St. Marks River and Apalachee Bay

Surface Water Improvement and Management Plan

November 2017

Program Development Series 17-03

Northwest Florida Water Management District

St. Marks River and Apalachee Bay Surface Water Improvement and Management Plan

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Cover Photograph: St. Marks River Rise (NWFWMD)

Executive Summary

The St. Marks River and Apalachee Bay watershed covers about 1,168 square miles of north Florida and south Georgia. The surface watershed interacts as a dynamic system with the underlying aquifers that are the source of the springs that contribute much to the baseflow of the watershed's rivers and to the character of the region. The watershed includes Florida's capital city and smaller coastal communities, as well as large undeveloped regions including forestland, extensive coastal marshes buffering the Gulf of Mexico, and state parks and public and private conservation lands that protect and sustain natural resources. Physiographically diverse, this watershed includes the red hills region of north Florida and south Georgia, sand hill remnants of historic shorelines, and large portions of the Woodville Karst Plain.

The water resources that comprise the St. Marks River and Apalachee Bay watershed provide numerous functions critical to our quality of life. The watershed's wetlands and floodplains store and regulate stormwater runoff, protecting water quality, providing flood protection, and recharging aquifers and potable water supplies. Its lakes, streams, and coastal waters sustain numerous species of fish, shellfish, and wildlife. Its springs provide extraordinary windows to the aquifer below, and the broad tidal marsh on Apalachee Bay provides shoreline stability and resiliency against storms and coastal change.

This is the second update to the St. Marks River and Apalachee Bay Surface Water Improvement and Management (SWIM) plan. The purpose of the plan is to provide a framework for resource management, protection and restoration using a watershed approach. Protecting and restoring watershed resources is a shared responsibility on the part of numerous watershed stakeholders, including local governments, state and federal agencies, private businesses, and the public. It requires building upon past accomplishments to encompass a wide range of management approaches.

Since 1997, when the St. Marks River and Apalachee Bay watershed SWIM plan was first approved, significant progress and noteworthy accomplishments have been achieved. The District published a groundbreaking study of nutrient sources affecting Wakulla Spring, and this helped lead to dramatic improvements in wastewater treatment – ultimately starting a trend toward reducing nitrogen loading within the spring contribution area. Cooperative efforts have included multiple stormwater retrofit projects to reduce nonpoint source pollution. Additionally, the District initiated development of Minimum Flows and Minimum Water Levels for Wakulla Spring, Sally Ward Spring, and St. Marks River Rise, and funding appropriated by the Florida Legislature is making possible the connection to central sewer of hundreds – ultimately thousands – of residences currently served by septic systems.

Nevertheless, significant challenges continue to affect the water quality, natural systems, and public benefits provided by watershed resources and by individual waterbodies and springs within it. Population in the basin has steadily increased over the last several decades: from 177,635 in 1990 to 263,167 in 2010, a nearly 48 percent increase over 20 years. Population over the next twenty years (2010-2030) is projected to increase more slowly at closer to 20 percent within the watershed, but with continuing changes in land use and increasing demands on wastewater and stormwater management systems. These changes require continuing cooperative efforts on the part of the state, regional and local governments, and the communities they serve. The actions taken now serve to both address current problems and continue to build the foundation for future efforts.

Strategies identified in the plan include continuing to address both point and nonpoint source pollution to better protect and restore water quality in surface waters and associated groundwaters. There are continuing needs to improve water quality and restore habitat within Wakulla Spring, to restore inland waters, and to better manage stormwater and wastewater in a manner appropriate to a karst landscape.

Additionally, emerging issues affecting water and habitat quality in Apalachee Bay demand resource protection and restoration actions both within the estuarine system and the contributing watershed.

Addressing these challenges requires a wide range of strategies. Among these are additional improvements in the treatment and management of stormwater runoff; implementation of best management practices for agriculture, silviculture, and construction activities; and continued advances in wastewater treatment and management. To complement these efforts, long-term protection of critical habitats and associated buffer areas is needed. Public outreach and education, monitoring, and analysis are needed in support of all of these. Projects identified in the plan are listed in the table below:

Recommended Projects: St. Marks River and Apalachee Bay SWIM Plan

Stormwater Planning and Retrofit
Septic Tank Abatement
Advanced Onsite Treatment Systems
Woodville Karst Springs Water Quality Protection and Enhancement
Agriculture and Silviculture BMPs
Riparian Buffer Zones
Aquatic, Hydrologic, and Wetland Restoration
Estuarine Habitat Restoration
Strategic Land Conservation
Watershed Stewardship Initiative
Sub-basin Restoration Plans
Wastewater Treatment and Management Improvements
Interstate Coordination
Analytical Program Support
Comprehensive Monitoring Program

To further implementation of priority projects, the plan outlines a range of available funding resources. Given the fact that funding sources change over time, it is intended to be adaptable to evolving programs and resources.

Addressing the issues outlined in this plan and implementation of the strategies described requires a long-term, comprehensive approach with continuing collaboration between state and federal agencies, local governments, nonprofit initiatives, regional agencies, private businesses, and members of the public. Additionally, while this plan is focused primarily on water quality and associated resources and benefits, it should be recognized that it fits within a wider range of resource management programs, including those focused on aquatic plant management, public access and recreation, fish and wildlife resources, and floodplain management.

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Abbreviations and Acronyms

ARPC	Apalachee Regional Planning Council
AWT	Advanced Wastewater Treatment
BMAP	Basin Management Action Plan
BMP	best management practice
cfs	cubic feet per second
CWA	Clean Water Act
DO	dissolved oxygen
EPA	U.S. Environmental Protection Agency
EPD	Georgia Environmental Protection Department
ERP	Environmental Resource Permitting
°F	Degree Fahrenheit (temperature)
F.A.C.	Florida Administrative Code
FDACS	Florida Department of Agriculture and Consumer Services
FDEC	Florida Demographic Estimating Conference
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FGS	Florida Geological Survey
FNAI	Florida Natural Areas Inventory
F.S.	Florida Statutes
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Fish and Wildlife Research Institute
GEBF	Gulf Environmental Benefit Fund
GEMS	Gulf Ecological Management Site
GIS	Geographic Information Systems
HAB	harmful algal blooms
I-10	Interstate 10
IWR	Impaired Surface Waters Rule
MFLs	minimum flows and minimum water levels
mgd	million gallons per day
MS4s	municipal separate storm sewer systems
NFWF	National Fish and Wildlife Foundation
NPL	National Priority List
NPS	nonpoint source
NRC	National Research Council
NRCS	Natural Resources Conservation
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRDA	Natural Resource Damage Assessment
NWFWMD	Northwest Florida Water Management District
NWS	National Weather Service
NWR	National Wildlife Refuge
OFWs	Outstanding Florida Waters
OSTDS	onsite sewage treatment and disposal systems
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (Act)
SAV	submerged aquatic vegetation
SEAS	Shellfish Environmental Assessment Section
SHCA	Strategic Habitat Conservation Area
SIMM	Seagrass Integrated Mapping and Monitoring
SMZs	Special Management Zones
STCM	Storage Tank and Petroleum Contamination Monitoring
SWIM	Surface Water Improvement and Management
SWTV	Surface Water Temporal Variability
TMDL	total maximum daily load
TN	total nitrogen
TNC	The Nature Conservancy
TPS	Thomas P. Smith Water Reclamation Facility
TRRF	Tram Road Reuse Facility
UF-IFAS	University of Florida Institute of Food and Agricultural Sciences
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOC	U.S. Department of Commerce
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WBID	waterbody identification number
WMA	water management area
WWTF	wastewater treatment facility

1.0 Introduction

Beginning in southern Georgia and extending through Florida's Big Bend region, the St. Marks River and Apalachee Bay watershed includes the St. Marks River, the Wakulla River, and Apalachee Bay, as well as their tributaries and drainage areas. Within Florida, the watershed is located primarily in Leon, Jefferson, and Wakulla counties (Figures 2-1 and 2-2). The watershed also includes numerous springs, including Wakulla Spring, Sally Ward Spring, St. Marks River Rise, and the Spring Creek Springs Group. Although a small portion of the watershed is located in Georgia, the scope of this plan, for implementation purposes, is limited to the Florida portion.

The St. Marks River and Apalachee Bay watershed provides important environmental functions with numerous benefits and services for people within the watershed. Among watershed services are regulation of discharge to surface and ground waters, water storage and flood attenuation, water quality protection, cycling of energy and nutrients, groundwater recharge, erosion control, and streambank stabilization. Among the human benefits of these are usable surface and ground waters, fish and wildlife resources, recreational opportunities, aesthetic characteristics, and associated economic benefits.

In the St. Marks River and Apalachee Bay watershed, major stakeholders include:

- Northwest Florida Water Management District
- Florida Department of Environmental Protection
- Florida Fish and Wildlife Conservation Commission
- Florida Department of Agriculture and Consumer Services
- Florida Department of Economic Opportunity
- Apalachee Regional Planning Council
- Leon, Wakulla, and Jefferson counties
- Municipalities, including Tallahassee, St. Marks, and Monticello
- U. S. Department of Agriculture
- U.S. Department of the Interior
- U.S. Fish and Wildlife Service
- The Nature Conservancy
- The National Fish and Wildlife Foundation
- Wakulla Springs Alliance
- Apalachee Audubon Society
- Friends of St. Marks National Wildlife Refuge
- Friends of the Apalachicola National Forest
- Friends of Wakulla Springs
- Unincorporated communities, including Crawfordville, Panacea, Lloyd, Medart, Newport, Shadeville, and Shell Point
- And many others

1.1 Purpose and Scope

The Surface Water Improvement and Management (SWIM) plan for the St. Marks River and Apalachee Bay watershed is intended to provide a framework for resource management, protection, and restoration using a watershed approach. The SWIM Program is administered through the Northwest Florida Water Management District (NWFWMD) and includes management actions to address water quality, natural systems, and watershed functions and benefits. This plan is an update to the original plan, developed in 1997 and updated in 2009.

Development of the 2017 St. Marks River and Apalachee Bay SWIM Plan update (hereafter the 2017 SWIM Plan) is funded by a grant from the National Fish and Wildlife Foundation's (NFWF) Gulf Environmental Benefit Fund (GEBF), with the intent to further the purpose of the GEBF to remedy harm and eliminate or reduce the risk to Gulf resources affected by the Deepwater Horizon oil spill.

The 2009 St. Marks River Watershed SWIM Plan recognized three priority objectives that also address three of the NWFWMD's statutory areas of responsibility:

- Water quality protection and improvement, focusing on prevention and abatement of nonpoint source (NPS) pollution in the upper reaches of the basin;
- Natural systems protection, enhancement, and restoration, including stream, wetland, aquatic, and riparian and upland buffer areas; and
- Flood protection, with a focus on protecting and restoring floodplain areas and functions.

This plan continues earlier planning efforts while also addressing new issues, ongoing challenges, and opportunities for achieving watershed protection and restoration. Further, the 2017 SWIM Plan describes the watershed's physical characteristics and natural resources, provides an assessment of the watershed's current condition, and identifies priority challenges affecting watershed resources and functions. The 2017 SWIM Plan also prescribes a set of management actions and projects to meet those challenges and needs. Management actions are generally limited to those within the mission and scope of the NWFWMD SWIM program, recognizing the ongoing initiatives and needs of local communities and other agencies. The projects outlined are intended to leverage funding from many sources; integrating the efforts of local governments, state and federal agencies, and private entities to achieve mutual objectives and goals; and to present innovative solutions to watershed issues.

1.2 SWIM Program Background, Goals, and Objectives

Surface Water Improvement and Management plans have been developed pursuant to the SWIM Act, enacted by the Florida Legislature in 1987 and amended in 1989 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 authorized the state's five water management districts to:

- Develop plans and programs to improve management of surface waters and associated resources;
- Identify current conditions and processes affecting the quality of surface waters;
- Develop strategies and management actions to restore and protect waterbodies; and
- Conduct research to improve scientific understanding of the causes and effects of the degradation of surface waters and associated natural systems.

In addition to the SWIM Act of 1987, the following Florida Statutes and administrative codes support and complement the SWIM program:

- Chapter 259, F.S.: Florida Forever Act: Land Acquisitions and Capital Improvements for Conservation or Recreation
- Chapter 375, F.S.: Land Acquisition Trust Fund
- Section 403.067(7)(A)4, F.S.: Total Maximum Daily Loads (TMDLs)
- Section 373.042, F.S.: Minimum Flows and Minimum Water Levels
- Chapter 62-43, Florida Administrative Code (F.A.C.): Surface Water Improvement and Management Act
- Chapter 62-302, F.A.C.: Surface Water Quality Standards
- Chapter 62-303, F.A.C.: Identification of Impaired Surface Waters
- Chapter 62-304, F.A.C.: TMDLs

For the purposes of SWIM, watersheds are the hydrological, ecological, and geographical units for planning and managing restoration efforts along Florida's Gulf Coast. Successful watershed management requires coordination and implementation of complementary programs and projects with jurisdictions, agencies, and other stakeholders across the watershed. Among these are local, state, and federal agencies; conservation land management organizations; non-governmental organizations; and other interested stakeholders.

The SWIM program addresses watershed priorities by identifying management options and supporting cooperative project implementation. Projects may include stormwater retrofits for water quality improvement, wetland and aquatic habitat restoration, resource assessments, and wastewater management improvements, among others.

Surface Water Improvement and Management plans integrate complementary programs and activities to protect and restore watershed resources and functions. They are also designed to address water quality and natural systems challenges more broadly outlined in the District's strategic plan.

2.0 Watershed Description

2.1 Geographic and Geological Characteristics

The St. Marks River and Apalachee Bay watershed covers approximately 747,956 acres and extends from the red hills of southern Georgia through the Big Bend of Florida. Approximately 91 percent of the watershed is in Florida, with the remainder in Georgia (Figure 2-1). Within Florida, the watershed encompasses portions of Leon, Jefferson, and Wakulla counties. The focus of this plan, for implementation purposes, is limited to the Florida portion of the watershed.

St. Marks River and Apalachee Bay watershed attributes:

- Two states: Georgia and Florida
- Three Florida counties
- 25 distinct natural communities
- One of the world's largest and deepest freshwater springs
- 1,168 square miles

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. The Wakulla River, the largest tributary of the St. Marks River, is a spring-fed river that merges with the St. Marks River approximately five miles north of Apalachee Bay.

Major stream systems and hydrologic features within the watershed include the St. Marks River, its primary tributary the Wakulla River, several large and numerous small lakes, the Woodville Karst Plain, and some of Florida's most important spring systems. These are described further below.

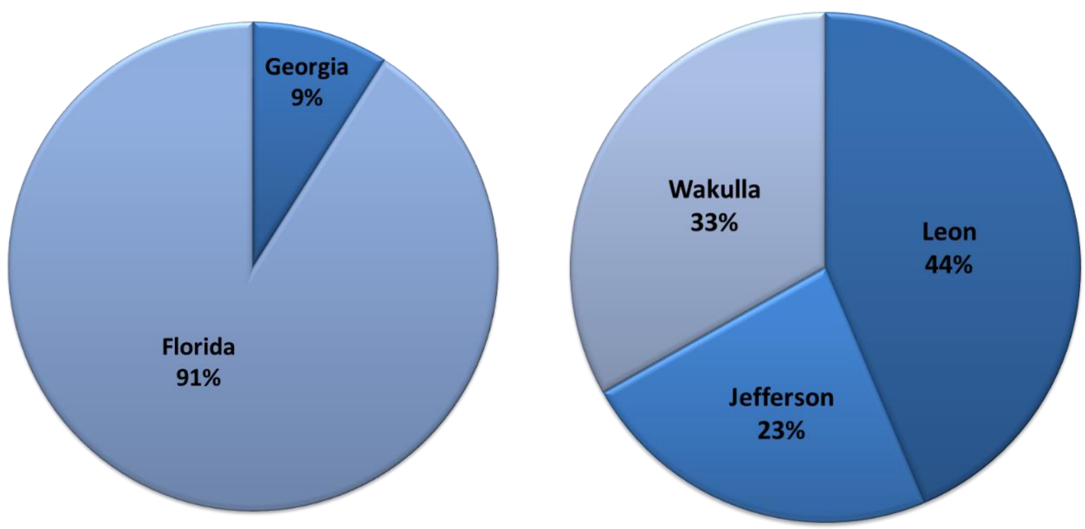


Figure 2-1 Proportion of the St. Marks River and Apalachee Bay Watershed by State and Florida Counties

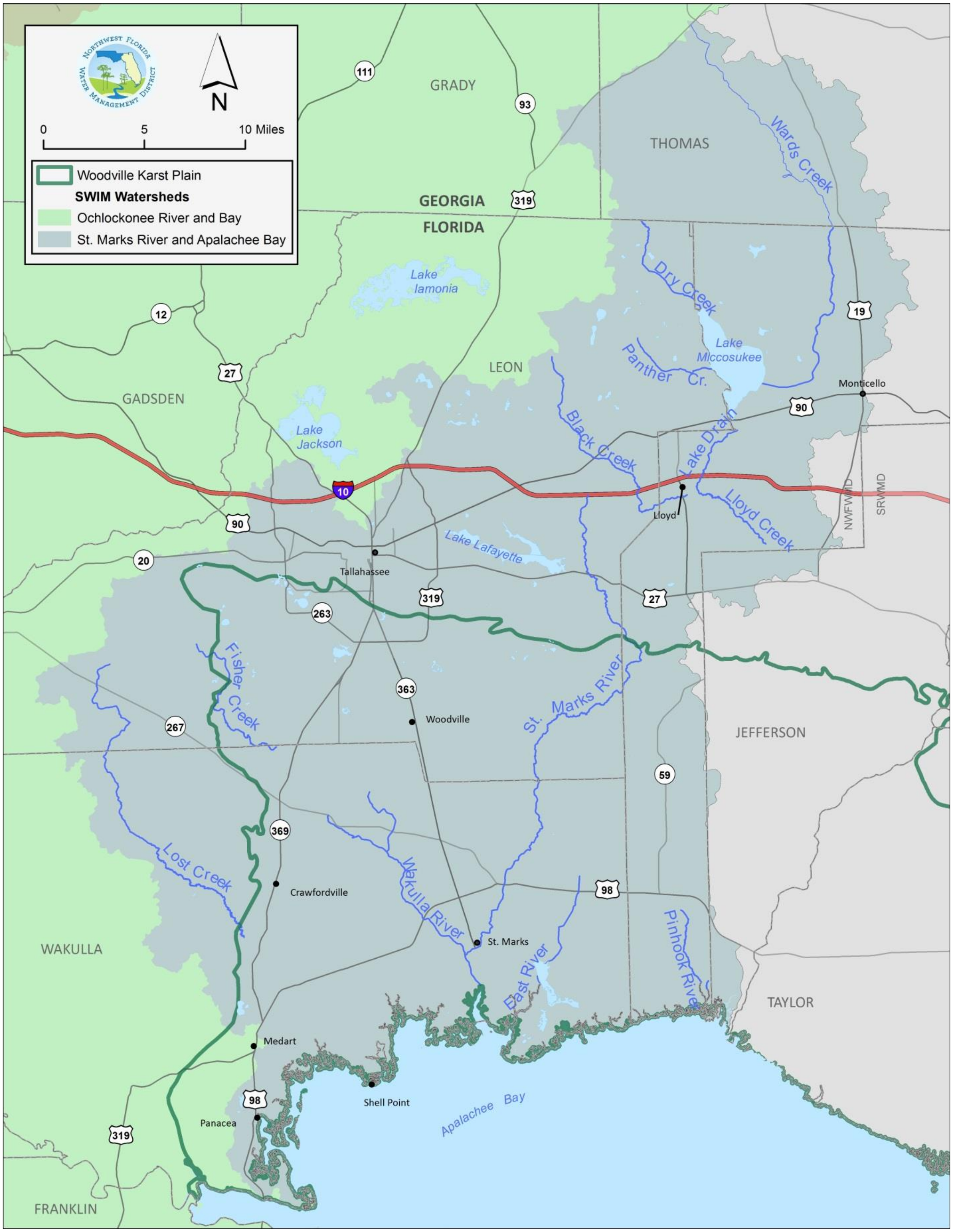


Figure 2-2 Features of the St. Marks River and Apalachee Bay Watershed

The St. Marks River and Apalachee Bay watershed is within the Gulf Coastal Plain physiographic region, characterized by gently rolling hills, ridges, and alluvial floodplains underlain by sediments of sand, gravel, porous limestone, chalk, marl, and clay. Within this greater physiographic region, the Florida portion of the watershed contains two localized physiographic regions: the Northern Highlands, north of the Cody Scarp; and the Gulf Coastal Lowlands to the south. The Northern Highlands are characterized by greater topographic relief and extensive sand and clay deposits overlying limestone bedrock. Within the watershed, this region is expressed as the Tallahassee Hills subdivision. South of the Cody Scarp, the Gulf Coastal Lowlands is an expansive, gently sloping plain dominated by karst features, regionally defined as the Woodville Karst Plain, extending to the Gulf of Mexico.

The Cody Scarp is the most prominent landform of the region's physiography, and differences in hydrology above and below the scarp influence the region's ecology. The Cody Scarp is a relict escarpment of the Pleistocene epoch, when sea level was nearly 200 feet higher than today. Due to soils of lower permeability, much of the rainfall above the Cody Scarp runs off as surface flow. Below the scarp, where confining units are thin or absent and karst features more numerous, rainwater directly recharges the Floridan aquifer with little surface runoff.

The Tallahassee Hills region is underlain by unconsolidated sand and clayey deposits of Pleistocene to Holocene age (from approximately 2.6 million years ago to present day). Beneath the surficial deposits, Miocene (23.03 to 5.3 million years before present) age clayey sediments, comprising the intermediate system, function as a semi-confining unit between the surficial sands and underlying Floridan aquifer limestones. Despite the general confinement of the aquifer in this region, hydrologic connectivity between surface waters and the Floridan aquifer exists for lakes with sinkhole features.

The watershed has three major hydrostratigraphic units: the surficial aquifer system, the intermediate system, and the Floridan aquifer system. The surficial aquifer is recharged through infiltration of rainwater and fluctuates in elevation with droughts or seasonal differences in rainfall. It is hydraulically connected to many lakes, ponds, wetlands, and streams. Below the surficial aquifer system is the intermediate system, a low permeability unit typically comprised of Miocene age clayey sediment. As described by the NWFWMD (2014), the Floridan aquifer system consists of a thick sequence of carbonate units of varying permeability, the top of which dips from the northeast to the southwest, with the elevation of the top of the system ranging from approximately 100 feet above sea level to more than 1,200 feet below sea level, where it discharges into the Gulf of Mexico.

Below the Cody Scarp, the surficial sediments and intermediate system are absent in many areas and the St. Marks Formation or Suwannee Limestone occur at or near land surface. In southern Leon County and much of Wakulla County, the limestone formations that underlay the ground surface include solution channels and conduits that have formed as the limestone has slowly dissolved due to percolation of acidic rainfall and surface water over many years (Lewis *et al.* 2009). The development of these features is most advanced within the Woodville Karst Plain.

Groundwater recharging the Floridan aquifer within the Woodville Karst Plain generally travels towards spring systems, including Wakulla Spring, Sally Ward Spring, St. Marks River Rise, and the Spring Creek springs group. The groundwater contribution area for Wakulla Spring (Figure 2-3) extends further north and west into Gadsden County and southwest Georgia, while the contribution area for the St. Marks River Rise extends north into southwest Georgia and to the eastern-most extent of the watershed.

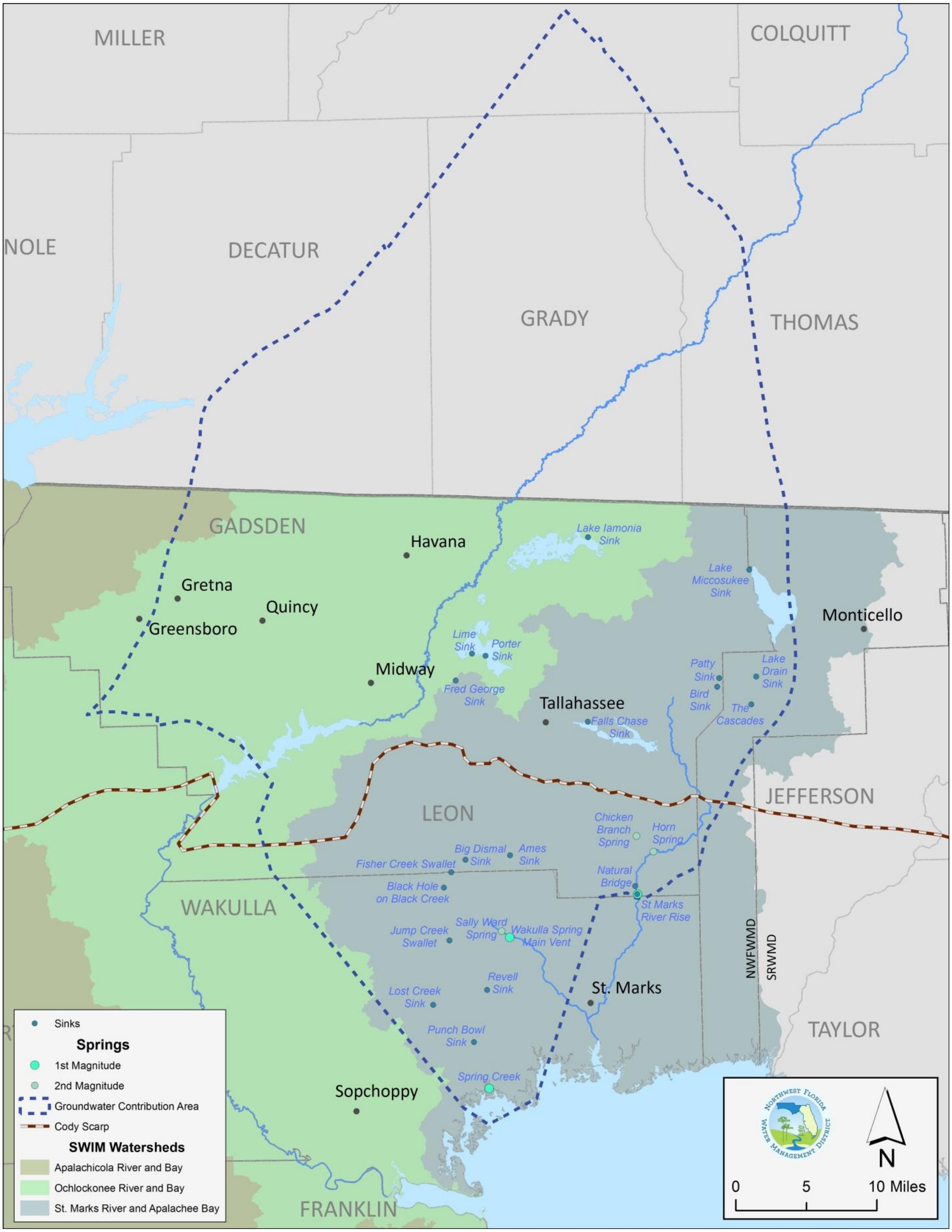


Figure 2-3 Wakulla Spring Groundwater Contribution Area

Soils within the St. Marks River and Apalachee Bay watershed range from moderately drained clay-rich soils inland to well-drained sandy soils along the coast. Soils within the northern watershed formed on beds of clayey and sandy parent materials. Upland soils of the Tallahassee Hills are well developed, with distinct horizons that exhibit the vertical movement of iron and organic materials. Upland soils below the Cody Scarp are generally sandy, some with loamy subsoil, and commonly moderately to well drained. Hydric soils (or wet soils that develop anaerobic conditions) occur in wetlands and floodplains across the watershed, while younger poorly developed soils can be found along the coastline.

2.2 Hydrologic Characteristics

2.2.1 Major Streams and Tributaries

The St. Marks River, which flows approximately 35 miles before discharging into Apalachee Bay, begins as an intermittent blackwater stream and flows south, 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 groundwater. Discharge measurements indicate that, on average, approximately 80 percent of the flow at the rise is contributed by spring discharge. The groundwater contribution area for the St. Marks River Rise extends into southwest Georgia and overlaps the St. Marks River surface water basin. The upper St. Marks River receives intermittent surface flow from four sub-basins in the upper watershed: Lake Miccosukee, Patty Sink Drain, Black Creek (upper), and Lake Lafayette. During moderate to wet periods, flow discharges from Lake Lafayette into the St. Marks River via an outlet structure (Lewis *et al.* 2009).

The main tributary of the St. Marks River is the Wakulla River, which originates in northern Wakulla County at Wakulla Spring and flows south approximately ten miles before joining the St. Marks River at the City of St. Marks. There is little direct surface water runoff to the Wakulla River; however, several sinking streams within the groundwater contribution area contribute water to the Floridan aquifer within the spring groundwater contribution area. Among these are Lost Creek, Fisher Creek, Jump Creek, and Black Creek. Surface water flowing into the Lost Creek swallet runs underground through the aquifer and conduit systems and discharges to either the Spring Creek Springs Group or Wakulla Spring, depending on hydrologic conditions.

2.2.2 Lakes

There are over 100 lakes in the watershed, encompassing about 3,000 acres (FDEP 2015a). A number of these are not connected with surface channels and are essentially closed, internally drained basins that recharge the underlying aquifer. Much of urban Tallahassee drains to Lake Munson, southwest of the city, and Lake Lafayette 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. Groundwater tracing studies funded by the Florida Geological Survey have confirmed a hydrologic connection between Ames Sink and Wakulla Spring (Kincaid and Werner 2008).

Lake Lafayette (Figure 2-4) was once an ancient tributary of the St. Marks River that is now generally a closed basin, connected intermittently to the St. Marks River during moderate to high water conditions. The lake system has been the subject of multiple alterations that have resulted in four distinct sections: Upper Lake Lafayette, Piney Z Lake, Lower Lake Lafayette, and Alford Arm. Construction of earthen dikes to separate the four sections of the Lake Lafayette system resulted in the isolation of Falls Chase Sink (sometimes called Upper Lafayette Sink) in upper Lake Lafayette, which historically drained the entire basin. The entire lake system, including Falls Chase Sink, which is hydrologically connected to the Floridan aquifer, receives drainage from eastern Tallahassee.

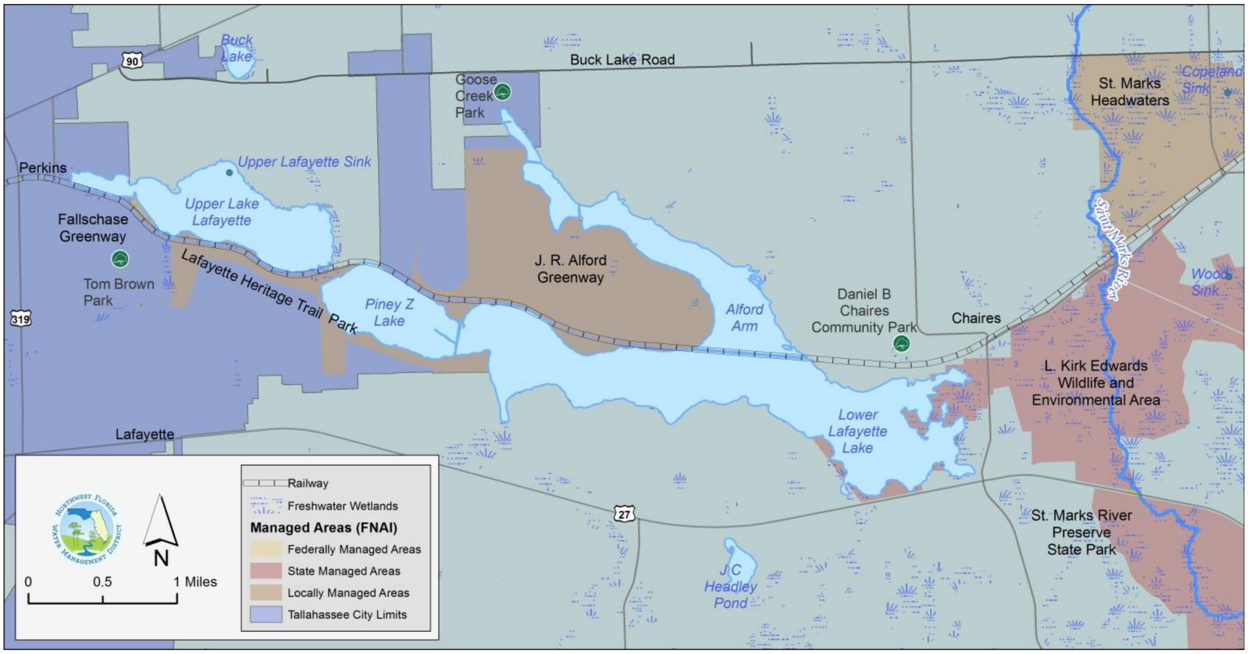


Figure 2-4 Lake Lafayette

Lake Miccosukee (Figure 2-5) 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.* 2002). An impoundment at the south end of the lake and a berm blocking Lake Miccosukee Sink artificially maintain the lake level. The lake discharges to the St. Marks River during very high flow conditions (Wade 2017).

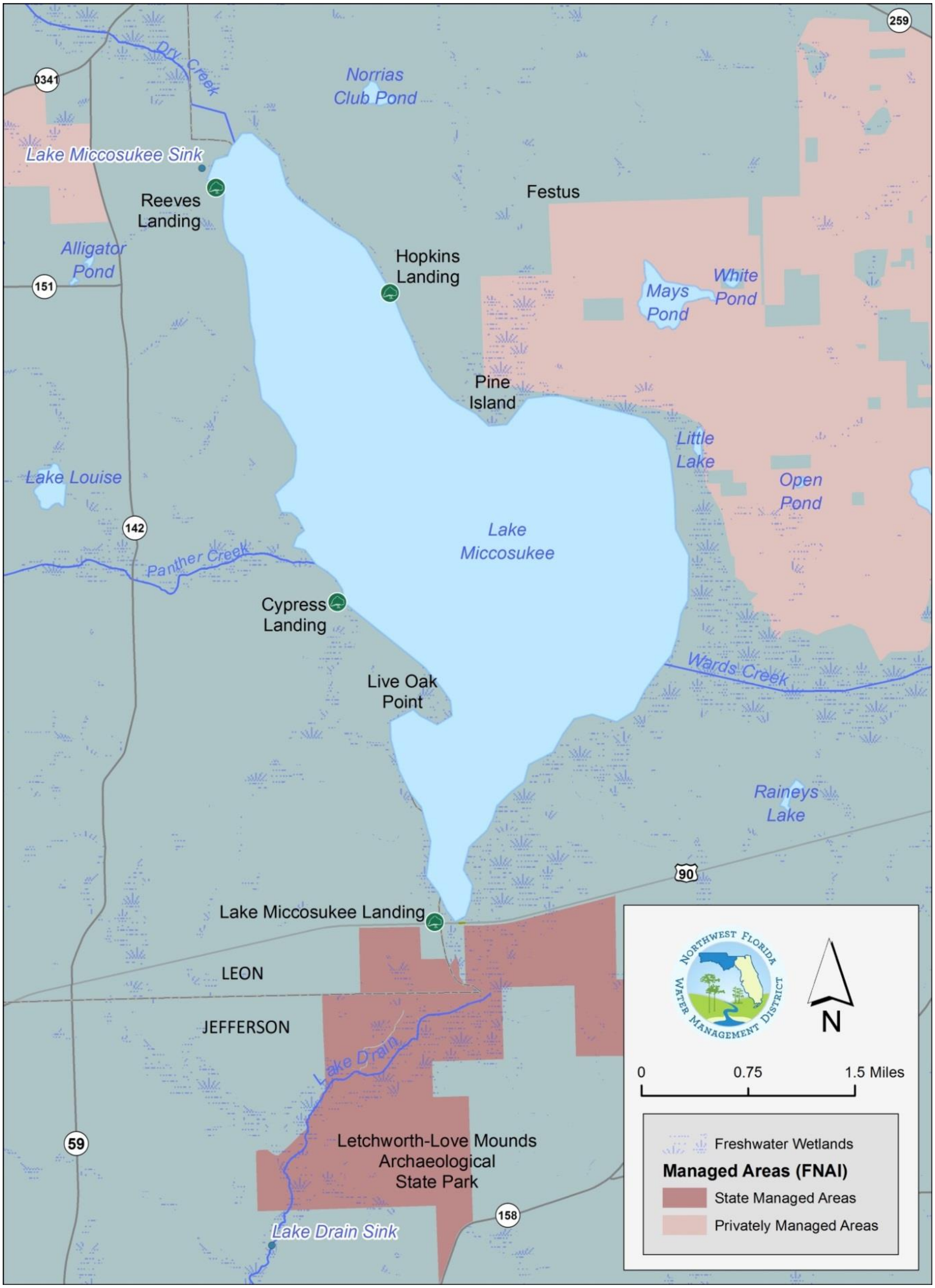


Figure 2-5 Lake Miccosukee

2.2.3 Springs and Karst Features

The hydrogeology of the St. Marks River and Apalachee Bay watershed is characterized by the interaction of surface water and groundwater due to the limestone bedrock and karst hydrogeology. Approximately 23 verified swallets have been identified and mapped north of the Cody Scarp with about 31 swallets and 47 springs mapped below the scarp (FGS 2015; NWFWMD 2016d). There are also numerous unmapped sinkholes. The system has three first magnitude (over 100 cubic feet per second [cfs] discharge) springs: Wakulla Spring, St. Marks River Rise, and the Spring Creek Springs Group, and three second magnitude (10-100 cfs discharge) springs: Horn, Sally Ward, and Chicken Branch springs.

Wakulla Spring is in Edward Ball Wakulla Springs State Park about 20 miles south of Tallahassee. It is one of the largest of Florida's springs, with a long-term median discharge of 547 cfs. The spring pool is roughly circular with a diameter of 315 feet north to south. The maximum pool depth is 185 feet. The vent opening is a horizontal ellipse along the south side of the pool bottom measuring approximately 50 feet by 82 feet. Along with a few smaller springs nearby, including Sally Ward Spring, Wakulla Spring is the primary source of the Wakulla River.

St. Marks River Rise is a resurgence of the St. Marks River, about a half mile south of where it sinks into a swallet at Natural Bridge. Because of significant ground water discharge at the rise, the St. Marks River flow, on average, increases from 80 cfs above the swallet to 480 cfs just downstream of the rise. The median spring discharge, based on the difference between upstream and downstream flow in the river, is 353 cfs.

The tidally influenced Spring Creek Springs Group includes 14 known submarine springs, including four major vents. Most vents discharge into the mouth of Spring Creek before it reaches the Gulf of Mexico. Discharge includes both saltwater and freshwater components. The average freshwater flow, based on USGS estimates, was 417 cfs during the period of June 2007-June 2010. Spring flow may exhibit short periods of reversal at high tide. During sustained dry conditions, flow at the Spring Creek springs may cease when salt water within the cave system blocks freshwater flow. This condition appears to be associated with a diversion of groundwater flow and increase in discharge at Wakulla Spring, which is hydrologically connected to the Spring Creek Springs (Davis and Verdi 2013). When the Spring Creek Springs cease to flow or reverse, water from the Lost Creek basin flows north into Wakulla Springs (Dyer 2015).

Ames Sink, Ames Sink 2, and Kelly Sink are receiving bodies for water flowing from Lake Munson and Munson Slough. On most occasions, Ames Sink drains outflow from Lake Munson to the Floridan aquifer. From there, the water travels toward Wakulla Spring where it is again discharged as surface water. Based on tracer test results, water can travel from Ames Sink to the vicinity of Wakulla Spring in as little as just over three weeks (Kincaid and Werner 2008).

Fred George Sink is a hydrologically important sinkhole feature in the City of Tallahassee that forms a connection with the upper Floridan aquifer. Several swallets in northeastern Leon County, including Bird, Patty, Lake Drain, Wood, and Copeland, contribute water within the Horn, St. Marks River Rise, and Wakulla Spring contribution areas. Additionally, Falls Chase Sink in Upper Lake Lafayette drains a significant portion of eastern Tallahassee (McGlynn 2006).

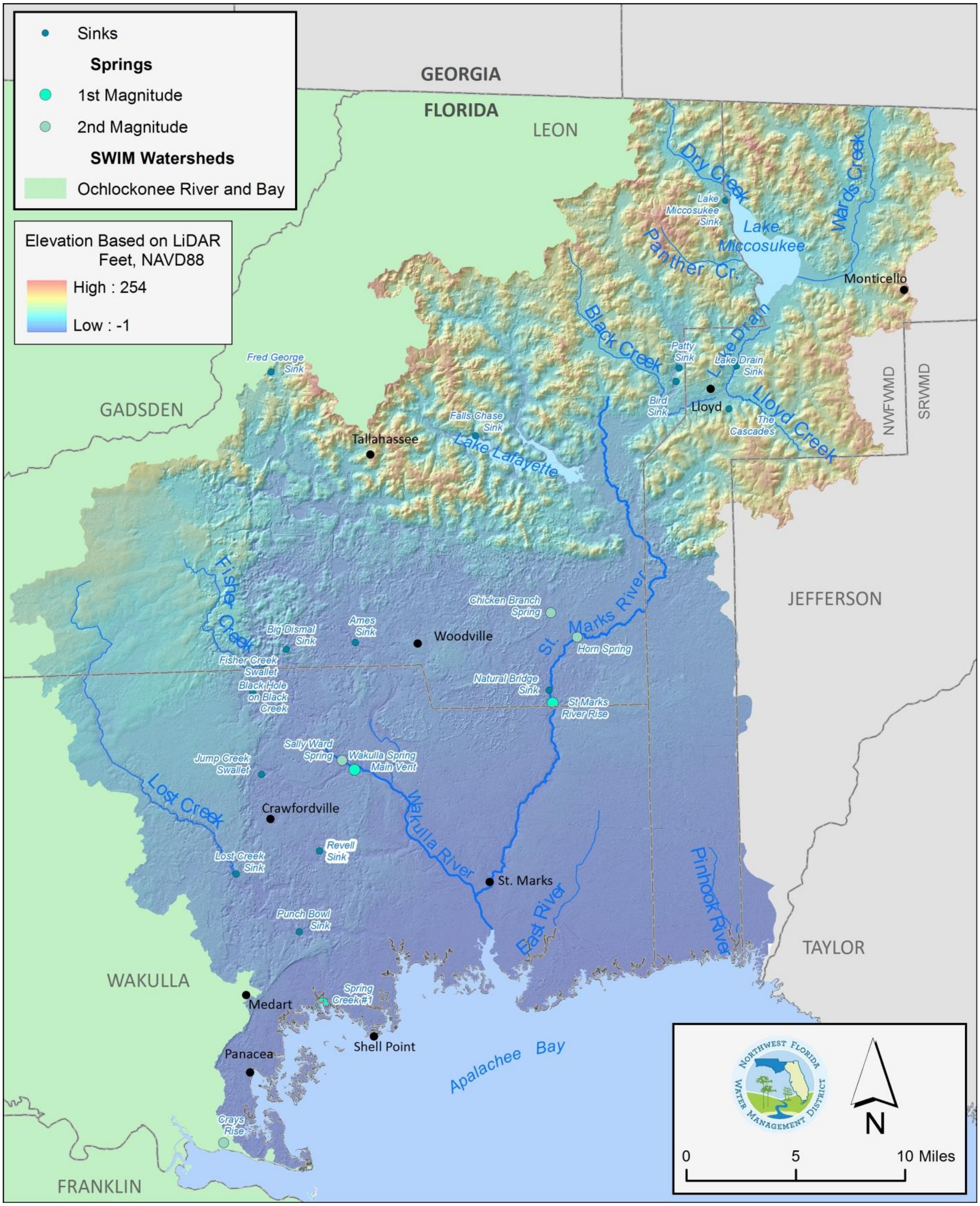


Figure 2-6 Topography and Major Waterbodies

2.2.4 Palustrine, Riparian, and Floodplain Habitats

Floodplain swamps, alluvial forest, bottomland forest Tupelo swamp, mixed hardwood swamp, hardwood hammock, and ironwood hammock are found along the St. Marks and Wakulla rivers (Research Planning, Inc. 2016). Fringing freshwater marsh is also found along the upper reaches of the Wakulla River (Lewis *et al.* 2009).

Compared to the Wakulla River, the channel of the St. Marks River is more incised and exhibits greater change in topographic elevation along its length. On a small scale, the floodplains exhibit localized topographic relief in the form of hummocks and sloughs. The Wakulla River floodplain is relatively broad and flat, with little topographic relief. Soils are comprised of mucky mineral materials and the seasonal high water level is at or near land surface (Research Planning, Inc. 2016).

Major floodplains and wetland systems are concentrated proximate to the major rivers, Lake Miccosukee, and within the coastal freshwater, brackish, and tidal marshes (Figure 2-7). The associated wetland communities are described further in Section 2.4 (Natural Communities).

2.2.5 Coastal Waterbodies

Located in the western extent of Florida's Big Bend coastline, Apalachee Bay is a shallow estuary open to the Gulf of Mexico. The bay includes smaller, more isolated embayments, including Dickson, Dickerson, Purify, Skipper, Goose Creek, and Oyster bays. The St. Marks River is the primary source of freshwater inflow to the bay. Freshwater also enters the bay from the Ochlocknee River on its western side, as well as from adjacent tidal creeks and springs, including the Spring Creek Springs Group.

Coastal waters in Apalachee Bay support expansive tidal marshes, tidal creeks, and aquatic estuarine habitats that include some of Florida's most extensive systems of seagrass beds. These communities are described further in Section 2.4.

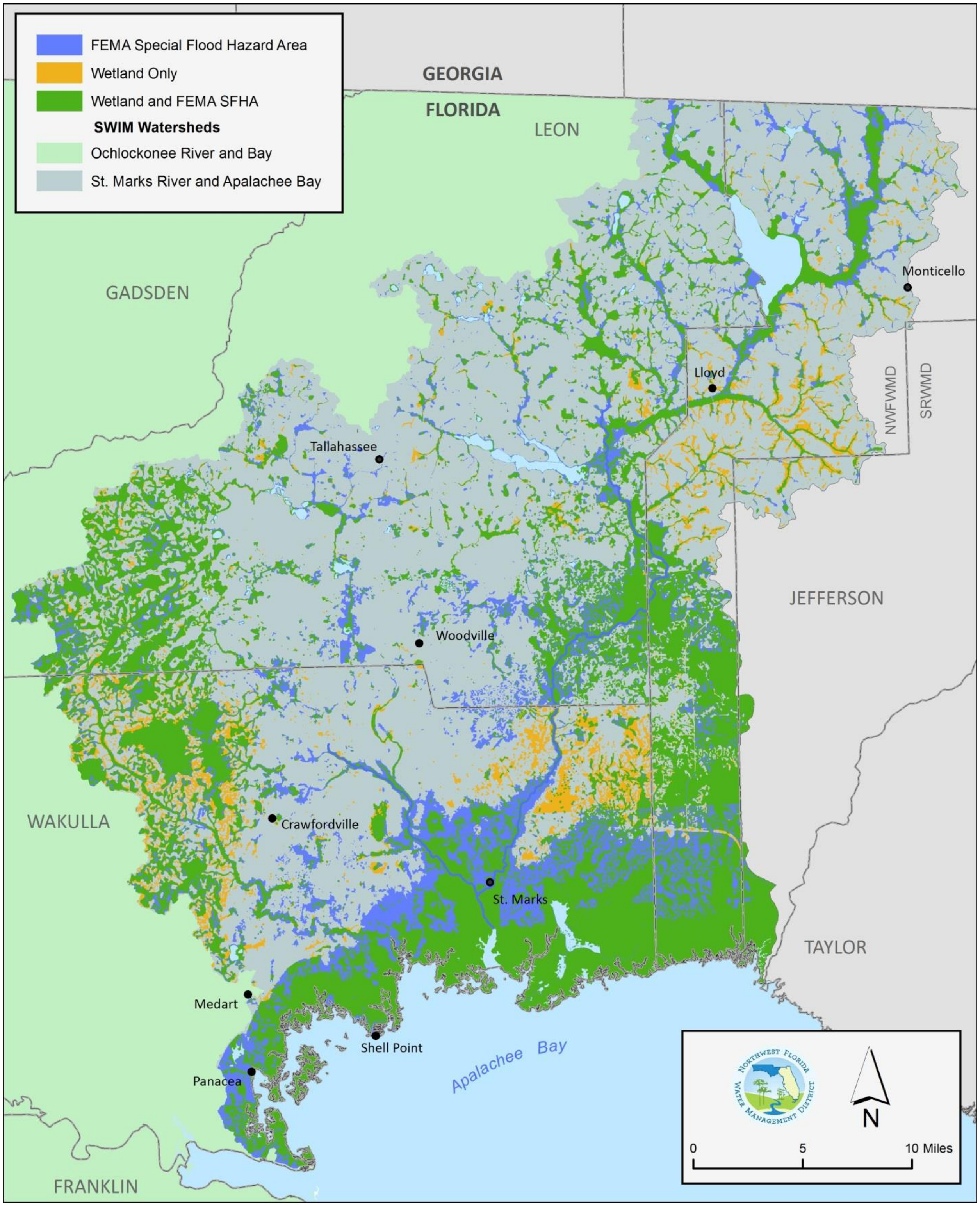


Figure 2-7 Floodplains and Wetlands

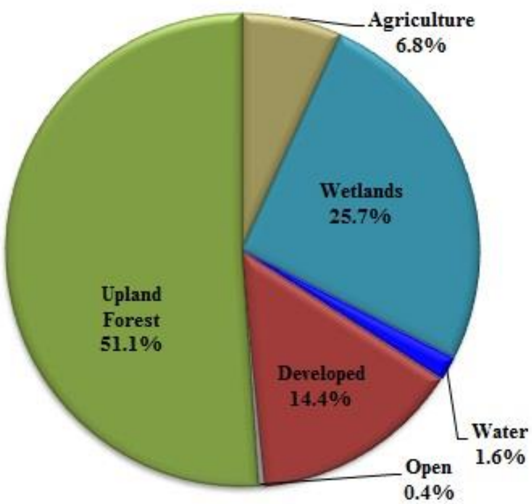
2.3 Land Use and Population

Land use in the northern watershed consists of a mixture of agriculture, silviculture, and residential uses (Figures 2-8 and 2-9; Table 2-1). In Georgia, Thomas County is nearly three-quarters agricultural, including crop land and forested lands (Thomas County 2008). Within Florida, agriculture occurs predominantly in northern Leon County and Jefferson County. Palustrine wetlands are adjacent to lakes Miccosukee and Lafayette, and along the St. Marks and Wakulla rivers, as well as their tributaries and other areas of low elevation. Most intensive land uses are concentrated in Tallahassee, with additional development in Crawfordville, the City of St. Marks, and the community of Panacea. The western portion of the watershed is dominated by the Apalachicola National Forest. Most of the southeastern-most portion of the watershed consists of silviculture and conservation lands. Coastal areas are predominantly wetlands and include the St. Marks National Wildlife Refuge and the Flint Rock Wildlife Management Area.

Table 2-1 2013-2014 Land Use and Land Cover in the St. Marks River and Apalachee Bay Watershed (Florida Only)

Land Use Category	Square Miles	Percent of Basin
Agriculture	69.5	6.7
Developed	157.0	15.1
Open Land	6.7	0.6
Upland Forests	518.7	49.8
Water	12.0	1.2
Wetlands	278.1	26.7

Source: FDEP 2017b



Source: FDEP 2017b

Figure 2-8 Land Use and Land Cover in the Greater St. Marks River and Apalachee Bay Watershed (including Georgia)

The St. Marks River and Apalachee Bay watershed contains 249,965 acres (37% of the watershed) of conservation and protected lands (Figure 3-7). The St. Marks National Wildlife Refuge is a continuous tract of forested land, impoundments, and wetlands that comprise over 72,000 acres. Congress designated 17,746 acres of the refuge as the St. Marks Wilderness Area in 1975, to be managed under the Wilderness Act of 1964 (78 Statute 890.892: 16 United States Code 1132). The Apalachicola National Forest comprises more than 571,000 acres, which includes 2,735 acres of water. Over 106,000 acres of the forest occur in the St. Marks River and Apalachee Bay watershed in Leon and Wakulla counties.

Throughout the watershed are ten state parks, preserves, and forests encompassing over 14,500 acres. The majority of these lands are managed by FDEP and the Florida Department of Agriculture and Consumer Services (FDACS). The FWC also owns and manages the Aucilla Wildlife Management Area, located along the eastern boundary of the watershed. In addition to these lands are 16 local parks, preserves, and greenways managed by Leon and Wakulla counties and the City of Tallahassee. Recent conservation land acquisitions include buffers adjacent to Horn Spring, Lake Munson, and Heritage Trail/Lake Piney Z and the Miccosukee Greenway and Alford Property (near Lake Lafayette). In October 2016, the Florida Cabinet voted to purchase the 11,027-acre Horn Spring property within the Upper St. Marks River Corridor Florida Forever project.

Tall Timbers Research Station and Land Conservancy owns and manages 17,745 acres of conservation lands in the watershed, while The Nature Conservancy owns and manages the 680-acre Fanlew Preserve and the 8,053-acre Flint Rock Tract in Jefferson County. The NWFWMD monitors approximately 1,375 acres of conservation easements within the watershed.

Leon County occupies the largest proportion of the watershed in terms of population. It also contains its largest city, Tallahassee. Wakulla County makes up the southeastern portion of the basin including most of the coastline. The City of St. Marks is the only municipality within Wakulla County. Unincorporated communities include Crawfordville, Panacea, Newport, Shadeville, and Shell Point. The population of Wakulla County has nearly tripled since 1980, exceeding the rate of growth of the state. Jefferson County occupies approximately 23 percent of the watershed in Florida and includes the City of Monticello. Table 2-2 displays population estimates for the watershed, based on spatial analysis of 2010 U.S. Census data, together with population projections to 2030 calculated based on countywide population growth projections from the University of Florida's Bureau of Economic and Business Research.

Table 2-2 Watershed Population Estimates: 2010-2030 (Florida Only)

County	2010	2020	2030
Leon	228,300	250,106	275,547
Wakulla	28,208	30,521	34,004
Jefferson	6,659	6,631	6,767
Total	**263,167**	**287,259**	**316,319**

2.4 Natural Communities

The St. Marks River and Apalachee Bay watershed supports a diversity of natural habitats, including upland, coastal, transitional, wetland, aquatic, estuarine, and marine communities. Based on spatial analysis of the watershed, there are 24 distinct natural communities within 15 broader ecological community categories recognized by the FNAI (FNAI 2010, 2016a, 2016b, 2016c). Among the prominent communities are palustrine wetlands, floodplain forests, spring run streams, lakes, extensive coastal marshes, and some of the largest and most important seagrass systems in Florida waters. The watershed also supports habitat for a number of rare, endemic, and protected species. Among these are the threatened frosted flatwoods salamander (*Ambystoma cingulatum*), the eastern indigo snake (*Drymarchon couperi*), the Gulf sturgeon (*Acipenser oxyrinchus desotoi*), and the West Indian manatee (*Trichechus manatus latirostris*).

Floodplain swamps, alluvial forest, bottomland forests, and hardwood and ironwood hammocks are found along the St. Marks and Wakulla rivers. Generally, the percentage of cover by sedges (*Cyperaceae*) decreases from the low plain to the upper slope, while the percentage of woody vegetation increases. Important canopy species in the St. Marks River floodplain include American hornbeam or ironwood (*Carpinus caroliniana*), swamp tupelo (*Nyssa sylvatica* var. *biflora*), pond cypress (*Taxodium asendens*), bald cypress (*Taxodium distichum*), swamp bay (*Persea palustris*), sweetbay magnolia (*Magnolia virginiana*), and American sweetgum (*Liquidambar styraciflua*) (Research Planning, Inc. 2016). Swamp dogwood (*Cornus foemina*), bald cypress (*Taxodium distichum*), and Walter viburnum (*Viburnum obovatum*) dominate the subcanopy on the lower floodplain (Light *et al.* 1993).

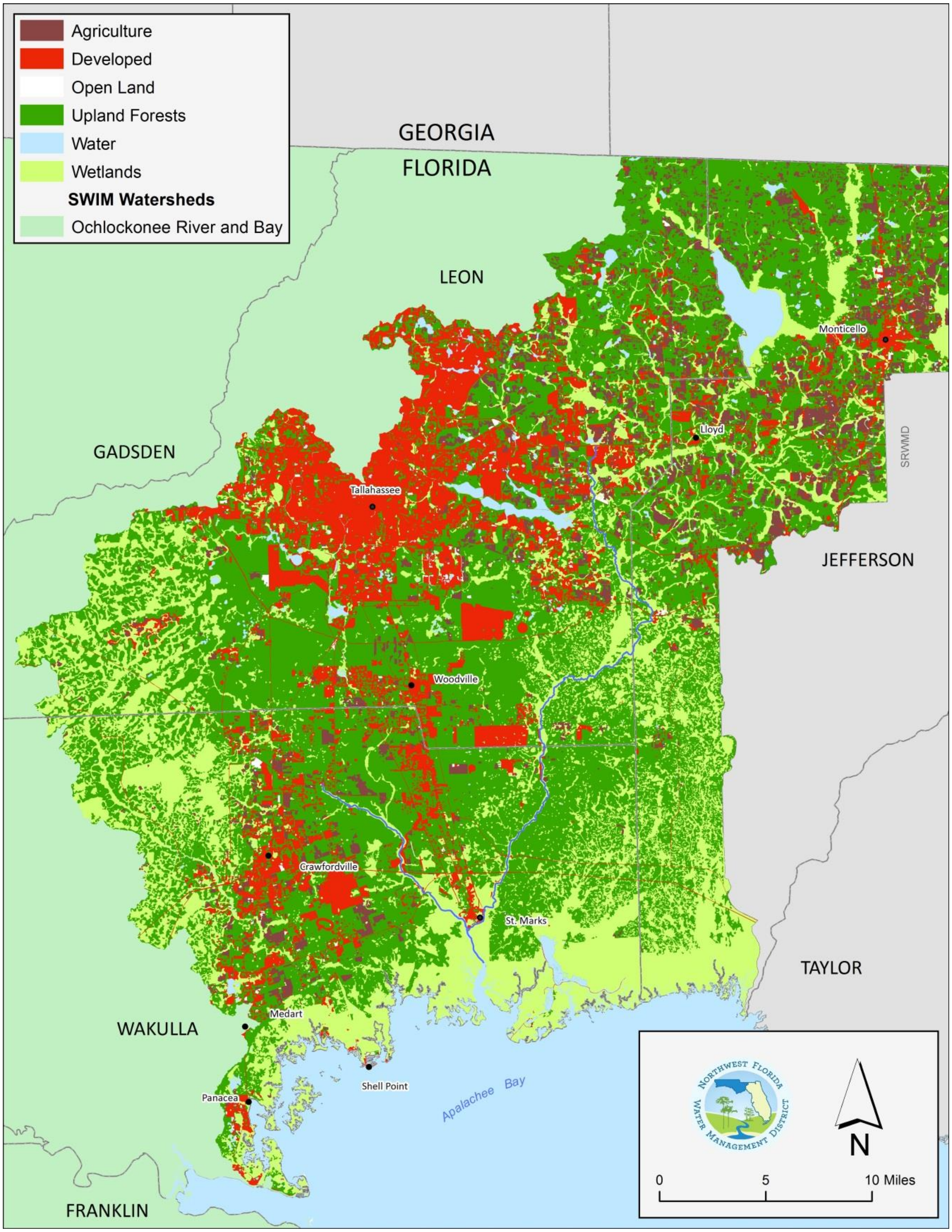


Figure 2-9 2013-2014 Land Use and Land Cover

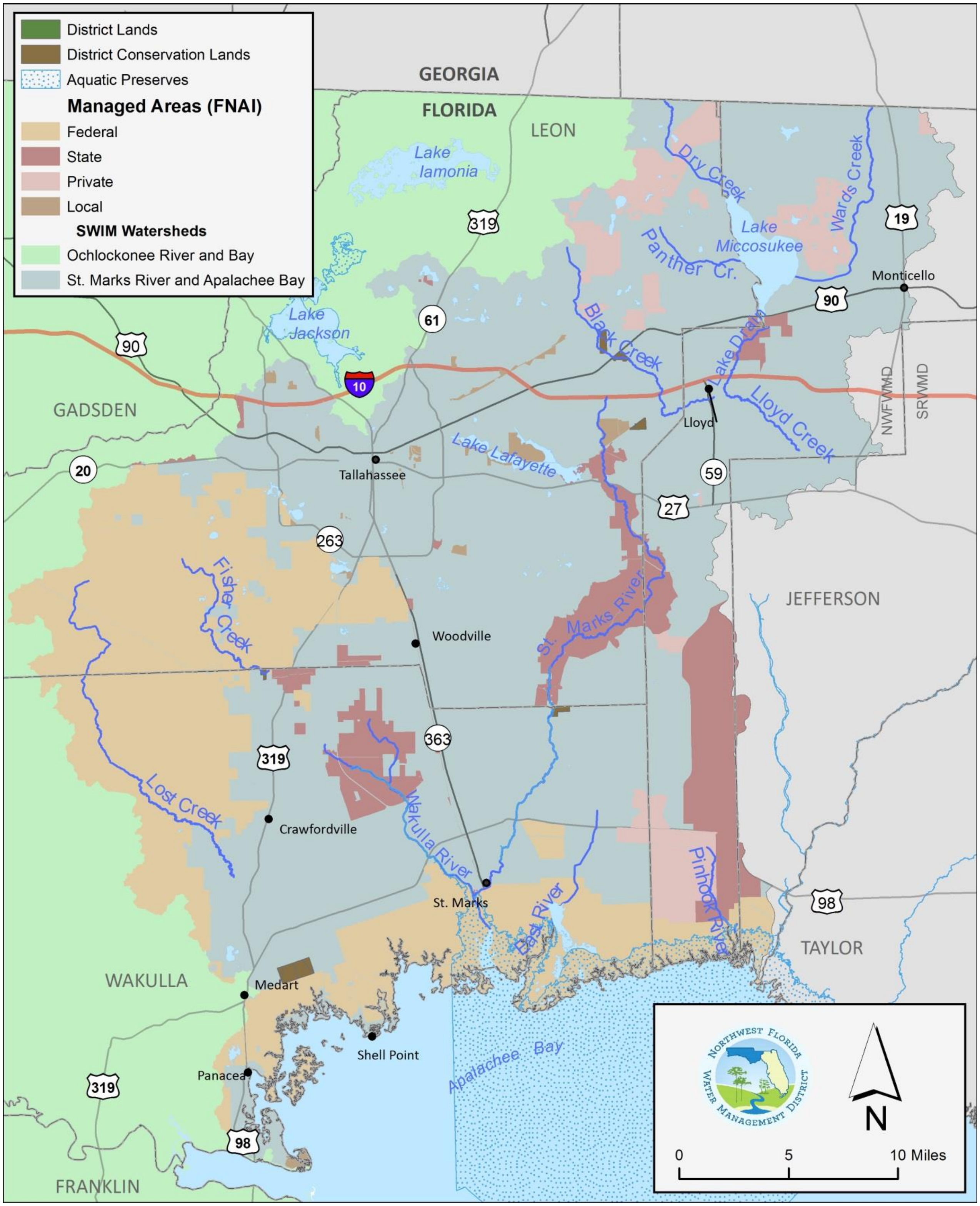


Figure 2-8 Conservation Lands within the St. Marks River and Apalachee Bay Watershed

Because changes in elevation can mean a substantial decrease in soil moisture, small scale relief creates hydrologically diverse habitats. A study of the St. Marks River hydrology, vegetation, and soils determined that the lower-lying portions of the floodplain flood up to four times a year and stay inundated for one to four weeks, while upslope flood waters recur roughly every five years (Light *et al.* 1993).

Estuarine marshland is abundant in the coastal extent of the watershed. McNulty *et al.* (1972) mapped approximately 137,600 acres of tidal marsh in the region from Alligator Harbor to the Econfina River. Apalachee Bay's coast is nearly contiguous salt marsh, while brackish marshes line the lower Wakulla and St. Marks rivers (Research Planning, Inc. 2016). Marsh species composition is influenced by a combination of salinity tolerance and differences in soil type, elevations and competitive interactions. Salt marshes in the Florida Panhandle are usually characterized by large, fairly homogeneous expanses of dense black needlerush (*Juncus roemerianus*). Often, they are accompanied on the waterward side by smooth cordgrass (*Spartina alterniflora*). The *Juncus* and *Spartina* zones are distinctive and can be separated easily by elevation.

Estuarine vegetation in the St. Marks River, below the confluence with the Wakulla River, was recently characterized using aerial photography and field sampling (Research Planning, Inc. 2016). In the upper estuary, contiguous hardwood forests include oaks, cedar, cabbage palms, and swamp bay tolerant of some inundation and low salinity. Sawgrass (*Cladium jamaicense*) is dominant in the upper estuary and is interspersed with black needlerush. Further south, needlerush is prevalent along the river edge and transitions to sawgrass, then hardwood forest. The lower estuary is dominated by saltmarsh cordgrass along the river edge and transitions to black needlerush.

Apalachee Bay supports one of the most extensive continuous seagrass systems in the U.S. (Lewis *et al.* 2009). Seagrass provides protective and foraging habitat for marine species and is important to the spawning cycle of many fish and invertebrates. The shallow waters of the Apalachee Bay are dominated by shoal grass (*Halodule wrightii*) and turtle grass (*Thalassia testudinum*), with manatee grass (*Syringodium filiforme*) and star grass (*Halophila engelmanni*) in deeper waters. Widgeon grass (*Ruppia maritima*) can also be found within estuarine waters. Yarbro and Carlson (2016) estimated that the seagrass coverage in the northern Big Bend region of Florida at 149,140 acres in 2006. The total coverage between 2001 and 2006 appeared generally stable, although losses were noted between the St. Marks and Ochlockonee rivers. Apparent declines in density and diversity were noted, and as much as 2,720 acres were identified as having converted from continuous to patchy beds.

Much of this system is within the Big Bend Seagrasses Aquatic Preserve (FDEP 2014a). This preserve off the coast of the Florida Big Bend is the largest aquatic preserve in the state, and includes over 984,000 acres of submerged lands (FDEP 2014a). The preserve is home to over 2,000 native species of plants and animals, including threatened and endangered species such as the West Indian manatee, the Atlantic hawksbill sea turtle (*Eretmochelys imbricata*), and the Kemp's Ridley sea turtle (*Lepidochelys kempii*) (FDEP 2014a).

Oyster bars are found in most river mouths in the watershed, including the St. Marks, East, and Wakulla rivers (USFWS 2010). The St. Marks National Wildlife Refuge has constructed oyster reefs that were designed to provide roosting area for whooping cranes to utilize during the winter as a part of the Whooping Crane Eastern Partnership (USFWS 2008).

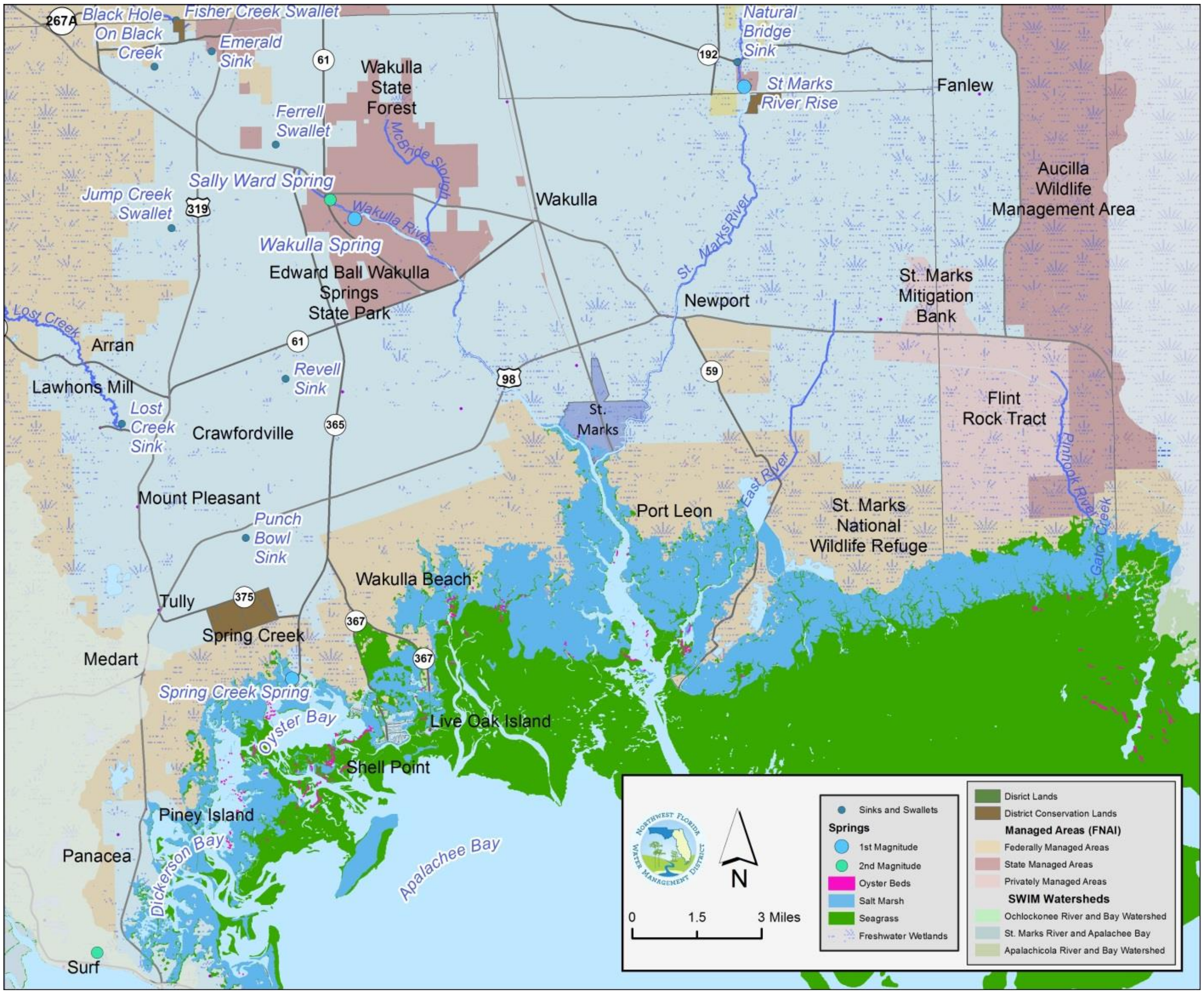


Figure 2-9 Coastal Features

3.0 Watershed Assessment and Water Resource Issues

3.1 Water Quality

Most of the watershed has relatively good water quality. Within the Gulf Coastal Lowlands, the St. Marks National Wildlife Refuge, Apalachicola National Forest, and state park lands provide substantial protection to water resource quality. There are some distinct water quality problems in the watershed, however. The interaction between surface and ground waters discussed above presents a considerable management challenge for both wastewater and stormwater management. The closed basin lakes in the more northern extent of the watershed are affected by stormwater runoff and NPS pollution and are breached in places by karst features, with leakage to underlying aquifers within Floridan Aquifer spring contribution areas. To the south, the Woodville Karst Plain receives stormwater runoff and wastewater effluent.

3.1.1 Impaired Waters

Of the 101 waterbody segments in the watershed, the FDEP has identified 33 with impaired water quality (FDEP 2014b). Twenty-three segments are listed as impaired for bacteria. Seven segments are impaired for nutrients, as are 12 for dissolved oxygen (DO), two for unionized ammonia, two for turbidity, and one for lead (FDEP 2014b). As illustrated by Figure 3-1, impairments for DO, nutrients, and turbidity are concentrated in the upper watershed, and bacteria-related impairments are both inland and in coastal waters. Among the waterbodies with listed impairments, the Lake Lafayette complex has impairments for nutrients, dissolved oxygen, biochemical oxygen demand, and bacteria. Similarly, impairments for Lake Munson and Munson Slough include nutrients, dissolved oxygen, turbidity, and lead. The overall list of impaired waters can be found in Appendix F. Total maximum daily loads (TMDLs) have been established for fecal coliform, dissolved oxygen, nutrients, turbidity, and unionized ammonia. These are concentrated in the Lake Munson basin, as well as at Wakulla Spring and the upper Wakulla River. Table 3-1 and Figure 3-1 show the FDEP's adopted TMDLs for the watershed (FDEP 2008, 2010, 2012, 2013). In addition to State-listed impaired waters, TMDLs established by the U.S. EPA are listed in Appendix F.

The FDEP has also adopted a statewide TMDL for reducing human health risks associated with consuming fish taken from waters impaired for mercury. Mercury impairments are based on potential human health risks (fish consumption advisories), not exceedances of water quality criteria. The primary source of mercury depositions in the environment is atmospheric deposition. It is estimated that about 70 percent of deposited mercury comes from anthropogenic sources (FDEP 2013). Approximately 0.5 percent of the mercury load in Florida waters has been identified as being discharged directly to surface waters by permitted industrial and domestic wastewater facilities (FDEP 2013). Only a small part of mercury in the environment is in the form of methylated mercury, which is biologically available to the food chain. The statewide TMDL for mercury includes a reduction target for fish consumption by humans and by wildlife and an 86 percent reduction in mercury from mercury sources in Florida (FDEP 2013).

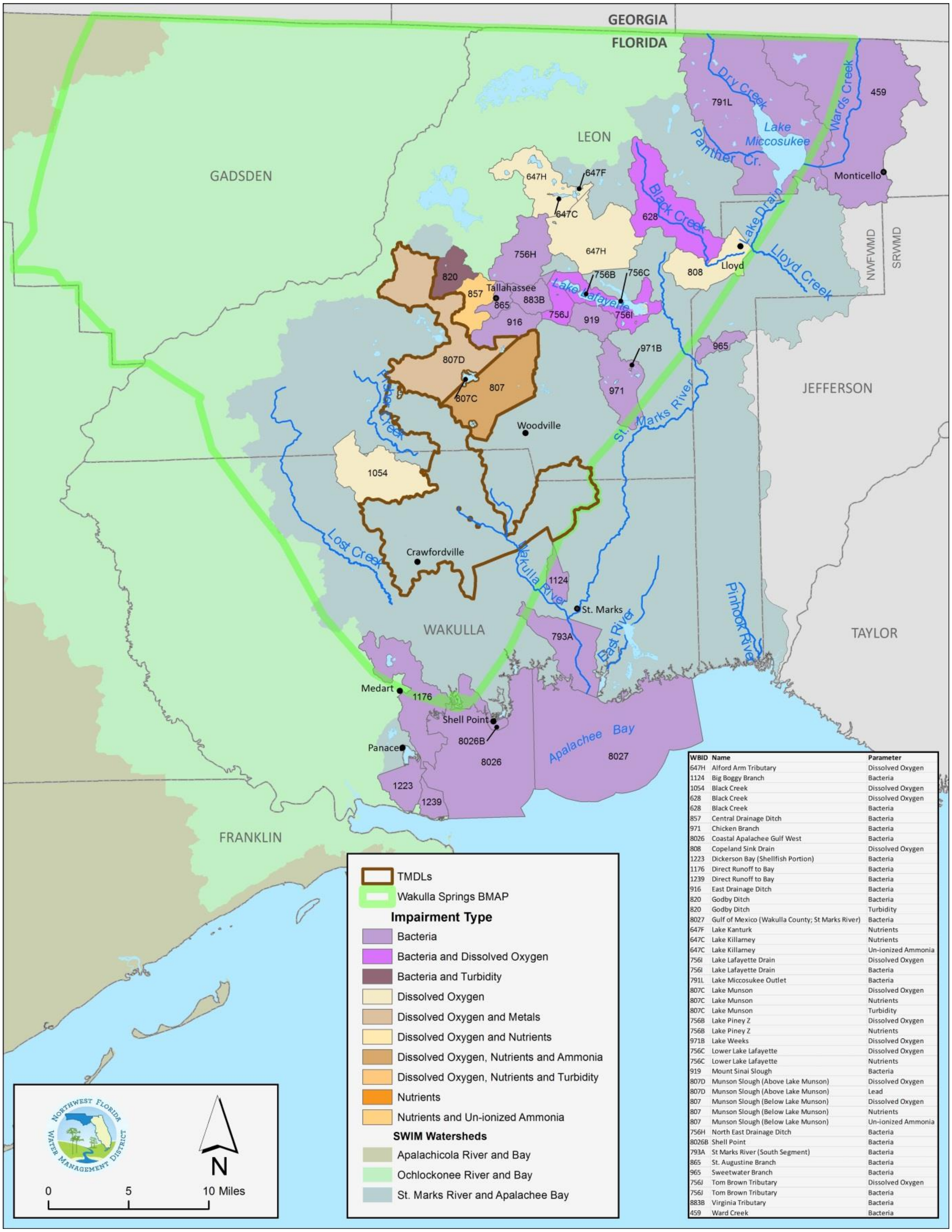


Figure 3-1 Listed Impaired Waterbody Segments, Excepting Mercury

Table 3-1 TMDLs Adopted by the FDEP

Waterbody Name	WBID(s)
Fecal Coliform	
Munson Slough	807D
Dissolved Oxygen	
Munson Slough	807D
Lake Munson	807C
Munson Slough below Lake Munson	807
Nutrients	
Lake Munson (TSI)	807C
Wakulla River (Biology)	1006
Turbidity	
Lake Munson	807C
Un-ionized Ammonia	
Munson Slough below Lake Munson	807

Sources: FDEP 2008, 2010, 2012, 2013.

Total maximum daily loads are implemented through Basin Management Action Plans (BMAPs) that identify specific management actions necessary to reduce pollutant loads. Basin Management Action Plans are developed by local stakeholders (public and private) in close coordination with the FDEP.

The FDEP adopted a BMAP for the upper Wakulla River and Wakulla Spring basin (FDEP 2015b, 2016b) in October 2015 with the goal of reducing nitrate levels to 0.35 mg/L. Nitrate levels observed in Wakulla Spring tripled from the 1970s through the 1990s (Chelette *et al.* 2002). This increase was largely attributable to nitrogen inputs south of the Cody Scarp. Since the TMDL was adopted in 2012, the largest source of nutrient loading to Wakulla Spring, the City of Tallahassee's Thomas P. Smith Water Reclamation Facility (TPS), was upgraded to reduce nitrate concentrations by approximately 80 percent. Further reductions in nitrate concentrations are expected in the river and spring due to this upgrade, as well as other completed actions in the basin. Nitrate concentrations at Wakulla Spring have decreased significantly during the last decade (Figure 3-2). Ongoing and future spring restoration projects are anticipated to result in further decreases in nitrate levels.

For point sources and municipal separate storm sewer systems (MS4s), the BMAP and required TMDL reductions are enforceable through National Pollutant Discharge Elimination System (NPDES) and state permits. For non-MS4 sources, the BMAP requirements and TMDL reductions are enforceable under Section 403.067, F.S. Furthermore, an agricultural NPS discharger included in a BMAP must demonstrate compliance with required reductions by either implementing the appropriate best management practices (BMPs) or conducting water quality monitoring prescribed by the FDEP or a water management district that demonstrates compliance with state water quality standards.

To further reduce nitrogen loading, Leon and Wakulla counties and the City of Tallahassee, in coordination with the FDEP, NWFWMD, and the Florida Department of Health (FDOH), are implementing a coordinated in initiative to reduced pollutant loading from onsite sewage treatment and disposal systems (OSTDS) throughout the watershed, with emphasis on the Upper Wakulla River and Wakulla Spring BMAP area. Within the BMAP area, primary focus areas (PFAs) were defined to represent areas where the aquifer is most vulnerable to inputs and to prioritize restoration actions (FDEP 2015b; Appendix C). Projects are being funded and implemented to connect existing septic systems to central sewer systems. Where connection to central sewer is not feasible, efforts are being made to deploy advanced passive OSTDS that achieve substantially greater pollutant removal than conventional systems.

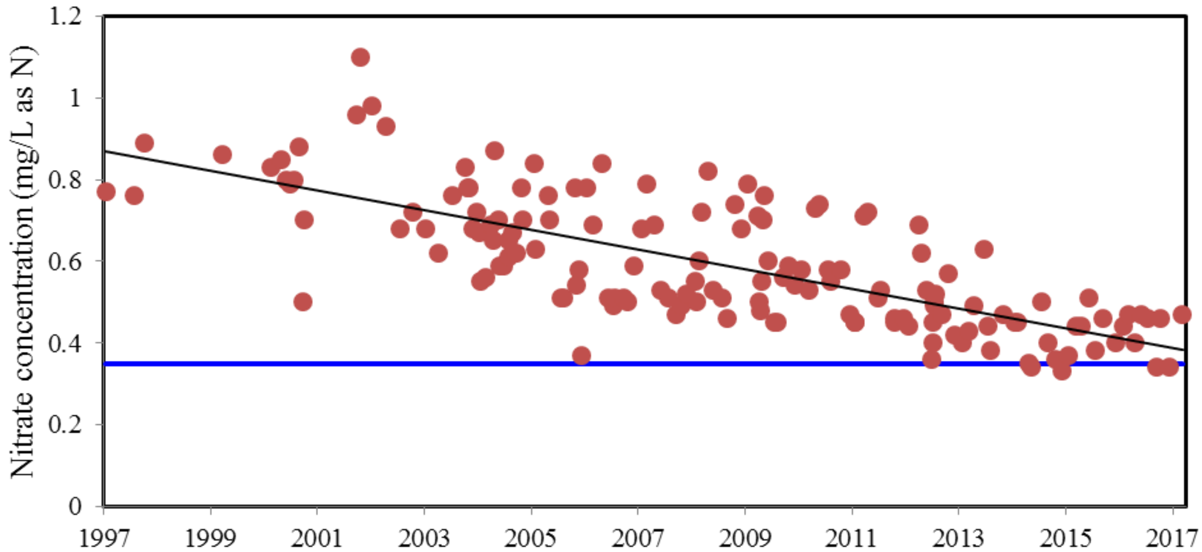


Figure 3-2 Nitrate Concentrations at Wakulla Spring: 1997 - 2016

3.1.2 Pollution Sources

Nonpoint source (NPS) pollution is generated when stormwater runoff collects pollutants from across the landscape (lawns, pavement, highways, 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, petroleum products, metals, pesticides, and other contaminants. Typical categories of NPS pollution include stormwater runoff from urban and agricultural lands and erosion and sedimentation from construction sites, unpaved roads, and destabilized stream banks. Atmospheric deposition of nitrogen, sulfur, mercury, and other toxic substances via fossil fuel combustion also contribute to NPS pollution.

Stormwater runoff is the primary contributor to NPS pollution and is closely associated with land use. Urban land use, especially medium- to high-density residential, commercial, and industrial uses, have the highest NPS pollution per acre due to increased impervious surface area that increases runoff and generates stormwater (EPA 2016d). In urban areas, lawns, roadways, buildings, commercial and institutional properties all contribute to NPS pollution (EPA 2016d).

Urban and suburban land uses are concentrated around the Tallahassee metropolitan area, with additional development around Crawfordville, Monticello, St. Marks, and unincorporated communities. Five municipalities in the watershed hold MS4 permits for stormwater conveyances that discharge to waters of the state. These are Leon County, Florida State University, Florida Agricultural and Mechanical University, the Federal Correctional Institution, and the City of Tallahassee.

Lake Munson receives stormwater runoff from Tallahassee and is among the most impacted waterbodies affected by NPS pollution (Leon County 2016). Lake Munson, including Munson Slough, has historically experienced nutrient enrichment, low DO, algal blooms, high bacteria levels, 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; McGlynn 2006). Leon County (2011; 2016), however, indicates that the lake has experienced degraded conditions with respect to BOD, nutrients, turbidity, and algal blooms. Among cited pollution sources are legacy pollutants within organic and nutrient-rich sediments, as well as NPS pollution. The Florida

Department of Health has established fish consumption health advisories for the lake associated with PCBs, as well as mercury (FDOH 2017).

Upper and Lower Lakes Lafayette and Piney Z Lake are affected by NPS pollution, manifested as nutrient enrichment, low DO, and bacterial contamination (Leon County 2016; EPA 2012; FDEP 2003). Elevated nutrient and chlorophyll-a levels in Upper Lake Lafayette may be exacerbated by fluctuating lake volume, as well as urban stormwater runoff (Leon County 2016). The Lake Lafayette basin includes much of eastern and northern Tallahassee, including extensive residential and commercial areas, major transportation routes, a park and sports complex, a Federal Correctional Institution, and the J.R. Alford Greenway.

Tallahassee and Leon County have completed extensive stormwater improvements in both the Lake Lafayette and Lake Munson sub-basins. These retrofit projects result in significantly improved water quality treatment, as well as localized improvements to flood protection.

Fertilizer application, ditching, road construction, and harvesting associated with agriculture and silviculture can also cause NPS pollution, erosion, sedimentation, and physical impacts to streams and lakes (Stanhope *et al.* 2008). Agricultural BMPs developed for row crops, cow/calf operations, and other agricultural operations can effectively reduce NPS pollution and promote water use efficiency (FDACS 1993, 2016a). Silviculture BMPs have also been demonstrated to effectively protect water quality (FDEP 1997; NWFWMD 1998).

Erosion and sedimentation are natural phenomena that can be accelerated by human activities, with resulting water quality impacts, including habitat smothering, elevated turbidity and suspended solids, and hydrologic impacts. Factors such as highly erodible soils, steep unstable slopes, and high rainfall intensities, are important factors in erosion and sedimentation (Reckendorf 1995).

Onsite sewage treatment and disposal systems are widespread sources of nutrients and other pollutants. Significant concentrations of OSTDS can degrade the quality of groundwater and proximate surface waters. While conventional OSTDS can control pathogens, surfactants, metals, and phosphorus, greater mobility of nitrogen in soils prevents complete treatment and removal of nitrogen. Dissolved nitrogen is frequently exported from drainfields through the groundwater (NRC 2000). Additionally, OSTDS in areas with high water tables or soil limitations may not effectively treat other pollutants. Pollutants can enter surface waters as seepage into drainage ditches, streams, lakes, and estuaries (EPA 2015; NRC 2000).

Florida Water Management Inventory data indicate approximately 33,400 known or likely septic systems in the watershed. Figure 3-3 shows approximate locations of known and likely septic tanks as of 2016 (FDOH 2016a). Across the watershed, most rural and unincorporated communities and some suburban areas rely on OSTDS systems for wastewater treatment.

Across the watershed, new septic installations have declined since the late 1970s. By the mid-1990s, Leon County began to see a decline in new installations, as did Jefferson counties at a more gradual pace (FDOH 2015b). Wakulla County saw a peak of new installations in 2005. However, the County also added 8,200 linear feet of sewer lines in the same year, as well as 5,700 linear feet of sewer in 2004 (FDOH 2015a; Wakulla County 2005).

Wakulla County currently has a local comprehensive plan policy that requires performance-based treatment systems for new development on parcels less than five acres within the Wakulla Spring Planning Area (which extends from the county line south to the Wakulla Springs State Park, beginning just west of Bloxham Cutoff to just east of Woodville Highway); within 150 feet of the high water level of any surface water, wet sink, swallet, or other karst feature providing direct connection to groundwater; within 300 feet of a first or second magnitude spring; and on parcels less than 0.229 acres.

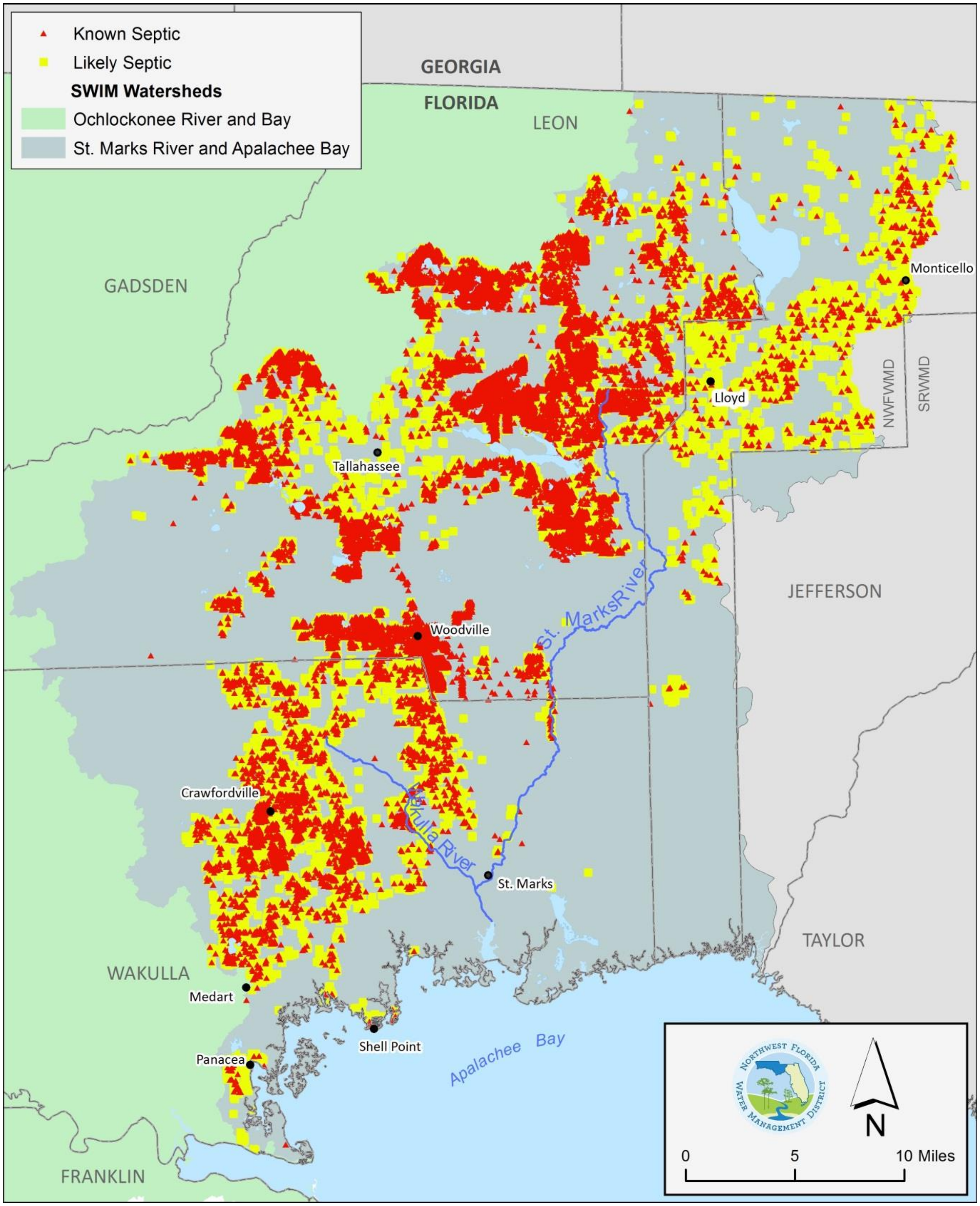


Figure 3-3 Septic Systems in the St. Marks River and Apalachee Bay Watershed

There are only a few marinas in the watershed, including several small, local marinas and access points at Shell Point, Panacea, and in the City of St. Marks. Marinas may be a source of NPS pollution given typical activities that occur—such as boat cleaning, fueling operations, and marine sewage discharge—and due to stormwater runoff from parking lots and hull maintenance and repair areas. Actual pollution from marinas can depend on the availability of pump-out facilities and the level and consistency of marina BMP implementation (FDEP 2015c). There are currently no Clean Marina designations and limited septic pump-out facilities in the watershed (FDEP 2015d).

Some pollutants, such as nitrogen and mercury, are also contributed to the landscape and waterbodies by atmospheric deposition. Most oxidized-nitrogen emissions are deposited close to the emission source and can especially impact surface water proximate to urban areas (Howarth *et al.* 2002a, 2002b, 2002c; NRC 2000). The final basin management action plan for the Lower Wakulla River (FDEP 2015b) describes atmospheric deposition as the source of approximately 13% of the nitrogen loading to the spring basin.

There are 13 permitted domestic wastewater facilities and 14 industrial wastewater facilities active within the watershed, as well as two power plants (Figure 3-5). Tallahassee's Arvah B. Hopkins Generating Station is located on the western watershed divide and discharges to the Ochlockonee River watershed. The highest concentrations of facilities are in Leon County near Tallahassee. Other facilities are in or near Woodville, St. Marks, and Panacea. Among the industrial facilities are 5 concrete batch plants and a concentrated animal feeding operation in Jefferson County. Domestic wastewater treatment facilities (WWTFs), flows and discharge type are included in Table 3-2 below.

In 2006, the City of Tallahassee initiated advanced wastewater treatment improvements at its T. P. Smith Water Reclamation Facility. The first phase of upgrades included a new headworks facility, pump station, multiple storage and feed facilities. Deep bed denitrifying filters were placed into service in August 2011. Updates to biological nutrient removal basins continued through 2015 (Hazen and Sawyer 2013). As a result of the new denitrifying filters coming online, nitrogen concentrations have been below 2 milligrams per liter since October 2012 (Hazen and Sawyer 2013; NWFWMD 2014).

Wastewater reclamation that supports beneficial reuse has the potential to further decrease pollution in surface waters, while also limiting or reducing potable water demand. In Tallahassee, the Tram Road Reuse Facility supplies public access reclaimed water for irrigation in the southeast portion of the city (City of Tallahassee 2016). Wakulla County is upgrading its Otter Creek WWTF to advanced wastewater treatment standards. A portion of the water reclaimed with this facility will be used to meet landscape irrigation needs within the county. 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.

Table 3-2 Domestic Wastewater Facilities

Facility Name	County	Permitted Flow (mgd)	2015 Flow (mgd)	Discharge Type*
Capital City Plaza WWTP	Jefferson	0.03	0.004	Rapid infiltration basin (RIB)
Disc Village WWTP	Leon	0.03	0.004	RIB
Grand Village MHP WWTP	Leon	0.03	0.005	Absorption field
Lake Bradford Estates MHP WWTF	Leon	0.043	0.008	Absorption field
Meadows at Woodrun WWTF	Leon	0.10	0.08	RIB
Sandstone Ranch	Leon	0.07	0.03	RIB

Facility Name	County	Permitted Flow (mgd)	2015 Flow (mgd)	Discharge Type*
WWTF				
T.P. Smith Water Reclamation Facility	Leon	26.50	19.20	Sprayfield; landscape irrigation
Western Estates MHP WWTP	Leon	0.02	0.01	RIB
Woodville Elementary School WWTP	Leon	0.01	0.002	Absorption field
River Plantation Estates WWTP	Wakulla	0.03	0.01	RIB
St. Marks WWTF	Wakulla	0.10	0.04	Reuse at power plant
Wakulla Middle School WWTP	Wakulla	0.02	0.003	RIB
Winco Utilities, Inc. WWTP	Wakulla	0.50	0.39	Sprayfield

Source: FDEP 2016a, 2017a
*See Parts II-VII of Chapter 62-610, F.A.C. for more information.
** FDEP Annual Reuse Inventory only includes facilities permitted at 0.1 mgd or greater.

There are 14 hazardous waste facilities registered as EPA Biennial Reporter facilities; 13 are in Tallahassee, while one is in St. Marks. EPA Biennial Reporter facilities handle hazardous waste and are required to report to the EPA Administrator at least once every two years (EPA 2016a). Additionally, 629 closed, three abandoned, and 471 active petroleum contamination tracking sites within the watershed are registered with the Storage Tank and Petroleum Contamination Monitoring (STCM) database. There are 23 contaminated dry cleaning sites eligible for the state-funded Dry-cleaning Solvent Cleanup Program within the basin. Most STCM and dry-cleaning sites are in historically developed areas in Tallahassee and Monticello, with additional sites in Crawfordville and St. Marks.

There are currently no EPA National Priority List (NPL) Superfund sites within the watershed. However, eight non-NPL Superfund sites are located within the basin: five in Tallahassee, one in Lloyd, and two in St. Marks. Cascades Park was the site of Centennial Field, a former landfill and athletic field. The City of Tallahassee and the state of Florida placed a cap over the landfill and removed more than 98,000 tons of contaminated material from the former gas plant (EPA 2016b). In 2014, the city completed redevelopment of the site with the completion of Cascades Park and stormwater management facility.

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), with dioxin is present in soils, sediments and groundwater (FDEP 2003). In 2009, the City of St. Marks received an EPA Brownfields Assessment grant to determine the extent of contamination at the former refinery, which positioned the city to receive an EPA cleanup grant in 2013. In 2014, St. Marks received a Brownfields Revolving Loan Fund sub-grant from the Tallahassee Brownfields Coalition to continue cleanup, construction, and renovation on the former refinery (City of Tallahassee 2014). The city and FDEP continue to work toward completion of remediation at the site.

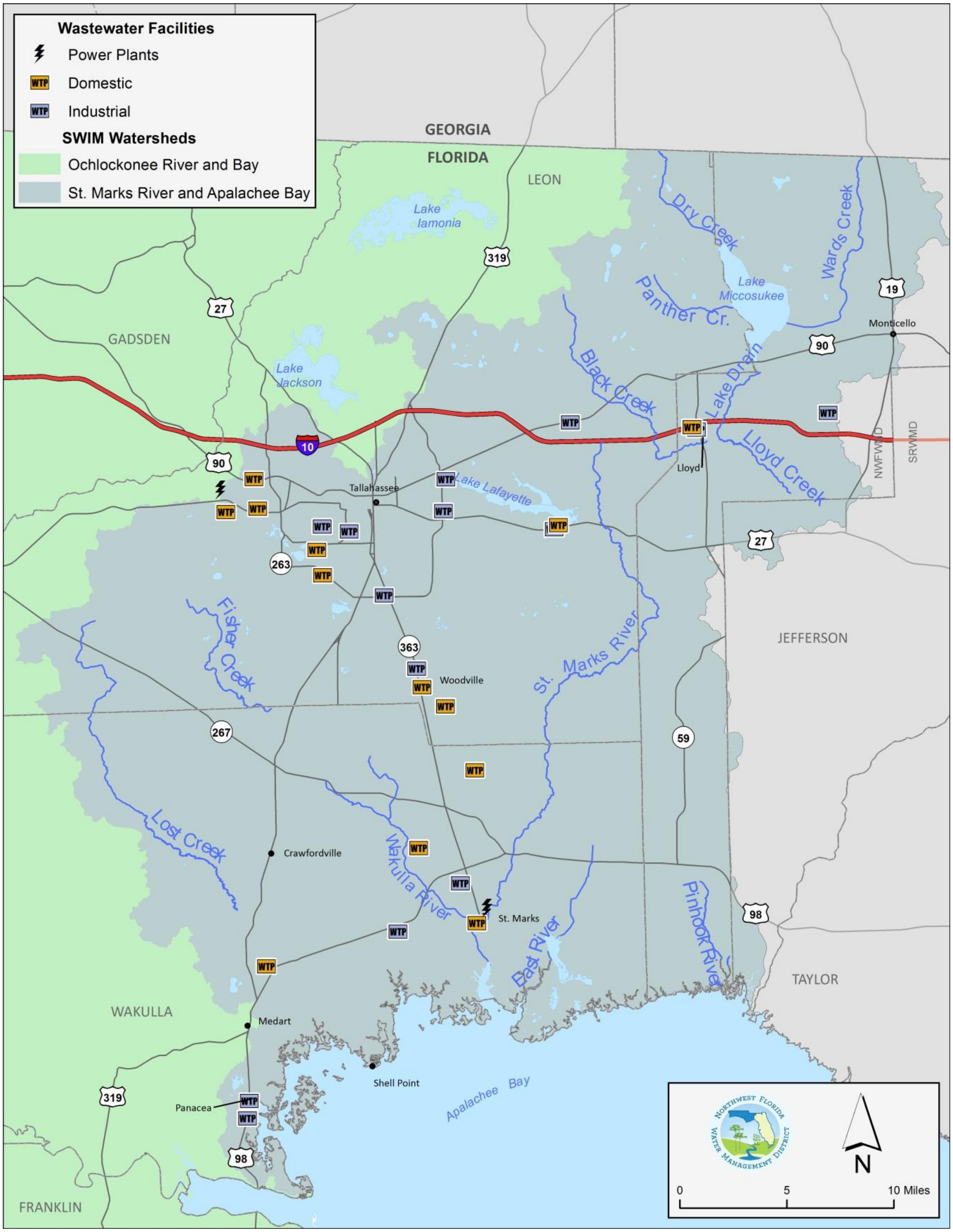


Figure 3-4 Permitted Wastewater Facilities within the St. Marks River and Apalachee Bay Watershed

3.2 Natural Systems

Many of the watershed's lakes have undergone hydrologic alteration and experienced point and nonpoint source pollution, particularly in the Tallahassee metropolitan area. In Lake Munson, deltas of transported sediment have accumulated, as has organic muck on the lake bottom (FDEP 2003). From 1934 to 1984, Lake Munson was the receiving waterbody for Tallahassee's municipal wastewater discharges. The construction of a sprayfield in 1984 for Tallahassee's municipal wastewater resulted in removal of this discharge, which improved the water quality in the lake. However, it still receives significant discharge in the form of stormwater runoff from approximately 38 percent of Tallahassee's urban area. Lake Lafayette, which was once a single waterbody, has been separated into four separate lakes by a series of earthen dikes. The Lake Lafayette System suffers from nutrient enrichment, low DO, a proliferation of aquatic vegetation, and invasive species including the channeled apple snail (*Pomacea canaliculata*) (McGlynn 2006).

As described by FDEP (2012), the upper reach of the Wakulla River has experienced ecological impacts due to the water quality issues described above. Extensive growth of non-native aquatic plants and algae 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 (*Pomacea paludosa*) and the limpkin (*Aramus guarauna*) population that feeds on them (Loper *et al*. 2005). Intensive efforts have been undertaken to remove hydrilla, including chemical treatment and mechanical harvesting. Increased numbers of manatees utilizing the spring, particularly during the winter months, has contributed to grazing. Invasive aquatic plants are also a problem on the St. Marks River, notably hydrilla, water hyacinth (*Eichhomia crassipes*), and water lettuce (*Pistia stratiotes*) (FDEP 2003).

Lewis *et al.* (2009) reviewed historical seagrass coverage data for Apalachee Bay and surrounding waters and indicated apparent losses between 1992 and 2001. Yarbro and Carlson (2016) observed coverage between 2001 and 2006 to be generally stable, although losses were noted between the St. Marks and Ochlockonee rivers. Apparent declines in density and diversity were noted, and as much as 2,720 acres were identified as having converted from continuous to patchy beds. Identified stressors included reduced optical water quality, resulting from elevated color and phytoplankton concentrations.

As described by Lewis *et al.* (2009), oyster reefs are the most abundant and important hard bottom habitats in Apalachee Bay. Natural oyster reefs are common in the lower St. Marks River and adjacent tidal marshes. The primary reef-building oyster in the Panhandle is the Eastern or American oyster (*Crassostrea virginica*).

Changes in the hydroperiod (seasonal pattern of water levels) due to regional climate shifts may affect tidal marsh coverage (USGS 1997). Recent investigations at the St. Marks National Wildlife Refuge by USFWS using the Sea Level Affecting Marshes Model (SLAMM) indicate tidal fresh marsh communities would transition to salt marsh with rising sea levels (USFWS 2012).

3.3 Floodplains and Floodplain Management

Floodplains provide important functions for water resources, as well as for the human community. Floodplains provide storage of floodwaters, reducing runoff velocity and preventing erosion and sedimentation. Floodplains attenuate potential flood effects, while also providing an ecological link between aquatic and upland ecosystems. They also provide important habitat for many terrestrial and aquatic species. In addition to impacting water resources, development and encroachment into flood-prone areas can place residents and property at risk. Floodplain encroachment reduces flood-carrying capacity, increases flood heights and velocities, and degrades natural systems in areas beyond the encroachment itself.

Maintaining the hydrological integrity of the floodplain can benefit surface water systems in drought conditions, as well as flood conditions. Floodplain vegetation reduces evaporation and increases soil water storage capacity. Riparian wetlands, marshes, and floodplain forests help to slow stormwater runoff, protecting water quality and regulating the release of water into streams and aquifers.

Riverine floods are common along major rivers and their tributaries. Within the St. Marks River and Apalachee Bay watershed, the St. Marks River, as well as tributary streams, wetlands, low-lying areas, coastal areas, and closed basins are subject to significant flooding. Flooding can be particularly problematic in high-growth and densely populated areas. Flooding impacts appear to be aggravated by inadequate public awareness of the potential for flooding events and associated consequences.

Federal Emergency Management Agency digital flood maps indicate that 335,142 acres (approximately 49 percent) of the St. Marks River and Apalachee Bay watershed are delineated as Special Flood Hazard Area. Lands prone to flooding are predominantly in the lower portion of the watershed in the coastal lowlands where extensive wetlands, old submerged beaches, and seagrass meadows have a wave dampening effect. Most of this region is public conservation land, so risks to private property are limited.

The coastline within the St. Marks River and Apalachee Bay watershed is an extensive low-energy area, with a gently sloping continental shelf, no offshore barrier islands, and several rivers, creeks, and marshes discharging directly into the Gulf of Mexico. During storm events, Wakulla County is susceptible to tide wave amplification. Storm surge elevations within the Apalachee Bay area are generally higher than the adjacent areas to the west and south of the bay, due to a combination of extensive offshore areas with shallow water depths and the effect of south-southeastern winds on local water movement (FEMA 2014).

4.0 Watershed Protection and Restoration

4.1 Management Practices

Watershed protection and restoration is inherently a collaborative effort on the part of state, regional, and federal agencies; local governments; nongovernment organizations; the business community; and the public. Implementation is conducted at the watershed, sub-watershed, and local scale. Recommended management strategies are described below.

4.1.1 Nonpoint Source Pollution Abatement

Addressing NPS pollution is a vital part of watershed management in the St. Marks River and Apalachee Bay watershed. As described above, stormwater runoff carries pollutants from the landscape that diminish water quality, and it can physically impact streams and aquatic habitats. Multiple strategies can be employed to collectively reduce NPS pollution and protect and improve water quality and watershed resources.

Stormwater Retrofit

Among the most effective means of reducing NPS pollution is to retrofit existing stormwater management systems to add treatment and improve, restore, or approximate natural hydrology. In addition to improving water quality, appropriately designed retrofit projects improve flood protection, reduce physical disturbance from erosion and sedimentation, and provide aesthetic and recreational use benefits.

Implementation may include a mixture of traditional and nonstructural approaches. There are numerous methods of stormwater management and treatment, among which are wet and dry detention ponds, infiltration systems, stormwater harvesting, wetland treatment systems, stormwater separator units, vegetated swales and buffers, pervious pavement, bioretention, vegetated swales and buffers, ditch blocks, green roofs, and chemical (alum) treatment. Specific measures employed depend on site conditions, including soils, water table conditions, flow, intended uses, and available land area. Optimally, a treatment train approach is employed, addressing hydrology and water quality treatment across a basin. Implementation is best accomplished within a wider, watershed context that incorporates initiatives such as Florida Friendly Landscaping (section 373.185, F.S.) and public outreach and awareness.

Within the St. Marks River and Apalachee Bay watershed, the greatest need and potential for stormwater retrofit efforts is within municipal and fringe areas with relatively dense development and significant areas of impervious surface. Examples include the Tallahassee area, Monticello, Crawfordville, Panacea, and St. Marks. Local governments normally take the lead in implementing stormwater retrofit projects, as they most commonly own, operate, and maintain stormwater management systems.

Agricultural Best Management Practices

Best management practices are individual or combined practices determined through research, field-testing, and expert review to be effective and practicable means for improving water quality, considering economic and technological constraints. Such measures can promote water use efficiency and protect fish and wildlife habitat. Such practices were pioneered for agriculture but have also been developed and effectively applied to silvicultural and urban land uses. Best management practices reduce soil loss, nutrient enrichment, sedimentation, discharge of chemical pollutants, and other adverse impacts (see, for example, Wallace *et al.* 2017, among many others). Implementation also often provides benefits for stream bank stability and fish and wildlife habitat. In addition to protecting water and habitat quality and conserving water, BMPs may reduce costs to producers by increasing operational efficiency and effectiveness.

Agricultural BMPs generally fall into two categories – structural and management. Structural BMPs, e.g., water-control structures and fencing, involve the installation of structures or changes to the land and are usually costlier than management BMPs. Management BMPs, such as nutrient and irrigation management, comprise the majority of the practices but may not be readily observable. Nutrient management addresses fertilizer type, amount, placement, and application timing, and it includes practices such as soil and tissue testing, application methods and rates, correct fertilizer formulations, and setbacks from water resources. Irrigation management addresses system maintenance, scheduling, and other measures that improve the overall efficiency of irrigation systems.

The Florida Department of Agriculture and Consumer Services has developed, evaluated, and approved BMPs that are specific to individual agricultural operations within Florida watersheds. As of August 2017, the DACS has adopted manuals for cow/calf, statewide citrus, vegetable and agronomic crops, nurseries, equine operations, specialty fruit and nut, sod, dairy, and poultry operations. A small farms manual is under development and adoption is expected in 2017. The sod and cow/calf manuals are currently under review and revision. Guidance for and assistance in enrolling in approved BMPs are provided by FDACS. Cost share programs are also conducted both by FDACS and the District. Additionally, FWC provides technical assistance to private landowners through its Landowner Assistance Program.

Implementation of approved BMPs or water quality monitoring is required in basins with adopted BMAPs. Whether required or not, however, implementation of BMPs are effective means of protecting and restoring watershed resources and functions and are recommended land use practices for implementation of this plan.

Within the St. Marks River and Apalachee Bay watershed, the most extensive and concentrated areas of agricultural land use are within Leon and Jefferson Counties, notably including the Tallahassee Hills/Valdosta Limesink region, south of Lake Lafayette, and surrounding Lake Miccosukee (Figure 2-9). Within these areas in particular, application of agricultural BMPs have potential to further protect and improve water quality and aquatic habitat conditions.

<u>Silviculture Best Management Practices</u>

The Florida Forest Service (FDACS 2008) defines silviculture BMPs as "the minimum standards necessary for protecting and maintaining the State's water quality as well as certain wildlife habitat values, during forestry activities." These practices are protective of water resources, including streams, downstream receiving waters, sinkholes, lakes, and wetlands. The FFS provides specific guidance on BMPs (FDACS 2008) and has established compliance monitoring requirements and procedures FDEP (1997) evaluated the effectiveness of silviculture BMPs and concluded that forestry operations conducted in accordance with the BMP manual resulted in no major adverse habitat alterations.

The primary BMPs established for forestry are special management zones (SMZs). These zones provide buffering, shade, bank stability and erosion-control, as well as detritus and woody debris. They are intended to protect water quality by reducing or eliminating sediment, nutrients, logging debris, chemicals, and water temperature fluctuations. They also maintain forest attributes that provide wildlife habitat. Widths of SMZs vary depending on the type and size of the waterbody, soils, and slope. Specific SMZs are described as follows.

1) The **Primary Zone** varies between 35 and 200 feet and applies to perennial streams, lakes, and sinkholes, OFWs, Outstanding Natural Resource Waters (ONRW), Class I Waters, and, in some cases, wetlands. A primary zone generally prohibits clear-cut harvesting within 35 feet of perennial

waters and within 50 feet of waters designated OFW, ONRW, or Class I. Other operational prescriptions also apply to forestry practices to protect water and natural resources.

2) The **Secondary Zone** applies to intermittent streams, lakes, and sinkholes. Unrestricted selective and clear-cut harvesting is allowable, but mechanical site preparation, operational fertilization, and aerial application or mist blowing of pesticide, are not. Loading decks or landings, log bunching points, road construction other than to cross a waterbody, and site preparation burning on slopes exceeding 18 percent are also prohibited. These zones vary in width between 0 and 300 feet.

3) The **Stringer** provides for trees to be left on or near both banks of intermittent streams, lakes, and sinkholes to provide food, cover, nesting, and travel corridors for wildlife.

Other BMPs detailed in the Florida silviculture BMP manual include practices for forest road planning, construction, drainage, and maintenance; stream crossings; timber harvesting; site preparation and planting; fire line construction and use; pesticide and fertilizer use; waste disposal; and wet weather operations. The BMP manual further includes specific provisions to protect wetlands, sinkholes, and canals. Associated with the BMP manual are separate forestry wildlife best management practices for state imperiled species (FDACS 2014).

Given that the St. Marks River and Apalachee Bay watershed is predominantly forested (Table 2-1; Figure 2-9), silviculture BMPs are some of the most important tools for protecting water quality and wetland and aquatic habitat quality within the watershed. The significant relief that exists within the upper watershed (Figure 2-6) suggests application of SMZs may be particularly useful for protecting downstream aquatic habitats from further impacts.

Low Impact Development

Inclusive of green infrastructure, urban best management practices, and Florida Friendly Landscaping, low impact development represents a framework for implementing innovative stormwater management, water use efficiency, and other conservation practices during site planning and development. Benefits include reduced runoff and NPS pollution, improved flood protection, and reduced erosion and sedimentation. Some specific practices include the following.

- Minimized structural alteration of low-lying, flood-prone lands; reserving such areas for passive public uses
- Minimized effective impervious area
- Vegetated swales
- Bioretention cells
- Rain gardens
- Infiltration and exfiltration systems
- Riparian buffers
- Greenways
- Certification programs, such as Florida Water Star[SM], and the Florida Green Building Coalition

For transportation infrastructure, practices recommended to protect water quality and floodplain and wetland functions include incorporating bridge spans that accommodate bank-full stream flows while maintaining intact floodplain, wetland, and wildlife passage functions.

Riparian Buffers

A riparian buffer zone is an overlay that protects an adjoining waterbody from effects of adjacent development, such as runoff, NPS pollution, erosion, and sedimentation. A buffer zone in this context refers to an area along the shoreline that is maintained in or restored to generally natural vegetation and habitat. In this condition, an intact buffer zone helps to simultaneously achieve three important goals: water quality protection, shoreline stability, and fish and wildlife habitat. Associated with these are other benefits, including aesthetic improvements and public access and recreation. These benefits are achievable for riparian areas along all types of waterbodies: stream/riverine, estuarine, lacustrine, wetlands, and karst features.

In general, the wider the buffer zone, the better these goals may be achieved, although specific requirements are defined based on community goals. Limited areas, for example, might be developed into recreational sites, trails, or other access points. Table 4-1 is a representation of generalized buffer zones, adapted from USFWS documentation, listing benefits provided by buffers of successively larger widths. Complicating buffer zone design is the fact that different sites have different ecological and physical characteristics. These characteristics (type of vegetation, slope, soils, etc.), when accounted for, would lead to different buffer widths for any given purpose. Alternatives to fixed-width buffer policies included tiered systems that can be adapted to multiple goals and site specific characteristics and uses. Wenger (1999) and Wenger and Fowler (2000) provide additional background, detail, and guidance for the design of buffer zone systems and policies.

Table 4-1 Generalized Buffer Zone Dimensions

	Buffer Width:					
Benefit Provided:	**30 ft**	**50 ft**	**100 ft**	**300 ft**	**1,000 ft**	**1,500 ft**
Sediment Removal	Water quality protection	Water quality protection	Water quality protection	Water quality protection	Water quality protection	Water quality protection
Maintain Stream Temperature	Aquatic habitat enhancement	Aquatic habitat enhancement	Aquatic habitat enhancement	Aquatic habitat enhancement	Aquatic habitat enhancement	Aquatic habitat enhancement
Nitrogen Removal		Water quality protection	Water quality protection	Water quality protection	Water quality protection	Water quality protection
Contaminant Removal		Water quality protection	Water quality protection	Water quality protection	Water quality protection	Water quality protection
Large Woody Debris for Stream Habitat		Aquatic habitat enhancement	Aquatic habitat enhancement	Aquatic habitat enhancement	Aquatic habitat enhancement	Aquatic habitat enhancement
Effective Sediment Removal			Water quality protection	Water quality protection	Water quality protection	Water quality protection
Short-Term Phosphorus Control			Water quality protection	Water quality protection	Water quality protection	Water quality protection
Effective Nitrogen Removal			Water quality protection	Water quality protection	Water quality protection	Water quality protection
Maintain Diverse Stream Invertebrates			Aquatic habitat enhancement	Aquatic habitat enhancement	Aquatic habitat enhancement	Aquatic habitat enhancement
Bird Corridors				Terrestrial riparian habitat	Terrestrial riparian habitat	Terrestrial riparian habitat
Reptile and Amphibian Habitat					Terrestrial riparian habitat	Terrestrial riparian habitat
Habitat for Interior Forest Species					Terrestrial riparian habitat	Terrestrial riparian habitat
Flatwoods Salamander Habitat – Protected Species						Vulnerable species protection

Key
Water quality protection
Aquatic habitat enhancement
Terrestrial riparian habitat
Vulnerable species protection

Adapted from USFWS 2001

<u>Basinwide Sedimentation Abatement</u>

Unpaved roads frequently intersect and interact with streams, creating erosion and runoff conditions that transport roadway materials directly into streams, smothering habitats and impacting water quality and the physical structure of the waterbodies. Borrow pits can also cause progressive erosion conditions that smother streams, severely damaging or destroying habitats and diminishing water quality. Risks are most pronounced in the upper portion of the St. Marks River and Apalachee Bay watershed, given slopes and prevalent soils.

Given the site specific and physical nature of the impacts, efforts taken at the local and regional level can lead to significant restoration of aquatic habitat conditions and improved water quality. Corrective actions may include replacing inadequate culverts with bridge spans or larger culverts that maintain floodplains and flows, hilltop-to-hilltop paving, use of pervious pavement, establishment of catch basins to treat and manage stormwater, and establishment of vegetated or terraced basins to eliminate gulley erosion.

In addition to addressing unpaved roads and gully erosion sites, comprehensive application of construction BMPs, to include sediment and erosion controls, protects water and habitat quality, as well as the physical structure of streams and other waterbodies. Extremely heavy and sustained precipitation events are common in northwest Florida; thus, for large-scale construction and transportation projects, implementing sediment controls and staging land clearing and stormwater treatment systems in a manner that exceeds standard practice for smaller projects would avoid major sedimentation and pollution events that are otherwise possible.

4.1.2 Wastewater Management and Treatment Improvements

Septic to Sewer Connections

Among the promising approaches for correcting current impacts and impairments are actions to improve the management and treatment of domestic wastewater. While expensive and engineering-intensive, such actions are technically feasible, proven approaches to improving water quality and aquatic habitat conditions, as well as public uses and benefits.

Extending sewer service to areas that currently rely on conventional onsite treatment and disposal systems for wastewater treatment and disposal can effectively reduce nutrient loading within the groundwater contribution area. As outlined above, there are over 33,000 known or likely conventional septic systems in the St. Marks River and Apalachee Bay watershed. As illustrated by Figure 3-4, these are particularly concentrated around Tallahassee, Woodville, and Crawfordville, within the Wakulla Springs BMAP area, as well as within the vicinity of the Wakulla River. Connecting residences and businesses in these areas to centralized wastewater treatment systems has the potential to substantially improve wastewater treatment and reduce loading of nutrients and other pollutants to these waterbodies and to downstream receiving waters.

It is estimated that there are over 7,000 OSTDS in the Wakulla Springs ground water contribution area south of the Cody Scarp, including over 6,600 within priority focus areas 1 and 2. Currently planned or proposed projects within Leon and Wakulla counties would provide for connection of approximately 4,200 units to central sewer.

Advanced Onsite Systems

Where extension of sewer service is not economically feasible due to the spatial distribution of rural populations, there is potential for installation of advanced onsite systems that achieve water quality treatment surpassing that provided by conventional systems. In particular, advanced passive systems are being developed to provide cost-effective and practical systems for reducing nitrogen and other pollutants from onsite sewage systems (FDOH 2015b). Pilot projects are underway in different areas of the state, including within the Wakulla Springs contribution area.

Water Reclamation and Reuse

For the purposes of this plan, water reuse refers to the application of reclaimed water for a beneficial purpose, with reclaimed water receiving at least secondary treatment and basic disinfection (Chapter 62-10, F.A.C.; Section 373.019, F.S.). Beneficial purposes include reusing reclaimed water to offset a current or known future potable water demand or other documented watershed and water resource challenges. Specific purposes include landscape and golf course irrigation, industrial uses, and other applications. Water reuse can be a key strategy in reducing or eliminating wastewater discharges and associated pollution of surface waters.

Centralized Wastewater Treatment Upgrade and Retrofit

For centralized wastewater treatment systems, conversion to advanced wastewater treatment has proven to be an effective means of reducing the load of nutrients and other pollutants discharging into surface and ground waters. Additionally, in many areas there is a significant need to rehabilitate existing sewer systems, including to correct inflow and infiltration problems and to reduce the number and severity of sanitary sewer overflow incidents. Accomplishing these actions can be expensive and difficult, given the need to retrofit existing systems in often highly developed areas. Upon completion, however, notable improvements can be achieved for water quality, public recreational uses, and fisheries.

4.1.3 Ecological Restoration

A wide array of measures may be employed to restore natural and historic functions to former or degraded wetland, aquatic, stream, riparian, and estuarine habitats. Enhancement actions, such as improving vegetation conditions, invasive exotic plant removal, and prescribed fire, are also often discussed in the context of restoration. Wetland, hydrologic, floodplain, shoreline, and stream restoration are discussed further below.

Wetland, Hydrologic and Floodplain Restoration

Wetland restoration includes actions to reestablish wetland habitats, functions, and hydrology. It frequently involves substrate composition and profile restoration and vegetation community reestablishment, including shrub reduction, exotic species removal, application of prescribed fire, and replanting.

Hydrologic and floodplain restoration include actions to reestablish flow ways and the timing of surface water flow and discharges. Actions include removing fill, replacing bridges and culverts with appropriate designs, establishing low-water crossings, restoring pre-impact topography and vegetation, and abandoning unneeded roads through fill removal and replanting. Restoration activities can have broad water resource benefits, including improved water quality, enhanced fish and wildlife habitat, and other restored wetland functions.

Hydrologic restoration is important for altered flow-ways and waterbodies in urban areas, such as the Tallahassee urban area, as well as for riverine systems and for larger wetland systems, such as St. Marks National Wildlife Refuge. Wetland restoration, including habitat enhancements and vegetation restoration, is broadly applicable at both large and smaller scales throughout the watershed.

Shoreline Restoration

Shoreline restoration refers to measures taken to restore previously altered shorelines and to protect eroding or threatened shorelines. Such restoration is accomplished using “living shorelines” techniques, which are a set of evolving practices that incorporate productive intertidal and shoreline habitats to protect shorelines while also enhancing or restoring natural communities, processes, and productivity. When planned and implemented appropriately, such efforts result in direct and tangible benefits for residents and the larger community, including fish and wildlife, improved water quality, shoreline protection, and aesthetic improvements.

Shoreline restoration in this context may be applicable as a potential strategy along altered and/or eroding shorelines, such as the vicinity of Shell Point Beach.

Stream Restoration

Tributary stream restoration includes actions to reestablish the hydrology and aquatic and riparian habitat that may have been impacted by road crossings, instream impoundments, erosion and sedimentation, runoff or other hydrologic effects of adjacent or upstream developments. This may also include developing more natural hydrology, wetlands, storage/treatment, and riparian vegetation along stormwater conveyances. In stream restoration may include efforts to reestablish natural channel and floodplain process and should accompany efforts to address offsite processes (erosion, sedimentation, etc.) that created the original impacts.

Lake Restoration

Lake restoration most frequently encompasses restoration actions described above, including NPS pollution abatement actions, conversion of conventional septic systems to central sewer or advanced onsite systems, and restoration of wetlands and tributary streams. Additionally, lake drawdowns and natural drydown events can be used as opportunities to remove contaminated and/or enriched sediments, thus removing legacy pollutants, as well as to promote oxidation of organic sediments and to improve vegetation conditions.

Estuarine Habitat Restoration

Implementation of wetland and shoreline restoration, as described above, as well as aquatic habitat restoration and enhancement can be implemented in a complementary manner to improve and restore estuarine habitat and productivity. Well-established, contiguous marshes; seagrass meadows; and oyster reefs provide habitat for a wide range of marine species, including recreational and commercially valuable seafood species.

Emergent marshes and oyster reefs serve as an important buffer between uplands and estuaries, filtering pollutants and consuming nutrients before they enter the water and reducing waves before they reach land. These communities promote sediment accumulation and shoreline stabilization, attenuate wave energy, protect marsh habitat, and buffer upland areas against wind and wave activity that expedite erosion. Each oyster can filter vast quantities of water, removing suspended particles that would otherwise reduce sunlight penetration needed for healthy seagrass beds.

4.1.4 Land Conservation

While the St. Marks River and Apalachee Bay watershed benefits from extensive public land areas that protect water quality and wetland and aquatic habitats and provide for public access and use, there are still opportunities to further protect water resources through the protection of sensitive areas, including riverine, stream-front, and estuarine shorelines. Additionally, resource conservation can be accomplished at a sub-basin or project-level scale to augment other strategies, including stormwater retrofit and hydrologic restoration, and to provide for compatible public access and recreation.

As demonstrated through the Florida Forever program and other state, federal, local, and private initiatives, preserving sensitive lands can be an effective part of protecting water quality and habitat, as well as preserving floodplain and wetland functions. Where land is acquired fee simple by public agencies, other benefits, such as public access and recreation, are also achieved. Resource protection can be achieved through less than fee, as well as fee simple acquisition.

4.1.5 Public Awareness and Education

Public awareness and education efforts span multiple purposes and are an essential component of many of the other actions described here. Among the purposes of awareness and education efforts are:

- Technical outreach to assist in implementing specific programs (for example, best management practices);
- Informing members of the public about the purpose and progress of implementation efforts;
- Providing opportunities for public engagement and participation, as well as public feedback and program accountability; and
- Providing broad-based educational efforts to inform members of the public and specific user groups about watershed resources, their benefits, and personal practices to ensure their protection.

Examples of public educational activities include technical training for BMPs, school programs (e.g., Grasses in Classes), public events, citizen science and volunteer programs, and project site visits.

Watershed stewardship programs can bring together multiple partners such as federal, state, and local agencies; non-profit groups; and citizen volunteers by identifying common program goals and achieving overlapping outcomes. Having a variety of participants may offer important insight and expertise, shared experiences through lessons learned, and pooling of available resources to implement projects. Specific program examples include, but are not limited to: Walk the WBIDs; Grasses in Classes; Offer Your Shell to Enhance Restoration (OYSTER); homeowner oyster gardening program; rain garden/rain barrel workshops; storm drain labeling; marina BMPs; landowner cost-share assistance programs for living shorelines; elected official information and training sessions; spring break restoration projects; and messaging through outlets such as public service announcements, social media, events, and festivals (e.g., Bay Day, Earth Day).

4.1.6 Options for Further Study and Analysis

Additional work is needed to further advance the scientific understanding of resource conditions and watershed challenges and opportunities. Additional analytical work can also support improved project planning and the incorporation of innovative methods for improved resource management.

- Develop improved and more detailed assessments of environmental conditions and trends, to include water quality, biology, and habitat.
- Evaluate the effects of land use and management on water quality with implications for spring water clarity.
- Assess long-term runoff and streamflow trends to better understand effects on floodplain storage and downstream habitats. Utilize information to identify options for water quality and aquatic habitat protection and restoration.
- Develop a watershed-wide NPS pollution potential assessment, at the 12-digit HUC level, to include analysis of land uses, applied loading rates, and potential BMP application.
- Develop a spatial analysis of OSTDS, to include pollutant loading estimates and estimates of potential pollutant load reduction and average receiving waterbody pollutant concentrations following connection to central sewer and/or conversion to advanced onsite systems. Delineate proposed target areas for central sewer connections and for advanced onsite systems.
- Develop a hydrodynamic model to improve the understanding of estuarine circulation, with application for estuarine and littoral restoration planning.

- Develop updated, regionally specific storm surge, floodplain, and sea level rise models to support project planning, floodplain protection, and adaptation planning, and to further the understanding of drivers of coastal habitat change.
- Evaluate the feasibility and potential benefits of proposed innovative and large-scale projects. Also identify and evaluate the potential for unintended adverse effects. Examples of such projects may include, but are not limited to:
  - Regional-scale shoreline habitat development proposals
  - Stream channel reconfiguration
  - Dredged material removal and disposal
  - Benthic dredging
- Develop analysis of estuarine habitat, conditions, and trends, including for shellfish and submerged aquatic vegetation habitat, with assessment of suitability for restoration.
- Develop improved metrics for monitoring and evaluating projects, programs, and environmental conditions and trends.

4.2 Implementation

Table 4-2 outlines the planning progression of priorities, objectives, and selected management options and approaches for the St. Marks River and Apalachee Bay watershed. These, in turn, inform and guide SWIM projects listed in Section 4.3. Following the discussion of watershed issues provided above, priorities and objectives are organized by major priority areas: water quality, floodplain functions, and natural systems. Education and outreach is included as well, since it is applicable to all priority areas.

Table 4-2 Watershed Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Water Quality		
Water Quality Impairments Water quality impairments for listed stream and estuarine waters, to include nutrients, dissolved oxygen, and bacteria Diminished water quality in Wakulla Spring and River, Lake Munson, Lake Lafayette, and other waterbodies Vulnerability of seagrass and oyster habitats Legacy pollutants, including within the sediments of lakes Munson and Lafayette	Protect water quality basin-wide, and restore water quality in impaired waters. Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs. Gain understanding of variables that affect water clarity in Wakulla Spring and Apalachee Bay. Reduce nutrient and bacteria concentrations in receiving waterbodies. Reduce water quality impacts from legacy pollutants.	• Implement BMAP for the upper Wakulla River and Wakulla Springs • Stormwater retrofit projects • Comprehensive and integrated basin-wide stormwater management plans • Conversion of septic systems to central sewer • Evaluation and deployment of advanced passive onsite systems • Upgrades to wastewater infrastructure • Agricultural and silvicultural BMPs • Fee simple and less-than-fee protection of spring contribution areas, floodplains, riparian habitats, and other sensitive lands • Floodplain and wetland restoration • Riparian buffer zones • Water reclamation and reuse
Wastewater Management Needs and opportunities for improved wastewater collection and treatment Point source discharges Inadequate treatment from conventional OSTDS	Reduce loading of nutrients and other pollutants from OSTDS. Expand the reuse of reclaimed water.	
Nonpoint Source Pollution Stormwater runoff Vulnerability of sensitive habitats, including springs and seagrasses	Improve treatment of urban stormwater Reduce basinwide NPS pollution.	

Table 4-2 Watershed Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Natural Systems		
Wetland Systems Wetland loss and degradation	Protect and where needed restore wetland hydrology, vegetation, and functions.	• Restoration of wetland hydrology and vegetation • Shoreline and riparian habitat restoration, integrated across multiple habitats where possible • Estuarine habitat restoration (e.g., oyster reefs, seagrasses, and tidal marsh) where water quality is sufficient • Natural channel stream restoration • Lake drawdown and drydown options for sediment removal and other sediment and vegetation management actions • Fee simple and less-than-fee protection of floodplains, riparian habitats, lands proximate to karst features, and other sensitive lands • Development and dissemination of enhanced modeling tools (such as suitability models for estuarine habitat restoration and enhancement) • Facilitation of shoreline/estuarine habitat migration along the coastal elevation and latitudinal gradients • Coastal adaptation and land use planning • Coastal infrastructure retrofits to enhance adaptation capacity and habitat resiliency • Development and dissemination of detailed elevation (LiDAR) data • Agricultural, forestry, and construction best management practices • Enhanced monitoring of hydrologic and water quality data
Estuarine and Coastal Habitat Vulnerability of seagrasses, oyster beds, and other estuarine and coastal habitats Saltwater intrusion that could alter brackish and freshwater habitats Shoreline destabilization and erosion Need for improved understanding of current and potential effects of sea level rise	Protect and restore estuarine benthic habitats Ensure restoration projects are compatible with coastal change. Protect and restore the function of vegetated riparian buffers. Protection and enhancement of fish and wildlife habitat, including designated critical habitat for listed species	
Riverine, Stream, and Lacustrine Habitats Vulnerability of springs Altered floodplains, riparian habitats, and tributary streams	Restore Wakulla Spring and the upper Wakulla River ecosystem. Protect and restore the St. Marks River ecosystem. Evaluate and correct hydrological alterations where necessary. Control erosion and sedimentation. Protect and restore riparian habitats. Protect and restore stream and lake habitats Protect and enhance fish and wildlife habitat, including designated critical habitat for listed species.	

Table 4-2 Watershed Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Floodplain Functions		
Impacts to Floodplains Headwater degradation and channelization Diminished or disconnected floodplain area Riparian buffer loss	Protect and reestablish functional floodplain area. Evaluate and correct hydrological alterations where necessary. Protect or restore stream, lacustrine, wetland, and coastal floodplain functions. Continue to make publicly available data and information to enable communities to reduce flood risk.	• Natural channel stream restoration • Fee simple and less-than-fee protection of floodplains, riparian habitats, and other sensitive lands • Protection and enhancement of riparian buffer zones • Wetland and floodplain restoration • Development and dissemination of detailed elevation (LiDAR) data • Stormwater retrofit • Continued flood map updates and detailed flood risk studies • Hydrologic restoration

Table 4-2 Watershed Priorities, Objectives, and Management Options

Watershed Priorities	Objectives	Management Options
Education and Outreach		
Public Education and Outreach Expanded public understanding of practices to protect water resources Expanded opportunities for public participation Enhanced BMP technical support opportunities	Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation. Conduct education and outreach about watershed resources and personal practices to protect water and habitat quality. Build the capacity of landowners, agricultural producers, and others to protect watershed resources, functions, and benefits. Support agricultural, silvicultural, and urban BMPs.	• Disseminate information about watershed resources and benefits via multiple approaches – Internet, publications, school programs, and workshops • Disseminate information about resource programs, outcomes, and opportunities for participation • Demonstration projects • Opportunities for volunteer participation in data collection and project implementation • Technical BMP education and training • Collaborative community initiatives, with opportunities for business participation and sponsorship • Internet applications for public participation and to make program information and resource data continually available • Classroom programs, including hands-on restoration activities • Community awareness and education events and programs • Hands-on, citizen science, including volunteer participation monitoring and restoration programs • Education and technical training workshops and resources for local government officials

4.3 Priority Projects

Projects proposed to address above-described priorities and objectives are listed below and described in more detail on the following pages. Priority projects, as described herein, comprise strategies intended to address identified issues that affect watershed resources, functions, and benefits. These projects are intended to support numerous site-specific tasks and activities, implemented by governmental and nongovernmental stakeholders for years to come. Most address multiple priorities, as indicated in Table 4-3. The projects included are limited to those within the scope and purview of the SWIM program; resource projects outside the scope of surface water resource protection and restoration are not included. With each project, conceptual scopes of work are presented, as are planning level cost estimates. Specific details, tasks, and costs will be developed and additional actions may be defined to achieve intended outcomes as projects are implemented. No prioritization or ranking is implied by the order of listing. Project evaluation and ranking will occur in multiple iterations in the future and will vary based on funding availability, specific funding source eligibility criteria, and cooperative participation.

Table 4-3 Recommended Projects: St. Marks River and Apalachee Bay SWIM Plan

PROJECT	WATERSHED PRIORITIES			
	WQ	**FLO**	**NS**	**EDU**
Stormwater Planning and Retrofit	✓	✓	✓	✓
Septic Tank Abatement	✓			✓
Advanced Onsite Treatment Systems	✓			✓
Woodville Karst Springs Water Quality Protection and Enhancement	✓		✓	
Agriculture and Silviculture BMPs	✓	✓	✓	✓
Riparian Buffer Zones	✓	✓	✓	✓
Aquatic, Hydrologic and Wetland Restoration	✓	✓	✓	✓
Estuarine Habitat Restoration	✓		✓	✓
Strategic Land Conservation	✓	✓	✓	✓
Watershed Stewardship Initiative	✓	✓	✓	✓
Sub-basin Restoration Plans	✓	✓	✓	✓
Wastewater Treatment and Management Improvements	✓		✓	
Interstate Coordination	✓			✓
Analytical Program Support	✓	✓	✓	✓
Comprehensive Monitoring Program	✓	✓	✓	✓

WQ – Water Quality
FLO – Floodplain Functions
NS – Natural Systems
EDU – Education and Outreach

Stormwater Planning and Retrofit

Description:

This strategy consists of planning and retrofitting stormwater management systems to improve water quality, as well as to improve flood protection and accomplish other associated benefits. In addition to constructing new facilities, the project includes evaluation and improvement of existing systems and adding additional BMPs within a treatment train to improve overall performance within a given basin.

Scope of Work:

1. Prioritize basins and sites based on water quality, hydrologic, and land use data, together with consideration of local priorities, opportunities for partnerships, and other factors.
2. Support stormwater master planning at the local and regional level.
3. Develop project-specific implementation targets and criteria, to include pollutant load reductions, success criteria, and measurable milestones.
4. Develop a public outreach and involvement plan to engage citizens in the project's purposes, designs, and intended outcomes. The plan should include immediate neighbors that would be affected by the proposed project and other interested citizens and organizations.
5. Develop detailed engineering designs, with consideration of regional and multipurpose facilities, innovative treatment systems, and treatment train approaches for basin-level stormwater management and treatment.
6. Install/construct individual retrofit facilities.
7. Monitor local water quality, including upstream/downstream and/or before and after implementation, as well as trends in receiving waters.
8. Analyze data to identify water quality trends in receiving waters.

Watershed Priorities:
- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems

Supporting Priorities:
- ✓ Stormwater runoff and NPS pollution

Objectives:
- ✓ Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs.
- ✓ Reduce basinwide NPS pollution.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Gain understanding of variables that affect water clarity in Wakulla Spring and Apalachee Bay.
- ✓ Restore Wakulla Spring and the upper Wakulla River ecosystem.
- ✓ Protect and restore the St. Marks River ecosystem.

Lead Entities:
- ✓ Local governments

Geographic Focus Areas:

All developed areas of the watershed. Among project focus areas are:
- ✓ Wakulla Springs BMAP area
- ✓ Tallahassee urban area
- ✓ Greater Lake Lafayette basin
- ✓ Lake Munson basin
- ✓ Crawfordville area
- ✓ Panacea area

Planning Level Cost Estimate:

$27,000,000*

*Costs for stormwater facilities vary widely, depending on types of facilities and whether land needs to be acquired.

Outcomes/Products:

1. Comprehensive stormwater management plans
2. Completed stormwater retrofit facilities
3. Improved water quality and flood protection
4. Data evaluation and system validation, with lessons applicable to future projects

Septic Tank Abatement

Description:

This strategy consists of converting OSTDS to central sewer to reduce pollutant export and improve surface and ground water quality. To facilitate accomplishment, among the project goals is to reduce or eliminate connection costs to homeowners.

Scope of Work:

1. Prioritize areas of need through spatial analysis of OSTDS distribution, proximity to karst and other sensitive resources, proximity to existing infrastructure, and resource monitoring data.
2. In cooperation with local governments and utilities, complete alternatives analysis, considering sewer extension, advanced onsite systems, and other approaches as appropriate.
3. Develop project-specific implementation targets and criteria, to include pollutant load reductions, success criteria, and measurable milestones.
4. Initiate a public outreach and involvement plan to engage the public in the project's purposes, designs, and intended outcomes.
5. Work with directly affected residents throughout the project; coordinate with neighborhoods and individual homeowners.
6. Install sewer line extensions, connect residences and businesses, and abandon septic tanks.
7. Monitor bacteria, nutrients, and other parameters in nearby groundwater and surface waterbodies.
8. Analyze data to identify changes in trends of target pollutants.

Watershed Priority:

- ✓ Water Quality
- ✓ Natural Systems

Supporting Priorities:

- ✓ Inadequate treatment from conventional OSTDS

Objectives:

- ✓ Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Gain understanding of variables that affect water clarity in Apalachee Bay.
- ✓ Restore Wakulla Spring and the upper Wakulla River ecosystem.
- ✓ Protect and restore the St. Marks River ecosystem.

Lead Entities:

- ✓ Utilities, local governments

Geographic Focus Areas:

Specific project focus areas include, but are not limited to:

- ✓ Wakulla Springs BMAP area Lake Munson basin
- ✓ Basins of karst lakes, including Lafayette and Miccosukee
- ✓ Woodville Karst Plain
- ✓ Spring Creek springs group

Planning Level Cost Estimate:

>$30,000,000

Outcomes/Products:

1. Completed implementation plans, prioritizing areas for septic-to-sewer conversion.
2. Improved surface and groundwater quality

Advanced Onsite Treatment Systems

Description:

This strategy consists of installation of advanced OSTDS to reduce pollutant loading. This approach is most appropriate in areas remote from existing central sewer infrastructure or likely extensions. It may be considered an adjunct to the Septic Tank Abatement project.

Scope of Work:

1. Prioritize areas of need through spatial analysis of OSTDS distribution, proximity to karst and other sensitive resources, proximity to existing infrastructure, and resource monitoring data.
2. In cooperation with FDOH and FDEP, evaluate passive technology onsite systems.
3. In cooperation with local governments, conduct outreach to property owners to facilitate installation of advanced onsite systems as an alternative to conventional OSTDS.
4. Develop project-specific implementation targets and criteria, to include pollutant load reductions, success criteria, and measurable milestones.
5. Install/construct advanced OSTDS based on prioritization of sites and funding availability.
6. Monitor bacteria, nutrients, and other parameters in nearby groundwater and surface waterbodies.
7. Analyze data to identify changes in trends of target pollutants.

Outcomes/Products:

1. Improved surface and groundwater quality

Strategic Priority:
✓ Water Quality ✓ Natural Systems
Supporting Priorities:
✓ Inadequate treatment from conventional OSTDS
Objectives:
✓ Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs. ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies. ✓ Gain understanding of variables that affect water clarity in Apalachee Bay. ✓ Restore Wakulla Spring and the upper Wakulla River ecosystem. ✓ Protect and restore the St. Marks River ecosystem.
Lead Entities:
✓ Utilities, local governments
Geographic Focus Areas:
Rural areas near surface waters and karst where central sewer is not available or cost-effective. ✓ Wakulla Springs priority focus areas ✓ Greater Wakulla Springs BMAP area ✓ Basins of karst lakes, including Lafayette and Miccosukee ✓ Woodville Karst Plain ✓ Spring Creek springs group
Planning Level Cost Estimate:
$15,000,000 (initial implementation)

Woodville Karst Springs Water Quality Protection and Enhancement

Watershed Priorities:
✓ Water Quality ✓ Natural Systems
Supporting Priorities:
✓ Wakulla Springs and the Wakulla River ✓ St. Marks River ✓ Wider complex of springs and karst features of the Woodville Karst Plain
Objectives:
✓ Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs. ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies. ✓ Gain understanding of variables that affect water clarity in Wakulla Spring. ✓ Restore Wakulla Spring and the upper Wakulla River ecosystem. ✓ Protect and restore the St. Marks River ecosystem.
Lead Entities:
✓ NWFWMD ✓ FDEP ✓ FDOH ✓ FWC ✓ Leon County ✓ Wakulla County ✓ City of Tallahassee ✓ Wakulla Springs Alliance
Geographic Focus Areas:
Woodville Karst Plain springs, including, but not limited to: ✓ Wakulla Springs and the Wakulla River ✓ Sally Ward Spring ✓ St. Marks Rise ✓ Horn Spring ✓ Spring Creek Springs Group
Planning Level Cost Estimate:
>$50,000,000

Description:

This strategy consists of integrated activities to protect and improve water quality in the spring and karst complex of the Woodville Karst Plain. Priorities include Wakulla, Sally Ward, and Horn springs; St. Marks River Rise; the Spring Creek Spring group; other springs and sinking streams; other karst features; and encompassing springsheds. Anticipated outcomes include improved water quality within the springs themselves, as well as improved water and habitat quality in downstream freshwater and estuarine receiving waters.

Scope of Work:

1. Work with local governments and stakeholders to update current priorities for spring protection and restoration, to include spatial analysis and delineation of optimal strategies within spring groundwater contribution areas.
2. Plan coordinated implementation of other projects outlined within this plan, including OSTDS abatement, wastewater improvements, stormwater retrofits, habitat restoration, land conservation, and outreach and education.
3. Continue to develop and leverage local, state, federal, and other funding sources.
4. Conduct engineering analyses of project alternatives to identify and refine optimal strategies.
5. Conduct outreach and engagement with the public and with identified stakeholders and organizations.
6. Support continued development and enhancement of groundwater flow models and potentiometric surface models.
7. Implement projects cooperatively with local governments, nongovernmental stakeholders, state and federal agencies, utilities, and the public.
8. Monitor trends in water quality and ecological conditions. Apply data and results for adaptive management and refinement of implementation strategies.

Outcomes/Products:

1. Continued improvements in water quality and aquatic habitat quality in spring systems and receiving waters

Agriculture and Silviculture BMPs

Description:

This strategy consists of development and implementation of agriculture and silviculture BMPs to reduce basinwide NPS pollution, protect habitat, and promote water use efficiency.

Scope of Work:

1. In consultation with FDACS, FWC, and NRCS, develop a comprehensive inventory of implemented agriculture and silviculture BMPs and identify potential gaps and/or potential improvements for implementation in the watershed.
2. In cooperation with FDACS, FFS, and the National Forest Service, evaluate relationships between forest management practices and hydrologic and water quality effects.
3. Based on funding resources, develop plans for cost-share or other assistance for implementation.
4. Develop an outreach plan to engage agricultural producers and forestry practitioners; supporting technical training and participation in developing implementation strategies.
5. Conduct program outreach to support implementation of property-specific approved BMPs, potentially including annual cost-share grant cycles as defined by funding sources.
6. Work with FDACS to offer free technical assistance in the design and implementation of property- and resource-specific BMPs.
7. Monitor water quality, including upstream/downstream and/or before and after project implementation, as well as trends in receiving waters. Additionally, conduct monitoring of participant experiences, encouraging feedback throughout and following implementation.

Watershed Priorities:

- ✓ Water quality
- ✓ Floodplain Functions
- ✓ Natural Systems
- ✓ Education and Outreach

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Headwater degradation and channelization
- ✓ Riparian buffer loss
- ✓ Wetland loss and degradation
- ✓ Physically altered and impacted tributary streams
- ✓ Needs for improved BMP technical support

Objectives:

- ✓ Reduce basinwide NPS pollution.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Restore the function of vegetated riparian buffers
- ✓ Support agricultural, silvicultural, and urban BMPs.
- ✓ Create long-term partnerships among stakeholders.

Lead Entities:

- ✓ FDACS
- ✓ NRCS
- ✓ FWC
- ✓ Private landowners
- ✓ NWFWMD
- ✓ IFAS Extension

Geographic Focus Areas:

For agriculture, areas of focus include:

- ✓ Lake Lafayette basin
- ✓ Tallahassee Hills/Valdosta Limesink region
- ✓ Lake Miccosukee basin
- ✓ Wakulla River and Springs BMAP area

For silviculture BMPs, the focus is basinwide.

Planning Level Cost Estimate:

- ✓ $250,000 annually

Outcomes/Products:

1. Improved water quality
2. Improved capacity on the part of landowners to implement practices protective of water quality and watershed resources

Riparian Buffer Zones

Description:

This strategy consists of protection and restoration of riparian buffers to protect or improve water quality, habitat, and shoreline stability.

Scope of Work:

1. Coordinate planning and implementation with other projects to achieve overarching objectives.
2. Conduct screening evaluation of riparian areas; classify sites based on character and function and geomorphologic stresses.
3. Prioritize sites based on potential for protection or restoration of riparian habitat and function.
4. Conduct outreach to local governments and private landowners to identify sites for implementation. Develop site specific implementation options, including streamside enhancements, overlay zones, and vegetation restoration.
5. Develop individual site plans, which detail proposed improvements and cost estimates.
6. Coordinate and support implementation by property owners and local governments.
7. Implement complementary initiatives that may include education and outreach, inspection programs, training, demonstration projects, and maintenance.
8. Conduct outreach by providing signage, tours, public access amenities, or similar for specific sites.
9. Monitor local water quality and habitat quality, including upstream/downstream and/or before and after project implementation.
10. Analyze data to identify water quality trends.

Watershed Priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems
- ✓ Education and Outreach

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Diminished or disconnected floodplain area
- ✓ Riparian buffer loss
- ✓ Physically altered and impacted tributary streams
- ✓ Public understanding of practices to protect water resources

Objectives:

- ✓ Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs
- ✓ Reduce basinwide NPS pollution.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Protect and reestablish functional floodplain area.
- ✓ Restore stream, wetland, lacustrine, and estuarine benthic habitats.

Lead Entities:

- ✓ Private landowners
- ✓ Local governments
- ✓ USFWS (Partners for Fish and Wildlife)
- ✓ FWC
- ✓ Southeast Aquatic Resources Partnership

Geographic Focus Areas:

- ✓ Headwater streams
- ✓ Estuarine shorelines
- ✓ Lakes and lake tributary wetlands and streams
- ✓ Karst features

Planning Level Cost Estimate:

$25,000 annually*

*Planning figure supporting implementation by property owners and local governments.

Outcomes/Products:

1. Improved protection of water quality, habitat, and shoreline stability
2. Establishment of demonstration sites to promote additional implementation of buffer zone concepts by private landowners, local governments, and state and federal agencies

Aquatic, Hydrologic, and Wetland Restoration

Description:

This strategy consists of implementation of a broad array of hydrologic and wetland protection and restoration measures to improve and protect surface water quality and to restore aquatic and wetland habitats. Such measures include but are not limited to vegetation reestablishment, restoration and enhancement of hydrologic connectivity, stream channel restoration, and floodplain reconnection and restoration.

Scope of Work:

1. Conduct a site inventory and evaluation, to include channelized streams, drained/filled wetlands, road fill, and other areas conveying water. Evaluate freshwater and tidal drainage patterns and any restrictions in tidal flow. This includes initial desktop data collection and analysis, together with field data collection and site evaluation.
2. Identify restoration options, to include hydrologic reconnection (e.g., fill removal, low water crossings), tidal creek restoration, natural channel stream restoration, lake restoration with drawdown or natural drydown events, floodplain reestablishment, vegetation community reestablishment, tidal and riparian marsh restoration, and other options based on site characteristics and historic habitats.
3. Prioritize sites based on inventory and site evaluation, as well as consideration of water quality, other site and resource data, severity of impacts, cumulative effects, land ownership, and accessibility.
4. Conduct public outreach adaptable to specific project sites. Characterize individual projects with a list of stakeholders for each site. For project sites adjacent to communities or private property, as well as those with significant public visibility, consider demonstration sites, public meetings, site visits, project website, and other forms of engagement.
5. Develop detailed site restoration designs for priority sites, taking into account public input and preferences.

Watershed Priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems

Supporting Priorities:

- ✓ Headwater degradation and channelization
- ✓ Diminished or disconnected floodplain area
- ✓ Wetland loss and degradation
- ✓ Physically altered and impacted tributary streams
- ✓ Saltwater intrusion that could alter brackish and freshwater habitats
- ✓ Shoreline destabilization and erosion

Objectives:

- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Prioritize and correct hydrological alterations, including channelized streams.
- ✓ Protect and reestablish functional floodplain area.
- ✓ Restore wetland area and functions.
- ✓ Restore stream, wetland, lacustrine, and estuarine benthic habitats.
- ✓ Prioritize and correct hydrological alterations.
- ✓ Ensure restoration projects are compatible with coastal change.

Lead Entities:

- ✓ FWC
- ✓ NWFWMD
- ✓ FDEP
- ✓ USFWS
- ✓ Public and private landowners

Geographic Focus Areas:

- ✓ Coastal tidal marsh
- ✓ Tributary streams affected by road crossings and channelization
- ✓ Urbanized drainage basins

Planning Level Cost Estimate:

TBD*

*Costs highly variable depending on specific sites and methods.

6. Execute on-the-ground restoration projects.
7. Monitor local water quality and physical and biological site characteristics, including before and after implementation.
8. Analyze data to identify water quality trends.
9. Communicate results to watershed stakeholders and participating agencies.

Outcomes/Products:

1. Restored wetland, aquatic, and floodplain habitats and functions
2. Improved protection of water quality and natural systems
3. Established demonstration sites to promote additional implementation by private landowners and local governments

Estuarine Habitat Restoration

Description:

This strategy consists of activities related to estuarine habitat restoration to improve surface water quality, aquatic habitats, and coastal resiliency. Implementation should be coordinated with other project options, to include stormwater retrofits and other NPS pollution abatement, and upstream wetland and hydrologic restoration.

Scope of Work:

1. Conduct a site inventory and evaluation, to include evaluation of such factors as need for stabilization, habitat stability, stressors impacting shorelines, projected sea level rise, shoreline profile, ecosystem benefits, property ownership, public acceptance, and feasibility.
2. Identify project options, which may include, but are not limited to:
   a) Restoration/establishment of riparian and littoral vegetation communities;
   b) On previously altered shorelines, establishment of integrated living shorelines and estuarine habitats;
   c) Restoration/reconnection of tidal marsh;
   d) Integrated restoration of multiple shoreline/estuarine habitats;
   e) Restoration of seagrass beds;
   f) Restoration/creation of oyster reefs or other benthic habitats.
3. Prioritize sites based on inventory and site evaluation, as well as consideration of water quality, other site and resource data, modeling tools, severity of impacts, cumulative effects, land ownership, and accessibility. Coordinate directly with riparian landowners.
4. Consider development of demonstration projects on public lands.
5. Conduct public outreach adaptable to specific project sites. For project sites adjacent to communities or private property, as well as those with significant public visibility, consider demonstration sites, public meetings, site visits, volunteer participation, project website, and other forms of engagement. Extend opportunities for participation to property owners, local governments, and other stakeholders.
6. Develop detailed site restoration designs for priority sites, taking into account public input and preferences.
7. Execute on-the-ground restoration projects as identified under Paragraph 2 above.

Watershed Priorities:

- ✓ Water Quality
- ✓ Natural Systems

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Inadequate treatment from conventional OSTDS
- ✓ Wetland loss and degradation
- ✓ Saltwater intrusion that could alter brackish and freshwater habitats
- ✓ Shoreline destabilization and erosion
- ✓ Need for improved understanding of current and potential effects of sea level rise

Objectives:

- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Restore wetland area and functions.
- ✓ Restore stream, wetland, lacustrine, and estuarine benthic habitats.
- ✓ Ensure restoration projects are compatible with coastal change.

Lead Entities:

- ✓ FWC
- ✓ FDEP
- ✓ USFWS

Geographic Focus Areas:

- ✓ Apalachee Bay and tidal tributaries

Planning Level Cost Estimate:

TBD*

*Cost estimates will await completion of site inventory and evaluation.

8. Monitor and evaluate habitat coverage, water quality, and habitat conditions before and after implementation
9. Compile and evaluate data to determine trends and to objectively measure project benefits and outcomes.

Outcomes/Products:

1. Restored wetland and estuarine habitats and functions
2. Improved protection of water quality and natural systems
3. Increased resiliency of estuarine habitats to anticipated sea level rise and extreme weather events
4. Establishment of demonstration sites to promote additional implementation by private landowners and local governments

Strategic Land Conservation

Description:

This strategy supports protection of floodplains, riparian areas, and other lands with water resource value to protect and improve surface water quality, with additional benefits for floodplain function and fish and wildlife habitat.

Scope of Work:

1. Use approved management plans and lists (such as the Florida Forever Work Plan) to complete an inventory of potential acquisition projects.
2. Evaluate whether potential sites augment other projects.
3. Identify potential funding sources that allow land acquisition as a component of achieving stated goals.
4. Where landowners have expressed interest, conduct a site analysis to include potential for achieving intended outcomes and potential for augmenting other projects.
5. Accomplish acquisition in accordance with statutory requirements.
6. Develop and implement restoration/ enhancement plans if appropriate.
7. Implement long-term monitoring program for conservation easements.

Outcomes/Products:

1. Long-term protection of water quality, habitat, and floodplains

Watershed Priorities:

- ✓ Water Quality
- ✓ Floodplain Functions
- ✓ Natural Systems

Supporting Priorities:

- ✓ Stormwater runoff and NPS pollution
- ✓ Wetland loss and degradation
- ✓ Saltwater intrusion that could alter brackish and freshwater habitats
- ✓ Shoreline destabilization and erosion
- ✓ Need for improved understanding of current and potential effects of sea level rise

Objectives:

- ✓ Reduce basinwide NPS pollution.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Protect and reestablish functional floodplain area.
- ✓ Restore the function of vegetated riparian buffers.
- ✓ Protect and restore the St. Marks River ecosystem.
- ✓ Restore stream, wetland, lacustrine, and estuarine benthic habitats.
- ✓ Ensure restoration projects are compatible with coastal change.

Lead Entities:

- ✓ FDEP
- ✓ Local governments

Geographic Focus Areas:

- ✓ Upper St. Marks River Corridor
- ✓ Dickerson Bay
- ✓ Wakulla Springs Protection Zone
- ✓ Apalachee Bay

Planning Level Cost Estimate:

$7,700,000*

*50% of DEP-estimated land value for designated projects

Watershed Stewardship Initiative

Description:

This purpose of the watershed stewardship initiative is to create meaningful experiences that result in action-oriented tasks leading to improvements in water quality, tangible improvements in habitat quality, and public knowledge of and appreciation of watershed resources and functions. Outreach activities should be well structured, project-oriented, and include hands-on activities, as well as education about personal practices to protect water quality and watershed resources.

Scope of Work:

1. Develop a comprehensive inventory of current stewardship and education efforts, including funding sources for each.
2. Evaluate initiatives ongoing elsewhere within the state and the country.
3. Analyze the feasibility of combining efforts and resources, where practical and beneficial, with existing community-based initiatives.
4. Identify potential gaps and/or additional areas of focus.
5. Continue existing programs and implement new individual programs based on availability of funding.
6. Include hands-on activities, such as vegetation planting, invasive species removal, site tours, project demonstrations, and volunteer monitoring.
7. Implement technical training for landowners, including for implementation of agricultural and silvicultural BMPs, as well as urban BMPs and pollution prevention practices.
8. Monitor program accomplishments and outcomes, including through feedback from participant and citizen surveys.

Watershed Priorities:
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems ✓ Education and Outreach
Supporting Priorities:
Needs for: ✓ Public understanding of practices to protect water resources ✓ Opportunities for public participation ✓ Improved technical knowledge of BMP methods
Objectives:
✓ Support agricultural, silvicultural, and urban BMPs. ✓ Conduct education and outreach about watershed resources and personal practices to protect water and habitat quality. ✓ Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation.
Lead Entities:
✓ FDEP ✓ Local Governments ✓ Private landowners and working forests
Geographic Focus Areas:
✓ Watershed-wide
Planning Level Cost Estimate:
$100,000 annually

Outcomes/Products:

1. Improved long-term protection of water quality, habitat, and floodplain functions
2. Improved public understanding of watershed resources, functions, and public benefits
3. Improved public understanding of, and participation in, resource programs and projects

Sub-basin Restoration Plans

Description:

This strategy consists of development of comprehensive restoration plans for discrete sub-basins or waterbodies. This work should incorporate aspects of other separate strategies described herein.

Scope of Work:

1. Evaluate and identify priority sub-basins in cooperation with local initiatives, state and federal agencies, and local governments.
2. Develop a scoping document outlining actions to be undertaken, customized for specific areas and needs.
3. Develop a public outreach and engagement plan to facilitate participation by affected neighborhoods and stakeholders.
4. With public and agency participation, identify specific goals for waterbody protection and restoration.
5. Incorporate separate strategies, including stormwater retrofit planning; OSTDS abatement; floodplain, wetland and hydrologic restoration; monitoring; and public outreach and engagement.
6. In cooperation with local governments and other stakeholders, conduct planning for lake restoration actions to be conducted in coordination with drawdowns or natural drydown events. This may include consideration and coordination of both sediment removal and vegetation management.
7. Identify separate actions and project types that can cumulatively achieve identified goals.
8. Implement public outreach and engagement plan by conducting field visits, public meetings, and providing innovative hands-on engagement opportunities. Coordinate with established watershed groups.
9. Implement selected actions.
10. Monitor program accomplishments and outcomes, including through feedback from participants and surveys of affected residents. Conduct monitoring pre- and post-implementation and of environmental trends within affected waterbodies.

Outcomes/Products:

1. Focused restoration plans, specific to priority waterbodies and basins
2. Improved water quality and aquatic and wetland habitat quality

Watershed Priorities:
✓ Water Quality ✓ Floodplain Functions ✓ Natural Systems ✓ Education and Outreach
Supporting Priorities:
✓ All supporting priorities
Objectives:
✓ All identified objectives
Lead Entities:
✓ Local governments ✓ Community-based initiatives ✓ FDEP ✓ FWC ✓ NWFWMD
Geographic Focus Areas:
Targeted sub-basins within the watershed, including, but not limited to: ✓ Wakulla Spring and Wakulla River ✓ Lake Munson ✓ Lake Lafayette ✓ Lake Miccosukee
Planning Level Cost Estimate:
TBD* *Costs depend on specific projects included

Wastewater Treatment and Management Improvements

Description:

This strategy consists of development and implementation of upgrades to centralized wastewater treatment collection systems to reduce pollutant loading within the watershed. Additional opportunities exist for water reclamation and reuse.

Scope of Work:

1. In cooperation with utilities and local governments, evaluate existing wastewater systems to identify areas and components with upgrade opportunities, as well as sewer service extension needs.
2. Prioritize systems based on factors such as age, pollutant discharge, apparent leakage, capacity, and access.
3. Develop detailed cost estimates. Show cost estimates for areas with outdated sewer systems that need to be upgraded, areas with a high density of septic tanks that can connect to a central water system, and areas where upgrades are needed, but are determined to be lower in priority.
4. Implement/construct enhanced wastewater treatment and water reclamation and reuse systems.
5. In accordance with wastewater permits, monitor water quality in proximate surface and ground waters.
6. Evaluate data to identify trends of target pollutants.

Outcomes/Products:

1. Improved water and aquatic habitat quality

Watershed Priorities:
✓ Water Quality
Supporting Priorities:
✓ Needs and opportunities for improved wastewater collection and treatment ✓ Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
Objectives:
✓ Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies. Gain understanding of variables that affect water clarity in Wakulla Spring and Apalachee Bay
Lead Entities:
✓ Local governments ✓ Utilities
Geographic Focus Areas:
✓ Watershed-wide ✓ Systems within spring contribution areas and proximate to direct coastal drainages
Planning Level Cost Estimate:
$72,000,000* *Costs depend on specific projects included

Interstate Coordination

Description:

This strategy consists of activities related to interstate coordination to improve and protect surface water quality in the basin.

Scope of Work:

1. Develop a comprehensive plan for coordination between interstate agencies within the watershed. Evaluate case studies of successful interstate programs.
2. Develop a comprehensive contact list for the jurisdictions within the watershed. Develop an email distribution list, SharePoint group, and/or website to foster easy file and information sharing. Agencies should include USDA, Georgia Department of Natural Resources, other federal and state agencies, local governments (counties and cities), and non-profit watershed groups.
3. Identify areas of study and possible gaps in information.
4. Coordinate with Thomas County in Georgia on development of sub-basin plans, agricultural/silvicultural BMPs, and sediment abatement issues.
5. Continually inform and engage all stakeholders during progress or discussions of watershed issues. Hold regular open joint meetings between stakeholders from both states.
6. Coordinate closely on all implementation projects for stormwater management, hydrologic alteration/restoration, sedimentation, agricultural BMPs, etc. Utilize a publicly shared file and discussion tool (such as a website) to house the status and outcome(s) of all implementation projects within the watershed (within both states).

Watershed Priorities:

- ✓ Water Quality
- ✓ Natural Systems
- ✓ Education and Outreach

Supporting Priorities:

- ✓ Public education and outreach
- ✓ Expansion of cooperative community initiatives

Objectives:

- ✓ Reduce basinwide NPS pollution.
- ✓ Reduce nutrient and bacteria concentrations in receiving waterbodies.
- ✓ Support agricultural, silvicultural, and urban BMPs.
- ✓ Conduct education and outreach about watershed resources and personal practices to protect water and habitat quality.
- ✓ Create long-term partnerships among stakeholders, including government, academic institutions, non-governmental organizations, businesses, residents, and others, to maximize effectiveness of project implementation.

Lead Entities:

- ✓ State and federal agencies
- ✓ Local governments

Geographic Focus Areas:

Watershed-wide with focus on northern extents of the watershed where Florida and Georgia interface

Planning Level Cost Estimate:

$25,000 annually

Outcomes/Products:

1. Progress toward basin approach to watershed protection
2. Expanded public participation and knowledge of watershed resources and management needs

Analytical Program Support

Watershed Priorities:
✓ All identified program priorities
Supporting Priorities:
✓ All identified program priorities
Objectives:
✓ All watershed objectives
Lead Entities:
✓ State and federal resource agencies ✓ NWFWMD ✓ US EPA ✓ USFWS ✓ FWC ✓ Educational and research institutions ✓ Other cooperative, public-private initiatives
Geographic Focus Areas:
✓ Watershed-wide
Planning Level Cost Estimate:
TBD* *Costs highly variable

Description:

This strategy is intended to support dedicated scientific assessment and analysis to improve watershed management, protection, and restoration. The tasks involved are inherently progressive and will therefore change and be redefined as information is developed and in response to ongoing and future conditions and management actions.

Scope of Work:

Integral components of this strategy include but are not limited to the actions presented below.

1. For specific resource functions and at the sub-basin level, develop and refine metrics for evaluating conditions and guiding implementation
2. In support of Urban Stormwater Retrofits, develop a stormwater pollutant loading analysis to include NPS pollutant loading estimates at the sub-basin level and pollutant load reduction estimates based on proposed or potential BMPs and facilities. Develop planning level estimates of potential water quality effects (pollutant concentrations) for receiving waterbodies.
3. Also in support of Urban Stormwater Retrofits, evaluate existing stormwater management systems to identify potential or needed improvements.
4. Evaluate innovative methods and designs to improve stormwater treatment, wastewater treatment and management, and ecological restoration.
5. In support of Septic Tank Abatement and implementation of Advanced Onsite Systems, develop a spatial analysis of OSTDS to include pollutant loading estimates and estimates of potential pollutant load reduction following connection to central sewer and/or conversion to advanced onsite systems. In cooperation with local governments and utilities, delineate proposed target areas for central sewer connections and for advanced onsite systems.
6. In support of Agricultural and Silvicultural BMPs, develop an agricultural NPS pollution abatement plan. For this purpose, develop nonpoint source pollutant loading estimates at the sub-basin level for watershed areas that are substantially agricultural in land use, and develop pollutant load reduction estimates and targets based on application of proposed or potential BMPs. Develop planning level estimates of water quality effects (pollutant concentrations) for receiving waterbodies.
7. Identify research needs that would quantify the water quality benefits of BMP implementation, provide outreach and training, and strategies for implementing BMPs.
8. Inventory, evaluate, and prioritize unpaved road stream crossings and other sedimentation sites in support of Basinwide Sedimentation Abatement.
9. Evaluate the site-specific feasibility and potential benefits and impacts of proposed innovative and/or large-scale projects, which may include but are not necessarily limited to:
    a. Regional-scale shoreline habitat development proposals
    b. Passive and/or pumped estuarine flushing systems

   c. Proposals for major hydrologic alterations, such as causeway alterations, locks and dams, and barrier island pass alteration and maintenance
   d. Stream channel reconfiguration
   e. Benthic dredging
   f. Dredged material removal and disposal

10. Develop and refine hydrodynamic and water quality modeling tools. Develop specific management applications in cooperation with resource agencies and other public and nonprofit initiatives.
11. Evaluate effects of land use and management, to include forest management practices, on water quality. Identify and/or refine management options to protect and improve water quality.
12. Identify and describe long-term trends with respect to wetland and aquatic habitats, aquatic plants, and water chemistry. Identify management implications and recommendations.
13. Evaluate nearshore groundwater discharges within the estuary. Identify management implications and recommendations.
14. Develop improved quantitative and qualitative metrics for evaluating conditions and guiding program and project implementation.

Outcomes/Products:

1. Improved understanding of watershed challenges and opportunities
2. Updated project priorities
3. Innovative project planning
4. Improvement in scientific basis for management strategies and actions
5. Improved understanding of quantitative potential of and expectations for environmental change in response to resource management
6. Improved metrics for evaluating conditions and guiding and tracking program implementation
7. Reduced risks of unintended adverse environmental or economic effects

Comprehensive Monitoring Program

Watershed Priorities:
✓ All identified program priorities
Supporting Priorities:
✓ All identified program priorities
Objectives:
✓ All watershed objectives
Lead Entities:
✓ State resource agencies ✓ Local governments ✓ Community-based watershed monitoring initiatives ✓ Institutions of higher education; other environmental and watershed organizations ✓ Wakulla Springs Alliance
Geographic Focus Areas:
✓ Watershed-wide
Planning Level Cost Estimate:
$1,500,000 annually

Description:

This strategy provides for monitoring of program and project implementation, project outcomes, water quality, and habitat quality.

Scope of Work:

1. Identify appropriate parameters, to include environmental conditions and trends, and program parameters.
2. Establish a comprehensive and cumulative geodatabase of projects.
3. Further clarify and incorporate indicators at the watershed and subwatershed level.
4. Delineate sensitive/priority areas, e.g., proximity to surface waters and karst.
5. Develop public outreach application/website to communicate program implementation, outcomes, and trend data.
6. Develop an inventory of organizations (and associated contacts) that currently or previously conducted field monitoring within the watershed, including funding sources for each. Evaluate the feasibility of combining efforts and resources, where practical and beneficial.
7. Identify potential gaps and/or additional areas of focus.
8. Develop core sampling designs for field monitoring. Determine optimal site distribution.
9. If appropriate, develop and implement a volunteer pool and volunteer training program.
10. Establish cooperative efforts with existing community initiatives and state and local agencies.
11. Support equipment acquisition where needed.
12. Where existing initiatives are not in place, consider developing a citizen water quality monitoring volunteer pool for target areas within the watershed.
13. Periodically conduct a comprehensive evaluation, at the watershed level, of program implementation, outcomes, and resource trends.

Outcomes/Products:

1. Improved long-term protection of water quality, habitat, and floodplain functions
2. Evaluations of project and program effectiveness, facilitating feedback and adaptive management
3. Improved public understanding of watershed resources, functions, and public benefits
4. Communication of program accomplishments to the public, elected officials, and stakeholders
5. Improved program accountability to the public and stakeholders
6. Improved public understanding of, and participation in, resource programs and projects

4.4 Project Development Guidelines

This section outlines potential criteria to be used for project selection and prioritization. These items are not intended to be pass-fail for projects, but rather identify provisions that should receive consideration when making project ranking or funding decisions. Criteria specific to any given prioritization or funding decision are often defined, at least in part, by the funding resources under consideration. Individual sources of funding often are guided by criteria and guidelines established by statute or program documentation.

Generally suggested criteria include the following:

1. Projects with responsible parties that will implement, operate, and maintain the completed facilities;
2. Projects that achieve multiple, complementary objectives;
3. Restoration that is substantially self-sustaining;
4. Responsible parties that support long-term monitoring to facilitate verification, lessons learned, and adaptive management;
5. Sites and systems that reflect and are adaptable to natural variability; and
6. Cost effectiveness, technical feasibility, and regulatory factors are criteria to be considered in prioritization and funding.

Natural variability, for example, would include a habitat restoration project that is adaptable to cyclic climatic conditions (e.g., seasonal, hydrologic), discrete events (e.g., coastal storms), and long-term changes in the environment (e.g., climate change and sea level rise).

4.5 Funding Sources

Funding sources change over time. An outline of current funding sources, including descriptions of eligibility and project types contemplated, is provided in Table 4.4. These include Deepwater Horizon related sources and state, federal, and local government programs. Private funding sources, including from nonprofit organizations and private grant programs, may also be available.

Table 4-4 Funding Sources and Eligibility

Funding Source	Eligibility	Project Types
RESTORE Act		
Equal State Allocation (also known as Direct Component or Bucket/Pot 1)	75% of funds allocated to the eight disproportionately affected Panhandle coastal counties: Bay, Escambia, Franklin, Gulf, Okaloosa, Santa Rosa, Wakulla, and Walton. Remainder of funds allocated to the 15 non-disproportionately affected Gulf Coast counties, including Jefferson County in northwest Florida.	• Restoration and protection of the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches and coastal wetlands; • Mitigation of damage to fish, wildlife and natural resources; • Implementation of a federally-approved conservation management plan; • Workforce development and job creation; • Improvements to state parks located in coastal areas affected by the *Deepwater Horizon* oil spill; • Infrastructure projects benefitting the economy or ecological resources; including port infrastructure; • Coastal flood protection and related infrastructure; • Promotion of tourism and Gulf seafood consumption; or • Administrative costs and planning assistance.

Funding Source	Eligibility	Project Types
Gulf Coast Ecosystem Restoration Council (also known as The RESTORE Council or Bucket/Pot 2)	Project selection based on Comprehensive Plan developed by the RESTORE Council with input from the public.	The Initial Comprehensive Plan adopts five goals: • Restore and Conserve Habitat; • Restore Water Quality; • Replenish and Protect Living Coastal and Marine Resources; • Enhance Community Resilience; or • Restore and Revitalize the Gulf Economy.
Oil Spill Restoration Impact Allocation (also known as The Gulf Consortium, or Bucket/Pot 3)	The Gulf Consortium, consisting of 23 Gulf Coast counties, is developing the State Expenditure Plan for Florida that must be submitted by the Governor to the RESTORE Council for its review and approval.	All projects, programs, and activities in the State Expenditure Plan that contribute to the overall ecological and economic recovery of the Gulf Coast (same project types as listed under the Equal State Allocation above).
NOAA RESTORE Act Science Program (also known as Bucket/Pot 4)	• Institutions of higher education; • Non-profit organizations; • Federal, state, local and tribal governments; • Commercial organizations; and • U.S. territories.	Research, observation, and monitoring to support the long-term sustainability of the ecosystem, fish stocks; fish habitat; and the recreational, commercial, and charter fishing industry in the Gulf of Mexico, including: • Marine and estuarine research; • Marine and estuarine ecosystem monitoring and ocean observation; • Data collection and stock assessments; • Pilot programs for fishery independent data and reduction of exploitation of spawning aggregations; • Cooperative research; or • Administrative costs.
Centers of Excellence (also known as Bucket/Pot 5)	University of South Florida, Florida Institute of Oceanography is administering Florida's Centers of Excellence Program.	• Coastal and deltaic sustainability, restoration, and protection, including solutions and technology that allow citizens to live in a safe and sustainable manner in a coastal delta in the Gulf Coast Region; • Coastal fisheries and wildlife ecosystem research and monitoring in the Gulf Coast Region; • Offshore energy development, including research and technology to improve the sustainable and safe development of energy resources in the Gulf of Mexico; • Sustainable and resilient growth, economic and commercial development in the Gulf Coast Region; and • Comprehensive observation, monitoring, and mapping of the Gulf of Mexico.
Other Deepwater Horizon Funding		
Natural Resource Damage Assessment (NRDA)	Trustee Implementation Groups develop restoration projects guided by the programmatic restoration plan finalized in 2016. Public may submit project ideas & comment on plans.	The final plan takes a comprehensive and integrated ecosystem-level approach to restoring the Gulf of Mexico: • Restore and Conserve Habitat • Restore Water Quality • Replenish and Protect Living Coastal and Marine Resources • Provide and Enhance Recreational Opportunities

Funding Source	Eligibility	Project Types
National Fish and Wildlife Foundation (NFWF)	NFWF manages the Gulf Environmental Benefit (GEBF) fund established in 2013. In consultation with FWC and FDEP, NFWF identifies priority restoration and conservation projects for GEBF funding.	Projects that: • Restore and maintain the ecological functions of landscape-scale coastal habitats, including barrier islands, beaches & coastal marshes; • Restore and maintain the ecological integrity of priority coastal bays and estuaries; and • Replenish and protect living resources including oysters, red snapper and other reef fish, Gulf Coast bird populations, sea turtles and marine mammals.
Federal Sources		
Land and Water Conservation Fund	Projects that protect national parks, areas around rivers and lakes, national forests, and national wildlife refuges.	Many types of projects may be supported, including • Recreational trails • Restoration projects • grants to protect working forests, wildlife habitat, critical drinking water supplies • Also provide matching grants for state and local parks and recreation projects
North American Wetlands Conservation Act	Projects that increase bird populations and wetland habitat, while supporting local economies and traditional uses.	• Projects must protect migratory birds and associated habitats
National Coastal Wetlands Conservation Act	State and local governments, private landowners, and conservation organizations	• Projects that protect, restore and enhance coastal wetland ecosystems and associated uplands
NOAA Coastal Resilience Grants	• Non-profit organizations • Institutions of higher education • Regional organizations • Private entities • States, territories and federally recognized Indian tribes • Local governments	• Strengthening Coastal Communities: activities that improve capacity of coastal jurisdictions (states, counties, municipalities, territories, and tribes) to prepare and plan for, absorb impacts of, recover from, and/or adapt to extreme weather events and climate-related hazards. • Habitat Restoration: activities that restore habitat to strengthen the resilience of coastal ecosystems and decrease the vulnerability of coastal communities to extreme weather events and climate-related hazards.
NOAA Office of Education Grants	Educational institutions and organizations for education projects and programs	• Environmental Literacy Program provides grants and in-kind support for programs that educate and inspire people to use Earth systems science to improve ecosystem stewardship and increase resilience to environmental hazards. • Bay Watershed Education and Training (B-WET) provides competitive funding to support meaningful watershed educational experiences for K–12 audiences • Cooperative Science Centers provide awards to educate and graduate students who pursue degree programs with applied research in NOAA mission-related scientific fields.
US EPA Environmental Education Grants	• Local education agencies • State education or environmental agencies • Colleges or universities • Non-profit organizations • Noncommercial educational broadcasting entities • Tribal education agencies	Environmental education projects that promote environmental awareness and stewardship and help provide people with the skills to take responsible actions to protect the environment. This grant program provides financial support for projects that design, demonstrate, and/or disseminate environmental education practices, methods, or techniques.

Funding Source	Eligibility	Project Types
US EPA – Exchange Network Grant Program	States, territories and federally recognized Indian tribes	Promotes improved access to, and exchange of, high-quality environmental data from public and private sector sources.
US EPA - Water Infrastructure Finance and Innovation Act (WIFIA) Program	• States, territories and federally recognized Indian tribes • Partnerships and joint ventures • Corporations and trusts • Clean Water and Drinking Water State Revolving Fund (SRF) programs	Accelerates investment in water infrastructure by providing long-term, low-cost supplemental loans for regionally and nationally significant projects.
US Fish and Wildlife Service and FWC, Partners for Fish and Wildlife	• Private landowners	Cooperative and voluntary effort between landowners, the FWC, and the USFWS to improve habitat conditions for fish and wildlife.
State Sources		
FDEP (WMDs) Spring Restoration Program	•Local governments •Public and non-profit utilities •Private landowners	State Spring Restoration funding efforts include land acquisition and restoration, septic to sewer conversion, and other projects that protect or restore the quality or quantity of water flowing from Florida’s springs.
FDEP Special Management Area Grants	State agencies and water management districts	Research or coordination efforts in areas of special management. Examples of areas of special management would include, but not be limited to Areas of Critical State Concern, Critical Wildlife Areas, Aquatic Preserves, National Estuary Programs, and Surface Water Improvement and Management waterbodies
FDEP Coastal Partnership Initiative	Coastal counties and municipalities within their boundaries required to include a coastal element in the local comprehensive plan	Coastal resource stewardship and working waterfronts projects.
FDEP Beach Management Funding Assistance (BMFA) Program	• Local governments • Community development districts • Special taxing districts	Beach restoration and nourishment activities, project design and engineering studies, environmental studies and monitoring, inlet management planning, inlet sand transfer, dune restoration and protection activities, and other beach erosion prevention related activities consistent with the adopted Strategic Beach Management Plan.
FDEP Florida Communities Trust	Local governments and eligible non-profit organizations	Acquisition of land for parks, open space, greenways and projects supporting Florida's seafood harvesting and aquaculture industries.
Florida Forever	Funding is appropriated by the legislature distributed by the FDEP to state agencies	Acquisition of public lands in the form of parks, trails, forests, wildlife management areas, and more.
FDEP Coastal and Estuarine Land Conservation Program	States that have a coastal zone management program approved by NOAA or a National Estuarine Research Reserve (NERR)	Acquisition of property in coastal and estuarine areas that have significant conservation, recreation, ecological, historical, or aesthetic values, or that are threatened by conversion from a natural or recreational state to other uses.
FDEP Clean Vessel Act Grants	Facilities that provide public access to pump-out equipment	Construction, renovation or installation of pump out equipment or pump out vessels.
FDEP Clean Water State Revolving Fund Loan Program (CWSRF)	Project sponsors	Planning, designing, and constructing water pollution control facilities.

Funding Source	Eligibility	Project Types
FDEP Clean Water State Revolving Fund Program Small Community Wastewater Construction Grants	Small communities and wastewater authorities	This grant program assists in planning, designing, and constructing wastewater management facilities. An eligible small community must be a municipality, county, or authority with a total population of 10,000 or less, and have a per capita income (PCI) less than the State of Florida average of $26,503.
FDEP 319 grants	• State and local governments • Special districts, including water management districts • Nonprofit public universities and colleges • National Estuary Programs	Projects or programs that reduce NPS pollution. Projects or programs must be conducted within the state's NPS priority watersheds, including SWIM watersheds and National Estuary Program waters. All projects should include at least a 40% nonfederal match.
FDEP 319 Education Grants	Local governments in Florida	For projects that provide education and outreach about nonpoint source pollution in the adopted Basin Management Action Plan (BMAP) areas.
FDEP TMDL Water Quality Restoration Grants	Local governments and water management districts	Projects that: • Reduce NPS loadings from urban areas affecting verified impaired waters. • Are at least the 60% design phase. • Have permits issued or pending. • Include storm monitoring to verify load reduction. • Will be completed within three years of appropriation. • Include a minimum of 50% match with at least 25% provided by the local government. • Allocate grant funds to construction of BMPs, monitoring, or related public education.
FDACS Rural and Family Lands Protection Program	Agricultural landowners	State conservation easements that: • Protect valuable agricultural lands. • Ensure sustainable agricultural practices and reasonable protection of the environment. • Protect natural resources in conjunction with economically viable agricultural operations.
FDACS Forest Stewardship Program	Private forest landowners with at least 20 acres of forest land	Cost-share grants for implementation of stewardship to improve and maintain timber, wildlife, water, recreation, aesthetics, and forage resources.
FDACS Endangered and Threatened Plant Conservation Program	Private individuals and non-federal government entities	Actions that restore and maintain populations of listed plants on public land and on private lands managed for conservation purposes.
Natural Resources Conservation Service	Private agricultural producers, landowners, and local governments	• Conservation Innovation Grants (CIG) stimulate development and adoption of innovative conservation approaches and technologies. • The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers that address natural resource concerns and improve water and air quality, conserve ground and surface water, reduce soil erosion and sedimentation, or improve or create wildlife habitat • Emergency Watershed Protection Program includes assistance to remove debris from streams, protect streambanks, establish cover on critically eroding lands, repair conservation practices, and purchase of floodplain easements.

Funding Source	Eligibility	Project Types
FWC Wildlife Grants Program	State fish and wildlife agencies	Projects identified within State Wildlife Action Plan, including fish and wildlife surveys, species restoration, habitat management, and monitoring.
FWC Landowner Assistance Program	Private landowners	Cooperative and voluntary effort between landowners, the FWC, and the USFWS to improve habitat conditions for fish and wildlife.
Local Governments		
Local Government General Revenue	Defined by local statute. Generally local projects as approved by elected body, frequently leveraging state, federal, and other funding sources.	Defined by local statute and elected board.
Utility Funds – Stormwater and Wastewater	Utility projects benefiting rate payers. May leverage other local, state, and federal funding.	Stormwater and wastewater capital improvement and maintenance projects.

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Appendix A Implementation and Achievements of the Previous SWIM Plan

Previous SWIM Plan Issues and Priorities

The NWFWMD developed a SWIM Plan for the St. Marks River and Apalachee Bay watershed in 1997 (Ryan and Hemmert 1997) and updated the plan in 2009 (NWFWMD 2009). The 2009 plan update recognized three priority objectives, which also address three of the NWFWMD's statutory areas of responsibility relating to watershed management:

- Water quality protection and improvement, focusing on prevention and abatement of NPS pollution in the upper reaches of the basin;
- Natural systems protection, enhancement, and restoration, including stream, wetland, aquatic, and riparian habitat restoration on lands purchased for conservation in the lower basin; and
- Protection and, if necessary, restoration of floodplain functions.

These objectives, with associated strategies, are further described in Table A-1. The 2009 SWIM Plan also identified individual tactics that could be employed to implement the strategies in Table A-1 including:

- Resource characterization;
- Hydrologic data collection and monitoring;
- Freshwater needs assessment;
- Local stormwater planning assistance;
- Construction of stormwater retrofit facilities and implementation of BMPs;
- Integration of Flood Hazard Map Modernization;
- Preservation of critical lands and habitats;
- Ecological restoration;
- Public education and outreach; and
- Reuse of reclaimed water.

Table A-1 2009 SWIM Plan Objectives and General Strategies

Management Objectives	General Strategies
Water Quality Protection and Improvement	Reduce NPS pollution watershed-wide through stormwater planning, retrofits, 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 – Promoting Natural Floodplain 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.

Source: NWFWMD 2009

Progress toward Meeting Plan Goals and Objectives

Since the first SWIM Plan was approved for the St. Marks River and Apalachee Bay in 1997, considerable progress has been made both in implementing projects and initiatives to address these challenges. The projects include 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 improvements in 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.

Reflecting the shared responsibility inherent in watershed management, accomplishments should be recognized on the part of numerous watershed stakeholders, including local governments, state and federal agencies, academic institutions, and others. Among the noteworthy accomplishments are:

- Implementation of major wastewater treatment improvements by the City of Tallahassee, as well as additional improvements in Wakulla County and extension of sewer service in both Leon and Wakulla counties.
- Implementation-dedicated programs and projects to retrofit stormwater systems and improve water quality treatment by Leon County and the City of Tallahassee.
- Implementation of ERP by the District and the FDEP.
- Substantial progress by the NWFWMD in developing minimum flows and minimum water levels (MFLs) for St. Marks River Rise, Wakulla Spring, and Sally Ward Spring.
- Adoption by FDEP of a final nutrient TMDL for the upper Wakulla River and a BMAP for the upper Wakulla River and Wakulla Springs.

Cooperative projects that have been implemented or are ongoing in the watershed are listed in Table A-2. The District's Consolidated Annual Reports (http://www.nwfwater.com/Data-Publications/Reports-Plans/Consolidated-Annual-Reports) provide listings and descriptions of specific projects that have been completed under the auspices of the SWIM and Florida Forever programs.

Table A-2 Project Implementation

Project	General Description	Lead Entity	Corresponding SWIM Project[1]	Status[2]
Gibby Pond Regional Stormwater Facility	15.3 acre regional stormwater facility to provide treatment for 264 acre basin.	Blueprint 2000; Leon County; FDOT	Stormwater retrofit facilities and BMPs	Complete 2008
Caroline Courts Subdivision Stormwater Improvement	Flood protection and water quality project; constructed wet detention pond to reduce localized flooding and improve quality of stormwater discharge in Lake Munson basin.	City of Tallahassee	Stormwater retrofit facilities and BMPs	Complete 2005
Call St. and Cadiz Stormwater Retrofit	Retrofit to the stormwater management system for 90-acre sub-watershed area known as Franklin Blvd. Ditch. Project created new dry detention facility to address flood issues, while reducing pollutant loads.	City of Tallahassee	Stormwater retrofit facilities and BMPs	Complete 2007
Campus Circle Stormwater Improvement	Two-acre retention pond, with CDS unit to treat forty acres of runoff in Lake Munson basin; includes interceptor unit to catch suspended solids, as well as improved flood protection.	City of Tallahassee	Stormwater retrofit facilities and BMPs	Complete 2006

Project	General Description	Lead Entity	Corresponding SWIM Project[1]	Status[2]
Tram Road Public Access Reuse Facility	Construction of treatment system to provide public access reclaimed water to reduce potable water usage within Wakulla springshed; also helps further distribute nutrient applications.	City of Tallahassee	Reuse of Reclaimed Water	Complete 2008
Wakulla County Reuse Project	Reuse transmission line to complement wastewater treatment plant improvements. Provides reclaimed water to golf course and reduces demand on Floridan aquifer.	Wakulla County	Reuse of Reclaimed Water	Complete 2009 (AWT treatment addition under construction)
Advanced Wastewater Treatment and Water Reuse Facilities	Funding contributed to purchase of membrane bioreactors installed as part of the AWT improvements at the Lake Bradford Road Wastewater Treatment Plant.	City of Tallahassee	Reuse of Reclaimed Water	Complete 2009
Cascades Park Watershed Resource Restoration	Stormwater treatment and stream restoration for portions of St. Augustine Branch as part of the larger Capital Cascade Trail project. Includes two wet detention pods and several park/trail amenities.	Blueprint 2000; Leon County	Stormwater retrofit facilities and BMPs	Complete 2013
Lake Munson Target Area: Woodside Heights Wastewater Retrofit Project	Design, engineering and construction of sanitary sewer lines in the Woodside Heights neighborhood to the City of Tallahassee's advanced wastewater treatment plant.	Leon County	Septic Tank Abatement (2017 plan update)	Engineering
Magnolia Gardens and Wakulla Gardens Sewer Line Extension	Design, engineering and construction of sanitary sewer lines in the Magnolia Gardens and Wakulla Gardens subdivisions.	Wakulla County	Septic Tank Abatement (2017 plan update)	Phase I under construction; Phase II in engineering
Septic Connection to Existing Sewer in the Wakulla BMAP	Design, engineering and construction of approximately 120 properties currently on OSTDS to existing central sewer in the Wakulla BMAP PFA1.	City of Tallahassee	Septic Tank Abatement (2017 plan update)	Planning
Advanced Septic Systems Pilot Project	Design, engineering and construction of individual advanced septic systems in Leon County and Wakulla County neighborhoods. Exact location and number of unity to be determined.	Wakulla County Leon County	Advanced Onsite Treatment Systems (2017 plan update)	Planning
Woodville Sewer System Project	Design, engineering and construction of sanitary sewer lines for approximately 2150 residences in Leon County currently served by OSTDS; for connection to COT central sewer system.	Leon County	Septic Tank Abatement (2017 plan update)	Planning
Lake Munson Dam Replacement and Lake Drawdown	Lake enhancement and restoration	Leon County	N/A	Complete 2012
Lake Munson Sediment Investigation	Lake enhancement and restoration	Leon County	N/A	Planning

[1]2009 plan projects unless otherwise indicated
[2]As of June 2017

Appendix B Related Resource Management Activities

Much of the progress to date is attributable to cooperative efforts made on the part of local governments, state and federal agencies, the District, and private initiatives. Many programs and projects share common goals, and their implementation is most frequently accomplished through coordinated planning, funding, management, and execution. This section describes historical and ongoing activities and programs to address resource issues within the watershed.

Minimum Flows and Minimum Water Levels

Section 373.042, F.S., requires each water management district to develop minimum flows and minimum water levels (MFLs) for specific surface and groundwaters within their jurisdiction. A minimum flow is defined by section 373.042, F.S., as "the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area," and a minimum water level is "the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources or ecology of the area." Minimum flows and minimum water levels are calculated using best available data and consider natural seasonal fluctuations; non-consumptive uses; and environmental values associated with coastal, estuarine, riverine, spring, aquatic, and wetlands ecology as specified in Section 62-40.473, F.A.C. (NWFWMD 2016c).

The process of establishing MFLs involves a series of steps including identification of priority waterbodies, data collection, technical assessments, peer review, rule-making and rule adoption. Adopted MFLs are considered when reviewing consumptive use permit applications. A recovery or prevention strategy must be developed for any waterbody where consumptive uses are currently or anticipated to result in flows or water levels below adopted MFLs.

The District is currently working on the development of MFLs for three priority waterbodies within the St. Marks River and Apalachee Bay watershed: Wakulla Spring, St. Marks River Rise, and Sally Ward Spring. Extensive data collection is ongoing, including ecologic, hydrologic, and water quality data at 58 additional sites. Technical assessments have been initiated to quantify the springs flows needed to protect and maintain water resource values such as fish and wildlife habitat, fish passage, estuarine resources, water quality, aesthetic and scenic attributes, and recreation in and on the water. The technical assessment for the St. Marks River Rise MFL is on schedule to be complete in 2018. The technical assessments for the Wakulla Spring and Sally Ward Spring MFLs are scheduled to be complete in 2020.

Special Resource Management Designations

Outstanding Florida Waters

In addition being a SWIM priority, the St. Marks River and Apalachee Bay watershed includes waterbodies and segments that receive additional regulatory protection through designation as Outstanding Florida Waters (OFWs) per Section 62-302.700, Florida Administrative Code (F.A.C.). Designated OFWs in the watershed include:

- 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
- Mashes Sands (Wakulla County park);
- Florida State Parks – Edward Ball Wakulla Springs State Park, San Marcos de Apalachee State Historic Site, Letchworth Mounds, Natural Bridge Battlefield State Historic Site
- Big Dismal Sink within the Apalachicola National Forest
- Fort San Luis

Aquatic Preserves

Florida currently has 41 aquatic preserves managed by FDEP encompassing approximately 2.2 million acres of submerged lands protected for their biological, aesthetic, and scientific value. The Big Bend Seagrasses Aquatic Preserve is within the St. Marks River and Apalachee Bay watershed. As discussed above, this preserve is the largest in Florida, and it encompasses expansive aquatic habitats including some of the largest seagrass beds in Florida waters. The preserve is home to more than 2,000 native species of plants and animals including threatened and endangered species such as the West Indian manatee (*Trichechus manatus*), the Atlantic hawksbill sea turtle (*Eretmochelys imbricata*), and the Kemp's Ridley sea turtle (*Lepidochelys kempii*) (FDEP 2014a).

Surface Water Classifications

Most of the waters throughout the St. Marks River and Apalachee Bay watershed have been classified by the state as Class III waters (designated for recreation and maintenance of a healthy, well-balanced population of fish and wildlife). Most of the coastal waters and tributaries of Apalachee Bay have been designated Class II waters, to support shellfish propagation or harvesting. Class III waters within the estuary include those within and proximate to bayous and other areas with substantial freshwater inflow. Additional information may be found in Chapter 62-302, F.A.C.

Conservation Lands

The St. Marks River and Apalachee Bay watershed contains 461,601 acres (62 percent of the watershed) of conservation and protected lands. Because of the relatively low density of development, particularly in the coastal lowland region, most of the basin's rivers and lakes and the estuary are in relatively good condition. As described in Section 2.3, major public lands include state and local conservation lands, private conservation lands, the St. Marks National Wildlife Refuge, and the Apalachicola National Forest.

Throughout the watershed are ten state parks, preserves, and forests encompassing over 14,500 acres, the majority managed by FDEP and FDACS. In addition to these are 16 local parks, preserves, and greenways managed by Leon and Wakulla counties and the City of Tallahassee. Recent conservation land acquisitions (using state and local funds) include buffers adjacent to Horn Spring, Lake Munson, and Heritage Trail/Lake Piney Z and the Miccosukee Greenway and Alford Property (near Lake Lafayette).

Within the City of Tallahassee, the Tallahassee-Leon County Greenways Program was created to build a community-wide greenways system intended to protect and manage riparian corridors, floodplains, and other environmentally sensitive areas (City of Tallahassee and Leon County 2015). Additionally, the Tallahassee-Leon County Comprehensive Plan provides policies to map and protect floodplains, floodways, altered wetlands, watercourses, closed basins, active karst features, canopy road corridors, and highly and erodible soils (City of Tallahassee 2015).

The NWFWMD monitors approximately 1,375 acres of conservation easements within the watershed. Also, approximately 17,745 acres of conservation lands are owned and managed by the Tall Timbers Research Station and Land Conservancy. The Nature Conservancy owns and manages the 680-acre Fanlew Preserve and the 8,053-acre Flint Rock Tract in Jefferson County, adjacent to the Aucilla Wildlife Management Area.

Conservation lands are described in some detail in Appendix G.

Gulf Ecological Management Sites

The watershed includes one designated Gulf Ecological Management Site (GEMS): the Big Bend Seagrasses Aquatic Preserve in Apalachee Bay. The GEMS Program is an initiative of the Gulf of Mexico Foundation, the EPA Gulf of Mexico Program, and the five Gulf of Mexico states (Gulf of Mexico Foundation 2015). Designated GEMS are priorities for protection, restoration, and conservation by state and federal authorities due to unique ecological qualities such as habitats significant to fish, wildlife, or other natural resources (Gulf of Mexico Foundation 2015).

Critical and Strategic Habitat Conservation Areas

The St. Marks River and Apalachee Bay watershed includes designated critical habitat for the threatened frosted flatwoods salamander (*Ambystoma cingulatum*) in areas located to the east and southeast of the St. Marks River. Additionally, certain areas within the watershed have been identified by the FWC as Strategic Habitat Conservation Areas (SHCAs). Strategic Habitat Conservation Areas are important habitats in Florida that presently lack conservation protection. The majority of SHCAs support three species: the Florida black bear (*Ursus americanus floridanus*), swallow-tailed kite (*Elanoides forficatus*), and the Cooper's hawk (*Accipiter cooperii*). Appendix D provides a list of species that are protected and tracked for the watershed, as well as their habitat requirements.

Coastal Barrier Resource System

Congress passed the Coastal Barrier Resources Act of 1982 to minimize loss of human life by discouraging development in high risk areas; to reduce wasteful expenditure of federal resources; and to protect the natural resources associated with coastal barriers. The Act restricts most Federal expenditures and financial assistance that tend to encourage development, including Federal flood insurance, in the John H. Chafee Coastal Barrier Resource System (CBRS). The CBRS contains two types of mapped units, System Units and Otherwise Protected Areas (OPAs). These designated areas are ineligible for both direct and indirect federal expenditures and financial assistance. Most new Federal expenditures and assistance, including Federal flood insurance, are prohibited within System Units. Within OPAs, the only Federal spending prohibition is on Federal flood insurance. If a proposed project is located within the CBRS, federal funding cannot be used to accomplish that project (including "any project to prevent the erosion of, or to otherwise stabilize, any inlet, shoreline, or inshore area") unless it meets one of the exceptions listed under Section 6 of the CBRA. Within the St. Marks River and Apalachee Bay watershed, Mashes Island, Piney Island, and part of Apalachee Bay have been designated within the CBRS.

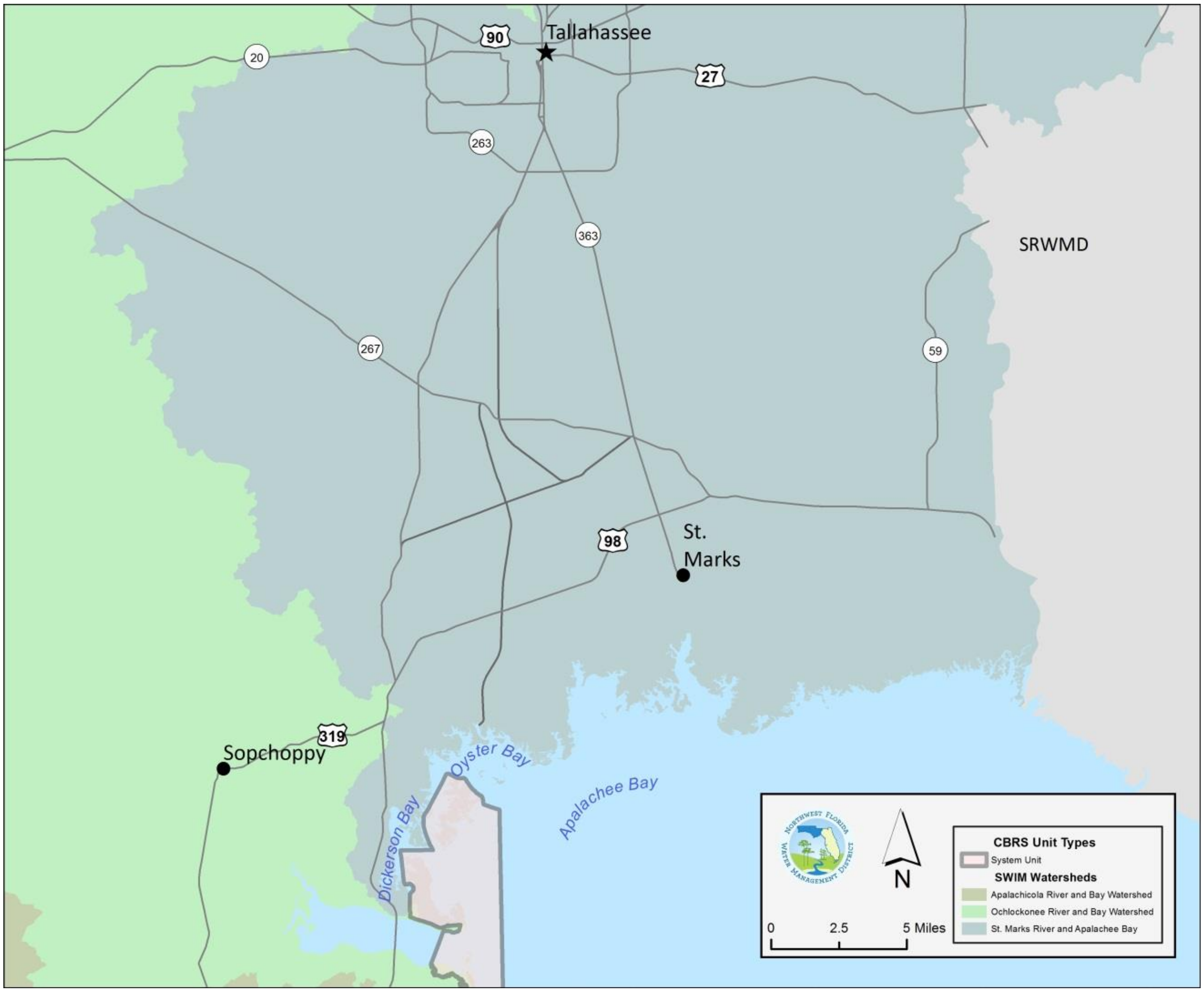

Figure B-1 Coastal Barrier Resource System Designated Areas within the St. Marks River and Apalachee Bay Watershed

Deepwater Horizon: RESTORE Act, Natural Resource Damage Assessment (NRDA), and NFWF Projects

The FDEP and the FWC are the lead state agencies in Florida for responding to the impacts of the 2010 Deepwater Horizon oil spill and the resulting restoration process. Restoration projects submitted to FDEP's Deepwater Horizon project portal are considered for funding under the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast Act (RESTORE Act) Comprehensive Plan Component, the NRDA, and the NFWF's GEBF.

RESTORE Act

The RESTORE Act of 2012 allocates to the Gulf Coast Restoration Trust Fund 80 percent of administrative and civil penalties resulting from the oil spill. The primary means of allocation under the RESTORE Act are as follows:

Direct Component Funds ("Bucket 1"): Thirty five percent of the funds in the Trust Fund will be split evenly among the five Gulf States. Florida's seven percent of these funds will be directly allocated to 23

Gulf Coast counties in Florida (5.25 percent to the eight disproportionately affected counties in the Panhandle from Escambia to Wakulla counties; and 1.75 percent to the 15 non-disproportionately impacted Gulf Coastal counties – Jefferson to Monroe counties). To receive funds under the Direct Component, each county is required to submit a Multiyear Implementation Plan, subject to review by the U.S. Department of the Treasury, detailing the county's plan to expend funds for a set of publically vetted projects and goals (FDEP 2016b).

Comprehensive Plan Component ("Bucket 2"): The Gulf Coast Ecosystem Restoration Council, which includes the five Gulf States and six federal agencies, is charged with developing and implementing a Comprehensive Plan for the Gulf Coast Region. Projects can be submitted by the Council members and federally recognized Native American tribes.

Spill Impact Component ("Bucket 3"): Each of the five Gulf states will receive these funds to implement a State Expenditure Plan. In Florida, this plan is being developed through the Gulf Consortium, which was created by inter-local agreement among Florida's 23 Gulf Coast counties. Once developed and approved by the Governor, the State Expenditure Plan shall be submitted by the Governor to the RESTORE Council for its review and approval. Projects will be submitted by each of the 23 counties on Florida's Gulf Coast.

Natural Resource Damage Assessment

The Oil Pollution Act of 1990 authorizes certain state and federal agencies to evaluate the impacts of the Deepwater Horizon oil spill. This legal process, known as Natural Resource Damage Assessment (NRDA), determines the type and amount of restoration needed to compensate the public for damages caused by the oil spill. The FDEP, along with the FWC, are co-trustees on the Deepwater Horizon Trustee Council.

National Fish and Wildlife Foundation

The National Fish and Wildlife Foundation (NFWF) established the GEBF to administer funds arising from plea agreements that resolve the criminal cases against BP and Transocean. The purpose of the GEBF, as set forth in the plea agreements, is to remedy harm and eliminate or reduce the risk of future harm to Gulf Coast natural resources. The plea agreements require the NFWF to consult with state and federal resource agencies in identifying projects. The FWC and the FDEP work directly with the NFWF to identify projects for the state of Florida, in consultation with the USFWS and NOAA. From 2013 to 2018, the GEBF will receive a total of $356 million for natural resource projects in Florida. However, the allocation of funds is not limited to five years. The amount of these funds that will be allocated to projects in the Ochlockonee River and Bay watershed is unknown as of this writing.

The Nature Conservancy (TNC): Watershed Management Planning

To achieve comprehensive and long-term success for Gulf restoration, TNC facilitated a community-based watershed management planning process in 2014 and 2015 along Florida's Gulf Coast for the following six watersheds: Perdido Bay, Pensacola Bay, Choctawhatchee Bay, St. Andrew and St. Joseph bays, Apalachicola to St. Marks, and the Springs Coast. The process was designed to:

- Develop watershed-based plans that identify the most pressing environmental issues affecting each watershed and solutions that address the issues, regardless of political jurisdiction and funding source;
- Create long-term partnerships among stakeholders in each watershed and across the regions to maximize effectiveness of project implementation and funding efforts; and

- Provide a screening tool to evaluate the project priorities of these watershed plans for potential funding by the communities, the FDEP, the FWC, the NFWF, and the Gulf Coast Ecosystem Restoration Council (TNC 2014).

The plan developed for the Apalachicola to St. Marks watersheds identifies 11 projects to address four major actions (TNC 2014):

- Protect, restore, create and/or manage natural habitat and resources and increase buffer areas;
- Increase cooperation and coordination for management, monitoring, funding, implementation, outreach, and enforcement;
- Reduce impacts to groundwater and ensure adequate fresh water availability; and
- Reduce sedimentation.

To complete the planning process and ensure that all of the priority issues are identified and addressed, the plan recommended updating the 2009 St. Marks River and Apalachee Bay SWIM Plan—the subject of this report (TNC 2014).

Water Quality Monitoring

The majority of the monitoring data in the St. Marks River and Apalachee Bay watershed, including chemical and biological data, has been collected by or for the FDEP Northwest District (FDEP 2003). Data-gathering activities include working with environmental monitoring staff in the NWFWMD and local and county governments to obtain applicable monitoring data from their routine monitoring programs and special water quality projects in the basin. All of the data collected by the FDEP and its partners is uploaded to the statewide water quality database for assessment.

Several water quality monitoring programs are ongoing in the watershed. These include Leon County, the NWFWMD, the FDACS Shellfish Environmental Assessment Section (SEAS), and the FDOH Florida Healthy Beaches monitoring program (FDEP 2003).

The following subsections provide an overview of these programs and some of their relevant findings.

FDEP/NWFWMD

Long-term trends in the water quality of Florida’s waters are monitored by FDEP’s Surface Water Temporal Variability (SWTV) and Groundwater Temporal Variability (GWTV) Monitoring Networks. These are statewide networks of fixed sites selected to reflect the water quality impacts across the state. The GWTV network includes monthly field readings and a quarterly, lab analyzed, water quality sample from a groundwater well near the border of Leon and Wakulla Counties and directly from the vent of Wakulla Spring. Monthly samples for the SWTV network include one sample just downstream of the Wakulla Spring pool, one station roughly one-half mile downstream that captures the contributions of Sally Ward Spring, and a third sample is collected at the highway 365 bridge just below the park, capturing several additional spring fed tributaries such as McBride and North Sloughs. The SWTV network also includes a station on the St. Marks River at Highway 98 where monthly water quality samples are collected. Additionally, the NWFWMD is collecting quarterly water quality samples from the main vent of the St. Marks River Rise as part of the NWFWMD’s Water Quality Trend network. Parameters monitored include color, alkalinity, turbidity, suspended and dissolved solids, nutrients, total organic carbon, chlorides, sulfate, metals (calcium, potassium, sodium, magnesium), pH, conductivity, temperature, DO, total coliform bacteria, fecal coliform bacteria, enterococci bacteria, and Escherichia bacteria. The water quality stations are located on gauged streams, which provide for calculated stream discharges (FDEP 2016c). Bi-annual biological sampling is also performed on the Wakulla River in order to evaluate ecological health.

The FDEP has also developed the Nitrogen Source Inventory and Loading Tool to identify and quantify the major contributing nitrogen sources to groundwater in areas of interest. This GIS and spreadsheet-based tool provides spatial estimates of the relative contribution of nitrogen from various sources. It takes into consideration the transport pathways and processes affecting the various forms of nitrogen as they move from the land surface through soil and geologic strata that overlie and comprise the upper Floridan aquifer (FDEP 2016c).

FDEP Northwest District

The FDEP's Northwest District has collected considerable biological data and conducted biological evaluations of numerous stream and other aquatic habitat sites throughout the watershed (FDEP 2003). The biological data collected by the FDEP Northwest District includes Stream Condition Index, Wetland Condition Index, and Bioassessment data; all accessible in the STOrage and RETrieval (STORET) database. The data is included in the Impaired Surface Waters Rule (IWR) assessments, including the most recent assessment IWR run 50 which can be found on the FDEP website: http://www.dep.state.fl.us/water/watersheds/assessment/basin411.htm.

Florida Department of Agriculture and Consumer Services

To minimize the risk of shellfish-borne illness, the FDACS continually monitors and evaluates shellfish harvesting areas and classifies them accordingly. It also ensures the proper handling of shellfish sold to the public. Under the SEAS program, FDACS monitors bottom and surface temperature, salinity, DO, surface pH, turbidity, fecal coliform bacteria, water depth, and wind direction and speed at shellfish beds.

Florida Department of Health

The Florida Healthy Beaches Program was begun by the FDOH as a pilot beach monitoring program in 1998 and was expanded to include all the state's coastal counties in August 2000. Local county health departments participate in the program with weekly monitoring of beaches for *enterococcus* and fecal coliform bacteria. The departments issue health advisories or warnings when bacterial counts are too high (FDEP 2003). The Wakulla County Health Department monitors water quality at Shell Point Beach and Mashes Sands Beach and issues beach closures and warnings when bacterial counts exceed water quality standards. Water quality data is available through the Florida Healthy Beaches Program (FDOH 2016b).

Florida LakeWatch

The University of Florida's LakeWatch volunteer monitoring program collects water quality data at dozens of sites within the watershed. Parameters monitored include total nitrogen, total phosphorus, chlorophyll-*a*, and *Secchi* depth, which are collected monthly at lake stations and some stream stations by citizen volunteers. Data are sometimes collected on aquatic vegetation (FDEP 2003).

Submerged Aquatic Vegetation Monitoring

Since 2009, the FWC's FWRI has monitored changes in the extent, density, and patchiness of seagrass in the Big Bend region as part of the statewide Seagrass Integrated Mapping and Monitoring (SIMM) program. The maps are generated through photointerpretation of high-resolution imagery. The FWRI is currently conducting a study to identify the roadblocks to seagrass recovery, which may be different from the causes for the loss of seagrasses.

Water Resource Quality Restoration and Protection Programs

Total Maximum Daily Loads

Total maximum daily loads (TMDLs) are developed for waterbodies that are verified as not meeting adopted water quality standards to support their designated use. They provide important water quality restoration goals to guide restoration activities. They also identify the reductions in pollutant loading required to restore water quality. Total maximum daily loads are implemented through the development and adoption of BMAPs that identify the management actions necessary to reduce the pollutant loads. Basin Management Action Plans are developed by local stakeholders (public and private) in close coordination with the Water Management Districts and the FDEP. Although water segments with adopted TMDLs are removed from the state's impaired waters list, they remain a high priority for restoration. The FDEP has developed specific guidance for implementing fecal coliform TMDLs that focuses on identifying and removing bacteria sources (FDEP 2011).

The FDEP adopted a final nutrient TMDL for the upper Wakulla River in 2012 that established a TMDL for nitrate (monthly average) at 0.35 mg/L, indicating 56.2% reduction from values observed at the time of adoption (FDEP 2012). The final Basin Management Action Plan (BMAP) for implementation of the TMDL in the upper Wakulla River and Wakulla Springs was approved by the Department in 2015 (FDEP 2015b). The BMAP delineates two primary focus areas for management strategies. The BMAP includes specific strategies and projects designed to reduce nitrate loading and improve water quality within the spring and river.

National Pollutant Discharge Elimination System (NPDES) Permitting

Point sources that discharge to surface waterbodies require a NPDES permit. These permits can be classified into two types: domestic or industrial wastewater discharge permits, and stormwater permits. All NPDES-permitted point sources may be affected by the development and implementation of a TMDL. All NPDES permits include "reopener clauses" that allow the FDEP to incorporate new discharge limits when a TMDL is established. These new limitations may be incorporated into a permit when a TMDL is implemented or at the next permit renewal, depending on the timing of the permit renewal and workload. For NPDES municipal stormwater permits, the FDEP will insert the following statement once a BMAP is completed (FDEP 2003):

> *The permittee shall undertake those activities specified in the (Name of Waterbody) BMAP in accordance with the approved schedule set forth in the BMAP.*

The FDEP implements the NPDES stormwater program in Florida under delegation from the EPA. The program requires the regulation of stormwater runoff from MS4s generally serving populations of more than 10,000 and denser than 1,000 per square mile, construction activity disturbing more than one acre of land, and ten categories of industrial activity. An MS4 can include roads with drainage systems, gutters, and ditches, as well as underground drainage, operated by local jurisdictions, the Florida Department of Transportation (FDOT), universities, local sewer districts, hospitals, military bases, and prisons.

Leon County conducts an ambient condition and trend monitoring program. The program includes quarterly water quality sampling and annual sediment and biological assessments of 13 lakes, 27 streams, and two rivers at a total of 73 monitoring stations. The 2016 Water Quality Report for data collected in 2015 is available as an Interactive Water Quality Data Map at the following link: http://cms.leoncountyfl.gov/Home/Departments/Public-Works/Engineering-Services/ Stormwater-Management/Water-Quality-Data (Leon County 2016).

The City of Tallahassee also conducts a Lakes Monitoring Program. The program monitors approximately 10 lakes within the city limits to track water quality trends and implement potential improvements if warranted. Twenty plus water quality parameters are evaluated on a quarterly cycle. Lake Vegetative Index surveys within each lake are performed bi-annually to evaluate lake community health.

Domestic and Industrial Wastewater Permits

In addition to NPDES-permitted facilities, all of which discharge to surface waters, Florida also regulates domestic and industrial wastewater discharges to groundwater via land application. Since groundwater and surface water are so intimately linked in much of the state, reductions in loadings from these facilities may be needed to meet TMDL limitations for pollutants in surface waters. If such reductions are identified in the BMAP, they would be implemented through modifications of existing state permits (FDEP 2003).

Best Management Practices

Best management practices (BMPs) include structural controls (such as retention areas or detention ponds) or non-structural controls (such as street sweeping or public education). Many BMPs have been developed for urban stormwater to reduce pollutant loadings and peak flows. These BMPs accommodate site-specific conditions, including soil type, slope, depth to groundwater, and the use designation of receiving waters (such as drinking water, recreation, or shellfish harvesting).

The passage of the 1999 Florida Watershed Restoration Act (Chapter 99-223, Laws of Florida) increased the emphasis on implementing BMPs to reduce NPS pollutant discharges from agricultural operations. It authorized the FDEP and the FDACS to develop interim measures and agricultural BMPs. While BMPs are adopted by rule, they are voluntary if not covered by regulatory programs. If they are adopted by rule and the FDEP verifies their effectiveness, then implementation provides a presumption of compliance with water quality standards, similar to that granted a developer who obtains an ERP (FDACS 2016a).

Over the last several years, the FDACS has worked with farmers, soil and water conservation entities, the University of Florida's Institute of Food and Agricultural Sciences, and other interests to improve product marketability and operational efficiency of agricultural BMPs, while at the same time promoting water quality and water conservation objectives.

Agricultural land use in Leon and Wakulla counties is primarily silviculture, with some pastures and sod operations. BMPs have been developed and adopted into rules for silviculture, row crops, container plants, cow-calf, and dairies (FDACS 2016a; FDACS 2016b).

Spring Protection and Restoration

Since 2013, Florida has made substantial commitments to protecting and restoring Florida's springs, their ecological value, and associated public benefits. As of 2017, more than $48 million in grant funds have been approved for projects in northwest Florida, leveraging an over $22 million in additional local and federal funds. Projects funded in the St. Marks River and Apalachee Bay watershed include cooperative projects with Wakulla County, Leon County, and the City of Tallahassee to extend sewer service to areas currently served by septic systems, resulting in improved wastewater treatment and removal of septic systems from sensitive areas. Additionally, a pilot project to evaluate advanced onsite treatment systems has been initiated in rural areas of Leon and Wakulla counties within the Wakulla Spring groundwater contribution area. Fee simple or conservation easement projects are also underway to increase the long-term protection of spring resources. These efforts together are expected to contribute substantially to other priorities identified in the Upper Wakulla River and Wakulla Spring BMAP.

The Florida Springs and Aquifer Protection Act of 2016 (373.801-373.813 Florida Statutes), furthers protection and restoration of Florida's ecologically significant spring ecosystems by defining requirements for Outstanding Florida Springs, including for protection of water quality, delineation of priority focus areas, and establishment of related MFLs. The 2016 Legislature also passed the Legacy Florida Act, which provides for recurring appropriations for spring restoration and protection statewide.

Lake Management

Existing Lake Management plans for the St. Marks River and Apalachee Bay watershed include:

- Lake Lafayette Management Plan (May 1996)
- Lake Lafayette Management Plan (July 2005)
- Lake Miccosukee Management Plan (March 1989)
- Lake Munson Action Plan (January 1994)

Restoration and habitat enhancement projects have been conducted to address several lakes through state funding, federal grants, and local funding. Much of the state funding for habitat enhancement and restoration of lakes has been made available through the FWC. The 1999 Florida Forever legislation included a fisheries restoration program targeting Florida lakes deemed to be in priority need of attention. Starting in July 2001, funding was made available to the FWC to perform lake drawdowns, remove muck and sediments, reestablish native submersed and emergent vegetation, implement tussock control measures, and carry out other enhancements to fishery habitat through 2010.

Leon County, the FWC, and the City of Tallahassee committed substantial resources to restoring Lake Munson (McGlynn 2006). The Lake Munson Action Plan was implemented after record flooding in Leon County by a series of tropical storms and depressions in 1994 (Leon County 1994). Leon County began Lake Munson restoration activities in 1999 (FDEP 2003). The Lake Henrietta stormwater facility was completed in 2000. Other recent activities include removing a sediment delta at the entry point of Munson Slough and regrading and stabilizing Munson Slough to reduce erosion. FWC, local governments, and state resource agencies are evaluating plans to remove muck from the remainder of the lake bottom.

In 2007, a 25-acre wet detention treatment facility with trash traps was constructed to reduce sediments, slow runoff, and reduce trash before water enters the restored and stabilized channel north of Lake Munson. During the 2006 reconstruction of Orange Avenue, a wet detention treatment facility and floodplain storage infrastructure was constructed at the intersection of Meridian and Orange Avenue. Trash capture was incorporated on the East Drainage Ditch east of Jim Lee Road. Leon County continues to monitor Lake Munson for DO, nitrogen concentrations, and other water quality parameters (Hill 2010; Richardson 2007).

Lake Miccosukee is managed by the FWC to provide high-quality wetland habitat for waterfowl, as well as hunting opportunities. In 2012, repair work was competed on the fixed-crest weir that controls water levels within the lake and allows for periodic drawdowns (Ducks Unlimited n.d.). Prior to hydrological alteration, Lake Miccosukee drained naturally through sinkholes; however, in 1954, an earthen dike was built around the larger sinkhole near the northwest shore of the lake and lake managers assumed the responsibility for regulating the lake's water level. The 1989 management plan suggests that frequent drawdowns, up to every five years, may be necessary to maintain the lake's sport fish population and reduce the build-up of organic materials on the lake bottom (Lake Miccosukee Technical Advisory Committee 1989). The FWC's Aquatic Resources Enhancement Section initiated an extreme drawdown of Lake Miccosukee in March 1999 and closed the lake to fishing. Muck was then removed from four sites around the lake. In the process, approximately 25 acres of the lake bottom were scraped. To control woody tussocks and oxidize organic material, 1,300 acres on the bottom were burned.

Hydrologic alterations have made managing the Lake Lafayette basin as a single unit challenging (McGlynn 2006). A project to restore Lake Piney Z in the Lake Lafayette chain was conducted from 1996 to 1998. It included a drawdown, muck removal, creation of six earthen fishing fingers and five wildlife islands, and installation of a water control structure in the 197-acre lake. The City of Tallahassee also purchased 407 acres of surrounding land. The Existing Status and Management Plan for Lake Lafayette and the Lake Lafayette Watershed (Leon County 2005) describes a hydrologic budget, water quality characteristics, physical characteristics, and pollutant loading for each lake in the basin. The plan offers management strategies for each lake component, as well as a discussion of restoring Lake Lafayette to a single lake system. The continuation and expansion of vegetation control/removal is recommended for all lakes in the basin, along with preventative actions such as establishing vegetative buffers, revising stormwater and construction regulations, and increasing public awareness.

University of Florida Institute of Food and Agricultural Sciences Extension

The University of Florida's Institute of Food and Agricultural Sciences (IFAS) is a federal-state-county partnership that focuses on research, teaching, and extension to "*develop knowledge in agriculture, human and natural resources, and the life sciences, and enhance and sustain the quality of human life by making that information accessible*."

Many IFAS programs and partnerships help protect water resources across the St. Marks River and Apalachee Bay watershed and the State of Florida, including the Fisheries and Aquatic Sciences and Marine Sciences Program, Aquatic and Invasive Plants Center, Florida Cooperative Fish and Wildlife Research Unit., Florida Partnership for Water, Agriculture and Community Sustainability, the Natural Resources Leadership Institute, the Wetland Biogeochemistry Laboratory, and the Shellfish Aquaculture Extension among others.

To promote environmentally sound forestry practices, IFAS offers the voluntary Forest Stewardship Program, which seeks to help private landowners develop a plan to increase the economic value of their forestland while maintaining its environmental integrity (UF-IFAS 2016). The Extension also works with farmers and homeowners across the state to minimize the need for pesticides and fertilizers through environmentally friendly BMPs.

City and County Initiatives

Wakulla County, in partnership with Leon County, FDOH, and the City of Tallahassee, developed an OSTDS Initiative to reduce nitrogen inputs from septic systems to the Upper Wakulla River and Wakulla Springs Basin as part of the 2015 BMAP (FDEP 2015b).

Leon County's Water Resources Program collects quarterly data on 39 water chemistry parameters at 37 monitoring stations across the County, including 13 lakes, 27 streams, and two river systems. The program also assesses water quality using the Lake Vegetation Index, which evaluates how closely a given lake's plant community resembles a pristine condition, and the Stream Condition Index, which evaluates the biological health of a stream based on the population and diversity of macroinvertebrates (Leon County 2016).

The City of Tallahassee constructed a land application system for disposal of municipal wastewater in the late 1970s and eliminated the direct discharge of municipal sewage to Munson Slough in the early 1980s. This has been the most significant step toward improving water quality in Lake Munson (FDEP 2003). During the same period, Wakulla County created a municipal WWTF (spray irrigation) and required coastal residents and businesses in the communities of Panacea and Ochlockonee Bay to connect to the central system and discontinue the use of individual septic tanks. More recently, the City of Tallahassee's TPS facility was upgraded to reduce nitrate loadings to Wakulla Spring by approximately 80 percent.

Further reductions in nitrate concentrations are expected in the river and springs due to this upgrade, as well as other completed actions in the basin. Prior to the upgrade, the facility was identified as the largest source of nitrate loading to the upper Wakulla River and Wakulla Spring (FDEP 2015b).

The City of Tallahassee Stormwater Management Division and the Leon County Public Works Department have carried out extensive stormwater management activities for the basin. Activities have focused on implementing drainage improvements, carrying out stormwater retrofits, and restoring Tallahassee lakes. Improved treatment systems and the cessation of surface water discharges resulted in significant water quality improvements. However, not until the 1980s was urban stormwater pollution addressed as a significant concern for water quality. Since that time, state and local governments and the general public have become more aware of the need for stormwater treatment, and there are increasing numbers of stormwater projects as well as use of nonstructural management practices. The non-structural stormwater practices include public information, staff training, incident reports, and other activities to address and prevent polluted stormwater. In accordance with the 1990 Tallahassee–Leon County Comprehensive Plan, a stormwater ordinance and a stormwater utilities department were created. From the resultant Stormwater Master Plan, local stormwater planners developed a list of approximately 20 capital improvement projects to address flooding and drainage improvements. Many of these being implemented also include a stormwater treatment or restoration components.

As required by the Tallahassee-Leon County Comprehensive Plan, an Aquifer Protection Program was established to protect wellheads, delineate high-recharge areas and areas most susceptible to ground water contamination, and identify contaminated areas. The City of Tallahassee Aquifer Protection Program is responsible for implementing the 1992 Aquifer Recharge/Wellhead Protection Ordinance. Projects in which the city has been involved include a karst inventory of Leon County and a wellhead protection assessment and modeling project funded by the EPA. The NWFWMD and the USGS have provided support to the city (FDEP 2003).

Development guidelines and permitting requirements to prevent or minimize stormwater contamination also resulted from the Comprehensive Plan and the stormwater ordinance. New developments are now required to include adequate stormwater treatment measures. Redeveloped sites must also be retrofitted to provide treatment, and efforts are made to preserve sensitive areas (FDEP 2003). The city has constructed 11 regional facilities throughout the community that incorporate both water quality treatment as well as flood prevention into their design. In 2013-2014, the City of Tallahassee completed the Upper Lake Lafayette Nutrient Reduction Project to treat stormwater that flows into Upper Lake Lafayette. The $5.6 million project includes structural and process improvements that will greatly enhance the capacity of the existing Weems Stormwater Facility to remove pollutants. Cascades Park was constructed by the City of Tallahassee and Leon County in 2014 as a multi-purpose stormwater facility to provide flood relief in downtown Tallahassee. It offers a variety of outdoor and recreational amenities, including a state-of-the-art amphitheater, interactive water fountain, children's play area, Smokey Hollow Commemoration and miles of multi-use trails. The park was funded by Blueprint 2000 through the use of a one-cent local option sales tax, leveraging matching grants from the District and other sources.

In 1999, the City of Tallahassee Stormwater Management Division began implementing a Stormwater Pollution Reduction Program, which incorporates strategic stormwater retrofits and a management program to reduce stormwater pollution from existing developed areas. Initial phases of the process have been completed (City of Tallahassee and Environmental Research and Design 2002), including a monitoring program and development of a computer model to simulate existing and future pollutant loadings. These led to the development of a problem prioritization system to identify areas with the optimum potential for stormwater treatment list of stormwater treatment scenarios. A list of stormwater treatment alternatives and a financial plan have been developed and presented to the City Commission for review and approval. Milestones for implementation of the selected stormwater treatment alternatives will then be included in the Comprehensive Plan (FDEP 2003). For the last ten years, the City of Tallahassee has sponsored the TAPP – Think About Personal Pollution Campaign to help educate citizens on ways that they can make small personal changes in their home and yard practices to help keep local lakes, sinks, and streams cleaner. The campaign has been recognized nationally for its effectiveness.

Florida Forever

Florida Forever is Florida's conservation and recreation lands acquisition program. Under section 373.199, F.S., and the NWFWMD Florida Forever 2016 Five Year Work Plan, a variety of projects may be implemented, including capital projects, land acquisition, and other environmental projects. Since its inception, the District's land acquisition program has sought to bring as much floodplain as possible of the major rivers and creeks under public ownership and protection (NWFWMD 2016b).

The watershed includes significant areas on the state's approved Florida Forever lands acquisition list, including Wakulla Spring Protection Zone, Florida's First Magnitude Springs, Millstone Plantation, St. Joe Timberland, and the Upper St. Marks River Corridor.

Restoration and habitat enhancement projects have been conducted to address several lakes, partly through state funding, partly by federal grants, and partly by Leon County. Much of the state funding for habitat enhancement and restoration of lakes has been made available through the FWC. The 1999 Florida Forever legislation includes a fisheries restoration program targeting Florida lakes deemed to be in priority need of attention. Starting in July 2001, funding was made available to the FWC to perform lake drawdowns, remove muck and sediments, reestablish native submersed and emergent vegetation, implement tussock control measures, and carry out other enhancements to fishery habitat through 2010 (FDEP 2003).

The NWFWMD's primary focus within the watershed has been to acquire less than fee rights on privately owned floodplain land separating existing federal and state properties. Protection of floodplain, wetland, and riparian lands bordering the river and its tributaries can protect water quality and habitat, as can protection of high recharge areas within spring groundwater contribution areas. The District presently has 1,376 acres in less than fee holdings in the area and has identified for potential fee or less than fee acquisition approximately 45,456 acres along the St. Marks and Wakulla rivers and approximately 16,583 acres in the Wakulla Springs Groundwater Contribution Area (NWFWMD 2016b). Additionally, with Florida Forever funding, the District provided grant funding to assist in construction of many of the projects listed in Appendix A. These include the Cascades Park, Gibby Pond, Caroline Courts, Call Street and Cadiz, and Campus Circle stormwater projects.

Regional Mitigation for State Transportation Projects

Under Section 373.4137, F.S., the NWFWMD offers mitigation services, as an option, to the FDOT for transportation projects with unavoidable wetland impacts when the use of private mitigation banks is not feasible. As required by this statute, a regional mitigation plan has been developed and is updated annually to address FDOT mitigation needs submitted to the NWFWMD. Components of the Umbrella Plan include the federally permitted "In-Lieu Fee Program" instrument and other mitigation projects (NWFWMD 2016a). The District does not compete with private mitigation banks. One, the St. Marks Mitigation Bank, is located in the St. Marks River and Apalachee Bay watershed. The District's mitigation plan is developed and implemented in consultation with the FDOT, the FDEP, the USACE, the EPA, the USFWS, the U.S. National Marine Fisheries Service, and the FWC and is maintained and available for review at http://www.nwfwmdwetlands.com/.

Florida Environmental Resource Permitting (ERP)

Florida established the ERP program to prevent stormwater pollution to Florida's rivers, lakes, and streams, and to help provide flood protection. The ERP program regulates the management and storage of surface waters and provides protection for the vital functions of wetlands and other surface waters. Environmental resource permits are designed to obtain 80 percent average annual load reduction of total suspended solids. In northwest Florida, the ERP program is jointly implemented by the NWFWMD and the FDEP.

Other Programs and Actions

Several local initiatives have been key partners in advancing watershed resource protection programs, as well as building community support for watershed protection through the citizen advisory councils and volunteer organizations. Among these are citizen or citizen-government groups with an interest in protecting or enhancing water resources are active in the St. Marks River and Apalachee Bay watershed. Most organizations have a specific geographic focus at either the watershed or waterbody level. Identified organizations include:

- **Wakulla Springs Alliance** – The Wakulla Springs Alliance was organized in 1992 to protect and restore spring flow, water quality, and ecological health of Wakulla Spring and the Wakulla River. The Alliance sponsors tours of the basin as well as analytical work, and it actively works with FDEP, the NWFWD, and local governments to promote protection and restoration of the spring and associated resources.
- **Apalachee Audubon** – Apalachee Audubon is North Florida's chapter of the National Audubon Society, a non-profit organization dedicated to the "protection of the environment through education, appreciation, and conservation" through education, membership, field trips, and public programs (Apalachee Audubon Society 2016). The Apalachee Audubon Society Conservation Plan outlines the organization's plans to conduct conservation activities such as direct habitat enhancement projects and wildlife monitoring to identify population trends. The Conservation plan also outlines the Apalachee Audubon's goal and intent to comment on agency resource management plans and public position statements that concern important conservation issues in North Florida (Apalachee Audubon Society 2016).

Appendix C Geographic and Physical Characteristics

Overview

The greater St. Marks River and Apalachee Bay watershed covers approximately 1,169 square miles of Florida and Georgia. About 91 percent of this area is within Florida (Figure C-1). There is distinct topographical variation, with the highest elevations and most significant slopes within the northern extent of the watershed (Figure C-2). The majority of the watershed, and all of its lower reach, is defined by a broad coastal plain.

Generalized land cover (Figure C-3) reflects major urban development associated with the City of Tallahassee in the central portion of the watershed, with significant areas of development further south and east of the city. Upland forests and wetlands both have extensive coverage throughout the watershed planning area.

The following three figures depict the interstate basin, topography, and generalized land use and land cover.

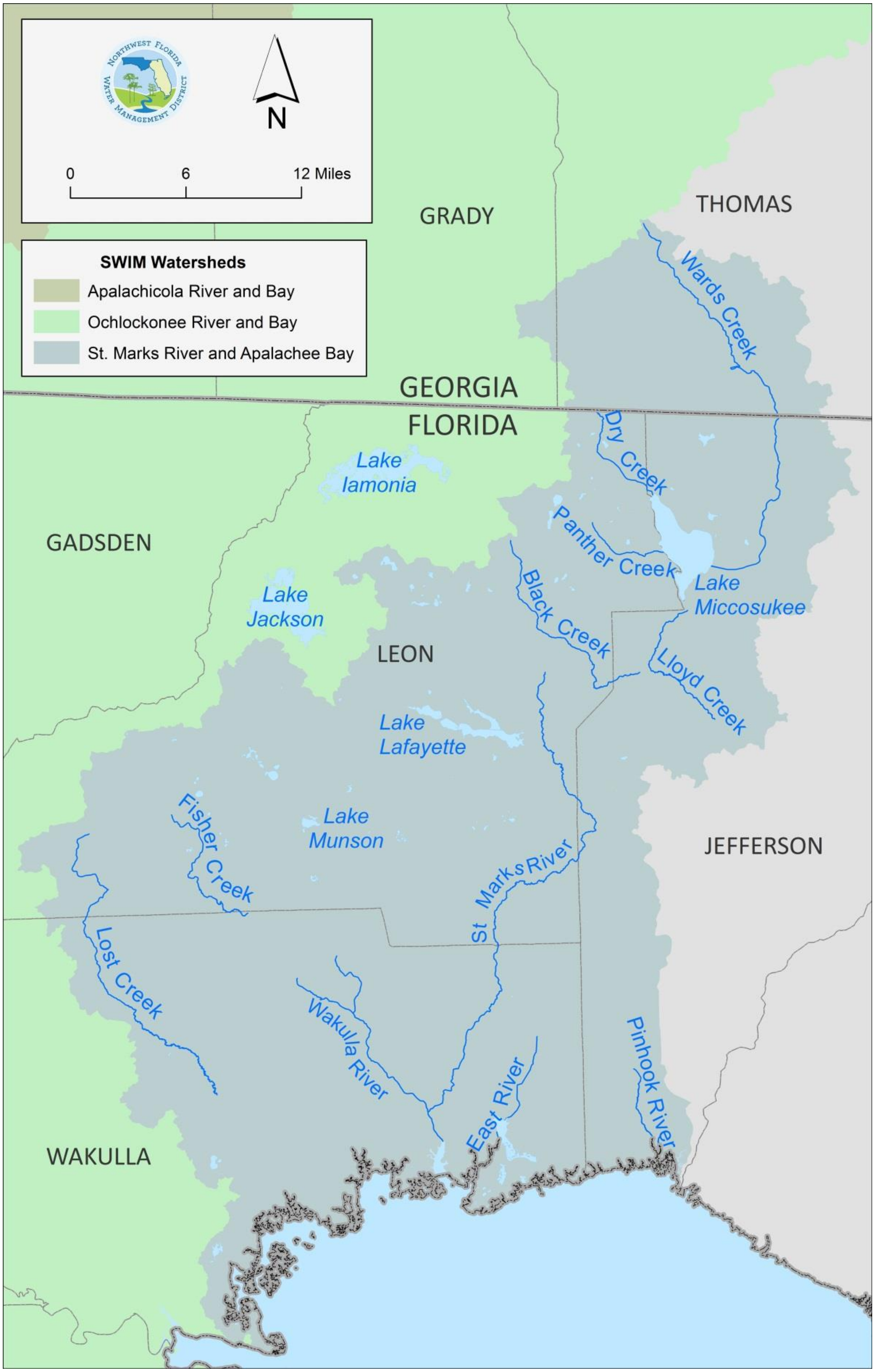

Figure C-1 Greater St. Marks River and Apalachee Bay Watershed

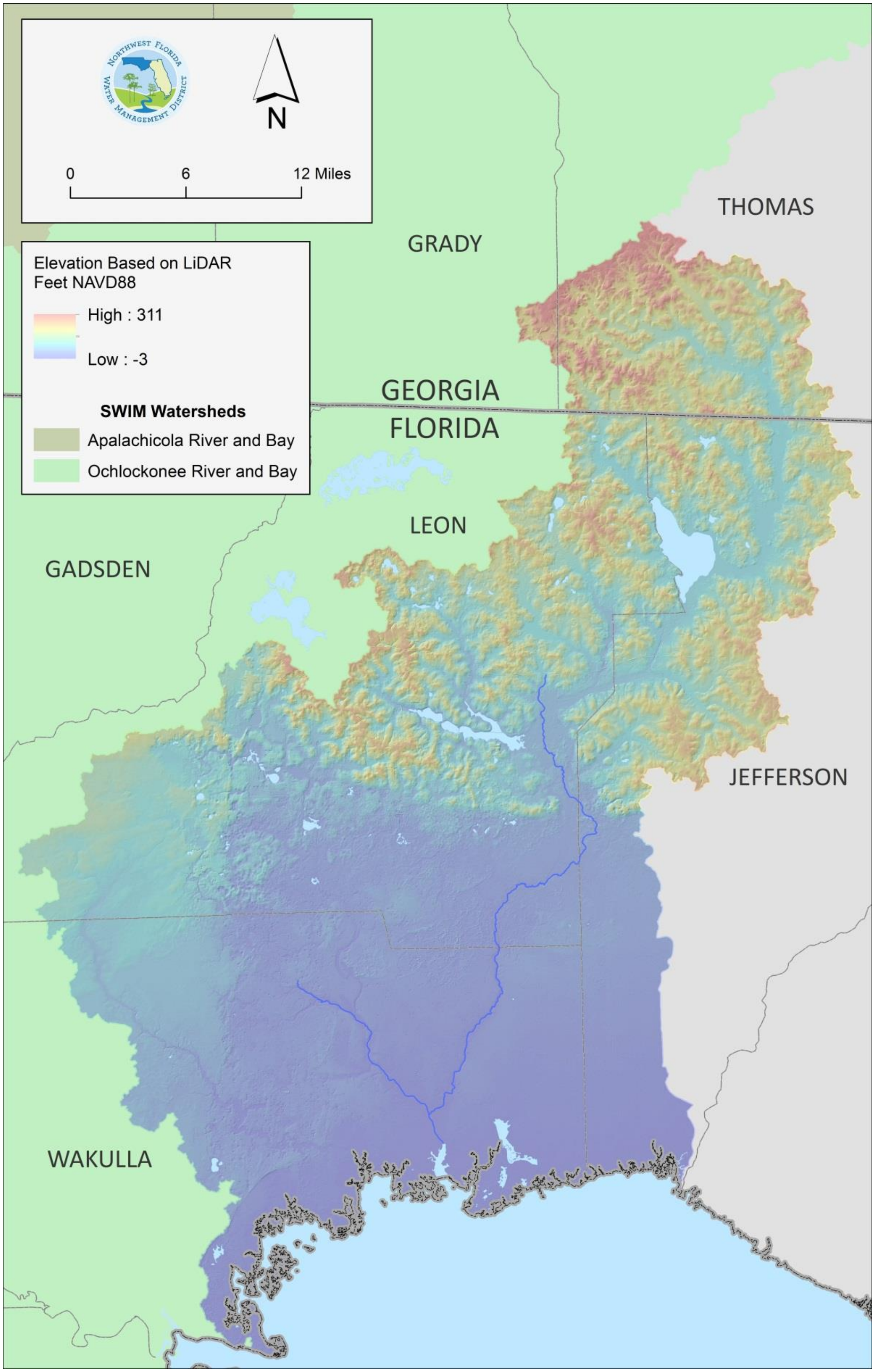

Figure C-2 Greater St. Marks River and Apalachee Bay Watershed Topography

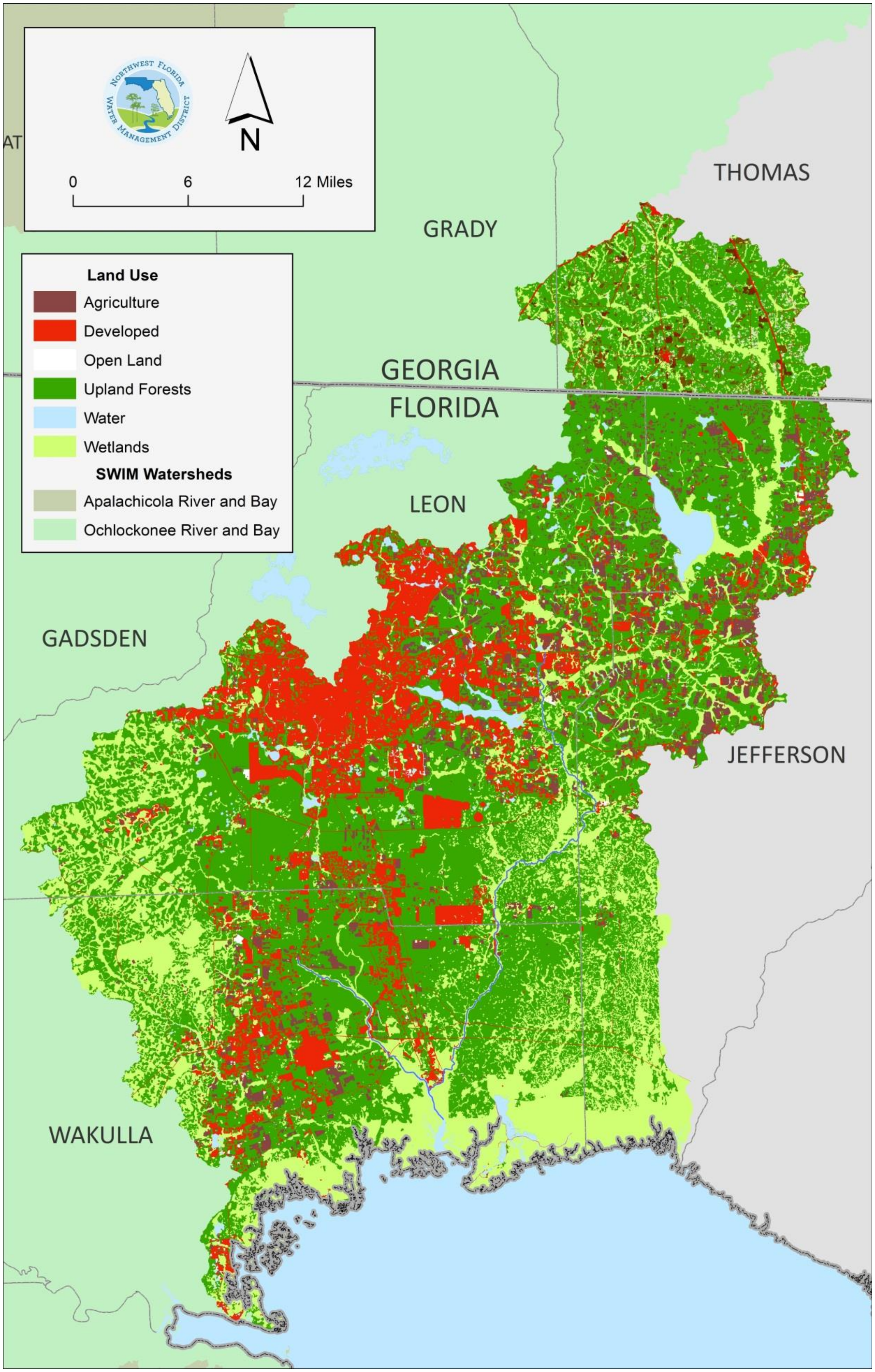

Figure C-3 Greater St. Marks River and Apalachee Bay Watershed Land Use and Land Cover

The St. Marks River and Apalachee Bay watershed encompasses two localized physiographic regions in Florida separated distinctly by the Cody Scarp: the Tallahassee Hills subdivision of the Northern Highlands and the Gulf Coastal Lowlands. Both regions exhibit distinct geology and soils. The Tallahassee Hills are erosional-remnant hills and ridges that have elevations up to 260 feet. The region has sandy and red clay soils and is characterized by high runoff and low recharge. Intermittent streams are common. The Coastal Lowlands region is a flat, weakly dissected alluvial plain formed by deposition of continental sediments onto a submerged, shallow continental shelf, that were later exposed by sea level subsidence. Local relief varies from 0 to 100 feet (USDA 2014) relative to mean sea level. For coastal areas, fluvial deposition and shore zone processes are active in developing and maintaining beaches, swamps, and mud flats.

Floridan Aquifer Vulnerability Assessment

In 2017, the Florida Geological Survey released the Floridan Aquifer System Contamination Potential (FAVA II) dataset (Figure C-4). This dataset was calculated through the application of the weights of evidence method. This method examines different data layers including point and area data to determine relative vulnerability. These maps were developed to provide FDEP with a ground-water resource management and protection tool to carry out agency responsibilities related to natural resource management and protection regarding the Floridan Aquifer System. The maps are not appropriate for site specific analysis.

Figure C-4 overlays the FAVA II dataset over the watershed, together with the primary focus areas (PFAs) defined in the Upper Wakulla River and Wakulla Springs Basin Management Action Plan. These PFAs were defined to represent areas in the basin where the aquifer is most vulnerable to inputs and with the most connectivity between ground water and Wakulla Springs (FDEP 2015b).

As depicted in the figure, those areas where the Floridan Aquifer is most vulnerable to contamination include most of the watershed planning area, including both defined PFAs. No areas classified as least vulnerable are located within the St. Marks River and Apalachee Bay Watershed. The lowest area of vulnerability within the planning area is classified as “More Vulnerable.” Limited areas, mostly near the fringe of the watershed, are within this classification.

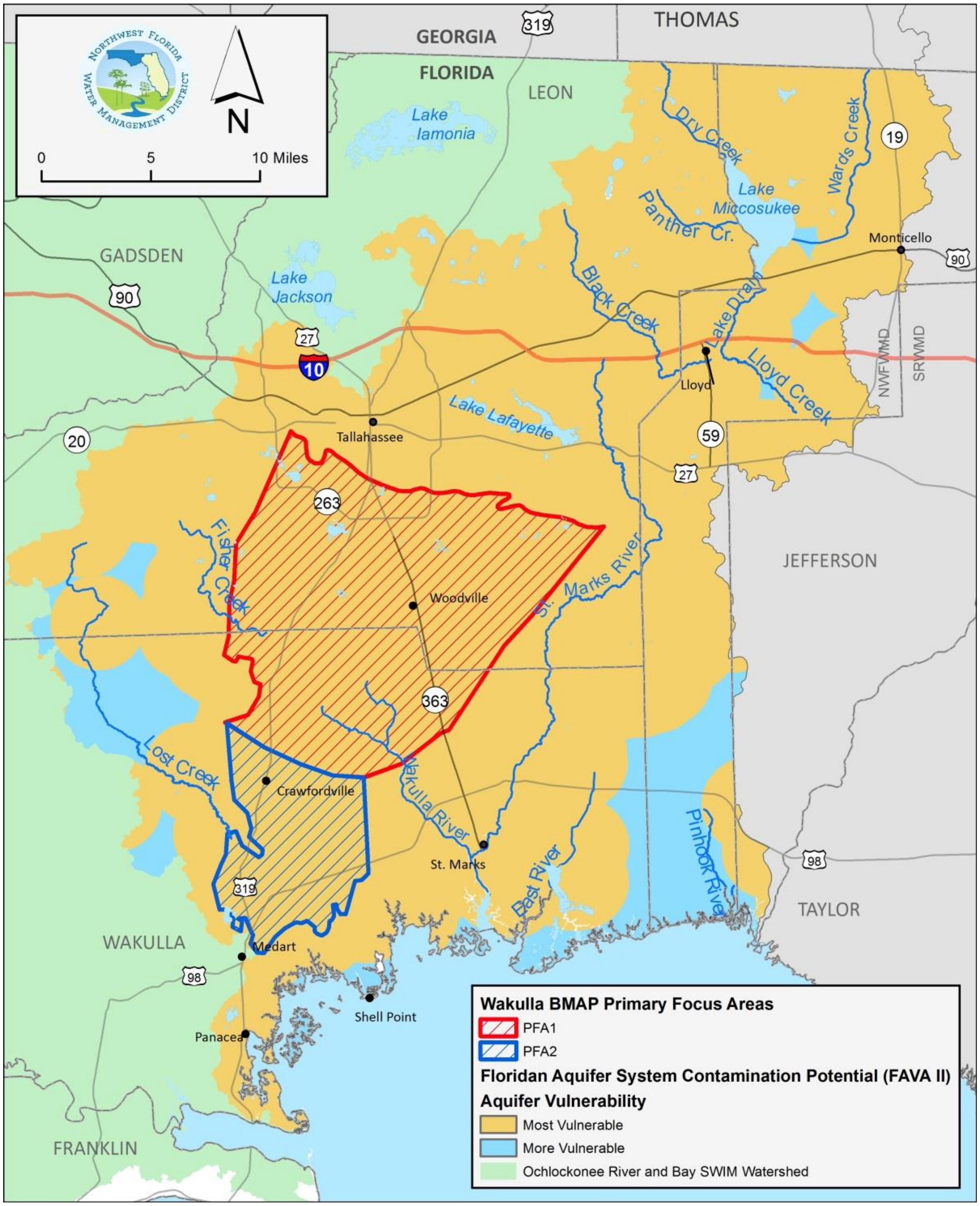

Figure C-4 Floridan Aquifer System Contamination Potential

Geologic Units

The Tallahassee Hills are immediately underlain by the Miccosukee Formation, which is made up of interbedded clay, silt, sand, and gravel (USDA 1981). The Miccosukee Formation caps topographically high areas on the Tifton Upland and lies uncomfortably on the Miocene Hawthorn Group–Torreya Formation. In the upper St. Marks River and Apalachee Bay watershed, limestone karst landscapes lead to hydrologic connectivity to the Floridan aquifer through a series of springs and sinkholes.

In the Coastal Lowlands, ancient marine geomorphic features, including beach ridges, spits, bars, dunes, and terraces, make up the modern topography. The Gulf Coastal Lowlands are dived into the Woodville Karst Plain and the Apalachicola Coastal Lowlands. The Woodville Karst Plain is a low, gently sloping plain consisting of sand dunes lying on a limestone surface that begins in the southern part of Leon County and extends southward through Wakulla County to the Gulf (USDA 1981). It is bounded on the west by the Apalachicola Coastal Lowlands and extends eastward into Jefferson County. It is characterized by loose quartz sand thinly veneering a limestone substratum that has resulted in sinkhole sand dune topography. The porous sands allow rainwater to rapidly move into the soluble underlying limestone, which has been continuously and rapidly lowered from its original level (USDA 1989).

The Gulf Coastal Lowlands region is essentially flat and has a Pleistocene-age to Holocene-age sand cover extending from the Gulf of Mexico north to the Cody Scarp in Leon County. Holocene-age alluvial and eolian deposits are predominantly fine-grained quartz sand and are difficult to differentiate from Pleistocene sediment. In the Woodville Karst Plain, east of Crawfordville and Panacea, sediment is made up of quartz sand generally no more than 20 feet thick underlain by a karstic, early Miocene limestone. The eastern part of the watershed in Jefferson County encompasses a transitional geological area that separates the thick Tertiary carbonate sediment characteristic of the Florida peninsula from the predominant age-equivalent clastic sediment of western Florida. This area is underlain by thick limestones, dolomites, sands, and clays.

The Apalachicola Coastal Lowlands are west of U.S. Highway 319. This region is made up of flat, sandy areas underlain by thick sandy clay, clayey sand, and peat. The water table is close to the surface and during the rainy season much of the area is swampy. These sediments are underlain by early Miocene limestone. The early Miocene sediments of the St. Marks Formation, where present, are underlain by the Suwanee limestone and are overlain by the Hawthorn Group (also absent in some areas). The St. Marks Formation underlies nearly all of Wakulla County and interfaces with the Chattahoochee Formation to the west. The early Miocene Torreya Formation is characteristically a siliciclastic unit consisting of very fine or medium clayey sand to sandy silty clay. The Torreya Formation extends into northwestern and western Wakulla County (USDA 1991).

Soils within the St. Marks River and Apalachee Bay watershed have been used for extensively for crop production, silviculture, and pastureland since the state’s settlement. Along with being a valuable agricultural resource, soils also protect water quality by absorbing runoff, store soil organic carbon, and help mitigate flooding. The following soils are found in the Florida portion of the watershed:

Ultisols – Intensely-weathered soils of warm and humid climates, ultisols are usually formed on older geologic formations in parent material that is already extensively weathered (i.e., upland areas of the watershed). They are generally low in natural fertility and high in soil acidity, but contain subsurface clay accumulations that give them a high nutrient retention capacity. In the St. Marks River and Apalachee Bay watershed, soils found north of the Woodville Karst Plain where the landscape has been relatively stable over recent geologic time are primarily ultisols (Collins 2010). Ultisols are the primary agricultural and silvicultural soils of the watershed, as their high clay content contributes to nutrient and water retention, when properly managed and are found in eastern Leon County and western Jefferson County.

Entisols – Young soils that show little development, entisols have no diagnostic horizons, and are largely unaltered from their parent material, which can be unconsolidated sediment or rock (USDA 2014). Entisols are found in the Tallahassee metropolitan area, and in northeastern Jefferson County near the Georgia border and west of Lake Miccosukee, where surficial processes are active (Collins 2010).

Spodosols – Spodosols are sandy, acidic soils, often found in cool, moist climates such as coastal conifer forests (USDA 2014). They are easily identified by their strikingly-colored horizons, which form as a result of leaching and accumulation processes. Spodosols can be found throughout the central portion of the Aucilla Wildlife Management Area and along the southern and eastern margin of Lake Miccosukee in Jefferson County (Collins 2010). The presence of spodosols indicates an area that was historically dominated by a pine (longleaf) over-story.

Alfisols – South of Tallahassee and along the coast from Medart to the eastern edge of the watershed, soils are classified predominantly as alfisols, or forest soils. Alfisols are extensive throughout Wakulla County and southern Jefferson County, making up large portions of the St. Marks National Wildlife Refuge and the Flint Rock Wildlife Management Area. Soils within the Apalachicola National Forest are classified primarily as alfisols, inceptisols, and histosols (wetland soils).

Inceptisols – Inceptisols are described as soils in the beginning stages of soil profile development, as the differences between soil horizons are just beginning to appear in the form of color variation due to accumulations of small amounts of clay, salts, and organic material. Inceptisols occur predominantly within the Apalachicola National Forest and in the coastal portion of the watershed where the St. Marks River drains into Apalachee Bay (Collins 2010).

Histosols – Predominantly composed of organic material in various stages of decomposition, histosols are usually saturated, resulting in anaerobic conditions, slower rates of decomposition, and increased organic matter accumulation. Histosols generally consist of at least half organic materials and are common in wetlands (USDA 2014). Histosols in the St. Marks River and Apalachee Bay watershed occur in eastern Wakulla County, throughout the Apalachicola National Forest, and along Munson Slough within the Tallahassee metropolitan area. Many of these histosols reflect the relic hydrology prior to extensive urbanization (Collins 2010; USDA 2014). Histosols cover approximately 6,155 square miles in the state of Florida and store more organic carbon than any other soil type (Kolka et al. 2016; Vasques et al. 2010). Drainage of wetland areas and the associated decomposition of organic matter stored in histosols is a well-documented source of atmospheric carbon dioxide and methane.

Appendix D Threatened and Endangered Species within the Watershed

The St. Marks River and Apalachee Bay watershed supports a wide array of biological resources and habitats; and therefore, many species of flora and fauna. This Appendix provides a list of species that are protected and tracked for the watershed, as well as their habitat requirements.

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Plants					
Andropogon arctatus	Pinewood Bluestem	S3	T	N	Lacustrine: wet pine flatwoods, seepage wetlands, bogs, wet pine savannas
Arnoglossum diversifolia	Indian-plantain	N	T	P	Palustrine: forested wetland
Asclepias viridula	Green Milkweed	S2	T	N	Palustrine: wet prairie, seepage slope edges
Aristida simpliciflora	Southern Threeawn	N	E	N	N/A
Aster spinulosus	Pinewoods Aster	S1	E	N	Palustrine: seepage slope Terrestrial: sandhill, scrub and mesic flatwoods
Baptisia megacarpa	Apalachicola Wild Indigo	S2	E	N	Palustrine: floodplain forest Terrestrial: upland mixed forest, slope forest
Baptisia simplicifolia	Scareweed	S3	T	SSC	N/A
Brickellia cordifolia	Flyer's Nemesis	S1	E	SSC	Terrestrial: upland hardwood forest, near streams
Calamintha dentata	Toothed Savory	S3	T	N	Terrestrial: longleaf pine-deciduous oak sandhills, planted pine plantations, sand, open and abandoned fields, and roadsides
Calamovilfa curtissii	Curtiss's Sandgrass	S3	T	N	Palustrine: mesic and wet flatwoods, wet prairie, depression marsh
Callirhoe papaver	Poppy Mallow	S2	E	CE	Terrestrial: upland mixed forest, roadsides; edge or understory
Calycanthus floridus	Sweetshrub	S2	E	CE	Terrestrial: upland hardwood forest, slope forest, bluffs Palustrine: bottomland forest, stream banks, floodplains
Calystegia catesbaeiana	Catesby's Bindweed	SH	E	N	Terrestrial: Longleaf pine-wiregrass sandhill.
Cleistes divaricata	Spreading pogonia	N	E	N	N/A
Crataegus phaenopyrum	Washington Hawthorn	S1	E	N	Palustrine: basin swamp, basin marsh, edges of wet areas
Conradina canescens	Short-leaved rosemary	N	N	E	N/A
Cuphea aspera	Tropical Waxweed	S1	E	N	Palustrine: wet prairie, seepage slope Terrestrial: mesic flatwoods

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Drosera intermedia	Water Sundew	S3	T	CE	Lacustrine: sinkhole lake edges Palustrine: seepage slope, wet flatwoods, depression marsh Riverine: seepage stream banks, drainage ditches
Drosera tracyi	Tracy's Sundew	N	E	N	N/A
Euphorbia telephioides	Telephus Spurge	S1	E	N	Terrestrial: mesic flatwoods; disturbed wiregrass areas, coastal scrub
Forestiera godfreyi	Godfrey's Swamp Privet	S2	E	P	Terrestrial: forest-hardwood, on wooded slopes of lake & river bluffs
Galactia smallii	Small's milkpea	N	N	E	N/A
Gentiana pennelliana	Wiregrass Gentian	S3	E	SSC	Palustrine: seepage slope, wet prairie, roadside ditches Terrestrial: mesic flatwoods, planted slash pine
Harperocallis flava	Harper's beauty	N	N	E	N/A
Hexastylis arifolia	Heartleaf Wild Ginger	S3	T	CE	Riverine: seepage stream bank Terrestrial: slope forest
Hymenocallis godfreyi	Godfrey's spiderlily	S1	E	N	N/A
Justicia crassifolia	Thickleaved Waterwillow	S2	E	N	Palustrine: dome swamp, seepage slope Terrestrial: mesic flatwoods
Kalmia latifolia	Mountain Laurel	S3	T	CE	Riverine: seepage stream bank Terrestrial: slope forest, seepage stream banks
Lachnocaulon digynum	Panhandle Bog Buttons	S3	T	N	Riverine: pool Palustrine: bog/fen, forested wetland
Leitneria floridana	Corkwood	S2	T	N	N/A
Liatris provincialis	Godfrey's Gayfeather	S2	E	N	Terrestrial: sandhill, scrub, coastal grassland; disturbed areas
Lilium catesbaei	Catesby Lily	N	T	N	Palustrine: wet prairie, wet flatwoods, seepage slope Terrestrial: mesic flatwoods, seepage slope; usually with grasses
Linum westii	West's Flax	S2	E	N	Palustrine: dome swamp, depression marsh, wet flatwoods, wet prairie, pond margins
Lupinus westianus	Gulf Coast Lupine	S2	T	N	Terrestrial: beach dune, scrub, disturbed areas, roadsides, blowouts in dunes
Lobelia cardinalis	Cardinal flower	N	T	N	N/A
Macbridea alba	White Birds-in-a-nest	S2	E	T	Palustrine: seepage slope Terrestrial: grassy mesic pine flatwoods, savannahs, roadsides, and similar habitat
Macranthera flammea	Hummingbird Flower	S2	E	N	Palustrine: seepage slope, dome swamp edges, floodplain swamps Riverine: seepage stream banks Terrestrial: seepage slopes

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Magnolia ashei	Ashe's Magnolia	S2	E	SSC	Terrestrial: slope and upland hardwood forest, ravines
Magnolia pyramidata	Pyramid Magnolia	S3	E	CE	Terrestrial: slope forest
Malaxis uniflora	Green Addersmouth	S3	E	CE	Palustrine: floodplain forest Terrestrial: slope forest, upland mixed forest
Malus angustifolia	Southern Crabapple	N	T	N	N/A
Myriophyllum laxum	Piedmont Water-milfoil	S3	N	N	Riverine: creek, pool, spring/spring brook Palustrine: riparian, temporary pool
Nyssa ursina	Bog Tupelo	S2	N	N	Open bogs, wet flatwoods, and swamps, often with titi
Opuntia stricta	Prickly Pear Cactus	N	T	N	N/A
Phoebanthus tenuifolius	Narrowleaf Phoebanthus	S3	LT	N	Terrestrial: sandy pinelands
Pinckneya bracteata	Fever Tree	N	T	CE	Palustrine: creek swamps, titi swamps, bogs
Pinguicula ionantha	Panhandle Butterwort	S2	E	T	Palustrine: wet flatwoods, wet prairie, bog; in shallow water Riverine: seepage slope; in shallow water. Also, roadside ditches and similar habitat
Pinguicula lutea	Yellow Butterwort	N	T	CE	Palustrine: flatwoods, bogs
Pinguicula planifolia	Swamp Butterwort	N	T	SSC	Palustrine: wet flatwoods, seepage slopes, bog, dome swamp, ditches; in water
Pinguicula primuliflora	Primrose-flowered Butterwort	S3	E	N	Palustrine: bogs, pond margins, margins of spring runs
Platanthera blephariglottis	Whitefringed Orchid	N	T	N	N/A
Platanthera ciliaris	Yellowfringed Orchid	N	T	CE	Palustrine: bogs, wet flatwoods Terrestrial: bluff
Platanthera clavellata	Green Rein Orchid	SH	E	N	Lacustrine: seepages, springs (usually wooded); shrub borders of acid bogs; swamp woods; creek floodplains; occasionally open fens; and in the northern or mountainous part of its range, seepage slopes or sunlit stream beds, disturbed sites, such as abandoned quarries, road banks, ditches, and sandy-acid mine tailings
Platanthera integra	Orange Rein Orchid	S3	E	N	Palustrine: wet prairie, seepage slope Terrestrial: mesic flatwoods
Plantanthera nivea	Snowy Orchid	N	T	CE	Palustrine: bogs
Polygonella macrophylla	Largeleaf jointweed	S2	T	N	Terrestrial: scrub, sand pine/oak scrub ridges
Rhexia parviflora	Apalachicola Meadowbeauty	S2	E	N	Palustrine: dome swamp margin, seepage slope, depression marsh; on slopes; with hypericum

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Rhexia salicifolia	Panhandle Meadowbeauty	S2	T	P	Lacustrine: full sun in wet sandy or sandy-peaty areas of sinkhole pond shores, interdunal swales, margins of depression, marshes, flatwoods, ponds and sandhill upland lakes
Ribes echinellum	Miccosukee gooseberry		E	T	Lacustrine: shores of Lake Miccosukee
Rhododendron austrinum	Florida Flame Azalea	S3	E	CE	Lacustrine: shaded ravines & in wet bottomlands on rises of sandy alluvium or older terraces.
Ruellia noctiflora	Nightflowering Ruellia	S2	E	N	Lacustrine: moist to wet coastal pinelands, bogs, low meadows, open pine savannahs
Salix eriocephala	Hearleaved Willow	S1	E	N	Palustrine: floodplain swamp, alluvial woodlands
Sarracenia leucophylla	Whitetop Pitcher Plant	S3	E	N	Palustrine: wet prairie, seepage slope, baygall edges, ditches
Sarracenia minor	Hooded Pitcher Plant	N	T	CE	Palustrine: seepage slopes and bogs; wet flatwoods
Sarracenia psitticina	Parrot Pitcher Plant	N	T	CE	Palustrine: wet flatwoods, wet prairie, seepage slope
Sarracenia purpurea	Decumbent Pitcher Plant	N	T	N	Palustrine: bogs
Scutellaria floridana	Florida Skullcap	S1	E	T	Palustrine: seepage slope, wet flatwoods, grassy openings Terrestrial: mesic flatwoods
Sideroxylon lycioides	Buckthorn	N	E	N	Palustrine: bottomland forest, dome swamp, floodplain forest
Sideroxylon thornei	Thorn's Buckthorn	N	E	N	Palustrine: hydric hammock, floodplain swamp
Spiranthes laciniata	Lace-lip Ladies'-tresses	N	T	N	Palustrine: wet flatwoods
Stachydeoma graveolens	Mock Pennyroyal	S2	E	N	Palustrine: forested wetland Terrestrial: forest edge, forest/woodland, savanna, woodland - conifer
Stewartia malacodendron	Silky Camelia	S3	E	N	Palustrine: baygall Terrestrial: slope forest, upland mixed forest; acid soils
Verbesina chapmanii	Chapman's Crownbeard	S3	T	N	Palustrine: seepage slope Terrestrial: mesic flatwoods with wiregrass
Xyris longisepala	Kral's Yelloweyed Grass	S2	E	P	Lacustrine: sandhill upland lake margins
Xyris scabrifolia	Harper's Yelloweyed Grass	S3	T	SSC	Palustrine: seepage slope, wet prairie, bogs
Invertebrates					
Crangonyx grandimanus	Florida Cave Amphipod	S2S3	N	N	Caves

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Crangonyx hobbsi	Hobbs' Cave Amphipod	S2S3	N	N	Caves
Dromogomphus armatus	Southeastern Spinyleg	S3	N	N	Riverine: small spring fed streams with muck bottom
Panopea bitruncata	Atlantic Geoduck	S3	N	N	N/A
Procambarus orcinus	Woodville Karst Cave Crayfish	S1	N	N	Caves of Leon and Wakulla counties
Procambarus horsti	Big Blue Springs Cave Crayfish	S1	N	N	Subterranean springs of Jefferson and Leon counties
Progomphus bellei	Belle's Sanddragon	S3	N	N	Lacustrine: sandy lakes Riverine: first order sandy streams
Remasellus parvus	Swimming Little Florida Cave Isopod	S1S2	N	N	Caves
Somatochlora provocans	Treetop Emerald	S3	N	N	Riverine: Sand bottomed forest streams and seeps
Tachopteryx thoreyi	Gray Petaltail	S3	N	N	Palustrine: mucky seeps in forested areas, flat or on hillside and associated with either streams or ponds
Fish					
Acipenser oxyrinchus desotoi	Gulf Sturgeon	S2	FT	T	Estuarine: various Marine: various habitats
Ameirus serracanthus	Spotted Bullhead	S3	N	N	Riverine: deep holes of small to medium rivers with slow to swift currents and rock substrates or sand bottoms; it also occurs over mud bottoms, typically near stumps, in impoundments
Atractosteus spatula	Alligator Gar	S3	N	N	Riverine: sluggish pools of large rivers and their bayous, oxbow lakes, swamps, and backwaters, rarely brackish or marine waters along the coast
Micropterus notius	Suwannee Bass	S3	N	N	Riverine: Rivers with moderate to swift currents near limestone or woody structure

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Amphibians					
Ambystoma cingulatum	Frosted Flatwoods Salamander	S2S3	FT	T(CH)	Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland, temporary pool Terrestrial: forest - conifer, forest/woodland, savanna, woodland - conifer
Desmognathus apalachicolae	Apalachicola Dusky Salamander	S3	N	N	Palustrine: seepage stream edges at bottoms of deep, moist, wooded ravines that support mixed-hardwood forest on slopes
Lithobates capito	Gopher Frog	S3	N	P	Terrestrial; sandhill, scrub, scrubby flatwoods, xeric hammock (reproduces in ephemeral wetlands within these communities)
Notophthalmus perstriatus	Striped newt	S2	C	C	Terrestrial: longleaf pine-dominated savanna, scrub, or sandhill habitats Palustrine: ephemeral ponds; eggs
Reptiles					
Alligator mississippiensis	American Alligator	S4	FT (S/A)	SAT	Estuarine: herbaceous wetland Riverine: big river, creek, low gradient, medium river, pool, spring/spring brook Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland
Caretta caretta	Loggerhead Sea Turtle	S3	FT	T	Terrestrial: sandy beaches; nesting
Chelonia mydas	Green Sea Turtle	S2	FE	E	Terrestrial: sandy beaches; nesting
Crotalus adamanteus	Eastern Diamondback Rattlesnake	S3	N	N	Palustrine: riparian Terrestrial: grassland/herbaceous, old field, savanna, shrubland/chaparral, woodland - conifer, woodland - hardwood, woodland - mixed
Dermochelys coriacea	Leatherback Sea Turtle	S2	FE	E	Terrestrial: sandy beaches; nesting
Drymarchon couperi	Eastern Indigo Snake	S3	FT	T	Estuarine: tidal swamp Palustrine: hydric hammock, wet flatwoods Terrestrial: mesic flatwoods, upland pine forest, sandhills, scrub, scrubby flatwoods, rockland hammock, ruderal
Eretmochelys imbricata imbricata	Hawksbill Sea Turtle	S1	FE	E	Marine coastal and oceanic waters. Nests on coastal sand beaches, often in vegetation.
Gopherus polyphemus	Gopher Tortoise	S3	ST	C	Terrestrial: sandhills, scrub, scrubby flatwoods, xeric hammocks, coastal strand, ruderal

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Lepidochely kempii	Kemp's Ridley Sea Turtle	S1	FE	E	Terrestrial: sandy beaches; nesting
Macroclemys apalachicolae	Alligator Snapping Turtle	S3	SSC	P	Estuarine: tidal marsh Lacustrine: river floodplain lake, swamp lake Riverine: alluvial stream, blackwater stream
Nerodia clarkii clarkii	Gulf Salt Marsh Snake	S2	N	N	Estuarine: herbaceous wetland, scrub-shrub wetland
Pituophis melanoleucas mugitus	Florida Pine Snake	S3	ST	P	Lacustrine: ruderal, sandhill upland lake Terrestrial: sandhill, scrubby flatwoods, xeric hammock, ruderal
Heterodon simus	Southern Hognose Snake	S2	N	N	Palustrine: sandhill, pine flatwood, sand ridges Terrestrial: coastal dunes
Thamnophis sauritus sackeni	Florida Ribbon Snake	S1	N	N	Terrestrial: pinelands, hardwood hammocks Palustrine: cypress strands, prairies, marshes, streams, ponds, bogs
Pseudemys suwanniensis	Suwannee Cooter	S3	N	N	Riverine: blackwater, alluvial, and spring-fed rivers, impoundments
Birds					
Ammodramus maritimus juncicola	Wakulla Seaside Sparrow	SNR	ST	N	Estuarine: tidal marshes
Ammodramus maritimus peninsulae	Scott's Seaside Sparrow	S2	ST	N	N/A
Aramus guarauna	Limpkin	S3	N	N	Estuarine: scrub-shrub wetland Palustrine: forested wetland, herbaceous wetland, riparian
Calidris canutus rufa	Red knot	S2	FT	T	Estuarine: bays, tidal flats, salt marshes Terrestrial: sandy beaches Marine: aerial, near shore
Charadrius alexandrius	Snowy Plover	S2	ST	N	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas.
Charadrius melodus	Piping Plover	S2	FT	T	Estuarine: exposed unconsolidated substrate Marine: exposed unconsolidated substrate Terrestrial: dunes, sandy beaches, and inlet areas. Mostly wintering and migrants.
Cistothorus Palustris marianae	Marian's Marsh Wren	S3	ST	N	N/A

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Egretta caerulea	Little Blue Heron	S4	ST	N	Estuarine: herbaceous wetland, lagoon, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian, scrub-shrub wetland
Egretta rufescens	Reddish Egret	S2	ST	N	Estuarine: tidal swamp, depression marsh, bog, marl prairie, wet prairie Lacustrine: flatwoods/prairie lake, marsh lake Marine: tidal swamp
Egretta thula	Snowy Egret	S3	N	N	Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian
Egretta tricolor	Tricolored Heron	S4	ST	N	Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian
Eudocimus albus	White Ibis	S4	ST	N	Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, scrub-shrub wetland, tidal flat/shore Riverine: low gradient Lacustrine: shallow water Palustrine: forested wetland, herbaceous wetland, riparian
Falco peregrinus	Peregrine Falcon	S2	N	N	Marine: aerial Estuarine: aerial, bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, tidal flat/shore Riverine: aerial Lacustrine: aerial Palustrine: aerial, herbaceous wetland, riparian Terrestrial: cliff, desert, shrubland/chaparral, tundra, urban/edificarian, woodland - conifer, woodland - hardwood, woodland - mixed
Falco sparvarius paulus	Southeastern American Kestrel	S3	T	N	Estuarine: various habitats Palustrine: various habitats Terrestrial: open pine forests, clearings, ruderal, various
Haematopus palliatus	American Oystercatcher	S2	ST	N	Estuarine: tidal flat/shore Terrestrial: bare rock/talus/scree, sand/dune

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Haliaeetus leucocephalus	Bald Eagle	S3	N	BGEPA	Estuarine: marsh edges, tidal swamp, open water Lacustrine: swamp lakes, edges Palustrine: swamp, floodplain Riverine: shoreline, open water Terrestrial: pine and hardwood forests
Mycteria americana	Wood Stork	S2	FT	T	Estuarine: marshes Lacustrine: floodplain lakes, marshes (feeding), various Palustrine: marshes, swamps, various
Nyctanassa violacea	Yellow-crowned night heron	S3	N	N	Estuarine: bays, bayous, tidal marsh Palustrine: Cypress swamps Riverine: streams, lowland rivers
Pandion haliatus	Osprey	S3S4	N	N	Marine: near shore Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river Riverine: big river, medium river Lacustrine: deep water, shallow water Palustrine: forested wetland, riparian Terrestrial: cliff
Picoidesborealis	Red-cockaded Woodpecker	S2	FE	E	Terrestrial: mature pine forests
Rhynchops niger	Black Skimmer	S3	ST	N	Marine: near shore Estuarine: bay/sound, herbaceous wetland, lagoon, river mouth/tidal river, tidal flat/shore Riverine: big river, low gradient Lacustrine: deep water, Shallow water Palustrine: riparian Terrestrial: sand/dune
Sterna antillarum	Least Tern	S3	ST	E	Estuarine: various Lacustrine various Riverine: various Terrestrial: beach dune, ruderal. Nests common on rooftops
Sterna maxima	Royal Tern	S3	N	N	Marine: near shore Estuarine: bay/sound, lagoon, river mouth/tidal river, tidal flat/shore Terrestrial: sand/dune
Sterna sandvicensis	Sandwich Tern	S2	N	N	Marine: near shore Estuarine: bay/sound, lagoon, river mouth/tidal river, tidal flat/shore Terrestrial: sand/dune

Scientific Name	Common Name	Regulatory Designation			Natural Communities
		FNAI	State	Federal	
Mammals					
Mustela frenata olivacea	Southeastern Weasel	S3	N	N	Palustrine: forested wetland, riparian Terrestrial: forest - hardwood, old field, woodland - conifer, woodland - hardwood, woodland - mixed
Myotis grisescens	Gray Bat	S1	FE	E	Palustrine: caves, various Terrestrial: caves, various
Sciuris niger shermani	Sherman's Fox Squirrel	S3	N	N	Terrestrial: woodland - conifer, woodland - mixed
Trichechus manatus latirostris	West Indian Manatee	S2	FE	E	Estuarine: submerged vegetation, open water Marine: open water, submerged vegetation
Ursus americanus floridanus	Florida Black Bear	S2	N	N	Palustrine: forested wetland, riparian Terrestrial: forest - hardwood, forest - mixed

Sources: FNAI 2010; FWC 2016; USFWS 2016.

Key:
FNAI STATE ELEMENT RANK
S1 = Critically imperiled in Florida because of extreme rarity (5 or fewer occurrences or less than 1000 individuals) or because of extreme vulnerability to extinction due to some natural or man-made factor.
S2 = Imperiled in Florida because of rarity (6 to 20 occurrences or less than 3000 individuals) or because of vulnerability to extinction due to some natural or man-made factor.
S3 = Either very rare and local in Florida (21-100 occurrences or less than 10,000 individuals) or found locally in a restricted range or vulnerable to extinction from other factors.
S4 = Apparently secure in Florida (may be rare in parts of range).
S5 = Demonstrably secure in Florida.
SH = Of historical occurrence in Florida, possibly extirpated, but may be rediscovered (e.g., ivory-billed woodpecker).
SX = Believed to be extirpated throughout Florida.
SU = Unrankable; due to a lack of information no rank or range can be assigned.
SNA = State ranking is not applicable because the element is not a suitable target for conservation (e.g. a hybrid species).
SNR = Element not yet ranked (temporary).

FEDERAL LEGAL STATUS
BGEPA = Protected by Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act
C = Candidate species for which federal listing agencies have sufficient information on biological vulnerability and threats to support proposing to list the species as Endangered or Threatened.
CE = Consideration encouraged
E = Endangered: species in danger of extinction throughout all or a significant portion of its range.
E, T = Species currently listed endangered in a portion of its range but only listed as threatened in other areas
E, PDL = Species currently listed endangered but has been proposed for delisting.
E, PT = Species currently listed endangered but has been proposed for listing as threatened.
E, XN = Species currently listed endangered but tracked population is a non-essential experimental population.
E(CH) = Endangered critical habitat
N = None
P = Petition for Federal listing
T = Threatened: species likely to become Endangered within the foreseeable future throughout all or a significant portion of its range.
T(CH) = Threatened critical habitat
PE = Species proposed for listing as endangered
PS = Partial status: some but not all of the species' infraspecific taxa have federal status
PT = Species proposed for listing as threatened
SAT = Treated as threatened due to similarity of appearance to a species which is federally listed such that enforcement personnel have difficulty in attempting to differentiate between the listed and unlisted species.
SC = Not currently listed, but considered a "species of concern" to USFWS.

STATE LEGAL STATUS
C = Candidate for listing at the Federal level by the U. S. Fish and Wildlife Service
FE = Listed as Endangered Species at the Federal level by the U. S. Fish and Wildlife Service
FT = Listed as Threatened Species at the Federal level by the U. S. Fish and Wildlife Service
FXN = Federal listed as an experimental population in Florida
FT(S/A) = Federal Threatened due to similarity of appearance
ST = State population listed as Threatened by the FWC. Defined as a species, subspecies, or isolated population which is acutely vulnerable to environmental alteration, declining in number at a rapid rate, or whose range or habitat is decreasing in area at a rapid rate and as a consequence is destined or very likely to become an endangered species within the foreseeable future.
SSC = Listed as Species of Special Concern by the FWC. Defined as a population which warrants special protection, recognition, or consideration because it has an inherent significant vulnerability to habitat modification, environmental alteration, human disturbance, or substantial human exploitation which, in the foreseeable future, may result in its becoming a threatened species. (SSC* for Pandion haliaetus (Osprey) indicates that this status applies in Monroe county only.)
N = Not currently listed, nor currently being considered for listing.

Plants: Definitions derived from Sections 581.011 and 581.185(2), Florida Statutes, and the Preservation of Native Flora of Florida Act, 5B-40.001. FNAI does not track all state-regulated plant species; for a complete list of state-regulated plant species, call Florida Division of Plant Industry, 352-372-3505 or see: http://www.doacs.state.fl.us/pi/.
E = Endangered: species of plants native to Florida that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue; includes all species determined to be endangered or threatened pursuant to the U.S. Endangered Species Act.
T = Threatened: species native to the state that are in rapid decline in the number of plants within the state, but which have not so decreased in number as to cause them to be Endangered.
N = Not currently listed, nor currently being considered for listing.

Appendix E Habitats and Natural Communities

The FNAI defines a natural community as a distinct and recurring assemblage of populations of plants, animals, fungi, and microorganisms naturally associated with each other and their physical environment. Based on GIS analysis there are 24 unique natural communities recognized by the FNAI within the St. Marks River and Apalachee Bay watershed (FNAI 2010). Habitats and Natural Communities were identified using the 2010 Florida Land Use, Cover and Forms Classification System (FLUCCS) data from the NWFWMD, as well as the 2004-2013 Statewide Land Use Land Cover datasets created by the five Water Management Districts in Florida. Data were modified and refined based on aerial photograph signatures and field observations. Below are community descriptions (excerpts from FNAI 2010) with some site-specific information about many of the communities in the watershed.

Upland Communities	
Mesic Flatwoods	Mesic flatwoods can be found on the flat sandy terraces left behind by Plio-Pleistocene high sea levels. Mesic flatwoods consist of an open canopy of tall pines (commonly longleaf pine or slash pine) and a dense, low ground layer of shrubs, grasses (commonly wiregrass), and forbs. The most widespread natural community in Florida, mesic flatwoods are home to many rare plants and animals such as the frosted flatwoods salamander (*Ambystoma cingulatum*), the reticulated flatwoods salamander (*Ambystoma bishop*), the red-cockaded woodpecker (*Leuconotopicus borealis*), and many others. Mesic flatwoods require frequent fire and all of its constituent plant species recover rapidly from fire, including many rare and endemic plants. In the Panhandle north of the Cody Scarp, mesic flatwoods occupy relatively small, low-lying areas (FNAI 2010). Within the St. Marks River and Apalachee Bay watershed, healthy mesic flatwoods occur in the Apalachicola National Forest and the in the St. Marks National Wildlife Refuge in the northeastern section of the park near the St. Marks River and the City of St. Marks (USFWS 2013).
Sandhill	Sandhill communities are characterized by broadly-spaced pine trees with a deciduous oak understory sparse midstory of deciduous oaks and a moderate to dense groundcover of grasses, herbs, and low shrubs. Species typical of sandhill communities include longleaf pine (*Pinus palustris*), turkey oak (*Quercus laevis*), and wiregrass (*Aristida stricta var. beyrichiana*). Sandhill is observed on crests and slopes of rolling hills and ridges with steep or gentle topography. Sandhill communities are important for aquifer recharge, as sandy soils allow water to infiltrate rapidly, resulting in sandy, dry soil, with little runoff evaporation. Fire is a dominant environmental factor in sandhill ecology and is essential for the conservation of native sandhill flora and fauna (FNAI 2010). Within the St. Marks River and Apalachee Bay watershed, exemplary sandhill communities can be found extensively throughout the Apalachicola National Forest and within the Wakulla and Panacea units of the St. Mark's National Wildlife Refuge in southern Wakulla County (near Alligator Lake north of Panacea) (FNAI 2010).

Scrub	Scrub is a community composed of evergreen shrubs, with or without a canopy of pines, and is found on well-drained, infertile, narrow sandy ridges distributed parallel to the coastline. Signature scrub species include three species of shrubby oaks, Florida rosemary (*Ceratiola ericoides*), and sand pine (*Pinus clausa*), which may occur with or without a canopy of pines. Scrub is characterized by burn intervals of five to 40 years, depending on the dominant vegetation. An exemplary scrub community site is located in the southeastern corner of Compartment P9 in the St. Mark's National Wildlife Refuge.
Terrestrial Caves	Terrestrial caves are cavities below the surface that lack standing water. These caves develop in areas of karst topography; water moves through underlying limestone, dissolving it and creating fissures and caverns. Most caves have stable internal environments with temperature and humidity levels remaining fairly constant. In areas where light is present, some plants may exist, although these are mostly limited to mosses, liverworts, ferns, and algae. Subterranean natural communities such as terrestrial caves are extremely fragile because the fauna they support are adapted to stable environments and do not tolerate environmental changes (FNAI 2010). An exemplary site includes Cal's Cave in Wakulla County.
Upland Glade	Upland glade is a largely herbaceous community with woody inclusions that occurs on thin soils over limestone outcrops on steep topography. It is found in small openings ranging from 0.1 to 2 acres in size within an otherwise forested landscape. Open portions of upland glade are dominated by black bogrush (*Schoenus nigricans*) and/or other graminoids, A set of limestone-loving shrubs and trees on deeper soil within the glade, or on the edges form a shrubby transition to upland hardwood forest. Characteristic woody species include red cedar (*Juniperus virginiana*), eastern redbud (*Cercis canadensis*), and sugarberry (*Celtis laevigata*). In the St. Marks River and Apalachee Bay, upland glade is found primarily on Oligocene Marianna Limestone between the 130- and 150-foot contours.
Upland Hardwood Forests	Upland hardwood forests are described as having a well-developed, closed-canopy dominated by deciduous hardwood trees such as southern magnolia (*Magnolia grandiflora*), pignut hickory (*Carya glabra*), sweetgum (*Liquidambar styraciflua*), Florida maple (*Acer saccharum ssp. floridanum*), live oak (*Quercus virginiana*), American beech (*Fagus grandifolia*), white oak (*Q. alba*), and spruce pine (*Pinus glabra*), and others. This community occurs on mesic soils in areas sheltered from fire, on slopes above river floodplains, in smaller areas on the sides of sinkholes, and occasionally on rises within floodplains. It typically supports a diversity of shade-tolerant shrubs, and a sparse groundcover. Upland hardwoods occur throughout the Florida Panhandle and can be found in upper portions of the watershed. An exemplary site is located at Wakulla Springs State Park (FNAI 2010).

Wet Flatwoods	Wet flatwoods are pine forests with a sparse or absent midstory. The typically dense groundcover of hydrophytic grasses, herbs, and low shrubs occurring in wet flatwoods can vary depending on the fire history of the system. Wet flatwoods occur in the ecotones between mesic flatwoods and shrub bogs, wet prairies, dome swamps, or strand swamps and are common throughout most of Florida. Wet flatwoods also occur in broad, low flatlands, frequently within a mosaic of other communities. Wet Flatwoods often occupy large areas of relatively inaccessible land, providing suitable habitat for the Florida black bear (*Ursus americanus floridanus*) as well as a host of rare and endemic plant species (FNAI 2010). This community type is found interspersed throughout the Apalachicola National Forest. An exemplary site is located in the St. Mark's National Wildlife Refuge west of Buckhorn Creek in the Panacea Unit.
Coastal Communities	
Tidal Flat	Tidal flats are stretches of shoreline that are protected from the waves that pound the beaches. Tidal flats are also known as mudflats (because their surface soils are muds brought in by channels from uplands) and intertidal zones (because they are between the tides -- exposed at low tide and flooded at high tide). We may not see much besides mud when we look at tidal flats, but many animals see breakfast, lunch, and dinner. A world of invertebrate animals lives in and on that mud, including tube worms, sand dollars, burrowing shrimp, sea cucumbers, and assorted mollusks and crabs. Not only are there lots of different animal species, but also there are thousands of animals per square foot. These invertebrates live on tiny bits of leaves and stems of both land and aquatic plants that are brought into the mudflats in freshwater channels or by the tides. The invertebrates become food for fish and birds. When the tide comes in, fish come with it and have a feast; when the tide goes out, birds will feast. Tidal flats are essential refueling stops for migrating shorebirds. Exemplary tidal flat community is located at the St. Mark's National Wildlife Refuge.
Transitional and Wetland Communities	
Basin Marsh	Basin marshes, unlike depression marshes, are marshes that lack a fire-maintained matrix community and rather, occur in relative isolation as larger landscape features. Basin marshes are regularly inundated freshwater from local rainfall, as they occur around fluctuating shorelines, on former "disappearing" lake bottoms, and at the bead of broad, low basins marking former embayments of the last high-sea level stand. Species composition is heterogeneous both within and between marshes and generally includes submerged, floating, and emergent vegetation with intermittent shrubby patches. Common species include maidencane (*Panicum hemitomon*), sawgrass (*Cladium sp.*), bulltongue arrowhead (*Sagittaria lancifolia*), pickerelweed (*Pontederia cordata*), and cordgrass (*Spartina sp.*) (FNAI 2010). In the St. Marks River and Apalachee Bay watershed, basin marsh occurs around Lake Miccosukee.

Basin Swamp	Basin swamp is a wetland vegetated with hydrophytic trees, commonly including pond cypress (*Taxodium ascendens*) and swamp tupelo (*Nyssa sylvatica var. biflora*) and shrubs that can withstand an extended hydro-period. Basin swamps are characterized by highly variable species composition and are expressed in a variety of shapes and sizes due to their occurrence in a variety of landscape positions including old lake beds or river basins, or ancient coastal swales and lagoons that existed during higher sea levels. Basin swamps can also exist around lakes and are sometimes headwater sources for major rivers. Many basin swamps have been heavily harvested and undergone significant hydrological changes due to the conversion of adjacent uplands to agricultural and silvicultural lands (FNAI 2010). An exemplary basin swamp community is located in the Aucilla Wildlife Management Area west of the Wacissa River.
Baygall	Baygall is an evergreen-forested wetland dominated by bay species including loblolly bay (*Gordonia lasianthus*), sweetbay (*Magnolia virginiana*), and/or swamp bay (*Persea palustris*). This community can be found on wet soils at the base of slopes or in depressions; on the edges of floodplains; and in stagnant drainages. Baygalls are not generally influenced by flowing water, but may be drained by small blackwater streams. Most baygalls are small; however, some form large, mature forests, called "bay swamps." The dominance of evergreen bay trees rather than a mixture of deciduous and evergreen species can be used to distinguish baygall from other forested wetlands (FNAI 2010). An exemplary baygall community is located in the Aucilla Wildlife Management Area west of Aucilla River.
Dome Swamp	Dome swamp is an isolated, forested, and usually small depression wetland consisting of predominantly pond cypress (*Taxodium ascendens*) and/or swamp tupelo (*Nyssa sylvatica var. biflora*). This community occurs within a fire-maintained community such as mesic flatwoods and commonly occupies depressions over a perched water table. Smaller trees grow on the outer edge of the swamp where the water is shallow, while taller trees grow deeper in the swamp interior creating the characteristic dome shape. Shrubs are typically sparse to moderate, but dome swamps with high fire frequencies or fire exclusion, the shrub layer may be absent. Many dome swamps form when poor surface drainage causes the dissolution of limestone bedrock, creating depressions which fill in with peat or marl. Surficial runoff from the surrounding uplands supplies much of the water within dome swamps. Consequently, water levels in these communities fluctuate naturally with seasonal rainfall changes. Dome swamps may also be connected directly to the aquifer, where groundwater influences the hydrological regime. Thus dome swamps can function as reservoirs that recharge the aquifer. Logging, nutrient enrichment, pollution from agricultural runoff, ditching, impoundment, and invasive exotic species invasion have degraded dome swamps. Some dome swamps have been used as treatment areas for secondarily-treated wastewater (FNAI 2010). Dome swamp community can be found at the St. Marks National Wildlife Refuge and at Wakulla Springs State Park.

Floodplain Swamp	Floodplain swamp is a closed-canopy forest community of hydrophytic trees such as bald cypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), swamp tupelo (*N. sylvatica var. biflora*), or ogeechee tupelo (*N. ogeche*). Floodplain swamp occurs on frequently- or permanently-flooded hydric soils adjacent to stream and river channels and in depressions and oxbows within the floodplain. The understory and groundcover are sparse in floodplain swamps, which can also occur within a complex mosaic of communities including alluvial forest, bottomland forest, and baygall. As rivers meander, they create oxbows and back swamps that are important breeding grounds for fish when high water connects them to the river. Floodplain swamp communities provide important wildlife habitat, contribute to flood attenuation, and help protect the overall water quality of streams and rivers. These communities may also transform nutrients or act as a nutrient sink depending on local conditions. This makes floodplain swamps useful for the disposal of partially-treated wastewater. Artificial impoundments on rivers can severely limit the seasonal flooding effects that maintain healthy floodplain systems; particularly, the stabilization of alluvial deposits and the flushing of detritus (FNAI 2010). Floodplain swamp communities are distributed along most creeks and streams within the watershed, particularly along the St. Marks River. An exemplary site is located just east of Shell Island along the St. Mark's River just north of where the Wakulla River and St. Mark's River merge.
Wet Prairie	Wet prairie is an herbaceous community usually occurring on acidic, continuously wet, but not inundated, soils. This community can be found on somewhat flat or gentle slopes between lower lying depression marshes, shrub bogs, or dome swamps or on slightly higher wet or mesic flatwoods. Wet prairies in northern Florida are some of the most diverse communities in the U.S., with an average of over 20 species per square meter in some places and over 100 total species in any given stand. The Panhandle is a hotspot for rare plants of the wet prairie community with 25 out of the 30 rare species found in this community; 12 of these are endemic to the Panhandle (FNAI 2010). This community type is found throughout the Apalachicola National Forest. Exemplary sites are located in the Panacea Unit of the St. Mark's National Wildlife Refuge.

Aquatic Communities	
Blackwater Streams	Blackwater streams are perennial or intermittent seasonal watercourses laden with tannins (natural organic chemicals), particulates, and dissolved organic matter and iron. These dissolved materials result from the streams' origins in extensive wetlands with organic soils that collect rainfall and discharge it slowly to the stream. The dark-colored water reduces light penetration and, inhibits photosynthesis, and prevents the growth of submerged aquatic plants. Blackwater streams are frequently underlain by limestones and have sandy bottoms overlain by organics that have settled out of suspension. Blackwater streams are the most widely distributed and numerous riverine systems in the southeast Coastal Plain (FNAI 2010) and found draining into most creeks, streams and bayous in the watershed. The St. Marks River begins as a blackwater stream in the northern reaches of the watershed. Many of the St. Marks River's smaller tributaries are true blackwater streams, including several streams that traverse the Apalachicola National Forest and the St. Marks National Wildlife Refuge.
Seepage Streams	Seepage streams may be perennial or intermittent seasonal as they originate from shallow groundwater percolating through sandy upland soils. Seepage streams are small magnitude features, and unlike other stream communities in Florida, they lack a deep aquifer water source and extensive swamp lowlands surrounding their head waters. Seepage streams are generally sheltered by a dense overstory of broad-leaved hardwoods which block out most sunlight. Filamentous green algae occur sporadically within the stream, while vegetation at the water's edge may include mosses, ferns and liverworts. Seepage streams are often associated with seepage slope and slope forest communities near their head waters, and bottomland forest, alluvial forest and floodplain swamp communities near their mouths. The waters of seepage streams is filtered by percolation through deep soils which slows the release of rainwater and buffers temperature extremes, creating low flow rates of clear, cool, unpolluted water. Seepage streams are generally confined to areas where topographic relief is pronounced such as northern Florida (FNAI 2010). Within the St. Marks River and Apalachee Bay watershed seepage streams are found throughout the Apalachicola National Forest and the St. Marks National Wildlife Refuge.
Sinkhole Lakes	Sinkhole lakes typically form in deep, funnel-shaped depressions in limestone bedrock and are moderately widespread in the karst regions of the Florida Panhandle. Sinkhole depressions are geologic features which are relatively permanent; however, water levels may fluctuate dramatically due to hydrologic connectivity with the aquifer. Sinkhole lakes are characterized by clear, alkaline water with high concentrations of calcium, bicarbonate, and magnesium. The vegetation in some sinkhole lakes is absent or limited to a narrow fringe of emergent species at the edge of the water, while other sinkhole lakes are completely covered by floating vegetation. Sinkhole Lakes are considered endangered in Florida due to the threat of erosion which destroys the surrounding vegetation and pollutes the aquifer with which these lakes are closely connected (FNAI 2010). Sinkhole lakes are prevalent throughout the watershed in areas where karst geology exists. An exemplary sinkhole lake is Lake Jackson in Leon County (Tallahassee).

Spring-run Streams	Spring-run streams generally have sandy or limestone bottoms and derive most of their water from artesian openings to the underlying aquifer, making their waters clear, circumneutral, mineral-rich, and cool. These conditions are highly conducive for plant growth, thus, spring-run streams are extremely productive aquatic habitats. Good examples in the watershed are listed and described in Section 2.3. Agricultural, residential, and industrial pollutants that enter the groundwater may infiltrate the deep aquifer that feeds a Spring-run stream. Herbicides applied to control aquatic plant growth are particularly detrimental because they can induce eutrophication in spring run streams. Overuse and misuse of spring-run streams from recreation is also a threat to this unique community (FNAI 2010). Spring run streams are found throughout the northern portions of the watershed where karst geology is prominent. Within the St. Marks River and Apalachee Bay watershed, the Wakulla River is an exemplary spring-run stream.
Estuarine and Marine Communities	
Salt Marsh	Salt marsh is a largely herbaceous tidal zone community commonly consisting of saltmarsh cordgrass (*Spartina alterniflora*), which dominates the seaward edge, and needlerush (*Juncus roemerianus*), which dominates higher, less frequently flooded areas. Salt marshes form where the coastal zone is protected from large waves, either by the topography of the shoreline, a barrier island, or by location along a bay or estuary. Salt marshes support a number of rare animals and plants, and provide nesting habitat for migratory and endemic bird species. Many of Florida's extensive salt marshes are protected in aquatic preserves, but the loss of marshes and adjacent seagrass beds due to human impacts such as shoreline development, ditching, and pollution and natural stressors, such as sea level rise, have vastly reduced their numbers. Salt marshes are instrumental in attenuating wave energy and protecting shorelines from erosion (FNAI 2010) and are found in the coastal/estuarine portion of the watershed. Salt marsh communities are common throughout the St. Marks River and Apalachee Bay watershed and are particularly extensive at the St. Marks National Wildlife Refuge.
Seagrass Beds	Seagrass beds consist of expansive stands of submerged aquatic vascular plants including turtlegrass (*Thalassia testudinum*), manateegrass (*Syringodium filiforme*), and shoalgrass (*Halodule wrightii*), which occur predominantly in subtidal zones in clear low-energy coastal waters. Seagrass beds occur on unconsolidated substrates and are highly susceptible to changes in water temperature, salinity, wave-energy, tidal activity, and available light. This natural community supports a wide variety of animal life including manatees, marine turtles, and many fish, particularly spotted sea trout (*Cynoscion nebulosus*), spot (*Micropogonias undulates*), sheepshead, (*Archosargus probatocephalus*), and redfish (*Sciaenops ocellatus*). Pollution, particularly sedimentation and wastewater/sewage, have led to the widespread loss of seagrasses in nearly every bay in the Florida Panhandle (FNAI 2010). Seagrass beds occur throughout the Apalachee Bay.

Oyster/Mollusk Reef	Oyster/Mollusk reef consists of expansive concentrations of sessile mollusks, which settle and develop on consolidated substrates including rock, limestone, wood, and other mollusk shells. These communities occur in both the intertidal and subtidal zones to a depth of 40 feet. In Florida, the American oyster (*Crassostrea virginica*) dominates mollusk reef communities, but other organisms including species of sponge, anemones, mussels, the burrowing sponge anemones, mussels, clams, barnacles, crabs, amphipods, and starfish live among or within the reef itself. Mollusks are filter-feeders that remove toxins from polluted waters and improve overall water quality (FNAI 2010). However, higher levels of toxins and bacteria can contaminate and close areas for commercial harvest and human consumption. Oyster/mollusk reefs can be found throughout the Apalachee Bay.
Unconsolidated (Marine) Substrate	Unconsolidated (marine) substrate consists of coralgal, marl, mud, mud/sand, sand or shell deposited in expansive, open areas of subtidal, intertidal, and supratidal zones. Unconsolidated substrates support large populations of tube worms, sand dollars, mollusks, isopods, amphipods, burrowing shrimp, and an assortment of crabs, but lack dense populations of sessile plant and animal species. Unconsolidated substrates are an important feeding ground for bottom-feeding fish, shorebirds, and invertebrates. These areas also grade into a variety of other natural communities, making them the foundation for the development of other marine and estuarine habitats. Unconsolidated substrate communities are found throughout the estuarine and riverine portions of the watershed. They are susceptible to many types of disturbances including vehicle traffic, low-dissolved oxygen (DO) levels, as well as the accumulation of metals, oils, and pesticides in the sediment (FNAI 2010). Unconsolidated (marine) substrate can be found throughout the Apalachee Bay.

Source: FNAI 2010.

Appendix F Impaired Waterbody Segments in the St. Marks River and Apalachee Bay Watershed

All states are required to submit lists of impaired waters that are too polluted or degraded to meet water quality standards and their designated use (potable, recreational, shellfish harvesting) to the EPA under section 303(d) of the CWA (EPA 2016a). The following table provides a list of 2013 FDEP designated and impaired waters in the St. Marks River and Apalachee Bay watershed.

Waterbody ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
647H	Alford Arm Tributary	Leon	3F	Dissolved Oxygen
1124	Big Boggy Branch	Wakulla	3F	Fecal Coliform
1054	Black Creek	Leon, Wakulla	3F	Dissolved Oxygen
628	Black Creek	Leon	3F	Dissolved Oxygen
628	Black Creek	Leon	3F	Fecal Coliform
857	Central Drainage Ditch	Leon	3F	Fecal Coliform
857	Central Drainage Ditch	Leon	3F	Nutrients (Chlorophyll-a)
971	Chicken Branch	Leon	3F	Fecal Coliform
8026	Coastal Apalachee Gulf West	Wakulla	3M	Bacteria (in Shellfish)
808	Copeland Sink Drain	Jefferson, Leon	3F	Dissolved Oxygen
1223	Dickerson Bay (Shellfish Portion)	Wakulla	2	Fecal Coliform (SEAS Classification)
1176	Direct Runoff to Bay	Wakulla	2	Fecal Coliform (SEAS Classification)
1239	Direct Runoff to Bay	Wakulla	2	Fecal Coliform (SEAS Classification)
916	East Drainage Ditch	Leon	3F	Fecal Coliform
820	Godby Ditch	Leon	3F	Fecal Coliform
820	Godby Ditch	Leon	3F	Turbidity
8027	Gulf of Mexico (Wakulla County; St Marks River)	Wakulla	2	Fecal Coliform (SEAS Classification)
647F	Lake Kanturk	Leon	3F	Nutrients (TSI)
647C	Lake Killarney	Leon	3F	Nutrients (TSI)
647C	Lake Killarney	Leon	3F	Un-ionized Ammonia
756I	Lake Lafayette Drain	Leon	3F	Dissolved Oxygen
756I	Lake Lafayette Drain	Leon	3F	Fecal Coliform
791L	Lake Miccosukee Outlet	Jefferson, Leon	3F	Fecal Coliform

Waterbody ID	Water Segment Name	County	Waterbody Class[1]	Parameters Assessed Using the Impaired Waters Rule (IWR)
807C	Lake Munson	Leon	3F	Dissolved Oxygen
807C	Lake Munson	Leon	3F	Nutrients (TSI)
807C	Lake Munson	Leon	3F	Turbidity
756B	Lake Piney Z	Leon	3F	Dissolved Oxygen
756B	Lake Piney Z	Leon	3F	Nutrients (TSI)
971B	Lake Weeks	Leon	3F	Dissolved Oxygen
756C	Lower Lake Lafayette	Leon	3F	Dissolved Oxygen
756C	Lower Lake Lafayette	Leon	3F	Nutrients (TSI)
807D	Munson Slough (Above Lake Munson)	Leon	3F	Dissolved Oxygen
807D	Munson Slough (Above Lake Munson)	Leon	3F	Lead
807	Munson Slough (Below Lake Munson)	Leon	3F	Dissolved Oxygen
807	Munson Slough (Below Lake Munson)	Leon	3F	Nutrients (Chlorophyll-a)
807	Munson Slough (Below Lake Munson)	Leon	3F	Un-ionized Ammonia
756H	North East Drainage Ditch	Leon	3F	Fecal Coliform
8026B	Shell Point	Wakulla	3M	Bacteria (Beach Advisories)
793A	St Marks River (South Segment)	Wakulla	2	Fecal Coliform (3)
793A	St Marks River (South Segment)	Wakulla	2	Fecal Coliform (SEAS Classification)
865	St. Augustine Branch	Leon	3F	Fecal Coliform
965	Sweetwater Branch	Jefferson	3F	Fecal Coliform
756J	Tom Brown Tributary	Leon	3F	Dissolved Oxygen
756J	Tom Brown Tributary	Leon	3F	Fecal Coliform
919	Mt. Sinai Slough	Leon	3F	Fecal Coliform
883B	Virginia Tributary	Leon	3F	Fecal Coliform
459	Ward Creek	Jefferson	3F	Fecal Coliform

Notes:
* = new Florida listings since 2003
Footnote 1 - Florida's waterbody classifications:
1 - Potable water supplies
2 - Shellfish propagation or harvesting
3F - Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in fresh water
3M - Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife in marine water
4 - Agricultural water supplies
5 - Navigation, utility, and industrial use

Footnote 2 - TSI = trophic state index
Source: FDEP 2014b

The following table provides a list of EPA established TMDLs in the Ochlockonee River and Bay watershed.

Waterbody ID	Water Segment Name	County	Waterbody Class[1]	Pollutant
857	Central Drainage Ditch	Leon	3F	Nitrogen, Total
857	Central Drainage Ditch	Leon	3F	Fecal
857	Central Drainage Ditch	Leon	3F	Total Coliform
916	East Drainage Ditch	Leon	3F	Total Coliform
916	East Drainage Ditch	Leon	3F	Fecal
820	Godby Ditch	Leon	3F	Phosphorus, Total
756F	Lake Lafayette (Upper Segment)	Leon	3F	Nitrogen, Total
756F	Lake Lafayette (Upper Segment)	Leon	3F	Phosphorus, Total
756	Lake Lafayette Drain	Leon	3F	Fecal
756	Lake Lafayette Drain	Leon	3F	Total Coliform
865	St. Augustine Branch	Leon	3F	Nitrogen, Total
865	St. Augustine Branch	Leon	3F	Total Coliform
865	St. Augustine Branch	Leon	3F	Fecal
459	Ward Creek	Leon	3F	Fecal

Source: EPA 2016e

Appendix G Public and Conservation Lands within the St. Marks River and Apalachee Bay Watershed

Within the St. Marks River and Apalachee Bay watershed there are approximately 230,800 acres of conservation lands, including 160,553 acres of federally managed lands, 37,645 acres state-managed, 4,294 acres of locally managed lands, and 28,308 acres of privately managed lands. The details of these conservation lands are presented in the following table (FNAI 2016a, 2016b):

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Federally Managed					
Apalachicola National Forest	US Dept. of Agriculture, Forest Service	Franklin, Leon, Liberty, Wakulla	The Apalachicola National Forest includes longleaf pine sandhills and flatwoods and harbors the largest population of red-cockaded woodpeckers in the state. Wet prairies, seepage slopes, ravines, numerous blackwater streams can also be found in this forest.	http://www.fs.fed.us	106,361
Levy Ditch Research Natural Area	US Dept. of the Interior, Fish and Wildlife Service	Wakulla	This research natural area is part of the St. Marks National Wildlife Refuge, located just west of Panacea.	http://www.fws.gov/southeast	1
Abe Trull Research Natural Area	US Dept. of the Interior, Fish and Wildlife Service	Wakulla	This research natural area is part of the St. Marks National Wildlife Refuge located adjacent to State Road 367.	http://www.fws.gov/southeast	26
Byrd Hammock Research Natural Area	US Dept. of the Interior, Fish and Wildlife Service	Wakulla	This research natural area is part of the St. Marks National Wildlife Refuge located south of U.S. Highway 98, east of Spring Creek Highway, and west of Wakulla Beach Road.	http://www.fws.gov/southeast	24
Coggins Branch Research Natural Area	US Dept. of the Interior, Fish and Wildlife Service	Wakulla	This research natural area is part of the St. Marks National Wildlife Refuge located adjacent to State Road 367.	http://www.fws.gov/southeast	20

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Gum Swamp Research Natural Area	US Dept. of the Interior, Fish and Wildlife Service	Wakulla	This research natural area is part of the St. Marks National Wildlife Refuge located in eastern Wakulla County near the Flint Rock Tract.	http://www.fws.gov/southeast	103
St. Marks National Wildlife Refuge	US Dept. of the Interior, Fish and Wildlife Service	Jefferson, Taylor, Wakulla	The St. Marks National Wildlife Refuge includes a large area of protected coast from the Aucilla River to Ochlockonee Bay. Natural communities include estuarine tidal marsh, coastal hammock, wet flatwoods, mesic flatwoods, dome swamps, depression marshes, and bottomland forests. The refuge has extensive artificial impoundments managed for waterfowl and used by many other bird species.	http://www.fws.gov/southeast	54,017
State-Managed					
Alfred B. Maclay Gardens State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Leon	Alfred B. Maclay Gardens State Park is within the Tallahassee metropolitan area. Significant features include an upland clastic lake and ravines with slope forests.	http://www.floridastateparks.org/	6
Aucilla Wildlife Management Area	FL Fish and Wildlife Conservation Commission	Jefferson, Taylor	Aucilla Wildlife Management Area, north of St. Marks National Wildlife Refuge, includes large stretches of the Aucilla and Wacissa Rivers as well as their riparian areas and floodplains. Along with springs, blackwater streams and rivers, the WMA also includes sinkholes, limestone outcrops, and a variety of wetland habitats.	http://myfwc.com	18134

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Bailey's Mill Conservation Easement	FL Dept. of Environmental Protection, Div. of State Lands	Jefferson,	Bailey's Mill Conservation Easement is a privately owned easement managed by the FDEP located south of Lake Miccosukee and adjacent to the Letchworth Mounds Conservation Easement.	http://www.dep.state.fl.us/lands	437
Billingsley Conservation Easement	Northwest Florida Water Management District	Leon	The Billingsley Conservation Easement is a privately owned easement managed by the NWFWMD located northeast of Tallahassee and east of the Miccosukee Canopy Road Greenway.	http://www.nwfwater.com/	195
Blueprint 2000 Conservation Easement	Northwest Florida Water Management District	Leon	The Blueprint 2000 Conservation Easement is a privately owned easement managed by the NWFWMD located northwest of Lake Lafayette adjacent to the CSX Railroad.	http://www.nwfwater.com/	132
Capital Circle Office Complex Conservation Area	FL Dept. of Management Services, Div. of Real Estate, Development & Management	Leon	The Capital Circle Office Complex Conservation Area is located in southeastern Tallahassee near the Southwood community. It contains three distinct habitats: a wetland drainage basin dominated by oaks; a sandhill community with mature longleaf pines; and a sandhill community with young longleaf pines ranging from 12'-15' in height. A self-guided narrative trail system consisting of pond overlooks, wood chip paths, and interpretive signage is planned for the conservation area.		84

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Carlton Farms Conservation Easement	Northwest Florida Water Management District	Leon, Wakulla	Carlton Farms Conservation Easement is a privately owned easement managed by the NWFWMD located near the Leon Sinks Geological Area in the Apalachicola National Forest.	http://www.nwfwater.com/	63
Carpenter and Westmark Conservation Easement	Northwest Florida Water Management District	Wakulla	Carlton Farms Conservation Easement is a privately owned easement managed by the NWFWMD located adjacent to the St. Marks National Wildlife Refuge near Spring Creek.	http://www.nwfwater.com/	359
Carroll Conservation Easement	Northwest Florida Water Management District	Wakulla	Carroll Conservation Easement is a privately owned easement managed by the NWFWMD located adjacent to the Carpenter and Westmark Conservation Easement.	http://www.nwfwater.com/	371
Edward Ball Wakulla Springs State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Wakulla	Wakulla Springs State Park is centered around one of the world's largest and deepest freshwater spring, the headwaters of the Wakulla River. The park has extensive floodplain forests, swamps, upland hardwood forest, and a recent acquisition of extensive cut-over longleaf pine sandhills.	http://www.floridastateparks.org/	6042
Gerrell Conservation Easement	Northwest Florida Water Management District	Wakulla	The Gerrell Conservation Easement is a privately owned easement managed by the NWFWMD located south of Natural Bridge Historic Battlefield State Park just south of the Leon/Wakulla County line.	http://www.nwfwater.com/	145

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
L. Kirk Edwards Wildlife and Environmental Area	FL Fish and Wildlife Conservation Commission	Leon	The L. Kirk Edwards Wildlife and Environmental Area is part of the Lake Lafayette ecosystem. Wood stork and great egret rookeries occur on the property. FWC owns the land west of Chaires Cross Road, and the Wood Sink tract east of the road is titled to the State of Florida.	http://myfwc.com	1785
Lake Talquin State Forest	FL Dept. of Agriculture and Consumer Services, Florida Forest Service	Gadsden, Leon, Wakulla	Lake Talquin State Forest includes the shores of Lake Talquin. It contains pine and hardwood forests and deep ravines along the edge of the lake that form refugee for many rare plants and animals. The 2018-acre Rocky Comfort Tract is jointly owned and co-managed by FDACS, FFS, and FWC.	http://www.floridaforestservice.com/index.html	19,169
Letchworth Mounds Conservation Easement	FL Dept. of Environmental Protection, Div. of State Lands	Jefferson, Leon	The Letchworth Mounds Conservation Easement is a privately owned easement located adjacent to the Letchworth-Love Mounds Archaeological State Park south of Lake Miccosukee in Leon and Jefferson counties.	http://www.dep.state.fl.us/lands	1272
Letchworth-Love Mounds Archaeological State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Jefferson	This park contains Florida's tallest Native American ceremonial mound. The 46-foot-high structure was built between 1100 and 1800 years ago by Native Americans. The people who built the mound are believed to have been members of the Weedon Island Culture, who lived in North Florida between 200 and 800 A.D. A nature trail winds around the perimeter of the ceremonial mound.	http://www.floridastateparks.org/	190

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Millstone Plantation Conservation Easement	FL Dept. of Environmental Protection, Div. of State Lands	Leon	The Millstone Plantation Conservation Easement is a privately owned easement with no public access located south of Lake McBride just north of Tallahassee.	http://www.dep.state.fl.us/lands	92
Natural Bridge Battlefield Historic State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Leon	Natural Bridge is the site of the second largest Civil War battle in Florida. The park includes a sinkhole where the St. Marks River drops into the earth and flows underground for one-quarter of a mile before reemerging.	http://www.floridastateparks.org/	135
Pace Conservation Easement	Northwest Florida Water Management District	Leon	Pace Conservation Easement is a privately owned easement managed by the NWFWMD located just northeast of Tallahassee.	http://www.nwfwater.com/	121
San Marcos de Apalache Historic State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Wakulla	Located at the confluence of the St. Marks and the Wakulla Rivers, this park is the site of an old fort. Most of the land is devoted to historical education.	http://www.floridastateparks.org/	15
St. Marks River Preserve State Park	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Jefferson, Leon	The St. Marks River Preserve State Park is located along the St. Marks River south of Lower Lake Lafayette, east of Tallahassee.	http://www.floridastateparks.org/	2593
Tallahassee-St. Marks Historic Railroad State Trail	FL Dept. of Environmental Protection, Div. of Recreation and Parks	Leon, Wakulla	This is a former railroad line that has been converted to a paved 15.8-mile long recreational trail connecting Tallahassee and to the City of St. Marks.	http://www.floridastateparks.org/	151

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Wakulla State Forest	FL Dept. of Agriculture and Consumer Services, Florida Forest Service	Leon, Wakulla	Wakulla State Forest consists of cutover sandhills with remnant longleaf-wiregrass vegetation, and mixed hardwood-pine forest. The forest contains a portion of the spring-fed McBride Slough. The former "Woodville State Forest" tract in Leon County is primarily planted slash pine and sand pine in what was formerly longleaf pine-wiregrass sandhills. There are a few areas of natural longleaf, a dome swamp, and small pond.	http://www.floridaforestservice.com/index.html	4935
Locally Managed					
A. J. Henry Park	City of Tallahassee	Leon	A. J. Henry Park is a city park located in northeastern Tallahassee adjacent to Shakey Pond in the Whitfield Plantation community.	http://www.talgov.com/parks	75
Barnette W. Allen Nature Preserve	City of Tallahassee	Leon	Barnette W. Allen Nature Preserve is a city park located in central Tallahassee southeast of Leon High School.	http://www.talgov.com/parks	9
Dr. Charles Billings Greenway	City of Tallahassee	Leon	Dr. Charles Billings Greenway is a city greenway consisting of two tracts located on Silver Lake and Lake Henrietta in southwestern Tallahassee.	http://www.talgov.com/parks	25
Fallschase Greenway	Leon County	Leon	Fallschase Greenway consists of Upper Lake Lafayette in eastern Tallahassee.	http://www.leoncountyfl.gov/parks	201
Fred George Greenway	Leon County	Leon	The Fred George Greenway is located adjacent to Capital Circle Northwest in Tallahassee south of Lake Jackson.	http://www.leoncountyfl.gov/parks	164

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Gil Waters Preserve at Lake Munson	Leon County	Leon	The Gil Waters Preserve at Lake Munson is located on the southern margin of Lake Munson in the southern Tallahassee metropolitan area.	http://www.leoncountyfl.gov/parks	67
Golden Aster Preserve	City of Tallahassee	Leon	The Golden Aster Preserve, located south of Lake Bradford in Tallahassee, consists of remnant sandhill with an overgrown hardwood understory.	http://www.talgov.com/parks	31
Governor's Park	City of Tallahassee	Leon	Governor's Park is a city park located in east-central Tallahassee.	http://www.talgov.com/parks	192
Harvey/Mowrey Parcel	Wakulla County	Wakulla	The Harvey/Mowrey Parcel is a tract of conservation land in Panacea near Dickerson Bay in coastal Wakulla County.		14
Indian Head Acres Park	City of Tallahassee	Leon	Indian Head Acres Park is a local park in residential community of south-central Tallahassee.	http://www.talgov.com/parks	31
J. R. Alford Greenway	Leon County	Leon	This property is a vista of rolling hills that includes natural habitats such as herbaceous marsh and hardwood/pine forests in addition to pastureland. Alford Arm is adjacent to the Lake Lafayette ecosystem.	http://www.leoncountyfl.gov/parks	789
Lafayette Heritage Trail Park	City of Tallahassee	Leon	The Lafayette Heritage Trail Park includes Lake Lafayette and adjacent property to the south and east. This trail connects Lake Lafayette with the J.R. Alford Greenway and runs adjacent to the CSX Railroad in eastern Tallahassee. The trail consists of upland mixed forest along the lakeshore.	http://www.talgov.com/parks	796

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Mashes Sands Park	Wakulla County	Wakulla	Beach dune with tidal marsh and trails through scrubby flatwoods and mesic flatwoods.	http://www.wcprd.com/Parks/parks_mashessands.asp	326
Miccosukee Canopy Road Greenway	Leon County	Leon	This 6.4-mile long linear park and greenway consists of a strip of vegetation on either side of Miccosukee Road acquired to protect the historic tree canopy effect. Natural features include a 45-acre pine-oak-hickory forest on the eastern half of the property south of Miccosukee Road.	http://www.leoncountyfl.gov/parks	502
Northwest Park	City of Tallahassee	Leon	Northwest Park is a city park in northwestern Tallahassee.	http://www.talgov.com/parks	78
San Luis Mission Park	City of Tallahassee	Leon	San Luis Mission Park is in western Tallahassee and includes a historic 1700's Spanish mission.	http://www.talgov.com/parks	69
Shepherd's Branch Habitat Mitigation Area Conservation Easement	City of Tallahassee	Leon	The Shepherd's Branch Habitat Mitigation Area Conservation Easement is managed as a gopher tortoise mitigation site by Capital Region Community Development District (owner of the property) and City of Tallahassee, which holds and monitors the conservation easement. Nest boxes for southeastern American kestrel have been installed at the site.		168

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
St. Marks Headwaters	Leon County	Leon	The St. Marks Headwaters consists of wetlands and wet flatwoods across much of the site, as well as some restoration areas with old field and agricultural activity.	http://www.leoncountyfl.gov/parks	755
Privately Managed					
Chemonie Plantation Conservation Easement	Tall Timbers Research, Inc.	Leon	Chemonie Plantation Conservation Easement is a privately-owned easement managed by Tall Timbers that is located between northeastern Tallahassee and Lake Miccosukee in Leon County.	http://www.talltimbers.org	1938
Chemonie Trust Conservation Easement	Tall Timbers Research, Inc.	Leon	Chemonie Trust Conservation Easement is a privately-owned easement managed by Tall Timbers located adjacent to the Woodfield Springs Plantation Conservation Easement in northern Leon County.	http://www.talltimbers.org	225
Crow Pond Conservation Easement	Tall Timbers Research, Inc.	Jefferson	Crow Pond Conservation Easement is a privately-owned easement managed by Tall Timbers located east of the St. Marks River Preserve State Park.	http://www.talltimbers.org	114
Fanlew Preserve	The Nature Conservancy	Jefferson	The Fanlew Preserve is a tract of conservation land owned by TNC located adjacent to the northwestern boundary of the Aucilla WMA.	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/index.htm	680

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Flint Rock Tract	The Nature Conservancy	Jefferson	The Flint Rock Tract is a tract of conservation land owned by TNC located adjacent to the southwestern boundary of the Aucilla WMA.	http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/index.htm	8053
Horseshoe Plantation Conservation Easement	Tall Timbers Research, Inc.	Leon	Horseshoe Plantation Conservation Easement is a privately-owned conservation easement managed by Tall Timbers located in northern Leon County, south of Lake Iamonia.	http://www.talltimbers.org	367
Mays Pond Plantation Conservation Easement	Tall Timbers Research, Inc.	Jefferson	Mays Pond Plantation Conservation Easement is a privately-owned conservation easement managed by Tall Timbers located in northern Jefferson County, adjacent to the northwest bank of Lake Miccosukee.	http://www.talltimbers.org	5507
Merrily Plantation Conservation Easement	Tall Timbers Research, Inc.	Jefferson	Merrily Plantation Conservation Easement is a privately-owned conservation easement managed by Tall Timbers located in northern Jefferson County.	http://www.talltimbers.org	340
Miccosukee Hills Conservation Easement	Apalachee Land Conservancy	Leon	The Miccosukee Hills Conservation Easement consists of 11 acres of bottomland forest with the remainder primarily upland pine forest.		354
St. Marks Mitigation Bank	Westervelt Ecological Services	Jefferson, Wakulla	The St. Marks Mitigation Bank is a privately owned and managed mitigation bank on the Wakulla-Jefferson County line, adjacent to the northern boundary of the Flint Rock Tract.	http://www.wesmitigation.com/	1477

Conservation Land	Managing Agency	County(ies)	Description	Website	Acres Within Watershed
Straw Pond Conservation Easement	Tall Timbers Research, Inc.	Leon	The Straw Pond Conservation Easement is a privately-owned conservation easement managed by Tall Timbers located northwest of Lake Miccosukee.	http://www.talltimbers.org	400
Sunny Hill Plantation Conservation Easement	Tall Timbers Research, Inc.	Leon	The Sunny Hill Plantation Conservation Easement is a privately-owned conservation easement managed by Tall Timbers located northwest of Lake Miccosukee.	http://www.talltimbers.org	6367
Woodfield Springs Plantation Conservation Easement	Tall Timbers Research, Inc.	Leon	The Woodfield Springs Plantation Conservation Easement is to the west of Lake Miccosukee and to the southeast of Lake Iamonia.	http://www.talltimbers.org	2485