FINAL

BASIN MANAGEMENT ACTION PLAN

for the Implementation of the Total Maximum Daily Load for Nutrients (Biology) by the Florida Department of Environmental Protection in the Upper Wakulla River and Wakulla Springs Basin

prepared by the
Division of Environmental Assessment and Restoration
Water Quality Restoration Program
Florida Department of Environmental Protection
Tallahassee, FL 32399

in cooperation with the
Upper Wakulla River and Wakulla Springs Basin Technical Stakeholders

October 2015

ACKNOWLEDGMENTS

The Florida Department of Environmental Protection adopted the *Upper Wakulla River and Wakulla Springs Basin Management Action Plan* by Secretarial Order as part of its statewide watershed management approach to restore and protect Florida's water quality. The plan was developed in cooperation with the Upper Wakulla River and Wakulla Springs Basin stakeholders, identified below, with participation from affected local, regional, and state governmental interests; elected officials and citizens; and private interests.

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
Jonathan P. Steverson, Secretary

UPPER WAKULLA RIVER AND WAKULLA SPRINGS BASIN PARTICIPANTS

CATEGORY	NAME OF ENTITY
RESPONSIBLE STAKEHOLDERS	Agricultural Producers Leon County Wakulla County City of Tallahassee Florida Department of Transportation District 3 Gadsden County Jefferson County City of Gretna City of Midway City of Quincy Town of Havana Federal Correctional Institution, Tallahassee Florida Agricultural and Mechanical University Florida State University Tallahassee Community College Talquin Electric Cooperative
RESPONSIBLE AGENCIES	Florida Department of Agriculture and Consumer Services Florida Department of Environmental Protection, including Wakulla Springs State Park Florida Department of Health Leon County Health Department Northwest Florida Water Management District Wakulla County Health Department
OTHER INTERESTED STAKEHOLDERS	1000 Friends of Florida Citizens Florida Department of Economic Opportunity Friends of Wakulla Springs Wakulla Springs Alliance

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LIST OF ACRONYMS AND ABBREVIATIONS

AVA	Aquifer Vulnerability Assessment
AWT	Advanced Wastewater Treatment
BMAP	Basin Management Action Plan
BMP	Best Management Practice
CASTNET	Clean Air Status and Trends Network
CFR	Code of Federal Regulations
CR	County Road
DEAR	Division of Environmental Assessment and Restoration
Department	Florida Department of Environmental Protection
DO	Dissolved Oxygen
EPA	United States Environmental Protection Agency
ERP	Environmental Resource Permit
F.A.C.	Florida Administrative Code
FAMU	Florida Agricultural and Mechanical University
FAR	Florida Administrative Register
FDACS	Florida Department of Agriculture and Consumer Services
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FGS	Florida Geological Survey
F.S.	Florida Statutes
FSU	Florida State University
FWRA	Florida Watershed Restoration Act
FYN	Florida Yards and Neighborhoods
GIS	Geographic Information Systems
gpd	Gallons Per Day
HA	Habitat Assessment
IWR	Impaired Surface Waters Rule
kg/yr	Kilograms Per Year
LA	Load Allocation
LDI	Low-Impact Development
LID	Low-Impact Development
LIDAR`	Light Detection and Ranging
LVS	Linear Vegetation Survey
MFLs	Minimum Flows and Levels
Mgd	Million Gallons Per Day
mg/L	Milligrams Per Liter
MS4	Municipal Separate Storm Sewer System
N	Nitrogen
NADP	National Atmospheric Deposition Program
NELAP	National Environmental Laboratory Accreditation Program
NNC	Numeric Nutrient Criteria
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NSILT	Nitrogen Source Inventory and Loading Tool
NWFWMD	Northwest Florida Water Management District

OFW	Outstanding Florida Water
OSTDS	Onsite Treatment and Disposal System
PFA	Priority Focus Area
ppb	Parts Per Billion
PSPZ	Primary Springs Protection Zone
QA/QC	Quality Assurance/Quality Control
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States (Act)
RIB	Rapid Infiltration Basin
RPS	Rapid Periphyton Survey
SBIO	Statewide Biological Database
SCI	Stream Condition Index
SESF	Southeast Spray Field
SOP	Standard Operating Procedure
SRF	State Revolving Fund
STORET	Storage and Retrieval (Database)
TCC	Tallahassee Community College
TIF	Tax Increment Financing (District)
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
UF–IFAS	University of Florida –Institute of Food and Agricultural Sciences
UFA	Upper Floridan Aquifer
U.S.	United States
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WBID	Waterbody Identification (Number)
WLA	Wasteload Allocation
WWTP	Wastewater Treatment Plant
WWTF	Wastewater Treatment Facility

SUMMARY

UPPER WAKULLA RIVER AND WAKULLA SPRINGS BASIN

The Wakulla River watershed and the Wakulla Springs springshed are located in portions of southern Georgia and Gadsden, Jefferson, Leon, and Wakulla Counties in Florida. The Upper Wakulla River and Wakulla Springs Basin Management Action Plan focuses on the portion of the springshed located in Florida, referred to as the BMAP basin (see **Figure ES-1**). The BMAP basin encompasses an area of approximately 848,445 acres, or 1,325 square miles.

Wakulla Springs is the primary source of water to the Wakulla River. Within the Upper Wakulla River and Wakulla Springs Basin, the Cody Scarp generally separates the semiconfined geologic features to the north (soils characterized with lower potential for ground water impacts) and areas of unconfined geologic features to the south (highly permeable karst areas with a high potential for ground water impacts).

The Wakulla River is about nine miles long, starting near Camp Indian Springs and joining the St. Marks River near Fort San Marcos de Apalache. However, the BMAP extent of the Upper Wakulla River ends at the Highway 98 bridge. Major centers of population in the basin include the city of Tallahassee, Woodville, and Crawfordville. As reported by Kincaid (2010), the efforts of numerous underwater cave explorers and scientists have identified a complex system of ground water conduits that interconnect many of the sinking streams in the basin, as well as the city of Tallahassee Southeast Spray Field (SESF) to the Wakulla River and Wakulla Springs.

In the Upper Wakulla River and Wakulla Springs Basin, two Priority Focus Areas (PFAs) were identified to focus management strategies for the first BMAP iteration. These PFAs represent the areas in the basin where the aquifer is most vulnerable to inputs and where there are the most connections between ground water and Wakulla Springs.

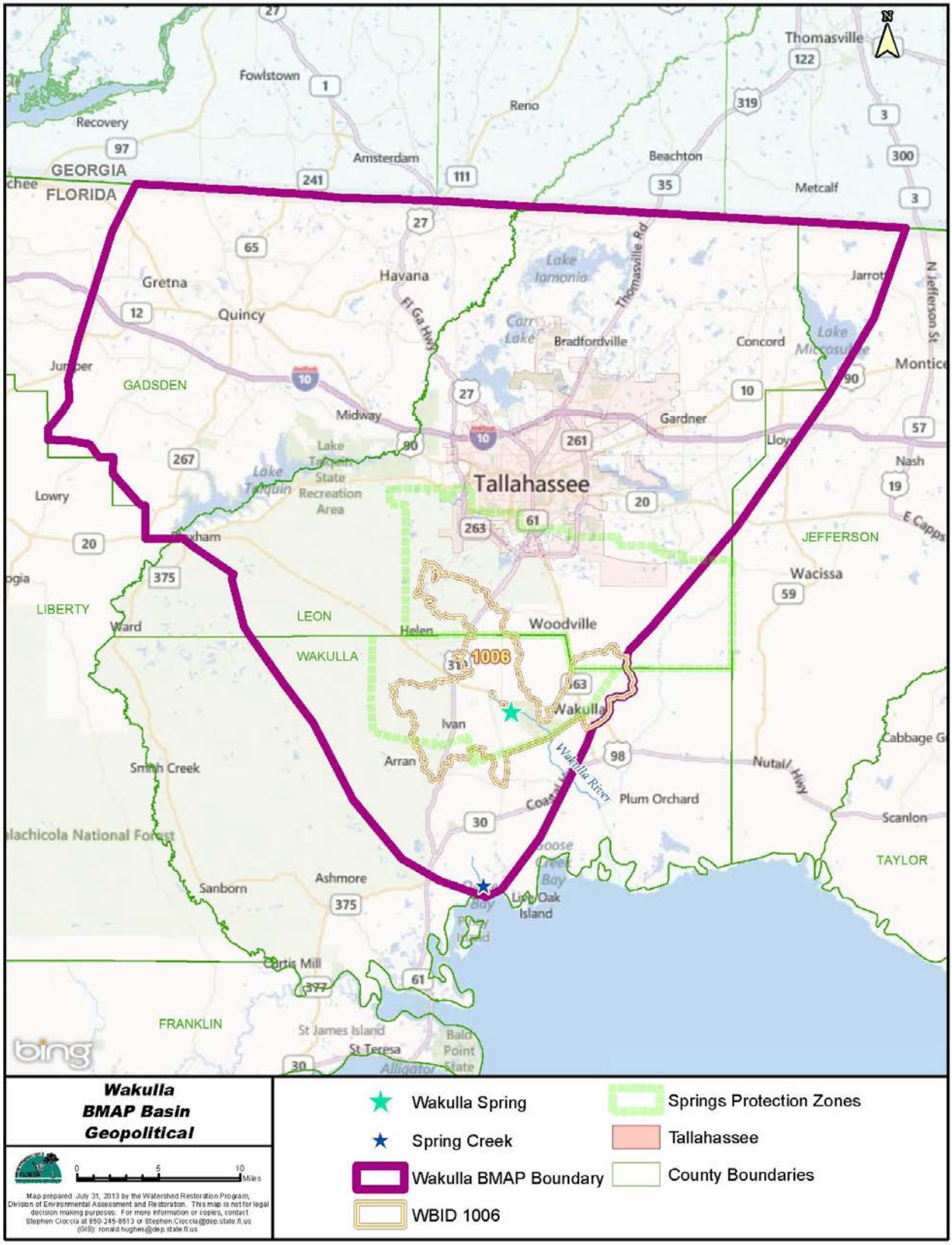

FIGURE ES-1: UPPER WAKULLA RIVER AND WAKULLA SPRINGS BASIN

TOTAL MAXIMUM DAILY LOADS

TMDLs are water quality targets based on state water quality standards for specific pollutants, such as excessive nitrate. The department determined that the Upper Wakulla River segment with waterbody identification (WBID) number 1006 was impaired by nitrate, defined in the TMDL as nitrate + nitrite as nitrogen, using data from January 1, 2000, through June 30, 2007. This determination was made based on Stream Condition Index (SCI) surveys that indicated healthy biological community conditions in the Upper Wakulla River in only seven of 27 sampling events. The biological community in the river is affected by excessive algal mats linked to elevated nitrate concentrations from anthropogenic sources. **Table ES-1** lists the TMDL and pollutant load allocation adopted by rule for the Upper Wakulla River WBID.

TABLE ES-1: UPPER WAKULLA RIVER TMDL

[1] There are no National Pollutant Discharge Elimination System (NPDES) wastewater facilities that discharge directly into the Upper Wakulla River.
[2] Not applicable; none of the NPDES municipal separate storm sewer systems (MS4s) discharges directly into the Upper Wakulla River.

WBID	PARAMETER	TMDL MILLIGRAMS PER LITER (MG/L)	TMDL % REDUCTION	WASTELOAD ALLOCATION FOR WASTEWATER	WASTELOAD ALLOCATION FOR NPDES STORMWATER (% REDUCTION)	LOAD ALLOCATION (% REDUCTION)
1006	Nitrate, as monthly average	0.35	56.2%	N/A[1]	N/A[2]	56.2%

UPPER WAKULLA RIVER AND WAKULLA SPRINGS BMAP

Paragraph 403.067(7)(a)1, Florida Statutes (F.S.), authorizes the department to adopt BMAPs that provide for phased implementation of the strategies necessary to ultimately achieve the associated TMDLs. This approach allows stakeholders to establish management strategies and incrementally plan, budget, and execute projects while simultaneously monitoring and conducting studies to better understand the water quality dynamics (sources and response variables) in the basin. This BMAP is the first iteration for the Upper Wakulla River and Wakulla Springs Basin and it covers a five-year period.

Since the TMDL assessment period, the largest source of loading to the Upper Wakulla River and Wakulla Springs, the city of Tallahassee's T.P. Smith Wastewater Treatment Facility (WWTF), has been upgraded to reduce nitrate concentrations by approximately 80 percent. Further reductions in nitrate concentrations are expected in the river and springs due to this WWTF upgrade, as well as other completed actions in the basin (see **Figure ES-2**). Given the need for further monitoring to determine to what extent additional reductions are needed, this BMAP used a sufficiency-of-effort evaluation based on source categories to move forward with reductions in the first five-year implementation period.

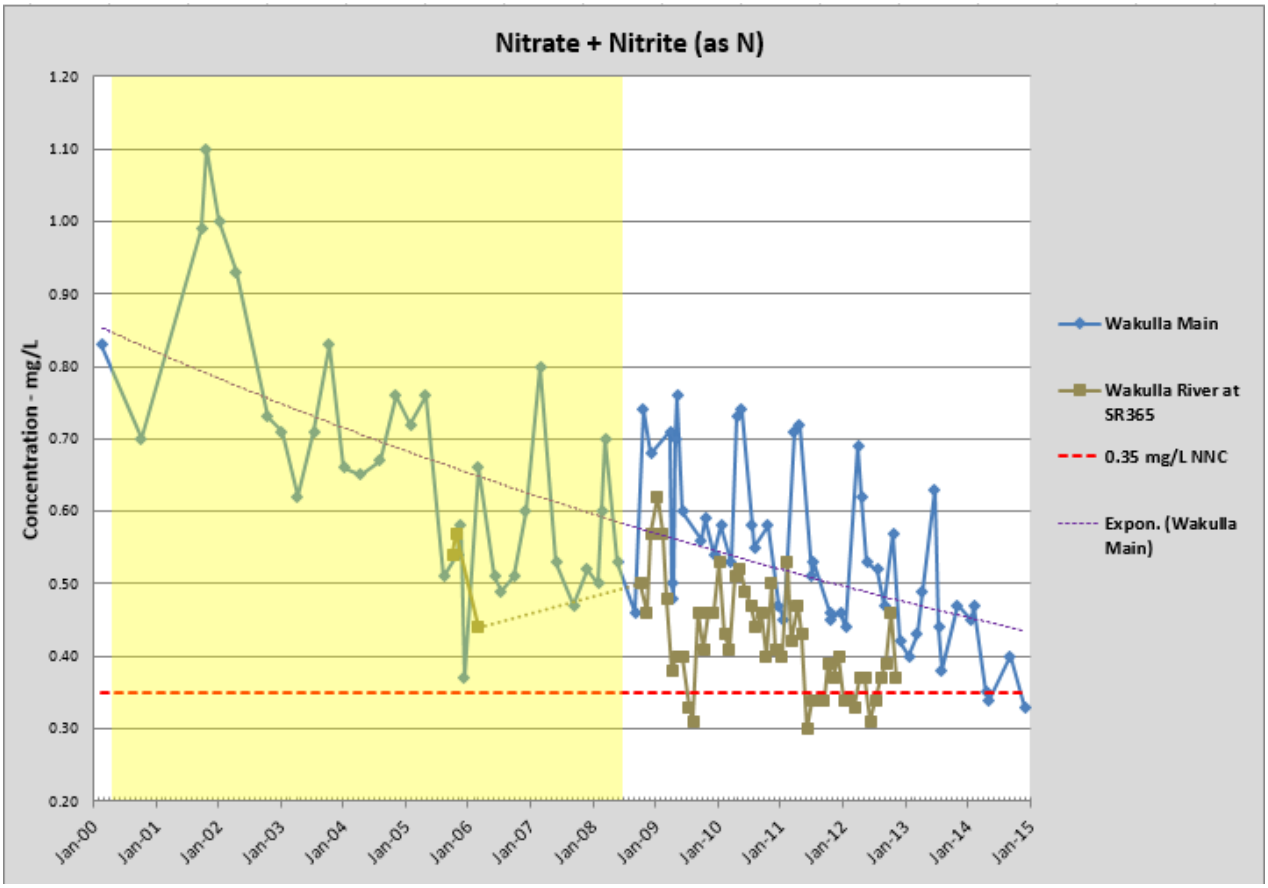

FIGURE ES-2: WATER QUALITY TRENDS IN THE WAKULLA RIVER AND WAKULLA SPRING VENT

Using information on sources in the basin, the stakeholders in the PFAs were asked to submit management strategies to reduce nitrate loading from the sources they are responsible for managing. The department then compared the strategies provided with the sources in the PFAs to evaluate whether each of the existing sources was sufficiently addressed for the first BMAP iteration and whether strategies were in place or would be put into place to reduce nitrate sources. Where needed, the department requested additional details and strategies from the responsible stakeholders to assess sufficiency for the first BMAP iteration.

To ensure sufficiency for addressing onsite sewage treatment and disposal systems (OSTDS), the department is undertaking an OSTDS Initiative, in cooperation with the Florida Department of Health (FDOH), city of Tallahassee, Leon County, Wakulla County, and other parties. The objective of the OSTDS Initiative is to identify and implement effective, financially feasible strategies to reduce nutrient loads from OSTDS sources. The department and stakeholders will identify options for addressing OSTDS loading, identify effective strategies for the Upper Wakulla River and Wakulla Springs Basin,

establish educational and outreach programs, determine responsibilities, and identify funding sources and an implementation schedule for the management strategies.

For the first five years of BMAP implementation, collectively the management strategies included in the BMAP are sufficient and reasonable to address nitrate loading in the PFAs to the Upper Wakulla River and Wakulla Springs Basin. Additional management strategies may be required in the next BMAP iteration unless more current water quality data indicate that the designated uses have been achieved.

The requirements of this BMAP are enforceable by the department. For point sources to surface waters, both WWTFs and MS4s, the BMAP and required TMDL reductions are also enforceable through NPDES or state permits. For non-MS4 sources, the BMAP requirements and TMDL reductions are enforceable under Section 403.067, F.S. Furthermore, an agricultural nonpoint source 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 department or a water management district that demonstrates compliance with state water quality standards.

GOAL OF THE BMAP

The goal of the BMAP is to restore Wakulla Springs and the Upper Wakulla River to a sustainable biological community that is resilient to the impacts of existing and continuing human use and development on the land from which Wakulla Springs draws its waters. The BMAP addresses anthropogenic sources in the basin that have resulted in impairment of the ecological community of the Upper Wakulla River to the extent that the TMDL target is met. Management strategies in the BMAP have been developed to make progress towards the TMDL targets for allowable nitrate-nitrogen concentration (0.35 mg/L) and recovery of the biological impairment to meet the department's Class III biology criteria in the impaired segment and therefore, to meet the waterbody's designated uses.

KEY ELEMENTS OF THE BMAP

This BMAP addresses the key elements required by the Florida Watershed Restoration Act (FWRA), Chapter 403.067, F.S., including the following:

- Document how the public and other stakeholders were encouraged to participate or participated in developing the BMAP (**Section 1.3.1**).

- Identify the mechanisms by which potential future increases in pollutant loading will be addressed (**Section 0**).

- Document management strategies to achieve the TMDLs (**Chapter 4** and **Chapter 5**).

- Document the implementation schedule, feasible funding strategies, responsibilities, and milestones (**Chapter 4** and **Chapter 5**).

- Identify monitoring, evaluation, and a reporting strategy to evaluate reasonable progress over time (**Section 6.3**).

ANTICIPATED OUTCOMES OF BMAP IMPLEMENTATION

Through the implementation of management strategies and additional source assessment in this BMAP, stakeholders expect the following outcomes:

- Continued improvement in the water quality conditions in the Upper Wakulla River and Wakulla Springs.

- Decreased loading of the target pollutant (nitrate).

- Increased coordination, such as through the OSTDS Initiative and annual meetings, among state and local governments and within divisions of local governments in problem solving for water quality restoration.

- Determination of effective management strategies through the stakeholder decision-making and priority-setting processes.

- Enhanced public awareness of pollutant sources, pollutant impacts on water quality, and corresponding corrective actions.

- Enhanced understanding of basin hydrology, water quality, and pollutant sources.

BMAP COST

Costs were provided for 29 percent of the management strategies identified in the PFAs. For those strategies with provided costs, the estimated total cost is more than $299,151,300. Of this total, $235,873,000 has been spent on projects completed since 2004, $11,845,500 has been spent on ongoing projects, and $51,432,800 could be spent on planned or proposed projects. In addition, costs were

provided for 33 percent of the strategies identified outside the PFAs, with an estimated total cost of almost $9,520,000. Of this cost, $7,570,000 has been spent on completed projects and $1,200,000 could be spent on proposed projects. Some of these cost estimates may include operations and maintenance for structural projects.

The funding sources for the management strategies range from local contributions to legislative appropriations. Stakeholders will continue to explore new opportunities for funding assistance to ensure that the strategies listed in this BMAP can be maintained at the necessary level of effort.

BMAP FOLLOW-UP AND COMMITMENT TO IMPLEMENTATION

The department will work with stakeholders to organize the monitoring data and track management strategy implementation. The results of these efforts will be used to evaluate whether the BMAP is effective in reducing nitrate concentrations and loads in the basin. In addition to activities for the OSTDS Initiative, the Upper Wakulla River and Wakulla Springs stakeholders will meet approximately annually after BMAP adoption to follow up on plan implementation, share new information, and continue to coordinate on TMDL-related issues. More frequent meetings may be held, if needed.

The stakeholders have committed to implementing the management strategies included in this BMAP and to work together to attain the Upper Wakulla River TMDL.

Chapter 1: CONTEXT, PURPOSE, AND SCOPE OF THE PLAN

The Upper Wakulla River and Wakulla Springs Basin is located in the Big Bend area of Florida in Gadsden, Jefferson, Leon, and Wakulla Counties. The Upper Wakulla River and Wakulla Springs are designated as Outstanding Florida Waters (OFWs), and are important resources that have been affected by nitrate loading from anthropogenic sources in the basin. To address nitrate impacts to the aquatic biological community in this impaired water, the Florida Department of Environmental Protection adopted a Total Maximum Daily Load to reduce nitrate inputs to the river and springs. The largest source of water to the Wakulla River is Wakulla Springs. The river and springs are a very dynamic ground water and surface water–fed system.

This Basin Management Action Plan represents the joint efforts of multiple stakeholders to prepare strategies for water quality restoration for the Upper Wakulla River and Wakulla Springs to work towards achieving the adopted TMDL. The BMAP includes management strategies to reduce nitrate concentrations in the Upper Wakulla River, targeted at restoring the natural aquatic biological community, along with a monitoring plan to guide effective long-term restoration efforts. The BMAP was developed as part of Florida's TMDL Program. Stakeholder involvement is critical to the success of the TMDL Program.

Stakeholder involvement is particularly essential to develop, gain support for, and secure commitments in a BMAP. The department invited all interested stakeholders to participate in the Upper Wakulla River and Wakulla Springs BMAP development and facilitated participation to ensure that all voices were heard and opinions considered. This approach resulted in the use of a phased implementation process to achieve the TMDL targets. The first five-year BMAP iteration is expected to achieve discernible results through the actions outlined in this document.

To determine progress towards achieving the TMDL target for the allowable nitrate-nitrogen concentration in the impaired segment, the nitrate-nitrogen concentrations at the BMAP monitoring stations will be evaluated using a methodology similar to that used to develop the TMDL nitrate-nitrogen target (0.35 milligrams per liter [mg/L]). The month and monitoring station location with the highest average concentration will be compared with the target of 0.35 mg/L to determine the percent reduction achieved to date, and whether the target concentration has been achieved. The TMDL target

for recovery from the biological impairment will be evaluated based on whether the impaired segment meets the department's Class III biology criteria and therefore, the waterbody's designated uses.

This chapter describes the TMDL Program, stakeholder involvement in BMAP development, BMAP purpose and scope, BMAP approach, the TMDL addressed, assumptions and considerations identified during BMAP development, and future growth in the basin.

1.1 WATER QUALITY STANDARDS AND TMDLS

Florida's water quality standards are designed to ensure that surface waters can be used for their designated purposes, such as drinking water, recreation, wildlife, habitat, and agriculture. Currently, most surface waters in Florida, including those in the Upper Wakulla River Basin, are categorized as Class III waters, meaning they must be suitable for recreation and must support the propagation and maintenance of a healthy, well-balanced population of fish and wildlife. **Table 1** shows all designated use categories.

TABLE 1: DESIGNATED USE ATTAINMENT CATEGORIES FOR FLORIDA SURFACE WATERS

* Class I and II waters include the uses of the classifications listed below them.
** Surface water classification for waters in the Upper Wakulla River Basin.

CATEGORY	DESCRIPTION
Class I*	Potable water supplies
Class II*	Shellfish propagation or harvesting
Class III**	**Recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife**
Class III-Limited	Fish consumption, recreation or limited recreation, and/or propagation and maintenance of a limited population of fish and wildlife
Class IV	Agricultural water supplies
Class V	Navigation, utility, and industrial use (*no current Class V designations*)

Under Section 303(d) of the federal Clean Water Act, every two years each state must identify its "impaired" waters, including estuaries, lakes, rivers, and streams, that do not meet their designated uses and are not expected to improve before the next 303(d) list is prepared for the basin. The department is responsible for developing this 303(d) list of impaired waters in Florida.

Florida's 303(d) list identifies waterbody segments that do not meet the state's water quality standards and are thus considered impaired. In Florida, the four most common water quality concerns are nutrients, oxygen-demanding substances, mercury, and fecal coliforms. The 303(d)-listed waterbody segments are candidates for more detailed assessments of water quality to determine whether they are

impaired according to state statutory and rule criteria. The department develops and adopts TMDLs for the waterbody segments it identifies as impaired and for which a causative pollutant has been identified. A TMDL is the maximum amount of a specific pollutant that a waterbody can assimilate while maintaining its designated uses.

The water quality evaluation and decision-making processes for listing impaired waters and establishing TMDLs are authorized by Section 403.067, Florida Statutes (F.S.), known as the Florida Watershed Restoration Act (FWRA), and contained in Florida's Identification of Impaired Surface Waters Rule (IWR) (Chapter 62-303, Florida Administrative Code [F.A.C.]). The impaired waterbody addressed in this BMAP, the Upper Wakulla River, is a Class III water. The TMDL for the Upper Wakulla has been established and addresses the nitrate + nitrite as the nitrogen concentration target required for this waterbody to maintain a healthy aquatic biological community per the Class III designated use.

TMDLs are developed and implemented as part of a watershed management cycle that rotates through the state's 52 river basins every five years to evaluate waters, determine impairments, and develop and implement management strategies to restore impaired waters to their designated uses. **Table 2** summarizes the five phases of the watershed management cycle.

TABLE 2: PHASES OF THE WATERSHED MANAGEMENT CYCLE

PHASE	ACTIVITY
Phase 1	Preliminary evaluation of water quality.
Phase 2	Strategic monitoring and assessment to verify water quality impairments.
Phase 3	Development and adoption of TMDLs for waters verified as impaired.
Phase 4	Development of management strategies to achieve the TMDL(s).
Phase 5	Implementation of TMDL(s), including monitoring and assessment.

1.2 TMDL IMPLEMENTATION

Rule-adopted TMDLs may be implemented through BMAPs, which contain strategies to reduce and prevent pollutant discharges into impaired waterbodies through various cost-effective means. During Phase 4 of the watershed management cycle, the department and the affected stakeholders in the various basins jointly develop BMAPs or other implementation approaches. Based on practical considerations, a basin may have more than one BMAP. The FWRA contains provisions that guide the development of BMAPs and other TMDL implementation approaches.

Stakeholder involvement is critical to the success of the TMDL Program and varies with each phase of implementation to achieve different purposes. The BMAP development process is structured to achieve cooperation and consensus among a broad range of interested parties. As indicated in the statute, the department invites stakeholders to participate in the BMAP development process and encourages public participation and consensus to the greatest practicable extent. The department must hold at least one noticed public meeting in the basin to discuss and receive public comments during the planning process.

1.3 UPPER WAKULLA RIVER AND WAKULLA SPRINGS BMAP

1.3.1 PLAN PURPOSE AND SCOPE

The purpose of this BMAP is to implement nitrate reductions to achieve the Upper Wakulla River TMDL. This plan outlines management strategies that have provided or will provide nitrate reductions and a schedule for implementation for the first five-year BMAP iteration. The BMAP also details a monitoring approach to measure progress towards the nitrate target concentration and improvement in the health of the river's biological community. Stakeholders will meet approximately annually to review progress made towards achieving the TMDL.

In 2009, the department adopted a nutrient TMDL for the Upper Wakulla River, the segment with waterbody identification (WBID) number 1006. Based on potentiometric maps of ground water levels, the Wakulla Springs springshed is located in portions of southern Georgia and Gadsden, Jefferson, Leon, and Wakulla Counties in Florida. Based on topographic maps and surficial water features, the Upper Wakulla River surface watershed extends into Leon and Wakulla Counties. The Upper Wakulla River and Wakulla Springs BMAP focuses on the portion of the springshed located in Florida (see **Figure 1**). The BMAP basin encompasses an area of approximately 848,445 acres, or 1,325 square miles, which is larger than the basin area included in the TMDL. The BMAP basin boundary was extended based on information from basin studies, potentiometric surface maps, and feedback from stakeholders.

1.3.1.1 Priority Focus Areas

In the Upper Wakulla River and Wakulla Springs Basin, two Priority Focus Areas (PFAs) were identified to focus management strategies for the first BMAP iteration (see **Figure 1**). These PFAs represent the areas in the basin where the aquifer is most vulnerable to pollutant inputs, where ground water travels the fastest, and where there is a known connectivity between ground water pathways and

Wakulla Springs. The PFAs were identified using information on the areas classified as "most" and "more" vulnerable from the Leon County Aquifer Vulnerability Assessment (AVA) (Baker *et al.* 2007) and Wakulla County AVA (Baker *et al.* 2009). Development of the PFA boundaries did not take surface features or land use activities into account. The PFAs provide a guide for focusing strategies where science suggests these efforts will best benefit the spring.

PFA1 is the primary area of concern for sources contributing to the nitrate impairment. This area has either documented evidence or the highest probability of regularly contributing loading to the ground water flows to Wakulla Springs. PFA1 has the highest probability for surficial infiltration and contribution to ground water based on information in the AVA reports. This area also has the most direct and fastest ground water travel times to Wakulla Springs, based on dye trace studies conducted in the basin.

PFA2 is the secondary area of concern for sources contributing to the nitrate impairment. This area also has a high probability for surficial infiltration to ground water and contribution to Wakulla Springs, based on the AVA reports. However, this area has a more intermittent contribution to ground water flows to the springs, based on dye trace studies in the basin.

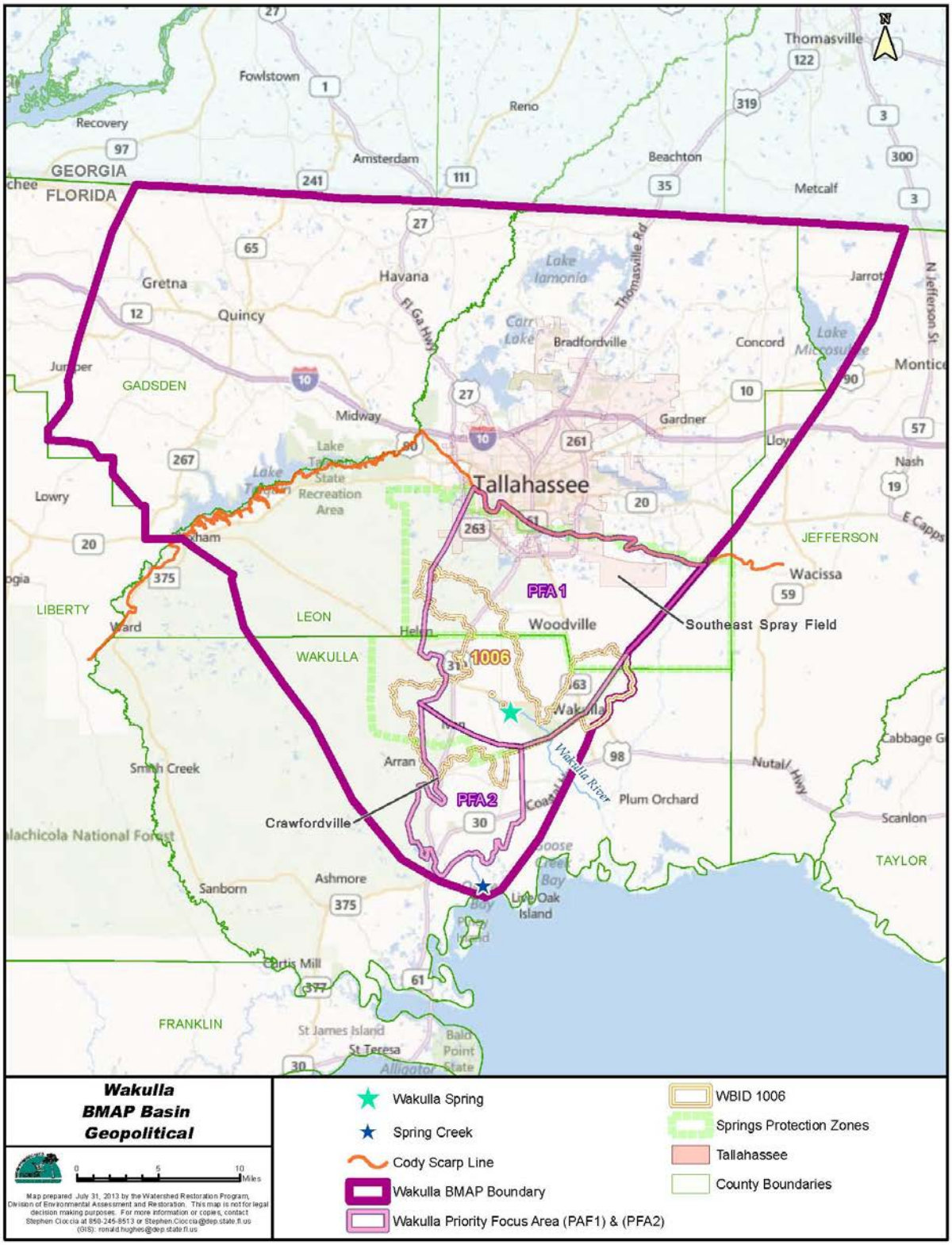

FIGURE 1: UPPER WAKULLA RIVER AND WAKULLA SPRINGS BASIN

1.3.2 STAKEHOLDER INVOLVEMENT

The BMAP process engages local stakeholders and promotes coordination and collaboration to address the nitrate reductions to achieve the Upper Wakulla River TMDL. The following stakeholders are responsible for load reductions and monitoring in the PFAs:

- Agriculture.
- City of Tallahassee.
- Florida Department of Agriculture and Consumer Services (FDACS).
- Florida Department of Environmental Protection, including Wakulla Springs State Park.
- Florida Department of Health (FDOH).
- FDOH in Wakulla County.
- Florida Department of Transportation (FDOT) District 3.
- Leon County.
- Leon County Health Department.
- Northwest Florida Water Management District (NWFWMD).
- Wakulla County.

In addition, the following entities are responsible for load reductions in the basin but outside the PFAs:

- City of Gretna.
- City of Midway.
- City of Quincy.
- Federal Correctional Institution, Tallahassee.

- Florida Agricultural and Mechanical University (FAMU).
- Florida State University (FSU).
- Gadsden County.
- Jefferson County.
- Tallahassee Community College (TCC).
- Talquin Electric Cooperative.
- Town of Havana.

In addition to the responsible stakeholders above, several other interested parties and entities participated in the Upper Wakulla River and Wakulla Springs BMAP meetings, as follows:

- 1000 Friends of Florida.
- Citizens.
- Florida Department of Economic Opportunity.
- Friends of Wakulla Springs.
- Wakulla Springs Alliance.

In January 2013, the department initiated the BMAP development process and held a series of technical meetings involving stakeholders and the general public. The purpose of these meetings was to consult with stakeholders to gather information about the basin and identify specific management strategies that would reduce nitrate loading. Technical meetings were used to gather information, identify potential sources, define management strategies currently under way or planned, and develop the BMAP contents and actions to reduce nitrate loading with the ultimate goal of achieving the TMDL. All technical meetings were open to the public and noticed in the *Florida Administrative Register (FAR)*. Technical meetings were held regularly throughout the BMAP development process on the following dates:

— January 18, 2013.

— February 22, 2013.

— March 28, 2013.

— April 18, 2013.

— May 16, 2013.

— June 25, 2013.

— August 15, 2013.

— September 19, 2013.

— October 31, 2013.

— August 21, 2014.

In addition to technical meetings, the department met with responsible stakeholders in one-on-one meetings to discuss different aspects of the BMAP, such as management strategies. Stakeholders were also encouraged to contact department staff via phone and email to participate in forming the plan. A public workshop on the BMAP was also held on August 31, 2015. The public workshop was noticed in the *Tallahassee Democrat*.

Except as specifically noted in subsequent sections, this BMAP document reflects the department's approach to achieving the TMDL based on its research and input from stakeholders, along with public input from workshops and meetings held to discuss key aspects of the TMDL and BMAP development.

1.3.3 BMAP APPROACH

The BMAP provides for phased implementation under Paragraph 403.067(7)(a)1, F.S. The management actions and adaptive management approach described in the BMAP will address nitrate reductions, and the process will continue until the TMDL target is attained. The phased BMAP approach allows for the implementation of management strategies designed to achieve incremental reductions, while simultaneously monitoring and conducting studies to better understand the water quality dynamics in the

basin. The total reductions to achieve the Upper Wakulla River TMDL will be addressed in five-year increments.

A nitrogen source inventory and loading tool (NSILT) was developed in support of the BMAP decision making process (**Section 3.3**). The NSILT was developed from an extensive review of literature on nitrogen sources and migration/transformation to the aquifer and eventually to the Upper Wakulla River and Wakulla Springs. The NSILT provides the best available assessment of where nitrogen is currently being applied in the BMAP area and is contributing to elevated nitrogen concentrations in the Upper Wakulla River and Wakulla Springs Basin. The NSILT is intended to assist stakeholders and the department in identifying locations where future projects will have the greatest impact in reducing nitrogen loads.

Since the TMDL assessment period, the largest sources of loading to the Upper Wakulla River and Wakulla Springs, which comprise the city of Tallahassee's wastewater treatment facility (WWTF) and Southeast Spray Field (SESF), have been upgraded to reduce nitrate concentrations applied to the land surface. Current data indicate that these upgrades have reduced total nitrogen (TN) loading to the SESF by 80 percent, or about 214,939 kilograms per year (kg/yr) (**Section 4.1.1** for more details). The Upper Wakulla River and Wakulla Springs Basin is a ground water–driven system, resulting in a lag time between nitrate reductions from management strategy implementation and a change in water quality in the river and springs. Therefore, further reductions in nitrate concentrations are expected in the river and springs due to the completed actions.

Given the progress in load reductions made to date, and the need for further monitoring to determine to what extent additional reductions are needed, this BMAP used a sufficiency-of-effort evaluation rather than detailed allocations to move forward with reductions in the first five-year iteration. It is not currently feasible to assign detailed allocations for nutrient loads to surface water and ground water in the PFAs. At present, the specific load reductions needed from management strategies benefiting the springshed were not calculated due to the complexities of fate and transport of pollutants in the springshed and the uncertainty associated with expected reductions from some measures.

Using information on sources in the basin (see **Section 3.1**), stakeholders in the PFAs were asked to submit management strategies to reduce nitrate loading from the sources they are responsible for managing. The department then compared the strategies provided with the sources in the PFAs to

evaluate whether each of the existing sources was sufficiently addressed for the first BMAP iteration and whether strategies were in place or would be put into place to reduce future nitrate sources. Where needed, the department requested additional details and strategies from the responsible stakeholders to ensure sufficiency for the first BMAP iteration.

Collectively, the management strategies included in the BMAP are sufficient to address nitrate loading in the PFAs to the Upper Wakulla River and Wakulla Springs Basin over the next five years. **Chapter 4** describes these strategies. Stakeholders outside the PFAs also provided management strategies, described in **Chapter 5**. After Year 4 of BMAP implementation, the department will evaluate available water quality data to determine progress towards the nitrate target. Discussions will then be held with responsible stakeholders to identify additional strategies for the next BMAP iteration, as needed.

1.3.4 Onsite Sewage Treatment and Disposal Systems (OSTDS) Initiative

With the major reductions made in WWTF loading in the basin, OSTDS presently contribute more nitrogen to ground water than all other source categories evaluated in the BMAP area. The department understands that the selection of management strategies to reduce OSTDS loads requires sufficient time for stakeholders to consult with local decision makers, plan implementation timelines, consider funding sources—especially state and federal grant funding—and budget available funds. To reduce this source of loading in the future, the department, along with FDOH, the city of Tallahassee, Leon County, Wakulla County, and other parties, will develop a comprehensive and sustainable plan with nitrogen-reducing projects that focus on OSTDS sources. This plan will be developed through the OSTDS Initiative.

The objective of the OSTDS Initiative is to identify effective, financially feasible strategies to reduce existing loading and prevent future nutrient loading from OSTDS sources. The department and stakeholders will identify options for addressing OSTDS loading, identify effective management and engineering strategies to reduce loading from OSTDS in the Upper Wakulla River and Springs Basin, establish education and outreach programs that provide area residents with information about OSTDS systems and their effect on Wakulla Springs, determine responsibilities and legal parameters, and identify funding sources and an implementation schedule for the management strategies and any facility construction.

The OSTDS Initiative will result in comprehensive and sustainable management and engineering strategies for nitrogen reduction from OSTDS for Leon County, Wakulla County, and the city of Tallahassee as applicable. These projects can be separate, shared, or implemented in collaboration with any combination of these jurisdictions.

1.3.4.1 General Direction for the OSTDS Initiative

The department will facilitate the organization of an advisory committee that will include representatives from FDOH, Leon County, Wakulla County, the city of Tallahassee, and other vested stakeholders such as homeowners, private utilities, and environmental or community groups, from the Wakulla Springs BMAP area. This advisory committee, which has no binding authority upon any individual entity, will be tasked with three main objectives, as follows, to meet the goal of developing and implementing management strategies necessary to reduce nutrient loading from OSTDS in a realistic time frame:

1. Identify, collect, and evaluate credible scientific information pertinent to the nutrient impact of OSTDS on Wakulla Springs.

2. Develop a public education plan that at a minimum provides area residents with reliable and understandable information about OSTDS systems and their effect on Wakulla Springs.

3. Develop an OSTDS plan that identifies cost-effective and financially feasible projects that target nutrient load reductions from OSTDS systems needed to implement the TMDL.

An initial technical meeting will be held within three months of BMAP adoption to present the methodology and geographic information system (GIS) data to prioritize areas where OSTDS pose the greatest risk based on the number of these systems in aggregate, soil drainage conditions, aquifer and surface water vulnerability, proximity to the spring, and ground water travel time

Within three years from the date of BMAP adoption, the advisory committee, in conjunction with the department, will finalize an OSTDS plan that identifies specific projects and schedules to achieve nutrient load reductions. The plan will be adopted as part of the BMAP and will be consistent with BMAP obligations required in a National Pollutant Discharge Elimination System (NPDES) municipal

separate storm sewer system (MS4) permit. The advisory committee may consider as necessary the following components in order to achieve the load reductions:

- The inventory and geographic distribution of OSTDS in the priority areas, including Leon County's Primary Springshed Protection Zone and Wakulla County's Primary Springshed Protection Zone. Existing systems and areas where future growth is expected should be included.

- Existing and planned wastewater treatment and collection facilities, including the parcels currently being served and existing and design capacities.

- The nutrient reductions from OSTDS necessary to achieve the TMDL.

- Projects that are in process, shovel-ready prior to the end of this first five-year BMAP cycle, and in priority geographic areas. A list of these projects and management strategies, including a schedule for implementation, will be submitted to the department and as appropriate, incorporated into the OSTDS plan.

- Reduction goals may be achieved in multiple ways, including the connection of existing OSTDS to central WWTFs, the use of cluster systems, educational strategies, requirements for new development to be served by central wastewater service, the adoption of technologies recommended by FDOH's Nitrogen Reduction Study, or other strategies that may be appropriate. The strategies will be prioritized based on their effectiveness and feasibility, taking into account the financial needs of local service providers and impacts on homeowners.

- Projects in any long-range capital plans, including consideration of wastewater management or facilities plan(s).

The timing of the implementation of plan components may change depending on legislative direction, state and local funding, and the potential use of the Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States (RESTORE) Act. This plan will be reviewed and updated annually to include flexibility to substitute projects due to funding availability.

1.3.5 POLLUTANT REDUCTION AND DISCHARGE ALLOCATIONS

1.3.5.1 Categories for Rule Allocations

The rules adopting TMDLs must establish reasonable and equitable allocations that will alone, or in conjunction with other management and restoration activities, attain the TMDLs. Allocations may be to individual sources, source categories, or basins that discharge to the impaired waterbody. The allocations in rule identify either how much pollutant discharge each source designation may continue to contribute (discharge allocation), or the load or percentage of its loading the source designation must reduce (reduction allocation). Currently, the TMDL allocation categories are as follows:

- **Wasteload Allocation (WLA)** is the allocation to point sources permitted under the NPDES Program. It includes the following:
  - Wastewater Allocation is the discharge allocation to industrial and domestic WWTFs.
  - NPDES Stormwater Allocation is the allocation to NPDES stormwater permittees that operate MS4s. These permittees are treated as point sources under the TMDL Program.
- **Load Allocation (LA)** is the allocation to nonpoint sources, including agricultural runoff and stormwater from areas that are not included in an MS4 permit.

The TMDL did not specify WLAs to NPDES WWTFs or MS4s because there are no WWTFs and MS4s with discharges into the Upper Wakulla River WBID (Department 2012a). However, this BMAP includes WWTFs and MS4s discharges in the Upper Wakulla River and Wakulla Springs Basin.

1.3.5.2 Allocations Implemented by the BMAP

The FWRA, Section 403.067, F.S., states that the BMAP must equitably allocate pollutant reductions to individual basins, as a whole to all basins, or to each identified point source or category of nonpoint sources, as appropriate. Allocations are determined based on a number of factors listed in the FWRA, including cost-benefit, technical and environmental feasibility, implementation time frames, and others. The adopted TMDL (see **Section 1.3.6**) sets the allocations, as a percent reduction, to the nonpoint source category (LA) to achieve the target concentration of 0.35 mg/L of nitrate + nitrite in the Upper Wakulla River. This BMAP implements the TMDL allocations for the nonpoint sources by assigning the TMDL target as a whole to all basins. However, the BMAP initially focuses on achieving the

TMDL target in the PFAs, and includes more stringent nitrogen limitations for WWTFs that discharge to land surface infiltration and contribute nitrogen loading to ground water in PFA1. More detailed allocations may be developed, if needed, for the next BMAP iteration.

The main sources of loading to the Upper Wakulla River come from the surrounding springshed, and the 0.35 mg/L nitrate + nitrite target concentration is also the criterion for springs. Therefore, the reductions associated with the strategies in this BMAP will improve the quality of both the Upper Wakulla River and Wakulla Springs.

1.3.6 Upper Wakulla River TMDL

The department adopted the *Nutrient (Biology) TMDL for the Upper Wakulla River (WBID 1006)* in March 2012 through Rule 62-304.300(2), F.A.C. (see **Appendix B**). The department determined that the Upper Wakulla River (WBID 1006) was impaired by nitrate based on Stream Condition Index (SCI) surveys that indicated healthy biological community conditions in only seven of 27 sampling events. The biological community in the river is affected by excessive algal mats that were linked to elevated nitrate concentrations from anthropogenic sources (Department 2012a). The TMDL defined the nitrate target as composed of both nitrate and nitrite as nitrogen. **Table 3** lists the TMDL and pollutant load allocations adopted by rule for the Upper Wakulla River.

TABLE 3: UPPER WAKULLA RIVER TMDL

[1] There are no NPDES wastewater facilities that discharge directly into the Upper Wakulla River.
[2] Not applicable; none of the NPDES MS4s discharges directly into the Upper Wakulla River.

WBID	PARAMETER	TMDL (MG/L)	TMDL % REDUCTION	WLA FOR WASTEWATER	WLA FOR NPDES STORMWATER (% REDUCTION)	LA (% REDUCTION)
1006	Nitrate, as monthly average	0.35	56.2%	N/A[1]	N/A[2]	56.2%

1.4 ASSUMPTIONS AND CONSIDERATIONS REGARDING TMDL IMPLEMENTATION

The water quality impacts of BMAP implementation are based on several fundamental assumptions about the pollutant targeted by the TMDL, waterbody response, and natural processes. In addition, there are important considerations about the nature of the BMAP and its long-term implementation. These assumptions and considerations are discussed below.

1.4.1 Assumptions

The following assumptions were used during the BMAP process:

— Reductions in nitrate concentrations in the Upper Wakulla River and Wakulla Springs will result in improved biological communities, including a reduction in the amount of algae present in the river.

— The largest source of nitrate loading to the Upper Wakulla River is through Wakulla Springs. Therefore, management strategies that reduce nitrate loading to ground water were the priority for this BMAP iteration, including more stringent nitrogen limitations for WWTFs that discharge to land surface infiltration and contribute nitrogen loading to ground water in PFA1.

— The scope of the TMDL did not include the adjacent Wakulla Springs vent area (WBID 1006X), and therefore these waters are not applicable for determining achievement of the restoration targets. Although the TMDL did not include the upstream Wakulla Springs vent area, the BMAP incorporates Wakulla Springs and its contributing springshed in the BMAP area. This is based on the integral role of the springshed as the primary source of water inflow to the Upper Wakulla River.

— The BMAP focuses on reductions and management strategies in two PFAs. The PFAs were identified using best available information on the most vulnerable aquifer areas and ground water pathways to determine where management strategies would be most beneficial to improving water quality in the Upper Wakulla River and Wakulla Springs. Pollutant loads contributed in the PFAs are considered to result in the largest magnitude and most immediate impacts to the Upper Wakulla River. In future iterations, the PFAs may be refined using the latest data. The areas of the basin outside the PFAs also contribute loading to the river and springs, but to a much lesser magnitude than the areas in the PFAs. Depending on water quality changes in the Upper Wakulla River and Wakulla Springs, additional management strategies in the area outside the PFAs may be required in future BMAP iterations.

1.4.2 CONSIDERATIONS

This BMAP requires that all stakeholders in the basin implement the management strategies set forth in this document within the first five-year BMAP cycle. However, the full attainment of the TMDL target will be a long-term process. In evaluating the need for future projects from individual entities, the

department will take into consideration past reduction efforts from particular sources. While many of the projects and activities contained in the BMAP are recently completed or currently ongoing, many projects will require time to design, secure funding, and construct. However, funding was considered, to the extent practicable, when determining the schedule for meeting BMAP requirements. Although strategic funding can be problematic, funding limitations do not affect the requirement that each entity in the PFAs must implement the management strategies listed in the BMAP in order to cumulatively achieve water quality standards.

However, the full implementation of this BMAP will be a long-term process, adaptively managed in five-year cycles. Since BMAP implementation is a long-term process, the TMDL established for the basin will likely not be achieved in the first five-year iteration. It is understood that waterbodies can respond differently to the reduced concentrations and loading. Regular follow-up and continued coordination and communication by stakeholders will be essential to ensure the implementation of management strategies and assessment of effects. Additional management strategies required to achieve the TMDL will, if necessary, be developed as part of the second BMAP iteration. During the BMAP process, the following items were identified that could be addressed in future watershed management cycles to ensure that future BMAPs use the most accurate information:

- **Water Quality Standards** – Since the department adopted the Upper Wakulla River TMDL, numeric nutrient criteria (NNC) were established for both streams and springs. For future evaluations to determine whether the Upper Wakulla River and Wakulla Springs Basin is meeting water quality standards, the department will use these NNC. The BMAP monitoring plan (see **Section 6.3**) was designed to collect the data necessary for these new evaluations. These standards require both the TMDL target nitrate concentration and a healthy biological community to be attained to meet the TMDL. If the nutrient target has been achieved but the biological community is not responding, the Upper Wakulla River would still be considered impaired. The department would then have to determine if the nitrate target should be modified or if another factor is causing the impairment.

- **Basin Boundary** – The BMAP basin boundary was determined using information from studies in the basin that delineated boundaries based on potentiometric surface data,

water level measurements, and dye trace studies. The available boundaries were compiled by the department, and the BMAP basin boundary was identified with input from stakeholders. In future iterations of the BMAP, the basin boundaries may be modified based on new evidence and better science.

— **Georgia Sources** – The BMAP focuses on the Upper Wakulla River and Wakulla Springs Basin in Florida, as the department only has authority to address nutrient loading in the state. However, a portion of the Wakulla Springs springshed extends into Georgia. Available data indicate that the largest nutrient loading sources reaching the Upper Wakulla River and Wakulla Springs are in Florida. However, if significant sources in Georgia are identified, addressing these sources should be considered in the next BMAP iteration. Leon County has already begun efforts to address some of the nutrient loading from Georgia, as summarized in **Table 4**.

TABLE 4: LEON COUNTY STRATEGIES TO ADDRESS SOURCES IN GEORGIA

NAME	DESCRIPTION	COMPLETION DATE	STATUS
Cities of Thomasville and Moultrie	Based on proactive challenges by Leon County with Georgia Environmental Protection Division, the cities of Thomasville and Moultrie were required to conduct water quality monitoring and upgrades when their plants are expanded.	April 2007	Completed
City of Cairo	Based on proactive challenges by Leon County with Georgia Environmental Protection Division, Cairo closed its sewage land application and built a new treatment facility with additional capacity and capabilities to reduce nitrogen and fecal coliform discharge levels to the Ochlocknee River.	2005	Completed
BASF Corporation Plant in Attapulgus	Leon County is challenging the renewal of the plant's permit to prevent the direct discharge of approximately one million pounds of nitrate per year into the Little River, which flows to Lake Talquin.	Expected by 2018	Ongoing

— **OSTDS** – Based on evaluations of loading in the basin, OSTDS is now the largest contributor of nitrate in the Upper Wakulla River and Wakulla Springs Basin (see **Section 1.3.4**. However, the management strategies to address OSTDS that can be implemented at this time are limited. FDOH is currently conducting a multiyear study to determine the best systems to attenuate nitrate loading. This study is anticipated to be completed in January 2016, and the study results will then be brought to the Legislature for consideration. The results of the study will help to guide OSTDS

management strategies in the basin. In the meantime, the department will work with responsible local stakeholders and FDOH in the OSTDS Initiative (see **Section 1.3.4**) to identify appropriate management strategies and funding sources to address OSTDS loading.

- **Authority To Address OSTDS –** To successfully implement the strategies that will be identified through the OSTDS Initiative, some stakeholders have expressed a need for the authority for local governments to address OSTDS loading, and this authority will need to come from the Florida Legislature. Any rules initiated by stakeholders cannot be less stringent than any state rules for OSTDS. During the first BMAP iteration, proposed legislation may be drafted by local stakeholders, in collaboration with interested parties, such as the Wakulla Springs Alliance.

- **Lake Swallets** –Several lakes in the basin have known sinkholes that drain to ground water. In the next BMAP iteration, if data are available, the nitrate loads from these lakes could be considered and management strategies to address the loading identified, as needed.

- **Management Strategy Implementation** – The department will consider the management strategies listed in this BMAP and the associated nitrogen reductions in the next BMAP iteration when identifying the additional load reductions required to meet the TMDL and which sources should implement strategies to achieve the necessary reductions.

- **Increases in Wastewater Volume in the PFAs –** Through future development and the connection of OSTDS to central wastewater treatment systems, the amount of treated wastewater discharged in the PFAs may increase. The department will evaluate if there is a net increase in treated wastewater discharge in the PFAs as part of the OSTDS Initiative, and determine if additional strategies are needed to address any additional wastewater loading for the second BMAP iteration.

1.5 FUTURE GROWTH IN THE WATERSHED

The FWRA requires BMAPs to "identify the mechanisms by which potential future increases in pollutant loading will be addressed." Since the TMDL reductions are based on decreasing loads from past development, it is important that loads from new development are well controlled. Although future development may meet state and local standards, the development may still add nutrient loading to the Upper Wakulla River and Wakulla Springs Basin. To ensure that future growth does not add to the degradation of these waterbodies, local governments must be proactive in controlling loads from future growth.

This BMAP relies on strategies from stakeholders that help to minimize loading from future sources. The city of Tallahassee and Leon County have enacted ordinances to establish a Primary Springs Protection Zone (PSPZ) that reduces development in the urban fringe in the PSPZ and allows development in the urban area only to the extent permitted by the future land use map. Wakulla County has a similar ordinance that establishes the Wakulla Springs Special Planning Area (see **Figure 2**). Wakulla County has a comprehensive plan policy that requires advanced wastewater treatment (AWT) (3 mg/L for TN) for any WWTF or spray field located in the special planning area. Leon County has proposed an amendment to its code to require AWT in the PSPZ for any WWTF.

The city of Tallahassee, Leon County, and Wakulla County each have fertilizer use ordinances. Tallahassee and Leon County have existing education and outreach programs to educate the public about fertilizer use, and Wakulla County will add public outreach activities. The city of Tallahassee and Leon County also have pet waste management ordinances to help reduce impacts from pet waste in the basin. Leon County adopted countywide land development regulations, which include the city of Tallahassee, that exceed state stormwater standards, and the county is also planning to create a low-impact development (LDI) ordinance to further address loads from new development. Wakulla County has comprehensive land use policies for certain future developments in the county, such as the Northeast Wakulla Sustainable Community, tjat require higher stormwater treatment levels and a no net increase in nutrients. FDOT has a program to avoid mapped karst caves when constructing stormwater treatment ponds that will help to reduce loading to ground water from future projects. Wakulla Springs State Park also has educational and outreach programs to educate the public about the importance of the river and springs.

In addition to the items that will be developed through the OSTDS Initiative (see **Section 1.3.4**), Leon County has proposed an effort to sewer in the PSPZ, if funding becomes available. Leon County is also proposing to modify its code for OSTDS, as needed, based on the results of the FDOH study. Wakulla County has an adopted Comprehensive Plan policy requiring advanced nitrogen reducing onsite systems on parcels of certain sizes. Wakulla County is also proposing to sewer three historical neighborhoods, if funding becomes available, removing approximately 2,251 OSTDS that could occur through future development, in addition to the 1,330 OSTDS already in use.

The strategies listed above would help to reduce nitrate loading from future development for a variety of sources. The sufficiency of this BMAP relies on these management strategies.

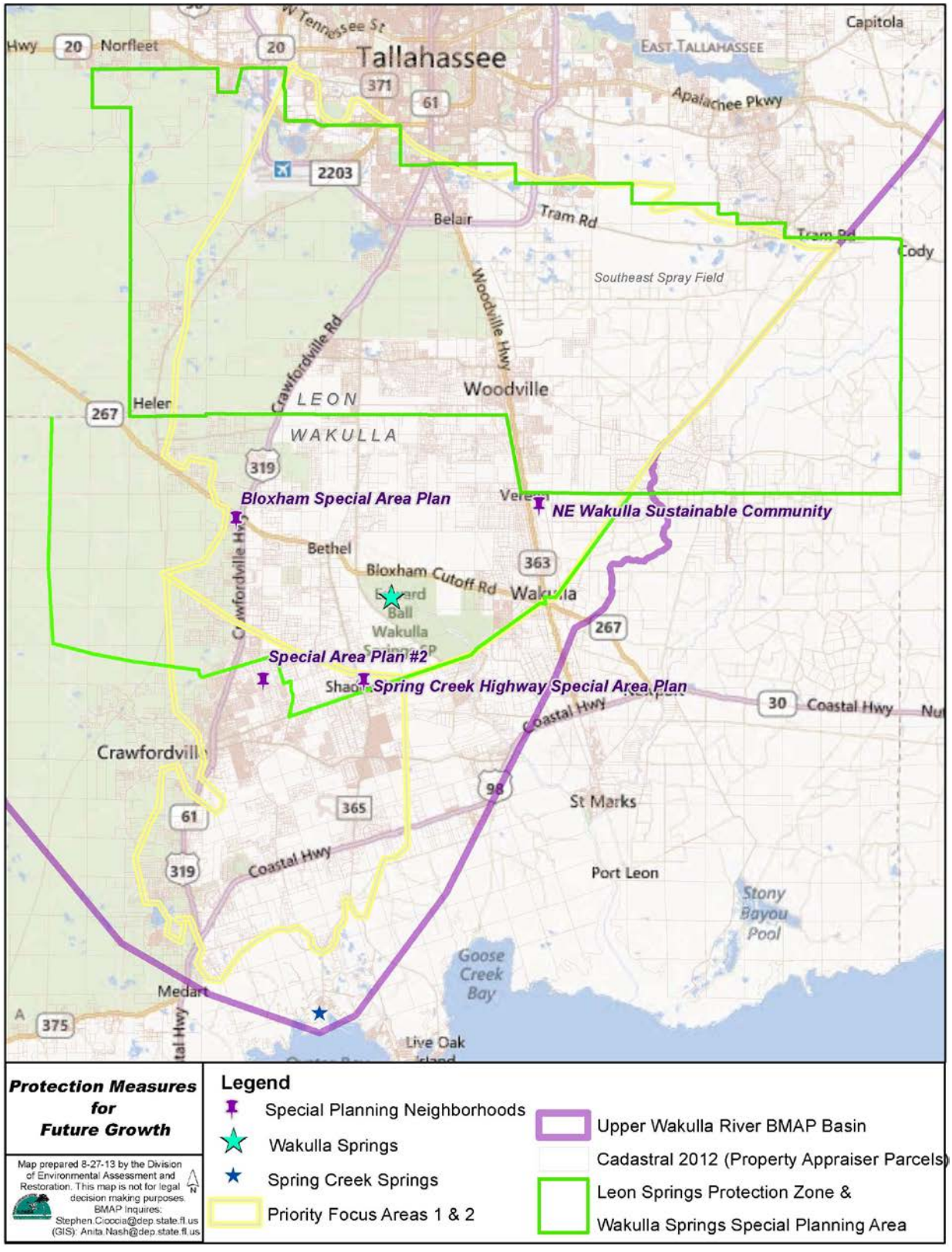

FIGURE 2: PROTECTION MEASURES FOR FUTURE GROWTH

Chapter 2: UPPER WAKULLA RIVER AND WAKULLA SPRINGS BASIN SETTING

2.1 LAND USE COVERAGE

Land cover categories for the Upper Wakulla River and Wakulla Springs Basin were aggregated using the simplified Level 1 codes, shown in **Table 5**. Natural lands including upland nonforested, upland forests, water, and wetlands make up 84.1 percent of the acreage in the basin. Urban land uses including urban and built-up; barren land; and transportation, communication, and utilities makes up 9.1 percent of the basin. The remaining 6.7 percent is agricultural land uses. **Figure 3** shows the distribution of land uses in the Upper Wakulla River and Wakulla Springs Basin.

TABLE 5: 2009 LAND COVER IN THE UPPER WAKULLA RIVER AND WAKULLA SPRINGS BASIN

- = Empty cell/no data

LEVEL 1 LAND COVER CODE	LAND COVER DESCRIPTION	ACRES	% TOTAL
1000	Urban and Built-Up	66,045.7	7.8%
2000	Agriculture	57,105.6	6.7%
3000	Upland Nonforested	51,270.2	6.0%
4000	Upland Forests	449,521.9	53.0%
5000	Water	19,838.5	2.3%
6000	Wetlands	193,613.0	22.8%
7000	Barren Land	806.5	0.1%
8000	Transportation, Communication, and Utilities	10,255.2	1.2%
-	**TOTAL**	**848,456.6**	**100.0%**

In PFA1, 88.8 percent of the area is natural lands, 7.9 percent is urban lands, and 3.4 percent is agricultural lands, as shown in **Table 6**.

TABLE 6: 2009 LAND COVER IN PFA1

- = Empty cell/no data

LEVEL 1 LAND COVER CODE	LAND COVER DESCRIPTION	ACRES	% TOTAL
1000	Urban and Built-Up	5,435.0	5.3%
2000	Agriculture	3,508.6	3.4%
3000	Upland Nonforested	9,294.4	9.0%
4000	Upland Forests	73,194.9	70.8%
5000	Water	918.9	0.9%
6000	Wetlands	8,318.7	8.1%
7000	Barren Land	179.9	0.2%
8000	Transportation, Communication, and Utilities	2,476.9	2.4%
-	**TOTAL**	**103,327.3**	**100.0%**

In PFA2, 77.6 percent of the area is natural lands, 15.3 percent is urban lands, and 7.0 percent is agricultural lands, as shown in **Table 7**.

TABLE 7: 2009 LAND COVER IN PFA2

- = Empty cell/no data

LEVEL 1 LAND COVER CODE	LAND COVER DESCRIPTION	ACRES	% TOTAL
1000	Urban and Built-Up	4,285.7	14.4%
2000	Agriculture	2,095.9	7.0%
3000	Upland Nonforested	2,477.1	8.3%
4000	Upland Forests	17,510.1	58.9%
5000	Water	161.1	0.5%
6000	Wetlands	2,956.2	9.9%
7000	Barren Land	47.3	0.2%
8000	Transportation, Communication, and Utilities	207.6	0.7%
-	**TOTAL**	**29,741.0**	**100.0%**

For the portion of the basin outside the PFAs, 83.8 percent is natural lands, 9.1 percent is urban lands, and 7.2 percent is agricultural lands, as shown in **Table 8**.

TABLE 8: 2009 LAND COVER IN THE BASIN OUTSIDE THE PFAS

- = Empty cell/no data

LEVEL 1 LAND COVER CODE	LAND COVER DESCRIPTION	ACRES	% TOTAL
1000	Urban and Built-Up	56,325.0	7.9%
2000	Agriculture	51,501.1	7.2%
3000	Upland Nonforested	39,498.7	5.5%
4000	Upland Forests	358,816.9	50.2%
5000	Water	18,758.5	2.6%
6000	Wetlands	182,338.1	25.5%
7000	Barren Land	579.3	0.1%
8000	Transportation, Communication, and Utilities	7,570.7	1.1%
-	**TOTAL**	**715,388.3**	**100.0%**

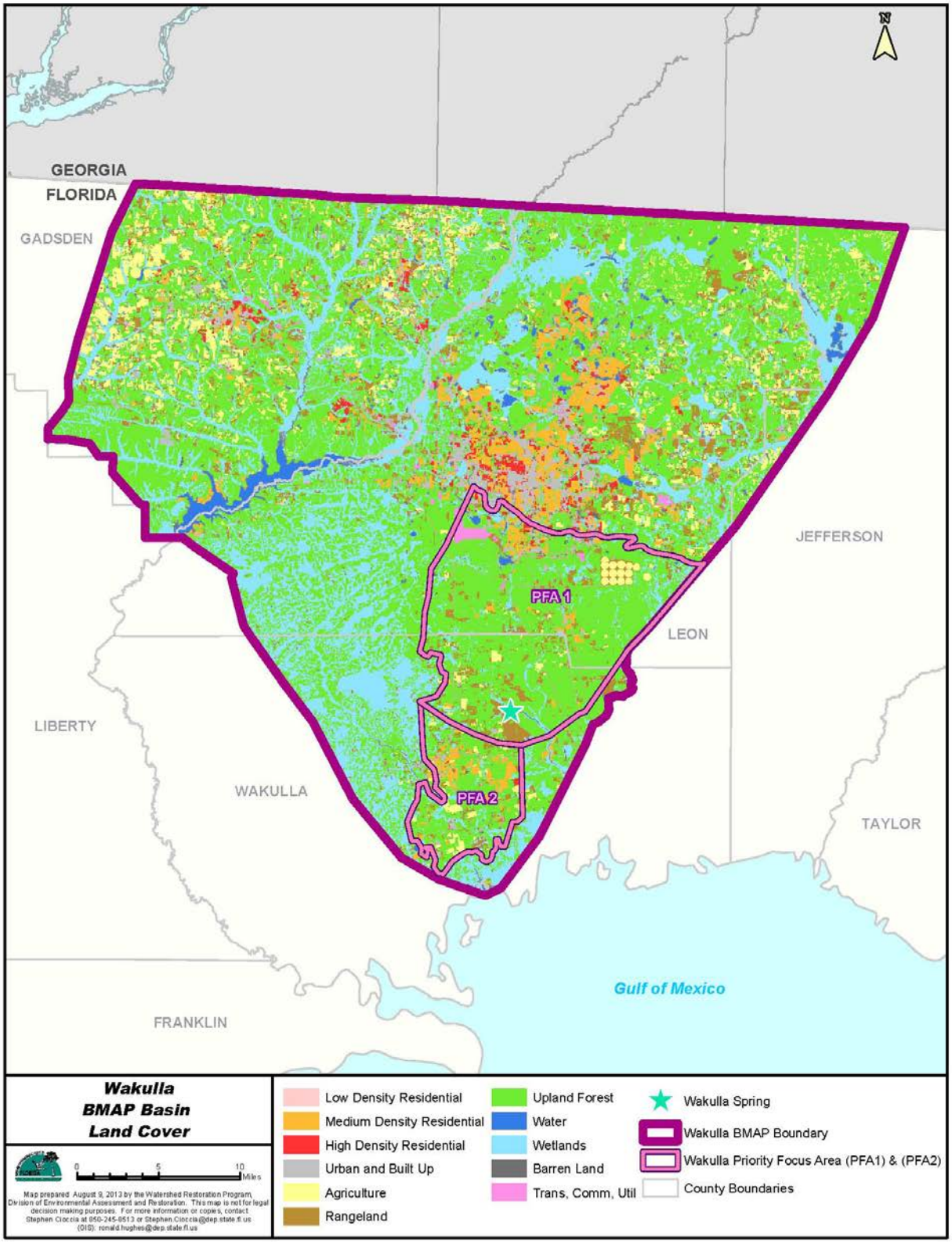

FIGURE 3: 2004 LAND COVER IN THE UPPER WAKULLA RIVER AND WAKULLA SPRINGS BASIN

2.2 HYDROLOGY

In the Wakulla springshed, ground water occurs primarily in the Floridan aquifer, a vast carbonate aquifer system that is present throughout virtually all of Florida, as well as southern parts of Alabama and Georgia. The Floridan is the source of water for potable supply, irrigation, and industrial uses throughout most of the region. Wakulla Springs, located in the Ocala Karst District of the Woodville Karst Plain, is the primary source of the Wakulla River. In the Wakulla River watershed, the Cody Scarp generally separates the semiconfined and unconfined geologic areas. In the northernmost portion of the Wakulla springshed, the Floridan aquifer is confined by a thick overburden of sediment and/or clay that helps to protect against contamination. Moving southward, breaches are present in the confining layer, mainly sinkholes, which provide pathways for recharge and the introduction of contaminants. The unconfined or poorly confined regions of the Floridan aquifer (regions with less than 25 feet of sediment cover) extend slightly north of the Cody Scarp into the southern part of the city of Tallahassee urban area and southward towards the Gulf Coast.

This southern portion of the springshed is situated in the Woodville Karst Plain, which is part of the Gulf Coastal Lowland physiographic region. It extends from the southern edge of the city of Tallahassee to the Gulf of Mexico, in southeastern Leon County and eastern Wakulla County. Its northern border, the Cody Scarp, formed about 100,000 years when ocean levels rose. Capped by less than 20 feet of quartz sands, the Woodville Karst Plain gently slopes toward the Gulf. The porous sands allow water to move rapidly to the underlying soluble carbonates (limestone) that are present at or near the land surface, recharging the Floridan aquifer in the area. Over time, this acidic water has dissolved the limestone, resulting in karst terrain characterized by abundant springs, sinks, sinking streams, karst windows (collapsed segments of underground streams), swallets (caves or holes that swallow a stream), and dolines (collapsed caves), in addition to a well-developed system of tunnels or conduits.

These features result in areas where ground water has direct access from the surface (via sinkholes) and surface waters whose pathways often flow beneath the sand and limestone surface layer (sinking streams), merging with ground water. The karst subsurface is also characterized by expansive areas of extremely porous formations, due to this limestone surface layer dissolution. This results in a large and extensive cave system and tunnel/conduit network that provides direct pathways and allows short travel times for surface runoff through ground water to the spring vent at the headwaters of the Wakulla River (Peer Review Committee 2005). As reported by Kincaid (2010), the efforts of numerous underwater

cave explorers and scientists have identified a complex system of ground water conduits that interconnects many of the sinking streams in the watershed, as well as the city of Tallahassee SESF, to the Wakulla River and Wakulla Springs. The BMAP PFAs represent the areas in the basin where the aquifer is most vulnerable to pollutant inputs, where ground water travels fastest, and where there is a known connectivity between ground water pathways and Wakulla Springs (see **Section 1.3.1.1**).

The Floridan aquifer generally flows in a southerly direction under the watershed to outflow from Wakulla Springs, Spring Creek Springs, the Lower St. Marks River, and the Gulf of Mexico. Ground water flow is increased by contributions from local rainfall and sinking streams. Data from potentiometric maps indicate that the steepest hydraulic gradient is just below the Cody Scarp and slowly declines towards the Gulf of Mexico. Wakulla Springs sits in the center of a zone of high hydraulic movement with lowered potentiometric surface that funnels water to Wakulla Springs. Therefore, small increases in the local hydraulic head resulting from short-term, intensive rainfall events should result in a significant increase in spring discharge.

Observations of unusually high and low tides in Wakulla Springs along with tracer tests led to the conclusion that flow from the Spring Creek Springs Group can travel either to Spring Creek Springs or to Wakulla Springs, depending on the hydraulic conditions at either site. Therefore, when the water level at Spring Creek Springs is higher than the level at Wakulla Springs (as observed during an abnormally high tide), the Spring Creek Springs Group will flow to Wakulla Springs. When the reverse is true (as observed during an abnormally low tide), Spring Creek Springs will receive the flow. During more neutral conditions, the flow splits between the two outlets. A variety of other factors, such as vegetation restricting flow in the Wakulla River and saltwater intrusion can create fluctuations in the relative water levels of the two springs, in turn affecting the fraction of the Springs Creek Springs Group discharge that flows to Wakulla Springs (Davis *et al.* 2010). The two-phased nature of the spring discharge volume and the area from which the water is drawn makes it difficult to determine nitrate loading from different sources in the basin.

Springs provide the majority of the flow in the Wakulla River. The river is about nine miles long, starting near Camp Indian Springs and joining the St. Marks River near Fort San Marcos. Major centers of population in the basin include the city of Tallahassee, Woodville, and Crawfordville. The Wakulla River from Wakulla Springs downstream is tidally affected. The potential for saltwater intrusion into

the ground water system exists, as the Floridan aquifer is directly connected to the Gulf of Mexico (Department 2012a).

2.3 WATER QUALITY AND BIOLOGICAL COMMUNITY TRENDS

The Upper Wakulla River was found to be impaired based on failing SCI scores between February 2000 and May 2007. The poor biological community scores were due to the fact that sensitive taxa were affected by the smothering of substrate by hydrilla, occasional low dissolved oxygen (DO), and slightly elevated conductivity. The water quality data collected during this time indicated that ammonia levels (mostly below detection) and phosphorus levels (averaging 0.03 mg/L) generally represented excellent conditions, while nitrate concentrations were elevated from anthropogenic sources. Therefore, the Upper Wakulla River was found to be impaired for nitrates, as evidenced by an aquatic biological community impacted by excessive hydrilla growth and algal mats (Department 2012a).

The highest nitrate concentration is found at the spring vent, and the nitrate concentration decreases as the water moves downriver (see **Figure 4**). When comparing the data from the TMDL verified period (2000–07) with more recent data (2008–15), nitrate concentrations at the vent are declining. In the ground water caves and tunnels that feed Wakulla Spring, nitrate concentrations were higher in B- and C-Tunnels than in the Main Tunnel, indicating that other sources of flow to the springs are diluting the concentrations observed at the spring vent (see **Figure 5**). The data from K-Tunnel (see the location in **Figure 6**) indicate lower nitrate levels; this tunnel may be diluting flows from the other tunnels. B-, C-, D-, and K-Tunnels continue to show mean nitrate + nitrite concentrations above the target concentration of 0.35 mg/L. B-, C-, and D-Tunnels are the major contributors (see **Figure 5**), with the highest mean nitrate concentration in B-Tunnel. These tunnels bring contributing flows from the SESF and Ames Sink to the Upper Wakulla River and Wakulla Springs. However, there are declining trends in nitrate concentrations in B-, C-, and D-Tunnels. (Department 2013d). The K-Tunnel nitrate concentrations reached levels below the target concentration of 0.35 mg/L in 2014 and early 2015 (see **Figure 5**). **Figure 7** shows the contributing area to Wakulla Springs in Florida.

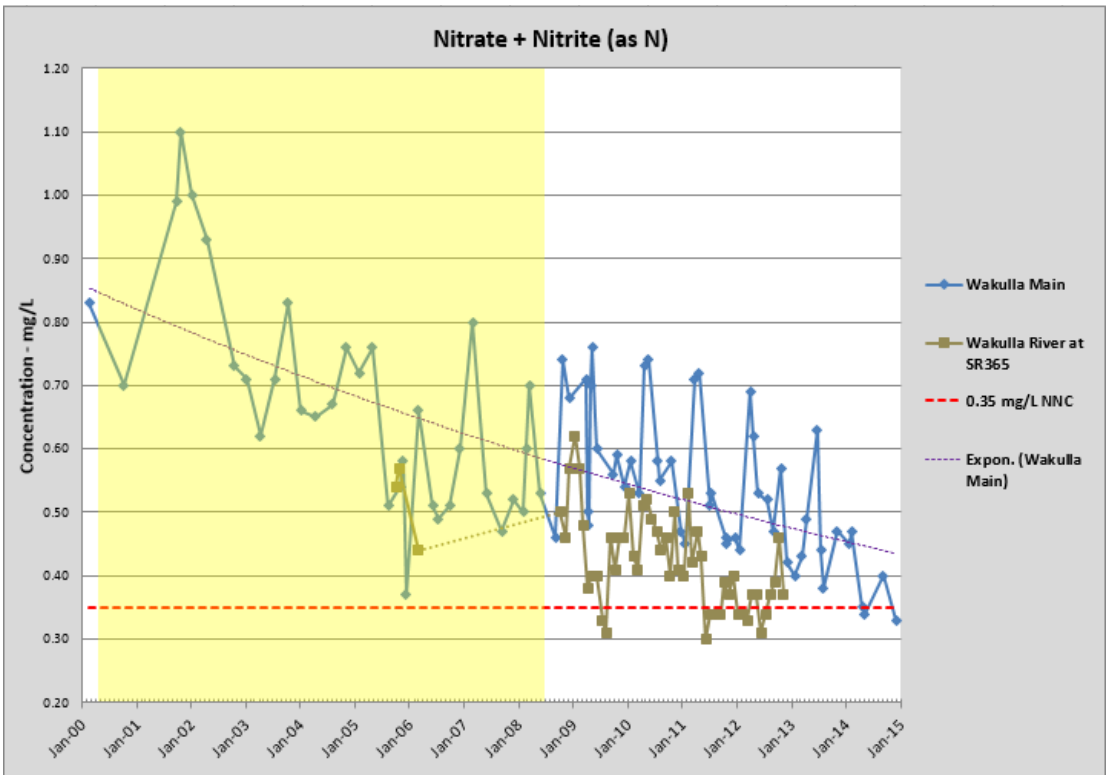

FIGURE 4: NITRATE-NITRITE WATER QUALITY TRENDS IN THE WAKULLA RIVER AND WAKULLA SPRING VENT

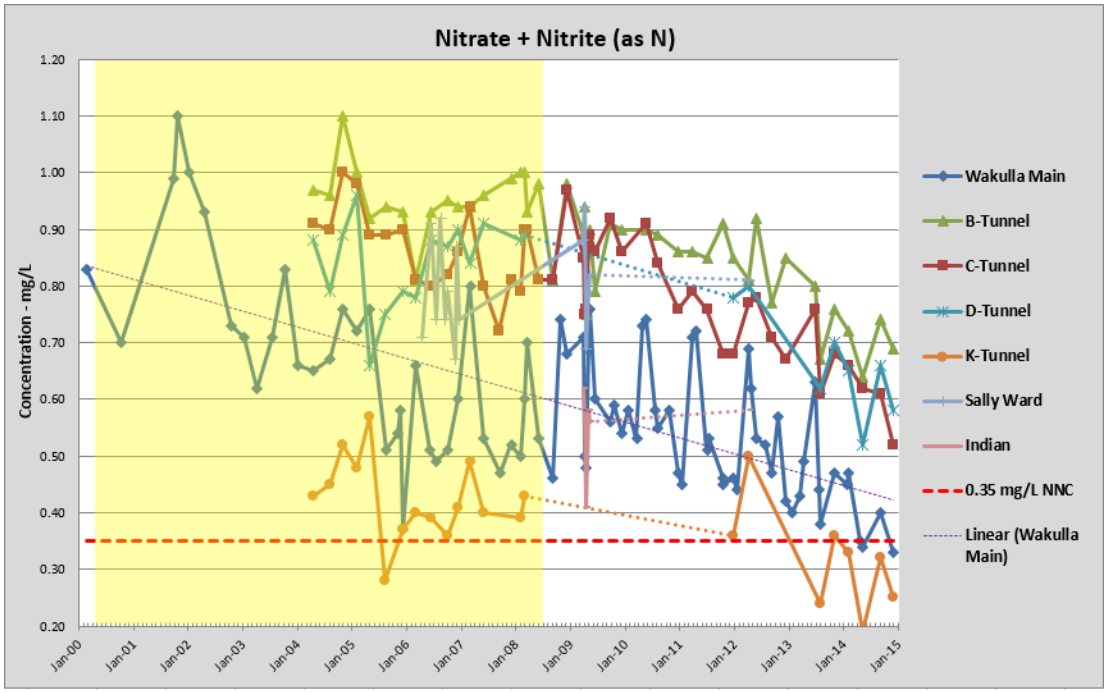

FIGURE 5: NITRATE-NITRITE WATER QUALITY TRENDS IN THE WAKULLA SPRINGS TUNNELS

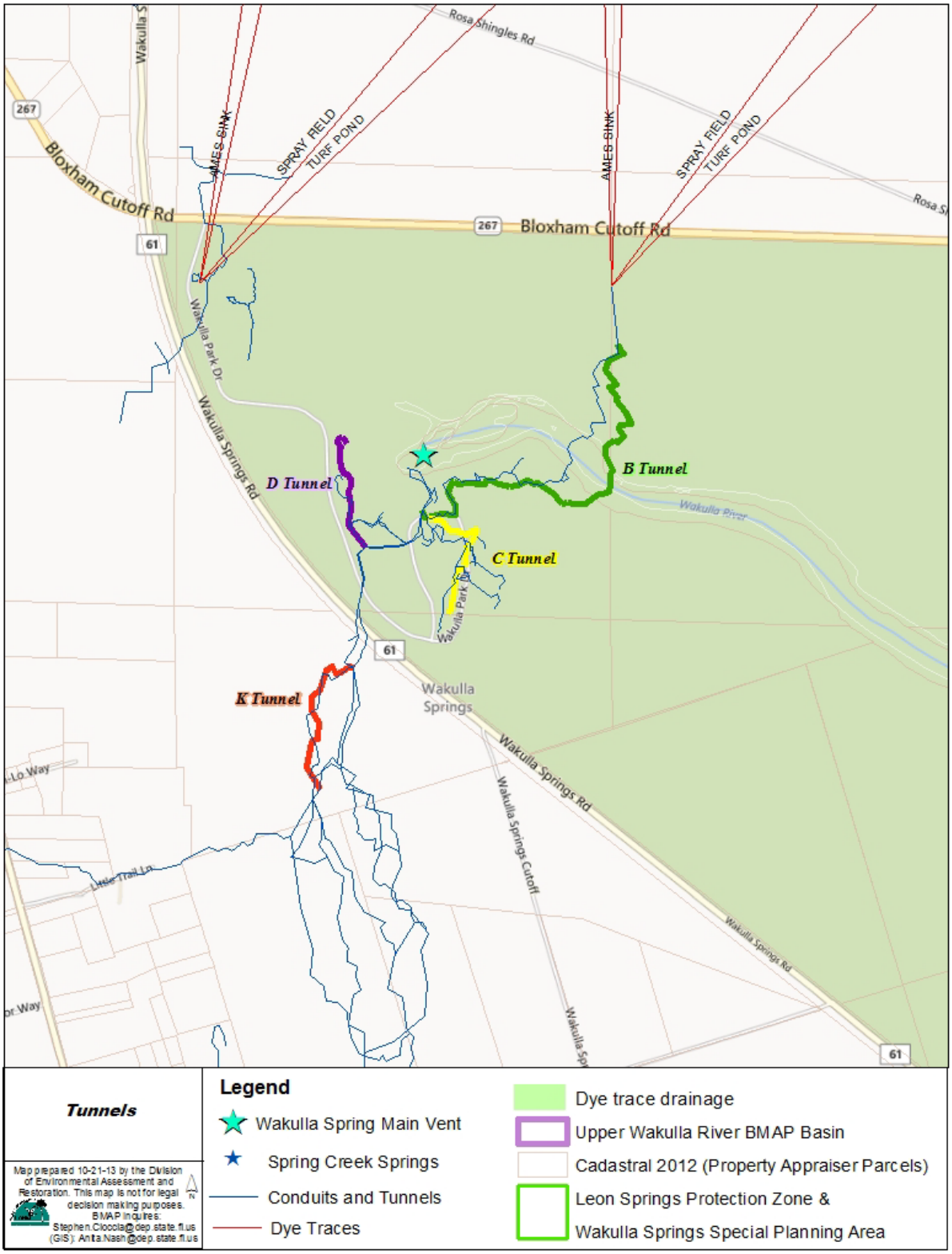

FIGURE 6: LOCATIONS OF THE MAIN WAKULLA SPRINGS TUNNELS

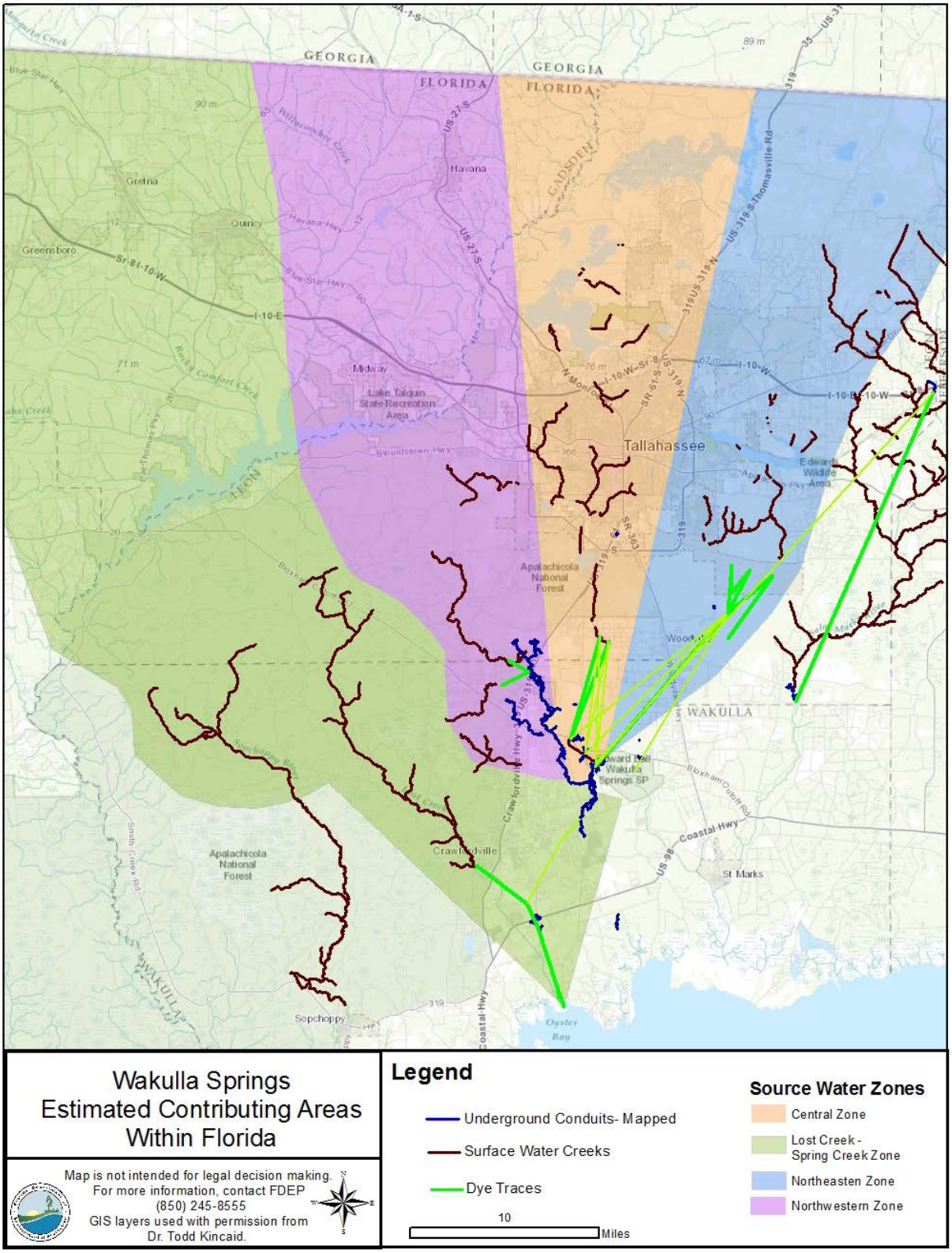

FIGURE 7: ESTIMATED CONTRIBUTING AREAS TO WAKULLA SPRINGS

The SCI is a biological assessment procedure that measures the degree to which flowing fresh waters support a healthy, well-balanced biological community, as indicated by benthic macroinvertebrates. A balanced faunal community is achieved if the average score of at least two temporally independent SCIs is 40 or higher, with neither of the two most recent SCI scores less than 35.

The 2004 SCI score in the Upper Wakulla River was categorized as "very poor." In 2007, the SCI score was "poor." Thus, while there seems to be a slight improving trend in biological conditions, the overall quality is still poor. In April 2012, a Rapid Periphyton Survey (RPS) conducted in the Upper Wakulla River found that 75 percent of the points assessed ranked higher than four for algal coverage, indicating visible filamentous algae. Additional samples are needed to confirm the results of this survey. An RPS sample from below Highway 98, collected in April 2012, showed that 40 percent of the points assessed had a rank of four or higher, indicating visible filamentous algae (Department 2013b); however, this site is located in the extreme downstream portion of the Wakulla River.

Figure 8 shows the SCI results collected at the upstream station at the Boat Tram and a site farther downstream at County Road (CR) 365. The average of the samples at the Boat Tram site was 35 and the average of the two most recent samples was 36; both of these values are below the impairment thresholds. The average SCI score for the all samples at the CR 365 site is 46 and the average of the two most recent samples is 37. Except for the October 28, 2014, sample from this location, the SCI scores were all above the impairment threshold. In this particular sample, the amphipod *Hyalella Azteca*, which is common in systems dominated by aquatic vegetation, and is often the dominant taxon in SCI samples from the Wakulla River, comprised 85 percent of the organisms identified and may have skewed the result due to its overabundance. Subsequent sampling conducted in March and May 2015 suggests it was an artifact of that particular sampling event. The average SCI score for the Boat Tram site through seven sampling events was 34 and the average SCI score at the CR 365 location was 47.

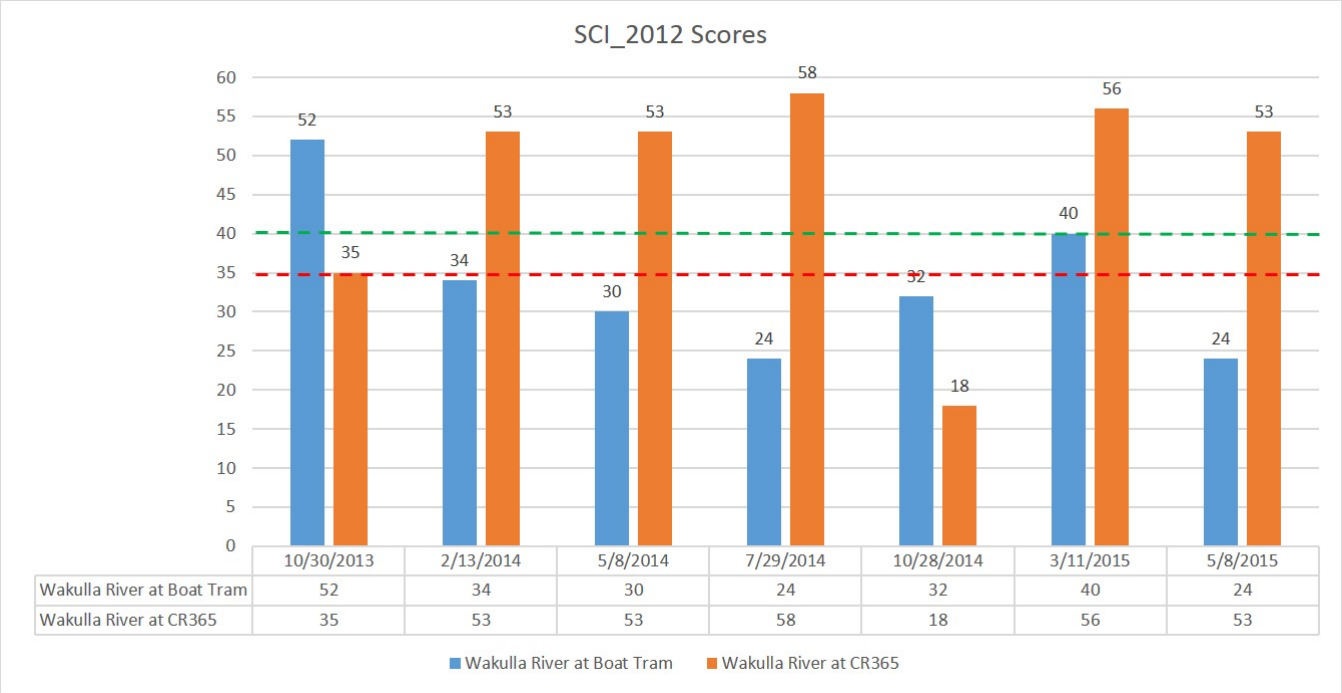

FIGURE 8: SCI RESULTS FOR TWO SITES ON THE WAKULLA RIVER, OCTOBER 30, 2013–MAY 8, 2015

To determine the source of the nitrate loading in the basin, the department collected data between March and December 2011 from the different tunnels around Wakulla Springs and from the springs themselves. Using information on nitrogen isotopes to correlate to sources, the data indicated that the A- and K-Tunnels in the south and west had a much lower wastewater signature than the B-, C-, and D-Tunnels in the north and east. The springs also showed a significant wastewater nitrate signature. These data had a nitrogen isotope signature in the wastewater/manure signature field (Department 2013c).

To determine if the nitrate is coming from humans or livestock, another tracer is needed. The department uses sucralose as a tracer for human sources. Sucralose is the main ingredient in Splenda®, and studies from around the world have detected sucralose in ground water with human wastewater influences. Sucralose is very stable, passes through wastewater treatment into the final effluent, and is not affected by chlorination or tertiary treatment. Sucralose has the added advantage that it is never used in animal feed and is therefore not expected to be present in the byproducts of animal waste. The median sucralose levels in the A- and K-Tunnels, based on data from 2011 to 2012, were only slightly above the detection limit, which is 0.01 parts per billion (ppb). The B-, C-, and D- Tunnels had sucralose concentrations between 0.033 and 0.035 ppb, indicating human influence from the north and east. This is consistent with findings from other studies in the basin (Department 2013c).

2.4 IMPACT OF NITRATE ON WATER QUALITY AND THE BIOLOGICAL COMMUNITY

Nitrate appears to be the crucial nutrient feeding the growth of algae and hydrilla in the Upper Wakulla Springs and Wakulla River. It is a common form of combined nitrogen in most natural surface fresh waters and some ground water in Florida. Nitrate occurs naturally but is also produced by human activities. Most plants cannot directly use nitrogen in its molecular form but instead use nitrogen in the form of either nitrate or ammonium. The primary natural sources of nitrate on the earth's surface include volcanic activity, lightning, and biological fixation. In biological fixation, molecular nitrogen is fixed by a special bacterium associated with certain plants, notably legumes, sugarcane, and some ferns, and may be further oxidized to nitrate by other bacteria. Nitrate is also produced from the breakdown of animal manure and dead plants (Peer Review Committee 2005).

Human activities are greatly increasing the amount of nitrogen cycling between the living world and the soil, water, and atmosphere. In fact, humans have already doubled the rate of nitrogen entering the land-based nitrogen cycle, and that rate is continuing to climb. Elevated concentrations of nitrate in ground water commonly result from agricultural and urban land use practices in ground water recharge areas. The proximity of these areas to points of discharge (*i.e.*, springs) can result in elevated nitrate levels in surface waters. Nitrate ions are mobile in ground water and surface water. There are essentially no solubility constraints on the amounts found in ground water because the nitrate ion does not sorb to soils or rock, and thus nitrate can move freely through the soil and the ground water system.

In surface waters, nitrate acts as a fertilizer for aquatic plants. Nitrate levels much less than 1 mg/L can cause a significant shift in the balance of spring ecological communities. With an overly abundant supply of nutrients, aquatic plants and algae grow rapidly, filling the water with thick masses of green vegetation. Oxygen in the water is used up, leading to negative impacts to the aquatic community (Peer Review Committee 2005).

Increasing nitrate levels in the Floridan aquifer in the Woodville Karst Plain in Leon and Wakulla Counties, as well as in water emanating from Wakulla Springs, are a significant ecological concern. Because a spring is a discharge point, the quality of spring water can be considered characteristic of a large cross-section of the aquifer. An increase in nitrate concentration in Wakulla Springs can be interpreted either as a widespread increase in nitrate concentration in the ground water from a large area

of the aquifer (resulting, for example, from septic systems), or as a significant increase in one or a few specific inputs (such as a WWTF).

Nitrate sources for Wakulla Springs appear to be a combination of both types. **Figure 9** illustrates the sources, reservoirs, and pathways of nitrogen in the unconfined portion of the Wakulla springshed. Under a thin veneer of sand lies a limestone matrix whose voids are saturated with ground water below the water table. The horizontal striping indicates the water-filled conduit that conveys water and pollutants to Wakulla Springs. The large checkered arrow denotes stormwater and sinking streams. Inputs of nitrate consist of atmospheric deposition, fertilizers, septic systems, land spraying, and residuals. Reservoirs consist of soils, vegetation, and livestock. Sinks of nitrogen (not illustrated) include the harvesting and decay of vegetation and removal of livestock. The nitrogen that enters ground water finds its way to Wakulla Springs (Peer Review Committee 2005).

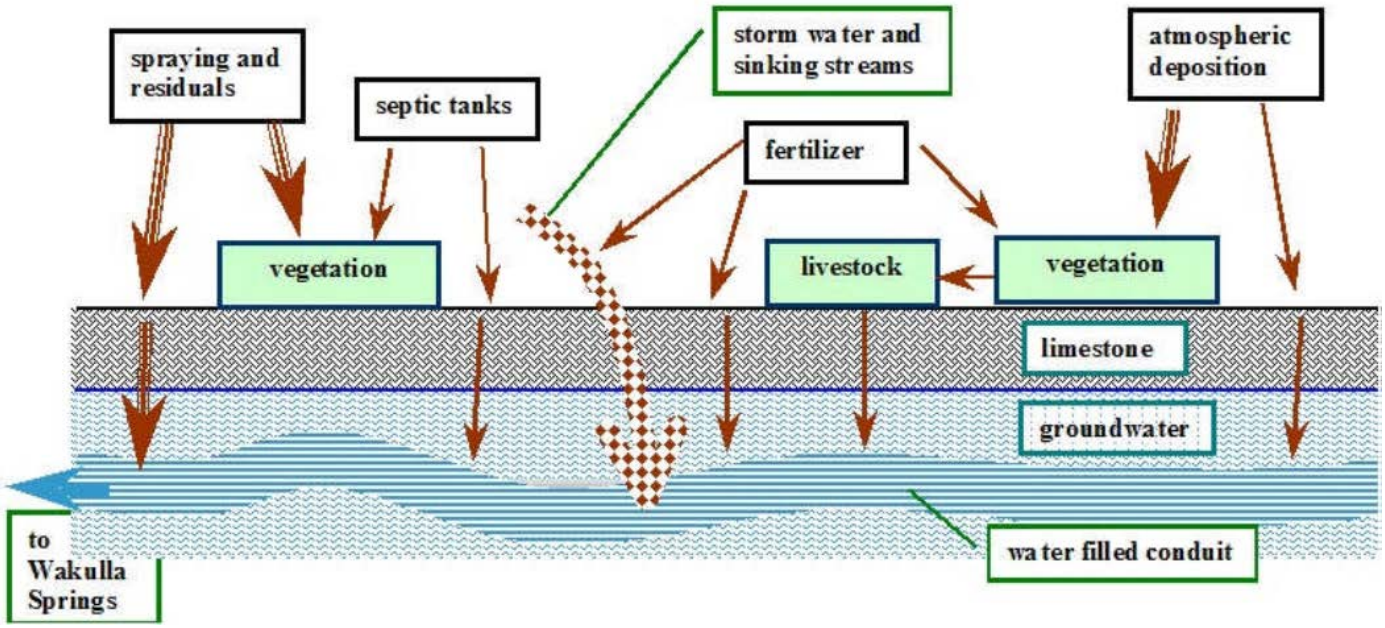

FIGURE 9: SCHEMATIC OF SOURCES, RESERVOIRS, AND PATHWAYS OF NITROGEN IN THE UNCONFINED PORTION OF THE WAKULLA SPRINGSHED

Chapter 3: POLLUTANT SOURCES AND ANTICIPATED OUTCOMES

The TMDL includes estimates of nitrate loading in the Upper Wakulla River and Wakulla Springs Basin from WWTFs, OSTDS, fertilizer, livestock, atmospheric deposition, sinking streams, and stormwater. Since atmospheric deposition is considered a mostly uncontrollable source, the TMDL did not require reductions from this source. The contributions from sinking streams, including Munson Slough, Fisher Creek, Black Creek, and Lost Creek, were minimal and thought to be temporary in response to large rainfall events (Chelette *et al.* 2002). Therefore, the BMAP focuses on addressing nitrate loading from WWTFs, OSTDS, fertilizer, livestock, and stormwater. Additional details about the sources in the basin and the NSILT that was developed to estimate the contribution from nutrient sources applied at the land surface are provided in the subsections below.

3.1 NSILT

The NSILT is a GIS- and spreadsheet-based tool that provides estimates of the relative contribution of nitrogen from various sources, including the following:

- Atmospheric deposition.
- WWTFs.
- Septic tanks.
- Farm fertilizer.
- Urban fertilizer.
- Livestock.
- Sinking streams.

The department prepared the NSILT as a tool to identify areas where nitrogen source reduction efforts could be focused to achieve the most beneficial and cost-effective effect on water quality. The general approach for the NSILT is to characterize groundwater recharge, identify categories of land use that are potential nitrogen sources, estimate nitrogen input at the land surface, and calculate the estimated nitrogen load to ground water.

3.1.1 Estimating Nitrogen Inputs

The first step in the NSILT process is to estimate the nitrogen input to the land surface for each of the land use categories in the basin (see **Section 2.1**). Attenuation factors were then applied to the input to land surface based on the various environmental processes that could transform nitrogen in the subsurface, such as denitrification, nitrification of ammonia, uptake by vegetation, and mineralization of organic nitrogen. The final step to estimate the nitrogen load is to apply an areal weighting factor based on the rate of recharge to ground water, resulting in the estimated nitrogen loads to ground water. The factors used in the NSILT are summarized in **Table 9** and **Table 10** (Eller *et al.* 2014).

Table 9: Environmental Attenuation Factors

Source Category	Attenuation Factor
Atmospheric Deposition	90%
WWTFs	60%
Septic Tanks	40%
Farm Fertilizer	70%
Urban Fertilizer	80%
Livestock	75%
Sinking Streams	20%

Table 10: Recharge Factors

Recharge	Factor
Unconfined	90%
Semiconfined	40%
Confined	10%

3.2 Summary of Sources in the Basin

3.2.1 Atmospheric Deposition

Atmospheric deposition rates (both wet and dry) were estimated for the BMAP area. The wet deposition rate was estimated using the Quincy (FL14) and Sumatra (FL23) monitoring stations from the National Atmospheric Deposition Program (NADP). The dry deposition rate was estimated from the Sumatra (SUM156) monitoring station (also the location of the FL23 station) from the Clean Air Status and Trends Network (CASTNET). The annual average TN deposition from these sites was estimated from 2009 through 2012. Based on this information, the average atmospheric deposition rate was 2.80 kilograms of TN per hectare (Eller *et al.* 2014).

3.2.2 WWTFs

There are 23 permitted WWTFs in the basin. TN effluent concentrations were obtained from the discharge monitoring reports for each facility. If only nitrate data were collected, these data were used to project the TN concentration. For facilities that did not collect TN or nitrate data, an estimate of 8.97 mg/L of TN was used. For facilities without flow data, 50 percent of the design capacity was used. Based on the most current available data for each facility, the estimated total input of nitrogen from wastewater facilities to the BMAP area was 71,484 kg/yr of TN (Eller *et al.* 2014).

During the TMDL assessment period, the largest WWTF load was the city of Tallahassee's T.P. Smith Water Reclamation Facility and Spray Field, located in PFA1. The city completed the upgrade to AWT by spring 2015; however, since November 2012, the facility has met the AWT permit requirements of 3 mg/L TN. This upgrade has resulted in large reductions of TN from the effluent applied to the land surface at the spray field (see **Section 4.1.1** for additional details). In addition, the city removed biosolids application in the basin (see **Section 4.1.1**), further reducing the impacts of the WWTF in the basin.

Also, located in PFA1 are four smaller WWTFs (**Table 11** and **Figure 10**). During the first BMAP iteration, the department will work with existing WWTFs in PFA1 to determine if any reductions are required to help address the Upper Wakulla River impairment (see **Section 4.1.1** for more details).

TABLE 11: WASTEWATER TREATMENT FACILITIES IN PFA1

FACILITY	PERMIT NUMBER	DESIGN CAPACITY (MILLION GALLONS PER DAY [MGD])	DISPOSAL METHOD
T.P. Smith Water Reclamation Facility	FLA010139	26.5	Spray field
Woodville Elementary School	FLA010136	0.01	Rapid infiltration basin (RIB)
DISC Village	FLA010137	0.03	Spray field
Winco Utilities, Inc.	FLA016544	0.495	Spray field
Lake Bradford Estates	FLA010148	0.043	Absorption beds

In 1995, the United States Environmental Protection Agency (EPA) authorized the department to implement the NPDES Program to permit wastewater discharges to state surface water, including industrial and domestic wastewater facilities. Permits are issued under the applicable provisions of Chapter 403, F.S., and appropriate rules in Chapter 62-600, F.A.C., with applicable sections of 40 Code of Federal Regulations (CFR) incorporated by reference. These regulations, rules, and statutes give the

department the authority to regulate domestic and industrial wastewater facilities. For those entities with WWTF strategies in the PFAs, if they fail to implement their approved list of strategies in the BMAP they will be subject to the appropriate enforcement actions, as outlined in 40 CFR 123.45, as well as Sections 403.061, 403.121, and 403.161, F.S., and Subsection 62-650.300(4), F.A.C.

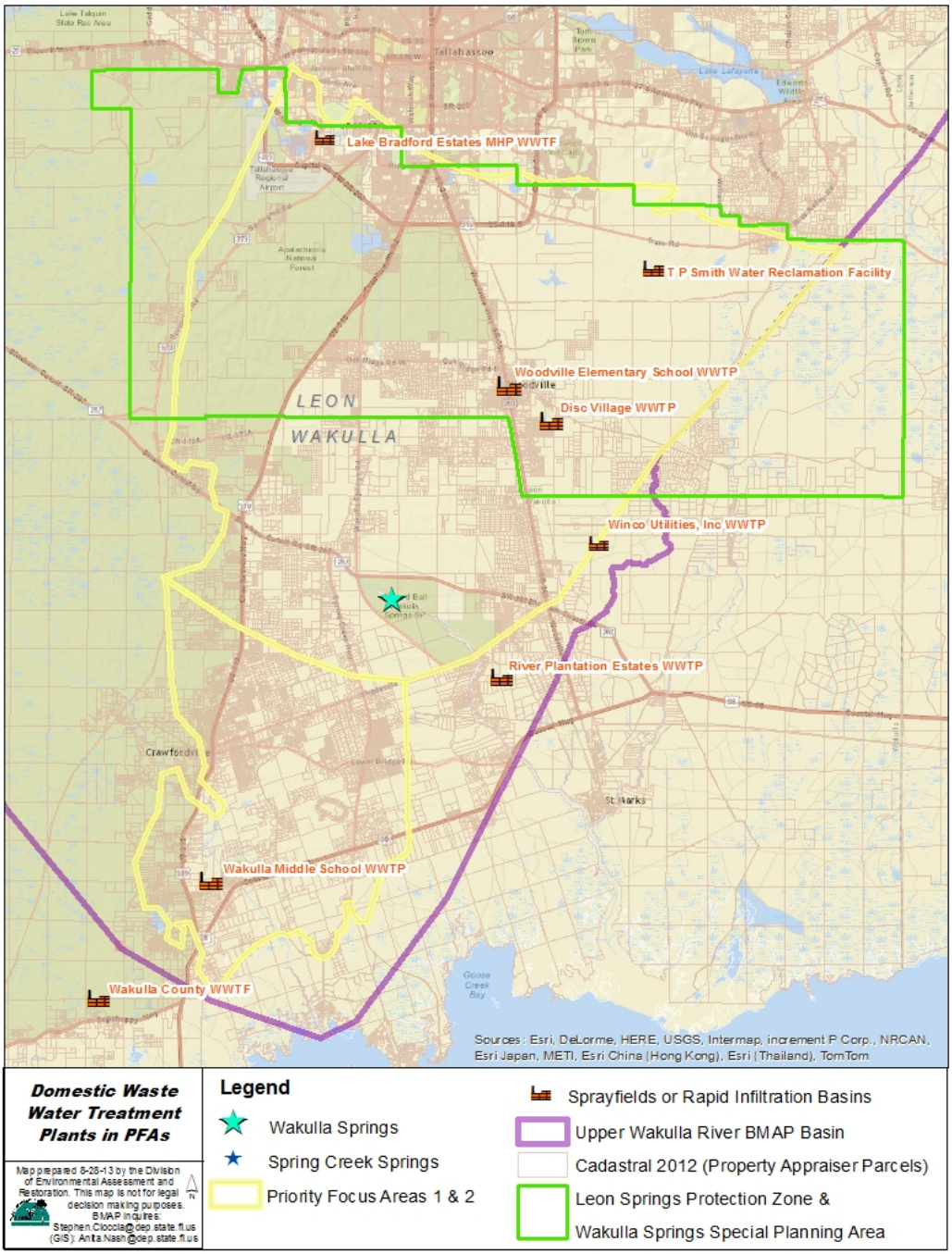

FIGURE 10: DOMESTIC WASTEWATER TREATMENT PLANTS (WWTPS) AND FACILITIES IN THE PFAS

3.2.3 OSTDS

OSTDS, or septic systems, are commonly used where central sewer does not exist. When properly sited, designed, constructed, maintained, and operated, OSTDS are a safe means of disposing of domestic waste (Department 2012a). However, in karst areas, such as the PFAs in the Upper Wakulla River and Wakulla Springs Basin, the nitrate contributions from OSTDS to ground water can be significant. A septic system study was conducted by FSU's Department of Earth, Ocean, and Atmospheric Science in the Woodville area, which is located in southern Leon County and northern Wakulla County (Harden *et al.* 2010). FSU researchers injected dye into two shallow wells and then collected samples at several springs and Wakulla tunnels. Dye was recovered in Wakulla Spring, Sally Ward Spring, Indian Springs, and the six tunnels. Based on the distances from the two wells (5.2 and 6.0 miles) to Wakulla Springs, the dye traveled at a rate of about 327 feet (100 meters) per day (Department 2012b).

The NSILT found approximately 52,446 OSTDS within the BMAP boundary (16,173 OSTDS in the unconfined recharge area, 22,005 in the semiconfined recharge area, and 14,268 in the confined recharge area). Approximately 9,640 septic tanks are located in PFA1 and 5,062 septic tanks in PFA2 (see **Figure 11**). Based on the 2010 United States Census, there are 2.48 people per household in Leon County, 2.93 people per household in Wakulla County, 2.74 people per household in Gadsden County, and 2.61 people per household in Jefferson County. FDOH estimates that there is an average annual input of 4.5 kg of nitrogen (N) per person from a septic tank. Based on this information, the OSTDS contribution to the land surface in the BMAP area is estimated to be 615,463 kg/yr of N (Eller *et al.* 2014).

With the reduction in loading from the city of Tallahassee WWTF, OSTDS are now the largest source of nitrates to ground water, contributing more than one-third of the estimated loading (**Figure 12;** Department 2013a). Strategies to address OSTDS loading will be determined through the OSTDS Initiative (see **Section 1.3.4**).

It is important to note that there are varying estimates of the number of OSTDS in the Upper Wakulla River and Wakulla Springs Basin. OSTDS estimates are also included in Lombardo (2011), Chelette (2002), the FDOH model (2009), and local government reports. As part of the OSTDS Initiative, a more refined estimate of the number of septic tanks in each PFA will be determined.

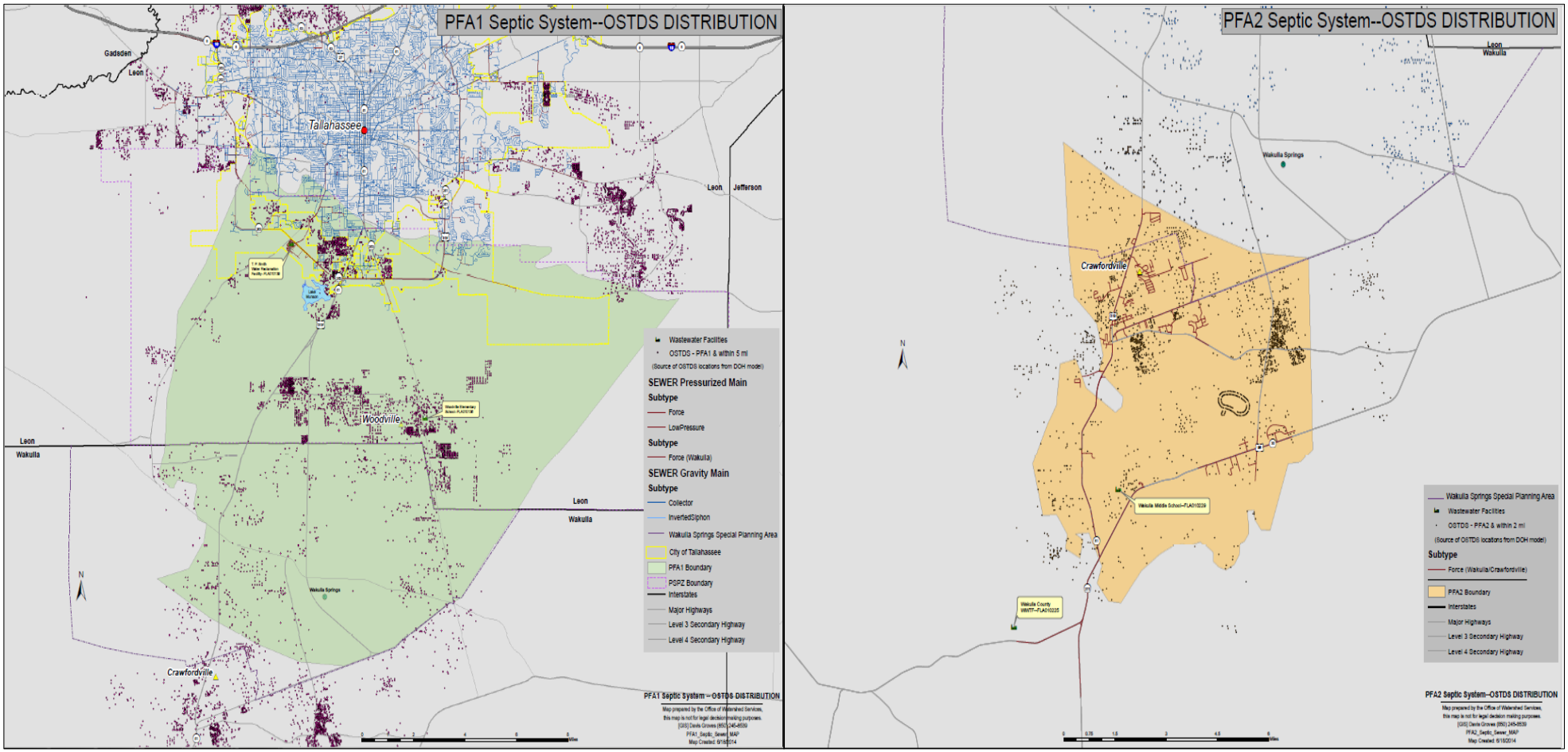

FIGURE 11: CURRENT LOCATIONS OF OSTDS IN THE PFAS

3.2.4 RESIDENTIAL FERTILIZER

Fertilizer used on lawns and landscaping in residential areas can contribute to nitrate loading to ground water. The NSILT used FDACS fertilizer sales data to determine the annual amount of fertilizer sold in each county included in the contributing area for nonfarm applications. The percentage of urban land use from the contributing area was compared with the total urban areas for the entire county to adjust the county-specific data to the contributing area boundary. The fertilizer sales data also include information on the amount of TN in fertilizer sold. Using these data, urban fertilizer contributes approximately 226,204 kg/yr of N in the BMAP basin. Leon County, Wakulla County, and the city of Tallahassee have implemented fertilizer ordinances and educational programs to help address this source (see **Chapter 4**).

3.2.5 AGRICULTURAL FERTILIZER AND LIVESTOCK

For the agricultural fertilizer amounts, the department took the acreage for each agricultural commodity type in the basin, based on 2009 land use coverage, and multiplied the acreage by the University of Florida–Institute of Food and Agricultural Sciences (UF–IFAS) recommended fertilizer application rates. The result is an estimate of 560,784 kg/yr of N in the BMAP area (Eller *et al.* 2014).

To estimate the contribution from livestock in the BMAP basin, the NSILT used the United States Department of Agriculture (USDA) Census of Agriculture, which is conducted every five years. This census provides the number of livestock by animal for each county. To adjust the data from each county to fit the BMAP area, the department determined the percentage of land uses in the each county in the basin considered to be livestock lands. The estimate for the number of each livestock animal type is multiplied by literature values of the waste factors in lbs/day of N for each animal. Based on these estimates, livestock contribute 338,946 kg/yr of N in the BMAP area (Eller *et al.* 2014).

The city of Tallahassee implemented management practice changes during the TMDL assessment period to eliminate the application of fertilizer on the SESF, where crops are grown. This change in management practice resulted in another significant reduction in the amount of TN applied in the basin.

Based on 2009 land cover, non-forestry agriculture makes up about 4 percent of the acreage in the PFAs (see **Figure 12**). The majority of agriculture in the PFAs comprises pasture and rangeland, followed by hayfields and field crops. There are also smaller numbers of horse farms, row crops, other grove types, nurseries and vineyards, ornamental nurseries, and tree nurseries. Outside the PFAs, nonforestry

agriculture constitutes about 7 percent of the acreage, with pasture and rangeland making up the majority of the agricultural lands. Hayfields and row, field, and mixed crops are the next most common types of agriculture. FDACS is working with producers in the basin to enroll them in the appropriate best management practice (BMP) programs. During this process, FDACS determines whether agricultural operations are appropriate for enrollment, such as those in commercial production. Unimproved pasture with no animals, fallow lands, and other lands not in production are not eligible for enrollment. A large portion of the remaining acreage identified as agricultural in the land use data is likely to be noncommercial and potentially inappropriate for BMP enrollment. FDACS will attempt to identify noncommercial and out-of-production lands in the first phase of the BMAP.

Lands identified as not in production may result in an agricultural load reduction "credit," depending on the specific circumstances. The department and FDACS will work together to identify small residential farms that may be addressed through UF–IFAS Extension and/or BMPs developed by the department, such as the small horse farm BMP manual recently published. Where FDACS identifies clear errors in land use data, such as golf courses classified as agriculture, the total agricultural acreages estimated for the BMAP basin will decrease by that amount, and the changes will be incorporated during annual updates.

Agricultural enforcement for BMAP actions is based on the FWRA, which states that nonpoint source dischargers who fail either to implement the appropriate BMPs or conduct water quality monitoring prescribed by the department or a water management district that demonstrates compliance with water quality standards may be subject to enforcement action by either of those agencies. All agricultural nonpoint sources in the BMAP area are statutorily required either to implement FDACS-adopted BMPs or to conduct water quality monitoring that demonstrates compliance with state water quality standards.

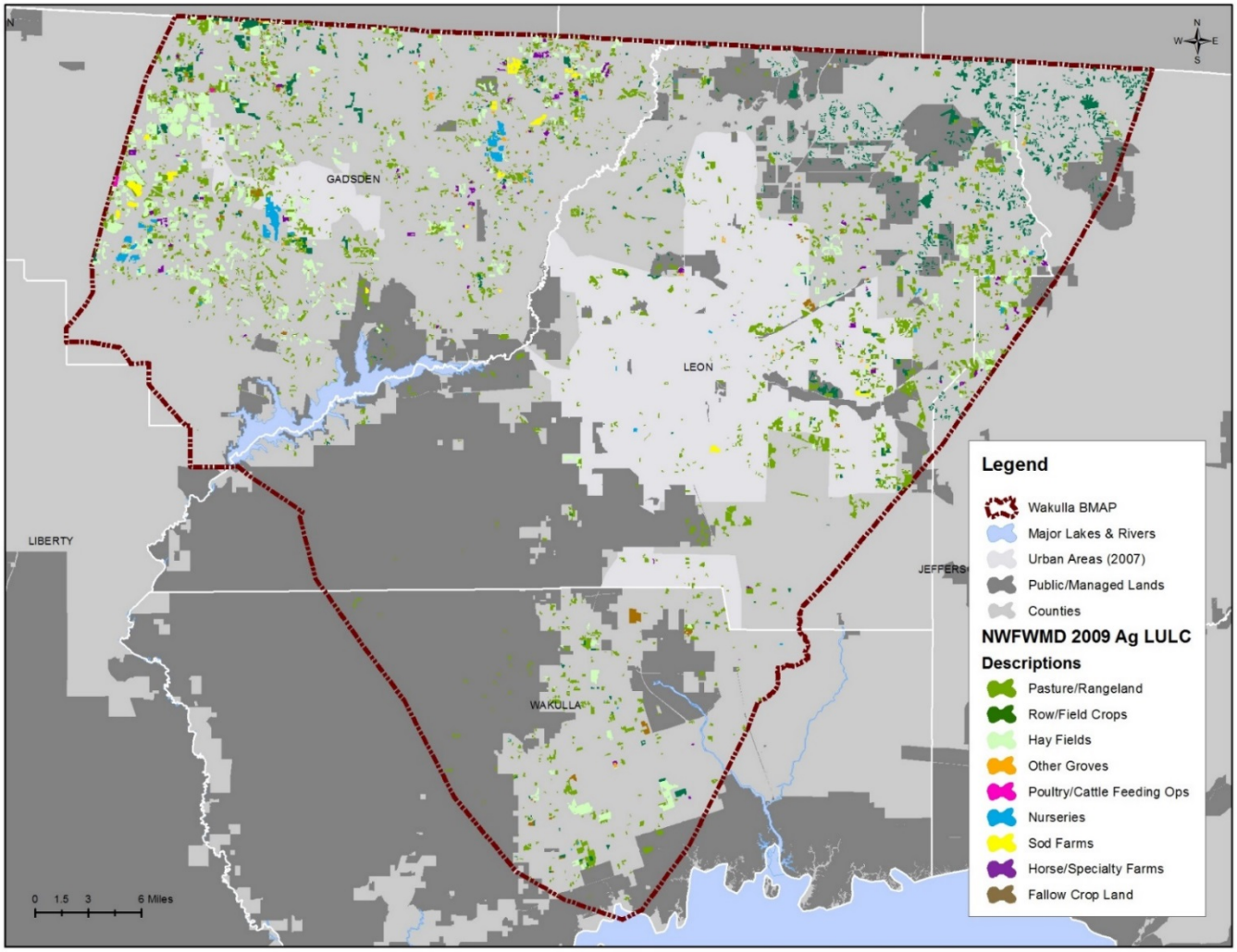

FIGURE 12: 2009 AGRICULTURAL LANDS IN THE UPPER WAKULLA RIVER AND WAKULLA SPRINGS BMAP AREA

3.2.6 SINKING STREAMS

In karst areas, sinkholes can form and capture the flow of surface streams. Water from these sinking streams, also known as swallets, can have a detrimental impact on ground water quality. There are four prominent sinking streams in the BMAP area: Lost Creek, Black Creek, Munson Slough, and Fisher Creek. To assess the nitrogen inputs attributed to these streams, the department evaluated the discharge data, as well as nitrogen concentrations, from these streams. Discharge data for Fisher Creek (Station 02326993) and Lost Creek (Station 02327033) were obtained from the United States Geological Survey (USGS) National Water Information System. Discharge data were available for 2007–09 for Fisher Creek and for 2002–07 for Lost Creek. The NWFWMD maintains a gaging station located on Munson

Slough, and data from 2002–10 were obtained by request. Black Creek does not have an active gaging station, but discharge data were provided from a water quality study conducted from March 2009 to May 2009. All four sinking streams are located in the unconfined recharge area in the BMAP basin. Based on the data collected, the estimated TN loading from the sinking streams is 3,867 kg/yr for Fisher Creek, 31,865 kg/yr for Lost Creek, 7,034 kg/yr for Black Creek, and 3,652 kg/yr for Munson Slough (Eller *et al.* 2014).

3.2.7 STORMWATER

Stormwater runoff is the responsibility of MS4s and urban nonpoint sources, and these entities are described in detail below.

3.2.7.1 MS4s

Several stakeholders in the basin are regulated by the Florida NPDES stormwater program because they discharge stormwater and qualify as an MS4. While there are no direct contributions from these MS4s to the Upper Wakulla River watershed (WBID 1006), the MS4s are located in the Upper Wakulla River and Wakulla Springs BMAP area. An MS4 is a conveyance or system of conveyances such as roads with stormwater systems, municipal streets, catch basins, curbs, gutters, ditches, constructed channels, or storm drains that are designed or used for collecting or conveying stormwater. An MS4 can be operated by municipalities, counties, drainage districts, colleges, military bases, or prisons, to name a few examples. By definition, the components of an MS4 system do not include waters of the state of Florida or of the United States. Instead, the MS4 ultimately discharges into such waters.

The basic requirements of the program serve as a foundation for the stormwater management efforts of these communities. The EPA developed the federal NPDES stormwater permitting program in two phases. Phase I, which began in 1990, addresses large and medium MS4s located in incorporated areas and counties with populations of 100,000 or more, as well as specific industrial activities. Phase II, which started in 1999, addresses small MS4s that are designated according to population and other criteria established in federal and state rules. Small MS4s include those located in an urbanized area with a population of at least 50,000 people and/or those serving a population of 1,000 or more people per square mile.

In October 2000, the EPA authorized the department to implement the NPDES stormwater permitting program in the state. This permitting has remained separate from state Stormwater/Environmental

Resource Permit (ERP) Programs and local stormwater/water quality programs, which have their own regulations and permitting requirements. Florida's rules for MS4s can be found in Chapters 62-4, 62-620, 62-621 and 62-624, F.A.C.

Table 12 lists the entities in the Upper Wakulla River and Wakulla Springs Basin currently designated as MS4s.

TABLE 12: ENTITIES IN THE UPPER WAKULLA RIVER AND WAKULLA SPRINGS BMAP BASIN DESIGNATED AS MS4S

MS4 PERMIT PHASE	PERMITTEE	PERMIT NUMBER
I	Leon County	FLS000033
I	FDOT District 3	FLS000033
I	City of Tallahassee	FLS000034
II	FSU	FLR04E051
II	FAMU	FLR04E095
II	Federal Correctional Institution, Tallahassee	FLR04E096

All NPDES permits, including MS4 permits, must be consistent with the requirements of adopted TMDLs. Paragraph 403.067(7)(b), F.S., prescribes the criteria for TMDL implementation. In accordance with this section, the implementation of a TMDL or BMAP for holders of NPDES MS4 permits must be achieved to the maximum extent practicable, through the use of BMPs or other management strategies. The implementation of BMPs consistent with the provisions of the stormwater management program required under an MS4 permit constitutes compliance with the standard of reducing pollutants to the maximum extent practicable for discharges to unimpaired waters. However, MS4s must also continue to assess and adjust their list of approved management strategies to achieve the greatest reduction of pollutants practicable to protect receiving waters in accordance with an adopted TMDL or BMAP.

Entities that fail to implement their list of approved strategies in order to reduce pollutants to the maximum extent practicable standard will be subject to enforcement action in accordance with Sections 403.067, 403.121, 403.141, and 403.161, F.S., and Subsection 62-650.300(4), F.A.C. In addition, both Phase I and Phase II MS4 permits include provisions for revising the effluent limitations, monitoring requirements, and stormwater management programs to meet applicable TMDL allocations that are consistent with the assumptions and requirements of the adopted BMAP.

3.2.7.2 Urban Nonpoint Sources

Reductions in loads carried by stormwater that are separate from discharges by a permitted MS4 were established in the "load allocation" component of the TMDL. Subsubparagraph 403.067(7)(b)2.f, F.S., prescribes the pollutant reduction actions required for nonagricultural pollutant sources that are not subject to NPDES permitting. These "non-MS4" sources must also implement the pollutant reduction requirements detailed in a BMAP. The entities that may be responsible for reducing nonpoint sources in the Upper Wakulla River and Wakulla Springs Basin are as follows:

- Gadsden County.
- Jefferson County.
- Wakulla County.
- City of Gretna.
- City of Midway.
- City of Quincy.
- Town of Havana.

Failure by a nonpoint source to reduce loadings, as required in a BMAP, can result in enforcement action by the department under Subparagraph 403.067(7)(b)2(h), F.S. The department can designate an entity as a regulated Phase II MS4 if its discharges are determined to be a significant contributor of pollutants to surface waters of the state in accordance with Rule 62-624.800, F.A.C. The designation of an entity as a Phase II MS4 can occur when a TMDL has been adopted for a waterbody or segment into which the entity discharges the pollutant(s) of concern. If an entity is designated as a regulated Phase II MS4, it is subject to the conditions of the Phase II MS4 Generic Permit.

3.3 Summary of Loading to Ground Water

The total nitrogen input applied to the land surface described above was multiplied by the environmental attenuation and recharge factors shown in **Table 9** and **Table 10**, respectively. **Table 13** lists the inputs, the intermediate step with attenuation factors applied, and the final estimated loads to the upper Floridan aquifer (UFA) with both attenuation and recharge factors applied.

Based on these calculations, approximately 342,048 kg/yr of N enters ground water in the BMAP basin. The relative contribution of major sources of nitrogen to ground water is described in **Figure 13**, including controllable sources such as septic tanks, farm fertilizer, livestock, urban fertilizer, and WWTFs (Eller *et al.* 2014).

TABLE 13: ESTIMATED NITROGEN INPUTS AND LOADS TO THE UFA IN THE WAKULLA SPRING AND RIVER BMAP AREA

		NITROGEN LOADING CATEGORIES (inputs and loads in kg/yr)							
	Confinement	Atmospheric Deposition	WWTFs	Septic Tanks	Farm Fertilizer	Urban Fertilizer	Livestock	Sinking Streams	Totals
INPUTS	Unconfined	339,424	54,219	195,871	2,831	27,470	54,348	46,140	**720,303**
	Semiconfined	263,138	12,546	246,395	102,117	111,705	69,368	N/A	**805,268**
	Confined	358,313	7,143	173,198	455,837	87,029	215,230	N/A	**1,296,750**
	Total Inputs (kg-N/yr)	**960,875**	**73,907**	**615,463**	**560,784**	**226,204**	**338,946**	**46,140**	**2,822,321**
ATTENUATION FACTORS APPLIED	*Attenuation Factors*	*90%*	*60%*	*40%*	*70%*	*80%*	*75%*	*20%*	
	Unconfined	33,942	21,688	117,522	849	4,945	13,587	36,912	**229,995**
	Semiconfined	25,648	5,018	147,189	23,433	22,188	17,342	N/A	**249,487**
	Confined	32,262	2,759	100,839	102,391	16,837	52,460	N/A	**350,572**
	Total after Attenuation (kg-N/yr)	**91,853**	**29,465**	**365,550**	**126,672**	**44,519**	**83,389**	**36,912**	**752,997**
LOADS TO UFA (RECHARGE FACTORS APPLIED)	*Recharge Factors*								
	Unconfined (90%)	30,548	19,519	105,770	764	4,945	12,228	33,221	**206,995**
	Semiconfined (40%)	10,526	2,007	59,135	12,254	8,936	6,937	N/A	**99,795**
	Confined (10%)	3,583	286	10,392	13,675	1,741	5,381	N/A	**35,057**
	TOTAL LOADS TO UFA (kg-N/yr)	**44,657**	**21,812**	**175,297**	**26,693**	**15,622**	**24,546**	**33,221**	**341,847**

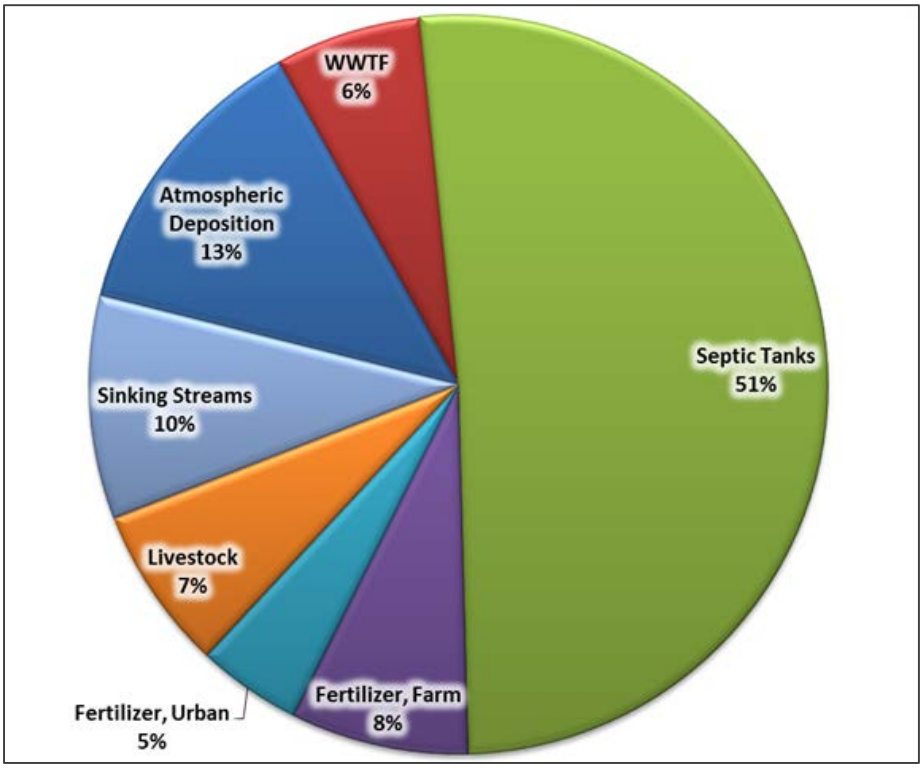

FIGURE 13: RELATIVE NITROGEN LOADS TO THE UFA CONTRIBUTED FROM THE NITROGEN SOURCE CATEGORIES EVALUATED FOR THE WAKULLA SPRING AND RIVER BMAP AREA

3.4 ANTICIPATED OUTCOMES OF BMAP IMPLEMENTATION

With the implementation of the management strategies outlined in this BMAP, reductions in the nutrient loads to the Upper Wakulla River and Wakulla Springs Basin are expected to decrease the contribution of nitrate to the river and springs. The following outcomes are expected from BMAP implementation:

- Continued improvement in water quality conditions in the Upper Wakulla River and Wakulla Springs.
- Decreased loading of the target pollutant (nitrate).
- Increased coordination, such as through the OSTDS Initiative and annual meetings, among state and local governments and within divisions of local governments in problem solving for water quality restoration.
- Determination of effective management strategies through the stakeholder decision-making and priority-setting processes.

— Enhanced public awareness of pollutant sources, pollutant impacts on water quality, and corresponding corrective actions.

Chapter 4: MANAGEMENT STRATEGIES IN THE PFAS

"Management strategies" refers to the suite of activities that the responsible Upper Wakulla River and Wakulla Spring BMAP entities will be conducting to achieve nitrate reductions. These strategies include structural and nonstructural activities. Under Paragraph 403.067(7)(a), F.S., a BMAP is required to integrate the appropriate management strategies available to the state through existing water quality protection programs to achieve the TMDLs. In the case of this BMAP, management strategies relate to standards for WWTFs, a process to address the management and mitigation of impact from OSTDS, residential fertilizer use, agricultural BMPs, and stormwater management.

The stakeholders submitted strategies that have been completed since January 1, 2004, and are planned within the first five-year BMAP iteration. January 1, 2004, was selected as the starting point for the BMAP strategies because it is the midpoint of the verified period used to determine impairment in the Upper Wakulla River. Since the Upper Wakulla River and Wakulla Springs Basin is a ground water–driven system, the department reasoned that due to the delay between reduction strategies and detection of the results that the full benefits of the management strategies completed during the TMDL verified period were not seen in the water quality data. Therefore, these projects have provided additional benefits during the latter portion of the verified period to the Upper Wakulla River and Wakulla Springs and should be listed in the BMAP.

The management strategies were submitted to provide reasonable assurance to the department that each responsible entity has a plan on how to reduce nitrate concentrations. The sections below outline the strategies submitted by the stakeholders in the PFAs.

4.1 SUFFICIENCY OF EFFORT EVALUATION

The tables in **Section 4.2** list the management strategies to reduce nitrate concentrations in the PFAs. The nitrate load reduction strategies outlined in the project tables, including the activities highlighted below, are expected to reduce nitrate concentrations and improve water quality in the Upper Wakulla River and Wakulla Springs. As water quality improves as a result of these strategies, and as more data are collected to show the nitrate concentrations and health of the biological community in the Upper Wakulla River and Wakulla Springs, future BMAP iterations may recommend different or additional strategies. For this BMAP iteration, the full implementation of the management strategies listed in the tables for the PFAs is sufficient to significantly reduce nitrate concentrations and make substantial

progress towards meeting the TMDL target. The sufficiency of this BMAP relies on these management strategies; by inclusion in the BMAP, it is required that they remain in effect without substantial revision, as determined by the department.

4.1.1 WWTFs Sufficiency

The largest point source facility identified in the TMDL was the city of Tallahassee's T.P. Smith Water Reclamation Facility and Spray Field. In 2008, the city began to upgrade the WWTF to meet AWT standards. The target TN concentration in the effluent was achieved ahead of schedule in November 2012, reducing TN from about 12 mg/L to less than 3 mg/L. Therefore, this facility has met the requirement to achieve the 3.0 mg/L effluent TN concentration and meets the Upper Wakulla River TMDL.

The change in TN concentration removed approximately 214,939 kg/yr of TN from application at the spray field. It should be noted that the 214,939 kg/yr reduction is based on the permitted flow and concentration for the treatment facility. The actual flow and concentration are much lower, such that the actual load reduction achieved is much greater, on the order of 280,000 kg/yr. The greater reduction value is not used in the sufficiency evaluation because the city is entitled by permit to increase its flow to 26.5 mgd, which will in turn increase the TN discharged. Because the BMAP uses the smaller reduction value, the increase in TN load that occurs with growth is already accounted for in determining compliance with the TMDL and will not constitute an increase in load for BMAP purposes.

The city also removed its WWTF biosolids application from the basin, resulting in a reduction of 169,347 kg/yr of TN that was previously applied to the land in the basin. In addition, the city has a program to assess and rehabilitate the sewer collection system in the older parts of the system. Of the total 895 miles of sewer system, 356 miles are part of the older system. Approximately 7 percent of the older system sewer lines are in PFA1. The assessment of the older system will be completed by the end of 2014, and the rehabilitation of the system will be completed by 2021.

Wakulla County has an adopted comprehensive plan policy that requires AWT (3 mg/L) for any WWTF or spray field located in the Wakulla Springs Special Planning Area. The county conducts routine inspections and maintenance of the sewer collection system throughout the county. Wakulla County is proposing to upgrade its WWTF for improved treatment and to connect OSTDS to central sewer in PFA2. The current WWTF provides secondary treatment, and the proposed upgrade would be to AWT.

The Upper Wakulla River and Wakulla Springs BMAP requires the following:

- Existing WWTFs with a permitted capacity of 100,000 gallons per day (gpd) or greater and all new WWTFs permitted by the department, after the adoption of this BMAP, with a discharge, reuse, or land application site in PFA1 shall achieve an annual average final effluent TN concentration of no greater than 3.0 mg/L.

- Existing WWTFs permitted by the department, with a discharge, reuse, or land application site in PFA1 with a permitted capacity less than 100,000 gpd and greater than or equal to 20,000 gpd, shall achieve an annual average final effluent TN concentration of no greater than 6.0 mg/L.

- Existing WWTFs permitted by the department with a discharge, reuse, or land application site in PFA1 with a permitted capacity less than 20,000 gpd shall achieve an annual average final effluent TN concentration of no greater than 10.0 mg/L.

Based on currently available data and analysis, these effluent limitation requirements are appropriate to protect ground water quality and prevent contribution to water quality impairment in the Upper Wakulla River. Existing WWTFs are those facilities permitted by the department on or before the date of BMAP adoption.

As a part of BMAP implementation, the department will evaluate requests from existing WWTFs to determine whether the TN effluent limits established above may be modified or waived as described in **Section 4.1.1.1** below. The owners of existing WWTFs which have not already achieved permit limitations equal to or more stringent than those required above will be given the opportunity to demonstrate reasonable assurance that the reuse or land application project would not cause or contribute to a violation of the 0.35 mg/L nitrate concentration established by the Upper Wakulla River TMDL. Should the department concur with the reasonable assurance demonstration request (as specified in **Section 4.1.1.1**), the TN effluent limitation established here may be modified or waived.

For the first BMAP iteration, the largest source of WWTF loading has been addressed, the department is implementing new treatment requirements for WWTFs in PFA1, and the responsible entities have plans to improve sewer collection systems and prevent future loading from WWTFs. Thus the department determined that these strategies sufficiently address nitrate loading from the WWTFs in the PFAs.

4.1.1.1 Reasonable Assurance Demonstration

Those WWTFs which are permitted by the department on or before the date of BMAP adoption and which have not already achieved permit limitations equal to or more stringent than those required in **Section 4.1.1**, will be given the opportunity to demonstrate reasonable assurance that the reuse or land application project would not cause or contribute to a violation of the 0.35 mg/L nitrate concentration at the spring vent established by the Upper Wakulla River TMDL. The permittee must submit this request to the department's Northwest District Office – Wastewater Program staff prior to or at the time of permit application. The demonstration must be based on relevant water quality data, physical circumstances, or other site-specific credible information needed to show a nitrate concentration no greater than 0.35 mg/L at the spring vent. This demonstration may include factors such as the following:

- Dilution.
- Site-specific geological conditions.
- Research/studies, including dye tracer tests.
- Ground water transport modeling.

The demonstration will be jointly reviewed by appropriate staff from the following department programs: Northwest District Office – Wastewater Program, Florida Geological Survey (FGS), and Division of Environmental Assessment and Restoration (DEAR). If the department's review results in concern that the reuse or land application site effluent is reaching karst conduits, additional information may be necessary for a final determination of the necessary TN effluent limit. The final decision of demonstration of reasonable assurance will be made by the Northwest District Director in conjunction with input from FGS and DEAR staff.

If the TN final effluent limit, as described in **Section 4.1.1,** is modified or waived subsequent to the demonstration of reasonable assurance, the permit will include effluent monitoring requirements for TN and ground water monitoring requirements from the Floridan aquifer for nitrate as nitrogen. At each permit renewal, the demonstration of reasonable assurance will be reviewed by the departmental programs previously identified in the joint review to reasonably assure that the reuse or land application would not cause or contribute to a violation of the 0.35 mg/L nitrate concentration at the spring vent

established by the Upper Wakulla River TMDL. This review will include the original data obtained during the initial demonstration as well as any new data that have been obtained since permit issuance.

4.1.2 OSTDS SUFFICIENCY

Prior to the completion of the OSTDS Initiative identified in **Section 1.3.4**, the following activities will be implemented by stakeholders. Leon County will prepare a GIS inventory of the OSTDS located in the county, revise its septic system ordinance to require greater separation between the drainfield and seasonal high water table to reduce the amount of nitrate that enters ground water, and install educational kiosks about septic systems at the Woodville Community Center. The county will review the results of the FDOH study on nitrate-reducing OSTDS and modify its code, if appropriate, in the OSTDS Initiative process.

Subsequent to the development of the OSTDS Plan, the county and department will identify septic systems in the PFAs that are not feasible to connect to central sewer, and develop a funding plan and schedule to assist homeowners with upgrading to advanced nitrate-reducing systems, if such technologies are available. The city of Tallahassee and Leon County have enacted ordinances to establish the PSPZ, which reduces development in the urban fringe in the PSPZ and allows development in the urban area only to the extent permitted by the future land use map. In addition, the county is proposing to sewer within the PSPZ to remove OSTDS, depending on project and funding approval through the county's sales tax process.

As part of the Alternatives to Sewer Solutions Study (included in the 2014 extension of the local sales tax), Leon County and the city have agreed to study and develop preferred options for management alternatives to traditional OSTDS in the unincorporated areas of Leon County, including the PSPZ. This project will identify preferred options for responsible management entities, including recommendations for financing and management structures for identified preferred options; recommend regulatory measures; and identify other issues related to OSTDS financing. The comprehensive management and engineering plan resulting from this project will provide direction for proposing sewer or cluster projects, for which funding is also available through the sales tax process.

This strategy would result in a large TN reduction when infrastructure projects are completed and connections occur. The department will identify state and federal funds to minimize connection fees for homeowners.

Wakulla County has an adopted comprehensive plan policy that requires advanced nitrogen-reducing OSTDS on parcels smaller than five acres in the Wakulla Springs Special Planning Area; within 150 feet of a surface water, swallet, or other karst feature, or within 300 feet of a first- or second-magnitude spring; and on all parcels less than 0.229 acres in size. Wakulla County is pursuing funding for planned sewer in Greiner's Addition, Magnolia Gardens, and Wakulla Gardens; this could remove the existing 1,330 septic systems and an estimated potential 2,251 additional systems in the future. The county is seeking funding to inspect and repair old, damaged, and failing OSTDS in the Wakulla Springs Basin. The county is also looking to form a tax increment financing (TIF) district for the Crawfordville area to fund improvements, including basic infrastructure. Additionally, the county continues the effort to modify the development code to require upgraded designs for new home construction.

Wakulla Springs State Park sewered its property in 1992, removing all OSTDS in the park except for one septic system serving the gatehouse. This wastewater treatment system is a performance-based treatment system with a high nitrogen removal efficiency.

In addition, the department, FDOH, city of Tallahassee, Leon County, and Wakulla County will work together through the OSTDS Initiative to identify effective management strategies for the basin, and to develop the strategies and milestones. By the end of the first five-year BMAP iteration, the responsible stakeholders will have already begun to implement or will be ready to implement agreed-on OSTDS reduction strategies.

Based on the adopted and planned measures and actions resulting from the OSTDS Initiative, OSTDS sources will be sufficiently addressed for the first iteration of the BMAP. Depending on water quality trends, additional efforts may be needed in future BMAP iterations to address OSTDS.

4.1.3 RESIDENTIAL FERTILIZER SUFFICIENCY

The city of Tallahassee has a fertilizer use ordinance and an educational program. Based on surveys conducted after the ordinance was adopted and educational efforts began, the city determined that the number of households applying fertilizer decreased by 49 percent between 2007 and 2012. In addition, for those households still applying fertilizer, the amount applied per household decreased by 27 percent.

FDOT District 3 has eliminated fertilizer use for turf maintenance along the roadways in the basin and is therefore no longer a source of fertilizer, except during the establishment of new turfgrass. This fertilizer cessation removed about 4,640 kg/yr of TN applied to the land surface.

Leon County has a fertilizer ordinance for commercial applicators and is considering modifying the ordinance to reduce nitrogen application rates in areas south of the Cody Scarp, if allowable by Florida law. The county also has an educational and outreach program that provides the public with information about fertilizer use through the Florida Yards and Neighborhoods (FYN) Program, the distribution of pamphlets, presentations, and workshops.

Wakulla County has an adopted fertilizer use ordinance that adopts the model ordinance on Florida-friendly fertilizer use on urban landscapes. The county is also planning to add fertilizer management educational and outreach efforts.

The responsible stakeholders have strategies in place to reduce/remove fertilizer use; therefore, these strategies are collectively sufficient to address sources of residential fertilizer during the first BMAP iteration.

4.1.4 AGRICULTURAL FERTILIZER AND LIVESTOCK SUFFICIENCY

In 2007, the city of Tallahassee eliminated fertilizer application on the SESF where crops are grown, resulting in a reduction of 61,500 kg/yr of TN previously applied to the land.

Iin the PFAs, approximately 5,766.52 acres are in agricultural land use, of which 1,308.85 acres, or 22.7 percent, were enrolled in FDACS BMP programs as of June 30, 2013. During the first BMAP iteration, FDACS plans to enroll additional producers in BMPs, with an enrollment target in the PFAs of 90 percent of the total agricultural acres. Adjustments may be made to the total agricultural acreage in the PFAs may be necessary as FDACS assesses the current uses of those areas identified as agricultural land uses.

It is important to understand that even if all targeted agricultural operations are enrolled, not all of the acreage listed as agriculture (**Table 20**) will be included in enrollment figures. The Notices of Intent (NOIs) will document the estimated total number of acres where applicable BMPs are implemented, not the entire parcel acreage. This is because land use data can include nonproduction acres (such as buildings, parking lots, and fallow acres) that will not be counted on the NOIs submitted to FDACS.

Significant amounts of acreage may also need to be enrolled, such as lands not actively involved in commercial agriculture (operations conducted as a business). There are often areas of low-density residential uses on large parcels of grassed land, or land that was but is no longer in commercial agricultural production. This information is impossible to discern in the photo interpretation process used to generate the land use data. Local governmental, NWFWMD, or departmental BMPs may address these noncommercial sources.

For these reasons, attaining 90 percent enrollment of the current agricultural land use acreage may constitute full enrollment of the operations appropriate to enroll. Therefore, this percentage may need to be adjusted based on further analysis of land use data and additional information collected during the enrollment process. FDACS will address this matter in future BMAP annual reports as needed. Agricultural enforcement for BMAP actions is based on the FWRA, which states that nonpoint source dischargers who fail either to implement the appropriate BMPs or conduct water quality monitoring prescribed by the department or a water management district that demonstrates compliance with water quality standards may be subject to enforcement action by either of those agencies. All agricultural nonpoint sources in the BMAP area are statutorily required either to implement FDACS-adopted BMPs or to conduct water quality monitoring that demonstrates compliance with state water quality standards.

With the implementation of these strategies, agricultural fertilizer and livestock nitrate loading in the PFAs will be sufficiently addressed for the first BMAP iteration.

4.1.5 STORMWATER SUFFICIENCY

The city of Tallahassee has a pet waste ordinance and an educational program that reaches out to the public about pet waste management. Since the adoption of the ordinance and the implementation of the educational efforts, the city found that 34 percent of dog owners began picking up after their pets. In addition, the city has constructed over 70 various stormwater treatment capital improvement projects throughout the city since 2004 (see **Appendix C**).

FDOT District 3 has implemented street sweeping of its curb and gutter roads in urbanized areas through contracts with Leon County and the city of Tallahassee. District 3 is also working with the department to investigate the use of innovative nitrogen removal technologies for future projects in the PFAs.

Leon County enacted a pet waste ordinance in 2011 that includes an educational program to promote the clean up of pet waste. The county also adopted irrigation and landscaping ordinances. The county participates in the FYN Program, which provides education and outreach to the public. The county adopted land development regulations in 2012, including minimum environmental regulations countywide that exceed state stormwater standards. These minimum countywide regulations also apply in the city of Tallahassee. The county also adopted comprehensive plan amendments that reduced allowable development in the urban fringe areas, in order to focus development in the urban areas. In addition, the county is proposing to develop a low-impact development (LID) program that would provide incentives to reduce nitrogen loading to surface and ground waters.

Leon County has also completed several stormwater improvement projects. The county constructed two stormwater retrofit ponds in Harbinwood Estates and planted/stabilized 1,200 linear feet of channel. The county constructed the 10-acre Fuller Road Regional Facility as a stormwater retrofit project at Interstate 10 and United States (U.S.) Highway 27. The county removed a 15-acre nutrient sediment dam and stabilized Munson Slough as part of the Lake Munson erosion and flood protection upgrades. The county also maintains the stormwater system in accordance with the MS4 permit and sweeps 762 miles of roads annually, removing approximately 51.3 kg/yr of TN.

Wakulla County has adopted comprehensive plan policies that establish special area plans for three projects in the Wakulla Springs Basin. These policies require nitrate loading analyses for development and establish standards for stormwater, karst feature protections, landscaping, and open space.

These strategies together will sufficiently address stormwater nitrate loading for the first BMAP iteration.

4.1.6 OTHER STRATEGIES

Stakeholders have also implemented or are planning to implement studies, protection measures, and source control efforts that will help improve water quality in the Upper Wakulla River and Wakulla Springs Basin.

The city of Tallahassee and Leon County both have an ordinance identifying the PSPZ. The city of Tallahassee adopted comprehensive plan amendments that reduced the amount of development allowed

in urban fringe areas inside the PSPZ and requires a no net increase in dwelling units from the future land use map in the PSPZ.

FDOT District 3 has implemented a protection measure that avoids constructing stormwater treatment ponds directly over mapped karst caves. A 300-foot buffer is provided around these known karst caves.

Leon County conducts water quality sampling at 73 sites and uses the data in annual water quality reports to help prioritize water quality project needs. The county completed a study on Woodville recharge aquifer protection using a grant from the EPA and is also planning to create annual Wakulla Springs status reports for the Board of County Commissioners. In addition, the county has purchased land to protect sinks in the basin and has an adopted aquifer wellhead protection ordinance, a litter control program, and an Adopt-A-Road program.

Leon County and Wakulla County prepared AVA reports (Baker *et al.* 2007; Baker *et al.* 2009) to determine the most vulnerable areas in each county. The city of Tallahassee, Leon County, and Wakulla County funded a study (Lombardo 2011) to identify options for addressing OSTDS loading. Wakulla County has a springs protection ordinance identifying the Wakulla Springs Special Planning Area and is considering the expansion of this area based on geologic vulnerability. The county has ordinances that requires karst buffers and ground water extraction limitations. Wakulla County also has comprehensive plan policies that set standards for the Northeast Wakulla Sustainable Community; work to develop solutions to restore the health of Wakulla Springs; protect the functions of ground water recharge areas, springs, and springsheds; and encourage development in Crawfordville with connection to sewer service. The county's litter control ordinance prohibits litter and dumping along roadways and waterways.

In addition, Wakulla Springs State Park conducts several educational and outreach programs to educate the public about the Wakulla River and Wakulla Springs. The Learning in Florida's Environment Program occurs annually with middle-school students. The Project Learning Tree Program also occurs annually and involves nature activities with elementary school students. The Green Guide Class is an environmental education program to train Green Guides to conduct river wildlife surveys, aquatic studies on the river, and tree identification. Wakulla Springs State Park also participates in the annual Wakulla Wildlife Festival and hosts a variety of Park Ranger programs.

4.2 STAKEHOLDER MANAGEMENT STRATEGIES

Table 14 through **Table 20** set forth the management strategies, and time frames for the implementation of those strategies, required in this BMAP. **Figure 14** shows the area of agricultural land uses enrolled in FDACS BMP Program in the PFAs as of June 2015. Additional reductions are expected in future BMAP phases to meet the loads specified in the TMDLs. Where available, the tables provide information on the assigned nutrient reductions, shown in kg/yr, for projects benefiting the watershed. The BMAP strategies represent a considerable local, regional, and state investment in a multifaceted approach to water quality protection and restoration in the Upper Wakulla River and Wakulla Springs system. Responsible entities submitted these management strategies to the department with the understanding that the strategies would be included in the BMAP, thus requiring each entity to implement the proposed strategies in a timely way and achieve the assigned load reduction estimates. However, this list of strategies is meant to be flexible enough to allow for changes that may occur over time. Any change in listed management strategies, or the deadline to complete these actions, must first be approved by the department. Substituted strategies must result in equivalent or greater nutrient reductions than expected from the original strategies.

The following tables summarize the management strategies provided by each of the stakeholders in the PFAs. For future management strategies, stakeholders are identifying feasible funding strategies to implement the activities identified in the tables. These funding strategies include the Leon County sales tax extension, RESTORE Act funding, Section 319 funding, and TMDL grants (see **Appendix D** for other funding sources).

TABLE 14: DEPARTMENT MANAGEMENT STRATEGIES

NUMBER	NAME	DESCRIPTION	STATUS	CATEGORY
FDEP-1	TN Requirements for WWTFs in PFA1	Update permits, as needed, to incorporate new requirements for WWTFs 1.	Ongoing	Wastewater

TABLE 15: FDOT DISTRICT 3 MANAGEMENT STRATEGIES

N/A = Not applicable
* The estimated reductions are based on the amount of TN applied to the land surface and do not represent the nitrate loading to ground water.

NUMBER	NAME	DESCRIPTION	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
FDOT-1	Fertilizer Cessation	Eliminated fertilizer use for ongoing turf maintenance in entire basin, including areas outside PFAs.	Complete	4,640.0	Residential Fertilizer
FDOT-2	Street Sweeping	Contract for street sweeping of FDOT curb and gutter roads in urbanized areas of Leon County and city of Tallahassee.	Ongoing	284.6	Stormwater
FDOT-3	Innovative Nitrogen Removal Technologies	Investigating use of innovative nitrogen removal technologies as part of present work program in PFAs.	Planned	N/A	Stormwater
FDOT-4	Avoidance of Mapped Karst Caves	Avoid constructing ponds directly over mapped karst caves by providing 300-foot buffer.	Ongoing	N/A	Protection Measure

TOTAL ESTIMATED REDUCTIONS = 4,924.6 KG/YR OF TN

TABLE 16: WAKULLA SPRINGS STATE PARK MANAGEMENT STRATEGIES

NUMBER	NAME	DESCRIPTION	COST	STATUS	CATEGORY
WP-1	Learning in Florida's Environment	Annual environmental education program with three outdoor field activities to investigate biodiversity of park wildlife: (1) river wildlife survey to observe and record wildlife on river, (2) aquatic study of Wakulla River to collect macroinvertebrates and others, and (3) aquatic study of Cypress Dome to collect macroinvertebrates and others. Students develop hypotheses related to habitat to investigate diversity of park aquatic wildlife. Total of 180 6th grade middle school students participated over four field trip days (45 students per day).	17 staffing days	Ongoing	Education
WP-2	Project Learning Tree	Annual environmental education program with three participatory nature activities involving 320 elementary school students.	2 staffing days	Ongoing	Education
WP-3	Green Guide Class	Annual environmental education program with 24 Green Guides in training. Four outdoor field activities to investigate biodiversity of park wildlife: (1) river wildlife survey to observe and record wildlife on river, (2) aquatic study of Wakulla River to collect macroinvertebrates and others, (3) aquatic study of Cypress Dome to collect macroinvertebrates and others, and (4) tree identification workshop. Occurs over two field trip days.	3 staffing days	Ongoing	Education
WP-4	Wakulla Wildlife Festival	Annual environmental education program with bird of prey and reptile shows, over 25 nature related exhibits, seven nature field trips, and over 2,500 park visitors of all ages. All-day event to promote environmental awareness and nature appreciation.	24 staffing days	Ongoing	Education
WP-5	Park Ranger Programs	Monthly morning nature walks, annual songbird walk, annual photographers' tour, annual medicinal plant walk, and annual Swift Night Out!	3.5 staffing days	Ongoing	Education

TABLE 17: CITY OF TALLAHASSEE MANAGEMENT STRATEGIES

N/A = Not applicable
* The estimated reductions are based on the amount of TN applied to the land surface and do not represent the nitrate loading to ground water.

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	START DATE	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
COT-1	Wastewater Treatment Facility Upgrade to AWT	Upgrade to AWT to reduce nitrogen concentration by 75% at spray field near Tram Road and improve quality of reuse.	$227,000,000	2008	11/2012	Completed	214,939.0	Wastewater
COT-2	Biosolids Application Elimination	Eliminated biosolids disposal in springshed.	N/A	2001	2006	Completed	169,347.0	Wastewater
COT-3	Assessment and Rehabilitation of the Sewer Collection System	Project consisting of assessment and rehabilitation of sewer collection system. "Older systems," constructed of vitrified clay pipe, consist of 356 miles of 895 total miles in system. Of 356 miles of "old system," approximately 26 miles (7%) are in PFA1. rehabilitation of sewer system is prioritized based on level of severity or in conjunction with other planned projects, such as repaving of a roadway. Completion of assessment expected by 12/31/2014 and completion of rehabilitation by 2021.	$10,000,000	2011	2021	Ongoing	N/A	Wastewater
COT-4	Fertilizer Use Ordinance (Number 08-O-72AA)	Households that applied fertilizer (2007 vs. 2012) decreased 49%, level of nitrogen applied per household decreased 27%.	N/A	2009	Ongoing	Ongoing	129.4	Residential Fertilizer
COT-5	Public Education for Stormwater, Fertilizer, and Pet Waste	Public education using various media resources to promote behavioral changes for individuals and businesses to conserve water and reduce or eliminate pollution impacts to surface water and ground water.	$1,700,000 (since 2006)	2006	Ongoing	Ongoing	46.6	Residential Fertilizer
COT-6	Spray Field Fertilizer Application	Eliminated fertilizer application on spray field (in springshed).	N/A	2007	2007	Completed	61,500.0	Farm Fertilizer
COT-7	Pet Waste Ordinance (Number 10-0-15AA)	34% of dog owners began picking up after their pets.	N/A	06/2008	Ongoing	Ongoing	29.1	Stormwater
COT-8	Stormwater Improvement Projects	Conveyance improvements, including Wilson Ridge Flood Relief, 1102 Tanner, Trapnell Street, 1543 Coleman, Cypress Lake and Roswell Drive	$990,000	2004	2012	Completed	13.9	Stormwater
COT-9	PSPZ Ordinance (Number 08-O-68AA)	Identifies PSPZ where development has to meet more stringent requirements.	N/A	04/2009	Ongoing	Ongoing	Not quantified	Protection Measure
COT-10	Comprehensive Plan Provisions	Reduced allowed development in urban fringe inside PSPZ; created transfer of development units system that allows no net increase in dwelling units in PSPZ;	N/A	2009	Ongoing	Ongoing	Not quantified	Protection Measure

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	START DATE	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
	(Conservation Element Policy 4.2.5)	and allows transfer of development rights from rural to urban fringe areas into Woodville.						
COT-11/LC-29	Alternatives to Sewer Solutions Study	Funding to study and develop preferred options for management alternatives to traditional OSTDS in unincorporated areas of Leon County, including PSPZ; identify preferred options for responsible management entities, including recommendations for financing and management structures for identified preferred options; recommend regulatory measures; identify other issues related to sewage treatment and disposal system financing.	Unknown	2018	2019	Adopted in Sales Tax Project List	Planning for comprehensive long-term reduction for development in unincorporated area	OSTDS

TOTAL COST = $239,690,000

TOTAL ESTIMATED REDUCTIONS = 446,005.0 KG/YR OF TN

TABLE 18: LEON COUNTY MANAGEMENT STRATEGIES

N/A = Not applicable
* The estimated reductions are based on the amount of TN applied to the land surface and do not represent the nitrate loading to ground water.
** The estimated project cost is only for adding the sewer force main in the PSPZ. There will be additional costs for the homeowners to connect to the sewer system.
*** The estimated reductions for this project are for a one-time removal of nutrients. Therefore, the benefits from this project will not occur on an annual basis.

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	START DATE	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
LC-1	Sewering in PSPZ	County identified project both in its adopted sewer master plan and water and sewer interlocal agreement with city as targeted area for sewer. Funds for project are available through county's share of Blueprint Water Quality Funding supported by local infrastructure sales tax, subject to annual budget and appropriation.	$24,500,000**	2020	2025	Proposed	Reductions will be calculated as part of OSTDS Initiative	OSTDS
LC-2	Septic Tank Inventory	Preparation of GIS inventory of all septic systems in Leon County.	$50,000	2013	2015	Proposed	N/A	OSTDS
LC-3	Septic Tank Repairs	Proposed revision to septic tank ordinance to require repairs to have minimum of 24 inches separation between drainfield and seasonal high water table.	Staff time	2015	2016	Proposed	N/A	OSTDS
LC-4	Septic Tank Nitrogen Removal Requirements	Pending results of FDOH evaluation of passive systems, as referenced in Section 381.0065(4)(x), F.S, county shall(1) review results of this Florida study of nitrogen-reducing, performance-based OSTDS, including passive systems; (2) identify passive systems regulated under Section 381.0065, F.S., approved by state for permitting and appropriate for use in Leon County; (3) evaluate factors such as cost and operational feasibility of such passive systems; and (4) develop proposed amendment to code of laws requiring the of appropriate systems for new construction in PSPZ.	Staff time	2015	2017	Proposed	N/A	OSTDS
LC-5	Septic Tank Education	Add educational kiosks at Woodville Community Center to explain how septic systems work.	$2,500	2015	2016	Proposed	21.7	OSTDS
LC-6	Enacted Comprehensive Fertilizer Ordinance (Number 09-34)	Requires commercial applicators to follow set of BMPs for fertilizer application.	Staff time	2009	2009	Completed	12.4	Residential Fertilizer

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	START DATE	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
LC-7	Fertilizer Ordinance Modification	Consider modification to fertilizer ordinance to reduce nitrogen application rates below Cody Scarp, if allowable by Florida law.	Staff time	2014	2014	Proposed	N/A	Residential Fertilizer
LC-8	Education and Outreach	Outreach through FYN, illicit discharge program, pamphlets, presentations, workshops, and special events.	Staff time	N/A	Ongoing	Ongoing	24.7	Residential Fertilizer, Stormwater
LC-9	Enacted Pet Waste Ordinance (Number 11-21)	Education program to promote cleanup of pet waste as contributor to surface water pollution.	Staff time	N/A	08/2011	Completed	15.5	Stormwater
LC-10	Land Development Regulations	Adopted new minimum countywide environmental regulations that exceed state stormwater standards.	Staff time	2011	2012	Completed	N/A	Stormwater
LC-11	Comprehensive Plan Provisions (Conservation Element Policy 4.2.5)	Reduced allowable development in urban fringe from up to 1 unit per acre to 1 unit per 3 acres. Transfer of density with no net increase in dwelling units as allowed on future land use map permitted.	Staff time	01/2008	04/2009	Completed	N/A	Stormwater
LC-12	Lake Munson Erosion and Flood Protection Upgrades	Removed 15-acre nutrient sediment dam in 2002, stabilized Munson Slough to reduce erosion, and repaired dam for stabilization of lake hydroperiod.	$7,200,000	1996	2012	Completed	157,068.2***	Stormwater
LC-13	Low-Impact Development	Develop LID incentives to reduce nitrogen loading to surface water and ground water.	Staff time	2013	2014	Completed	N/A	Stormwater
LC-14	Street Sweeping	Contract for 821 miles of street sweeping annually throughout BMAP area; collects 124.75 tons/yr.	$ 75,500/yr	N/A	Ongoing	Ongoing	51.3	Stormwater
LC-15	FYN Program	Participation in FYN Program through Cooperative Extension Service.	$55,000/yr	N/A	Ongoing	Ongoing	74.2	Stormwater
LC-16	Irrigation Ordinance	Irrigation Ordinance.	N/A	N/A	Ongoing	Ongoing	12.4	Stormwater
LC-17	Landscaping Ordinance	Landscaping Ordinance.	N/A	N/A	Ongoing	Ongoing	12.4	Stormwater
LC-18	Aquifer Vulnerability Assessment	Study to determine areas with most direct connections to Wakulla Springs. Study ignored sinks in surface waters in its assessment.	$73,000	2006	10/2007	Completed	N/A	Study
LC-19	Lombardo Report	In conjunction with city of Tallahassee and Wakulla County, this report compiled previous studies to identify nitrogen loading to Wakulla Springs and to identify treatment and management options, where central sewer is not available, to reduce nitrate loading to Wakulla Springs from septic systems located in Leon and Wakulla Counties.	$60,000	04/2010	02/2013	Completed	N/A	Study

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	START DATE	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
LC-20	Water Quality Sampling	Sample 73 sites in 13 lakes, 27 streams, and 2 rivers.	$250,000	N/A	Continuous	Ongoing	N/A	Study
LC-21	Preparation of Annual Water Quality Report	Prepare and publish annual water quality report to document health of natural systems and use it to prioritize water quality project needs.	$15,000/yr	N/A	Available in summer of each year	Ongoing	N/A	Study
LC-22	Woodville Recharge Aquifer Protection Study	EPA grant to study 60-square-mile Woodville Recharge Basin for flooding, water quality, and aquifer protection.	$300,000	2005	2007	Completed	N/A	Study
LC-23	Annual Wakulla Springs Status Report	Commitment to developing annual status report on Wakulla Springs for Board of County Commissioners.	Staff time	01/2014	01/2018	Ongoing	N/A	Study
LC-24	Established Primary Springs Protection Zone (Number 09-12)	Enacted to establish defined area for enforcement for additional water quality protection in this zone.	Staff time	2006	03/2009	Completed	Not quantified	Protection Measure
LC-25	Eight Mile Pond	Acquisition of 132 acres immediately upstream of Ames Sink to preserve/protect sink. Property acquired through environmental permitting as mitigation for Florida Gas Transmission Line linear impacts.	Staff time	2009	07/2010	Completed	N/A	Protection Measure
LC-26	Aquifer Wellhead Protection Ordinance (Number 07-20)	Includes Aquifer Protection Program.	Staff time	N/A	07/2007	Completed	N/A	Protection Measure
LC-27	Litter Control Program	Maintain 2,316 miles of right-of-way, collecting 78.4 tons of waste.	Staff time	N/A	Ongoing	Ongoing	N/A	Other Source Control
LC-28	Adopt-A-Road Program	Maintain 112 miles of right-of-way, collecting 2.11 tons of trash.	N/A	N/A	Ongoing	Ongoing	N/A	Other Source Control

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	START DATE	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
LC-29/ COT-11	Alternatives to Sewer Solutions Study	Funding to study and develop preferred options for management alternatives to traditional OSTDS in unincorporated areas of Leon County, including PSPZ; identify preferred options for responsible management entities, including recommendations for financing and management structures for identified preferred options; recommend regulatory measures; identify other issues related to sewage treatment and disposal system financing.	Unknown	2018	2019	Adopted in Sales Tax Project List	Planning for comprehensive long-term reduction for development in unincorporated area	OSTDS

TOTAL COST = $32,581,000

TOTAL ESTIMATED REDUCTIONS = 157,609.0 KG/YR OF TN

TABLE 19: WAKULLA COUNTY MANAGEMENT STRATEGIES

N/A = Not applicable
TBD = To be determined
* The estimated reductions are based on the amount of TN applied to the land surface and do not represent the nitrate loading to ground water.

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	START DATE	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
WC-1	Comprehensive Plan Infrastructure Policy 1.3.6	Requires AWT for any WWTF or spray field located in Wakulla Springs Special Planning Area.	N/A	2006	Ongoing	Ongoing	Not quantified	Wastewater
WC-2	Otter Creek WWTP Upgrade and Capacity Expansion	Upgrading and expanding capacity of Otter Creek WWTP from 0.6 to 1.2 mgd (funding secured through USDA Rural Development loan/grant)	$12,000,000	2015	TBD	Preliminary Engineering Plan is being revised and design in process	Not quantified	WC-2
WC-3	Public Education on OSTDS	Provide citizens and officials with best available information for decision making regarding use of OSTDS and decentralized wastewater systems to reduce nutrients in ground water to springs.	N/A	2007	2007	Completed	Not quantified	OSTDS
WC-4	Comprehensive Plan Infrastructure Policy 1.3.7	Requires nitrogen-reducing septic systems on parcels smaller than five acres in Wakulla Springs Special Planning Area; within 150 feet of surface water, swallet, or other karst feature, or within 300 feet of first- or second-magnitude spring; and on all parcels less than 0.229 acres in size.	N/A	2012	Ongoing	Ongoing	Not quantified	OSTDS
WC-5	Magnolia Gardens Central Sewer Installation – Phase I	Planned central sewer installation for Magnolia Gardens Phase I. There are potentially 180 existing septic system connections projected. Conceptual planning for Phases II and III is ongoing.	$4,300,000	Not finalized	Not finalized	Partially funded	Not quantified	OSTDS
WC-6	Wakulla Gardens Central Sewer Installation – Phase I	Planned central sewer installation for Wakulla Gardens Phase I. There are potentially 90 existing septic system connections projected. Conceptual planning for Phases II and III is ongoing.	$4,300,000	Not finalized	Not finalized	Partially funded	Not quantified	OSTDS
WC-7	Greiner's Addition Central Sewer Installation	Planned central sewer installation for Greiner's Addition neighborhood.	Not yet funded	Unknown	Unknown	Not yet funded	Not quantified	OSTDS

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	START DATE	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
WC-8	Wakulla County WWTF – Plantation River Estates	Wakulla County will assume ownership and management of River Plantation Estates WWTP sewer system and wastewater treatment facility. Project includes removal and replacement of existing facility.	$4,900,000 Not yet funded	TBD	Estimated 2019	Unfunded	TBD	Wastewater
WC-9	Wakulla Springs Watershed	Inspect and repair old, damaged, and failing systems in Wakulla Springs watershed area.	1,380,300 Not yet funded	10/15/2012	N/A	Advanced planning, seeking funding	Not quantified	OSTDS
WC-10	Crawfordville TIF District	TIF District for Crawfordville area to fund improvements including basic infrastructure.	N/A	11/5/2012	Ongoing	Ongoing	Not quantified	OSTDS
WC-11	Fertilizer Use Ordinance 2010-1	Adopts model ordinance on Florida-friendly fertilizer use on urban landscapes.	N/A	2/4/2010	N/A	Ongoing	22.0	Residential Fertilizer
WC-12	Fertilizer Management Education	Education and outreach to public about fertilizer management.	N/A	2014	2014	Proposed	Part of WC-11	Residential Fertilizer
WC-13	Comprehensive Plan Future Land Use Policies 1.2.10, 1.2.10.2, and 1.2.10.3 - Special Area Plans	Establishes special area plans for Bloxham Special Area Plan, Special Area Plan #2, and Spring Creek Highway Special Area Plan in Wakulla Springs Basin. Requires nitrate loading analyses for development. Establish standards for stormwater, karst feature protections, landscaping, and open space.	N/A	2004	Ongoing	Ongoing	Not quantified	Stormwater
WC-14	Wakulla County Aquifer Vulnerability Assessment	Modeling effort to identify most vulnerable areas in county.	N/A	2007	09/2009	Completed	N/A	Study
WC-15	Comprehensive Plan Future Land Use Policy 1.2.9.1 - Northeast Wakulla Sustainable Community	Establishes standards for 606-acre site in Wakulla Springs Basin. Requires no net increase in nutrients or phosphorus loading to ground water. Sustainable community standards established for stormwater, ground water, open space, and BMPs. Requires AWT standards for sanitary sewer service to site.	N/A	2003	Ongoing	Ongoing	Not quantified	Protection Measure

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	START DATE	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
WC-16	Ordinance 2006-58 (Multiple Objectives and Policies in Comprehensive Plan Conservation and Future Land Use Elements)	Add karst buffers; require nitrate loading study for proposed development greater than one acre (if karst feature on site is found to have direct connection to aquifer); incorporate FYN practices and landscaping standards that promote native vegetation for new subdivisions; reduce nitrates from public facilities; and address stormwater, water conservation, wastewater facilities, treated wastewater reuse, and natural water flows.	N/A	2006	Ongoing	Ongoing	Not quantified	Protection Measure
WC-17	Comprehensive Plan Conservation Objective 12.0	Develop solutions to restore health of Wakulla Springs by reducing pollutants in ground water and implementing policies for Wakulla Springs Special Planning Area.	N/A	2010	Ongoing	Ongoing	Not quantified	Protection Measure
WC-18	Comprehensive Plan Conservation Policy 12.1	Establishes transfer of development rights policy to encourage development in Crawfordville with connection to sewer service, no future land use map amendments in PSPZ shall be permitted that would result in net increase in residential density above two units per acre; fertilizer restrictions based on FYN Program.	N/A	2010	Ongoing	Ongoing	N/A	Protection Measure
WC-19	Comprehensive Plan Conservation Policy 12.2	County will consider expanding Wakulla Springs Special Planning Area based on geological vulnerability.	N/A	2010	Ongoing	Ongoing	N/A	Protection Measure
WC-20	Comprehensive Plan Infrastructure Objective 2.5	To protect functions of ground water recharge areas, springs, and springsheds.	N/A	1995	Ongoing	Ongoing	Not quantified	Protection Measure
WC-21	Ground Water Extraction Ordinance	Requests NWFWMD to establish minimum flows and levels (MFLs) for Wakulla Springs and requests NWFWMD to deny permits to transport water from Wakulla Springs springshed and Ochlockonee and St. Marks Rivers.	N/A	N/A	6/18/2012	Ongoing	N/A	Protection Measure

Number	Name	Description	Estimated Cost	Start Date	Comple-tion Date	Status	Estimated Reductions (kg/yr of TN)*	Category
WC-22	Litter Regulations. Code of Ordinances Section 27.049	Prohibits litter and dumping along roadways and waterways, and establishes penalties.	N/A	1992	Ongoing	Ongoing	N/A	Other Source Control

Total Cost = $26,880,300
Total Estimated Reductions = 22 kg/yr of TN

Table 20: Agricultural Land Uses and BMP Enrollment in the PFAs as of June 30, 2015

N/A = Not applicable
Note: The acreage identified as agricultural in land use data may not all be in active commercial production, and therefore may not all be targeted for enrollment. Reductions from 100 percent enrollment are 2,671.61 kg/year of TN on the land surface.

2009 NWFWMD Land Use	Acres	Related FDACS BMP Programs	Enrolled Acres	Related NOIs
Pasture and Rangeland	3,762.36	Cow/Calf	1,157.03	4
Row/Field/Mixed Crops	288.48	Vegetable/Agronomic Crops	0.00	N/A
Hay Fields	1,163.58	Vegetable/Agronomic Crops Revision (Future)	0.00	N/A
Fallow Cropland	472.66	N/A	0.00	N/A
Horse Farms	37.29	Equine	0.00	N/A
Other Groves	19.24	Specialty Fruit and Nut	0.00	N/A
Nurseries and Vineyards	15.36	Future Nursery, Specialty Fruit and Nut	0.00	N/A
Tree Nurseries	2.77	Future Nursery, Specialty Fruit and Nut	0.00	N/A
Ornamentals	14.78	Container Nursery	0.00	N/A
Total	**5,776.52**	**N/A**	**1,157.03**	**4**

Area Enrolled (as of June 30, 2015) = 1,157.03 acres
Remaining Area To Enroll = 4,619.49 acres

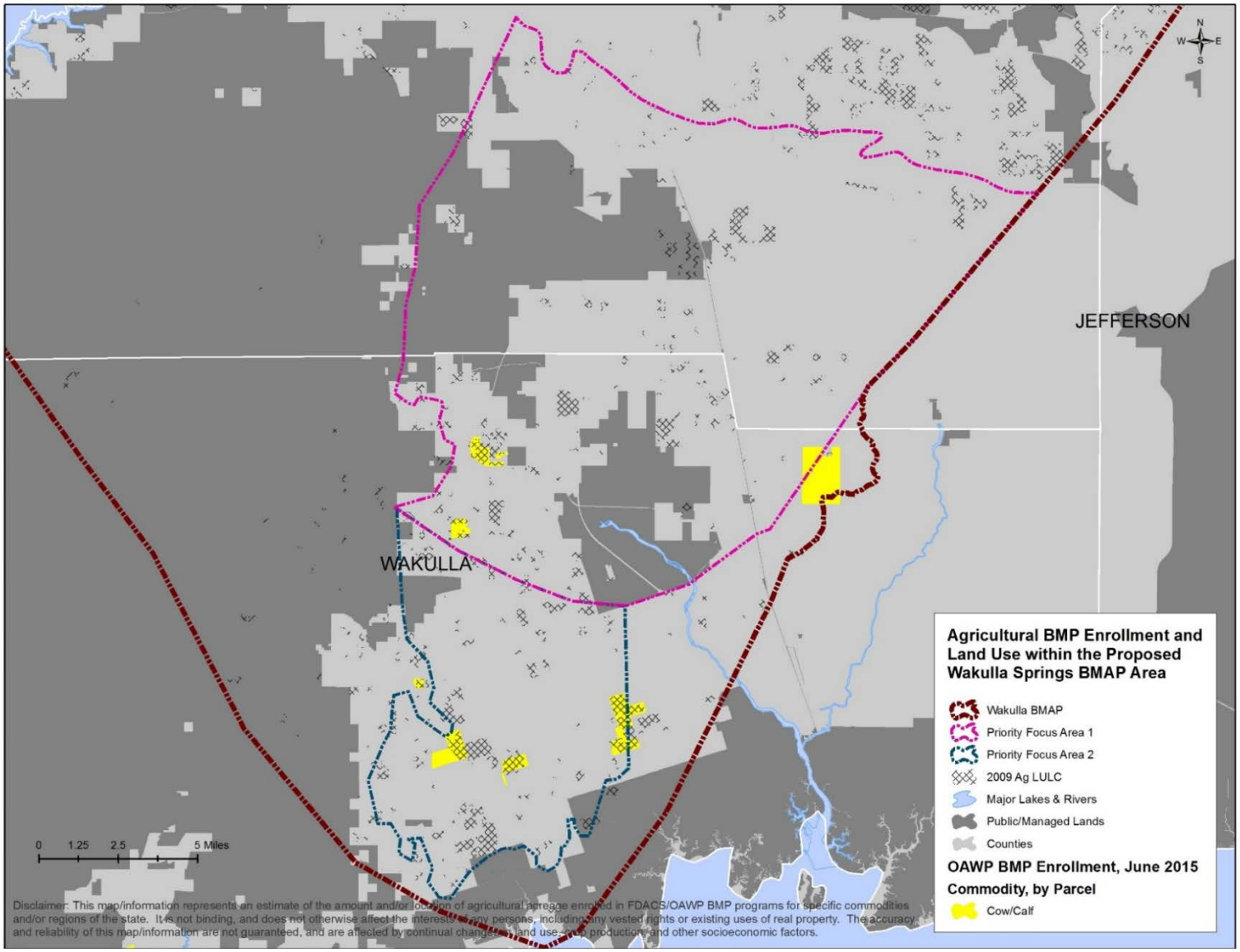

FIGURE 14: AGRICULTURAL LANDS ENROLLED IN BMPS IN THE PFAS, AS OF JUNE 2015

Chapter 5: MANAGEMENT STRATEGIES OUTSIDE THE PFAS

In addition to the management strategies implemented by the stakeholders in the PFAs listed in **Chapter 4**, strategies are also being implemented or are planned for outside the PFAs by the stakeholders listed below. These strategies will also help to reduce nitrate loading to the Upper Wakulla River and Wakulla Springs.

5.1 AGRICULTURE

In the portion of the Upper Wakulla River and Wakulla Springs Basin located outside the PFAs, there are approximately 58,468.32 acres of nonforestry agricultural land uses, of which 5,898.71 acres, or 10.1 percent, were enrolled in FDACS BMP programs as of June 30, 2015 (see **Table 21** and

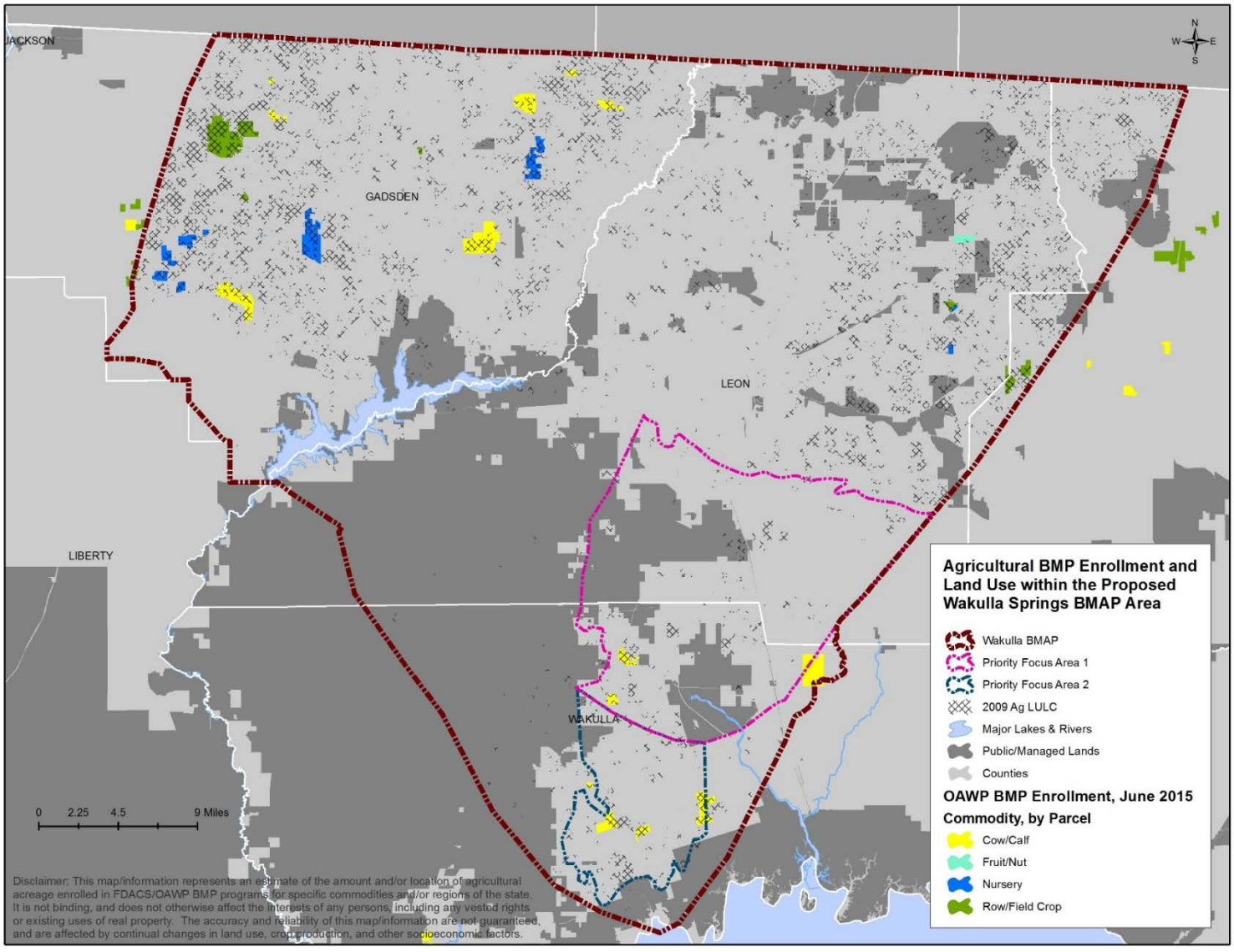

Figure 15). During the first BMAP iteration, FDACS will continue to enroll additional producers in BMPs to the extent possible. See **Section 4.1.4** regarding agricultural BMP enrollment in the PFAs for additional information on agricultural land use and FDACS enrollment goals.

TABLE 21: AGRICULTURAL LAND USES AND BMP ENROLLMENT OUTSIDE THE PFAS AS OF JUNE 30, 2015

N/A = Not applicable

[1] Enrollment numbers will depend on the ability of field staff to identify and locate producers, and whether producers choose to implement BMPs or monitor their water quality. Also, specific agricultural land uses and number of agricultural operations may change from year to year. Progress on enrollment, based on the best available information, will be included in the BMAP annual progress reports.

2009 NWFWMD LAND USE	ACRES[1]	RELATED FDACS BMP PROGRAMS	ACREAGE ENROLLED	RELATED NOIS
Pasture and Rangeland	26,894.80	Cow/Calf	2,867.40	11
Row/Field/Mixed Crops	11,775.52	Vegetable/Agronomic Crops	1,960.21	6
Hay Fields	13,926.93	Vegetable/Agronomic Crops Revision (Future)	N/A	N/A
Fallow Cropland	821.32	N/A	N/A	N/A
Horse Farm	1,298.26	Equine	0.00	N/A
Other Groves	475.53	Specialty Fruit and Nut	40.00	1
Nurseries and Vineyards	102.96	Nursery, Specialty Fruit and Nut	0.00	N/A
Tree Nurseries	155.11	Nursery	0.00	N/A
Ornamentals	1,629.87	Nursery	2,751.84	6
Sod Farms	1,260.62	Statewide Sod	0.00	N/A
Specialty Farms	48.67	Conservation Plan Rule	0.00	N/A
Cattle Feeding	55.15	Conservation Plan Rule	0.00	N/A
Poultry Feeding	23.58	Conservation Plan Rule	0.00	N/A
TOTAL	**58,468.32**	**N/A**	**7,619.45**	**24**

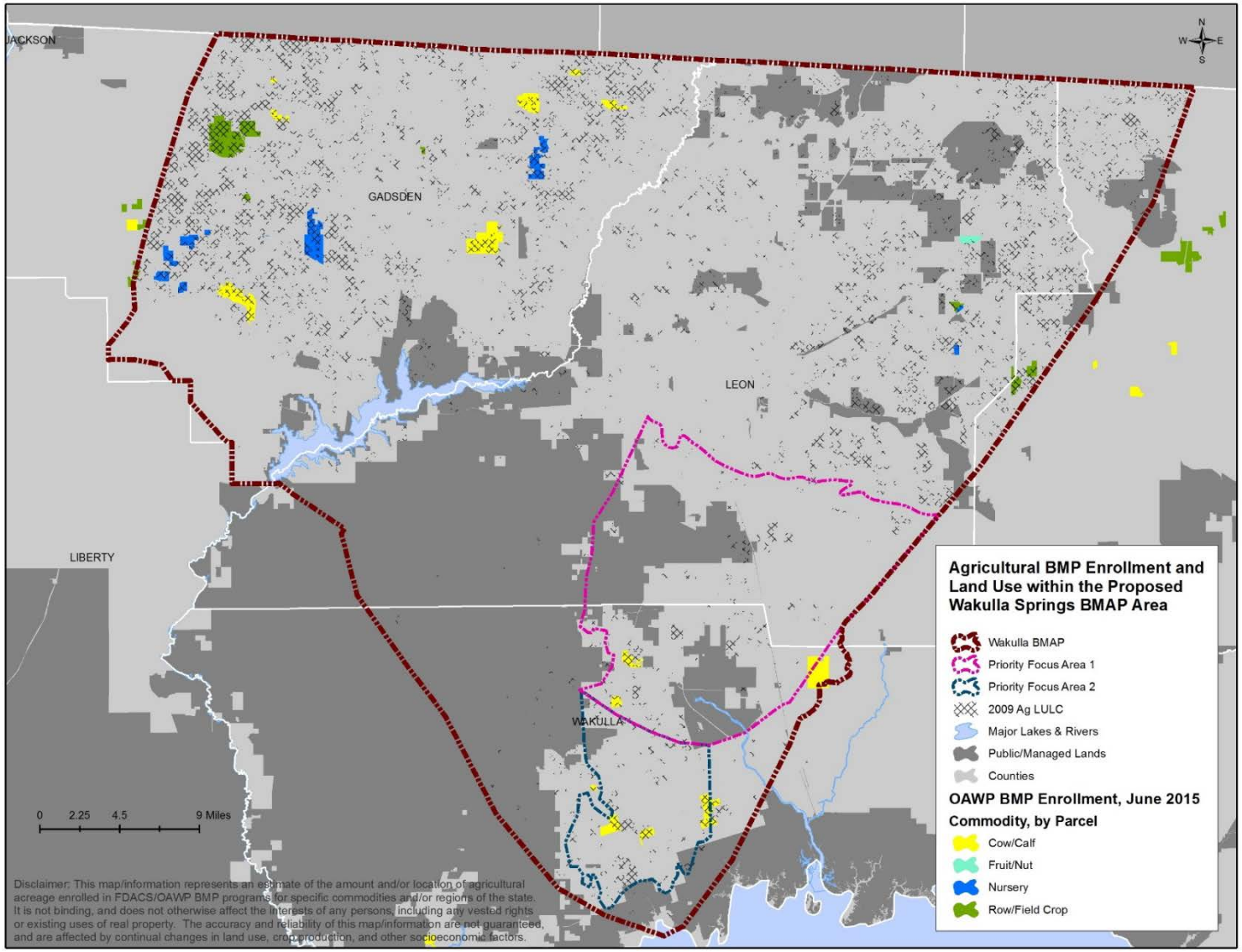

FIGURE 15: AGRICULTURAL LANDS ENROLLED IN BMPS OUTSIDE THE PFAS, AS OF JUNE 2015

5.2 CITY OF GRETNA MANAGEMENT STRATEGIES

The city of Gretna does not apply fertilizer on any city-owned property. **Table 22** summarizes the city's management strategies.

TABLE 22: CITY OF GRETNA MANAGEMENT STRATEGIES OUTSIDE THE PFAS

NUMBER	NAME	DESCRIPTION	STATUS	CATEGORY
CG-1	No Fertilizer Use	Fertilizer is not applied on any city-owned property.	Ongoing	Residential Fertilizer

5.3 CITY OF QUINCY MANAGEMENT STRATEGIES

The city of Quincy's WWTF is AWT. A city ordinance requires minimum stormwater treatment levels and the use of BMPs, including slow-release fertilizers. In addition, the city conducts street sweeping weekly. **Table 23** summarizes the city of Quincy's strategies.

TABLE 23: CITY OF QUINCY MANAGEMENT STRATEGIES OUTSIDE THE PFAS

NUMBER	NAME	DESCRIPTION	STATUS	CATEGORY
CQ-1	City of Quincy WWTF	AWT at WWTF.	Completed	WWTF
CQ-2	Land Development Code – Watershed Conservation Measures	Ordinance that requires minimum stormwater treatment levels and use of BMPs including slow-release fertilizers.	Ongoing	Residential Fertilizer/ Stormwater
CQ-3	Street Sweeping	Sweeping streets in south side of city one week and north side following week.	Ongoing	Stormwater

5.4 FAMU MANAGEMENT STRATEGIES

As part of FAMU's MS4 activities, the school implements several management strategies to address stormwater, including the following:

- Campuswide letter to all students and staff on stormwater practices.
- Website about stormwater activities.
- Public service announcements (PSAs) on the FAMU public radio station about the effects of illicit discharges and illegal disposal of waste.
- Education about stormwater practices at athletic events and student activities.
- Stormwater system mapping.
- Illicit discharge screening.

— Stormwater system inspections and maintenance.

— Street sweeping.

Table 24 summarizes FAMU's management strategies.

TABLE 24: FAMU MANAGEMENT STRATEGIES OUTSIDE THE PFAS

NUMBER	NAME	DESCRIPTION	STATUS	CATEGORY
FAMU-1	NPDES MS4 Permit	Stormwater system maintenance and education.	Ongoing	Stormwater

5.5 FEDERAL CORRECTIONAL INSTITUTION, TALLAHASSEE MANAGEMENT STRATEGIES

The Federal Correctional Institution, Tallahassee maintains approximately 255 catch basins/stormwater drains that make up the MS4 system. These catch basins/stormwater drains are inspected quarterly. In addition, no fertilizer is applied on the facility grounds. **Table 25** summarizes the Federal Correctional Institution, Tallahassee's management strategies.

TABLE 25: FEDERAL CORRECTIONAL INSTITUTION, TALLAHASSEE MANAGEMENT STRATEGIES OUTSIDE THE PFAS

NUMBER	NAME	DESCRIPTION	STATUS	CATEGORY
FCI-1	NPDES MS4 Permit	Stormwater system inspection and maintenance.	Ongoing	Stormwater
FCI-2	No Fertilizer Use	Fertilizer is not applied on facility grounds.	Ongoing	Fertilizer

5.6 FSU MANAGEMENT STRATEGIES

FSU has a fertilizer rule in its University Master Plan that requires the use of slow-release fertilizers and/or carefully managed fertilizer application times to minimize the leaching of nutrients to ground water. Dehydrated cow manure with a 2-1-2 analysis is used when planting, and a 15-0-15 mix with half of the nitrogen water-insoluble is used twice a year on turfgrass in high-priority areas such as athletic fields.

Through the MS4 permit, FSU also implements several management strategies to address stormwater including the following:

— Newsletter distributed several times per year to all faculty and staff through the mail and also electronically.

— Website about stormwater activities.

— On-campus PSAs.

— Base map of the entire campus stormwater drainage system.

— Illicit discharge policies.

— Stormwater hotline for faculty, staff, students, and visitors to report potential violations.

— Litter control and grounds maintenance.

Table 26 summarizes FSU's management strategies.

TABLE 26: FSU MANAGEMENT STRATEGIES OUTSIDE THE PFAS

N/A = Not applicable

NUMBER	NAME	DESCRIPTION	START DATE	STATUS	CATEGORY
FSU-1	Fertilizer Rule in University Master Plan	Use slow-release fertilizers and/or carefully managed fertilizer applications to ensure maximum root uptake and minimal surface water runoff or leaching to ground water.	2008	Ongoing	Fertilizer
FSU-2	NPDES MS4 Permit	Stormwater system maintenance and education.	N/A	Ongoing	Stormwater

5.7 GADSDEN COUNTY MANAGEMENT STRATEGIES

Gadsden County has a comprehensive plan policy that requires a 100-foot setback for OSTDS from surface waters and wetlands, helping to minimize loading from OSTDS to surface waterbodies. The county also has a policy that requires water and sewer connection for any new development that occurs within 0.25 miles of available service that will help to reduce the number of OSTDS installed in the future in the areas of central sewer connection. In addition, the county has a policy requiring a 50-foot natural buffer around jurisdictional wetlands, rivers, creeks, streams, and lakes. Gadsden County has adopted minimum procedures, policies, and design standards to manage stormwater runoff, known as the Gadsden County Stormwater Policy and Procedures Manual. The county's stormwater pollution abatement requirements are increased by 50 percent (1.5 times the normal treatment requirements) for facilities discharging into waterways and waterbodies recognized by the state as requiring special protection. **Table 27** summarizes Gadsden County's management strategies.

TABLE 27: GADSDEN COUNTY MANAGEMENT STRATEGIES OUTSIDE THE PFAS

NUMBER	NAME	DESCRIPTION	STATUS	CATEGORY
GC-1	Comprehensive Plan Policy 4.5.1 and 5.2.11 in Infrastructure and Conservation Element	Requires 100-foot setback for OSTDS from wetlands, creeks, streams, lakes, *etc*.	Ongoing	OSTDS
GC-2	Comprehensive Plan Policy 5.2.4 and 5.2.11 in Conservation Element	Requires 50-foot natural buffer around all jurisdictional wetlands.	Ongoing	Protection Measure
GC-3	Comprehensive Plan Infrastructure Element	Water and sewer connection required for new development within 0.25 miles of available service.	Ongoing	Wastewater
GC-4	Section 3.4 Special Drainage Basins - Water Quality (Pollution Abatement) in Stormwater Policies and Procedures Manual	Requires 1.5 times normal treatment requirement.	Ongoing	Stormwater

5.8 TALQUIN ELECTRIC COOPERATIVE MANAGEMENT STRATEGIES

Talquin Electric Cooperative completed a project on Highway 267 to add central sewer, eliminating OSTDS for an existing motel and two future hotels. It also added a sewer system along Beech Ridge Trail in Leon County, removing 12 homes from OSTDS. Talquin is currently in the process of abandoning the Oyster Bay WWTP, removing the plant's discharge from the coastal area. The sewer collection system associated with this WWTP will be connected to Wakulla County's WWTF. Talquin is also looking to obtain funding to upgrade the Gadsden East WWTP to add a treatment wetland, resulting in zero effluent discharge from this facility.

Table 28 summarizes Talquin's management strategies.

TABLE 28: TALQUIN ELECTRIC COOPERATIVE MANAGEMENT STRATEGIES OUTSIDE THE PFAS

* The estimated reductions are based on the amount of TN applied to the land surface and do not represent the nitrate loading to ground water.

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	COMPLE-TION DATE	STATUS	ESTIMATED TN REDUCTION*	CATEGORY
TEC-1	Oyster Bay WWTP Abandonment	Decommissioned to connect coastal area sewer system to Wakulla County's sewer system in effort to move WWTP away from coastal areas.	$750,000	9/1/2013	Construction	100%	Wastewater
TEC-2	Gadsden East WWTP	Construct treatment wetland by retrofitting three existing RIBs and building additional treatment cells, so te wetland has zero effluent discharge. Wetland's nitrogen reduction will be achieved through te natural wetland process and will require very little energy for operation and maintenance.	$200,000	12/31/2013	Planned; seeking funding	98%	Wastewater
TEC-3	Highway 267 Sewer	Partnership with Gadsden County and city of Quincy to provide central sewer system to Highway 267/I-10 interchange for existing motel and two future , eliminating OSTDS.	$400,000	06/2008	Completed	80%	Wastewater
TEC-4	Beech Ridge Trail Sewer	Sewer system along Beech Ridge Trail to remove approximately 12 homes from OSTDS.	$40,000	12/2004	Completed	80%	Wastewater

TOTAL ESTIMATED COST = $1,390,000

5.9 TCC MANAGEMENT STRATEGIES

In spring 2012, TCC stopped applying fertilizer on the main campus. The previous applications were between 2,000 and 2,400 pounds of 18-0-18 fertilizer to the centipede sod throughout the campus each spring. In addition, TCC cut in half the amount of fertilizer used on the athletic fields. The new application rate is 300 pounds of fertilizer on the baseball field and 100 pounds of fertilizer on the softball and intramural fields, applied three times per year. TCC will continue this reduction in fertilizer application on the main campus and athletic fields. **Table 29** summarizes TCC's management strategies.

TABLE 29: TCC MANAGEMENT STRATEGIES OUTSIDE THE PFAS

NUMBER	NAME	DESCRIPTION	START DATE	STATUS	CATEGORY
TCC-1	Fertilizer Cessation	Cessation of fertilizer application on main campus and reduction of application on athletic fields by half.	12/2012	Ongoing	Residential Fertilizer

5.10 TOWN OF HAVANA MANAGEMENT STRATEGIES

The town of Havana conducts quarterly sweeping of all the streets within the town limits, helping to reduce the amount of pollutants that run off from the roads. **Table 30** summarizes the town of Havana's management strategies.

TABLE 30: TOWN OF HAVANA MANAGEMENT STRATEGIES OUTSIDE THE PFAS

NUMBER	NAME	DESCRIPTION	STATUS	CATEGORY
TH-1	Street Sweeping	Quarterly street sweeping of all town roads.	Ongoing	Stormwater

5.11 LEON COUNTY MANAGEMENT STRATEGIES OUTSIDE THE PFAS

In addition to the activities conducted by the county in the PFA, the county has constructed stormwater retrofits and acquired land for preservation and wetland rehydration projects, as summarized in **Table 30**.

TABLE 31: LEON COUNTY MANAGEMENT STRATEGIES OUTSIDE THE PFAS

* The estimated reductions are based on the amount of TN applied to the land surface and do not represent the nitrate loading to ground water.

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
LC-29	Harbinwood Estates Ponds	Constructed two stormwater retrofit ponds and planted/stabilized 1,200 linear feet of channel.	$2,980,000	06/2008	Completed	108.0	Stormwater
LC-30	Fuller Road Regional Facility	Constructed 10-acre stormwater retrofit facility at Interstate-10 and Highway 27.	$800,000	03/2010	Completed	208.2	Stormwater
LC-31	Fred George Basin Acquisition	Acquisition of 166 acres, including Fred George Sink, for preservation/protection of sink.	$2,600,000	2012	Completed	N/A	Protection Measure
LC-32	Fred George Basin Wetland Rehydration	Wetland rehydration through grade restoration and construction of trash racks at inflow points are planned to improve water quality prior to runoff entering Fred George Sink.	$200,000 (survey), $800,000 (construc-tion)	2019	Planned	N/A	Protection Measure

TOTAL ESTIMATED COST = $7,380,000
TOTAL ESTIMATED REDUCTIONS = 316.2 KG/YR OF TN

5.12 CITY OF TALLAHASSEE MANAGEMENT STRATEGIES OUTSIDE THE PFAS

In addition to the activities conducted by the city in the PFA, the city has constructed stormwater retrofits and conducts annual street sweeping, as summarized in Table 30**Table 32**.

TABLE 32: CITY OF TALLAHASSEE MANAGEMENT STRATEGIES OUTSIDE THE PFAS

* The estimated reductions are based on the amount of TN applied to the land surface and do not represent the nitrate loading to ground water.

NUMBER	NAME	DESCRIPTION	ESTIMATED COST	COMPLE-TION DATE	STATUS	ESTIMATED REDUCTIONS (KG/YR OF TN)*	CATEGORY
COT-12	Stormwater Treatment Projects	81 stormwater projects city-wide outside of PFA1) completed since 2004, examples include Lower CDD, Frenchtown Pond, and Emory Court, Weems Pond projects. See complete list in Appendix C	$82,303,740	Est 2018	Ongoing		Stormwater
COT-13	Street Sweeping	City-wide street sweeping annually collects and estimated 2000 tons of material and 2000 pounds (942 kg) of total nitrogen removed.	$1,500,000	Ongoing	Ongoing	942	Stormwater

TOTAL ESTIMATED COST = $83,803,740
TOTAL ESTIMATED REDUCTIONS = 942 KG/YR OF TN

Chapter 6: ASSESSING PROGRESS AND MAKING CHANGES

Successful BMAP implementation requires commitment and follow-up. In the commitment to plan implementation (see **Section 6.5**), stakeholders have expressed their intention to carry out the plan, monitor its effect, and continue to coordinate within and across jurisdictions to achieve water quality targets. Stakeholders have committed to and are required to implement the assigned projects and activities in the first five-year phase of this BMAP. The FWRA requires that an assessment be conducted every five years to determine whether there is reasonable progress in achieving pollutant load reductions. This chapter contains the water quality monitoring component sufficient to make this evaluation.

6.1 TRACKING IMPLEMENTATION

The department will work with stakeholders to track project implementation and organize the monitoring data collected each year. The project and monitoring information will be presented in an annual report. In addition to activities for the OSTDS Initiative, the Upper Wakulla River and Wakulla Springs stakeholders have agreed to meet approximately every 12 months after the adoption of the BMAP to follow up on plan implementation, share new information, and continue to coordinate on TMDL-related issues. The following types of activities may occur at annual meetings:

- Implementation Data and Reporting –
    - Collect project implementation information from stakeholders, MS4 permit reporting, WWTF upgrade plans, and FDACS agricultural BMP enrollment and compare with the BMAP schedule.
    - Discuss the data collection process, including any concerns and possible improvements to the process.
    - Review the monitoring plan implementation, as detailed in **Section 6.3**.
    - Department will annually collect FDOH OSTDS data by county and by PFA areas to track new, repaired, and upgraded systems and will provide the information to stakeholders.
- Sharing New Information –
    - Report on results from water quality and biological monitoring and trend information.

- Provide updates on new management strategies in the basin that will help reduce nutrient loading.
- Identify and review new scientific developments in addressing nutrient loads and incorporate any new information into annual progress reports.

— Coordinating TMDL-Related Issues –

- Provide updates from the department on the basin cycle and activities related to any impairments, TMDLs, and BMAP.
- Obtain reports from other basins where tools or other information may be applicable to the Upper Wakulla River and Wakulla Springs TMDL.

Covering all of these topics is not required for the annual meetings, but this list provides examples of the types of information that should be considered for the agenda to assist with BMAP implementation and improve coordination among the agencies and stakeholders.

6.2 ADAPTIVE MANAGEMENT MEASURES

Adaptive management involves setting up a mechanism for making adjustments in the BMAP when circumstances change or feedback indicates the need for a more effective strategy. Adaptive management measures include the following:

— Procedures to determine whether additional cooperative strategies are needed.

— Criteria/processes for determining whether and when plan components need revision due to changes in costs, environmental impacts, social effects, watershed conditions, or other factors.

— Descriptions of stakeholders' role after BMAP completion.

Key components of adaptive management to share information and expertise are tracking plan implementation, monitoring water quality and pollutant loads, and holding periodic meetings. BMAP execution will be a long-term process, and some projects will extend beyond the first BMAP phase. For example, during the first iteration, the OSTDS Initiative will be implemented to identify what strategies are most applicable to the basin to reduce nitrate loading, determine a timeline for future strategies, and identify which stakeholders are responsible for implementing the necessary strategies in the next BMAP iteration.

The department and stakeholders will track implementation efforts and monitor water quality to measure effectiveness and ensure BMAP compliance. The stakeholders will meet approximately every 12 months to discuss implementation issues, consider new information, and, if the basin is not projected to meet the TMDL, determine additional corrective actions. Information on the implementation of management strategies will be collected annually from the participating entities and organized into reports. The stakeholders will review these reports to assess progress towards meeting the BMAP goals.

6.3 WATER QUALITY MONITORING

6.3.1 MONITORING OBJECTIVES

Focused objectives are critical for a monitoring strategy to provide the information needed to evaluate implementation success. The primary objectives of the monitoring strategy for the Upper Wakulla River and Wakulla Springs Basin are described below, and will be used to evaluate the success of the BMAP:

- Track trends in nitrate concentrations and loads in the Upper Wakulla River and Wakulla Springs.

- Track trends in the biological communities in the Upper Wakulla River.

6.3.2 WATER QUALITY MONITORING PARAMETERS, FREQUENCY, AND NETWORK

To achieve the first objective above, the monitoring strategy focuses on collecting the suggested parameters included in **Table 32** for the river sites and **Table 33** for the spring vent and conduit sites. The core parameters are directly related to the impairment in the Upper Wakulla River and Wakulla Springs Basin. Supplemental parameters and field parameters are monitored primarily to support the interpretation of core water quality parameters. At a minimum, the core parameters will be tracked to determine progress towards meeting the TMDL.

TABLE 33: WATER QUALITY MONITORING PARAMETERS FOR THE RIVER SITES

PARAMETER TYPE	PARAMETER NAME
Core	Nitrate + Nitrite (as N) Ammonia (as N) Kjeldahl Nitrogen
Supplemental	Chlorophyll-*a* Total Organic Carbon Total Phosphorus Chloride Sulfate Fluoride Calcium Magnesium Sodium Potassium Alkalinity Hardness Turbidity (lab) Specific Conductance (lab) Color (true) Total Suspended Solids Total Dissolved Solids
Field	Water Temperature pH Specific Conductance Dissolved Oxygen Sample Depth Secchi Depth

TABLE 34: WATER QUALITY MONITORING PARAMETERS FOR THE SPRING VENT AND CONDUIT SITES

PARAMETER TYPE	PARAMETER NAME
Core	Nitrate + Nitrite (as N) Ammonia (as N) Kjeldahl Nitrogen
Supplemental	Sucralose Nitrogen Isotopes Oxygen Isotopes Total Phosphorus Ortho-Phosphate (as P) Organic Carbon Dissolved Solids Suspended Solids Turbidity Color (true) Boron Calcium Magnesium Sodium Potassium Chloride Sulfate Fluoride Alkalinity
Field	Water Temperature pH Specific Conductance Dissolved Oxygen Sample Depth

Table 35 lists the water quality stations in the BMAP monitoring network sampled by the NWFWMD and the department. The water quality monitoring will be conducted in accordance with the frequencies below.

In addition, flow stations (listed in **Table 35**) will help determine loads to the river to achieve the first objective. These flow stations are maintained by the USGS and FGS. **Figure 16** also shows the locations of the flow stations in the monitoring network. The Spring Creek flow station is included in the BMAP monitoring plan because it will be helpful in understanding the movement of water in the aquifer. This gage will allow Spring Creek Springs flow volumes and periods of reverse flows at Spring Creek to be correlated with flows and water chemistry at the Wakulla Springs vent. This could help stakeholders determine where to carry out management strategies in the future. The gage will also provide information expected to support the NWFWMD in setting MFLs for the Wakulla River.

TABLE 35: BMAP WATER QUALITY MONITORING NETWORK

SAMPLING ENTITY	STATION ID	STATION NAME	STATION TYPE	FREQUENCY	SITE ESTABLISHED
NWFWMD	S587	Spring Vent	Recorder – discharge	15-minute	05/1997
NWFWMD	S587	Spring Vent	Water quality vent	Quarterly	04/2000
NWFWMD	S266	Upper Bridge	Water quality river	Monthly	08/2009
Department	S266	200 meters Downstream of Upper Bridge	Water quality river	Twice per year (with biology)	01/2014
Department	S98	Half Mile Downstream of Spring Vent @ Boat Maintenance Tram	Water quality river	Twice per year (with biology)	01/2014
NWFWMD	S556	Recreation Area Boat Dock	Water quality river	Monthly	10/2013
NWFWMD	S556	Recreation Area Boat Dock	Recorder – temperature, conductance	Hourly	03/1999
NWFWMD	S98	Boat Maintenance Tram	Recorder – stage	5-minute	12/1987
Department	9695	Spring Vent	Water quality vent	Quarterly	09/2001
Department	20383	B-Tunnel	Water quality conduit	Quarterly	04/2004
Department	20385	C-Tunnel	Water quality conduit	Quarterly	04/2004
Department	20387	D-Tunnel	Water quality conduit	Quarterly	04/2004
Department	20388	AD-Tunnel	Water quality conduit	Quarterly	04/2004
Department	20340	K-Tunnel	Water quality conduit	Quarterly	04/2004
Department	20381	AK-Tunnel	Water quality conduit	Quarterly	04/2004
Department	S556	Recreation Area Boat Dock	Nitrate meter	Continuous	12/2013
USGS	02327022	Wakulla River near Crawfordville, FL	Flow	Continuous	10/2004
Department	B_TUNNEL	B-Tunnel	Flow	15-Minute	12/2003
Department	C_TUNNEL	C-Tunnel	Flow	15-Minute	12/2003
Department	D_TUNNEL	D-Tunnel	Flow	15-Minute	02/2004
Department	AD_TUNNEL	AD-Tunnel	Flow	15-Minute	02/2004
Department	K_TUNNEL	K-Tunnel	Flow	15-Minute	02/2004
Department	AK_TUNNEL	AK-Tunnel	Flow	15-Minute	02/2004
USGS	02327031	Spring Creek Gage	Flow	Continuous	10/2013

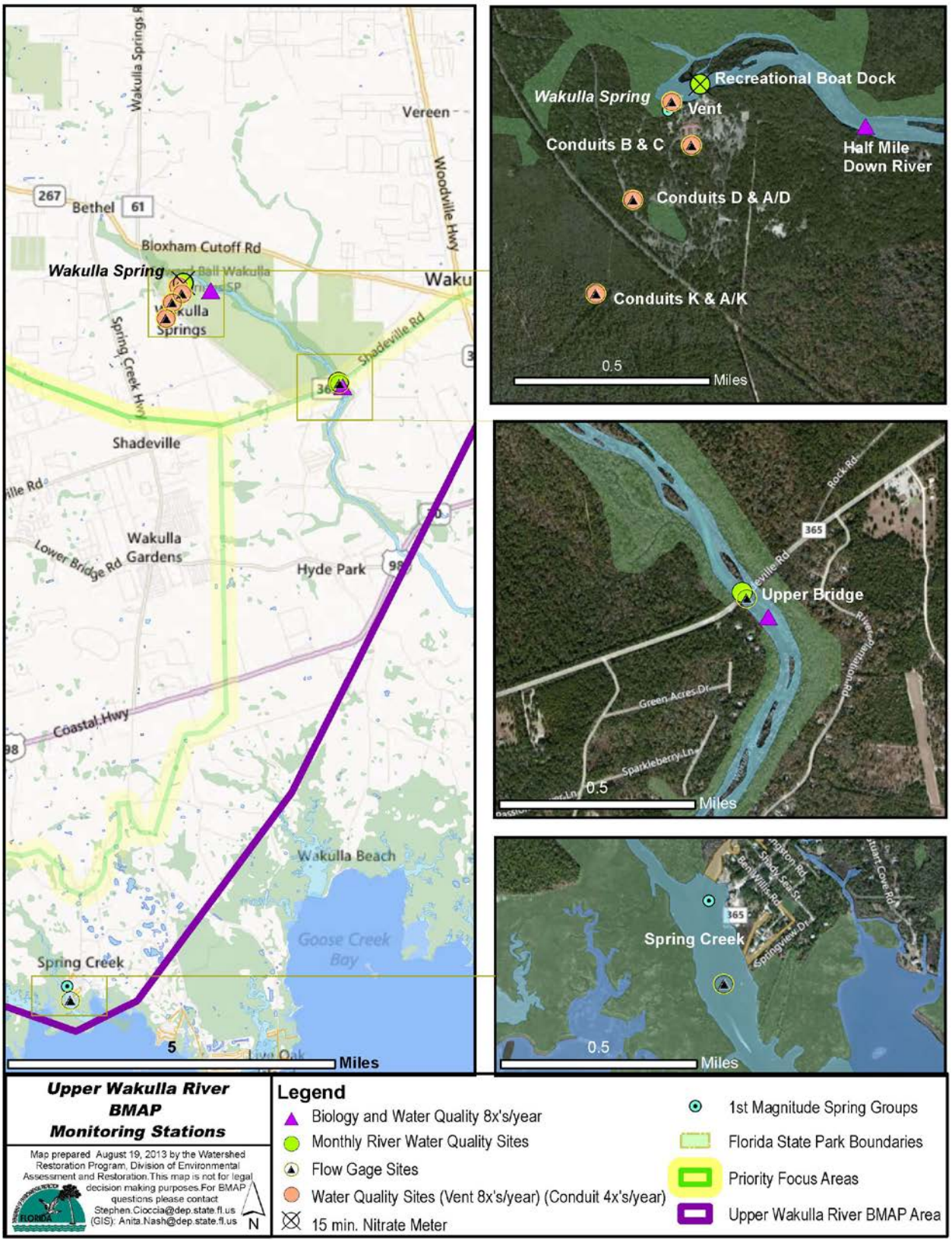

FIGURE 16: MONITORING NETWORK FOR THE UPPER WAKULLA RIVER AND WAKULLA SPRINGS

6.3.3 BIOLOGICAL MONITORING

To meet the second monitoring plan objective, several types of biological monitoring will be carried out to assess the health of the Upper Wakulla River. An RPS will be conducted to assess the abundance and variety of algae in the river. A Linear Vegetation Survey (LVS) will be conducted to assess the types and density of vegetation present in the river and to identify the native versus non-native species. An SCI will be conducted to measure the number of different organisms present in the river. In addition, Habitat Assessments (HA) will be conducted to assess the river conditions and habitat present to support the SCI evaluation. Water quality samples will also be collected with the biological monitoring. **Table 36** summarizes the biological monitoring, and **Figure 16** shows the locations for this sampling.

TABLE 36: BIOLOGICAL MONITORING

SAMPLING ENTITY	TYPE OF MONITORING	STATION ID	LOCATION	FREQUENCY	START DATE
NWFWMD	RPS	S266	200 meters Downstream of Upper Bridge	Twice per year	10/2013
NWFWMD	LVS	S266	200 meters Downstream of Upper Bridge	Twice per year	10/2013
NWFWMD	SCI	S266	200 meters Downstream of Upper Bridge	Twice per year	10/2013
NWFWMD	HA	S266	200 meters Downstream of Upper Bridge	Twice per year	10/2013
Department	RPS	S266	200 meters Downstream of Upper Bridge	Twice per year	01/2014
Department	LVS	S266	200 meters Downstream of Upper Bridge	Twice per year	01/2014
Department	SCI	S266	200 meters Downstream of Upper Bridge	Twice per year	01/2014
Department	HA	S266	200 meters Downstream of Upper Bridge	Twice per year	01/2014
NWFWMD	RPS	S98	Half Mile Downstream of Spring Vent @ Boat Maintenance Tram	Twice per year	10/2013
NWFWMD	LVS	S98	Half Mile Downstream of Spring Vent @ Boat Maintenance Tram	Twice per year	10/2013
NWFWMD	SCI	S98	Half Mile Downstream of Spring Vent @ Boat Maintenance Tram	Twice per year	10/2013
NWFWMD	HA	S98	Half Mile Downstream of Spring Vent @ Boat Maintenance Tram	Twice per year	10/2013
Department	RPS	S98	Half Mile Downstream of Spring Vent @ Boat Maintenance Tram	Twice per year	01/2014
Department	LVS	S98	Half Mile Downstream of Spring Vent @ Boat Maintenance Tram	Twice per year	01/2014

SAMPLING ENTITY	TYPE OF MONITORING	STATION ID	LOCATION	FREQUENCY	START DATE
Department	SCI	S98	Half Mile Downstream of Spring Vent @ Boat Maintenance Tram	Twice per year	01/2014
Department	HA	S98	Half Mile Downstream of Spring Vent @ Boat Maintenance Tram	Twice per year	01/2014

6.3.4 DATA MANAGEMENT AND ASSESSMENT

The Florida Storage and Retrieval (STORET) database serves as the primary repository of ambient water quality data for the state of Florida. The department pulls water quality data used for impaired water evaluations and TMDL development directly from the STORET database. Ambient water quality data collected as part of the BMAP will be uploaded into STORET for long-term storage and availability. Water quality data will be uploaded to STORET at least once every six months, upon completion of the appropriate quality assurance/quality control (QA/QC) checks.

The biological data will be stored in the Statewide Biological (SBIO) database, which is also a department database. The biological data will be uploaded at least once every six months, after the appropriate QA/QC checks.

The water quality and biological data will be analyzed during BMAP implementation to determine trends in water quality and the health of the biological community. To determine progress towards achieving the TMDL target for allowable nitrate-nitrogen concentrations in the impaired segment, the nitrate-nitrogen concentrations at the BMAP monitoring stations will be evaluated using a methodology similar to that used to develop the TMDL nitrate-nitrogen target. The month and monitoring station location with the highest average concentration will be compared with the TMDL target of 0.35 mg/L to determine the percent reduction achieved to date, and whether the target concentration has been achieved. The TMDL target for recovery of the biological impairment will be evaluated using the ability of the impaired segment to meet the department's Class III biology criteria.

6.3.5 QUALITY ASSURANCE/QUALITY CONTROL

Stakeholders participating in the monitoring plan must collect water quality data in a manner consistent with the department's standard operating procedures (SOPs) for QA/QC. The most current version of these procedures is available online. For BMAP-related data analyses, entities should use National Environmental Laboratory Accreditation Conference National Environmental Laboratory Accreditation

Program (NELAP)–certified laboratories or other labs that meet the certification and other requirements outlined in the SOPs.

6.4 RESEARCH STUDIES

During the BMAP process, stakeholders identified several research items they would like to pursue, if funding becomes available. These research topics include the following:

- Determine the nitrate contributions to Wakulla Springs during the reverse flow scenario where portions of the Spring Creek springshed flow to Wakulla Springs using data collected by the NWFWMD and by potentially increasing the frequency of monitoring in the conduits that reverse flow.

- Conduct a dye trace study in Crawfordville to determine the contributions from septic systems during the reverse flow scenario where portions of the Spring Creek springshed flow to Wakulla Springs.

- Evaluate the drinking water well data to identify wells with high nitrate concentrations and conduct further research to determine the source(s) of these high concentrations.

- Update the potentiometric surface data for the basin to better define the boundary; this will likely be performed for NWFWMD's MFLs modeling.

- Run the AVA model for the entire BMAP basin, and incorporate the Light Detection and Ranging (LIDAR) data from Wakulla County.

- Verify the effectiveness of agricultural BMPs in the Upper Wakulla River and Wakulla Springs Basin.

- Monitor before and after project implementation, as desired, to determine the nitrate reduction benefits of the projects.

- Add nitrate data loggers to the river water quality sampling locations (Upper Bridge and Recreation Area Boat Dock) to obtain better information about how nitrate concentrations change in the river.

- Develop a water budget and nutrient transport model for the Upper Wakulla River and Wakulla Springs Basin.

- Determine the effects of saltwater intrusion and sea-level rise on the biological community in the Upper Wakulla River and Wakulla Springs.

- Measure color, using ultraviolet-visible light absorption spectrophotometry, in the Upper Wakulla River to determine the effects on water quality and the biological community.

- Create an Aquifer Watch Program for the Upper Wakulla River and Wakulla Springs Basin to gather additional water quality data on ground water in the basin.

- Assess the nitrate contributions to ground water from sinkholes in the basin.

6.5 COMMITMENT TO PLAN IMPLEMENTATION

Paragraph 403.067(7), F.S., lays out the mechanisms for BMAP implementation. While the BMAP is linked by statute to permitting and other enforcement processes that target individual entities, successful implementation mandates that local stakeholders willingly and consistently work together to attain adopted TMDLs. This collaboration fosters the sharing of ideas, information, and resources. The stakeholders have demonstrated their willingness to confer with and support each other in their efforts.

APPENDICES

APPENDIX A: RULE 62-304(2), F.A.C., THE UPPER WAKULLA RIVER TMDL

(2) Upper Wakulla River. The nitrate TMDL to address the biological impairment is an in-stream monthly mean concentration of 0.35 mg/L and is allocated as follows:

(a) The WLA for wastewater sources is not applicable.

(b) The WLA for discharges subject to the department's NPDES Municipal Stormwater Permitting Program is not applicable.

(c) The LAs for nonpoint sources are to address anthropogenic sources in the basin such that in-stream nitrate concentrations meet the TMDL target, which, based on the mean concentrations from the 2002-2007 period, will require a 56.2 percent reduction of nitrate at sources contributing to the observed biological impairment.

(d) The Margin of Safety is implicit.

(e) While the WLA and LAs for nitrate have been expressed as the concentration and percent reduction needed to attain the applicable Class III biology criterion, it is the combined reductions from both anthropogenic point and nonpoint sources that will result in the required reduction of in-stream nitrate concentrations. However, it is not the intent of the TMDL to abate natural background conditions.

APPENDIX B: CITY OF TALLAHASSEE STORMWATER TREATMENT PROJECTS IN THE UPPER WAKULLA RIVER AND WAKULLA SPRINGS BASIN

TABLE B-1: SUMMARY OF THE CITY OF TALLAHASSEE'S STORMWATER TREATMENT PROJECTS

PROJECT NAME	STATUS	PROJECT TYPE	MAP LABEL
Northeast Ditch At Lonnbladh Rd	Complete/Constructed	Channel Stabilization	SW01
Frenchtown SW Improvements Master Plan	Complete/Constructed	Wet Detention w/ Storm Drain Improvements	SW02
Campus Circle	Complete/Constructed	Wet Detention w/ Storm Drain Improvements	SW03
Connie Drive	Complete/Constructed	Channel Stabilization w/ Sd Improvements	SW04
Call Street & Cadiz Street	Complete/Constructed	Dry Detention w/ Sd Improvements	SW05
SPI - Royal Oaks Channel Lining Phase 1B	Complete/Constructed	Conveyance Improvement	SW06
SPI - Salmon Dr Ditch Lining (1706 Salmon Drive)	Complete/Constructed	Conveyance Improvement	SW07
SPI - O'Brien Drive Drainage Improvements (Phase 1)	Complete/Constructed	Conveyance Improvement	SW08
Betton/Cline/Chamberlin	Complete/Constructed	Conveyance Improvement	SW09
SPI - Shamrock North Drng Imp	Complete/Constructed	Conveyance Improvement; Includes $ From Spi.	SW10
SPI - Ivan Drive Drainage Improvements	Planned/Proposed	Conveyance Improvement	SW11
SPI - Hutchinson Road Drainage	Complete/Constructed	Conveyance Improvement	SW12
SPI - Arkansas Street Drainage Improvements	Planned/Proposed	Stormdrain Improvements	SW13
SPI - Shamrock-Foxford Drainage Improvements	Planned/Proposed	Conveyance Improvement	SW14
SPI - 2018 Lee Avenue	Planned/Proposed	Stormdrain Improvements	SW15
SPI - Glendale Neighborhood Drainage Improvements	Planned/Proposed	Stormdrain Improvements	SW16
Pickett Court Area Stormwater	Complete/Constructed	Will Be Revived At A Later Date.	SW17
Upper West Ditch Stormwater Facility	Planned/Proposed	Sedimentation Basin	SW18
Royal Oaks Creek Study (Royal Oaks Stormwater Imp)	Planned/Proposed	Channel Stabilization	SW19
Meginnis Creek at Sharer Road	Complete/Constructed	Channel Stabilization	SW20
Chapel Drive Stormwater Improvements	Complete/Constructed	Stormdrain Improvements	SW21
Emory Court & Dupont Drive Area Flood Relief	Complete/Constructed	Channel Stabilization	SW22
East Georgia St/Meridian St Stormwater Improvement	Complete/Constructed	Stormdrain Improvements	SW23
Upper Lake Lafayette NRF	Complete/Constructed	Alum	SW24
Ford Street Drainage Improvements	Complete/Constructed	Stormdrain Improvements	SW25
Lafayette Park Stormwater Outfall Phase II	Complete/Constructed	Stormdrain Improvements	SW26
Lafayette Park Stormwater Outfall Phase I	Complete/Constructed	Dry Detention	SW27
Park Avenue Tributary#1 Drainage Improvement	Complete/Constructed	Wet Detention & Channel Stabilization	SW28
Inglewood Neighborhood Drainage Improvements	Active/Designed	Stormdrain Improvements	SW29
Greenwood SWMF (part of Frenchtown Master Plan)	Active/Designed	Wet Detention	SW30
Killarney Way at Shamrock Stormwater Improvements	Complete/Constructed	Wet Detention w/ Storm Drain Improvements	SW31
Karen Lane Drainage Improvements	Complete/Constructed	Stormdrain Improvements	SW32
Lower CDD Erosion Control Project	Planned/Proposed	Channel Stabilization	SW33

PROJECT NAME	STATUS	PROJECT TYPE	MAP LABEL
Concord Road Stormwater Facility	Complete/Constructed	Wet Detention w/ Storm Drain Improvements	SW34
College Jefferson St Stormwater Improvements	Complete/Constructed	Stormdrain Improvements	SW36
Gaines St. - Madison St. Supplemental SW Outfall-1	Design	Stormdrain Improvements	SW37
Gaines St. - Madison St. Supplemental SW Outfall-2	Under Construction	Stormdrain Improvements	SW38
Gaines St. - Madison St. Supplemental SW Outfall-3	Design	Stormdrain Improvements	SW39
South City/Country Club Creek Drainage Improve	Planned/Proposed	Channel Stabilization	SW40
Eastgate Flood Relief Project Phase II	Under Construction	Stormdrain Improvements	SW41
Eastgate Flood Relief Project Phase I	Complete/Constructed	Channel Stabilization w/ SD Improvements	SW42
SPI - 4029 & 4033 Brandon Hill & 4036 Brandon Hill Dr (aka 2936 Edenderry Drive)	Complete/Constructed	Conveyance Improvement	SW43
SPI - Baldwin Drive Minor Drainage Improvements	Complete/Constructed	Conveyance Improvement	SW44
SPI - Runnymede Drainage Improvements	Complete/Constructed	Conveyance Improvement	SW45
SPI - Woodbern Lane Ditch Enclosure	Complete/Constructed	Conveyance Improvement	SW46
SPI - Richardson Road Drainage Improvements	Complete/Constructed	Conveyance Improvement	SW47
SPI - 2212 EastGate Way	Complete/Constructed	Conveyance Improvement	SW48
SPI - Copper Creek Dr. Minor Drainage Improvements	Complete/Constructed	Conveyance Improvement	SW49
SPI - 4052 Roscrea Drive	Complete/Constructed	Conveyance Improvement	SW50
SPI - Bay Shore Drive Stormwater Outfall Improvement	Complete/Constructed	Conveyance Improvement	SW51
SPI - Big Oak St Outfall Improvements	Complete/Constructed	Conveyance Improvement	SW52
SPI - 2945 Edenderry Drive	Complete/Constructed	Conveyance Improvement	SW53
SPI - 551 Stonehouse Road	Complete/Constructed	Conveyance Improvement	SW54
SPI - Spruce Avenue	Complete/Constructed	Conveyance Improvement	SW55
SPI - Villages of Killearn / Kinsail Drive OutfalI	Complete/Constructed	Conveyance Improvement	SW57
SPI - Ravine Drive	Complete/Constructed	Conveyance Improvement	SW58
SPI - Mahoney Drive Drainage Improvements	Complete/Constructed	Conveyance Improvement	SW59
SPI - McGuire Pond (905 and 907 Alliegood Court)	Complete/Constructed	Pond Grading	SW60
SPI - O'Brien Drainage Improvements Phase 2 (O'Brien & Grey Abbey Ct.)	Complete/Constructed	Conveyance Improvement	SW61
SPI - Sandhurst Drive Bypass Outfall	Complete/Constructed	Conveyance Improvement	SW63
SPI - 708 East Jefferson Street	Complete/Constructed	Conveyance Improvement	SW66
SPI - 3700/3703 Mockingbird Drive	Complete/Constructed	Conveyance Improvement	SW67
SPI - Teal Lane	Complete/Constructed	Conveyance Improvement	SW68
SPI - 2925 Edenderry Ditch Enclosure	Complete/Constructed	Conveyance Improvement	SW69
SPI - Millard Street Drainage Improvements	Complete/Constructed	Conveyance Improvement	SW70
SPI - 3742 Shamrock West Drainage Improvements	Complete/Constructed	Conveyance Improvement	SW71
SPI - Bonnie Drive Drainage Improvements (1103 Bonnie Dr)	Complete/Constructed	Conveyance Improvement	SW72
SPI - Winthrop Road	Complete/Constructed	Conveyance Improvement	SW74
SPI - 903 Beard St	Planned/Proposed	Conveyance Improvement	SW75

PROJECT NAME	STATUS	PROJECT TYPE	MAP LABEL
SPI - Limerick Drive Stormwater Outfall Improvements	Under Construction	Conveyance Improvement	SW76
SPI - Devils Dip Drainage Improvements	Active/Designed	Conveyance Improvement	SW77
SPI - 2713 Bedford Way	Complete/Constructed	Conveyance Improvement	SW78
SPI - Armistead Road Drainage Maintenance	Complete/Constructed	Conveyance Improvement	SW79
SPI - Shannon Foxford Drainage Improvements	Planned/Proposed	Conveyance Improvement	SW80
SPI - Faringdon Drive (2764 Farringdon Dr)	Complete/Constructed	Conveyance Improvement	SW81
SPI - Shamrock North & Edenderry	Complete/Constructed	Conveyance Improvement	SW82
SPI - Short Street Improvements	Planned/Proposed	Conveyance Improvement	SW83
Killarney Way at Shamrock Stormwater Improvements	Complete/Constructed	Wet Detention w/ Storm Drain Improvements	SW84
SPI - Bradford Road Stormwater Outfall	Under Construction	Conveyance Improvement	SW85
Middlebrooks Circle Conveyance Improvements	Complete/Constructed	Channel Stabilization	SW86
Pensacola-MLK Drainage Improvements	Complete/Constructed	Stormdrain Improvements	SW87

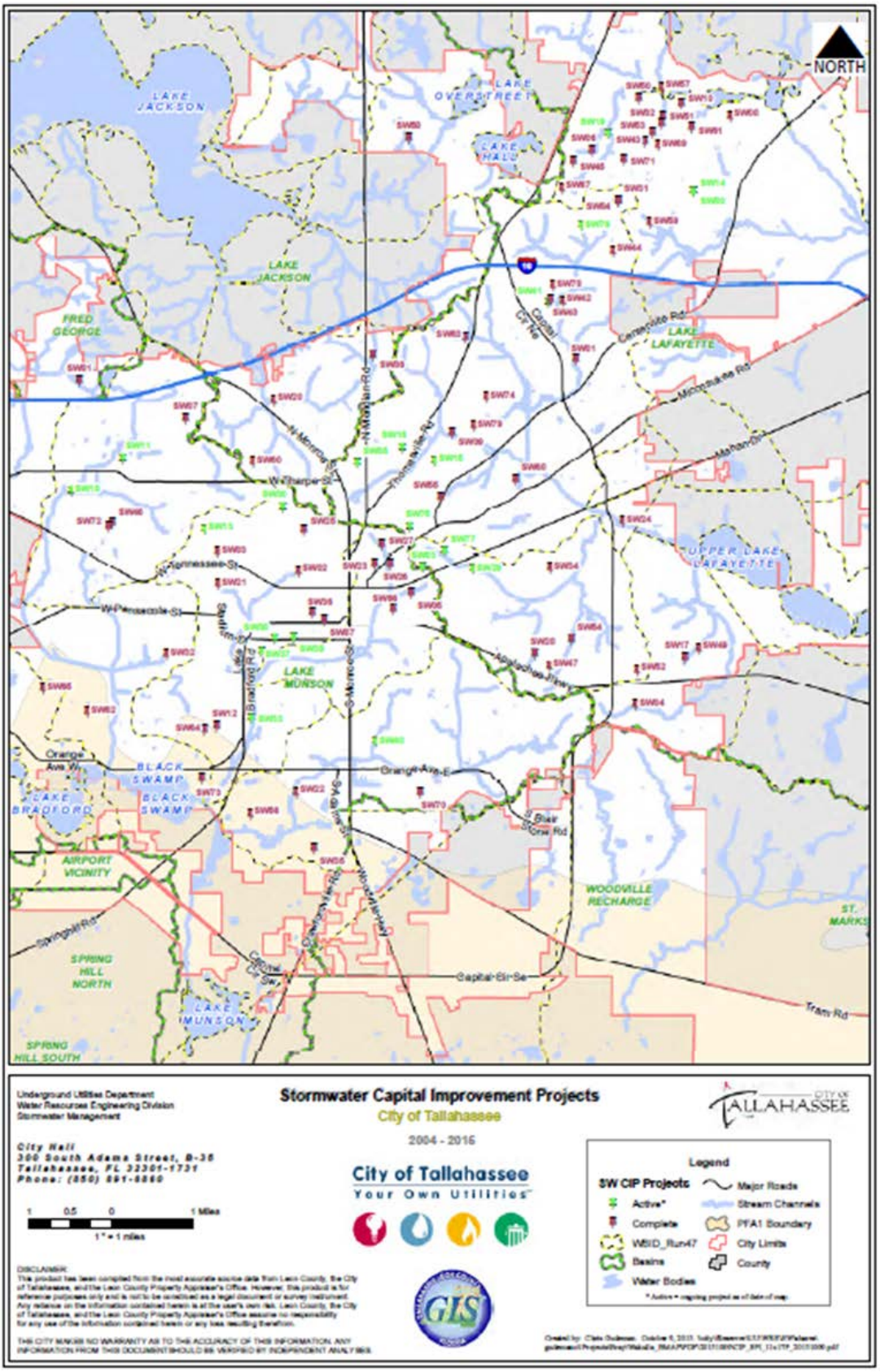

FIGURE B-1: LOCATION OF THE CITY OF TALLAHASSEE'S STORMWATER TREATMENT PROJECTS

APPENDIX C: POTENTIAL FUNDING SOURCES

A BMAP must identify feasible funding strategies for implementing the management strategies presented. This appendix provides a list of potential funding sources.

The **Clean Water State Revolving Fund (SRF) loan program** provides low-interest loans to local governments to plan, design, and build or upgrade wastewater, stormwater, and nonpoint source pollution prevention projects. Certain agricultural best management practices may also qualify for funding. Discounted assistance for small communities is available. Interest rates on loans are below market rates and vary based on the economic wherewithal of the community. The Clean Water SRF is Florida's largest financial assistance program for water infrastructure.

The **Drinking Water SRF loan program** provides low-interest loans to local governments and certain private utilities to plan, design, and build or upgrade drinking water systems. Discounted assistance for small communities may be available. Interest rates on loans are typically 40 percent below market rates.

The **Small Community Wastewater Facilities Grants Program** provides grants to fund the construction of wastewater facilities in municipalities with 10,000 or fewer people and per capita income levels below Florida's average per capita income. A local match is required. The program is linked to the Clean Water SRF loan program outlined above, and is highly competitive.

Florida's **Section 319 grant program** administers funds received from the EPA to implement projects or programs that reduce nonpoint sources of pollution. Projects or programs must benefit Florida's priority watersheds ("impaired waters"), and local sponsors must provide at least a 40 percent match or in-kind contribution. Eligible activities include the demonstration and evaluation of urban and agricultural stormwater BMPs, stormwater retrofits, and public education.

TMDL water quality restoration grants for projects related to the implementation of TMDLs may be available through periodic legislative appropriations to the department. When funds are available, the program prioritizes stormwater retrofit projects to benefit impaired waters, somewhat along the lines of the Section 319 grant program listed above.

The Florida Legislature may solicit applications directly for **Community Budget Issue Request** projects, including water projects, in anticipation of upcoming legislative sessions. This process is an opportunity to secure legislative sponsorship of project funding through the state budget. The

Legislature may coordinate applications with the department. In other years, the Legislature will not solicit projects but may include them in the budget in any event. Contact your local legislative delegation to determine whether there are opportunities available to fund your project. Information on contacting Senators and Representatives is available online.

A number of other programs at both the state and federal levels offer the possibility of water infrastructure funding. These include the following:

Florida Department of Economic Opportunity **Small Cities Community Development Block Grant Program** funds are available annually for water and sewer projects that benefit low- and moderate-income persons. Monies also may be available for water and sewer projects that serve a specific "job-creating entity" as long as most of the jobs created are for people with low or moderate incomes. More information is available online.

The **Florida Rural Water Association Loan Program** provides low-interest bond or bank financing for community utility projects in coordination with the department's SRF programs discussed above. Other financial assistance may also be available. ook for the links to "Funding" and "Long-Term Financing."

The **Enterprise Florida** program is a resource for a variety of public and private projects and activities, including those in rural communities, to facilitate the creation, capital investment, and strengthening and diversification of local economies by promoting tourism, trade, and economic development. The various Enterprise Florida programs and financial incentives are intended, among other things, to provide additional financial assistance to enable communities to better access other infrastructure funding programs. Contact information is available from the "Contact Us" link at the top of the web page.

Florida's **five regional water management districts** also offer financial assistance for a variety of water-related projects, for water supply development, water resource development, and surface water restoration. Assistance may be provided from ad valorem tax revenues or from periodic legislative appropriations for Alternative Water Supply Development and Surface Water Improvement and Management projects. The amount of funding available, matching requirements, and types of assistance may vary from year to year. For information on funding opportunities, contact the water management district with jurisdiction in your area—a map and links to each of the districts are available online.

The United States Department of Commerce **Economic Development Administration Public Works and Development Facilities Program** provides funding to help distressed communities in economic decline revitalize, expand, and upgrade their physical infrastructure to attract new industry, encourage business expansion, diversify local economies, and generate or retain long-term, private sector jobs and investment. The program focuses on redeveloping existing infrastructure.

The USDA **Rural Development Rural Utilities Service Guaranteed and Direct Loans and Grants Program** provides a combination of loans and grants for water, wastewater, and solid waste projects to rural communities and small incorporated municipalities. Some nonprofit entities also may be eligible.

Congress's **State and Tribal Assistance Grant Program** provides the opportunity to secure Congressional sponsorship of project funding, including water project funding, through the annual federal budget process. The program's stated purpose is to strengthen state, local governments, and tribal abilities to address environmental and public health threats while furthering environmental compliance. You may want to consider contacting your Representatives or Senators for assistance in pursuing funding.

Grants.gov is the official federal website for information on more than 1,000 federal grant programs. The site includes an automatic email notification system for keeping apprised of federal grant opportunities.

The **Catalog of Federal Domestic Assistance** provides a database of all federal programs available to state and local governments; public, quasipublic, and private profit and nonprofit organizations and institutions; specialized groups; and individuals. There are a variety of sources of niche funding that may be appropriate to your situation. There are also private funding sources (endowments, private trusts, *etc.*) that may, on occasion, fund water-related projects; a variety of sources to investigate these opportunities are available on the web.

The **Florida Resource Directory** provides a searchable directory of information about and links to many state and federal programs with resources available to help local communities. Funding for water-related projects is just one of many types of assistance identified here.

If you are interested in **disaster relief**, your first contacts should be to Florida's **Division of Emergency Management** or your county emergency management agency, and the **Federal Emergency**

Management Agency at 1.800.621.FEMA (3362), where the process for securing disaster-related infrastructure assistance begins.

APPENDIX D: DETAILS ON THE SCI

The SCI is a biological assessment procedure that measures the degree to which flowing fresh waters support a healthy, well-balanced biological community, as indicated by benthic macroinvertebrates. A balanced faunal community is achieved if the average score of at least two temporally independent SCIs is 40 or higher, with neither of the two most recent SCI scores less than 35.

When the SCI bioregions were initially developed in 1992, there were relatively few data available for some of the bioregions, particularly the eastern portion of the Panhandle region. The department has subsequently collected thousands of new SCIs throughout the state. In addition, better GIS tools now available allow more accurate spatial resolution. In 2012 the department undertook a reanalysis of the SCI regions to better define the macroinvertebrate expectations across the state. The reanalysis of the SCI regionalization indicated that the Panhandle bioregion should be divided into the Panhandle West and Big Bend bioregions because they have significantly different taxa at reference sites .During the SCI reevaluation, the bioregion boundaries were also redrawn to be consistent with watershed boundaries. The original bioregion boundaries bisected watersheds, which meant that the biological expectation in some streams changed upstream or downstream of an imaginary line across the stream. Greater detail concerning the reanalysis of the SCI bioregions and the results of that evaluation are provided in Appendix B of the Technical Support Document.[1] As part of the reassessment, the SCI equations were also updated and SCI scores were recalculated. The original listing of the Wakulla River was based on earlier versions of the SCI. This report uses the revised regions and equations for what is now referred to as the SCI-2012 (Figure D-1).

[1] Florida Department of Environmental Protection. March 2013. *Technical Support Document: Derivation of dissolved oxygen criteria to protect aquatic life in Florida's fresh and marine waters.* DEP-SAS-001/13. Tallahassee, FL.

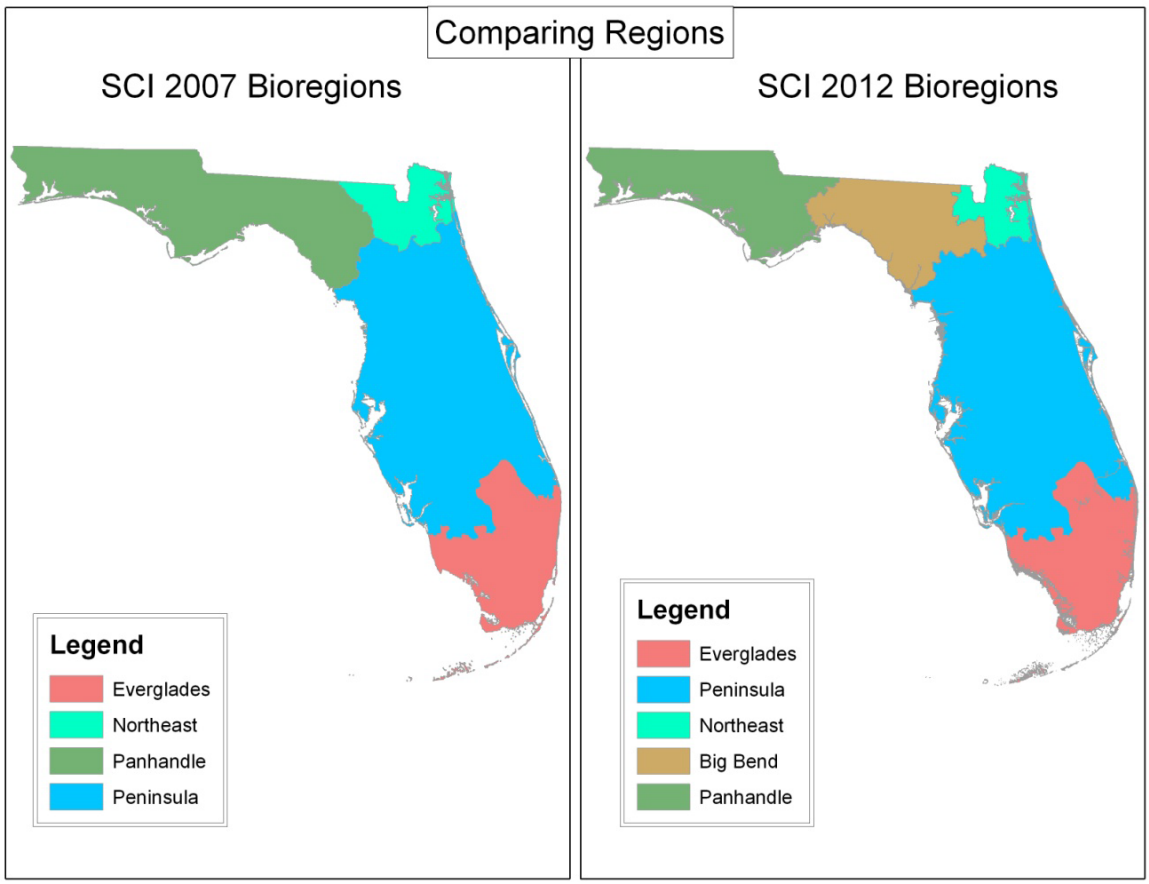

FIGURE D-1. COMPARISON OF THE SCI 2007 BIOREGIONS WITH THE NEW 2012 BIOREGIONS

APPENDIX E: BIBLIOGRAPHY OF KEY REFERENCES AND WEBSITES

KEY REFERENCES

Baker, A.E., A.R. Wood, J.R. Cichon, and J.L. Johnson. July 2007. *The Leon County Aquifer Vulnerability Assessment*. Prepared for the Leon County Board of County Commissioners in fulfillment of Leon County Project No. BC-06-21-06-53.

Baker, A.E., A.R. Wood, and J.R. Cichon. September 2009. *The Wakulla County Aquifer Vulnerability Assessment*. Prepared for the Florida Department of Environmental Protection as part of the Florida Aquifer Vulnerability Assessment (FAVA) Phase II Project, Contract No. RM059.

Chelette, A., T.R. Pratt, and B.G. Katz. April 2002. *Nitrate loading as an indicator of nonpoint source pollution in the Lower St. Marks-Wakulla Rivers watershed*. Water Resources Special Report 02-1. Northwest Florida Water Management District.

Davis, J.H., B.G. Katz, and D.W. Griffin. 2010. *Nitrate-N movement in groundwater from the land application of treated municipal wastewater and other sources in the Wakulla Springs springshed, Leon and Wakulla Counties, Florida, 1966-2018.* United States Geological Survey Scientific Investigations Report 2010-5099.

Florida Department of Environmental Protection:

———. 2001. *Basin status report: Ochlockonee and St. Marks.* Tallahassee, FL: Watershed Planning and Coordination Section, Bureau of Watershed Management.

———. 2012a. *TMDL report: Nutrient (biology) TMDL for the Upper Wakulla River (WBID 1006).* Tallahassee, FL: Division of Water Resource Management, Bureau of Watershed Management.

———. 2012b. Kincaid, T, G. Davies, C. Werner, and R. DeHan. *Demonstrating interconnection between a wastewater application facility and a first magnitude spring in a karstic watershed: Tracer study of the Southeast Farm Wastewater Reuse Facility, Tallahassee, Florida*. Tallahassee, FL: Florida Geological Survey.

———. 2013a. Eller, K., B. Katz, and R. Hicks. *Wakulla Springs Basin nitrogen sourcing inventory*. Tallahassee, FL: Ground Water Management Section. PowerPoint presentation.

———. 2013b. Jackson, J. *Wakulla River biological assessments.* Tallahassee, FL: Standards and Assessment Section. PowerPoint presentation.

———. 2013c. Katz, B. *Using nitrogen isotopes to identify sources of nitrogen in the Wakulla Springs Basin.* Tallahassee, FL: Ground Water Management Section. PowerPoint presentation.

———. 2013d. Maddox, G. *Summary of water quality data and the existing monitoring network: Current & recent nitrate trends in Wakulla Springs and River.* Tallahassee, FL: Ground Water Management Section. PowerPoint presentation.

———. July 2014. Eller, K., and B. Katz. *Nitrogen source inventory and loading estimates for the Wakulla Spring Contributing Area*. Tallahassee, FL: Ground Water Management Section.

Florida Department of Health. 2009. Hall, P., and S.J. Clancy. *The Florida statewide inventory of onsite sewage treatment and disposal systems (OSTDS): Final draft report and database.* Prepared for the Florida Department of Health, Bureau of Onsite Sewage Programs, by EarthSTEPS and GlobalMind. Available: http://www.doh.state.fl.us/environment/ostds/research/07

Harden, H., B. Katz, D. Griffin, P. McMahon, E. Wade, R. Hicks, and J. Chanton. March 18, 2010. Fate of effluent-borne contaminants beneath septic tank drainfields overlying a karst aquifer. *Journal of Environmental Quality.*

Kincaid, T. 2010. *Understanding Florida's karst results & lessons learned from the Woodville Karst Plain research*. GeoHydros LLC, 27 Keystone Ave., Reno, NV 89503. PowerPoint presentation.

Lombardo Associates, Inc. November 2011. *Onsite sewage treatment and disposal and management options – Final report for Wakulla Springs, Leon County, Wakulla County & City of Tallahassee, FL.* 188 Church St., Newton, MA 02458.

Peer Review Committee. December 2005. *Degradation of water quality at Wakulla Springs, Florida: Assessment and recommendations*. Report of the Peer Review Committee on the Workshop *Solving water pollution problems in the Wakulla springshed of north Florida*, May 12-13, 2005, Tallahassee, FL.

STORMWATER AND WATER QUALITY PROTECTION WEBSITES

LIST OF LOCAL AND REGIONAL STORMWATER AND WATER QUALITY PROTECTION WEBSITES AND EMBEDDED LINKS

NWFWMD

LIST OF STATE STORMWATER AND WATER QUALITY PROTECTION WEBSITES

General Portal for Florida
Department
Watershed Management
TMDL Program
BMPs, Public Information, and Environmental Education Resources
NPDES Stormwater Program
Nonpoint Source Funding Assistance
Surface Water Quality Standards
Identification of Impaired Surface Waters Rule
STORET Program
Criteria for Surface Water Quality Classifications
FDACS Office of Agricultural Water Policy
FDACS Adopted Agricultural BMPs
City of Tallahassee and Leon County Comprehensive Plan
Wakulla County Comprehensive Plan

LIST OF NATIONAL STORMWATER AND WATER QUALITY PROTECTION WEBSITES

Center for Watershed Protection
EPA Office of Water
EPA Region 4 (Southeast United States)
Clean Water Act History
USGS: Florida Waters