Tampa Bay

Surface Water Improvement and Management (SWIM) Plan

Southwest Florida Water Management District

February 8, 1999

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Southwest Florida Water Management District
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Executive Summary

In recognition of the need to place additional emphasis on the restoration, protection and management of the surface water resources of the State, the Florida Legislature, through the Surface Water Improvement and Management (SWIM) Act of 1987, directed the state's water management districts to "design and implement plans and programs for the improvement and management of surface water" (Section 373.451, F.S.). The SWIM legislation requires the water management districts to protect the ecological, aesthetic, recreational, and economic value of the state's surface water bodies, keeping in mind that water quality degradation is frequently caused by point and non-point source pollution, and that degraded water quality can cause both direct and indirect losses of habitats.

In accordance with the law and strongly supported by the Agency on Bay Management (ABM), the Southwest Florida Water Management District (SWFWMD) selected Tampa Bay to be included in its list of priority water bodies for the SWIM Program and was designated as the top priority. A management plan was originally prepared and approved in 1988 based on *The Future of Tampa Bay*, a management plan generated from the 1985 Tampa Bay Management Study Commission. The SWIM Plan was revised in 1992 and is being revised again following the completion of the Tampa Bay National Estuary Program's (now Tampa Bay Estuary Program - TBEP) Comprehensive Conservation and Management Plan (CCMP).

For the Tampa Bay SWIM Plan, the ABM's and TBEP's previous activities and the CCMP are the basis for the SWIM Plan's strategies for the protection and restoration of Tampa Bay. In fact, much of the supporting information was taken verbatim from *The Future of Tampa Bay* and the CCMP. In preparing the SWIM Plan, staff reviewed the goals, initiatives, and strategies for restoring and protecting Tampa Bay from the CCMP and then focused on activities identified for the District that can be accomplished within the legislative charge of SWIM - improving or protecting water quality and natural systems.

The Tampa Bay SWIM Plan has incorporated the following goals from the TBEP CCMP:

- Cap nitrogen loadings to Tampa Bay at existing levels (1992-1994 average) to encourage the regrowth of an additional 12,350 acres of seagrass.

- Protect relatively clean areas of the bay from increases in toxic contamination, and minimize risks to marine life and humans associated with toxic contaminants to impacted areas.

- Increase and preserve the quantity, quality and diversity of seagrass communities. The long-term goal is to restore 12,350 acres of seagrass and protect the bay's existing 25,600 acres.

- Restore and optimum balance of wetland and associated upland habitats for fish and wildlife, while protecting and enhancing existing habitats. Specific targets include:

- restoration of a minimum of 100 acres of low-salinity tidal marsh every five years, for a total increase over time of 1,800 acres, and the preservation of the existing habitat
- protection and enhancement of the bay's mangrove and salt marsh communities which total nearly 14,000 acres
- restoration over time of 150 acres of salt barren habitat

A Pollutant Load Reduction Goal (PLRG) has been established for the bay. The consensus of the scientific community in Tampa Bay is that the nitrogen concentrations are presently acceptable and the management approach is to "hold the line" on nitrogen. Nitrogen loadings are expected to increase 7 percent by 2010, or about 17 tons per year, as a result of population growth. Therefore, local governments and industries will need to offset loadings to the bay by this amount to maintain existing nitrogen loadings. As such, the PLRG for Tampa Bay is:

! **Reduce nitrogen concentration in Tampa Bay by 7 percent by 2010, or about 17 tons per year or as necessary to offset loadings to the bay as a result of population growth**

Strategies to achieve the goals include primarily stormwater retrofit projects and habitat restoration projects. Stormwater retrofit projects are designed to provide treatment for stormwater from previously untreated urban and industrial areas. The stormwater treatment process of detaining runoff into holding ponds, biological assimilation and physical removal reduces the amount of nutrients (primarily nitrogen and phosphorus) and toxic materials entering the receiving waters. The habitat restoration goals, and to a lesser degree the nitrogen removal goals, will be achieved through construction of "habitat mosaics" designed to include as many different habitat types as the site allows, including oligohaline (low-salinity) habitats.

This revised Tampa Bay SWIM Plan provides details for twelve (12) habitat restoration projects; two (2) assessment projects; two (2) monitoring projects; two (2) identified stormwater retrofit projects and place holders for additional projects opportunities that are identified each year from local governments or other groups. The projects identified are consistent with the Tampa Bay Estuary Program's Comprehensive Conservation and Management Plan.

The District has many tools available to implement the legislative intent of the SWIM program, including but not limited to, integrated planning and coordination, regulatory authority, land acquisition programs and the SWIM program itself. Each of these areas provide opportunities to assist in the management of Tampa Bay, one of the prominent natural systems within the District.

With adequate funding and implementation, the SWIM Plan for Tampa Bay will be one of the vehicles through which the District and the State of Florida contribute to ongoing efforts to restore and protect Tampa Bay.

Introduction

THE SWIM ACT

In recognition of the need to place additional emphasis on the restoration, protection and management of the surface water resources of the State, the Florida Legislature, through the Surface Water Improvement and Management (SWIM) Act of 1987, directed the state's water management districts to "design and implement plans and programs for the improvement and management of surface water" (Section 373.451, Florida Statutes). The SWIM legislation requires the water management districts to protect the ecological, aesthetic, recreational, and economic value of the state's surface water bodies, keeping in mind that water quality degradation is frequently caused by point and non-point source pollution, and that degraded water quality can cause both direct and indirect losses of habitats.

Under the Act, water management districts prioritize water bodies based on their need for protection and/or restoration. This prioritization process is carried out in cooperation with the Florida Department of Environmental Protection (FDEP), the Florida Game and Fresh Water Fish Commission (FGFWFC), the Department of Agriculture and Consumer Services (DACS), the Department of Community Affairs (DCA), and local governments. Tampa Bay was named as the top ranked priority for the Southwest Florida Water Management District.

Following the selection of the priority water bodies and in accordance with the law that created SWIM, a SWIM Plan must be drafted, reviewed and approved before state SWIM funds can be spent on restoration, protection or management activities. The purpose of the Tampa Bay SWIM Plan is to set forth a realistic course of action, with the number of projects, the size of the projects, and the effort needed to accomplish them consistent with levels and trends of SWIM funding. The law also stipulates that the plans must be updated at a minimum once every three years. A Tampa Bay SWIM Plan was originally prepared and approved in 1988 and updated in 1992. The next update was delayed until the completion of the Tampa Bay National Estuary Program's (TBEP) Comprehensive Conservation and Management Plan (CCMP) for the bay.

The State's and the water management district's Surface Water Improvement and Management (SWIM) programs are but one of the tools available to protect and restore Tampa Bay and its watershed. The Southwest Florida Water Management District has several water resource management related responsibilities that can affect Tampa Bay which are detailed later in this chapter.

SWIM FUNDING

Only water bodies with approved SWIM Plans are eligible for funding from the Ecosystem Management and Restoration Trust Fund. Funding from the Ecosystem Management and Restoration Trust Fund requires a 40 percent match by the Southwest Florida Water Management District. Monies placed in the Ecosystem Management and Restoration Trust Fund continue to be dependent upon a yearly appropriation by the state legislature. The

lack of a dedicated source of funding for SWIM activities weakens long-term planning and implementation of environmental rehabilitation in priority water bodies.

TAMPA BAY MANAGEMENT ISSUES

In preparing the SWIM Plan staff reviewed the goals, initiatives, and strategies for restoring and protecting Tampa Bay proposed as part of the TBEP's CCMP and then focused on activities identified for the District that can be accomplished within the legislative charge of SWIM - improving or protecting water quality and natural systems. The following management issues are the basis for the preparation of the Tampa Bay SWIM Plan:

Nitrogen and Water Quality: Excess nitrogen in rainfall, stormwater runoff and from domestic and industrial point sources accelerates the growth of algae in the bay, limiting light penetration to seagrasses, which require light to grow. Past water quality declines contributed to the loss of nearly half of the bay's seagrasses (or almost 19,000 acres) from the 1950s to the 1980s, although seagrasses are gradually returning in areas of the bay where water quality has improved. Nitrogen loadings are expected to increase 7 percent by 2010, or about 17 tons per year, as a result of population growth. Therefore, local governments and industries will need to offset loadings to the bay by this amount to maintain existing nitrogen loadings.

Bay Habitats: The protection of existing seagrass beds and restoring the vital underwater seagrass meadows to1950s levels, and the restoration of coastal wetland habitats except in areas that have been permanently altered is a principal objective. More than 4,000 acres of new or expanded seagrass beds have been documented in the bay since 1982, thanks to improvements in water quality. Recovery, however, will be a long-term process due to the time it takes for seagrasses to recolonize an area once conditions have improved. For coastal habitats, the objective is to restore the historic balance of coastal habitats in order to better support the bay's fish and wildlife populations, recognizing that some of the vital habitats have declined more rapidly than others. Declines have been particularly severe for tidal streams and tributaries, which are critical nurseries for numerous species of fish, such as snook and mullet. Restoring low-salinity tidal stream habitat, while preserving existing salt marshes and mangroves may be accomplished either through habitat restoration or enhancement of existing areas that have been severely degraded.

Pollutant Load Reduction Goal: The FDEP requires that a pollutant load reduction goal be developed for each SWIM water body. City of Tampa staff have documented the relationships between modeled nitrogen loads, annual average water column chlorophyll *a* levels, and seagrass acreage in Hillsborough Bay, the northeastern part of Tampa Bay. The TBEP expanded this approach to establish management objectives for nitrogen to other bay segments. Through a SWIM funded project, the optimum light climate for seagrasses was established. Since the majority of the light attenuators in the water column are algal cells, a chlorophyll *a* and nitrogen relationship was determined and an optimum nitrogen concentration was identified. This optimum nitrogen concentration compared to existing nitrogen loadings became a load reduction (PLRG). Reductions of nitrogen loadings, primarily as a result of improvements to sewage treatment, have allowed

for considerable reductions in chlorophyll *a* concentrations. The consensus of the scientific community in Tampa Bay is that the nitrogen concentrations are presently acceptable and the management approach is to "hold the line" on nitrogen.

TAMPA BAY SWIM PLAN GOALS

The Tampa Bay SWIM Plan has incorporated the following goals from the TBEP CCMP:

- Cap nitrogen loadings to Tampa Bay at existing levels (1992-1994 average) to encourage the regrowth of an additional 12,350 acres of seagrass.

- Protect relatively clean areas of the bay from increases in toxic contamination, and minimize risks to marine life and humans associated with toxic contaminants to impacted areas.

- Increase and preserve the quantity, quality and diversity of seagrass communities. The long-term goal is to restore 12,350 acres of seagrass and protect the bay's existing 25,600 acres.

- Restore and optimum balance of wetland and associated upland habitats for fish and wildlife, while protecting and enhancing existing habitats. Specific targets include:

    - restoration of a minimum of 100 acres of low-salinity tidal marsh every five years, for a total increase over time of 1,800 acres, and the preservation of the existing habitat
    - protection and enhancement of the bay's mangrove and salt marsh communities which total nearly 14,000 acres
    - restoration over time of 150 acres of salt barren habitat

The following Pollutant Load Reduction Goal (PLRG) has been established for the bay:

Reduce nitrogen concentration in Tampa Bay by 7 percent by 2010, or about 17 tons per year or as necessary to offset loadings to the bay as a result of population growth

Management Strategies

The SWIM Plan's management strategies for protecting and restoring Tampa Bay are the based on the TBEP's technical assessments and the Comprehensive Conservation and Management Plan (CCMP) The District played a significant role in the development of the CCMP and continues to be an active partner as the TBEP moves to implementation. The District sits on the Policy and Management Committees of the TBEP and contributes a considerable amount of local matching funds from the five Basin Boards surrounding Tampa Bay. District staff participated fully in the Technical and Community Advisory Committees contributing to the understanding of the technical issues and development of

strategies and actions. The District's extensive commitment of staff time and resources was made, in part, with the expectation that the CCMP would guide the development of the next SWIM Plan for Tampa Bay.

To address these priority problems, key areas were identified in the CCMP and "Action Plans" were prepared as priority activities for managing and restoring Tampa Bay. The action plans within each of the key areas identified a range of strategies that allow local communities to maximize return on their investment in bay recovery and protection. Many actions also achieve multiple environmental objectives, such as pollution prevention and water conservation. Responsible parties were identified within each action plan that were, because of existing authority or responsibility, expected to participate in the implementation of the action plan.

Action Plan Responsibilities

The Southwest Florida Water Management District was identified as a responsible party for several of the action plans included in the CCMP. Of these action plans, the SWIM Plan is proposing projects to implement the associated action plans.

Action Plan WQ-1 Implement Nitrogen Management Goals for Tampa Bay

- Stormwater Rehabilitation
- Sumner Road Stormwater Management Improvement
- Balm Road Scrub Marsh
- Assessment of Microbial Indicators and Pathogens in the Tampa Bay Watershed.
- Support Ongoing Bay-wide Water Quality Modeling
- Hypoxia

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

- The Kitchen (Dug Creek, Davis Tract and Port Redwing) Habitat Restoration
- Delaney Creek Habitat Restoration
- North Apollo Beach Habitat Restoration
- Cargil Habitat Restoration
- MacDill AFB Habitat Restoration
- Palm River/Tampa Bypass Canal Restoration
- Dick Creek Habitat Restoration
- Rocky Creek Habitat Restoration
- Clam Bayou Habitat Restoration
- Howard Frankland West Habitat Restoration
- Terra Ceia Isles Habitat Restoration
- Allen's Creek Habitat Restoration

Action Plan BH-8 Expand Habitat Mapping and Monitoring Programs

- Tampa Bay Seagrass Mapping and Monitoring

Strategies to achieve the goals include primarily stormwater retrofit projects and habitat

restoration projects. Stormwater retrofit projects are designed to provide treatment for stormwater from previously untreated urban and industrial areas. The stormwater treatment process of detaining runoff into holding ponds, biological assimilation and physical removal reduces the amount of nutrients (primarily nitrogen and phosphorus) and toxic materials entering the receiving waters. The habitat restoration goals, and to a lesser degree the nitrogen removal goals, will be achieved through construction of "habitat mosaics" designed to include as many different habitat types as the site allows, including oligohaline (low-salinity) habitats.

Action Plans within the CCMP that required coordination and/or direct action by the District other than through SWIM can be accomplished through existing duties and responsibilities of the District, such as land acquisition, regulatory and planning. The detail regarding the District's activities under these action plans is provided in Appendix B.

Linkage to Other Water Resource Management Activities

In addition the projects that are initiated by SWIM, the SWIM Program is able to accomplish its objectives more effectively and efficiently by coordinating internally with other District programs and externally through partnerships with local governments and other state and federal agencies.

Internal Linkages

The District has many tools available to implement the legislative intent of the SWIM program, including but not limited to, integrated planning and coordination, regulatory authority, land acquisition programs and the SWIM program itself. Each of these areas provide opportunities to assist in the management of Tampa Bay, one of the prominent natural systems within the District.

The SWFWMD's Water Management Plan - As required in Chapter 373 of Florida Statutes, the District prepared its Water Management Plan (DWMP). Within this plan, the District delineated its mission into four areas of responsibility; water supply, flood protection, water quality management and natural systems management. The DWMP recognizes that the integration of all these areas is essential to effective planning and management of the resource. District Water Management Plan has listed policies that relate to the restoration, protection and management of Tampa Bay

Comprehensive Watershed Management - The District has recognized a need to take a more aggressive and unified approach to surface water management and has created an initiative which would prioritize resource management needs by watershed throughout the District. It is intended to combine water quantity (i.e., flood) management with water quality and natural systems objectives, as well as water supply when applicable. Ultimately regulation, land acquisition, facilities and land use controls would be combined into a comprehensive surface water management strategy including appropriate policies, on a watershed specific basis. This effort is the District's embodiment of the EPA's watershed

planning approach and the FDEP's Ecosystem Management initiative.

Local governments, as the parties responsible for land planning/development and service provision, will be key players in this integrated management approach. Similarly, the State's Ecosystem Management initiative will provide an impetus to collective efforts as it implements an environmental strategy that encourages innovation, pollution prevention, incentive-based regulatory alternatives, public education and individual stewardship.

Regulation

Wetlands Protection Through Regulatory Programs - One way that the District achieves wetlands protection is through regulatory programs. Wetlands protection is addressed under Chapters 40D-2, 40D-3, 40D-4, 40D-40 and 40D-45, F.A.C. The District's surface water permitting rules (40D-4, 40 and 45, F.A.C.) Require that any impact to wetlands not specifically exempted must either be avoided or compensated. Compensation for impacts include as a minimum, type-for-type mitigation at a one-to-one ratio. Other types of compensation may be required, including preservation of associated upland areas, alternate types of wetland creation, protection of exempt wetlands, and restoration for previously impacted wetlands. The intent is to ensure that the habitat necessary for the survival of fish and wildlife is maintained.

Minimum Flows and Levels - Another management tool available for water and related natural resource protection is through the District's minimum flow and levels program (MFL). Maintaining minimum flows and levels is a significant statutory charge for Florida's water management districts. SWFWMD programs for minimum flows and levels originate in Chapter 373.042, F.S., as well as from the District's desire to treat the environment as a rightful "user" of water. If water resources and associated natural systems are to be protected and maintained, the identification and establishment of water levels and flows is essential. Such activities will also serve to balance water withdrawals for human needs with protection of surface water levels for navigation, recreation and related functions.

Once established, MFLs are implemented through a variety of means. Most prevalent is the application of these flows and levels to the District's water use permitting program. As directed by Chapter 373.042, F.S., the District may restrict withdrawals of water which would cause flows and levels to drop below their established minimums and which would be significantly harmful to the water resources or ecology of an area. The District's water use permitting rules, which include criteria to prevent adverse impacts from occurring as a result of withdrawals, effectively establish MFLs for specific sources throughout the District.

Regulatory minimum flows are now in effect for three rivers, including the Manatee, Little Manatee and Peace rivers. The minimum flows (and withdrawal rates) for these streams have been established through existing water use permits. The minimum flow for the Little Manatee River may be revised pending the resolution of an electrical power plant site certification process for a fuel conversion. The minimum flows and allowable withdrawals rates for the Manatee River are being reexamined, with possible

revisions at the time of permit renewal. Minimum flows have not been established for four watercourses in the District which support major withdrawals (Hillsborough and Braden rivers, Shell Creek and Big Slough Canal).

Mitigation Banking - Mitigation banking allows developers to compensate for wetland losses in one place by preserving, restoring or creating wetlands in another to achieve a no-net loss of wetlands. The rule allows mitigation banking in some instances, although it remains a controversial issue.

Land Acquisition - Land acquisition at the District is guided and funded by two major statewide initiatives: The Water Management Lands Trust Fund (a.k.a. Save our Rivers Program or SOR), and Preservation 2000 (P-2000). These programs target the protection of natural resources at the local and regional level. Lands of importance to water resources and water management are acquired along with lands of unique environmental values endangered by development activities. The District owns over 200,000 acres, the majority of which were purchased through the SOR and P2000 programs. Many recent land purchases have been a joint acquisition between the District and a partner such as local governments in the case of Cockroach Bay and Wolf Branch, or with other state agencies. Leveraging District land acquisition funds with those of local governments and other agencies can and has resulted in significant acquisitions that would otherwise not be made. These programs have been coordinated with SWIM Plans by focusing on critical habitats, such as wetlands and their interconnected upland communities that are part of Tampa Bay's ecosystem that should be acquired for preservation or for restoration.

Basin Board Activities - The eight Basin boards or the SWFWMD have specific functions and duties that are consistent with Chapter 373, F.S., and the programs of the Governing Board. Their purpose is to identify and evaluate key water resource management issues in order to develop and fund management strategies to address them. The Basin boards are facilitator in the resolution of non-regulatory water management issues for a number of other governments. It is at the Basin level that intergovernmental water resource programs are implemented, monitored and evaluated for improvement. The Basins are a sounding board for the District, a means of obtaining feedback from local governments and citizens. Basin boards also serve as funding partners for local governments and others in addressing mutually beneficial water resource solutions.

The District, through the eight basin boards, has an established Cooperative Funding Program which provides financial assistance on a cost-share basis primarily to local governments for regional water resource projects. Projects can also be funded through "Basin initiatives" where a Basin decides to provide the impetus for a water management solution, with or without a local partner. Many of the Basins presently have in place a five-year plan which outlines the types of activities it expects to undertake in the next five years and provides an estimate of the funding required to support these projects. The Basin plans were prepared in close coordination with local governments demonstrating another opportunity for integration with local governments and ensuring the most efficient and cost-effective approach to addressing the mutual water resource management goals and objectives.

External Linkages

FDEP - Ecosystem Management Initiative - Ecosystem Management is a process for managing environmental resources that originated at the State level. The Florida Department of Environmental Protection is required by the Florida Environmental Protection Act of 1993 to develop and implement measures to "protect the functions of entire ecological systems through enhanced coordination or public land acquisition, regulatory and planning programs."

FDEP has defined ecosystem management as an integrated, flexible approach to management of Florida's biological and physical environments - conducted through the use of tools such as planning, land acquisition, environmental education, regulation and pollution prevention - designed to maintain, protect and improve the State's natural, managed and human communities. The primary goal of this effort is to provide for the maintenance of a healthy, sustainable environment for the benefit of present and future generations.

The District has been an active participant in this evolving process, both in terms of statewide program development, and support for the Hillsborough River Basin Pilot Project. The Pilot is one of six throughout the State intended to illustrate how this concept can provide for a comprehensive, holistic linking of environmental protection at many governmental (and private) levels. A strong correlation is apparent between SWFWMD's Comprehensive Water Management Initiative (CWM) and Surface Water Improvement and Management (SWIM) and FDEP's Ecosystem Management.

Tampa Bay National Estuary Program - In 1991, Tampa Bay was chosen by the U.S. Environmental Protection Agency as an estuary of national significance. Consequently, the Tampa Bay National Estuary Program (TBNEP) convened a management conference to complete technical and early action demonstration projects and prepare a Comprehensive Conservation and Management Plan (CCMP). The TBNEP's previous activities and the CCMP are the technical basis for the Tampa Bay SWIM Plan's strategies for the protection and restoration of Tampa Bay. The District played a significant part in the TBNEP process. The District held seats on the Policy and Management Committees of the TBNEP and contributed a considerable amount of local matching funds from the five Basin Boards surrounding Tampa Bay. District staff participated fully in the Technical and Community Advisory Committees contributing to the understanding of the technical issues and development of strategies and actions. The District's extensive commitment of staff time and resources were, in part, with the expectation that the CCMP would guide the development of the next Tampa Bay SWIM Plan. The CCMP, completed in 1996, describes the state of Tampa Bay along with the management structure charged with the bay's protection, identifies specific and attainable targets as a foundation for restoration and protection and proposes action plans identifying strategies that assist local communities in selecting cost-effective environmental improvements.

The NEP partners signed an Interlocal Agreement in February 1998 to implement the CCMP for Tampa Bay pledging to achieve the goals of the bay management plan and committing to specific actions and timetables. The Interlocal Agreement also defined the

governance and organization for the implementation phase of the program. Along with the organizational definition came a name change. The Tampa Bay National Estuary Program will become the Tampa Bay Estuary Program (TBEP).

This SWIM Plan has been prepared by reviewing the available data relevant to Tampa Bay and using that information to develop a project list for converting CCMP initiatives, whenever appropriate, into SWIM activities. The plan focuses on activities identified for the District that can be accomplished within the legislative charge of SWIM - improving or protecting water quality and natural systems. Additionally, by sharing responsibilities with other state and local agencies, SWIM projects can be planned to prevent duplication in effort and orient various entities toward those activities which they are best suited.

Local Government Coordination and Partnering - Building on the relationships and partnerships that have been developed over the past two decades of bay management activities in Tampa Bay is central to the future of managing the bay and are core to this update of the Tampa Bay SWIM Plan. Local governments are key to the implementation of any management activity that is proposed for the bay.

The District has recently prepared integrated plans for many the local governments in the District. The purpose of an integrated plan is to identify and evaluate key water resource management issues within the local government's jurisdiction and to develop common District and local government strategies to address these issues. The integrated plan is intended to serve as a tool to foster the integration of land use planning and growth management activities of local governments with the water use planning and management activities of the District. This effort will strengthen the local government's comprehensive plan by linking local water resources planning to the best available data and other resources of the District. The development of the integrated plans is a cooperative effort of the District, local governments and citizens. This endeavor is best viewed as a process, however, since it is intended to promote continuing relations and mutual planning in the best interest of the resource. It is hoped the action strategies identified will end up back in the local government plan where local and District energies, and funding, can be directed toward them.

Local governments and other state and regional agencies offer not only a funding partner but a wide range of services -- from land acquisition and technical assistance to providing equipment and personnel -- all of which when combined with District and State resources can make for a substantial effort. As an example, Hillsborough County, through its own Environmental Lands Acquisition and Protection (ELAP) Program, has acquired hundreds of acres of land that they would not have normally due to its marginal environmental benefit (in its present condition). The land was acquired only because of the ability and commitment of the District through SWIM to restore the property. The District could not afford to purchase the land and restore it and the county had the ability to purchase property but was without the means to restore it. The synergy between the District and Hillsborough County is obvious in this case and there are many other examples of partnerships developed because of the need for restoration and management of activities in Tampa Bay and the limitations of any one agency or organization to address those needs.

Priority Projects

The projects as described in this plan are consistent with the District's Water Management Plan, the Basin Board Five Year Plans and the TBEP's CCMP. The projects are focused on those action plans that can be accomplished within the legislative charge of SWIM, specifically improving or protecting water quality and natural systems. The following project summary sheets included the description and projected cost for the projects.

Project Title: Stormwater Rehabilitation

Action Plan(s) Addressed:

Action Plan WQ-1 Implement Nitrogen Management Goals for Tampa Bay

Summary:

Runoff from urban, agricultural and industrial land uses have been shown to contain loadings of nutrients, suspended solids (both organic and inorganic) and heavy metals. One of the strategies to reduce these pollutants is through the design and implementation of stormwater collection and treatment systems. New development is required to address stormwater from not only from a volume perspective, but from a water quality perspective. To reduce pollutants from areas developed prior to present stormwater rules will require a retrofit or rehabilitation. The District and local governments will join forces to design and construct stormwater treatment systems to reduce nutrients and/or suspended solids and the heavy metals associated with this fine particulate material.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 15,000	$ 15,000	$ 15,000
Contracts:	$ 500,000	$ 500,000	$ 500,000
Expenses:	$ 1,200	$ 1,200	$ 1,200
Equipment:	$ 1,000	$ 1,000	$ 1,000
Total:	$ 517,200	$ 517,200	$ 517,200

Agency or Local Government Coordination and Partnering:

Agencies and local governments are preparing their action plans to meet their implementation obligations pursuant to the implementation agreement for the Tampa Bay National Estuary Program. A major portion of those action plans will include projects to reduce nutrients (specifically nitrogen) and toxins (primarily heavy metals) discharged to the bay.

The District, through the cooperative funding programs of the Basin Boards and through SWIM funding can join with the local governments to cost share many of these projects and allow for more to be accomplished. The Action Plans for all agencies and local governments are still being prepared and reviewed by the TBNEP and as such, no specific cooperative projects for fiscal years beyond FY 99 have been identified at this time, however it is expected that several will ultimately be proposed and meet the criteria for funding under this SWIM Plan.

Project Title: Sumner Road Stormwater Management Improvement

Action Plan(s) Addressed:

Action Plan WQ-1 Implement Nitrogen Management Goals for Tampa Bay

Summary:

Construction of a sedimentation basin within the Bullfrog Creek watershed to reduce pollutant loads and floodplain encroachment from a 190 acre drainage area. Major land use is agriculture and erosion occurs due to man-made alteration of the natural drainage system. Amount of erosion is impacting the existing conveyance system and wetland areas. A seven-acre pond is proposed to control sediment deposition, provide water quality treatment prevent wetland impacts, and restore floodplain. Regionally, this project will improve the water quality which discharges to Bullfrog Creek, eliminate floodplain encroachment and provide proper stormwater conveyance. Locally, it will protect adjacent wetlands and be a potential source for irrigation to neighboring farms. It will also reduce flooding and impacts to local conveyance facilities.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 15,000	$ 0	$ 0
Contracts:	$ 200,000	$ 0	$ 0
Expenses:	$ 1,200	$ 0	$ 0
Equipment:	$ 1,000	$ 0	$ 0
Total:	$ 217,200	$ 0	$ 0

Agency or Local Government Coordination and Partnering:

This is a cooperative project with Hillsborough County which initially came to the District through the Cooperative Funding Program of the Alafia River Basin Board. The County will be responsible for the design, permitting and construction of the project and the District will share the cost of the project with the County. This partnership fulfils the needs of both the County and the District and ultimately more projects can be accomplished because of the cost sharing relationship.

Project Title: Balm Road Scrub Marsh

Action Plan(s) Addressed:

Action Plan WQ-1 Implement Nitrogen Management Goals for Tampa Bay

Summary:

Construction of a sedimentation and treatment facility and creation of additional floodplain within the Bullfrog Creek watershed. Approximately 125 acres will be restored to a natural state and 100 acres converted to floodplain to attenuate increased flows due to surrounding agricultural practices. The project will collect excess runoff via bypass swales from about 1,025 acres of mostly agricultural land use and treat it via biological and physical processes. Regionally, this project will provide water quality improvements and reduced pollutant load to Bullfrog Creek and Tampa Bay. It will increase available wildlife habitat through a freshwater marsh creation. Locally and regionally the project will provide additional flood attenuation.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 15,000	$ 0	$ 0
Contracts:	$ 200,000	$ 0	$ 0
Expenses:	$ 1,200	$ 0	$ 0
Equipment:	$ 1,000	$ 0	$ 0
Total:	$ 217,200	$ 0	$ 0

Agency or Local Government Coordination and Partnering:

This is a cooperative project with Hillsborough County which initially came to the District through the Cooperative Funding Program of the Alafia River Basin Board. The County will be responsible for the design, permitting and construction of the project and the District will share the cost of the project with the County. This partnership fulfils the needs of both the County and the District and ultimately more projects can be accomplished because of the cost sharing relationship.

Project Title: Assessment of Microbial Indicators and Pathogens in the Tampa Bay Watershed.

Action Plan(s) Addressed:

WW-4 Revise HRS Rules to Incorporate Environmental Performance or Design Standards for Septic Systems

Summary:

Develop and implement a cooperative project (with the Florida Department of Health, University of South Florida, and possibly other local government agencies) to evaluate potential sources and loadings of microbial pathogens within the Tampa Bay watershed.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 5,000	$ 0
Contracts:	$ 100,000	$ 0	$ 0
Expenses:	$ 1,200	$ 1,200	$ 0
Equipment:	$ 1,000	$ 1,000	$ 0
Total:	$ 107,200	$ 7,200	$ 0

Agency or Local Government Coordination and Partnering:

SWIM will be partnering with the Tampa Bay Estuary Program (TBEP) and coordinating with the Pinellas County and Hillsborough County Departments of Health to develop this project. The TBEP will assist with additional funding up to approximately $40,000 to develop a diagnostic microbial survey of the Bullfrog Creek watershed.

Project Title: Support Ongoing Bay-wide Water Quality Modeling

Action Plan(s) Addressed:

Action Plan WQ-1 Implement Nitrogen Management Goals for Tampa Bay

Summary:

Statistical and mechanistic models were used to assess current impacts of external nitrogen loadings on the water quality of Tampa Bay, and to predict the reductions in future loadings that will be required to reach selected water quality targets. Nitrogen was identified as the pollutant of primary interest because it is the nutrient that can potentially limit algal growth in the bay, and has substantial anthropogenic loadings which can be managed through actions taken in the watershed. An initial water quality target, developed by the TBNEP, is an ambient chlorophyll concentration that will allow sufficient light penetration through the water column to support the establishment and survival of seagrasses to the depths observed in the bay in the early 1950's (1-2m in most bay segments). Based on monthly water quality data and pollutant loading estimates for the period 1985-1994, the models were used to predict the external nitrogen loadings to the bay, and ambient nitrogen concentrations within the bay, appropriate to reach this target. Those estimates were used, in turn, to identify appropriate nitrogen management goals for the Tampa Bay watershed. Because the statistical and mechanistic models are based on very different technical approaches, SWIM and TBNEP staff believe that nitrogen management goals developed using the combined results of both models will be more robust, and more widely accepted by the local technical community, than goals developed using either model alone. As requested by the TBNEP, the District will take responsibility for maintaining and updating the modeling effort

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 10,000	$ 10,000	$ 10,000
Contracts:	$ 15,000	$ 50,000	$ 15,000
Expenses:	$ 1,200	$ 1,200	$ 1,200
Equipment:	$ 1,000	$ 1,000	$ 1,000
Total:	$ 27,200	$ 67,200	$ 27,200

Agency or Local Government Coordination and Partnering:

Several agencies and local governments are working to collect and maintain a long term data set for environmental parameters for the bay, the most notable being the water quality monitoring program by the Environmental Protection Commission of Hillsborough County. All if the information from the various sources will be utilize for maintaining and updating the modeling effort.

Project Title: Hypoxia

Action Plan(s) Addressed:

Action Plan WQ-1 Implement Nitrogen Management Goals for Tampa Bay

Summary:

Hypoxia, defined as low levels of dissolved oxygen in the water column can be a serious problem to the flora and fauna of an estuarine system that can not move about. Low oxygen levels can generally be attributed to a stratified water column and high oxygen demands from nutrient rich organic sediments, or from high oxygen demand within the water column such as the presence of an algae bloom (respiration at night) or the oxygen demand of decaying algal cells. Low or no oxygen can cause physiological stress and death of attached or slow moving marine animals. This project will determine the frequency, duration, and spatial extent of historic, current, and predicted future hypoxic conditions in Tampa Bay. Although hypoxic events in Charlotte Harbor are thought to be natural phenomena, such is not the case in areas such as Long Island Sound and Chesapeake Bay. As expected increases in Bay-wide nitrogen loads might conceivably be associated with increases in the frequency, duration or spatial extent of hypoxic conditions, this project is essential for the wise management of Tampa Bay's water resources.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 5,000	$ 5,000
Contracts:	$ 150,000	$ 150,000	$ 0
Expenses:	$ 1,200	$ 1,200	$ 1,200
Equipment:	$ 1,000	$ 1,000	$ 1,000
Total:	$ 157,200	$ 157,200	$ 7,200

Agency or Local Government Coordination and Partnering:

Several agencies and local governments are working to collect and maintain a long term data set for environmental parameters for the bay, the most notable being the water quality monitoring program by the Environmental Protection Commission of Hillsborough County. Information from the various sources will be utilized to evaluate the frequency, duration or spatial extent of hypoxic conditions in Tampa Bay. The results will be made available to the many entities involved in bay management

Project Title: The Kitchen (Dug Creek, Davis Tract and Port Redwing) Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

Port Redwing is a 270 acre parcel located in the mid-eastern reaches of Tampa Bay, just north of the Big Bend power plant. During 1995, after initial nomination by the National Audubon Society, the District and Hillsborough County cooperatively purchased the Port Redwing parcel. The $3 million acquisition was a tri-party affair through joining of forces of the District with Hillsborough County and the Tampa Port Authority. The Port would assume ownership of the southern 170 acres for port development deep water port, and the County would develop a "green space" bay-front nature park on the northern 100 acres. Hillsborough County (via ELAPP) also provided 50% of acquisition fees for the northern tract. The SWIM program began cooperating with Hillsborough County for the implementation of a large (≤40-50 acres) restoration project. This acquisition is but the first of series of proposed acquisitions throughout "The Kitchen" area that would provide several opportunities to restore a significant amount of a variety of habitats.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 5,000	$ 5,000
Contracts:	$ 400,000	$ 400,000	$ 400,000
Expenses:	$ 1,200	$ 1,200	$ 1,200
Equipment:	$ 1,000	$ 1,000	$ 1,000
Total:	$ 407,200	$ 407,200	$ 407,200

Agency or Local Government Coordination and Partnering:

The District and Hillsborough County (via ELAPP) cooperatively purchased the Port Redwing parcel with the expectation that the District will accomplish the environmental restoration for the site. The significance of this partnership is that this property would not normally be purchased under a land protection program due to its environmentally disturbed state. If lack of funding or other reasons kept the property from being restored, public money would have been spent to purchase property of limited environmental value rather than more environmentally desirable properties -- a politically unpalatable position.

Project Title: Delaney Creek Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

Delaney Creek is a highly altered creek system in Hillsborough County. The intent of the project is to restore the creek by altering the shoreline to a more natural condition and replanting with native Florida vegetation. There are opportunities to provide oligohaline habitats consistent with the TBEP's "restoring the balance" concept.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 0	$ 5,000	$ 5,000
Contracts:	$ 0	$ 250,000	$ 375,000
Expenses:	$ 0	$ 1,200	$ 1,200
Equipment:	$ 0	$ 1,000	$ 1,000
Total:	$ 0	$ 257,200	$ 377,200

Agency or Local Government Coordination and Partnering:

Only the land that is in public ownership will be considered for restoration. Close coordination with the County is essential to maximize the benefit of the project and to ensure that the needs and expectations of the respective cooperators are met.

Project Title: North Apollo Beach Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

Apollo Beach Park is a 58 acre parcel of land located in south Hillsborough County. The Big Bend Power Plant is across the channel to the northeast. The entire peninsula was created out of sand dredged from Tampa Bay in 1955. Prior to this time, the site was part of Tampa Bay and vegetated with seagrasses. The project is consistent with the Tampa Bay Estuary Program's Master Plan for Habitat Restoration and Protection.

In cooperation with the County, approximately 15 acres of wetland would be created that would more closely resemble the natural habitats of Tampa Bay. Due to the adjacent power plant discharge, the waters surrounding the site are frequented by a large number of Florida manatees. For this reason, we plan to work in conjunction with FDEP to design habitats that would be used specifically by manatees. Several large open water features and channels will be included in the design. Numerous tidal platforms and creeks will also be constructed.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 0	$ 0
Contracts:	$ 300,000	$ 0	$ 0
Expenses:	$ 1,200	$ 0	$ 0
Equipment:	$ 1,000	$ 0	$ 0
Total:	$ 307,200	$ 0	$ 0

Agency or Local Government Coordination and Partnering:

This fifteen (15) acre Tampa Bay estuarine wetland restoration project is proposed on land acquired by Hillsborough County for a park. Part of the funds for acquisition was provided by the Community Lands Trust Fund from the State. A factor in the decision to award the funds to the County was the restoration concept for portion of the site. District and County staff will be coordinating closely to ensure that the restoration and park designs are compatible and to endure that the construction for both projects be done efficiently and cost-effective.

Project Title: Cargil Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

Cargil Fertilizer, Inc. is a private entity owning 370 acres of coastal property just south of the Alafia River. An undetermined portion of the site has been set aside by Cargil as a conservation easement. The property is composed mainly of ditched mangrove swamp, saltern and coastal hammock. Exotic vegetation is also prevalent, especially along the berms and approaches to a 50 acre settling pond built by the company. Opportunities for restoration exist primarily along the numerous mosquito ditches found on site. Exotic Brazilian pepper trees should be removed and areas graded to better suit native vegetation. Many of the ditches could also be reworked to increase the complexity of the site.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 0	$ 5,000	$ 5,000
Contracts:	$ 0	$ 250,000	$ 375,000
Expenses:	$ 0	$ 1,200	$ 1,200
Equipment:	$ 0	$ 1,000	$ 1,000
Total:	$ 0	$ 257,200	$ 377,200

Agency or Local Government Coordination and Partnering:

Cargil Industries, a fertilizer manufacturer on the shores of Tampa Bay will be the primary cooperator. With public land available for restoration becoming more and more limited, entering into a partnership with Cargil can provide the land necessary to do restoration.

Project Title: MacDill AFB Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

Phase 1, a lagoonal system has been restored and existing habitats enhanced via exotic plant removal and grading to high and low intertidal elevations. Phase 2 is south of Phase 1, involving disturbed shoreline, transitional, wetland, and upland areas adjacent to the golf course (southeastern reaches of the interbay peninsula). Completion of design and construction of Phase 2 is anticipated during 1997 although construction funds may be insufficient to complete the project (to be addressed in future budgets). Preliminary field work and design considerations were done for a Phase 3 project. Significant acreages (20+ acres) hold potential for this last phase associated with the golf course and a major drainage ditch draining an inland basin.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 5,000	$ 0
Contracts:	$ 278,321	$ 0	$ 0
Expenses:	$ 1,200	$ 0	$ 0
Equipment:	$ 1,000	$ 0	$ 0
Total:	$ 285,521	$ 5,000	$ 0

Agency or Local Government Coordination and Partnering:

The cooperative relationship between the District and the U. S. Air Force represents a rare opportunity to work with a military branch of the federal government for environmental enhancement/restoration. The Federal government, as MacDill AFB, is the single owner of the largest continuous shoreline of Tampa Bay. At a time when publicly held land available for restoration is becoming more and more limited, MacDill AFB can provide the land necessary to do restoration.

Project Title: Palm River/Tampa Bypass Canal Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

The proposed project is to alter the channel configuration by raising the bottom of the existing channel and maintain the necessary volume for flood relief by altering the shoreline from a steep slope to a more natural shallow wide floodplain. The Tampa Bay community has invested heavily in the restoration of Tampa Bay at the results are being seen in the form of improved water quality, restored submerged and intertidal habitats and the return of fish and wildlife populations previously lost to the Bay community. The reconfiguration of the channel will provide both water quality and habitat restoration benefits to an area of Tampa Bay that continues to exhibit the poorest water quality and limited fish and wildlife habitat value.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 0	$ 5,000	$ 5,000
Contracts:	$ 0	$ 400,000	$ 400,000
Expenses:	$ 0	$ 1,200	$ 1,200
Equipment:	$ 0	$ 1,000	$ 1,000
Total:	$ 0	$ 407,200	$ 407,200

Agency or Local Government Coordination and Partnering:

This project provides an opportunity to partner for the first time with the U.S. Army Corps of Engineers. The Corps can provide funding (with a local match), and technical assistance such as diagnostic/feasibility and design. The District and Corps are able to facilitate the restoration in the Palm River as a result of the partnership that they were not able to do separately because of either financial limitations or lack of institutional inertia.

Project Title: Dick Creek Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

Dick Creek drains a highly developed section of west Tampa and has consequently been heavily channelized for flood control purposes. Some restoration potential exists in the easement portions of the creek, which are owned primarily by Hillsborough County. The lower reaches of the creek interconnect with the mouth of Rocky Creek, an area which formerly contained many braided side channels and oxbows. Excavation of Channel "G" has disrupted the natural flow and caused a number of these backwater areas to become choked with vegetation and sediment. Plans for restoration could include regrading or removing sections of the channel berm to restore circulation to existing backwater areas.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 0	$ 5,000	$ 5,000
Contracts:	$ 0	$ 150,000	$ 450,000
Expenses:	$ 0	$ 1,200	$ 1,200
Equipment:	$ 0	$ 1,000	$ 1,000
Total:	$ 0	$ 157,200	$ 457,200

Agency or Local Government Coordination and Partnering:

The FDEP owns a portion of this property with the remainder falling under private ownership. While no formal agreement in place yet, FDEP and Hillsborough County are likely cooperators and at a minimum, there must be close communication with the public land-owners and the District.

Project Title: Rocky Creek Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

Rocky Creek is located in a heavily developed region of west Tampa, just north of the Tampa approach to the Courtney Campbell Causeway. For nearly its entire length, Rocky Creek is tightly bordered by residential and commercial development. Two sections of the creek have been channelized for flood control purposes, but much of the original stream channel still remains. Channel "A" diverts excess water under conditions of high flow from Rocky Creek into the heavily channelized Dick Creek to the west. Channel "G" intersects Rocky Creek along its middle reaches and acts to divert water away from residential areas and into the creek.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 0	$ 5,000	$ 5,000
Contracts:	$ 0	$ 100,000	$ 300,000
Expenses:	$ 0	$ 1,200	$ 1,200
Equipment:	$ 0	$ 1,000	$ 1,000
Total:	$ 0	$ 107,200	$ 307,200

Agency or Local Government Coordination and Partnering:

These two areas are owned by Hillsborough County and afford the greatest opportunity for restoration along the creek. Most of the remaining sections of the creek are privately owned. As such, District and County staff will work closely to ensure that any designs for restoration projects are prepared with considerable County review and input.

Project Title: Clam Bayou Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

SWIM began preliminary planning of a Phase 2 project for Clam Bayou during 1995. Phase 2 proposed to develop a "Clam Bayou Nature Park" for all of Clam Bayou. Preliminary field work was conducted and groundwork laid for the development of the preserve. Due to the size, complexity, and expense, development of the preserve will have to be done in phases and must address several key points: habitat enhancement, restoration and/or creation projects, land acquisition, stormwater treatment, sewage overflow problems, jurisdiction and management of the preserve. One large potential project involves the dredging of Clam Bayou to restore the original sand substratum (in general, currently buried under 1-6 feet of fine grain sediments). Phase 2 offers great potential for widespread, significant improvements to Clam Bayou; the site truly can become a green oasis of natural, productive habitats in a sea of urban development.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 5,000	$ 5,000
Contracts:	$ 300,000	$ 700,000	$ 700,000
Expenses:	$ 1,200	$ 1,200	$ 1,200
Equipment:	$ 1,000	$ 1,000	$ 1,000
Total:	$ 307,200	$ 707,200	$ 707,200

Agency or Local Government Coordination and Partnering:

The land for this project has as yet, not been acquired. Getting the land into public ownership will require close coordination between, FDEP (Pollution Recovery Trust Fund [PRTF]), Gulfport, St. Petersburg, FDEP Aquatic Preserve Program, SWFWMD Land Resources, and possibly Pinellas County. Any effort toward the design of this potentially extensive project cannot occur until the land is purchased.

Project Title: Howard Frankland West Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

The FDEP has been working with FDOT to restore low lying coastal areas on the west side of the Howard Frankland Bridge in conjunction with several ongoing road improvement projects. The FDEP was going to design this project, however the funding FDEP anticipated from the Pollution Recovery Trust Funds, are now not available. As a result, the District is doing the design and permitting activities for the site. The District has been working with FDOT, Pinellas County and the State Bureau of Submerged Lands (DEP) to expand the original project scope.

A cooperative agreement has been approved between the District and Pinellas County to proceed with the restoration project. A consultant will be hired to assist with the design of this project. An area contiguous to this restoration project is within DOT's right of way and is covered with exotic vegetation, the District has decided to remove all of the exotics from this area (30-50 acres) which will assist with reducing survey costs and aid in the overall design of the restoration activities planned for the site.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 5,000	$ 0
Contracts:	$ 800,000	$ 800,000	$ 0
Expenses:	$ 1,200	$ 1,200	$ 0
Equipment:	$ 1,000	$ 1,000	$ 0
Total:	$ 807,200	$ 807,200	$ 0

Agency or Local Government Coordination and Partnering:

The land available for restoration is owned by several public entities, FDOT, FDEP and Pinellas County. As such, the need for close coordination with all of the entities is obvious. There is the potential for significant restoration at this site, as well as a site for FDOT mitigation Projects. The multiple owners and varied restoration needs and expectations however will require considerable communication and coordination for the project to achieve the full potential of the site.

Project Title: Terra Ceia Isles Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

Terra Ceia Isles is a 1600 acre publicly-owned parcel located on Tampa Bay just north of the Sunshine Skyway Bridge approach in Manatee County. Over 1000 acres of this site are defined as jurisdictional wetland areas including intertidal mangrove swamp, *Juncus* marsh, and freshwater and ephemeral wetlands. The 580 acre upland portion was largely cleared for agriculture and has since been abandoned. A few pockets of natural upland still exist, but most of the site is dominated by exotic Brazilian pepper, *Melaleuca* (punk tree), cogon and guinea grass. Removal of exotic vegetation would be a priority with the cleared uplands being planted as an upland/wetland habitat mosaic complete with transitions into existing wetland areas.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 5,000	$ 5,000
Contracts:	$ 500,000	$ 500,000	$ 500,000
Expenses:	$ 1,200	$ 1,200	$ 1,200
Equipment:	$ 1,000	$ 1,000	$ 1,000
Total:	$ 507,200	$ 507,200	$ 507,200

Agency or Local Government Coordination and Partnering:

The District and the FDEP now share in the ownership of the Terra Ceia Isles. The District's purchase was partially for preservation and partially for restoration. The are hundreds of acres that are opportunities for restoration. Agency partnering has provided the land and that partnership will continue to accomplish the restoration as envisioned.

Project Title: Allen's Creek Habitat Restoration

Action Plan(s) Addressed:

Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Summary:

Design and implement an approximately 14 acre oligohaline habitat restoration project along Allen's Creek in Pinellas County. The project is part of an overall restoration master plan for Tampa Bay and meets the goals and objectives of both the Tampa Bay SWIM Plan and the Tampa Bay Estuary Program CCMP. The project will provide critical nursery habitat for a number of economically important fish species and will help improve water quality in a highly urbanized watershed.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 5,000	$ 0
Contracts:	$ 60,000	$ 200,000	$ 0
Expenses:	$ 1,200	$ 1,200	$ 0
Equipment:	$ 1,000	$ 1,000	$ 0
Total:	$ 67,200	$ 207,200	$ 0

Agency or Local Government Coordination and Partnering:

Pinellas County has a long standing interest in improving Allen's Creek. The County has purchased several parcels of land along the creek for water quality and natural systems improvement. The District and the County have worked closely together on previous projects in Allen's Creek and this project is a continuation of that successful partnership.

Project Title: Tampa Bay Seagrass Mapping and Monitoring

Action Plan(s) Addressed:

Action Plan BH-8 Expand Habitat Mapping and Monitoring Programs

Summary:

A seagrass mapping effort, initiated in 1988 to monitor improvements to the Tampa Bay system continues. Every other year true color photos are flown in December though January to capitalize on times of maximum water clarity and best light penetration. These photos are prepared and photo interpreted for SAV populations. Areas of representative signatures are chosen and field checked for bottom composition.

To provide more detailed site-specific information, seventy transect locations were initially selected to represent the Tampa Bay ecosystem. Transects were 1000 meters long with information collected at 100 meter intervals. Seagrass species, blade length, water depth, epiphyte loading, and bottom composition were recorded at each data point. In addition, dissolved oxygen (DO), water temperature and salinity is measured. All of these sites are visited at least once a year (October). This monitoring effort will continue to further assess the health of Tampa Bay.

Annual Budget Estimates:

	FY 99	FY 00	FY 01
Salaries:	$ 5,000	$ 5,000	$ 5,000
Contracts:	$ 60,000		$ 65,000
Expenses:	$ 200	$ 200	$ 200
Equipment:	$ 500	$ 500	$ 500
Total:	$ 65,700	$ 5,700	$ 70,700

Agency or Local Government Coordination and Partnering:

SWIM will coordinate seagrass mapping and the dissemination of data through the TBEP. In 1998, the TBEP coordinated the participation of several local agencies (including Pinellas County, Hillsborough County, Manatee County, and FDEP-FMRI) in the seagrass monitoring effort. Previously, SWIM conducted a labor-intensive seagrass transect monitoring effort on an annual basis. This work will now be shared by the participating agencies based on the geographical location of transects.

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APPENDIX A

Physical Characteristics and Technical Assessments

A.1 MANAGEMENT BOUNDARIES

The management boundaries of the Tampa Bay SWIM water body have not changed since the original 1988 SWIM Plan and are consistent with those used by the Tampa Bay National Estuary Program. The area covered by the Tampa Bay SWIM Plan includes the estuarine system, watersheds and marine areas (Figure 2.1). The estuarine system hereafter referred to as "Tampa Bay" includes a connected group of estuaries and 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 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 (1,031 square kilometers) including all intertidal wetlands.

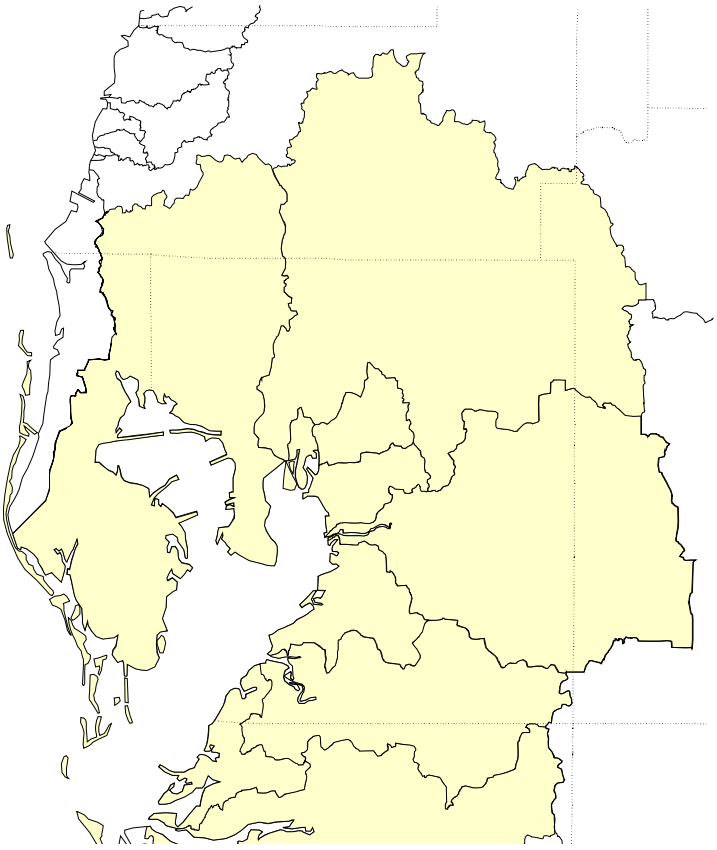


Figure 2.1

The contributing 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 approximately 2200 square miles (5,698 square kilometers). The zones of the estuary as defined by Lewis and Whitman (1982) have been accepted as the sub-division of the bay (Figure 2.2).

A.2 PHYSICAL CHARACTERISTICS

The description of the physical characteristics of Tampa Bay (geology, soils, meteorology, hydrology, and circulation and flushing) has not changed substantially since the preparation of the 1998 SWIM Tampa Bay Management Plan. Much of the following text has been taken *verbatim* from that plan and the TBNEP Comprehensive Conservation and

Management Plan.

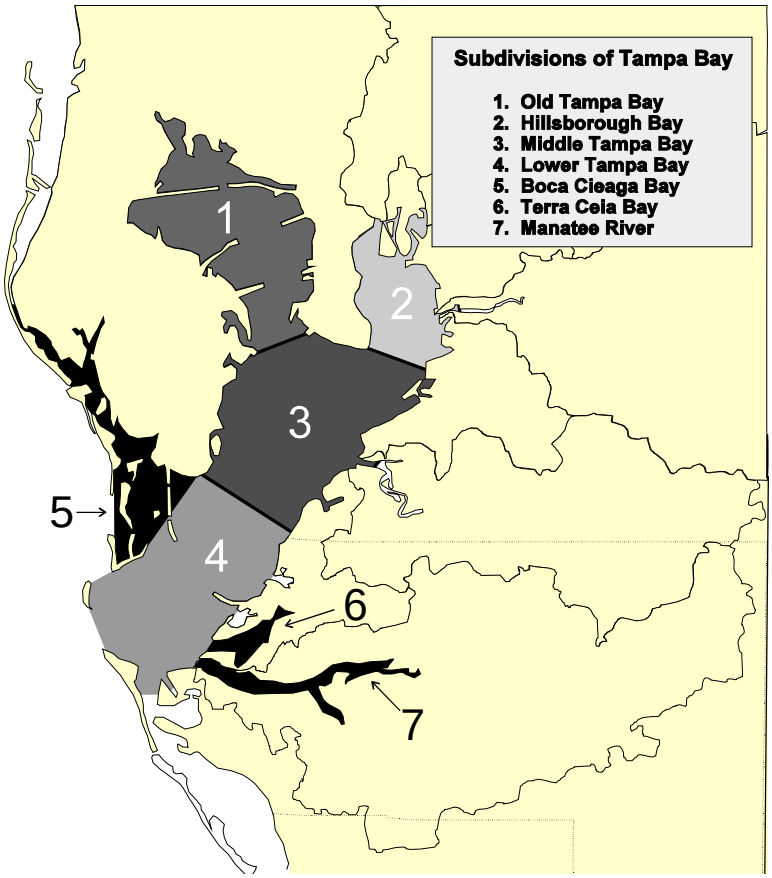


Figure 2.2

A.2.1 Geology

The following account of the development of the modern bay is adapted from Lewis and Estevez (1988).

The shape of Tampa Bay is the result of movements in the course of rivers and a long period of rising sea level. Doyle (1985) reported ancient river channels buried beneath Tampa Bay; one such channel underlies the southern end of the Pinellas Peninsula (Stahl 1970). When sea level was lower, the Hillsborough, Palm, and Alafia Rivers probably converged in a basin now called Hillsborough Bay; the combined streams probably flowed southwesterly toward Egmont Key. The Manatee River is thought to have been independent of the ancestral Tampa Basin Stream, flowing westerly to the gulf near Anna Maria (Stahl 1970).

The recent geology of the upper bays remains a puzzle. Old Tampa Bay may represent an open passage from the bay to the gulf located north of an island of old terraces in Pinellas County. The upper bay may have been etched by the Anclote River in earlier days (Stahl 1970), or by discharges of Lake Tarpon (Hutchinson 1983), which until recently was a brackish tidal body connected underground to the gulf (Hunn 1975). Equally problematic is the relationship between the Withlacoochee and Hillsborough Rivers (and perhaps the Palm River). Even today, waters of the Withlacoochee overflow into the Hillsborough River drainage, and both rivers are regarded as youthful geological features (White 1958, 1970). Boca Ciega Bay is only about 5,000 years old and resulted primarily from longshore sediment transport and barrier island formation (Stahl 1970).

Sediments in Tampa Bay are quartzitic with carbonate mixtures. Bay sediments derive from reworking of terrace deposits, in situ production and weathering of shell, and inshore movement of gulf sediment. Immense deposits of oyster shell underlie Hillsborough Bay and have been mined for many years for use as fill.

Sea level has risen during the past 10,000 years at a diminishing, slow rate. In the past 4,500 years the sea has risen about 3 m (10 ft) with some fluctuations (Brooks 1974), about 30 cm (12 in) of the rise occurring from 1550-1850, and 20-25 cm (8-10 in.) of it since 1870 (Swanson 1974). The rising sea has etched the estuarine shorelines of the bay, confused zonation patterns in mangrove forests (Estevez and Mosura 1985), structured the direction and rate of longshore sediment movement on the gulf beaches, and trapped sediments in the bay. According to Brooks (1974), "backfilling of the estuary from sediments derived from offshore began about 8,000 years ago. Considering the fact that the average depth of the bay is now less than ten feet, the thickness and volume of recent sediments are astounding."

Meade suggested that weak estuaries such as Tampa Bay export little fine sediment, a point supported by mathematical models (Ross et al. 1984).

A.2.2 Soils

The following summary of soils of the Tampa Bay area was excerpted from Roush (1985):

Soils of the Tampa Bay area are derived from marine deposits known as the Suwannee, Tampa, Hawthorn and Bone Valley formation laid down during the late Oligocene and lower and middle Miocene periods. These geologic formations were further modified by the marine environment and fluctuating sea levels during Pleistocene and recent times with the formation of three Bay proximal (Pamlico, Talbot and Penholoway) and three Bay distal (Wicomico, Sunderland and Coharie) marine terraces in the tri-county Tampa Bay area. Surficially, these are expressed as various soil associations within the terraces as influenced by climate, drainage, mineral and organic content. Residual mineral and organic plus recent marine mineral-shell deposits have developed into approximately 96 classifiable and 23 non-classifiable soil series with measurable chemical and physical properties. Interpretations for potential usage for agricultural, engineering and urban purposes have been determined. Modem soil surveys are available for each of the three counties. A current soil survey using the latest of technological and edaphic correlation procedures has recently been completed for Manatee County and is currently in progress for Hillsborough County, Florida.

A.2.3 Meteorology of the Region

The following description of meteorological condition in the Tampa Bay was adapted from Lewis and Estevez (1988):

The amount of freshwater in Tampa Bay and hence, the salinity of the bay, depend at any given time on positive effects of rainfall, runoff, and groundwater efflux, and negative effects of evapotranspiration, consumptive uses, and groundwater influx.

The bay is affected by warm, relatively humid summers resulting from the Bermuda high pressure cell and by mild, relatively dry winters when continental air masses prevail. Because moderate amounts of rain fall in the spring, it is useful to distinguish three

categories of weather from an ecological point of view. The warm, dry period occurs from late April to mid-June. The warm, wet period coincides with summer and early fall. The cold period spans November to April and becomes progressively drier, although cold fronts may cause short periods of heavy rain in January or February.

Wooten (1985) summarized temperature data for the Tampa Bay area. Mean annual temperature based on four decades of records at Tampa is 22.30°C (72.1°F). Mean monthly low and high temperatures are 16.0°C (60.8°F) and 27.80 C (82.0°F) in January and August, respectively. Warming is most rapid in March April and cooling most rapid in October-November. Extreme low and high temperatures are 7.80 C (18.0°F) and 36.7°C (98.1°F).

Temperature trends vary around the bay area. Air temperatures in St. Petersburg are moderated by proximity to the Gulf of Mexico, whereas temperatures become more extreme inland along the floodplains of major rivers.

Evaporative and transpirative flux data for the actual bay are lacking, but Simon (1974) reported 162.6 cm (64.0 in) of Class A pan evaporation, and Vishner and Hughes (1969) gave lake evaporation rates of 127-132 cm/yr (50-52 in/yr)for the area surrounding Tampa Bay end described a"surplus water"gradient from 0 on the coast to about 15 cm (5.9 in) in the upper Hillsborough River Basin. Quantitative data on evapotranspiration rates in major biotic communities in and around the bay are needed.

Rainfall at Tampa averaged 123.7 cm (48.7 in) for the period 1943-82. The wettest end driest years were 1959 and 1956, with 194.5 cm (76.6 in) and 73.4 cm (28.9 in), respectively. The lowest monthly mean rainfall (trace amounts) occurred in January (1950), April (1967 and 1981), and November (1960). The highest monthly mean rainfall was in July 1960, when 52.3 cm (20.6 in) of rain was recorded at Tampa. Palmer (1978) determined that mean annual rainfall increases concentrically from Tampa.

About 60% of all rainfall occurs in the wet season of June through September, a period when some rain fell even in the driest of years. Wooten (1985) noted that rainfall was above average from the 1930's to the 1950's and has been below average since the 1960's.

A.2.4 Hydrology

The following account of hydrology and water quality is excerpted from The Future of Tampa Bay (Tampa Bay Management Study Commission. 1985). Revisions have been made where necessary to update the information and clarify its presentation.

A.2.5 Hydrographic Features

Tampa Bay is Florida's largest open water estuary. Tampa Bay proper covers 373 square miles (966 square kilometers) and is, in places, wider than ten miles (16 kilometers). Including all contiguous wetlands, the total area of the bay is about 398 square miles

(1031 square kilometers), and the estimated average volume of the bay is 116 billion cubic feet (3.3 billion cubic meters) (Ross et al., 1984).

Goodwin (1984) computed changes in physical characteristics within subareas of the bay since 1885. The area of Tampa Bay has been reduced by 3.6% with most (3.0%) occurring before 1972. Hillsborough Bay surface area was reduced by 13.6% due primarily to residential and port-related filling. Lower Tampa Bay has lost 1.9% of its total area, but this figure would be considerably higher if middle and upper Boca Ciega Bay had been considered (Lindall and Trent 1975). The seemingly low amount of bay area lost to filling occurred mostly along shorelines and shallow areas of high biological productivity. Definitive data on shoreline loss by type are not yet available in Tampa Bay but a preliminary estimate of 44% loss in total mangrove and marsh acreage illustrates the relative importance of the lost area (Lewis, 1978). In Charlotte Harbor, Harris et al. (1983) calculated that between 1945 and 1982 mangrove and marsh acreage actually increased by 2%. By comparison losses in Tampa Bay have been considerable.

Tampa Bay is a naturally shallow body of water, having an average depth of about 12 feet (4 m) (Goodwin, 1984), and a maximum natural depth of about 90 feet (27 m) in Egmont Channel at the mouth of the bay. Approximately 90% of the bay is less than 22 feet (7 m) deep (Olson and Morrill 1955). According to Goodwin (1984), the average depth of Tampa Bay has increased by more than 5% during the past century, with an increase of almost 30% in Hillsborough Bay. Most of the depth increase is associated with channel dredging and a general rise in sea level.

As an important port of commerce, Tampa Bay has an extensive navigational system. A total of 42 nautical miles of channels with designed mean low water depths of between 20 and 43 feet (6 and 13 m) are present (Simon 1974). The main shipping channel was first dredged in the 1880's and was recently deepened to 43 feet (13 m) with a width of 400 feet (122 m). The channel provides access to Port Manatee, Port Tampa, Port Sutton, the Alafia River, a number of electrical power plants and Tampa Harbor.

Sediments and bottom features in Tampa Bay are generally uniform in character with the majority of coverage being unconsolidated sediments or soft bottom. Sediments are primarily composed of reworked terrace quartz and nearshore sands as well as biogenic carbonate shell fragments. The mean size of sediment particles increases from the upper to the lower reaches of the bay. Organic sediments and clays are prominent primarily in the upper portions of Hillsborough Bay (Goodell and Gorsline 1960) and major segments of the channels are depositories for fine-grained material. Areas of hard or live bottom, including outcrops of rocky relief and oyster bars, occur in the bay but generally are poorly documented.

A.2.6 Circulation and Flushing

The freshwater drainage basin surrounding Tampa Bay covers an area of about 2,200 square miles (5698 square kilometers) (Hutchinson 1983) and contains four major rivers including the Hillsborough, Alafia, Little Manatee and Manatee. Another, the Palm River,

once drained lands between the Hillsborough and Alafia Rivers but has been completely channelized and controlled since 1970, and is now identified as the Tampa Bypass Canal. The Lake Tarpon outlet to Old Tampa Bay is a significant man-made tributary completed in 1971. The Hillsborough and Manatee (and its tributary, the Braden River) are impounded as municipal reservoirs. The Little Manatee is cropped for power plant cooling water but is otherwise regarded to be in best ecological condition overall. The Alafia is significantly impacted by phosphate mining and processing, and some of its tributaries are impounded at places. Numerous lesser tributaries and three major flood control channels also drain into Tampa Bay.

Over 450 billion gallons (12.7 billion cubic meters) of freshwater annually flow into Tampa Bay with peak periods of stream flow corresponding to periods of greatest rainfall (summer and fall). Approximately 85 % of all flows to the bay are represented by the discharges of the four major rivers . Mean annual discharges of the Hillsborough (1.53×10^{11} ga/yr [4.33×10^{9} m^3/yr]) exceed the others (Alafia: 1.12×10^{11} ga/yr [3.17×10^{9} m3/yr]; Manatee: 6.87×10^{10} ga/yr [1.94×10^{9} m^3/yr]; Little Manatee: 5.94×10^{10} ga/yr [1.68×10^{9} m^3/yr]), (Dooris and Dooris 1984).

Groundwater discharges to the bay are seasonal and greatest during and after the wet season. The roles of groundwater discharge in bay ecology are poorly understood, but can be postulated as (a) reducing peak runoff rates and constituent loads; (b) prolonging estuarine conditions along shorelines and in marshes or mangrove forests; and © creating favorable refugia and nursery areas for marine life in tidal creeks. Drainage of uplands around the bay has concentrated the different flows of surficial groundwater discharge, routed it to major stormwater outlets, and altered the hydrology and constituent loads of manmade tributaries so that many of the benefits of diffuse flows have probably been lost (Estevez and Lewis 1988).

The tides of Tampa Bay may be classified as mixed - a combination of diurnal and semi-diurnal components. The average tidal range is 1.2 ft. (0.4 m), with a range of about 3.5 ft (1.1 m) to 0.2 ft (0.1 m). or less (Corps of Engineers 1974). The tidal heights are greatly influenced by wind direction and velocity, being elevated by strong winds from the southwest, and reduced by winds from the northeast. The tidal lag from the mouth to the head of the bay is generally on the order of four hours (Simon 1974). In general, maximum currents exist at the mouth of the bay where velocities exceed 6.0 ft/sec (1.8 m/sec) on ebb tide and are below 3.5 ft/sec (1.1 m/sec) on flood tide. Current velocities decrease markedly moving from the mouth to the head of the bay system, such that in Hillsborough Bay and northern Old Tampa Bay currents of less than 10% of those at the bay mouth are observed (Simon 1974). The pattern of circulation in the lower portions of the bay has a net counterclockwise movement, with the flood flow being concentrated toward the eastern side. The major component of the ebb flow, especially from Old Tampa Bay, is directed towards the western shore. Little circulation is apparent in Hillsborough Bay, which serves as a trap for the effluents entering from both municipal and industrial outfalls, as well as from the Hillsborough River (Simon 1974).

Ross (1975) demonstrated the existence of tidal gyres in Tampa Bay. Gyres are circular

features of tide induced circulation which form when wind and density stratification are absent. The gyres range in diameter from one to over six miles (1.6 to over 9.7 kilometers) and may significantly retard pollutant dispersion and transport in upper portions of the bay. It is hypothesized that the existence of numerous causeway structures crossing Tampa Bay contributes significantly to the creation of tidal gyres.

Both circulation and flushing in the bay are determined largely by the inflow of freshwater relative to tidal action. Total freshwater inflow to Tampa Bay is about 45 m^3 /sec (1590 ft^3/sec), much less than the average tidal flow at half tide of 25,500 m^3 /sec (9.0×10^5 ft^3/sec). Thus, Tampa Bay may be considered a neutral or mildly positive estuary which, due to bottom topography and low inflows, is vertically well mixed and unstratified with regard to salinity (Dinardi 1978).

Goodwin (1984) concluded that historic and recent alterations to the physical dimensions of Tampa Bay have been responsible for:

- decreased surface area and tidal prism, especially in Hillsborough Bay;
- increased depth and volume, especially in Hillsborough Bay;
- major reductions in flood and ebb tide transport caused by causeways and filling of upper Hillsborough Bay;
- major changes in net circulation in Old Tampa Bay and Hillsborough Bay; and,
- increased inland (trapping) and seaward (export) exchange potential for tidally induced flushing.

Overall, the work of Goodwin (1984) underscores the following important conclusions: (1) that physical changes to the bay have caused significant effects in circulation and flushing; (2) that Hillsborough Bay was naturally an area of poor flushing (and was thus the worst place for municipal and industrial waste to have been discharged); and (3) that the continued flow of freshwater to Tampa Bay and especially Hillsborough Bay is essential to maintain flushing, even though the volume is low compared to the average tidal prism. These same conclusions probably apply to Old Tampa Bay as well (Estevez and Lewis 1988).

A.3 WATER AND SEDIMENT QUALITY

Since the 1980s, local communities have made significant strides in improving water quality in Tampa Bay. The quality of the bay's water and sediments is important to the animals and plants that reside in them, and also affects human use and enjoyment of the bay.

Excess amounts of nutrients and chemicals—some naturally occurring, others generated by humans—can jeopardize the bay's health. The most striking example of this occurred

from the 1960s to the late 1970s, when excess nitrogen from discharges of partially treated sewage led to excess algae growth and low dissolved oxygen and light levels in the bay—a condition known as eutrophication. Degraded water quality contributed to seagrass losses by blocking light to the bay's underwater grass beds. Sediment quality also has been impacted by potentially toxic contaminants carried in stormwater runoff, wastewater and atmospheric deposition to the bay. Studies conducted by the National Oceanic & Atmospheric Administration (NOAA) and the Florida Department of Environmental Protection (FDEP) in the last decade have revealed high levels of contaminants (including heavy metals, pesticides, PAH's and PCB's) in sediments at several bay sites, including upper Hillsborough Bay, Boca Ciega Bay and Bayboro Harbor (Long *et.al*. 1991).

New studies show that atmospheric deposition of pollutants may play a much larger role in the bay's water quality than previously realized. Nitrogen and potentially toxic pollutants, primarily from industrial and vehicle emissions, fall to the surface of the bay and its tributaries or on the land where they are carried to the bay in stormwater runoff. Research financed by the Tampa Bay NEP indicates that almost one-third of the bay's total nitrogen load may come from atmospheric deposition directly to the surface of the bay (Zarbock *et.al*. 1996).

Recent attention also has focused on the problem of sanitary sewer overflows caused by heavy rainstorms that force some municipal treatment plants to shunt raw or partially treated sewage to Tampa Bay. Sewage overflows are of particular concern in St. Petersburg, where low land elevations and rapid population growth have combined to strain existing municipal sewer and stormwater systems. In August 1995, St. Petersburg was forced to shunt more than 15 million gallons of raw sewage into canals leading to the bay when torrential rains caused sewer backups (City of St. Petersburg, unpublished data. 1995). Corrective actions will be costly and will take time, but they are necessary to minimize associated water quality impacts and allay public concerns about the bay's safety as a recreational and fisheries resource.

Since 1974, the Environmental Protection Commission (EPC) of Hillsborough County has conducted a comprehensive water quality monitoring program in the bay's four major segments. The wealth of data compiled by EPC is the principal source of information for the following status and trends on bay water quality. A benthic monitoring program recently established by the counties surrounding the bay will track trends in sediment quality and the abundance and distribution of bottom-dwelling animals.

A.3.1 Water Clarity

Proper water clarity is essential in maintaining the bay's ecological equilibrium. It determines where and how well submerged vegetation will grow and also enhances the aesthetic appeal of the bay. Water clarity is greatest in the lower part of Tampa Bay because of natural circulation and flushing from the Gulf. Here, visibility (based on Secchi disk measurements) extends to an average annual depth of 2.5 meters (8.2 feet). It naturally decreases moving up the bay, dropping to an average of approximately 2 meters

(6.6 feet) in Middle Tampa Bay and Old Tampa Bay. In Hillsborough Bay, which has poor circulation and receives a larger share of nutrients and sediments from major rivers, average water clarity drops to 1.5 meters (4.8 feet) (Environmental Protection Commission of Hillsborough County 1995). Water clarity changes noticeably with the seasons, improving in cooler months and declining in summer, when warm temperatures, extended daylight and heavy rains stimulate the growth of microscopic algae (or phytoplankton). Suspended algae in the water column reduces the amount of light that penetrates to underwater seagrasses. In fact, the ability of seagrasses to recolonize the bay hinges on the amount of sunlight various grass species receive, as well as shading factors, such as the amount of drift macro-algae and epiphytic or attached algal growth on grass blades. For most seagrass species, an estimated 20 to 25 percent of the light striking the bay's surface must penetrate to the bay bottom to allow seagrass regrowth (Janicki and Wade 1996). The light requirement for turtle grass, the most common seagrass species in Tampa Bay, is estimated to be 20.5 percent of incoming light at the deep edges of the grass beds (Dixon and Leverone 1995).

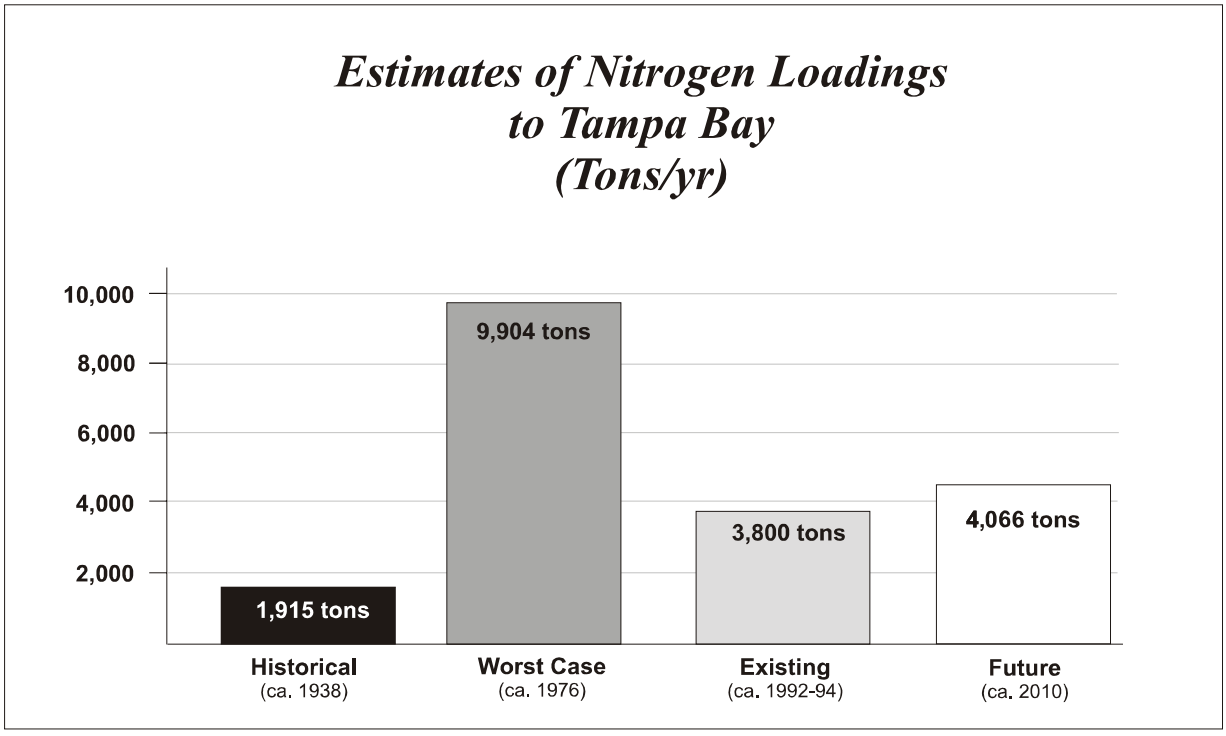
By maintaining or slightly improving water clarity, light conditions should be sufficient to gain back a majority of the seagrasses present in Tampa Bay in the 1950s, excluding areas that have been permanently altered (Janicki and Wade 1996). Concentrations of chlorophyll a are a useful indicator of algal biomass. In 1991, mean annual levels of chlorophyll a for Tampa Bay were near their lowest point since 1974. Overall, levels from 1989 to 1994 were low enough throughout the bay to allow 20 to 22 percent of the surface light to penetrate to depths where seagrasses grew in the 1950s (Janicki and Wade 1996).

A.3.2 Nitrogen

Despite progress in bay cleanup, nitrogen continues to be a key focus of concern for Tampa Bay. Excess amounts of this otherwise beneficial nutrient can pollute the bay by accelerating algal growth. Excess algae reduces light penetration to seagrasses and, ultimately, depletes the water of dissolved oxygen. Water quality improvements are attributed mainly to advances in domestic and industrial wastewater treatment and associated declines of nitrogen in effluent discharged from these facilities. Until the late 1970s, most sewage treatment plants operating along the bay pumped partially treated sewage into Tampa Bay. This nutrient-rich effluent was a chief cause for the pollution that sparked noxious algal blooms and depleted oxygen and sunlight in the bay. Scientists estimate that the bay's total annual nitrogen loading in 1976 was more than 2.5 times greater than the load for the years l992-1994 (Zarbock *et.al.* 1994 and Martin *et.al.* 1996).

Today, all sewage treatment plants discharging to the bay and its tributaries provide Advanced Wastewater Treatment (AWT), a process that substantially reduces nitrogen in effluent. The retrofit of Tampa's Howard F. Curren facility at Hookers Point, the area's largest plant, was a catalyst in the bay's water quality recovery. St. Petersburg's pioneering wastewater reuse program, which eliminated almost all its direct wastewater discharges to Tampa Bay, also contributed to improving water quality. Similar reuse programs now are underway in many other bay area communities. A number of smaller package plants also operate along the bay, although none discharge directly to the bay. One of these facilities is located at Tampa's MacDill Air Force base, which is home to the U.S. Central Command. The treated effluent is reused for spray irrigation at the 5,600-acre base (Department of the Air Force 1996). A focus of the NEP has been to establish and allocate nitrogen loading goals for Tampa Bay to encourage seagrass recovery. By signing an Interlocal Agreement in 1998, local government and agency partners in the NEP approved a long-term seagrass restoration goal for Tampa Bay of 12,350 acres, and pledged to protect the bay's existing 26,650 acres of seagrass. The restoration goal is based on restoring seagrasses to levels documented in the 1950s, excluding areas that have been permanently altered (Janicki *et.al.* 1994).

By the year 2000, an additional 84 tons of nitrogen is expected to enter Tampa Bay as a result of population growth and associated development. Therefore, local governments and other industries will need to reduce or avoid increasing the amount of nitrogen they generate by this amount to maintain current levels. NEP's local government partners agreed to accept responsibility for reducing nitrogen loadings associated with stormwater runoff and wastewater discharges by about 6 tons per year from 1995-2000, or a total of 28 tons per year by 2000.



Source: Coastal Environmental, Inc. (1994, 1996)

The NEP created the Nitrogen Management Consortium, an alliance of local governments, regulatory agencies and key industry representatives, and tasked he group with developing a specific action plan to address the remaining 11 tons per year, or 56 tons per year by the year 2000, of nitrogen linked to atmospheric deposition, industrial point sources, fertilizer shipping and handling practices and intensive agriculture. The Consortium approved the Nitrogen Management Resolution and Action Plan in February 1998.

Consortium members include representatives from the NEP's Management Board, electric utilities, fertilizer manufacturers and agriculture. Industries which are not official members of the Consortium, such as Tampa Electric Company and Florida Power Corporation, also have participated in the group's discussions and offered valuable recommendations. Efforts by Tampa Electric to reduce NOx emissions from its power plants on Tampa Bay are among the key industry projects included in the Action Plan.

The Resolution and Action Plan identify specific actions each Consortium member will take to meet its nitrogen management commitment. The Resolution must be ratified by the members' governing bodies, a process expected to occur in the next few months.

Consortium members already have made substantial progress in meeting the nitrogen loading goals. In fact, estimates show that the baywide nitrogen reduction goal can be achieved or surpassed by the year 2000 from projects already completed or begun by Consortium members. Among those ongoing or planned projects are land acquisition programs that prevent environmentally significant lands from being developed; construction of regional stormwater treatment facilities; and improvements in manufacturing processes that reduce pollution.

The NEP will review and revise the nitrogen management goals every five years, or more often if warranted. Revisions will take into account additional sources of nitrogen to the bay, as well as unforeseen events such as spills.

A.3.3 Toxic Contaminants

Toxic contaminants represent another primary focus of concern for bay managers. Overall, Tampa Bay has relatively low to moderate levels of most toxic parameters when compared to other urban estuaries; however high levels of contaminants occur in areas adjacent to stormwater discharges. Toxics of concern include various trace metals, pesticides, polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs) (Frithsen *et.al*.1995). These substances, some naturally occurring and others synthetic, can be damaging or deadly to marine life when present in sufficiently high concentration. In addition, they have the potential to affect human health.

Recent studies by NOAA, the FDEP and the Tampa Bay NEP provide the most complete assessment to date of toxic substances of concern and their distribution in Tampa Bay (Long *et.al.* 1991 and Zarbock *et.al.* 1996). Contamination appears to be centered around large urban centers, ports and marinas, and concentrations generally diminish from the

top of the bay toward the Gulf.

Results of a recent risk assessment conducted for the Tampa Bay NEP indicate that some contaminants are present at concentrations high enough to be harmful to fish and wildlife, either through direct exposure to bay sediments or indirectly through the food web. The study, completed in 1996, assessed the risk to human health and marine life from contaminants in Hillsborough Bay and Boca Ciega Bay, two of Tampa Bay's most impacted sectors and identified potential sources in these two watersheds (Parsons Engineering Science, Inc. 1997). The primary contaminants of concern identified in the study include metals, PAHs, PCBs, and chlorinated pesticides. Most of these pollutants enter the bay in stormwater runoff or through atmospheric deposition.

Although levels of most contaminants documented locally pose no known risk to humans, effects of repeated exposure to small amounts of these materials remain largely unknown. Some contaminated sediments remain inert or inactive for many years, then are disturbed by dredging, shipping, storms or animal activity. Bottom dwellers that filter contaminated sediments—and the fish, birds and humans that ultimately consume them—can be placed at risk, since some toxic substances increase in concentration as they ascend the food web.

A.4 POLLUTION PATHWAYS AND SOURCES

Nitrogen and toxic contaminants follow several pathways to the bay, entering in stormwater runoff from urban, residential and agricultural lands; atmospheric deposition (pollutants transported to the bay in rainfall and dryfall); and municipal and industrial wastewater. Septic systems and spillage of fertilizer product in handling and transport also can contribute significantly to nitrogen loadings in localized bay sectors.

Anthropogenic sources of nitrogen include nitrogen oxides from power plant and vehicle emissions (entering the bay from the atmosphere); treated effluent from municipal and industrial wastewater plants; fertilizer from yards and farms; leachate from septic tanks and small package treatment plants; and animal wastes entering the bay in stormwater runoff.

Potentially toxic contaminants such as metals and chemicals can originate from industrial and municipal wastewater; pesticides from yards and farms; contaminants from roadways and paved surfaces washed into the bay in stormwater runoff; and industrial and vehicle emissions. Nine toxic waste sites on the federal government's Superfund list are located in the Tampa Bay watershed in basins draining to Old Tampa Bay and Hillsborough Bay. Additional sites are proposed for designation. Although impacts to the bay from these sites vary and are difficult to quantify, they will be evaluated by NEP as possible contributors to hot spots of contamination (Parsons Engineering Science, Inc. 1996). EPA also has identified 38 smaller hazardous materials sites at MacDill Air Force Base, which are in various stages of evaluation and remediation (Heintz 1992).

A.4.1 Stormwater Runoff

Stormwater runoff from the Tampa Bay watershed contributes about 45 percent of the bay's total annual nitrogen load; a significant portion of that amount may actually come from the air when nitrogen compounds fall to the ground and enter the bay in runoff (Zarbock *et.al.* 1996). Runoff also conveys more than 60 percent of the annual loadings for each of the following metals: chromium, zinc, mercury and lead, as well as significant amounts of other potentially toxic pesticides and substances. Atmospheric deposition directly to the bay's surface, and municipal and industrial wastewater, carry the bulk of remaining pollutants (Frithsen *et.al.* 1995).

Fine-grained particles carried in stormwater runoff also are regarded as pollutants. These total suspended solids (TSS) may reduce water clarity and sunlight available for seagrass growth, and convey toxic contaminants to the bay.

Urban stormwater runoff accounts for about 15 percent, or 570 tons, of the bay's total annual nitrogen loadings. Of that amount, approximately two-thirds comes from residential areas. By comparison, commercial/industrial sites account for about one-third of the total nitrogen in urban runoff, although their per-acre contributions are higher than that of residential land uses (Zarbock *et.al.* 1996).

Runoff from intensive agricultural land uses (mostly citrus and vegetable production) contributes about 6 percent of total bay nitrogen loadings, as well as sediments and pesticides. Agricultural runoff from pastures and rangelands, which cover roughly 28 percent of the watershed, account for another 13 percent of total bay nitrogen loadings. Forests and wetlands (at 7 percent) and mining (at 4 percent) comprise the remainder of nitrogen loadings in stormwater runoff (Zarbock *et.al.* 1996).

A.4.2 Atmospheric Deposition

Coastal waters of the United States receive large quantities of nutrients, heavy metals and chemicals from the air—and Tampa Bay is no exception. Until recently, atmospheric deposition (pollutants carried in rainfall and dryfall, which consist of small particles and aerosols) had not been identified as a significant problem for Tampa Bay. Studies now suggest that about 29 percent of the bay's total nitrogen loadings are from atmospheric pollutants falling directly on the water (Zarbock *et.al.* 1996).

Nitrogen loadings from atmospheric deposition are actually much higher when pollutants falling in the watershed are included, since many of these will eventually enter the bay in stormwater runoff. About 1,100 tons of nitrogen is estimated to fall on the open bay each year in rainfall and dryfall. Another 6,600 tons fall in the watershed, although experts can't say how much of that reaches the bay. EPA estimates that as much as 67 percent of the bay's total nitrogen load could come from the atmosphere (Patwardhan and Donigian 1994).

Several forms of nitrogen are contained in rainfall and dryfall to Tampa Bay. Nitrogen oxides (NOx)—mostly linked to power plant and vehicle emissions—are chemically transformed in the air, eventually returning to earth in aerosol or dissolved forms, such as

nitric acid and other soluble nitrates in rainfall. Combined emissions from motor vehicles and power plants contributed almost 70 percent of the total nitrogen oxides that fell to the earth in the United States in 1984. Industrial sources provided another 15 percent (Fisher *et.al.* 1988).

In the Tampa Bay region, stationary sources (primarily power plants) contribute an estimated 70 percent of the manmade NOx emissions as compared to 30 percent from motor vehicles (Florida Department of Environmental Protection 1994). One utility, Tampa Electric Company—which operates two coalfired power plants on the bay—is the single largest source of NOx emissions in the region. According to the EPC of Hillsborough County, these two facilities emitted approximately 90,000 tons of NOx in 1994, representing nearly two-thirds of the total NOx emissions for Hillsborough and Pinellas counties (Environmental Protection Commission of Hillsborough County 1996).

However, researchers can't say how much of what is emitted locally stays in the region or what percentage of emissions from outside the region are deposited here, since airborne contaminants may travel hundreds (or even thousands) of miles before settling to Earth. They also can't pinpoint what portion of nitrogen loadings from the atmosphere comes from natural sources, such as lightning. Additional research on natural and manmade sources and the relative contributions from local and distant sources is needed to effectively manage atmospheric deposition in Tampa Bay, which is expected to increase as population, power consumption and motor vehicle traffic grow (Fisher *et.al.* 1988).

Between 1995 and the year 2010, nitrogen loadings to the bay from all sources are expected to increase by about 7 percent, or 17 tons per year (Zarbock *et.al.* 1996). But those estimates do not include changes that could occur as a result of new and unforeseen industrial discharges to the bay, or increased power generation at local utilities. Florida Power & Light (FP&L) Company's request to burn the controversial new fuel called Orimulsion, for example, would have resulted in increased activity at its Manatee County plant. That increase in power generation would have resulted in an additional 20 tons of nitrogen loadings to the bay each year, according to the company. FP&L's request to burn the fuel was denied in April 1996 by the Governor and Cabinet in a 4-3 vote. The decision is now being appealed.

Toxic substances also enter the bay from the atmosphere in large quantities. For example, studies estimate that 44 percent of the bay's total cadmium loading, and about one-sixth of its copper and lead loadings, come from the air (Frithsen *et.al.* 1995). PAHs also enter the bay from the atmosphere, although loadings and specific sources are unknown. PAHs are associated with fossil fuel combustion, such as power plant and motor vehicle emissions and waste incineration.

A.4.3 Wastewater

While advances in wastewater treatment and increased regulation have helped reduce pollution, permitted sewage treatment plants and industries discharging directly to the bay ("point" sources) still contribute substantial pollutants to Tampa Bay.

Municipal sewage treatment plants in the watershed contribute about 10 percent (or 360 tons) of the bay's total annual nitrogen loadings (Zarbock *et.al.* 1996). Although all sewage treatment plants with surface discharge to the bay or its tributaries now provide Advanced Wastewater Treatment, roughly 36 billion gallons of effluent are still discharged to the bay each year, with Hillsborough Bay receiving the largest portion. In 1991, this bay segment received two-thirds of the cumulative nitrogen load from domestic wastewater treatment plants discharging to the bay (Zarbock *et.al.* 1994).

Wastewater discharged from industrial facilities in the Tampa Bay watershed is responsible for about 4 percent of total nitrogen loadings (Zarbock *et.al.* 1996). Fertilizer manufacturing and shipping facilities are the largest industrial point sources.

Industrial and municipal point sources also are a major pathway for toxic substances, contributing roughly 30 percent of the bay's total loadings of arsenic, cadmium, chromium and copper, as well as low levels of other contaminants (Frithsen *et.al.* 1995). Residents also can contribute to the problem by pouring down drainpipes toxic cleaners or solvents that local sewage treatment plants cannot completely remove.

A.4.4 Other Sources

Septic tanks, which are estimated to serve about 20 percent of the watershed's populace, also are a key part of the pollution puzzle in localized sectors of Tampa Bay. Preliminary studies conducted for the Southwest Florida Water Management District (SWFWMD) suggest that nitrogen loadings from septic systems, as well as septic waste and sewage treatment sludge, contribute as much as 4 percent to the bay's overall nitrogen loadings (Owen Ayres and Associates, Inc. 1995). Older septic systems located near the bay pose a particular threat to water quality, since most are not designed for nitrogen removal.

Disposal of sewage sludge poses a special problem, particularly in the Hillsborough and Manatee river basins, because of the number of permitted disposal sites. Different agencies regulate disposal sites and it is difficult to determine how much material is being spread and how it is handled. Additionally, some of the sludge disposed of in the Tampa Bay watershed actually comes from outside the region (Owen Ayres and Associates, Inc. 1995).

High densities of mostly older septic tanks can contribute to degraded water quality (nutrients and pathogens) in creeks where circulation is limited and the water table is near the ground surface. Pinellas County's Allen's Creek and several creeks in Hillsborough County are among those thought to be at risk (Zarbock, personal communication 1995). Septic systems along tributaries leading to Tampa's McKay Bay also are believed to be a problem (Cardinale, personal communication 1995) Springs that feed into the bay's rivers and smaller tributaries also may be impacted by septic tank leachate, especially in areas with very porous soils (Jones and Upchurch 1993).

Preliminary estimates developed for the NEP suggest that ground water and springs contribute about 5 percent of the bay's total nitrogen loadings. (Brooks *et.al.*1993).

Nitrogen (particularly nitrate) concentrations in springs in the area appears to be increasing, possibly due to changes in land use in the spring recharge areas (Jones and Upchurch 1993).

Another 7 percent of the bay's total nitrogen loadings is attributed to fertilizer lost during shiploading and landside on route to port (Zarbock *et.al.* 1996). However, the amount has declined substantially since 1991 as a result of efforts to improve portside facilities.

A.5 BAY HABITATS

While many bay animals prefer the open water of the estuary, others require the food and shelter supplied by various structural habitats, including seagrasses, mangroves, salt marshes and uplands. Together, these habitats form a natural network that sustains vast populations of fish, birds and other wildlife.

Since 1950, about half of the bay's natural shoreline and nearly 40 percent of its seagrasses have been destroyed, along with significant portions of upland habitat (Wade and Janicki 1993). Most casualties were sustained before the mid-1970s, when the environmental impacts of unmanaged growth became evident.

Now, water quality improvements are helping in the recovery of the bay's living resources, and seagrasses have been a key beneficiary. Since the 1980s, grass beds have made an impressive comeback in many areas of the bay in response to improving water quality.

Trends for the recovery of saltwater wetlands are not as clear. Between 1950 and 1990, the bay experienced a net loss of approximately 5,128 acres, or 21 percent, of emergent tidal wetlands. Of that amount, a larger loss of tidal marsh (-38 percent) and salt barren (-36 percent) habitat has occurred compared to mangrove habitat (-13 percent). Recent studies show a slight increase in the bay's saltwater wetlands from 1982 to 1990, which is generally attributed to wetland colonization of new emergent land created from bottom-fill, as well as wetland creation and restoration (Janicki, *et.al.* 1994). However, the quality or productivity of these new wetlands is not fully known.

A.5.1 *Seagrasses*

Seagrasses provide shelter, nursery and feeding habitat for many popular fish and shellfish, including snook, red drum, seatrout, shrimp and the bay scallop. These shallow grass flats also are an important feeding ground for the endangered Florida manatee, of which about 200 are estimated to visit the bay. Grass beds also help to improve water clarity by anchoring bottom sediments and reducing nutrients in the water column. Their importance and environmental requirements make seagrasses an excellent indicator of the bay's overall health.

Because seagrasses require light to grow, light limits the depths at which they occur. Even in the clearest waters of lower Tampa Bay, seagrasses typically grow no deeper than 6 to 8 feet.

In 1950, about 40,000 acres of seagrass flourished along the shallow shelf of the bay. By 1982, only 21,600 acres remained, and Hillsborough Bay's 2,700 acres of seagrasses had been virtually eliminated (Lewis *et.*al. 1991). Three factors are believed to have caused the baywide decline: dredging and filling for waterfront development; reduced light penetration as a result of shading by algae and epiphytic growth fueled by excess nutrients discharged to the bay in wastewater and stormwater runoff; and cloudiness (or turbidity) caused by sediment resuspension (Lewis *et.al*. 1991).

An estimated 13,200 acres of bay bottom have been filled since the early l900s, and more than 90 percent of the filling occurred along the bay's shallow shelf where seagrasses once thrived (Wade and Janicki 1993). Hillsborough Bay is one of the bay's most impacted segments. Its surface area has been reduced by 14 percent as a result of residential development at Davis Islands, creation of spoil islands, and construction of port and power generating facilities. That compares to a surface area reduction of 3.6 percent for the entire bay caused by filling for development (Goodwin 1987).

Seagrasses have rebounded in recent years as a result of improving water quality. From 1982 to 1992, bay seagrass coverage increased by about 4,000 acres, or 18.5 percent, raising the bay's total acreage to more than 25,600 acres (Lewis *et.al*. 1991). Most of the incoming grass is shoal grass (*Halodule wrightii*), a early-colonizer that may eventually be replaced in many areas by turtle grass (*Thalassia testudinum*), a later successional species (T. Ries, personal communication 1996).

Seagrass gains are largely attributed to upgrades in sewage treatment plants that led to substantial declines in nitrogen loadings to the bay. Declines in nitrogen loadings resulted in lower phytoplankton density and corresponding improvements in water clarity. Increased water clarity enabled more light to penetrate to underwater seagrasses.

Drought conditions prevalent in the 1980s also may have assisted seagrass regrowth, since less rainfall brings fewer nutrients and contaminants into the bay. Seagrass recovery efforts of the NEP focus mainly on regulating the bay's nitrogen intake, but other factors, such as turbidity from boat traffic in certain areas (such as ports and marinas) and water color affected by tannins entering the bay from rivers draining swamp and cypress areas, also influence seagrasses by determining how much light reaches the grass beds. These factors may be increasingly significant in areas of the bay where nitrogen management alone does not achieve seagrass restoration goals.

Seagrass transplanting also may be viable in some areas of the bay, although its success rate varies and it is still experimental. Pioneering efforts by scientists at the Florida Marine Research Institute (FMRI) show promise in laboratory cultivation of plant fragments for large-scale restorations (Durako *et.al.* 1993). Some local transplanting projects, such as the City of Tampa's in Hillsborough Bay, have been successful (Johansson 1995). The NEP will evaluate suitable areas for transplanting projects as part of its overall seagrass recovery strategy. Continued monitoring will be necessary to document the trends in seagrass regrowth.

Although more than 40 percent of seagrasses reveal little or no damage from boat propellers, seagrass scarring is an important problem in some parts of the bay. Studies by the FMRI indicate that about 27 percent of Tampa Bay's seagrasses are moderately to heavily scarred—second in severity only to the Florida Keys (Sargent *et.al.* 1995). Signs of chronic damage are evident around many passes and channels. Studies at Weedon Island Preserve suggest that propeller scars in turtle grass may take more than five years to heal (Durako *et.al.* 1992).

Intense scarring at Cockroach Bay in southern Hillsborough County and at Pinellas County's Ft. DeSoto Park has prompted boating restrictions and other measures in these areas to protect seagrasses (Ehringer 1994). Channel marking and education appear to be the most effective techniques for reducing damage to grass beds (Sargent *et.al.* 1996).

The quality of the bay's seagrasses, and their utilization by animals, has not yet been fully evaluated. However, the SWFWMD recently modified its seagrass monitoring program to include assessments of seagrass quality at 60 locations around the bay. Monitoring parameters include seagrass species diversity, density and quantity of epiphytic algae attached to the grass blades, as well as physical parameters such as salinity, pH and water depth (T. Ries, unpublished data 1995).

A.5.2 Soft-Bottom

More than 80 percent of the bay bottom is sand or mud, although the term "soft bottom" can be misleading since a large part of the bay floor is actually hard-packed sand and shell (Wade and Janicki 1993). These bottom sediments support a large variety of organisms, including parchment worms, clams, tunicates (or sea squirts) and conchs. The surface sediments of this dynamic habitat are periodically churned up and re-deposited by bottom dwelling animals, as well as by waves, currents and dredging (Lewis and Estevez 1988). More than 500 types of macroinvertebrates baywide and an average of 10,000 organisms per square meter were documented in 1993—the first year of benthic sampling conducted by the EPC of Hillsborough County and Manatee County for the Tampa Bay NEP (Grabe *et.al.* 1996).

Dredging of navigation channels and underwater disposal of dredged material have impacted an estimated 14,400 acres of bay bottom, mostly in deep-water areas of the bay. An additional 1,200 acres of deep-water soft bottom has been filled to create spoil islands and causeways shell (Wade and Janicki 1993).

The long-term effects of disposal on these soft-bottom habitats has not been well documented. However, the benthic monitoring program established in 1993 by NEP and the bay's three surrounding counties will eventually enable scientists to assess trends in the quality of these bottom communities. Samples are taken each year during the critical monitoring period (September and October) at more than 100 stations, and analyzed for the number and diversity of organisms, as well as sediment quality and chemistry (Grabe *et.al.* 1996). A sediment toxicity analysis was added in 1996.

A.5.3 Hard-Bottom

Although relatively rare in Tampa Bay, hard- or "live-" bottom habitat features a composition of plants and animals that is unlike any other in the bay ecosystem. Hard-bottom habitat is formed when natural outcroppings of rock or limestone—or man-made bridge pilings or reefs—along the bay bottom are colonized by corals, barnacles, sponges and algae that attract small fish and larger predators. Its colorful inhabitants include sea fans, anemones and tunicates.

A preliminary study conducted for the Tampa Bay NEP revealed more than 850 acres of hard-bottom habitat in Tampa Bay (Savercool and Lewis 1994). Major communities are located at Rocky Point (Old Tampa Bay) near Cockroach Bay (Middle Tampa Bay) and in portions of Lower Tampa Bay. Long-term trends in hard-bottom coverage are not yet available.

Oyster reef communities are another distinct hard-bottom habitat, although they have not been well-documented in Tampa Bay. The reef's intricate structure provides habitat for scores of invertebrates and fish species.

While historical estimates of hard-bottom are sketchy, the bay once supported a thriving oyster fishery. The most recent estimate of oyster coverage was 8,300 acres in 1972 (Lewis and Estevez 1988). Oysters are no longer commercially harvested, since most areas of the bay have been closed to shellfishing because of unsafe or suspected high levels of bacterial contamination.

Additionally, eight artificial reefs have been established in Tampa Bay to expand natural hard-bottom and enhance fishing. Other man-made habitats include bridge and dock pilings, seawalls and spoil islands. These artificial habitats provide additional structure for attaching organisms such as oysters, sponges and tunicates.

A.5.4 ***Estuarine Wetlands***

The natural shoreline of the bay is bordered by a broad intertidal zone of wetlands, submerged at high tide and exposed at low tide. These dynamic wet zones, which include mangroves, marshes and mud flats, provide vital food and protection for various marine creatures. They also buffer uplands from storms and help filter nutrients and particulates in runoff from the surrounding watershed.

A.5.4.1 Marshes and Mangroves

While mangrove and marsh habitats may occur independently, they often occur together, with red, white and black mangroves interspersed with salt marsh species, such as smooth cordgrass and black needlerush. Mangroves outnumber marshes in Tampa Bay by more than a 3-to-1 ratio (Janicki *et.al*. 1994). However, salt marshes composed of rushes, sedges and grasses are the dominant natural habitat along the bay's major tributaries.

Decaying mangrove leaves provide a nutrient-rich food called detritus for small fish, shrimp and crabs. The sturdy roots of the mangrove trees anchor the shoreline, while the mangrove canopies serve as roosts and nests for a remarkable variety of resident and wintering birds.

Mangroves and marshes also support juvenile fish, such as snook, tarpon, red drum and mullet, and protect them from larger predators. Mature mangroves in quiet lagoons and canals in fairly high-salinity areas provide an important nursery habitat for snook.

Mangroves in Tampa Bay are particularly vulnerable to damage or destruction from periodic freezes, since the bay is near the northern limit for these species. This underscores the importance of maintaining a healthy abundance of these wetland habitats. Dense stands of mangroves not only are better equipped to survive a freeze, they also provide more food and better habitat for the animals they support.

Pruning of mangroves can affect their productivity. Public outcry against a 1995 law that made it easier for residents to trim mangroves prompted the Florida Legislature to revisit the issue in 1996. A new mangrove trimming bill was passed, reinstating some trimming restrictions and providing additional penalties for violators. State officials do not know how many acres of mangroves were trimmed during 1995, but say the damage was severe in many cases.

About 21 percent (5,128 acres) of Tampa Bay's original saltwater wetlands were destroyed between 1950 and 1990, primarily due to dredging and filling for waterfront development. These losses were not distributed equally among bay habitats, with the greatest declines documented for tidal marshes (38 percent), followed by salt barrens (36 percent) and mangroves (13 percent)ratio (Janicki *et.al*. 1994).

The steepest declines occurred during the 1950s and 1960s, when efforts to develop coveted waterfront property for residential and commercial uses proceeded unchecked. The passage of wetlands protection laws during the mid-1970s and 1980s has greatly slowed the rate of loss, and studies indicate a slight increase in tidal wetland coverage since 1982, due to recent habitat restoration efforts and natural colonization of marshes and mangroves along causeways and other filled lands ratio (Janicki *et.al*. 1994).

Recent estimates of wetland habitat in Tampa Bay indicate that about 18,800 acres of mangrove forests and salt marshes remain (Janicki *et.al*. 1994). However, thousands of acres of these native habitats have been displaced by invasive exotic plants, such as the Australian pine and Brazilian pepper.

A.5.4.2 Mud Flats and Salt Barrens

Mud and sand flats along the bay's perimeter also are an important part of the estuarine wetland system. While these largely non-vegetated areas may appear barren and lifeless to an untrained eye, they are highly productive and valuable.

On closer inspection, so-called "non-vegetated" shallow bottom areas more closely resemble a secret garden teeming with microscopic plant life. Invisible to the untrained eye, single-celled algae and bacteria proliferate here, giving the bay floor a subtle brown or greenish cast. What's more, these diminutive residents pack a sizeable punch as fuel for the bay's primary productivity. Indeed, in shallower ecosystems, the sheer number of these bottom-dwelling organisms often exceeds the amount of phytoplankton in overlying waters (MacIntyre *et.al.* 1996).

Mud flats support a diverse community of bottom-burrowing creatures, including worms, clams and crabs, which are pursued by wading birds and raccoons foraging for food at low tide. At high tide, fish enter the flats in search of food.

These areas also are prime feeding areas for a number of migratory birds, including ducks, gulls, avocets and several species of sandpiper, which seek refuge in Tampa Bay each winter.

Fewer than 900 acres of salt barren remain, mostly along the bay's southeastern rim (Janicki *et.al*. 1994). Historical estimates of this habitat are unavailable. Salt barrens form in areas where brackish water moves in during very high tides and evaporates, creating open stretches of salty, dry soil. This hyper-saline terrain supports low-growing succulent plants and serves as a seasonal feeding habitat for wading birds.

A.5.5 Associated Uplands

Neighboring upland habitats of pine forests, hammocks and shrubs also have been heavily impacted by development. Often overlooked or undervalued, these buffer areas and associated freshwater wetlands provide important habitat for numerous animals, including the wood stork, white ibis, osprey, bald eagle and Sherman's fox squirrel. Many of the birds and animals that live in coastal wetlands or along the shore hunt for food in upland forests and fields. Likewise, many upland species depend on adjacent wetlands for survival.

Almost all coastal pine forests, which are critical nesting sites for bald eagles, have been eliminated from the shores of Tampa Bay, and about 40 percent of this habitat has been lost throughout the watershed (Beever, J., personal communication. 1995). Coastal hammocks also have declined. Coastal hammocks of live oaks and cabbage palms occur in patches where wetlands transition to uplands, and are home to raccoons, bobcats, foxes and other animals that feed in neighboring wetlands.

A.5.6 Low-Salinity Habitats

The bay's four major rivers—the Hillsborough, Alafia, Manatee and Little Manatee—and more than 100 smaller tributaries provide critical low- and medium-salinity habitat for numerous species of fish and shellfish at early stages in their development. Variations in the salt content of the water, from the low-salinity reaches of the bay's tributaries to full-strength sea water at the mouth of the bay, determine which areas of the estuary are

inhabitable for some species and not for others. Oysters, for example, flourish in low-salinity areas of the bay where they are protected from snail predators. Similarly, fish with wide salinity tolerances use low-salinity areas in rivers to avoid predators that cannot tolerate these conditions.

Called oligohaline from the Greek *oligos* (small) and *haline* (salty), the low-salinity areas occur in the upper reaches of the bay's tributaries, where salinities range from zero to 10 parts per thousand (ppt), as compared to about 35 ppt at the mouth of Tampa Bay. Downstream, mesohaline or medium-salinity zones occur within a salinity range of 11 to 19 ppt.

Low and medium-salinity habitats are a primary nursery for red drum, snook and tarpon, as well as numerous non-game species such as the striped mullet. Some of the most highly productive juvenile nursery habitat occurs where these low-salinity waters overlap with shoreline or submerged vegetation. As the fish mature, they typically move to more saline zones in the estuary or out into the Gulf of Mexico (Killam *et.al.* 1992).

Efforts to protect these highly productive nursery habitats depend on maintaining the proper timing and flows of fresh water and salt water within the bay's tributaries. Four major tributaries—the Hillsborough River, Palm River (Tampa Bypass Canal), Manatee River and Braden River—have dams or reservoirs that divert fresh water to serve the region's drinking water and irrigation needs. During dry season, when water demand is highest, reservoirs on the Hillsborough, Palm and Manatee rivers release almost no water downstream.

Local water supply development plans may further reduce the flow of fresh water into already impacted tributaries and bay segments. For example, the Tampa Water Resource Recovery Project would remove up to 50 million gallons per day (mgd) of fresh water currently discharged to Hillsborough Bay from the City of Tampa's sewage treatment plant, and possibly reduce flows to the Tampa Bypass Canal and McKay Bay. However, the project also will remove a major source of excess nitrogen to the bay. An environmental impacts assessment will be conducted as part of this project (CH_2M Hill 1995).

Additionally, the West Coast Regional Water Supply Authority proposes to remove 7 mgd from the Alafia River during the first phase of its 1995 Water Resource Development Plan (1995-2000) (CH_2M Hill 1995).

The impact of reservoirs on the low and medium-salinity habitats downstream is the subject of several ongoing assessments. One study of flow variations on the Manatee River indicates that, on average, river area and volume within the low-salinity band were reduced 33 percent and 22 percent, respectively, as a result of reservoir operations for the period 1982-199A. Consequently, the area of wetlands coinciding with this low-salinity band was reduced by 150 acres, or 25 percent (Walters *et.al.* 1994).

Modeling comparisons of historic and modern landscapes indicate that net freshwater inflows to the main body of Tampa Bay have changed little since the 1950s, assuming the

same amount of rainfall each year (Zarbock *et.al.* 1995). This is mainly a result of increases in urban and agricultural stormwater runoff, which have countered decreases in freshwater flows from rivers. However, long-term measurements of river flows by the U.S. Geological Survey indicate that some rivers in southwest Florida (including the Hillsborough River) have experienced gradual freshwater declines since the 1930s, partly because of declining rainfall (Coastal Environmental, Inc. 1996).

A.6 FISHERIES

Recent trends in the populations of many sport and commercial fish species in Tampa Bay are difficult to determine. Anecdotal reports from sport fishermen indicate some species such as snook and red drum are responding positively to fishing regulations designed to increase their numbers. On the other hand, commercial landings of black (or striped) mullet and spotted seatrout are significantly below historical catches.

A constitutional ban on gill netting, triggered in part by declining mullet stocks, took effect in July 1995. Supporters believe the ban will lead to increases in mullet populations, which are fished almost exclusively by commercial netters. The ban also may benefit other species like spotted seatrout and sheepshead, targeted by both commercial and recreational fishermen.

Bait fish such as menhaden and herring also were targeted for increased protection following precipitous declines in bait fish landings in the late 1980s. The 1993 ban on purse seining in the bay is expected to stabilize bait fish populations, as well as benefit other fish and birds that feed on the bait fish. Careful monitoring of fish populations will be necessary to gauge the effectiveness of these regulations and determine the need for further management actions.

Until recently, resource managers have had to estimate populations of important fishery species in Tampa Bay from landings data because direct measurements were not available. These data, which record the amounts and types of fish brought to Pinellas and Hillsborough docks by area fishermen, indicate that 3.7 million pounds of 11 commercial species of finfish were harvested from the bay in 1990—a decrease of 24 percent since 1966. The decrease is largely due to reduced catches of mullet and sea trout, while landings for the remaining species stayed the same or increased slightly (Norris, M., personal communication 1995).

However, records going further back, to 1950, show that harvests of spotted sea trout declined 86 percent in the bay by 1990, from 487,000 pounds to 67,000 pounds. Similarly, red drum harvests plummeted from 80,000 pounds in 1950 to 15,000 pounds in 1986, the last full year of available data prior to a statewide ban on commercial red drum harvests These raw data do not reflect changes in fishery management plans or quotas (Norris, M., personal communication 1995).

Prior to the net ban, mullet was the most sought-after commercial species in the bay, comprising almost half of the 1992 landings of finfish and shellfish, or A.3 million pounds.

By comparison, bay harvests of spotted seatrout and bait shrimp were only 40,000 pounds and 26,000 pounds, respectively (Norris, M., unpublished data 1994).

Although useful, landings can be a misleading indicator of population stocks because natural fluctuations and changes in market demand, gear efficiency and fishing regulations may affect them. Additionally, commercial landings are often under-reported and tend to decline as recreational fishing increases. Recognizing this, the FMRI in 1989 initiated a Critical Fisheries Monitoring Program (CFMP) to provide more reliable estimates of stock sizes and distribution of important species and key prey species. The research also is helping clarify the crucial role habitat plays in the life cycles of many species.

A summary of results of the first three years of the CFMP (1989-1991) found that 78 percent of the juvenile spotted seatrout collected were captured over seagrass beds, further validating the importance of seagrass habitat to this species. Small red drum were found in relative abundance in the bay's major tributaries, while small snook are known to frequent at least two of the rivers, the Alafia and Little Manatee (Wade *et.al.* 1992).

Mirroring declines in fish stocks, Tampa Bay's once-thriving commercial shellfish industry also has virtually collapsed, although bait shrimping and some food shrimping continues. Harvests of clams and oysters throughout the bay are restricted or prohibited because of documented or potential bacterial contamination from fecal coliform associated with human and animal wastes entering the bay in stormwater runoff. In the few unrestricted areas remaining, shellfish populations are not large enough to support commercial harvest.

However, reassessments of closed or restricted areas are not routinely performed by the state, and it is possible that actual water quality conditions in specific areas do not warrant the restrictions. That's because decisions to classify or reclassify areas in most cases are based on land use considerations and the documentation of or potential for contamination following a major storm event, rather than actual water quality conditions (Pierce, B., personal communication 1995).

The bay's fisheries also are impacted by entrainment, the capture of planktonic eggs and larvae of fish and shellfish in power plant cooling intakes. The five power plants around Tampa Bay take in a daily average of about A.3 billion gallons of bay water. An estimated 274 billion fish eggs and 83 billion fish larvae are captured annually in cooling intakes in Tampa Bay, according to power plant monitoring data from the early 1980s (Tampa Bay Regional Planning Council 1985).

Assuming 100 percent mortality, the impact of steam electric plants on the fishery stocks of Tampa Bay may be significant. However, in the absence of sufficient base line data on stock sizes and normal survival rates, it is difficult to fully assess this impact. Further evaluation is needed to understand the cumulative impacts of power plant entrainment on the bay's fisheries.

Habitat declines, water quality and fishing impacts are considered the primary factors

responsible for changes in fish populations. The relative impact of each factor is often hard to discern because of natural fluctuations in stock sizes.

Despite these pressures, improving water quality and restoration of habitats through out Tampa Bay are creating more favorable conditions for fish and shellfish and for the seagrass habitats they require. One potential beneficiary is the bay scallop, which all but disappeared from Tampa Bay in the 1960s. While experts can't say why the scallop departed decades ago, they suspect these highly sensitive creatures were casualties of pollution. Water quality in Tampa Bay now has improved to levels that may support scallop recovery (Leverone 1993), and some restocking efforts have been undertaken (Blake *et.al.* 1993).

Mortality for scallops transplanted in the bay was unacceptably high in 1995, according to a 1996 report from the FMRI for the Tampa Bay NEP. Researchers say red tide—a common Gulf coast nemesis—is likely to blame. FMRI believes that bay scallops can be successfully cultured and reintroduced to Tampa Bay, but recommends selecting a variety of transplant sites within the lower bay to minimize exposure and localized impacts (Arnold *et.al.* 1996).

A.7 BAY WILDLIFE

Tampa Bay supports a magnificent array of wildlife, from the familiar brown pelican to the bottom-hugging sea squirt. But many of these animals also are threatened by impacts to water quality and habitats.

Birds are perhaps the most easily recognized and appreciated creatures in the ecosystem, and mangrove islands in the bay are among the most important nesting sites in the nation. These islands support as many as 40,000 pairs of approximately 25 species each season, including brown pelicans, cormorants, ibis, spoonbills, herons, egrets and skimmers (Paul, R., unpublished data 1995). The bay also attracts a sizable and diverse number of wintering waterbirds, including the white pelican, which travels more than 2,000 miles on its annual pilgrimage from the Western U.S. and Canada. Bird populations have dramatically declined in the last half-century as the region has been developed. Most vulnerable are beach-nesting shorebirds such as the black skimmer and wading birds such as the white ibis, which lives along the bay but depends upon freshwater crayfish and insects to feed its young. As these small, inland ponds and marshes dry up or are converted for development, ibis populations have plummeted. Since the 1940s, the Tampa Bay breeding population of the ibis has declined by as much as two-thirds, from an estimated 30,000 pairs to 11,000 pairs (Paul, R., unpublished data 1995). In addition to habitat losses, the bay's bird populations also have been impacted by human intrusion into rookeries and by entanglement in monofilament fishing line.

Marine mammals and sea turtles also make their home in Tampa Bay. More than 500 bottlenose dolphins are estimated to be year-round residents. The bay also is the winter home of as many as 200 manatees, according to FMRI researchers (Wright *et.al.* 1996). These gentle, plant-eating giants cluster around the warm-water discharges of the bay's

power plants and feed in the grass beds at the bay's perimeter.

An unprecedented die-off in early 1996 brought the total number of manatee deaths in Florida for the first six months of the year to 302—more than twice the previous record set in 1990. The single event, believed to be caused by red tide, claimed about 11 percent of the state's estimated 2,600 manatees (FDEP 1996). Even without this unusual event, manatee deaths statewide—including Tampa Bay—through October 1996 were still higher than previous years, and collisions with watercraft remain the primary human related cause of manatee mortalities (Weigle 1996).

Although often inconspicuous, marine turtles are common inhabitants of the bay. The loggerhead (a threatened species) and Kemp's ridley (one of the 12 most endangered animals in the world) are year-round residents. Green turtles and hawksbills also visit the bay, although the latter, a more tropical species, is quite rare. Nesting season brings the female turtles on shore at Anna Maria Island, Egmont Key and at beaches along Pinellas County (Meylan *et.al.* 1996).

Mostly out of sight to casual observers of the bay is a diverse array of bottom dwelling creatures known as the benthic community. Included among the more than 1,200 species of benthic organisms documented in the bay are the commonly known blue crab, pink shrimp, brittle starfish and sea squirt (Simon and Mahadevan 1985). These epifauna, which reside on the surface of the sediment, and their neighboring infauna, which live below the surface, are an important link in the bay's food web. They also play an indispensable role in the cycling of major nutrients, including carbon, phosphorous and nitrogen. While their feeding habits vary, these animals mostly scavenge on the bottom, feeding on decaying plant and animal material or filtering microscopic organisms like phytoplankton from bay waters. In doing so, filter feeders like oysters, scallops and sea squirts help maintain water clarity.

APPENDIX B

Action Plans in the CCMP for Which the District Was Identified as a Responsible Party

There are action plans in the CCMP for which the District was identified as a responsible party for significant actions for the long term management of the Bay. The following details the actions proposed for addressing these action plans.

B.1 WATER AND SEDIMENT QUALITY

B.1.1 Action Plan WQ-1 Implement Nitrogen Management Goals for Tampa Bay

Controlling the bay's nitrogen intake as a means of regaining vital underwater seagrass beds has been one of the most prominent initiatives of the Tampa Bay NEP. Seagrasses were selected by NEP as a yardstick by which efforts to improve the bay will be measured because of their overall importance to the bay ecosystem, and because they are an important barometer of their environment, signaling changes in long-term water quality trends.

An incredible variety of marine creatures—from the stately seahorse to the blue-eyed scallop to the portly manatee—find food, shelter or protection from predators in these dense underwater pastures. In fact, studies show that seagrass beds harbor 50 percent more fish and invertebrates than sand-bottom areas of the bay. Seagrasses also anchor shifting sand and filter pollutants from the water, much as grasses help stabilize the soil on dry land.

Since the turn of the century, pollution and dredging have destroyed more than half of the bay's seagrass beds. But surveys have recorded more than 4,000 acres of new or expanded seagrass beds in Tampa Bay since 1982, some in areas like Hillsborough Bay that had been barren for decades.

This remarkable comeback is largely credited to improvements in sewage treatment that have reduced the amount of nitrogen flowing into the bay, since excess nitrogen causes algae blooms that cloud the water and keep sunlight from reaching the grasses. Using computer models, scientists with the NEP calculate that water quality is now good enough to allow the natural growth, over time, of more than 12,000 acres of seagrass.

In July 1996, the Tampa Bay NEP adopted a five-year management goal to cap nitrogen loadings at existing levels (1992-94 average) to assist the seagrass recovery process. Nitrogen loadings to Tampa Bay are expected to increase 7 percent by the year 2010 as a result of population growth. This equates to an increase of 17 tons per year, or a total of 266 tons of nitrogen per year by 2010. Consequently, local governments and industries will need to offset loadings to the bay by this amount in order to maintain the bay's current nitrogen levels.

Local government and agency partners already have tentatively accepted responsibility for reducing their future nitrogen contributions by at least 6 tons per year, or 90 tons per year by 2010. This is the amount associated with stormwater runoff and municipal point-source discharges. These partners — Hillsborough, Pinellas and Manatee counties, the cities of Tampa, St. Petersburg and Clearwater and participating agencies — are now developing plans which identify specific projects to address their share of the cleanup. Nitrogen reductions will be carried over from year to year and credited against the remaining shortfall. Additionally, communities may achieve their target loadings more rapidly by implementing projects with greater nitrogen reductions or preventing anticipated increases.

A Nitrogen Management Consortium was established in October 1996 to develop a plan to address the remaining 11 tons per year of nitrogen, which comes from atmospheric deposition, industrial point sources, fertilizer shipping and handling, and intensive agriculture. Participants also are exploring ways to equitably assign the responsibility for managing nitrogen loadings among dischargers, based on their contribution to the problem.

The Consortium is comprised of local utilities, phosphate mining and fertilizer handling companies and agricultural interests, as well as the NEP's six local government partners and regulatory agencies. Working together, the group will identify nitrogen management projects to satisfy the nitrogen management goals established for Tampa Bay. The NEP will assist the Consortium by developing a list of the most cost-effective projects to pursue.

The approach advocated by NEP stresses cooperative solutions and flexible strategies over rigid "command and control" regulatory requirements. Under this plan, local governments and industries may select from among a range of options—as long as the overall goals for nitrogen management are met. This flexibility allows communities to focus their limited resources on the most cost-effective and environmentally beneficial actions.

Without this consensus-building approach to bay management, regulators would have to rely on the traditional permitting and compliance process to achieve the goals of the bay plan. That method can be more time-consuming and expensive, and lacks the flexibility the NEP partners have endorsed.

The NEP will review and revise nitrogen management goals every five years, or more often, if significant new information becomes available.

District Action:
The District has prepared an estimate of expected nitrogen reduction resulting from the implementation of specific stormwater retrofit projects. These projects provide the basis of the District's portion of the Nitrogen Management Consortium Action Plan. The District intends to remain an active participant in the Nitrogen Management Consortium and will continue to support nitrogen management efforts.

Project Name: Stormwater Retrofit Projects for Old Tampa Bay

Project Description: The construction of six stormwater management best management practice projects in Old Tampa Bay watersheds. Treatment methods include wet detention with filtration and alum injection.
Project Participants: SWFWMD, City of Safety Harbor, Pinellas County, City of Tampa, City of Clearwater, and Hillsborough County
Location (drainage basin): Old Tampa Bay
Contribution Toward Goal: Reduction of 2,799 lbs of nitrogen per year
Implementation Schedule:
Alligator Creek @ Channel H - Complete
Brushy Creek Wetland Enhancement - Complete
Al Lopez Park Pond Enhancement - Complete
Clearwater Mall Retrofit - Construction to be completed in 1998
Red Maple Swamp -Construction to be completed in 1998
Safety Harbor - Complete
Likelihood of Completion: High
How financed: SWFWMD, Ecosystem Management and Restoration Trust Fund, Local Governments

Project Name: Stormwater Retrofit Projects for Hillsborough Bay
Project Description: The construction of five stormwater management best management practice projects in Hillsborough Bay watersheds. Treatment methods include wet detention with filtration and alum injection.
Project Participants: SWFWMD, City of Plant City, Hillsborough County, and the City of Tampa
Location (drainage basin): Hillsborough Bay
Contribution Toward Goal: Reduction of 9,242 lbs of nitrogen per year
Implementation Schedule:
Lowry Park East - Complete
Lowry Park West - Design 1997, Construction 1999
Delaney Creek Wetland Treatment - Complete
East Lake Alum - Design 1997, Construction 1998
Pistol Range Retrofit - Design 1997, Construction 1999
Likelihood of Completion: High
How financed: SWFWMD, Ecosystem Management and Restoration Trust Fund, Local Governments

Project Name: Alafia River Corridor Land Acquisition
Project Description: Acquisition of 30,414 acres of land along the Alafia River. 4,053 acres have been acquired with 26,361 acres remaining.
Project Participants: SWFWMD, Hillsborough County
Location (drainage basin): Hillsborough Bay
Contribution Toward Goal: Reduction of 1,816 lbs of nitrogen per year
Implementation Schedule: On-going
Likelihood of Completion: Dependent on willing land sellers.
How financed: Save Our Rivers, Preservation 2000, local and state governments.

Project Name: Stormwater Retrofit Projects for Middle Tampa Bay
Project Description: The construction of five stormwater management best management practice projects in Middle Tampa Bay watersheds. Treatment methods include wet detention with filtration and alum injection.
Project Participants: SWFWMD, City of St Petersburg, Pinellas Park Water Management District, Pinellas County, and Hillsborough County
Location (drainage basin): Middle Tampa Bay
Contribution Toward Goal: Reduction of 11,407 lbs of nitrogen per year
Implementation Schedule:
Mirror Lake - Design by January 1998. Construction by July 1998
Pinellas Park Channel 2 - Complete
Haynesworth Tract - Construction to be completed in 1998
Lake Maggiore - To be completed in 1998
Cockroach Bay Stormwater - Completed
Likelihood of Completion: High
How financed: SWFWMD, Ecosystem Management and Restoration Trust Fund, Local Governments, Federal Grants

Project Name: Little Manatee River Land Acquisition Project
Project Description: Acquisition of 30,698 acres of land along the Little Manatee River. 1,210 acres have been acquired with 29,488 remaining.
Project Participants: SWFWMD, Hillsborough County
Location (drainage basin): Middle Tampa Bay
Contribution Toward Goal: Reduction of 656 lbs of nitrogen per year
Implementation Schedule: On-going
Likelihood of Completion: Dependent on willing land sellers.
How financed: Save Our Rivers, Preservation 2000, local and state governments.

Project Name: Stormwater Retrofit Projects for Boca Ciega Bay
Project Description: The construction of twelve stormwater management best management practice projects in Boca Ciega Bay watersheds. Treatment methods include wet detention with filtration and alum injection.
Project Participants: SWFWMD, City of North Redington Beach, City of St Petersburg, Pinellas Park Water Management District, Pinellas County, and City of South Pasadena, City of Seminole
Location (drainage basin): Boca Ciega Bay
Contribution Toward Goal: Reduction of 11,306 lbs of nitrogen per year
Implementation Schedule:
Clam Bayou Borrow Pit - Design by January 1998. Construction by June 1998
Jungle Lake Enhancement - Complete
102nd Ave. Pond Enhancement - Complete
94th Ave. Pond Enhancement - Complete
Bath Club Concourse - Completed
Pinellas County EMS Site - Complete
Largo Regional - Design 1997, Construction 1998
Downtown Largo Regional - Design 1997, Construction 1998

Lake Seminole Pond 6 - Design 1998, Construction 1999
Lake Seminole "Dogleg" - Design 1998, Construction 1999
South Pasadena - Complete
St. Pete Junior College Wetland - Design 1998, Construction 1999
Likelihood of Completion: High
How financed: SWFWMD, Ecosystem Management and Restoration Trust Fund, Local Governments, Federal Grants

Project Name: Wood Ibis Park Stormwater Retrofit Project
Project Description: Stormwater retrofit for 72 acres of residential area in the City of Gulfport in accordance with current regulatory design criteria for new development. Area to be retrofitted was developed prior to 1982 stormwater rule.
Project Participants: SWFWMD and City of Gulfport
Location (drainage basin): Lower Tampa Bay
Contribution Toward Goal: Reduction of 363 lbs of nitrogen per year
Implementation Schedule: design in 1997; construct in 1998
Likelihood of Completion: High
How financed:

Project Name: Tampa Bay Estuarine System Land Acquisition Project
Description: Acquisition of 13,434 acres along Terra Ceia Bay. 1,833 acres have been acquired with 11,601 remaining.
Project Participants: SWFWMD and Manatee County
Location (drainage basin): Lower Tampa Bay
Contribution Toward Goal: Reduction of 745 lbs of nitrogen per year
Implementation Schedule: On-going
Likelihood of Completion: Dependent on willing land sellers.
How financed: Save Our Rivers, Preservation 2000, local and state governments.

Project Name: Tampa Bay Pollution Load Reduction Goal
Project Description: The District will incorporate resource-based water clarity, chlorophyll-a, and nitrogen loading goals into the pollutant load reduction goals (PLRGs) for Tampa Bay.
Project Participants: SWFWMD
Location (drainage basin): Bay-wide
Contribution Toward Goal:
Implementation Schedule: First draft of Plan by March 1998
Likelihood of Completion: High
How financed: SWFWMD

Project Name: Incorporate Nitrogen Goals into Basin-specific Watershed Management Plans
Project Description: The District will incorporate resource-based nitrogen loading goals and PLRGs for Tampa Bay in the SWIM and CSWM management plans it is currently developing for hydrologic basins within the Tampa Bay watershed.

Project Participants: SWFWMD
Location (drainage basin): Bay-wide
Contribution Toward Goal:
Implementation Schedule: SWIM plan (draft) by March 1998, CSWM Plans by Aug-Dec 1998
Likelihood of Completion: High
How financed: SWFWMD, SWIM

Project Name: Support Ongoing Bay-wide Water Quality Modeling
Project Description: The nitrogen management goals set by the TBNEP are a result of several related modeling tasks. These task involved: 1) the estimation of nitrogen off of the watershed, 2) the determination of water quality in Tampa Bay, and 3) the modeling of the bay response to changes in loading and the establishment of nitrogen management targets. The District will take responsibility for performing these tasks every 5 years, as requested by TBNEP. Estimated costs to the District of assuming this workload are expressed as staff time requirements or *F*ull *T*ime *E*quivalents if the work is performed by District staff and funding requirements if the work is performed by a contractor. These include:

a) Watershed Loading - Updating watershed nitrogen loading estimates.
Anticipated cost = 0.6 FTEs or $30,000

b) Bay Water Quality - Update Tampa Bay water quality analysis using local governments' monitoring data and the EMAP-based statistical algorithms developed by TBNEP to perform analyses of spatial water quality trends.
Anticipated cost = 0.3 FTEs or $15,000

c) Water Quality Modeling - Maintaining and executing the two existing (empirical and mechanistic) water quality models for Tampa Bay.
Anticipated cost = 0.9 FTEs or $45,000

Project Participants: SWFWMD with support from the TBEP Technical Advisory Committee
Location (drainage basin): Bay-wide
Contribution Toward Goal:
Implementation Schedule: Anticipated revisions starting in FY 1998 and completed by end of 1999.
Likelihood of Completion: High
How financed: SWFWMD

Project Name: Assessment of Microbial Indicators and Pathogens
Project Description: Although the District has not been identified as a responsible agency under public health actions, a project to provide base-line information on potential sources and loadings of microbial pathogens within the Tampa Bay watershed is proposed. The determination of sources and fate of pathogenic microorganisms (including bacteria, viruses, and protozoa) in significant tributaries of Tampa Bay. By January 1999, a review of health standards for measuring bacterial

contamination will be complete. Parties will supplement Action Plans as appropriate to develop specific actions to address bacterial contamination for those swimming areas and shellfish harvesting areas not meeting health standards by January 2002. The project will determine the predictors or indicators of human pathogens and the associated risk of illness with exposure to contaminated waters. Potential remediation measures will be identified for future actions.

Project Participants: SWFWMD, Florida Department of Health, University of South Florida
Location (drainage basin): Bay-wide
Contribution Toward Goal: This project will provide base-line data on potential sources and loadings of microbial pathogens within the Tampa Bay watershed.
Implementation Schedule: FY 99
Likelihood of Completion: High
How financed: SWFWMD

B.1.2 Action Plan SW-1 Continue Support for the Florida Yards and Neighborhoods Program and Similar Pollution Prevention Initiatives

Yards and neighborhoods are among the bay's first lines of defense against pollution in stormwater runoff. Yet many homeowners fail to understand the potential impact of excess fertilizer, pesticides and water used in landscape maintenance on the health of Tampa Bay.

In fact, scientists estimate that residential land uses in the Tampa Bay watershed contribute about 10 percent of the bay's total nitrogen loadings, as well as other pollutants such as pesticides and herbicides. The impact on Tampa Bay may be immediate in a waterfront neighborhood, or gradual, through the flow of stormwater drains, ditches, streams or rivers.

These findings became the springboard for the development of the Florida Yards & Neighborhoods (FY&N) Program, established in 1991 to enlist residents in pollution prevention by improving their landscaping practices. Experts from the Florida Cooperative Extension Service (FCES), which administers the Program statewide, encourage residents to conserve water and limit their use of fertilizers and pesticides — techniques that can save homeowners considerable time and money. The Program also promotes the establishment of true Florida Yards, featuring plants suited to local conditions, climate and wildlife.

FY&N was developed by the National Estuary Programs of Tampa Bay and Sarasota Bay and the FCES. The West Coast Regional Water Supply Authority (WCRWSA) is currently the major funding source for the Tampa Bay FY&N program, which also draws support from some local governments.

Since its inception, the FY&N Program has assisted dozens of neighborhoods and

thousands of individual homeowners through workshops, neighborhood evaluations and plantings, educational literature and the development of model Florida Yards at public venues. The Program also coordinates with local developers and retailers to promote these concepts. A Florida Yard featured in the 1996 Parade of Homes at Fish Hawk Trails in Hillsborough County received extensive publicity and attention. Home Depot recently began publicizing FY&N tips in its in-store literature and advertising inserts.

This action seeks to continue support for FY&N to effectively reach a larger and more diverse audience in the Tampa Bay region. The NEP also recognizes and supports the efforts of several local initiatives, such as the Hillsborough County Adopt-A-Pond Program, which promote water quality stewardship and neighborhood action.

Strategy:

Strategies to continue and expand the FY&N Program, and further enlist developers, retailers and the horticulture/pest control industries in promoting these concepts, are proposed below.

A. Promote Florida Yard materials and messages at major retail outlets, home and garden shows, public events, and public venues such as The Florida Aquarium.

B. Pursue arrangements to distribute and bar-code FY&N materials so they may be sold at cost through retail establishments, with revenues tagged for additional reprints.

C. Increase mass-media publicity efforts and promote the use of existing public service announcements on cable, network and government access stations. Counties also should consider paid media placement campaigns to broaden public interest and awareness of FY&N messages. Media efforts should be coordinated on a regional basis to maximize cost-efficiency and audience reach.

D. Increase the number of individuals pursuing Florida Yard certification.

District Action:

Project Name: Xeriscape and Florida Yards & Neighborhood
Project Description: In FY 97 and 98, the District partnered with the Pinellas and Hillsborough County Cooperative Extension Services, local governments and educational facilities to sponsor workshops for the public focusing on Xeriscape and Florida Yards & Neighborhood concepts. Similar projects are included in planning and budgeting for FY 99 and 2000.

Project Name: Xeriscape and Florida Yards & Neighborhood
Project Description: In FY 98, the District partnered with the Pinellas and Hillsborough County Cooperative Extension Services, local governments and the construction industry and business to provide area builders and developers with

education focusing on environmentally-sound practices, including Florida Yards & Neighborhoods concepts. Similar expanded projects are included in planning and budgeting for FY 99.

Project Name: Project Greenhouse
Project Description: The Hillsborough River, Alafia River, and Northwest Hillsborough Basin Boards of the District are considering a funding proposal to develop a demonstration site (Project Greenhouse) in Tampa to provide all segments of the population with education about environmentally sound practices, materials and products, including demonstration and education about Florida Yards & Neighborhoods.

B.1.3 Action Plan SW-2 Assist Businesses in Implementing Best Management Practices to Reduce Stormwater Pollution, and Develop Model Landscaping Guidelines for Commercial Use

Local communities offer various levels of assistance to businesses in assessing site management practices and developing pollution prevention strategies. These programs can benefit businesses by identifying opportunities for cost-savings, such as reducing a company's expenditures for fertilizer and pesticides used in landscape maintenance. Pollution prevention programs also benefit local government sponsors, who might otherwise be forced to rely exclusively on costlier stormwater treatment.

One example is Hillsborough County's Operation BayWorks - Businesses for a Cleaner Future, established in 1993 with a small grant from the Tampa Bay NEP. The program enlists and aids businesses in the construction, manufacturing, landscaping and automotive repair industries in the development of pollution prevention plans. Participants learn industry-specific best management practices to reduce pollution associated with landscape management, construction equipment and repair, and hazardous materials use and disposal. Specialty businesses such as auto repair shops are a key target because their collective contribution to pollution in runoff can be substantial. These smaller businesses typically lack knowledge about their potential impact on the environment, as well as the resources to research best management practices on their own.

Local communities are encouraged to evaluate programs such as Operation BayWorks as a model for regional implementation to reduce stormwater pollution from commercial sites. Efforts such as these may help local governments meet federal mandates for pollution prevention as required in National Pollutant Discharge Elimination System (NPDES) stormwater permits.

The Tampa Bay NEP also recommends the development of model landscaping guidelines for incorporation into local government landscape ordinance codes. These guidelines could then become incorporated into the site review process for new development and promoted throughout the development community.

Commercial landscapes often feature large areas of high-maintenance turf grass and

exotic plants that demand a steady stream of fertilizer, pesticides and water. Stormwater pollution from commercial sites can be reduced with changes in maintenance practices and landscape design, such as downsizing turf areas and expanding the use of water-thrifty and pest-resistant plants.

Strategy:

Develop a model landscaping ordinance for adoption throughout the region. The guidelines should be succinct, user-friendly and include a comparison of costs to develop and maintain traditional landscapes vs. a model Florida landscape based on FY&N principles.

District Action:

Project Name: Xeriscape and Florida Yards & Neighborhood

Project Description: The District, in cooperation with the other Water Management Districts, has completed a landscape ordinance model. In addition the District worked with the Pinellas County Technical Education Center, the Pinellas County and City of St. Petersburg utilities and the Pinellas County Cooperative Extension Service to offer Xeriscape workshops to county residents. Information about the reduction of water for irrigation, lawn maintenance, and reducing fertilizers and pesticides use was provided to participants.

Project Name: Florida Aquarium

Project Description: The District, in cooperation with the Florida Aquarium, developed and constructed a demonstration, educational and research parking site that is designed to reduce runoff through the use of natural filtration and porous surfaces. Research is currently ongoing at the site to determine its effectiveness in reducing and in treatment of non-point source pollution.

B.1.4 Action Plan SW-4 Require Pervious Paved Surfaces

Like all growing metropolitan areas, the Tampa Bay region contains large amounts of impervious surfaces that increase stormwater runoff and associated surface water pollution by preventing stormwater from seeping into the ground. The impact may be immediate in a waterfront area, or gradual, through the flow of stormwater drains, ditches, ponds and streams.

Existing regulations complicate the problem. Many development standards require that large amounts of impervious surface be incorporated into projects to support parking. Commercial developments, for example, are often required to have a certain number of parking spaces based on a development's total square footage or anticipated absolute maximum demand. These requirements may over-estimate actual parking needs, which may be better served through a combination of traditional surfaces for main parking lots and pervious surfaces for overflow areas.

The use of pervious materials may also be appropriate for parking lots being enlarged or

reconstructed in the urban core. Options include turf block (concrete blocks with holes to allow turf growth and water infiltration), grass and specialized pervious hard surface materials. The cost-effectiveness of these alternative surfaces will be evaluated as part of this action. Some materials can cost as much as three times the amount of traditional pavement.

Strategy:

This action calls for an evaluation of the costs and suitability of pervious surface materials, and promotion of their use where appropriate. It also recommends incentives for developers to incorporate these materials in new developments and redevelopment projects in urban areas closest to hot spots of contamination in the bay.

Identify target areas in which the use of alternative surface materials should be encouraged, and suggest draft revisions to agency rules regulating stormwater to allow credits for pervious pavement. Provide recommendations to the NEP Management Committee in 1997.

- Establish target boundaries for urban sub-basins near bay hot spots of sediment contamination, and overlay information on the areas where local governments are encouraging redevelopment.

- In other areas of the watershed, identify areas where soils may be conducive to the use of pervious pavement.

- Suggest draft rule revisions, including credits for pervious paving.

Revise local government and agency regulations to encourage the use of pervious alternatives to traditional paving. Options may include:

- basing parking space requirements on expected demand rather than absolute maximum demand, particularly for large developments such as malls, and commercial developments and multi-family dwellings

- providing tax incentives or credits within new taxing sub-districts for the use of pervious paving.

- increasing the ratio of landscaping to site size to reduce impervious surface.

District Action:

Actively participate (through TBEP) in development of recommendations for pervious surface use and identify target areas in which alternative surface materials should be used. Additionally, the District will continue research on paving materials at the Florida Aquarium site and other sites as appropriate. District Regulatory staff will explore the appropriate use of flexible or alternative criteria on an action-by-action basis. If, over time, a common alternative emerges, then District staff will consider making rule

changes to incorporate this common alternative.

Contribution toward goal: Implementation of these activities will provide data on the performance and long-term maintenance characteristics of one or more pervious surfaces. This information will assist local governments in developing policies regarding possible regulatory incentives for the use of such surfaces.

Implementation schedule: ongoing

B.1.5 Action Plan SW-5 Require Older Properties Being Redeveloped to Meet Current Stormwater Treatment Standards for That Portion of the Site Being Redeveloped, or Provide Equivalent Compensation

Redevelopment of existing properties is encouraged and can be highly desirable as a means of re-energizing a community's urban core. Infrastructure and public services are already in place, and development remains concentrated where impacts have already occurred—a strategy many urban planners advocate as a means of discouraging urban sprawl and associated stormwater pollution. To encourage redevelopment, many communities offer financial incentives or exemptions to developers. For instance, local governments may offer a developer an exemption from meeting regulatory criteria for stormwater treatment even if significant amounts of new impervious surface are added in redevelopment.

However, properties being redeveloped must be considered in efforts to reduce pollution from urban stormwater runoff, since many of these properties were developed prior to the adoption of state stormwater regulations that set criteria for on-site stormwater management. Most properties developed prior to 1982 were not required to provide stormwater detention and few of these sites have any means of managing or providing water quality treatment for stormwater. Redeveloped sites also are typically utilized at a higher intensity, further contributing to overall stormwater impacts. These areas are often land-limited, concentrated in downtown business and commercial districts, and in drainage basins that continue to be significant contributors to stormwater pollution.

Furthermore, while new development standards may control stormwater runoff, they are only as effective as the BMPs they utilize. Overall increases in pollution from stormwater runoff will still occur, making it necessary to retrofit some older urban areas. This may be accomplished through regional stormwater treatment, in areas where this is feasible and affordable.

Local government requirements for redevelopment vary, but most offer exemptions of one form or another from stormwater treatment standards, either for projects under a particular size or in special areas, such as historical districts and downtowns. The Southwest Florida Water Management District (SWFWMD) currently requires that permittees meet new development stormwater treatment standards only if there is an increase in pollution or change in the discharge point. This action seeks to require that properties being

redeveloped meet current stormwater standards, but only for that portion of the property that is impacted. Furthermore, when on-site treatment is not feasible, developers should be given the flexibility to satisfy their requirements in other ways. These recommendations are based on an existing redevelopment ordinance for the City of St. Petersburg, which was adopted in 1994 and widely considered to be fair as well as environmentally beneficial. Since its adoption, the City has granted only one exemption.

By allowing alternative on-site treatment or off-site mitigation, communities can continue to encourage redevelopment without sacrificing stormwater treatment and associated impacts to the bay. As part of this effort, the NEP will evaluate the alternative best management practices that might be used when on-site treatment is not feasible. Options include contributions to a regional stormwater facility located in the same drainage area (possibly through payments to a stormwater "bank"), the collection of stormwater in cisterns or underground vaults, the use of sediment sumps, or improvements to existing stormwater systems adjacent to the site, as well as non-structural BMPs such as street sweeping.

Strategy:

This strategy calls for revisions to existing rules and regulations to require that properties being redeveloped meet current stormwater treatment standards. This would apply only to that portion of the site being redeveloped and in cases where more than 3,000 square feet of impervious surface are added or reconstructed. When on-site treatment is not feasible, rule revisions should allow developers to provide equivalent value, either through contributions to a stormwater "bank," off-site mitigation or by implementing approved BMPs.

Revise local government comprehensive plans and codes and SWFWMD regulations to require that properties being redeveloped meet existing stormwater treatment standards according to criteria outlined above. If on-site treatment is not feasible, allow equivalent off-site mitigation or compensation. This may entail:

- amendments to SWFWMD stormwater rules to allow alternative stormwater treatment options for properties being redeveloped

- amendments to local development standards, including zoning laws and comprehensive plans and codes, to require stormwater treatment for properties being redeveloped, and to allow alternative means to satisfy those requirements when on-site treatment is not feasible

District Action:

Participate (through TBEP) in the comparison of alternative stormwater treatments. The District will continue research on paving materials at the Florida Aquarium site and other sites as appropriate. District Regulatory staff will explore the appropriate use of flexible or alternative criteria on an action-by-action basis. If, over time, a common alternative emerges, then District staff will consider making rule changes to

incorporate this common alternative.

B.1.6 Action Plan SW-8 Encourage Best Management Practices on Farms

Stormwater runoff from agricultural operations contributes significant amounts of nitrogen, pesticide residues and suspended solids to waterways. This action is aimed at reducing nitrogen loadings to the bay from runoff associated with agricultural operations.

While intensive agriculture accounts for only 6 percent of the bay's total nitrogen loading, studies commissioned by the Tampa Bay NEP indicate it is a major contributor in localized areas of south Hillsborough and Manatee counties. The studies indicate that 23 percent of the land in the Little Manatee River basin is intensively farmed, mainly with row crops and citrus groves. These operations contribute an estimated 23 percent of the total nitrogen load entering the bay from that watershed. In the Manatee River segment, intensive farming operations comprise an estimated 9 percent of the nitrogen load.

The use of BMPs developed by agricultural experts can assist farmers in minimizing impacts to water and sediment quality while ensuring profitable crop production. BMPs generally include a broad array of structural and non-structural recommendations; many are targeted specifically at reducing fertilizer or pesticide use and improving water management.

Most bay area farmers utilize some BMPs in their daily operations. However, more widespread acceptance and promotion of BMPs—with recommendations tailored specifically for different crops—are needed. A first step might be to expand and update the BMP selector guides produced by the University of Florida's Institute of Food and Agricultural Services (IFAS) to reflect new technologies available since the guide was last revised in 1983. The BMP guides also could be tailored to specific segments of the agricultural industry.

Additionally, some types of agricultural operations which generate intensive nutrient loadings, such as dairy farming, may warrant cost-sharing programs to assist farmers in making the improvements necessary to retain and/or treat runoff on site. Dairy farmers, for instance, face costly mandates to retain runoff on their property by constructing lagoons and upgrading cooling ponds to prevent ground or surface water contamination by nitrates.

BMPs aimed at conserving water also may be adapted to reduce fertilizer use and, subsequently, farm runoff. One technique developed in recent years allows fertilizer to be applied through drip or microjet irrigation systems. This practice, called "fertigation," enables farmers to apply liquid fertilizer in smaller, more precise doses, reducing the chance of over fertilization. Use of fertigation can add flexibility and precision to a fertilizer management program, thus benefiting the farmer as well as the bay, although it is not economically feasible for every type of crop. However, to realize these benefits, farmers must be properly instructed in the operation of fertigation systems, which are computer-controlled and require some training to master.

Farmers are not required to install fertigation systems. Nevertheless, more than 95 percent of Florida strawberry growers use drip irrigation, and most of those fertigate. A smaller percentage of vegetable growers have converted to micro-irrigation, but most who have also fertigate. The situation is reversed among citrus growers: most have converted to micro-irrigation, but a smaller percentage fertigate. Fertigation and micro-irrigation are often cost-prohibitive for lower market value crops such as water melons, and currently considered too labor-intensive for non-mulched crops such as cabbage and potatoes. However, rules developed by the Southwest Florida Water Management District (SWFWMD) offer opportunities to encourage and expand use of fertigation where practicable.

Rules adopted by SWFWMD for the Southern Water Use Caution Area require farmers to reduce water use by specific amounts over a period of years. The farmers may utilize a variety of irrigation methods to achieve the efficiencies required. One method of reducing water consumption is through the use of micro-irrigation systems, which deliver controlled amounts of water directly to a plant's roots. These systems also can be used to apply liquid fertilizer in the same controlled manner. If growers chose micro-irrigation systems to comply with new water use restrictions, they will have the opportunity to fertigate as well. Growers should be aware of the environmental benefits as well as the costs associated with fertigation so they can make the best choices for their irrigation systems.

The District's Agricultural Ground and Surface Water Management program (AGSWMP) provides another opportunity to promote the use of BMPs. This program allows farmers to implement a surface and ground water management plan in lieu of obtaining an Environmental Resource Permit. The voluntary plans are developed by the Natural Resources Conservation Service (NRCS)—formerly the Soil Conservation Service—and administered by SWFWMD. The plans could be strengthened by encouraging the use of fertigation and other runoff-reducing BMPs as applicable.

Strategy:

The strategy for this action focuses on more aggressive promotion of BMPs, improved instruction in the use of fertigation systems, and the investigation of funding programs that could provide financial assistance to farmers who wish to utilize BMPs.

Investigate the potential for strengthening AGSWMPS to strongly encourage runoff-reducing BMPs, where economically feasible, including fertigation and micro-irrigation systems. Where effective BMPs are not already in use, encourage their use.

District Action:

The District will continue to work closely with the agricultural community to ensure BMP's are utilized through the Agricultural Ground and Surface Water Management program (AGSWMP). District Regulatory staff will explore the appropriate use of flexible or alternative regulatory criteria on an action-by-action basis. If, over time, a common alternative emerges, then District staff will consider making rule changes

to incorporate this common alternative.

B.1.7 Action Plan SW-9 Improve Compliance with Agricultural Ground and Surface Water Management Plans

Florida statutes exempt certain agricultural activities from surface water permitting requirements designed to minimize impacts to wetlands, flooding and water quality. However, confusion about or misinterpretation of the exemptions has led to agricultural activities which may have adverse environmental impacts.

In an effort to ensure that surface water degradation is minimized or eliminated, the Southwest Florida Water Management District and the Natural Resource Conservation Service, formerly the Soil Conservation Service, have developed a voluntary program that assists farmers in protecting water resources. The Agricultural Ground and Surface Water Management Program, or AGSWMP, educates farmers about exemptions and helps farmers develop water management plans that often enable them to qualify for a permit exemption.

A matrix of best management practices (BMPs) has been developed for the program, listing each BMP and its potential benefits. Using this matrix, NRCS specialists inspect an agricultural operation and evaluate which BMPs are suitable. A plan is developed and the farmer is asked to implement its recommendations, providing a faster, non-regulatory avenue for compliance with surface water rules.

Since the program's creation in 1991, surface water management plans have been developed for more than 3,000 acres of farmland in Hillsborough and Manatee counties. While these efforts are impressive, the percentage of agricultural lands managed under these plans remains small in comparison to the farmed acreage in the region. Hillsborough and Manatee counties, for example, had more than 112,000 acres devoted to citrus, vegetables, or some other form of intensive agriculture in 1990.

Compliance also has been a lingering problem with the program. Once the plan is approved, few if any follow-up inspections are conducted to ensure that farm operators have implemented the plans. Lack of sufficient staff to handle these responsibilities has been identified as a major reason for the lack of follow-up.

The AGSWM program provides a streamlined, less cumbersome approach for growers to comply with the intent of SWFWMD's wetlands and water quality protection rules. But without a reasonable effort to check on the implementation of the AGSWM plans, the effectiveness of the program cannot be determined.

Strategy:

The strategy for this action involves one regulatory action to monitor compliance with AGSWM plans and one voluntary action to encourage greater participation in the program.

1) When SWFWMD visits a farm in conjunction with a water use renewal permit, it can use that occasion to check compliance with the farm's AGSWM plan. The site visit made at the time of water use permit renewal provides a convenient time to verify that an existing AGSWM plan is being implemented as agreed to by the grower.

   If the inspection shows that a farming operation is not in compliance with the approved AGSWM plan, SWFWMD could allow a grace period in which to comply. Failure to comply within the grace period could be grounds to nullify the permit exemption and require a formal Environmental Resource Permit.

2) Recruit growers in Hillsborough and Manatee counties who have successfully implemented AGSWM plans to showcase the results of their efforts to other who qualify for the AGSWM program. Responsible parties: SWFWMD, ARCS, local extension services

District Action:

The District will continue to work closely with the agricultural community to ensure compliance with the Agricultural Ground and Surface Water Management program (AGSWMP) plans. District Regulatory staff will explore the appropriate use of flexible or alternative regulatory criteria on an action-by-action basis. If, over time, a common alternative emerges, then District staff will consider making rule changes to incorporate this common alternative.

B.1.8 Action Plan WW-1 Expand the Use of Reclaimed Water Where Reuse Benefits the Bay

St. Petersburg's pioneering efforts in wastewater reuse for residential irrigation in the late 1970s were at the forefront of a technological movement that would offer both substantial benefits and some important challenges- to a region anxious to conserve its freshwater supplies, and at the same time, save the bay from an overly rich diet of nutrients discharged in wastewater.

Today, projects to reclaim wastewater for irrigation and other applications are underway in all three counties bordering the bay. Local governments now reuse roughly 40 million gallons of treated wastewater per day, mostly for urban and agricultural irrigation, but also for industrial purposes. Projects planned or underway in local communities will more than triple that amount.

The Wilson-Grizzle Bill, which called for advanced technology to limit pollutants discharged to the bay from domestic wastewater facilities, was a driving force behind these early efforts and a lifeline for a polluted bay. The legislation prompted the City of Tampa in 1979 to upgrade its wastewater treatment plant at Hookers Point, a change that helped bring about sweeping improvements in the bay's water quality. At the same time, St. Petersburg was launching its reclaimed water project, which eliminated most of its direct wastewater discharges to the bay. The Wilson-Grizzle legislation was eventually repealed but a subsequent Grizzle-Figg bill reinstated the requirements for advanced wastewater

treatment.

The potential benefits of reuse to the bay and to a water-thirsty region are substantial. Reuse already has helped to reduce annual nitrogen loadings to the bay and will play a key role in the strategy to reduce future nitrogen loadings—although reuse does not completely eliminate nitrogen loadings since some portion will eventually enter the bay in stormwater runoff. It is also widely recognized as a cost-effective, long-term alternative source of water for irrigation and commercial applications and potentially for potable needs. Reuse is a key element of the Southwest Florida Water Management District's (SWFWMD) New Water Source Initiative, a strategic blueprint designed to reduce the area's dependence on groundwater and protect the Floridan Aquifer from saltwater intrusion. SWFWMD's regional basin boards also have been instrumental in providing cooperative funding for innovative reuse programs.

Nevertheless, projects to reclaim wastewater should be evaluated carefully to determine their net impact to the bay and to address various public health and logistical concerns. The City of Tampa is now proposing a project to reclaim as much as 50 million gallons of the treated wastewater it discharges daily to Hillsborough Bay from its Howard F. Curren facility at Hookers Point. Discharges from this facility now represent about 7 percent of the total freshwater inflow to Hillsborough Bay during the dry months of the year.

While the bay will benefit from the reduction in nutrients to this heavily impacted sector of the bay, a part of this load may be rerouted to the Tampa Bypass Canal, mixed with canal water, and then pumped to the Hillsborough Reservoir. Additionally, Hillsborough Bay will lose a portion of its freshwater inflow. A planning and environmental impact assessment for this project began in late 1995.

Strategy:

This strategy is to evaluate and recommend implementation of reclaimed water projects that result in a net benefit to Tampa Bay.

1) Evaluate the environmental impacts of the major reuse projects planned for the Tampa Bay region, including the net effects of reducing or eliminating the discharge (changes in salinity and pollutant loadings) and any corresponding impacts to rivers and reservoirs. Evaluations also should adequately address the project's ability to satisfy any public health concerns or perceptions stemming from the use of reclaimed water. Any environmental impacts associated with reuse projects should be balanced against the public need for cost-effective water supply alternatives. The Tampa Bay National Estuary Program recommends implementation of those reuse projects that benefit the bay.

2) If current municipal and industrial reuse expansion plans coupled with other efforts to reduce pollution are insufficient to meet long-term goals for nitrogen management in the bay, investigate additional opportunities to expand reuse by interconnecting distribution systems or constructing larger storage facilities.

District Action:

The District has developed an effective program to promote the reuse of water. Two mechanisms which encourage the development of reuse systems are: 1) regulatory requirements for water use permittees, and 2) financial assistance through the basin Cooperative Funding program and the New Water Sources Initiative program. Regulatory policies require permitted water users to utilize the lowest quality of water appropriate for the specific use, not to waste water, and to incorporate reuse measures to the greatest extent possible. Reclaimed water may be considered a lower quality water than potable groundwater and must be used if the water is available and is technically and economically feasible.

The District's regulatory reuse requirements are complemented by two funding assistance programs: 1) the Cooperative Funding Program, and 2) the NWSI program. The Cooperative Funding Program will fund up to 50% of the cost of reuse system design and construction; for pumping, storage, and transmission facilities; and for master plans. As of 1997, over 100 reuse projects had been awarded cooperative funding District-wide. When fully developed, these project will provide more than 100 mgd of reclaimed water.

Within the Tampa Bay watershed, 11 major reuse project will be implemented or will begin construction between 1995 - 2000. All of the projects will either reduce or eliminate direct or indirect discharges to Tampa Bay. Many of these projects are phased and transcend bay segments and cannot be listed as benefiting specific portions of Tampa Bay. Major projects in which the District is cooperating are:

Northwest Hillsborough Reuse Project
Manasota Regional Reuse System Project
South Tampa Area Reuse Project
Gulfport Reclaimed Water System
City of Oldsmar Reclaimed Water System
City of Dunedin Reclaimed Water Transmission Mains
Pinellas County Reclaimed Water System
Clearwater Reclaimed Water System
Largo Reclaimed Water System
City of Pinellas Park Reclaimed Water System
City of Tampa Water Resource Recovery Project

B.2 BAY HABITATS

B.2.1 Action Plan BH-1 Implement the Tampa Bay Master Plan for Habitat Restoration and Protection

Recognizing that some coastal habitats have been lost in greater proportion than others, the NEP Master Plan for Habitat Restoration and Protection seeks to restore the historic balance of habitats in Tampa Bay. The Plan outlines specific strategies and goals to

increase certain habitats while preserving and enhancing those that now exist.

The Plan emphasizes the restoration of low-salinity tidal streams found along the dozens of meandering creeks that eventually enter Tampa Bay. These quiet areas, critical to the life cycle of fish such as snook and mullet and birds like the great blue heron and snowy egret, comprised about half of all estuarine wetland habitats at the turn of the century. Today, these low-salinity habitats make up about 22 percent of the total. In contrast, mangrove forests also made up about 50 percent of the shoreline in 1900. Today, they account for about 73 percent of the remaining shoreline vegetation —although mangroves—like all of the bay's habitats—have experienced substantial declines in acreage.

The plan seeks to restore a minimum of 100 acres of low-salinity tidal streams every five years, while preserving and enhancing existing mangrove and salt marsh vegetation. The Plan also identifies 28 sites as priorities for habitat protection, either through direct purchase of lands or other means such as conservation easements on private property. Most of these sites were recently incorporated into the Southwest Florida Water Management District's (SWFWMD) Save our Rivers/Preservation 2000 Plan, which sets priorities for public lands acquisition.

While the NEP Plan most heavily focuses on repairing tidal streams, other habitats also will be gradually restored. Attention will be directed to salt barrens (extremely salty high marsh), upland forests and mud flats, all of which play an important role in the Tampa Bay ecosystem. The NEP's Habitat Restoration Subcommittee has adopted the Florida Game & Freshwater Fish Commission's (FGFWFC) strategies for upland restoration. Upland protection needs will be met in part through local land acquisition efforts.

The concept of restoring the balance is relatively new and has important implications for Tampa Bay and other coastal areas. Traditionally, habitat restoration and land acquisition have been largely opportunistic endeavors: Agencies and communities have sought to purchase and restore habitat based on what was available or, in some cases, most visibly connected to the bay. This approach toward highly visible projects helped to build community awareness of the environmental plight and needs of the bay at a time when this was critically needed. It also demonstrated to skeptics that habitat restoration was possible.

In recent years, restoration efforts have increasingly focused on providing a mosaic of habitat types within a given project to maximize the benefits to fish and wildlife. The NEP Plan takes this concept a step further by developing restoration and protection goals based on the needs of key wildlife "guilds," or groups of animals that share common habitat and feeding preferences.

The white ibis provides a textbook example of how this new planning approach might protect an impacted species. Populations of the white ibis have declined dramatically in the last half-century, resulting in its listing by the FGFWFC as a species of special concern. Adult ibis nest along the bay, but require inland freshwater sources of food for

their young. These shallow freshwater wetlands or "frog" ponds have been hard hit hard by development—forcing the ibis to travel farther and farther to find food for their young.

The NEP Plan outlines four management strategies for the protection and restoration of seasonal freshwater ponds. The first is to identify and protect all potential ibis for aging habitat within a certain distance from the bird colonies in Tampa Bay. The second is to create a wetland mitigation banking system that creates or restores seasonal marshes within these foraging areas before these impacts become unavoidable. One potential location for such a bank is the combined TECO and Reeder Farms property south of Cockroach Bay where three of the four white ibis foraging zones overlap.

The third strategy is to create or restore marshes on publicly owned land. Finally, the Plan recommends that communities and agencies actively seek to acquire new properties for habitat restoration and protection, and especially for seasonal marsh restoration.

Other components of the NEP Plan address management of public lands, especially exotic species control and eradication. The Plan also seeks to direct mitigation to priority restoration projects using criteria discussed in Action BH-2. The Habitat Restoration and Protection Master Plan for Tampa Bay is available under separate cover from the NEP.

Already, about 207 acres along Tampa Bay have been restored through projects financed primarily by the SWFWMD's Surface Water & Management (SWIM) program and the Florida Department of Environmental Protection's Pollution Recovery Trust Fund. Several projects now underway and in the planning stages will boost that number by up to 1,000 acres.

Pinellas, Hillsborough and Manatee counties all have administrative programs for the public purchase of environmentally sensitive lands. Pinellas and Hillsborough counties programs are funded by local taxes that complement state-funded public land acquisition programs such as Preservation 2000, Save Our Rivers, and Conservation and Recreational Lands (CARL). Manatee County's program is for the purchase of land in the Lake Manatee Reservoir and is financed by the county's Water Utilities Enterprise Fund. Private land acquisition programs such as the Nature Conservancy also contribute to the preservation of upland and wetland habitats.

Strategy:

Through the end of 1997, the District SWIM staff either completed or had under development 30 restoration projects for Tampa Bay: 25 projects under development and five projects either fully or partially constructed. Since 1989, SWIM restoration projects have evolved from small, simple salt marshes ($\leq$0.1 acre) to large, complex assemblages of coastal habitats ($\geq$650 acres). Since 1989, 30 restoration projects have been completed for a total of 207.1 acres.

These progressive, interdisciplinary projects typically combine coastal habitat enhancement, restoration and creation (including improved water quality through

enhanced tidal flushing and/or water circulation) with stormwater treatment. In addition, each project typically employs the restoration strategy of enhancing, restoring, and/or creating habitat mosaics ("ecosystem restoration" approach). A habitat mosaic represents a collection of habitats normally found in coastal ecosystems, inclusive of uplands, transitional habitats, freshwater wetlands, and various estuarine habitats (open water, live bottom, seagrass beds, low and high salt marshes, salterns, mud flats, etc.). To date, all SWIM projects have been constructed on public land and represent cooperative efforts (both financially and in-kind services) between the District and a local government or state agency. Each project has involved a year or more of planning, permitting, and implementation. This TBNEP action plan presents steps to implement the Tampa Bay Master Plan for Habitat Restoration and Protection, including elements to secure and preserve funding sources.

1) Finalize the list of priority restoration projects compiled from the individual plans of various agencies and local governments. Responsible parties: Tampa Bay NEP; in cooperation with the established workgroup of agencies, organizations and local governments

2) Ensure that priorities for habitat restoration and protection are incorporated into the 1997 action plans submitted to NEP by local governments and agencies for implementation of the CCMP. Additionally, ensure that these projects are incorporated into local government and agency permit reviews and conditions.

3) Direct public and private mitigation to restoration projects identified as priorities.

4) To support implementation of restoration and protection efforts:

   - Pursue a permanent source of funding for the SWIM Program;

   - Secure funding for the Florida Marine Research Institute's Marine Habitat and Restoration Program, which was discontinued recently due to state funding cutbacks;

   - Secure a permanent source of funding for Preservation 2000, the state environmental lands acquisition program;

   - Amend provisions of the Hillsborough County Pollution Recovery Trust Fund to require that monies collected from fines be spent within a reasonable period of time.

District Action:

The Tampa Bay Master Plan for Habitat Restoration and Protection is a listing of potential sites. The projects selected for implementation by the District are based on: the availability of land (to date, all SWIM projects have been constructed on public land and represent cooperative efforts, both financially and in-kind services, between the District and a local government or state agency); the potential for

creating a meaningful acreage of restored coastal habitats; the ability to maximize the number of habitat types; and the ability to meet the TBNEP goals for "restoring the balance".

From 1989 through 1994, the District completed twenty-one habitat restoration projects bay-wide. These projects resulted in over eighty-one acres of enhanced and/or restored coastal habitats for Tampa Bay. For the period 1995 - 2000, the District proposes the following habitat restoration projects:

Project Name: Balm-Boyette Habitat Restoration Site
Project Description: The Balm-Boyette project is the creation and restoration of 1,000 acres of freshwater habitat specifically designed as a forage area for wading birds. The site is within the feeding area for the Alafia River rookery identified in "Restoring the Balance." Implementation of this project is highly compatible with the TBNEP's "Restoring the Balance" approach to ecosystem restoration.
Project Participants: SWFWMD , Hillsborough County.
Location (drainage basin): Hillsborough Bay
Contribution Toward Goal: 1,000 acres of freshwater habitat
Implementation Schedule: Design FY 99, Construction starting FY 01

Project Name: Coastal Habitat Restoration in the Tampa Bay Watershed
Project Description: The implementation of habitat restoration project combining coastal habitat enhancement, restoration and creation including where feasible, improved water quality through enhanced tidal flushing, water circulation, and/or stormwater treatment. Each project typically employs the restoration strategy of enhancing, restoring, and/or creating habitat mosaics ("ecosystem restoration" approach). A habitat mosaic represents a collection of habitats normally found in coastal ecosystems, inclusive of uplands, transitional habitats, freshwater wetlands, and various estuarine habitats (open water, live bottom, seagrass beds, low and high salt marshes, salterns, mud flats, etc.). The District SWIM Program's use of the habitat mosaic restoration strategy is highly compatible with the TBNEP's "Restoring the Balance" approach to ecosystem restoration.

Project Participants: SWFWMD, City of Oldsmar, City of Gulfport, City of St. Petersburg, City of Clearwater, Pinellas County, FDOT, FDEP, City of Tampa, Hillsborough County, Port Manatee, Tampa Electric, Cargill, private land owners.

Old Tampa Bay Watershed
Contribution Toward Goal: 123 acres
Implementation Schedule:
Osgood Point - Complete, 10 acres
Tarpon Outfall Canal II - Complete, 1 acre
Del Oro Tract - Complete, 1 acre
Mobbly Bay I - Complete, 14 acres
Cooper's Point -Design 1995, Construction 1999, 7 acres
Allens Creek I - Completed, 1 acres

Howard Frankland West - Design 1996, Construction 1999, 55 acres
Cypress Point - Design 1996, Construction 2000, 5 acres
Mobbly Bay II - Design 1998, Construction 1999, 10 acres
Allens Creek II - Design 1999, Construction 2000, 14 acres
Rocky Creek - Design 2000, Construction 2002, 10 acres
Dick Creek - Design 2000, Construction 2002, 10 acres
Tarpon Outfall Canal - Design 1999, Construction 2000, 5 acres
Likelihood of Completion: High
How financed: SWFWMD, Ecosystem Management and Restoration Trust Fund, Local Governments, Federal Grants, Private

Hillsborough Bay Watershed
Contribution Toward Goal: 140 acres
Implementation Schedule:
SE McKay Bay - Design 2000, Construction 2001, 8 acres
Dug Creek - Design 1998, Construction 1999, 10 acres
Davis Tract - Design 1998, Construction 1999, 100 acres
Port Redwing - Design 1999, Construction 2000, 30 acres
Cracker Rd. Fish Farm - Dependant upon acquisition, 40 acres
US 41 Fish Farm -Dependant upon acquisition, 10 acres
Cargill Property - Design 2001, Construction 2002, 50 acres
Delaney Creek Popoff II -Dependant upon acquisition, 50 acres
Likelihood of Completion: High
How financed: SWFWMD, Ecosystem Management and Restoration Trust Fund, Local Governments, Federal Grants, Private

Middle Tampa Bay Watershed
Contribution Toward Goal: 575 acres
Implementation Schedule:
MacDill AFB I - Complete, 34 acres
Cockroach Bay 1A, 1B - Complete, 103 acres
MacDill AFB II - Design 1998, Construction 2000, 33 acres
Mangrove Bay III - Design 1997, Construction 1998, 21 acres
Bartlett Park - Design 1997, Construction 1998, 4 acres
Wolf Branch Creek - Design 1999, Construction 2000, 200 acres
Cockroach Bay 1C, 1D - Design 1999, Construction 2000, 100 acres
Apollo Beach - Design 1998, Construction 2000, 50 acres
MacDill AFB III - Design 2000, Construction 2001, 30 acres
Likelihood of Completion: High
How financed: SWFWMD, Ecosystem Management and Restoration Trust Fund, Local Governments, Federal Grants

Lower Tampa Bay Watershed
Contribution Toward Goal: 710 acres
Implementation Schedule:

Terra Ceia Buffer Preserve - Design 1999, Construction 2000, 650 acres
Emerson Point - Design 1998, Construction 1999, 50 acres
Braden River II - Design 1995, Construction 1998, 5 acres
South Skyway - Design 1996, Construction 1998, 5 acres

Likelihood of Completion: High
How financed: SWFWMD, Ecosystem Management and Restoration Trust Fund, Local Governments, Federal Grants

Boca Ciega Bay Watershed
Location (drainage basin): Boca Ciega Bay
Contribution Toward Goal: 40.5 acres
Implementation Schedule:
Joe's Creek 1A - Complete, 0.5 acres
Long Cross Bayou - Complete, 2 acres
Clam Bayou I - Complete, 10 acres
Boca Ciega II - Design 1996, Construction 1999, 3 acres
Clam Bayou II - Design 1998, Construction 2000, 25 acres
Cross Bayou/Joe's Creek - Design 1997, Construction 1999, 5 acres

Likelihood of Completion: High
How financed: SWFWMD, Ecosystem Management and Restoration Trust Fund, Local Governments, Federal Grants

B.2.2 Action Plan BH-2 Establish and Implement Mitigation Criteria for Tampa Bay and Identify Priority Sites for Mitigation

Mitigation — the process by which applicants whose projects impact wetlands create new ones in their place or restore or enhance existing wetlands—is required of both private developers and public agencies in Florida to compensate for loss of natural habitats. Typically, these manmade wetlands are established on the same site as the project, in an area not slated for development.

But keeping track of these projects—and how closely they mimic natural wetlands—has proven difficult with the government's limited resources. Studies by the Florida Department of Natural Resources' Aquatic Preserves Division and Marine Research Institute in 1988 reported a failure rate of more than 80 percent for mitigation projects in Southwest Florida and Tampa Bay. A follow-up study conducted by the Florida. Department of Environmental Protection (FDEP) revealed that one-third of applicants issued permits by the agency had never even attempted the required mitigation. Of those that had, only 13 of 62 mitigation projects were deemed "ecologically successful," meaning they generally provided the same functions as natural wetlands destroyed by the project.

In addition to problems with enforcing mitigation requirements, some bay managers believe the mitigation criteria used by the state is insufficient to protect some particularly valuable bay habitats.

Problems with the current mitigation program, and pressures from private interests who

view it as too cumbersome, have led to a new concept called "mitigation banking." It allows developers to compensate for wetland losses in one place by preserving, restoring or creating wetlands in another to achieve a no-net loss of wetlands.

A new FDEP rule allows mitigation banking in some instances, although it remains a controversial issue. Proponents say mitigation banking can consolidate man-made marshes into central areas, increasing the odds for success and making the permits easier to monitor and enforce. Proponents also say it will result in larger wetland areas that are more useful for birds and other wildlife than, for instance, a tiny wetland in the middle of a shopping center or along a busy road. Critics say mitigation banking will make it easier to destroy wetlands. If an applicant can simply pay to restore marshes somewhere else, they fear there will be little incentive to preserve wetlands on site. Many concerns about mitigation banking stem from provisions (or lack of provisions) in the new state rule.

Under the rule, mitigation banks are optional and can be either publicly or privately owned or operated. The state encourages a free-market approach, so does not specify how much a developer can be charged for mitigation credits. Generally, the price of credits covers the cost of the restoration and monitoring for several years, in addition to providing a margin of profit for the private restoration company. Banks are jointly administered by the FDEP and the state's water management districts.

The state rule also allows private companies to purchase lands for mitigation banks, or developers themselves to purchase and operate mitigation banks. Additionally, the new rule permits developers to transfer their mitigation to publicly owned lands if the landowner agrees, as is the case with a bank on state-owned property at Little Pine Island in Lee County.

Whether mitigation banks should be permitted on publicly owned lands is a key area of disagreement among bay managers. Some believe mitigation should only be allowed on private lands, with those lands subsequently turned over to a public agency for management. Others say mitigation banking offers a chance to restore damaged public lands much faster than limited government funds currently permit.

The shortcomings of the current mitigation program and the lack of a significant track record on wetland mitigation banking will continue to make the issue of how and where banks should be used complex and controversial.

The Tampa Bay National Estuary Program (NEP) supports the development of mitigation criteria for the Tampa Bay region, including the development of a regional mitigation banking plan that addresses specific habitat needs and priorities. A workgroup of the Natural Resources Committee of the Agency on Bay Management (ABM) was convened in May 1996 to evaluate existing guidelines and develop recommendations. Participants have reviewed and compared federal, state and local criteria for mitigation banking, as a first step in developing recommendations for the Tampa Bay region. The group also is identifying areas that may be desirable for banking, based on priorities for restoration and protection established in the NEP's Master Plan for Habitat Restoration and Protection.

A regional mitigation banking plan would accomplish several goals. First, it would ensure appropriate siting of banks in areas where they are most likely to succeed and where other valuable habitats, such as mature pine forests, are not sacrificed for wetlands. A regional plan also would prevent a profusion of widely scattered banks that are difficult to monitor, and would give local governments guidance in drafting future land-use plans.

Permitting agencies should continue to emphasize avoidance of wetland impacts in lieu of on- or off-site mitigation. Where wetlands impact cannot be avoided, on-site mitigation should be encouraged if it is likely to be effective. If on-site compensation is not feasible, mitigation banking should be encouraged.

Strategy:

STEP 1 Identify areas where mitigation banks should be used in the Tampa Bay watershed, and develop criteria for management and operation of those banks.

A. Generate a map that identifies all existing and proposed preserves and major conservation easements, using the NEP's 1996 base map from the Habitat Restoration and Protection Plan for Tampa Bay and the Game & Fresh Water Fish Commission's Regional Wildlife Habitat Plan (1996). Identify areas best suited to mitigation banking.

B. Evaluate and recommend criteria for mitigation banking in the Tampa Bay region. The ABM workgroup has considered:

- whether mitigation conducted by local governments and private developers should count toward overall habitat restoration goals for Tampa Bay. Projects which produce a net increase in valuable estuarine, oligohaline and native upland watershed habitats should "count" toward the overall restoration goals for Tampa Bay.

- specific criteria to decide when on- or off-site mitigation is most appropriate. Recommendations being developed.

- ownership, management and associated cost issues, including whether mitigation banks operated on private lands purchased by the developer or private bank operator should be deeded to a public agency. Recommendations are being developed.

- limitations on the total number of mitigation banks, and the number that one private operator can manage, and provisions to make banks large enough to increase ecological values and prevent a glut of banks with no "customers." Recommendations being developed.

- siting considerations, to ensure that wetland values lost in one area are replaced in the same general area, thus preventing an overall decline in

water quality or habitat within one watershed (for example, positioning banks adjacent to existing wetlands could make replicating the types of wetlands lost easier, increase its probability of success, and boost its value to wildlife). Another issue involves siting banks in areas that fill gaps in existing wildlife habitat corridors. Workgroup is evaluating FDEP language to decide if changes are needed.

- provisions to ensure the bank mimics as closely as possible the values, appearance and function of the original habitat. Where this is not practical, mitigation credits should be granted at a higher ratio, as in low-salinity tidal streams, salt barrens, hard-bottom communities or other critical habitats within Tampa Bay. The following ratios have been presented for consideration: 2:1 (creation), 4:1 (restoration/enhancement), 10:1 (preservation). [from Scientifically Defensible Compensation Ratios for Wetland Mitigation] .

- bank monitoring, enforcement and penalties for noncompliance. Recommendations being developed.

- provisions for preservation of existing wetlands within a mitigation bank as compensation if the environmental benefits of such activity will significantly exceed the level of impact. Recommendations being developed.

- whether mitigation banks should be considered a replacement for publicly financed restoration projects. Mitigation banking should not replace publicly financed restoration. However, the potential exists for some mitigation banking credits to be generated by local governments for restoration projects that produce a net habitat gain and help achieve the goals of the bay restoration plan.

- safeguards to protect productive native uplands from conversion to wetlands. The group is strongly opposed to converting productive native uplands to wetlands. Recommendations being developed.

- mandating the establishment of a trust fund to ensure long-term management of the mitigation bank. The trust fund could be managed by a public agency, with additional oversight by a non-profit group such as The Nature Conservancy. The group supports this concept. Most existing mitigation banking criteria address this issue.

Private industry and other non-governmental and environmental groups have been urged to participate. Recommendations will be forwarded to the Tampa Bay NEP in early 1997 following review by the full Agency on Bay Management.

STEP 2 Implement recommendations from Step 1, and direct mitigation of estuarine impacts to high-priority restoration areas identified in the Tampa Bay NEP

Habitat Restoration and Protection Master Plan.

District Action:

Participate (through TBEP and the ABM) in the review of mitigation criteria. District Regulatory staff will explore the appropriate use of flexible or alternative criteria on an action-by-action basis. If, over time, a common alternative emerges, then District staff will consider making rule changes to incorporate this common alternative.

In a related effort, the District has been legislatively required to provide mitigation for Florida Department of Transportation (FDOT) road projects occurring within the SWFWMD. The impacts are determined by the FDOT and the District prepares a mitigation plan, submits it to the FDEP and the legislature for approval, and then constructs the mitigation. Funding is provided based on $75,000 per acre of impact. It is unlikely that the existing level of funding will be sufficient to provide all mitigation required. This issue will likely be addressed in future legislative sessions. The District has recently prepared the second annual FDOT mitigation plan and utilized, where able, sites listed on the Tampa Bay Master Plan for Habitat Restoration and Protection. No projects directly related to mitigation banking are proposed at this time.

B.2.3 Action Plan BH-6 Encourage Waterfront Residents to Enhance Shorelines and Limit Runoff from Yards

About half of Tampa Bay's natural shoreline has been altered by development or hardened through the construction of seawalls, piers and jetties that limit plant and animal life. These changes have led to significant declines in intertidal marsh and mangrove habitat, which supply food and shelter for marine creatures and filter pollutants contained in runoff.

This action presents steps to encourage waterfront residents to soften or enhance sea-walls and degraded natural shorelines with native vegetation, limestone rip-rap, terracing or habitat reefs. When properly designed, these improvements not only benefit the environment, but also can boost property values by improving shoreline stability and aesthetic appeal. However, cost, permitting complexity and lack of information about suitable options are often key deterrents to homeowners, who also are limited by site specific considerations.

Currently, residents who wish to stabilize their shoreline may need to obtain a general permit to install rip-rap or to soften existing structures, but the criteria for obtaining this permit vary according to the nature of the surrounding shoreline and the type and amount of work proposed. Exempting certain types of enhancement activities from the permit requirement, or mandating only that the homeowner notify Florida Department of Environmental Protection (FDEP) of the work—a noticed exemption—may encourage more residents to undertake these projects.

Local communities seeking to encourage waterfront residents to enhance shorelines may gain the most by targeting larger, finger-fill communities, where group permits are feasible,

especially when seawalls are replaced or repaired. The City of Clearwater's Environmental Advisory Board, for example, has discussed the possibility of allowing homeowner groups to adopt a management plan for their shorelines to encourage the planting or preservation of mangroves. The management plan would specify mangrove trimming guidelines, and homeowners who agree to abide by the guidelines could do the pruning themselves, instead of having to hire a landscape architect as mandated by the current state mangrove trimming rule.

Limiting pollution in runoff from waterfront yards also is encouraged. Residents can help to reduce pollution to Tampa Bay by applying the eco-landscaping techniques prescribed by the Florida Yards & Neighborhoods (FY&N) Program, which is administered by local cooperative extension services. A companion FY&N homeowner's guide, which features low-maintenance landscape design and maintenance tips, is ideally suited to the environmentally conscious waterfront resident. Adopt-A-Canal programs also may be effective in select areas in improving water and habitat quality in canals through public stewardship and education.

Strategy:

The following strategy focuses on incentives and efforts to streamline procedures for residential shoreline enhancement, as well as informational resources to assist water-front residents in evaluating shoreline options and implementing landscaping practices to reduce runoff from their yards.

1) Develop property tax or other financial incentives to encourage habitat enhancement along seawalls, and establish cost-share programs to promote group-permit shoreline enhancement projects. For instance, property owners currently are entitled to lower property valuations if part of their property is placed in a conservation easement; perhaps a similar program could be instituted for homeowners who use alternative shoreline stabilization and enhancement techniques. Additionally, a shoreline management plan such as that proposed by the Clearwater's Environmental Advisory Board could result in significant cost-savings to participating homeowners by allowing them to trim their own mangroves under approved guidelines.

2) Evaluate whether a low-cost or no-cost general permit, a noticed exemption or a full exemption is the best mechanism for encouraging shoreline enhancement, and develop criteria for review of projects that will be eligible for the streamlined permit process. Rule revisions may be needed to incorporate exemptions into existing rules.

3) Develop and distribute a resource card (#10-envelope size) to waterfront residents through annual property tax notices to promote available tax incentives for shoreline enhancement, as well as resources and publications addressing waterfront landscaping and exotic plant control, and canal maintenance and improvement. SWFWMD's 1993 report on Best Management Practices for Improvement of Residential Canals includes informative boilerplate text for a public brochure on enhancement of hardened shorelines. Text should be expanded to provide more

detail on general shoreline design options, associated costs, and appropriate contacts, and then produced as a brochure for public distribution.

District Action:

Project Name: Adopt-a-Pond

Project Description: Hillsborough County and the District cooperatively sponsored a program that offers county residents training and support necessary to maintain effective stormwater drainage systems in their communities. The program assists neighborhoods in properly landscaping the banks and shallow areas of the ponds which are critical to their continued effectiveness. Additionally, the program provides workshops to increase community understanding of water quality issues and facilitates storm drain marking. Budgeted for FY 99 is assistance for Pinellas County to implement a pilot project modeled after the Adopt-a-Pond program in Hillsborough County.

B.2.4 Action Plan BH-7 Improve Compliance with and Enforcement of Wetland Permits

State rules regarding mitigation for wetland impacts have been developed to offset wetland losses. However, a study of mitigation compliance completed by the Florida Department of Environmental Regulation—now Florida Department of Environmental Protection (FDEP)—in 1992 concluded that the majority of mitigation projects had either never been constructed or failed to comply with the terms of their permit and did not function properly. The generally low success rate statewide has been largely attributed to staffing shortfalls and organizational structures that have traditionally segmented rather than integrated permitting, compliance monitoring and enforcement functions. Without strong compliance monitoring and enforcement, regulated interests often have little incentive to perform compensatory mitigation in a manner consistent with the rules.

Wetland mitigation rules are administered by the FDEP, Southwest Florida Water Management District, and by local governments with delegated or legislative authority for wetland permitting.

Non-compliance with wetland mitigation permits in the Tampa Bay watershed has likely contributed to a net loss of both freshwater and tidal wetlands. However, documenting these trends has been extremely difficult because efforts to track compliance between and within various regulatory agencies have been inconsistent and lacking in sufficient detail. Inconsistent mitigation ratios, wetland delineation criteria, and design and performance standards have further complicated efforts to assess results. Improving permit compliance will require that agencies focus first on recognizing and permitting effective mitigation designs, as well as increasing inspections during and after construction, and following up to promote better project maintenance by regulated interests. Access to mitigation sites also is a factor. In this regard, locally administered programs may have an advantage over state or regional programs, although the costs of absorbing these additional responsibilities may be an obstacle.

The state's new Environmental Resource Permitting (ERP) program, which consolidates existing wetland resource, management and storage of surface waters, and sovereign lands regulatory programs into a single permitting function, is expected to improve compliance monitoring and enforcement by increasing interagency coordination and reducing inconsistencies and duplication. Implementation of the ERP will create key opportunities for the consolidation and reorganization of these functions within regulatory agencies and participating local governments, and the creation of uniform standards for wetland delineation. Additionally, the Environmental Protection Commission (EPC) of Hillsborough County is currently developing a Memorandum of Understanding with SWFWMD which will allow EPC to conduct all wetland compliance and enforcement tasks within Hillsborough County. This agreement would result in more timely and consistent reviews of mitigation projects, while eliminating duplication of services and the potential for conflicting compliance criteria.

Strategy:

The strategy to improve wetland permit compliance monitoring and enforcement focuses on establishing level-of-service targets, continued implementation and periodic assessment of integrated permitting concepts advanced through the ERP program, and evaluation of existing staffing and funding resources and needs as the basis for recommendations for action. This strategy also calls for standardization of monitoring and reporting requirements within and between enforcing agencies and municipalities.

1) Conduct a workshop to establish level-of-service targets for wetland permits (performance criteria and monitoring requirements) and compliance monitoring and enforcement within the Tampa Bay watershed, and assess associated staff and funding needs. In establishing level-of-service targets, participants should explore how principles of ecosystem management— which emphasize overall environmental benefits to the watershed—can be integrated into permitting and compliance programs. Additionally, they should evaluate ways to standardize reporting and monitoring methods between and within agencies.

2) Expand agency and local government permitting staff training and regular retraining to increase the emphasis on recognizing quality wetland mitigation designs as a first step to ensure that quality projects are permitted. The FDEP's statewide mitigation coordinator may be able to assist in organizing regular regional training seminars.

3) Continue to integrate permitting and compliance monitoring and enforcement functions in an effort to maximize efficiency and provide "cradle to grave" permit oversight, in which the same personnel that conduct permit reviews also are responsible for compliance follow-up. Also, encourage interagency compliance monitoring teams where feasible, including federal agencies.

4) Based on recommendations from Step 1, standardize mitigation success criteria as well as monitoring and reporting requirements for created and restored wetlands.

5) Assess the effectiveness of efforts to improve compliance monitoring and enforcement in the Tampa Bay watershed, including progress toward level-of-service targets (particularly compliance rates), results of integrating staff to assist in these efforts, and associated costs to agencies and applicants. Results of the assessment should be reported in the Tampa Bay NEP's Biennial Environmental Monitoring Report and the Agency on Bay Management's State of the Bay report.

District Action:

Any activity in this area, particularly related to compliance monitoring, would occur through close coordination with the regulatory side of the District. District staff will explore the appropriate use of flexible or alternative criteria on an action-by-action basis. If, over time, a common alternative emerges, then District staff will consider making rule changes to incorporate this common alternative. No projects have been proposed at this time.

B.2.5 Action Plan BH-8 Expand Habitat Mapping and Monitoring Programs

A critical element of the bay's management plan is the establishment and maintenance of a monitoring program to measure progress toward meeting the goals of the Tampa Bay National Estuary Program (NEP). This is very important to the local and state governments implementing actions, since counties, cities and state agencies must have adequate information to evaluate whether efforts spent on pollution abatement or other changes in the watershed are reflected in improvements in bay quality. Monitoring of habitats is also necessary to track progress toward reaching long-term restoration and protection goals set by the program, and provide essential information that can be used to redirect and refocus the plan.

One of the first efforts of the Tampa Bay NEP was to initiate a multi-year effort to develop a baywide monitoring program capable of reliably measuring changes in bay quality. This plan incorporates and expands on existing programs where possible, and consists of seven major elements: water quality, berths, seagrass, bay scallop, fisheries, coastal marshes and mangroves, and oligohaline habitats.

This action ensures implementation of habitat monitoring elements defined in the baywide monitoring plan.

Strategy:

1) Continue the existing Southwest Florida Water Management District Surface Water Improvement and Management (SWFWMD-SWIM) monitoring program mapping areal extent of seagrass in Tampa Bay to track trends in areal extent and progress toward restoration goals.

   The extent of seagrass coverage in all areas of Tampa Bay is currently being monitored by SWFWMD-SWIM every two years. To date, no permanent funding source for the mapping program has been identified.

2) Implement the Seagrass Conditions Monitoring Program as developed by the Tampa Bay NEP Technical Advisory Committee. Hillsborough County monitors seagrass conditions in Cockroach Bay, and Pinellas County conducts seagrass monitoring in Fort DeSoto Park to track rates of seagrass scarring. The City of Tampa conducts seagrass quality monitoring in Hillsborough Bay. SWFWMD-SWIM is conducting the second year of the Seagrass Conditions Monitoring Program throughout the bay as a pilot project. Potential entities responsible for conducting biannual seagrass conditions monitoring in upcoming years remain to be identified.

3) Develop and implement a monitoring program to track habitat quantity and quality in coastal marshes, oligohaline habitats and associated uplands, as well as restored habitats.

Development of these elements of the habitat monitoring program will be initiated as part of the habitat restoration and protection master plan. This plan will identify responsible entities for implementation.

District Action:

Project Name: Environmental Monitoring - Seagrass Mapping
Project Description: The District will map seagrass acreage and location using aerial photographs taken every two year and verify the data with field checks. This project will provide an important indication of the success of seagrass recovery rate.
Project Participants: SWFWMD
Location (drainage basin): Bay-wide
Contribution Toward Goal:
Implementation Schedule: ongoing
Financed: SWFWMD

Project Name: Land Use Mapping
Project Description: The District will continue to update GIS-based land cover maps every 5 years. This project will provide an important source of data for watershed loading calculations.
Project Participants: SWFWMD
Location (drainage basin): Bay-wide
Contribution Toward Goal:
Implementation Schedule: ongoing
Likelihood of Completion: High
How financed: SWFWMD (existing District activity; no additional cost)

B.2.6 Action Plan FI-1 Establish and Maintain Minimum Seasonal Freshwater Flows Downstream of Dams

Estuaries, where fresh water and salt water mix, are highly productive natural habitats for fish and other marine life. The juveniles of many aquatic species, including spotted seatrout, snook, red drum and tarpon, depend on the low and medium-salinity portions of

these shallow waters, especially in the tidal sections of rivers and streams. However, the productivity of these habitats as nurseries and feeding areas depends largely on maintaining an adequate supply of fresh water upstream at certain times of the year.

In this region, potable water for drinking, irrigation and industrial uses comes from reservoirs and from groundwater sources. Demand for fresh water in the tri-county area is expected to increase from 544 million gallons per day (mgd) in 1990 to 765 mad in 2020, according to the Southwest Florida Water Management District.

Florida Statutes Section 373.042 (1991) directs the state's water management districts to establish "minimum flows" for watercourses and "minimum levels" for surface waters and aquifers. The statute defines minimum flows as the limits at which further withdrawals would be "significantly harmful to the water resources or ecology of the area." Legislation passed in 1996 requires the District to set minimum flows for priority surface waters in the northern Tampa Bay area by October 1, 1997.

Minimum flows based on river ecology have not yet been set for the Hillsborough, Palm and Braden rivers. A preliminary minimum flow of 0.425 cubic feet per second (cfs)—or roughly 275,000 gallons per day which is the current estimated leakage from the dam—was set for the Manatee River in 1991. The flow's adequacy is now being examined by SWFWMD in cooperation with Manatee County.

Minimal flows were not required when control structures were constructed on the Hillsborough, Palm, Braden and Manatee rivers (all prior to 1972). Nevertheless, a series of ongoing and recently completed studies should provide SWFWMD with sufficient information to set thresholds for each river to protect the productivity of the river and the bay downstream of the dams.

A minimum flow study is not planned for the Alafia River because the SWFWMD Needs and Sources Study concluded that water supplies were not needed from the Alafia for the 1990-2020 planning horizon. However, the West Coast Regional Water Supply Authority (WCRWSA) has recently proposed to remove 7 mad of fresh water from the Alafia in the first phase of its 1995 Water Resource Development Plan (1995-2000).

Studies on the Braden, Hillsborough, Manatee and Little Manatee rivers, and the Tampa Bypass Canal, have addressed various aspects of river flow and ecology. Evaluation of these studies will provide vital information in establishing minimum flow requirements.

Strategy:

This action is to evaluate and set minimum seasonal freshwater inflows to Tampa Bay from rivers impounded by dams to protect the ecological integrity of vital downstream fisheries habitats.

1) Conduct technical workshops for each impounded river to evaluate results of freshwater studies and develop recommendations for minimum freshwater flow

requirements.

At the request of SWFWMD, the Tampa Bay NEP convened an advisory committee in October 1996 to assist in establishing flow requirements for the Hillsborough/Palm River system by October 1997.

NEP also sponsored an initial workshop on the Manatee River in August 1995, which included local government and agency representatives, scientists, engineers, utilities and community interest groups.

In evaluating available studies, participants are considering:

- whether flows to the downstream portions of impounded rivers have been quantified.
- if appropriate flows to restore and maintain critical low-salinity habitats can be determined from the studies
- the impacts of various flow-release scenarios on public water supplies and economic development.

2) Establish seasonal flow requirements by the state-mandated deadlines for the Hillsborough, Palm, Manatee and Braden rivers, incorporating recommendations from advisors and considering other socio-economic and environmental factors.

District Action:

The Southwest Florida Water Management District has established a schedule for adopting minimum flow regulations for the Manatee, Braden, Little Manatee, Alafia and Hillsborough Rivers and the Tampa Bypass Canal. Minimum flows will be established for the Hillsborough River/Tampa Bypass Canal system by October 1, 1997; for the Manatee, Braden, and Little Manatee Rivers by 10/01/1999; and for the Alafia River by 10/01/2001. Minimum flows are regulatory limits to water withdrawals that serve to maintain a quantity, or quantities, of stream flow in the tributary to sustain natural systems. The stream flow quantity reserved for environmental requirements can vary daily or seasonally depending on the characteristics and regulation of the respective system.

The establishment of minimum flows for these six tributaries to the bay will be based technically on hydrologic, ecological, and water use information collected for these systems as part of District required studies. Other information and input gained from workshops sponsored by the Tampa Bay NEP will be thoroughly considered in establishing minimum flows. The District will coordinate with the TBNEP concerning the logistics of these workshops. The District will also work with the affected parties who provide water supplies so that various options can be pursued so that water demands can be met while meeting minimum flow requirements. The monitoring of environmental response to minimum flows will be evaluated, and as deemed

necessary, provisions to conduct such monitoring through regulatory or other programs will be pursued. No specific SWIM related projects are proposed at this time.

B.3 PUBLIC EDUCATION AND INVOLVEMENT

A Community Advisory Committee established in 1991 has assisted the Tampa Bay National Estuary Program in developing outreach strategies. and understanding public concerns and perceptions about the bay. Appointed by the NEP's Policy Committee, members include representatives of agriculture, business, education, fishing and the environment, who also share their perspectives as citizen taxpayers and residents of the communities they represent.

The Committee has played a key role in soliciting public feedback on strategies for bay improvement. In 1995, citizen advisors hosted a series of informal focus groups to discuss the bay's most pressing needs and options for addressing them with neighbors, business associates, maritime and fishing groups, and other community interests. Feedback from these participants identified areas of broad support and issues of potential controversy. A second and highly successful series of focus groups and larger Town Meetings on Tampa Bay were conducted in 1996, following the January 1996 release of the draft Comprehensive Conservation & Management Plan (CCMP).

This action plan, developed by the Committee, recommends priorities and plans for public education and involvement in the future as the NEP and its community partners begin implementation of the CCMP.

Future community outreach should seek to:

- foster continued community support for bay restoration and CCMP implementation by continuing to educate residents about bay issues, and publicize the bay's progress and needs

- improve public faith in the ability of bay managers and organizations dedicated to its restoration to "work smart" to leverage resources, avoid duplication and focus on priorities

- maximize direct opportunities for public involvement in bay restoration and protection.

A top priority in 1997 will be the development and distribution of a public summary of the final CCMP for residents, legislators and community leaders. This will lay the foundation for a series of annual progress reports to the community documenting progress in the implementation of the bay plan.

Other 1997 initiatives proposed by the Community Advisory Committee include:

- a public opinion poll to identify community concerns and comprehension of bay

issues, as well as gauge support for bay restoration initiatives and funding

- a small grants program to support grass-roots bay restoration and improvement projects by community groups and schools, with special outreach to low-income and minority groups

- periodic public forums, sponsored by NEP, on controversial and important bay issues, such as NEP's televised debate on the Ban-The-Nets referendum

- development of a graphic-and-text environmental index on the state of Tampa Bay for periodic publication in local newspapers

The Committee and NEP also will evaluate the need for a companion to the 1996 Teachers Guide to Tampa Bay, a middle-school curriculum kit developed by the NEP and Tampa Tribune for distribution to more than 350 schools. Additionally, the Committee recommends:

- continued distribution of the Boater's Guide to Tampa Bay, a publication of the NEP and Florida Marine Research Institute which already has been distributed to more than 100,000 boaters.

- continuation of the NEP newsletter, *Bay Guardian*, to spotlight the state of the bay and progress in the bay's recovery, and aggressive efforts to publicize bay issues in the media to inform and educate the public;

- continued advocacy of bay restoration and protection efforts to cooperation with other public policy and interest groups, and efforts to educate the public on issues affecting the bay;

- continued support for organizations that enlist and effectively utilize volunteers, such as Tampa BayWatch, The Florida Aquarium and the National Audubon

- periodic "spotlight on solutions" field trips targeting and co-sponsored by various audiences with regulatory and natural resource interests. For example, a field trip hosted by a local alliance of developers might target urban designers and showcase exemplary commercial landscapes that enhance the environment. Public field trips to bay restoration sites and parks also might be offered in cooperation with The Florida Aquarium.

Funding to implement these initiatives will be covered in the NEP's annual workplan or secured through grants and community partnerships.

District Action:

The District has been involved in the following education projects that specifically address Public Education and Involvement.

Project Name: Florida Aquarium Parking Lot
Project Description: The parking lot at the Florida Aquarium was developed in partnership with the District to provide a site for stormwater research that doubles as an educational site. Exhibitry along Garrison Channel explains stormwater pollution and its effect and water quality, details the features in the parking lot design that reduce stormwater pollution, and offer ideas for individuals to adopt.

Project Name: Adopt-a-Pond
Project Description: Hillsborough County and the District cooperatively sponsored a program that offers county residents that training and support necessary to maintain effective stormwater drainage systems in their communities. The program assists neighborhoods in cleaning and planting stormwater ponds, provides workshops to increase community understanding of water quality issues and facilitates storm drain marking.

Project Name: Community Grants
Project Description: The District's Basin Boards provide small grants to individuals, associations and other organizations to help communities learn about their water resources. Several projects sponsored in the Tampa Bay area address water quality concerns.

Project Name: Xeriscape University
Project Description: The District worked with the Pinellas County Technical Education Center, the Pinellas County and City of St. Petersburg utilities and the Pinellas County Cooperative Extension Service to offer Xeriscape workshops to county residents. In addition to providing information about the reduction of water for irrigation, the workshop provided participants with information about lawn maintenance to assist them in reducing fertilizers and pesticides used in their landscape Maintenance practices.

Project Name: Stormwater Management Video
Project Description: The District cooperated with Pinellas County to produce two videos designed to help county employees and the public understand the effect of non-point-source pollution on water quality. The video details actions individuals can take to reduce pollution. One of the videos is used in the county's employee development program; the other airs regularly on government access television and was aired on commercial television with assistance from the Tampa Bay Regional Planning Council.

Appendix C

Regulatory Jurisdictions Within the Tampa Bay Basin

FEDERAL

Federal jurisdiction in Tampa Bay involves the regulatory responsibilities of the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Coast Guard, the U.S. Fish and Wildlife Service, and the U.S. Department of Interior (which coordinates its many agriculture-related activities with those of the Florida Department of Agriculture and Consumer Services). Their main regulatory functions include overseeing dredge and fill activities, maintaining navigability of the waters of the United States, overseeing cleanups following pollution spills, protecting endangered species, protecting overall environmental quality, and managing offshore activities. These agencies, in conjunction with the U.S. Geological Survey and the National Oceanic and Atmospheric Administration, also contribute to the collection of technical data concerning Tampa Bay and its watershed.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers is concerned with all activities which affect navigable waters of the United States, particularly those involving construction of structures and dredging and filling in navigable waters. The Corps is also involved in permitting the placement of dredge and fill material into navigable waters and adjacent wetlands, and in funding aquatic plant control in navigable and public waters.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency is the primary federal agency responsible for water quality protection. The agency oversees hazardous waste cleanups, protection of public drinking water systems, all point source pollutant discharges into waters of the United States (National Pollutant Discharge Elimination System permits), and the protection and restoration of surface and groundwater. The agency also reviews Corps of Engineers permit activities, sets minimum quality standards, and sets guidelines for state environmental programs. EPA also funds sewerage facilities' studies through the SWFRPC and the TBRPC, and system improvements through the Florida Department of Environmental Protection.

The EPA's greatest presence in Tampa Bay is through its National Estuary Program, established under Section 320 of the Clean Water Act.

U.S. Coast Guard

The U.S. Coast Guard is the primary federal agency entrusted with marine law enforcement. The Guard's mission also includes hazardous materials cleanups, search and rescue, buoys replacement, vessel safety inspection, and right-of-way clearance on

navigable waterways.

U.S. Department of Commerce

Within the department, the National Oceanic and Atmospheric Administration, which includes the National Weather Service and the National Hurricane Center, is a scientific and data collection agency which assimilates oceanographic and meteorological information in the form of maps, charts, interpretive reports, and other documents. The National Marine Fisheries Service administers NOAA's program to manage living marine resources for commercial and recreational use. It supports fisheries management operations, international fisheries affairs, fishery development, trade, and industry assistance activities, habitat conservation activities, and scientific and technical aspects of NOAA's marine fisheries resources programs.

U.S. Department of Interior

The primary water-related functions performed by this agency involve the review of proposed activities which may impact threatened or endangered species, review of U.S. Army Corps of Engineers permits for potential effects on fish and wildlife, and management of all federally-owned public lands. Within the department, the U.S. Geological Survey conducts investigations concerning hydrology, hydrogeology, water use, and ground and surface water quality. The U.S. Fish and Wildlife Service manages and restores fish and wildlife populations and conducts research on the effects of pollution on those resources. The National Park Service maintains federal parks and sanctuaries, regulating multiple uses on these lands to achieve a balance of benefits for both man and wildlife. The department also oversees those requests and offshore activities associated with exploration and development on the outer continental shelf.

STATE AGENCIES (after Barile et al. 1987)

Many state agencies are involved in environmental regulation and resource management in the Tampa Bay watershed and estuary. The Florida Department of Environmental Regulation (FDER) and the Florida Department of Natural Resources (FDNR), have merged into the Florida Department of Environmental Protection (FDEP) are leading agencies in the protection and management of Tampa Bay. Other relevant entities include the Florida Department of Community Affairs, the Florida Game and Freshwater Fish Commission, the Marine Fisheries Commission, Florida Department of Agriculture and Consumer Services, Florida Department of Health and Rehabilitative Services, Florida Sea Grant Program, and the Florida Department of Transportation.

Department of Agriculture and Consumer Services (DACS)

The Department, through its Division of Agriculture and Environmental Services (AES) regulates the registration and use of pesticides, including the purchase of restricted

pesticides, maintains registration and quality control of fertilizers, regulates pest control operations, mosquito control, and evaluates and manages environmental impacts associated with agrichemicals.

Through the Division of Forestry, the DACS is responsible for developing Best Management Practices (BMPs) to control forestry-related nonpoint source pollution. The Division of Forestry is also responsible or statewide implementation of BMPs, and for monitoring public and private forestry operations to determine BMP compliance and effectiveness. Florida's 34 State Forests and several other parcels of public land and managed by the Division of Forestry.

The Division of Plant Industry is responsible for, among other duties, regulating the movement of noxious weeds, and, with input from the Endangered Plant Advisory Council, protecting endangered, threatened or commercially exploited plant species.

The Office of Water Policy Coordination is responsible for participating in water policy issues to ensure the availability of an adequate supply and quality of water for the production of food and fiber. The office cooperates with agencies and agricultural producers to make available streamlined agricultural regulatory processes and voluntary, incentive-based, acceptable alternatives and agricultural BMPs consistent with the sustainability of agriculture and resource conservation. The office provides assistance to Soil and Water Conservation Districts, including the Tampa and the Manatee River Districts, in carrying out conservation activities at the local and watershed level, and providing improved local delivery of resource management services to agricultural producers. The office facilitates the participation of Soil and Water Conservation Districts in water-related issues at the county or watershed level.

Department of Community Affairs

This department is responsible for reviewing local comprehensive plans and has jurisdiction over developments of regional impact (DRI's). DRI investigations are concerned with proposed developments which have the potential to affect the health, safety, or welfare of citizens of more than one county.

The Comprehensive Plans of both Sarasota and Manatee counties have been reviewed by the DCA. All have come into compliance with the Local Comprehensive Planning Act, either through a final review action, a stipulation agreement, or a settlement agreement.

Department of Environmental Protection

The Florida Department of Environmental Protection, itself a result of the merger of the old Department of Environmental Regulation and the Department of Natural Resources, is the lead state agency involved in water quality, pollution control, and resource recovery programs. The department sets state water quality standards and has permit jurisdiction

over point and nonpoint source discharges, certain dredge and fills activities, drinking water systems, power plant siting, and many construction activities conducted within waters of the state. The department also interacts closely with other federal and state agencies on water-related matters, and the Department and the District share responsibilities in non-point source management and wetland permitting.

The department is the primary reviewer of SWIM plans and is responsible for the disbursement of monies from the SWIM Trust Fund to the water management districts.

The Department is also highly involved in the management of estuarine resources, primarily through the divisions of Law Enforcement, Marine Resources, Resource Management, and State Lands.

The Department, through its Division of Law Enforcement's Marine Patrol, serves as an enforcement agency for the Florida Endangered and Threatened Species Act and the Oil Spill Prevention and Pollution Control Act. The Florida Marine Patrol also enforces state motorboat laws and the saltwater fisheries regulations of the Marine Fisheries Commission.

The Division of Marine Resources includes the Florida Marine Research Institute (FMRI) and the Bureau of Marine Resource Regulation and Development's Shellfish Environmental Assessment Section (SEAS). The FMRI conducts studies throughout Tampa Bay with respect to habitat quality (e.g., marsh and seagrass habitats), habitat utilization and value with respect to important fisheries, and fish population dynamics and stock assessment. However, at present, the Juvenile Fish Monitoring Program does not include sample sites in Tampa Bay. The SEAS classifies and determines the opening and closure of shellfish harvesting areas.

The Division of State lands oversees the management of state lands, including state parks.

The Department's Bureau of Geology reviews leasing requests involving nearshore and state waters. The Bureau of Beaches and Shores oversees beach renourishment activities.

Florida Game and Freshwater Fish Commission

It is the mission of the Florida Game and Freshwater Fish Commission to manage fresh water aquatic life andwild animal life and their habitats to perpetuate a diversity of species with densities and distributions that provide sustained ecological, recreational, sceintific, educational, aesthetic and economic benefits. Its efforts within the SWIM plan area primarily involve freshwater sport and commercial fishing, fisheries and habitat management, fish stocking, fisheries research, wildlife monitoring, enforcement of fisheries/wildlife regulations, listed species protection, wildlife research, development review, and regional planning.

The Commission is directed to review SWIM plans to determine if the plan has adverse effects on wild animal life and fresh water aquatic life and their habitats.

Marine Fisheries Commission

The Marine Fisheries Commission manages marine fish species (excluding endangered or threatened species) by regulating their harvesting. The Commission's jurisdiction covers the following areas: a) gear specifications, b) prohibited gear, c) bag limits, d) size limits, e) species that may not be sold, f) protected species, g) closed areas, h) quality control codes, I) harvesting seasons, j) special considerations related to egg-bearing females, and k) oyster and clam relaying. The MFC is required to make annual recommendations to the Governor and Cabinet regarding marine fisheries research priorities.

Department of Health and Rehabilitative Services

The Department of Health and Rehabilitative Services is responsible for the permitting of septic systems and other on-site disposal systems (OSDS's) through its county health departments. It also coordinates mosquito control programs.

Department of Transportation

The Department of Transportation's Project Development and Environmental Offices in Bartow assist in the design, review, and permitting of road and right-of-way projects in the Tampa Bay region, and would play an important role in the enhancement of circulation in northeaster Palma Sola Bay during the reconstruction of the Palma Sola Causeway.

Florida Sea Grant Program

The Florida Sea Grant Program is supported by awards from the Office of Sea Grant (National Oceanic and Atmospheric Administration) under provisions of the National Sea Grant College and Programs Act of 1966. The Florida Sea Grant Program has three major components: applied marine research, education, and advisory services (through local marine extension agents).

Florida Sea Grant provides scientific research and habitat-related information that are useful in the management of Tampa Bay's natural resources.

SUB-STATE AGENCIES

Two sub-state agencies exist that would be involved in the implementation of the SWIM plan. These are the Tampa Bay Regional Council and the Southwest Florida Water Management District.

The Tampa Bay Regional Council is the Regional Planning Agency designated in Section

186.505 of the Florida Statutes. It performs the responsibilities described in that section and the Regional Planning Agency roles assigned in Section 380.05, F.S. (Resource Planning Committees, DRI reviews and Ch. 163, Local Plan Reviews). The Agency on Bay Management (ABM), which was formed following the completion of the Tampa Bay Management Study Commission to serve as an advisor to the Tampa Bay Regional Council on Tampa Bay management issues and to oversee the implementation of the final study commission report, The Future of Tampa Bay. The 60+ member coalition – which includes elected officials, regulators, local governments, and representatives of special interest groups – has been successful in focusing public attention on bay problems and in bringing together diverse and often conflicting bay users. In 1987, the Legislature created the SWIM Program and at the urging of the ABM, Tampa Bay was named as a priority waterbody. The Southwest Florida Water Management District has utilized the ABM as an advisory body while preparing the SWIM management plans. The ABM was also the driving force behind the nomination of Tampa Bay to the EPA to be included in the National Estuary Program.

The Southwest Florida Water Management District is responsible for performing duties assigned under Ch. 373, F.S., as well as duties delegated through DEP for Chs. 253 and 403, F.S., and for local plan review (Ch. 163, F.S.). It performs those duties for the Entire Tampa Bay watershed.

LOCAL GOVERNMENTS

The Policy Committee of the Tampa Bay National Estuary Program was comprised of six local governments; the City of Tampa, City of St. Petersburg, City of Clearwater, Manatee County, Hillsborough County; and Pinellas County. There are, however, seventeen local governments within the Tampa Bay watershed which play a role in management of Tampa Bay through the daily management of their communities, the planning, zoning and other land use decisions, and the implementation and enforcement of local codes.

Appendix D

Advertisement in the Florida Administrative Weekly