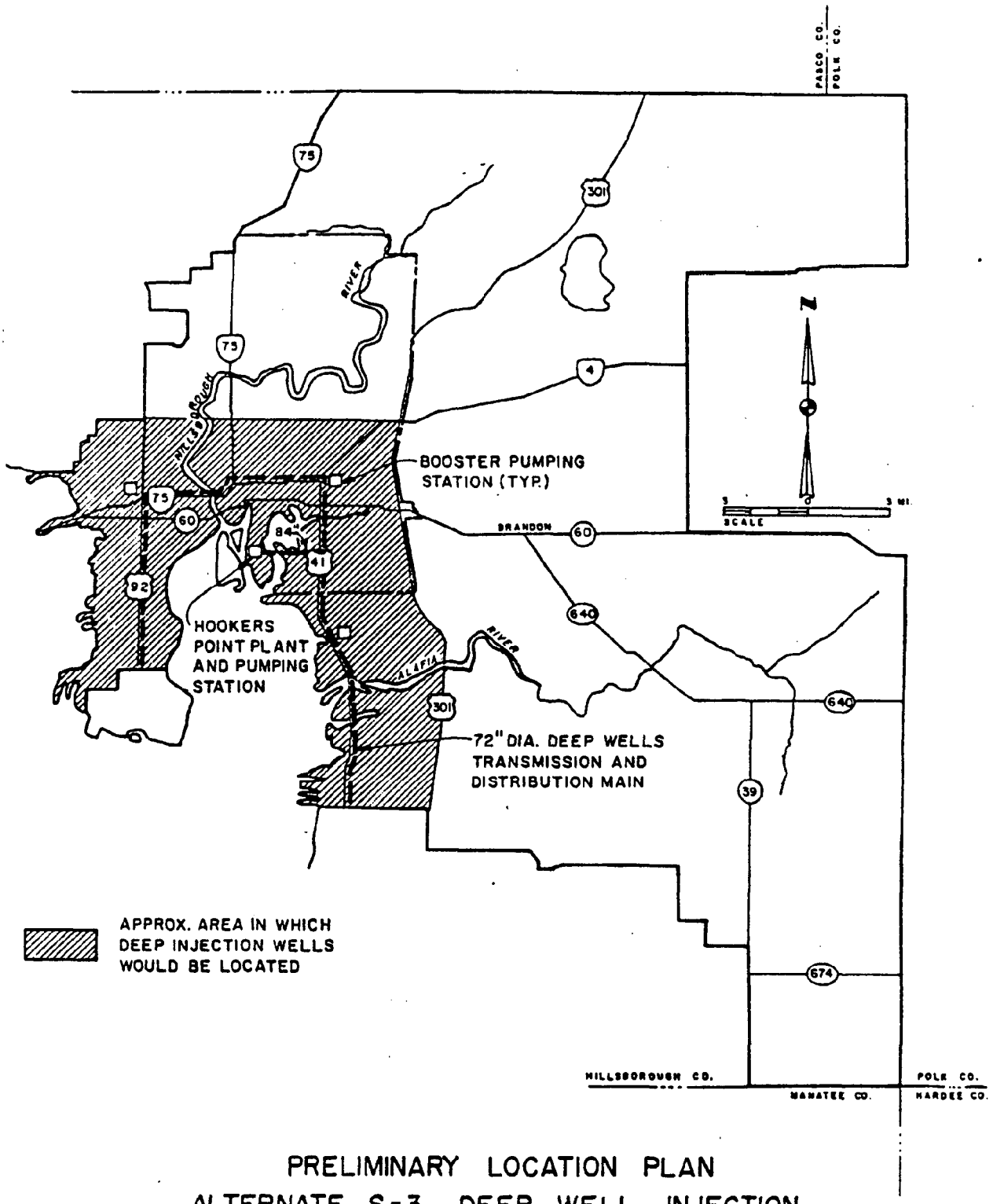



# PRELIMINARY LOCATION PLAN
# ALTERNATE S-2, GULF OUTFALL
# SECONDARY TREATMENT

SMITH AND GILLESPIE
GREELEY AND HANSEN
ENGINEERS

CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
EPA NO. C12063401.0

Figure 5-4

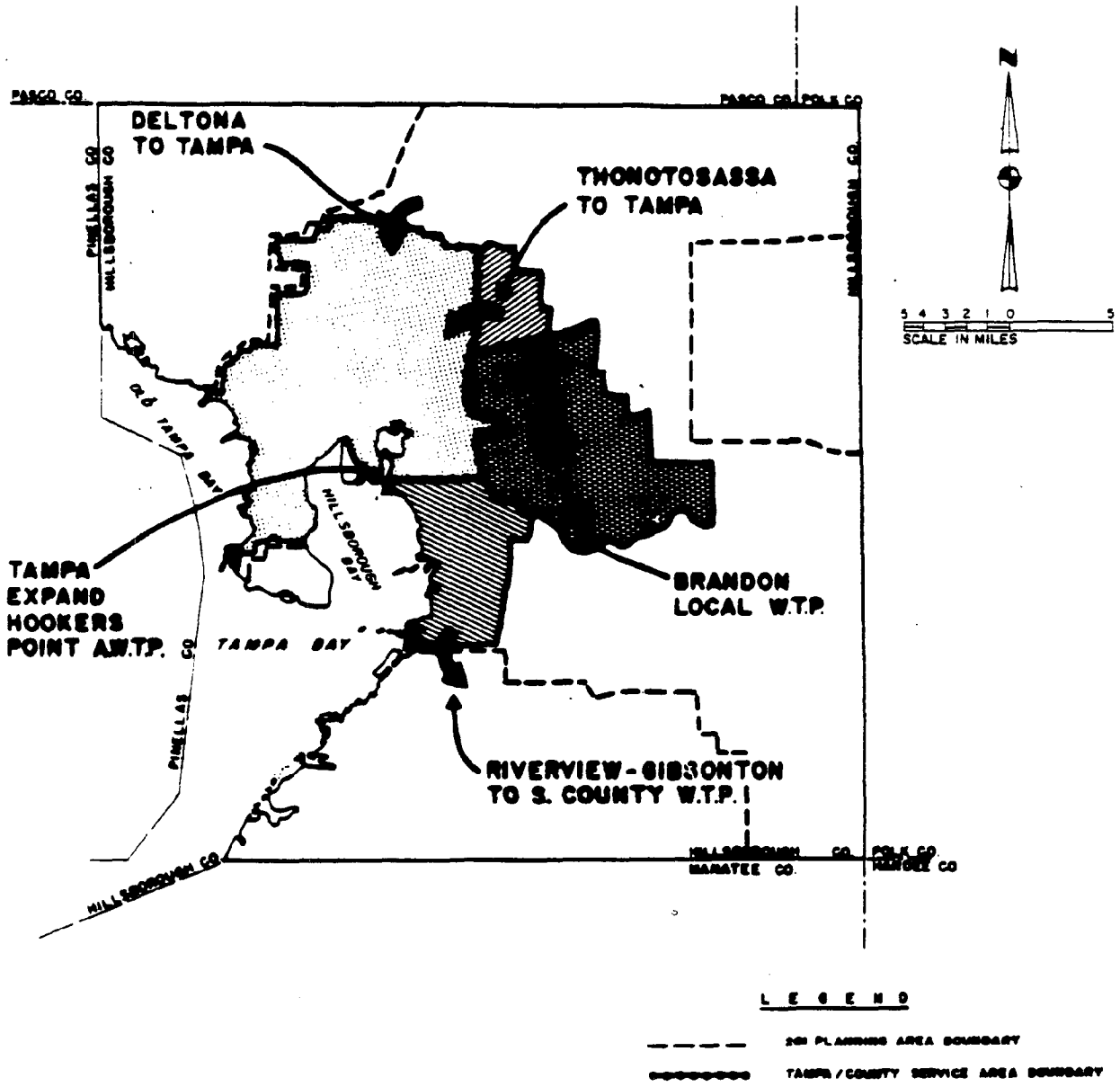



# PRELIMINARY LOCATION PLAN
# ALTERNATE S-3, DEEP WELL INJECTION
# SECONDARY TREATMENT (FILTERED EFFLUENT)

SMITH AND GILLESPIE
GREELEY AND HANSEN
ENGINEERS

CENTRAL HILLSBOROUGH COUNTY - TAMPA
201 FACILITY PLAN
EPA NO. C12063401.0

Figure 5-5




## SELECTED PLAN

Actual costs, to date, for the AWT alternative, are in the range of $114 million (8). When compared to the capital costs associated with the three secondary treatment and disposal alternatives, (estimated in 1984 dollars) the AWT alternative is by far the most cost effective method of sewage treatment and disposal.

Comparative costs of the AWT alternative and the three secondary treatment and disposal alternatives are summarized as follows:

- Gulf Outfall (Route No. 2) would be double the cost of the AWT alternative, costing an additional $123.5 million to implement.

- Gulf Outfall (Route No. 1) would cost an additional $145 million to implement.

- Spray irrigation, with and without crop recovery, would be over three times the cost of the AWT alternative, costing an additional $164.3 million to implement.

- Deep well injection would be a staggering ten times the cost of the AWT alternative, costing an additional $1 billion to implement.

b. **Hillsborough Northwest**

The Hillsborough Northwest 201 Planning Area is situated north of Old Tampa Bay and the City of Tampa (please refer back to Figure 5-1). A listing of the treatment facilities currently serving the area, including the degree of treatment provided, method of recovered water reuse, and current operating situation, is given in Table 5-3.

The Northwest Area is currently experiencing difficulty meeting wastewater demands.(9) The area is served by three major treatment plants. The River Oaks AWT Facility, located in the southern portion of the area is overloaded. The design capacity is 4.7 mgd, while the most recent records show up to 6.0 mgd sometimes flowing through the plant. After less than AWT treatment the recovered water is discharged into Channel A, a man-made water course constructed to alleviate flooding. Wastewater discharged into Channel A ultimately enters the waters of Tampa Bay (Figure 5-6). The Florida Department of Environmental Resources (FDER) allows such a discharge as long as certain wastewater treatment criteria are met, however, because the facility is overloaded, these limits are not currently being met.

To improve this situation, the County is in the process of expanding the River Oaks AWT facility to 10.0 mgd. The expansion is under construction and is expected to be completed in January 1988. It must be emphasized that FDER has restricted the total future recovered water flow to Channel A to that quantity that will produce no more poundage than legally allowed

TABLE 5-3
SUMMARY OF COUNTY-OWNED WASTEWATER TREATMENT FACILITIES
HILLSBOROUGH COUNTY, FLORIDA
(Northwest Area)

| Facility | Treatment | Design Capacity (mgd) | Reuse Method | Comments |
|---|---|---|---|---|
| NORTHWEST AREA | | | | |
| 1. River Oaks | AWT | 4.67 | Surface Water Discharge | Influent flow currently exceeds capacity; EPA administrative order issued; loading in violation of permit |
| 2. River Oaks Interim | Secondary | 1.0 | Spray Irrigation (Pasture) | Plant to be taken offline with River Oaks expansion |
| 3. Tampa Suburban | AST | 0.75 | Spray Irrigation (Urban) | Limited by reuse capacity. Current activities to complete Rocky Point Golf Course connection scheduled by January 1986 |
| 4. Dale Mabry | AST | 4.5 | Spray Irrigation (Urban) & Surface Water Discharge | 30-month TOP issued 10/85 to remove discharge to Brushy Creek can be operated at 5 mgd for short term; local golf course irrigation limited to 3 mgd. |
| 5. Sun Lake Park | Secondary | 0.07 | Evaporation/ Percolation Pond | Marginal performance record; TOP pending |
| 6. Van Dyke | AST | 2.5 | Spray Irrigation (Urban) | Currently under construction with operational start-up scheduled for Spring 1986 |

Notes: Treatment Levels: Secondary (90% removal), Advanced Secondary Treatment (AST), Advanced Waste Treatment (AWT, nutrient removal)

Source: Hillsborough County Wastewater Master Plan, November 1985

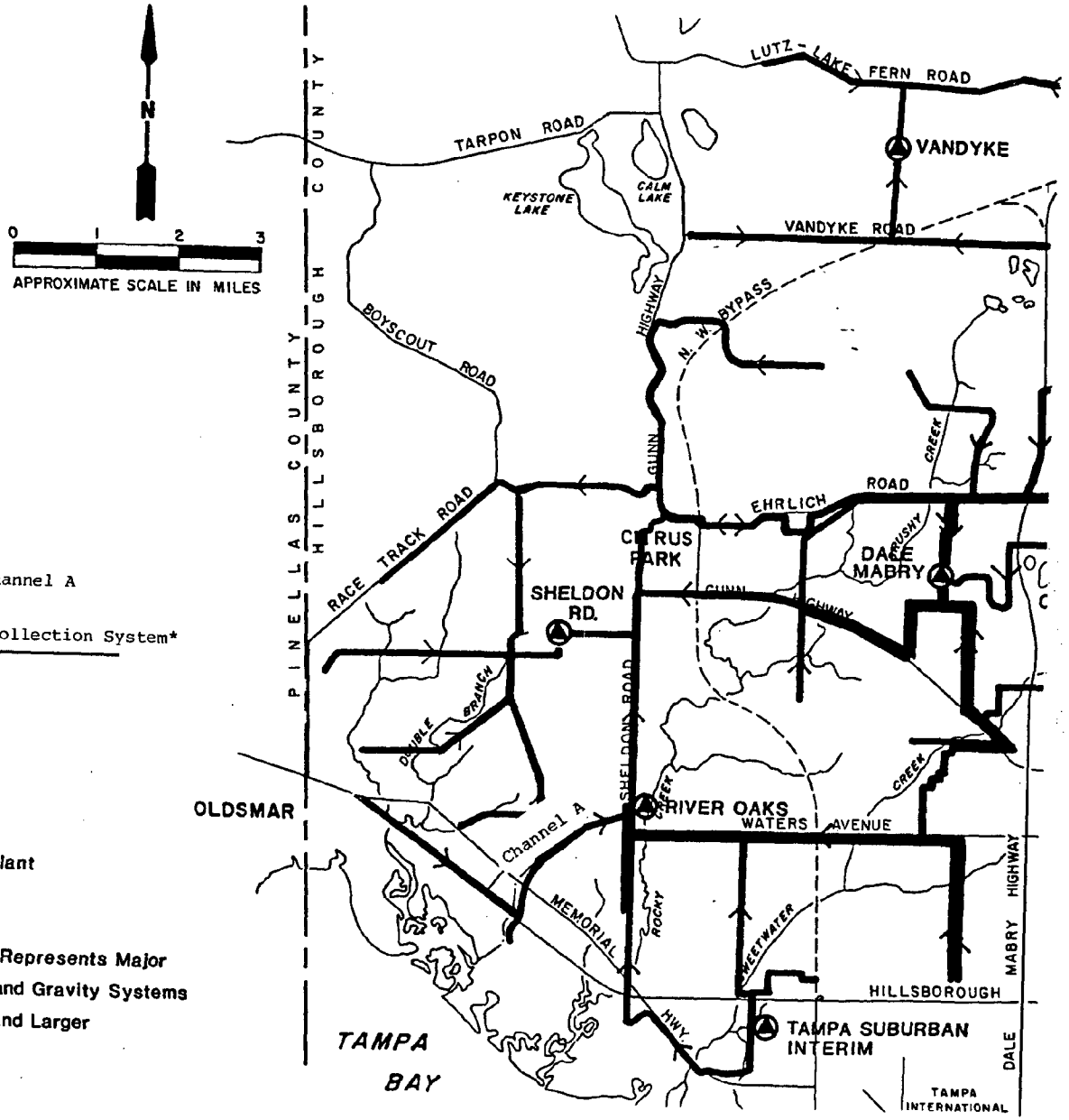



Figure 5-6
Relative Location of Channel A

**LEGEND**

Existing Collection System*

Wastewater Treatment Plant

* NOTE:

Collection System Shown Represents Major Wastewater Force Mains and Gravity Systems Generally 12" Diameter and Larger

now, which because of the improved level of AWT, should be about 7.5 mgd. As the plant flow increases beyond this amount, other means of recovered water use must become available.

The River Oaks Interim Plant is located on the same site as the River Oaks AWT Plant. The 1.0 mgd interim facility was provided to relieve some of the capacity demands on the AWT facility. Although the plant is operating reasonably well, two upcoming events will shape its future. First, the site itself is so small that expansion of the AWT plant will require dismantling the interim plant. For this reason, the construction schedule has been modified so that limited treatment from expanded facilities will be available to replace the treatment capacity lost as the interim facility is taken off-line. Second, the current recovered water spray irrigation site (owned by U.S. Home) is going to be developed, so a new site must be found.

In September of 1985, an additional interim plant was placed in operation on the site of a former plant, called Tampa Suburban Utilities. This 0.75 mgd steel tank facility is presently only operating at about 0.25 mgd because land is not available to spray irrigate the additional recovered water. The 0.25 mgd is irrigating the adjacent Rocky Point Golf Course.

The FDER operating permit for the Northwest Area's Dale Mabry Advanced Secondary Treatment (AST) plant (formerly known as the Carrollwood Village Plant) expired in January 1985. The Plant is supposed to provide recovered water to local golf courses for irrigation, with an infrequent emergency discharge allowed to Brushy Creek. In fact, discharge to Brushy Creek has been almost continuous because the capacity of the golf courses is about 3.0 mgd, while the plant is operating at 4.2 mgd. In October 1985, FDER issued a 30-month Temporary Operating Permit (TOP) which requires the County to either discontinue the discharge to Brushy Creek or demonstrate to FDER that the discharge does not adversely affect Brushy Creek. In the meantime, recovered water flow to Brushy Creek may continue as long as the plant's maximum treated quantity does not exceed 5.0 mgd and the high quality of the water is maintained.

Finally, a review of the list of "permitted but not connected" commitments for the Dale Mabry Facility appear to exceed the 5.0 mgd limit by 1.0 mgd or more. While this added flow will not show up immediately, plans must be made now for both its treatment and the reuse of the recovered water it creates.

In an agreement with four developers in 1984, the County authorized the private construction of a 1.5 mgd treatment plant centered among the four developments between Lutz-Lake Fern Road and Van Dyke Road. The developers will be repaid for the plant by receiving credit on future capacity fees. The plant is to be operational in March 1986 and will be operated and maintained by the County. The developers have agreed to take back all recovered water created by the plant and use it within the development's boundaries.

From the preceding discussion it is apparent that Hillsborough County is faced with an emergency in its Northwest area. Simply stated, the facilities construction for treatment and recovered wastewater reuse have not kept pace with the growth that the area has experienced. Briefly, the Hillsborough Northwest 201 Facilities Plan, revised in 1979, called for only two wastewater treatment plants to serve the area: The River Oaks and Dale Mabry Plants. Both plants required spray irrigation as the preferred "effluent disposal" program. The estimate of expansion costs, and construction and land costs for the River Oaks effluent disposal system, was $30.5 million.(10) In 1984 dollars, this figure would increase to approximately $38.8 million.(11)

**Master Plan**

Solutions for the northwest area are controlled or influenced by numerous factors, one of the most important of which is the fact that the River Oaks AWT plant expansion to 10.0 mgd will not be completed until 1988, and the newly granted Dale Mabry TOP also expires in 1988.

The short-term program for the Northwest calls for three aggressive recovered water reuse programs. First, developments in the area must follow a "take-back" program which the County intends to establish as mandatory through the passage of an ordinance. It will require that lawn and parkway irrigation systems be constructed within all new developments for irrigation with recovered water.

Second, for the Dale Mabry plant, a wet weather recovered water discharge to Brushy Creek must be pursued. EPA has already issued a draft federal permit which authorizes such a seasonal discharge, and FDER has indicated a willingness to listen. Both agencies require further analysis of the water quality situation before such discharge can be approved.

Finally, numerous wetlands dot the northern and western portions of the area. Currently available statewide draft rules from FDER (in response to the Warren B. Henderson Wetlands Act of 1984) indicate that with sufficient monitoring, 1 inch/week of recovered water (258 acres/mgd) will be allowed to be distributed to wetlands. Some wetlands are being studied in anticipation of this reuse potential. It is important to note here that the draft rule presently implies the purchase of wetlands before use. Since the wetlands augmentation program is so critical to the short- and long-term programs, the County must explore all proper legal means to obtain the use of the wetlands at minimal cost.

In the long-term plan, recovered water is seen as becoming a valuable commodity. The recent water restrictions caused by drought are expected to happen again. Continually available

recovered water for lawn sprinkling and golf course irrigation is, and will be, an attractive selling feature in developments. New "take-back" ordinances, described earlier, will also require it. As the demand for potable water increases with the population, industrial reuse will be a necessity because regulatory agencies will require its consideration prior to groundwater sources being approved or renewed. Therefore, a major goal of the long-term plan is to provide for a recovered water distribution system to be sure that there is a place for the water to go and that, whenever possible, it serves a conservation purpose when it gets there.

Once the River Oaks expansion is complete, no further expansion will be possible there, due to the severely limited size of the site. The River Oaks Facility will have to rely on all aspects of recovered water reuse: wetlands augmentation, take-back programs and golf course irrigation. In addition, there will be continued discharge into Channel A.

Estimated costs for the River Oaks Facility expansion, which includes an interim irrigation relocation, pump station and force main construction and flow equalization, are in the range of $24.9 million.(12)

**Summary**

The existence of a major wastewater treatment facility, River Oaks, adjacent to Channel A, made this stream a logical receiving waterway. However, in an attempt to discontinue surface water discharge the Northwest 201 plan called for disposal of effluent by land application, e.g. spray irrigation. The estimated cost for expansion and associated construction, in 1984 dollars, was $38.8 million. The current situation with the River Oaks Facility, however, is one of expansion to 10.0 mgd and the utilization of a variety of wastewater reuse systems, in addition to continued discharge to Channel A. The estimated cost for this expansion and associated construction is $24.9 million.

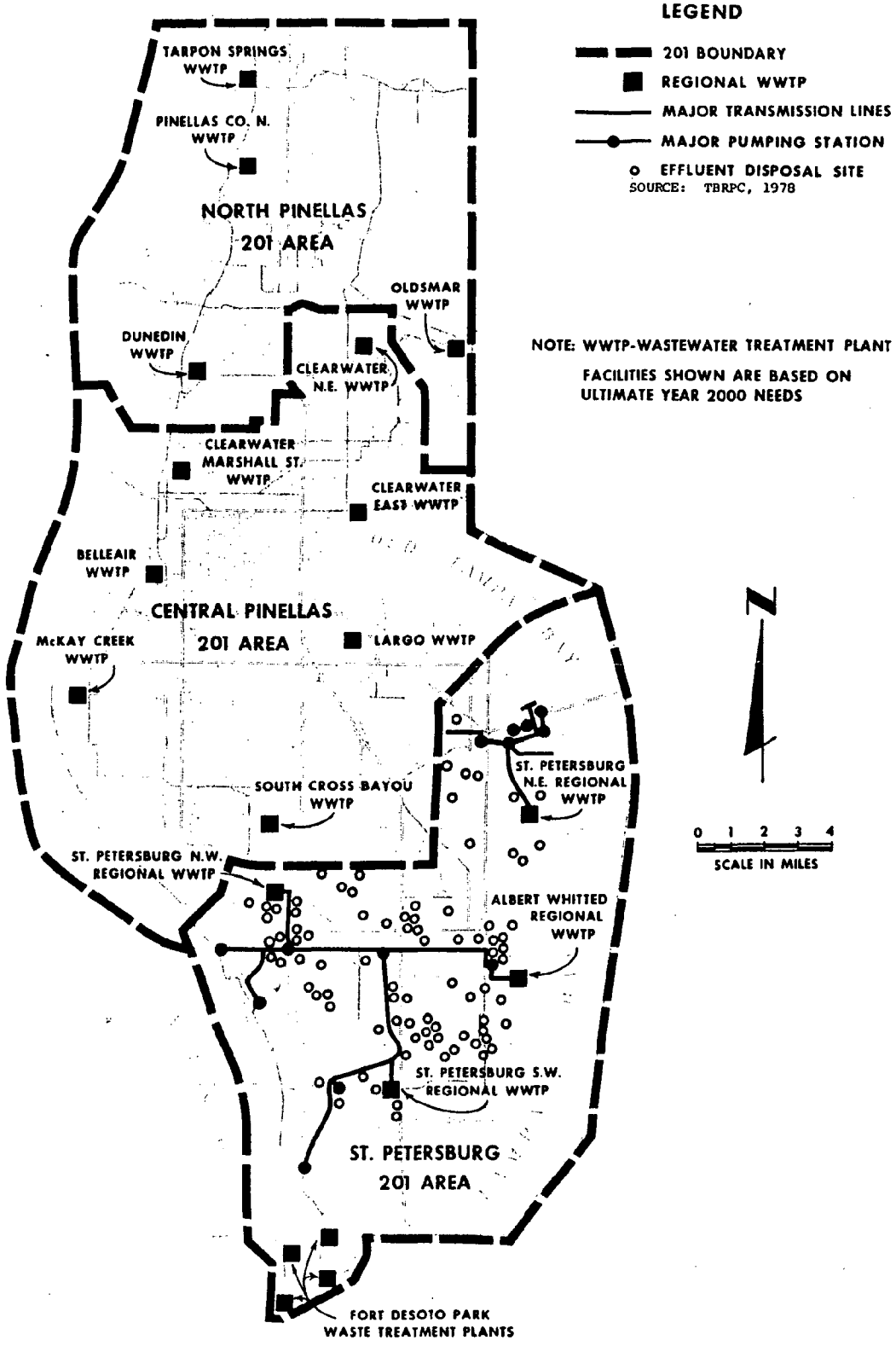
The employment of surface water discharge at the River Oaks Facility results in a cost-savings of approximately $14 million.

2. Pinellas County

There are three 201 Planning Areas in Pinellas County: North Pinellas, Central Pinellas and the City of St. Petersburg (see Figure 5-7).

Pinellas County is the most developed and populated area in the Tampa Bay Region. The County is served by 15 regional wastewater treatment facilities, concentrated mostly along Tampa Bay and the Gulf of Mexico.

Figure 5-7




**PINELLAS COUNTY** 201 PLANNING AREAS

The 201 planning process for the City of St. Petersburg has already been completed. St. Petersburg has achieved the most cost-effective plan for wastewater treatment and recycling system. All of the effluent will be used for spray irrigation with the deep well injection as a back-up system. However, many of the other facilities in Pinellas County discharge their effluent to surface waters. The wastewater treatment-disposal systems of the North Pinellas area and the City of St. Petersburg are examined here.

a. North Pinellas County

The Environmental Impact Statement (EIS) for North Pinellas County, Florida addresses alternative wastewater treatment-disposal systems and the potential impacts of these systems. (13) The study area for the EIS includes the northern half of Pinellas County including all of the City of Clearwater and locations within the county north of Clearwater as shown on Figure 5-8.

Facilities planning for the EIS Study Area was accomplished through the North Pinellas County 201 Plan (which included areas within the county north of the City of Clearwater: Dunedin, Oldsmar, Tarpon Springs and unincorporated areas) and the Central Pinellas County 201 Plan (which included the cities of Clearwater and Safety Harbor and areas further south). Recommendations of the 201 plans are summarized in Table 5-4. All existing nearshore surface water discharges were to be replaced by several deep well injection and spray irrigation alternatives. A Gulf outfall was also recommended as both a primary and a back-up disposal method.

Review of the facilities plans raised substantive questions concerning the disposal options of deep well injection and a Gulf outfall, lack of wasteload allocations to area surface waters and the impact of sewering the environmentally sensitive area east of Lake Tarpon.

Based upon the concerns raised in the 201 Plans and through the review and scoping processes, the following issues were identified as the major elements of the EIS:

- Development and evaluation of wastewater disposal alternatives for the numerous municipal wastewater treatment facilities;
- Development and evaluation of wastewater management alternatives for the developing area east of Lake Tarpon;
- Evaluation of the environmental effects and costs associated with the disposal of wastewater through a Gulf outfall; and
- Evaluation of water conservation and wastewater reuse in light of existing groundwater supply limitations in the study area.

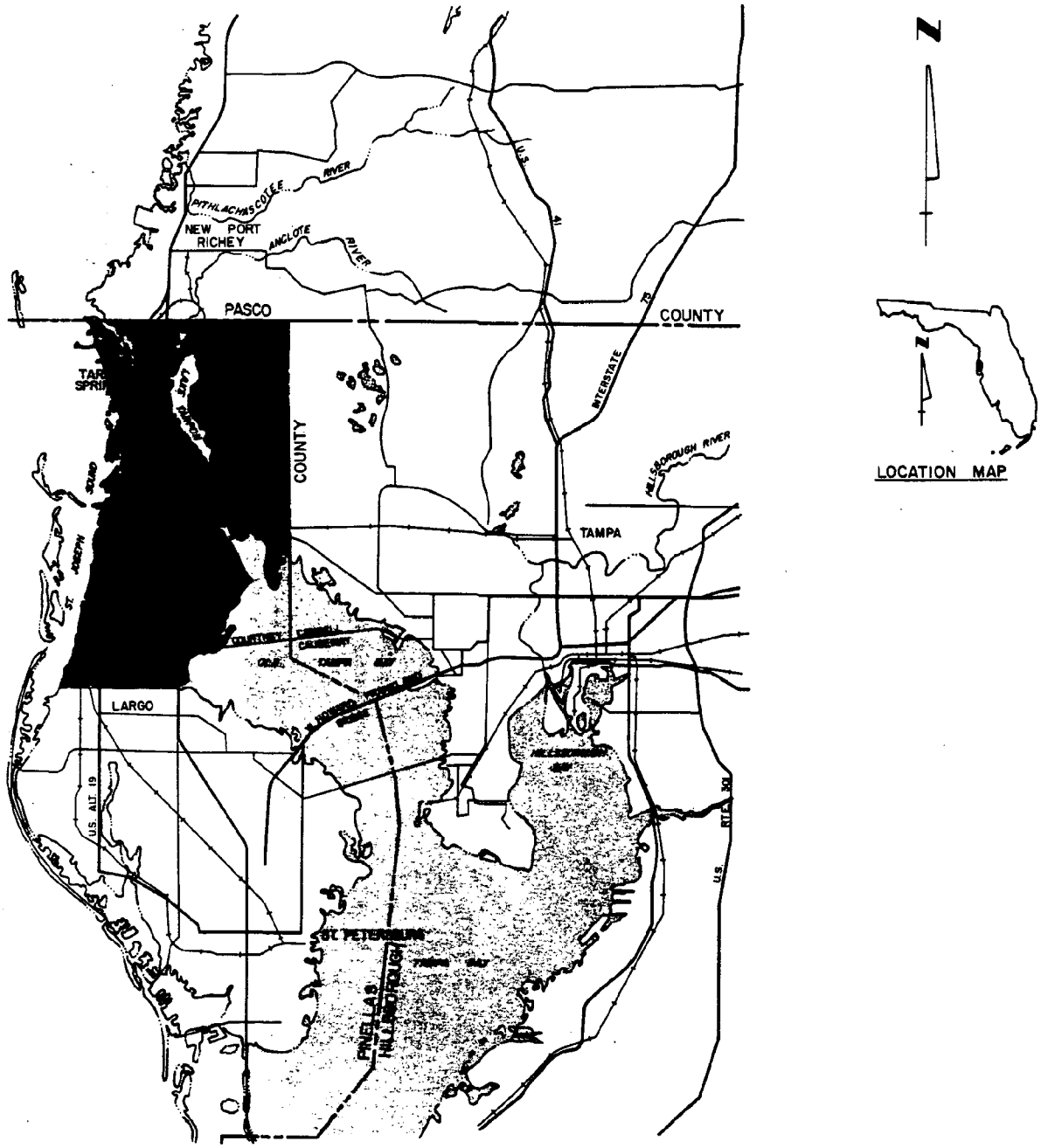



Figure 5-8

NORTH PINELLAS COUNTY, FLORIDA
ENVIRONMENTAL IMPACT STATEMENT

## STUDY AREA

5 0 5 10

SCALE IN MILES

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV ATLANTA, GEORGIA

TABLE 5-4
PINELLAS COUNTY
201 PLAN RECOMMENDATIONS

| Service Area | 1984 Capacity (MGD) / 1984 Flow (MGD) | Year 2000 Projected Flows (MGD) | Current Wastewater Treatment Levels | Effluent Disposal: Current Method | Effluent Disposal: Method Recom. in 201 Plan |
|---|---|---|---|---|---|
| **Clearwater** | | | | | |
| East Plant | 5.0 / 5.3 | 5.3 | Secondary plus effluent filtration | Discharge to Old Tampa Bay, 650 ft. from shore | Deep-well injection near the treatment plant |
| Northeast Plant (1) | 8.0 / 4.6 | 12.0 | Secondary (with filters being installed) | Effluent discharged through East Plant's out fall | Deep-well injection near East Plant in combination with East Plant |
| **Oldsmar** | | | | | |
| Oldsmar Plant | 1.0 / 0.75 | 4.5 (2) -7.5 (2) | Secondary with nitrification | Evap./perc. ponds | Spray irrigation as primary method; perc. ponds as backup method |
| **Safety Harbor** | | | | | |
| Safety Harbor | 0.35 / 0.11 | Redirect flow to Clearwater N.E. Plant | Secondary | Redirect flow to Clearwater N.E. Plant | Redirect flow to Clearwater N.E. Plant |

(1) Includes Safety Harbor's flows
(2) Includes 3.5 MGD from unsewered area east of Lake Tarpon

Source: EPA, Environmental Impact Statement, North Pinellas County, Florida September 1985

Development and Evaluation of Alternatives

Six basic wastewater disposal alternatives were evaluated for the existing municipal facilities:

- Discharge to coastal waters (Old Tampa Bay, Clearwater Harbor-St. Joseph Sound or the Anclote River);
- A Gulf outfall extending from Clearwater Beach Island, Honeymoon Island or the mainland north of Honeymoon Island;
- Deep well injection at the Marshall St. Plant or south of the study area possibly at the county's McKay Creek Wastewater Treatment Plant and injection site;
- Slow rate (spray irrigation) or rapid rate (rapid infiltration) land application;
- Wastewater reuse of nonpotable wastewater for irrigating recreational or other open land areas and industrial cooling service water; and
- The No Federal Action (no-action) alternative.

Cost Analysis

(a) Tampa Bay Subarea Cost Summary

The Old Tampa Bay Subarea involves facilities (Oldsmar, Clearwater Northeast, and Clearwater East) with proposed discharges to Upper Old Tampa Bay (north of the Courtney Campbell Causeway) or Lower Old Tampa Bay (south of the causeway). The general findings of the cost analysis are summarized below:

- The individual service area disposal options with a surface water discharge treated to secondary levels with no outfall extension are least costly;
- Regional and sub-regional options are more costly than individual options;
- A sub-regional alternative combining all facilities for a discharge to Lower Old Tampa Bay at secondary treatment levels is the least costly non-individual service area option;
- Reuse plus secondary treatment and filtration is cost competitive with regional Gulf outfall and deep well injection options; and
- The regional Gulf outfall option (with secondary treatment and with the outfall located four miles offshore from Honeymoon island) is cost competitive with the regional deep-well injection option.

## Conclusions

In the absence of approved wasteload allocations for area surface waters (except the Anclote River), EPA could not select a preferred alternative for wastewater disposal for all of North Pinellas County. The EIS must instead be viewed as providing input to the Florida DER in their wasteload allocation decisions and to local agencies for their wastewater management decisions. The identification of the most cost effective, environmentally sound disposal alternative that would be eligible for EPA funding can not be accomplished until the wasteload allocation process is completed.

The alternatives involving discharge into Old Tampa Bay, Clearwater Harbor and St. Joseph Sound can undergo no further screening by EPA at this time. Additional definitive decisions can not be made until wasteload allocations for those water bodies are available.

## Recommendations

- **Wastewater Reuse**

  The wastewater reuse alternatives for each service area were identified as the environmentally preferred disposal alternative. Reuse is the only management option that responds to the area's surface water quality problems while addressing ground water supply limitations. **In general terms, the cost of waste-water reuse represents an additional $41 to $48 million beyond the costs associated with surface water disposal options at AWT and secondary treatment levels, respectively for all seven treatment plants.**

  These costs do not recognize any value for the recycled wastewater or the reduced costs associated with lesser needs for potable supplies.

- **Old Tampa Bay Subarea**

  In the absence of wasteload allocations for this subarea, numerous alternatives remain viable for the Clearwater East, Clearwater Northeast and Oldsmar service areas. The information from the EIS process is available to the state for use in their decisions. Upon completion of the wasteload allocation process, the most cost-effective environmentally sound option for funding eligibility can then be selected.

- **Remaining Alternatives**

  Wasteload allocations for Old Tampa Bay and Clearwater Harbor-St. Joseph Sound are in the process of being developed. The selected treatment level for each body of water could be as minimal as secondary wastewater treatment or as stringent as not allowing any wastewater discharge.

Therefore, all of the screened alternatives listed in Table 5-5 for the Clearwater East, Clearwater Northeast and Oldsmar service areas remain under consideration.

b. City of St. Petersburg

The St. Petersburg 201 planning area is located in the southern part of Pinellas County between Tampa Bay and the Gulf of Mexico (refer back to Figure 5-7).

The City of St. Petersburg is currently served by four existing municipal wastewater treatment plants, plus four package treatment plants at Fort DeSoto Park. The following are the wastewater facilities that serve the St. Petersburg 201 planning area:

1. Albert Whitted Wastewater Treatment Plant (6.4 MGD)
2. Northeast Wastewater Treatment Plant (16.0 MGD)
3. Northwest Wastewater Treatment Plant (20.0 MGD)
4. Southwest Wastewater Treatment Plant (20.0 MGD)
5. Fort De Soto Park Wastewater Treatment package plants (0.134 MGD)

In response to PL 92-500 and the Wilson-Grizzle Bill, the City of St. Petersburg conducted extensive research in the spray irrigation of treated effluent. Numerous spray irrigation sites throughout the city were selected. The testing and monitoring results showed that the soils did not present constraints for effluent disposal on land, however, there were isolated instances of sites that were poorly drained and had a high water table.

In 1977, the St. Petersburg City Council adopted the concept of zero discharge of treated wastewater to surface waters of Tampa Bay, via wastewater reuse.

The primary objective of the St. Petersburg 201 Facility Plan, completed in 1978, was to consolidate treatment plant service areas where it proved to be most cost-effective. The alternative chosen was a four plant configuration utilizing only the St. Petersburg plants, plus the Fort DeSoto Park package wastewater treatment plants.

Currently, three of the City's four wastewater treatment plants supply water to the effluent distribution system. At the present moment, all of the effluent from the Albert Whitted Plant is discharged to Tampa Bay, however, it is scheduled to be tied to the effluent distribution system before 1987, thereby interconnecting completely the four regional treatment plants.

Effluent disposal is accomplished through spray irrigation, with a deep-well injection back-up. The spray irrigation system consists of a complete secondary water main of 100-miles, carrying effluent to the four quadrants of the City. Excess effluent not used for irrigation is injected via deep wells into a brine

TABLE 5-5
WASTEWATER DISPOSAL ALTERNATIVES

Individual Alternatives

City of Clearwater East Service Area

- Continue existing discharge to Old Tampa Bay south of the Courtney Campbell Causeway
- Discharge to Old Tampa Bay at different location south of Causeway
- Discharge to Old Tampa Bay north of Causeway
- Distribution of reusable wastewater to parks, golf courses and other lands for nonpotable uses

City of Clearwater Northeast Service Area

- Resume former discharge which flows into Possum Branch (and subsequently to Old Tampa Bay)
- Discharge directly to Possum Branch
- Discharge to Safety Harbor
- Discharge to Old Tampa Bay north of Causeway
- Discharge of reusable wastewater to parks, golf courses and other lands for nonpotable uses.

Source: EPA, Environmental Impact Statement, North Pinellas County, Florida, September 1985

City of Oldsmar Service Area

- Discharge to Safety Harbor
- Discharge to Mobbly Bay
- Discharge the Old Tampa Bay north of Courtney Campbell Causeway
- Combine with Higgins Power Plant cooling water and effluent prior to discharge to Old Tampa Bay
- Distribution of reusable wastewater to parks, golf courses and other lands for nonpotable uses

Source: EPA Environmental Impact Statement, North Pinellas County, Florida, September, 1985

zone a thousand feet below the ground. An impermeable layer of rock and clay over-laying the brine zone prevents vertical migration of the effluent, eliminating the possibility of contaminating groundwater.

Construction costs of the wastewater reuse system is estimated at approximately $48 million. The City of St. Petersburg's share of this total is estimated at approximately $9.6 million, or 20 percent of the total cost.(14)

## C. POWER PLANT SITINGS

There are six power generating plants existing along the shores of Tampa Bay (Figure 5-9). The three plants owned by Florida Power Corporation are the A.W. Higgins Plants located near Oldsmar on Old Tampa Bay, the P.L. Bartow Plant located south of Gandy Bridge in Pinellas County and the Bayboro Plant located adjacent to Bayboro Harbor in St. Petersburg. The three plants owned by Tampa Electric Company are the Hooker's Point Station in Tampa, the Gannon Station, also located adjacent to Hillsborough Bay and the Big Bend Station located south of the Alafia River.

Power plants are sited along the bay partly due to the need for large quantities of cooling water. While it is not necessary to site a power plant on the bay, large quantities of water are necessary and not easily obtained from other sources.

In an effort to examine the economic benefits derived from location along Tampa Bay, two "case studies" are presented. The first case study examines the Tampa Electric Company's Big Bend Unit 4 electric generating plant, and the second study examines Florida Power Corporation's Cooling Water Report for the Bartow Plant.

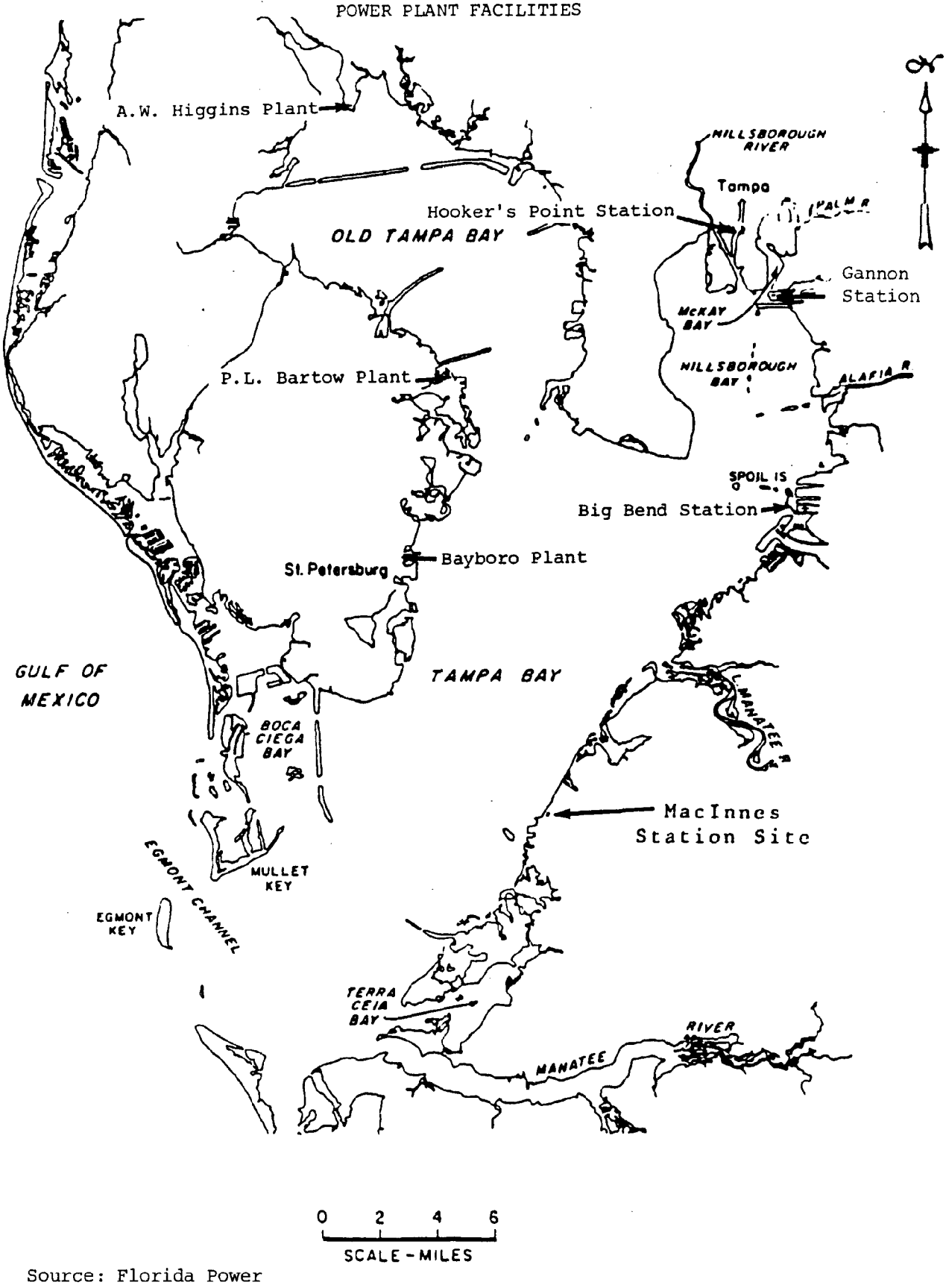
### 1. Big Bend Unit 4

Tampa Electric Company (TECO), a company which is principally engaged in the generation and sale of electricity, serves an area of nearly 1900 square miles on the central west coast of Florida, including all of Hillsborough County and parts of Pasco, Pinellas, and Polk Counties. TECO serves approximately 316,000 customers; TECO's service area is shown in Figure 5-10.

TECO produces electricity in three wholly owned power plants located on or near the eastern shores of Tampa Bay. The units in these plants have a generation capability mix of approximately 65 percent coal, 29 percent No. 6 low-sulfur oil, and 6 percent No. 2 low-sulfur oil. The energy produced from these plants has a generation mix of approximately 80 percent coal, 19 percent No. 6 fuel oil, and 1 percent No. 2 low-sulfur oil.

Hookers Point Station is the oldest of TECO's three power plants. It is located just southeast of the Tampa business district on Hookers Point, fronting the Seddon Ship Channel.

Figure 5-9
POWER PLANT FACILITIES

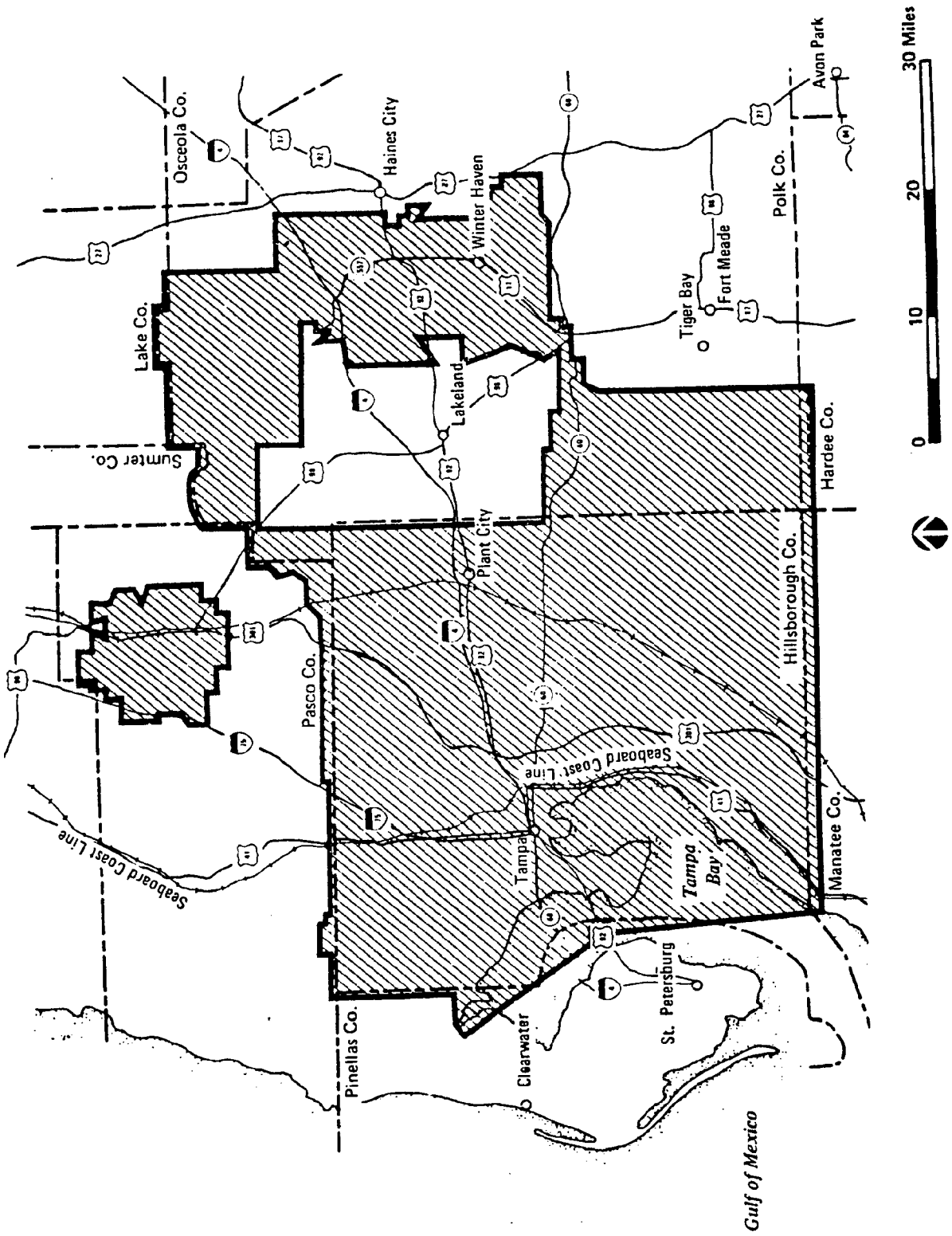



Source: Florida Power
Florida Power and Light
Tampa Electric Company



THE TAMPA BAY SYSTEM

FIGURE 5-10




Service Area: Tampa Electric Company

Gannon Station is 6 miles south of Tampa. The six units at this site originally burned coal. To comply with environmental requirements, the first four units were converted to No. 6 low-sulfur oil in 1975 and 1976. Units 5 and 6 burn low-sulfur coal. An additional 14-megawatt gas turbine, which burns No. 2 low-sulfur oil, is also located at Gannon Station. TECO converted the first four units back to coal, beginning in 1983.

Big Bend, located 10 miles south of Tampa, is TECO's newest power plant. The three existing units burn coal. One 14-megawatt and two 65-megawatt gas turbines, which burn No. 2 low-sulfur oil, are located just north of Big Bend Station.

During the early 1980s, TECO proposed to construct and operate a 417 MW (net) capacity coal-fired steam electric generating plant at the existing 1675 acre Big Bend complex in Hillsborough County. Because the operation of Big Bend Unit 4 would require a National Pollutant Discharge Elimination System (NPDES) permit, the project was subject to the provisions of the National Environment Policy Act (NEPA). Consequently, an Environmental Impact Statement (EIS) was prepared.

The EIS contains information and data related to the need and purpose for the Big Bend Unit, alternative sites and plant systems, affected environment and environmental consequences, and monitoring programs.

Big Bend Unit 4 began commercial service during the first quarter of 1985. The unit and supporting facilities are located on approximately 230 acres at TECO's Big Bend complex. Unit 4 was constructed directly adjacent to the existing three units and will be operational for approximately 30 years.

Cooling System Alternatives

Cooling alternatives evaluated for Unit 4 included (1) once-through cooling with conventional and fine mesh screens, (2) cooling towers, and (3) cooling ponds. Cooling water sources considered included Hillsborough Bay, saline groundwater, freshwater (groundwater and surface water), and treated municipal wastewater (15).

Cooling system evaluation was a major issue in the NEPA process. Prior to commencement of the EIS, EPA Region IV had found that operation of Units 1, 2, and 3 was entraining significantly great numbers of eggs and larvae of fish and shellfish so as to adversely effect the aquatic ecosystem of Hillsborough Bay. Subsequently, modifications to the conventional once-through systems (shutting off the dilution pumps) were instituted to reduce the entrainment impacts. These impacts were reduced by approximately 36% with no substantial and unacceptable thermal impact on the aquatic resources of Hillsborough Bay.

Use of Hillsborough Bay as a source of cooling water in conjunction with conventional screens on the once-through cooling intake struc-

ture was judged to be an unacceptable alternative for Unit 4 because the entrainment and impingement losses for Units 1-4 would be potentially adverse.

EPA's tentative determination was that once-through cooling with fine mesh screens on the Units 3 and 4 intake structures would not result in unacceptable adverse entrainment impacts from the Big Bend complex. EPA tentatively determined that thermal impacts to be associated with operation of Units 1-4 would not cause an unacceptable adverse impact.

The other major cooling system alternative considered was a cooling tower for Unit 4. With this alternative, entrainment impacts and thermal impacts would be less severe. However, salt drift associated with operation of the cooling tower could potentially cause an adverse impact on the agricultural industry adjacent to the complex. A mechanical draft cooling tower would cost $40 million more than the fine mesh screen option.(16)

Cooling ponds were not a viable alternative since the required land was unavailable at the Big Bend complex and at other sites. Use of freshwater for cooling purposes is inconsistent with the water management policies of the Southwest Florida Water Management District. Freshwater is becoming a critical resource in Florida and provisions for its distribution and utilization are structured toward more essential needs.

A potential source of cooling water considered in the analysis was treated municipal wastewater. Because the water would need to be transported in a pipeline for approximately 6 miles, it was judged to be a less viable alternative economically and potentially environmentally (cooling towers would be needed) than the once-through cooling with fine mesh screens alternative. There would be no entrainment/impingement impacts associated with this alternative.

**The Selected Alternative**

The two types of systems that were considered most feasible for application in the project were once-through cooling and closed-cycle cooling (cooling towers). Several different design alternatives for each type of system were examined carefully from the point of view of impacts on the site and its environs. Table 5-6 shows a comparison of the principal potential impacts of each major alternative considered.

The alternative chosen was once-through cooling with fine-mesh screens on Units 3 and 4, with no dilution. Unit 4 was equipped with a fine-mesh screen and Unit 3 was retrofitted, to reduce the entrainment and impingement losses of marine organisms. Unit 4 was constructed with a condensor independent of Units 1, 2, and 3, but is cooled by water withdrawn from Hillsborough Bay via the existing intake channel. Operation of Unit 4 will require approximately 347 million gallons of cooling water per day and will increase the total cooling-water requirements of Big Bend Station to 1388 million gallons per day.

## Table 5-6 Comparison of the major environmental impacts of the principal alternatives for waste-heat rejection

| Alternative | Thermal impacts | Entrainment impacts | Impingement impacts | Salt drift impacts | Fogging | Land requirements |
|---|---|---|---|---|---|---|
| 1. Once-through cooling for Units 1-4, conventional screens, no dilution | Area of the warmest portions of the plume larger than that of any other alternative | Large numbers of organisms entrained (approximately 33% more than present entrainment with Units 1-3) | Impingement rates about 33% higher than present levels with Units 1-3 | None | Occasional fogging of water areas into which discharge plume flows; some increase in area over existing situation with Units 1-3 | Considered as base condition for this analytical table |
| 2. Same as Alternative 1, but with dilution | Overall plume larger than that of any other alternative, but area of warmest temperatures smaller than that of Alternative 1 | More organisms entrained than with any other alternative because of additional organisms introduced into thermal plume by dilution | Approximately the same as Alternative 1 | None | About the same as Alternative 1 | Commitment of small additional area adjacent to existing dilution system for third pump |
| 3. Once-through cooling for Units 1-4, fine-mesh screens on Units 3 and 4, no dilution | Same as Alternative 1 | Numbers of organisms entrained about the same as for existing Units 1-3 | Impingement rates somewhat below present levels | None | Same as Alternative 1 | Commitment of some small additional area in intake canal |
| 4. Same as Alternative 3, but with dilution | Same as Alternative 2 | Entrainment rate somewhat lower than with Alternative 2 | Approximately the same as Alternative 3 | None | Same as Alternative 2 | Commitments as for Alternatives 2 and 3 combined |
| 5. Once-through cooling for Units 1-4, fine-mesh screens on all units, no dilution | Same as Alternative 1 | Lowest entrainment rate of all once-through alternatives; rate below that of existing system on Units 1-3 | Lowest impingement rate of any of the once-through alternatives | None | Same as Alternative 1 | Commitments of small area intake canal beyond that needed for Alternative 3 |
| 6. Same as Alternative 5, but with dilution | Same as Alternative 2 | Numbers entrained greater than for Alternative 5 because of additional organisms introduced into thermal plume by dilution flow | Approximately the same as Alternative 5 | None | Same as Alternative 2 | Commitments as for Alternatives 2 and 5 combined |
| 7. Saltwater cooling towers for Unit 4 | Very small increase in size of thermal plume over present situation with Units 1-3 | Very small increase in numbers entrained over present situation with Units 1-3 | Very small increase in numbers impinged over present situation with Units 1-3 | Largest quantities of salt released into air than with any cooling-tower alternative considered | Some fogging in area of the tower; no increase in sea fogging over present situation with Units 1-3 | Large commitment of additional land areas to the south of discharge canal near mangrove area |
| 8. Brackish-water cooling towers for Unit 4 | Same as Alternative 7 | None | None | Somewhat smaller quantities of salt released than in Alternative 7 | Same as Alternative 7 | Same as Alternative 7 |
| 9. Freshwater cooling towers for Unit 4 | Same as Alternative 7 | None | None | Lowest quantities of salt released of any cooling-tower alternative considered | Same as Alternative 7 | Same as Alternative 7 |

There were two types of closed-cycle heat rejection systems considered for Big Bend Unit 4. They were a natural draft wet-cooling tower and a concrete, circular mechanical draft wet-cooling tower with multiple fans. The latter was selected as the preferred closed-cycle system, primarily on the basis of economics. The capital and performance costs associated with the natural-draft closed cycle system was established to be approximately $22 million more than those of the mechanical-draft system.

In either case, a closed-cycle system for Big Bend Unit 4 would have been substantially more expensive than the chosen alternative of a once-through system. Table 5-7 provides a summary of the cost comparison between the once-through system alternative and the closed-cycle cooling system.

The alternative chosen specified constructing a 417 MW facility at the Big Bend complex. A once-through cooling system with fine mesh screens on the Units 3 and 4 intake structures would be employed, and Hillsborough Bay would serve as the source of cooling water as well as the point of discharge.

When the cost comparison between the once-through system and the closed-cycle cooling system is considered, as illustrated in Table 5-7, it is apparent that, from a purely economic perspective, the former alternative is economically preferable. The actual total costs incurred with the installation of a once-through cooling system with fine-mesh screens are in the range of $11.3 million (17). The next best alternative, e.g. construction of a cooling tower, would result in costs over five times that of a conventional once-through system, or nearly $52 million.

**2. Florida Power Corporation, P.L. Bartow Plant**

In November 1976, the U.S. Environmental Protection Agency (EPA) issued an NPDES permit for Florida Power Corporation's (FPC) P. L. Bartow Plant, a 494.4 MW (nameplate), three-unit electric generating station, located on Weedon Island on Tampa Bay.(18)

The conditions of the permit required FPC to submit to EPA for approval of a detailed implementation schedule to provide offstream cooling facilities in lieu of the existing once-through cooling water system and, furthermore, to implement this schedule after approval.

In December 1976, FPC requested an adjudicatory hearing regarding certain provisions of the NPDES permit. One of these was the provision requiring offstream cooling facilities.

**Off-Stream Cooling Alternatives**

An evaluation of the technical feasibility of four potential cooling water alternatives was performed for the Bartow Plant. The alternatives included: (1) dilution pumps, (2) auxiliary or "helper" cooling towers, (3) off-stream mechanical draft cooling tower, and (4) Ecolaire Oriented Spray Cooling System.

TABLE 5-7
COSTS OF USING ONCE-THROUGH COOLING WITH FINE-MESH SCREENS
AND A MECHANICAL-DRAFT COOLING TOWER AT BIG BEND STATION
(Thousands of Dollars, 1985)

| Costs | Once-through Cooling With Fine-mesh Screens *Units 3 & 4 | Once-through Cooling With Fine-mesh Screens Units 1 & 2 | Cooling Tower |
|---|---|---|---|
| Capital | $ 8,690 | $ 6,460 | $ 31,373 |
| Revenue Requirements | | | |
| Operating Cost Penalties | 520 | 520 | 19,256 |
| Operation and Maintenance | 1,005 | 1,005 | 1,173 |
| TOTAL | $ 10,215 | $ 7,985 | $ 51,802 |

Source: U.S. EPA Final Environmental Impact Statement. Tampa Electric Company Big Bend Unit 4, January 1982

* Chosen Alternative

1. Dilution Pumps

This alternative considered the use of dilution water flow to decrease the discharge water temperature during peak unit loads in the summer months. Two half-capacity dilution pumps would be installed in the in-take water structure to pump cold water into the discharge canal, thereby reducing the discharge temperature of the water entering Tampa Bay.

The capital costs included an amount for canal preparation which would include some excavating of the existing discharge canal, to allow proper flow of the dilution water into the discharge canal. The operating costs were based on operating only during the summer months, as needed, to provide supplemental cooling during peak load and peak ambient conditions. Maintenance costs were included.

In 1979 dollars, the total capital investment for the dilution pumps was $9,840,000, the total annual operating cost was $70,800, and the total annual cost $1,578,000.

2. "Helper" Cooling Towers

Another supplemental cooling arrangement was to utilize a "helper" cooling tower to decrease the discharge temperature during peak load and peak ambient conditions. The "helper" cooling tower was to be operated during the summer to limit the discharge temperature to a predetermined value.

The "helper" cooling tower is sized so that a 95°F discharge temperature would be maintained based on a 92°F inlet water temperature, a 79°F wet bulb temperature, and all three units at full load. One round mechanical draft tower with 12 fans was considered in this alternative. From a cooling water system design viewpoint, the location along the existing discharge canal was relatively ideal; however, it was abnormally close to four (4) existing combustion turbine peaking units.

The operating costs were based on operating the cooling tower during the summer months only, as needed, to decrease the discharge water temperature.

In 1979 dollars, the total capital investment for the "helper" cooling tower was $17,963,000, the total annual operating cost was $441,000, and the total annual cost $3,195,000.

3. Off-stream Mechanical Draft Cooling Towers

Several significant plant site construction modifications would have been required if offstream mechanical draft cooling towers were to be installed. The major changes would have included: (1) the excavation and modification of the existing circulating water piping, (2) the relocation of the circulating water pumps, (3) the excavation, placement, and backfill of new circulating water piping to the cooling towers, and (4) the excavation and construction of the cooling towers and foundation.

The most advantageous arrangement for offstream cooling towers was two round, mechanical draft towers, one for Units 1 and 2, and one for Unit 3.

The cooling towers would be the counterflow fill type so that they could be partitioned into sections. One tower would service Units 1 and 2 and the other tower would service Unit 3 only. The tower that services Units 1 and 2 would be partitioned into two sections and sized to handle the heat load and water flow from each unit. A section could be isolated, as required, if Unit 1 was operating but Unit 2 was not. Separate cooling tower booster pumps, piping, and distribution systems would be designed for each section of that tower.

In 1979 dollars, the total capital investment for the offstream cooling towers was $39,188,000, the total annual operating cost was $3,044,000 and the total annual cost $9,052,000.

4. Oriented Spray Cooling System

The use of an Ecolaire Oriented Spray Cooling System (OSCS) was also evaluated. The OSCS functions like a cooling tower -- but without a stack, roof, or walls. The system produces its own airflow through a circular arrangement of patented spray trees. Each spray tree consists of a vertical riser pipe with a series of horizontal branch pipes and spray nozzles. The momentum and heat transfer between the sprayed water drops and the surrounding air draws cool air from around the periphery through the fill section to cool the water. The air then exits up from the center of the system as a warm plume. The ability of the system to induce airflow through the spray fill area permits consistent performance regardless of ambient wind conditions.

Based upon the design parameters, Ecolaire proposed a system consisting of four octagonal modules, each 420 feet in diameter. A 420-foot spacing would also have been required between each of the modules. Therefore, the minimum dimensions of the OSCS basin which would be capable of cooling the water for the three units would be 420 by 2,940 feet. Since the area for a system of that size was not available at the Bartow Plant, the OSCS was not considered further.

**Conclusion**

The adjudicatory hearing requested by FPC, regarding the provision requiring offstream cooling facilities, was never held, largely because of the lack of local opposition to the existing system of once-through cooling. However, the study, as presented, indicated that modification of the existing once-through cooling water system at the Bartow Plant was (is) technically feasible. Table 5-8 illustrates the capital costs associated with three of the four potential cooling water alternatives. The Oriented Spray Cooling System was the only alternative for which capital costs were not provided.

TABLE 5-8
OFFSTREAM COOLING FACILITIES OPTIONS

| Option | Capital Cost 1979 Dollars | 1984 Dollars[1] |
|---|---|---|
| Dilution Pumps | 9,840,000 | 12,497,000 |
| "Helper" Cooling Towers | 17,963,000 | 22,813,000 |
| Offstream Mechanical Draft Cooling Towers | 39,188,000 | 49,768,000 |

Source: Florida Power Corporation "Cooling Water Report for the Paul L. Bartow Plant," Environmental and Licensing Affairs, December 1980

[1]U.S. Department of Commerce, Composite (Construction) Cost Index, 1985. Adjustment for Inflation (+27%)

The Bartow Plant is approximately 30 years old, with Units 1, 2, and 3 having commenced commercial operation in 1958, 1961, and 1963, respectively. As new generating units are placed into the service in the FPC system, the use of the Bartow Plant will decrease accordingly.

In view of the age of the Bartow Plant, the expected decrease in use, and costs involved (as illustrated in Table 5-8), FPC did not consider it appropriate to make any modifications to the existing once-through cooling water system. The capital costs associated with the next best available alternatives range from $12.5 million to nearly $50 million (in 1984 dollars). The location of the Bartow Plant on Tampa Bay and the ability to utilize the once-through cooling system results in a cost savings of many millions of dollars.

**Transportation Savings**

The location of the Bartow, Bayboro and Higgins power plants on Tampa Bay also results in a transportation cost savings for the Florida Power Corporation (FPC). The Bartow facility serves as a "port of entry" for ocean-going vessels, which transport residual and distillate oil, the principle source of fuel for the three facilities. The oil is brought into the Bartow facility and then dispersed to the Higgins and Bayboro plants, by barge, resulting in a transportation cost savings when compared to the next best available alternative of transporting by truck. In addition to these facilities, the FPC Anclote River Power Plant, located on the Anclote River in southwestern Pasco County, also receives residual oil from the Bartow Plant, via a pipeline. Due to the Anclote Plant's location, in an environmentally sensitive area, no channel dredging or excavation has been permitted, thus eliminating the use of a barge or similar vessel to bring in the oil. Again, truck transportation would be the next best available alternative.

Table 5-9 illustrates the cost savings associated with transporting oil by barge, truck and pipeline. The Suwannee River facility is a land-locked power plant located in northern Florida, near Lake City. The residual and distillate oil, both used at the facility, are brought in by truck from the Port of Jacksonville.

The water-borne transportation cost of barging oil into the Bartow plant is considered to be zero, in that such cost is included in the original purchase price of the oil. The costs associated with barging oil to the Higgins and Bayboro facilities, in 1985, range from $.42 per barrel to $.45 per barrel, respectively. The cost associated with moving oil from the Bartow Facility to the Anclote Plant, in 1985, is $.41 per barrel. The cost associated with the truck transportation of residual and distillate oil to the Suwanee River Facility, in 1985, was $1.22 and $1.08, respectively. The transportation cost projections for 1986 are similar.

TABLE 5-9
FLORIDA POWER TRANSPORTATION COSTS (Projected)
RESIDUAL AND DISTILLATE OIL

| Fuel | Facility | 1985 (June-December) Transportation $/barrel | 1986 (January-March) Transportation $/barrel |
|---|---|---|---|
| Residual | Bartow | 0.00 | 0.00 |
| Residual | Higgins | .42 (A) | .44 (A) |
| Residual | Suwannee River | 1.22 (B) | 1.29 (B) |
| Distillate | Bayboro | .45 (A) | .48 (A) |
| Distillate | Suwannee River | 1.08 (B) | 1.14 (B) |
| Residual | Anclote | .41 (C) | .43 (C) |

Notes: Bartow is the site of origination
(A) Fuel transported by barge
(B) Fuel transported by truck
(C) Fuel transported by pipeline

Source: Florida Power Corporation

In 1984, FPC barged approximately 4.6 million barrels of oil to the Bartow Plant, for consumption at the Bartow Facility, and distribution to the Higgins Plant (by smaller barges) and the Anclote Plant (via the pipeline). Without the Bartow Plant's location on Tampa Bay, that amount of fuel would have to be transported by other means. The next best available alternatives are rail and truck transportation. Because rail facilities are not present at any of these facilities, the next best alternative for transportation would be by truck. Using a truck delivery cost of $1.15 per barrel, as an estimate, the terminal facility at the Bartow Plant resulted in a transportation cost savings of $5.3 million in 1984. (19)

## D. FOOTNOTES


1. Florida Department of Environmental Regulation, 1984, "Tampa Bay 205(j) Water Quality Impact Study."

2. Ibid.

3. Tampa Bay Regional Planning Council, 1983. "Tampa Bay Management Study". TBRPC, St. Petersburg, FL.

4. Ibid.

5. Tampa Bay Regional Planning Council, 1985. The Future of Tampa Bay. TBRPC, St. Petersburg, FL.

6. Smith and Gillespie, et. al., 1980. Central Hillsborough County - Tampa, 201 Facility Plan.

7. U.S. Environmental Protection Agency, 1983. Record of Decision of the Final Environmental Impact Statement for Proposed Wastewater Facilities for Central Hillsborough - Tampa.

8. Morriss, J. P. Personal Communication. City of Tampa, Sanitary Sewer Department, Tampa, FL, December 11, 1985.

9. Hillsborough County Wastewater Master Plan, November 1985.

10. U.S. Environmental Protection Agency, July 1979, Hillsborough County, Florida. Northwest Area 201 Facilities Plan.

11. U.S. Department of Commerce, Composite (Construction) Cost Index, 1985. Adjustment for Inflation (+27%).

12. Ibid. Hillsborough County Wastewater Master Plan, Table 4-3.

13. This discussion of Pinellas County wastewater facilities is condensed from the following document: U.S. Environmental Protection Agency, 1985. Final Environmental Impact Statement. North Pinellas County, Florida. Wastewater Facilities.

14. Greer, Glenn, Personal Communication. City of St. Petersburg Public Utilities Department, January 20, 1986.

15. U.S. Environmental Protection Agency, 1982. Final Environmental Impact Statement. Tampa Electric Company. Big Bend Unit 4.

16. Ibid.

17. Autry, A.S. Personal Communication. Tampa Electric Company, Department of Environmental Affairs, Tampa, FL, December 9, 1985.

18. Florida Power Corporation, 1980. Cooling Water Report for the Paul L. Bartow Plant.

19. Wieland, K.H. Personal Communication. Florida Power Corporation, St. Petersburg, FL, December 19, 1985.

# CHAPTER 6
# BENEFITS OF TAMPA BAY TO COMMERCIAL FISHING

## A. INTRODUCTION

The commercial fishing industry is an important source of income and employment along Florida's extensive coastline, including Tampa Bay. Tampa Bay serves as a nursery and habitat area for many commercially valuable species of fish (finfish) and shellfish. The economic base model, presented in Chapter 3, identifies commercial fishing (SIC 091) as a basic export or growth sector for the Tampa Bay region. A six-year trend, 1979 to 1984, will be analyzed in this chapter.

### Population Growth

As referred to earlier in this study, all four counties within the Tampa Bay region have experienced explosive population growth in the past two decades (see Table 2-1).

Population growth and accompanying residential and recreational development have put heavy pressure on waterfront property used by the fishing and seafood industry. Docking space has been converted from commercial to recreational use as the number of pleasure boats has increased in the region.

### Boat Registrations

The number of commercial boats registered in Hillsborough, Manatee, Pasco and Pinellas Counties has increased somewhat over the past six years, however, the figures remain far below the number of commercial vessels registered in the mid-to-late 1960s. The number of commercial boats reached a high of 4,339 in 1965-66, then generally declined (Table 6-1). Pinellas County currently has the largest number of commercial boats registered with 1,456 while Pasco County has the fewest with 289 (Table 6-2). Commercial boat registration data for 1981-82 was not available.

## B. FLORIDA WEST COAST VOLUME AND VALUE OF COMMERCIAL LANDINGS

The west coast of Florida represents a region that provides a major percentage of the state's total production of finfish and shellfish. Counties included in the west coast are Escambia, Santa Rosa, Okaloosa, Walton, Holmes, Washington, Bay, Jackson, Calhoun, Gulf, Gadsden, Liberty, Franklin, Leon, Wakulla, Taylor, Dixie, Levy, Citrus, Hernando, Pasco, Pinellas, Hillsborough, Manatee, Sarasota, Charlotte, Lee, Collier, Jefferson, and Monroe.

TABLE 6-1
COMMERCIAL BOATS REGISTERED ANNUALLY
TAMPA BAY REGION

| Year | Commercial Boats Registered |
|---|---|
| 1979-80 | 2,974 |
| 1980-81 | 2,444 |
| 1981-82 | N/A |
| 1982-83 | 2,945 |
| 1983-84 | 3,030 |
| 1984-85 | 3,260 |

Source: Florida Department of Natural Resources, Bureau of License and Motorboat Registration.

TABLE 6-2
COMMERCIAL BOATS REGISTERED
BY COUNTY

| Year | Commercial Boats Registered | | | |
|---|---|---|---|---|
| | Hillsborough | Manatee | Pasco | Pinellas |
| 1979-80 | 791 | 388 | 299 | 1,496 |
| 1980-81 | 575 | 331 | 254 | 1,284 |
| 1981-82 | N/A | N/A | N/A | N/A |
| 1982-83 | 714 | 474 | 272 | 1,485 |
| 1983-84 | 718 | 534 | 301 | 1,477 |
| 1984-85 | 942 | 573 | 289 | 1,456 |

Source: Florida Department of Natural Resources, Bureau of License and Motorboat Registration

Landings in the 30-county area averaged approximately 117 million pounds for the six-year period, 1979-1984. Landings have ranged from a minimum of 108 million pounds in 1979, to a maximum of slightly more than 139 million pounds in 1981. (Table 6-3) west coast landings have shown an increase of approximately five percent over the last six years.

Finfish landings for the six-year period averaged 64 million pounds or 55 percent of the total landed. Shellfish landings averaged 53 million pounds or 45 percent of the total.

Total value of landings on the west coast has averaged approximately $106 million. Total value has ranged from approximately $86 million in 1980, to $119 million in 1981. (Table 6-3) Value of shellfish landings for the six-year period, averaged $72 million, or 70 percent of the total value. Value of finfish landings averaged $34 million or 30 percent of the total.

## C. TAMPA BAY REGION VOLUME AND VALUE OF COMMERCIAL LANDINGS

Landings in the four-county area have averaged approximately 26 million pounds for the six-year period 1979-1984. (For reporting purposes, landings for Pasco County are combined with Citrus County.) Landings have ranged from a minimum of approximately 23 million pounds in 1979, to a maximum of slightly more than 29 million pounds in 1982. (Table 6-4)

Finfish landings for the six-year period averaged 19 million pounds, or 72 percent of the total landed. Shellfish landings averaged 7 million pounds or 28 percent of the total.

Total value of landings in the Tampa Bay region averaged approximately $20 million. Total value has ranged from $13 million in 1979, to $25 million in 1983. (Table 6-4)

Value of finfish landings for the six-year period averaged $10 million, or 51 percent of the total value. Value of shellfish landings averaged slightly less than $10 million or 49 percent of the total.

Landings in the Tampa Bay region averaged approximately 23 percent of the total Florida West Coast landings over the six-year period. Finfish landings averaged 30 percent, while shellfish landings averaged approximately 14 percent of the Florida West Coast landings.

Total value of landings in the Tampa Bay region averaged approximately 19 percent of the total value of landings for the Florida west coast, over the six-year period. Value of finfish landings averaged approximately 30 percent, while value of shellfish landings averaged approximately 13 percent of the Florida west coast value of landings.

Based on the average for the six-year period, 1979-1984, Pinellas County landed the largest percentage (36) of the four counties in the Tampa Bay region. Manatee, Citrus-Pasco, and Hillsborough Counties landed 27, 21 and 16 percent, respectively.

TABLE 6-3
FLORIDA WEST COAST LANDINGS AND VALUE
OF FINFISH AND SHELLFISH, 1979-1984
(In million pounds and million dollars)

| | POUNDS | | | DOLLARS | | |
|---|---|---|---|---|---|---|
| Year | Finfish | Shellfish | Total | Finfish | Shellfish | Total |
| 1979 | 53.2 | 55.3 | 108.5 | $ 20.8 | $ 70.0 | $ 90.8 |
| 1980 | 62.5 | 51.9 | 114.4 | 27.2 | 58.6 | 85.8 |
| 1981 | 75.4 | 63.7 | 139.1 | 38.1 | 80.9 | 119.0 |
| 1982 | 70.4 | 46.1 | 116.5 | 40.4 | 73.4 | 113.8 |
| 1983 | 61.9 | 47.3 | 109.2 | 37.2 | 75.7 | 112.9 |
| 1984 | 60.0 | 54.0 | 114.0 | 37.4 | 74.3 | 111.7 |

Source: U.S. National Marine Fisheries Service

TABLE 6-4
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN THE TAMPA BAY REGION
(Citrus-Pasco, Hillsborough, Manatee, Pinellas Counties)
1979-1984
(In million pounds and million dollars)

| | POUNDS | | | DOLLARS | | |
|---|---|---|---|---|---|---|
| Year | Finfish | Shellfish | Total | Finfish | Shellfish | Total |
| 1979 | 17.4 | 5.3 | 22.7 | $ 6.7 | $ 6.7 | $ 13.4 |
| 1980 | 17.1 | 6.2 | 23.3 | 8.1 | 7.1 | 15.2 |
| 1981 | 21.1 | 7.4 | 28.5 | 10.7 | 8.7 | 19.4 |
| 1982 | 21.9 | 7.5 | 29.4 | 11.9 | 10.9 | 22.7 |
| 1983 | 18.3 | 10.0 | 28.3 | 11.2 | 13.9 | 25.1 |
| 1984 | 19.7 | 8.0 | 27.7 | 12.0 | 11.0 | 23.0 |

Source: U.S. National Marine Fisheries Service

The largest percentage of finfish landings for the six-year period was by Manatee County (36), while Pinellas, Hillsborough and Citrus-Pasco Counties averaged 35, 16 and 12 percent, respectively.

The largest percentage of shellfish landings was by Citrus-Pasco Counties (42), while Pinellas, Hillsborough and Manatee Counties averaged 37, 19 and 2 percent, respectively, for the six-year period.

Pinellas County was also responsible for the largest percentage in value of landings for the region. The value of Pinellas County landings averaged 53 percent of the regional total, while Hillsborough, Citrus-Pasco, and Manatee Counties averaged 17, 16, and 14 percent, respectively.

### Citrus-Pasco Counties

Citrus-Pasco Counties landings for the six-year period, 1979 - 1984, averaged 56 percent shellfish and 44 percent finfish, or 3.1 million pounds and 2.4 million pounds, respectively, for a total average of 5.5 million pounds. In 1984, the counties landed 66 percent shellfish and 34 percent finfish, or 3.7 million pounds and 1.9 million pounds, respectively, for a total of 5.6 million pounds.

Total value of landings in Citrus-Pasco for the six-year period, averaged $3.1 million, with $2.3 million in shellfish and $800 thousand in finfish, or 75 percent and 25 percent, respectively. In 1984, the value of landings totaled $3.4 million, with $2.8 million in shellfish and $600 thousand in finfish, or 81 percent and 19 percent, respectively. (Table 6-5)

### Hillsborough County

Hillsborough County landings for the six-year period, 1979 - 1984, averaged 68 percent finfish and 32 percent shellfish, or 3.0 million pounds and 1.4 million pounds, respectively, for a total average of 4.4 million pounds. In 1984, the county landed 71 percent finfish and 29 percent shellfish, or 2.9 million pounds and 1.2 million pounds, respectively, for a total of 4.1 million pounds. (Table 6-6)

Total value of landings in Hillsborough County for the six-year period, averaged $3.3 million, with $2.2 million in shellfish and $1.1 million in finfish, or 68 percent and 32 percent, respectively. In 1984, the value of landings totaled $3.0 million, with $2.4 million in shellfish and $600 thousand in finfish, or 79 percent and 21 percent, respectively. (Table 6-6)

### Manatee County

Manatee County landings for the six-year period, 1979 - 1984, averaged 98 percent finfish and 2 percent shellfish, or 7.0 million pounds and 100 thousand pounds, respectively, for a total average of 7.1 million pounds. In 1984, the county landed 98 percent finfish and 2 percent shellfish, or 8.3 million pounds and 200 thousand pounds, respectively, for a total of 8.5 million pounds. (Table 6-7)

TABLE 6-5
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN CITRUS-PASCO COUNTIES
1979-1984
(In thousand pounds and thousand dollars)

| | POUNDS | | | DOLLARS | | |
|---|---|---|---|---|---|---|
| Year | Finfish | Shellfish | Total | Finfish | Shellfish | Total |
| 1979 | 2,797 | 2,225 | 5,022 | $ 732 | $ 1,292 | $ 2,024 |
| 1980 | 2,202 | 2,515 | 4,717 | 744 | 1,633 | 2,378 |
| 1981 | 2,654 | 2,706 | 5,360 | 987 | 1,971 | 2,959 |
| 1982 | 2,890 | 3,038 | 5,928 | 978 | 2,470 | 3,449 |
| 1983 | 2,189 | 4,529 | 6,718 | 708 | 4,017 | 4,724 |
| 1984 | 1,922 | 3,740 | 5,662 | 664 | 2,831 | 3,495 |

Source: U.S. National Marine Fisheries Service

TABLE 6-6
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN HILLSBOROUGH COUNTY
1979-1984
(In thousand pounds and thousand dollars)

| | POUNDS | | | DOLLARS | | |
|---|---|---|---|---|---|---|
| Year | Finfish | Shellfish | Total | Finfish | Shellfish | Total |
| 1979 | 2,684 | 1,189 | 3,873 | $ 917 | $ 1,856 | $ 2,773 |
| 1980 | 3,307 | 1,382 | 4,689 | 1,447 | 1,826 | 3,273 |
| 1981 | 2,476 | 1,076 | 3,552 | 1,071 | 1,498 | 2,569 |
| 1982 | 4,642 | 1,796 | 6,438 | 1,566 | 2,798 | 4,364 |
| 1983 | 2,130 | 1,815 | 3,945 | 841 | 3,264 | 4,105 |
| 1984 | 2,958 | 1,185 | 4,143 | 647 | 2,449 | 3,096 |

Source: U.S. National Marine Fisheries Service

TABLE 6-7
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN MANATEE COUNTY
1979-1984
(In thousand pounds and thousand dollars)

| | POUNDS | | | DOLLARS | | |
|---|---|---|---|---|---|---|
| Year | Finfish | Shellfish | Total | Finfish | Shellfish | Total |
| 1979 | 5,962 | 91 | 6,053 | $ 1,698 | $ 225 | $ 1,924 |
| 1980 | 4,462 | 127 | 4,589 | 1,440 | 225 | 1,665 |
| 1981 | 8,719 | 169 | 8,888 | 3,025 | 318 | 3,343 |
| 1982 | 6,862 | 168 | 7,030 | 2,518 | 368 | 2,886 |
| 1983 | 7,453 | 198 | 7,651 | 3,054 | 457 | 3,511 |
| 1984 | 8,375 | 182 | 8,557 | 2,978 | 396 | 3,374 |

Source: U.S. National Marine Fisheries Service

Total value of landings in Manatee County for the six-year period, averaged $2.7 million, with $2.4 million in finfish and $400 thousand in shellfish, or 73 percent and 27 percent, respectively. In 1984, the value of landings totaled $3.3 million, with $2.9 million in finfish and $400 thousand in shellfish, or 88 percent and 12 percent, respectively. (Table 6-7)

**Pinellas County**

Pinellas County landings for the six-year period, 1979 - 1984, averaged 71 percent finfish and 29 percent shellfish, or 6.8 million pounds and 2.7 million pounds, respectively, for a total average of 9.5 million pounds. In 1984, the county landed 69 percent finfish and 31 percent shellfish, or 6.5 million pounds and 2.9 million pounds, respectively, for a total of 9.4 million pounds. (Table 6-8)

Total value of landings in Pinellas County for the six-year period, averaged $10.4 million, with $5.7 million in finfish and $4.7 million in shellfish, or 55 percent and 45 percent, respectively. In 1984, the value of landings totaled $13 million, with $7.7 million in finfish and $5.3 million in shellfish, or 59 percent and 41 percent, respectively. (Table 6-8)

## D. SPECIES LANDINGS AND VALUES IN THE TAMPA BAY REGION, 1979-1984

**Finfish**

Major species of finfish commonly caught in Tampa Bay waters include drum, flounder, mullet, sea trout, and sheepshead. (Table 6-9)

Drum landings for the six-year period averaged 179 thousand pounds, with an average value of $60 thousand. Landings of drum fluctuated from a low of 81 thousand pounds in 1980, to a high of 256 thousand pounds in 1984. Value of drum fluctuated from a low of $36 thousand in 1980, to a high of $111 thousand in 1981.

Flounder landings for the six-year period averaged 24 thousand pounds, with an average value of $12 thousand. Landings of flounder fluctuated from a high of slightly less than 40 thousand pounds in 1983, to a low of slightly less than 14 thousand pounds in 1984.

Mullet landings for the six-year period averaged approximately seven million pounds, with an average value of $1.5 million. Landings of mullet fluctuated from a high of 8.5 million pounds in 1981, to a low of approximately four million pounds in 1984. Value of mullet fluctuated from a high of slightly less than two million dollars in 1981, to a low of approximately one million dollars in 1984.

Sea trout landings for the six-year period averaged 186 thousand pounds, with an average value of $125 thousand. Landings of sea trout fluctuated from a high of 280 thousand pounds in 1979, to a low of 93 thousand pounds in 1983. Value of sea trout fluctuated from a high of approximately $154 thousand in 1979, to a low of $70 thousand in 1983.

TABLE 6-8
COMMERCIAL LANDINGS AND VALUE
OF FINFISH AND SHELLFISH IN PINELLAS COUNTY
1979-1984
(In thousand pounds and thousand dollars)

| | POUNDS | | | DOLLARS | | |
|---|---|---|---|---|---|---|
| Year | Finfish | Shellfish | Total | Finfish | Shellfish | Total |
| 1979 | 5,933 | 1,829 | 7,762 | $ 3,366 | $ 3,336 | $ 6,702 |
| 1980 | 7,101 | 2,207 | 9,308 | 4,498 | 3,415 | 7,913 |
| 1981 | 7,255 | 3,441 | 10,696 | 5,597 | 4,947 | 10,544 |
| 1982 | 7,481 | 2,499 | 9,980 | 6,784 | 5,226 | 12,010 |
| 1983 | 6,530 | 3,439 | 9,969 | 6,605 | 6,121 | 12,726 |
| 1984 | 6,466 | 2,949 | 9,415 | 7,706 | 5,323 | 13,029 |

Source: U.S. National Marine Fisheries Service

TABLE 6-9
SPECIES LANDINGS & VALUES (FINFISH)
IN THE TAMPA BAY REGION, 1979-1984
(HILLSBOROUGH, MANATEE & PINELLAS COUNTIES)

| | Drum (Black & Red) | | Flounder | | Mullet (Black & Silver) | | Sea Trout (Spotted, White) | | Sheepshead | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pounds | Dollars | Pounds | Dollars | Pounds | Dollars | Pounds | Dollars | Pounds | Dollars |
| 1979 | 91,592 | $ 37,508 | 26,788 | $ 10,952 | 8,010,614 | $1,477,935 | 280,751 | $ 153,824 | 15,495 | $ 3,353 |
| 1980 | 81,224 | 36,167 | 24,309 | 13,258 | 7,721,027 | 1,514,425 | 192,368 | 118,267 | 21,152 | 3,848 |
| 1981 | 264,055 | 111,214 | 20,718 | 11,325 | 8,506,019 | 1,977,725 | 218,312 | 147,641 | 34,750 | 7,370 |
| 1982 | 191,899 | 96,768 | 18,226 | 11,507 | 7,253,156 | 1,615,140 | 169,643 | 121,226 | 37,762 | 10,255 |
| 1983 | 100,030 | 63,104 | 39,882 | 17,141 | 4,026,223 | 1,196,145 | 93,272 | 70,542 | 11,883 | 3,622 |
| 1984 | 255,948 | 18,821 | 13,981 | 8,415 | 3,872,946 | 1,162,426 | 161,169 | 136,655 | 33,045 | 9,942 |

Source: U.S. National Marine Fisheries Statistics

Sheepshead landings for the six-year period averaged approximately 26 thousand pounds, with an average value of only six thousand dollars. Landings of sheepshead fluctuated from a high of approximately 38 thousand pounds in 1982, to a low of approximately 12 thousand pounds in 1983. Value of sheepshead fluctuated from a high of $10 thousand in 1982, to a low of approximately four thousand dollars in 1983.

These five major species accounted for approximately 42 percent of the finfish landed over the six-year period, and 18 percent of the value. In 1984, these species accounted for approximately 24 percent of the total finfish landed and 12 percent of the total value. Offshore species, which include snapper and grouper, account for a larger percentage of the three-county volume and value of finfish.

**Shellfish**

Major species of shellfish commonly caught in Tampa Bay waters include clams, blue crabs (hard), stone crabs, oysters and bait shrimp. (Table 6-10)

Hard clam landings for the six-year period averaged 141 pounds, with an average value of only $419. There were no reports of landings of hard clams in 1979, 1980 and 1984.

Blue crab (hard) landings for the six-year period averaged 185 thousand pounds, with an average value of approximately $61 thousand. Landings of blue crab fluctuated from a high of 278 thousand pounds in 1982, to a low of 143 thousand pounds in 1984. Value of blue crab fluctuated from a low of $35 thousand in 1979, to a high of approximately $89 thousand in 1982.

Stone crab landings for the six-year period averaged 50 thousand pounds, with an average value of $84 thousand. Landings of stone crab fluctuated from a low of 14 thousand pounds in 1981, to a high of approximately 100 thousand pounds in 1984. Value of stone crab fluctuated from a low of $16 thousand in 1981, to a high of $213 thousand in 1984.

Oyster landings for the six-year period averaged six thousand pounds, with an average value of approximately seven thousand dollars. Landings of oysters fluctuated from a high of 14 thousand pounds in 1981, to a low of 132 pounds in 1982. There were no landings of oysters reported for 1979. Value of oysters fluctuated from a high of approximately $16 thousand in 1981, to a low of $167 in 1982.

Bait shrimp landings for the six-year period averaged approximately 82 thousand pounds, with a value of approximately $158 thousand. Landings of bait shrimp fluctuated from a low of 45 thousand pounds in 1981, to a high of approximately 117 thousand pounds in 1984. Value of bait shrimp fluctuated from a low of $77 thousand in 1980, to a high of $245 thousand in 1984.

TABLE 6-10
SPECIES LANDINGS & VALUES (SHELLFISH)
IN THE TAMPA BAY REGION, 1979-1984
(HILLSBOROUGH, MANATEE & PINELLAS COUNTIES)

| | Clams (Hard) | | Crabs (Blue, Hard) | | Crabs (Stone) | | Oysters | | Shrimp (Bait) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pounds | Dollars | Pounds | Dollars | Pounds | Dollars | Pounds | Dollars | Pounds | Dollars |
| 1979 | - | $ - | 169,065 | $ 35,506 | 17,392 | $ 24,202 | - | $ - | 113,501 | $ 181,813 |
| 1980 | - | - | 148,739 | 37,193 | 27,933 | 40,568 | 13,731 | 14,637 | 47,311 | 77,161 |
| 1981 | 225 | 684 | 222,621 | 62,901 | 14,351 | 15,721 | 14,351 | 15,721 | 45,545 | 85,548 |
| 1982 | 70 | 158 | 278,395 | 88,994 | 67,368 | 92,663 | 132 | 167 | 105,330 | 211,686 |
| 1983 | 128 | 416 | 150,482 | 54,480 | 71,786 | 116,238 | 2,939 | 3,479 | 61,540 | 144,446 |
| 1984 | - | - | 143,326 | 49,802 | 98,928 | 213,319 | 219 | 399 | 116,745 | 245,322 |

Source: U.S. National Marine Fisheries Statistics

These five major species accounted for approximately 7.5 percent of the shellfish landed in Hillsborough, Pinellas and Manatee Counties over the six-year period, and 4.2 percent of the value. In 1984, these species accounted for approximately 8.3 percent of the total shellfish landed and 6.3 percent of the total value.

**Summary**

A total of 22.1 million pounds of fish, valued at $19.5 million, were landed in Hillsborough, Manatee and Pinellas Counties in 1984. Pinellas County accounted for approximately 43 percent of the total landings in 1984, and 67 percent of the total value. Approximately 80 percent of the pounds landed in 1984 were finfish, while shellfish accounted for 42 percent of the total value of landings.

**Fishermen**

As illustrated in Table 6-11, a total number of 1,952 commercial fishermen plied their trade during 1984, in Hillsborough, Manatee and Pinellas Counties. This represented ten percent of all fishermen in Florida.

**Processing**

As illustrated in Table 6-12, the Tampa Bay region had a total of 46 seafood processing and wholesaling plants in 1984, with an average monthly employment of 200 persons. Data for Manatee County was not available.

TABLE 6-11
SALTWATER PRODUCTS LICENSES ISSUED
1984

| County | No. of Licenses Issued |
|---|---|
| Hillsborough | 519 |
| Manatee | 328 |
| Pinellas | 1,105 |
| Total | 1,952 |
| Florida | 19,275 |

Source: Florida Department of Natural Resources, November 1985

TABLE 6-12
TAMPA BAY REGION
SEAFOOD PROCESSING AND WHOLESALING PLANTS
1984

| County | No. of Establishments | Average Monthly Employment |
|---|---|---|
| Hillsborough | 30 | 133 |
| Pinellas | 10 | 43 |
| Pasco | 6 | 24 |
| Manatee | N/A | N/A |
| Total | 46 | 200 |

Source: Florida Department of Labor and Employment Security

# CHAPTER 7
# BENEFITS OF TAMPA BAY TO WATERFRONT PROPERTY OWNERS

## A. INTRODUCTION

The various uses and attributes of Tampa Bay are a source of many benefits to local residents and tourists alike. In this chapter, an attempt will be made through the use of a survey, to document the value of an aesthetic attribute (water view) and benefits that are provided by Tampa Bay, to owners of private, single-family residential waterfront homes.

In general terms, it is the presence of the bay that enhances the value and desirability of the homes and neighborhoods located on the bay. The benefits (services) accruing to waterfront property owners that will be considered, are as follows: aesthetic value of the waterfront vista or view; swimmability of the water close to the home; fishability of the water close to the home; navigability of the water close to the home; and suitability of the water close to the home for various water sports and activities.

Like any freely accessible body of water, the Tampa Bay estuary is considered a public good. Individuals cannot be excluded from enjoying its services because it is difficult or impossible to collect fees for the benefits it provides. Thus, the services of the estuary, such as navigability and fishability, cannot be purchased in the market place. They are complementary to access to the estuary. There are private and public accesses to the estuary. In this chapter, the complementarity of access by private waterfront homes is the basis for the estimates of these services.

## B. METHODOLOGY

It has been determined that a number of studies exist on property values which attempt to incorporate valuation of beneficial and detrimental neighborhood and environmental externalities. One such study uses, as its base, a model of determination of residential property values, developed for Pinellas County.(1) It was decided that the methodology of this study would be applied to single-family residential, waterfront structures, located within the economic study area. Emphasis would be placed on neighborhood conditions, local public schools, water views, water quality and travel time to job locations. Based upon the previous study, the variables shown in Figure 7-1 were chosen. A questionnaire was designed to measure the aesthetic value and services, as perceived by owners of waterfront homes.

The property appraisers from Hillsborough, Manatee and Pinellas Counties were contacted in July 1985, and asked to provide information and data pertaining to 1984 sales of waterfront homes. After numerous discussions and meetings, it was determined that only Pinellas County could provide the requisite information in a timely and inexpensive manner. (The information requested is as follows: Property address; 1984 sale price; effective square footage; year built; presence of a

FIGURE 7-1

VARIABLES

| | |
|---|---|
| price | price of property in dollars |
| area | effective square footage as defined by Property Appraiser's Office |
| age | age of home in years |
| pool | 1 if has a pool, 0 if not |
| dock | 1 if has a dock, 0 if not |
| block | 1 if concrete block construction, 0 if not |
| canal | 1 if on canal, 0 if not |
| ciega | 1 if on Boca Ciega Bay, 0 if not |
| Tbay | 1 if on Tampa Bay, 0 if not |
| mTax | 1984 tax rate for the property |
| zone | allowed housing density per acre |
| parcel2 | parcel number in batch2 |
| clean1 | cleanliness of neighborhood rated excellent |
| clean2 | cleanliness of neighborhood rated good |
| clean3 | cleanliness of neighborhood rated fair |
| clean4 | cleanliness of neighborhood rated poor |
| maint1 | road, street maintenance rated excellent |
| maint2 | road, street maintenance rated good |
| maint3 | road, street maintenance rated fair |
| maint4 | road, street maintenance rated poor |
| chacond1 | change in condition of houses rated excellent |
| chacond2 | change in condition of houses rated good |
| chacond3 | change in condition of houses rated fair |
| chacond4 | change in condition of houses rated poor |
| chacond5 | dont know change in condition of houses |
| schools1 | condition of local public schools rated excellent |
| schools2 | condition of local public schools rated good |
| schools3 | condition of local public schools rated fair |
| schools4 | condition of local public schools rated poor |
| schools5 | dont know condition of schools |
| parcel3 | parcel number in batch3 |
| watview1 | neighborhood waterview rated excellent |
| watview2 | neighborhood waterview rated good |
| watview3 | neighborhood waterview rated fair |
| watview4 | neighborhood waterview rated poor |
| watdn | waterview not rated |
| swim1 | neighborhood swimming conditions rated excellent |
| swim2 | neighborhood swimming conditions rated good |
| swim3 | neighborhood swimming conditions rated fair |
| swim4 | neighborhood swimming conditions rated poor |
| swimdn | swimming conditions not rated |
| fish1 | neighborhood fishability rated excellent |
| fish2 | neighborhood fishability rated good |
| fish3 | neighborhood fishability rated fair |
| fish4 | neighborhood fishability rated poor |
| fishdn | fishability not rated |
| navigat1 | neighborhood water navigability rated excellent |
| navigat2 | neighborhood water navigability rated good |
| navigat3 | neighborhood water navigability rated fair |
| navigat4 | neighborhood water navigability rated poor |
| navigdn | navigability not rated |

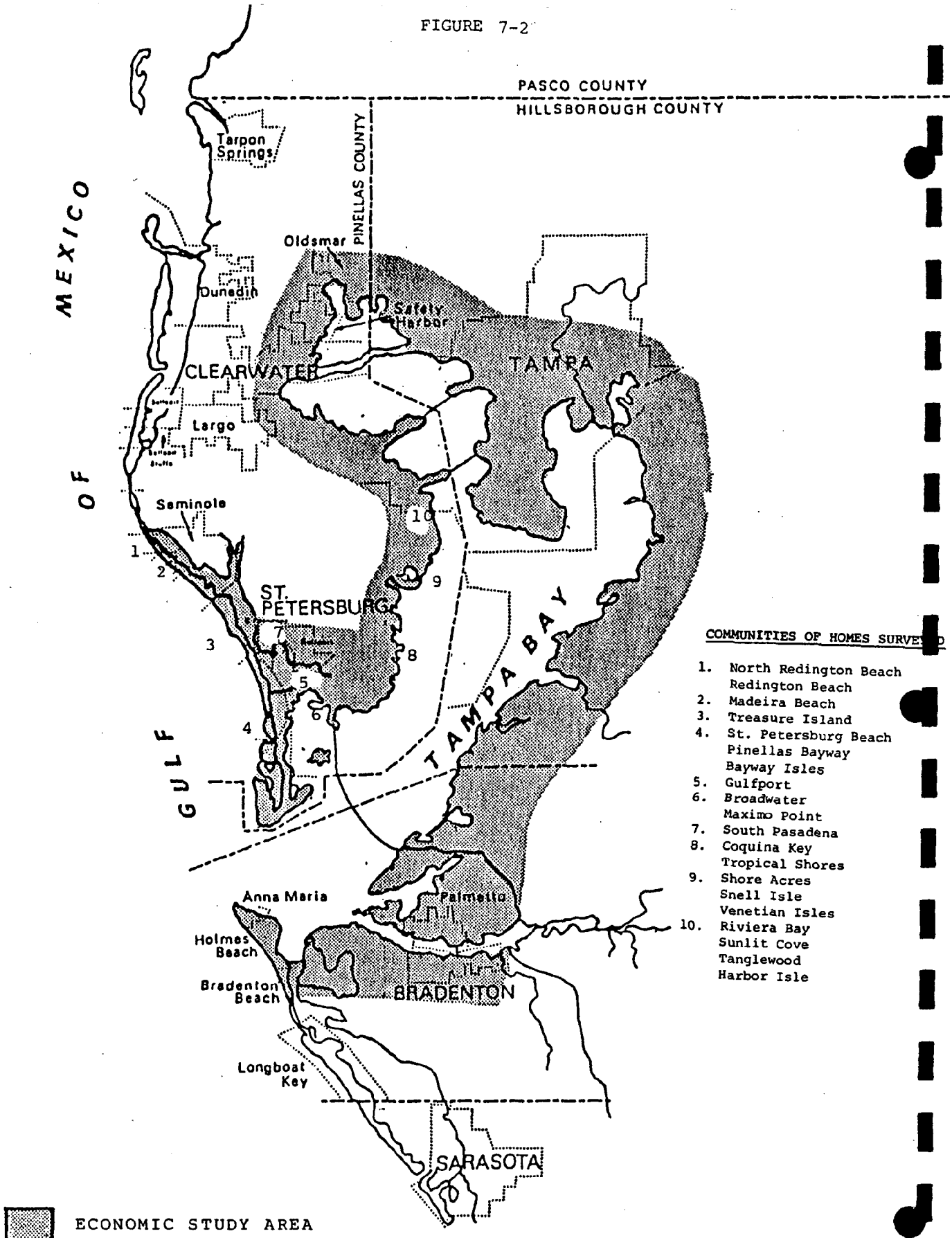
pool and/or dock; concrete block or other construction; and, location of water frontage. Zoning densities were obtained from the Pinellas County Department of Planning and from the respective local government. Millage rates, levied for 1984 taxes, were obtained from the office of the Pinellas County Tax Collector.)

A computer printout was received from the Pinellas County Property Appraiser in August, 1985. The printout contained information on approximately 530 waterfront homes sold in 1984. It was immediately evident that the majority of homes were located in the southern half of Pinellas County. Subsequently, a decision was made to record data and survey only those homes located in southern Pinellas. The original sample size consisted of 265 properties (50 percent of the total sold in 1984), however 17 properties had to be omitted, as there was either incomplete data or they were located outside of the original economic study area. The data base, consisting of 248 waterfront properties, included the following communities: Treasure Island; St. Petersburg Beach/Pinellas Bayway/Bayway Isles; South Pasadena; Broadwater/Maximo Point; Madeira Beach; North Redington Beach and Redington Shores; Shore Acres/Snell Isle/Venetian Isles; Gulfport; Coquina Key/Tropical Shores; and Riviera Bay/Sunlit Cove/Tanglewood/Harbor Isle (Figure 7-2).

A survey of homeowners was undertaken, of those individuals who purchased their waterfront home during 1984. The questionnaire contained ten questions pertaining to the quality of the neighborhood and local public schools, water views, water quality and the average travel time to the job location (Figure 7-3). A letter, shown in Figure 7-4, was mailed to approximately 265 addresses, identified by the Pinellas property appraiser. The letter requested the homeowners' cooperation in participating in the survey.

The interviewing began on Thursday, October 3, 1985, and was completed on Saturday, October 12, 1985. The times that the interviewing took place ranged from 1:00 p.m. until dusk on weekdays, and 11:00 a.m. until 6:00 p.m. on weekends. There was a minimum of two attempts made to contact the residents, usually on different days but in some cases, at different times on the same day. If, after a second attempt, the residents were either not at home or were not interested in participating, then a neighbor was interviewed. If the home was obviously vacant (and often times up for sale), then a neighbor was interviewed immediately. In all cases of neighbor interviews, the neighbor's home was also a waterfront home, located on the same side of the street, within two or three houses. In instances of an incorrect address or the inability to locate a home, then a neighbor was interviewed in the approximate location of the address given. In all instances the questions and choices of response were read aloud, and in no instance were residents under the age of 18 interviewed. The survey was well received, and there were few cases of uncooperative homeowners.

FIGURE 7-2




COMMUNITIES OF HOMES SURVEYED

1. North Redington Beach
   Redington Beach
2. Madeira Beach
3. Treasure Island
4. St. Petersburg Beach
   Pinellas Bayway
   Bayway Isles
5. Gulfport
6. Broadwater
   Maximo Point
7. South Pasadena
8. Coquina Key
   Tropical Shores
9. Shore Acres
   Snell Isle
   Venetian Isles
10. Riviera Bay
    Sunlit Cove
    Tanglewood
    Harbor Isle

FIGURE 7-3

DATE_____

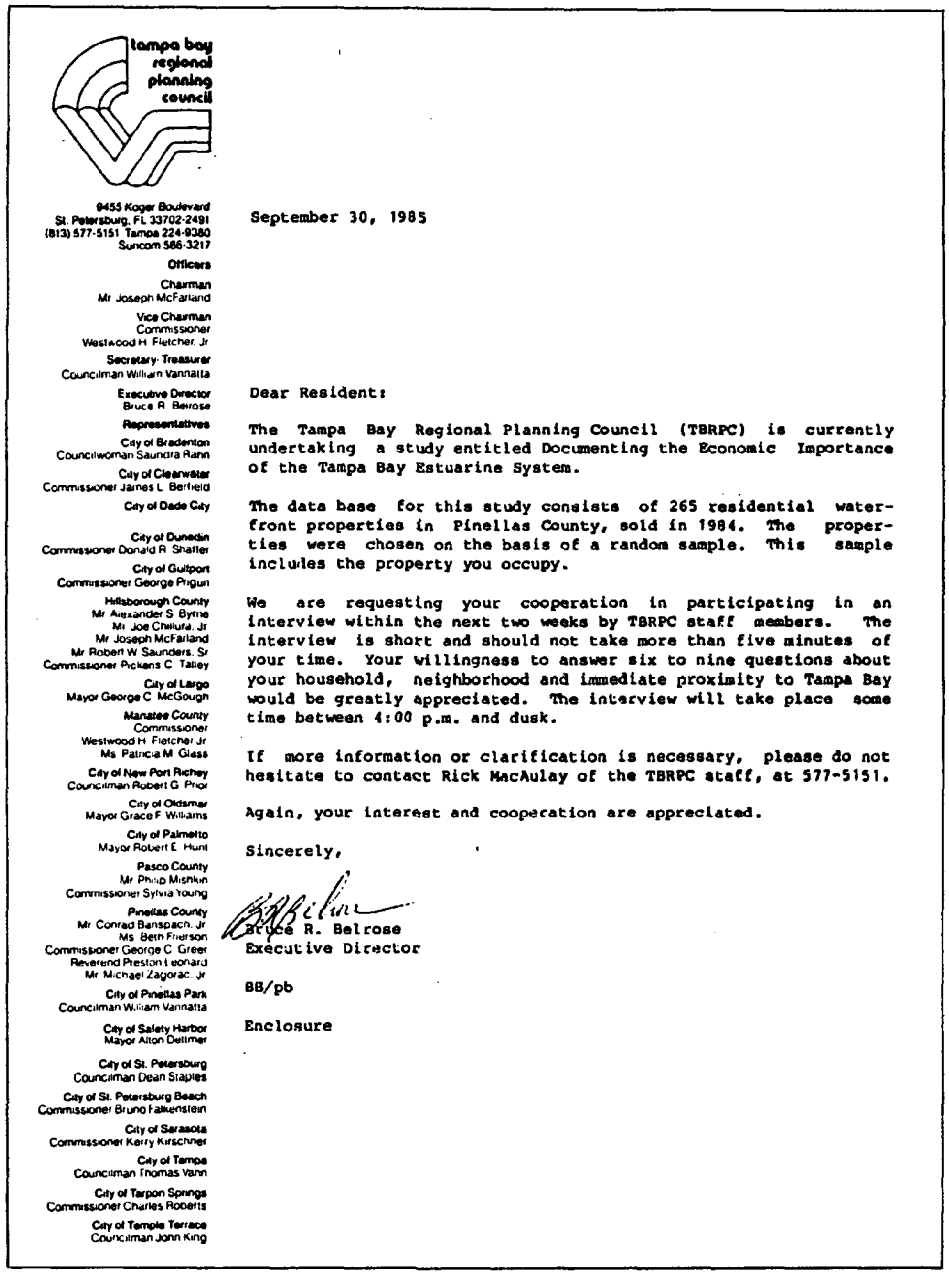
PARCEL #_____

INTERVIEW ADDRESS_____

NEIGHBORHOOD/SUBDIVISION_____

| | Excellent | Good | Fair | Poor | Don't Know |
|---|---|---|---|---|---|
| 1. How do you rate the week-to-week cleanliness of your neighborhood's roads, streets and alleys? | 1 | 2 | 3 | 4 | 5 |
| 2. How do you rate the basic structural maintenance of your neighborhood's roads, streets and alleys? | 1 | 2 | 3 | 4 | 5 |
| 3. How do you rate the change in conditions of houses in your neighborhood, within the past three years? | 1 | 2 | 3 | 4 | 5 |
| 4. How do you rate the quality of the local public schools? | 1 | 2 | 3 | 4 | 5 |
| 5. How do you rate your water view? | 1 | 2 | 3 | 4 | 5 |
| 6. How do you rate the swimmability of the water close to your home? | 1 | 2 | 3 | 4 | 5 |
| 7. How do you rate the fishability of the water close to your home? | 1 | 2 | 3 | 4 | 5 |
| 8. How do you rate the navigability of the water close to your home? | 1 | 2 | 3 | 4 | 5 |
| 9. How do you rate the suitability of the water close to your home for other water sports? | 1 | 2 | 3 | 4 | 5 |
| 10. What is the average travel time to the job location (by car) by the head of household? | _____ (minutes) | | | | |

FIGURE 7-4



tampa bay regional planning council

9455 Koger Boulevard
St. Petersburg, FL 33702-2491
(813) 577-5151 Tampa 224-9380
Suncom 586-3217



September 30, 1985

Dear Resident:

The Tampa Bay Regional Planning Council (TBRPC) is currently undertaking a study entitled Documenting the Economic Importance of the Tampa Bay Estuarine System.

The data base for this study consists of 265 residential waterfront properties in Pinellas County, sold in 1984. The properties were chosen on the basis of a random sample. This sample includes the property you occupy.

We are requesting your cooperation in participating in an interview within the next two weeks by TBRPC staff members. The interview is short and should not take more than five minutes of your time. Your willingness to answer six to nine questions about your household, neighborhood and immediate proximity to Tampa Bay would be greatly appreciated. The interview will take place some time between 4:00 p.m. and dusk.

If more information or clarification is necessary, please do not hesitate to contact Rick MacAulay of the TBRPC staff, at 577-5151.

Again, your interest and cooperation are appreciated.

Sincerely,

Bruce R. Belrose
Executive Director

BB/pb

Enclosure

## C. RESULTS

A summary of the property data and information collected on the 265 waterfront properties sold in southern Pinellas County in 1984, is as follows:

- The 1984 mean sale price was approximately $130,000, and the median sale price $122,000 (Figure 7-5);
- The mean effective square footage and age of home are 2,125 square feet and 22 years respectively;
- Approximately 36 percent of the waterfront homes had a swimming pool, and 76 percent had a dock. Approximately 92 percent of the homes were of concrete block construction; and
- Approximately 53 percent of the homes were identified as being located on a canal, 36 percent on Boca Ciega Bay, and 11 percent on Tampa Bay.

The results of the 248 waterfront properties surveyed are illustrated in Figure 7-6. A summary of the results is as follows:

- Approximately 93 percent of the homeowners surveyed stated that their water view was either excellent or good;
- Approximately 68 percent of those interviewed stated that the swimmability of the water close to their home was either fair or poor, while three percent were not sure;
- Approximately 51 percent of those interviewed stated that the fishability of the water close to their home was either fair or poor, while four percent were not sure;
- Approximately 85 percent of those interviewed stated that the navigability of the water close to their home was either excellent or good;
- Approximately 58 percent of those interviewed stated that the suitability of the water close to their home for water sports was either fair or poor; and
- The mean average travel time to the job location, by car, by the head of the household was 21 minutes.

## D. DISCUSSION

An attempt was made, through the use of a survey and questionnaire, to document the value of an aesthetic attribute (water view) and benefits accruing to owners of residential waterfront property along Tampa Bay and Boca Ciega Bay, in southern Pinellas County. In addition to the water vista, the benefits accrued by property owners, considered in this chapter, include swimming, fishing, and the ability to navigate and engage in water sports in water close to their home.

FIGURE 7-5

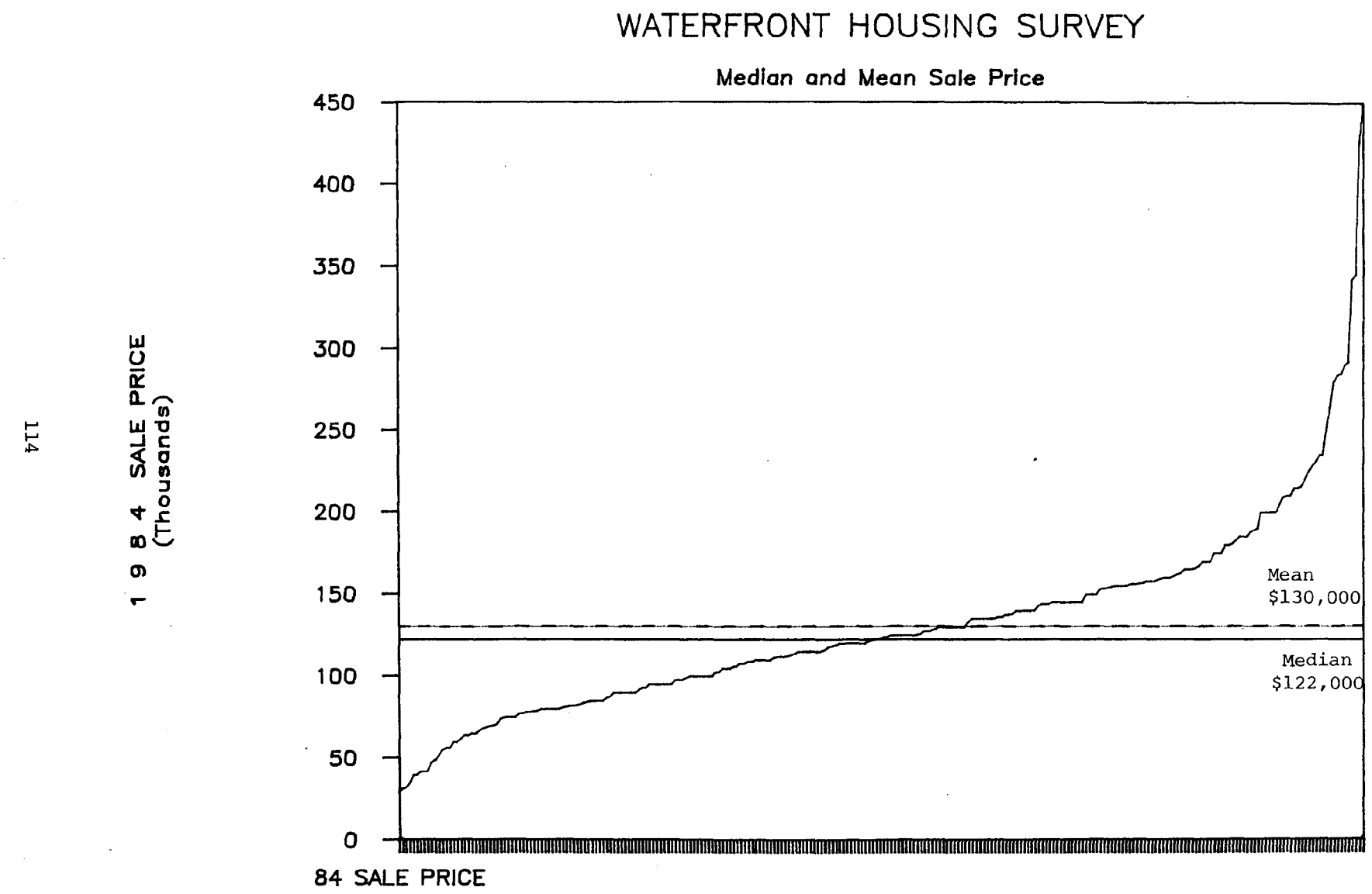
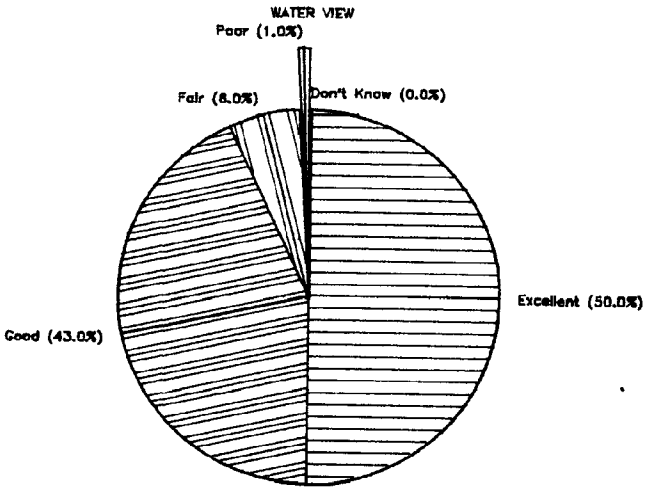
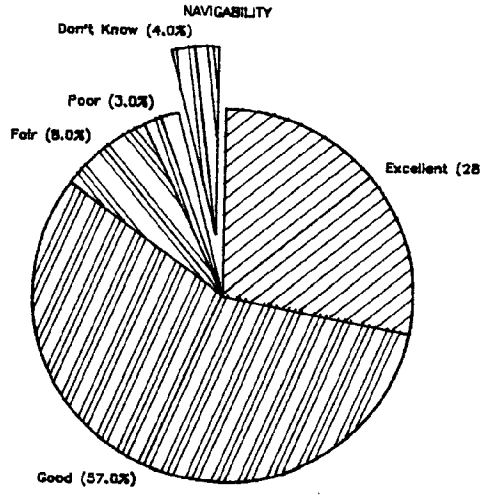

WATERFRONT HOUSING SURVEY
Median and Mean Sale Price
450
400
350
300
250
200
150
100
50
0
1 9 8 4 SALE PRICE (Thousands)
Mean
$130,000
Median
$122,000
84 SALE PRICE

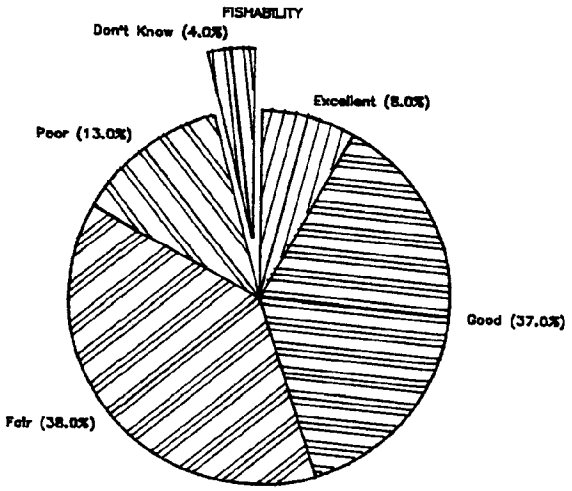
FIGURE 7-6

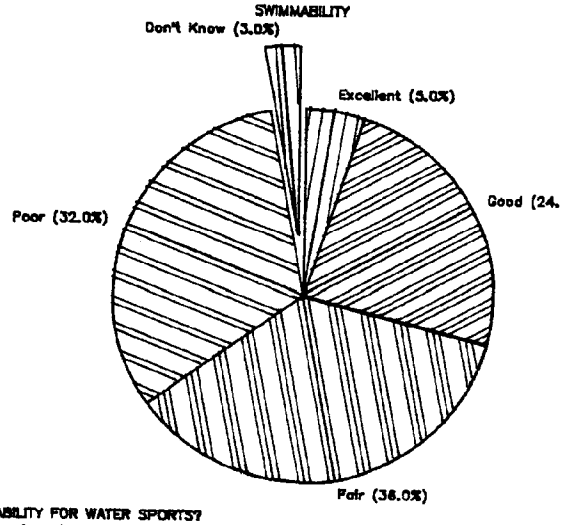
# VALUE OF WATER VIEW AND BENEFITS

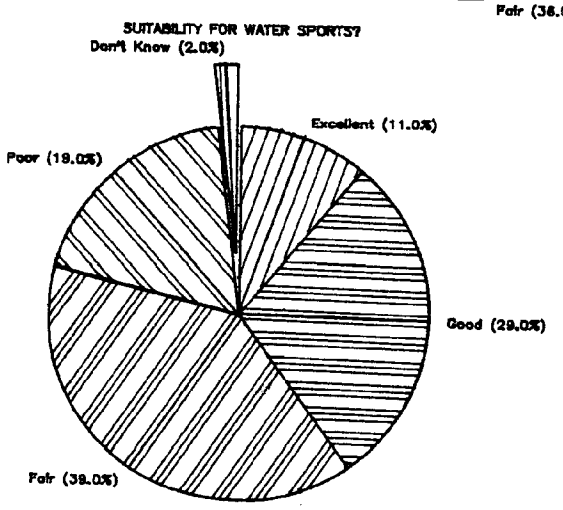
## PROVIDED BY TAMPA BAY



Of the total respondents, 93 percent rated their water view as excellent or good, perhaps indicating the importance of the view in their consideration to purchase waterfront property. Only six percent of those homeowners surveyed rated their water view fair and one percent poor.

The next most highly rated benefit was the ability to navigate a boat in the water close to the home, followed by the benefits of being able to fish and swim in the water close to the home. It appears that the lowest rated benefit accrued by owners of waterfront property dealt with the suitability of engaging in water sports in the water close to the home. The results of this survey seem to suggest that individuals will purchase homes on the water primarily for the view, and secondarily for access.

In general terms, owners of single-family, residential waterfront homes are willing to pay considerably more, as evidenced by the survey results, which found the median 1984 sale price to be $122,000 and the mean sale price to be $130,000, whereas the average 1984 purchase price for a home in Hillsborough and Pinellas Counties was approximately $69,800.(2)

Although the analysis contained in this chapter addresses residential waterfront property surveyed in southern Pinellas County, it is likely that these same findings hold true for such property located in both Hillsborough and Manatee Counties.

## E. FOOTNOTES

1. Hanni, Eila, "Effect of the Enforcement of Residential land Use Ordinances on Property Values", presented at the Annual Meeting of Western Economists Association, San Francisco, CA, June 18, 1979.

2. Board of Realtors: Tampa, St. Petersburg, Bradenton, 1984.

# CHAPTER 8
# BENEFITS OF TAMPA BAY TO WATER-ORIENTED RECREATIONAL ACTIVITIES

## A. INTRODUCTION

The uses and attributes of Tampa Bay discussed and illustrated in previous chapters have included shipping and water-borne commerce, electric and sanitary services, commercial fishing and benefits associated with waterfront home ownership. One of the obvious uses of Tampa Bay, and one which requires further study because of a present lack of information, is that of recreation. Although recreational benefits are difficult to quantify, the following analysis will attempt to identify the potential magnitude of the recreational benefits associated with Tampa Bay.

The economic value, and thus benefits, of recreation-related uses and attributes of Tampa Bay, described in this chapter, include boating, saltwater fishing, beach activities and saltwater boat ramp use.

## B. RECREATION SURVEY

On May 10, 1982, the Tampa Bay Regional Planning Council (TBRPC) established the Tampa Bay Study Committee. The Study Committee was charged with the task of identifying critical bay problems and evaluating potential solutions for those problems. (1) Initially, five subcommittees were formed to specifically address ecological, industrial, institutional, economic and recreational aspects of Tampa Bay.

The goal established by the Recreation Subcommittee was to maximize current and future recreational benefits for Tampa Bay area residents, with due concern for the environment. (2) It was decided that a recreation survey would be employed, to assess the current level and areas of recreational use on Tampa Bay. (3)

There were 95 sites selected, initially, for surveying in Pinellas, Hillsborough and Manatee Counties. The sites included restaurants, parks, beaches, piers and marinas. Due to budget and personnel constraints, only 29 sites were surveyed: 27 sites in Pinellas County and one each in Hillsborough and Manatee Counties. Figure 8-1 illustrates the sites that were surveyed in June and July, 1984.

Approximately 1,358 interviews were conducted utilizing the questionnaire shown in Figure 8-2. The surveyors attempted to interview only those adults who stated that they were Tampa Bay area residents, however, individuals who were seasonal residents were also interviewed.

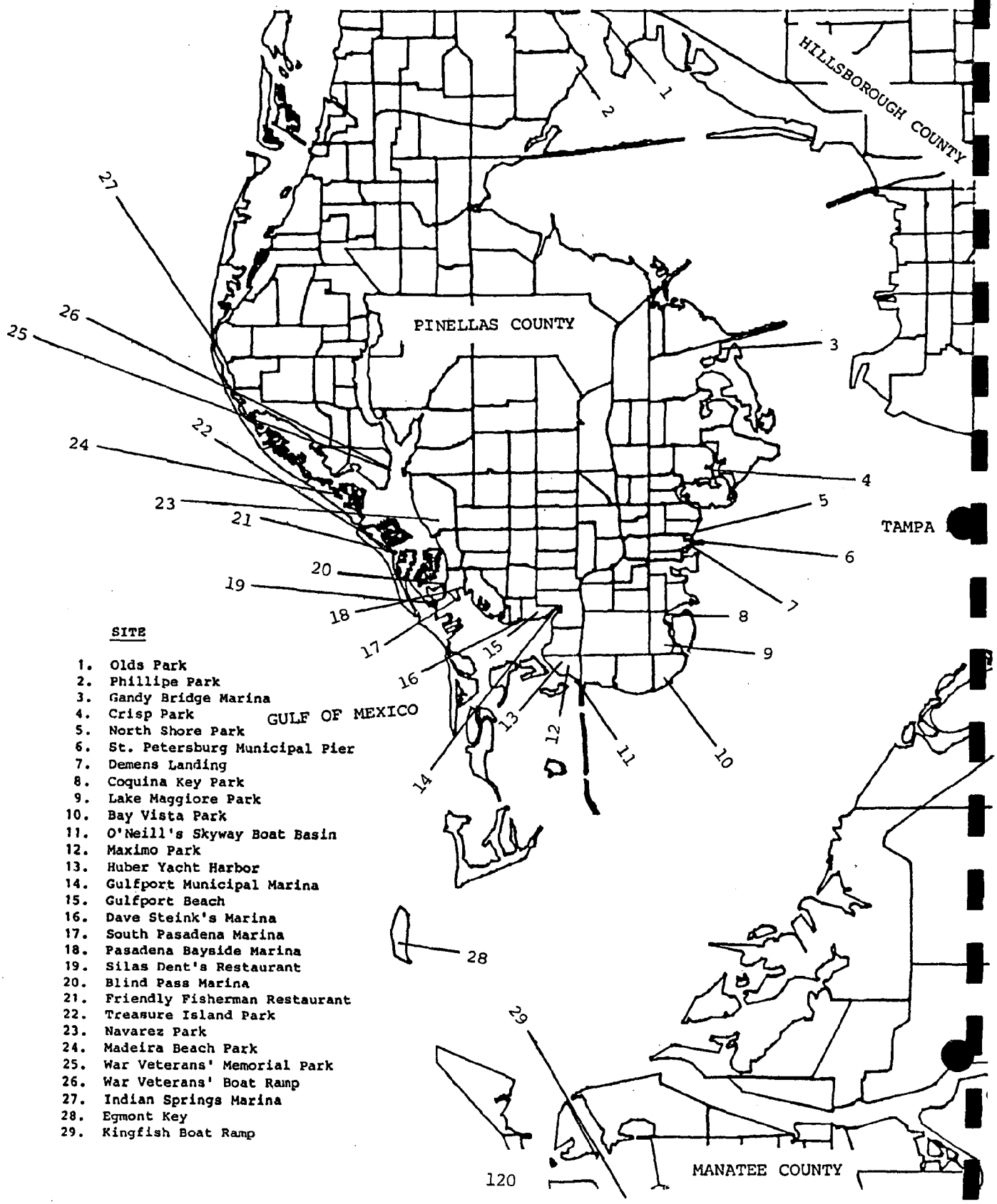
### Analysis

The results of the survey are shown in Figure 8-3. The recreational activities demonstrating the highest participation rates included the following: viewing sunsets or other scenic amenities; swimming; dining

FIGURE 8-1

# TAMPA BAY RECREATION STUDY

## Survey Sites




SITE

1. Olds Park
2. Phillipe Park
3. Gandy Bridge Marina
4. Crisp Park
5. North Shore Park
6. St. Petersburg Municipal Pier
7. Demens Landing
8. Coquina Key Park
9. Lake Maggiore Park
10. Bay Vista Park
11. O'Neill's Skyway Boat Basin
12. Maximo Park
13. Huber Yacht Harbor
14. Gulfport Municipal Marina
15. Gulfport Beach
16. Dave Steink's Marina
17. South Pasadena Marina
18. Pasadena Bayside Marina
19. Silas Dent's Restaurant
20. Blind Pass Marina
21. Friendly Fisherman Restaurant
22. Treasure Island Park
23. Navarez Park
24. Madeira Beach Park
25. War Veterans' Memorial Park
26. War Veterans' Boat Ramp
27. Indian Springs Marina
28. Egmont Key
29. Kingfish Boat Ramp

Figure 8-2

TAMPA BAY
RECREATION SURVEY

Site_____
Activity_____
Day of week_____ Date_____
Time_____

Background Information:
Sex_____ Marital Status_____ Number in household_____

Age
_____15 and under
_____16-20
_____21-25
_____26-30
_____31-35
_____36-40
_____41-45
_____46-50
_____51-55
_____56-60
_____61-65
_____66 and older

What city do you live in?_____ Zip Code_____
How long have you lived there?_____years
Last previous residence_____(city/state) Zip Code_____

How many times per year do you engage in the following activities on or along Tampa Bay?

| Boating | Times/year |
|---|---|
| Motorboating | _____ |
| Racing | _____ |
| Sailing | _____ |
| Waterskiing | _____ |
| Other (Please specify) _____ | _____ |
| Camping | _____ |
| Dining at restaurants on Tampa Bay | _____ |
| Fishing | _____ |
| Swimming | _____ |

| | Times/year |
|---|---|
| Nature study | _____ |
| Picnicking | _____ |
| Scuba diving | _____ |
| Shellfishing | _____ |
| Swimming | _____ |
| Viewing sunsets or other scenic amenities | _____ |
| Visiting historical/ archaeological sites | _____ |
| Other (specify) _____ | _____ |

Do you feel that the following facilities are adequate for your needs?

| Boating | YES | NO | DO NOT USE |
|---|---|---|---|
| Boat ramps | _____ | _____ | _____ |
| Pumpout facilities | _____ | _____ | _____ |
| Gasoline facilities | _____ | _____ | _____ |
| Diesel facilities | _____ | _____ | _____ |
| Marina slips on a permanent basis | _____ | _____ | _____ |
| Marina slips on a transient basis | _____ | _____ | _____ |
| Restaurants with docking facilities | _____ | _____ | _____ |
| Camping facilities | _____ | _____ | _____ |
| Fishing | | | |
| Bait and tackle shops | _____ | _____ | _____ |
| Piers | _____ | _____ | _____ |
| Other (Please specify) _____ | _____ | _____ | _____ |
| Picnic areas | _____ | _____ | _____ |
| Restaurants with a scenic view of Tampa Bay | _____ | _____ | _____ |
| Other (Please specify) _____ | _____ | _____ | _____ |

Please describe any difficulties you have had with any of the above mentioned facilities.

Figure 8-3

TAMPA BAY
RECREATION SURVEY

Site_____
Activity_____
Day of week_____ Date____
Time_____

Background Information:
Sex_____ Marital Status_____ Number in household_____

Age
_____15 and under
_____16-20
_____21-25
_____26-30
_____31-35
_____36-40
_____41-45
_____46-50
_____51-55
_____56-60
_____61-65
_____66 and older

What city do you live in?_____ Zip Code_____
How long have you lived there?_____years
Last previous residence_____(city/state) Zip Code_____

How many times per year do you engage in the following activities on or along Tampa Bay?

| Boating | Times/year |
|---|---|
| Motorboating | 34.0 |
| Racing | 0.7 |
| Sailing | 9.2 |
| Waterskiing | 6.1 |
| Other (Please specify) | 1.9 |
| Camping | 4.6 |
| Dining at restaurants on Tampa Bay | 52.8 |
| Fishing | 40.1 |

| | Times/year |
|---|---|
| Nature study | 29.2 |
| Picnicking | 22.1 |
| Scuba diving | 4.1 |
| Shellfishing | 6.4 |
| Swimming | 83.6 |
| Viewing sunsets or other scenic amenities | 93.0 |
| Visiting historical/ archaeological sites | 6.0 |
| Other (specify) | 19.4 |

Do you feel that the following facilities are adequate for your needs?

| Boating | YES | NO | DO NOT USE |
|---|---|---|---|
| Boat ramps | 72.23 | 27.77 | |
| Pumpout facilities | 63.72 | 36.28 | |
| Gasoline facilities | 80.60 | 19.40 | |
| Diesel facilities | 69.40 | 30.60 | |
| Marina slips on a permanent basis | 63.03 | 36.97 | |
| Marina slips on a transient basis | 60.0 | 40.00 | |
| Restaurants with docking facilities | 50.49 | 49.51 | |
| Camping facilities | 67.33 | 32.67 | |
| Fishing | | | |
| Bait and tackle shops | 87.07 | 12.93 | |
| Piers | 78.59 | 21.41 | |
| Other (Please specify) | | | |
| Picnic areas | 81.80 | 18.20 | |
| Restaurants with a scenic view of Tampa Bay | 76.65 | 23.35 | |
| Other (Please specify) | | | |

Please describe any difficulties you have had with any of the above mentioned facilities.

at restaurants on Tampa Bay; fishing; and motorboating. In all instances the identified recreation facilities were perceived to be adequate for the needs of the respondents.

The Tampa Bay Recreation Survey was successful in identifying the nature of recreational activities engaged in, and the frequency, of use.

## C. RECREATIONAL BOATING

As illustrated in Table 8-1, the number of recreational (pleasure) boats registered in Pinellas, Hillsborough and Manatee Counties has shown a significant increase between 1979 and 1985 (20 percent, 18 percent and 15 percent respectively). In 1985, Pinellas County had the largest number of pleasure boats registered, with 34,541, while Hillsborough County was a close second with 33,447 boats registered.

In Chapter 3 of this study, through the use of an economic base model, many export industries were identified, i.e., industries within the local economy that cause funds to flow in and "drive" the economy. Two such industries were Ship and Boat Building and Repairing (SIC 373) and Boat Dealers (SIC 555). These industries satisfy local consumption of their respective product or service and sell their excess to additional businesses and residences outside the boundaries of the local Tampa Bay economy, thus injecting funds and stimulating local economic conditions. In 1984, the retail sales reported for motorboats, yachts and marine accessories, in Pinellas, Hillsborough and Manatee Counties, was approximately $184 million. (4)

Boating related activities, undertaken on Tampa Bay, include sailing, snorkeling, scuba diving, swimming, water skiing and sport fishing. Quality of available activities and accessibility are two major factors that can affect recreational boating. (5) Factors affecting the quality of available activities or the desirability to undertake such activities include the boater's perception of water quality, water clarity, and scenic amenities. Access to the water and boating facilities is also an important factor in the use of Tampa Bay for recreational boating. In general, boaters gain access to Tampa Bay in three ways: public and private boat ramps; individual slips (residential or marina); and marina launching facilities.

There are 47 public and private marinas located within the boundaries of Tampa Bay. (6) This figure does not include private facilities located on the premises of condominiums, residential communities, and private clubs, etc., which are not available to the public. Marinas that are open to the public provide approximately 3,562 wet and 1,310 dry slips, respectively. (Figure 8-4 illustrates the relative location of marinas along Tampa Bay.)

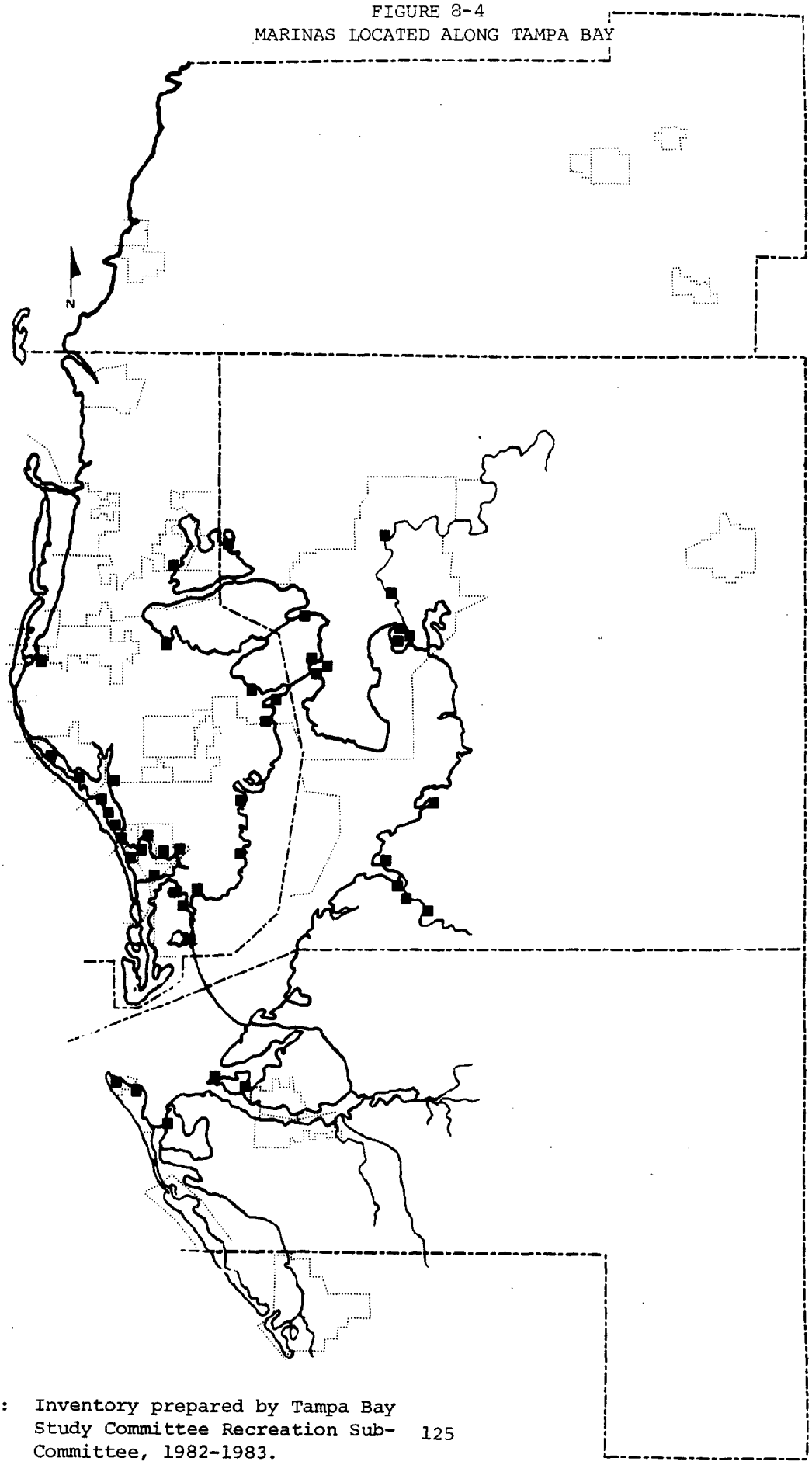
In addition to marinas, there are numerous boat launching facilities located along the shores of Tampa Bay. A large portion of recreational boaters, particularly those with smaller boats, use boat ramps. Factors determining use of boat ramps include proximity to residence,

TABLE 8-1
PLEASURE BOATS REGISTERED

| YEAR | HILLSBOROUGH | MANATEE | PINELLAS |
|---|---|---|---|
| 1979-80 | 28,394 | 9,641 | 28,707 |
| 1980-81 | 29,041 | 9,902 | 29,741 |
| 1981-82 | 29,086 | 9,942 | 29,871 |
| 1982-83 | 30,040 | 10,237 | 30,599 |
| 1983-84 | 30,945 | 10,808 | 31,907 |
| 1984-85 | 33,447 | 11,067 | 34,541 |

Source: Florida Department of Natural Resources, Bureau of License and Motorboat Registration

FIGURE 8-4
MARINAS LOCATED ALONG TAMPA BAY




Source: Inventory prepared by Tampa Bay Study Committee Recreation Sub-Committee, 1982-1983.

proximity to destination point, quality of ramp and facilities available at the ramp. (The economic value of saltwater boat ramp use will be discussed later.)

## D. RESIDENT AND TOURIST WATER-RELATED RECREATIONAL DEMANDS

Table 8-2 contains information regarding 1983 estimates of resident and tourist water-related recreational demands in Pasco, Hillsborough, Pinellas and Manatee Counties, based on surveys conducted by the Florida Department of Natural Resources (FDNR), Divison of Recreation and Parks. (7) The benefits associated with recreational fishing can be analyzed in far greater detail than those accruing from other types of recreational activities, such as picnicking, canoeing, nature study, etc. For this reason, the following analysis will first assess the economic impacts associated with recreational fishing alone, using Florida-specific estimates of user willingness to pay for saltwater fishing, (8) and then assess the economic impacts associated with other forms of recreation, using the unit day approach. (9) Both methods will be used in an effort to demonstrate the magnitude of the economic impacts associated with recreation in the Tampa Bay area, subject to the limitations of the available data and methodology.

The economic value of recreational fishing includes both the direct gross expenditures by anglers and the perceived value to the user. The former includes such expenditures as travel cost and fishing equipment, while the latter is a measure of user willingness to pay for the right to fish. For saltwater fishing in Florida, gross expenditures are estimated to be $58.25 per day for tourists and $16.44 per day for residents, where the difference between tourist and resident estimates is due to larger expenditures associated with travel and supplies. Both resident and tourist anglers have the same estimated saltwater recreational fishing user value of $36.56 per day. Consequently, the total annual economic value of recreational fishing in the Tampa Bay area is estimated to be $197 million (in 1983 dollars), as shown in Table 8-3.

The preceeding analysis indicates that the Tampa Bay area has a substantial value as a recreational resource for saltwater fishing alone. Although there is no such well-developed methodology by which to estimate the economic value of other types of water-related recreation, there is a fundamental procedure which is commonly used: the unit day approach. This type of evaluation is based on the users willingness to pay for various outdoor recreational activity with an average estimated economic value of $2.95 per day. As shown in Table 8-4, the total annual economic value of other recreational activities in the Tampa Bay area is estimated to be $23 million (in 1983 dollars).

## E. SUMMARY

The economic benefits of recreation-related uses and attributes of Tampa Bay described in this chapter, include boating, saltwater fishing, beach activities and saltwater boat ramp use. It should be noted that the recreation uses and attributes of Tampa Bay, not presented here include the following: restaurants offering a scenic view of Tampa Bay; sporting goods sales and service; bait and tackle

TABLE 8-2
RECREATION DEMAND FOR SPECIFIED SALT-WATER RELATED
RECREATIONAL ACTIVITIES IN THE TAMPA BAY REGION, 1983

| DEMAND (user occasions) | | | |
|---|---|---|---|
| SALTWATER BEACH ACTIVITIES | SALTWATER FISHING (NON-BOAT) | SALTWATER FISHING (BOAT) | SALTWATER BOAT RAMP USE |
| 6,882,109 | 1,863,668 | 1,314,007 | 844,515 |

Notes: Demand figures include both resident and tourist demand. A "user occasion" is defined as one person doing one thing one time. These figures are region-wide, which would include Pasco County, and probably overestimate the true recreation demand of Tampa Bay.

Source: Florida Department of Natural Resources, Division of Recreation and Parks, 1983.

TABLE 8-3
ECONOMIC VALUE OF SALTWATER FISHING
IN THE TAMPA BAY AREA (in 1983 dollars)

| | Demand (user occasions) | | | Economic Value (in 1983 dollars) | | |
|---|---|---|---|---|---|---|
| | Saltwater Fishing (Non-Boat) | Saltwater Fishing (Boat) | Total Saltwater Fishing | Annual Gross Expenditures 1 | Annual User Value 2 | Total Annual Economic Value |
| Tourists | 452,326 | 240,471 | 692,797 | $ 40,355,425 | 25,328,658 | 65,684,083 |
| Residents | 1,411,342 | 1,073,536 | 2,484,878 | 40,851,394 | 90,847,139 | 131,698,533 |
| | | | | TOTAL: | | $197,382,616 |



Notes: 1 Estimated Gross Expenditure of $58,25/day for tourists.
Estimated Gross Expenditure of $16.44/day for residents.

2 Estimated saltwater fishing user value of $36.56/day for tourists and residents.

Sources: Florida Department of Natural Resources, Division of Recreation and Parks, 1983.
Bell, 1979.

TABLE 8-4
ECONOMIC VALUE OF OTHER RECREATIONAL ACTIVITIES
IN THE TAMPA BAY AREA (in 1983 dollars)

| Demand (user occasions) | | |
|---|---|---|
| Saltwater Beach Activities | Saltwater Boat Ramp Use | Total Annual Economic Value 1 (in 1983 dollars) |
| 6,882,109 | 844,515 | $ 22,793,540 |

Notes: 1 Estimated Average Outdoor Recreation User Value of $2.95/day

Sources: Florida Department of Natural Resources, Division of Recreation and Parks, 1983.
U.S. Water Resources Council, 1979

shop sales; boat rentals and charters; sportfishing tournaments; sailing school courses; boating safety and diving instruction courses; and miscellaneous travel expenses, equipment rental and admittance fees.

The information necessary to calculate the economic impacts of the aforementioned uses and attributes of Tampa Bay is not presently available, hence, a precise evaluation of the economic benefits of Tampa Bay to water-oriented recreational activities cannot be calculated at this time.

Therefore, the true recreational value of Tampa Bay would be far greater than the figures in this chapter indicate. The important point of this analysis is that the (recreational) economic value of Tampa Bay is significant to the region's economy.

## F. FOOTNOTES

1. Tampa Bay Regional Planning Council, 1983, Tampa Bay Management Study.

2. Ibid. p. 3.

3. Mente, Ronald F. "Tampa Bay Recreation Survey" Tampa Bay Study Committee, 1984.

4. Florida Department of Revenue, 1984 Retail Sales By Category.

5. Tampa Bay Regional Planning Council, 1983, Tampa Bay Management Study.

6. Ibid. p. 31.

7. Methodology and information used in the preparation of this discussion is largely condensed from the following: Economic Impact Statement for the Proposed Revisions of Chapter 17-3.041, F.A.C. Sarasota Bay and Lemon Bay Outstanding Florida Waters (OFW) Designations.

8. Bell, Frederick W., Recreational Versus Commercial Fishing in Florida: An Economic Impact Analysis, Florida State University, Tallahassee, Florida, 1979.

9. U.S. Water Resources Council, Procedures For Evaluation of National Economic Development (NED) Benefits and Costs in Water Resources Planning, Federal Register, Vol. 44, No. 102, Washington, D.C. 1979.

# CHAPTER 9
# ECOLOGICAL SERVICES OF TAMPA BAY

## A. INTRODUCTION

### Estuarine Ecology

The intertidal and submerged wetlands of Tampa Bay perform many natural functions having intrinsic value. The value of the estuary as a regional economic resource is, however, viewed by various industries and individuals from many different, and often conflicting perspectives. For example, industries relying upon the availability of a source of water-bound transport may perceive the bay's value in the same sense that land-based industries would value railroad frontage in determining location decisions. For other firms, industries and even local governments, the bay is considered to be a convenient receptacle for the inexpensive disposal of industrial and urban wastes or available space for further development.

The environmental quality of the bay is intuitively an important component in the decision making processes of the majority of individuals and industries considering locating and/or operating in the Tampa Bay area. But for those industries dependent upon the harvest of living resources, or the availability of bay-oriented recreational opportunities, the value of the bay is perceived to be intimately tied to its ecological health.

Of all bodies of water, estuarine systems offer the greatest diversity in water composition. An estuary is defined as a semi-enclosed coastal body of water with an open access to the ocean, that is measurably diluted by the influx of freshwater.(1) Freshwater mixing with salt water creates unique chemical and physical environments each of which supports different communities of organisms particularly suited to that type of water.

According to Taylor (2), the recorded diversity and abundance of macro-invertebrate marine life in the Tampa Bay estuary is not exceeded by any other estuary between Chesapeake Bay and the Laguna Madre of Texas. The richness of Tampa Bay marine life has been attributed to the geographic position of the estuary between temperate and subtropical waters.(3) Another contributing factor to the diversity and abundance of Tampa Bay marine life is that salinity is typically in the range of 25-35 ppt over most of the estuary, without the wide fluctuations and significant vertical stratification that characterize many other estuaries. As a result of the stability of the salinity regime, many ocean species can co-exist with typical estuarine species.

The importance of rivers and creeks to estuaries has been documented by studies throughout the world. Rivers and lesser streams import freshwater, foodstuffs, sediments, minerals and nutrients to estuaries and provide critical habitat, refuge, feeding and breeding grounds for the early life history stages of marine and estuarine life forms. Rivers and lesser tributaries flowing to Tampa Bay vary greatly in

condition. Historical and anecdotal evidence exist to show that these streams were immensely productive estuarine zones. Modern data on relatively pristine rivers and creeks support this view.

The Tampa Bay estuary and contiguous coastal waters serve as home, feeding ground and/or nursery for more than 270 species of resident, migrant and commercial fishes of the Gulf of Mexico that utilize estuaries at some time in their life cycle. The most critical use of Tampa Bay, for numerous species, is as a protected nursery area for larval and juvenile stages. The protective function arises from the generally greater osmoregulatory capabilities of younger marine fishes, shallow depths and protective cover. Reduced salinities in estuarine waters tend to exclude larger marine restricted fishes that otherwise prey on young juveniles and larvae. The nursery function is developed from the high primary productivity of estuaries which provide a ready source of food.

Dredging, filling, commercial and residential development have contributed significantly to the loss of live bay bottom. Boca Ciega Bay for example, has lost 22 percent of bay bottom through dredging and filling to create finger canals and increase the number of structures having water frontage. These "dead-end" finger canals severely restrict the mixing of the water, degrading the water quality in the canal. The loss of live bay bottom also eliminates the nursery function of the area affecting the recruitment of juvenile fish and other equally important marine organisms.

Tampa Bay is a naturally shallow body of water, having an average depth of about 12 feet (4), and a maximum natural depth of about 90 feet in Egmont Channel, at the mouth of the bay. Approximately 90 percent of the bay bottom is less than 22 feet in depth.(5) Despite the relative shallow nature of Tampa Bay, the estuarine ecosystem provides excellent resiliency to man-made and natural destructive forces.

The resiliency potential of estuaries is aided by the vigor of the rhythmic and turbulent circulation pattern which continuously and endogenously renews the supply of water, food larvae, nutrients and other essential elements of any small damaged area. This assists in recovery and protects long-term net stability patterns of the estuarine system.

The substantial buffering capacity of estuaries, usually operating through the carbonate system, is another element which resists changes imposed on estuaries. The capacity of seawater to assimilate and/or dilute toxic pollutants has been well documented. The potential is not so great as the buffering capacity of the open ocean, but it is greater than most rivers, and is enormously important in the estuaries where pollution is received, as in Tampa Bay.

Many species have biological characteristics or adaptations which provide special advantages in estuarine survival. These characteristics usually protect the species against natural violence in estuaries, and they are often helpful in resisting terrigenous forces. Simon (6) believes that such resilence exists because of natural stress factors, such as red tide, which favor organisms that recover quickly.

Such long-term periodic stresses as hurricanes, droughts, and red tide may, in effect, pre-adapt the benthic community to other stresses that originate from man's activities (e.g. slime spills, shell dredging, thermal and industrial effluent).

**Habitat**

The importance of mangrove forests, salt marshes, and seagrass beds to coastal and estuarine ecosystems has been well documented over the past two decades. As primary producers, these species of wetland vegetation provide the foundation of coastal and estuarine food webs; both as direct sources of nutrition and as generators of detrital particles. Secondary to their role as primary producers, coastal and estuarine wetlands provide protection and habitat for such organisms as shrimp, crabs, scallops and juvenile fishes. Also, wetland vegetation provides necessary substrate for the attachment of organisms that are major food sources for many economically important species of finfish.

In addition to their contributions to the biology of the marine ecosystems, coastal and estuarine wetlands play an important role in modifying the geologic and hydrographic characteristics of the area. Acting as baffles, roots and leaves reduce the velocity of water over the bottom causing suspended particles to settle out and become trapped at the base of the plants. In this way mangroves, marshes, and seagrasses reduce turbidity, increase sedimentation rates, stabilize sediments, and attenuate wave action on adjacent shorelines. The binding and stabilization characteristics of these habitats are documented by reports of some coastal marshes and seagrass meadows surviving the destructive scouring forces of coastal storms and hurricanes in the Gulf states.

The mangrove forest community exists near the beginning of the estuarine wetland zone. Mangroves share commensal communities of associated flora and fauna commonly attached to the root system. General consensus of opinion is that mangroves, particularly red mangroves, through their ability to trap sediments, act as land stabilizers rather than land builders.(7) Localized environmental factors such as soil salinity and tidal flushing, determine zonation patterns among mangrove species.

Salt prairies and marshes provide habitat for a variety of fish and wildlife, in addition to the specialized vegetation that occurs in this extremely sensitive zone. Salt barrens, because of the hypersaline soil water, are generally devoid of vegetation. As this soil water slowly leaches from the surface and is diluted by rainwater, salt flats (prairies) and meadows (marshes) may form. These rapidly changing physiochemical conditions caused by tides, evaporation, and freshwater runoff result in unique and sporadic assortment of vegetation. In general, the moderate to high salinity marshes support more marine invertebratae (snails, mussels, polychaetes) than do the low salinity marshes.(8) Other important invertebrate groups include amphipods, benthic forminiferans, insects and their larvae.

Additionally, marshes attract numerous wading birds (herons and egrets), other more transient birds (red winged blackbird, marsh hawk), mammals (rabbits, raccoons), and some reptiles (alligators, szat marsh snake).

Seagrass beds are widely recognized as one of the most productive benthic habitats encountered in estuarine and nearshore waters. Seagrasses play at least four roles in the ecology of an estuary: (1) habitat; (2) food source; (3) nutrient buffer; and (4) sediment trap. Seagrasses serve as a fisheries habitat including: nurseries for juvenile stages of some fish species; refuge for mating blue crabs, other invertebrates, and finfish; a substrate for epiphytic plants and animals; and habitat for all fauna subsisting directly on seagrasses and its epiphytes or detritus derived from them.

The Tampa Bay estuarine system is, both directly and indirectly, a vitally important economic asset to the numerous municipalities surrounding the bay. Now the second largest population center in Florida, this rapid urbanization has transformed the Tampa Bay area into a major economic asset both to the state, and to the nation as a whole. Tampa Bay constitutes the central geographic feature most responsible for both historic and present shipping, industrial development, aesthetic, and recreational values that encompass the overall attractiveness of the region to population influx. The rapid growth rate of the region's population and business sector over the past 30 years confirms that the mere presence of Tampa Bay has contributed significantly to the economic growth and diversity of the region.

## B. WATER QUALITY "INDEPENDENT" USES OF TAMPA BAY

### Shipping and Water-Borne Commerce

Examples of economic entities which are dependent upon the direct utilization of Tampa Bay would include the port facilities of Tampa, St. Petersburg and Manatee County; ship building and repair firms as well as other marina facilities located around the bay; and the commercial and recreational fishing industries. Indirectly, the mere presence of the bay attracts industries and businesses such as water-oriented residential developments, restaurants, and a myriad of related support industries and commercial and recreational activities that would exist without consideration of the water quality.

The direct and indirect economic impacts associated with the port activities on and along Tampa Bay are considerable. The primary direct impact of the Port of Tampa is estimated at $298 million per year. This figure represents a measure of the revenues that flow from the principal port users. Another primary impact concerns the total direct employment associated with port activities. The primary indirect impact associated with Tampa Bay port activities is the transportation savings that the users of the ports realize by routing their shipments via Tampa Bay ports in lieu of some other port or mode of transportation.

Tampa Bay is one of the country's key commercial waterways, utilizing Florida's largest open water estuary. Including all contiguous wetlands the total area of the bay is about 398 square miles, representing an average volume within the bay of 116 billion cubic feet.(9) The numerous ports and supporting facilities located within Tampa Bay directly benefit from the bay system. Goods and services economicallly can be transported across great distances and in large volumes, by the water transport system. The natural shape of Tampa Bay provides shelter and easy access for deep draft ocean-going vessels. The port of Tampa has become the nation's seventh largest port in terms of tonnage transported, and is the third largest U.S. port in volume of foreign exports.

During the past 100 years, channel dimensions in Tampa Bay have repeatedly been enlarged, allowing larger ships to call on the ports, resulting in a dramatic increase in the annual tonnage transiting the port. The deepening of Tampa's shipping channels has resulted in a tremendous economic impact. Dredging is a critical component of the port operations that provide a necessary transportation link which major portions of the region's economy depend upon. The shallow natural depth of Tampa Bay has required the dredging of well in excess of 100 million cubic yards of material to create and maintain the large port infrastructure in place today. Disposal practices, historically, have resulted in large-scale changes in shoreline and benthic topography, and are commonly viewed as major contributors to the loss of natural habitats and changes in water quality which the bay has experienced.

The ports located on Tampa Bay realize approximately $281 million in transportation savings. This, however, is not without cost. There is a need for maintenance dredging to keep the ports operating. It is imperative that the dredge spoil is placed in an area where it will result in minimal damage to the fragile ecological systems. Dredging can result in physical alteration, turbidity problems, and resuspension of sediments which can affect seagrasses and other types of highly productive emergent and submergent vegetation. The loss of this vegetation results in a loss of habitat available for nursery utilization and subsequently affecting the adult populations of finfish and shellfish, not only in the bay, but in Gulf populations as well.

Electric and Sanitary Services

Currently, the vast quantities of water existing in Tampa Bay are utilized as a receiving body for treated wastewater and industrial effluent discharges, as well as a source of cooling water for electric power generating facilities located on the bay.

It has been documented in this study that the least costly method of wastewater disposal involves the ultimate disposal of treated wastewater to surface waters of Tampa Bay. The next best available alternatives include wastewater reuse via spray irrigation, deep-well injection and a gulf outfall, or a combination of each of these. Wastewater treatment with discharge into Tampa Bay may be the least costly and economically preferable method, however, it is perhaps the most costly

regarding the ecological health of the bay due to the contribution of excessive nutrients and fecal coliform, resulting in closure of public beaches, shellfishing areas and eutrophication within the bay.

It has also been documented in this study that the use of bay water as a cooling source for electric power generating plants located along Tampa Bay results in both economic and environmental impacts. Cooling system alternatives available to both the Florida Power Corporation and the Tampa Electric Company include the conventional once-through cooling system, cooling towers and cooling ponds. The least costly and economically preferable system is that of once-through cooling. However, there are environmental impacts associated with both the intake of water from Tampa Bay and the ultimate discharge into the Bay.

The vast quantities of water contained within Tampa Bay provides an easily accessible cooling water source (and reservoir). The most economical way of condensing steam to be returned to the boilers, in the electrical power production process, is achieved using an open-cycle cooling system which passes water from the environment through the condensor element and discharges it back into the environment at an elevated temperature. Although the discharges of "waste" heat into the subtropical Tampa Bay estuary results in demonstrable impacts, perhaps a greater problem results from the capture and inclusion of planktonic eggs and larvae of fish and shellfish in the cooling water of power plants. This process termed "entrainment", usually leads to high rates of mortality for those organisms involved. Mortality results from thermal stresses, chemical stresses (associated with biocides used to prevent fouling of the cooling system), physical stresses (associated with pressure changes) and other impacts and abrasions during passage through the cooling system. Assuming a 100 percent mortality rate for all entrained organisms, and adjusting for estimated natural mortality rates of estuarine fish eggs and larvae, it can be estimated that power plant entrainment is responsible for annually removing approximately three billion harvestable adults from the commercial and recreational fisheries of Tampa Bay.(10)

Historically, the diluting potential of bay waters has been taken for granted in the design of stormwater systems. In the past, stormwater drainage systems were designed to remove the potential floodwaters as quickly as possible. In effect, this was accomplished by channeling runoff directly into Tampa Bay and tributaries without the benefit of pretreatment. Urban and agricultural stormwater runoff have been identified as the major sources of water pollution in Tampa Bay, with the former apparently predominating.(11) Due to the highly urbanized character of the study area, and the slow natural flushing rates in portions of the estuary, stormwater runoff pollution presents a particularly intractable problem for Tampa Bay.

Stormwater runoff and municipal discharge are major contributors of nutrients into the water column. This addition of nutrient rich material can result in a eutrophication problem in the bay. This nutrient rich condition can trigger algal blooms which will cause fish kills, shade out submergent plants, and create unpleasent odors in the bay.

## C. WATER QUALITY "DEPENDENT" USES OF TAMPA BAY

### Benefits of Tampa Bay to Waterfront Property Owners

In general terms, the presence of Tampa Bay enhances the value and desirability of the homes and neighborhoods located on the bay. It appears that owners of single-family, residential waterfront property are willing to pay more for their home, primarily for the water view, and secondarily for the ease of access to the bay and ability to navigate a boat close to their home.

The intrinsic value of Tampa Bay is closely associated with water quality. A waterfront home on Tampa Bay would not be as valuable if the bay water were to deteriorate or be degraded. The value of property fluctuates in relation to its geographic proximity to Tampa Bay and tributaries. Valuations of land adjacent to water will vary according to proposed land use and zoning densities. However, it is generally accepted that property values increase with water frontage or direct access to the bay.

In addition to residential property values, commercial and office space located on or near the waters of Tampa Bay generally demand a higher price per square foot. Again, the environmental amenity offered is largely one of a water view. Some examples of waterfront development that preclude higher prices in terms of owning, leasing or utilizing include: highrise, waterfront office space; hotel, motel, and tourist court establishments; and restaurants, and other eating and drinking places.

### Water-Oriented Recreational Activities

The recreation-related uses of Tampa Bay include boating, fishing, saltwater beach activities and boat ramp use. These activities have a tremendous impact on the region's economy. As documented earlier in this study, the retail sales reported for motorboats, yachts and marine accessories in Pinellas, Hillsborough and Manatee Counties was approximately $184 million in 1983. The total economic value of recreational fishing in the Tampa Bay region is estimated at $197 million.

The recreational benefits of Tampa Bay are directly linked to water quality and aesthetic benefits. The alteration of the system beyond its ability to recover will cause significant degradation, resulting in a decline in tourism, boating, and recreational activities in general. The bay could become a major liability rather than an asset.

### Commercial Fishing

The commercial fishing industry is an important source of income and employment in the Tampa Bay region. A total of 1,952 commercial fishermen plied their trade during 1984 in Hillsborough, Manatee and Pinellas Counties, which represents ten percent of all commercial fishermen in Florida. A total of 22.1 million pounds of fish, valued at $19.5 million, were landed in Hillsborough, Manatee and Pinellas Counties in 1984.

Historically, Tampa Bay has been one of the state's most productive fishery habitats. Prior to the turn of the century, sturgeon were still fished commercially. The bay supported thriving scallop and oyster fisheries up until about the early 1950s. Those fisheries have since collapsed completely primarily due to overfishing, water quality degradation and habitat loss. Tampa Bay still supports reasonably productive fisheries for spotted seatrout, red and black drum and mullet. Of special concern are spotted seatrout and red drum which constitute the bulk of the recreational finfish landings in Tampa Bay.

Commercially and recreationally valuable macroinvertebrates within the Tampa Bay estuary include the following: pink shrimp, stone crab, blue crab, oyster, bay scallop, southern quahog, sunray venus clam, and squid.(12) Currently, the most valuable fishery is the pink shrimp.

Both commercial and recreational fisheries are affected by a loss of habitat. With 90 percent of the commercially and recreationally valuable species being estuarine dependant, any loss of saltmarsh shoreline (development activities) or seagrass beds (dredging, water quality) will contribute to the decline of fishery stocks. This trend can be slowed through the acceptance of the value of these habitats and efforts to restore this valuable area where possible.

## D. SUMMARY

Tampa Bay is the largest open water estuary in the State of Florida, with over 1.6 million people living in the three counties bordering its shores. This population represents a 45 percent increase since 1970. Once the state's most diverse and productive estuarine system, rapid urban and industrial development have significantly changed the character and ecology of Tampa Bay. Recent studies have indicated that 44 percent of the original 25,000 acres of mangrove forests and salt marshes have been destroyed, and 81 percent of the original 76,500 acres of seagrasses have disappeared. This habitat loss has resulted in declining populations of economically important fish and shellfish including a complete collapse of fisheries, scallops and oysters, and major declines for bait shrimp, spotted seatrout and red drum.

Presently, Tampa Bay continues to perform the various natural functions indicative of all estuaries, however, the ability of the bay to "function naturally" has been stressed by 100 solid years of competing uses. Although the Tampa Bay estuary has great resiliency and recovery potential through the natural systems, it takes many years for the system to recover. Tampa Bay is being stressed through stormwater runoff, wastewater discharge, dredging activities, development and habitat loss, faster than the system can recover naturally. In order for Tampa Bay to remain an economic resource, it must be allowed to function as a natural resource.

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# APPENDIX A

APPENDIX A

## Study Area Economic Base Model

| *1 SIC CODE | *2 E INDUSTRY BY REGION MONTH 1 | *3 E INDUSTRY BY REGION MONTH 2 | *4 E INDUSTRY BY REGION MONTH 3 | *5 CONTACTS INFLUENTIAL DATA | *6 AVERAGE MONTHLY E IR | *7 E INDUSTRY NATIONAL MONTH 1 | *8 E INDUSTRY NATIONAL MONTH 2 | *9 E INDUSTRY NATIONAL MONTH 3 | *10 AVERAGE MONTHLY E IN | EIR/EIN | *11 ER/EN | *12 LQI | *13 XIR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 016 | 1487 | 3076 | 3500 | 46 | 2733.6667 | 71205 | 71089 | 82013 | 74769 | 0.036561498304 | 0.003637972 | 10.0499678382 | 2461.659162695 |
| 017 | 96 | 147 | 158 | 43 | 176.66667 | 121151 | 116039 | 128315 | 121835 | 0.001450048563 | 0.003637972 | 0.398587095649 | -266.565612037 |
| 018 | 539 | 596 | 629 | 603 | 1191 | 102600 | 105246 | 115409 | 107751.67 | 0.011053193299 | 0.003637972 | 3.038284597797 | 799.0024890153 |
| 024 | 149 | 149 | 156 | 0 | 151.33333 | 26349 | 26190 | 26192 | 26243.667 | 0.005766470641 | 0.003637972 | 1.585078488741 | 55.85961742068 |
| 072 | 340 | 647 | 503 | 0 | 496.66667 | 65340 | 61738 | 62383 | 63153.667 | 0.007864415368 | 0.003637972 | 2.161758275228 | 266.9154163266 |
| 074 | 320 | 329 | 339 | 17 | 346.33333 | 81035 | 80772 | 81911 | 81239.333 | 0.004263123774 | 0.003637972 | 1.17184083828 | 50.78693998385 |
| 075 | 68 | 77 | 76 | 9 | 82.666667 | 37425 | 37541 | 38215 | 37727 | 0.002191180498 | 0.003637972 | 0.602308290395 | -54.5830906171 |
| 076 | 164 | 143 | 245 | 0 | 184 | 98979 | 89982 | 84388 | 91116.333 | 0.002019396449 | 0.003637972 | 0.55508855788 | -147.478639558 |
| 078 | 1089 | 1126 | 1100 | 88 | 1193 | 137198 | 138821 | 154219 | 143412.67 | 0.008318651537 | 0.003637972 | 2.286618007561 | 671.2687812066 |
| 091 | 137 | 129 | 141 | 0 | 135.66667 | 13814 | 13753 | 13201 | 13589.333 | 0.009983320251 | 0.003637972 | 2.744199556852 | 86.22905695351 |
| 138 | 34 | 31 | 33 | 3 | 35.666667 | 354100 | 350800 | 347400 | 350766.67 | 0.00010168203 | 0.003637972 | 0.027950198351 | -1240.41253028 |
| 147 | N/A | N/A | N/A | 1113 | 1113 | 21200 | 21300 | 21300 | 21266.667 | 0.052335423197 | 0.003637972 | 14.38587980079 | 1035.632469101 |
| 152 | 1846 | 1871 | 1849 | 872 | 2727.3333 | 480600 | 475900 | 478300 | 478266.67 | 0.005702536939 | 0.003637972 | 1.5675044922 | 987.4127481577 |
| 153 | 292 | 261 | 260 | 11 | 282 | 59500 | 59800 | 61500 | 60266.667 | 0.00467920354 | 0.003637972 | 1.286212197679 | 62.75157387807 |
| 154 | 2077 | 2065 | 2068 | 834 | 2904 | 469000 | 465000 | 471000 | 468333.33 | 0.006200711744 | 0.003637972 | 1.704442008401 | 1200.216600103 |
| 161 | 589 | 596 | 584 | 184 | 773.66667 | 174100 | 174100 | 189500 | 179233.33 | 0.004316533383 | 0.003637972 | 1.186521988531 | 121.6208772543 |
| 162 | 2513 | 2458 | 2438 | 537 | 3006.6667 | 509600 | 505500 | 513300 | 509466.67 | 0.005901596441 | 0.003637972 | 1.622221658715 | 1153.241365313 |
| 171 | 3310 | 3321 | 3303 | 477 | 3788.3333 | 514400 | 510500 | 505900 | 510266.67 | 0.007424222629 | 0.003637972 | 2.040758779147 | 1931.997654642 |
| 172 | 655 | 680 | 708 | 73 | 754 | 119600 | 119700 | 118300 | 119200 | 0.006325503356 | 0.003637972 | 1.738744532766 | 320.3537766526 |
| 173 | 2198 | 2238 | 2210 | 841 | 3056.3333 | 413800 | 409000 | 408700 | 410500 | 0.007445391799 | 0.003637972 | 2.04657772768 | 1562.945961822 |
| 174 | 2122 | 2191 | 2258 | 104 | 2294.3333 | 308600 | 320200 | 315100 | 314633.33 | 0.007292086026 | 0.003637972 | 2.004437275153 | 1149.706179481 |
| 175 | 557 | 561 | 579 | 11 | 576.66667 | 123000 | 120500 | 120600 | 121366.67 | 0.004751441912 | 0.003637972 | 1.306068969047 | 135.1381713625 |
| 176 | 945 | 913 | 908 | 237 | 1159 | 154700 | 156900 | 147500 | 153033.33 | 0.007573513396 | 0.003637972 | 2.081795593209 | 602.2690684039 |
| 177 | 470 | 478 | 479 | 6 | 481.66667 | 96300 | 101200 | 102100 | 99866.667 | 0.004823097463 | 0.003637972 | 1.325765535753 | 118.3545623186 |
| 178 | 56 | 56 | 57 | 0 | 56.333333 | 15200 | 14900 | 15300 | 15133.333 | 0.00372246696 | 0.003637972 | 1.023225933455 | 1.278695358026 |
| 179 | 1495 | 1506 | 1508 | 497 | 2000 | 340900 | 341100 | 346500 | 342833.33 | 0.005833738454 | 0.003637972 | 1.603568960791 | 752.7820449867 |
| 201 | 86 | 91 | 88 | 78 | 166.33333 | 345500 | 343200 | 345900 | 344866.67 | 0.000482312005 | 0.003637972 | 0.132577174336 | -1088.28183075 |
| 203 | 146 | 356 | 250 | 3093 | 3343.6667 | 201900 | 207600 | 204900 | 204800 | 0.016326497396 | 0.003637972 | 4.487802233261 | 2598.610068144 |
| 204 | 36 | 32 | 32 | 83 | 116.33333 | 131500 | 130600 | 129200 | 130433.33 | 0.000891898799 | 0.003637972 | 0.24516375585 | -358.179438467 |
| 205 | 405 | 395 | 377 | 77 | 469.33333 | 213700 | 212700 | 212800 | 213066.67 | 0.002202753442 | 0.003637972 | 0.605489443067 | -305.797164328 |
| 208 | N/A | N/A | N/A | 751 | 751 | 221500 | 221000 | 222400 | 221633.33 | 0.003388479471 | 0.003637972 | 0.931419971278 | -55.2957883212 |
| 209 | 946 | 1010 | 1013 | 407 | 1396.6667 | 162500 | 161100 | 163700 | 162433.33 | 0.008598399343 | 0.003637972 | 2.363514649827 | 805.7388013502 |
| 212 | 585 | 645 | 674 | 0 | 634.66667 | 5600 | 5500 | 5400 | 5500 | 0.115393939394 | 0.003637972 | 31.71930674175 | 614.6578224686 |
| 232 | N/A | N/A | N/A | 725 | 725 | 334100 | 337700 | 343300 | 338366.67 | 0.002142646045 | 0.003637972 | 0.588967215164 | -505.96834821 |
| 233 | 600 | 440 | 601 | 138 | 685 | 391800 | 402300 | 401100 | 398400 | 0.00171937751 | 0.003637972 | 0.472619818097 | -764.367914275 |
| 239 | 291 | 289 | 288 | 54 | 343.33333 | 176800 | 178800 | 180800 | 178800 | 0.001920208799 | 0.003637972 | 0.527824010831 | -307.136001688 |
| 243 | 807 | 840 | 837 | 107 | 935 | 211200 | 211400 | 216400 | 213000 | 0.004389671362 | 0.003637972 | 1.206626042427 | 160.1120337837 |
| 245 | 274 | 320 | 330 | 161 | 469 | 66000 | 67800 | 70900 | 68233.333 | 0.006873473376 | 0.003637972 | 1.889369680325 | 220.7690662215 |
| 249 | 86 | 88 | 102 | 18 | 110 | 79500 | 80300 | 82200 | 80666.667 | 0.001363636364 | 0.003637972 | 0.374834244585 | -183.463048238 |
| 251 | 215 | 221 | 222 | 67 | 286.33333 | 288400 | 292600 | 293200 | 291400 | 0.000982612674 | 0.003637972 | 0.270099045 | -773.771611997 |
| 254 | 60 | 73 | 69 | 3 | 70.333333 | 63200 | 63300 | 63700 | 63400 | 0.00110935857 | 0.003637972 | 0.30493875979 | -160.314070695 |
| 264 | 127 | 129 | 126 | 325 | 452.33333 | 217100 | 219200 | 220000 | 218766.67 | 0.002067651988 | 0.003637972 | 0.568352965505 | -343.53360286 |
| 265 | 310 | 313 | 451 | 433 | 791 | 193200 | 194000 | 194900 | 194033.33 | 0.004076619138 | 0.003637972 | 1.120574733596 | 85.11222983642 |
| 271 | 3507 | 3467 | 3586 | 187 | 3707 | 435900 | 437100 | 437100 | 436700 | 0.008488664987 | 0.003637972 | 2.333351040598 | 2118.297770673 |
| 272 | 435 | 442 | 437 | 97 | 535 | 101600 | 102200 | 102800 | 102200 | 0.005234833659 | 0.003637972 | 1.43894294154 | 163.1992950831 |
| 273 | 14 | 16 | 15 | 19 | 34 | 99800 | 101000 | 101700 | 100833.33 | 0.000337190083 | 0.003637972 | 0.092686285934 | -332.828810298 |

(* See Description Attached)

( N/A-Not Available)

| 1 SIC CODE | 2 E INDUSTRY BY REGION MONTH 1 | 3 E INDUSTRY BY REGION MONTH 2 | 4 E INDUSTRY BY REGION MONTH 3 | 5 CONTACTS INFLUENTIAL DATA | 6 AVERAGE MONTHLY E IR | 7 E INDUSTRY NATIONAL MONTH 1 | 8 E INDUSTRY NATIONAL MONTH 2 | 9 E INDUSTRY NATIONAL MONTH 3 | 10 AVERAGE MONTHLY E -IN | EIR/EIN | 11 ER/EN | 12 LQI | 13 XIR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 274 | 182 | 198 | 196 | 11 | 203 | 53800 | 54200 | 55000 | 54333.333 | 0.003736196319 | 0.003637972 | 1.026999838231 | 5.336872467505 |
| 275 | 1378 | 1384 | 1397 | 925 | 2311.3333 | 451900 | 454300 | 459200 | 455133.33 | 0.005078365314 | 0.003637972 | 1.395933165932 | 655.571159512 |
| 279 | 117 | 125 | 124 | 18 | 140 | 45700 | 45800 | 45900 | 45800 | 0.003056768559 | 0.003637972 | 0.840239791355 | -26.6191025949 |
| 284 | 140 | 129 | 139 | 64 | 200 | 143800 | 144800 | 145700 | 144766.67 | 0.001381533502 | 0.003637972 | 0.379753782218 | -326.657032438 |
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| 287 | 195 | 188 | 290 | 120 | 344.33333 | 60400 | 61200 | 62200 | 61266.667 | 0.005620239391 | 0.003637972 | 1.54488267001 | 121.446935539 |
| 289 | 39 | 39 | 40 | 29 | 68.333333 | 91300 | 91500 | 91700 | 91500 | 0.000746812386 | 0.003637972 | 0.205282628182 | -264.541074689 |
| 295 | 2 | 1 | 48 | 65 | 82 | 22400 | 23200 | 23700 | 23100 | 0.00354978355 | 0.003637972 | 0.975758985903 | -2.03714563191 |
| 306 | 43 | 56 | 59 | 21 | 73.666667 | 130100 | 131500 | 132800 | 131466.67 | 0.000560344828 | 0.003637972 | 0.154026715447 | -404.605342529 |
| 307 | 791 | 787 | 768 | 264 | 1046 | 521100 | 530300 | 536000 | 529133.33 | 0.001976817437 | 0.003637972 | 0.543384505253 | -878.972077577 |
| 321 | N/A | N/A | N/A | 393 | 393 | 16200 | 16000 | 15800 | 16000 | 0.0245625 | 0.003637972 | 6.751701830583 | 334.792453242 |
| 322 | N/A | N/A | N/A | 183 | 183 | 100099 | 101500 | 101200 | 100933 | 0.001813083927 | 0.003637972 | 0.498377692363 | -184.191394808 |
| 325 | N/A | N/A | N/A | 178 | 178 | 36600 | 36800 | 37900 | 37100 | 0.004797843666 | 0.003637972 | 1.318823811136 | 43.0312509548 |
| 327 | 350 | 340 | 379 | 358 | 714.33333 | 176300 | 179300 | 185500 | 180366.67 | 0.003960450933 | 0.003637972 | 1.088642598115 | 58.164509355889 |
| 329 | 42 | 42 | 43 | 376 | 418.33333 | 116800 | 118200 | 119000 | 118000 | 0.00354519774 | 0.003637972 | 0.974498445667 | -10.9473240072 |
| 331 | N/A | N/A | N/A | 194 | 194 | 343800 | 345900 | 347900 | 345866.67 | 0.000560909792 | 0.003637972 | 0.15418201194 | -1064.25313575 |
| 341 | N/A | N/A | N/A | 353 | 353 | 60300 | 61100 | 61700 | 61033.333 | 0.005783724741 | 0.003637972 | 1.589821268949 | 130.9624622626 |
| 342 | 24 | 25 | 21 | 6 | 29.333333 | 145000 | 145800 | 146900 | 145900 | 0.000201050948 | 0.003637972 | 0.055264572197 | -501.446733667 |
| 344 | 1659 | 1719 | 1641 | 216 | 1889 | 434700 | 435200 | 436500 | 436133.33 | 0.004331244268 | 0.003637972 | 1.190565693706 | 302.3592879539 |
| 345 | 6 | 6 | 6 | 8 | 14 | 91300 | 92300 | 93400 | 92333.333 | 0.000151624549 | 0.003637972 | 0.041678320337 | -321.906051083 |
| 347 | 134 | 135 | 137 | 3 | 138.33333 | 98400 | 99700 | 101100 | 99733.333 | 0.001387032086 | 0.003637972 | 0.381265224271 | -224.493708125 |
| 349 | 287 | 290 | 292 | 258 | 547.66667 | 222500 | 224200 | 225700 | 224133.33 | 0.00244348602 | 0.003637972 | 0.671661640133 | -267.724050835 |
| 352 | 26 | 27 | 26 | 30 | 56.333333 | 114600 | 117900 | 119600 | 117366.67 | 0.000479977279 | 0.003637972 | 0.131935408631 | -370.643275281 |
| 353 | 100 | 102 | 102 | 44 | 145.33333 | 261400 | 265400 | 270200 | 265666.67 | 0.000547051443 | 0.003637972 | 0.150372650525 | -821.154474295 |
| 354 | 195 | 200 | 206 | 107 | 307.33333 | 297300 | 301000 | 303000 | 300433.33 | 0.001022966826 | 0.003637972 | 0.281191531386 | -785.634622771 |
| 355 | 238 | 233 | 243 | 67 | 305 | 164200 | 165000 | 165800 | 165000 | 0.001848484848 | 0.003637972 | 0.508108642659 | -295.265325942 |
| 356 | 134 | 129 | 133 | 117 | 249 | 264600 | 267000 | 271000 | 267533.33 | 0.000930725143 | 0.003637972 | 0.255836281066 | -724.278688083 |
| 357 | 170 | 162 | 164 | 32 | 197.33333 | 492300 | 494700 | 495500 | 494166.67 | 0.000399325464 | 0.003637972 | 0.109765962934 | -1600.43100143 |
| 359 | 524 | 511 | 519 | 0 | 518 | 255800 | 257900 | 261100 | 258266.67 | 0.002005678885 | 0.003637972 | 0.551317895107 | -421.566817253 |
| 366 | 198 | 203 | 199 | 193 | 393 | 593200 | 593700 | 598100 | 595000 | 0.000660504202 | 0.003637972 | 0.181558368554 | -1771.59314506 |
| 367 | 857 | 870 | 878 | 654 | 1522.3333 | 635700 | 648800 | 660300 | 648266.67 | 0.002348313451 | 0.003637972 | 0.645500752269 | -836.042436146 |
| 369 | N/A | N/A | N/A | 563 | 563 | 159000 | 159600 | 160400 | 159666.67 | 0.003526096033 | 0.003637972 | 0.96924779821 | -17.8628103562 |
| 371 | 123 | 122 | 128 | 294 | 418.33333 | 833300 | 852100 | 863000 | 849466.67 | 0.000492465861 | 0.003637972 | 0.135368250575 | -2672.00233663 |
| 372 | 90 | 91 | 96 | 75 | 167.33333 | 581500 | 588200 | 591000 | 586900 | 0.000285113875 | 0.003637972 | 0.078371658946 | -1967.79224118 |
| 373 | 2618 | 2952 | 2928 | 63 | 2895.6667 | 196700 | 201700 | 203600 | 200666.67 | 0.014430232558 | 0.003637972 | 3.966559901416 | 2165.647017743 |
| 379 | 84 | 87 | 85 | 0 | 85.333333 | 48100 | 49500 | 50800 | 49466.667 | 0.001725067385 | 0.003637972 | 0.474183842206 | -94.6249987269 |
| 381 | N/A | N/A | N/A | 378 | 378 | 77600 | 77700 | 78600 | 77966.667 | 0.004848225737 | 0.003637972 | 1.33267275672 | 94.35947527699 |
| 391 | 44 | 44 | 44 | 0 | 44 | 52400 | 52500 | 52600 | 52500 | 0.000838095238 | 0.003637972 | 0.230374316672 | -146.9935128 |
| 394 | 212 | 220 | 224 | 3 | 221.66667 | 108800 | 113400 | 116800 | 113000 | 0.001961651917 | 0.003637972 | 0.539215830706 | -189.424132312 |
| 395 | 125 | 124 | 126 | 0 | 125 | 33100 | 33000 | 33300 | 33133.333 | 0.003772635815 | 0.003637972 | 1.03701627023 | 4.461871921901 |
| 399 | 240 | 241 | 239 | 277 | 517 | 123700 | 125200 | 126500 | 125133.33 | 0.004131592968 | 0.003637972 | 1.135685854531 | 61.76847806321 |
| 401 | N/A | N/A | N/A | 510 | 510 | 361400 | 364300 | 366200 | 363966.67 | 0.001401227219 | 0.003637972 | 0.385167160385 | -814.100423023 |
| 411 | 598 | 588 | 586 | 69 | 659.66667 | 77700 | 80200 | 80300 | 79400 | 0.008308144416 | 0.003637972 | 2.283729826579 | 370.8117158799 |
| 412 | 139 | 134 | 132 | 18 | 153 | 39700 | 39200 | 38600 | 39166.667 | 0.003906382979 | 0.003637972 | 1.073780482785 | 10.51277616523 |
| 413 | N/A | N/A | N/A | 162 | 162 | 39400 | 36800 | 36400 | 37533.333 | 0.00431616341 | 0.003637972 | 1.18642029103 | 25.45479656344 |
| 421 | 1290 | 1276 | 1263 | 2093 | 3369.3333 | 1141400 | 1148700 | 1160800 | 1150300 | 0.002929090962 | 0.003637972 | 0.805143971851 | -815.425481402 |
| 422 | 274 | 260 | 254 | 342 | 604.66667 | 86300 | 85200 | 84700 | 85400 | 0.007080405933 | 0.003637972 | 1.946250980079 | 293.9838858457 |
| 445 | 391 | 373 | 368 | 200 | 577.33333 | 27400 | 27000 | 27900 | 27433.333 | 0.021044957473 | 0.003637972 | 5.784805206828 | 477.5316437878 |
| 446 | 508 | 572 | 578 | 330 | 882.66667 | 99200 | 97100 | 101500 | 99266.667 | 0.008891873741 | 0.003637972 | 2.444184436146 | 521.537345322 |
| 452 | 74 | 75 | 76 | 3 | 78 | 400700 | 402800 | 404900 | 402800 | 0.000193644489 | 0.003637972 | 0.053228696103 | -1387.37498963 |
| 458 | 89 | 89 | 89 | 137 | 226 | 56600 | 57000 | 57300 | 56966.667 | 0.0039672323 | 0.003637972 | 1.090506649547 | 18.75688039691 |
| 471 | 95 | 97 | 98 | 257 | 353.66667 | 55600 | 57100 | 57500 | 56733.333 | 0.006233842538 | 0.003637972 | 1.713548949686 | 147.2724071205 |
| 472 | 495 | 490 | 495 | 211 | 704.33333 | 155400 | 157200 | 160500 | 157700 | 0.004466286197 | 0.003637972 | 1.227685809467 | 130.6252[illegible]05994 |
| 481 | 41 | 41 | 41 | 4210 | 4251 | 999300 | 994400 | 99100 | 697600 | 0.00609375 | 0.003637972 | 1.675040530488 | 1713.[illegible]096135 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIC CODE | E INDUSTRY BY REGION MONTH 1 | E INDUSTRY BY REGION MONTH 2 | E INDUSTRY BY REGION MONTH 3 | CONTACTS INFLUENTIAL DATA | AVERAGE MONTHLY E IR | E INDUSTRY NATIONAL MONTH 1 | E INDUSTRY NATIONAL MONTH 2 | E INDUSTRY NATIONAL MONTH 3 | AVERAGE MONTHLY E IN | EIR/EIN | ER/EN | LQI | XIR |
| 483 | 454 | 436 | 501 | 806 | 1269.6667 | 225800 | 226800 | 227400 | 226666.67 | 0.005601470588 | 0.003637972 | 1.53972353077 | 645.0597542612 |
| 489 | 90 | 89 | 87 | 417 | 505.66667 | 143300 | 143900 | 145600 | 144266.67 | 0.003505083179 | 0.003637972 | 0.963471817527 | -19.171379935 |
| 491 | N/A | N/A | N/A | 4472 | 4472 | 432300 | 431200 | 431600 | 431700 | 0.010359045634 | 0.003637972 | 2.84747836609 | 2901.487629035 |
| 492 | N/A | N/A | N/A | 131 | 131 | 170200 | 169600 | 169500 | 169766.67 | 0.000771647359 | 0.003637972 | 0.212109226957 | -486.606324247 |
| 495 | 194 | 220 | 188 | 312 | 512.66667 | 54100 | 53800 | 54000 | 53966.667 | 0.009499691167 | 0.003637972 | 2.611260345845 | 316.3374620807 |
| 501 | 1229 | 1229 | 1231 | 418 | 1647.6667 | 408700 | 409400 | 410700 | 409600 | 0.004022623698 | 0.003637972 | 1.105732551042 | 157.553469661 |
| 502 | 477 | 530 | 488 | 254 | 752.33333 | 117200 | 119100 | 117800 | 118033.33 | 0.006373905676 | 0.003637972 | 1.752049287453 | 322.9314102704 |
| 503 | 636 | 639 | 647 | 1113 | 1753.6667 | 193100 | 194400 | 196300 | 194600 | 0.009011647825 | 0.003637972 | 2.477107750185 | 1045.717379222 |
| 504 | 151 | 152 | 146 | 30 | 179.66667 | 72000 | 72600 | 73200 | 72600 | 0.002474747475 | 0.003637972 | 0.680254740172 | -84.4500767479 |
| 505 | 451 | 448 | 459 | 296 | 748.66667 | 128400 | 129200 | 130100 | 129233.33 | 0.005793139025 | 0.003637972 | 1.592409052826 | 278.5194608731 |
| 506 | 715 | 723 | 714 | 837 | 1554.3333 | 452400 | 454300 | 459100 | 455266.67 | 0.003414116269 | 0.003637972 | 0.938466974544 | -101.913903378 |
| 507 | 843 | 838 | 814 | 428 | 1259.6667 | 240400 | 241600 | 242500 | 241500 | 0.005216011042 | 0.003637972 | 1.433769097211 | 381.0965077876 |
| 508 | 3187 | 2912 | 2989 | 4264 | 7293.3333 | 1348600 | 1360200 | 1369900 | 1359566.7 | 0.00536445436 | 0.003637972 | 1.474572878395 | 2347.268313292 |
| 509 | 494 | 440 | 460 | 586 | 1050.6667 | 190400 | 190500 | 192200 | 191033.33 | 0.005499912755 | 0.003637972 | 1.511807471441 | 355.6928115203 |
| 511 | 299 | 314 | 304 | 644 | 949.66667 | 167600 | 168000 | 169700 | 168433.33 | 0.0056382 | 0.003637972 | 1.549829195995 | 336.91097 |
| 512 | 136 | 137 | 141 | 82 | 220 | 157300 | 155900 | 156200 | 156466.67 | 0.0014061 | 0.003637972 | 0.386492915166 | -349.2213 |
| 513 | 104 | 113 | 116 | 127 | 238 | 172000 | 173800 | 174800 | 173533.33 | 0.0013715 | 0.003637972 | 0.376994257519 | -393.3094 |
| 514 | 2538 | 2576 | 2575 | 2014 | 4577 | 695100 | 697600 | 701200 | 697966.67 | 0.0065576 | 0.003637972 | 1.802548327247 | 2037.817 |
| 515 | 20 | 19 | 20 | 39 | 58.666667 | 145600 | 143000 | 143900 | 144166.67 | 0.0004069 | 0.003637972 | 0.111858049713 | -465.8076 |
| 516 | 172 | 166 | 165 | 317 | 484.66667 | 124900 | 124700 | 125300 | 124966.67 | 0.0038784 | 0.003637972 | 1.066079649309 | 30.041473 |
| 517 | 367 | 380 | 381 | 379 | 755 | 210000 | 209000 | 208600 | 209200 | 0.003609 | 0.003637972 | 0.992032632657 | -6.063674 |
| 518 | 465 | 449 | 444 | 894 | 1346.6667 | 148100 | 148400 | 148700 | 148400 | 0.0090746 | 0.003637972 | 2.494404586605 | 806.79167 |
| 519 | 909 | 932 | 1039 | 423 | 1389.6667 | 392300 | 397200 | 400200 | 396566.67 | 0.0035042 | 0.003637972 | 0.963241356219 | -53.03163 |
| 521 | 398 | 413 | 544 | 195 | 646.66667 | 323900 | 323300 | 328500 | 325233.33 | 0.0019883 | 0.003637972 | 0.546545234494 | -536.523 |
| 523 | 185 | 180 | 177 | 131 | 311.66667 | 61800 | 60600 | 61200 | 61200 | 0.0050926 | 0.003637972 | 1.39984393811 | 89.0228 |
| 525 | 343 | 346 | 353 | 387 | 734.33333 | 149800 | 149300 | 150300 | 149800 | 0.0049021 | 0.003637972 | 1.347479342683 | 189.36518 |
| 526 | 231 | 235 | 227 | 190 | 421 | 42400 | 43800 | 51900 | 46033.333 | 0.0091455 | 0.003637972 | 2.513913666433 | 253.53204 |
| 527 | 60 | 59 | 59 | 66 | 125.33333 | 25900 | 26800 | 27800 | 26833.333 | 0.0046708 | 0.003637972 | 1.283904294495 | 27.714427 |
| 531 | 575 | 571 | 585 | 5569 | 6146 | 1941600 | 1825700 | 1825400 | 1864233.3 | 0.0032968 | 0.003637972 | 0.906218604231 | -636.0281 |
| 533 | 66 | 68 | 65 | 1256 | 1322.3333 | 206900 | 198700 | 199900 | 201833.33 | 0.0065516 | 0.003637972 | 1.800896441613 | 588.06938 |
| 539 | 24 | 24 | 23 | 38 | 61.666667 | 119000 | 115800 | 115200 | 116666.67 | 0.0005286 | 0.003637972 | 0.145292892901 | -362.7634 |
| 541 | 1121 | 1114 | 1132 | 3592 | 4714.3333 | 2291800 | 2278900 | 2276000 | 2282233.3 | 0.0020657 | 0.003637972 | 0.567807244685 | -3588.367 |
| 542 | 103 | 95 | 91 | 41 | 137.33333 | 56500 | 56700 | 56600 | 56600 | 0.0024264 | 0.003637972 | 0.666960658209 | -68.57586 |
| 543 | 87 | 95 | 92 | 3 | 94.333333 | 22100 | 20700 | 20900 | 21233.333 | 0.0044427 | 0.003637972 | 1.221202515324 | 17.087068 |
| 544 | 16 | 17 | 19 | 23 | 40.333333 | 21000 | 25300 | 23600 | 23300 | 0.001731 | 0.003637972 | 0.475826780679 | -44.43141 |
| 545 | 117 | 123 | 193 | 169 | 313.33333 | 37100 | 37000 | 37000 | 37033.333 | 0.0084608 | 0.003637972 | 2.325704223826 | 178.60712 |
| 546 | 307 | 303 | 305 | 366 | 671 | 142400 | 144100 | 144500 | 143666.67 | 0.0046705 | 0.003637972 | 1.283829029828 | 148.34474 |
| 549 | 57 | 57 | 56 | 74 | 130.66667 | 34600 | 34000 | 33500 | 34033.333 | 0.0038394 | 0.003637972 | 1.055360928926 | 6.8543641 |
| 551,2 | 2772 | 2782 | 2801 | 785 | 3570 | 790700 | 798000 | 803500 | 797400 | 0.0044771 | 0.003637972 | 1.230644660551 | 669.08139 |
| 553 | 476 | 477 | 457 | 786 | 1256 | 279000 | 269800 | 273000 | 273933.33 | 0.0045851 | 0.003637972 | 1.260333395761 | 259.43829 |
| 554 | 1693 | 1717 | 1705 | 400 | 2105 | 566900 | 566800 | 566100 | 566600 | 0.0037151 | 0.003637972 | 1.021212723069 | 43.72525 |
| 555 | 233 | 232 | 225 | 121 | 351 | 23100 | 23400 | 24600 | 23700 | 0.0148101 | 0.003637972 | 4.070984580427 | 264.78007 |
| 556,559 | 85 | 81 | 77 | 57 | 138 | 24500 | 24900 | 25200 | 24866.667 | 0.0055496 | 0.003637972 | 1.52546483453 | 47.535771 |
| 557 | 82 | 89 | 86 | 26 | 111.66667 | 25500 | 27000 | 29600 | 27366.667 | 0.0040804 | 0.003637972 | 1.121611198778 | 12.107509 |
| 561 | 94 | 96 | 112 | 241 | 341.66667 | 120000 | 114900 | 114000 | 116300 | 0.0029378 | 0.003637972 | 0.807539143536 | -81.42944 |
| 562 | 476 | 509 | 537 | 1366 | 1873.3333 | 345900 | 338300 | 340800 | 341666.67 | 0.0054829 | 0.003637972 | 1.507138406519 | 630.35968 |
| 564 | 15 | 18 | 14 | 44 | 59.666667 | 34800 | 30200 | 30300 | 31766.667 | 0.0018783 | 0.003637972 | 0.516298445322 | -55.89957 |
| 565 | 121 | 113 | 118 | 255 | 372.33333 | 182100 | 174400 | 174000 | 176833.33 | 0.0021056 | 0.003637972 | 0.578773278443 | -270.9813 |
| 566 | 170 | 175 | 170 | 460 | 631.66667 | 211600 | 205300 | 206600 | 207833.33 | 0.0030393 | 0.003637972 | 0.83543649595 | -124.4251 |
| 569 | 169 | 171 | 169 | 282 | 451.66667 | 48900 | 48700 | 49100 | 48900 | 0.0092365 | 0.003637972 | 2.538924978658 | 273.76985 |
| 571 | 1292 | 1292 | 1399 | 815 | 2142.6667 | 373900 | 371900 | 374800 | 373533.33 | 0.0057362 | 0.003637972 | 1.576761244934 | 783.76298 |
| 572 | 146 | 142 | 147 | 209 | 354 | 80800 | 79700 | 78000 | 79500 | 0.0044528 | 0.003637972 | 1.223987042695 | 64.781252 |
| 573 | 274 | 270 | 286 | 344 | 620.66667 | 180200 | 184600 | 185200 | 183333.33 | 0.0033855 | 0.003637972 | 0.930588484556 | -46.29481 |
| 581 | 10150 | 10400 | 10633 | 8436 | 18830.333 | 4855600 | 4864600 | 4966400 | 4895533.3 | 0.0038464 | 0.003637972 | 1.057301097233 | 1020.5217 |
| 591 | 757 | 759 | 775 | 891 | 1654.6667 | 523200 | 521100 | 519400 | 521233.33 | 0.0031745 | 0.003637972 | 0.872607665209 | -241.5654 |
| 592 | 222 | 220 | 227 | 266 | 489 | 122400 | 122200 | 120600 | 121733.33 | 0.004017 | 0.003637972 | 1.104180395193 | 46.137582 |
| 593 | 284 | 292 | 306 | 15 | 309 | 70100 | 70500 | 70900 | 70500 | 0.004383 | 0.003637972 | 1.204786380467 | 52.522997 |
| 594 | 1850 | 1888 | 1947 | 1193 | 3088 | 667900 | 649400 | 645300 | 654200 | 0.0047203 | 0.003637972 | 1.297500216046 | 708.03893 |
| 596 | 164 | 175 | 183 | 269 | 443 | 255400 | 256500 | 256000 | 255966.67 | 0.0017307 | 0.003637972 | 0.475730504978 | -488.1995 |
| 598 | 69 | 75 | 112 | 144 | 229.33333 | 109600 | 109100 | 107700 | 108800 | 0.0021078 | 0.003637972 | 0.579400646041 | -166.478 |

| 1 SIC CODE | 2 E INDUSTRY BY REGION MONTH 1 | 3 E INDUSTRY BY REGION MONTH 2 | 4 E INDUSTRY BY REGION MONTH 3 | 5 CONTACTS INFLUENTIAL DATA | 6 AVERAGE MONTHLY E IR | 7 E INDUSTRY NATIONAL MONTH 1 | 8 E INDUSTRY NATIONAL MONTH 2 | 9 E INDUSTRY NATIONAL MONTH 3 | 10 AVERAGE MONTHLY E IN | EIR/EIN | 11 ER/EN | 12 LQI | 13 XIR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 599 | 1129 | 1135 | 1139 | 469 | 1603.3333 | 280900 | 295600 | 286000 | 287500 | 0.0055768 | 0.003637972 | 1.5329453048 | 557.41648 |
| 602 | 3295 | 3295 | 3338 | 5364 | 8673.3333 | 1516700 | 1514800 | 1516600 | 1516033.3 | 0.0057211 | 0.003637972 | 1.572598923874 | 3158.047 |
| 604,605 | N/A | N/A | N/A | 440 | 440 | 49500 | 49700 | 50300 | 49833.333 | 0.0088294 | 0.003637972 | 2.427020393031 | 258.70774 |
| 612 | 265 | 266 | 264 | 1301 | 1566 | 305300 | 306200 | 308100 | 306533.33 | 0.0051087 | 0.003637972 | 1.404283318229 | 450.84042 |
| 614 | 503 | 515 | 521 | 564 | 1077 | 206000 | 207200 | 209100 | 207433.33 | 0.005192 | 0.003637972 | 1.427177019314 | 322.36341 |
| 615 | 143 | 137 | 136 | 160 | 298.66667 | 36600 | 36100 | 36600 | 36433.333 | 0.0081976 | 0.003637972 | 2.253349383731 | 166.12323 |
| 616 | 79 | 82 | 75 | 477 | 555.66667 | 88300 | 89200 | 91200 | 89566.667 | 0.0062039 | 0.003637972 | 1.705330738854 | 229.82567 |
| 621 | 339 | 337 | 327 | 797 | 1131.3333 | 270900 | 274600 | 276500 | 274000 | 0.004129 | 0.003637972 | 1.134960396377 | 134.5291 |
| 628 | 50 | 48 | 53 | 103 | 153.33333 | 60200 | 60800 | 61600 | 60866.667 | 0.0025192 | 0.003637972 | 0.692464869514 | -68.09788 |
| 631 | 238 | 273 | 266 | 6 | 265 | 541200 | 540800 | 540000 | 540666.67 | 0.0004901 | 0.003637972 | 0.134727721697 | -1701.93 |
| 632 | 20 | 19 | 20 | 317 | 336.66667 | 148800 | 150100 | 151100 | 150000 | 0.0022444 | 0.003637972 | 0.616949401087 | -209.0291 |
| 633 | 21 | 19 | 18 | 0 | 19.333333 | 470900 | 469800 | 470800 | 470500 | 4.109E-05 | 0.003637972 | 0.011295040644 | -1692.332 |
| 636 | 164 | 161 | 167 | 201 | 365 | 43700 | 44100 | 44600 | 44133.333 | 0.0082704 | 0.003637972 | 2.273352706961 | 204.44418 |
| 641 | 3267 | 3654 | 3373 | 6904 | 10335.333 | 493200 | 496800 | 497500 | 495833.33 | 0.0208444 | 0.003637972 | 5.729667964753 | 8531.5057 |
| 651 | 2068 | 2089 | 2105 | 763 | 2850.3333 | 480400 | 476900 | 474800 | 477366.67 | 0.005971 | 0.003637972 | 1.641285938128 | 1113.6869 |
| 653 | 1223 | 1240 | 1307 | 1192 | 2448.6667 | 371400 | 374700 | 377600 | 374566.67 | 0.0065373 | 0.003637972 | 1.796971669065 | 1086.0037 |
| 654 | 31 | 31 | 34 | 115 | 147 | 25000 | 25500 | 26000 | 25500 | 0.0057647 | 0.003637972 | 1.584593394755 | 54.231722 |
| 655 | 606 | 606 | 685 | 546 | 1178.3333 | 113900 | 112000 | 114100 | 113333.33 | 0.0103971 | 0.003637972 | 2.857927372682 | 766.02988 |
| 671 | 250 | 264 | 260 | 36 | 294 | 72200 | 72100 | 71700 | 72000 | 0.0040833 | 0.003637972 | 1.122420321284 | 32.06604 |
| 679 | 42 | 41 | 42 | 96 | 137.66667 | 31600 | 31300 | 31500 | 31466.667 | 0.004375 | 0.003637972 | 1.202593201376 | 23.191825 |
| 701 | 3371 | 3851 | 3868 | 4292 | 7988.6667 | 1098100 | 1114800 | 1148700 | 1120533.3 | 0.0071293 | 0.003637972 | 1.959702771754 | 3912.1981 |
| 702 | 37 | 39 | 42 | 3 | 42.333333 | 12900 | 13000 | 13300 | 13066.667 | 0.0032398 | 0.003637972 | 0.890550067491 | -5.20283 |
| 703 | 46 | 54 | 57 | 38 | 90.333333 | 14500 | 14600 | 15500 | 14866.667 | 0.0060762 | 0.003637972 | 1.670225535287 | 36.248821 |
| 721 | 1051 | 1068 | 1083 | 825 | 1892.3333 | 354600 | 352700 | 352200 | 353166.67 | 0.0053582 | 0.003637972 | 1.472850342714 | 607.523 |
| 722 | 37 | 37 | 38 | 203 | 240.33333 | 50600 | 53400 | 52800 | 52266.667 | 0.0045982 | 0.003637972 | 1.263949997365 | 50.188681 |
| 723 | 1098 | 1118 | 1145 | 376 | 1496.3333 | 304600 | 304800 | 305800 | 305066.67 | 0.0049049 | 0.003637972 | 1.348261958286 | 386.50944 |
| 724 | 63 | 64 | 69 | 27 | 92.333333 | 22800 | 22700 | 22900 | 22800 | 0.0040497 | 0.003637972 | 1.113177332602 | 9.3875792 |
| 725,9 | 154 | 182 | 205 | 282 | 462.33333 | 173800 | 186500 | 192600 | 184300 | 0.0025086 | 0.003637972 | 0.689557613749 | -208.1448 |
| 726 | 174 | 176 | 180 | 197 | 373.66667 | 72200 | 72500 | 73400 | 72700 | 0.0051398 | 0.003637972 | 1.412832361295 | 109.18613 |
| 731 | 588 | 602 | 598 | 434 | 1030 | 173600 | 174900 | 174900 | 174466.67 | 0.0059037 | 0.003637972 | 1.622801677931 | 395.29521 |
| 732 | 336 | 331 | 315 | 325 | 652.33333 | 76700 | 76400 | 77400 | 76833.333 | 0.0084902 | 0.003637972 | 2.333783596002 | 372.81584 |
| 733 | 805 | 824 | 750 | 637 | 1430 | 152900 | 153200 | 154600 | 153566.67 | 0.0093119 | 0.003637972 | 2.559645177911 | 871.32882 |
| 734 | 1843 | 1935 | 1883 | 1063 | 2950 | 568000 | 571700 | 574000 | 571233.33 | 0.0051643 | 0.003637972 | 1.419544988828 | 871.86932 |
| 736 | 3214 | 3656 | 3349 | 1000 | 4406.3333 | 726700 | 734100 | 764800 | 741866.67 | 0.0059395 | 0.003637972 | 1.632646557358 | 1707.4434 |
| 737 | 1838 | 1814 | 1843 | 1127 | 2958.6667 | 451700 | 455700 | 459600 | 455666.67 | 0.0064931 | 0.003637972 | 1.784799624691 | 1300.9642 |
| 739 | 5027 | 5050 | 5150 | 2260 | 7335.6667 | 1596900 | 1609500 | 1623300 | 1609900 | 0.0045566 | 0.003637972 | 1.252510499981 | 1478.8961 |
| 751 | 232 | 236 | 235 | 1398 | 1632.3333 | 127000 | 128300 | 130000 | 128433.33 | 0.0127096 | 0.003637972 | 3.493588762531 | 1165.0965 |
| 753 | 1689 | 1714 | 1794 | 404 | 2136.3333 | 385800 | 392500 | 398600 | 392300 | 0.0054457 | 0.003637972 | 1.496895199761 | 709.15705 |
| 754 | 379 | 396 | 417 | 9 | 406.33333 | 74200 | 79900 | 80200 | 78100 | 0.0052027 | 0.003637972 | 1.430118761029 | 122.20775 |
| 762 | 377 | 368 | 390 | 283 | 661.33333 | 86000 | 85700 | 86000 | 85900 | 0.0076989 | 0.003637972 | 2.116254702838 | 348.83157 |
| 763,9 | 719 | 732 | 743 | 331 | 1062.3333 | 181800 | 182600 | 184900 | 183100 | 0.0058019 | 0.003637972 | 1.594825427806 | 396.22072 |
| 764 | 93 | 105 | 104 | 3 | 103.66667 | 23300 | 23900 | 24500 | 23900 | 0.0043375 | 0.003637972 | 1.192290051813 | 16.719144 |
| 781 | 18 | 18 | 18 | 26 | 44 | 98800 | 100000 | 103100 | 100633.33 | 0.0004372 | 0.003637972 | 0.120185342417 | -322.1012 |
| 782 | N/A | N/A | N/A | 40 | 40 | 10400 | 10400 | 10500 | 10433.333 | 0.0038339 | 0.003637972 | 1.053847077427 | 2.0438289 |
| 783 | 51 | 50 | 63 | 81 | 135.66667 | 98600 | 96200 | 98500 | 97766.667 | 0.0013877 | 0.003637972 | 0.381437189 | -220.0057 |
| 791,9 | 1562 | 1594 | 1538 | 251 | 1815.6667 | 484700 | 494600 | 516700 | 498666.67 | 0.003641 | 0.003637972 | 1.000844181497 | 1.5314594 |
| 792 | 274 | 312 | 332 | 44 | 350 | 89900 | 92500 | 94900 | 92433.333 | 0.0037865 | 0.003637972 | 1.040830754887 | 13.730152 |
| 793 | 296 | 298 | 304 | 87 | 386.33333 | 105200 | 107000 | 107200 | 106466.67 | 0.0036287 | 0.003637972 | 0.997445582177 | -0.989384 |
| 794 | 1035 | 995 | 1853 | 386 | 1680.3333 | 58300 | 60000 | 61200 | 59833.333 | 0.0280836 | 0.003637972 | 7.719566832487 | 1462.6614 |
| 801 | 4494 | 4030 | 4041 | 451 | 4639.3333 | 880300 | 885500 | 887600 | 884466.67 | 0.0052453 | 0.003637972 | 1.441832445854 | 1421.6687 |
| 802 | 1489 | 1478 | 1472 | 174 | 1653.6667 | 424200 | 423100 | 423200 | 423500 | 0.0039048 | 0.003637972 | 1.073334884494 | 112.98566 |
| 803 | 161 | 158 | 166 | 21 | 182.66667 | 27900 | 28100 | 28400 | 28133.333 | 0.0064929 | 0.003637972 | 1.784755787012 | 80.318397 |
| 804 | 463 | 463 | 466 | 269 | 735 | 144800 | 147000 | 150900 | 147566.67 | 0.0049672 | 0.003637972 | 1.365388983098 | 196.15665 |
| 805 | 2184 | 2163 | 2196 | 723 | 2904 | 1126200 | 1127600 | 1131900 | 1128566.7 | 0.0025732 | 0.003637972 | 0.707310459227 | -1201.694 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIC CODE | E INDUSTRY BY REGION MONTH 1 | E INDUSTRY BY REGION MONTH 2 | E INDUSTRY BY REGION MONTH 3 | CONTACTS INFLUENTIAL DATA | AVERAGE MONTHLY E IR | E INDUSTRY NATIONAL MONTH 1 | E INDUSTRY NATIONAL MONTH 2 | E INDUSTRY NATIONAL MONTH 3 | AVERAGE MONTHLY E IN | EIR/EIN | ER/EN | LQI | XIR |
| 806 | 11347 | 11138 | 11057 | 886 | 12066.667 | 3016300 | 3013700 | 3012400 | 3014133.3 | 0.0040034 | 0.003637972 | 1.100437908768 | 1101.335 |
| 807 | 520 | 544 | 543 | 234 | 769.66667 | 109500 | 109800 | 110000 | 109766.67 | 0.0070118 | 0.003637972 | 1.927404591195 | 370.33864 |
| 808 | 834 | 847 | 847 | 519 | 1361.6667 | 182500 | 183900 | 185600 | 184000 | 0.0074004 | 0.003637972 | 2.034200094253 | 692.27988 |
| 809 | 774 | 805 | 840 | 267 | 1073.3333 | 101500 | 102800 | 103900 | 102733.33 | 0.0104478 | 0.003637972 | 2.871864361495 | 699.59238 |
| 811 | 3072 | 3081 | 3076 | 759 | 3835.3333 | 617100 | 623900 | 628200 | 623066.67 | 0.0061556 | 0.003637972 | 1.692034774239 | 1568.6344 |
| 821 | 18729 | 18934 | 18890 | 56 | 18907 | 341500 | 346200 | 346500 | 344733.33 | 0.0548453 | 0.003637972 | 15.07578837478 | 17652.87 |
| 822 | 2101 | 2136 | 2193 | 905 | 3048.3333 | 735100 | 826000 | 830200 | 797100 | 0.0038243 | 0.003637972 | 1.051212055758 | 148.50611 |
| 824 | 89 | 90 | 89 | 144 | 233.33333 | 57300 | 58900 | 60400 | 58866.667 | 0.0039638 | 0.003637972 | 1.089552164327 | 19.178068 |
| 823,829 | 173 | 173 | 169 | 424 | 595.66667 | 65400 | 66300 | 67300 | 66333.333 | 0.0089799 | 0.003637972 | 2.468380819365 | 354.34788 |
| 832 | 787 | 806 | 862 | 423 | 1241.3333 | 272400 | 278800 | 282300 | 277833.33 | 0.0044679 | 0.003637972 | 1.228131173379 | 230.58354 |
| 833 | 606 | 591 | 597 | 131 | 729 | 197300 | 198800 | 202400 | 199500 | 0.0036541 | 0.003637972 | 1.004443043384 | 3.2246514 |
| 835 | 900 | 918 | 957 | 470 | 1395 | 311000 | 314200 | 317500 | 314233.33 | 0.0044394 | 0.003637972 | 1.220288847598 | 251.82803 |
| 836 | 1030 | 1060 | 1070 | 52 | 1105.3333 | 256000 | 256000 | 257400 | 256466.67 | 0.0043099 | 0.003637972 | 1.184685374359 | 172.31487 |
| 839 | 733 | 749 | 742 | 161 | 902.33333 | 224400 | 226000 | 226800 | 225733.33 | 0.0039973 | 0.003637972 | 1.098783156232 | 81.121861 |
| 861 | 342 | 345 | 340 | 107 | 449.33333 | 84900 | 85700 | 86700 | 85766.667 | 0.005239 | 0.003637972 | 1.440093840835 | 137.31663 |
| 862 | 54 | 54 | 50 | 53 | 105.66667 | 37900 | 37800 | 37900 | 37866.667 | 0.0027905 | 0.003637972 | 0.76704636788 | -32.09119 |
| 863 | 309 | 288 | 324 | 144 | 451 | 134300 | 137100 | 136900 | 136100 | 0.0033137 | 0.003637972 | 0.910875673468 | -44.12794 |
| 864 | 1202 | 1158 | 1129 | 249 | 1412 | 302600 | 316000 | 318000 | 312200 | 0.0045227 | 0.003637972 | 1.243204246614 | 276.22524 |
| 866 | 48 | 48 | 47 | 111 | 158.66667 | 859500 | 858000 | 856600 | 858033.33 | 0.0001849 | 0.003637972 | 0.050830247585 | -2962.834 |
| 869 | 369 | 362 | 361 | 0 | 364 | 66000 | 67500 | 67700 | 67066.667 | 0.0054274 | 0.003637972 | 1.491885005286 | 120.01337 |
| 881 | 845 | 851 | 823 | 0 | 839.66667 | | | | 0 | | 0.003637972 | 0 | 0 |
| 891 | 1651 | 1650 | 1662 | 1628 | 3282.3333 | 581700 | 583400 | 589100 | 584733.33 | 0.0056134 | 0.003637972 | 1.542998550933 | 1155.09 |
| 893 | 997 | 1010 | 1028 | 1243 | 2254.6667 | 382000 | 392200 | 392900 | 389033.33 | 0.0057956 | 0.003637972 | 1.593074979813 | 839.37442 |
| 899 | 72 | 84 | 93 | 14 | 97 | 0 | 20900 | 21000 | 13966.667 | 0.0069451 | 0.003637972 | 1.909060329222 | 46.189662 |
| 912 | 5513 | 5643 | 5710 | 0 | 5622 | N/A | N/A | N/A | 0 | - | 0.003637972 | 0 | 5622 |
| 913 | 8626 | 8464 | 8460 | 0 | 8516.6667 | N/A | N/A | N/A | 0 | - | 0.003637972 | - | 8516 |
| 921 | 699 | 712 | 729 | 0 | 713.33333 | N/A | N/A | N/A | 0 | - | 0.003637972 | - | 713 |
| 922 | 1824 | 1843 | 1876 | 0 | 1847.6667 | N/A | N/A | N/A | 0 | - | 0.003637972 | - | 1847 |
| 931 | 355 | 390 | 404 | 0 | 383 | N/A | N/A | N/A | 0 | - | 0.003637972 | - | 383 |
| 951 | 38 | 39 | 39 | 0 | 38.666667 | N/A | N/A | N/A | 0 | - | 0.003637972 | - | 38 |
| 953 | 36 | 34 | 38 | 8 | 44 | N/A | N/A | N/A | 0 | - | 0.003637972 | - | 44 |
| 962 | 81 | 82 | 81 | 0 | 81.333333 | N/A | N/A | N/A | 0 | - | 0.003637972 | - | 81 |
| 971 | 9 | 3 | 4 | 0 | 5.3333333 | N/A | N/A | N/A | 0 | - | 0.003637972 | - | 5 |

## ECONOMIC BASE MODEL COLUMN DESCRIPTION

| Column | Heading | Description |
|---|---|---|
| 1 | SIC CODE | Standard Industrial Classification (SIC) code for establishments found within the study area. The three-digit code represents the type of activity in which the establishments are engaged. |
| 2 | EMPLOYMENT/INDUSTRY BY REGION, MONTH 1 | Florida Department of Labor and Employment Security. Study area employment totals for January 1984. |
| 3 | EMPLOYMENT/INDUSTRY BY REGION, MONTH 2 | Florida Department of Labor and Employment Security. Study area employment totals for February 1984. |
| 4 | EMPLOYMENT/INDUSTRY BY REGION, MONTH 3 | Florida Department of Labor and Employment Security. Study area employment totals for March 1984. |
| 5 | CONTACTS INFLUENTIAL DATA | Contacts Influential International Corp.<br>Marketing Information Services<br>3500 East Fletcher Ave., Suite 423<br>Tampa, FL 33612<br>The figures shown represent the average annual employment, in 1984, for those establishments with headquarters located outside of the study area, and those establishments otherwise not included in the Florida Department of Labor and Employment Security employment totals. |
| 6 | AVERAGE MONTHLY EIR | The derivation is as follows:<br>$\frac{\text{EIR, Month 1 + EIR, Month 2 + EIR, Month 3}}{3}$<br>+ Contacts Influential (CI) Data |
| 7 | EMPLOYMENT/INDUSTRY BY NATION, MONTH 1 | U.S. Department of Labor, Bureau of Labor Statistics. National employment totals for January 1984. |
| 8 | EMPLOYMENT/INDUSTRY BY NATION, MONTH 2 | National employment totals for February 1984. |
| 9 | EMPLOYMENT/INDUSTRY BY NATION, MONTH 3 | National employment totals for March 1984. |

| Column | Heading | Description |
|---|---|---|
| 10 | AVERAGE MONTHLY EIN | The derivation is as follows:<br>$\frac{\text{EIN, Month 1 + EIN, Month 2 + EIN, Month 3}}{3}$ |
| 11 | ER/EN | $\frac{\text{Total Employment Region (Study Area)}}{\text{Total Employment Nation}}$<br>$\frac{333,391}{91,637,000} = .0036379$ |
| 12 | LQI | Location Quotient for Industry "I". The derivation is as follows:<br>$\frac{EIR}{EIN} / \frac{ER}{EN}$ |
| 13 | XIR | Exogenous or Export Employment. The derivation is as follows:<br>$XIR = \left[\frac{EIR}{EIN} - \frac{ER}{EN}\right] EIN$ |

APPENDIX B

APPENDIX B

Summary of Study Area
SICs by Major Group

| | | LQI IMPORT | LQI EXPORT | EXPORT EMPLOYMENT |
|---|---|---|---|---|
| MAJOR GROUP 01. Agricultural production - crops | | | | |
| 016 | Vegetables and Melons | | 10. | 2462 |
| 017 | Fruits and Tree Nuts | .39 | | 0 |
| 018 | Horticulture Specialties | | 3.0 | 799 |
| MAJOR GROUP 02. Agricultural production--livestock | | | | |
| 024 | Dairy Farms | | 1.5 | 56 |
| MAJOR GROUP 07. Agricultural services | | | | |
| 072 | Crop Services | | 2.1 | 267 |
| 074 | Veterinary Services | | 1.1 | 51 |
| 075 | Animal Services | .60 | | 0 |
| 076 | Farm Labor and Management | .55 | | 0 |
| 078 | Landscape and Horticulture Services | | 2.2 | 671 |
| MAJOR GROUP 09. Fishing, hunting, and trapping | | | | |
| 091 | Commercial Fishing | | 2.7 | 86 |
| MAJOR GROUP 13. Oil and gas extraction | | | | |
| 138 | Oil and Gas Field Services | .02 | | 0 |
| MAJOR GROUP 14. Mining of nonmetallic minerals | | | | |
| 147 | Chemical and Fertilizer Mineral Mining | | 14. | 1036 |
| MAJOR GROUP 15. Building construction | | | | |
| 152 | Residential Building Contractors | | 1.5 | 987 |
| 153 | Operative Builders | | 1.2 | 63 |
| 154 | Nonresidential Building Contractors | | 1.7 | 1200 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 16. Construction other than building construction | | | | |
| 161 | Highway and Street Construction | | 1.1 | 122 |
| 162 | Heavy Construction | | 1.6 | 1153 |
| MAJOR GROUP 17. Construction--special trade contractors | | | | |
| 171 | Plumbing, Heating, Air Conditioning | | 2.0 | 1932 |
| 172 | Painting and Decorating | | 1.7 | 320 |
| 173 | Electrical Work | | 2.0 | 1563 |
| 174 | Masonry, Tile Setting | | 2.0 | 1150 |
| 175 | Carpentering | | 1.3 | 135 |
| 176 | Roofing and Sheet Metal | | 2.0 | 602 |
| 177 | Concrete Work | | 1.3 | 118 |
| 178 | Water Well Drilling | | 1.0 | 1 |
| 179 | Misc. Special Trade | | 1.6 | 753 |
| MAJOR GROUP 20. Food and kindered products | | | | |
| 201 | Meat Products | .13 | | 0 |
| 203 | Canned and Preserved Fruits and Vegetables | | 4.48 | 2599 |
| 204 | Grain Mill Products | .02 | | 0 |
| 205 | Bakery Products | .60 | | 0 |
| 208 | Beverages | .93 | | 0 |
| 209 | Misc. Food Preparations | | 2.36 | 806 |
| MAJOR GROUP 21. Tobacco manufactures | | | | |
| 212 | Cigars | | 31. | 615 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 23. Apparel from fabrics | | | | |
| 232 | Men's and Boy's Clothing | .58 | | 0 |
| 233 | Women's Outerwear | .47 | | 0 |
| 239 | Misc. Fabricated Textile | .52 | | 0 |
| MAJOR GROUP 24. Lumber and wood products | | | | |
| 243 | Millwork | | 1.2 | 160 |
| 245 | Wood Buildings & Mobile Homes | | 1.8 | 221 |
| 249 | Misc. Wood Products | .37 | | 0 |
| MAJOR GROUP 25. Furniture and fixtures | | | | |
| 251 | Household Furniture | .27 | | 0 |
| 254 | Fixtures and Partitions | .30 | | 0 |
| MAJOR GROUP 26. Paper and allied products | | | | |
| 264 | Paper Products | .56 | | 0 |
| 265 | Paper Boxes & Containers | | 1.1 | 85 |
| MAJOR GROUP 27. Printing and publishing | | | | |
| 271 | Newspapers: Publishing | | 2.3 | 2118 |
| 272 | Periodicals: Publishing | | 1.4 | 163 |
| 273 | Books | .09 | | 0 |
| 274 | Misc. Publishing | | 1.0 | 5 |
| 275 | Commercial Printing | | 1.3 | 656 |
| 279 | Service Industries for Printing | .84 | | 0 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 28. Chemical and allied products | | | | |
| 284 | Soap and Cosmetics Preparations | .37 | | 0 |
| 285 | Paint and Varnish Products | .98 | | 0 |
| 287 | Agriculture Chemicals | | 1.5 | 121 |
| 289 | Misc. Chemical Products | .20 | | 0 |
| MAJOR GROUP 29. Petroleum refining and related industries | | | | |
| 295 | Paving and Roofing Materials | .97 | | 0 |
| MAJOR GROUP 30. Rubber and miscellaneous products | | | | |
| 306 | Rubber Products | .15 | | 0 |
| 307 | Misc. Plastic Products | .54 | | 0 |
| MAJOR GROUP 32. Stone, clay, glass, and concrete products | | | | |
| 321 | Flat Glass | | 6.7 | 335 |
| 322 | Glassware | .49 | | 0 |
| 325 | Clay Products | | 1.3 | 43 |
| 327 | Concrete and Plaster Products | | 1.0 | 58 |
| 329 | Misc. Nonmetallic Mineral Products | .97 | | 0 |
| MAJOR GROUP 33. Primary metal industries | | | | |
| 331 | Steel Products | .15 | | 0 |
| MAJOR GROUP 34. Fabricated metal products | | | | |
| 341 | Metal Cans and Containers | | 1.5 | 131 |
| 342 | Hardware | .05 | | 0 |
| 344 | Fabricated Structural Metal Products | | 1.1 | 302 |
| 345 | Screw Machine Products | .04 | | 0 |

| | | LQI IMPORT | LQI EXPORT | EXPORT EMPLOYMENT |
|---|---|---|---|---|
| 347 | Metal Services | .38 | | 0 |
| 349 | Misc. Fabricated Metal Products | .67 | | 0 |
| MAJOR GROUP 35. Machinery | | | | |
| 352 | Farm and Garden Machinery | .13 | | 0 |
| 353 | Construction Machinery | .15 | | 0 |
| 354 | Metal Working Machinery | .28 | | 0 |
| 355 | Special Industry Machinery | .50 | | 0 |
| 356 | General Industrial Machinery | .25 | | 0 |
| 357 | Office & Computing Machines | .10 | | 0 |
| 359 | Misc. Machinery Machines | .55 | | 0 |
| MAJOR GROUP 36. Electrical and electronic machinery | | | | |
| 366 | Communication Equipment | .18 | | 0 |
| 367 | Electronic Components | .64 | | 0 |
| 369 | Misc. Electrical Equipment | .96 | | 0 |
| MAJOR GROUP 37. Transportation equipment | | | | |
| 371 | Motor Vehicles & Equipment | .13 | | 0 |
| 372 | Aircraft and Parts | .07 | | 0 |
| 373 | Ship & Boat Building & Repairing | | 3.9 | 2166 |
| 379 | Misc. Transportation Equip. | .47 | | 0 |
| MAJOR GROUP 38. Measuring, analyzing, and controlling equipment | | | | |
| 381 | Engineering & Scientific Instruments | | 1.3 | 94 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 39. Miscellaneous manufacturing industries | | | | |
| 391 | Jewelry and Silverware | .23 | | 0 |
| 394 | Toys and Sporting Goods | .53 | | 0 |
| 395 | Office Supplies | | 1.0 | 4 |
| 399 | Misc. Manufactures | | 1.1 | 62 |
| MAJOR GROUP 40. Railroad transportation | | | | |
| 401 | Railroads | .38 | | 0 |
| MAJOR GROUP 41. Local and suburban transit | | | | |
| 411 | Local Transportation | | 2.2 | 371 |
| 412 | Taxicabs | | 1.0 | 10 |
| 413 | Intercity Highway Transportation | | 1.1 | 25 |
| MAJOR GROUP 42. Motor freight transport and warehousing | | | | |
| 421 | Trucking, Local & Long Distance | .80 | | 0 |
| 422 | Public Warehousing | | 1.9 | 294 |
| MAJOR GROUP 44. Water transportation | | | | |
| 445 | Local Water Transportation | | 5.7 | 477 |
| 446 | Water Transportation Services | | 2.4 | 521 |
| MAJOR GROUP 45. Transportation by air | | | | |
| 452 | Noncertified Air Transportation | .05 | | 0 |
| 458 | Air Transportation Services | | 1.0 | 19 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 47. Transportation services | | | | |
| 471 | Freight Forwarding | | 1.7 | 147 |
| 472 | Arrangement of Transportation | | 1.2 | 131 |
| MAJOR GROUP 48. Communication | | | | |
| 481 | Telephone Communication | | 1.6 | 1713 |
| 483 | Radio & Television Broadcasting | | 1.5 | 445 |
| 489 | Communication Services | .96 | | 0 |
| MAJOR GROUP 49. Electric, gas, and sanitary services | | | | |
| 491 | Electric Services | | 2.8 | 2901 |
| 492 | Gas Production and Distribution | .21 | | 0 |
| 495 | Sanitary Services | | 2.6 | 316 |
| MAJOR GROUP 50. Wholesale trade--durable goods | | | | |
| 501 | Motor Vehicles & Automotive Equip. | | 1.1 | 157 |
| 502 | Furniture and Home Furnishings | | 1.7 | 323 |
| 503 | Lumber and Construction Materials | | 2.4 | 1046 |
| 504 | Sporting Goods and Toys | .68 | | 0 |
| 505 | Metals and Minerals | | 1.5 | 278 |
| 506 | Electrical Goods | .93 | | 0 |
| 507 | Hardware and Plumbing Equipment | | 1.4 | 381 |
| 508 | Machinery Equipment and Supplies | | 1.4 | 2347 |
| 509 | Misc. Durable Goods | | 1.5 | 356 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 51. Wholesale trade--nondurable goods | | | | |
| 511 | Paper and Paper Products | | 1.5 | 337 |
| 512 | Drugs and Sundries | .38 | | 0 |
| 513 | Apparel and Notions | .37 | | 0 |
| 514 | Groceries and Related Products | | 1.8 | 2038 |
| 515 | Farm-Product Raw Materials | .11 | | 0 |
| 516 | Chemicals and Allied Products | | 1.0 | 30 |
| 517 | Petroleum and Petroleum Products | .99 | | 0 |
| 518 | Beer, Wine and Distilled Beverages | | 2.4 | 807 |
| 519 | Misc. Nondurable Goods | .96 | | 0 |
| MAJOR GROUP 52. Building materials, hardware, mobile home dealers | | | | |
| 521 | Lumber and Other Building Materials | .54 | | 0 |
| 523 | Glass and Paint Stores | | 1.3 | 89 |
| 525 | Hardware Stores | | 1.3 | 189 |
| 526 | Retail Nurseries & Garden Stores | | 2.5 | 253 |
| 527 | Mobile Home Dealers | | 1.2 | 28 |
| MAJOR GROUP 53. General merchandise stores | | | | |
| 531 | Department Stores | .90 | | 0 |
| 533 | Variety Stores | | 1.8 | 588 |
| 539 | Misc. General Merchandise Stores | .14 | | 0 |
| MAJOR GROUP 54. Food Stores | | | | |
| 541 | Grocery Stores | .56 | | 0 |
| 542 | Meat Markets | .66 | | 0 |
| 543 | Fruit and Vegetable Stores | | 1.2 | 17 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| 544 | Candy and Nut Stores | .47 | | 0 |
| 545 | Dairy Products | | 2.3 | 179 |
| 546 | Retail Bakeries | | 1.2 | 148 |
| 549 | Misc. Food Stores | | 1.0 | 7 |
| MAJOR GROUP 55. Automotive dealers, service stations | | | | |
| 551,2 | New and Used Car Dealers | | 1.2 | 669 |
| 553 | Auto Supply Stores | | 1.2 | 259 |
| 554 | Gasoline Service Stations | | 1.0 | 44 |
| 555 | Boat Dealers | | 4.0 | 265 |
| 556,9 | Recreation & Utility Trailer Dealers | | 1.5 | 47 |
| 557 | Motorcycle Dealers | | 1.1 | 12 |
| MAJOR GROUP 56. Apparel and accessory stores | | | | |
| 561 | Men's and Boy's Clothing | .80 | | 0 |
| 562 | Women's Clothing Stores | | 1.5 | 630 |
| 564 | Children's & Infant's Wear Stores | .51 | | 0 |
| 565 | Family Clothing Stores | .57 | | 0 |
| 566 | Shoe Stores | .83 | | 0 |
| 569 | Misc. Apparel and Accessories | | 2.5 | 274 |
| MAJOR GROUP 57. Furniture and home furnishings | | | | |
| 571 | Furniture Stores | | 1.5 | 784 |
| 572 | Household Appliance Stores | | 1.2 | 65 |
| 573 | Radio, Television & Music Stores | .93 | | 0 |
| MAJOR GROUP 58. Eating and drinking places | | | | |
| 581 | Eating and Drinking Places | | 1.0 | 1020 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 59. Miscellaneous retail | | | | |
| 591 | Drug Stores | .87 | | 0 |
| 592 | Liquor Stores | | 1.1 | 46 |
| 593 | Used Merchandise Stores | | 1.2 | 52 |
| 594 | Misc. Shopping Goods Stores | | 1.2 | 708 |
| 596 | Nonstore Retailers | .47 | | 0 |
| 598 | Fuel and Ice Dealers | .57 | | 0 |
| 599 | Retail Stores | | 1.5 | 557 |
| MAJOR GROUP 60. Banking | | | | |
| 602 | Commercial Banks | | 1.5 | 3158 |
| 604,5 | Trust Companies | | 2.4 | 259 |
| MAJOR GROUP 61. Credit agencies | | | | |
| 612 | Savings and Loans | | 1.4 | 451 |
| 614 | Personal Credit Institutions | | 1.4 | 322 |
| 615 | Business Credit Institutions | | 2.2 | 166 |
| 616 | Mortgage Bankers and Brokers | | 1.7 | 230 |
| MAJOR GROUP 62. Security and commodity brokers | | | | |
| 621 | Security Brokers and Dealers | | 1.1 | 134 |
| 628 | Security and Commodity Services | .69 | | 0 |
| MAJOR GROUP 63. Insurance | | | | |
| 631 | Life Insurance | .13 | | 0 |
| 632 | Medical Service & Health Insurance | .61 | | 0 |
| 633 | Fire, Marine & Casualty Insurance | .01 | | 0 |
| 636 | Title Insurance | | 2.2 | 204 |

| | | LQI IMPORT | LQI EXPORT | EXPORT EMPLOYMENT |
|---|---|---|---|---|
| MAJOR GROUP 64. Insurance Agents | | | | |
| 641 | Insurance agents | | 5.7 | 8531 |
| MAJOR GROUP 65. Real Estate | | | | |
| 651 | Real Estate Operators | | 1.6 | 1114 |
| 653 | Real Estate Agents | | 1.7 | 1086 |
| 654 | Title Abstract Offices | | 1.5 | 54 |
| 655 | Subdividers & Developers | | 2.8 | 766 |
| MAJOR GROUP 67. Holding and other investing offices | | | | |
| 671 | Holding Offices | | 1.1 | 32 |
| 679 | Misc. Investing | | 1.2 | 23 |
| MAJOR GROUP 70. Hotels, and other lodging places | | | | |
| 701 | Hotels and Motels | | 1.9 | 3912 |
| 702 | Rooming & Boarding Houses | .89 | | 0 |
| 703 | Camps and Trailer Parks | | 1.6 | 36 |
| MAJOR GROUP 72. Personal services | | | | |
| 721 | Laundry Services | | 1.4 | 607 |
| 722 | Photographic Studies | | 1.2 | 50 |
| 723 | Beauty Shops | | 1.3 | 386 |
| 724 | Barber Shops | | 1.1 | 9 |
| 725,9 | Shoe Repair, & Misc. Services | .68 | | 0 |
| 726 | Funeral Services | | 1.4 | 109 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 73. Business services | | | | |
| 731 | Advertising | | 1.6 | 395 |
| 732 | Credit Reporting & Collection | | 2.3 | 373 |
| 733 | Mailing & Reproduction Services | | 2.5 | 871 |
| 734 | Services to Buildings | | 1.4 | 872 |
| 736 | Personnel Supply Services | | 1.6 | 1707 |
| 737 | Computer Services | | 1.7 | 1301 |
| 739 | Misc. Business Services | | 1.2 | 1479 |
| MAJOR GROUP 75. Automotive repair, services | | | | |
| 751 | Automotive Rentals | | 3.4 | 1165 |
| 753 | Automotive Repair | | 1.4 | 709 |
| 754 | Automotive Services | | 1.4 | 122 |
| MAJOR GROUP 76. Miscellaneous repair services | | | | |
| 762 | Electrical Repair Shops | | 2.1 | 349 |
| 763,9 | Watch, Clock, Misc. Repair | | 1.5 | 396 |
| 764 | Furniture Repair | | 1.1 | 17 |
| MAJOR GROUP 78. Motion pictures | | | | |
| 781 | Motion Picture Production | .12 | | 0 |
| 782 | Motion Picture Distribution | | 1.0 | 2 |
| 783 | Motion Picture Theaters | .38 | | 0 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 79. Amusement and recreation services | | | | |
| 791,9 | Dance Halls, Studios, Misc. Amusement Services | | 1.0 | 1 |
| 792 | Producers and Entertainers | | 1.0 | 14 |
| 793 | Bowling and Billiard Establishments | .99 | | 0 |
| 794 | Commercial Sports | | 7.7 | 1463 |
| MAJOR GROUP 80. Health services | | | | |
| 801 | Offices of Physicians | | 1.4 | 1422 |
| 802 | Offices of Dentists | | 1.0 | 113 |
| 803 | Offices of Osteopathic Physicians | | 1.7 | 80 |
| 804 | Offices of Other Health Practitioners | | 1.3 | 196 |
| 805 | Nursing and Personal Care Facilities | .70 | | 0 |
| 806 | Hospitals | | 1.1 | 1101 |
| 807 | Medical and Dental Labs | | 1.9 | 370 |
| 808 | Outpatient Care Facilities | | 2.0 | 692 |
| 809 | Health and Allied Care Services | | 2.8 | 700 |
| MAJOR GROUP 81. Legal services | | | | |
| 811 | Legal Services | | 1.6 | 1569 |
| MAJOR GROUP 82. Educational services | | | | |
| 821 | Elementary and Secondary Schools | | 15. | 17,653 |
| 822 | Colleges and Universities | | 1.0 | 148 |
| 824 | Vocational Schools | | 1.0 | 19 |
| 823,9 | Libraries and Educational Services | | 2.4 | 354 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMEN |
| MAJOR GROUP 83. Social services | | | | |
| 832 | Individual and Family Services | | 1.2 | 231 |
| 833 | Job Training Services | | 1.0 | 3 |
| 835 | Child Day Care Services | | 1.2 | 252 |
| 836 | Residential Care | | 1.1 | 172 |
| 839 | Social Services | | 1.0 | 81 |
| MAJOR GROUP 86. Membership organizations | | | | |
| 861 | Business Associations | | 1.4 | 137 |
| 862 | Professional Organizations | .76 | | 0 |
| 863 | Labor Organizations | .91 | | 0 |
| 864 | Civic and Social Associations | | 1.2 | 276 |
| 866 | Religious Organizations | .05 | | 0 |
| 869 | Membership Organizations | | 1.4 | 120 |
| MAJOR GROUP 88. Private households | | | | |
| 881 | Private Households | N/A | N/A | N/A |
| MAJOR GROUP 89. Miscellaneous services | | | | |
| 891 | Engineering & Architectural Services | | 1.5 | 1155 |
| 893 | Accounting Services | | 1.5 | 839 |
| 899 | Miscellaneous Services | | 1.9 | 46 |

| | | LQI | | EXPORT |
|---|---|---|---|---|
| | | IMPORT | EXPORT | EMPLOYMENT |
| MAJOR GROUP 91-97. Public administration | | | | |
| 912 | Legislative Bodies | - | - | 5622 |
| 913 | Executive & Legislative Combined | - | - | 8516 |
| 921 | Courts | - | - | 713 |
| 922 | Public Order & Safety | - | - | 1847 |
| 931 | Finance & Taxation | - | - | 383 |
| 951 | Environmental Quality | - | - | 38 |
| 953 | Housing & Urban Development | - | - | 44 |
| 962 | Transportation | - | - | 81 |
| 971 | National Security | - | - | 5 |
| | TOTAL EXPORT EMPLOYMENT | | | 127,323 |

TAMPA BAY REGIONAL PLANNING COUNCIL STAFF

| | |
|---|---|
| Bruce R. Belrose | Executive Director |
| Julia E. Greene | Asst. Director, Planning & Policy Development |
| Manny L. Pumariega | Asst. Director, Administration & Finance |
| Sheila C. Benz | Asst. Director, Policy Management |
| Mary G. Wiser | Director, Public Information |

| | |
|---|---|
| Douglas E. Robison | Program Manager |
| Michael J. Perry | Program Manager |
| JoAnn Finley | Program Manager |
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