

An Evaluation of Nutrient Sources and Potential Nutrient Reduction Projects for Poe Spring



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Project Goals

1.

Evaluate existing data and literature to identify nutrient sources within Poe Spring springshed

2.

Prioritize areas for nutrient reduction and stormwater management projects

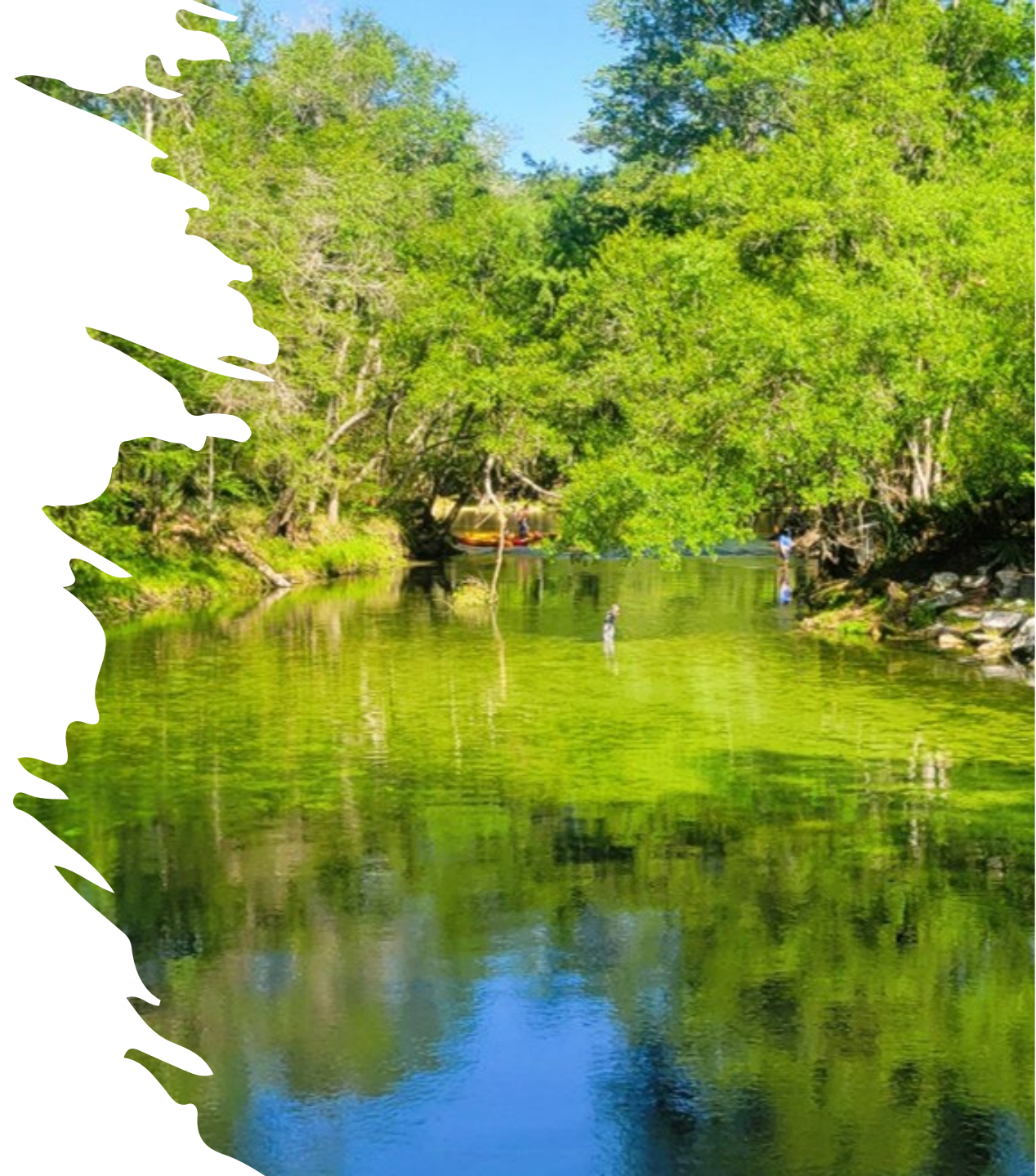
3.

These projects will help protect the spring from degradation and maintain this high-quality public resource

Background

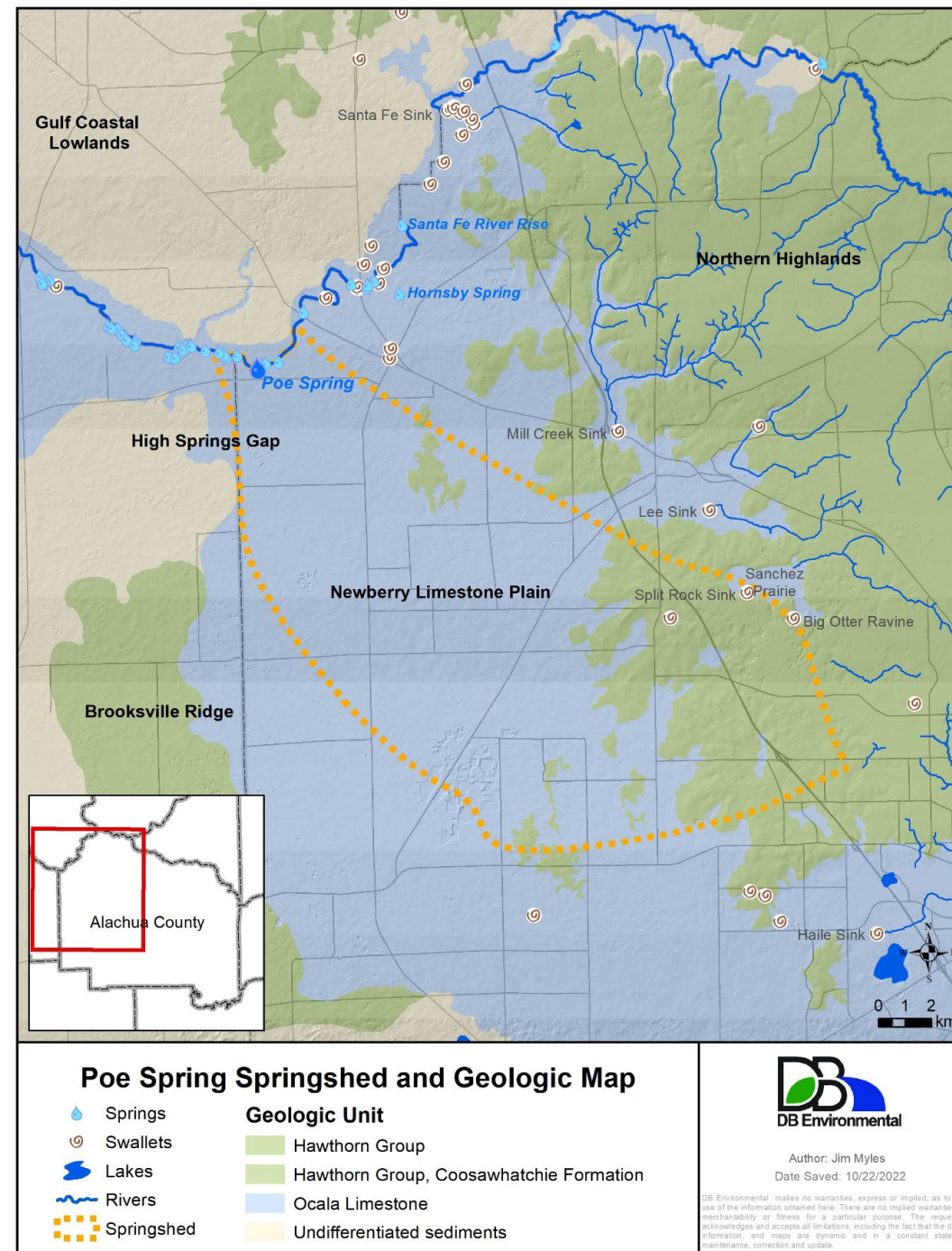
Literature Review

- All available datasets, the Santa Fe River TMDL, BMAP, and many other relevant literature.
- Together these provided a synthesis of information most relevant to Poe Spring protection and restoration.
- Potential loading of nitrogen (N) and phosphorus (P) from both OSTDS and stormwater were reviewed, particularly stormwater inputs from controllable sources encompassing developed land uses.



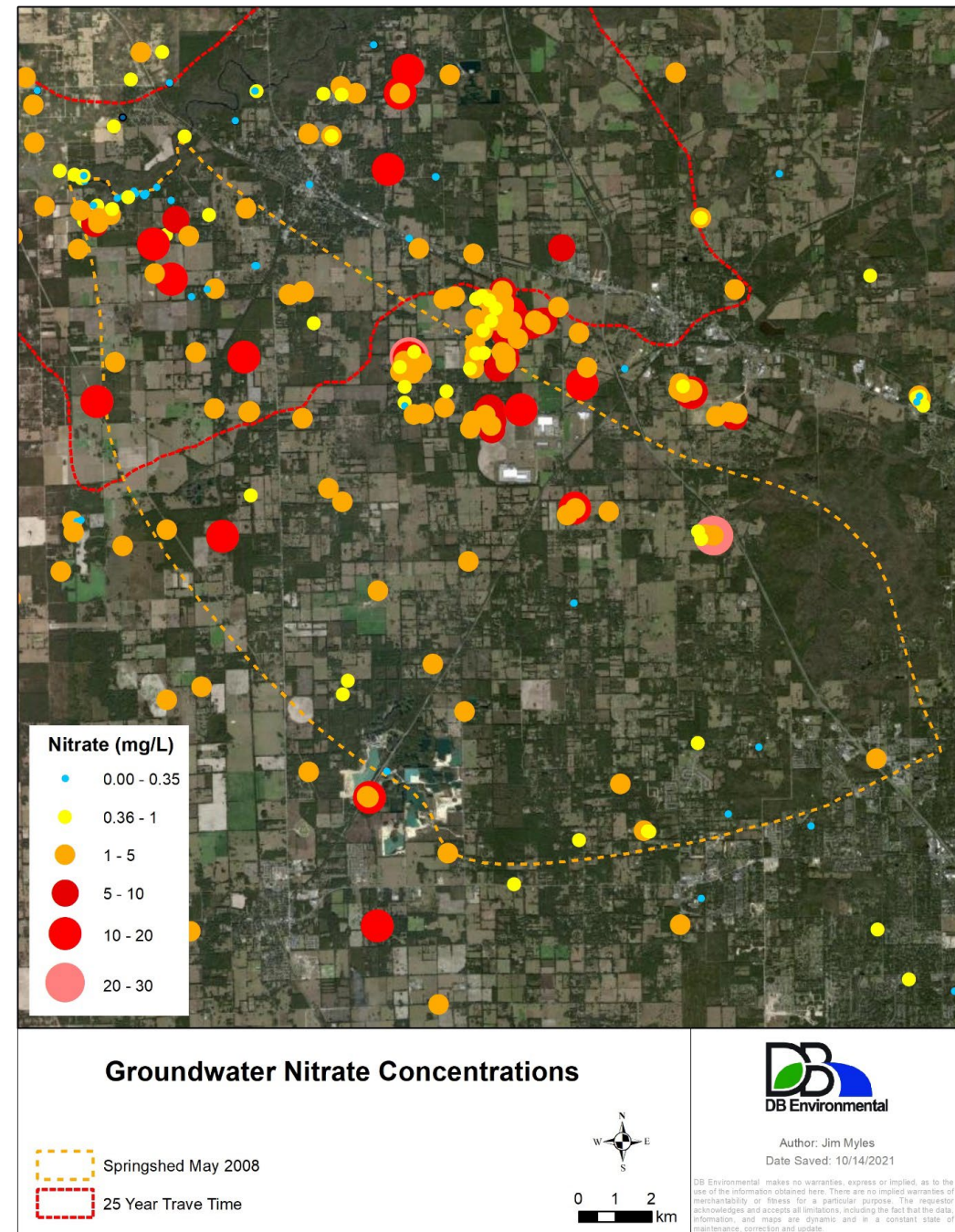
Springshed

- Three springshed delineations have been completed, but overall extent is still unknown
- Though Poe Springs is not within the Priority Focus Areas (PFAs), Alachua County ordinances exist to reduce nutrient pollution to groundwater outside of the PFAs
- The water quality protection and stormwater management ordinances along with the new septic tank upgrade program will help address the nutrient load



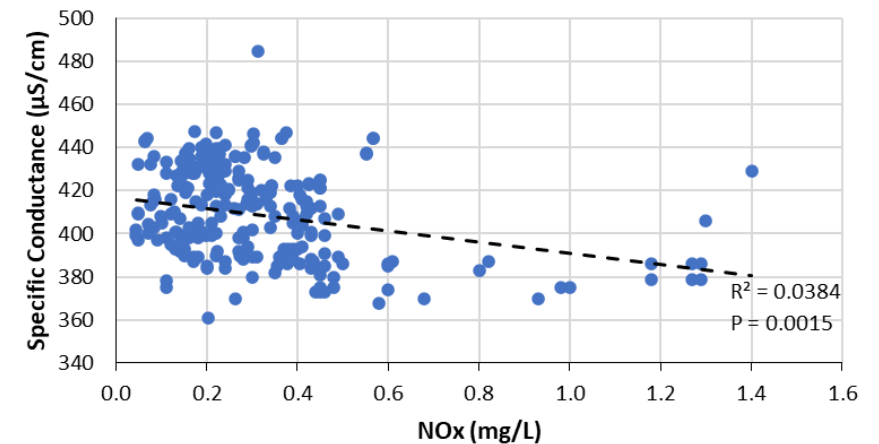
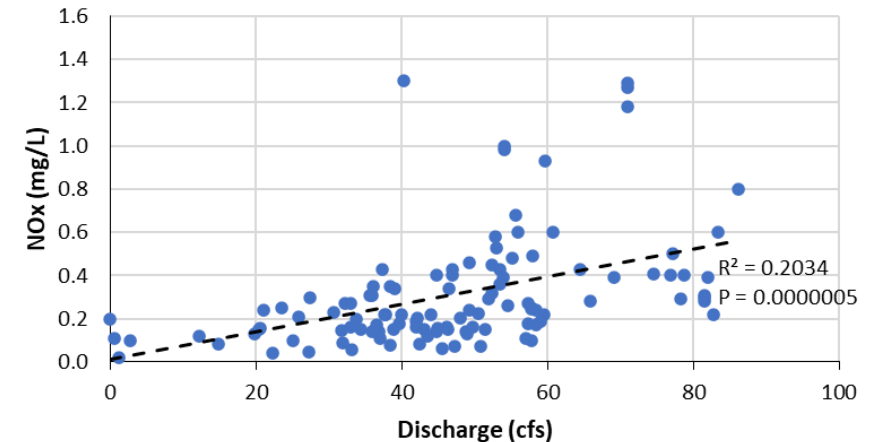
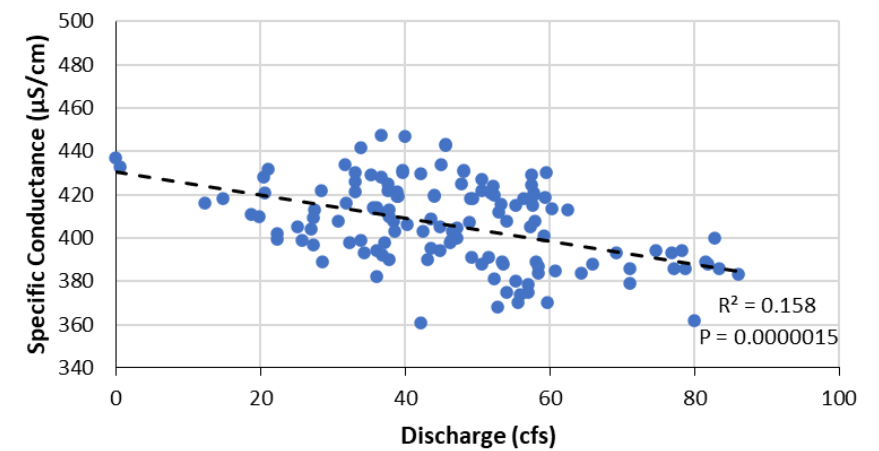
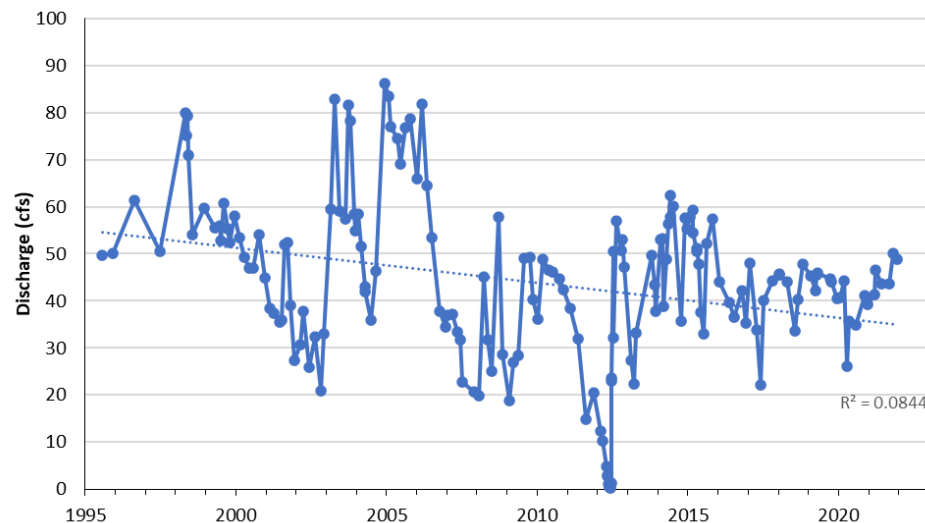
Nitrate Load

- Nitrate load in the Suwannee and Santa Fe Rivers has significantly increased between 1979 and 2005 (Hornsby 2007)
- According to the BMAP the total load reduction is **1,853,372 lbs-N/yr** at the PFA spring vents to meet the requirements within 20 years (FDEP 2018)
- NSILT analysis of PFAs suggested farm fertilizer represented the largest load of TN to groundwater, however Poe was not included
- During the FDEP evaluation period for the Santa Fe River TMDL (2000-2007), nitrate concentrations in Poe Spring did not exceed 0.35 mg/L and it therefore was not considered impaired by excessive nitrate



Nitrate Levels and Discharge

- 269 WQ samples reported from Poe Spring since 1997
 - Mean Nitrate concentration of 0.29 mg/L
 - Overall, the trend in total discharge from spring is downward
- Periods of elevated nitrate levels (>0.35 mg/L) coincided with elevated spring discharge following large rain events
- WQ and isotopic evidence of denitrification in Poe Spring may explain the relatively low NOx concentrations observed there
- Low conductivity, high nitrate surface water may be contributing significantly to total nitrate discharge from Poe Spring



Existing Springs Restoration Strategies

Strategy Components

Flow

- Flow restoration and consumptive use within the springshed was not assessed as part of this study

Water Quality

- Existing nutrient reduction strategies within BMAP focused on:
 - Policies to promote BMPs when using farm fertilizers and handling livestock and dairy waste
 - Policies to reduce sports turfgrass and urban turfgrass utilization
 - Upgrading wastewater treatment facilities along with enhancing OSTDSs or converting them to sewer systems

Current Projects

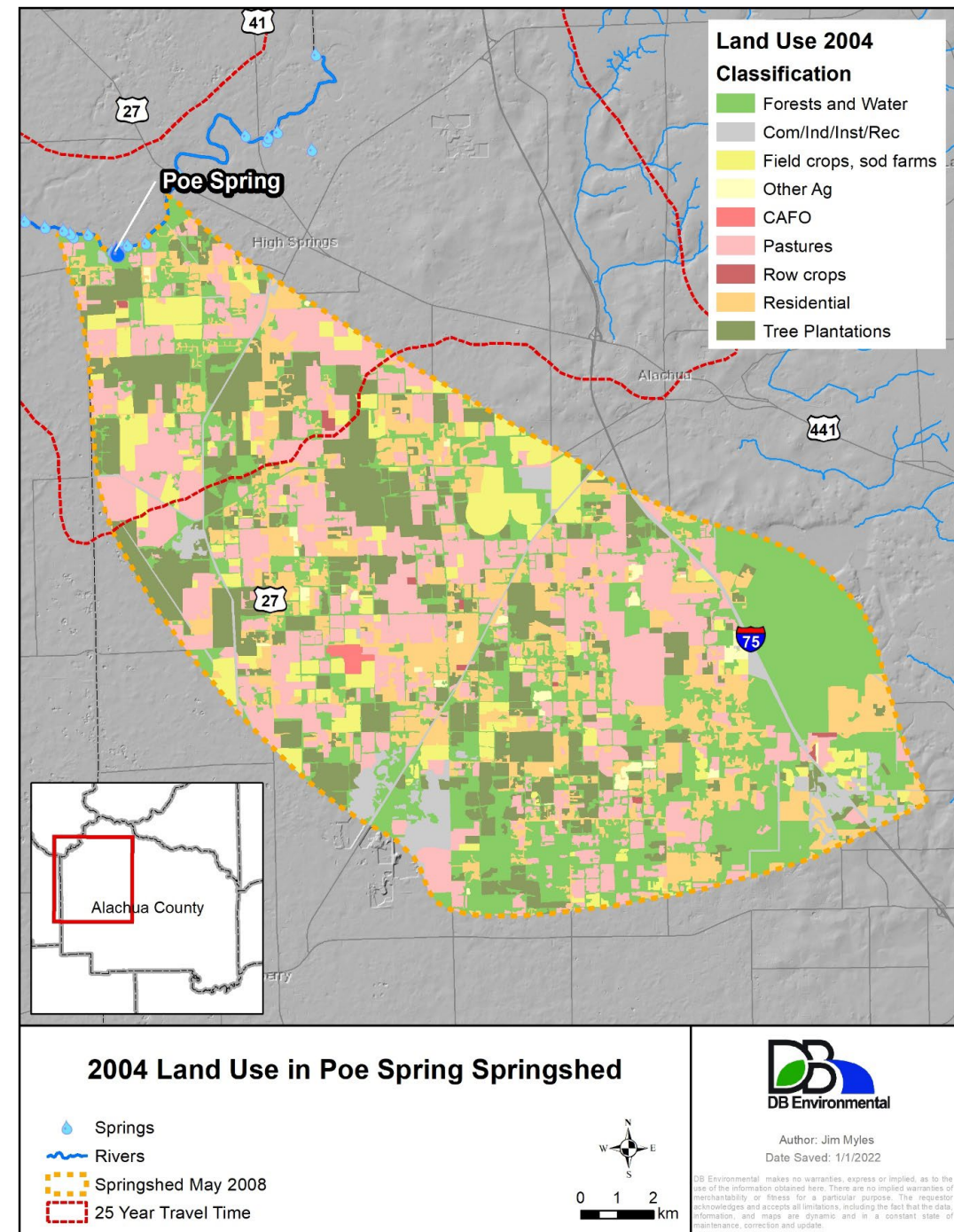
- Two current projects in the BMAP that occur within the Poe Spring springshed
 - The Poe Spring Domestic Sewage Infrastructure Upgrade (Project Number AC-01)
 - Anticipated to reduce nitrogen loads by **2,599 lbs-N/yr**
 - City of High Springs WWTF Infiltration Wetlands (Project Number HS-01)
 - Anticipated to reduce nitrogen load by **1,753 lbs-N/yr**
 - Total reduction of nitrogen loading within the Poe Spring springshed - **4,352 lbs-N/yr**
- While agriculture and septic systems were identified as primary controllable sources, stormwater runoff from developed areas are another source the County can address.
- To reduce N loading to Poe Spring, the county should focus on strategies to identify vulnerable areas within the springshed

Proposed Springs Restoration Strategies

Potential Nutrient Reduction Projects

Land Use Loading Models

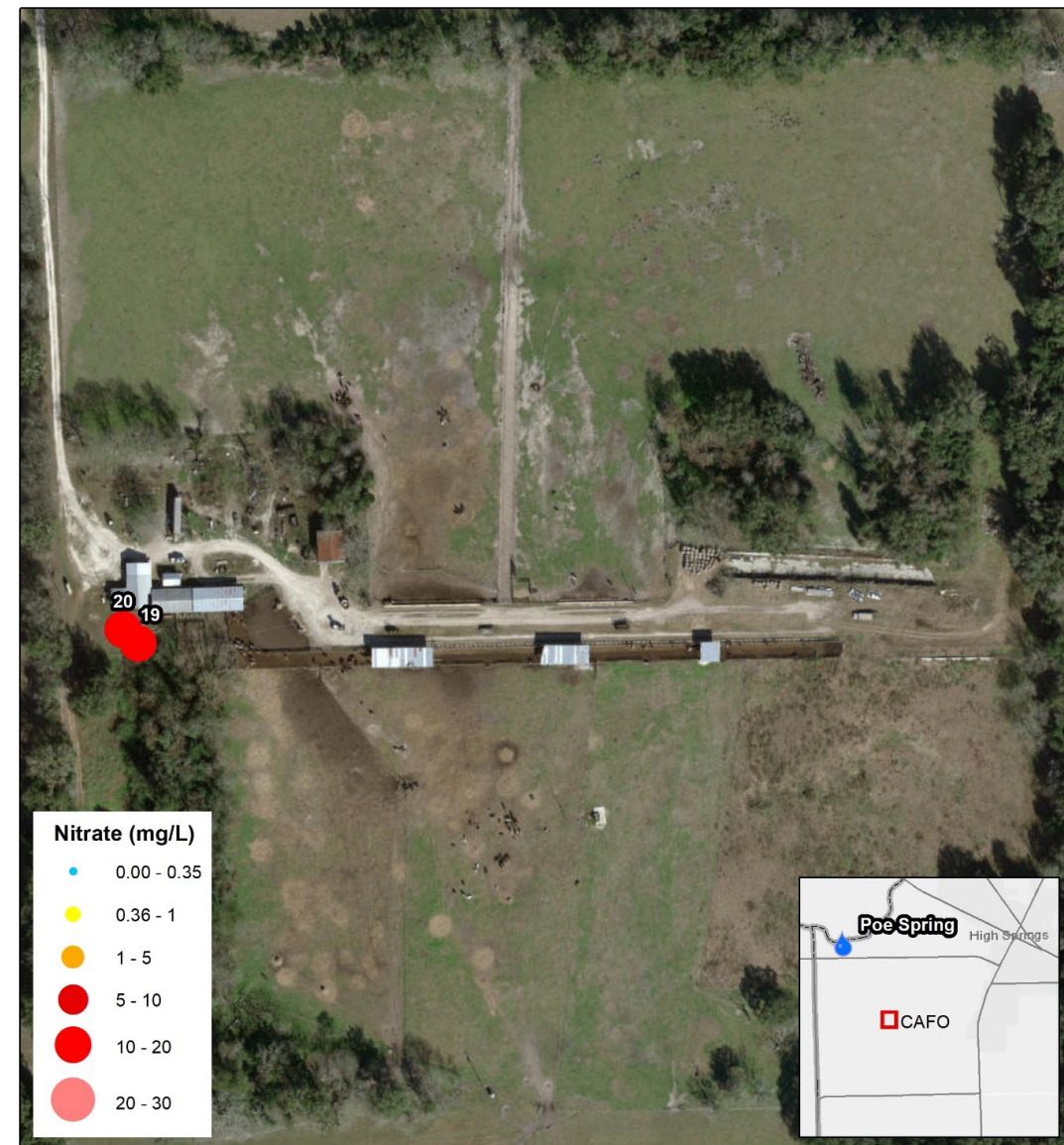
- Two land use models have been developed to estimate nutrient sources within the springshed:
 - **AMEC GIS model (Tucker and Arenberg 2013)** - last run using 1995 and 2004 Land Use data
 - **NSILT model (Eller and Katz 2017)**
- The updated land use data can be used in either model to determine recent nitrate loading in the springshed
- Most recent available Land Use and Land Cover datasets
 - **SRWMD** - includes estimates of land use and land cover from 2010
 - **FDEP** - using imagery from 2019 and 2020 (FDEP 2022)



Potential Nutrient Reduction Projects

Nitrate Plume Investigations

- Nitrate concentrations variable well-to-well across Poe Spring springshed.
- Wells near hot spots of nitrate could be identified and sampled to determine extent of plumes.
- Agricultural producers in these areas with extremely high concentrations of nitrate (~20 mg/L) may be eligible for grant funding to implement more aggressive nutrient management strategies



Groundwater Nitrate Concentrations
at a Cattle Feeding Operation

0 20 40
m



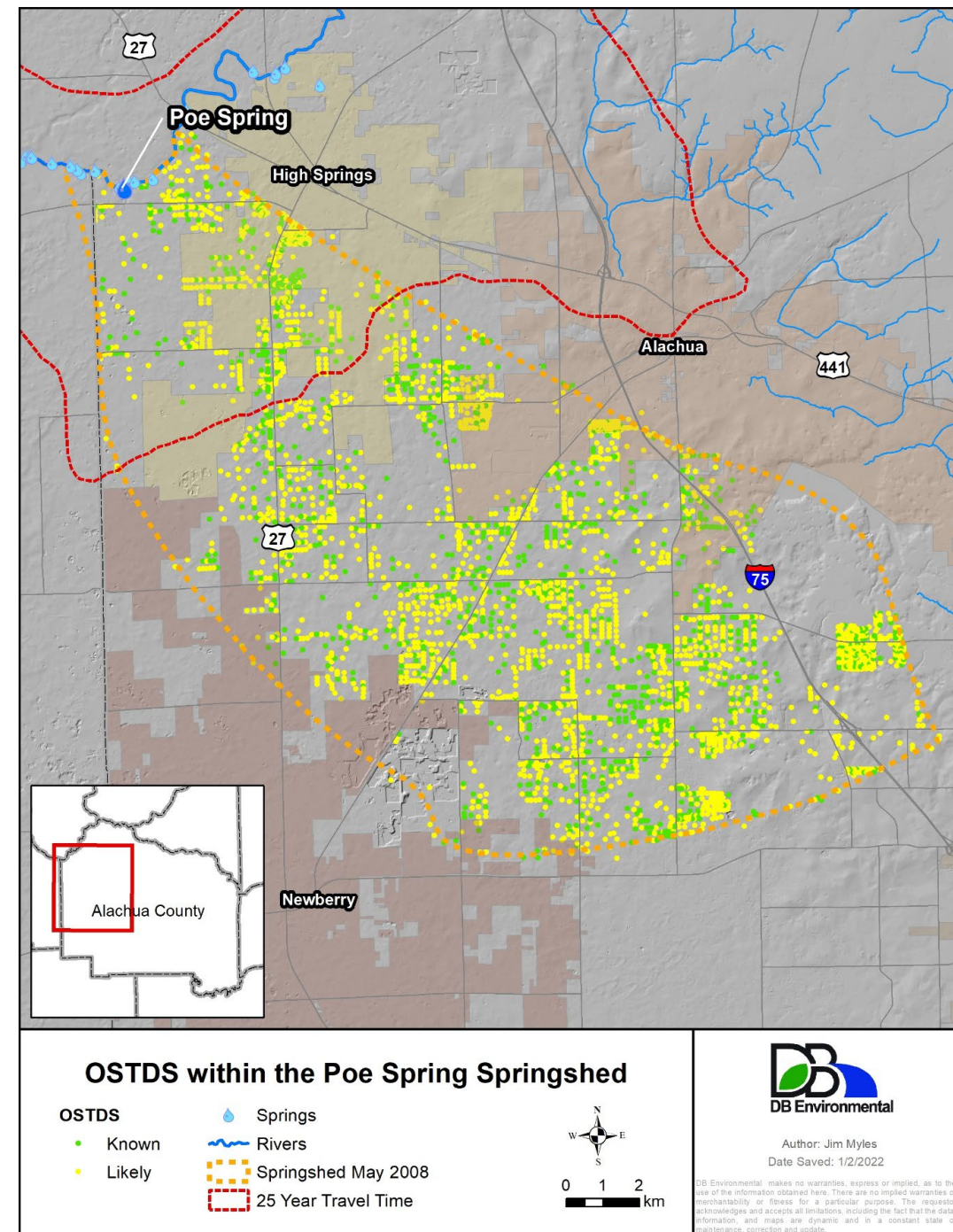
Author: Jim Myles
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Potential Nutrient Reduction Projects

OSTDS

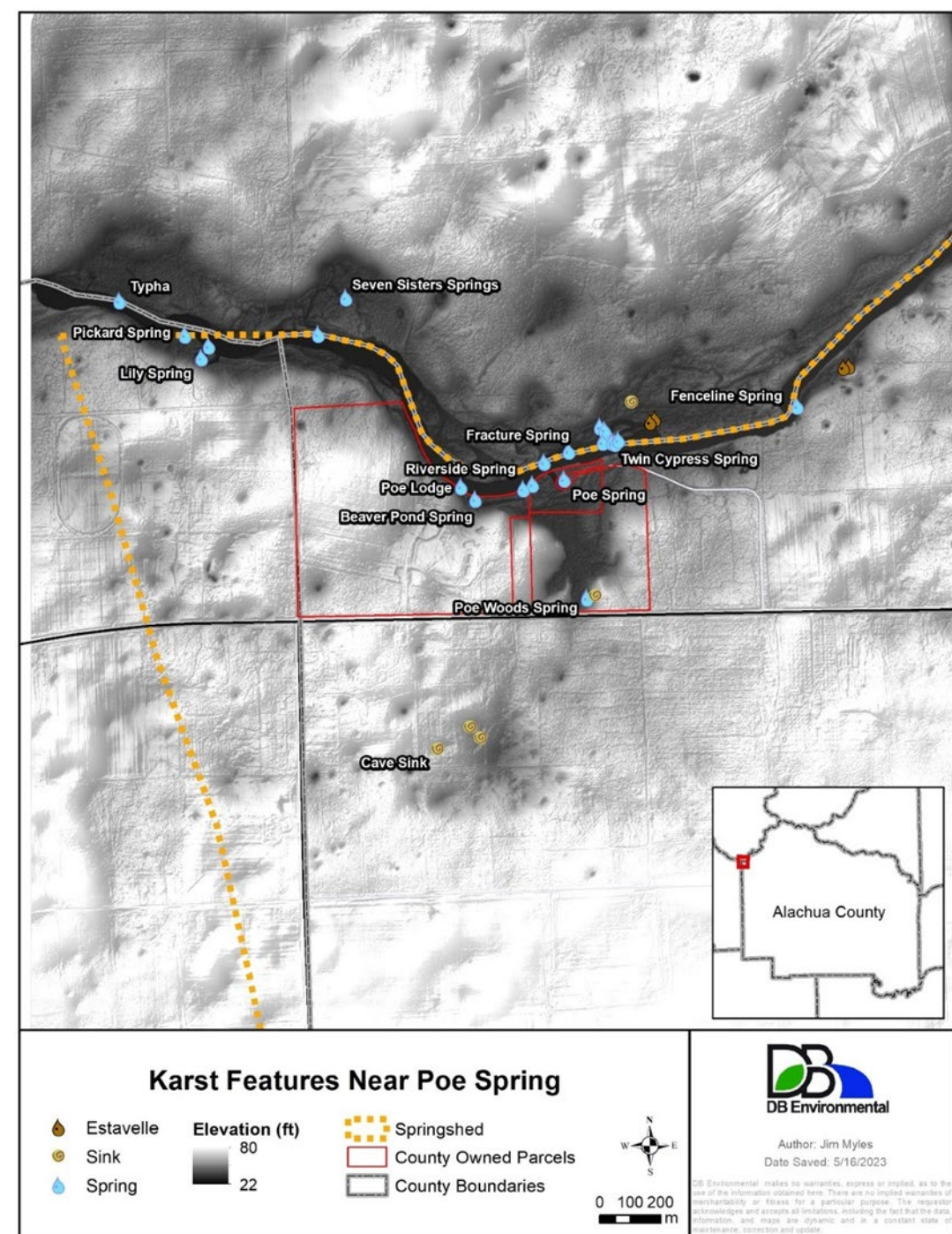
- Potential projects to determine impact of septic systems upriver of Poe Spring:
 - Dye trace study
 - Detailed sampling of Poe Spring and groundwater
- Previous nutrient source evaluation done by ACEPD in 2014 (ACEPD 2014a)
- Wastewater tracers include nutrients, ions, nitrate isotopes, organic wastewater compounds, pharmaceuticals, and microbiological indicators
- With sufficient evidence, SRWMD may be more inclined to fund upgrading systems to mitigate impact



Potential Nutrient Reduction Projects

Land Conservation

- The County should consider purchasing the agricultural lands immediately upgradient (South) of Poe Spring for conservation and conversion to longleaf pine habitat
- This property contains a closed depression which is a primary recharge area as well as several karst features (Butt et al. 2015).
- The property was subsequently nominated for acquisition, but additional support and funding from SRWMD are necessary
- Applying for grant funding from the SRWMD should be completed in the next phase of this project
- Identifying and prioritizing other parcels containing closed depressions and sinkholes should also be completed



Potential Nutrient Reduction Projects

Agriculture

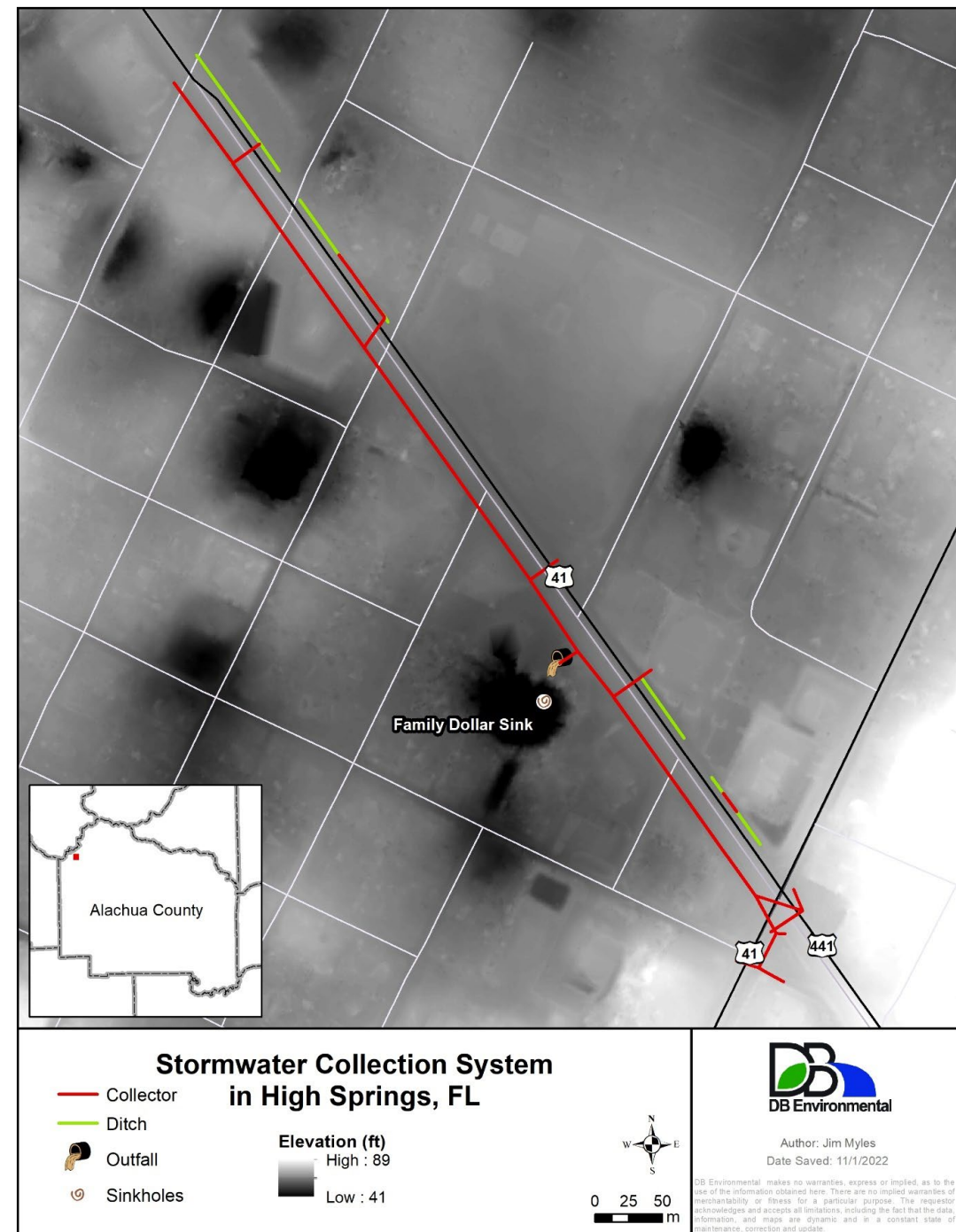
- FDACS should ensure producers are enrolled in BMPs and have signed a NOI
- Of special interest is the AFO located just 1.6 miles from the spring
- County could explore possibilities for grant funding to treat nitrate contaminated groundwater at this and other similar operations.



Potential Nutrient Reduction Projects

Stormwater

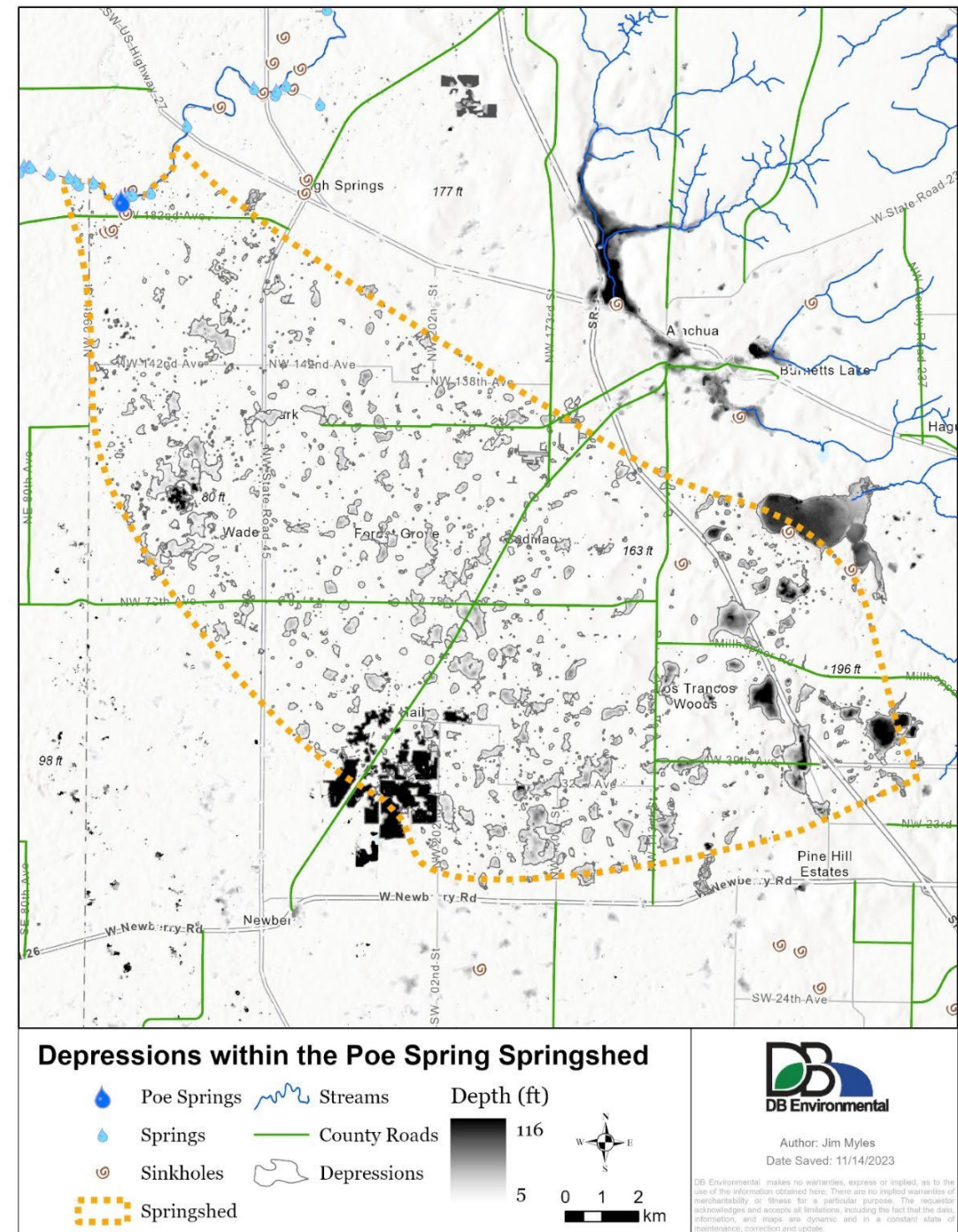
- The Alachua County Stormwater Treatment Manual (Alachua County 2018) does not address existing stormwater discharges
- Focus on identifying stormwater discharges directed toward karst features
- By identifying the stormwater infrastructure and modeling of the digital elevation model (DEM).
- Then designs for reducing N loads from untreated stormwater can be completed



Scope of Work

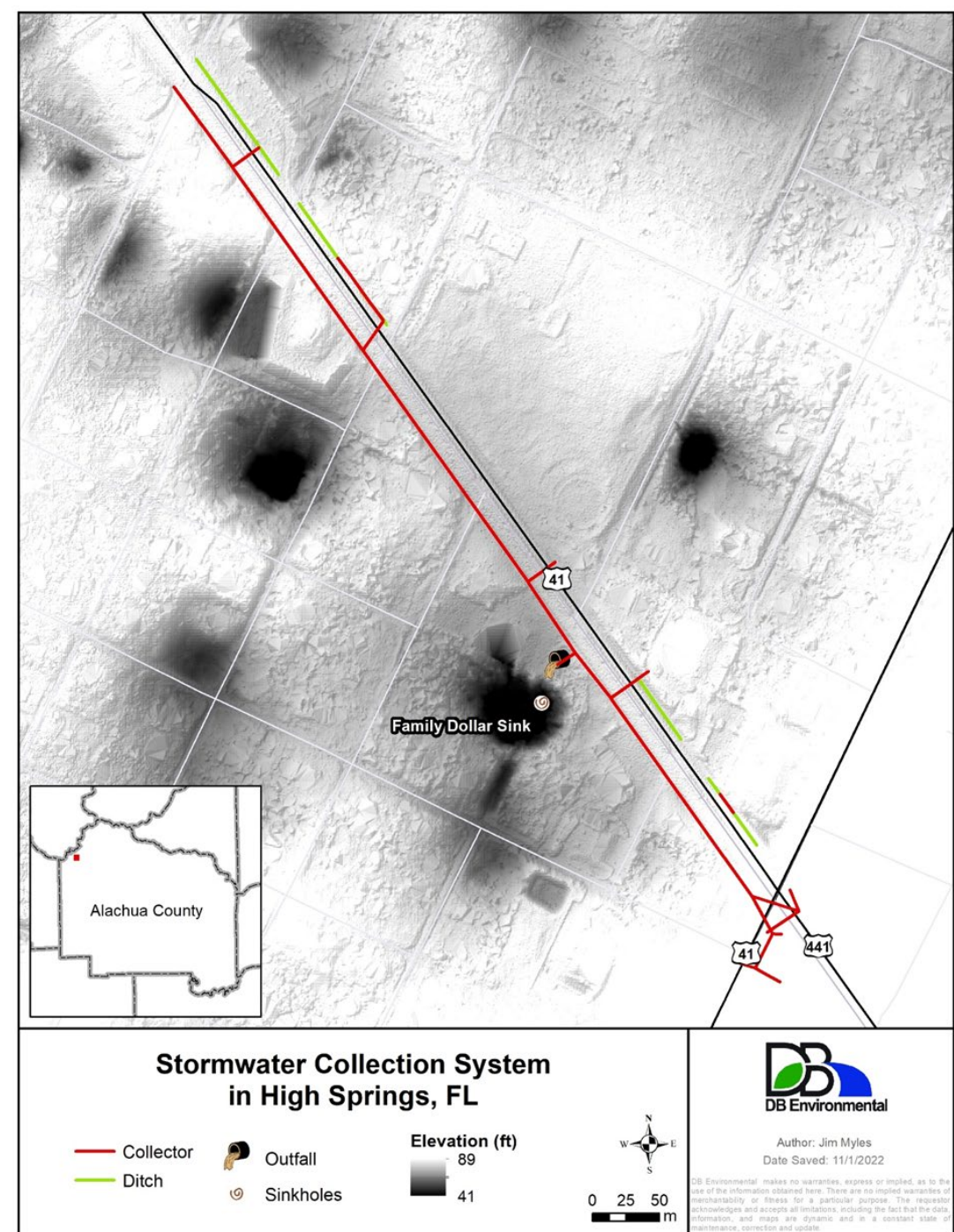
Task 1 – Evaluation of Stormwater Sources

- Identifying Stormwater Infrastructure
 - Culverts, Flow Paths
 - Integrate FDOT Geodatabase
 - Identify Stormwater Basins
- Recondition the DEM to create a hydrologically correct elevation model
- Identifying all closed depressions in the springshed
- Assess the vulnerability of closed depressions based on recently published land use data for the SRWMD (FDEP 2022)



Task 1 – Evaluation of Stormwater Sources

- Model flow path and watershed of these sinks and other Stream-to-Sink Basins like Blues Creek and Turkey Creek
- Previously identified sinks:
 - Karst Features Near the Spring
 - Family Dollar Sink
 - City Hall Sink
 - US 27 and NW 172nd Avenue Sink



Questions



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