Santa Fe River
Basin Management Action Plan

Division of Environmental Assessment and Restoration
Water Quality Restoration Program
Florida Department of Environmental Protection

with participation from the
Santa Fe River Basin Stakeholders

June 2018

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Tallahassee, FL 32399
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Acknowledgments

The Florida Department of Environmental Protection adopted the *Santa Fe River 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 coordination with 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
Noah Valenstein, Secretary

Table A-1. Santa Fe River Basin stakeholders

Type of Entity	Name
Responsible Stakeholders	Agricultural producers Counties: Alachua Bradford Columbia Gilchrist Union Cities, Towns, and Communities: Archer Fort White High Springs La Crosse Lake City Newberry Florida Department of Transportation
Responsible Agencies	Florida Department of Agriculture and Consumer Services Florida Department of Environmental Protection Florida Department of Health Florida Fish and Wildlife Conservation Commission Suwannee River Water Management District
Other Interested Stakeholders	Homeowners/Citizens Santa Fe River Partnership The Ichetucknee Partnership Ichetucknee Springs Partnership Ichetucknee Springs Working Group Santa Fe Springs Working Group Florida Farm Bureau Federation Florida Onsite Wastewater Association Florida Springs Council Florida Springs Institute University of Florida Institute of Food and Agricultural Sciences

Appendix A contains links to important sources referenced in this document. For additional information on the watershed management approach for the Santa Fe River, contact:

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Table of Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

ac	Acre
AWT	Advanced Wastewater Treatment
ATU	Aerobic Treatment Unit
BAF	Biochemical Attenuation Factor
BAM	Biosorption Activated Media
BMAP	Basin Management Action Plan
BMPs	Best Management Practices
CAFO	Concentrated Animal Feeding Operation
CASTNET	Clean Air Status and Trends Network
CMAQ	Community Multiscale Air Quality
DEP	Florida Department of Environmental Protection
DMR	Discharge Monthly Report
DO	Dissolved Oxygen
EPA	Environmental Protection Agency (U.S.)
F.A.C.	Florida Administrative Code
F.A.R.	Florida Administrative Register
F.S.	Florida Statutes
FDACS	Florida Department of Agriculture and Consumer Services
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FF	Farm Fertilizer
FGS	Florida Geological Survey
FLUCCS	Florida Land Use Cover and Forms Classification System
FLWMI	Florida Water Management Inventory
FOWA	Florida Onsite Wastewater Association
FPS	Florida Park Service
FSAID	Florida Statewide Agricultural Irrigation Demand
FYN	Florida Yards and Neighborhoods
GIS	Geographic Information System
gpd	Gallons Per Day
GRU	Gainesville Regional Utilities
HA	Habitat Assessment
IA	Implementation Assurance
ILG	Irrigated Lands Geodatabase
IV	Implementation Verification
in/yr	Inch Per Year
lb-N/yr	Pounds of Nitrogen Per Year
LVS	Linear Vegetation Survey
LW	Livestock Waste
MFL	Minimum Flow and Level
mgd	Million Gallons Per Day

mg/L	Milligrams Per Liter
N	Nitrogen
N/A	Not Applicable
NADP	National Atmospheric Deposition Program
NELAC	National Environmental Accreditation Conference
NELAP	National Environmental Accreditation Program
NNC	Numeric Nutrient Criteria
NOI	Notice of Intent
NSF	NSF International (formerly National Sanitation Foundation)
NSILT	Nitrogen Source Inventory Loading Tool
NTN	National Trends Network
OAWP	Office of Agricultural Water Policy (FDACS)
OFS	Outstanding Florida Spring
OSTDS	Onsite Sewage Treatment and Disposal System
PBTS	Performance-based Treatment System
PFA	Priority Focus Area
PSA	Public Service Announcement
QA/QC	Quality Assurance/Quality Control
RFA	Restoration Focus Area
RIB	Rapid Infiltration Basin
RIVER	Regulatory Initiative Valuing Environmental Resources (Program)
RPS	Rapid Periphyton Survey
SAV	Submerged Aquatic Vegetation
SBIO	DEP Statewide Biological Database
SCI	Stream Condition Index
SOP	Standard Operating Procedure
SRWMD	Suwannee River Water Management District
STF	Sports Turfgrass Fertilizer
STORET	Florida Storage and Retrieval System
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management
TBD	To Be Determined
TDEP	Total Atmospheric Deposition Model
TIP	The Ichetucknee Partnership
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
UFA	Upper Floridan Aquifer
UF–IFAS	University of Florida Institute of Food and Agricultural Sciences
USDA	U.S. Department of Agriculture
USGS	U.S. Geologic Survey
UTF	Urban Turfgrass Fertilizer

WAFR	Wastewater Facility Regulation (Database)
WBID	Waterbody Identification (Number)
WIN	Florida Watershed Information Network (Database)
WMD	Water Management District
WWTF	Wastewater Treatment Facility

Executive Summary

Santa Fe River Basin

The Florida Springs and Aquifer Protection Act (Chapter 373, Part VIII, Florida Statutes [F.S.]), provides for the protection and restoration of Outstanding Florida Springs (OFS), which comprise 24 first magnitude springs, 6 additional named springs, and their associated spring runs. The Florida Department of Environmental Protection (DEP) has assessed water quality in each OFS and determined that 24 of the 30 OFS are impaired for the nitrate form of nitrogen. Three springs in the Santa Fe River Basin are impaired OFS: Devil's Ear Spring; Hornsby Spring; and the Ichetucknee Spring Group, for a total of 3 impaired OFS addressed in this BMAP. There are three additional OFS in the Santa Fe Basin Management Action Plan (BMAP) area that are unimpaired: Poe Spring; Columbia Spring; and Treehouse Spring.

The Santa Fe River BMAP area (**Figure ES-1)** comprises over one million acres in Alachua, Bradford, Columbia, Gilchrist, and Union counties. Population centers include Lake City and Fort White in Columbia County and Alachua, Archer, High Springs, La Crosse, and Newberry in Alachua County.

Santa Fe River Priority Focus Areas (PFAs)

This BMAP delineates three PFAs in the Santa Fe River BMAP area: Devil's Complex PFA; Hornsby PFA; and the Ichetucknee PFA. The Devil's Complex PFA includes 125,528 acres; the Hornsby PFA covers 49,542 acres; and the Ichetucknee PFA includes 182,864 acres. Additional springs in this basin that are not designated as OFS include Devil's Eye Spring, Little Devil's Spring, Ginnie Springs, Gilchrist Blue Spring, July Spring, and Rum Island Spring.

Nitrogen Source Identification, Required Reductions, and Options to Achieve Reductions

DEP set nitrate water quality restoration targets of 0.35 milligrams per liter (mg/L) for the Santa Fe River and associated springs, including the three OFS addressed by this BMAP.

The Nitrogen Source Inventory Loading Tool (NSILT) developed by DEP calculated estimated loads to groundwater for multiple source categories in each of the OFS springsheds and PFAs. The main sources in the Santa Fe River Basin are farm fertilizer (FF) and livestock waste (LW). In the Devil's Complex PFA, FF represents 62 %, LW represents 16 %, and dairy waste 4 % of the total nitrogen loading to groundwater. In the Hornsby PFA, FF represents 60 % and LW represents 12 % of the total nitrogen loading to groundwater. In the Ichetucknee PFA, FF represents 43 % and LW represents 19 % of the total nitrogen loading to groundwater.

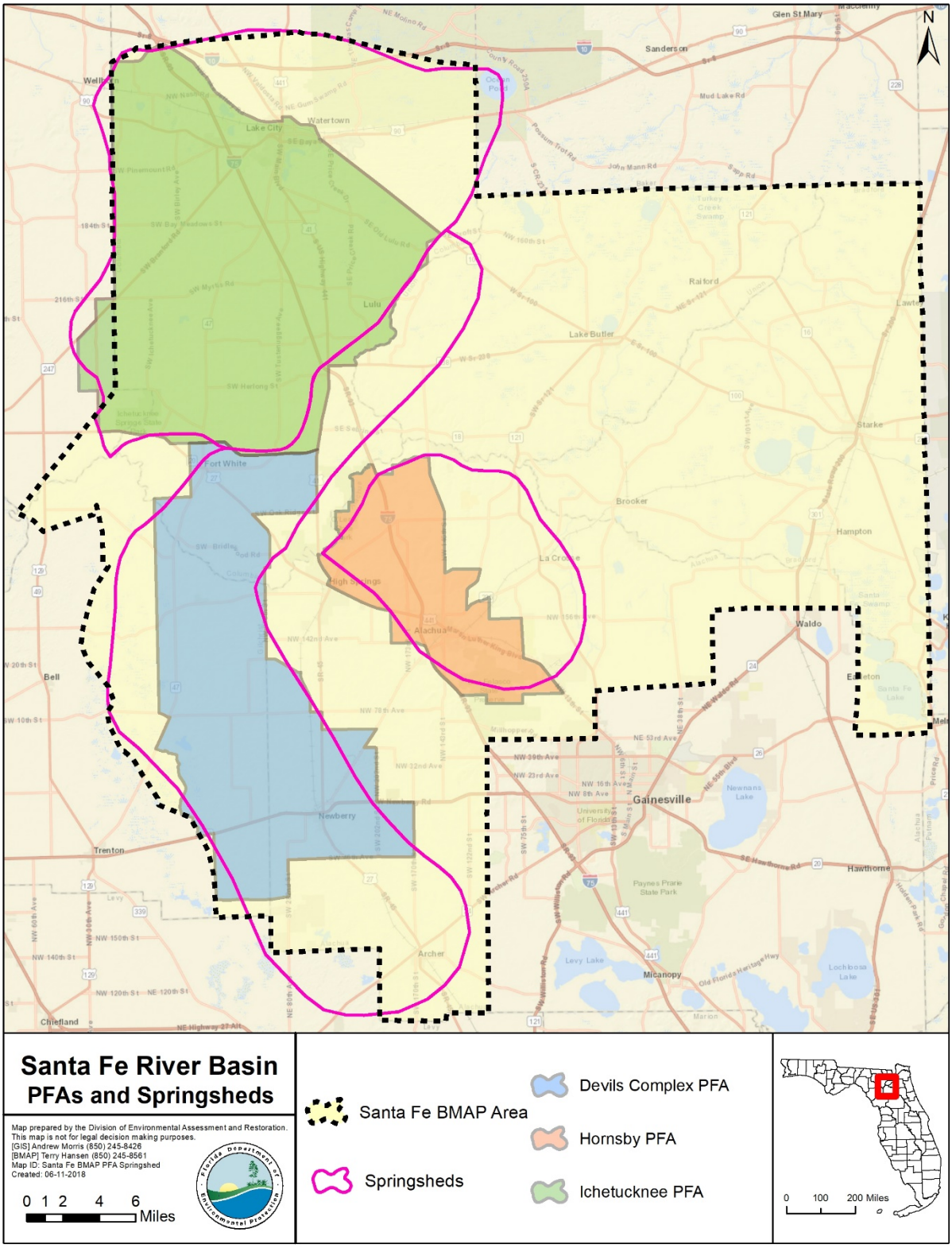

Figure ES-1. Santa Fe River BMAP and PFA boundaries

The total load reduction required to meet the total maximum daily loads (TMDLs) at the spring vents is 1,853,372 pounds of nitrogen per year (lb-N/yr). To measure progress towards achieving the necessary load reduction, DEP has established the following milestones:

- Initial reduction of 556,012 lb-N/yr (30 %) within 5 years.
- An additional 926,686 lb-N/yr (50 %) within 10 years.
- The remaining 370,674 lb-N/yr (20 %) within 15 years.
- For a total of 1,853,372 lb-N/yr within 20 years.

The policies and submitted projects included within this BMAP are estimated to achieve a reduction of 628,738 to 1,248,134 lb-N/yr to groundwater. While reductions to groundwater will benefit the spring, it is uncertain to know with precision how those reductions will impact the necessary reductions at the spring. DEP will continue to monitor the spring to evaluate those reductions as projects are implemented against the required load reductions above. The BMAP is designed to achieve 80 % of the load reductions needed for the spring vent within 10 years of adoption and 100 % within 15 years. Projects and strategies are designed to achieve nitrogen reductions in the Santa Fe River Basin but are expected to provide benefits to all springs vents within the springshed/contributing area. DEP will evaluate progress towards these milestones and will report to the Governor and Florida Legislature. DEP will adjust management strategies to ensure the target concentrations are achieved.

For the list of projects to improve water quality, see **Appendix B**. Possible load reductions include projects resulting from policies for owner-implemented best management practices (BMPs) for FF, dairy waste, and other LW; wastewater treatment facility (WWTF) upgrades; policies to reduce urban turfgrass fertilizer (UTF) application; and voluntary onsite sewage treatment and disposal system (OSTDS) enhancements or conversions to sewer.

Successful BMAP implementation requires commitment, dedicated state funding, and follow-up. Stakeholders have expressed their intention to carry out the plan, monitor its effects, and continue to coordinate within and across jurisdictions to achieve nutrient reduction goals. As the TMDLs must be achieved within 20 years, DEP, water management districts (WMDs), Florida Department of Health (FDOH), and Florida Department of Agriculture and Consumer Services (FDACS) will implement management strategies using the annual Legacy Florida appropriation from the legislature of at least $50 million to reduce nitrogen in impaired OFS. DEP, working with the coordinating agencies, will continue to invest existing funds and explore other opportunities and potential funding sources for springs restoration efforts.

Restoration Approaches

Load reduction to the aquifer is needed to achieve the load reductions requirements at the spring vent. To ensure that load reductions are achieved at the spring vent, the following restorations actions are being established. These actions are designed to reduce the amount of nutrients to the

aquifer, which will reduce the load at the vent and ultimately achieve the necessary reductions. Monitoring of the vent during implementation will be implemented to monitor progress.

- **New OSTDS** – Upon BMAP adoption, the OSTDS remediation plan prohibits new systems on lots of less than 1 acre within the PFAs, unless the system includes enhanced treatment of nitrogen as defined by the OSTDS remediation plan, or unless the OSTDS permit applicant demonstrates that sewer connections will be available within 5 years. The OSTDS remediation plan is incorporated as **Appendix D**.

- **WWTFs** – The effluent standards listed in **Table ES-1** will apply to all new and existing WWTFs in the BMAP (inside and outside the PFAs).

Table ES-1. WWTF effluent standards

gpd = Gallons per day

95% of the Permitted Capacity (gpd)	Nitrogen Concentration Limits for Rapid Infiltration Basins (RIBs) and Absorption Fields (mg/L)	Nitrogen Concentration Limits for All Other Land Disposal Methods, Including Reuse (mg/L)
Greater than 100,000	3	3
20,000 to 100,000	3	6
Less than 20,000	6	6

- **UTF** – UTF sources can receive up to 6 % credit for the DEP-approved suite of public education and source control ordinances. Entities have the option to collect and provide monitoring data to quantify reduction credits for additional measures.

- **Sports Turfgrass Fertilizer (STF) –** STF sources include golf courses and other sporting facilities. Golf courses can receive up to 10 % credit for implementing the Golf Course BMP Manual. Other sports fields can receive up to 6 % credit for managing their fertilizer applications to minimize transport to groundwater.

- **FF** – All FF sources are required to implement best management practices (BMPs) or perform monitoring to demonstrate compliance with the TMDL. A 15 % reduction to groundwater is estimated for owner-implemented BMPs. Additional credits could be achieved through better documentation of reductions achieved through BMP implementation or the implementation of additional agricultural projects and practices, such as precision irrigation, soil moisture probes, controlled release fertilizer, and cover crops.

- **LW** – All LW sources are required to implement BMPs or perform monitoring. A 10 % reduction to groundwater is estimated for owner-implemented BMPs. Additional credits could be achieved through better documentation of reductions achieved through BMP implementation.

- **Dairies** – Permitted dairies with an approved nutrient management plan receive a 15 % reduction to groundwater for owner-implemented BMPs. Additional credits could be achieved through better documentation of reductions achieved through BMP implementation.

Section 1: Background

1.1 Legislation

Chapter 373, Part VIII, Florida Statutes (F.S.), the Florida Springs and Aquifer Protection Act, provides for the protection and restoration of Outstanding Florida Springs (OFS), which comprise 24 first magnitude springs, 6 additional named springs, and their associated spring runs. The Florida Department of Environmental Protection (DEP) has assessed water quality in each OFS and determined that 24 of the 30 OFS are impaired for the nitrate form of nitrogen. Three springs in the Santa Fe River Basin are impaired OFS: Devil's Ear Spring; Hornsby Spring; and the Ichetucknee Spring Group. There are three additional OFS in the Santa Fe BMAP area that are unimpaired: Poe Spring; Columbia Spring; and Treehouse Spring.

Development of the basin management action plan (BMAP) to meet the new requirements of the Florida Springs and Aquifer Protection Act for the Santa Fe River Basin was initiated in 2016.

1.2 Water Quality Standards and Total Maximum Daily Loads (TMDLs)

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality criteria. The Santa Fe River and impaired springs addressed in this BMAP are Class III waterbodies with a designated use of recreation, propagation, and the maintenance of a healthy, well-balanced population of fish and wildlife. These waters are impaired by nitrate nitrogen, which in excess has been demonstrated to adversely affect flora or fauna through the excessive growth of algae. Excessive algal growth results in ecological imbalances in the springs and river and can produce human health problems, foul beaches, inhibit navigation, and reduce the aesthetic value of the resources.

DEP adopted nutrient TMDLs for certain waters in the Santa Fe River Basin in 2008, including three sections of the Lower Santa Fe River (**Table 1**). The TMDLs established a monthly average nitrate target of 0.35 milligrams per liter (mg/L) of nitrate to be protective of the aquatic flora or fauna in the Lower Santa Fe River and the associated springs. The period of record for water quality data evaluated for the TMDLs was June 1, 2000 through June 30, 2007. The OFS associated with the Santa Fe River are required to meet the same water quality target.

Table 1 lists the nitrate (as nitrogen) restoration targets of 0.35 mg/L. The TMDL targets are listed as monthly averages instead of daily values because changes in aquatic vegetation biomass do not respond instantaneously to changes in nutrient concentrations. A yearly average was not appropriate because algal growth responds to seasonal changes. The percent reductions are the load reductions needed to attain the numeric nutrient criteria (NNC) through the implementation of this BMAP.

Table 1. Restoration targets for the impaired river and OFS in the Santa Fe River Basin

Waterbody or Spring Name	Basin	Waterbody Identification (WBID) Number	Parameter	TMDL (mg/L)
Lower Santa Fe	Lower Santa Fe	3605A, 3605B, and 3605C	Nitrate, monthly average	0.35

1.3 BMAP Requirements

Section 403.067(7), F.S., provides DEP the statutory authority for the BMAP Program. A BMAP is a comprehensive set of strategies to achieve the required pollutant load reductions. In addition to specifying BMAP statutory authority, the Florida Springs and Aquifer Protection Act (Part VIII of Chapter 373, F.S.) describes additional requirements for the 30 OFS.

1.4 BMAP Area

The BMAP area (**Figure 1**) encompasses over one million acres in Alachua, Bradford, Columbia, Gilchrist, and Union counties. Population centers include Lake City and Fort White in Columbia County and Alachua, Archer, High Springs, La Crosse, and Newberry in Alachua County.

The BMAP area contains three impaired OFS (Devil's Ear, Hornsby, and the Ichetucknee Spring Group). Additional springs in this basin that are not designated as OFS include Devil's Eye Spring, Little Devil's Spring, Ginnie Springs, Gilchrist Blue Spring, July Spring, and Rum Island Spring. The BMAP area includes the surface water basin as well as the groundwater contributing areas for the springs (or springsheds). Springsheds for the OFS were delineated or reviewed by Suwannee River Water Management District (SRWMD) with input from the Florida Geological Survey (FGS). A springshed is the area of land that contributes water to a spring or group of springs, mainly via groundwater flow. **Table 2** lists the acreage, number of designated OFS, and land uses associated with the three priority focus areas (PFAs).

1.5 PFAs

In compliance with the Florida Springs and Aquifer Protection Act, this BMAP delineates three PFAs in the Santa Fe River BMAP area: Devil's Complex PFA; Hornsby PFA; and the Ichetucknee PFA. A PFA is defined as the area(s) of a basin where the Floridan aquifer is generally most vulnerable to pollutant inputs and where there is a known connectivity between groundwater pathways and an OFS. The PFAs provide a guide for focusing restoration strategies where science suggests these efforts will most benefit the springs. The documents that describe the delineation process for each PFA are on the DEP website. The link to the PFA documents is provided in **Appendix C.**

1.5.1 Description

Nitrogen sources are more likely to influence groundwater quality under certain conditions. For example, where soils are sandy and well drained, less nitrogen is converted to gas and released

into the atmosphere or taken up by plants, compared with other soil types. Therefore, local soils play a role in how much nitrogen travels from the land surface to groundwater in a specific springshed. Also, the underlying geologic material influences the vulnerability of the underlying aquifers and the rate of lateral movement within the Floridan aquifer toward the springs and river. These conditions, and others, were considered in the delineation of the Devil's Complex, Hornsby, and Ichetucknee PFAs (see **Appendix C**).

The PFA boundaries delineated in **Figure 1** were developed by overlaying geographic information system (GIS) coverages of groundwater recharge rates, aquifer vulnerability, soil types, conservation lands, and potential nitrogen source information. A description of each PFA follows the figure.

Following BMAP adoption, DEP will ensure that the GIS files associated with the PFA boundary are available to the public on the DEP Map Direct webpage.

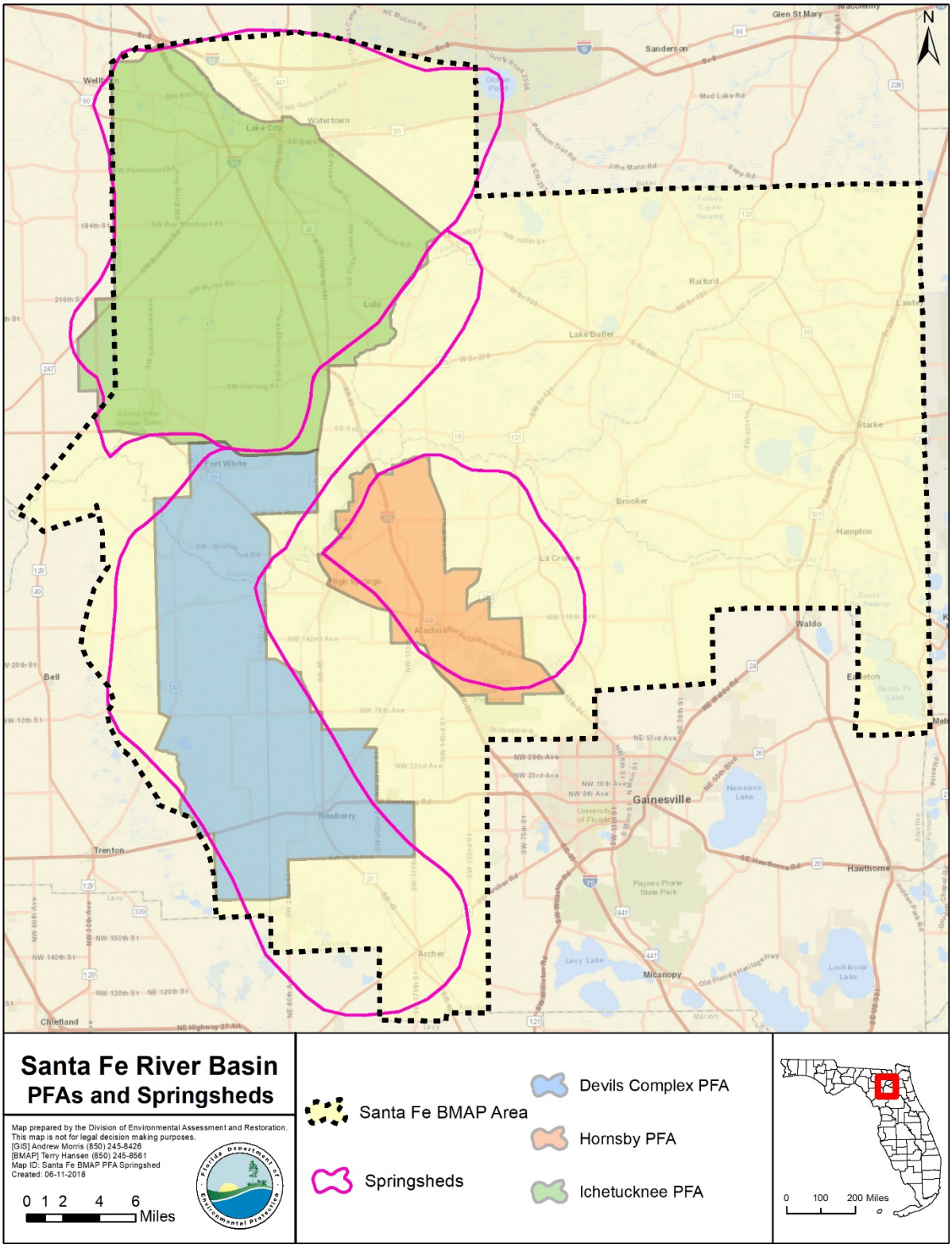

Figure 1. Santa Fe River BMAP area and PFA boundaries

Table 2. Acreage for the PFAs and the Santa Fe BMAP area

Characteristic	Devil's Complex PFA	Hornsby PFA	Ichetucknee PFA	Total BMAP Area
Acreage	125,528 acres	49,542 acres	182,891 acres	1,076,657 acres

Table 3. OFS in the BMAP area

Springs	Location (County)	Impaired?
Columbia	Columbia	No
Devil's Ear	Gilchrist	Yes
Hornsby	Alachua	Yes
Ichetucknee Spring Group	Columbia/Suwannee	Yes
Poe	Alachua	No
Treehouse	Alachua	No

Table 4. Land uses for each PFA

Land use data from the Statewide Data Miner for years 2013-2014.

Land Use	Devil's Complex PFA	Hornsby PFA	Ichetucknee PFA
Forest	51,206	20,841	72,528
Agriculture	39,820	14,400	44,196
Urban	17,791	8,559	35,805
Wetlands	5,466	2,388	10,668
Rangeland	51,206	1,641	11,939
Water	635	343	2,743
Other	3,353	1,370	4,985

The Devil's Complex PFA comprises 125,528 acres. The PFA covers areas with high groundwater recharge/vulnerability conditions and soil conditions that tend to leach nitrogen. It includes potential areas of higher nitrogen loading from agriculture and urban land uses, as well as an area where groundwater travel to the springs could occur rapidly. It also includes interconnected areas of agricultural land use, areas of urban development, areas with onsite sewage treatment and disposal systems (OSTDS or septic systems, the terms are used interchangeably through this document), domestic wastewater facilities, and concentrated animal feeding operations (CAFOs). All of these have the potential to contribute to nitrogen enrichment in the aquifer and springs.

The Devil's Complex PFA includes parts of Gilchrist, Alachua, and Columbia counties. The PFA also includes the City of Newberry. Conservation land boundaries, natural features, political boundaries, roads, and survey boundaries in the area were also considered in the development of a readily identifiable boundary.

Hornsby PFA comprises an area of 49,542 acres. The PFA covers areas with high groundwater recharge/vulnerability conditions and soil conditions that tend to leach nitrogen. It includes potential areas of higher nitrogen loading from agriculture and urban land uses, as well as an area where groundwater travel to the springs could occur rapidly. It also includes interconnected areas of agricultural land use, areas of urban development, areas with OSTDS, domestic wastewater facilities, and CAFOs. All of these have the potential to contribute to nitrogen enrichment in the aquifer and springs.

The Hornsby PFA is located in Alachua County. It includes the cities of High Springs and Alachua. Conservation land boundaries, natural features, political boundaries, roads, and survey boundaries in the area were all considered in the development of a readily-identifiable PFA boundary.

The Ichetucknee PFA includes an area of 182,891 acres. This area has high groundwater recharge/vulnerability conditions and soil conditions that tend to leach nitrogen. It includes potential areas of higher nitrogen loading from agriculture and urban land uses, as well as an area where groundwater travel to the springs could occur rapidly. It also includes interconnected areas of agricultural land use and larger areas of urban development, which have the potential to contribute to nitrogen enrichment in the aquifer and springs.

The Ichetucknee PFA is mainly located in Columbia County, with a portion of Suwannee County as well as a small portion of Union County (about 40 acres). Conservation land boundaries, natural features, political boundaries, roads, and major survey boundaries in the area were used in the development of a readily identifiable boundary.

1.5.2 Additional Requirements

In accordance with Section 373.811, F.S., the following activities are prohibited in each PFA in the Santa Fe River BMAP:

- New domestic wastewater disposal facilities, including rapid infiltration basins (RIBs), with permitted capacities of 100,000 gpd or more, except for those facilities that meet an advanced wastewater treatment (AWT) standard of no more than 3 mg/L total nitrogen (TN) on an annual permitted basis.

- New OSTDS on lots of less than one acre inside the PFAs unless additional nitrogen treatment is provided, as specified in the OSTDS remediation plan (see **Appendix D** for details).

- New facilities for the disposal of hazardous waste.

- The land application of Class A or Class B domestic wastewater biosolids not in accordance with a DEP-approved nutrient management plan establishing the rate at which all biosolids, soil amendments, and sources of nutrients at the land application site can be applied to the land for crop production, while minimizing

the amount of pollutants and nutrients discharged to groundwater or waters of the state.

- New agricultural operations that do not implement BMPs, measures necessary to achieve pollution reduction levels established by DEP, or groundwater monitoring plans approved by a water management district or DEP.

1.5.2.1 Biosolids and Septage Application Practices

In the PFA, the aquifer contributing to the springs is highly vulnerable to contamination by nitrogen sources and soils have a high to moderate tendency to leach applied nitrogen. DEP previously documented elevated nitrate concentrations in groundwater beneath septage application zones in spring areas. To assure that nitrogen losses to groundwater are minimized from permitted application of biosolids and septage in the PFA, the following requirements apply to newly-permitted application sites and existing application sites upon permit renewal.

All permitted biosolids application sites that are agricultural operations must be enrolled in the The Florida Department of Agriculture and Consumer Services (FDACS) BMP Program or be within an agricultural operation enrolled in the FDACS BMP Program for the applicable crop type. Implementation of applicable BMPs will be verified by FDACS in accordance with Chapter 5M-1, Florida Administrative Code (F.A.C.). Permitted biosolids application sites that are new agricultural operations must also comply with Subsection 373.811(5), F.S. Biosolids application sites must be certified as viable agricultural operations by an acknowledged agricultural professional such as an agricultural consultant or agricultural extension agent. Effective nutrient management practices must be ongoing at the application zones in the permit. Plant uptake and harvesting are vital components of the nutrient management plan to remove nitrogen and prevent it from leaching to groundwater. If DEP determines that the site is not a viable agricultural site implementing a nutrient management plan, corrective action will be required.

Groundwater monitoring for nitrate is required for all biosolids and septage land application sites in the PFA to assure compliance with nutrient management objectives in this BMAP. However, groundwater monitoring is not required if the site nutrient management plan limits biosolids application rates of TN with no adjustment for available nitrogen normally allowed by subsections 62-640.500(5) and (6), F.A.C. (e.g. for a recommended fertilizer rate of 160 pounds of nitrogen per acre, only 160 pounds of TN per acre shall be applied). For septage application, groundwater monitoring is not required if the site nutrient management plan limits application rates to 30,000 gallons per acre for sites accepting mixtures of septage and grease (food establishment sludge) or to 40,000 gallons per acre for sites accepting septage without grease. The permit renewal application will include a trend analysis for nitrate in groundwater monitoring wells during the previous permit cycle, and an evaluation of the potential for the facility to cause or contribute to exceedance of the TMDL.

1.6 Other Scientific and Historical Information

In preparing this BMAP, DEP collected and evaluated credible scientific information on the effect of nutrients, particularly forms of nitrogen, on springs and springs systems. Some of the information collected is specific to the Santa Fe River Basin, while other references provided information on related knowledge for restoring springs, such as nitrogen-reducing technologies, the treatment performance of OSTDS, and runoff following fertilizer applications.

1.7 Stakeholder Involvement

Stakeholder involvement is critical to develop, gain support for, and secure commitments in a BMAP. The BMAP process engages stakeholders and promotes coordination and collaboration to address the pollutant load reductions necessary to achieve the TMDLs. DEP invites stakeholders to participate in the BMAP development process and encourages public participation and consensus to the greatest practicable extent. **Table A-1** lists the stakeholders who participated in the development of this BMAP.

During the development of the Santa Fe River BMAP, DEP held a series of meetings involving stakeholders and the general public. The purpose of these meetings was to consult with stakeholders to gather information, evaluate the best available science, develop an OSTDS remediation plan (including a public education plan), define management strategies and milestones, and establish monitoring requirements. All meetings were open to the public and noticed in the *Florida Administrative Register* (F.A.R.). Additionally, a public meeting on the current BMAP was held on May 29, 2018, and was noticed in the F.A.R. and in local newspapers.

Upon BMAP adoption, DEP intends to facilitate annual meetings with stakeholders to review progress towards achieving the TMDLs.

1.8 Description of BMPs Adopted by Rule

Table 5 lists the adopted BMPs and BMP manuals relevant to this BMAP.

Table 5. BMPs and BMP manuals adopted by rule as of June 2017

Agency	F.A.C. Chapter	Chapter Title
FDACS Office of Agricultural Water Policy (OAWP)	5M-6	Florida Container Nursery BMP Guide
FDACS OAWP	5M-8	BMPs for Florida Vegetable and Agronomic Crops
FDACS OAWP	5M-9	BMPs for Florida Sod
FDACS OAWP	5M-11	BMPs for Florida Cow/Calf Operations
FDACS OAWP	5M-12	Conservation Plans for Specified Agricultural Operations
FDACS OAWP	5M-13	BMPs for Florida Specialty Fruit and Nut Crop Operations
FDACS OAWP	5M-14	BMPs for Florida Equine Operations
FDACS OAWP	5M-16	BMPs for Florida Citrus

Agency	F.A.C. Chapter	Chapter Title
FDACS OAWP	5M-17	BMPs for Florida Dairies
FDACS OAWP	5M-18	Florida Agriculture Wildlife BMPs
FDACS OAWP	5M-19	BMPs for Florida Poultry
FDACS Division of Agricultural Environmental Services	5E-1	Fertilizer
FDACS Division of Aquaculture	5L-3	Aquaculture BMPs
FDACS Florida Forest Service	5I-6	BMPs for Silviculture
FDACS Florida Forest Service	5I-8	Florida Forestry Wildlife BMPs for State Imperiled Species
DEP	62-330	Environmental Resource Permitting

Section 2: Implementation to Achieve the TMDLs

2.1 Allocation of Pollutant Loads

DEP collected and evaluated credible scientific information on the effect of nutrients, particularly forms of nitrogen on the seven OFS, described below.

2.1.1 Nutrients in the Springs and Spring Systems

DEP developed the Nitrogen Source Inventory Loading Tool (NSILT) to provide information on the major sources of nitrogen in the groundwater contributing area for the OFS in the three sub-basins. In addition, this tool is used to estimate nitrogen loads to groundwater from these sources in the spring contributing area. The NSILT is a GIS- and spreadsheet-based tool that provides spatial estimates of the relative contribution of nitrogen from major nitrogen sources and accounts for the transport pathways and processes affecting the various forms of nitrogen as they move from the land surface through the soil and geologic strata.

The first major factor to consider in estimating the loading to groundwater in the NSILT is the attenuation of nitrogen as it moves from its source through the environment, before it reaches the Upper Floridan aquifer (UFA). The movement of nitrogen from the land surface to groundwater is controlled by biological and chemical processes that occur as part of the nitrogen cycle, as well as hydrogeological processes. Many of these processes attenuate (impede or remove) the amount of nitrogen transported to groundwater. An understanding of how water moves through the subsurface and the processes that transform the different forms of nitrogen is essential for estimating nitrogen loading to groundwater from various sources.

A second major factor to consider in estimating the loading to groundwater is the geologic features in the springshed and the related "recharge rate." Water movement between the shallow groundwater (surficial aquifer, where present) and the deeper aquifer (UFA) is slowed by a low permeability layer of clay, silt, and fine sand that retards the vertical movement of infiltrating water from the surface. The UFA occurs in limestone that can be prone to dissolving, and, over geologic time, the development of numerous karst features (sinkholes, caves, and conduits). These features allow water from the land surface to move directly and relatively rapidly into the aquifer and in some areas for groundwater in the aquifer to move rapidly to the springs.

Potential recharge rates from the surface to the UFA are affected by variations in the geologic materials and the presence of karst features. DEP estimated the recharge rate ranges and grouped them into three rate categories, which were applied in the NSILT:

- Low recharge (0 to 3 inches per year [in/yr]).
- Medium recharge (3.01 to 10 in/yr).
- High recharge (greater than 10 in/yr).

In the NSILTs, DEP applied different attenuation factors to different types of sources, so that various biological, chemical, and hydrogeological effects could be estimated. The attenuation that was applied means that the amount of nitrogen leaving a source (such as a livestock operation or a newly fertilized yard) reduces the amount of nitrogen predicted to reach the aquifer. In the Devil's Complex, Hornsby, and Ichetucknee NSILT estimates, the attenuation rates ranged from 90 % (for atmospheric deposition) to 25 % (for wastewater disposal in a RIB). This means that, for these examples, only 10 % of nitrogen from atmospheric deposition is expected to reach the aquifer, while 75 % of nitrogen from a RIB is expected to reach groundwater, because the remainder is attenuated by various chemical and biological processes.

2.1.2 Estimated Nitrogen Loads

Table 6, Table 7, and **Table 8** list the estimated nitrogen loads to groundwater by source in each PFA and springshed. Note that urban stormwater loads are included in urban turfgrass fertilizer (UTF) estimates, while agricultural stormwater loads are included in farm fertilizer (FF) and livestock waste (LW) estimates. Nitrogen loading to surface water will be reduced through the activities and strategies for the sources identified in this chapter for groundwater loading. PFA boundaries follow geopolitical boundaries and often extend beyond the springshed resulting in some sources having a larger load to groundwater in the PFA than for the springshed.

Table 6. Estimated nitrogen load to groundwater by source in the Devil's Complex PFA and Springshed

Nitrogen Source	Total Nitrogen Load to Groundwater in Pounds of Nitrogen per Year (lb-N/yr)		% Contribution	
	PFA	Springshed	PFA	Springshed
OSTDS	35,731	53,540	6	6
UTF	22,257	30,491	3	3
Atmospheric Deposition	56,805	93,357	9	10
FF	396,210	588,568	62	63
Sports Turfgrass Fertilizer (STF)	156	156	<1	<1
Permitted Dairies	22,658	22,658	4	3
LW	102,367	142,419	16	15
Wastewater Treatment Facilities (WWTFs)	2,696	2,841	<1	<1
Total	**638,973**	**934,030**		

Table 7. Estimated nitrogen load to groundwater by source in the Hornsby PFA and Springshed

Nitrogen Source	Total Nitrogen Load to Groundwater (lb-N/yr)		% Contribution	
	PFA	Springshed	PFA	Springshed
OSTDS	13,244	12,666	7	5
UTF	18,567	21,624	10	8
Atmospheric Deposition	17,808	22,315	9	8
FF	117,215	175,447	60	64
STF	1,891	1,891	<1	<1
Permitted Dairies	0	1,545	<1	<1
LW	22,257	37,317	12	13
WWTFs	2,735	2,735	1	1
Total	**193,986**	**275,539**		

Table 8. Estimated nitrogen load to groundwater by source in the Ichetucknee PFA and Springshed

Nitrogen Source	Total Nitrogen Load to Groundwater (lb-N/yr)		% Contribution	
	PFA	Springshed	PFA	Springshed
OSTDS	101,716	116,338	12	14
UTF	83,152	91,774	10	11
Atmospheric Deposition	95,884	122,248	11	15
FF	363,986	292,783	43	36
STF	15,601	15,601	2	2
LW	161,273	166,877	19	20
WWTFs	27,407	14,928	3	2
Total	**849,020**	**820,549**		

2.1.3 Assumptions and Considerations

The NSILT estimates are based on the following assumptions and considerations:

- **NSILT Nitrogen Inputs** – The methods used to estimate nitrogen inputs for each pollutant source were based on a detailed synthesis of information, including direct water quality measurements, census data, surveys, WWTF permits, published scientific studies and reports, and information obtained in meetings with agricultural producers. For some pollutant source categories, nitrogen inputs were obtained using assumptions and extrapolations, and as a result, these inputs

could be subject to further refinement if more detailed information becomes available.

- **OSTDS Load Contribution –** A per capita contribution to an OSTDS of 9.012 lb-N/yr was used to calculate loading from OSTDS. The average household contribution was estimated based on 2010 U.S. Census Bureau data on the weighted average number of people per household for the counties in the area and additional information on the time spent away from home by the school-age population and labor force.

- **Nitrogen Attenuation Factors –**To estimate the amount of nitrogen loading to the aquifer, DEP applied two nitrogen attenuation factors. Biological and chemical processes that occur as part of the nitrogen cycle, as well as hydrogeological processes, control the movement of nitrogen from the land surface to groundwater. Biochemical attenuation accounts for biochemical processes that convert or transform the different forms of nitrogen, while hydrogeological attenuation accounts for spatial variations that affect the rate of water infiltrating through geological media to recharge the UFA. Given the relatively large range of literature-reported values of biochemical nitrogen attenuation for each source category, DEP used an average biochemical attenuation factor for each source based on land use practices and hydrogeological (i.e., recharge) conditions in the contributing areas.

Other assumptions and considerations for BMAP implementation include the following:

- **Unquantified Project Benefits** – Nitrogen reductions for some of the projects and activities listed in this BMAP cannot currently be quantified. However, because of their positive impact, it is assumed that these actions will help reduce pollutant loads, and estimated loading reductions may be determined at a later date and assigned to these activities.

- **Atmospheric Deposition** – Atmospheric sources of nitrogen are local, national, and international. .Atmospheric sources are generally of low nitrogen concentration compared with other sources and are further diminished through additional biological and chemical processes before they reach groundwater. Atmospheric deposition sources and trends will need to be re-evaluated periodically.

- **OSTDS Inventory and Loading Calculations** – The total number of OSTDS in the basin is estimated based on local information and Florida Department of Health (FDOH) data. Future BMAPs and the associated OSTDS loading calculations may be adjusted based on improved data on the number, location, and type (conventional and enhanced nitrogen reducing) of existing septic systems, and may include additional OSTDS installed since BMAP adoption.

- **PFA** – The PFA provides a guide for focusing strategies where science suggests efforts will best benefit the springs. The PFA boundaries may be adjusted in the future if additional relevant information becomes available.

- **Project Collection Period –** The BMAP project collection period is limited to projects after a certain date, based on the data used to calculate the reductions needed. Reductions from older projects are already accounted for in the baseline loading. The period of record for water quality data evaluated for the TMDLs was June 1, 2000 through June 30, 2007, so projects completed in the springshed after June 2000, were considered for inclusion in this BMAP.

- **Legacy Sources** – Land uses or management practices not currently active in the basin may still be affecting the nitrate concentration of the springs. The movement of water from the land surface through the soil column to the UFA and through the UFA to the spring system varies both spatially and temporally and is influenced by local soil and aquifer conditions. As a result, there may be a delay between when nitrogen input to the UFA occurs and when that load ultimately arrives at an OFS. The impact of this delay is not fully known.

- **Implementation Schedule** – BMAP implementation is a 20-year process. This plan defines nitrogen reduction milestones for 5-year (30 %), 10-year (50 %), and 15-year (20 %) implementation, so that the TMDLs will be met no later than the 20-year goal (see **Section 2.1.6** for further details). Further, the total reductions and project credits may be adjusted under the adaptive management approach used for the BMAP. This approach requires regular follow-up to ensure that management strategies are carried out and that their incremental effects are assessed. This process acknowledges that there is some uncertainty associated with the outcomes of proposed management strategies and the estimated response of concentration at the springs. As more information is gathered and progress towards each 5-year milestone is reviewed, additional management strategies to achieve the TMDLs will be developed or existing strategies refined to better address the sources of nitrogen loading.

- **Changes in Spring Flows** – The role of this BMAP is specifically to promote the implementation of projects that reduce the nitrogen load to groundwater, while the minimum flows and levels (MFLs) established for specific springs address water flows and levels. To maximize efforts between the two programs, spring protection projects should provide both water quality and quantity benefits.

2.1.4 Loading by Source

Based on the NSILT estimates, the pie charts in **Figure 2**, **Figure 3**, and **Figure 4** depict the estimated percentage of nitrogen loading to groundwater by source in each springshed. FF and

LW (mainly from dairies and beef cattle cow-calf operations) are responsible for the majority of the nitrogen sources in each springshed. Stormwater loading to groundwater is incorporated into the various source categories.

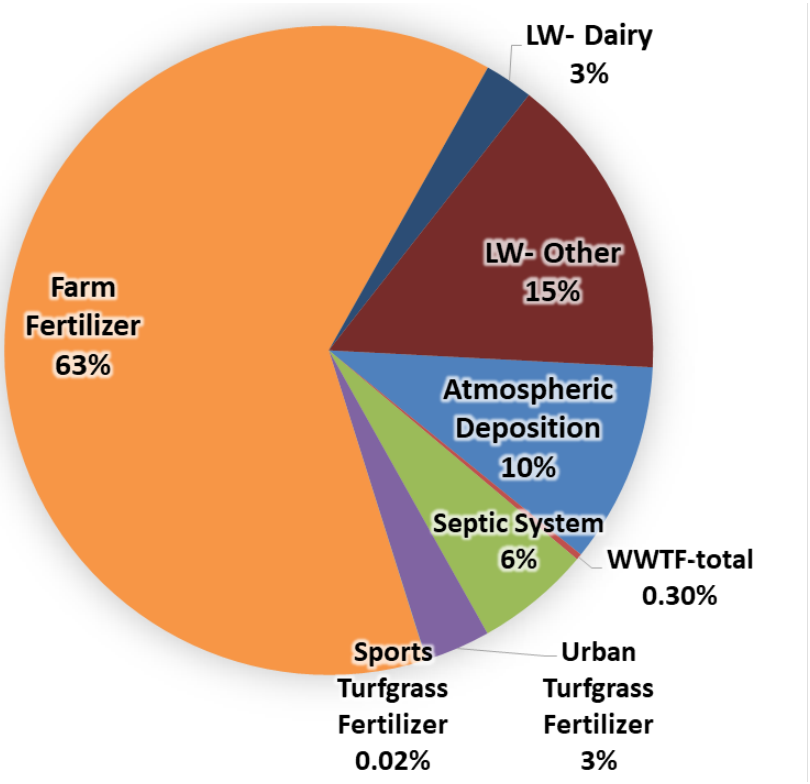

Figure 2. Loading to groundwater by source in the Devil's Complex Springshed

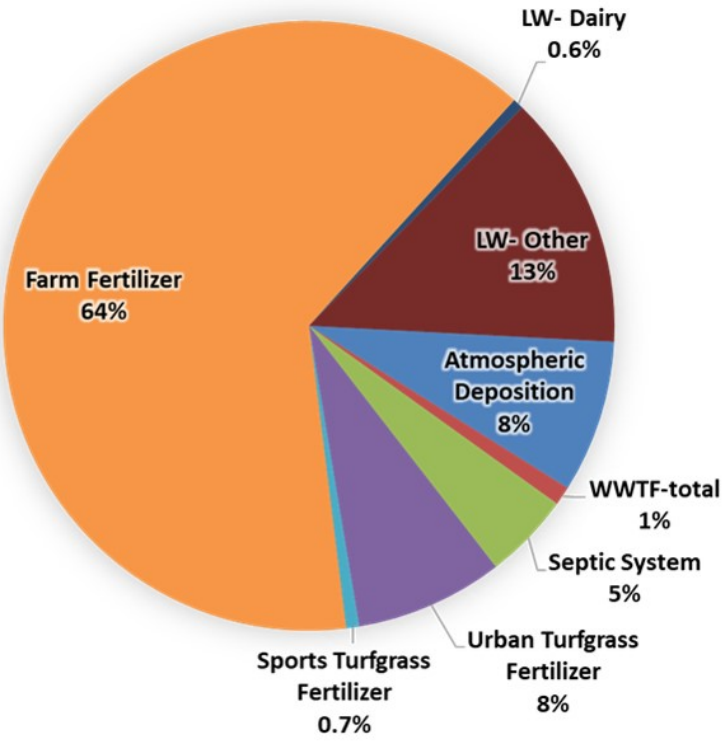

Figure 3. Loading to groundwater by source in the Hornsby Springshed

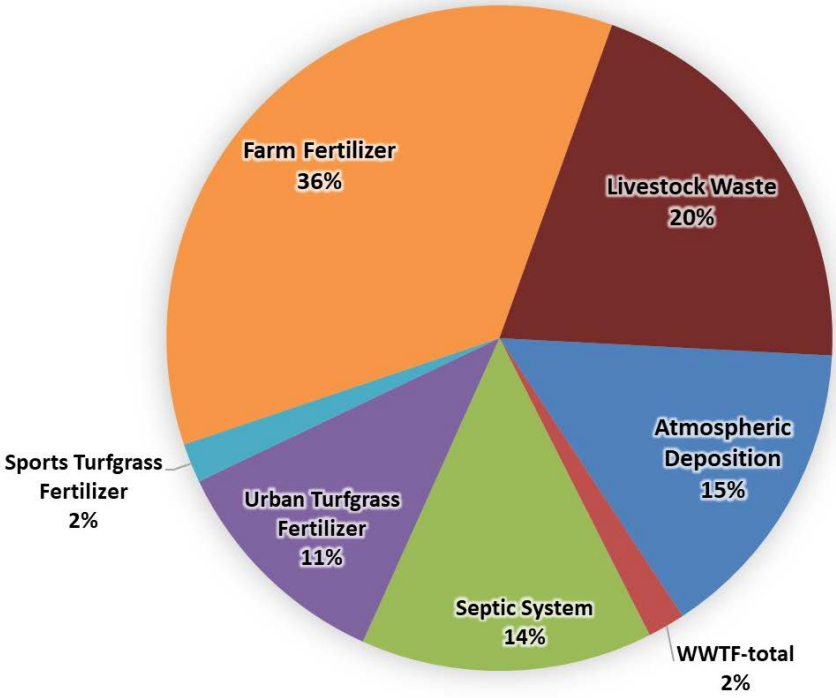

Figure 4. Loading to groundwater by source in the Ichetucknee Springshed

2.1.5 Loading Allocation

The nitrogen source reductions are based on the measured nitrate concentrations and flows at the vent, along with the TMDL target nitrate concentration. **Table 9** lists the measured nitrate (as nitrogen) loads at the spring vents compared with the TMDL loading based on a target nitrate concentration of 0.35 mg/L. The difference between the spring vent loading and the TMDL loading estimates is the required reduction to meet the TMDLs. The total load that is required to be reduced in the basin is being allocated to the entire basin and actions defined by the BMAP to reduce loading to the aquifer are needed to implement this allocated load. Load reductions were also calculated for the areas outside the springshed but inside the BMAP area boundary, based on the average load per acre inside the springshed and the total acres outside the springshed but in the BMAP area (**Table 10**).

Table 9. Total reduction required to meet the TMDLs by area

Note: The load at the spring vent was calculated using the upper 95% confidence intervals of flow and nitrate data from 2008 to 2018 (breakpoint was selected as 2008). TMDL loads use TMDL concentration of 0.35 mg-N/L and the same flow data used for spring vent calculation.

Area	Total Load at Spring Vents (lb-N/yr)	TMDL Load (lb-N/yr)	Required Reduction to Meet TMDL (lb-N/yr)
Devil's Complex	1,899,233	664,731	1,234,501
Hornsby	435,385	152,385	283,000
Ichetucknee	308,107	107,837	200,269
West BMAP Area	96,083	33,629	62,454
East BMAP Area	112,535	39,387	73,148
Total	**2,851,342**	**997,970**	**1,853,372**

2.1.6 Description of 5-, 10-, and 15-year Milestones/Reduction Schedule

The overall load reduction targets are 30 % of the total within 5 years, 80 % of the total within 10 years, and 100 % of the total within 15 years. DEP will evaluate progress towards these milestones and will report to the Governor and Florida Legislature. DEP will adjust management strategies that reduce loading to the aquifer to ensure the target concentrations are achieved.

Table 10 lists the estimated nitrogen reduction schedule, by milestone. Progress will be tracked yearly and adjustments made as needed. At the 5-year milestone, progress will be assessed and load reductions adjusted as necessary. Entities have flexibility in the types and locations of projects as long as they achieve the overall required load reductions. The monitoring of existing groundwater and springs sampling locations is essential. **Section 2.3** describes detailed source reduction strategies.

Table 10. Nitrogen reduction schedule (lb-N/yr)

5-Year Milestone (30% of Total)	10-Year Milestone (50% of Total)	15-Year Milestone (20% of Total)	Total Nitrogen Reduction (100%)
556,012	926,686	370,674	**1,853,372**

2.2 Prioritization of Management Strategies

The management strategies listed in **Appendix B** are ranked with a priority of high, medium, or low. In 2016, the Florida Legislature amended the Watershed Restoration Act (Section 403.067, F.S.), creating additional requirements for all new or revised BMAPs. BMAPs must now include planning-level details for each listed project, along with their priority ranking.

Project status was selected as the most appropriate indicator of a project's priority ranking based primarily on need for funding. Projects with a "completed" status were assigned a low priority. Projects classified as "underway" were assigned a medium priority because some resources have been allocated to these projects, but additional assistance may be needed for the project to be completed. High priority was assigned to projects listed with the project status "planned" as well as certain "completed" projects that are ongoing each year (any project with one of these project types: "street sweeping," "catch basin inserts/inlet filter cleanout," "public education efforts," "fertilizer cessation," "fertilizer reduction," or "aquatic vegetation harvesting"), and select projects that are elevated because substantial, subsequent project(s) are reliant on their completion.

2.3 Load Reduction Strategy

A precise total load reduction to groundwater needed to meet the TMDL is unknown and dependent on a number of complex factors. Ultimately there must be a reduction at the spring vent of at least 1,853,372 lb-N/yr. Based on the totals of all the credits from BMAP actions and policies, the range of total reductions to groundwater is between 628,738 and 1,248,134 lb-N/yr (see **Table 11**). However, due to the proximity of these reductions to the spring and the uncertainties of fate and transport in the karst geology, additional actions may be necessary to ensure that the loading at the vent is achieved within the timeline of the BMAP.

To achieve reductions outside the scope of the policies listed, additional project options are available to local entities but have not been planned. Other efforts could be pursued to further reduce the nitrogen load to groundwater in the Santa Fe River Basin.

Table 11. Summary of potential credits for the Santa Fe River BMAP to meet the TMDL

Note: No reductions are estimated for atmospheric deposition sources.

Nitrogen Source	Credits to Load to Groundwater Based on Project Tables (lb-N/yr)	Description
OSTDS	11,959	Credits identified for stakeholder OSTDS projects (enhancement or sewer).
UTF	19,173	DEP approved credits (6%) for public education activities

Nitrogen Source	Credits to Load to Groundwater Based on Project Tables (lb-N/yr)	Description
		as well as credits identified for stakeholder stormwater projects.
FF Projects	98,100	Credits identified for stakeholder farm fertilizer projects.
FF	232,273	15% BMP credit on farm fertilizer load to groundwater, assuming 100% owner-implemented and verified BMPs on all fertilized lands.
Permitted Dairies Projects	200	Credits identified for stakeholder dairy projects.
Permitted Dairies	7,189	15% BMP credit on permitted dairy load to groundwater, assuming 100% owner-implemented and verified BMPs at permitted dairies.
LW	51,541	10% BMP credit on load to groundwater, assuming 100% owner-implemented and verified BMPs at all livestock facilities.
STF	2,267	6% BMP credit for sports fields and 10% BMP credit for golf courses on STF load to groundwater, assuming 100% BMP implementation on golf courses and sports fields.
WWTF	21,309	Achieved by BMAP WWTF policy (achieving 3 or 6 mg/L).
WWTF Projects	29,877	Credits identified for wastewater projects.
Total Credits from BMAP Policies and Submitted Projects	**473,889**	
Advanced Agricultural Practices and Procedures	154,849 - 774,244	Includes 10% to 50% reduction from 100% of fertilized acres with a change in practice.
Total Credits	**628,738 – 1,248,134**	**Load reduction to meet the TMDL at the spring vents is 1,853,372 lb-N/yr.**

2.4 OSTDS Management Strategies

Overall, there are currently more than 500 OSTDS in the PFAs on lots less than one acre, based on FDOH estimates. This BMAP lists 7 specific projects (5 with estimated reductions) (**Appendix B**) that reduce nitrogen loading from existing OSTDS on variably sized parcels for a total of 11,959 lb-N/yr. **Figure 5** shows the locations of the OSTDS in the BMAP area.

In addition to the 7 listed projects, DEP assessed the overall OSTDS loading compared with other nitrogen sources in the PFAs, as well as the relative loading in the wider BMAP area. Based on these assessments, DEP has determined that for the Santa Fe River BMAP area, OSTDS contribute less than 20 % of nonpoint source nitrogen pollution to the OFS. Per the Santa Fe River Basin NSILTs, septic systems contribute 12 % of the nitrogen loading in the Devil's Complex PFA, 14 % in the Hornsby PFA, and 14 % in the Ichetucknee PFA. Irrespective of the percent contribution, nitrogen loading from OSTDS contribute to the significant

degradation of the groundwater, and DEP has determined that an OSTDS remediation plan is necessary to achieve the TMDLs and to limit the increase in nitrogen loads from future growth. Accordingly, the OSTDS remediation plan prohibits the installation of new conventional systems on lots less than 1 acre within the PFA. The OSTDS remediation plan is incorporated as **Appendix D**.

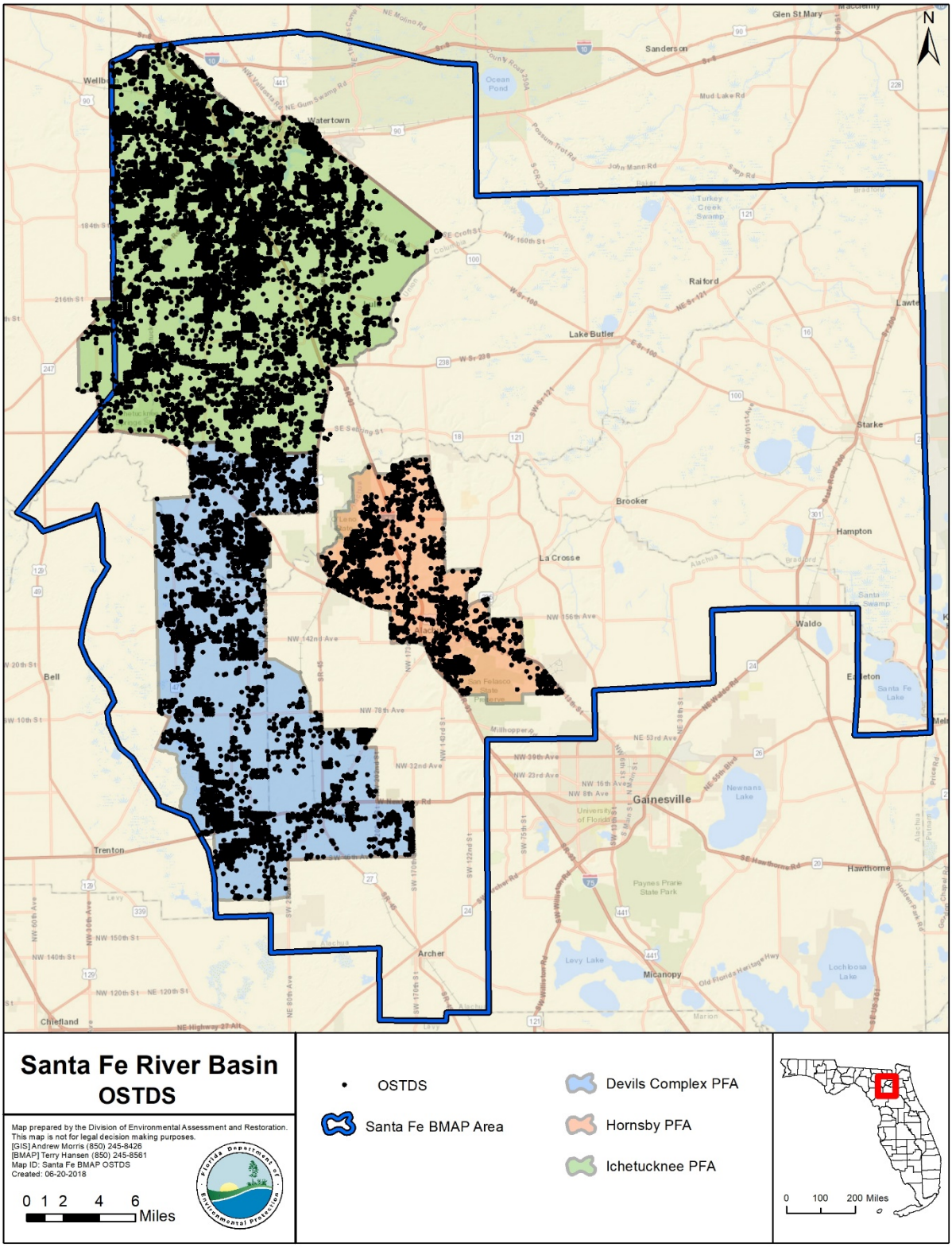

Figure 5. OSTDS locations in the Santa Fe River BMAP area

2.5 UTF Management Strategies

UTF consists of fertilizers applied to the turfgrass typically found in residential and urban areas (including residential lawns and public green spaces). It is applied by either the homeowner or a lawn service company on residential properties, while on nonresidential properties, it may be applied by contractors or maintenance staff.

2.5.1 Fertilizer Ordinance Adoption

As required by the Florida Legislature, as described in Subsection 373.807(2), F.S., local governments with jurisdictional boundaries that include an OFS or any part of a springshed or the delineated PFA of an OFS, are required to develop, enact, and implement a fertilizer ordinance by July 1, 2017. The statutes require any ordinance to be based, at a minimum, on the DEP model ordinance for Florida-friendly fertilizer use on urban landscapes.

2.5.2 Prioritized Management Strategies and Milestones

Based on the fertilizer ordinances required to be in place at the time of BMAP adoption, the associated credits for UTF reductions to groundwater are 3,470 lb-N/yr (see **Table 12**). Additional environmental benefits could be credited if the counties and municipalities implement other public education efforts and source control ordinances (see **Table 13).**

Local stormwater projects that treat urban runoff, including nitrogen from urban fertilizer, are also in place (see **Appendix B**), for a total estimated reduction to groundwater of 15,703 lb-N/yr.

Table 12. Current project credits to reduce UTF loading to groundwater

Project Category	Project Credits Based on Management Actions in Appendix B (lb-N/yr)
Fertilizer Ordinances (all entities)	3,470
Stormwater Improvements	15,703
Total Project Credits	**19,173**

Since there is uncertainty about the data used in the NSILT estimates to calculate the UTF loading to groundwater, DEP will work toward collecting better data by documenting reductions with the stakeholders. Also, DEP will work with the stakeholders to develop additional measures to reduce fertilizer application.

2.5.3 Additional UTF Reduction Options

The anticipated reduction from UTF sources is currently limited to 6 % of the estimated load to groundwater. This reduction can be achieved through a 6 % total credit if each local government has an applicable fertilizer ordinance, landscape ordinance, irrigation ordinance, and pet waste ordinance; carries out public education activities; and implements the Florida Yards and Neighborhood (FYN) Program (**Table 13**).

Table 13. Maximum UTF load reductions based on existing public education credit policies

UTF Source Control Measures	Credit, Based on Estimated Load to Groundwater (%)	Possible Nitrogen Credits (lb-N/yr)
Fertilizer Ordinance	0.50	3,470
Pet Waste Ordinance	0.50	3,470
Landscape Ordinance	0.50	3,470
Irrigation Ordinance	0.50	3,470
FYN Program	3.00	20,820
Public Education Program	1.00	4,878
Total Possible Credits	**6.00**	**41,639**

If all the local governments were to implement the full suite of public education measures, a 41,639 lb-N/yr reduction could be achieved. Currently, it is assumed that all local governments have or will adopt the required fertilizer ordinance for a reduction credit of 3,470 lb-N/yr. Thus, an additional 38,169 lb-N/yr reduction could be achieved through public education and source control efforts.

2.6 Agricultural Sources Management Strategies and Additional Reduction Options

Based on data including Florida Statewide Agriculture Irrigation Demand (FSAID) IV geodatabase land use, FDACS identified agricultural acreage within the BMAP. An estimated 204,890 acres of land in the springshed area are considered agricultural, of which 45,734 acres are identified as crop fertilizer croplands, 22,739 acres are livestock lands, and 136,417 acres are identified as both fertilizer croplands and livestock lands.

2.6.1 FF Loading

Nitrogen in agricultural fertilizer is applied at varying rates, depending on the crop and individual farm practices. In the Devil's Complex PFA, the NSILT estimated total nitrogen load to groundwater from FF is 396,210 lb-N/year, approximately 62 % of the total nitrogen load to groundwater. In the Hornsby PFA, the NSILT estimated total nitrogen load to groundwater from FF is 117,215 lb-N/year, approximately 60 % of the total nitrogen load to groundwater. In the Ichetucknee PFA, the NSILT estimated total nitrogen load to groundwater from FF is 363,986 lb-N/year, approximately 43 % of the total nitrogen load to groundwater. FF includes commercial inorganic fertilizer applied to row crops, field crops, pasture, and hay fields. Some of the FF application sites are associated with dairies.

2.6.2 LW Loading

Agricultural practices specific to LW management were obtained through meetings with University of Florida Institute of Food and Agricultural Sciences (UF-IFAS) extension staff, FDACS field representatives, agricultural producers, and stakeholders. In the Devil's Complex PFA, the NSILT estimated total nitrogen load to groundwater from LW is 102,367 lb-N/year, or

16 % of the total nitrogen load to groundwater. In the Hornsby PFA, the NSILT estimated total nitrogen load to groundwater from LW is 22,257 lb-N/year, or 12 % of the total nitrogen load to groundwater. In the Ichetucknee PFA, the NSILT estimated total nitrogen load to groundwater from LW is 161,273 lb-N/year, or 19 % of the total nitrogen load to groundwater.

2.6.3 Permitted Dairies

The loading from LW at DEP-permitted dairies was estimated separately from other LW because specific permit information was available to account for loads, waste management practices, and nutrient management plans. The NSILT estimated total nitrogen load to groundwater from animal waste at permitted dairies in the Devil's Complex PFA is 22,658 lb-N/yr, or 4 % of the total nitrogen load to groundwater in the BMAP area; there were no identified permitted dairy loads in the Hornsby and Ichetucknee PFAs. Commercial fertilizer applied to hay and silage at dairies is accounted for in the FF category.

2.6.4 Prioritized Management Strategies and Milestones

Subsection 403.067, F.S., requires agricultural nonpoint sources in a BMAP area either to implement the applicable FDACS-adopted BMPs, which provides a presumption of compliance with water quality standards, or conduct water quality monitoring prescribed by DEP or SRWMD that demonstrates compliance with water quality standards. Further, based on the Florida Springs and Aquifer Protection Act, Subsection 373.811(5), F.S., prohibits any new agricultural operations with the PFAs that do not implement applicable FDACS BMPs, measures necessary to achieve pollution reduction levels established by DEP, or groundwater monitoring plans approved by a WMD or DEP. Failure to implement BMPs or conduct monitoring that demonstrates compliance with pollutant reductions may result in enforcement action by DEP (s. 403.067(7)(b), F.S.).

FDACS will work with applicable producers within the BMAP area to implement BMPs. As of December 31, 2017, notices of intent (NOIs) to implement BMPs covered 119,824 agricultural acres in the Santa Fe River Basin BMAP area. No producers are conducting water quality monitoring in lieu of implementing BMPs at this time. **Appendix B** lists project information. **Appendix F** provides detailed information on BMPs and agricultural practices in the BMAP area.

With crop-specific BMP enrollment or monitoring for FF areas, an estimated 232,273 lb-N/yr reduction to groundwater can be achieved, based on an average reduction of 15 % in the nitrogen load to groundwater. While DEP has listed larger percentage reductions in nitrogen from agricultural BMPs in estimating benefits to surface waters, the best data available on benefits to groundwater from BMPs indicate a 15 % reduction in the load to groundwater where owner-implemented BMPs are in place.

For DEP-permitted dairies, the estimated load reductions from owner-implemented BMPs are 15 % in the nitrogen load to groundwater, or 7,189 lb-N/yr, assuming 100 % BMP implementation

at these dairies. Additionally, stakeholder projects are estimated to achieve 200 lb-N/yr in reductions, for a total estimated permitted dairy reduction of 7,389 lb-N/yr.

For all livestock operations not included in the DEP-permitted dairies category, owner-implemented BMPs are expected to achieve a reduction of 51,541 lb-N/yr, using an estimated 10 % reduction in the load to groundwater from owner-implemented BMPs at livestock operations.

Summarizing the reductions discussed above, the total reduction from BMP implementation of all agricultural sources is 389,304 lb-N/yr.

2.6.5 Additional Agricultural Reduction Options

Further reductions may be achieved through implementing additional agricultural projects or practices, including land acquisition and conservation easements. SRWMD is implementing projects to encourage low input agriculture and water quality improvement technologies. Examples of these projects include providing incentives for producers to transition to less intensive cropping systems, changing land use to fallow or native landscape, or changing the type of cropping system. Other reductions associated with the implementation and modification of BMPs may be realized through ongoing studies and data collection. Basin-specific studies are underway to evaluate and demonstrate the effectiveness of BMPs on a site-specific basis.

Table 14 identifies possible projects and practices with the estimated acreages. FDACS used FSAID IV to identify crop types and acreages where projects and practices could potentially be implemented.

Table 14. Estimated acreages for additional agricultural projects and practices

Action	Acreage
Precision Irrigation	16,340
Soil Moisture Probes	15,447
Precision Fertilization	12.219
Controlled Release Fertilizer	4,418
Cover Crops	12,670
Banders	13,963
Peanut Hay Mix Pasture Systems	124,775

The projects and practices listed in **Table 14** are a component of the reductions to groundwater that could be achieved through changes in practices (**Table 15**). For example, a 75 % reduction of fertilizer loss to groundwater on 25 % of the fertilized lands would result in an estimated reduction of 290,342 lb-N/yr. Note that these estimates are averaged over the entire basin, and the recharge characteristics of a specific site and the fertilization practices for specific crops may change the estimated reduction for specific acres with a conservation easement or change in fertilization.

Table 15. Potential for additional load reductions to groundwater

% of Fertilized Acres with a Change in Practice	Number of Fertilized Acres with a Change in Practice	100% Reduction in Load to Groundwater (lb-N/yr reduced)	75% Reduction in Load to Groundwater (lb-N/yr reduced)	50% Reduction in Load to Groundwater (lb-N/yr reduced)	25% Reduction in Load to Groundwater (lb-N/yr reduced)	10% Reduction in Load to Groundwater (lb-N/yr reduced)
100	104,757	1,548,489	1,161,367	774,244	387,122	154,849
75	78,568	1,161,367	871,025	580,683	290,342	116,137
50	52,378	774,244	580,683	387,122	193,561	77,424
25	26,189	387,122	290,342	193,561	96,781	38,712
10	10,476	154,849	116,137	77,424	38,712	15,485

Beyond enrolling producers in the FDACS BMP Program and verifying implementation, FDACS will work with DEP to improve the data used to estimate agricultural land uses in the springshed. FDACS will also work with producers to identify a suite of agricultural projects and research agricultural technologies that could be implemented on properties where they are deemed technically feasible and if funding is made available. The acreages provided by FDACS are preliminary estimates of the maximum acreages and will need to be evaluated and refined over time. As presented here, these projects are based on planning-level information. Actual implementation would require funding as well as more detailed designs based on specific information, such as actual applicable acreages and willing landowners.

2.7 STF Management Strategies

STF areas fall into two main categories that are evaluated separately: golf courses and sporting facilities (such as baseball, football, soccer, and other fields). There are only three identified golf courses in the entire BMAP area. There are few sports fields in the BMAP area, so golf courses are estimated to be the main source of the load to groundwater in this source category.

2.7.1 Prioritized Management Strategies and Milestones

DEP will work with sports field managers and the golf course superintendent to ensure relevant BMP implementation and to estimate reductions associated with these efforts. To improve the golf course loading estimate over a literature-based approach, DEP will also confer with the golf course superintendent to identify the actual rate of fertilizer application to update the golf course load to groundwater. The golf course is expected to implement the BMPs described in the DEP BMP manual, *Best Management Practices for the Enhancement of Environmental Quality on Florida Golf Courses* for an estimated 10 % reduction in load.

Sports field managers can assist by reducing fertilizer use, using products that reduce leaching, and more efficiently irrigating their sports turf. The estimated credit for better management of nongolf sports turfgrass is 6 % of the starting load to groundwater. Based on these approaches, the initial calculation of reductions from STF sources is 2,267 lb-N/yr, as listed in **Table 16**.

Table 16. Maximum load reductions from STF improvements based on existing credit policies

STF Source Control Measures	Credit Based on Estimated Load to Groundwater (%)	Possible Nitrogen Credits (lb-N/yr)
Golf Course BMP Implementation	10	2,115
Sports Fields BMPs	6	152
Total Possible Credits		**2,267**

2.8 WWTF Management Strategies

In the Santa Fe River BMAP area, treated effluent containing nitrogen is discharged to sprayfields, RIBs, and percolation ponds, and is reused for irrigation water and power generation. The estimated nitrogen load from WWTFs is estimated to be 35,439 pounds. The discharge location (such as proximity to the spring, highly permeable soils, etc.) and level of wastewater treatment are important factors to consider when addressing loadings to groundwater. Additionally, addressing the nitrogen loading from OSTDS could increase the volume of effluent treated and disposed of by WWTFs.

2.8.1 Summary of Facilities

There are several WWTFs located in the Santa Fe River BMAP area, including 11 domestic WWTFs permitted to discharge more than 100,000 gallons of treated effluent per day (or 0.1 million gallons per day [mgd]). **Figure 6** shows the locations of domestic WWTFs in the Santa Fe River Basin with discharges to surface water and other disposal methods.

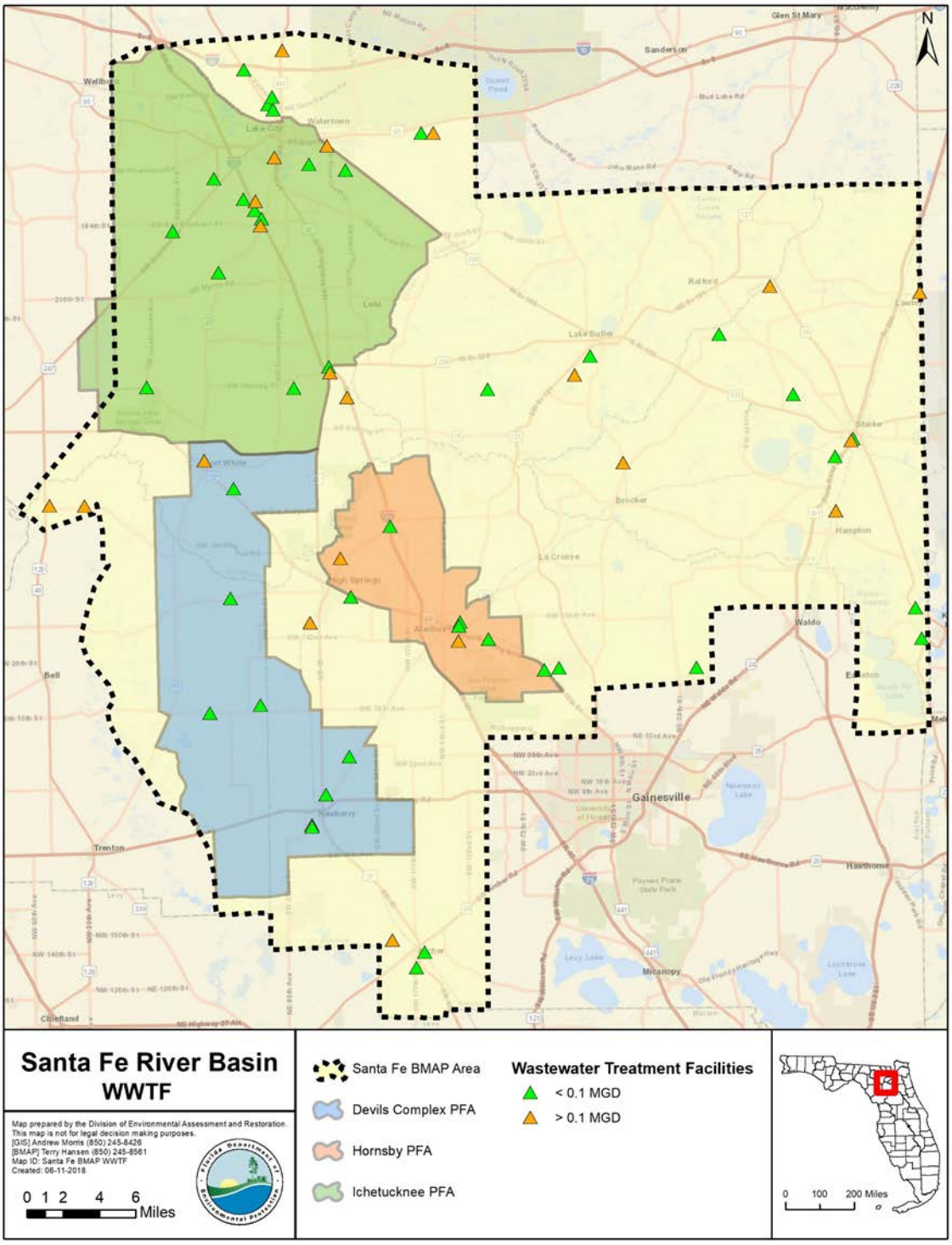

Figure 6. Locations of domestic WWTFs in the Santa Fe River BMAP area

2.8.2 Wastewater Management Standards and Reuse Management

The Florida Springs and Aquifer Protection Act prohibits new domestic wastewater disposal facilities in the PFAs, including RIBs, with permitted capacities of 100,000 gallons per day (gpd) or more, except for those facilities that provide AWT that reduces total nitrogen in the effluent to 3 mg/L or lower, on an annual permitted basis.

DEP requires the nitrogen effluent limits listed below in any new or existing wastewater permit in the BMAP area, unless the utility/entity can demonstrate reasonable assurance that the reuse or land application of effluent would not cause or contribute to an exceedance of the nitrate concentrations established by the Santa Fe River TMDLs. To demonstrate reasonable assurance, the utility/entity shall provide relevant water quality data, physical circumstances, or other site-specific credible information needed to show their facility would not cause a nitrate concentration that would be greater than 0.35 mg/L at the spring vents. This demonstration may include factors such as dilution, site-specific geological conditions, research/studies, including dye tracer tests, and groundwater transport modeling. Should DEP concur with the reasonable assurance demonstration request, the TN effluent requirements established here may be modified for the applicant or waived.

The nitrogen effluent limits listed in **Table 17** will be applied as an annual average to all new and existing WWTFs with a DEP-permitted discharge. New effluent standards will take effect at the time of permit renewal or no later than five years after BMAP adoption, whichever is sooner.

Table 17. Wastewater effluent standards for the BMAP area

95% of the Permitted Capacity (gpd)	TN Concentration Limits for RIBs and Absorption Fields (mg/L)	TN Concentration Limits for All Other Land Disposal Methods, Including Reuse (mg/L)
Greater than 100,000	3	3
20,000 to 100,000	3	6
Less than 20,000	6	6

Additionally, new or existing wastewater permits in the BMAP area must require at least quarterly sampling of the effluent discharge for TN and report these sampling results in the discharge monitoring reports (DMRs) submitted to DEP.

DEP encourages the reuse of treated wastewater for irrigation as a water conservation measure. The expansion of reuse water for irrigation can reduce reliance on the Floridan aquifer for water supply. The nitrogen load to groundwater from reuse water is expected to be reduced through these WWTF policies, as improvements in reuse water quality will both reduce loads from this source and limit future increases in loading from reuse because of higher treatment levels.

2.8.3 Prioritized Management Strategies and Milestones

Based on the current volumes of discharge and effluent concentrations, the estimated reductions to be achieved through the implementation of these revised wastewater standards are estimated to be 21,309 lb-N/yr. **Appendix B** contains detailed information on projects that have either been completed, are underway, or are planned to reduce nitrogen loading from WWTFs.

2.9 Atmospheric Deposition Management Strategies

2.9.1 Summary of Loading

Atmospheric deposition is largely a diffuse, albeit continual, source of nitrogen. Nitrogen species and other chemical constituents are measured in wet and dry deposition at discrete locations around the U.S. In 2014, Schwede and Lear published a hybrid model for estimating the total atmospheric deposition of nitrogen and sulfur for the entire U.S., referred to as the total atmospheric deposition model or "TDEP." Deposition data from several monitoring networks—including Clean Air Status and Trends Network (CASTNET), the National Atmospheric Deposition Program (NADP) Ammonia Monitoring Network, the Southeastern Aerosol Research and Characterization Network, and modeled data from the Community Multiscale Air Quality (CMAQ) Modeling System—are combined in a multistep process with National Trends Network (NTN) wet deposition values to model total deposition. The TDEP model run used for the NSILT included data from 2011 to 2013.

2.9.2 Description of Approach

Atmospheric sources of nitrogen are local, national, and international. Atmospheric sources are generally of low nitrogen concentration compared with other sources and are further diminished through additional biological and chemical processes before they reach groundwater. Atmospheric deposition sources and trends will be re-evaluated periodically.

2.10 Future Growth Management Strategies

New development primarily falls into to two general source categories: new urban development and new agriculture. Nutrient impacts from new development are addressed through a variety of mechanisms outlined in this BMAP as well as other provisions of Florida law. For instance, wastewater from all new and existing urban development is treated through either domestic WWTFs or OSTDS. New WWTFs must meet the stringent nitrogen limitations set forth in this BMAP. Existing WWTFs also must be upgraded to meet these same BMAP requirements. Florida law requires new development to connect to WWTFs where sewer lines are available. Where sewer is not available within the PFA, this BMAP still prohibits the installation of new OSTDS on lots of less than one-acre unless the system includes enhanced treatment of nitrogen, as described in **Appendix D**. Likewise, all new agricultural operations must implement FDACS-adopted BMPs and potentially other additional measures (**Section 2.6**), or must conduct water quality monitoring that demonstrates compliance with water quality standards.

Other laws such as local land development regulations, comprehensive plans, ordinances, incentives, environmental resource permit requirements, and consumptive use permit

requirements, all provide additional mechanisms for protecting water resources and reducing the impact of new development and other land use changes as they occur. Through this array of laws and the requirements in this BMAP, new development must undertake nitrogen-reduction measures before the development is complete.

2.11 Protection of Surface Water and Groundwater Resources through Land Conservation

Maintaining land at lower intensity uses through land purchases or easements for conservation and recreational use is one strategy that can help reduce water quality impacts in the Santa Fe River Basin. **Table 18** identifies conservation lands and conservation easements in the Santa Fe River BMAP area as of April 2017.

Table 18. Conservation lands in the BMAP area

Name of Conservation Area	Acres in BMAP Area
Alligator Lake Park and Recreation Area	968
Ashton Biological Preserve	171
Bell Ridge Longleaf Wildlife and Environmental Area	720
Blues Creek Ravine	164
Bonnet Lake Conservation Easement	443
Camp Blanding Military Reservation	29
Camp Kulaqua Conservation Easement	197
Chinquapin Farm Conservation Easement	457
Chinquapin Farm Phase 1A Gopher Tortoise Recipient Site	200
Circle Pine Farm Agricultural and Conservation Easement	80
City of Newberry Conservation Easement	40
Deep Creek Conservation Area (SRWMD)	158
Devil's Millhopper Geological State Park	67
Dudley Farm Historic State Park	333
Edwards Bottomland	138
Falling Creek Park	51
Fort White Wildlife and Environmental Area	1,645
Freeland and Freeland Conservation Easement	108
Goethe State Forest	1,582
Graham Conservation Area	1,470
Ichetucknee Conservation Area	217
Ichetucknee Springs State Park	2,532
Ichetucknee Trace	664
Keystone Air Park Tract	24
Lake Santa Fe Parcels	138
Loncala, Inc. Conservation Easement #1	918
McCall Park	76
McKeithen Site	68
Mill Creek Nature Preserve	1,230
Monteocha Creek Conservation Easement	975
Nature Coast State Trail	80

Name of Conservation Area	Acres in BMAP Area
New River Conservation Area	665
New River Conservation Easement	167
Northeast Flatwoods Preserve	242
Odum Preserve	47
O'leno State Park	2,372
Olustee Creek Conservation Area	1,252
Osceola National Forest	23,676
Palatka-to-Lake Butler State Trail	295
Pareners Branch Conservation Area	464
Poe Springs Park	214
Raiford Wildlife Management Area	17,793
River Rise Preserve State Park	3,827
Robertson Conservation Easement	35
Rum Island Park	49
Running Over Ranch Conservation Easement	256
Saarinen Preserve	80
San Felasco Hammock Preserve State Park	7,353
San Felasco Park	190
Santa Fe River Preserve	187
Santa Fe River Ranch	738
Santa Fe River: Ratcliffe Tract	88
Santa Fe River-Hartzog Conservation Easement	119
Santa Fe Springs Conservation Area	875
Santa Fe Swamp Conservation Area	8,865
Stephens-Gracy Trail	83
Timber Company Conservation Easement	41
TTC/Gainesville Wellfield Conservation Easement	3,083
Turkey Creek Hammock Preserve	376
Upper Waccasassa Conservation Area	61
Warren Cave	4
Watermelon Pond Park	12
Watermelon Pond Preserve - Ferran	34
Watermelon Pond Preserve - Gladman	446
Watermelon Pond Preserve - King	40
Watermelon Pond Preserve - Metzger	641
Watermelon Pond Preserve - Wright	19
Watermelon Pond Wildlife and Environmental Area	1,288
Total	**91,918**

2.12 Commitment to Implementation

Successful BMAP implementation requires commitment, dedicated state funding, and follow-up. Stakeholders have expressed their intention to carry out the plan, monitor its effects, and continue to coordinate within and across jurisdictions to achieve nutrient reduction goals. As the TMDLs must be achieved within 20 years, DEP, WMDs, FDOH, and FDACS will implement management strategies using the annual Legacy Florida appropriation from the legislature of at

least $50 million to reduce nitrogen in impaired OFS. DEP, working with the coordinating agencies, will continue to invest existing funds and explore other opportunities and potential funding sources for springs restoration efforts.

Section 3: Monitoring and Reporting

3.1 Methods for Evaluating Progress

DEP 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 update. Stakeholders have agreed to meet annually after the adoption of the BMAP to follow up on plan implementation, share new information, and continue to coordinate on TMDL restoration-related issues. The following activities may occur at annual meetings:

Implementation data and reporting:

- Collect project implementation information from stakeholders, including FDACS agricultural BMP enrollment and FDOH-issued permits, 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 3.3**.

Sharing new information:

- Report on results from water quality 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 on addressing nutrient loads and incorporate any new information into annual progress reports.

Coordinating on TMDL restoration–related issues:

- Provide updates from DEP on the basin assessment 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 Santa Fe River Basin TMDLs.

3.2 Adaptive Management Measures

Adaptive management involves making adjustments in the BMAP when circumstances change or monitoring indicates the need for additional or more effective restoration strategies. Adaptive management measures may include the following:

- Implementing procedures to determine whether additional cooperative strategies are needed.

- Using criteria/processes for determining whether and when plan components need revision because of changes in costs, project effectiveness, social effects, watershed conditions, or other factors.

- Revising descriptions of stakeholders' roles during BMAP implementation and after BMAP completion.

- Updating information on corrective actions (and any supporting documentation) being implemented as data are gathered to refine project implementation schedules and performance expectations.

Key components of adaptive management are to share information and expertise include tracking plan implementation, monitoring water quality and pollutant loads, and holding periodic meetings.

3.3 Water Quality and Biological Monitoring

3.3.1 Objectives

Focused objectives are critical for a monitoring strategy to provide the information needed to evaluate implementation success. Since the BMAP implementation involves an iterative process, the monitoring efforts are related to primary and secondary objectives. The primary objectives focus on achieving water quality targets, while the secondary objectives focus on water quality parameters that can be used to provide information for future refinements of the BMAP. The monitoring strategy may be updated as necessary.

Primary objectives:

- Measure the water quality and biological response in the impaired springs, river, and/or groundwater at the beginning of the BMAP period and during implementation.

- Document nutrient trends in the Santa Fe River Basin and associated springs and groundwater.

- Focus BMP efforts by using water quality results combined with appropriate project information and land use in conjunction with statistical and spatial analysis tools.

Secondary objectives:

- Identify areas where groundwater data and modeling might help in understanding the hydrodynamics of the system.

- Confirm and refine nutrient removal efficiencies of agricultural and/or urban BMPs.
- Develop an advanced BMP implementation plan.
- Identify and implement more effective nutrient reduction strategies.
- Use nitrogen isotope and tracer sampling for evaluating nitrogen contributions from organic and inorganic sources.

3.3.2 Water Quality Parameters, Frequency, and Network

To achieve the objectives listed above, the monitoring strategy focuses on two types of indicators to track improvements in water quality: core and supplemental (**Table 19** and **Table 20,** respectively). The core indicators are directly related to the parameters causing impairment in the river or associated springs. Supplemental indicators are monitored primarily to support the interpretation of core water quality parameters. The monitoring network is established for a variety of purposes.

For this BMAP, nitrate is considered to be the key core parameter measured, to track progress in decreasing nitrogen concentrations in groundwater and the water surfacing at the spring vent. The other parameters are considered supplementary parameters for the BMAP, as they build information about groundwater and the spring but are not direct measurements of impairment.

At a minimum, the core parameters will be tracked to determine the progress that has been made towards meeting the TMDLs and/or achieving the NNC. Resource responses to BMAP implementation may also be tracked. A significant amount of time may be needed for changes in water chemistry to be observed.

Table 19. Core water quality indicators

Core Parameters
Chloride
Sulfate
Potassium
Ammonia as Nitrogen
Total Kjeldahl Nitrogen
Nitrate/Nitrite as Nitrogen

Table 20. Supplemental water quality indicators and field parameters

Supplemental Parameters
Specific Conductance
Dissolved Oxygen (DO)
pH
Temperature

Supplemental Parameters
Total Suspended Solids (TSS)
Nitrate and Oxygen Isotopes

Initially, data from the ongoing sampling effort being conducted by SRWMD will be used to determine progress towards the primary objectives. Surface water and groundwater monitoring network locations were selected to track changes in water quality and allow the annual evaluation of progress toward achieving the TMDL. **Figure 7** shows the locations of the river and spring stations currently being sampled that will be used for the BMAP monitoring in the Santa Fe River Basin.

The secondary (research) objectives will be developed based on the results of the actions occurring in the Santa Fe River Basin Restoration Focus Area (RFA). The number and location of the monitoring wells to be sampled or installed will be determined after the initial effort in the Santa Fe River Basin RFA provides information on the state of the system and where additional monitoring might be most effective. DEP and SRWMD will be responsible for activities to satisfy secondary monitoring objectives.

3.3.3 Biological Monitoring

Biological resource responses represent improvements in the overall ecological health of the Santa Fe River Basin (see **Table 21**).

Table 21. Biological response measures for spring runs

Biological Response Measures
Chlorophyll *a*
Stream Condition Index (SCI) score
Linear Vegetation Survey (LVS) score
Rapid Periphyton Survey (RPS) score
Key fish populations

An RPS will be conducted to assess the abundance and variety of algae in the river. An 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 (HAs) 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.

3.3.4 Data Management and Assessment

As of June 30, 2017, water quality data in Florida are entered by the entity collecting the data into the Florida Watershed Information Network (WIN) Database, which has replaced the Florida Storage and Retrieval System (STORET). DEP pulls water quality data directly from WIN and U.S. Geological Survey (USGS) databases for impaired waters evaluations and TMDL development. Data providers are required to upload their data regularly, so the information can

be used as part of the water quality assessment process and for annual reporting. Data providers should upload their data to WIN upon the completion of the appropriate quality assurance/quality control (QA/QC) checks. All data collected in the last quarter of the calendar year should be uploaded no later than April 1 of the following year.

Biological data collected by DEP are stored in the DEP Statewide Biological (SBIO) database. Biological data should be collected and regularly provided to DEP following the applicable standard operating procedures. All biological data collected in the last quarter of the calendar year should be uploaded or provided no later than April 1 of the following year.

The water quality data will be analyzed during BMAP implementation to determine trends in water quality and the health of the biological community. A wide variety of statistical methods are available for the water quality trend analyses. The selection of an appropriate data analysis method depends on the frequency, spatial distribution, and period of record available from existing data. Specific statistical analyses were not identified during BMAP development.

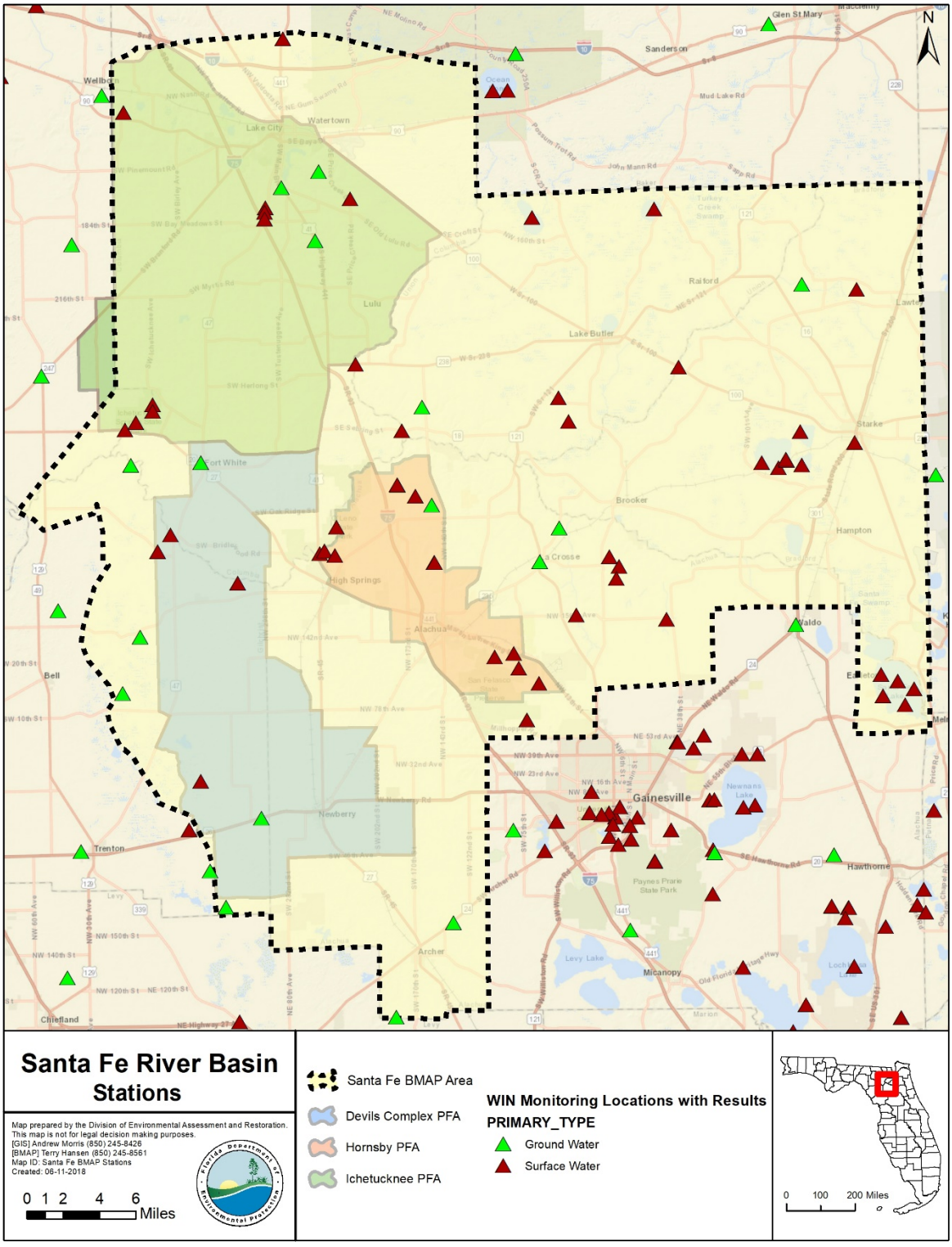

Figure 7. Groundwater and surface water stations sampled in the Santa Fe River Basin

3.3.5 QA/QC

Stakeholders participating in the monitoring plan must collect water quality data in a manner consistent with Chapter 62-160, F.A.C., and the DEP standard operating procedures (SOPs) for QA/QC required by rule. The most current version of these procedures is available on the DEP website. For BMAP-related data analyses, entities should use National Environmental Laboratory Accreditation Conference (NELAC) National Environmental Laboratory Accreditation Program (NELAP)–certified laboratories or other labs that meet the certification and other requirements outlined in the DEP SOPs.

Appendices

Appendix A. Important Links

The links below were correct at the time of document preparation. Over time, the locations may change and the links may no longer be accurate. None of these linked materials are adopted into this BMAP.

- DEP Website: http://www.floridadep.gov
- DEP Map Direct Webpage: https://ca.dep.state.fl.us/mapdirect/
- Searchable online version of PFA maps: https://www.floridadep.gov/pfamap
- Florida Statutes: http://www.leg.state.fl.us/statutes:
    - Florida Watershed Recovery Act (Section 403.067, F.S.)
    - Florida Springs and Aquifer Protection Act (Part VIII of Chapter 373, F.S.)
- DEP Model Ordinances: http://fyn.ifas.ufl.edu/fert_ordinances.html
- DEP Standard Operating Procedures for Water Quality Samples: http://www.dep.state.fl.us/water/sas/sop/sops.htm
- NELAC NELAP: https://fldeploc.dep.state.fl.us/aams/index.asp
- FDACS BMPs: https://www.freshfromflorida.com/Business-Services/Best-Management-Practices-BMPs/Agricultural-Best-Management-Practices
- FDACS BMP and Field Staff Contacts: http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy
- Florida Administrative Code (Florida Rules): https://www.flrules.org/
- SRWMD Surface Water Improvement and Management (SWIM) Plans: http://www.srwmd.state.fl.us/index.aspx?NID=447
- SRWMD 2017 Consolidated Annual Report: http://www.srwmd.state.fl.us/DocumentCenter/View/11712
- UF–IFAS Research: http://research.ifas.ufl.edu/

Appendix B. Projects to Reduce Nitrogen Sources

Prioritization of Management Strategies

The management strategies in **Table B-1** are ranked with a priority of high, medium, or low. In 2016, the Florida Legislature amended the Watershed Restoration Act (Section 403.067, F.S.), creating additional requirements for all new or revised BMAPs. BMAPs must now include planning-level details for each listed project, along with their priority ranking.

Project status was selected as the most appropriate indicator of a project's priority ranking based primarily on need for funding. Projects with a "completed" status were assigned a low priority. Projects classified as "underway" were assigned a medium priority because some resources have been allocated to these projects, but additional assistance may be needed for the project to be completed. High priority was assigned to projects listed with the project status "planned" as well as certain "completed" projects that are ongoing each year (any project with one of these project types: "street sweeping," "catch basin inserts/inlet filter cleanout," "public education efforts," "fertilizer cessation," "fertilizer reduction," or "aquatic vegetation harvesting"), and select projects that are elevated because substantial, subsequent project(s) are reliant on their completion.

Description of the Management Strategies

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.

While the 20-year planning period for this BMAP is 2018 to 2036, projects completed since June 2000, count toward the overall nitrogen reduction goals.

Estimated nitrogen reductions are subject to refinement based on DEP verification and/or on adjustment to calculations based on loading to groundwater rather than surface water. Agriculture load reductions (FDACS-01 and FDACS-02) assume 100 % enrollment and verification. Projects with a designation of TBD (to be determined) denotes information is not currently available, but will be provided by the stakeholder when it is available. Projects with a designation of N/A (not applicable) indicates the information for that category is not relevant to that project. Projects with a designation of "Not Provided" denotes that information was requested by DEP but was not provided by the lead entity.

Table B-1. Stakeholder projects to reduce nitrogen sources

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
Alachua County	AC-01	Poe Springs Domestic Sewage Infrastructure Upgrade	Install new waterless restrooms with larger holding tanks adjacent to springshed. Replace OSTDS with enhanced passive nitrogen system using biosorption activated media (BAM). Reduction estimate to land surface of 5,776 lb-N/yr.	Wastewater System Upgrade	Underway	2018	2019	OSTDS	2,599	$346,600	County/ SRWMD	County: $196,600 SRWMD: $150,000
Alachua County	AC-02	Hornsby Spring Restoration	Install temporary aerator to improve dissolved oxygen conditions, remove sediment to improve spring flow, and install submerged aquatic vegetation to improve water quality. Reduction estimate to land of 1,260 lb-N/yr.	Hydrologic Restoration	Underway	2017	TBD	Other	340	$443,480	County/ DEP	County: $20,000 DEP: $423,480
Alachua County	AC-03	Mill Creek Sink Water Quality Improvement Project - Phase II	See AL-01 for the Phase I project info. Phase II is the acquisition of 240 additional acres surrounding and upstream of Mill Creek Swallet.	Land Acquisition	Planned	2017	2018	Other	N/A	$2,600,000	County/ DEP	County: $1,300,000 DEP: $1,300,000
Alachua County	AC-04	Fertilizer Social Marketing Campaign	Implement a social marketing campaign designed to reduce fertilizer use and to estimate the resultant load reduction.	Education Efforts	Planned	2018	2021	UTF	TBD	$435,000	Partnership/ DEP	Partnership: $300,000 DEP: $135,000

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
Alachua County	AC-05	Interactive Paddling Trips	Implement education by coordinating 5-6 interactive paddling trips on the Santa Fe River with 120 stakeholders to explore actions that affect the health of our springs and groundwater.	Education Efforts	Planned	2018	2019	Other	N/A	$12,600	County/ Wildlife Foundation of Florida Springs Protection License Plate Grant	County $6,900 Grant: $5,700
Alachua County	AC-06	Interactive Stormwater and Wastewater Model	Interactive table top model for teaching children and adults about the difference between storm sewers and sanitary sewers.	Education Efforts	Underway	2017	TBD	Other	N/A	$6,500	Partnership	$6,500
Alachua County	AC-07	Santa Fe River Springs Submerged Aquatic Vegetation (SAV) Assessment	The goal of this project is to document the current condition of SAV at selected springs (pools and associated spring runs) on the Santa Fe River.	Study	Underway	2017	2019	Other	N/A	$24,500	County/ Wildlife Foundation of Florida Springs Protection License Plate Grant	$24,500
Alachua County	AC-08	Stream Bioassessment Study	The Stream Bioassessment Study project includes SCI in-stream biological assessment and Hester-Dendy sampling and analysis to provide ambient monitoring for TMDL and impaired watersheds.	Monitoring/ Data Collection	Underway	2017	2019	Other	N/A	$85,970	FDOT	$85,970

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
Alachua County	AC-09	Hornsby Springs Dissolved Oxygen and Faunal Study	This project seeks to evaluate the role of dissolved oxygen temporally and spatially and to explore what effect this may have on organisms, particularly macro-invertebrates.	Study	Planned	2018	2019	Other	N/A	$14,000	County/ Wildlife Foundation of Florida Springs Protection License Plate Grant	$14,000
Alachua County	AC-10	Santa Fe River Springs Signage	The goal of this project is to increase awareness about the springs of the Santa Fe River and current springs issues and solutions. Interpretive signs will be installed at selected springs or parks along the Santa Fe River.	Education Efforts	Planned	2018	2019	Other	N/A	$12,600	County/ Wildlife Foundation of Florida Springs Protection License Plate Grant	$12,600
City of Alachua	AL-01	Mill Creek Sink Water Quality Improvement Project	Purchase property to install water quality BMPs to reduce pollutant loads discharging directly into the sink. Nutrient loading should be reduced by 66% and benefit Hornsby Spring.	BMP Treatment Train	Underway	2017	2020	UTF	TBD	$1,400,000	DEP/ SRWMD	DEP: $1,000,000 SRWMD: $400,000
City of Archer	AR-01	Holly Hills Stormwater Improvements	Increase storage within existing stormwater ponds to alleviate flooding and improve water quality.	Stormwater Improvements	Underway	2017	2018	UTF	Not Provided	$87,000	City/ SRWMD	City: $4,000 SRWMD: $83,000
City of Hampton	HA-01	Master Drainage Study	Undertake study to address severe flooding issues.	Study	Planned	TBD	TBD	UTF	N/A	TBD	TBD	TBD

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
City of High Springs	HS-01	Infiltrative Wetlands for WWTF Effluent Treatment/ Disposal - Phase I	Convert City's existing effluent sprayfield into infiltration wetlands. 10 of 20 acres will be constructed in Phase I. This will benefit water quality in Hornsby and Poe Springs. Reduction estimated load to land surface of 4,870 lb-N/yr.	Wetland Treatment	Underway	2018	TBD	WWTF	1,753	$1,708,500	DEP	DEP: $1,708,500
City of High Springs	HS-02	Wastewater Collection System Extension - Phase A1	Provide central sewer to remaining areas served by septic systems. Elimination of 132 septic systems. Reduction estimate to land surface of 2,640 lb-N/yr.	Wastewater Service Area Expansion	Underway	2016	2019	OSTDS	1,188	$3,432,700	City/ DEP	City: $125,000 DEP: $3,307,700
City of High Springs	HS-03	Camp Kulaqua-Hornsby Spring Water Quality Improvement Project	Remove onsite wastewater treatment plant and effluent disposal and install new wastewater line to City's WWTF. Reduction estimated load to land surface of 97 lb-N/yr.	Wastewater System Upgrade	Underway	2015	2018	WWTF	44	$500,000	DEP/ SRWMD	DEP:$450,000 SRWMD: $50,000
City of High Springs	HS-04	Septic Tank Abatement	Eliminate 13 residential septic systems and connect to City's central sewer system. Reduction estimate to land surface of 330 lb-N/yr.	Wastewater Service Area Expansion	Underway	2017	2018	OSTDS	149	$175,000	City/ SRWMD	City: $25,000 SRWMD: $150,000

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
City of High Springs	HS-05	Wastewater Collection System Extension - Phase A2	Provide central sewer to remaining areas served by septic systems. Elimination of 168 septic systems. Reduction estimate to land surface of 5,880 lb-N/yr.	Wastewater Service Area Expansion	Planned	TBD	TBD	OSTDS	2,646	$3,453,600	TBD	TBD
City of High Springs	HS-06	WWTF Upgrade	WWTF upgrades to meet AWT standards. Effluent will be further treated with a constructed infiltrative/treatment wetland.	Wastewater System Upgrade	Planned	TBD	TBD	WWTF	TBD	$4,800,000	TBD	TBD
City of Lake City	LC-01	I-75/SR 47 Cannon Creek Sink Wastewater Improvement Project - Phase I	Eliminate septic systems from 30 businesses and 5 residences to benefit water quality in Ichetucknee Spring. Reduction estimate to land surface of 11,950 lb-N/yr.	Wastewater Service Area Expansion	Planned	2017	2019	OSTDS	5,378	$3,400,871	City/ DEP	City: $1,703,415 DEP: $1,697,456
City of Lake City	LC-02	Ichetucknee Springshed Water Quality Improvement Project	Convert City's wastewater effluent disposal system into 120 acres of constructed wetlands that provide 1.58 mgd of recharge water to aquifer and reduces nitrogen loads from WWTP by 85%. Reduction estimated load to land surface of 77,000 lb-N/yr.	Wetland Treatment	Completed	2014	2016	WWTF	27,720	$5,005,175	City/ DEP/ SRWMD/ Columbia County	City: $200,000 DEP: $3,900,000 SRWMD: $805,175 County: $100,000
City of Lake City	LC-03	Reclaimed Water System Upgrade - Phase I	Upgrade existing system to allow reclaimed water to be used by a local	Reclaimed Water	Underway	2017	2018	STF	TBD	$545,470	City/ SRWMD	City: $351,166 SRWMD: $194,304

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
			golf course and farmer.									
City of Newberry	NEW-01	Potable Water and Central Wastewater Improvements	Replace existing water and wastewater lines in close proximity to historic district, thereby reducing unaccounted water loss and preventing potential sewage spills.	Wastewater System Upgrade	Underway	2017	2018	WWTF	TBD	$650,000	City/ SRWMD	City: $611,566 SRWMD: $38,434
Columbia County	CC-01	Rum Island Park	Install new public restrooms with lift station and septic system in place of portable toilets. Install BAM to reduce nutrients around septic system. Project also involves bank restoration and dredging.	OSTDS	Underway	2018	2019	OSTDS	Not Provided	$300,000	County/ SRWMD	County: $150,000 SRWMD: $150,000
Columbia County	CC-02	Ichetucknee Trace-Clay Hole Creek/ Alligator Lake Aquifer Recharge and Stormwater Mitigation	Construct swales, canals, and stormwater canal structures to direct water to Alligator Lake to provide erosion control and water quality treatment before water enters aquifer. Reduction estimate of load to land surface of 30,000 lb-N/yr.	Regional Stormwater Treatment	Underway	2016	2018	UTF	8,100	$2,560,000	County/ DEP	County: $300,000 DEP: $2,260,000

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
Columbia County	CC-03	Ichetucknee Trace- Cannon Creek Project	Provide flood mitigation, water quality improvement, and aquifer recharge through the replacement of an old drainage well and 13 acres of wetland construction. Reduction estimate of load to land surface of 10,000 lb-N/yr.	Wetland Treatment	Planned	TBD	TBD	UTF	2,700	$3,030,000	County/ DEP	County: $780,000 DEP: $2,250,000
Columbia County	CC-04	Dream Inn Motel WWTP Closure	Remove the noncompliant WWTP that serves the motel and connect the motel to the County's central sewer system. This also includes relocating, upgrading, and enlarging the existing County WWTF to handle flow from motel. Reduction estimated load to land surface of 1,000 lb-N/yr.	Wastewater System Upgrade	Underway	2017	2018	WWTF	360	$354,737	County/ SRWMD	County: $210,437 SRWMD: $144,300
DEP Florida Park Service (FPS)	FPS-01	Ichetucknee Springs State Park	Remove septic system in wetlands at the Dampier's Landing Bath House and connect to existing wastewater treatment system in the uplands.	Wastewater Service Area Expansion	Planned	TBD	TBD	OSTDS	Not Provided	Not Provided	DEP	Not Provided
FDACS	FDACS-01	BMPs Implementation and Verification - Farm Fertilizer	Implementation of existing BMPs on applicable acreage. Up to 15% reduction in load to groundwater.	BMPs	Underway	Not Provided	Not Provided	FF	232,273	Not Provided	FDACS	TBD

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
FDACS	FDACS-02	BMPs Implementation and Verification - Livestock Waste	Implementation of existing BMPs at applicable facilities. Up to 10% reduction in load to groundwater.	BMPs	Underway	Not Provided	Not Provided	LW	51,541	Not Provided	FDACS	TBD
Florida Department of Transportation (FDOT)	FDOT-01	Fertilizer Elimination	Eliminate fertilizer in rights-of way. Reduction estimate of load to land surface of 16,901 lb-N/yr.	Fertilizer Cessation	Completed	Not Provided	Not Provided	UTF	4,563	Not Provided	Not Provided	Not Provided
Gainesville Regional Utilities (GRU)	GRU-01	Wetland Creation at Shands Facility	Constructed a recharge wetland at a new Shands facility that removes nutrients from reclaimed water and stormwater and provides aquifer recharge.	Wetland Treatment	Canceled	2015	TBD	UTF	Not Provided	$1,110,000	GRU/ DEP	GRU: $960,000 DEP: $150,000
Gilchrist County	GC-01	Santa Fe Park and Boat Ramp	Replace boat ramp, add docks and canoe launch, and remedy drainage to reduce sediment and nutrients.	Stormwater Improvements	Underway	2018	2019	UTF	Not Provided	$129,800	County/ SRWMD	County: $6,800 SRWMD: $123,000
Golf Courses	GC-01	Golf Course Reduction Credits	6% BMP credit on golf course load to groundwater, assuming 100% BMP implementation by golf course owners.	BMPs	Planned	TBD	TBD	STF	2,115	TBD	TBD	TBD
GRU	GRU-02	Oakmont Reclaimed Water Main Extension	Provide reclaimed water to irrigate 136 residential properties and 3 acres of common area.	Reclaimed Water	Underway	2017	2018	UTF	TBD	$452,571	GRU/ SRWMD	GRU: $339,428 SRWMD: $113,143
GRU	GRU-03	Oakmont Recharge Wetland	Construct a recharge wetland in an existing stormwater retention basin that will reduce nutrients while recharging aquifer.	Wetland Treatment	Underway	2017	2019	UTF	TBD	$400,000	GRU/ SRWMD	GRU: $250,000 SRWMD: $150,000

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
Local Governments	LG-01	Public Education	Adopted fertilizer ordinance.	Education Efforts	Planned	TBD	TBD	UTF	3,470	TBD	TBD	TBD
Permitted Dairies	PD-01	Dairy Reduction Credits	15% BMP credit on dairy load to groundwater assuming 100% owner implemented BMPs on all dairy lands.	BMPs	Planned	TBD	TBD	Dairy	7,189	TBD	TBD	TBD
Sports Fields	SF-01	Sports Field Reduction Credits	10% BMP credit on sports field load to groundwater, assuming 100% BMP implementation by sports field owners.	BMPs	Planned	TBD	TBD	STF	152	TBD	TBD	TBD
SRWMD	SRWMD-01	Suwannee River SWIM Plan	Implementation and periodic review and update of the Suwannee River SWIM Plan which includes the Santa Fe River and Ichetucknee River.	Study	Completed	2015	2017	Other	NA	$238,563	SRWMD	SRWMD: $238,563
SRWMD	SRWMD-02	Improved Nutrient Application Practices in Dairy Operations - Phase 2	To date, nine agreements with dairies to install screen separators to reduce wastewater solids. One agreement with a dairy in the Santa Fe Basin. DEP has allocated $2,120,000 for the overall districtwide program. Load reduction to land estimate of 1,485 lb-N/yr.	BMPs	Underway	2015	TBD	Dairy	200	$309,600	DEP/ SRWMD	DEP/ SRWMD: $309,600

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
SRWMD	SRWMD-03	Dairy Wastewater System Improvement	Cost-share projects with dairies to invest in advanced treatment technologies (bioreactors), additional wastewater storage, and advanced manure solid separation. Canceled because project location was determined to be outside the basin.	BMPs	Canceled	2016	Canceled	Dairy	0	$0	Canceled	Canceled
SRWMD	SRWMD-04	Dairy Wastewater Conservation and Nutrient Optimization Project	Improve the management of dairy wastewater by increasing storage pond sizes to achieve greater nutrient uptake and irrigation efficiencies. Six agreements executed to date. Canceled because project location was determined to be outside the basin.	BMPs	Canceled	2014	Canceled	Dairy	0	$0	Canceled	Canceled

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
SRWMD	SRWMD-05	Sustainable Suwannee Springs Agriculture Pilot Program - Low Input Agriculture	Agriculture operators are invited to submit proposals to transition to less intensive cropping systems, change the type of cropping system, or change the land use to fallow or native landscape for a certain amount of time or a permanent conservation easement. Priority is given to Convict, Fanning, and Ichetucknee springsheds. Load reduction to land estimate of 187,500 lb-N/yr.	BMPs	Underway	2016	2019	FF	33,750	$2,500,000	DEP	DEP: $2,500,000
SRWMD	SRWMD-06	Sustainable Suwannee Springs Agriculture Pilot Program - Advanced Water Quality Improvement Technologies	Agriculture operators, landowners, local governments, private companies, other entities may submit proposals for advanced technologies that can cost-effectively reduce nitrogen in groundwater that contributes to spring flow. Canceled because project location was determined to be outside the basin.	BMPs	Canceled	2016	Canceled	FF	Canceled	Canceled	Canceled	Canceled

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
SRWMD	SRWMD-07	Regional Initiative Valuing Environmental Resources (RIVER) Program	Benefits of the annual cost-share projects include: improving wastewater facilities serving hundreds of residents and commercial entities, preventing potential discharge of wastewater into receiving waters during various flood events, and significantly reducing nutrient leaching through the removal of a substantial number of septic systems.	WWTF Upgrade	Underway	2012	Not Provided	WWTF	TBD	$1,500,000/ annually	SRWMD	SRWMD: $1,500,000
SRWMD	SRWMD-08	Precision Agricultural Practices	Provide cost-share funds to agricultural producers within the BMAP area to implement precision nutrient and irrigation management technology. Districtwide program benefits and dollars split between Santa Fe and Suwannee BMAPs. Load reduction to land estimate of 312,500 lb-N/yr.	BMPs	Underway	2017	Not Provided	FF	56,250	$625,000	SRWMD	SRWMD: $625,000

Lead Entity	Project Number	Project Name	Project Description	Project Type	Project Status	Start Date	Estimated Completion Date	Nitrogen Source Addressed by Project	Estimated Nitrogen Load Reduction (lb-N/yr)	Cost Estimate	Funding Source	Funding Amount
SRWMD	SRWMD-09	Nursery Water Conservation Initiative	Assist nurseries in upgrading from overhead irrigation methods to micro-spray or drip irrigation. To date, 45 nurseries on 300 acres have received assistance. Load reduction to land estimate of 45,000 lb-N/yr.	BMPs	Underway	2015	Not Provided	FF	8,100	$1,321,150	DEP/ SRWMD/ Producers	DEP: $940,000 SRWMD: $39,325 Producers: $341,825
Various	OSTDS-01	Enhancement of Existing OSTDS - Voluntary	Repair, upgrade, replacement, drainfield modification, addition of effective nitrogen reducing features, initial connection to a central sewerage system, or other action to reduce nutrient loading, voluntarily taken by the owner of an OSTDS within the BMAP.	OSTDS Enhancement	Underway	2018	N/A	OSTDS	TBD	TBD	DEP	TBD
Wastewater Utilities	WU-01	Wastewater Treatment Facility Reduction Credits	Achieved by WWTF policy if implemented BMAP-wide, achieving 3 or 6 mg/L.	WWTF Upgrade	Planned	TBD	TBD	WWTF	21,309	TBD	TBD	TBD

Appendix C. PFAs

A PFA (Devil's Complex PFA; Hornsby PFA; and Ichetucknee Complex PFA) is defined as the area(s) of a basin where the Floridan aquifer is generally most vulnerable to pollutant inputs and where there is a known connectivity between groundwater pathways and an OFS. As required by the Florida Springs and Aquifer Protection Act, DEP delineated PFAs for the Devil's Complex Springshed, the Hornsby-Treehouse Springshed, and the Ichetucknee Springs Group Springshed. These PFAs are adopted and incorporated by reference into this BMAP. Detailed information on the PFAs is available in report format at the following link: http://publicfiles.dep.state.fl.us/dear/PFAs.

Appendix D. OSTDS Remediation Plan

The Florida Aquifer and Springs Protection Act specifies that if during the development of a BMAP for an OFS, DEP identifies OSTDS as contributors of at least 20 % of nonpoint source nitrogen pollution in a PFA or if DEP determines remediation is necessary to achieve the TMDL, the BMAP shall include an OSTDS remediation plan. Based on the Santa Fe River NSILT estimates and GIS coverages, OSTDS contribute approximately 6 %, 7 %, and 12 % of the pollutant loading in the Devil's Complex, Hornsby, and Ichetucknee PFAs, respectively. Irrespective of the percent contribution from OSTDS, DEP has determined that an OSTDS remediation plan is necessary to achieve the TMDLs and to limit the increase in nitrogen loads from future growth.

D.1 Plan Elements

D.1.1 Installation of New OSTDS

Per statute, new OSTDS on lots of less than one acre are prohibited within PFAs, if the addition of the specific systems conflicts with an OSTDS remediation plan incorporated into an OFS BMAP (see Section 373.811(2), F.S.). This OSTDS remediation plan prohibits new conventional systems on lots of less than one acre within the PFAs, unless the OSTDS includes enhanced treatment of nitrogen or unless the OSTDS permit applicant demonstrates that sewer connections will be available within 5 years. To aid in implementation, the DEP Map Direct webpage includes a detailed downloadable springs PFA boundary shapefile. DEP also maintains on its website an interactive map of the PFA and BMAP boundaries; the map can be easily searched for specific street address locations.

FDOH permits the installation of new OSTDS pursuant to Chapter 64E-6, F.A.C., which includes not only systems installed on a property where one has not previously been installed, but also systems installed to replace illegal systems, systems installed in addition to existing systems, and other new systems. FDOH permitting requirements with respect to the definition of "new" or "less than one acre" will be followed for this remediation plan. To meet the enhanced treatment of nitrogen requirement, the system must include at least one of the following nitrogen reducing enhancements:

- Features allowed pursuant to FDOH rule, such as in-ground nitrogen-reducing biofilters (media layer systems).

- Features consistent with and identified in the FDOH Florida Onsite System Nitrogen Removal Strategy Studies report, such as in-tank nitrogen-reducing biofilters.

- Other FDOH-approved treatment systems capable of meeting or exceeding the NSF International (NSF) Standard 245 nitrogen removal rate before disposing the wastewater in the drain field, such as aerobic treatment units (ATU) and performance-based treatment systems (PBTS). For FDOH-approved treatment systems that meet NSF 245,

but do not meet or exceed the minimum treatment level expected from the in-ground nitrogen-reducing biofilters, the drain fields, at minimum, shall be installed with a 24-inch separation between the bottom of the drain field and the seasonal high-water table.

D.1.2 Modification or Repair of Existing OSTDS

At this time, this remediation plan does not require the addition of nitrogen reducing enhancements upon modification or repair of existing OSTDS.

D.1.3 Other Plan Elements

Statutes also require that OSTDS remediation plans contain the following elements.

- An evaluation of credible scientific information on the effect of nutrients, particularly forms of nitrogen, on springs and spring systems. (See **Section D.2**.)
- Options for repair, upgrade, replacement, drain field modification, the addition of effective nitrogen-reducing features, connection to a central sewer system, or other action. (See **Section D.3**.)
- A public education plan to provide area residents with reliable, understandable information about OSTDS and springs. (See **Section D.4**.)
- Cost-effective and financially feasible projects necessary to reduce the nutrient impacts from OSTDS. (See **Section 2** and **Appendix B**.)
- A priority ranking for each project for funding contingent on appropriations in the General Appropriations Act. (See **Section 2** and **Appendix B**.)

The Florida Springs and Aquifer Protection Act defines an OSTDS as a system that contains a standard subsurface, filled, or mound drain field system; an aerobic treatment unit; a graywater system tank; a laundry wastewater system tank; a septic tank; a grease interceptor; a pump tank; a solids or effluent pump; a waterless, incinerating, or organic waste–composting toilet; or a sanitary pit privy that is installed or proposed to be installed beyond the building sewer on land of the owner or on other land on which the owner has the legal right to install such a system. The term includes any item placed within, or intended to be used as a part of or in conjunction with, the system. The term does not include package sewage treatment facilities and other treatment works regulated under Chapter 403, F.S.

D.2 Collection and Evaluation of Credible Scientific Information

As discussed in **Section 2,** DEP developed the NSILT, a planning tool that provides estimation of nitrogen loading sources to groundwater based on the best available scientific data for a particular geographic area. The NSILT estimates prepared for the Devil's Complex PFA,

Hornsby PFA, and Ichetucknee PFA were peer reviewed by SRWMD, FDOH, and FDACS. Additional technical support information concerning the NSILT can be found in **Appendix E**.

D.3 Remediation Options

The NSILT estimates that OSTDS contribute approximately 6 %, 7 %, and 12 % of the pollutant loading to groundwater in the PFAs in the Devil's Complex, Hornsby, and Ichetucknee PFAs, respectively. **Table D-1, Table D-2**, and **Table D-3** list the number of existing OSTDS in the PFAs and the estimated nitrogen reductions associated with enhancement or connection to sewer. See **Figure D-1** for OSTDS locations.

Table D-1. Estimated reduction credits for additional OSTDS enhancement or sewer in the Devil's Complex PFA*

***Estimated reductions are for either enhancement or sewer per parcel classification. Reductions cannot be combined for the same parcel classification, but can be combined between the different classifications. For example, the sewer credit associated with parcels less than one acre in size can be combined with the sewer credit associated with parcels one acre or greater in size.

Recharge Area	OSTDS Parcels Less Than One Acre in PFAs	Credit for Sewer (lb-N/yr)	Credit for Enhancement (lb-N/yr)	OSTDS Parcels One Acre and Greater in PFAs	Credit for Sewer (lb-N/yr)	Credit for Enhancement (lb-N/yr)
High	513	4,486	3,070	2,917	25,511	17,455
Medium	69	335	229	828	4,023	2,753
Total	**582**	**4,822**	**3,299**	**3,745**	**29,533**	**20,207**

Table D-2. Estimated reduction credits for additional OSTDS enhancement or sewer in the Hornsby PFA*

***Estimated reductions are for either enhancement or sewer per parcel classification. Reductions cannot be combined for the same parcel classification, but can be combined between the different classifications. For example, the sewer credit associated with parcels less than one acre in size can be combined with the sewer credit associated with parcels one acre or greater in size.

Recharge Area	OSTDS Parcels Less Than One Acre in PFAs	Credit for Sewer (lb-N/yr)	Credit for Enhancement (lb-N/yr)	OSTDS Parcels One Acre and Greater in PFAs	Credit for Sewer (lb-N/yr)	Credit for Enhancement (lb-N/yr)
High	402	3,516	2,405	1,078	9,428	6,450
Medium	3	15	10	320	1,555	1,064
Total	**405**	**3,530**	**2,415**	**1,398**	**10,982**	**7,514**

Table D-3. Estimated reduction credits for additional OSTDS enhancement or sewer in the Ichetucknee Complex PFA*

***Estimated reductions are for either enhancement or sewer per parcel classification. Reductions cannot be combined for the same parcel classification, but can be combined between the different classifications. For example, the sewer credit associated with parcels less than one acre in size can be combined with the sewer credit associated with parcels one acre or greater in size.

Recharge Area	OSTDS Parcels Less Than One Acre in PFAs	Credit for Sewer (lb-N/yr)	Credit for Enhancement (lb-N/yr)	OSTDS Parcels One Acre and Greater in PFAs	Credit for Sewer (lb-N/yr)	Credit for Enhancement (lb-N/yr)
High	4,247	37,142	25,413	6,028	52,718	36,070
Medium	646	3,139	2,147	1,564	7,599	5,199
Total	**4,893**	**40,281**	**27,560**	**7,592**	**60,317**	**41,269**

As required by statute, this OSTDS remediation plan identifies remediation options for existing OSTDS, including repair, upgrade, replacement, drain field modification, the addition of effective nitrogen-reducing features, connection to a central sewer system, or other action. More simply, remediation options can be classified as enhancement or replacement. Enhancement options consist of systems identified in either existing FDOH rules or existing and ongoing FDOH studies, or systems not otherwise prohibited by FDOH. Examples of enhancements include in-ground nitrogen-reducing biofilters (media layer systems); in-tank nitrogen-reducing biofilters; and ATU or PBTS capable of meeting or exceeding the NSF Standard 245 nitrogen removal rate before disposing wastewater in the drain field.

Nitrogen impacts from new development could also be reduced through prohibiting new conventional OSTDS on all lots in the PFAs, throughout the BMAP area, or both.

DEP, FDOH, and local governments will develop programs to help fund the additional costs required to upgrade existing OSTDS to include nutrient reducing features. Although upgrading existing OSTDS to include nitrogen reducing features is not required by this BMAP, upgrades would be beneficial within the PFAs and throughout the BMAP area. The funding program will be designed to prioritize OSTDS where it is most economical and efficient to add nutrient reducing features (i.e., systems needing a permit for a repair or modification, within the PFA, and on lots of less than one acre).

To facilitate incorporation of nitrogen reducing features at the time of a permit to repair or modify an existing OSTDS, FDOH will pursue regulatory solutions to accomplish the following objectives:

- Update OSTDS rule language regarding permits, variances, and waivers to include consideration of DEP-adopted OSTDS remediation plans.
- Update OSTDS rules to allow installation of passive remediation systems, including but not limited to systems featuring liners, nitrogen reducing material, or both underneath the drain field.

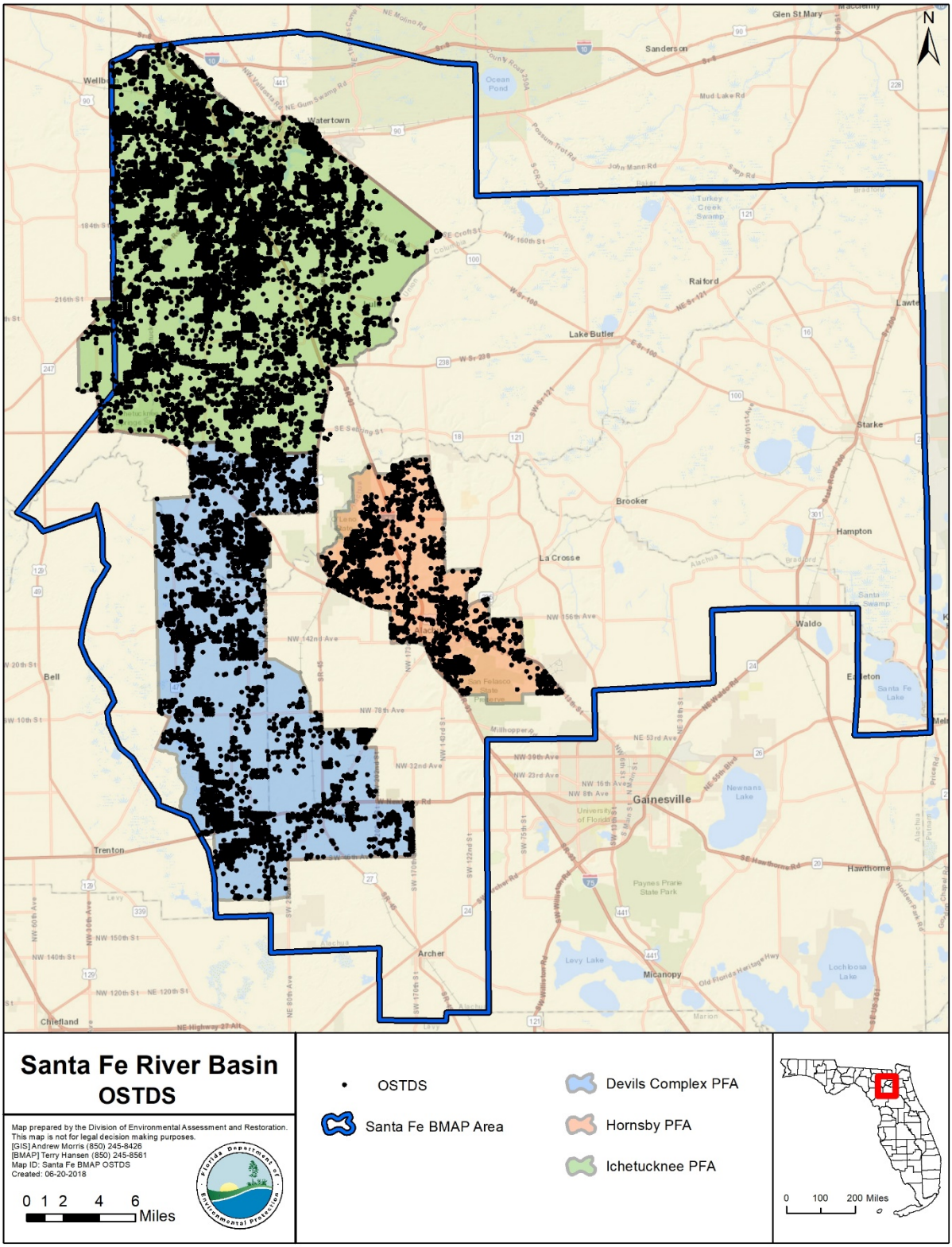

Figure D-1. OSTDS locations in the Santa Fe River BMAP Area

D.4 Public Education Plan

DEP and FDOH will develop and disseminate educational material focused on homeowners and guidance for builders and septic system contractors. The materials will identify the need for advanced, nitrogen reducing OSTDS along with the requirements for installing nitrogen reducing technologies under this OSTDS remediation plan. DEP will coordinate with industry groups such as Florida Home Builders Association and the Florida Onsite Wastewater Association (FOWA).

Appendix E. Technical Support Information

E.1. NSILT Data

An NSILT workbook was completed for the three springsheds in the Santa Fe River Basin BMAP: Ichetucknee Springs Group, Devil's Complex, and Hornsby-Treehouse. This technical support information identifies the data sources relied upon during NSILT development and documents the major assumptions used by DEP when applying the NSILT approach to the springsheds in the Santa Fe River Basin BMAP.

The general NSILT approach involves estimating the nitrogen load to the surface for various source categories based on land use. The NSILT subjects the surface loading to recharge and attenuation to derive the estimated load to groundwater at the top of the aquifer. The estimated load to groundwater determines the scope of reduction strategies needed in the BMAP for each source category. For additional information about the general NSILT approach, see any of the NSILT reports posted online at http://publicfiles.dep.state.fl.us/DEAR/NSILT/.

E.1.1 General Data Inputs

Hydrogeology and Aquifer Recharge
Aquifer recharge information is based on a merged layer that combines the 2002 USGS recharge layer for the intermediate and Floridan aquifer systems, and the 2009 aquifer recharge layer produced for the Florida Natural Area Inventory by the Florida Geological Society.

Land Use
Land use information is from SRWMD based on the 2011 Florida Land Use Cover and Forms Classification System (FLUCCS) and 2016−2017 property appraiser data for Suwannee, Gilchrist, Alachua, Levy, Columbia, Baker, and Union Counties.

E.1.2 Land Surface Nitrogen Inputs

Atmospheric Deposition
Atmospheric deposition information is derived from the TDEP hybrid model (Schwede and Lear 2014) that inputs wet and dry monitoring network data for the U.S. and calculates an estimated TN deposition load. The data set is comprised of data from 2011 to 2013.

WWTFs
The average annual input of nitrogen to the land surface was estimated for each effluent land application site in the BMAP area using TN concentration and discharge volume data available in the DEP Wastewater Facility Regulation (WAFR) database. The range of years for which data were available varied with the individual WWTFs; however, the majority of the data were from 2016 to 2017.

OSTDS

In 2014, FDOH began the Florida Water Management Inventory (FLWMI), a statewide project to develop GIS mapping attributes for water use and wastewater treatment method for all parcels by county. The results of this inventory can be obtained from FDOH.

Results from the 2016 release of the FLWMI were used to estimate the total number of septic systems within the BMAP area boundary. ArcGIS files provided the locations of both known and estimated septic systems.

The population served by the OSTDS was estimated using the 2010 U.S. Census Bureau data. Data were used to estimate the effective population and OSTDS usage. Several literature sources have reported a per capita contribution of 9.012 lb-N/yr, and this value was multiplied by the number of people using septic tanks within the different regions of the BMAP area (U.S. Environmental Protection Agency [EPA] 2002; Toor et al. 2011; Viers et al. 2012).

UTF

Urban turfgrass areas fertilization rates are derived from a 2008 SWFWMD study (Martin 2008). The results provided input data on percent of the population that fertilize, the applicator (landscape professional versus homeowner), and application rates.

The type of property where fertilizer is applied is estimated for nonresidential and residential parcels. The acreage receiving fertilizer is estimated the same for both parcel types by using county property appraiser data and zoning data. Impervious and pervious land areas are determined for each parcel.

Nonresidential parcels are assumed to be fertilized by a commercial service provider at a rate of 21.78 lb-N/acre (ac). Residential parcels are evaluated by estimating the percentage of the property fertilized and the probability of fertilization, listed below in **Table E-1**. For residential parcels, these factors are determined by utilizing property values (higher valued properties fertilize more often and in greater amounts) and parcel type (single-family residences fertilize more frequently than other residence types).

Table E-1. Average distribution of property values and the probability of fertilization within the three springsheds

Springshed	Property Value Label	Property Value	Probability of Fertilization (%)
Ichetucknee	Low	< $60,700	10
	Medium	$60,701 - $134,000	75
	High	> $134,001	90
Devil's Complex	Low	< $76,000	10
	Medium	$76,001 - $143,800	75
	High	> $143,801	90
Hornsby	Low	< $79,000	10
	Medium	$79,001 - $170,000	75

Springshed	Property Value Label	Property Value	Probability of Fertilization (%)
	High	> $170,001	90

STF

Sports turfgrass areas include golf courses and sporting facilities. Golf course input is estimated utilizing the statewide fertilizer application rate of 4.5 lb-N/1,000 square feet/yr.

Sporting facilities are assessed based on property appraiser data. Acreage of sports turfgrass is verified using aerial imagery. The commercial lawn service fertilizer application rate for nonresidential parcels is used (21.78 lb-N/ac).

Dairies

DEP permits and industry feedback are used to obtain herd size and characteristics for both permitted and non-permitted dairies. The confinement and grazing times; waste management and disposal methods: and herd characteristics are assessed individually for each dairy when detailed information is provided. A daily waste factor was applied to the average herd size and refined based on the site-specific waste handling methods used (**Table E-2**; Ruddy et al. 2006; Cabrera et al. 2006). For smaller dairies that do not require a confined animal feeding operation permit that specifies the waste handling methods, it was assumed that these facilities direct their wastewater to a waste storage pond and then the liquid waste is applied to a sprayfield.

Table E-2. Daily waste factors for dairy cattle

Livestock	Waste Factor (lb-N/day)
Lactating Dairy Cow	0.794
Dry Dairy Cow	0.397
Heifer/Springer	0.243
Springers	0.198
Bulls	0.375
Calves- Dairy	0.088

Livestock Waste

Nitrogen inputs from beef cattle and miscellaneous livestock are included in the livestock waste category.

For cow-calf operations, population numbers are derived from the 2016 U.S. Department of Agriculture (USDA) Survey of Agriculture and the estimated quantity of pasture acreage is based on SRWMD land use.

Populations of other livestock animals (goats, sheep, hogs, etc.) are estimated from the USDA census of agriculture and SRWMD land use coverage adjusted by percent of land likely to contain livestock in the springsheds. The nitrogen waste factor for each animal type is based on

published literature values and subdivided into locations and recharge area. The nitrogen waste factors per animal are listed in **Table E-3** (Goolsby et al. 1999; Chelette et al. 2002; Ruddy et al. 2006; Meyer 2012; Sprague and Gronberg 2013).

Table E-3. Daily waste factors for miscellaneous livestock

Livestock	Waste Factor (lb-N/day)
Chicken, Broilers	0.002
Chicken, Layers	0.003
Beef Cows	0.337
Other Beef Cattle	0.311
Calves Beef	0.068
Equine	0.273
Goats	0.035
Hogs	0.19
Sheep	0.198
Turkeys	0.006

FF

Water Management District land use information, and an agricultural land use planning tool called the FSAID Geodatabase, developed for the FDACS, were used to assign and classify crop types grown on identified agricultural acreages.

Agricultural fertilizer is applied at varying rates, depending on crop type and farm practices. The amount of irrigated lands and crop types was based on the 2015 FSAID Irrigated Lands Geodatabase (ILG). Beyond the areas specified by the ILG, additional agricultural areas were identified based on the WMD land use data and by county property appraiser data. Estimated applications rates are based on UF-IFAS recommendations and adjusted rates based on producer feedback. The rates are listed below in **Table E-4.** Application rates are applied to the calculated acreages for the corresponding crop types to estimate FF input.

Table E-4. Summary of crop types and assumed nitrogen application rates

Crop	Application Rate (lb-N/ac/yr)	Crop	Application Rate (lb-N/ac/yr)
Blueberries	50	**Ornamentals**	90
Cabbage	175	**Other Groves (Pecan, Avocado, Coconut, Mango, etc.)**	90
Cabbage_Kale	147.5	**Pasture**	80
Carrots	300	**Pasture_Rye**	110
Carrots_Corn	550	**Peanuts**	20
Carrots_Rye	300	**Peanuts_Pasture**	100
ContainerNursery	90	**Peanuts_Rye**	50
Corn	250	**Pecans**	90
Corn_Oats	250	**Potatoes**	200
Corn_Rye	250	**Row Crops**	106

Crop	Application Rate (lb-N/ac/yr)	Crop	Application Rate (lb-N/ac/yr)
Cotton	125	**Rye**	100
Cropland and Pastureland	60	**SmallVeg**	151
Field Corn	250	**Snap Beans**	90
Field Crops	90	**Sod**	50
Field Nursery	90	**Sod Farms**	50
Grains	110	**Sorghum**	150
Grass/Pasture	80	**Soybeans**	35
Hay	240	**Soybeans_Carrots**	335
Hay Fields	240	**Soybeans_DryBeans**	75
Hay_Bermuda	320	**Sweet Corn**	250
Hay_Oats	230	**SweetCornCoverCrop**	250
Horse Farms	30	**SweetPotatoes**	60
Improved Pastures	100	**Tobacco**	80
Melons	175	**Tree Nurseries**	90
Millet_Rye	165	**Vegetables**	151
Nurseries and Vineyards	90	**Vegetables_SpringOnion**	301
Oats	100	**Watermelon**	175

Estimated Nitrogen Inputs to Land Surface

Table E-5 identifies the estimated input from each source category by recharge area.

Table E-5. Estimated nitrogen inputs to the land surface by source category and recharge area within the three springsheds (lb-N/yr)

Springshed	Recharge	Atm Dep	WWTF	OSTDS	UTF	STF	FF	LW-Dairy	LW-Other	Total
Ichetucknee	High	1,094,848	7,654	231,502	315,661	57,782	1,371,135	-	1,633,211	4,711,792
	Medium	467,067	101,196	47,281	41,911	-	438,029	-	385,789	1,481,273
	Low	35,864	30,804	6,843	8,637	-	108,818	-	59,852	250,819
	Total	**1,597,780**	**139,654**	**285,627**	**366,209**	**57,782**	**1,917,981**	**-**	**2,078,852**	**6,443,884**
Devil's Complex	High	730,186	188	86,916	72,327	302	2,028,693	31,639	1,194,530	4,144,781
	Medium	549,156	13,477	57,578	72,782	497	2,229,491	33,681	690,327	3,646,988
	Low	18,212	329	673	1,499	-	22,725	-	39,491	82,928
	Total	**1,297,554**	**13,994**	**145,166**	**146,608**	**799**	**4,280,909**	**65,320**	**1,924,348**	**7,874,698**
Hornsby	High	165,854	7,563	21,664	55,424	5,145	592,734	-	232,944	1,081,328
	Medium	115,688	10	8,332	38,477	-	617,825	-	287,645	1,067,977
	Low	160,388	-	16,683	29,586	16,708	348,618	102,980	196,944	871,907
	Total	**441,930**	**7,573**	**46,679**	**123,488**	**21,854**	**1,559,177**	**102,980**	**717,533**	**3,021,213**

E.1.3 Nitrogen Attenuation and Loading to Groundwater

The two types of attenuation that are evaluated are biochemical attenuation factors (BAFs) and hydrogeological attenuation (i.e., recharge).

BAFs and Uncertainty Factors

The BAFs used to account for the processes affecting the movement of nitrogen from each source category in the subsurface are based on literature review of studies in Florida and similar areas. The BAFs in **Table E-6** are the result of this evaluation. The BAF is used to estimate what percent of the surface input could infiltrate to groundwater. For example, if 70 % of urban fertilizer is biologically attenuated, then the remaining 30 % could infiltrate to the groundwater.

The environmental attenuation of nitrogen from specific sources within the categories can vary substantially, both spatially and with depth in the subsurface, and will affect the amount of nitrogen leaching to groundwater and the relative contribution of nitrogen from each source category. The range in nitrogen attenuation can result from variability in soil properties, crop types, agricultural practices, nitrogen storage, volatilization of ammonia to the atmosphere, uptake by vegetation, denitrification, and other removal processes. The potential range in nitrogen attenuation for each source is shown in **Table E-6**.

Table E-6. Range of environmental attenuation of nitrogen from a detailed literature review

* Dairies showed a range of attenuation based on practices. Permitted dairies exhibit practices that result in higher attenuation.

N Source Category	Low-Level Attenuation (%)	Attenuation Used for This Analysis (%)	High-Level Attenuation (%)
Atmospheric Deposition	85	90	95
WWTFs-RIBs	10	25	40
WWTFs-Sprayfield	50	60	75
WWTF-Reuse	50	75	85
Septic Tanks	40	50	75
Dairies	30	50 and 85*	90
Farm Fertilizers	50	80	90
Urban Fertilizers	50	70	85

Hydrogeological Attenuation (i.e., Recharge)

Most of the nitrogen in a given year does not reach groundwater due to hydrogeologic nitrogen attenuation processes and variations in the rate of aquifer recharge. In areas of the Santa Fe River Basin BMAP where recharge rates are categorized as medium (3.01 to 10 in/yr) or high (greater than 10 in/yr), the UFA is more vulnerable to contamination than in areas where recharge rates are low (0 to 3 in/yr).

The recharge rate for the area where the surface input is calculated is based on the composite recharge map previously described. To account for variations in recharge rates to the UFA, non-attenuated nitrogen inputs in high rate recharge areas are multiplied by a weighting factor of 0.9,

while nitrogen inputs are multiplied by a weighting factor of 0.5 for medium rate recharge areas and 0.1 for low.

Estimated Nitrogen Loads to Groundwater

The surface inputs by source category are adjusted by applying the BAFs for the appropriate source category and location-based recharge factors to estimate the load to groundwater by source category.

It is important to note that this load is estimated for the top of the aquifer. As the load interacts with the aquifer, additional factors likely modify it prior to discharge at the spring vents. The estimated loads for each springshed are identified in **Table E-7.**

Table E-7. Estimated nitrogen load to groundwater by source category and recharge area within the three springsheds (lb-N/yr)

Springshed	Recharge	Atm Dep	WWTF	OSTDS	UTF	STF	FF	LW-Dairy	LW-Other	Total
Ichetucknee	High	98,536	1,790	104,176	85,228	15,601	246,804	-	146,989	699,125
	Medium	23,353	11,906	11,820	6,287	-	43,803	-	19,289	116,459
	Low	359	1,232	342	259	-	2,176	-	599	4,967
	Total	**122,248**	**14,928**	**116,338**	**91,774**	**15,601**	**292,783**	**-**	**166,877**	**820,551**
Devil's Complex	High	65,717	127	39,112	19,528	82	365,165	14,237	107,508	611,476
	Medium	27,458	2,701	14,394	10,917	74	222,949	8,420	34,516	321,431
	Low	182	13	34	45	-	454	-	395	1,123
	Total	**93,357**	**2,841**	**53,540**	**30,491**	**156**	**588,568**	**22,658**	**142,419**	**934,030**
Hornsby	High	14,927	2,732	9,749	14,965	1,389	106,692	-	20,965	171,418
	Medium	5,784	4	2,083	5,772	-	61,783	-	14,382	89,807
	Low	1,604	-	834	888	501	6,972	1,545	1,969	14,313
	Total	**22,315**	**2,735**	**12,666**	**21,624**	**1,891**	**175,447**	**1,545**	**37,317**	**275,539**

E.2 NSILT References

Cabrera, V.E., de Vries, A. and Hildebrand, P.E. 2006. Manure nitrogen production in North Florida dairy farms: a comparison of three models. *Journal of Dairy Science* 89, 1830-1841.

Cabrera, V.E., Hildebrand, P.E., Jones, J.W., Letson, D., and de Vries, A. 2006. An integrated North Florida dairy farm model to reduce environmental impacts under seasonal climate variability. *Agriculture, Ecosystems, and Environment* 113, 82-97.

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

Goolsby, D.A., W.A. Battaglin, G.B. Lawrence, R.S. Artz, and B.T. Aulenbach et al. 1999. *Flux and sources of nutrients in the Mississippi–Atchafalaya River Basin.* National Oceanic and Atmospheric Administration Coastal Ocean Program No. 17.

Martin, T. 2008. *Lawn care behavior, Crystal River/Weeki Wachee Spring and Rainbow River survey.* Final report prepared for the Southwest Florida Water Management District

Meyer, L.H. 2012. *Quantifying the role of agriculture and urbanization in the nitrogen cycle across Texas.* University of Texas graduate thesis.

Ruddy, B.C., D.L. Lorenz, and D.K. Mueller. 2006. *County-level estimates of nutrient inputs to the land surface of the conterminous United States, 1982–2001.* U.S. Geological Survey Scientific Investigations Report 2006-5012.

Schwede, D.B., and G.G. Lear. 2014. A novel hybrid approach for estimating total deposition in the United States. *Atmospheric Environment* 92: 207–220.

Sprague, L.A., and J.M. Gronberg. 2013. Estimation of anthropogenic nitrogen and phosphorus inputs to the land surface of the conterminous United States—1992, 1997, and 2002. U.S. Geological Survey Scientific Investigations Report 2012-5241.

Toor, G.S., M. Lusk, and T. Obreza. 2011. Onsite sewage treatment and disposal systems: Nitrogen. SL 348. Gainesville, FL: University of Florida Institute of Food and Agricultural Sciences.

U.S. Department of Agriculture Census of Agriculture website: https://www.agcensus.usda.gov

U.S. Environmental Protection Agency. 2002. *Onsite wastewater treatment systems manual.* EPA/625/R-00/008. Washington, DC: Office of Water.

Viers, J.H, D. Liptzin, T.S. Rosenstock, W.B. Jensen, and A.D. Hollander et al. 2012. Nitrogen sources and loading to groundwater. Technical Report 2. California State Water Resources Control Board.

Appendix F. FDACS Information on BMPs

F.1 Implementation of Agricultural BMPs

Agricultural nonpoint sources in a BMAP area are required by state law (Subsection 403.067(7), F.S.) either to implement FDACS-adopted BMPs, which provides a presumption of compliance with water quality standards, or to conduct water quality monitoring prescribed by DEP or SRWMD. Failure either to implement BMPs or conduct monitoring may result in enforcement action by DEP.

Growers who implement BMPs may be eligible for cost-share funding from FDACS, SRWMD, or others to defray partially the costs of implementation. Through the OAWP, the Florida Forest Service, and the Division of Aquaculture, FDACS develops, adopts, and assists producers in implementing agricultural BMPs to improve water quality and water conservation.

FDACS identified potential land that could be enrolled in the BMP Program in the Santa Fe River BMAP area using the FSAID IV geodatabase.

Table F-1 summarizes the land use data for agriculture in the Santa Fe River Basin. Based on the FSAID IV geodatabase, the total agricultural lands within the Santa Fe River Basin are 208,465 acres. **Table F-2** summarizes the agricultural land by crop type that was estimated to be fertilized and the corresponding acreages. The primary agricultural fertilized land use in the Santa Fe River Basin is Improved Pasture which comprises 67 % of the fertilized land use in the springshed. **Table F-3** provides a summary of the agricultural lands with livestock. It is important to note that some of the agricultural lands include more than one agricultural practice.

Figure F-1 shows the approximate location of the agricultural lands based on the FSAID within the Santa Fe River Basin.

Table F-1. Agricultural land use by nutrient source in the Santa Fe River BMAP area

Agricultural Nitrogen Loading Category	Acres
Crop Fertilizer Lands only	45,734
Livestock Lands only	22,739
Crop Fertilizer and Livestock Lands	136,417
Total	**204,890**

Table F-2. Fertilized croplands in the Santa Fe River BMAP area

Crop Type	Application Rate (lbs/acre)	Acres
Blueberries	50	475
Cabbage	151	35
Cabbage_Kale	147.5	84

Crop Type	Application Rate (lbs/acre)	Acres
Container Nursery	90	688
Corn	210	4,251
Corn_Rye	210	105
Cropland and Pastureland	60	11,642
Field Crops	90	353
Nursery	90	173
Grains	110	190
Grass/Pasture	80	1,994
Hay	240	30,566
Improved Pasture	60	122,782
Melons	175	32
Millet_Rye	165	110
Ornamental Container	90	326
Other Groves	90	29
Peanuts	20	5,944
Pecans	90	420
Snap Beans	90	60
Sod	50	41
Sorghum	105	45
Soybeans	35	663
Sweet Corn	250	63
Tobacco	80	20
Tree Crops	90	1
Vegetables	151	1,060
Total	-	**182,152**

Table F-3. Livestock lands in the Santa Fe River Basin BMAP area

Livestock Category	Acres
Cropland and Pastureland	11,642
Dairy	108
Grass/Pasture	1,994
Herbaceous (Dry Prairie)	3,986
Horse Farms	1,601
Improved Pasture	122,782
Mixed Shrubs	7
Mixed Upland Nonforested	22
Pasture	3,125
Poultry Feeding Operations	16
Poultry, Bees, Tropical Fish, Etc.	10
Shrub and Brushland	19
Specialty Farms	55
Unimproved Pastures	7,455
Woodland Pastures	6,337
Total	**159,159**

Agricultural land use data are critical for determining agricultural nonpoint source loads and developing strategies to reduce those loads in a BMAP area, but there are inherent limitations in the available data. The time of year when land use data are collected (through aerial photography) affects the accuracy of photo interpretation. Flights are often scheduled during the winter months because of weather conditions and reduced leaf canopies, and while these are favorable conditions for capturing aerial imagery, they make photo interpretation for determining agricultural land use more difficult (e.g., more agricultural lands are fallow in the winter months) and can result in inappropriate analysis of the photo imagery. There is also significant variation in the frequency with which various sources of data are collected and compiled, and older data are less likely to capture the frequent changes that often typify agricultural land use. In addition, agricultural activity is not always apparent, for example, acreage classified as improved pasture may be used for a cow-calf operation, consist of forage grass that is periodically harvested for hay, or simply be a fallow vegetable field awaiting planting. Finally, the classification method itself may be an issue, for example, property appraiser data assigns an agricultural land use designation to an entire parcel, although agricultural production may only be conducted on a portion of the parcel. Because of error in the collection and characterization of land use data and changes in land use over time, agricultural land use acreage estimates are subject to adjustment.

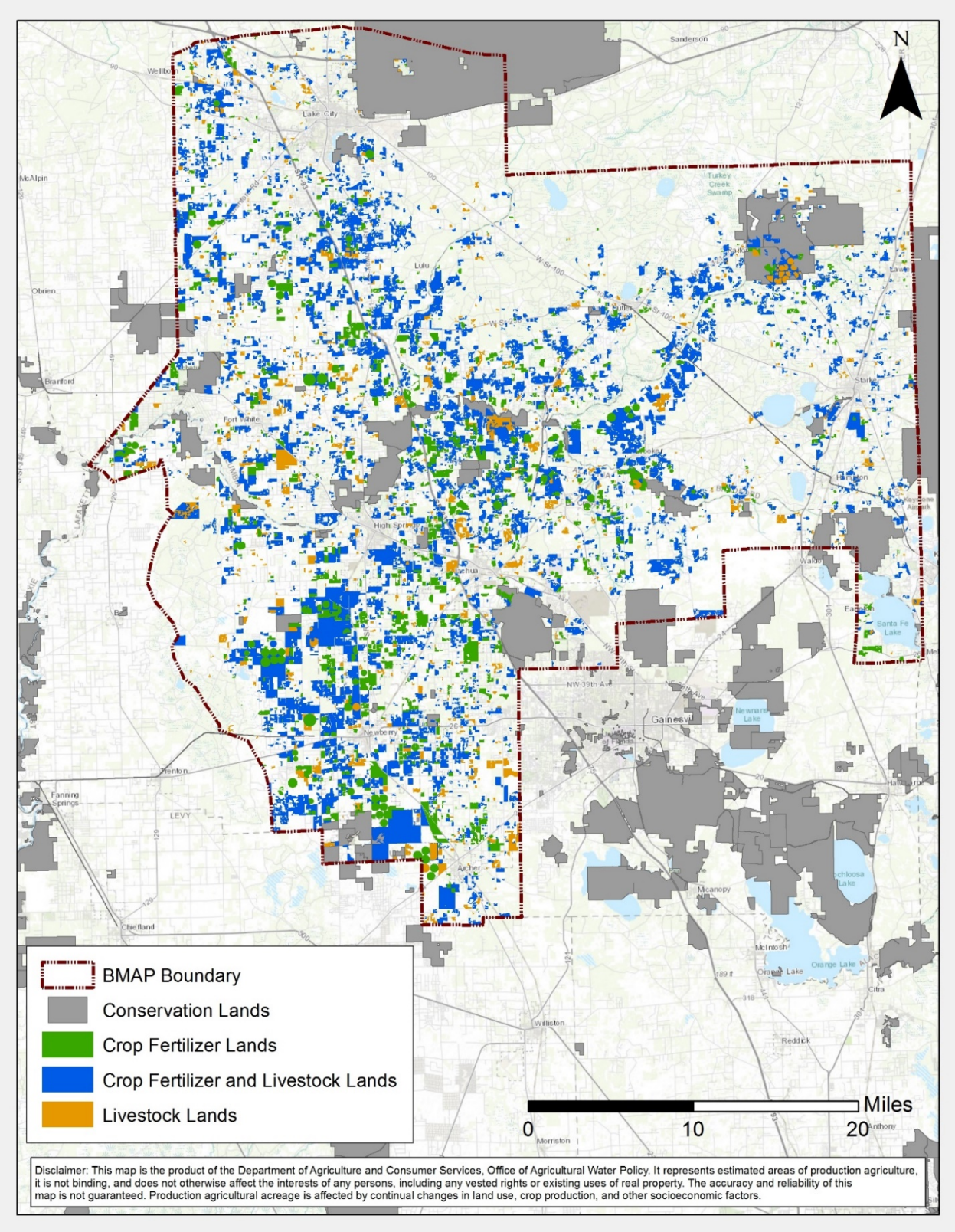

Figure F-1. Agricultural lands in the Santa Fe River BMAP area

F.2 Agricultural BMPs

Through the Office of Agricultural Water Policy, the Florida Forest Service, and the Division of Aquaculture, FDACS develops, adopts, and assists producers in implementing agricultural BMPs to improve water quality and water conservation. Adopted BMPs are initially verified by the FDEP as reducing nutrient loss (e.g., total nitrogen and total phosphorus [TP]) to the environment. OAWP BMPs are published in commodity-specific manuals that cover key aspects of water quality and water conservation. The BMP categories include:

- Nutrient Management practices that help determine appropriate source, rate, timing, placement of nutrients (including both organic and inorganic sources) to minimize impacts to water resources.

- Irrigation and Water Table Management practices that address methods for irrigating to reduce water and nutrient losses to the environment and to maximize the efficient use and distribution of water.

- Water Resource Protection practices such as buffers, setbacks, and swales to reduce or prevent the transport of nutrients and sediments from production areas to water resources.

The NOI and BMP checklist are incorporated into each manual.

Information on the BMP manuals and field staff contact information can be obtained here: http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy. Printed BMP manuals can be obtained by contacting OAWP field staff.

OAWP outreach to solicit enrollment extends to all types of agricultural operations, but is more intensive in BMAP areas because of the relationship of BMPs to the presumption of compliance with water quality standards in a BMAP area. FDACS field staff works with producers to enroll in the FDACS BMP program by signing a Notice of Intent to Implement BMPs, and enrollment is based on the expectation that producers recognize and address the water quality and conservation issues associated with their operations. Upon completion of all information in the BMP checklist, an NOI must be signed by the landowner or the landowner's authorized agent (who may be the producer if the producer is not the landowner).

F.3 BMP Enrollment

Figure F-2 shows the acres enrolled in the FDACS BMP Program in the Santa Fe River Basin as of December 31, 2017. **Table F-4** lists the acres enrolled in the FDACS BMP Program by manual and the number of NOIs associated with those acres. Given that the enrolled acres on which BMPs are implemented can contain nonproduction acres (such as buildings, parking lots,

and fallow acres), only the enrollment for the land classified as agriculture based on the FSAID is included in **Table F-4**.

As of December 31, 2017, NOIs cover 119,824 agricultural acres in the Santa Fe River BMAP area. No producers are conducting water quality monitoring in lieu of implementing BMPs at this time.

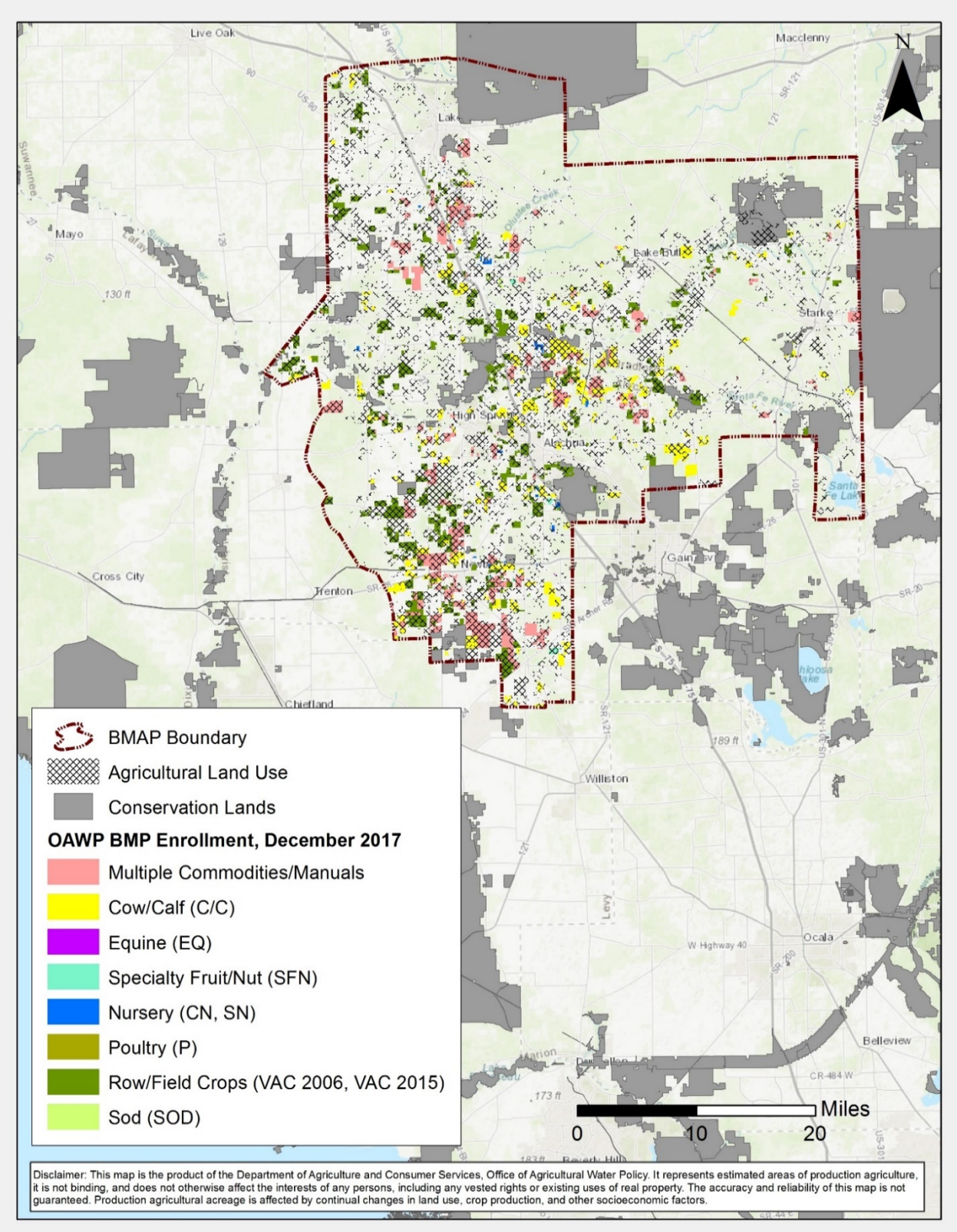

Figure F-2. BMP enrollment in the Santa Fe River Basin as of December 31, 2017

Table F-4. Agricultural acreage and BMP enrollment in the Santa Fe River Basin BMAP area as of December 31, 2017

Related FDACS BMP Programs	NOI Acreage Enrolled	Agricultural Land Use Acres within NOIs
Cow/calf	31,045	18,785
Equine	10	9
Fruit/nut	640	527
Nursery	1,095	681
Multiple Commodities	35,407	25,371
Poultry	73	0
Row/Field crops	51,281	35,366
Sod	273	200
Total	**119,824**	**80,939**

F.4 FDACS OAWP Role in BMP Implementation and Follow-Up

OAWP works with producers to submit NOIs to implement the BMPs applicable to their operations, provides technical assistance to growers, and distributes cost-share funding, as available, to eligible producers for selected practices. OAWP follows up with growers through site visits to evaluate the level of BMP implementation and record keeping, identify areas for improvement, if any, and discuss cost-share opportunities.

When DEP adopts a BMAP that includes agriculture, it is the agricultural producer's responsibility to implement BMPs adopted by FDACS to help achieve load reductions. If land use acreage corrections and BMP implementation do not fully account for the current agricultural load reduction allocation, it may be necessary to develop and implement cost-assisted field- or regional-level treatment options that remove nutrients from farms and other nonpoint sources. In that case, FDACS will work with DEP and SRWMD to identify appropriate options for achieving further agricultural load reductions.

Section 403.067, F.S. requires that, where water quality problems are demonstrated despite the proper implementation of adopted agricultural BMPs, FDACS must reevaluate the practices, in consultation with DEP, and modify them if necessary. Continuing water quality problems will be detected through the BMAP monitoring component and other DEP and SRWMD activities. If a reevaluation of the BMPs is needed, FDACS will also include SRWMD and other partners in the process.

F.5 OAWP Implementation Verification (IV) Program

OAWP established an Implementation Assurance (IA) Program in 2005 in the Suwannee River Basin as part of the multi-agency/local stakeholder Suwannee River Partnership. In early 2014, OAWP began to streamline the IA Program to ensure consistency statewide and across

commodities and BMP manuals. The IA Program was based on interactions with producers during site visits by OAWP staff and technicians as workload allowed. For the visits, field staff and technicians used a standard form (not BMP specific) developed in 2014, that focused on nutrient management, irrigation management, and water resource protection BMPs common to all of the BMPs that were adopted by rule. Once completed, these paper forms were submitted to OAWP staff and compiled into a spreadsheet, and the data were reported annually.

On November 1, 2017, the OAWP's IV rule (Chapter 5M-1, F.A.C.) became effective. The IV program provides the basis for assessing the status of BMP implementation and for identifying enrolled producers who require assistance with BMP implementation. The components of the IV program are 1) site visits; 2) implementation status reporting on common practices that apply across all BMP manuals; 3) technical assistance; and 4) external reporting. Implementation verification is confirmed by field staff through site visits and by producers through annual common practices status reports.

Site visits to agricultural operations by OAWP field staff and contract technicians are the most effective means to determine the status of BMP implementation. These visits also provide an opportunity to identify needs for assistance with implementation and explore potential improvements. Resource limitations prevent site visits from occurring on all enrolled operations every year, and for that reason, site visits are prioritized. The program objective is for field staff to conduct site visits for 5-10% of active NOIs each year, with approximately 10% of the site visit locations selected randomly.

Per the implementation verification rule, each year, producers participating in the BMP program will be requested to participate in reporting on the status of implementation of common practices only for their operations. Lack of response from enrollees with parcels in a BMAP area raises the priority of the operation for a site visit from field staff. Where a need is identified, the OAWP may facilitate technical assistance for the producer from UF-IFAS or other resources, including third-party vendors. In some cases, cost share support may be available. Data from producers and site visits will be used to complete the annual reports on the status of BMP implementation as required by s. 403.0675(2), F.S., beginning July 1, 2018. .

F.6 Beyond BMPs

Beyond enrolling producers in the FDACS BMP Program and verifying implementation, FDACS will work with DEP to improve the data used to estimate agricultural land uses in the springshed. FDACS will also work with producers to identify a suite of agricultural projects and research agricultural technologies that could be implemented on properties where they are deemed technically feasible and if funding is made available. The acreages provided by FDACS are preliminary estimates of the maximum acreages and will need to be evaluated and refined over time. As presented here, these projects are based on planning-level information. Actual implementation would require funding as well as more detailed designs based on specific information, such as actual applicable acreages and willing landowners. **Table F-5** summarizes potential practices that could be implemented in this BMAP area. It is important to note that the

research projects listed in the table are being conducted in the Suwannee River Basin. At some future point, the findings of these studies may be applicable to the Santa Fe River Basin. Actual implementation would require funding as well as more detailed design based on specific information, such as actual applicable acreages and willing landowners.

Table F-5. Beyond BMP implementation

Category	Name	Description
Practices	Precision Irrigation	Deployment of equipment, procedures, and training to improve location, volume, and timing of irrigation to match crop needs more precisely.
Practices	Soil Moisture Probes	Deployment, training, technical support, and use of soil moisture probes to manage irrigation systems.
Practices	Cover Crops	Planting of cover crops between production cycles to increase soil organic content, improve nutrient retention, and reduce erosion.
Research	Bioreactors	Bioreactors/denitrification walls and onsite capture and reuse of high-N water.
Research	Rotational Production	Conversion of conventional production operations to planned rotational production incorporating grass and cover crops. May include cattle.
Research	Soil Moisture Sensor Deployment and Calibration	Installation, training, monitoring, and research on use of electronic soil moisture sensors, including correlations to nutrient movement through the root zone.
Research	Controlled Release Fertilizer (CRF)	Application of new and developing fertilizer products that become available to crops via dissolution over longer periods in the growing season.
Research	Reuse of High Nutrient Value Water Sources	Study of potential sources of high nutrient value water, potential beneficial reuse sites, legal and regulatory obstacles, and costs.