

Comprehensive Wastewater Treatment Facilities Plan Task 6: Total Nitrogen Reductions Achieved Through Recommended Alternatives



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ACRONYMS AND ABBREVIATIONS

ATU	Aerobic Treatment Unit
AWTS	Alternative Wastewater Treatment System
BMAP	Basin Management Action Plan
CWTFP	Comprehensive Wastewater Treatment Facilities Plan
DEP	Department of Environmental Protection
FDOH	Florida Department of Health
INRB	In-Ground Nitrogen-Reducing Biofilter
JSA	Jim Stidham & Associates
lbs/yr	Pounds Per Year
OSTDS	Onsite Sewage Treatment and Disposal System
PBTS	Performance Based Treatment System
PFA	Priority Focus Area
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
WWTF	Wastewater Treatment Facility

EXECUTIVE SUMMARY

Leon County is developing a plan to reduce nitrogen loads from existing onsite sewage treatment and disposal systems (OSTDSs), as well as future development, to groundwater and surface waters. OSTDSs are also known as septic systems. The Florida Department of Environmental Protection (DEP) found that nutrient loads from several sources—including OSTDSs in Leon County—impaired Upper Wakulla River and Wakulla Spring. Leon County’s plan has two parts: (1) a comprehensive wastewater treatment facilities plan for the entire county, and (2) a more focused facilities plan for the part of the county that loads nitrogen to the Upper Wakulla River and Wakulla Spring Basin Management Action Plan (BMAP) priority focus area (PFA). Objectives of the plan are to: (1) identify OSTDSs to transition to alternative wastewater treatment systems (AWTSs) where the transition will most reduce nitrogen loads to surface waters and groundwater; and (2) identify future developments that require AWTSs to reduce nitrogen loads to surface waters and groundwater.

Leon County is developing the plan by progressing through eight major tasks. This report describes the results of task 6: total nitrogen (TN) reductions achieved through recommended alternatives. This task includes an evaluation of the estimated TN reductions from transitioning OSTDSs to the proposed AWTS technologies identified for the target areas in task 5. A phasing plan to achieve the DEP BMAP reductions for Leon County in the PFA is also included.

For each of the target areas within the PFA that includes Leon County, the Jim Stidham & Associates (JSA) team calculated nitrogen loads from existing OSTDSs in Leon County's portion of the PFA by following DEP's methodology used in the BMAP Nitrogen Source Inventory and Loading Tool and applying the percent nitrogen reduction for each AWTS technology. There are 2,438 parcels within Leon County in the PFA, which is 20% of the OSTDS within the two PFAs delineated by DEP in the BMAP. For these parcels, an estimated TN reduction of 17,512 pounds per year (lbs/yr) could be achieved by implementing the AWTS recommendations. This reduction falls within the range targeted for Leon County to meet BMAP requirements.

1.0 Introduction

The Florida Department of Environmental Protection (DEP, 2018) found that nutrient loads from several sources impaired the Upper Wakulla River and Wakulla Spring. To develop a plan to restore the river and spring, DEP calculated the maximum amount of nitrate that these waterbodies can receive each day, while still satisfying water quality standards. This maximum amount is called a total maximum daily load (TMDL). DEP prepared the Upper Wakulla River and Wakulla Spring Basin Management Action Plan (BMAP) to restore the river and spring by identifying actions that will reduce pollutant loads to these waterbodies. The BMAP was adopted by DEP in June 2018 and requires that stakeholders, including Leon County, reduce nitrogen loads to the river and spring from onsite sewage treatment and disposal systems (OSTDSs), also known as septic systems. Leon County contracted Jim Stidham & Associates (JSA) to develop the plan to reduce nitrogen loads from OSTDSs. JSA partnered with Advanced Geospatial, Applied Technology & Management, The Balmoral Group, Magnolia Engineering, and Tetra Tech to develop the plan. JSA and these partners are referenced throughout this plan as the JSA team.

The Leon County plan has two parts: (1) a comprehensive wastewater treatment facilities plan (CWTFP), and (2) a more focused facilities plan for the part of the county governed by the BMAP. The CWTFP is funded through a grant from the Blueprint Intergovernmental Agency. DEP funded the BMAP plan with a grant to the county. About 40% of Leon County is served by OSTDSs, about 20% is served by five centralized wastewater treatment facilities (WWTFs), and about 40% is government land that will not likely be developed during the next few decades and will not likely require wastewater treatment (Figure 1).

The objective of Leon County's plan is to identify existing OSTDSs to transition to alternative wastewater treatment systems (AWTSs), where the transition will result in the greatest reduction in nitrogen loads to the river and spring. The plan will produce guidance for the retrofit of existing development as well as direct technology selection for future development. The JSA team is creating the Leon County plan by performing the following tasks:

- Task 1. Develop a nitrogen reduction score to identify likely contribution of nitrogen from OSTDSs to groundwater and surface waters; use the score to quantify, rank, and identify OSTDSs to transition to AWTSs; and establish nitrogen reduction criteria for AWTSs for each of the separate delineated areas (Completed)
- Task 2. Quantify cost-effectiveness of AWTSs (Completed)
- Task 3. Identify other factors that influence selection of an AWTSs (Completed)
- Task 4. Provide education to the community regarding information compiled in tasks 1, 2, and 3 and survey opinions of the citizens of Leon County, with respect to this plan (Completed)
- Task 5. Analyze implementation scenarios for AWTSs (Completed)
- Task 6. Calculate the anticipated decrease in nitrogen load to the Upper Wakulla River and Wakulla Spring, between 2020 and 2040, due to OSTDS transition to AWTSs (Draft Completed)
- Task 7. Provide additional education to the community regarding the information compiled in tasks 1 through 6 and conduct additional survey of opinions of the citizens of Leon County, with respect to this plan
- Task 8. Present the plan to the Leon County Board of County Commissioners

This report describes task 6 of the Leon County plan: total nitrogen (TN) reductions achieved through recommended alternatives. The objective of task 6 was to estimate the TN reduction from transitioning OSTDSs to the proposed AWTS technologies identified for the target areas in task 5. In addition, this task includes a phasing plan to achieve the BMAP reductions for Leon County.

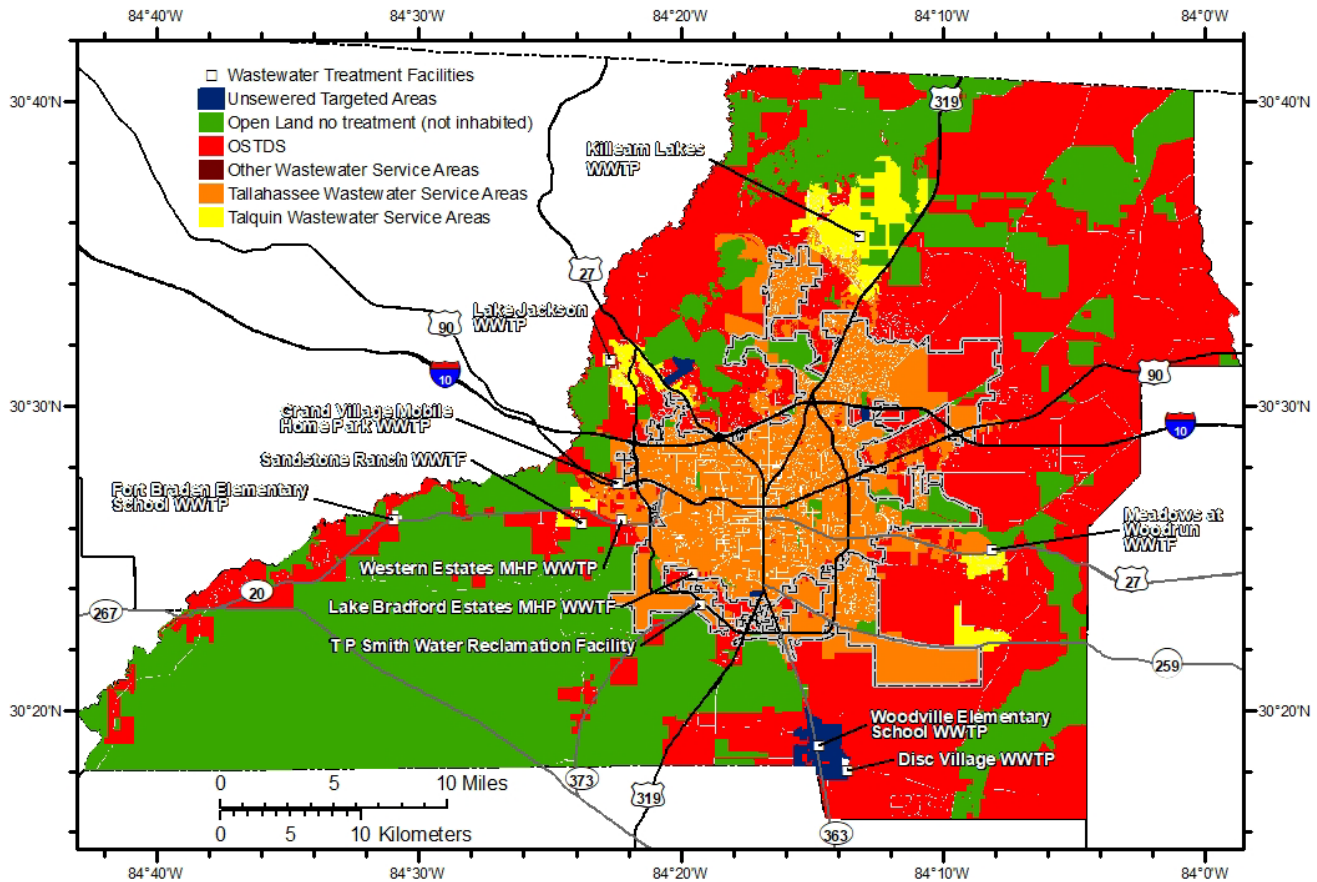


Figure 1. Parcels with an OSTDS, WWTF locations, parcels in the Tallahassee wastewater service area, and parcels in the Talquin service area.

In this report, the JSA team estimates the TN reductions from implementing the task 5 recommendations for the target areas (section 2.0), summarizes related assumptions to achieving the TN reductions (section 3.0), and recommends an approach for phasing AWTS implementation to achieve BMAP reductions (section 4.0).

2.0 Estimated TN Reductions

The Upper Wakulla River and Wakulla Spring BMAP includes an OSTDS Remediation Plan to address the nitrogen contributions from OSTDSs to the river and spring. As part of this plan, DEP estimated the potential reduction credits from upgrading existing OSTDSs to AWTSs or by connecting them to the central sewer system. DEP estimated that for the 11,917 OSTDSs in the two Priority Focus Areas (PFAs) identified in the BMAP, the potential TN reductions that could be achieved range from 77,277 pounds per year (lbs/yr), if all OSTDSs were upgraded, to 112,943 lbs/yr, if all OSTDSs were connected to the central sewer system (DEP, 2018). These estimated reductions are not an allocation and were not assigned to specific stakeholders and should be achieved by meeting statutory requirements for upgrade to an AWTS or connection to central sewer.

As noted in the task 1 report, the JSA team used Florida Department of Health (FDOH) information on OSTDS counts, which were then adjusted using professional judgement in areas where data conflicted with adjacent treatment types. Based on these updated count estimates, there are 2,438 OSTDSs within Leon County's portion of PFA1, which is about 20% of the total number of OSTDSs estimated by DEP in the two PFAs. Therefore, for this study, the JSA team targeted reductions of 20% for the Leon County

OSTDSs within PFA1 from upgrades to AWTSS or connection to the central sewer system. Based on the DEP range of reductions of 77,277 to 112,943 lbs/yr of TN, the range of reductions that Leon County should achieve to meet the TMDL requirements would be 15,455 to 22,589 lbs/yr of TN.

2.1. Target Area TN Reductions

In task 5, the JSA team identified "target areas" for the initial focus on OSTDS retrofits with recommended AWTSS technologies (Figure 2). Target areas were assigned identification numbers, which do not indicate priority. Due to BMAP requirements, all parcels within the PFA are included in a target area with proposed AWTSS to achieve requirements. In addition, all areas within 2,000 feet of existing central sewer are included in a target area.

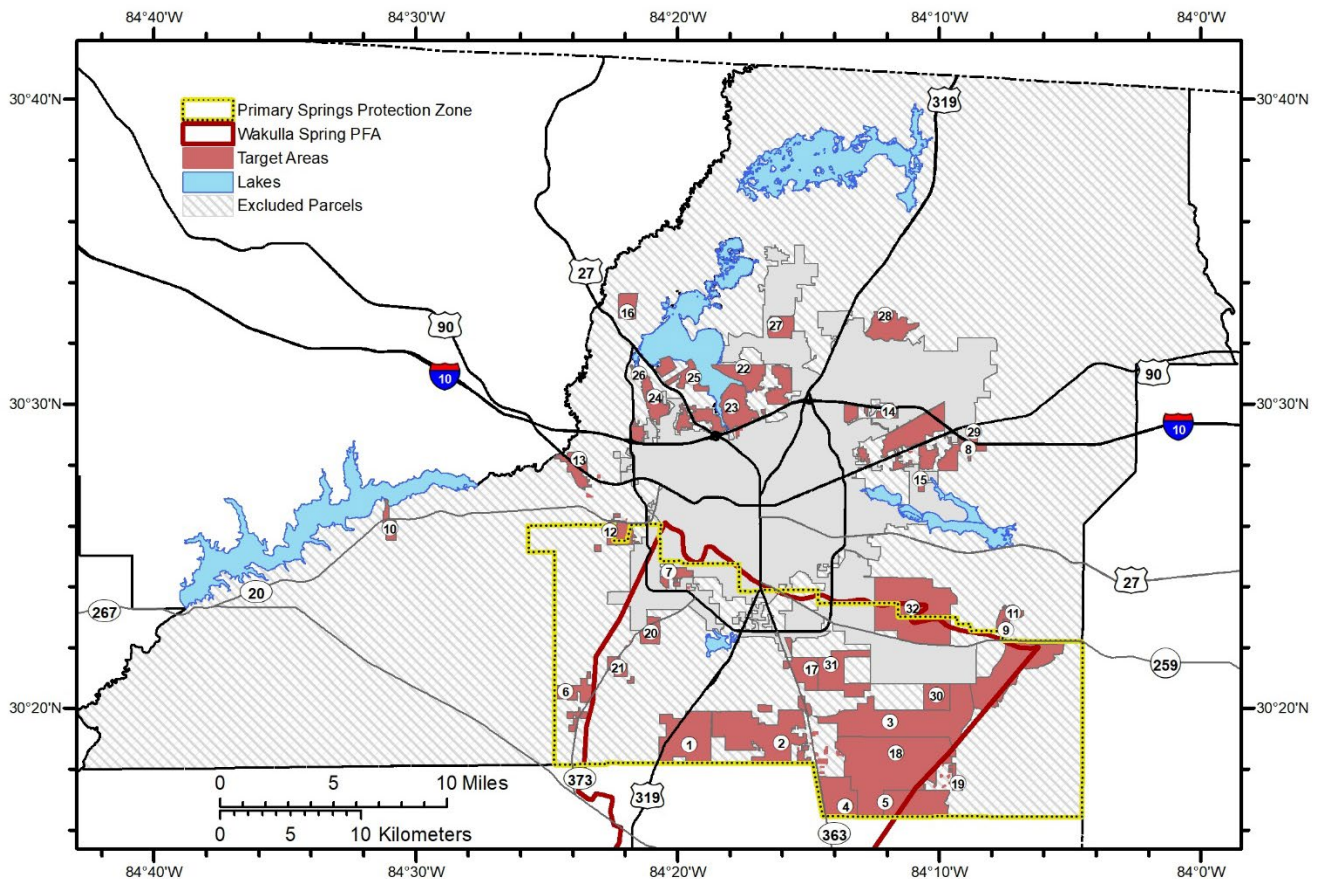


Figure 2. Overview of target areas for AWTSS.

2.1.1. PFA TN Reductions

For each of the target areas within the PFA, the JSA team calculated nitrogen loads from existing OSTDSs in Leon County's portion of the PFA following DEP's methodology used in the Upper Wakulla River and Wakulla Spring BMAP Nitrogen Source Inventory and Loading Tool (Lyon and Katz, 2018) and applying the percent nitrogen reduction from each AWTSS technology shown in Table 1.

In discussions with DEP about this plan, DEP staff confirmed that the TN reduction calculations should be applied in a manner consistent with the approach currently presented in the BMAP, with the understanding that this methodology may change in the future as the BMAP is updated or revised. It should be noted that the BMAP used a 65% reduction compared to conventional OSTDSs ("Base Case" in Table 1) for all AWTSS. In this report, the efficiencies in Table 1 for aerobic treatment units (ATUs),

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performance based treatment systems (PBTs), and in-ground nitrogen-reducing biofilters (INRBs) are based on information from FDOH (2020).

Table 1. Nitrogen load reduction by option, percent relative to OSTDS.

Treatment Option	Percent Nitrogen Reduction		
	Base*	Additional Treatment Relative to Base	Total Treatment
OSTDS (Base Case)	50.0%	0.0%	50.0%
ATU		+80.0%	90.0%
PBTS		+95.0%	97.5%
INRB		+65.0%	82.5%
Central Sewer		+95.0%	97.5%

* Base treatment efficiency includes reductions from the tank, drainfield, and underlying soil consistent with Lyon and Katz (2018).

The reductions for the existing OSTDS parcels within each target area in the PFA are summarized in Table 2 and shown in Figure 3. For the 2,438 parcels within the PFA, an estimated TN reduction of 17,512 lbs/yr could be achieved by implementing the AWTS recommendations. This reduction falls within the BMAP target range of 15,455 to 22,589 lbs/yr of TN as described in section 2.0.

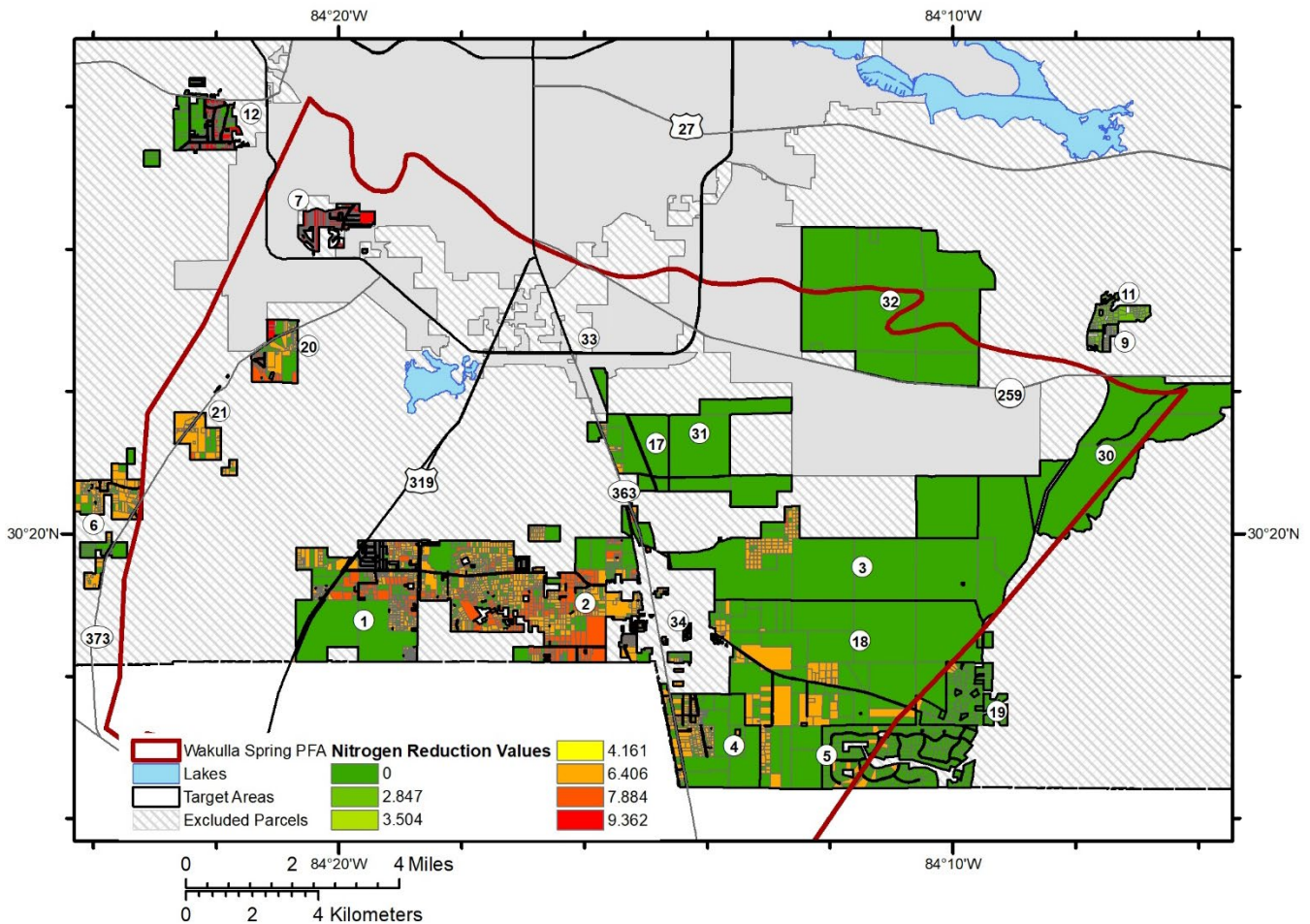


Figure 3. Estimated TN reductions for the target areas within the PFA.

2.1.2. Outside the PFA TN Reductions

For the target areas outside the PFA, the JSA team followed the same calculation methodology as outlined in section 2.1.1 to estimate the TN reductions. There are 7,630 existing OSTDS parcels within the target areas outside the PFA, which could achieve an estimated reduction of 33,353 lbs/yr of TN by implementing the AWTS recommendations. The estimated TN reductions for each target area outside the PFA are summarized in Table 3 and shown in Figure 4.

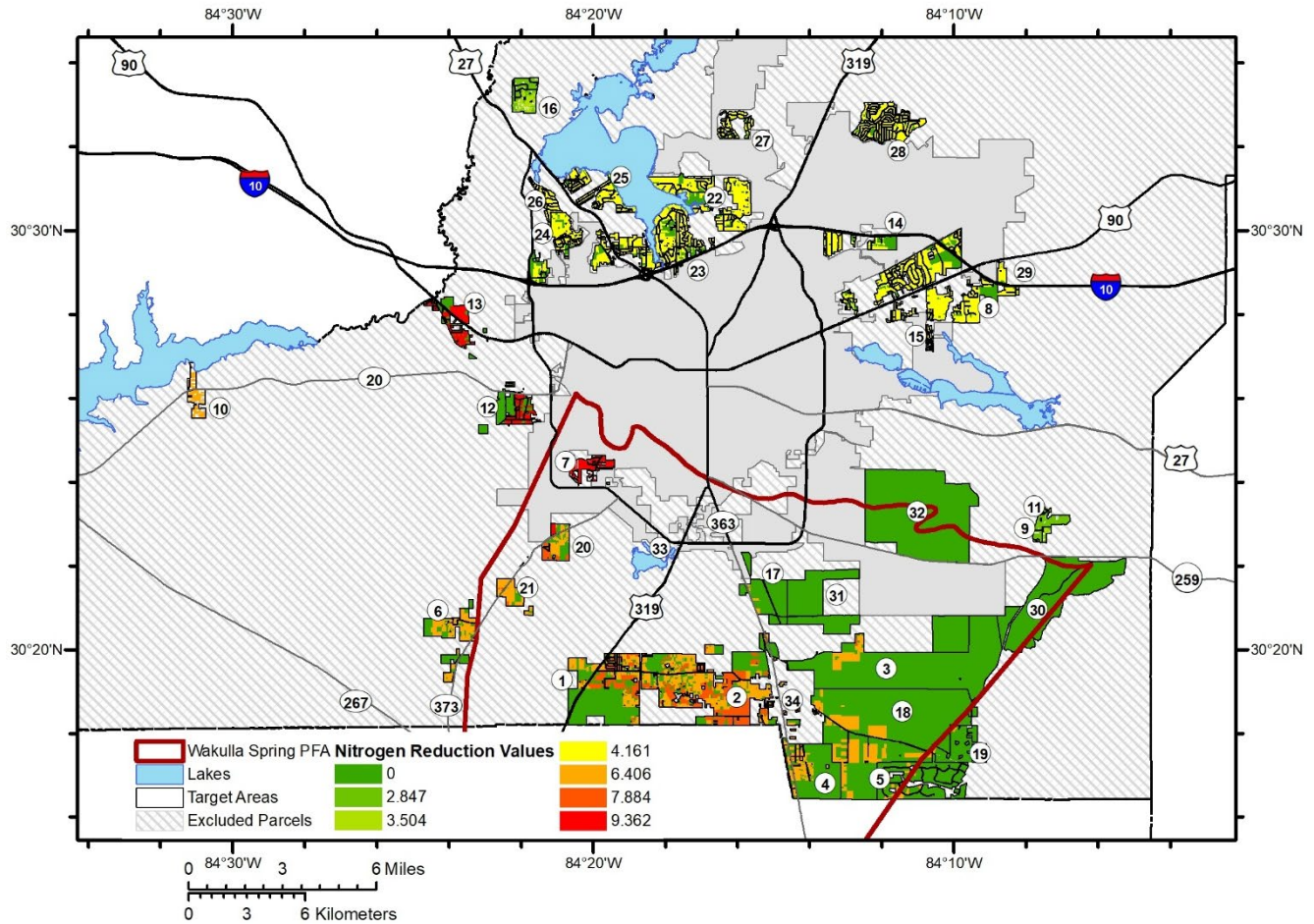


Figure 4. Estimated TN reductions by target area.

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Table 2. Estimated TN reductions in the PFA by target area.

Target Area Number	Target Area Name	Number of OSTDS Parcels	Existing TN Load (lbs/yr)	Future TN Load by Treatment Type (lbs/yr)			TN Reduction (lbs/yr)
				INRB	PBTS/ATU	Sewer	
1	Oak Ridge Road West	643	6,337	917	743	0	4,676
2	Oak Ridge Road East	854	8,416	1,624	755	0	6,037
3	Rhodes Cemetery Road	75	739	245	8	0	486
4	Pine Acres	190	1,872	593	35	0	1,244
5	Tallahassee Ranch Club	16	158	55	0	0	102
6	Spring Hill Trace/Cox Road	114	1,123	386	4	0	733
7	Lake Bradford	156	1,537	0	0	77	1,460
12	Pineridge Estates	60	591	0	0	30	562
18	Natural Bridge Road	25	246	59	16	0	172
20	Lonnie Gray Road	105	1,035	321	24	0	690
21	Robert Golden Road	1	10	3	0	0	6
23	Lakeshore	80	788	148	67	1	572
24	Huntington Estates	45	443	128	16	0	300
-	Not Applicable	74	642	153	11	8	471
Total	-	2,438	23,939	4,633	1,678	116	17,512

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Table 3. Estimated TN reductions outside the PFA by target area.

Target Area Number	Target Area Name	Number of OSTDS Parcels	Existing TN Load (lbs/yr)	Future TN Load by Treatment Type (lbs/yr)			TN Reduction (lbs/yr)
				INRB	PBTS/ATU	Sewer	
8	Buck Lake Woods	1,395	6,110	0	0	306	5,805
9	Kelly Court/Louvenia Woods	75	328	35	46	0	248
10	Nottingham Castle Estates/Tully Estates	90	887	310	0	0	577
11	Kellywood Farms/Powder Horn Woods	106	464	162	0	0	302
12	Pineridge Estates	168	1,656	0	0	83	1,573
13	Geddie Road/Barineau Road	194	1,912	0	0	96	1,816
15	Benjamin's Run	124	543	0	0	27	516
16	Farmview Estates/Box Wood Estates/North Lake Meadows	140	613	0	0	31	583
17	Rhodes Subdivision	284	1,244	210	129	0	905
25	Lake Breeze	597	2,615	0	0	131	2,484
26	Duck Lake Point	1,177	5,155	0	0	258	4,897
27	Rosehill	537	2,352	0	0	118	2,234
28	Killearn Acres	731	3,202	0	0	160	3,042
29	Plantation Forest Drive/Hill North Dale Drive North	325	1,424	0	0	71	1,352
30	Plank Road/Tram Road	84	368	0	0	18	350
31	Lutterloh Pond	1,455	6,373	0	0	319	6,054
32	Verdura Plantation	148	648	0	0	32	616
Total	-	7,630	35,894	718	174	1,649	33,353

2.2. Maintaining Target Reductions in Future Build Out

To maintain the target load reductions in future development within the PFA, it is important that AWTs or central sewer be used in lieu of conventional OSTDSs. Where possible, parcels should be connected to the central sewer system to achieve the highest level of treatment. Where central sewer is not feasible, the most applicable and cost-effective AWTs technology (ATU, PBTS, or INRB) should be used to provide nitrogen reductions.

3.0 Assumptions

The following subsections discuss the assumptions related to the estimated TN reductions to achieve Leon County's portion of the requirements in the BMAP OSTDS Remediation Plan.

3.1. Property Owner Participation Rate

The anticipated property owner participation rate in retrofit activities is difficult to predict. It is likely that the participation rate is a function of grants or subsidies to fund transition from OSTDSs to AWTs or the central sewer system. If transition is fully funded, participation would likely be greater than if transition is partly subsidized or not funded. A state grant and Leon County funding currently cover the costs associated with retrofits; however, these sources may not be available to fully fund retrofits in the future. If the regional economy is healthy and wages satisfy fundamental needs, property owners may be more willing to partly fund transition. If transition is subsidized or not funded, the property owner participation rate is likely a function of cultural value systems and opinions associated with water quality.

The estimated TN reductions provided in section 2.0 assume that all property owners within the PFA participate in either upgrading their existing OSTDSs to AWTs or connecting to the central sewer system to meet statutory and BMAP requirements. Based on recent Leon County septic-to-sewer-projects, the property owner participation rate has varied from 60% to 96% (Table 4). Connections for several of these projects are still underway.

Table 4. Owner participation rates in Leon County septic-to-sewer projects.

Project	Participation Rate
Northeast Lake Munson	60%
Annawood	83%
Belair Phase 1	83%
Woodside Heights	96%
Woodville	61%

Property owner participation rates may be improved through education. Leon County may maximize participation rates in the target areas through a directed campaign to provide guidance to homeowners about the water quality benefits of transitioning to AWTs. Such information could be attached to OSTDS repair permits and could be highlighted in within-district newsletters from the County Commissioners.

3.2. Conventional OSTDS Failure Rate

FDOH has been gathering information on domestic wastewater disposal methods throughout the state since 2014. FDOH used this information to create the Florida Water Management Inventory. The inventory for Leon County was last updated in October 2017 using parcel data from the 2016 tax assessment and the latest information from FDOH's Environmental Health database (FDOH, 2017). The inventory notes which parcels are known, likely, or somewhat likely to be served by septic systems, and provides information on construction, new, and repair permits. Based on the repair permit information, the septic system failure rate within Leon County is 19.5%. It is likely that there are more OSTDS failures than have been reported through the repair permits so the failure rate is likely higher. Additionally, 15.6% of the permits are noted as "predates 1998," which could indicate a higher likelihood of failure potential. The estimated TN

reductions in provided section 2.0 assume that upgrading the existing conventional OSTDSs to AWTSSs or connecting them to the central sewer system would help to reduce this failure rate and, therefore, reduce the introduction of additional nitrogen loading to the groundwater.

3.3. Reductions from Management of Conventional OSTDS

When properly sited, maintained, and operated, conventional OSTDSs are a safe means of disposing of domestic waste. However, conventional OSTDSs are not designed for nutrient removal, so even properly functioning systems will contribute high nitrogen concentrations to the system. Managing existing conventional OSTDSs to prevent failure will minimize additional nitrogen loading; however, the large nitrogen reductions needed to achieve the BMAP requirements cannot be achieved by proper management of conventional OSTDSs alone. Therefore, existing OSTDSs within the PFA must be retrofitted to AWTSSs or connected to the central sewer system.

3.4. Technology Performance

The use of AWTSSs within Florida is still fairly new, but these technologies are becoming more common, especially in areas around Outstanding Florida Waters that must meet the requirements of the Florida Springs and Aquifer Protection Act. Several approved ATU and PBTS models are on the market and have been used in Florida for years. INRBs are newer systems that are currently being tested throughout Florida, including within Leon County.

The estimated TN reductions in presented in section 2.0 are calculated using the best currently available information about AWTSS performance. As these systems are more widely used and tested throughout Florida, better information about their performance will become available. Adjustments to the recommended technology for some of the target areas may be needed in the future based on this newer information.

4.0 Phasing to Achieve BMAP Reductions

The AWTSS upgrades in the PFA target areas can be evenly distributed between now and the end of 2040 to help spread out the costs for meeting the BMAP requirements. This would result in an average of 132 OSTDS retrofits per year over the next 18.5 years. The retrofits should start in target areas 2 and 1, which combined are 62% of the existing OSTDS parcels within the PFA. The next target areas would be 4, 7, 6, and 20, which make up an additional 23% of the existing OSTDS parcels within the PFA. The remaining parcels in target areas 23, 3, 12, 24, 18, 5, and 21, plus several parcels outside a target area but within the PFA, should then be retrofitted.

There are several technical and physical constraints for implementing these phasing recommendations that could affect the timing to achieve the BMAP target reductions.

- **Owner participation** – As noted in section 3.1, the estimated reductions in this report are based on 100% implementation, which would require that all property owners within the PFA upgrade their conventional OSTDSs to AWTSSs or connect to the central sewer system. Without full participation, the total estimated reductions cannot be achieved, and additional target areas may need to be retrofitted to meet BMAP requirements to make up the difference.
- **Funding availability** – Owner participation is related to funding availability. If grants or other subsidies are available to help offset all or part of a property owner’s cost to retrofit their existing OSTDSs to AWTSSs or connect to the central sewer system, it is more likely that property owners will participate. In addition, funding will be needed for regional infrastructure for the cluster systems and central sewer system expansion. Without outside funding from state and/or federal sources, it will be difficult to achieve the BMAP reductions within the 20-year timeline.

- Technology feasibility – As noted in section 3.4, the estimated reductions are calculated using the efficiencies in Table 1. These efficiencies are based on the best information currently available. If any of the technologies are less efficient than estimated, alternative technologies may need to be used in a target area and/or additional target areas may need to be retrofitted to meet the BMAP requirements.
- Future development – As development continues within the PFA, the recommendations in section 2.2 must be implemented to reduce the amount of nitrogen loading associated with that new development. It is important that future development use nitrogen-reducing systems, instead of conventional OSTDSs, to prevent new nitrogen-loading sources to the river and spring.

If additional reductions are needed to meet BMAP requirements, transition to AWTSS within the target areas closest to the PFA will likely become a requirement, and these areas should be prioritized for retrofit after the PFA target area retrofits are completed.

For target areas outside the PFA that are not needed to meet BMAP reductions, the plan recommendations can be implemented as opportunities arise and funding becomes available. The phasing for the target areas recommended for sewer connection should follow the timing in the City of Tallahassee 2035 Master Sewer Plan Update (Hatch Mott MacDonald, 2016).

5.0 References

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