St. Marks River Watershed

Surface Water Improvement and Management Plan Update

Northwest Florida Water Management District
August 2009
Program Development Series 2009–02

St. Marks River Watershed

Surface Water Improvement and Management Plan Update

Developed by the Northwest Florida Water Management District under the auspices of the Surface Water Improvement and Management (SWIM) Program and in cooperation with the Florida Department of Environmental Protection

Program Development Series 2009-2
August 2009

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ABOUT THE NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT

The Northwest Florida Water Management District is one of five water management districts in Florida, created by the Water Resources Act of 1972 (Chapter 373, Florida Statutes) to address regional water resource issues while furthering statewide goals and policies. The District stretches from the St. Marks River Basin in Jefferson County to the Perdido River in Escambia County, covering approximately 11,305 square miles, or 17 percent of the state's geographic area. There are 63 incorporated cities within the District. It is bordered on the north by Georgia and Alabama, on the west by Alabama, on the south by the Gulf of Mexico, and on the east by the Suwannee River Water Management District, which shares Jefferson County with the District.

The District has worked for decades to protect and manage water resources in a sustainable manner for the continued welfare of people and natural systems across its 16-county region. A nine member Governing Board, appointed by the Governor and confirmed by the Florida Senate, guides District activities. The District serves Bay, Calhoun, Escambia, Franklin, Gadsden, Gulf, Holmes, Jackson, Leon, Liberty, Okaloosa, Santa Rosa, Wakulla, Walton, Washington and western Jefferson County.

As directed by Florida Statutes, the District has four interrelated areas of responsibility: Water Supply, Water Quality, Flood Protection, and Natural Systems. The District meets these responsibilities through programs established and implemented in cooperation with local governments, state and federal agencies, and resource stakeholders.

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Cover Photograph: Dogwoods blooming at Cherokee Sink, Edward Ball Wakulla Springs State Park. Leigh Brooks, 2008

District staff would like to especially recognize members of the St. Marks River Watershed SWIM Technical Advisory Group (TAG), who volunteered their time and efforts to assist in the development of this plan. Their assistance and thoughtful comments were invaluable and are gratefully acknowledged.

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EXECUTIVE SUMMARY

Since the first Surface Water Improvement and Management (SWIM) Plan was approved for the St. Marks River Watershed in 1997, considerable progress has been made both in developing an improved understanding of watershed resources and challenges and in implementing projects and initiatives to address these challenges. Such progress has included implementation of a number of stormwater retrofit projects to improve water quality and flood protection, enactment of local government initiatives and regulations protecting water resources, and significant investment in improved wastewater treatment and management systems. Additionally, ongoing scientific investigations have yielded new insights into the hydrogeology of the watershed and increased public awareness of its vulnerability. At the same time, the population of the region has been increasing at a rapid pace, bringing with it additional development and non-point source pollution.

The accomplishments achieved have proven important and timely, as the effects of population growth and development on some of the region's most valued resources have become increasingly apparent. Improvements that have been achieved must be seen as providing a foundation for continued and future efforts. Continued investment in stormwater retrofits, advanced wastewater treatment, and scientific research will protect water resources and help to reverse adverse effects that have already been realized.

This update to the St. Marks River Watershed SWIM Plan provides a framework for watershed protection and restoration, complementing other programs and initiatives of the Northwest Florida Water Management District, local governments, and state and federal agencies. The plan is focused on the long-term sustainability of watershed resources and functions that are essential to healthy and productive natural systems and the quality of the human environment. Among these are water storage and flood attenuation, water quality protection and improvement, and fish and wildlife habitat. These in turn provide quality of life, public health, and economic benefits for the community.

The resource challenges and management actions within this SWIM plan update describe three overarching priorities: water quality protection and improvement, natural systems protection and restoration, and flood protection. These are inherently interrelated, as reflected in the complementary strategies and practices proposed for implementation. The specific management actions described include those taken at multiple scales – from individual best management practices to regional scale projects requiring considerable community investment. Nonstructural approaches to resource protection are considered significant priorities, along with stormwater retrofit and other capital improvement projects.

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1.0 INTRODUCTION

1.1 Purpose and Scope

The purpose of the St. Marks River Watershed Surface Water Improvement and Management (SWIM) plan is to provide a framework for watershed resource protection and restoration, encompassing programs and statutory responsibilities of the Northwest Florida Water Management District (NWFWMD or District). This plan is an update to the original plan developed in 1997 (Ryan and Hemmert 1997). The planning area includes the Florida portion of the St. Marks River watershed, encompassing portions of Leon, Wakulla, and Jefferson counties. The scope of the plan includes management actions to address strategic priorities of water quality, natural systems, and flood protection, as described in Chapter 4.0 Management Actions.

The SWIM plan has been developed pursuant to the Surface Water Improvement and Management Act, as enacted through sections 373.451-373.459, Florida Statutes (F.S.). Through this act, the Legislature recognized threats to the quality and function of the state's surface water resources. The act directed the five water management districts to develop plans and programs for improvement and management of surface waters and to conduct research in order to improve scientific understanding of the causes and effects of the degradation of surface waters and associated natural systems.

1.2 Planning Approach

The approach of the St. Marks River SWIM plan update is to identify priority challenges affecting watershed resources and functions and prescribe a set of management actions to meet those needs. The management actions are limited to those within the mission and scope of the NWFWMD SWIM program, recognizing the ongoing initiatives of local communities and other agencies. Successful watershed management requires coordination and implementation of complementary programs under the purview of all jurisdictions and agencies involved in the watershed. Among these are local, state, and federal regulatory agencies; conservation lands acquisition and management programs; and other public, private, and stakeholder initiatives.

This plan is designed to address water quality and natural systems challenges that are more generally outlined in the District Water Management Plan (DWMP) (NWFWMD 2005). The plan integrates a number of complementary programs and activities to protect and restore watershed resources and functions. Projects may include stormwater retrofits for water quality improvement and flood protection, wetland and aquatic habitat restoration, resource assessments, floodplain mapping, public outreach and awareness initiatives, and watershed protection in support of water supply planning.

1.3 Plan Goal and Vision

The St. Marks River watershed shall be managed to ensure the long-term sustainability of watershed resources, values, and functions. This shall encompass preservation and, where necessary, restoration of ecosystem health and integrity.

The District's vision for this plan recognizes important water resource functions and benefits of the watershed which are further defined through the underlying hydrologic and ecological functions or processes, which may be described as follows:

- Important hydrologic functions include surface water storage, flood attenuation, recharge to ground water, and the quantity of surface water discharge. Maintaining and or restoring these functions are also strongly related to water quality.

- Water quality protection and improvement are accomplished through a variety of means, such as stormwater treatment facilities, best management practices (BMPs), wastewater treatment, pollution prevention, and public awareness.

- Habitat, which is highly dependent upon hydrologic function, provides for ecological diversity among aquatic, wetland-dependent, and terrestrial species. Restoration or preservation of these water resources provides many natural ecosystem benefits.

Associated with these functions are numerous benefits contributed by ecosystems for the human community, including:

- Usable surface and ground water resources;
- Public health benefits of good water quality;
- Fish and wildlife resources;
- Commercial and recreational fisheries ;
- Recreational and aesthetic water resource values;
- Environmental resiliency; and
- Economic benefits derived from all of the above.

1.4 Related NWFWMD Programs and Activities

A number of other programs and initiatives of the District are supportive of the SWIM program and cooperative efforts of local governments and other agencies. Thus, an important part of the District's vision is to integrate SWIM program activities in a coordinated fashion with these other programs. Cumulatively, the overall effort results in significant protection and improvement of water resources within the St. Marks River basin.

- Environmental Resource Permitting — Phase I (stormwater) of the Environmental Resource Permitting (ERP) program began October 1, 2007. With the first phase, the District implemented stormwater permitting to address water quality and flooding from construction and development. The program initiated special standards for sensitive karst areas. Phase II (wetland permitting) is expected to be implemented in the near future. Additional information may be found at www.nwfwmd.state.fl.us/permits/permits-ERP.html.

- Flood Map Modernization — National flood maps are being updated by the District through the Federal Emergency Management Agency (FEMA) map modernization program. The District is the cooperating technical partner with FEMA for performing flood hazard mapping in the Florida Panhandle. Flood insurance rate maps are being developed using high resolution aerial photography, Light Detection and Ranging (LiDAR) elevation data, and hydrologic studies, and are now available digitally for the first time. Public outreach is an important component of this initiative. The project is expected to be completed in 2010. For more information visit nwfwmdfloodmaps.com.

- Land Acquisition and Management — The NWFWMD has to date protected about 1,375 acres within the St. Marks River watershed through less-than-fee acquisition. Additionally, the District has worked cooperatively with the Tallahassee-Leon County Blueprint 2000 Intergovernmental Agency (Blueprint 2000) to protect and preserve lands with high water resources value within the St. Marks River basin in Leon County.

- Florida Forever Grant Program — The District had a competitive grant program for local governments and other government entities in northwest Florida as a means of identifying and funding capital improvements, with emphasis on those that help implement the SWIM plans. To date, nearly $2 million in grant funding has been awarded for four stormwater retrofit projects within the St. Marks River watershed. These grants have leveraged over $11 million in local match funding. Further information is available by visiting www.nwfwmd.state.fl.us/rmd/swim/fla_forever_grants/fla_forever_grants.htm.

- Regional Mitigation Planning — The District implements the Umbrella Regional Mitigation Plan for mitigation of regional transportation impacts. The plan encompasses state mitigation requirements under Section 373.4127, F.S. and federal requirements under Section 404 of the Federal Clean Water Act. Information is available at www.nwfwmdwetlands.com. Together with the District's Five Year Land Acquisition Work Plan, the SWIM Plan may help establish watershed acquisition and restoration priorities that would be eligible for funding through the Umbrella Mitigation Plan.

- Water Protection and Sustainability Program — The District provides cooperative construction grants for alternative water supply development and springs protection projects, with funding provided by the Water Protection and Sustainability Program Trust Fund. Among the projects that have received funding under this program are water reuse and advanced wastewater treatment initiatives of the City of Tallahassee and Wakulla County. Limited funding for SWIM may also be provided by this source.

- Regulation of Consumptive Use of Water and Wells — The District regulates the consumptive use of water under Rule 40A-2; wells are regulated under Rule 40A-3. District rules may be found at www.nwfwmd.state.fl.us/permits/ruleform.htm.

- LiDAR — This District is working with the National Oceanic and Atmospheric Administration (NOAA), Florida Division of Emergency Management, and local governments to acquire detailed topographic data using the LiDAR technology. Through the SWIM program, data will be available for the Florida portion of the basin, as well as other areas of the District.

- Monitoring — The District operates 53 surface water and rainfall monitoring stations in cooperation with Leon County and the City of Tallahassee. In a cooperative effort with the County, the District and National Weather Service operate the Leon County flood warning network – a real-time radio telemetry flood warning system that includes 14 stream and rainfall stations to help identify developing flood conditions for emergency management staff. Additionally, in cooperation with FDEP, the District collects long-term ground and surface water data through the Integrated Water Resources Monitoring and Ambient Surface Water Quality Assessment programs.

- Florida Springs Initiative – Through the Florida Springs Initiative, the District monitors discharge from Wakulla Springs. Additionally, the District conducts quarterly discharge measurements at St. Marks Spring and has completed a spring inventory of the St. Marks and Wakulla rivers (Barrios 2006).

- Regional Water Supply Planning – The District has updated a water supply assessment addressing the consumptive demands and the availability of ground water and surface water resources in the basin.

- Minimum Flows and Levels (MFL) – The District included Wakulla Springs on its MFL priority list, although establishment of a reservation may be the preferred means of protecting ecologically significant flows. See the discussion of freshwater needs in 3.2 Natural Systems.

2.0 ST. MARKS RIVER WATERSHED

The St. Marks River watershed (Figure 1) extends from the red hills of southern Georgia to the Gulf of Mexico, covering approximately 1,170 square miles (748,800 acres). Approximately 91 percent of the watershed (1,060 square miles or 678,400 acres) lies within Jefferson, Leon, and Wakulla counties in Florida; the remainder is in Thomas County, Georgia. Surface water features include the St. Marks River; its major tributary the Wakulla River, and the headwaters of the Wakulla River, Wakulla Springs. Other major surface water features within the watershed are lakes Miccosukee, Lafayette, and Munson, and the coastal receiving waters of Apalachee Bay. A brief description of these features and their condition follows. Lewis *et al.* (2009) provides a more complete account of the features, physiography, hydrology, biological resources, and resource uses of the watershed and Apalachee Bay. The watershed's hydrogeology is described by Chelette *et al*. (2002b) and Barrios (2006).

The St. Marks River begins as an intermittent blackwater stream, collecting surface water drainage from much of eastern Tallahassee. The stream submerges at Natural Bridge and re-emerges one-half mile south at St. Marks River rise, with its flow greatly augmented by the contribution of ground water. Discharge measurements indicate that on average about 24 percent of the discharge at St. Marks River rise is contributed by inflow at Natural Bridge swallet (Barrios 2006). From the rise, the river receives water from a series of Floridan Aquifer springs and takes on characteristics of a karst stream (Barrios 2006). The ten-mile long Wakulla River is the major tributary, beginning at Wakulla Springs and merging with the St. Marks River at the City of St. Marks about five miles north of Apalachee Bay. Surface water features of the watershed are shown in Figure 2. The estimated regional ground water contribution area for Wakulla Springs and springs of the St. Marks River is depicted in Figure 1 (Chelette *et al*. 2002b; Barrios 2006).

The watershed encompasses two main physiographic regions: the Tallahassee Hills subdivision of the Northern Highlands in the north and the coastal lowlands in the southern portion of the watershed (FDEP 2001; Pratt et al. 1996). These regions are physically divided by an escarpment designated as the Cody Scarp (Figure 2). North of the scarp, water generally drains to closed basin lakes. These lakes are karst features with connections to the Floridan Aquifer where the confining layer has been breached or is more permeable. Within the St. Marks River watershed, the eastern portion of the coastal plain is characterized by numerous karst features where surface and ground waters readily interact. This area is known locally as the Woodville Karst Plain. Barrios (2006) documents significant karst features within the watershed.

An essential aspect of the watershed with important management implications is the complex and widespread interaction between surface and ground waters. Recent and ongoing investigations have substantially increased understanding of the linkages between surface waters and the underlying Floridan Aquifer. Ground water is susceptible to contamination north of the Cody Scarp from pollutants carried a long distance in surface runoff draining to the lakes, and south of the scarp due to the relative absence of a confining layer. Detailed discussions are provided by Chelette *et al*. (2002b), Kinkaid (2003), and Barrios (2006).

Much of urban Tallahassee drains to Lake Munson, located southwest of the city, and Lake Lafayette, located to the east. Lake Munson is a cypress-lined impoundment of Munson Slough covering 255 acres. The lake drains south several miles to Ames Sink. The ground water tracing program of the Florida Geological Survey has confirmed a hydrologic connection between Ames Sink and Wakulla Springs (Kinkaid 2003).

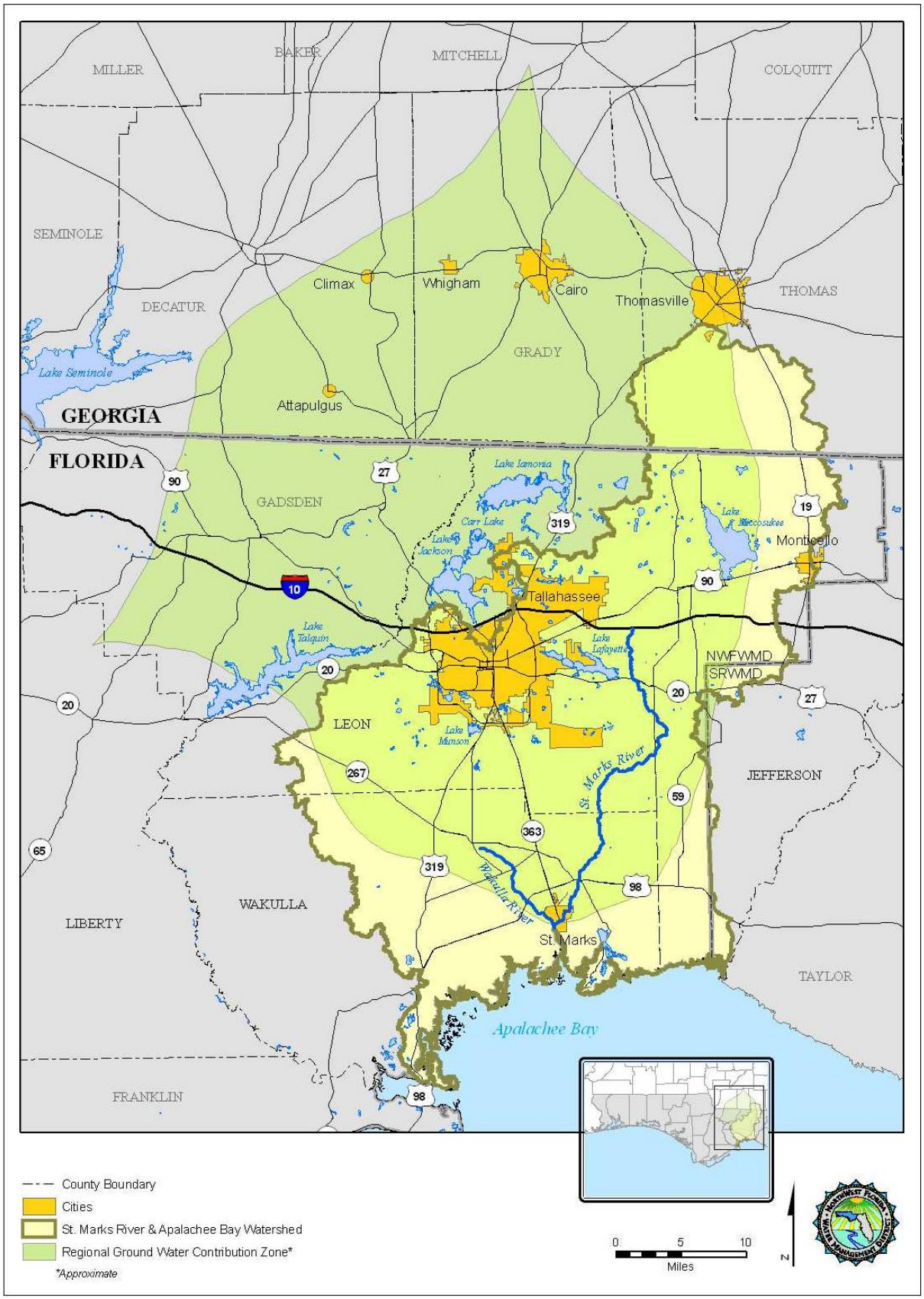

Figure 1. St. Marks River Watershed

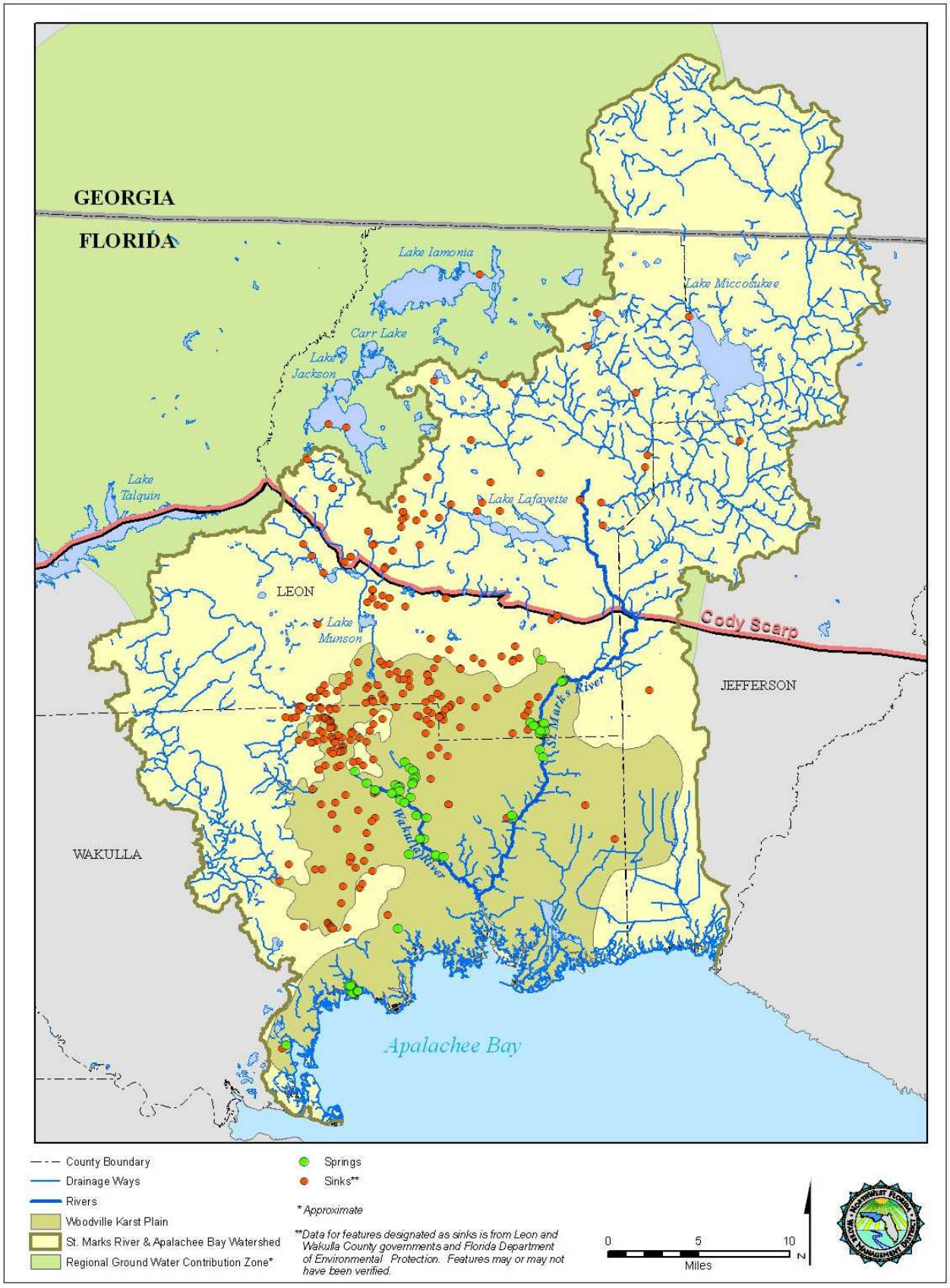

Figure 2. Surface Water Features of the St. Marks River Watershed

Lake Lafayette was an ancient tributary of the St. Marks River that now is a closed basin, connected only intermittently to the river during high water (Chelette *et al*. 2002b). The lake system has been the subject of multiple hydrologic alterations that have resulted in four distinct lake sections: Upper Lake Lafayette, Piney Z Lake, Lower Lake Lafayette, and Alford Arm. Upper Lafayette Sink, located in Upper Lake Lafayette, receives drainage from eastern Tallahassee.

Lake Miccosukee covers approximately 6,226 acres northeast of Tallahassee in Jefferson County. It too was a historic tributary of the St. Marks River that is now a closed basin (Chelette *et al*. 2002b). An impoundment at the south end of the lake and a berm blocking Lake Miccosukee Sink artificially maintain the lake level. Agriculture and rural development are the primary land uses within the lake's drainage basin.

The St. Marks River discharges into Apalachee Bay, a shallow estuary at the Big Bend of northwest Florida that is open and in direct contact with the Gulf of Mexico (Lewis *et al.* 2009). The portion of the bay of primary focus in this plan extends from Ochlockonee Point in the west to a southward extension of the NWFWMD boundary in the east. This includes tidal portions of the St. Marks and Wakulla rivers, as well as Dickerson Bay and Oyster Bay. The St. Marks River is a major source of freshwater to the central portion of Apalachee Bay. The bay also receives fresh water from many small streams within the St. Marks National Wildlife Refuge and the Spring Creek springs group. The Spring Creek group consists of 14 spring vents, including four major vents. It discharges into the mouth of Spring Creek at its confluence with Apalachee Bay. The springs are tidally influenced and are considered to be one of the largest groups of submarine springs in terms of flow. Reports suggest that the flow is highly variable and change significantly with tides and aquifer levels (Lane 2001). The spring system reportedly stopped discharging seaward for several months during the drought of 2006-2007.

In addition to the watershed being a SWIM priority, numerous waterbodies and segments within the St. Marks River watershed have been recognized and receive additional regulatory protection through designation as Outstanding Florida Waters (OFW) per Section 62-302.700, Florida Administrative Code (F.A.C.). Among the areas within the surface watershed designated as OFW are:

- The St. Marks River, except between Rattlesnake Branch and the confluence of the St. Marks and Wakulla rivers;
- Wakulla River;
- Big Bend Seagrasses Aquatic Preserve;
- St. Marks National Wildlife Refuge;
- Florida State Parks, including Edward Ball Wakulla Springs State Park, San Marcos de Apalachee State Historic Site, Letchworth Mounds, Natural Bridge Battlefield State Historic Site;
- Mashes Sands (Wakulla County park);
- Fort San Luis; and,
- Big Dismal Sink within the Apalachicola National Forest.

Additionally, Lake Jackson, Lake Talquin, and the Ochlockonee River are OFWs within the larger ground water contribution area (Figure 1).

Predominant land cover and land use in the watershed includes upland forest and silviculture, wetlands, and urban lands associated primarily with the City of Tallahassee. Other centers of development include the cities of St. Marks and Monticello and the unincorporated communities of Crawfordville, Woodville, and Panacea. Residential areas, while predominately in Leon County, are increasing in the Wakulla County portion of the watershed. Concentrations of residential

development are scattered across unincorporated areas throughout much of the watershed. Figure 3 displays generalized land use and land cover across the Florida portion of the St. Marks River watershed.

Over 220,000 acres within the watershed consist of public and private conservation lands (Table 1; Figure 4). Prominent among these are the Apalachicola National Forest, Wakulla State Forest, Wakulla Springs State Park, St. Marks River State Park and the St. Marks National Wildlife Refuge. A significant portion of the lower watershed and adjacent lands are within the National Wildlife Refuge. This refuge was established in 1931 to provide wintering grounds for migratory bird species (Lewis *et al.* 2009). Among other public lands in the watershed are the Tallahassee-St. Marks Historic Railroad State Trail (multi-use recreational trail from Tallahassee to St. Marks) and the San Marcos de Apalache Historic State Park (old Spanish fort at St. Marks). Lands of continuing public conservation acquisition interest are identified in the District's Five Year Land Acquisition Work Plan[1] and FDEP's Florida Forever Five Year Work Plan.[2]

Table 1. Conservation Lands in St. Marks River/Apalachee Bay Watershed

Owner or Easement Holder	***Area (acres)****
NWFWMD (Less than Fee)	1,375
City of Tallahassee	1,214
Leon County	662
Wakulla County	427
Tall Timbers Land Conservancy (Less Than Fee)	15,074
The Nature Conservancy	11,686
State of Florida	32,293
State of Florida (Less Than Fee)	1,363
St. Marks National Wildlife Refuge	51,106
Apalachicola National Forest	106,944
Total	**222,144**

**Area in acres, based on GIS analysis.*

[1] www.nwfwmd.state.fl.us/pubs/lands/workplan.pdf
[2] www.dep.state.fl.us/lands/FFplan.htm

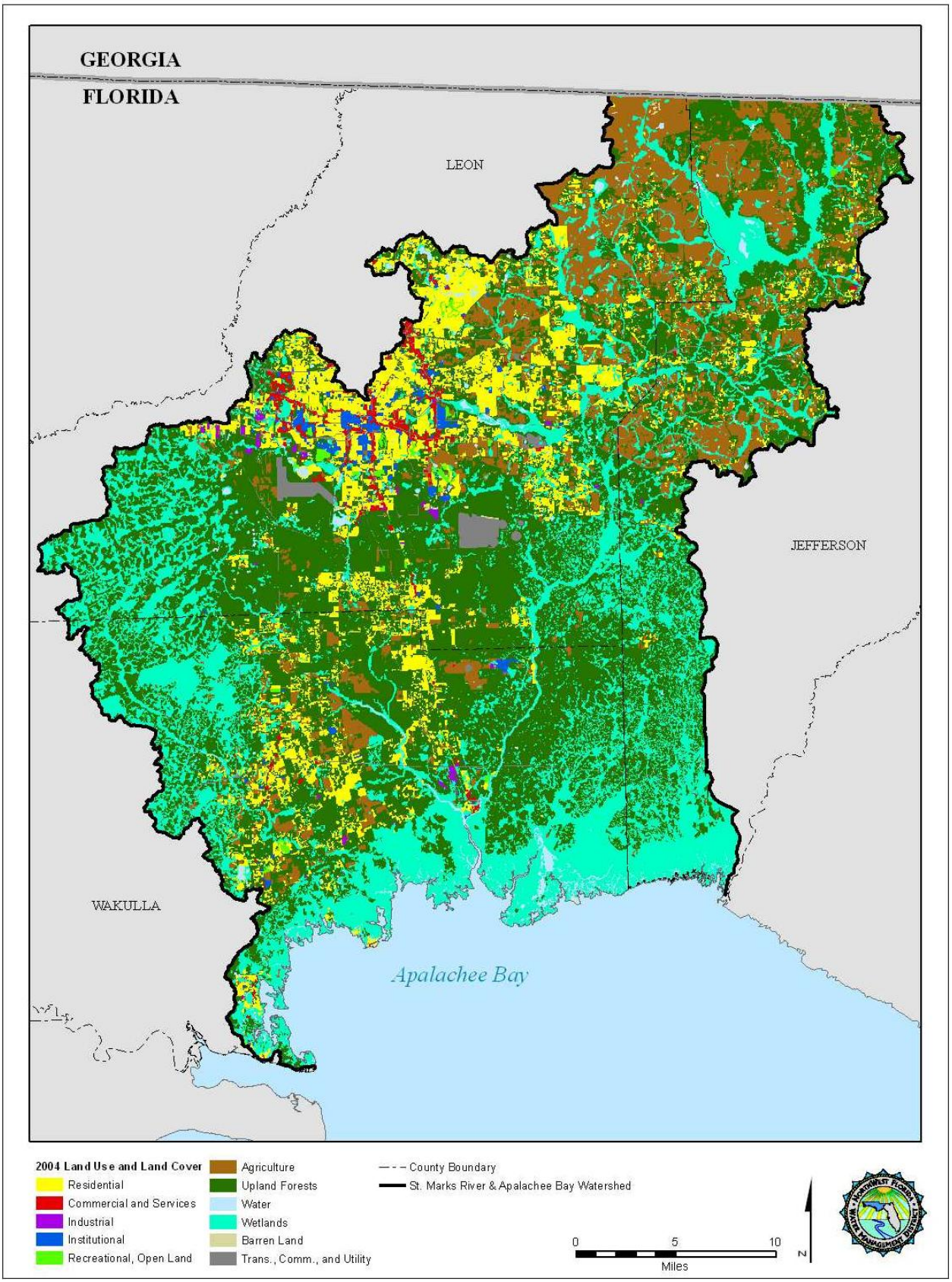

Figure 3. Land Use and Land Cover in the St. Marks River Watershed

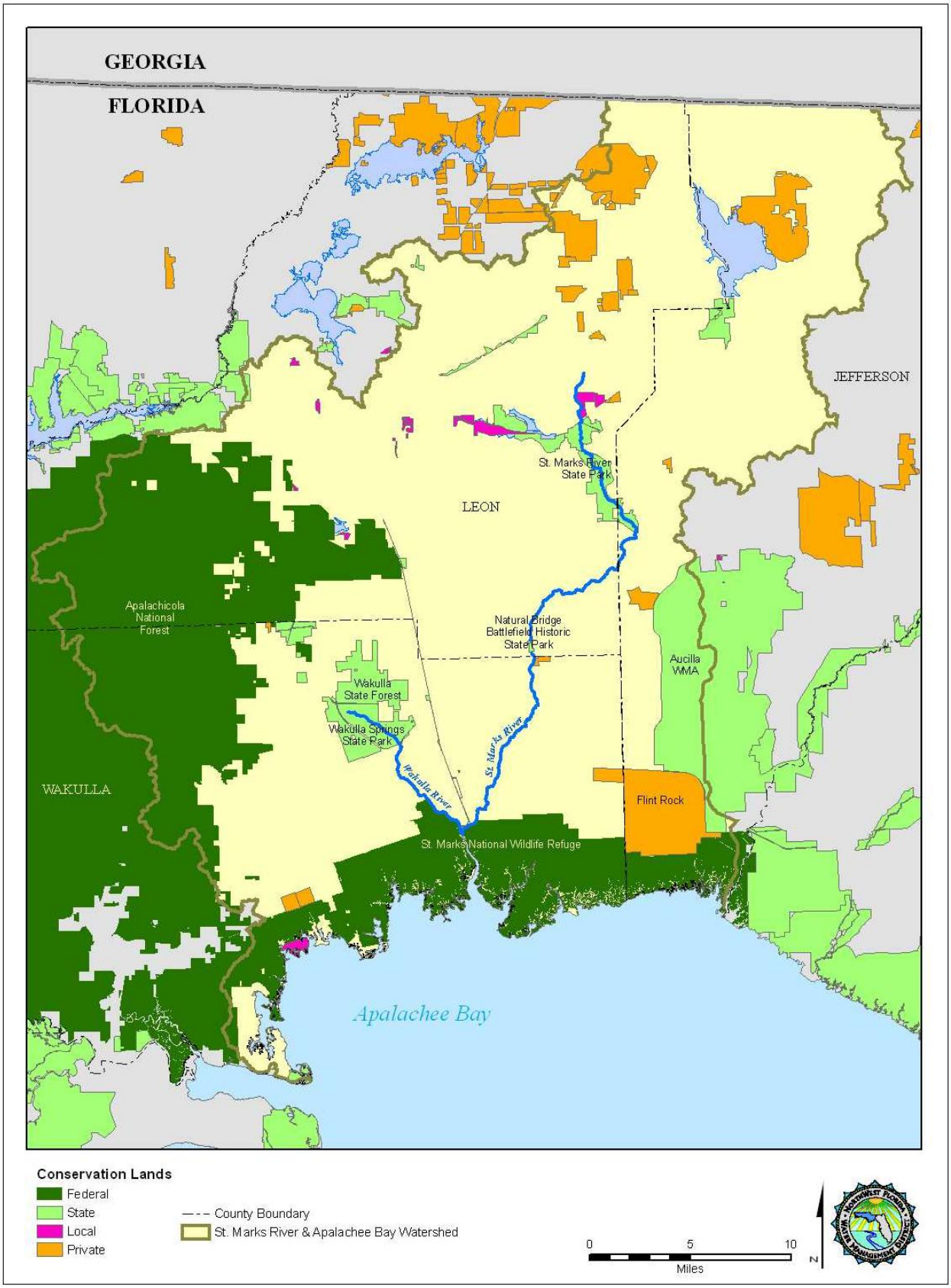

Figure 4. Conservation Lands in the St. Marks River Watershed

3.0 WATERSHED CONDITIONS

The St. Marks River watershed supports a wide array of aquatic and wetland resources and provides numerous functions and benefits for the human community. While the watershed continues to support a diverse ecosystem and important economic, cultural, and recreational characteristics and uses, it has been affected by anthropogenic impacts common to most of Florida's watersheds and coastal systems. Among these are point source and nonpoint source (NPS) pollution, habitat loss and degradation, and other direct and indirect effects of population growth and land use change. Existing literature and data sources are sufficient to provide a generalized description, if not a detailed assessment, of watershed conditions and trends.

3.1 Water Quality

Water quality protection within the St. Marks River watershed requires appropriate treatment and management of both point and nonpoint source pollution. The frequent interaction between surface and ground waters discussed in Section 2.0 presents a considerable management challenge. The closed basin lakes in the more northern extent of the watershed are breached in places by karst features, enhancing leakage to underlying aquifers. To the south, the Woodville Karst Plain receives stormwater runoff generated in the Tallahassee area as well as locally. The runoff and associated nonpoint source pollution can then be recharged directly into the Floridan Aquifer through karst features and generally unconfined conditions. Affected ground water later reemerges as surface water through numerous springs. This vulnerability of ground water quality affects both drinking water resources and springs that discharge back into surface waters.

A ground water tracing project in the Woodville Karst Plain conducted by the Florida Geological Survey and Hazlett-Kincaid, Inc., has confirmed through dye tests that Wakulla Springs receives ground water from Leon Sinks, Ames Sink, and the City of Tallahassee's Southeast Farm sprayfield (Kincaid 2003). Continuing work on this project has also found ground water connections between Leon Sinks and disappearing streams to the west. The vulnerability of ground water to contamination adversely affects water quality in spring systems as well as drinking water resources.

Nitrate levels observed in Wakulla Springs tripled from the 1970s through the 1990s (Chelette *et al*. 2002b). This increase is largely attributable to nitrogen inputs south of the Cody Scarp. Nitrogen sources include atmospheric deposition, wastewater treatment facilities, on-site sewage treatment and disposal systems (OSTDS or septic systems), livestock, commercial fertilizer, and sinking streams (Chelette *et al*. 2002b). Stormwater runoff also carries pollutants from the Tallahassee urban area into the spring contribution area through Munson Slough and Ames Sink. Karst features can rapidly transport surface pollutants into and through ground water (Chanton 2008). The extensive system of caves and underground conduits are probably important pathways of contamination (Kinkaid 2003).

Water quality problems have been documented in the St. Marks River and associated water bodies, including low dissolved oxygen related to nutrient enrichment (FDEP 2003). Lakes Munson and Lafayette receive most of the urban stormwater runoff from Tallahassee and are therefore among the most problematic areas affected by NPS pollution. Lake Munson, including Munson Slough, has experienced nutrient enrichment, low dissolved oxygen, algal blooms, high bacteria counts, and degraded sediment conditions (Bartel and Ard 1992). Water quality in the lake has reportedly improved since sewage discharge was discontinued and restoration efforts were initiated (Bartel and Ard 1992; FDEP 2003; and McGlynn 2006). Upper and Lower Lakes

Lafayette and Piney Z Lake are affected by intensive NPS pollution, manifested as nutrient enrichment, low dissolved oxygen, and bacterial contamination (FDEP 2003). Upper Lake Lafayette discharges to a sinkhole. Lake Miccosukee receives rural surface water runoff and has problems with excess nutrients, low dissolved oxygen, and high bacteria counts (FDEP 2003).

Bacterial contamination from across the landscape affects water quality. Persistently high bacteria counts have been found at Wakulla County beaches (Williams *et al*. 1981; Florida Department of Health 2008), with associated health advisories being issued. Sources of bacteriological contamination are often not well understood. Septic systems, NPS pollution, and wastewater overflows are commonly cited possible sources, as well as wildlife in unpopulated areas. Nearshore waters may also be affected by upland sources via submarine ground water discharge (FDEP 1999; Rutkowski *et al* 1999).

Point Source Pollution

As of December 2007, and as identified in Figure 5, there were 18 active industrial facilities and 17 active domestic facilities permitted by FDEP for wastewater discharge in the watershed.

In 2006, the City of Tallahassee committed to sizeable capital investment in advanced wastewater treatment (AWT) improvements at its treatment facilities. These efforts are expected to reduce nitrogen in treated wastewater by approximately 75% over six years (FDEP 2008). The T. P. Smith Water Reclamation Facility and Lake Bradford Road Wastewater Treatment Facility currently treat approximately 27.5 and 4.5 million gallons per day (MGD), respectively, of raw sewage. The resulting wastewater is used to irrigate the Southeast Farm Wastewater Reuse Facility eight miles east of the T. P. Smith facility. The City has constructed a new public access reuse facility on Tram Road that will use highly treated reclaimed water to replace 1.2 MGD of potable water irrigation in the southeast portion of the city. The AWT and reuse improvements are expected to reduce nitrogen inputs to ground water and improve the quality of water discharging at Wakulla Springs. The City of St. Marks' sewage treatment plant sends treated wastewater to Tallahassee's Purdom Power Plant for industrial reuse. The Purdom plant uses zero-discharge technology.

The defunct St. Marks Refinery on the bank of the St. Marks River in the City of St. Marks is a 55-acre site with significant environmental contamination from decades of asphalt and petroleum production. Contaminants found in sampling include dioxin, oils and grease, organics, and pentachlorophenol (PCP) (FDEP 2003). Dioxin has been found in the soil, ground water, and sediment (FDEP 2003). Contamination has been capped and contained by a berm that limits runoff from the site, and FDEP has overseen removal of the worst petroleum-contaminated soil.

There are 31 active landfills in Leon and Wakulla counties, and 33 inactive or closed facilities. Most of these sites have ground water monitoring wells. The Leon County Sanitary Landfill is located next to Lower Lake Lafayette. This landfill was identified as a possible source for impairment of this portion of the lake (FDEP 2003).

Nonpoint Source Pollution

Nonpoint source (NPS) pollution is generated when stormwater runoff collects pollutants from across the landscape (lawns, pavement, dirt roads, buildings, farms, forestry operations, and construction sites, etc.) and carries them into receiving waters. Pollutants entering the water in this way include nutrients, microbial pathogens, sediment, pesticides, heavy metals, and petroleum products. Pollutants entering the ground water may also emerge in surface waters via seepage and spring discharges.

Evaluations of the relationship between land use and water quality consistently report that urban land uses tend to have the greatest NPS pollutant loading per unit of area, generally followed by agricultural and lower intensity land uses (Harper 1994; NWFWMD 1998). Natural forests and wetlands tend to be associated with good water and habitat quality (Wang *et al*. 1997; Allan *et al*. 1997). Vegetation provides habitat, regulates runoff, maintains surface and surficial ground water flow, prevents erosion, and moderates effects of floods and droughts. Wetland functions include floodwater storage, sediment and shoreline stabilization, nutrient cycling, primary production, and fish and wildlife habitat. Silviculture activities can result in the discharge of sediments and other pollutants; however, when appropriate best management practices (BMPs) are employed, silviculture has been found to be consistent with maintenance of excellent water quality (FDEP 1997; NWFWMD 1998).

The environmental degradation commonly associated with intensive land use reflects not only the deposition of NPS pollutants, but also hydrologic changes and habitat loss caused by physical alterations to the land. Urbanization leads to the channeling of surface water, increased impervious surface area, erosion, and habitat loss. Resulting hydrologic effects include increased peak discharge volume and velocity, decreased time for runoff to reach receiving waters, increased frequency and severity of flooding, a lowered water table, and reduced dry weather stream flow (U.S. EPA 1993). Similarly, agricultural land use may cause stream channelization, erosion, and loss of protective vegetation, which affect surface water hydrology. Alterations such as these, coupled with the deposition of pollutants, generally increase pollutant loading and sedimentation.

As is the case across much of northwest Florida, the St. Marks River region has experienced considerable population growth. The population of Wakulla County has nearly tripled since 1980, exceeding the rate of growth of the state as a whole. Jefferson County's growth rate has been lower than the state's. Leon County's growth rate was high relative to the state's, but has been declining since 2000. Population figures are shown in Table 2. This growth has resulted in the transformation of land use in many areas from rural to urban/suburban in character. Resulting effects include increased NPS pollution, generation of additional wastewater, and habitat loss and fragmentation.

As noted above, on-site sewage treatment and disposal, or septic, systems are potential widespread sources of nutrients and other pollutants. Significant concentrations of OSTDS can result in degraded water quality in ground water and proximate surface waters. When a karst aquifer is close to the surface, there is limited ability for soils to attenuate nitrate from septic systems (Harden *et al*. 2008). Figure 6 illustrates the general distribution of septic systems in the watershed.

Table 2. Population Estimates and Projections by County: 1980-2030

County	*Population*						
	Census[1]			Estimate[2]	Projections[2]		
	1980	*1990*	*2000*	*2006*	*2010*	*2020*	*2030*
Jefferson[3]	6,422	6,778	7,741	8,612	8,940	9,660	10,320
Wakulla[4]	10,887	14,202	22,863	28,393	34,100	42,400	49,600
Leon[4]	148,655	192,493	239,452	272,497	291,700	331,600	363,700
Region Total[4]	165,964	213,473	270,056	309,502	334,740	383,660	423,620
Florida	9,746,961	12,938,071	15,982,824	18,349,132	19,974,200	23,552,100	26,513,300

[1]*Source: U.S. Census Bureau, Census 2000*

[2]*Source: University of Florida, Bureau of Economic and Business Research, Population Program, Florida Statistical Abstract 2007, Gainesville, FL, 919 p.*

[3]*Jefferson County figures represent the estimated NWFWMD share, approximately 60% of the county total.*

[4]*Population figures are not limited to the St. Marks River watershed area.*

Other potential sources of pollution include marinas, vessels, and boat ramps. Marinas are currently located in St. Marks, Panacea, and Shell Point. The Clean Vessel Act of 1992 prohibits discharge of raw sewage into fresh water or coastal salt-water. Under the Act, FDEP administers federal grant funding for construction and installation of sewage pump-out facilities and floating restrooms at marinas, purchase of pump-out boats, and educational programs for boaters. The FDEP also administers the Florida Clean Marina Program[3] to raise awareness of environmentally friendly practices to protect Florida's waterways and offers a "clean" designation for marinas, boatyards, and marine retailers that commit to using appropriate best management practices. None of the major marinas in the basin have pump-out facilities or Clean Marina designations.

[3] www.dep.state.fl.us/cleanmarina/CVA/default.htm

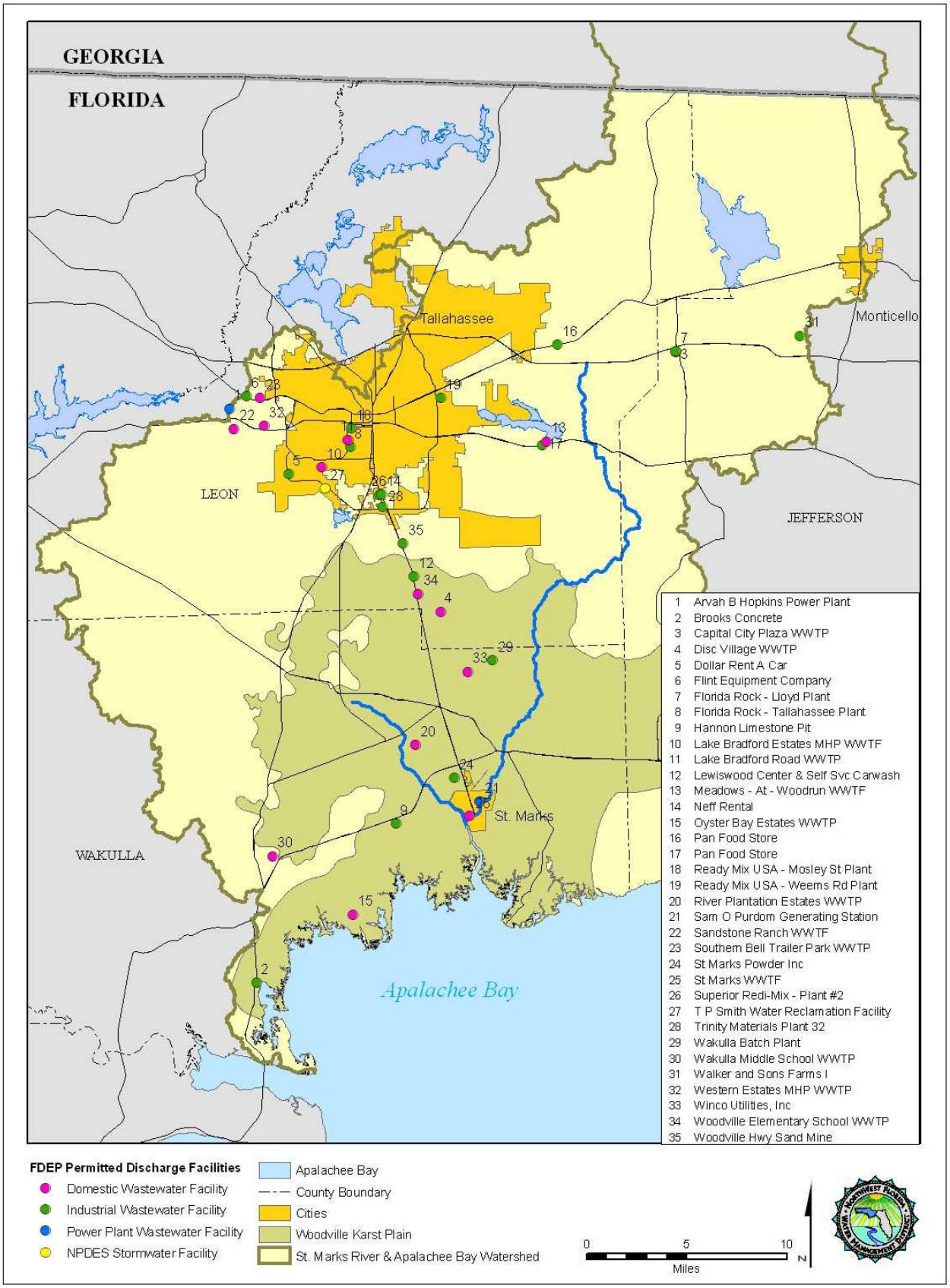

Figure 5. Point Source Discharges in the St. Marks River Watershed

3.2 Natural Systems

Wetland and Aquatic Habitats

The St. Marks River watershed includes a diverse association of upland, wetland, and aquatic ecosystems (Wolfe *et al*. 1988; Lewis *et al.* 2009). Fresh water aquatic habitats include the streams, lakes, springs, and sinks described above. Approximately 30% of the watershed consists of wetlands, as estimated from National Wetland Inventory data (Figure 7). Among these are wet pine flatwoods, bottomland hardwood forests, seepage swamps, and tidal freshwater and salt marshes. Wetlands provide important hydrologic, water quality, and habitat functions that have been widely described (e.g., NRC 2001, and many others). It should also be noted that upland ecosystems are integrated with and vital to the health of wetland and aquatic systems. Intact terrestrial communities, for example, regulate the storage and discharge of water, provide buffer areas protective of water quality, recharge ground water systems, and provide corridors necessary for the sustainability of wildlife and plant communities.

Apalachee Bay supports one of the most extensive continuous seagrass systems in the United States (Figure 7) (Lewis *et al.* 2009; FDNR 1988). Much of this system is encompassed within the Big Bend Seagrasses Aquatic Preserve (FDNR 1988). Nearshore waters are also substantially protected by the St. Marks National Wildlife Refuge. These habitats support wintering migratory waterfowl and many marine organisms, including juvenile Ridley sea turtles and commercially and recreationally important fish and shellfish. Seagrasses beds are among the most important ecological components of the estuary. They may, however, be readily affected by water quality degradation and physical impacts from prop scarring (Handley *et al*. 2007 and Sargent *et al*. 1995)). Lewis *et al.* (2009) reports on historical seagrass coverage data for Apalachee Bay. The data are indicative of a decline in seagrass area; however, there are uncertainties with the use of these data with respect to identification of long term trends.

The St. Marks National Wildlife Refuge and other public and private conservation lands provide a substantial buffer system that helps to protect water quality, provide flood protection, and sustain integrated terrestrial and aquatic ecosystems. The buffer also helps to protect inland areas from major storms and allows natural systems to adapt to sea level rise and climate-related change.

The upper reach of the Wakulla River has experienced extensive invasion by non-native aquatic plants. This has diminished native plant cover and stressed aquatic species. Hydrilla (*Hydrilla verticillata)* growth substantially impacted the ecosystem and may have contributed to the disappearance of native apple snails and the limpkin population that feeds on them (Loper *et al*. 2005). Intensive efforts have been undertaken to remove hydrilla, including chemical treatment and mechanical harvesting. Long-term maintenance will be needed to keep the plant under control. Invasive aquatic plants are also a problem on the St. Marks River, notably hydrilla, water hyacinth (*Eichhornia crassipes)* and water lettuce (*Pistia stratiotes)* (FDEP 2003).

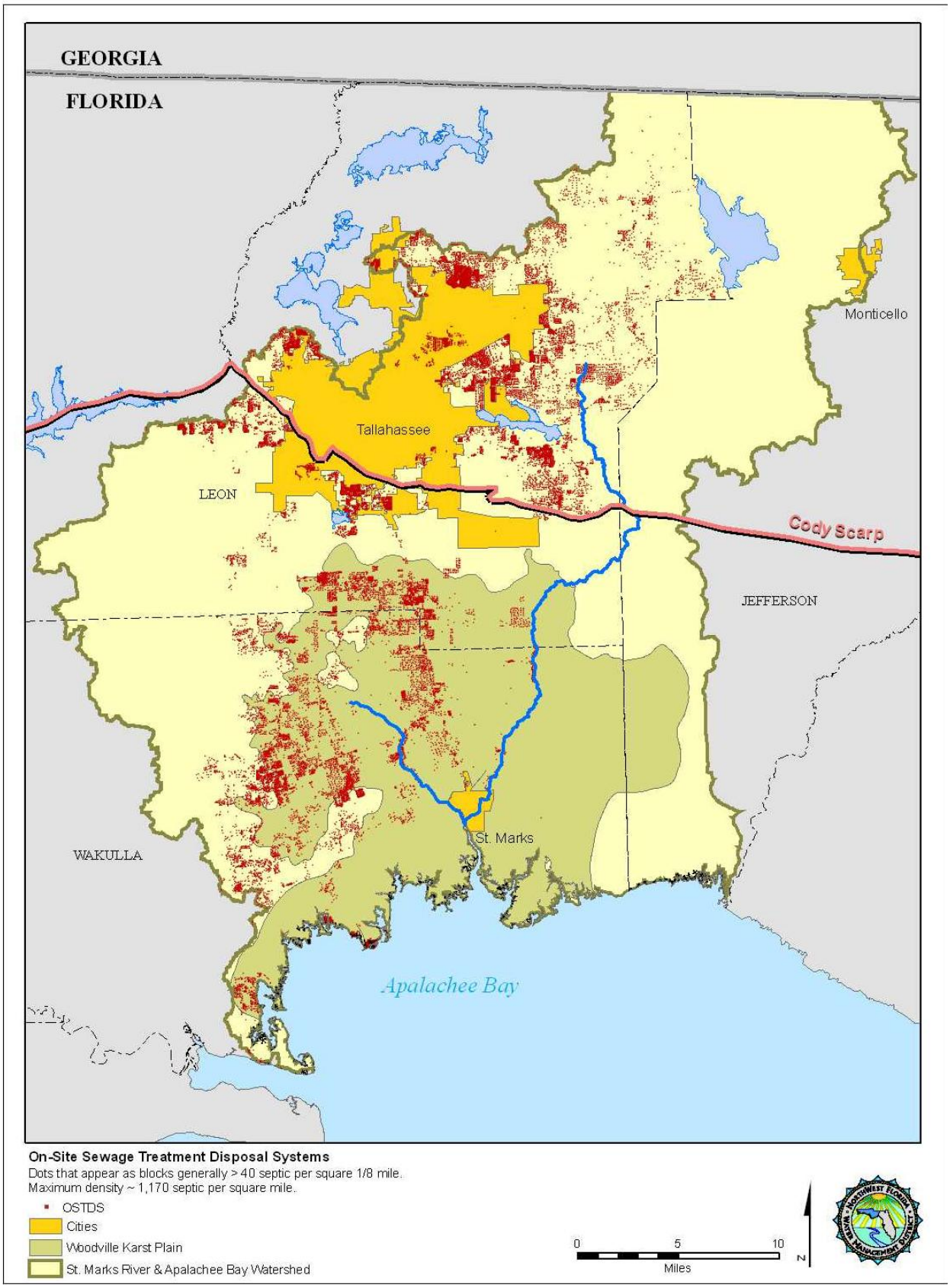

Figure 6. Distribution of On-Site Sewage Treatment and Disposal Systems

Freshwater Needs

The District has a minimum flows and levels (MFL) schedule for high priority water bodies.[4] This schedule and priority list includes Wakulla Springs within the St. Marks River Watershed. Wakulla Springs was added to the list when Florida Statutes directed the District to include all first magnitude springs on the MFL priority list. However, rather than develop an MFL, the District may elect to reserve the flows from the spring through formal adoption of a reservation. A reservation of all flows less previously permitted consumptive uses may be more protective than establishment of minimum flows, which may be too low to sustain or protect the system. Cumulative consumptive withdrawals across the region largely reflect groundwater withdrawals by local water supply utilities. These withdrawals are not expected to significantly affect total spring discharge. Further study through application of groundwater models developed for the basin is expected to provide a better understanding of the cumulative effects of withdrawal on spring flow. In order to quantify or at least depict the extent that freshwater flow from Wakulla Springs and the St. Marks River supports downstream aquatic systems, a freshwater needs assessment is ongoing. The Wakulla and St. Marks rivers support a significant estuarine aquatic system as well as freshwater riverine aquatic ecosystems. The extent that these freshwater sources influence the salinity and temperature distribution downstream has not been very well studied. The physical characteristics of the St. Marks River estuary have only recently been measured to better understand this flow system. The freshwater needs assessment will therefore take a closer look at the freshwater inputs from the St. Marks and Wakulla rivers to determine the influence freshwater flows have on the system downstream to the estuary.

3.3 Flood Protection

Flood protection needs within the St. Marks River watershed are closely related with stormwater management, as well as land use planning and land development regulation. Thus, for both retrofit and new development, flood protection and water quality treatment efforts must be closely coordinated through protection of floodplains, wetlands, natural hydrology, and recharge. Where necessary and appropriate, both retrofit needs and stormwater management for new development should be addressed through construction of facilities that provide both flood protection and water quality treatment.

To facilitate protection of floodplain and wetland resources, development of improved flood maps and elevation data are ongoing. These needs are being addressed through a cooperative effort between the District and FEMA to accurately identify flood hazards through the Flood Hazard Map Modernization program, the SWIM program, storm surge modeling, and other cooperative efforts. Additionally, ongoing land acquisition efforts serve to protect floodplains, wetlands, and associated public benefits. Restoration efforts implemented through SWIM and wetland mitigation also help restore natural hydrology, with benefits for flood protection, habitat, and water quality. Finally, implementation of the Environmental Resource Permitting (ERP) program in northwest Florida will help ensure flood protection is addressed in an integrated manner with water quality protection.

[4] www.nwfwmd.state.fl.us/rmd/mfl/mfl.htm

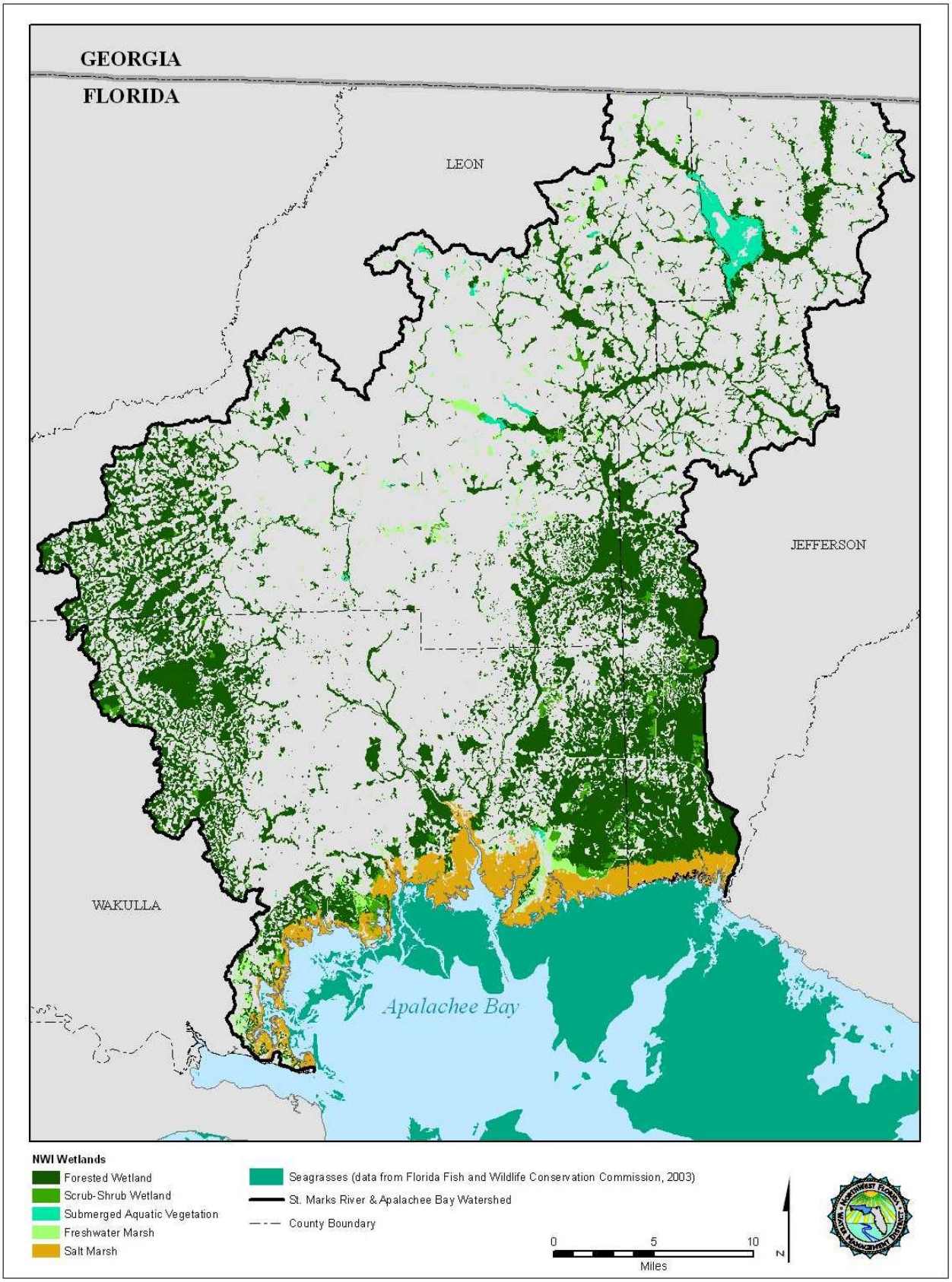

Figure 7. Wetland and Aquatic Habitats in the St. Marks River/Apalachee Bay Watershed

4.0 MANAGEMENT ACTIONS

Based on consideration of watershed conditions as outlined above, priority objectives for the St. Marks River watershed SWIM Plan are:

- Water quality protection and improvement, with a primary focus on prevention and abatement of nonpoint source pollutant loading.
- Natural systems protection, enhancement, and (as necessary) restoration.
- Flood protection, with a focus on protecting and restoring floodplain areas and functions.

Addressing these priorities will help accomplish the SWIM Plan goal as outlined in Chapter 1.4:

> *The St. Marks River watershed shall be managed to ensure the long-term sustainability of watershed resources, values, and functions. This shall encompass preservation and, where necessary, restoration of ecosystem health and integrity.*

While watershed needs and management strategies span the responsibilities and programs of a number of federal, state, and local agencies, the recommended actions discussed below are points of entry in which the SWIM program may best contribute to the overall watershed management effort. It should be noted that the management strategies described provide an umbrella for numerous, site-specific projects that may be ongoing at any given time. For the purpose of this plan, management actions are defined as "tactics" in recognition of the applicability of the encompassed approaches for a broad array of sites and conditions.

Table 3 describes objectives, strategies, and general indicators under the SWIM program for addressing the watershed priorities described above. Descriptions of individual management tactics that may be implemented to achieve these objectives follow. Due to the inherently interrelated and interactive nature of these objectives, the strategies and tactics listed generally apply to multiple objectives.

Table 3. Objectives and General Strategies

Objectives	***General Strategies***
Water quality protection and improvement	• Reduce nonpoint source pollution watershed-wide through stormwater planning, retrofit and related activities. • Support efforts to more effectively treat and reuse wastewater and stormwater.
Natural systems protection, enhancement, and restoration	• Protect, enhance, and (as necessary) restore wetlands, aquatic habitats, and riparian and upland buffer areas. • Develop an improved understanding of the freshwater inflow needs of riverine and estuarine ecosystems.
Flood protection – protect and restore floodplain area and function	• Develop/ distribute improved flood maps and topographic data. • Protect and restore floodplain areas and functions. • Implement stormwater retrofit projects to address flood protection in an integrated manner with water quality improvement.

Individual tactics that may be employed to implement these strategies are described below. Due to the inherently interrelated nature of the objectives, most tactics are applicable to multiple objectives. Relationships of the prescribed tactics to SWIM plan objectives are listed in Table 4. Potential funding alternatives are listed. General descriptions follow.

Table 4 also identifies the importance of key watershed protection and restoration strategies for water supply. Particularly in the St. Marks River watershed, where surface waters and major water aquifers interact as a single system, watershed management is essential for sustaining public water supplies. Additional information may be found in the current water supply assessment (NWFWMD 2008).

Table 4. Management Tactics and Funding Options

Management Tactics	*Water Quality*	*Natural Systems*	*Flood Protection*	*Water Supply*	*Funding Alternatives*
Resource characterization	✓	✓	✓	✓	• SWIM • State appropriation • Federal grants
Hydrologic data collection and monitoring	✓	✓	✓	✓	• SWIM • State funding • Federal grants
Freshwater needs assessment	✓	✓			• SWIM
Local stormwater planning assistance	✓	✓	✓		• Local governments • SWIM
Construction of stormwater retrofit facilities and implementation of BMPs	✓	✓	✓		• Local governments • SWIM • Florida Forever • Federal grants
Integration of Flood Hazard Map Modernization	✓	✓	✓		• Federal (FEMA) • SWIM
Preservation of critical lands and habitats	✓	✓	✓		• Local governments • Florida Forever • USDA programs • Private landowners and initiatives
Ecological restoration	✓	✓	✓		• Local governments • SWIM • Private landowners and initiatives • FDOT Mitigation • Federal grants

Management Tactics	*Water Quality*	*Natural Systems*	*Flood Protection*	*Water Supply*	*Funding Alternatives*
Public education and outreach	✓	✓	✓	✓	• Local governments • SWIM
Reuse of reclaimed water	✓	✓		✓	• Local governments • WPSPTF • SWIM • Florida Forever • Federal

* USDA – U.S. Department of Agriculture;
FEMA – Federal Emergency Management Agency;
WPSPTF – Water Protection and Sustainability Program Trust Fund;

Resource characterization – Due to the complexity of the St. Marks River watershed, an improved understanding of its characteristics (hydrology, water chemistry, and ecology) is essential to define appropriate strategies and implement successful management actions. Lewis *et al.* (2009) have drafted the most recent characterization under the SWIM program.

Hydrologic data collection and monitoring - Ongoing monitoring of conditions and trends improves understanding of resource characteristics and allows for adaptive management and assessment of plan implementation. Monitoring as previously described in Chapter 1.4 continues for Wakulla Springs, for basin delineation, hydrologic analyses and water quality. This program is integrated with other programs, including water supply planning and assessment, consumptive use permitting, the FDEP-funded springs initiative, and development of detailed topographic data using LiDAR technology.

Freshwater needs assessment: An important aspect to the conditions and management needs of the watershed is the role freshwater inflows from the Wakulla and St. Marks rivers have in supporting downstream aquatic ecology. Application of modern electronic measuring equipment and hydrodynamic modeling technology will help quantify freshwater flow needs of the estuarine system. Model development and analyses will be applied to improve the understanding of how freshwater flows from Wakulla Springs and the St. Marks River affect the downstream salinity distribution in the estuary. Cumulative effects on the estuarine system of potential future withdrawals then can be better evaluated. This analysis should quantify the extent of the downstream area affected by freshwater inflow and also relate to the discharge of freshwater from Wakulla Spring and other springs in the watershed. Further analysis utilizing recently developed groundwater models of the Floridan Aquifer by the USGS and others is also needed and planned to better understand the cumulative effects of groundwater withdrawals on spring flows during droughts or low flow periods.

Local stormwater planning assistance – Local stormwater master planning is important to the prevention of new sources of runoff and pollutant loading and to the abatement of existing NPS pollution. Stormwater plans detail the contributing areas of land-generated pollutant sources, water quality and flooding challenges, and identify priority projects and funding options. Structural and nonstructural approaches to resource protection are incorporated, depending on landscape characteristics, existing land use, and approved future land uses. Leon County and the City of Tallahassee have stormwater plans that address water quality. Wakulla County and the City of St. Marks have indicated a need to initiate development of stormwater plans.

Construction of stormwater retrofit facilities and implementation of BMPs – Development of regional and other priority retrofit facilities is essential for addressing existing NPS pollutant loading, addressing flooding issues, and restoring hydrologic conditions where necessary. Widespread implementation of best management practices, ideally implemented through a treatment train approach, maintains localized on-site hydrology and water quality and cumulatively benefits water quality and natural storage function throughout the watershed.

Integration of Flood Hazard Map Modernization Program – Modern and accurate floodplain maps and detailed topographic data will help improve resource protection on the part of the District, local governments, and other agencies. The data are directly applicable for stormwater management, floodplain delineation and protection, and restoration and protection of wetland and floodplain functions. As noted above, the District is working with FEMA to develop Digital Flood Insurance Rate Maps (DFIRMS) for the St. Marks River watershed. New DFIRMS have been developed for Leon County, and map development for Jefferson and Wakulla counties will continue through 2009. The DFIRMS will be publically available in electronic format.

Preservation of critical lands and habitats – Through the SWIM program, District staff will identify and map priority areas for land and habitat protection. Groundwater recharge areas, wetlands, floodplains, and riparian habitats must be protected in order to sustain and improve the quality and natural function of springs, rivers, and other water resources in the basin. Associated with the protection of lands are other public resource benefits, including fish and wildlife, recreational and aesthetic resources, public health benefits, useable surface and ground water resources, environmental resiliency, and the economic benefits of all of these.

Priority habitats and areas for preservation may include:

- Protective buffers along riparian areas and karst features, including mapped underlying cave systems
- Wetlands and floodplains
- Critical recharge areas
- Springs
- Potential wetland mitigation sites

Implementation may be achieved through a variety of nonstructural measures:

- Developing a land acquisition plan for protection of water resources and functions
- Coordination of planning initiatives which direct land acquisition initiatives
- Acquisition of conservation lands and easements, with emphasis on public access together with resource protection, enhancement, and restoration
- Private landowner initiatives
- Public education and outreach

Ecological restoration – Basin-wide priorities for restoration of existing resources may be indentified through monitoring, local knowledge, remote sensing, and onsite surveys. Watershed resource restoration is inclusive of wetland, lake, hydrologic, floodplain, vegetation, and aquatic habitat restoration. Potential restoration projects may include removal of sediments from Lake Munson and elimination of legacy pollutant loading affecting this waterbody; stream, wetland, and riparian habitat restoration; and mitigation projects.

Public education and outreach – Public education and outreach efforts are important to all aspects of watershed resource protection. Information may be provided through a variety of media, including the Internet, brochures, documents, presentations, and participation in public events.

Topics may include personal practices for preventing NPS pollution and preservation of critical habitats on private lands. Modern flood maps will be made available to the public, as well as to local governments and others. Additionally, public education and awareness efforts concerning watershed management help to develop public support for watershed initiatives through enhanced understanding of the issues involved and management approaches.

Reuse of reclaimed water – Treated wastewater and stormwater may prove to be feasible as a resource for landscape irrigation, agricultural crops, and other non-potable water needs. In addition to reducing demand on potable water supply sources and maximizing efficiency, reuse of reclaimed water may provide benefits for water quality and may enhance water available for natural systems when properly applied. Due to treatment requirements and distribution of reclaimed water over a wider treatment area, for example, reuse can reduce watershed loading of nutrients and other pollutants. Additionally, reuse distribution can increase beneficial ground water recharge over a relatively broad area of the watershed. Future reuse application should be located within suitable areas based on hydrogeologic and land use considerations. Additional needs include appropriate application and careful monitoring.

5.0 IMPLEMENTATION FUNDING AND ANNUAL WORK PLAN

Funding is budgeted annually for implementation of SWIM projects. An annual work plan of planned and project level funding for SWIM plan implementation is provided under separate cover and included within Chapter VIII of the District's March 1st Consolidated Annual Report.[5]

By working through complementary programs, as described above, SWIM plan implementation integrates and leverages a variety of funding sources. Direct funding to the District may be provided from:

- Water Management Lands Trust Fund, s. 373.59 F.S.
- Water Protection and Sustainability Program Trust Fund (if funded by the Legislature for SWIM), 403.890 F.S.
- Florida Forever Trust Fund (construction only), s. 259.1051 F.S.
- Legislative special appropriations, s. 373.459 F.S.
- Local government funding
- Florida Springs Initiative
- Other state and federal grant funds such as the 319H grant program.

Associated program funding, which complements and furthers implementation of this plan, may be indirectly provided by:

- Florida Department of Transportation mitigation funding, where appropriate, 373.4137 F.S.
- Water Protection and Sustainability Program Trust Fund, Alternative Water Supply (for construction of reuse facilities, and potentially other alternative water supply and water resource development projects), s. 373.1961 and s. 403.890 F.S.
- Environmental Resource Permitting Program (ERP), s. 373.4145 F.S. and s. 62-346, F.A.C.
- Federal Emergency Management Agency (FEMA) Map Mod

[5] www.nwfwmd.state.fl.us/pubs/consolidatedAR/consolAR.html

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APPENDIX: RELATED AND SUPPORTING INITIATIVES

Local Initiatives

a) **Leon County** — In 1992 Leon County initiated an **Aquifer Protection Program**, as specified in its Aquifer/Wellhead Protection Ordinance, to prevent contamination of the aquifer in Leon County. In 2005, the county updated its Aquifer Protection Code: www.talgov.com/you/water/pdf/aquifer_protection_code_2006.pdf.

Leon County has also completed the Leon County **Aquifer Vulnerability Assessment** (LAVA) to provide a science-based management tool to help minimize adverse impacts on ground-water quality. Additional information may be found at www.adgeo.net/lava.php.

The City of Tallahassee in 2006 signed an agreement to invest more than $160 million over six years to convert two wastewater facilities to **advanced wastewater treatment**, reducing the flow of nutrients into Wakulla Springs by 75 percent and significantly improving the quality of reuse water.

In 2008 the City of Tallahassee enacted a **pet waste ordinance** that requires pet owners to remove and properly dispose of their pet's fecal matter from public areas (Ordinance Number 08-O-23AA). This was a response to concern about coliform bacteria reported in area waters.

In 2009 the City of Tallahassee adopted a **fertilizer use ordinance** that sets forth specific management guidelines to minimize environmental effects. The ordinance requires training and licensing of applicators (Ordinance Number 08-O-72AA).

Amendments to the Tallahassee-Leon County Comprehensive Plan that provide further watershed protections were adopted in January 2009. Local ordinances to implement policies of the Comprehensive Plan are under development. City and county government have already adopted ordinances establishing a **Primary Springs Protection Zone**, to become effective upon the effective date of the Comprehensive Plan amendments.

The Tallahassee–Leon County **Watershed Protection Initiative** is seeking to address flood control and watershed protection through stormwater capital improvement projects. The Initiative is under the guidance of the Watershed Management Policy Board, established to coordinate watershed management plans of the City of Tallahassee and Leon County. Both Lakes Munson and Lafayette are included in the capital improvement plan. For more information, see www.leoncountyfl.gov/wpi/home.html.

Tallahassee-Leon County **Blueprint 2000** pledged to protect Lake Munson and Lake Lafayette through funding from a local option one cent sales tax. Included in the plan are several projects for stormwater improvement to these lakes and associated waterways. The plan also includes projects for ground water and floodplain protection. For more information, see www.blueprint2000.org/home.html. Additionally, as noted above, Blueprint 2000 has entered into agreement with the District to jointly pursue environmentally sensitive lands in the St. Marks River watershed for acquisition.

b) **Wakulla County** — In July 1994, Wakulla County passed the **Wakulla Springs Water Quality Protection Ordinance**. The ordinance requires registration of regulated substances in the special planning area and provides for inspection, containment, reporting, cleanup and monitoring. In April 2008, the county expanded the Springs Special Planning Area to include additional areas that have a demonstrated connection to the Wakulla Springs cave system.

An **aquifer vulnerability assessment** is under development in Wakulla County by Advanced GeoSpatial Inc. Version 1.3 is under review with the Florida Geological Survey, and when finalized will be available on the FGS web site.
www.dep.state.fl.us/geology/programs/hydrogeology/hydro_index.htm

In 2006 the county passed a **wetlands protection ordinance**. Ordinance 06-27 identifies allowable and conditional uses of wetlands and wetland buffer zones, establishes a 75 foot natural buffer zone, provides for variances, establishes design standards, and provides for enforcement and penalties.

Wakulla County Ordinance 2006-58, also passed in 2006, revised the comprehensive plan to protect and improve water quality. Among other things, the ordinance requires **performance-based treatment systems** (PBTS) that remove a higher level of nitrogen (treatment standard is 10 milligrams per liter) for onsite wastewater treatment and disposal for all new construction. Existing septic tanks and package treatment plants are to discontinue service if central sewer is made available or be replaced with performance-based treatment systems when they fail. All septic systems, new and existing, are to be inspected every three years by a licensed contractor. Standards and guidelines are established for central wastewater treatment facilities in this ordinance.

On behalf of Wakulla County, Harrington and Guo's 2007 work was an effort to provide citizens and officials with the best available information for decision making regarding the use of onsite sewage treatment and disposal systems and decentralized wastewater systems in order to reduce nutrients in ground water flowing to Wakulla Springs.

The 2006 ordinance also: adds **karst buffers**; requires a nitrate loading study for any proposed development greater than one acre; incorporates practices of the Florida Yards and Neighborhoods Program and landscaping standards that promote native vegetation for new subdivisions; reduces nitrates from public facilities; and, addresses stormwater, water conservation, wastewater facilities, treated wastewater reuse, and natural water flows.

The County's January 2008 **Evaluation and Appraisal Report** specifies several areas of the Land Development Code, the Comprehensive Plan and intergovernmental coordination to be addressed to protect environmental resources. Among the needed actions are monitoring impacts of multi-state water transfers; inventory of water, sewer and stormwater systems; countywide stormwater planning; a master plan for centralized or retrofit sewer systems; strengthening buffer regulations; a coastal management plan; preservation of habitat corridors; and, promoting smart development methods.
www.mywakulla.com/docs/EAR/WakullaCountyRevisedEAR.pdf

Wakulla County, in cooperation with the District, is funding the Wakulla Gardens Stormwater Project, an NPS water quality improvement and stormwater management plan for this historic subdivision.

c) **Jefferson County** — The county's **comprehensive plan** requires a 100 foot buffer around sinkholes and caves to protect ground water. Drainage wells are not allowed that dispose of stormwater into recharge areas of potable water aquifers. Untreated stormwater discharge is not allowed into natural water bodies; however, septic systems continue to be allowed in flood areas. Buffer widths of 100 feet are required for rivers, streams and lakes.

State and Regional Initiatives

a) **Total Maximum Daily Load (TMDL) Program** — The federal Clean Water Act, Section 303(d), is implemented in Florida under FDEP's TMDL program to check that surface waters meet water quality standards. The process includes assessing water quality, listing impaired waters, adopting TMDLs, determining pollutant sources, and implementing strategies to reduce pollution. TMDLs are the thresholds of pollutants that a water body can assimilate and still maintain water quality standards. FDEP's 2002 listing of impaired waters included 16 water bodies in the St. Marks River and Apalachee Bay watershed, and that may increase to 24 under proposed list revisions. TMDLs have not yet been developed for the watershed. www.dep.state.fl.us/water/tmdl/index.htm

b) **State Lands** — The State of Florida has acquired 2,590 acres along the upper St. Marks River corridor for a new state park. The State plans to protect additional lands in this area through fee simple acquisition under the Upper St. Marks River Corridor Florida Forever Project. Additional acquisitions have increased the size of Edward Ball Wakulla Springs State Park to 6,055 acres. Nearby, the Wakulla State Forest has been established and is now 4,219 acres. Additional lands may be acquired through the Wakulla Springs Protection Zone Florida Forever Project.

c) The **Florida Aquifer Vulnerability Assessment** is a GIS-based model developed by the Florida Geological Survey to show the relative probability that an aquifer could become contaminated from activities on the land surface. The maps are useful in guiding land use decisions and in identifying ground water recharge areas in need of protection. www.dep.state.fl.us/geology/programs/hydrogeology/fava.htm

d) A **Sensitive Karst Areas** map was developed by Florida Geological Survey for use in the *Environmental Resource Permit Applicant's Handbook - Volume II, Engineering Requirements for Stormwater Treatment and Management Systems - Water Quality and Water Quantity*. The map is used when siting proposed stormwater ponds and establishes additional design criteria for these structures. The designated area covers most of Leon and Wakulla counties.
www.dep.state.fl.us/geology/programs/hydrogeology/hydro_resources.htm#Sensitive_Karst_Areas

e) The multi-agency **Florida Springs Task Force** was formed in 1999 with support of the Governor and Florida Legislature to address declines seen in many of the state's springs. The manual *Protecting Florida's Springs: Land Use Planning Strategies and Best Management Practices* was developed to inform land use decision makers on

strategies for protection and restoration of springs and specifies permitting considerations for karst areas (FDCA and FDEP 2002). In 2001, the **Florida Springs Initiative** within FDEP was established as a comprehensive, coordinated program to increase protection of the state's springs. www.floridasprings.org

f) The **Big Bend Seagrasses Aquatic Preserve** is initiating seagrass monitoring in eastern Apalachee Bay, between the St. Marks and Aucilla rivers. Twenty five fixed sites will be monitored every other year, gathering various measurements (Charbonneau 2008).

g) The new **Urban Turf Fertilizer Rule** of the Florida Department of Agriculture and Consumer Services requires that fertilizer products for urban lawns and sports turf limit the amounts of nitrogen and phosphorous to that needed for healthy turf maintenance. This should reduce nutrients entering our water resources. www.flaes.org/complimonitoring/fertilizer.html

h) **Coastal Change Planning** — The Century Commission for a Sustainable Florida is developing technical information, recommendations, and policy proposals related to climate change, emerging sustainability technologies, and coastal resiliency in Florida. Related documents and information are at www.centurycommission.org/current_projects.asp. Two publications to assist community leaders and planners address the vulnerability of coastal areas and water resources have been developed by the Texas Coastal Watershed Program: *The Resilient Coast: Policy frameworks for adapting the built environment to climate change and growth in coastal areas of the U.S. Gulf of Mexico*[6], and *The Resilient Coast: Policy frameworks for adapting the Wetlands to climate change and growth in coastal areas of the U.S. Gulf of Mexico*[7].

[6] www.urban-nature.org/publications/documents/TheBuiltEnvironment08-sm_000.pdf
[7] www.urban-nature.org/publications/documents/ResilentCoastWetlands-sm.pdf

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