

LITTLE MANATEE RIVER WATERSHED MANAGEMENT PLAN EXECUTIVE SUMMARY

INTRODUCTION

The Local Government Comprehensive Planning and Land Development Regulation Act (LGCPLDRA), passed by the Florida Legislature in 1985, strengthens the role of local governments in developing and implementing a comprehensive plan to guide future growth and development. Florida Statute Section 163.3177 6(c) requires local governments to prepare an Element dealing specifically with the stormwater management system. Rule 9J-5.011, Florida Administrative Code (FAC), establishes the minimum criteria for preparing the Stormwater Management Element.

These laws and rules also require that local governmental bodies formally adopt the specific levels of service that are to be provided by certain public facilities located within their jurisdictions. Stormwater management facilities are included within this group of public facilities. Historically, the existing and ultimate practical and achievable level of service for stormwater facilities has been identified in Stormwater Management Master Plans.

The Hillsborough County Board of County Commissioners (HCBOCC) allocated funding to complete such detailed studies for all watersheds in unincorporated Hillsborough County. In May 1999, PBS&J contracted with the HCBOCC to develop the Little Manatee River Watershed Management Plan (LMRWMP). This plan addresses the level of service requirements contained in the Comprehensive Plan Stormwater Management Element as well as water quality, groundwater, and habitat issues in the watershed.

Project Location And General Description

As shown in **Figure ES-1**, the Little Manatee River (LMR) watershed lies primarily in southern Hillsborough County and northern Manatee County, Florida. The headwaters for the river lie in western Polk and Hardee Counties. The LMR watershed is bordered by the Alafia River and Bullfrog Creek watersheds on the north, the Manatee River watershed on the South, the Peace River watershed on the east and Tampa Bay on the west. The watershed includes the communities of Ruskin, Wimauma and Ft. Lonesome and major developments of Sun City Center and Sundance.

In general, the main channel of the river flows from east to west for approximately 40 miles and finally discharges into Tampa Bay, providing surface drainage for approximately 243 square miles (**Figure ES-2**). Approximately two-thirds of the total watershed area falls within Hillsborough County. It contains several major named tributaries, including South Fork and Curiosity Creek contained mostly in Manatee County, and Marsh Branch/Ruskin Inlet, Sun City Slough, Wildcat Creek, Cypress Creek, Dug Creek, Carlton Branch, Lake Wimauma Drain, Gully Branch, Pierce

Branch, Alderman Creek, and Howard Prairie Branch contained in Hillsborough County. Although the main focus of the study is on the river's watershed, Cockroach Bay was also included in the plan because of its ecological significance and proximity to the LMR watershed. The major focus of the Plan is the area within Hillsborough County. However, as the areas within the other jurisdictions impact the watershed conditions within Hillsborough County, they were also included in the study with a lower level of detail.

The LMR watershed contains only two natural lakes, Carlton Lake and Lake Wimauma, and a 4,000-acre cooling water reservoir located south of the river where it dips into Manatee County. Water from the reservoir is withdrawn from the Little Manatee River and is used to cool the existing Florida Power and Light (FP&L) electric generating facility. A period of outflows from this facility was analyzed as part of this project and it was concluded that such flows are not significant in terms of flood protection or water quality impacts to the LMR watershed.

Land use in the LMR watershed is dominated by agriculture, which encompasses about 49 percent of the total watershed area. The primary agricultural uses include pastureland and citrus and row crops, predominantly tomatoes. Much of the citrus is in the bedded form, grown on spodic soils that require extensive drainage and irrigation networks. Natural lands encompass about 18 percent of the basin area. Wide floodplain forests are located along most tributaries except in the river's headwaters, where steep banks reduce the wetland zone and xeric pineland forests border the streams. Extensive tidal marshes transition into mangrove forests in the lower tidal segments of the river. Urban areas are limited to the middle and lower reaches (i.e., Wimauma, Sun City, Sun City Center, Ruskin) and encompass only about 13 percent of the basin area. Areas in Ruskin and Cypress Creek have historically experienced urban flooding. Mining and associated barren lands represent about six percent of the basin area. However, the Four Corners Mine in the extreme eastern end of the basin is undergoing a significant expansion.

Because of its relatively undisturbed setting, the LMR displays what might be considered natural background water quality for tributaries in the eastern Tampa Bay watershed. These conditions may be used as basis for comparison with those occurring at nearby watersheds impacted by phosphate mining and intense agricultural activities. Despite the generally good water quality conditions, localized problems have been observed including high coliform counts and moderate to high nutrient levels. However, low fecal coliform to fecal strep ratios (FC/FS) indicate non-human contamination with the sources possibly being cattle feedlots and fish ponds.

Project Objectives

The overall project goal of this study was to develop a Comprehensive Watershed Management Plan to characterize existing hydrologic, hydraulic, water quality and habitat conditions in the watershed; identify and assess existing and potential problems areas; and formulate solution and/or prevention scenarios to improve or maintain future watershed conditions. Alternative solution scenarios to improve areas not currently meeting the County's level of service criteria were formulated and evaluated.

A number of other natural resource management programs that affect the LMR watershed that are

either being developed or implemented in the local area include:

- Tampa Bay National Estuary Program (TBNEP) Comprehensive Conservation and Management Plan (CCMP). This plan was approved by US EPA, the Governor, and the TBNEP Management Conference in early 1997 and is in its early implementation phase.
- Southwest Florida Water Management District (SWFWMD) Surface Water Improvement and Management (SWIM) Plan for Tampa Bay (1992). This plan for Tampa Bay addresses general issues associated with water quality, natural systems, land use, and watershed management.
- SWFWMD Comprehensive Watershed Management (CWM) Program for the Little Manatee River. This management initiative takes a resource-based approach to identifying, prioritizing, and addressing existing and potential issues related to water quality, flooding, water supply and natural systems within the SWFWMD area. The LMR CWM team recently completed an update to the plan.
- Hillsborough County LMR Land/Water Linkage. The purpose of this initiative by the Planning Department is to integrate land and water planning to achieve sound resource management and protection.

One of the strategies of the LMRWMP was to bring together the goals, objectives, management actions and funding resources of the various existing resource management plans into a unified framework. This framework addresses in a comprehensive manner issues that affect the LMR watershed. It was also intended that this plan be consistent, to the greatest extent feasible, with those other plans.

Project Scope

The project scope has two major components: a) characterization of existing conditions of the watershed, and b) identification of improvements necessary to address level of service deficiencies. The comprehensive LMRWMP addresses analysis of the following major elements:

- Flood Protection
- Water Quality
- Water Supply
- Natural Systems

EXISTING CONDITIONS FLOOD PROTECTION ANALYSIS

Perhaps the most important aspect of the LMRWMP is the proper representation of the hydrologic and hydraulic processes throughout the watershed that define flooding conditions. A good understanding of these watershed processes is necessary to determine the most effective means of controlling flooding and protecting public safety and environmental resources.

Watershed Hydrologic and Hydraulic Model Development

The Hillsborough County modified version of the EPA Storm Water Management Model (HC SWMM) version 4.31C was used for analysis of the hydrologic and hydraulic conditions of the LMR watershed. The hydrologic model contained in the HC SWMM makes use of the US Soil Conservation Service (SCS) Runoff Curve Number (CN) method. Expected stormwater runoff estimates are developed on the basis of soil and land cover characteristics. Discharges are routed through the system using a modified version of the SWMM EXTRAN block. The modified EXTRAN block contained in the HC SWMM model was used to route flows from the hydrologic model and compute water surface elevations at nodes and discharges at links throughout the hydraulic network. To provide the level of detail that was deemed necessary to accurately define and properly analyze the primary drainage facilities within the LMR watershed, it was divided into a total of 716 discrete subbasins. The LMR watershed hydraulic model comprises a total of 1,359 junctions and 2,530 linkages in its structure, representing the hydraulic features of 1,569 closed conduits and open channels.

Data for development of the hydrologic and hydraulic model were derived from several sources including previous studies, existing surveys, development plans and additional field survey conducted as part of this project. A GIS database was also used as a tool to store and retrieve all watershed information gathered and generated over the course of the watershed study.

Model calibration and verification of the LMR watershed hydrologic and hydraulic model was an important step that was undertaken for the purpose of ensuring that the developed models reflected observed conditions in the watershed. The calibrated model can then be used to predict system performance for future events and to evaluate alternative projects for the watershed.

The calibration process encompassed simulating a measured event by adjusting the hydrologic input parameters according to the measured rainfall depth and distribution so that computed and measured values closely match. A model is considered well calibrated when model results of stage, flow, and volume are in reasonable agreement with the recorded data at the gage stations. Once this agreement is achieved, the model can then be verified by comparing model results of a different storm event to the respective set of observed stage, discharge, and volume values without making adjustments to the hydraulic model (except for initial conditions). Model verification is an important step which ensures that adjustments made to the model during calibration are appropriate and to ensure that the model will produce reliable results. The hydrologic/hydraulic model was calibrated and verified to three separate historical storm events including the September 1988, September 1997 and October 1999 floods. In general, the simulated and observed stage and discharge values evaluated for the calibration and verification events produce a good match (**Figure ES-3**). The results of this analysis

showed that the computer model was capable of producing reliable results.

Flooding Level of Service Deficiencies and Problem Identification

Upon completion of the development of the hydrologic/hydraulic model of the LMR watershed primary drainage systems, the next step of the flooding conditions analysis was to apply the model to assess the performance of the watershed drainage facilities for a given set of design storm events. Flood profiles were developed for the LMR main channel and the main channels of select tributaries within each major system. Computed peak stages for the design events were also used to determine the flood protection level of service (FPLOS) in the watershed. Results of these simulations were then compared to Hillsborough County's adopted FPLOS criteria to identify locations within the watershed where the FPLOS criteria are not being met. These results were also compared to reported problem areas within the watershed. The Hillsborough County Comprehensive Plan, Stormwater Management Element contains definitions for flood protection level of service designations. According to these definitions, the FPLOS is determined by defining the storm return period and duration (i.e. 25-year/24-hour) that a particular facility can accommodate without causing flood waters to rise above an acceptable level. The flood level designations contained in the Comprehensive Plan are A, B, C and D, A being the highest level of protection and D being the lowest. The language describing the flood level designations is somewhat subjective. Therefore, it was necessary to establish quantitative criteria by which to assign FPLOS designations. The target Ultimate FPLOS, as defined by the Comprehensive Plan is a 25-year/24-hour level B for all major conveyance systems in Hillsborough County.

In order to maintain consistency with previous watershed management plans, the County recommended using the same flood level designation interpretations. The following table contains the interpretation of the Comprehensive Plan definitions used in to determine the FPLOS throughout the watershed.

Level	HC Comprehensive Plan Definitions	Master Plan Interpretations
A	No significant street flooding	Street flooding is less than 3"
B	No major residential yard flooding	Street flooding is more than 3", but less than 6"
C	No significant structure flooding	Street flooding is more than 6"
D	No limitation on flooding	Street flooding is 6" or more and structure flooding occurs
D*	No limitation on flooding	Structure flooding occurs where structure lower than street elevation
O	No limitation on flooding	No structure flooding and no public street flooding occurs

Inherent in the FPLOS designations contained in the Comprehensive Plan is the assumption that sites are higher than roads and structures are higher than sites. However, there are many locations

throughout the County where this is not the case. Therefore, the FPLOS analysis methodology used in the LMR watershed evaluates road and structure landmark elevations independently.

Critical landmark elevations were selected to be reflective of the worst case flooding that is expected to occur in a subbasin. These were obtained from field survey data, drainage maps, topographic maps and other topographic data sources. Every subbasin in the watershed was examined for the critical (lowest) structure, site and road elevation.

The identification of existing conditions within the watershed included a review of drainage complaints on file with Hillsborough County. The purpose of this review was to document past and current problems within the watershed as they related to flooding, water quality and maintenance concerns. The review also served to verify potential flood prone areas predicted by the Hillsborough County Modified EXTRAN model developed for the LMR watershed. Attempts were made during the review to document all complaints within the LMR watershed, although not all records contained complete information on the nature, depth or duration of flooding.

The reported and model predicted LOS problem areas were investigated where there was sufficient information provided and alternative measures were analyzed. Areas that showed opportunities for developing improvement projects were referred to as “project areas”. **Table ES-1** lists the eight project areas identified in this study and their location in the watershed. Alternatives analysis was focused on each of the project areas.

Table ES-1. Location of Project Areas		
Project Area	Location	Major Basin
1	Gulf City Road	Lower LMR
2	Marsh Branch north tributary	Lower LMR
3	Marsh Branch, Shell Point Road	Lower LMR
4	Curiosity Creek, Sundance Subdivision	Curiosity Creek
5	Wildcat Creek, Sun City Slough	Lower LMR
6	Sun City Center, Kings Point Subdivision	Lower Middle LMR
7	Dug Creek area	Lower Middle LMR
8	Carlton Branch	Upper Middle LMR

EXISTING CONDITIONS WATER QUALITY ANALYSIS

The Little Manatee River, along with the Alafia River, receives the greatest surface runoff volume in west central Florida. Water quality is generally good in the LMR Watershed, although streamflow and water quality data indicate agricultural runoff, originally pumped from the deep aquifer, contributes to dry season flows and pollutant loadings. The Little Manatee River has historically good water quality and, of the rivers flowing to Tampa Bay, it is in the best hydrobiological condition (Estevez *et al.* 1991). Both Cockroach Bay and a large portion of the Little Manatee River

have been designated Outstanding Florida Waterbodies by the State of Florida. As such, these waterbodies are afforded the highest level of water quality protection. FDEP has reported water quality in the Little Manatee as *good* (Paulic and Hand 1998) and EPA reported Index of Watershed Indicators for the Little Manatee River as “better quality” and “low vulnerability” (EPA 1999). In addition, 87 miles of the river meet designated uses and the river is not targeted for the upcoming total maximum daily loads (TMDL) program by FDEP (Paulic and Hand 1998).

The Florida Water Quality Assessment 305(b) Report is published every two years by FDEP (Hand *et al.* 1996) and contains water quality data for Florida streams in terms of the WQI. The 1996 305(b) Report classifies segments of the LMR as shown in **Table ES-2**.

Table ES-2. Surface water designations for portions of the Little Manatee River reported by Hand <i>et al.</i> (1996). Major subbasin designations in which the FDEP subbasins occur are listed in parentheses.	
FDEP Subbasin	FDEP designation
Lower LMR (Lower Middle LMR)	<i>Good</i> (basins south of the river) <i>Fair</i> (most of basin north of river)
LMR near Wimauma (Upper Middle LMR)	<i>Good</i> (Dug Creek) <i>Fair</i> (remainder of subbasin)
LMR North Fork (Upper LMR)	<i>Good</i> (entire reach)
LMR Ft. Lonesome (IMC mine)	<i>Good</i> (main stem) <i>Fair</i> (mined area of Alderman Creek)
LMR South Fork (LMR South Fork)	<i>Fair</i> (main stem) <i>Good</i> (all tributaries)
Cypress Creek LMR (Upper Middle LMR)	<i>Good</i>
Dug Creek (Upper Middle LMR)	<i>Good</i>
Carlton Branch (Upper Middle LMR)	<i>Good</i>

Water quality in the Little Manatee River is considered to range from *good* to *fair*. *Good* water quality is reported for the entire watershed except for the basins adjacent to the main stem and North Fork (Hand *et al.* 1996). There are no severe water quality problems reported, but elevated nutrient and bacteria levels are attributed to agricultural (pesticide and nutrients) and range land (bacteria and nutrients) in the upstream reaches, and on agriculture, septic tanks, package WWTPs, and fish farms in the downstream reaches. Encroaching residential development, agricultural irrigation, and phosphate mining activities are cited as potential threats to water quality in the Little Manatee River in the future.

Sediment quality is also a concern in the LMR Watershed, according to the 1996 305(b) Report (Paulic and Hand 1994). The 1994 305(b) report lists polycyclic aromatic hydrocarbons (PAH), polychlorinated biphenyl (PCB), and pesticides as contaminants of concern for Cockroach Bay, based on data obtained from the Florida Coastal Sediment Contaminants Atlas (Seal *et al.* 1994). It should be noted that the contaminants referenced as of concern for oyster tissue and sediment contamination are mostly chemicals that are no longer in use in the United States. Lead has been phased out as a gasoline additive, and PCBs and most persistent pesticides are not in common use.

Thus it is likely that levels of these chemicals observed now are residuals from past applications.

Water quality issues and areas of concern in the Little Manatee River watershed include:

- groundwater pumping for agricultural applications and commensurate impacts to groundwater levels as well as stormwater runoff, and saltwater intrusion;
- future expansion of phosphate mining industry into the central portion of the watershed along the Little Manatee River and associated impacts to surface water runoff; and
- increased urbanization and associated increases in impervious surfaces and commensurate increases in stormwater runoff.

An approach that has been used by federal and state regulatory agencies to quantify the amount of pollutants discharged into a waterbody is to estimate the average annual and seasonal pollutant loads. Pollution loads in the LMR watershed were estimated using the Pollutant Loading and Removal Model previously developed by the Hillsborough County Public Works/Stormwater Management Environmental Team (1999). As indicated previously, other sources of pollution in the watershed include nonpoint and point sources, septic tanks, atmospheric deposition, and septic sludge and wastewater residuals. Nonpoint source pollution is addressed here as nutrients and contaminants entering a receiving waterbody through stormwater runoff. Nonpoint source loadings originate from both urban and agricultural land use activities. Nonpoint source pollutants may include those applied in the watershed (fertilizer, pesticides), by-products of urban or agricultural activities (automobile fluids, animal waste, lawn clippings and other organic detritus, etc.), or atmospheric deposition.

The model uses land use, rainfall, soils and pollutant event mean concentrations (EMC) data to estimate pollutant loads and levels of treatment by subbasins in the watershed. GIS coverages of land use and hydrologic soil characteristics were intersected with subbasin delineations to provide runoff characteristics.

The model calculates loads for a total of 12 different parameters (pollutants) including:

- | | |
|---------------------------------------------------------|------------------------------|
| • 5-Day Biological Oxygen Demand (BOD ₅) | • Total Dissolved Phosphorus |
| • Total Suspended Solids (TSS) | • Oil and Grease |
| • Total Kjeldahl Nitrogen (TKN) | • Cadmium |
| • Nitrate + Nitrite (NO ₃ +NO ₂) | • Copper (Cd) |
| • Total Nitrogen | • Zinc (Zn) |
| • Total Phosphorus | • Lead (Pb) |

The 1995 Florida Land Use, Cover and Forms Classification System (FLUCFCS) (FDOT 1995) coverages provided by the SWFWMD were used to identify and quantify land uses in each subbasin. For pollutant loading estimates, land use classes were aggregated to correspond with Hillsborough County's current NPDES permit.

Based on the results of the pollutant loading and removal model, a water quality treatment level of service (LOS) was established for each subbasin within the LMR watershed. The results of this analysis can be used to assign priorities at a subbasin level for the implementation of water quality improvement alternatives in the watershed. Water quality treatment LOS was applied to this watershed study to provide comparisons of existing and proposed stormwater treatment conditions to pollutant loading goals.

The water quality modeling effort in this study focused only on land use as a basis for evaluating pollutant loads. For comparison purposes, pollutant loads based on stormwater runoff from single family (low to medium density) residential land use were selected as the standard for comparison. In this manner, the calculation of pollutant loads is similar with the concept of standard residential unit (SRU) sometimes used for stormwater utility assessments.

Based on the following ranges, water quality LOS criteria were defined as a score from A through F:

- **LOS A**, net load equivalent to 20 percent or less of untreated single family residential. A LOS equal to A for a subbasin would indicate the presence of a high percentage of undisturbed natural systems, or high percentages of developed areas treated with BMPs capable of removing pollution levels to those representing natural systems. Areas where typical land uses (residential) exhibit stormwater treatment levels above the minimum required per 62-40.432(5) F.A.C. (Water Policy) would also receive LOS A.
- **LOS B**, net load equivalent to between 20 and 40 percent of untreated single family residential areas. A LOS equal to B would indicate the presence of BMPs with removal efficiencies consistent with those representing adequately designed and maintained conditions and a relatively even mix of developed and natural land uses.
- **LOS C**, net load equivalent to between 40 and 70 percent of untreated single family residential areas. A LOS equal to C would indicate the presence of treatment systems showing removal efficiencies consistent with those representing average to poorly maintained conditions and a greater percentage of developed versus natural land uses.
- **LOS D**, net load equivalent to between 70 and 100 percent of untreated single family residential areas. A LOS equal to D would indicate minimal treatment of sub-basin discharges and a relatively high percentage of developed land uses.
- **LOS F**, net load equal to or greater than 100 percent of untreated single family residential areas. A LOS equal to F would indicate no treatment for sub-basin discharges, or the presence of extensive areas of land uses producing larger pollution loads per unit area than typical residential land uses.

The water quality LOS designations based on a comparison of existing land use conditions (net loads) to the low/medium density residential benchmark are listed in Appendix E of the final report. Overall LOS for the major subbasins in the LMR watershed is mapped in **Figure ES-4**. The most

frequent LOS score was F for all parameters combined which indicates that pollutant loads from existing conditions were equal to or higher than that of untreated residential land use. These results reflect the dominant agriculture land use throughout the watershed.

In addition, there is a conspicuous absence of treatment throughout the urban areas in the watershed, with the exception of Sun City and some of the newer developments. Interestingly, the northeastern portion of the watershed, where water quality in the Little Manatee River is considered good and indicative of less intense land use and more natural conditions, the treatment level of service remains low.

Of the eight major subbasins, six received “F” LOS ranks for eight of the 12 parameters examined. The IMC mining subbasin and Cockroach Bay were the only major subbasins to receive any “A” scores. Cockroach Bay ranked “A” for only oil and grease, while the mining subbasin scored “A” for TSS, oil and grease, as well as copper, lead and zinc.

Although there are few lakes in the LMR watershed, Lakes Wimauma and Carlton occur in closed subbasins and, based on the model, these areas are assumed to receive relatively high pollutant loads with little to no treatment and no flushing. As a result, continued loading to these surface waters could result in significant water quality degradation in the future if remediation measures are not implemented.

Importantly, the IMC mine and Cockroach Bay exhibited the best LOS rankings in the watershed and these results are somewhat consistent with previous studies in which water quality in the Ft. Lonesome area is considered good and water quality in Cockroach Bay is improving.

EXISTING CONDITIONS NATURAL SYSTEMS ANALYSIS

Although the LMR watershed has relatively little urbanization in comparison with other watersheds draining to Tampa Bay, agriculture and phosphate mining are conspicuous throughout the watershed. The downstream reaches of the Little Manatee River and Cockroach Bay are surrounded by predominantly row crops and residential with scattered commercial and industrial land uses. Farther upstream urban development includes high density residential associated with the community of Sun City, and Lake Wimauma. The distribution of row crops is extensive in the major basins. The upper reaches of the Little Manatee River include primarily agricultural and crop lands, whereas phosphate mining dominates the far eastern portion of the watershed.

As a result of the relatively undeveloped conditions in the watershed, natural systems are more extensive when compared with other watersheds in the Tampa Bay region and make up approximately 33 percent of the existing land cover in the LMR watershed. Combined upland communities, including pine flatwoods, scrubby flatwoods, and scrub, make up nearly twenty percent of the watershed (Flannery *et al.* 1991). The largest natural vegetation category, however, is wetlands forest (12.6 percent), which is associated primarily with stream and river channels. Herbaceous wetlands are scattered throughout the basin, and in combination with estuarine wetlands, comprise less than five percent of the watershed. Because of the importance of natural communities in providing habitat for fish and wildlife, this chapter provides descriptions of the natural systems that characterize the watershed, the associated species of interest, and habitat issues of concern in the watershed.

A map of habitat, based on GAP coverages (Cox *et al.* 1994) is provided in **Figure ES-5**. In it, natural habitats are mapped for the watershed, based on vegetation type rather than land use. As a result, the numbers of habitats identified are much more numerous when compared with land use and land cover and illustrate the diversity of habitat in the LMR watershed.

Many habitats in the watershed have been or will be disturbed due to mining, urban development, and exotic species expansion. These components were integrated and used to develop a map of habitat that can be considered stressed and/or sensitive, based on surrounding conditions (**Figure ES-6**).

Natural Systems Issues/Areas of Concern

Habitat restoration, exotic species, loss of habitat to development and mining, impacts of agricultural and urban runoff, and potential spills due to shipping are areas of concern in the LMR watershed. Acquisition and management of publicly owned lands, including coordinated planning between holdings (i.e. aquatic preserve, Tampa Electric Company (TECO) lands, Environmental Land Acquisition and Protection Program (ELAPP), State Recreation Area) are intended to protect and conserve natural areas in the watershed. These issues are discussed below.

Exotic and Invasive Plants. As a result of disturbance and habitat degradation, wetlands can be invaded by aggressive, highly-tolerant, non-native vegetation, such as purple loosestrife (*Lythrum salicaria*), water hyacinth (*Eichornia crassipes*), and salvinia (*Salvinia molesta*), or can be

dominated by a monoculture of cattails (*Typha spp.*) or common reed (*Phragmites spp.*) (McColligan and Kraus 1988; Weller 1981; Mitsch and Gosselink 1996). Particularly in constructed wetlands, including restored wetlands, non-native and tolerant native species may outcompete other species leading to a reduction in species diversity.

The proliferation of exotic or nuisance plant species within the watershed is a continuing problem. The most common exotic species include Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina equisetifolia*), melaleuca (*Malaleuca quinenervia*), and cogon grass (*Imperata cylindrica*). Other species are also present although their infestation is less extensive. These include air potato (*Dioscorea bulbifera*), skunk vine (*Paederia foetida*), and cattails (*Typha spp.*). All of these plants have been identified as nuisance species by the Florida Exotic Pest Plant Council (FEPPC). These plants displace native species and tend to dominate natural ecosystems by becoming mono-cultures.

Management of Publicly Owned Lands. Watershed management actions should support the management objectives of the publicly owned conservation lands within the watershed. These lands include the Little Manatee River State Recreation Area, Hillsborough County ELAPP land holdings, Cockroach Bay Aquatic Preserve, and the TECO Port Manatee Planning Area. In addition, coordination of planning objectives and actions between the conservation management groups charged with the management of these lands would benefit the watershed.

Mitigation of Potential Impact from Shipping Spills in Tampa Bay. Due to its location, the Little Manatee River and Cockroach Bay are particularly susceptible to damage caused by large marine fuel spills. Tampa Bay is home to five major seaports, a growing cruise ship industry and numerous power plants. Businesses depend on shipping to deliver fuels and chemicals. More than 4,000 ships enter Tampa Bay every year, transporting petroleum products and chemicals needed by area businesses. The mouth of the Little Manatee River is approximately 2,300 yards east of the main shipping channel, and is situated between Port Manatee and Big Bend port terminals. The Cockroach Bay area and the tidal portions of Little Manatee River are therefore vulnerable to spills from both ports and spills originating within shipping lanes.

Impacts of Agriculture in the Watershed. Agriculture encompasses nearly 50 percent of the land use in the LMR watershed and is associated with water quality problems due to excessive pumping and runoff. Historically, agriculture has been the major factor in freshwater and estuarine wetland loss and degradation. Agricultural activities can alter wetlands hydrology, water quality, and species composition. Excessive amounts of fertilizers and animal waste reaching wetlands in runoff from agricultural operations, including confined animal facilities, can cause eutrophication.

Impacts of Phosphate Mining in the Eastern Portion of the Watershed. Florida phosphate mining dates back to the first hardrock deposits found near Hawthorne in Alachua County in 1883. Phosphate mining involves stripping off the top layer of earth and piling it in rows to get to the layers of phosphate below. Following mining activities, reclamation occurs.

Phosphate mining has resulted in the loss of thousands of acres of wetlands in central Florida (Mitsch and Gosselink 1996) and future land use in the LMR watershed includes approximately one

third phosphate mining, while further expansion is planned in the eastern portion of the watershed. Acid drainage from active and abandoned mines causes extensive ecological damage. Unlike in the Alafia River, there are no gypsum stacks or phosphate processing activities in the LMR watershed, although there are clay settling ponds.

Phosphate mining displaces habitat and reclamation efforts occur over many years and may affect wetlands directly through the mining of the wetlands themselves. If wetlands are lost due to mining activities, the beneficial characteristics of wetlands are lost as well. This could potentially affect water quality and sediment deposition in addition to destruction of wetland habitat. Wetlands are home to wading birds, fish, amphibians, and other animals. Loss of wetland habitat means loss of the plants and animals living there, which may also affect other animals down the food chain.

Seagrass Restoration Efforts. Submerged and emergent aquatic vegetation communities have experienced a historical decline in acreage within the larger Tampa Bay area (Janicki *et al.* 1995; Lewis and Coastal 1995). Within Middle Tampa Bay, 4,100 acres of seagrasses have been targeted for restoration (Janicki *et al.* 1995); however, in most cases, restoration cannot occur without water quality improvements that result in increased light penetration.

EXISTING CONDITIONS WATER SUPPLY ANALYSIS

Water supply issues in the LMR watershed include groundwater use, surface water use, development of alternative water supplies, and establishment of minimum flows and levels. The south and central regions of Hillsborough County, including the LMR watershed, are served primarily by a well field in the Lithia area and the current most important water supply issue is the decline of water levels in the aquifers. This, in turn, can reduce the potential availability of water for public, agricultural, and industrial use and can result in significant environmental impacts. Alternative water supply sources are being developed in the Tampa Bay region as part of an approach to reduce/supplement existing groundwater supplies and alleviate pressure on the aquifers.

Water projects currently being developed in the Tampa Bay region to address future water supply include diverting flows from the Alafia and Hillsborough rivers, as well as the Tampa Bypass Canal, coupled with the construction of a reservoir in the Alafia River watershed. In addition, a desalination facility to be located adjacent to the Tampa Electric Company (TECO) Big Bend plant in southern Hillsborough County is currently under study. The Tampa Bay Water Master Water Plan has no water supply facilities planned within the LMR watershed.

Groundwater Use

Agricultural interests are by volume the greatest permitted users of groundwater resources within the LMR watershed. Within the LMR watershed, permitted users account for approximately 102 mgd of groundwater withdrawals primarily from the intermediate aquifer system and upper Floridan aquifer system. The greatest concentration of wells is in the western portion of the watershed, and conversely the greatest quantity of groundwater withdrawals occurs in the central and southeastern portions. Groundwater withdrawals in the southeastern portion of the watershed are primarily used for phosphate mining and associated activities. Groundwater withdrawals throughout the remainder

of the area are principally due to agriculture.

Surface Water

Currently, the use of surface water for water supply is not significant in the LMR. However, as indicated previously, as dictated by state law, alternate water supplies are being explored and developed as demands for fresh water supplies increase in the Tampa Bay area. Some of these supplies may include the use of water from the LMR.

Minimum Flows and Levels

Water Management Districts in Florida have been assigned the task of establishing “minimum flows and levels” (MFLs), which are directed to establish the amount of water that is needed in a lake, river, or aquifer to maintain adequate ecological conditions. In that sense, MFLs could also be defined as flows that can be withdrawn from a waterbody without causing significant harm to its current uses. The establishment of MFLs is an essential planning tool, and it may provide the basis of issuing water use permits and conserving water resources in the region.

Other Water Supply Sources

In addition to the existing groundwater sources and the potential surface water supply projects, the Tampa Bay region is in the process of implementing projects that consider other potential sources of water supply. Some of these supplies include desalinated water (which Hillsborough and Pasco already use), treated wastewater, continued conservation, and/or increased reclaimed water use.

Other water supply options that may be available in the LMR watershed include:

- Aquifer storage and recovery;
- Use of the Florida Power & Light cooling reservoir; or
- Use of abandoned phosphate mined areas.

RECOMMENDED PROJECT IMPLEMENTATION PLAN

Alternatives were developed to accomplish one or more of the goals of relevant state and local programs in terms of water quantity, water quality, habitat protection, and overall natural resource use, with emphasis on complying with the County Comprehensive Plan. In addition, the work effort considered goals delineated by specific programs in the LMR watershed including the SWFWMD SWIM (Surface Water Improvement and Management) Plan for Tampa Bay, the SWFWMD Comprehensive Watershed Management Plan (CWM) for the LMR Watershed, the Tampa Bay Estuary Program Comprehensive Conservation and Management Plan (CCMP); and the Cockroach Bay Aquatic Preserve Management Plan (CBAPMP).

Water Quantity Goals

- Meet to the maximum extent practicable the watershed's levels of service for flood protection.
- Minimize alterations to the peak, volume, and timing of floodwaters as watershed development occurs.
- Minimize alterations to the timing and volume of natural freshwater inflows to Tampa Bay.
- Reduce potential effects of freshwater inflows from urban and agricultural land uses.

Water Quality Goals

- Control nutrient and contaminants loading from urban land uses.
- Assess disruption of natural surface water treatment features (e.g., wetlands).
- Assess potential bacteria contamination impacts from septic tanks.
- Identify opportunities for erosion and sediment control.

Habitat Goals

- Assess habitat destruction, degradation, and fragmentation resulting from urban, mining, and agricultural activities.
- Identify opportunities for habitat restoration and creation.
- Assess exotic and nuisance plant infestations from species such as Brazilian pepper, Australian pine, and Melaleuca, which outcompete native vegetation.

Overall Resource Use Goals

- Assess enforcement of existing environmental and resource protection regulations.
- Assess promotion of educational programs to promote public awareness and participation.
- Assess bacterial contamination to shellfish harvesting and swimming.
- Assess existing and potential future resource use conflicts such as recreational and commercial fishing, use of public lands for preservation or recreation, etc.

- Assess existing and future land use conflicts such as displacement of agriculture by urban land, potential impacts to natural lands from mining, etc.

Projects were identified to improve flood control, water quality, natural systems and, if applicable, water supply conditions in the Little Manatee River (LMR) watershed. The recommended implementation plan considered separately the proposed (a) flood control and water quality projects and (b) natural systems projects. This procedure was selected because flood control and water quality projects involve primarily implementation of structural and non-structural approaches to help meet established objectives measured in terms of levels of service. In contrast, natural systems projects deal primarily with non-structural vegetation/wildlife management issues.

Based on the results of the existing conditions analysis, as well as the community input obtained through the public meetings, various problem areas and/or improvement opportunities were identified in the watershed. Areas that did not meet levels of service requirements for flood protection were identified through a review of historical data and the results of the hydrologic/hydraulic model.

Problem areas associated with pollutant loading were identified through the results of the pollutant loading model and review of engineering plans and aerial photographs of the various drainage basins, particularly within urban areas. The purpose of that review was to determine the presence and corresponding estimated pollution removal efficiency of Best Management Practices (BMPs) in the watershed. Opportunities for improvement of ecological conditions through implementation of natural resources projects were identified based on existing areas of natural habitat (particularly sensitive habitat), public land ownership maps, and other natural resources data.

Various alternatives were identified for each of the project areas. As expected, emphasis was placed in the developed, or under development areas. The alternatives vary in scope from an emphasis on flood protection to considering a combination of actions to include flood control, stormwater runoff treatment, water quality protection, and natural systems conservation and restoration. The projects considered as part of the various alternatives included new structures, retrofit opportunities, and non-structural strategies. Projects included conveyance improvements coupled with treatment/storage facilities such as wet detention, altered wetlands utilization/enhancement, and multipurpose facilities that can serve as park, conservation, and/or recreation areas.

Approaches to project development also considered the use of regional, multipurpose facilities that integrate water quantity and water quality management capabilities. Various non-structural strategies that could be implemented throughout the watershed were also considered, but not included in the alternatives and are addressed in Other Watershed Management Recommendations. Alternatives were selected for each project area and a preferred alternative was selected. Each project area was considered independently. Comparisons and rankings among the selected preferred alternatives were evaluated at a second evaluation stage.

Evaluation and Prioritization of Projects

This first step in the project alternatives evaluation and prioritization process consisted of establishing the evaluation criteria. A total of 10 criteria were identified and used to analyze and

compare proposed alternatives. The criteria included:

1. Flood protection for buildings and other structures
2. Flood protection for road access
3. Water quality and pollution load reduction potential
4. Conservation and restoration of natural systems
5. Water supply benefits
6. Feasibility, flexibility, and consistency with local plans and policies
7. Regulatory considerations and project permitting
8. Capital costs
9. Operation and maintenance issues and costs
10. Community acceptance

In the evaluation process proposed alternatives were scored for each criteria and ranked in an evaluation matrix. Through this process alternatives or a group of projects was selected for the problem areas.

The next step was the prioritization of selected projects that comprised each recommended alternative. Four criteria were identified and used to prioritize and compare the recommended flood control and water quality projects. The criteria used are listed below.

- Consistency with Existing Local, State and Federal Programs Affecting Watershed Management
- Project Costs Versus Benefit Ratio for Flood Control
- Project Cost Versus Benefit Ratio for Water Quality
- Public Acceptance

A total of five criteria were identified and used in a prioritization and ranking of the recommended natural systems projects. The criteria used are listed below.

- Impact on invasive/exotic vegetation
- Impact to protected species
- Public accessibility
- Impact to hydrology
- Connectivity with existing habitat/natural systems

In the prioritization process recommended projects were scored for each criteria and ranked in a matrix table. Through this process projects were prioritized for future implementation.

Summary of Recommended Projects

The recommended projects for the Little Manatee River (LMR) watershed are based upon input received from the third public meeting process and comments from Hillsborough County staff. As discussed, this plan considered separately the recommended (a) flood control and water quality projects and (b) the natural systems projects. The recommended project implementation plan for the

LMR watershed consists of 18 new flood control and water quality projects and 17 new natural systems projects. Each of the recommended projects is discussed in detail in Chapter 13 of the final report. Costs for each recommended project are presented in Appendix 13-A. The development of project implementation prioritization scoring is discussed in Chapter 16. A summary of the recommended flood control and water quality projects is presented in **Table ES-4** located at the end of this chapter. A summary of the recommended natural systems projects is included in **Table ES-5** located at the end of this chapter. In addition, a map depicting locations of the recommended projects is shown in **Figure ES-7**. The estimated total capital cost of implementing the recommended flood control/water quality and natural systems projects in the LMR watershed is \$30,181,000 and \$7,246,000, respectively, for a total estimated capital cost of \$37,427,000.

OTHER WATERSHED MANAGEMENT RECOMMENDATIONS

Investigations presented in prior sections were conducted to determine appropriate improvement measures for flood protection, water quality, natural systems and, if applicable, water supply conditions in the Little Manatee River (LMR) watershed. This section presents other recommendations that were developed to help manage the watershed beyond the implementation of the projects identified in this study to solve site-specific watershed problems.

Recommended Management Strategies

Management strategies and components are recommended for implementation in the LMR watershed. Management components are those strategies that involve non-structural modifications to the function and operation of a facility or resource within the LMR watershed.

Regional Versus Onsite Stormwater Management Systems. Wet detention is the most common stormwater runoff treatment system in Hillsborough County and throughout Florida. In general, there are two basic strategies for development of those stormwater management improvements on a countywide scale: regional and onsite.

A regional approach to stormwater management is preferred because of the following advantages: reduction of capital costs, reduction in total maintenance costs, greater reliability, greater opportunities to control multiple source pollutant loading, and the ability to provide multifunctional facilities. For these reasons, Hillsborough County should work closely with developers to support opportunities for regional stormwater treatment. The County should also continue to work with SWFWMD, FDOT, FDEP, USCOE, HCEPC, Tampa Bay Regional Planning Council and Manatee County through the Comprehensive Watershed Management (CWM) Program for water resource assessment and planning on a regional basis. Development of regional facilities has been recommended in this study to retrofit the areas of Sun City Center and Doug Creek. It is recommended that through the ELAPP program the County consider acquisition of properties along the LMR, outside of the floodplain, to develop as regional facilities. These facilities could then be integrated with the floodplain property to provide larger continuous areas that enhance the natural environment.

Retrofitting of Existing Treatment Facilities. A number of ponds exist in the watershed,

particularly in the Sun City Center area, that were built exclusively for flood control purposes. These facilities were constructed prior to the enactment of the current stormwater regulations. Retrofitting of one of these facilities to include stormwater runoff treatment is one of the recommended projects in this Management Plan. There may be other opportunities in the watershed throughout the secondary system, but their identification requires site-specific studies. It is recommended that the County investigate these opportunities in detail.

Improvement of Treatment Efficiency of Existing Stormwater Facilities. This recommended management action involves the development and implementation of a comprehensive local program to improve compliance monitoring and enforcement of permitted surface water management (MSSW) facilities in the basin. This program would involve the following elements:

1. Develop an inventory of all existing permitted MSSW facilities in the watershed, both public and privately owned, and identify target MSSW facilities for inspection and potential monitoring. Stormwater entering and discharging from the facility following a storm event should be sampled for TSS, BOD5, TN, and TP, and coliforms. The last four chemicals are the currently identified impairment parameters in the watershed.
2. Working cooperatively with the owners (if it is a privately-owned facility), develop a site-specific improvement plan for each target MSSW facility. The improvement plans could include such modifications as changing the water level control elevations or planting a littoral shelf.
3. Provide financial assistance and technical guidance to owners, as appropriate, to implement the facility improvement plans.
4. Although there are not too many existing facilities in the LMR watershed, The County should control stormwater runoff and pollutant loading from county-owned or operated facilities. To do so, government facilities should be inspected specifically for the purpose of identifying areas of stormwater runoff concerns such as exposed materials storage, maintenance improvements, and uncontrolled erosion or sedimentation. Based upon the inspection, the County should prepare plans for each facility to improve stormwater management; these plans are called stormwater pollution prevention plans (SWPPPs). The SWPPPs should document actions needed to reduce stormwater pollution.

Recommended Regulatory Program Improvements

Upon review of the extensive stormwater regulatory requirements applicable within Hillsborough County, there appears to be sufficient regulatory controls to manage stormwater pollution for new development. However, there are some issues related to regulatory programs recommended for improvement including operations and maintenance, enforcement of existing regulations and reduction of imperviousness.

Reduction of Imperviousness. Reducing imperviousness reduces stormwater runoff. The implementation of such source controls can be accomplished through regulatory reduction of imperviousness or through the effective reduction by landscaped swales along roads, driveways and

parking lots. It is recommended that the County offer incentives or otherwise encourage the reduction of imperviousness. It may be that this must be done on a case-by-case basis. For public developments, the County should adopt a policy of imperviousness reduction through design changes offering pervious pavement and more vegetated areas. For private developments, the County should develop standard incentives for impervious area reductions through regulatory changes. It is also recommended that the County strive to minimize the amount of directly connected impervious area (DCIA) on a site and promote the use of green buffer zones around paved areas for infiltration.

Land Use Planning and Controls. Land use planning and management presents an important opportunity to reduce/minimize pollutants in stormwater runoff and control flooding by using a comprehensive planning process to integrate County goals into the development and redevelopment process. Through the Hillsborough County Land Development Code, land uses are regulated sufficiently regarding stormwater management. Two recommendations are offered:

- The use of freshwater wetlands for the treatment of stormwater runoff should be encouraged. Wetlands are natural treatment facilities and generally, wetlands need water to survive. Many wetlands need to be rehydrated and stormwater is an excellent source of such water after treated by vegetated swale systems. It should be noted that sediment should be removed prior to discharge to the wetlands.
- The reduction of imperviousness of developed lands should be encouraged.

Low Impact Development. Because the LMR watershed is largely undeveloped, there are opportunities to guide new growth such that development impacts are minimized. It is recommended that the County promote what has been termed “low impact design”. Low impact development emphasizes environmental sensitive design development principles. Applying the principles together, planners, developers, and local officials can measurably reduce impervious cover, conserve natural areas, and reduce the impacts of stormwater from new development while at the same time enhancing both the natural environment and community well being. Therefore, it is recommended that the Hillsborough County Land Development Code be reviewed to incorporate low impact design concepts. Similarly, the Florida Yards and Neighborhoods program should be considered as part of the landscape regulations.

Nonstructural Stormwater Management Recommendations For Water Quality Improvements

Non-structural Best Management Practices (BMP) are recommended for use throughout the LMR watershed for pollutant source controls. Recommended strategies include:

- Public Information and Education
- Fertilizer Application Control
- Pesticide Use Control
- Aquifer Recharge
- Illicit Connections (Non-Stormwater Discharges) Identification and Removal

- Agricultural Source Controls

Public Information and Education. This recommended action involves the development and implementation of a comprehensive public involvement program for the LMR watershed. The program would include a number of elements including the following:

- Preparation of a semi-annual newsletter (e.g., twice per year) to be mailed to residents and businesses in the basin informing the public of the various components of the Plan as well as findings, trends, and upcoming activities.
- Production and airing of a government access television presentation on the LMR, with updates to the program to be made on an annual basis. A videotape of this presentation should be made available to citizens upon request.
- Establish a speakers bureau for homeowners association meetings and other public functions.
- Establish an information clearinghouse for technical reports, monitoring data, and other information related to the LMR.

Three other public involvement programs that are recommended for use throughout the LMR watershed are the Florida Clean Marina Program, the Florida Yards and Neighborhood Program, and a Local Citizens River Watch Program.

Fertilizer Application Control. Fertilizer application controls are implemented through a public information program by making the public aware of the principals of environmental landscape maintenance and the problems associated with overuse of fertilizers. Information programs should be extended to homeowners and civic associations in the Ruskin, Sun City Center, and Wimauma areas. It is also recommended that the County work closely with the Natural resources Conservation Service to implement agricultural BMPs, including fertilizer applications control.

Pesticide Use Control. Pesticide use control is also a voluntary control by citizens who use pesticides as part of their housekeeping and lawn maintenance activities. Information programs should be extended to homeowners and civic associations in the Ruskin, Sun City Center, and Wimauma areas. Coordination should also occur with the Natural resources Conservation Service.

Aquifer Recharge. Another problem associated with excessive groundwater withdrawals, especially in coastal communities, is saltwater intrusion (Mahon 1989). For those areas designated as probable recharge areas (Hydrologic Group A soils as defined by the SCS and USGS), it is recommended that the first 3 inches of runoff over DCIAs be retained and infiltrated onsite for all new development or construction so the County can maximize remaining recharge areas to ensure long-term protection of groundwater supplies. The County should also look for opportunities for aquifer storage and recovery (ASR) protection in agricultural areas in the Cockroach Bay and Lower Little Manatee major basins.

Illicit Connections (Non-Stormwater Discharges) Identification and Removal. In the 1987 Clean

Water Act Amendments, three major goals were identified: to control pollution from municipal stormwater systems to the maximum extent practicable (MEP), to eliminate “illicit” discharges to storm sewers and to control the discharge of stormwater from industrial activities. These goals have generated the National Pollutant Discharge Elimination System (NPDES) permitting programs for municipal storm sewer discharges to waters of the United States. For the second goal, “illicit” discharges are defined as those that are non-stormwater discharges to the storm sewer. The ongoing EPA NPDES illicit connection survey should be used to strengthen applicable codes and eliminate these connections that can cause plugs of toxic substances to enter surface waters. Aggressive inspection is a key component of this BMP program. Emphasis on cooperation and public outreach is also a critical to the effort to eliminate illicit discharges.

Agricultural Source Controls. Agriculture encompasses nearly 50 percent of the land use in the LMR watershed and is associated with water quality problems due to excessive pumping and runoff. Agriculture, like other industries, can impact water quality with the addition of pesticides, soil, animal waste, and nutrients that wash from farmlands into nearby surface waters that decrease the beneficial use of those resources. The County should enhance its current coordination activities with the natural Resources Conservation Service and the Florida Department of Agriculture and Consumer Services (DACS) in their ongoing programs of working with farmers to develop Farm Management Plans that focus on improving irrigation practices and chemical management programs.

Improved programs can further reduce nutrient and pesticide loadings to the watershed’s receiving waters from agricultural land uses. The County should also encourage the development of site-specific grazing management plans that protect soil and addresses the soil, plant and water relationship. Short-term objectives should move the site toward long-term goals.

Operations And Maintenance (O&M)

A recent survey by FDEP has reported that nearly 70 percent of existing treatment facilities in Florida are not properly maintained and therefore do not provide the intended pollutant removal effectiveness. Because of this, one of the most effective non-structural BMPs is routine maintenance of existing facilities. Currently, new development and significant redevelopment are required to provide treatment of stormwater runoff. Based upon review, existing regulatory requirements for stormwater treatment facilities should be sufficient to achieve the objectives of the LMRWMP. Therefore, it is recommended that, to confirm that maintenance will be provided to both public and private stormwater facilities, the following actions should be adopted:

1. It is recommended that the County first establish a routine inspection program with maintenance performed on an as needed basis. Additional personnel and equipment can be added until a desired level of service is achieved. The County has already initiated a GIS stormwater structure inventory. Once the database is established, the magnitude of the effort will be clear, and it will be easier to track inspections and maintenance to each facility and each subsequent visit. The County should keep and maintain an accurate inventory of equipment, including maintenance records and operating hours for each piece of equipment, to help identify failing equipment and justify the need for new/additional equipment. The County Maintenance Unit should keep and maintain an accurate inventory of equipment, including maintenance records and operating hours for each piece of equipment, to help

identify failing equipment and justify the need for new/additional equipment. At this time, it is recommended that an additional inspector be hired.

2. County inspectors should participate in the Florida Department of Environmental Protection's Sediment and Erosion Control training program. This would ensure that inspectors are properly trained on runoff control.
3. The County should evaluate the maintenance frequency guidelines identified in the O&M Plan (Appendix G, Table G-5), revise them to fit the observed needs within this watershed, and then incorporate this information into the maintenance standards as they are developed.
4. Additional personnel are needed for routine mowing, culvert maintenance, and ditch re-excavation and litter cleanup. Therefore, it is recommended that an additional 12 maintenance employees be added to South Service area staff.
5. The addition of two 12-person inmate crews is needed. The benefit of these crews relative to the cost is evident. However, County staff indicates that additional crews may not be available from the Corrections Department. Nevertheless, the purchase of additional personnel vans and the addition of personnel are included in our recommendation contingent on the commitment of additional crews.
6. The County currently does not have enough excavation equipment to routinely maintain all of the length of ditches in the County. A routine program would require 3 additional grad-alls and 2 dump trucks. However, the County may not need to routinely maintain all ditches. Therefore it is recommended that the County purchase 2 additional grad-alls and 1 dump trucks to work toward an acceptable level of service.
7. Although not a part of the scope for this project, it cannot be overlooked that the age of existing equipment in the County inventory is approaching the expected operable life. It is recommended that additional investigations be performed into how equipment maintenance costs can more easily be tracked.
8. Annually, the private development should document that maintenance has occurred through photographs and re-certification by the owner.
9. The County should inspect private stormwater facilities every other year with half of the facilities completed each year. Failure to comply with maintenance agreements should result in code enforcement.
10. As an option, the County can consider a stormwater facility operating permit that requires annual maintenance for compliance. Such a permit would need to create the administrative and regulatory ability to enforce.
11. Establish a cooperative program to remove Brazilian pepper from public and private property throughout the watershed. Citizen groups such as the Pepper Patrol located in the

local community can be a valuable resource.

Recommendations Associated With FEMA's National Flood Insurance Program And The Community Rating System

The development and implementation of stormwater management plans not only provides a direction for solving watershed issues in a community, but it could also impact directly in the community by lowering flood insurance premiums. Flood insurance throughout the nation is implemented through the National Flood Insurance Program (NFIP), which is administered by the Federal Emergency Management Agency (FEMA). An associate program of the NFIP is the Community Rating System (CRS) program. The objective of the CRS is to reward communities that are doing more than just meeting the minimum NFIP requirements to help their citizens prevent or reduce flood losses. The CRS also provides an incentive for communities to initiate new flood protection activities.

Based on an analysis of the current CRS Program, it is recommended that the following activities be implemented to reduce flood losses and provide lower flood insurance rates for the community.

1. Use the LMRWMP and the other plans to develop new base flood elevations. This will provide additional National Flood Insurance Program (NFIP) Community Rating System (CRS) points that would result in a lowering of flood insurance rates in the area.
2. Continue with the ELAPP acquisition process of properties along the LMR. Subsequently, the County can establish a regulatory floodway along the river where no allowable rise in flood elevations would be permitted. This would require an eventual control of both peak discharges and runoff volumes. Additional CRS points for the amount of preserved open space would also be obtained.
3. Issue an ordinance by which any residential and non-residential structure is required to have the lowest floor elevation no lower than 12 to 18 inches above the base flood elevation. This would add 100 point to the CRS credit.
4. Hazard disclosure is an important topic for flood protection. Issue an ordinance by which real estate agents are required to notify potential customers of the flood hazards associated with a property. This would discourage development of properties located in the flood hazard area.
5. Implement a program by which construction permitting for new development is based on the 100-year, 24-hour storm event. This will ensure that floodplain elevations are maintained throughout the watershed. Currently, the SWFWMD base permitting requirements for new development on the 25-year, 24-storm event.
6. Implement a program to acquire or relocate the repetitive loss properties in the LMR watershed. According to Hillsborough County information, five properties are currently included in FEMA's repetitive loss list.

7. Implement a reverse 911 system that is part of a flood-warning program in the area.

Monitoring And Evaluation Program

Recommendations to measure the success of the implementation of the LMRWMP have been included. The purpose of this effort is to help the regulatory agencies to determine the effectiveness of the implemented plan, to help the County decide whether or not limited public funds are being cost-effectively spent, and to show the benefits of the implemented LMRWMP to the public. The following areas are recommended for continued monitoring and evaluation:

- Municipal Facilities
- Maintenance
- Land Use Controls
- Capital Improvements
- Near Shore Water Quality
- Monitoring of Natural Habitat

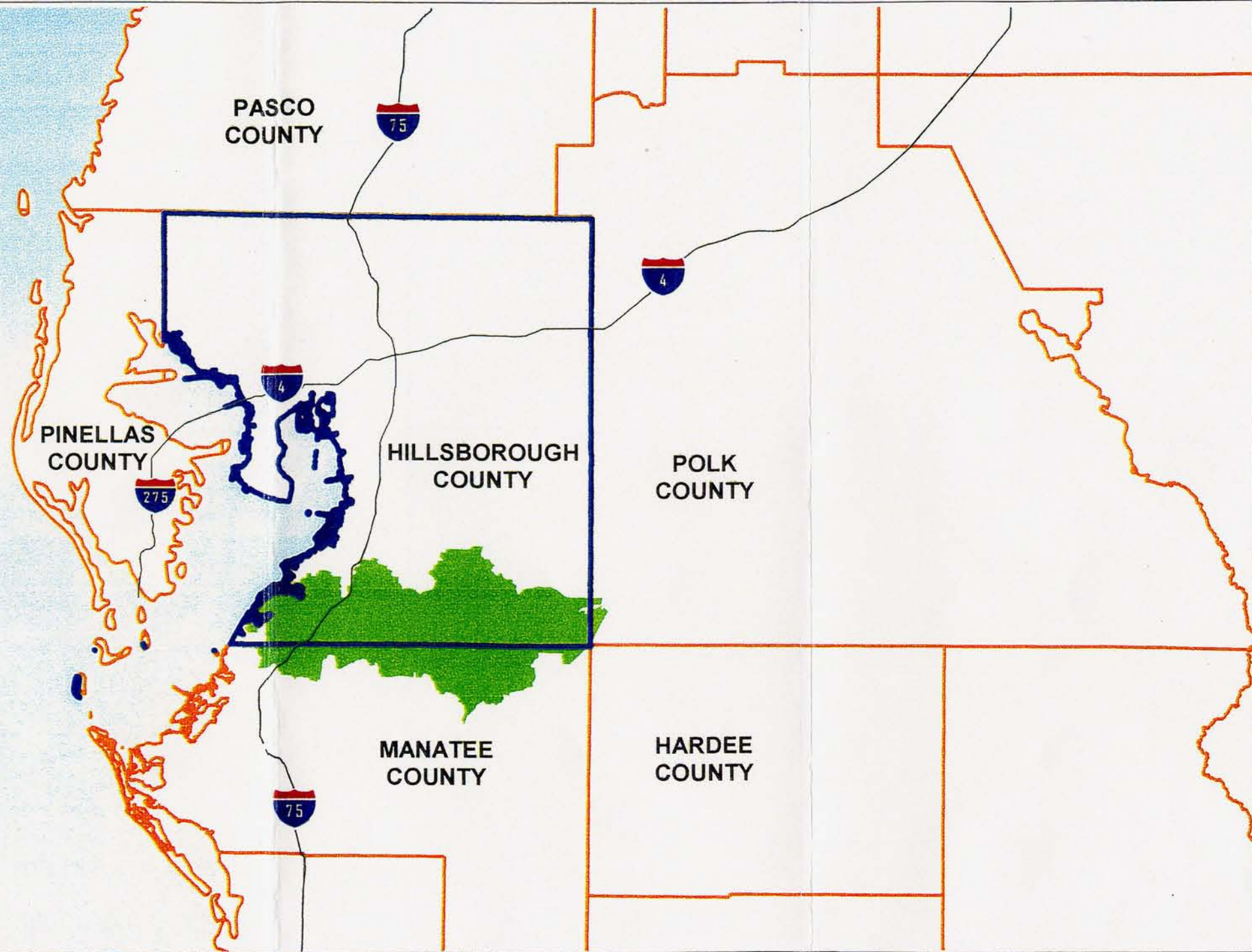
Additional Studies And Planning

The following additional water quality and ecological studies and planning are recommended for the LMR watershed.



- Periodically update the Watershed Management Plan to reflect changes in the development of the watershed, new monitoring data, findings from assessments and special studies, and new regulations that impact discharges to receiving waters and private stormwater management systems.
- Participate in re-evaluating the extent that agricultural irrigation waters are flowing to streams in the LMR watershed.
- Participate in review of streamflow management criteria for phosphate mining reclamation plans and if necessary develop improved technical methods to evaluate the effect of mine reclamation on streamflow.
- Participate in revision of the diversion schedule for diversions from the LMR by the Florida Power and Light Power Plant to comply with agency recommendations.
- Participate in collecting and evaluating hydrologic and ecological information necessary to establish minimum flows for the LMR. The County should then move to adopt minimum flows for the LMR so as not to harm the water resources or ecology of the area.
- Periodically update the hydrologic and hydraulic model developed for the watershed as the watershed and conveyance structures are modified, as more information becomes available and as necessary for changes in applicable regulations.

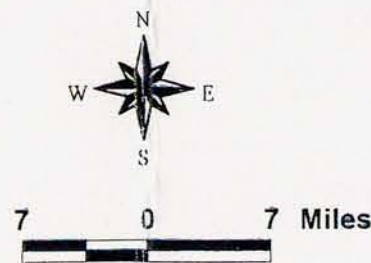




Gulf of Mexico



Legend

-  Interstate Highway
-  Hillsborough County



-  Watershed Boundary
-  County Boundary

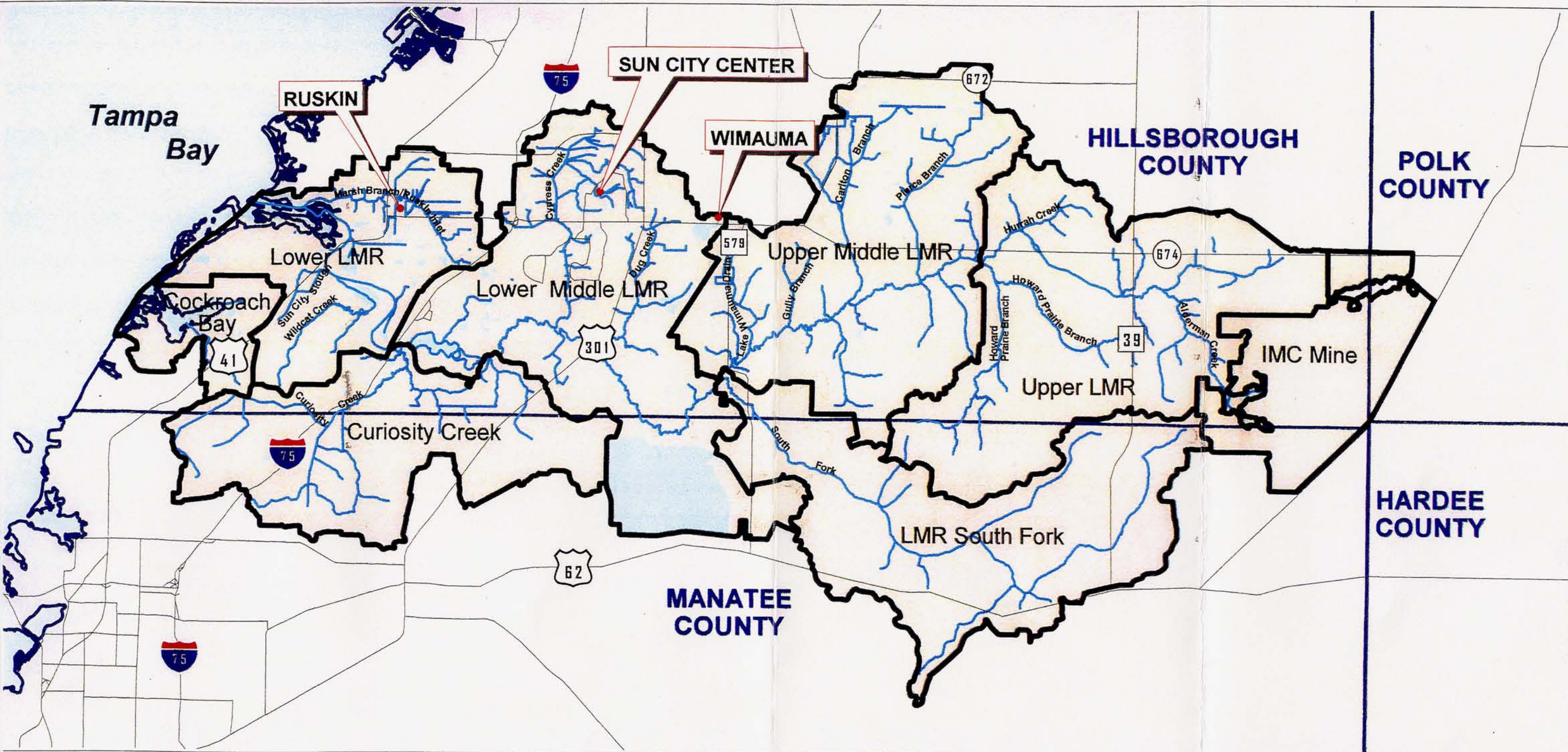
**Little Manatee River
Watershed Management Plan**

Figure ES-1
Location Map



Department of Public Works
Stormwater Management Section



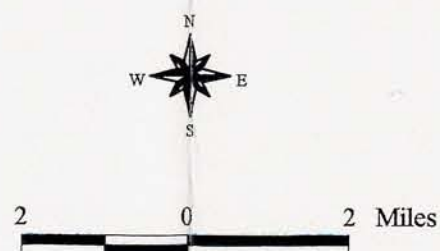


Department of Public Works
Stormwater Management Section



- Cities
- Roads
- Little Manatee River

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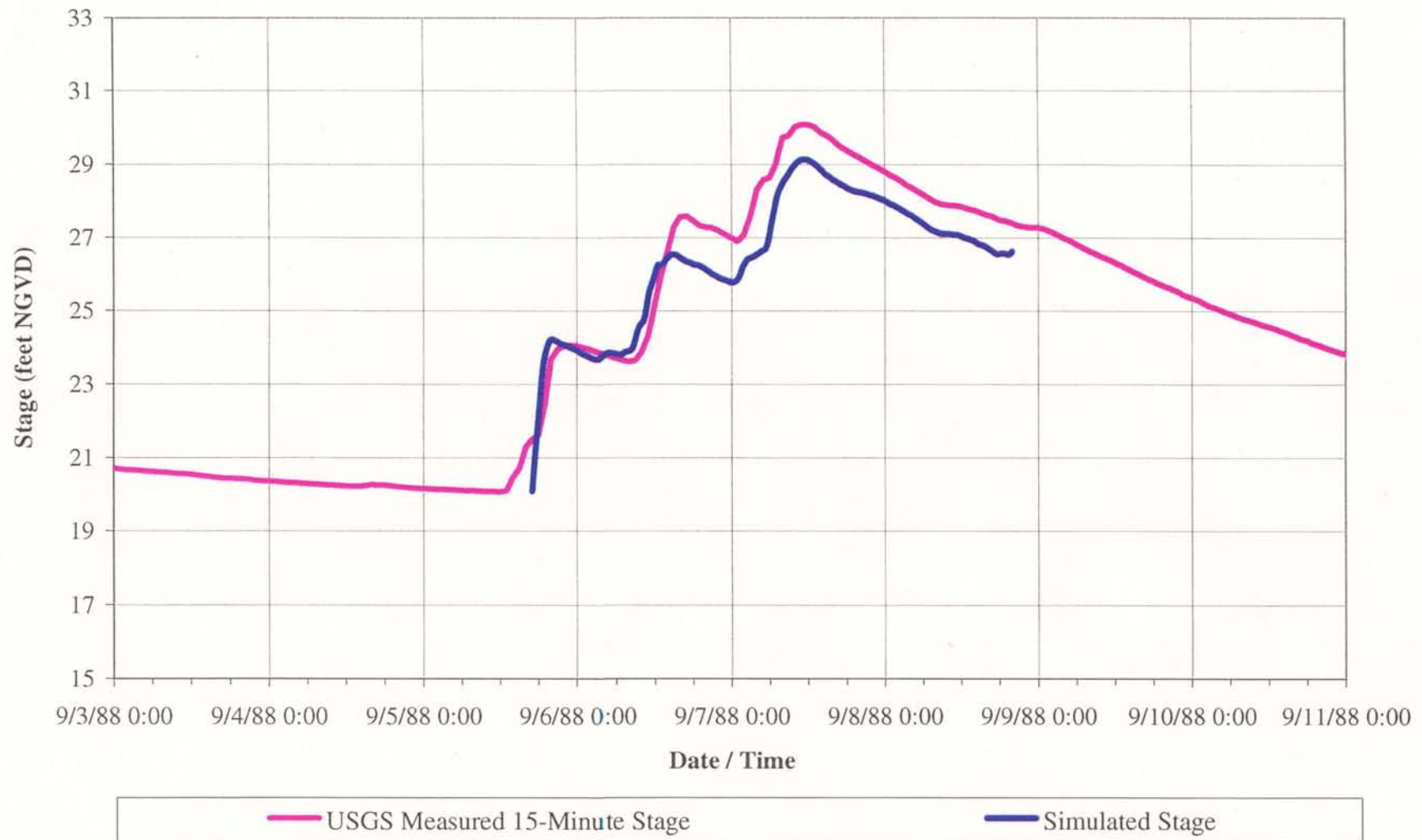
- Water
- Major Basin Boundary
- County Boundary

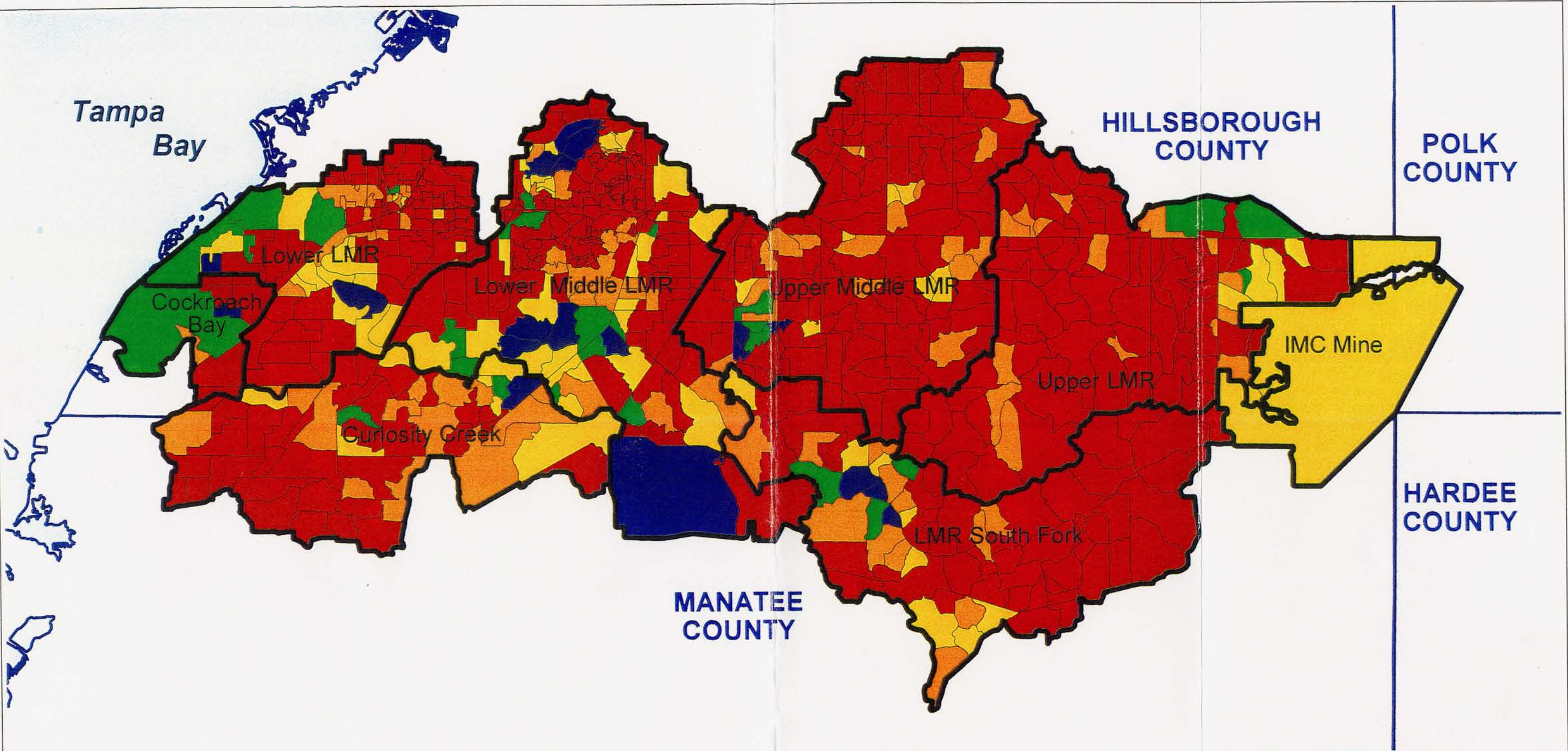
**Little Manatee River
Watershed Management Plan**

Figure ES-2
Major Conveyance
Systems



Figure ES-3 Comparison of Observed and Simulated Stage
USGS Gage 2300530 Cypress Creek at King's Blvd.
September 5-8, 1988 Calibration Event

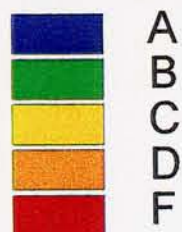




Department of Public Works
Stormwater Management Section



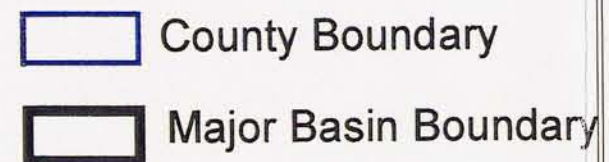
Water Quality LOS



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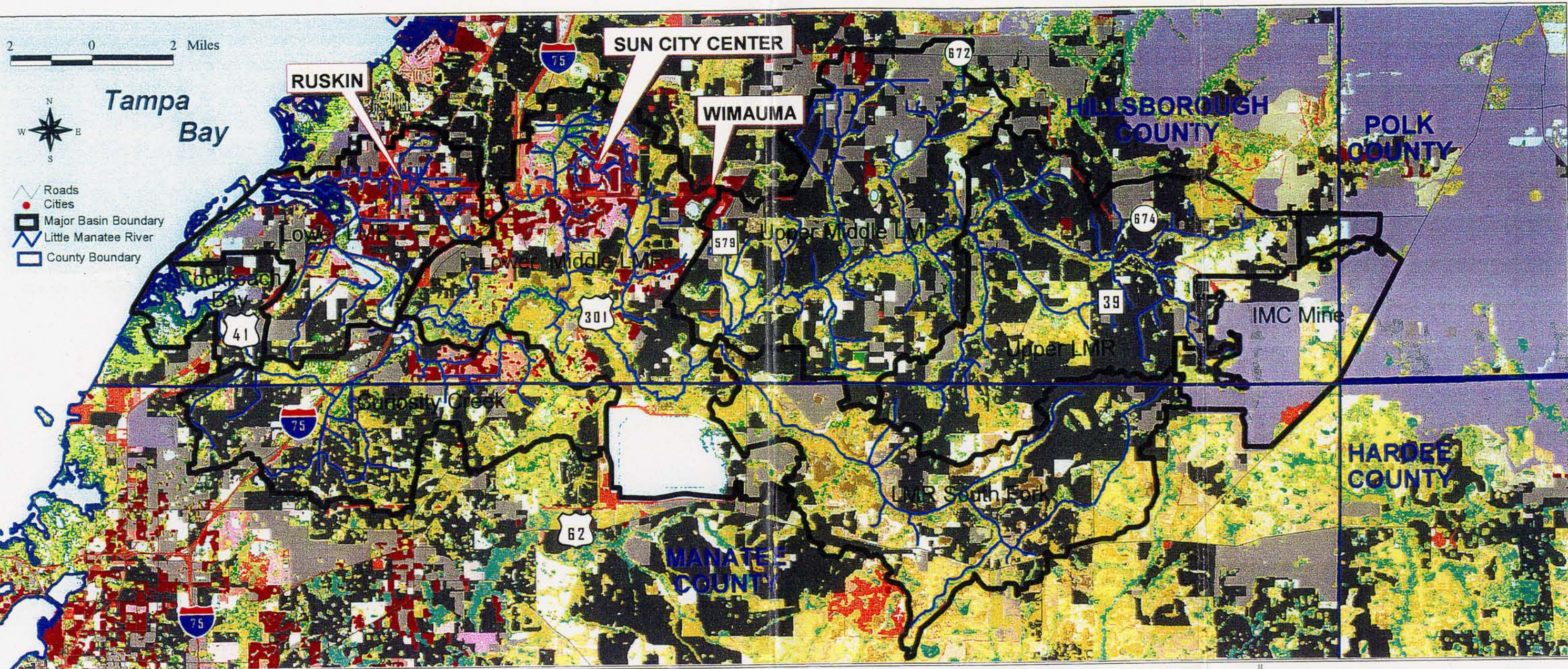
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**Little Manatee River
Watershed Management Plan**

Figure ES-4
Existing Water Quality
Treatment
Level of Service

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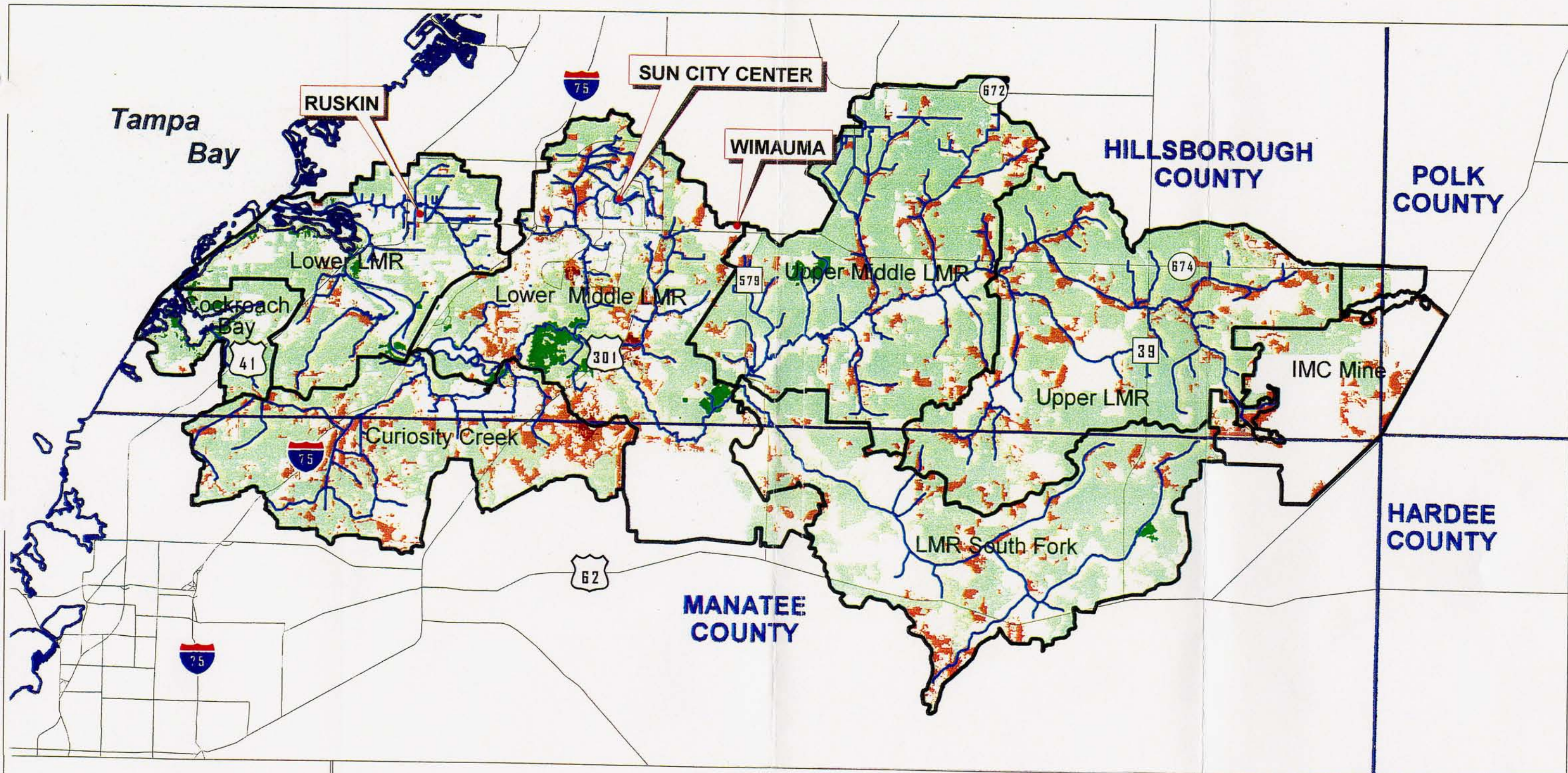
Department of Public Works
Stormwater Management Section



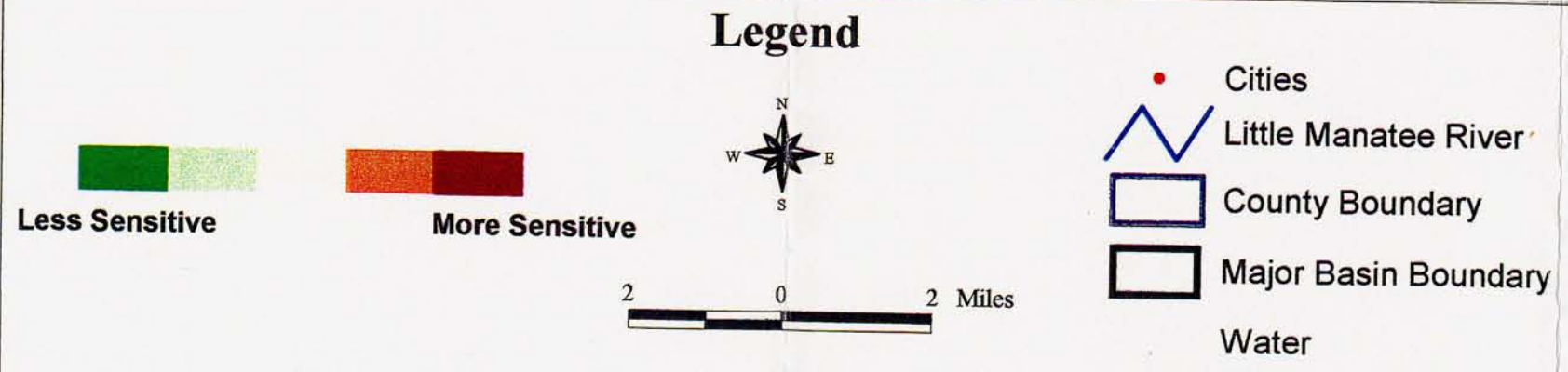
Little Manatee River Watershed Management Plan

Figure ES-5
Natural Habitat





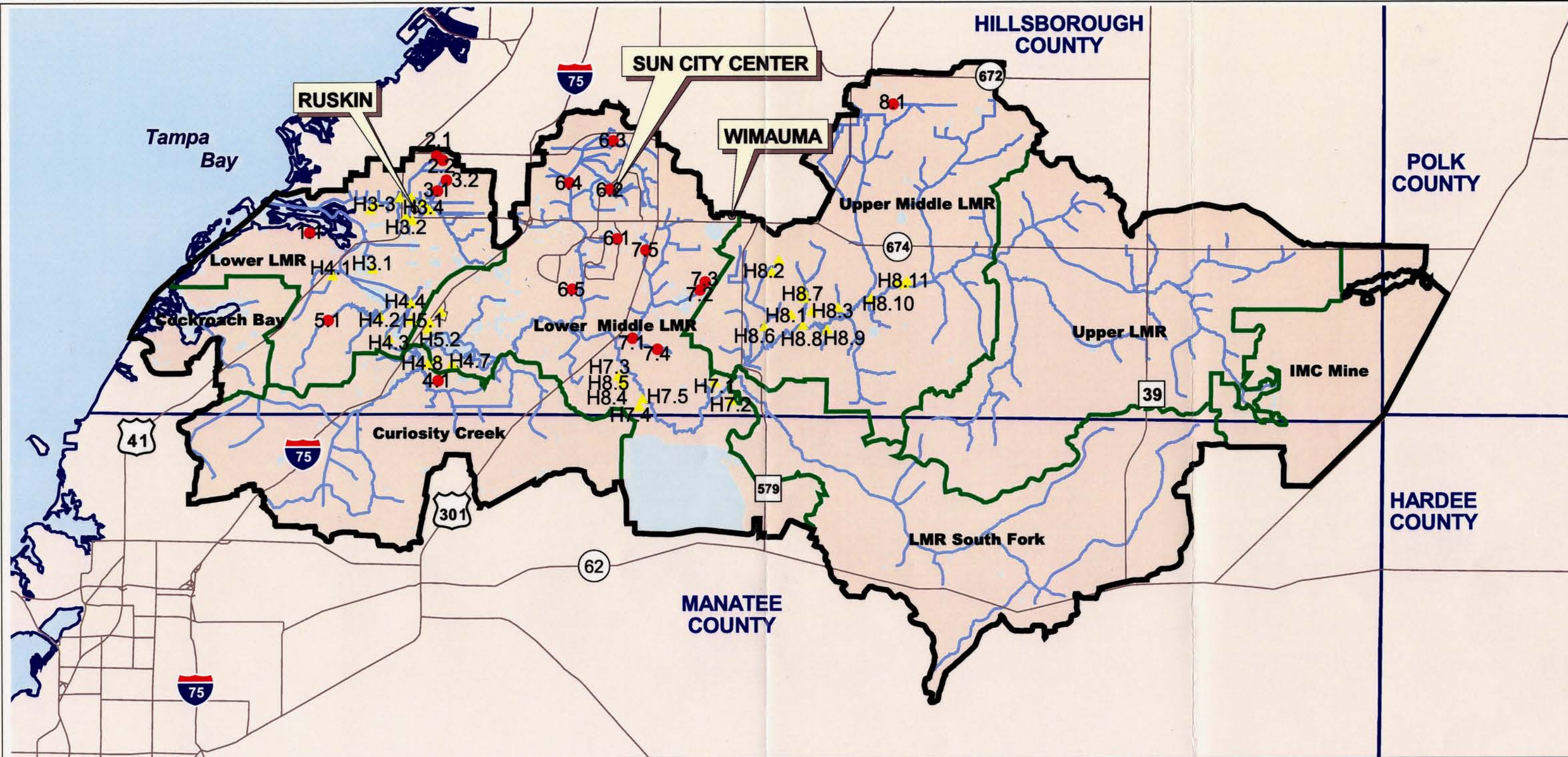
Department of Public Works
Stormwater Management Section



**Little Manatee River
Watershed Management Plan**

**Figure ES-6
Sensitive Habitat**

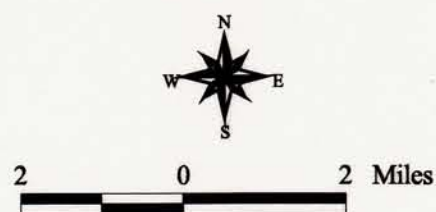




Department of Public Works
Stormwater Management Section



Legend



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Overall_map
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|---------------------------------------|------------------------------------------|------------------------------------------|----------------------|
| ● | Flood Control/
Water Quality Projects | ■ | Water |
| ▲ | Natural Systems Projects | — | Roads |
| ● | Cities | — | County Boundary |
| — | Little Manatee River | — | Watershed Boundary |
| | | — | Major Basin Boundary |

Little Manatee River Watershed Management Plan

Figure ES - 7
Recommended
Project Locations

PBSJ

Table ES-4

**Little Manatee River Watershed Management Plan
Recommended Flood Control and Water Quality Projects**



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
8.1	The analysis indicated that the Carlton Branch Lake Road crossing is likely to flood during large storm events, thus causing access problems to local residences. Development upstream of Carlton Branch Lake Road has also occurred with no consideration to stormwater runoff treatment because construction of residences has occurred independently, and not as part of a development plan. Therefore, untreated runoff is conveyed to secondary ditches for subsequent discharge to Carlton Branch.	1. Parallel the existing 28" x 42" ECMP culvert pipe under Carlton Lake Road with an additional pipe of the same size and split discharge to existing ditch draining southeasterly to Carlton Branch 2. Construct a longitudinal detention pond 800 ft long and 100 ft wide by expanding the existing ditch upstream and downstream of the culvert expansion.	\$404,000	1
6.4	Both flood protection and water quality problems have been identified in the Sun City Center / Kings Point area. Road flooding has occurred in the area adjacent to Pebble Beach Boulevard and Cherry Hills Drive. Water quality is a problem associated with the entire developed area between U.S. 301 and I-75 because the subdivisions were not designed to include water quality treatment facilities. Untreated stormwater flows discharge to Cypress Creek for subsequent conveyance to the Little Manatee River.	· Raise Cypress Creek control weir (located approximately 1,000 ft west of the northern end of American Eagle Boulevard) by 6 inches to create a temporary storage for water quality treatment of the Caloosa Country Club estates area, north of Sun City Center Boulevard. Install a 4" PVC pipe across the weir structure with an invert elevation equal to the current weir crest elevation for storage recovery.	\$20,000	2
1.1	Flooding problems have been reported on Gulf City Road in the Lower LMR Basin. Existing conditions model analysis predicts street flooding depths of more than 6 inches at the crossing between Manatee Harbor Road and Frisbie Road on the north edge of Section 14, T32S R18E. Gulf City Road provides access to all developments located on the south side of the Little Manatee River north of Cockroach Bay Road and west of .S. 41. The area receives agricultural runoff from an approximately 340-acre drainage area.	1. Replace the two existing 48-inch RCPs with three 66-inch RCPs (a detailed survey would indicate if it would be preferable to add two 66-inch RCPs to the existing structures). 2. Construct a 4-acre detention pond for water quality treatment. 3. Encourage implementation of non-structural BMPs in the drainage area including nutrient and pesticide management and crop residue use.	\$907,000	3

Table ES-4
Little Manatee River Watershed Management Plan
Recommended Flood Control and Water Quality Projects



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
7.3	Flood protection problems have been identified in the Dug Creek area at Saffold Road. Existing conditions model analysis predicts street flooding at Saffold Road, an unnamed road off Saffold Road, West Lake Drive and Bishop Road. Street flooding depths on Saffold Road for the 25-year event exceed 0.5 feet above the road. Street flooding depths are predicted to approach more than 1.5 feet above the road for the 25-year design event at Bishop Road. Untreated stormwater flows discharge from the St. Andrews subdivision and golf course to Dug Creek.	<ol style="list-style-type: none"> 1. Upgrade Bishop Road culvert crossing with an additional 42-inch RCP. 2. Construct a 15-acre detention pond to catch and treat the runoff upstream of Bishop Road. 	\$1,435,000	4
3.2	Flooding problems have been reported on Shell Point Road, 13th Street and Atlantic Drive. Existing conditions model analysis predicts street flooding for the 2.33-year design event along Shell Point Road, 13th Street NE, 12th Street NE and Atlantic Drive. Street flooding depths on Shell Point Road for the 25-year event range from 0.6 - 1.0 foot above the road. Structural flooding is predicted for the 25-year event in the development south of Atlantic Drive along with 2.9 feet of street flooding.	<ol style="list-style-type: none"> 1. Retrofit existing stormsewer outfalls along Atlantic Drive with check valves to avoid backflows from the main ditch. 2. Construct a 15-acre detention pond to catch and treat the runoff upstream of Atlantic Drive. 3. Encourage use of nutrient and pesticide management and residue use in the agricultural area (row crops) upstream of Atlantic Drive. 	\$2,061,000	5
4.1	The Sundance area in the Curiosity Creek basin is a single-family residential neighborhood that is drained through a system of man-made canals. No flooding problems have been identified, but the area has no stormwater treatment facilities. At the canal's discharge point, runoff is conveyed into an undeveloped area that is part of the LMR floodplain, from where it flows into the river. One portion of the downstream canal parallels an undeveloped area covered with wetland and upland vegetation. It is likely that the construction of the canal reduced the hydration opportunities in that area.	<ol style="list-style-type: none"> 1. Acquire the approximately Tidewater Growers Inc. 100-acre property that is located north of the ditch that receives stormwater flow from the Timberlee Road culvert. 2. Develop a stormwater wetland system in the portion of that property that is currently used for agriculture and integrate it with the existing adjacent natural systems. Design the system to treat stormwater flows equivalent to 0.5 inches of runoff from the Sundance development. 	\$3,353,000	6

Table ES-4
Little Manatee River Watershed Management Plan
Recommended Flood Control and Water Quality Projects



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
7.1	Flood protection problems have been identified in the Dug Creek area at Saffold Road. Existing conditions model analysis predicts street flooding at Saffold Road, an unnamed road off Saffold Road, West Lake Drive and Bishop Road. Street flooding depths on Saffold Road for the 25-year event exceed 0.5 feet above the road. Street flooding depths are predicted to approach more than 1.5 feet above the road for the 25-year design event at Bishop Road. Untreated stormwater flows discharge from the St. Andrews subdivision and golf course to Dug Creek.	1. Replace five 84-inch CMPs at Saffold Road with a 7' x 50' box culvert. 2. Acquire approximately 46-acre property and construct a storage/treatment facility on disturbed area downstream of Saffold Road.	\$5,320,000	7
6.5	Both flood protection and water quality problems have been identified in the Sun City Center / Kings Point area. Road flooding has occurred in the area adjacent to Pebble Beach Boulevard and Cherry Hills Drive. Water quality is a problem associated with the entire developed area between U.S. 301 and I-75 because the subdivisions were not designed to include water quality treatment facilities. Untreated stormwater flows discharge to Cypress Creek for subsequent conveyance to the Little Manatee River.	· Acquire and develop as an off-line regional water quality treatment facility an 80-acre piece of land located on the west side of the Cypress Creek main branch, south of Kings Boulevard (NE corner of S24 T32S R19E). That area is part of a larger property currently owned by WCI Communities Inc.	\$13,458,000	8
7.5	Flood protection problems have been identified in the Dug Creek area at Saffold Road. Existing conditions model analysis predicts street flooding at Saffold Road, an unnamed road off Saffold Road, West Lake Drive and Bishop Road. Street flooding depths on Saffold Road for the 25-year event exceed 0.5 feet above the road. Street flooding depths are predicted to approach more than 1.5 feet above the road for the 25-year design event at Bishop Road. Untreated stormwater flows discharge from the St. Andrews subdivision and golf course to Dug Creek.	1. Retrofit existing golf course pond in St. Andrews subdivision. 2. Construct online 4.6-acre pond.	\$550,000	9

Table ES-4
Little Manatee River Watershed Management Plan
Recommended Flood Control and Water Quality Projects



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
2.1	An isolated natural area is located west of 12th Street NE and north of 11th Avenue NE in Ruskin. This area was identified as a "Biodiversity Hotspot" based on the Florida Fish and Wildlife Conservation Commission. However, currently this area receives untreated stormwater runoff discharges from the surrounding urban and agricultural land uses that may threaten valuable habitat. In addition, drainage concerns due to needed maintenance of the existing ditches and culverts have been reported downstream, particularly at the intersection of 3rd Street NE and 7th Avenue NE.	1. Construct a 1.5-acre detention pond to catch and treat the runoff from the adjacent citrus grove on the north side of the natural area. 2. Encourage application of nutrient management practices and the use of drop irrigation systems in the upstream citrus groves.	\$454,000	10
2.2	An isolated natural area is located west of 12th Street NE and north of 11th Avenue NE in Ruskin. This area was identified as a "Biodiversity Hotspot" based on the Florida Fish and Wildlife Conservation Commission (Cox et.al., 1994). However, currently this area receives untreated stormwater runoff discharges from the surrounding urban and agricultural land uses that may threaten valuable habitat. In addition, drainage concerns due to needed maintenance of the existing ditches and culverts have been reported downstream, particularly at the intersection of 3rd Street NE and 7th Avenue NE.	1. Construct a 2.5-acre detention pond to treat runoff from the drainage area on the east side of 12th Street NE. 2. Encourage application of nutrient management practices and the use of drop irrigation systems in the upstream citrus groves.	\$607,000	11

Table ES-4
Little Manatee River Watershed Management Plan
Recommended Flood Control and Water Quality Projects



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
3.1	Flooding problems have been reported on Shell Point Road, 13th Street and Atlantic Drive. Existing conditions model analysis predicts street flooding for the 2.33-year design event along Shell Point Road, 13th Street NE, 12th Street NE and Atlantic Drive. Street flooding depths on Shell Point Road for the 25-year event range from 0.6 - 1.0 foot above the road. Structural flooding is predicted for the 25-year event in the development south of Atlantic Drive along with 2.9 feet of street flooding.	1. Replace culverts along the south side of Shell Point Road including: the single 15-inch RCP with three 30-inch RCPs (east of 12th Street); the two 24-inch RCPs and one 18-inch RCP (12th Street crossing) in series with two 36-inch RCPs; and the single 24-inch RCP with 2 42-inch RCPs (east of railroad). 2. Clear and snag railroad ditch (east and west side) from Atlantic Drive to Shell Point Road.	\$85,000	12
6.3	Street and structure flooding was reported after a significant September 2001 rainfall in the Sun City Center area near Del Webb Blvd., Brockton Green Drive and Tremont Court. Existing conditions model analysis predicts street flooding for the 10 year design event along Del Webb Blvd. Street flooding depths for the 25 year event are predicted to be over 8 inches and above the road.	1. Replace the four 30-inch RCP's at Del Webb Blvd. with one 4 ft X 12 ft box culvert 2. Clear and Snag channel (west side) from Del Webb Blvd. to approximately 800 ft downstream to improve conveyance. 3. Retrofit existing pond southwest of Tremont Court and west of Del Webb Blvd. with a new outfall discharging westerly. 4. Regrade swale between houses at the end of Tremont Court to drain toward a northwest stormwater pond. The swale will provide for overflow from a secondary system inlet located in the cul-de-sac.	\$232,000	13
7.2	Flood protection problems have been identified in the Dug Creek area at Saffold Road. Existing conditions model analysis predicts street flooding at Saffold Road, an unnamed road off Saffold Road, West Lake Drive and Bishop Road. Street flooding depths on Saffold Road for the 25-year event exceed 0.5 feet above the road. Street flooding depths are predicted to approach more than 1.5 feet above the road for the 25-year design event at Bishop Road. Untreated stormwater flows discharge from the St. Andrews subdivision and golf course to Dug Creek.	· Replace two 36-inch CMPs at West Lake Drive with 3, 36-inch RCPs.	\$42,000	14
6.1	Both flood protection and water quality problems have been identified in the Sun City Center / Kings Point area. Road flooding has occurred in the area adjacent to Pebble Beach Boulevard and Cherry Hills Drive. Water quality is a problem associated with the entire developed area between U.S. 301 and I-75 because the subdivisions were not designed to include water quality treatment facilities. Untreated stormwater flows discharge to Cypress Creek for subsequent conveyance to the Little Manatee River.	· Upgrade the 54" RCP culvert under South Pebble Beach Boulevard to double 54" RCPs and expand length of control structure from 6' to 18'.	\$64,000	15

Table ES-4

**Little Manatee River Watershed Management Plan
Recommended Flood Control and Water Quality Projects**



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
7.4	Flood protection problems have been identified in the Dug Creek area at Saffold Road. Existing conditions model analysis predicts street flooding at Saffold Road, an unnamed road off Saffold Road, West Lake Drive and Bishop Road. Street flooding depths on Saffold Road for the 25-year event exceed 0.5 feet above the road. Street flooding depths are predicted to approach more than 1.5 feet above the road for the 25-year design event at Bishop Road. Untreated stormwater flows discharge from the St. Andrews subdivision and golf course to Dug Creek.	1. Replace three 36-inch CMPs at unnamed road off Saffold Road with a 4' x 12' box culvert.	\$194,000	16
5.1	Existing conditions analysis predicts street flooding for the 5-year design event along Stephens Road. Street flooding depths for the 25-year event are predicted to be over 1.2 feet above the road.	1. Replace the two 54-inch RCPs along Stephens Road with a 6 ft by 24 ft box culvert. 2. Encourage the use of nutrient and pest management practices in the open pasture and hay fields existing upstream. Prescribed grazing and forage harvest are recommended practices applicable to pasture and hay fields, respectively.	\$398,000	17
6.2	Both flood protection and water quality problems have been identified in the Sun City Center / Kings Point area. Road flooding has occurred in the area adjacent to Pebble Beach Boulevard and Cherry Hills Drive. Water quality is a problem associated with the entire developed area between U.S. 301 and I-75 because the subdivisions were not designed to include water quality treatment facilities. Untreated stormwater flows discharge to Cypress Creek for subsequent conveyance to the Little Manatee River.	<ul style="list-style-type: none"> Replace the four 29" x 45" ECRPs with a 3' x 20' box culvert upstream of Cherry Hills Drive. Lengthen weir upstream of Cherry Hills Drive from 39' to 120'. Replace existing double 3.3' x 4' box culvert with a 3' x 15' box culvert under La Jolla Avenue. 	\$597,000	18

Table ES-5

**Little Manatee River Watershed Management Plan
Recommended Natural Systems Projects**



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
H7.1 - H7.2	Protecting habitat is important for preventing excessive runoff volumes and pollutant loadings, maintaining terrestrial and aquatic biodiversity, protecting stream channel stability, and reducing stream bank erosion. Restoration efforts in the LMR watershed should be focused on areas in the upper and middle portion of the watershed where previous land use activities have resulted in alterations in hydrology and soils. These changes have resulted in loss of habitat due to conversion to croplands and pasture and associated erosion. Soil compaction due to grazing is also a problem in many areas, although without more aggressive burn management, grazing is the means used to control understory vegetation and prevent uncontrolled fires.	Restoration projects north and south of the main river channel, between Saffold Road and C.R. 579. Regrade and replant streambank vegetation with native plant associations. Implement a monitoring program to evaluate the success of the restoration. Terminate grazing and implement prescribed burning in overgrown pasture areas. Support ongoing efforts to remove exotics and apply efforts to restoration sites. Encourage the practice of agricultural BMPs through education programs.	\$1,131,000	1
H4.7	Protecting habitat is important for preventing excessive runoff volumes and pollutant loadings, maintaining terrestrial and aquatic biodiversity, protecting stream channel stability, and reducing stream bank erosion. Restoration efforts in the LMR watershed should be focused on areas in the upper and middle portion of the watershed where previous land use activities have resulted in alterations in hydrology and soils. These changes have resulted in loss of habitat due to conversion to croplands and pasture and associated erosion. Soil compaction due to grazing is also a problem in many areas, although without more aggressive burn management, grazing is the means used to control understory vegetation and prevent uncontrolled fires.	Restoration project along the main channel at Lightfoot Road, east of I-75. (approximately 113 acres) Regrade and replant streambank vegetation with native plant associations. Implement a monitoring program to evaluate the success of the restoration. Terminate grazing and implement prescribed burning in overgrown pasture areas. Support ongoing efforts to remove exotics and apply efforts to restoration sites. Encourage the practice of agricultural BMPs through education programs.	\$505,000	2

Table ES-5

**Little Manatee River Watershed Management Plan
Recommended Natural Systems Projects**



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
H5.1	Protecting habitat is important for preventing excessive runoff volumes and pollutant loadings, maintaining terrestrial and aquatic biodiversity, protecting stream channel stability, and reducing stream bank erosion. Restoration efforts in the LMR watershed should be focused on areas in the upper and middle portion of the watershed where previous land use activities have resulted in alterations in hydrology and soils. These changes have resulted in loss of habitat due to conversion to croplands and pasture and associated erosion. Soil compaction due to grazing is also a problem in many areas, although without more aggressive burn management, grazing is the means used to control understory vegetation and prevent uncontrolled fires.	Restoration project on east side of I-75, west of 24th Street and on the north side of the river (approximately 180 acres). Regrade and replant streambank vegetation with native plant associations. Implement a monitoring program to evaluate the success of the restoration. Terminate grazing and implement prescribed burning in overgrown pasture areas. Support ongoing efforts to remove exotics and apply efforts to restoration sites. Encourage the practice of agricultural BMPs through education programs.	\$720,000	3
H8.1 - H8.3	Protecting habitat is important for preventing excessive runoff volumes and pollutant loadings, maintaining terrestrial and aquatic biodiversity, protecting stream channel stability, and reducing stream bank erosion. Restoration efforts in the LMR watershed should be focused on areas in the upper and middle portion of the watershed where previous land use activities have resulted in alterations in hydrology and soils. These changes have resulted in loss of habitat due to conversion to croplands and pasture and associated erosion. Soil compaction due to grazing is also a problem in many areas, although without more aggressive burn management, grazing is the means used to control understory vegetation and prevent uncontrolled fires.	Restoration projects west of S.R. 301, on the north and south sides of the Little Manatee River, from C.R. 579 to Grange Hall Loop. Regrade and replant streambank vegetation with native plant associations. Implement a monitoring program to evaluate the success of the restoration. Terminate grazing and implement prescribed burning in overgrown pasture areas. Support ongoing efforts to remove exotics and apply efforts to restoration sites. Encourage the practice of agricultural BMPs through education programs.	\$2,698,000	4

Table ES-5

**Little Manatee River Watershed Management Plan
Recommended Natural Systems Projects**



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
H4.3 - H4.6	Most exotic plant species were introduced into Florida without their native diseases and insects to control them in the environment. Many of these species out compete and displace native species, especially when an area has been disturbed by practices such as agriculture and development. The displacement of native vegetation can reduce habitat available for fish and wildlife as well as biodiversity. Six species of invasive exotic plants (Florida Exotic Pest Plant Council's List of Florida's Most Invasive Species – (Category I) have been identified as common within the LMR watershed: Brazilian pepper, australian pine, melaleuca (punk wood), carrot wood, cogon grass, rosary pea, and air potato. The purpose of exotic and invasive species removal projects is the restoration of native vegetation and habitat for fish and wildlife, including listed species.	Exotic and invasive species removal project upstream of S.R. 301 on main river channel. Removal of exotic and invasive species in parks and at boat ramps. Replacement with native species. Include education component as part of overall county education efforts.	\$116,000	5
H3.4	Most exotic plant species were introduced into Florida without their native diseases and insects to control them in the environment. Many of these species out compete and displace native species, especially when an area has been disturbed by practices such as agriculture and development. The displacement of native vegetation can reduce habitat available for fish and wildlife as well as biodiversity. Six species of invasive exotic plants (Florida Exotic Pest Plant Council's List of Florida's Most Invasive Species – (Category I) have been identified as common within the LMR watershed: Brazilian pepper, australian pine, melaleuca (punk wood), carrot wood, cogon grass, rosary pea, and air potato. The purpose of exotic and invasive species removal projects is the restoration of native vegetation and habitat for fish and wildlife, including listed species.	Exotic and invasive species removal project at Ruskin Inlet/Marsh Branch. Removal of exotic and invasive species in parks and at boat ramps. Replacement with native species. Include education component as part of overall county education efforts.	\$44,000	6

Table ES-5

**Little Manatee River Watershed Management Plan
Recommended Natural Systems Projects**



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
H4.1	Most exotic plant species were introduced into Florida without their native diseases and insects to control them in the environment. Many of these species out compete and displace native species, especially when an area has been disturbed by practices such as agriculture and development. The displacement of native vegetation can reduce habitat available for fish and wildlife as well as biodiversity. Six species of invasive exotic plants (Florida Exotic Pest Plant Council's List of Florida's Most Invasive Species – (Category I) have been identified as common within the LMR watershed: Brazilian pepper, australian pine, melaleuca (paua wood), carrot wood, cogon grass, rosary pea, and air potato. The purpose of exotic and invasive species removal projects is the restoration of native vegetation and habitat for fish and wildlife, including listed species.	Exotic and invasive species removal project in Sun City Heritage Park. Removal of exotic and invasive species in parks and at boat ramps. Replacement with native species. Include education component as part of overall county education efforts.	\$81,000	7
H4.2	Most exotic plant species were introduced into Florida without their native diseases and insects to control them in the environment. Many of these species out compete and displace native species, especially when an area has been disturbed by practices such as agriculture and development. The displacement of native vegetation can reduce habitat available for fish and wildlife as well as biodiversity. Six species of invasive exotic plants (Florida Exotic Pest Plant Council's List of Florida's Most Invasive Species – (Category I) have been identified as common within the LMR watershed: Brazilian pepper, australian pine, melaleuca (paua wood), carrot wood, cogon grass, rosary pea, and air potato. The purpose of exotic and invasive species removal projects is the restoration of native vegetation and habitat for fish and wildlife, including listed species.	Exotic and invasive species removal project in Wildcat Park. Removal of exotic and invasive species in parks and at boat ramps. Replacement with native species. Include education component as part of overall county education efforts.	\$399,000	8

Table ES-5

**Little Manatee River Watershed Management Plan
Recommended Natural Systems Projects**



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
H3.2	Most exotic plant species were introduced into Florida without their native diseases and insects to control them in the environment. Many of these species out compete and displace native species, especially when an area has been disturbed by practices such as agriculture and development. The displacement of native vegetation can reduce habitat available for fish and wildlife as well as biodiversity. Six species of invasive exotic plants (Florida Exotic Pest Plant Council's List of Florida's Most Invasive Species – (Category I) have been identified as common within the LMR watershed: Brazilian pepper, australian pine, melaleuca (paua wood), carrot wood, cogon grass, rosary pea, and air potato. The purpose of exotic and invasive species removal projects is the restoration of native vegetation and habitat for fish and wildlife, including listed species.	Exotic and invasive species removal project in Beaudette (Ruskin) Park. Removal of exotic and invasive species in parks and at boat ramps. Replacement with native species. Include education component as part of overall county education efforts.	\$483,000	9
H8.10 - H8.11	Erosion control projects are intended to decrease sedimentation in river and stabilize shoreline habitat and improve water quality and aquatic habitat. Areas of erosion control have been identified primarily along the middle basins.	Erosion control projects along main river channel, just below confluence with Pierce Branch, at Grange Hall Loop. Stabilize sandy levees along the river with grading and revegetation.	\$243,000	10
H3.3	Most exotic plant species were introduced into Florida without their native diseases and insects to control them in the environment. Many of these species out compete and displace native species, especially when an area has been disturbed by practices such as agriculture and development. The displacement of native vegetation can reduce habitat available for fish and wildlife as well as biodiversity. Six species of invasive exotic plants (Florida Exotic Pest Plant Council's List of Florida's Most Invasive Species – (Category I) have been identified as common within the LMR watershed: Brazilian pepper, australian pine, melaleuca (paua wood), carrot wood, cogon grass, rosary pea, and air potato. The purpose of exotic and invasive species removal projects is the restoration of native vegetation and habitat for fish and wildlife, including listed species.	Exotic and invasive species removal project at Ruskin Commongood. Removal of exotic and invasive species in parks and at boat ramps. Replacement with native species. Include education component as part of overall county education efforts.	\$151,000	11

Table ES-5

**Little Manatee River Watershed Management Plan
Recommended Natural Systems Projects**



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
H3.1	Most exotic plant species were introduced into Florida without their native diseases and insects to control them in the environment. Many of these species out compete and displace native species, especially when an area has been disturbed by practices such as agriculture and development. The displacement of native vegetation can reduce habitat available for fish and wildlife as well as biodiversity. Six species of invasive exotic plants (Florida Exotic Pest Plant Council's List of Florida's Most Invasive Species – (Category I) have been identified as common within the LMR watershed: Brazilian pepper, australian pine, melaleuca (pump wood), carrot wood, cogon grass, rosary pea, and air potato. The purpose of exotic and invasive species removal projects is the restoration of native vegetation and habitat for fish and wildlife, including listed species.	Exotic and invasive species removal project at Domino Boat Ramp. Removal of exotic and invasive species in parks and at boat ramps. Replacement with native species. Include education component as part of overall county education efforts.	\$177,000	12
H4.8	Erosion control projects are intended to decrease sedimentation in river and stabilize shoreline habitat and improve water quality and aquatic habitat. Areas of erosion control have been identified primarily along the middle basins.	Erosion control project along the main river channel at Lightfoot Road, east of I-75 (approximately 113 acres). Stabilize sandy levees along the river with grading and revegetation.	\$6,000	13
H5.2	Erosion control projects are intended to decrease sedimentation in river and stabilize shoreline habitat and improve water quality and aquatic habitat. Areas of erosion control have been identified primarily along the middle basins.	Erosion control project east side of I-75, west of 24th Street and on the north side of the river (approximately 180 acres). Stabilize sandy levees along the river with grading and revegetation.	\$76,000	14
H7.3 - H7.5	Erosion control projects are intended to decrease sedimentation in river and stabilize shoreline habitat and improve water quality and aquatic habitat. Areas of erosion control have been identified primarily along the middle basins.	Erosion control projects next to Saffold and Willow roads. Stabilize sandy levees along the river with grading and revegetation.	\$76,000	15
H8.6 - H8.9	Erosion control projects are intended to decrease sedimentation in river and stabilize shoreline habitat and improve water quality and aquatic habitat. Areas of erosion control have been identified primarily along the middle basins.	Erosion control projects next to Leonard Lee Road. Stabilize sandy levees along the river with grading and revegetation.	\$114,000	16

Table ES-5

**Little Manatee River Watershed Management Plan
Recommended Natural Systems Projects**



Project Number/Title	Problem Description	Recommended Project Description	Capital Cost	Ranking Number
H8.4 - H8.5	Protecting habitat is important for preventing excessive runoff volumes and pollutant loadings, maintaining terrestrial and aquatic biodiversity, protecting stream channel stability, and reducing stream bank erosion. Restoration efforts in the LMR watershed should be focused on areas in the upper and middle portion of the watershed where previous land use activities have resulted in alterations in hydrology and soils. These changes have resulted in loss of habitat due to conversion to croplands and pasture and associated erosion. Soil compaction due to grazing is also a problem in many areas, although without more aggressive burn management, grazing is the means used to control understory vegetation and prevent uncontrolled fires.	Restoration projects west of S.R. 301, on the south side of the river at Saffold Road and C.R. 579. Regrade and replant streambank vegetation with native plant associations. Implement a monitoring program to evaluate the success of the restoration. Terminate grazing and implement prescribed burning in overgrown pasture areas. Support ongoing efforts to remove exotics and apply efforts to restoration sites. Encourage the practice of agricultural BMPs through education programs.	\$226,000	17