PROJECTS TO
REDUCE NUTRIENT LOADING TO NEWNANS LAKE
FROM LITTLE HATCHET CREEK AND GUM ROOT SWAMP

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for

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2012 aerial photo showing location of Newnans Lake in relation to City of Gainesville, Little Hatchet Creek at the Gainesville airport, and Gum Root Swamp.

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CONTEXT

Water Quality in Newnans Lake

Newnans Lake is a shallow 6,600-acre lake in Alachua County, Florida. Newnans Lake was naturally nutrient-rich for thousands of years, perhaps due to the rich source of phosphorus in the Hawthorn Formation, a geologic layer at or near the surface in much of the lake's watershed (Odum 1953; Brenner & Whitmore 1998; Di et al. 2012). Over the last several decades, however, water quality in Newnans Lake has significantly declined, and the naturally clear tea-colored lake has turned turbid and green with microscopic algae.

The State of Florida considers Newnans Lake to be a Class III water body whose designated uses are recreation and propagation and maintenance of healthy well-balanced fish and wildlife populations. Water quality in Newnans Lake does not meet state standards due to excessive nitrogen and phosphorus that feed growth of microscopic algae in the lake water (Gao & Gilbert 2003). From 1995 through 2013, concentrations in Newnans Lake of total nitrogen (TN), total phosphorus (TP), and chlorophyll - a measure of algae in the water - were 3 to 4 times higher than state standards (FDEP 2014).

Current Sources of Nutrients in Newnans Lake

Degraded water quality in Newnans Lake is due to ongoing runoff of nutrients and sediments from the watershed into the lake, and perhaps to nutrient release from lake sediments.

According to FDEP's 2003 analysis of Total Maximum Daily Loads (TMDLs) for Newnans Lake, 26% of the TN and 35% of TP load is from the watershed and a point source (Gao & Gilbert 2003). FDEP's TMDL report recommended that watershed nutrient loads be reduced by 74% for TN and 59% for TP (Gao & Gilbert 2003).

Six years later the St. Johns River Water Management District (SJRWMD) published an analysis of Pollutant Load Reduction Goals for Newnans Lake, which included a longer period of data as well as baseflow and stormflow data from previously unsampled sites (Di et al. 2009; Lin 2009). SJRWMD agreed with FDEP on the target trophic state for Newnans Lake and that external nutrient loads need to be significantly reduced - by 66% for TN and 48% for TP.

Nutrients of concern in Newnans Lake are both phosphorus and nitrogen. FDEP's TMDL analysis indicated that growth of microscopic algae in Newnans Lake had gradually shifted from being co-limited by both nitrogen and phosphorus, to being limited only by phosphorus (Gao and Gilbert 2003). SJRWMD's PLRG analysis also indicated nitrogen and phosphorus co-limitation of algae growth in Newnans Lake, but with nitrogen limitation during some periods (Di et al. 2009). Therefore, both nitrogen and phosphorus need to be reduced in Newnans Lake to reduce the growth of algae and improve water quality.

Management Plans for Newnans Lake

There are 3 current management plans to improve water quality in Newnans Lake, all developed with input from stakeholders. In accordance with the Florida Watershed Restoration Act, the Florida Department of Environmental Protection (FDEP) convened the multi-stakeholder Orange Creek Basin Working Group, which developed a management action plan to restore water quality in Newnans Lake and other impaired water bodies to state standards (FDEP 2008). The

2008 Orange Creek Basin Management Plan (OCBMAP) contains 28 projects for improving water quality in Newnans Lake or its tributaries. In 2014 FDEP updated the 2008 OCBMAP based on input from the same working group (FDEP 2014). The 2014 OCBMAP contains 11 projects for improving water quality in Newnans Lake or its tributaries

In 2011 the St. Johns River Water Management District (SJRWMD) developed the Orange Creek Basin Surface Water Improvement and Management (SWIM) Plan with input from various basin stakeholders (Lippincott 2011). The SWIM plan contains over 20 projects for monitoring, diagnosing, or improving water quality in Newnans Lake and its tributaries.

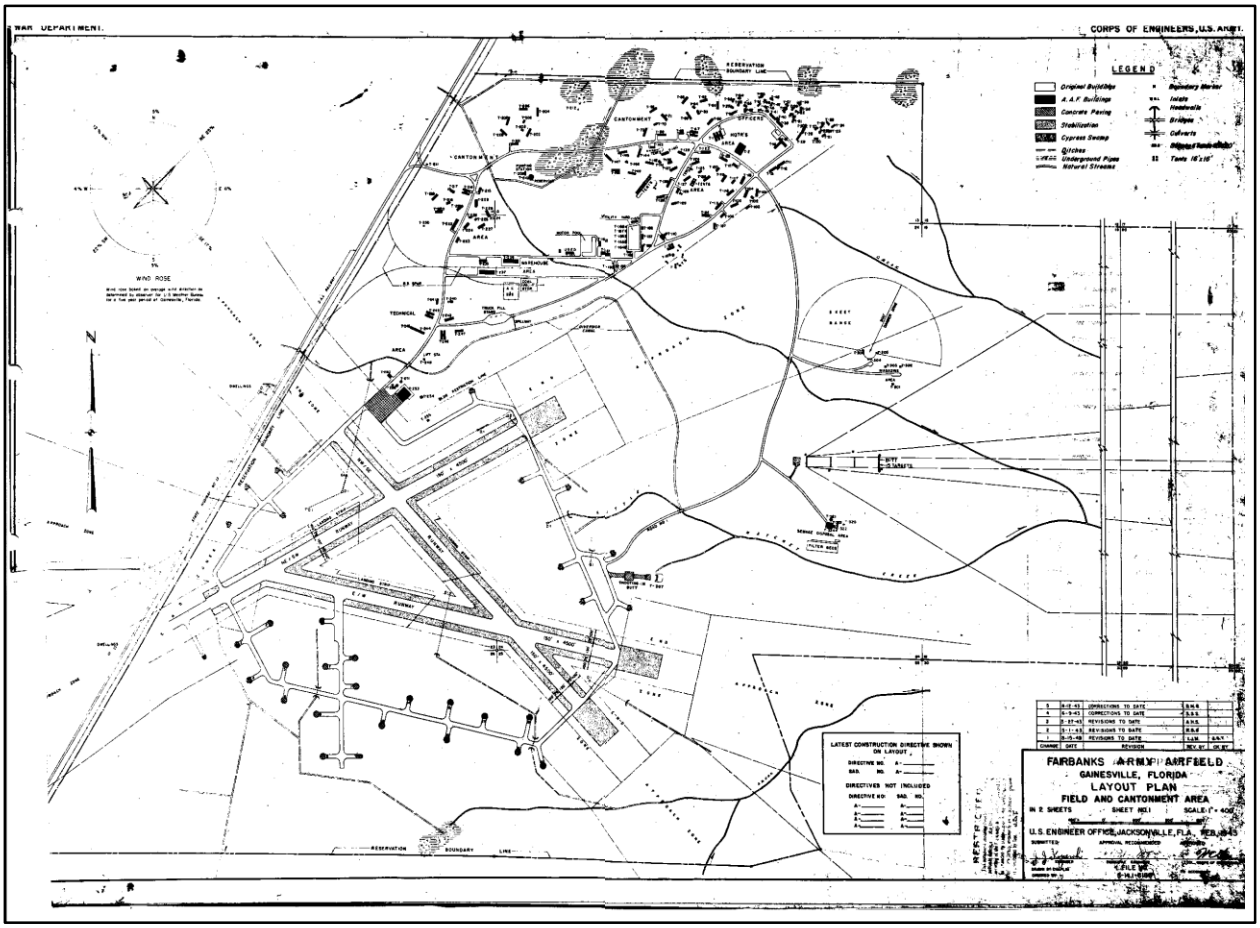
Geography and Hydrology of Little Hatchet Creek

Little Hatchet Creek originates in a watershed north and east of Gainesville, flowing to where it passes through a culvert under Waldo Road (SR 24). This is the location of a permitted discharge of treated wastewater from the Brittany Estates manufactured home community. From this point on, Little Hatchet Creek was rerouted into a "diversion canal" in the early 1940s for construction of runways at the Gainesville airport (see box insert).

Little Hatchet Creek is now a steep-sided ditch as it flows through the airport property and into downstream wetlands. Ditch banks are high (13 to 20 feet), steep and unstable, with a scoured streambed of exposed sandy clay, likely due to high volumes and velocities of rainwater runoff from impervious surfaces on the airport and adjacent industrial park (ACEPD 2007). After the airport, Little Hatchet Creek runs into Gum Root Swamp, a 500-acre forested wetland, before flowing to Newnans Lake via at least 3 flow paths, as shown in the map below.

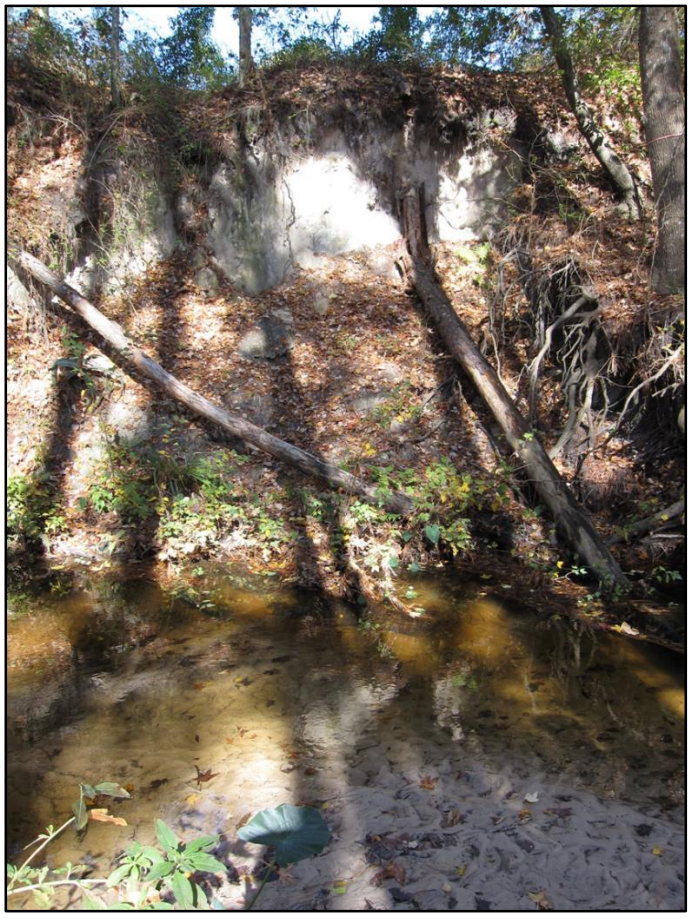
Little Hatchet is an intermittent stream, with little or no flow in dry seasons. Where it flows across the Gainesville airport, Little Hatchet Creek in 2007 had a mean flow of 2.02 cubic feet/second (cfs) and a maximum flow of 28.43 cfs (ACEPD 2007).

Construction of Gainesville Municipal Airport began in 1940 as a post-Depression Work Progress Administration project. During World War II, from 1942-1945, the Department of Defense took over and further developed the airport facility, temporarily renamed Alachua Army Airfield or Fairbanks Army Airfield. To comply with federal laws, an assessment was conducted in 2011 of the potential for contamination by hazardous substances at the former Alachua Army Airfield, now Gainesville Regional Airport. Surface water samples collected at a former sewage disposal area for the airfield showed no elevated levels of contaminants (FDEP 2011).



Map of Alachua Army Airfield showing 'diversion canal' that rerouted Little Hatchet Creek for construction of runways (FDEP 2011).

2012 aerial photograph showing approximate location of Little Hatchet Creek (red line) as it flows eastward from Waldo Road through Gum Root Swamp to Newnans Lake.



Steeply eroded ditch bank of Little Hatchet Creek where it runs through a ditch on the north side of the Gainesville airport.

New culvert where Little Hatchet Creek runs through a ditch on the north side of the Gainesville airport.

Large culvert where Little Hatchet Creek runs through a ditch at the end of a runway at Gainesville airport.

Large ditch at the end of a runway where Little Hatchet Creek runs through the Gainesville airport.

Large culvert where Little Hatchet Creek exits the Gainesville airport.

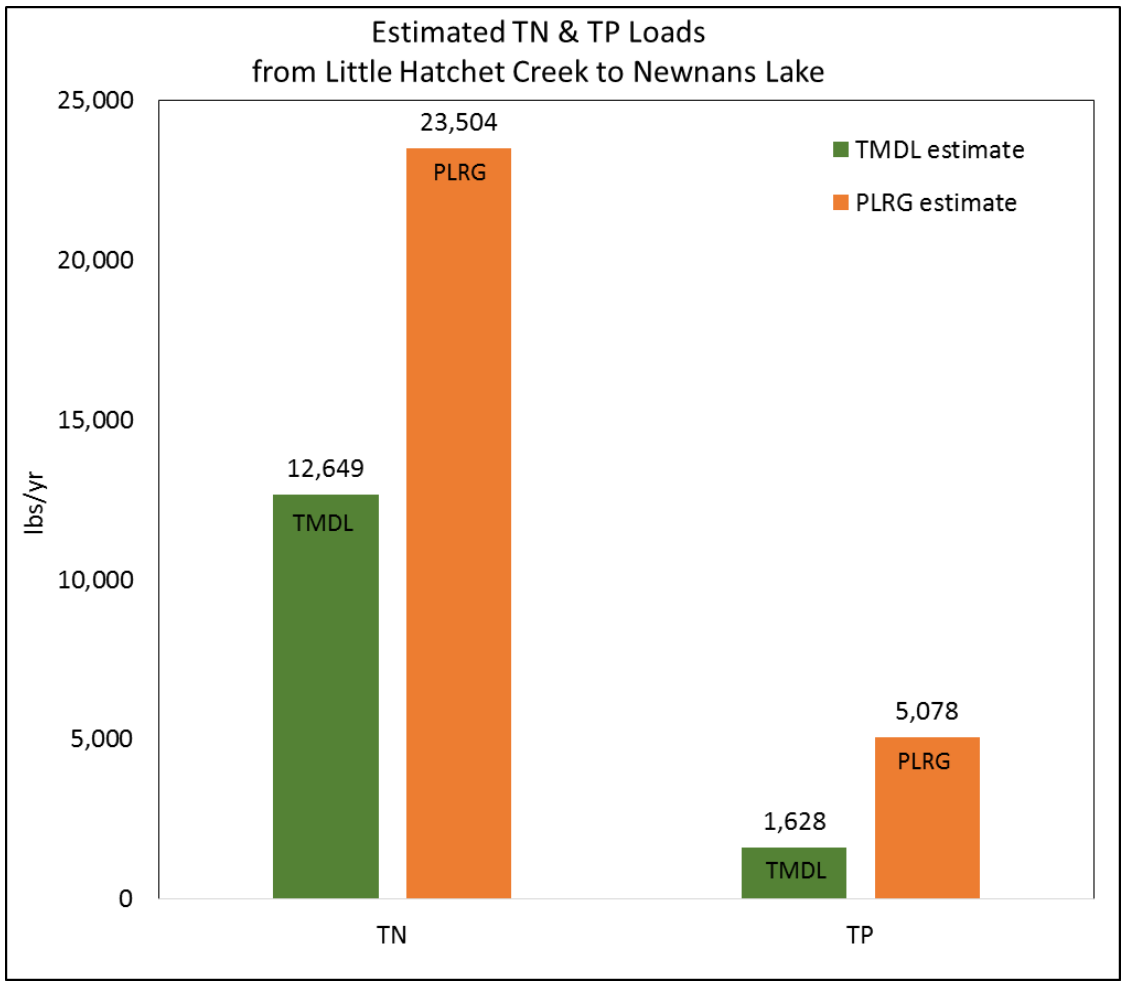
Steep-sided ditch where Little Hatchet Creek exits the Gainesville airport. Note accumulation of sediments.

Biological Condition of Little Hatchet Creek
Assessments of instream habitat and/or biology were conducted on Little Hatchet Creek at a site called LHATNB just downstream of the Gainesville airport. These assessments were conducted several times from 2003 through 2014 by Water and Air Research for Alachua County Environmental Protection Department (WAR 2004, 2011, 2015). The habitat assessments determined quality of habitat for aquatic macroinvertebrates, measuring substrate diversity and availability, water velocity, habitat smothering, artificial channelization, bank stability, riparian buffer-zone width, and riparian vegetation quality. The biological assessments measured the health of the stream by counting benthic macroinvertebrates.

At the times of these assessments, Little Hatchet Creek at this location had a healthy number of benthic macroinvertebrates but was most often found to have sub-optimal instream habitat because of low substrate availability, habitat smothering by sand after storms, and bank instability. The assessments noted that Little Hatchet Creek where it is channelized across the Gainesville airport lacks natural sinuosity and native riparian buffers, and is subject to higher volumes and velocities of storm flows due to impervious surfaces in developed areas in the upstream

For considerably more detail on the Little Hatchet Creek watershed, please refer to *Gainesville Creeks: A Status Report on Baseflow Water Quality, Stormwater and Ecosystem Health for the Orange Creek Basin 1998—2003* by Alachua County Environmental Protection Department at Link to report on Alachua County EPD website.

Nutrient Loading from Little Hatchet Creek to Newnans Lake
According to FDEP's 2003 TMDL analysis (Gao & Gilbert 2003), Little Hatchet Creek contributes about 15% of the TN (12,649 lbs/yr) and TP (1,628 lbs/yr) external loads to Newnans Lake According to SJRWMD's 2009 PLRG analysis (Lin 2009), Little Hatchet Creek contributes considerably more of external load - 18% of the TN (23,504 lbs/yr) and 24% of TP (5,078 lbs/yr) - to Newnans Lake as shown in the following chart.



Landfill Runoff – Two closed landfills are located in the Little Hatchet Creek watershed. The Gainesville Airport Landfill opened in the 1940s and was used by the City of Gainesville from 1964 through the early 1980s. It is located on the east edge of the Gainesville airport, about 0.3 mile east of NE 52 Drive and 0.3 mile south of Gun Club Road. The landfill borders the north bank of Little Hatchet Creek and is 1 mile upstream of Gum Root Swamp. Trenches in the landfill extend into the floodplain of Little Hatchet Creek (FDEP 2011).

The City of Gainesville is voluntarily remediating the Gainesville Airport Landfill to enhance adjacent wetlands and improve water quality in Little Hatchet Creek. Remediation, to be completed by fall 2015, includes grading slopes, removing surface trash from wetlands and Little Hatchet Creek, adding drainage structures, and capping the landfill with 2 feet of clean soil.

The Alachua County Northeast Landfill, closed 30 years ago, is 2 mile northeast of the Gainesville airport on NE 69 Avenue, and 1 mile north and upstream of Gum Root Swamp. Water quality monitoring is conducted around the Alachua County Northeast Landfill for compliance with and FDEP hazardous materials permit. Groundwater samples from 2010-2014 showed several nutrient-related trends: pH below the state standard, nitrate nitrogen and ammonia nitrogen above state standards, and iron very highly elevated, at times 100 times higher

than the state standard (JEA 2014). In August 2014, iron in surface water was 8 times higher than the state standard.

PROJECT JUSTIFICATION

Reducing watershed loading of nutrients to lakes can be an effective way of improve lake water quality in lakes like Newnans that became degraded primarily because of external nutrient loading. While there are 2 different estimates of TN and TP loads from Little Hatchet Creek to Newnans Lake, both load estimates are significant in terms of degrading lake water quality. The primary justification for these load-reduction projects is that they are likely to be cost-effective and feasible means of contributing to improved water quality to Newnans Lake.

PROJECT DESCRIPTIONS

Project 1. Eliminate wastewater nutrient load from Brittany Estates

The goal of this project is to explore the possibility of a partnership with Gainesville Regional Utilities (GRU) and the owner of Brittany Estates to affordably transfer wastewater from the community to GRU's Main Street Water Reclamation Facility, eliminating use of the community's on-site wastewater treatment plant and its discharge to Little Hatchet Creek.

Background

Brittany Estates is an age-restricted (55+) community of about 300 manufactured homes located at 5010 NE Waldo Road. Brittany Estates is owned by RHP Properties, the nation's largest private owner and operator of manufactured home communities http://www.rhp-properties.com/. Brittany Estates is managed Bay Shore Home Sales (www.BayshoreHomesNow.com 888-483-6681, local 372-6472), an entity of RHP Properties.

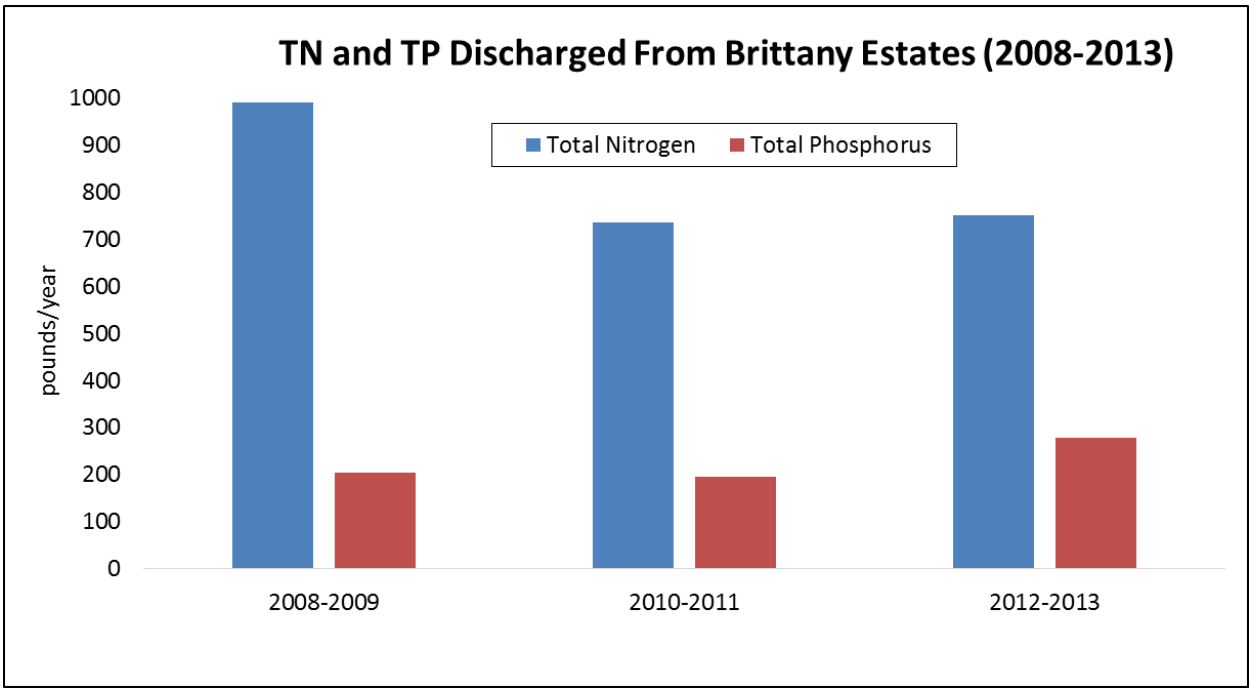
2015 aerial photograph of Brittany Estates manufactured home community on Waldo Road in Alachua County.

The manufactured homes in Brittany Estates are owned by individuals, who rent the lot that their home sits on from RHP Properties for $410/month which includes water, wastewater and trash pickup. Property maintenance is included in the monthly rent.

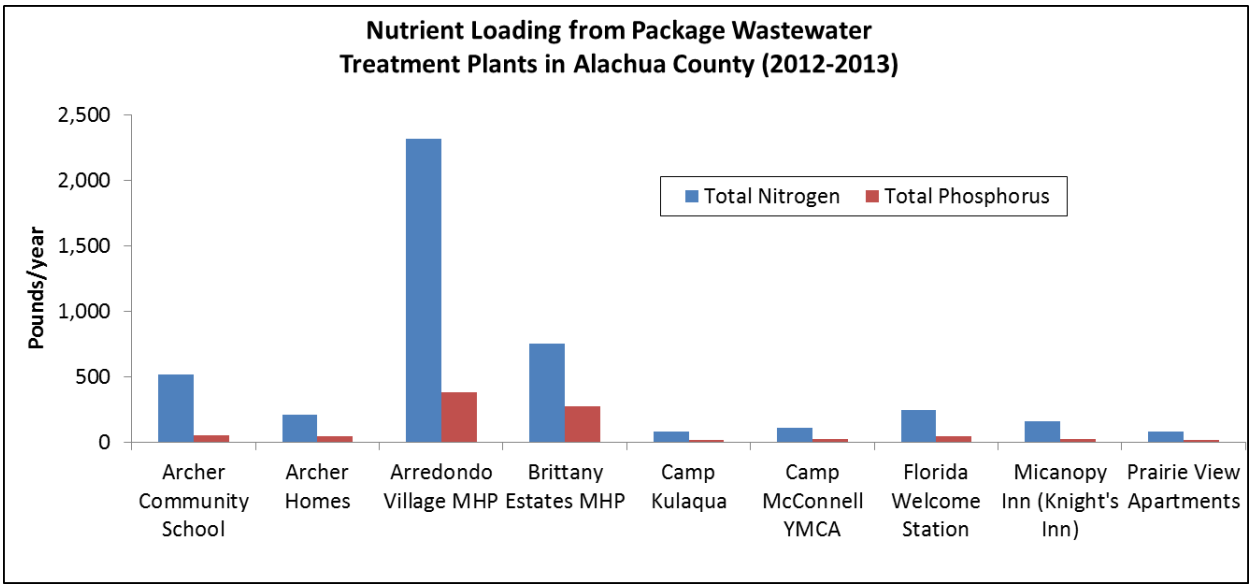
An onsite wastewater treatment facility at the Brittany Estates manufactured home community on Waldo Road is permitted by FDEP (permit # FL0040215 - expires August 28, 2016) to discharge up to 0.06 million gallons per day into Little Hatchet Creek, with total nitrogen discharge limited to 3,104 pounds per year and total phosphorous discharge limited to 386 pounds per year, and nitrate-nitrogen concentration not to exceed 12 mg/liter. The facility was first permitted in 1987 with percolation ponds with no surface discharge. The percolation ponds did not percolate, however, so the facility was redesigned and a later permit allowed discharge of treated wastewater to Little Hatchet Creek.

The TMDL for Newnans Lake assigned allowable waste load allocations to Brittany Estates that are the same as its permit limitations, that is, 3,104 lbs/yr TN and 386 lbs/yr TP - both about 4% of the total maximum daily load for Newnans Lake.

In 8 recent years - from 2006 through 2013 - Brittany Estates discharge of nitrate nitrogen (NO_3) was below the limit of 12 mg/liter allowed by their FDEP wastewater discharge permit. From 2008 through 2013, Brittany Estates discharge was below the limits of 3,104 lbs/yr TN and 386 lbs/yr TP allowed by the FDEP wastewater discharge permit, as shown in the following chart.



For comparison, however, in 2012-2013 Brittany Estates had the second highest discharge of total nitrogen and total phosphorus of the 9 package wastewater treatment plants in Alachua County, as shown on the following chart.



GRU's 2014 Consumptive Use Permit allows groundwater withdrawals for 20 years, contingent on returning reclaimed water back to the aquifer as recharge to reduce impacts due to pumping. This project could increase GRU's aquifer recharge by up to 0.06 MGD (60,000 gallons/day), potentially offsetting their groundwater withdrawals by the same amount.

Following are suggestions on how to proceed in gathering information that could help with decisions about whether to connect Brittany Estates to the municipal wastewater system:

- Meet with GRU discuss project goal and explore options to satisfy GRU interests.
- If GRU agrees to partner in this project, meet with corporate owner of Brittany Estates to explore options to satisfy their interests.
- Calculate cost savings of no longer operating, maintaining, monitoring, and reporting Brittany Estates' on-site wastewater plant, including elimination of anticipated capital costs for construction of a new plant when needed.
- Obtain external funding to share cost of GRU installation of new force main and lift station.
- Compare cost/lot for current wastewater treatment (on-site plant) versus cost/lot if billed monthly by GRU (about $15 for 2,000 gallons/month)
- Investigate programs to help low-income residents pay wastewater bill. For example, Gainesville Regional Utilities (GRU) advertises Project SHARE, a payment assistance program for the elderly, handicapped and those in financial hardship due to illness, funded through voluntary donations from GRU customers and employees, and administered by United Way of North Central Florida.

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Project 2. Reduce phosphorus load from Little Hatchet Creek

The goal of this project is to determine feasibility of reducing phosphorus load from Little Hatchett Creek to Newnans Lake by:

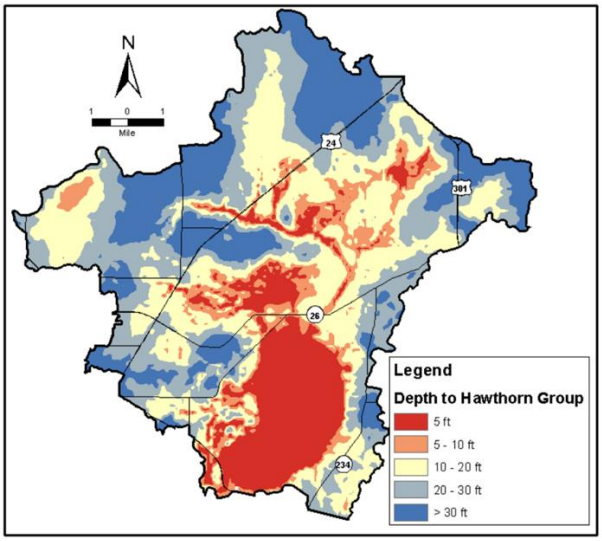
1. reducing volume and velocity of storm flows into Little Hatchet Creek,
2. reducing erosion P-rich Hawthorn materials into the ditch that contains the creek as it flows from Waldo Road through the Gainesville airport, and

3. chemically treating water from Little Hatchet Creek to significantly reduce phosphorus before it discharges into Newnans Lake.

Background

The dominant source of phosphorus in the water of Little Hatchet Creek appears to be phosphorus-rich materials (clays, clayey sands, sandy clays, and carbonates) in the creek bank and bed where the geologic Hawthorn Formation is at or near the land surface (Cohen et al 2008; Cohen et al. 2010), as shown on the following maps.

Map of sub-basins in the Newnans Lake watershed, including the Little Hatchet Creek sub-basin.



Map of depth to phosphorus-rich Hawthorn Formation in the Newnans Lake watershed.

Phosphorus enters Little Hatchet Creek in two ways: as P-rich flow from the surficial and intermediate aquifers and as erosion of P-rich materials. Baseflow has the highest TP concentrations in Little Hatchet Creek (ACEPD 2007).While the Hawthorn Formation is a natural source of phosphorus, the erosion of P-rich Hawthorn materials into Little Hatchet Creek is not entirely natural, and likely increased significantly beginning in the 1940s when the creek was re-routed and channelized into a ditch for construction of runways at the Gainesville airport. This is supported by 4 years of water quality data that shows a marked and consistent increase in phosphorus concentration in Little Hatchet Creek where it is ditched between Waldo Road and downstream of the airport (Cohen et al. 2010).

To confirm exposure of the Hawthorn Formation in the banks of the Little Hatchet Creek at the airport, soil samples were collected from the ditch bank, as shown in the following photo. Three samples from site 5, shown in the following photo, contained an extremely high concentration of total phosphorus, averaging 135 mg TP/cm^3 of soil (Grace 2014). For comparison, the TP concentration in a cubic centimeter soil was 2¼-million times higher than the healthy target concentration of TP (0.06 mg) in a liter of Newnans Lake water.

Eight sites where Hawthorn-derived soil was sampled for phosphorus content in 2014 by Alachua County Environmental Protection Department.


Sampling site 5 on Little Hatchet Creek where it is ditched on the north side of the Gainesville airport. Note the steeply under-cut bank.

Exacerbating this channelization, increases in impervious surface in the watershed since the 1940s create higher volumes and velocities of storm flow into Little Hatchet Creek, deepening and widening the ditch and exposing and eroding more Hawthorn-derived materials into the creek.

In fact, flow measured at a point in Little Hatchet Creek just downstream of the Gainesville airport increased rapidly when measured during 18 storms in 2007-08, attributed to upstream impervious surfaces at the airport and adjacent industrial park (ECT 2008).

Preliminary discussion between SJRWMD and Allan Penksa, CEO of Gainesville Regional Airport, in 2009 about reducing the P load in Little Hatchet Creek were positive and cooperative. Mr. Penksa pointed out relevant Federal Aviation Administration (FAA) requirements such as creating no new opportunities for standing water that could attract birds, which can collide with airplanes during takeoff and landing. The airport was interested in the possibility of hardening the edges of the large ditch at the end of the runway, enabling them to extend the runway to accommodate emergency landings.

Scope of Work

This project focuses on feasibility and conceptual design, necessary preliminaries to full design and construction.

Task 1: Reduce Storm Flows

This would likely be a collaboration with City of Gainesville Public Works Department, which plans to soon begin developing a stormwater management plan for the Little Hatchet Creek watershed. Cost estimates assume this collaboration.

Subtask 1.1: Identify and rank potential locations upstream of and around the Gainesville airport suitable for construction of stormwater storage basins, and conceptually design those basins.

- *Deliverables*: GIS map of identified properties with information on property ownership and value. Drawing of conceptual design of stormwater retention basin at each potential location.
- *Cost Estimate*: $12,000

Subtask 1.2: Identify locations in the Little Hatchet Creek watershed where new riparian buffers could be created or existing riparian buffers could be enhanced along the creek, and identify techniques to create or enhance those buffers.

- *Deliverables*: GIS map of identified buffer locations with information on property ownership and value. Description of techniques for creating or enhancing buffers at each potential location.
- *Cost Estimate*: $10,000

Subtask 1.3: Identify existing stormwater systems around and in the airport constructed prior to stormwater permit requirements, and design methods such as shallow swales to retrofit those systems to store stormwater, factoring in FAA regulations regarding standing water.

- *Deliverables*: GIS maps of identified stormwater systems with information on property ownership. Drawings of conceptual design of retrofits to store stormwater for each existing stormwater system.
- *Cost Estimate*: $16,000

Task 2: Reduce Bank Erosion
Design methods of reducing instream bank erosion from Waldo Road through the Gainesville airport. This would include methods such as channel re-contouring, revegetation, bank and bed hardening, and installation of pipes, as well as methods that improve aquatic habitat characteristics such as sinuosity and substrate.

- *Deliverables*: Drawings of conceptual design of methods to reduce bank erosion in each segment of Little Hatchet Creek from Waldo Road to the end of the airport property, with evaluation of costs and benefits of each design.
- *Cost Estimate*: $80,000

Task 3: Chemically Remove Phosphorus
Identify and evaluate systems for chemically treating water from Little Hatchet Creek to significantly reduce total phosphorus concentration before it is discharged to Newnans Lake. Criteria to factor in are:

- Zero discharge of phosphorus-bound flocculent from the system; flocculent to be periodically removed and properly disposed of elsewhere.
- Minimal long-term maintenance and cost.

Examples to consult are the small alum-drip systems operated by SJRWMD in former farm fields around Lake Apopka, and the large alum injection system operated by Lake County Water Authority on the Apopka-Beauclair Canal.

- *Deliverables*: Report with description of suitable systems, ranked based on criteria such as effectiveness at P removal, construction cost, maintenance cost, ease of maintenance, and footprint. Map of potential locations for suitable systems with information on property ownership and value.
- *Cost Estimate*: $12,000

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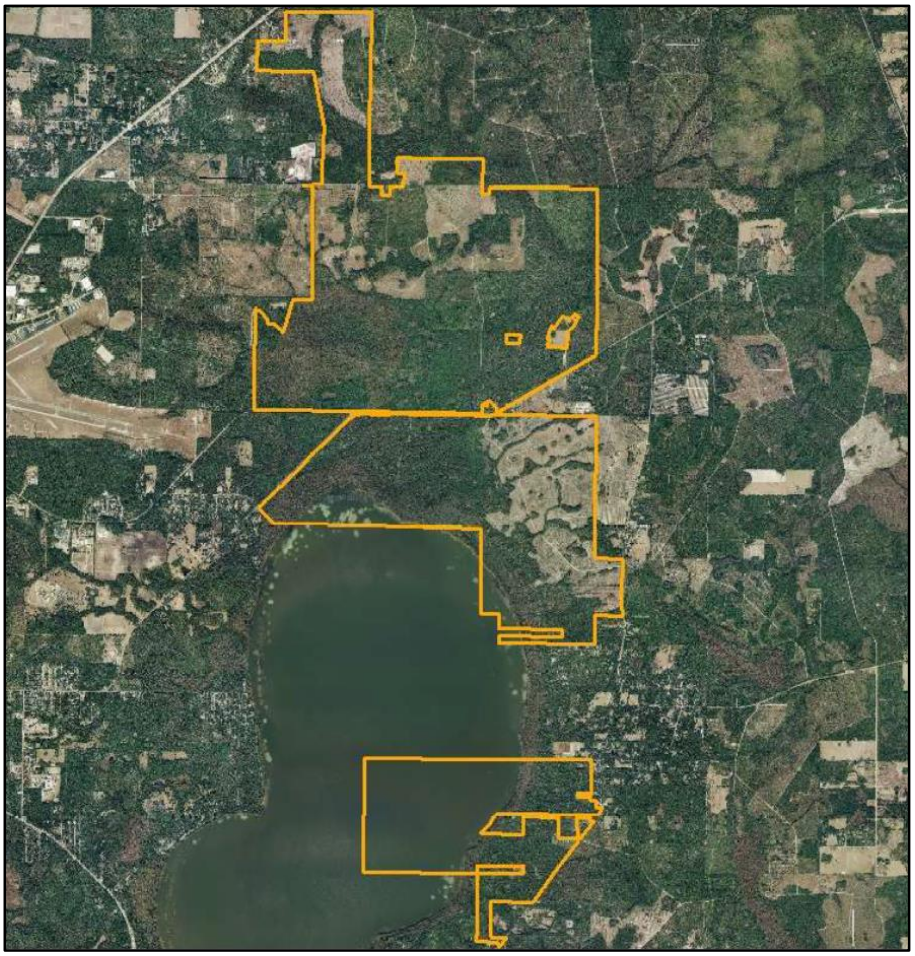
Project 3. Reduce phosphorus load from Gum Root Swamp
The goal of this project is to understand phosphorus dynamics in Gum Root Swamp sufficiently to determine if there are methods of reducing release of phosphorus from the swamp to Newnans Lake by enhancing the wetland's ability to assimilate, store, and/or transform phosphorus.

Background
Gum Root Swamp is a forested wetland covering approximately 800 acres in the Little Hatchet Creek watershed on the northeast shoreline of the Newnans Lake. Little Hatchet Creek enters Gum Root Swamp on the northeast corner. Water flows out of Gum Root Swamp into Newnans Lake through at least 3 flow paths, shown in the following aerial photo.

Gum Root Swamp showing Little Hatchet Creek inflow (blue line), swamp outflows (red lines), water-quality sampling sites (red stars), and roadways.

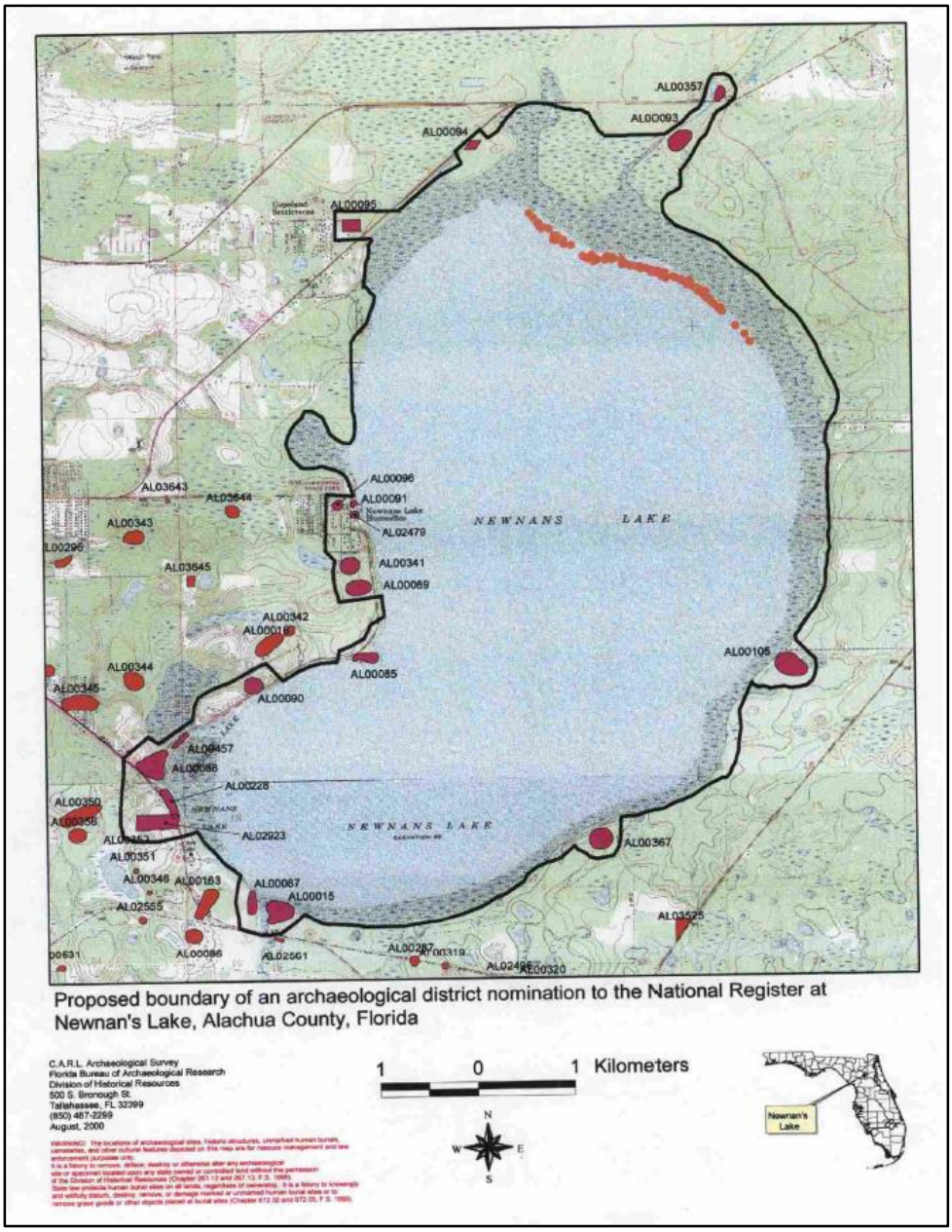
Three roads across Gum Root Swamp alter its historic hydrology, likely reducing flushing during high flows. The south side of Gum Root Swamp is bisected by State Road 222 and State Road 26, with 2 bridges and several culverts allowing flow under the roads form Gum Root Swamp to Newnans Lake. A lobe in the southeast corner of Gum Root Swamp is bisected by a limerock road not usually accessible to public vehicles.

Most of Gum Root Swamp is public conservation land owned by the St. Johns River Water Management Distract and managed by the District as part of the Newnans Lake Conservation Area, as shown in the following map. Part of the Newnans Lake Conservation Area, including Gum Root Swamp, is co-managed with FWC as the Hatchet Creek Wildlife Management Area, where hunting is allowed. A 372-acre triangular area of Gum Root Swamp located between SR 222 and SR 26 is Gum Root Park, owned and managed as a nature preserve by the City of Gainesville.



Boundary of Newnans Lake Conservation Area, which includes Gum Root Swamp, and is managed by the St. Johns River Water Management District.

Much of the southern portion of Gum Root Swamp, south of State Road 26, is considered by the Florida Division of Historical Resources to be eligible for designation as a National Register archeological district because the area contains at least 1 documented archeological site and is adjacent to the area where numerous ancient dugout canoes are buried in the lake sediments, as shown on the following map.



The quality of water in Little Hatchet Creek before it flows into Gum Root Swamp has been sampled by SJRWMD and Alachua County at Waldo Road and downstream of the Gainesville airport. Similarly, the quality of water flowing from Gum Root Swamp to Newnans is regularly sampled at the 2 bridges on SR 26.

Gum Root Swamp Nutrient Dynamics –Wetlands can naturally improve water quality through biological processes such as nutrient assimilation by plants, nutrient storage in wetland soils, and nutrient transformation by processes like denitrification.

The high-phosphorus Hawthorn Formation is at or close to the surface in much of Gum Root Swamp and its contributing watershed (Di et al. 2012). Erosion and chemical weathering of

calcium phosphate (= apatite) from these geologic sediments into Gum Root Swamp and Newnans Lake is thought to have been occurring for thousands of years (Odum 1953; Cohen 2010).

Phosphorus can be present in inorganic and organic forms in soils, with wide variance in its availability to biota. Inorganic forms include: porewater and exchangeable P (readily bioavailable); iron- and aluminum-bound P (slowly available); and calcium-bound P (very slowly available). Organic P forms include: dissolved organic P (readily bioavailable); microbial biomass P (readily bioavailable); fulvic acid-bound P (slowly available); humic acid-bound P (very slowly available); and residual organic P (not available) (Reddy et al. 2002).

University of Florida conducted 2 studies of sources of nutrients to Newnans Lake. As predicted, the first study found that flows out of Gum Root Swamp had significantly lower nitrogen concentration than flows coming in from Little Hatchet Creek (Cohen et al. 2008). Phosphorus concentrations were also lower but not as significantly.

The second study (Cohen et al. 2010) looked at removal and transformation of nutrients in Gum Root Swamp, and the results were not as predicted. Whereas wetlands typically reduce discharge of phosphorus in the summer, during this investigation summer flows out of Gum Root Swamp had the same phosphorus concentration as flows coming in from Little Hatchet Creek. Again contrary to most wetlands, Gum Root Swamp removed more phosphorus in winter, when flows out had lower phosphorus concentration than flows coming in from Little Hatchet Creek.

A possible reason for these effects may be that biological processes in Gum Root Swamp are phosphorus-saturated. If this is the case, phosphorus export would be regulated by biogeochemistry of iron-bound phosphorus and organic matter mineralization, and temperature and redox conditions would determine nutrient storage and release. In support of this, concentration of phosphorus flowing out of Gum Root Swamp increased with increasing temperature and dissolved oxygen (a metric that integrates wetland respiration), while phosphorus concentration of flows into Gum Root Swamp via Little Hatchet Creek did not increase with increasing temperature and dissolved oxygen (Cohen et al. 2010).

This project will build on this previous work to sufficiently understand phosphorus dynamics in Gum Root Swamp to determine if there are methods to reduce discharge of phosphorus from the swamp to Newnans Lake by enhancing the wetland's ability to assimilate, store, and/or transform phosphorus.

<u>Scope of Work</u>

Task 1. Determine the horizontal extent of storm-flow deposition of phosphorus-rich geologic sediments in Gum Root Swamp.

Determine phosphorus concentration in surface soils collected along transects across Gum Root Swamp, including a transect that begins at the end of the airport ditch containing Little Hatchet Creek.

- *Deliverables*: Map of phosphorus concentration in surface soils collected along transects.
- *Cost Estimate*: $6,000

Task 2. Identify physical and chemical controls on release and retention of phosphorus in soils in Gum Root Swamp.
Extract soil cores along transects across Gum Root Swamp, identify forms of phosphorus at various depths to help determine phosphorus availability. Conduct laboratory experiments to determine release rate of phosphorus from core samples under varying temperature, moisture, and oxygen conditions that mimic seasonal variation of conditions in Gum Root Swamp soils.

- *Deliverables:* Report identifying physical and chemical controls on release and retention of phosphorus in soils of Gum Root Swamp.
- *Cost Estimate*: $60,000

Task 3. Quantify the mass of phosphorus inflow and outflow through Gum Root Swamp throughout the year.
Construct a current water budget for Gum Root Swamp that includes inflows from surface runoff (baseflow and stormflow) and rainfall, and outflows from evapotranspiration and measured flow through all culverts and bridges under SR 222/SR26. Construct a current phosphorus budget for Gum Root Swamp that includes inputs from surface runoff (baseflow and stormflow), rainfall, and atmospheric dry deposition; release and retention from soil in Gum Root Swamp; and outflows through all culverts and bridges under SR 222/SR26. Collect water quality and hydrologic data necessary to fill data gaps.

- *Deliverables*: Report describing the current water and phosphorus budgets for Gum Root Swamp with supporting models, metadata, and data.
- *Cost Estimate:* $50,000

TOTAL COSTS AND FUNDING SOURCES

PROJECT 1 – ELIMINATE NUTRIENT LOAD FROM BRITTANY ESTATES	
(no budget; assume in-house contributions of labor from project partners)	n/a
PROJECT 2 – REDUCE PHOSPHORUS LOAD FROM LITTLE HATCHET CREEK	
Task 1: Reduce storm flows	
Subtask 1.1: New stormwater storage basins	$12,000
Subtask 1.2: New riparian buffers	$10,000
Subtask 1.3: Retrofit existing stormwater systems	$16,000
Task 2: Reduce bank erosion	$80,000
Task 3: Chemically remove phosphorus	$12,000
Total Cost – Little Hatchet Creek	**$130,000**
PROJECT 3 – REDUCE PHOSPHORUS LOAD FROM GUM ROOT SWAMP	
Task 1: Horizontal extent of geologic phosphorus deposition	$6,000
Task 2: Controls on phosphorus release and retention	$60,000
Task 3: Water and nutrient budgets	$50,000
Total Cost – Gum Root	**$116,000**
TOTAL COST – REDUCE NUTRIENT LOADS FROM LITTLE HATCHET CREEK AND GUM ROOT SWAMP	**$246,000**

The following table summarizes potential sources of funding for these projects:

Funding Source	Criteria	Application Deadline	Website	Contact	Notes
USDA Natural Resources Conservation Service – Regional Conservation Partnership Program	For large-scale partnerships with agriculture/silviculture to restore or sustain natural resources such as clean water, healthy productive soils, and enhanced wildlife and pollinator habitat. No required cost-share required.	Pre-proposal by July 8	http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/rcpp/		Perhaps relevant for minimizing erosion/runoff from OCB pine plantations.
Federal Aviation Administration grants	Allan Penksa, CEO of Gainesville Regional Airport, mentioned this as a possible funding source for work on the airport property.			Allan Penksa info@flygainesville.com 352-373-0249 ext. 111	
U.S. Department of Transportation - Transportation Investment Generating Economic Recovery (TIGER) grant program	Capital funding provided directly to *any* public entity for road, rail, transit, bicycle/pedestrian, port, and multi-modal projects that will have a significant impact on the nation, a region, or metropolitan area, providing significant and measurable improvements over existing conditions. Focus on projects that generate economic development and improve access to reliable, safe and affordable transportation, while emphasizing improved connection to employment, education, services and other opportunities, workforce development, or community revitalization.	June 5	http://www.dot.gov/tiger	TIGERgrants@dot.gov 202-366-0301	Perhaps relevant to retrofits to increase airport-area stormwater retention.
Florida Legislature - Community Budget Issue Request (CBIR)	Legislative sponsorship of wastewater, stormwater, surface water improvement, drinking water, and other water-related projects.	Submitted prior to the spring legislative session		Alachua County Legislative Delegation	
Florida Department of Environmental Protection - Clean Water State Revolving Fund (SRF) loan and grant program	$200-300 million/yr in low-interest loans to local governments to plan, design, and build or upgrade wastewater, stormwater, and nonpoint source pollution prevention projects. Certain agricultural BMPs may also qualify. Interest rates below market rates and vary based on the community.	Loans - June 1 Grants – June 30	www.dep.state.fl.us/water/wff/cwsrf	Tim Banks timothy.banks@dep.state.fl.us 850.245.8360	
Florida Department of Environmental Protection - Federal Section 319(h) grants	$7-8 million/yr in EPA funds for stormwater retrofit projects and stormwater BMPs in priority watersheds with verified impaired waters. At least 40% local match or in-kind contribution required. Approximately $5-6 million is available to FL each year depending on federal appropriations.	March 31	www.dep.state.fl.us/water/nonpoint/319h.htm	Kate Brackett kathryn.brackett@dep.state.fl.us 850.245.8682	
Florida Department of Environmental Protection - Total Maximum Daily Load (TMDL) funding	Variable legislative appropriation for stormwater retrofit projects in watersheds with verified impaired waters.	anytime	www.dep.state.fl.us/water/watersheds/tmdl_grant.htm	Kate Brackett kathryn.brackett@dep.state.fl.us 850.245.8682	

St. Johns River Water Management District – Water Quality / Nutrient Reduction grants program	2-yr maximum; Eligible includes stormwater improvement, connection to central sewer for package plants, construction, construction engineering and inspection, piping, pumping stations and storage facilities, transmission and distribution systems, expansion of central sewer connections, water quality BMPs. Ineligible include design, permitting, feasibility studies, preparation of bids, geotechnical investigations, land and easement acquisition, staff time, equipment purchases, operation and maintenance activities. Will provide up to 33% of costs for water quality projects.	January 5 - March 13	http://sjrwmd.com/funding/	Troy Rice trice@sjrwmd.com 321- 984-4938	
Florida Fish and Wildlife Conservation Commission – Aquatic Habitat Restoration/Enhancement grants	For managing, enhancing, and preserving aquatic habitat for the long-term well-being of fish and aquatic wildlife and the benefit of the people of Florida. Requires unspecified cost-share that can include eligible in-kind services.	November 15 for July 1 funding	http://myfwc.com/conservation/freshwater/ahre/	Dale Jones Dale.Jones@MyFWC.com 386-758-0525	Includes wetland habitats

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