**Wakulla Springs Alliance**

**9-15-17 Board Meeting Minutes and Action Items**

**WSA Action Info**

This section provides information on what you and others can do to support research-based actions to enhance water quality and quantity in Wakulla Springs and the springshed, and improve related environmental, economic and social systems. Efforts by all, produce results!

**Background**

* [Wakulla Springs Information](http://wakullaspringsalliance.org/information/)
* [WSA Purpose and Plans](http://akullaspringsalliance.org/purpose-plans/)
* [WSA Action Resources](http://wakullaspringsalliance.org/plans-reports-videos-resources/)

**Upcoming Events**

* Horn Springs Preliminary Public Workshop Wednesday, September 27th at the Woodville Community Center, 8000 Old Woodville Road, Tallahassee, FL 32305. The meeting will run from 5:30 – 8:00. You may also provide input at [http://www.dep.state.fl.us/parks/planning](https://urldefense.proofpoint.com/v2/url?u=http-3A__www.dep.state.fl.us_parks_planning&d=DwMFAg&c=HPMtquzZjKY31rtkyGRFnQ&r=5VSOSvrRzToVE7HVNfgg2A&m=_DWRsQYoaYPHO9KAyO4K5bZbY2_s-I3z8J4zS6Lw4vI&s=y_IY-hCbS0J53DZ1orSHIcySt5CnMaRPNyFOXbg0sHU&e=)
* 2017 Caverns Cultural Celebration, Friday and Saturday, October 6-7, 2017 from 9:00 AM to 3:00 PM CT, Hickory Pavilion at Florida Caverns State Park
* BMAP OSTDS committee Tuesday, October 17, 2:00 PM, Woodville Community Center, 8000 Old Woodville Rd.
* FDOT public meeting October 24 to take input on using a bridge rather than culverts at the crossing of the Bradford chain of lakes (between Cascade & Minnehaha).  Do not have time or location yet.

**Action Items from the 9-15-17 WSA Board Meeting**

* Debbie Lightsey will talk to CONA & the TAPP about water quality education & advocacy.
* Howard Kessler will look for information on pharmaceuticals in the water.
* Rob Williams will take the lead on supporting funding for FL Forever.
* Jim Stevenson will set up a meeting with Rep Beshears,
* Cal Jamison and Sean McGlynn will attend the Wakulla Delegation Meeting.
* Tom Taylor and Bob Henderson will meet to develop a proposal for possible WSA sponsor categories and amounts.
* The Dark Water III grant proposal submission was approved unanimously.
* Everyone is encouraged to buy springs license plates.
* Sean McGlynn will send the USF Fish Study report to Jim Stevenson and to Tom Taylor.
* Provide input on the wastewater plan RFP at the BMAP OSTDS committee Tuesday, October 17, 2:00 PM, Woodville Community Center, 8000 Old Woodville Rd.
* Debbie Lightsey, Pam Hall and Bob Deyle will draft a letter for EC approval.
* Everyone is encouraged to attend the Oct 24 public meeting on the Capital Circle SW project that will address whether there should be a bridge or culverts for connections between the lakes on each side of the roadway. Sean will speak for WSA, Debbie for the Neighborhood Association, Gail Fishman for the Native Plant Society.
* We need to work with the WMD on their karst area highway project stormwater policies. There is a at UCF that is developing the science to support new solutions.
* Invite the UCF stormwater institute and DOT folks to the FSU karst symposium in Nov.

**9-15-17 WSA Board Meeting Minutes**

**Overview**

The Wakulla Springs Alliance held their regular Board meeting on September 15, 2017 at the Renaissance Building. The draft agenda, treasurer’s report and list of participants can be found in Appendices A, B and C. Review the action items underlined for your commitments and actions you can help with. Our success in protecting and enhancing Wakulla Springs depends on the actions of the WSA board, advisors, partners and supporters. This report is based on the secretary’s notes and does not capture everything or exactly what was said.

**Opening**

* Welcome and meeting agenda review by Seán McGlynn, then everyone introduced themselves.
* There was a motion and second to approve the minutes and financial report; it passed unanimously

**Park Status Update -** Jim Stevenson

* Everyone is encouraged to attend the Horn Springs Preliminary Public Workshop Wednesday, September 27th at the Woodville Community Center, 8000 Old Woodville Road, Tallahassee, FL 32305. The meeting will run from 5:30 – 8:00, allowing ample time for interactive planning exercises. This is sure to be a unique workshop focused on discussing the upcoming unit management plan for this new addition. Though there will be multiple ways for you to provide input at the meeting, you may also visit our site at [http://www.dep.state.fl.us/parks/planning](https://urldefense.proofpoint.com/v2/url?u=http-3A__www.dep.state.fl.us_parks_planning&d=DwMFAg&c=HPMtquzZjKY31rtkyGRFnQ&r=5VSOSvrRzToVE7HVNfgg2A&m=_DWRsQYoaYPHO9KAyO4K5bZbY2_s-I3z8J4zS6Lw4vI&s=y_IY-hCbS0J53DZ1orSHIcySt5CnMaRPNyFOXbg0sHU&e=).
* Both the Director and Assistant Director positions at the DEP Division of Parks are vacant.

**Committee Reports from Retreat**

* Committee on recommendations for reformulating the board, board meetings, memberships, bylaws, et cetera: Ryan Smart (chair) Howard Kessler and Bob Henderson.
  + The committee met, there is work being done but they are not ready to present a report.
* Educate the public and advocate on behalf of the Alliance: Gail Fishman (chair), Ryan Smart, Debbie Lightsey, Bob Deyle, Bob Henderson, Howard Kessler, and Jim Stevenson
  + They met on August 8 and talked about presentations at meetings.
  + We will get septic tank information out. Debbie will talk to CONA but they may not be too enthusiastic about this topic. They are more concerned with stormwater. Best to spend time on City groups. CONA has some information on fertilizer use. The CONA-Sustainable Tallahassee sustainability award can include Springs related criteria. Having a TAPP presentation could be a check item.
  + We could have a special springshed tour for key leaders.
  + There are PSAs on dog poop. TAPP has a $200k budget and we can talk to them. Debbie will follow-up on this. They have a good video on fertilizer. It would be good to get them to focus on springs as well as lakes.
  + Gail has checked on the use of the King Auditorium. Keep website and FB current.
  + Howard Kessler will look for information on pharmaceuticals in the water.
  + Jim Stevenson is doing an OLLI group that can become advocates. There will also be tours for McClay and other schools.
* Land Acquisition/Management: Rob Williams (chair), Ryan Smart, Cal Jamison, and Albert Gregory.
  + There are 3 proposed acquisitions.
  + We need to support funding for FL Forever and join the Conservation Coalition, Audubon and others’ efforts. Many of the priority projects are in Montfort and Beshears districts. We can talk to Lorraine Ausley who is on the appropriation committee. Beshears is concerned about purchasing too much land but he can be influenced. Some are archeological and paddling sites and these groups can also be supportive. Audubon will have a legislative day to lobby for FL Forever. We need outreach to legislators now.
  + Wakulla County Commission will be meeting with the legislative delegation on September 28th.
  + The Corbett property is approved and it is not being bought. This and other properties have failed because sellers are not willing to sell. We need willing sellers.
  + The appraisals are the problem. They don’t look at the value of the spring. They lower the value if there is a spring, sinkhole or eagle.
  + Rob Williams will take the lead on supporting funding for FL Forever.
  + Jim Stevenson will set up a meeting with Rep Beshears.
  + Cal Jamison and Sean McGlynn will attend the Wakulla Delegation Meeting.
* Water Quality: Bart Bibler (chair), Bob Deyle, Seán McGlynn, and Cal Jamison.
  + See the outline of Bob Deyle’s PowerPoint in Appendix D. Note: this is a format that other committees can use for their section of the WSA strategic plan.
  + Debbie Lightsey will ask Pam Hall to consider drafting a comp plan amendment related to the requirement for performance-based septic systems in the Priority Springs Protection Areas.
  + Chuck Hess reported that the BP oil spill funds will be used for sewer projects
* Water Quantity: Bart Bibler (chair) and Cal Jamison.
  + The new target date for setting the MFL is 2020. The NWFWMD is developing the hydrodynamic flow that will look at the estuarine conditions. This and another model will be completed in 2018 and will be peer reviewed. There will be public involvement. The WMD is working with Georgia on flow information. They are sharing data.
  + MFLs are difficult because of legal limitations on challenges. This may require legislation. “Significant harm” versus “harm” as the legal criteria will make a difference. The FL Springs Council is working on this. Having a peer review is positive.
* Advancing Science/Research: Sean McGlynn (chair), Bob Deyle, and Cal Jamison.
  + We wrote a BP proposal 6 years ago that used Bruce Means and Bob Knight. This needs to be updated. We need more monitoring data from the BP proposal. Fish surveys would be helpful.
  + The committee has not met.
  + We need to focus on the data to test hypotheses rather than gather all possible data.
* Ecosystem Restoration: Bob Deyle (Chair), Gail Fishman, Seán McGlynn, and Rob Williams
  + See the outline of Bob Deyle’s PowerPoint in Appendix E. Note: this is a format that other committees can use for their section of the WSA strategic plan.
  + Sean McGlynn will send the USF Fish Study report to Jim Stevenson and to Tom Taylor to post on the website.
  + Consider also doing a dye test in Fred George Sink.
* Comment letter to the Water Management District (SWIM): Seán McGlynn and Bob Deyle,
  + The St Marks and Ochlocknee SWIM plans look good. The plan was presented to the WMD board and they approved it and staff is authorized to make some minor changes based on public comments.
* Solicit funds from Alliance for the administrative fund: Tom Taylor and Bob Henderson.
  + The following are possible sponsor categories and amounts. Tom and Bob will meet to develop a proposal for the next meeting.

WS Saint 500

WS Patron 100

WS Sustainer 50

WS Supporter 25

WS Eagle 250+

WS Osprey 100

WS Limpkin 50

WS Coot 25

**What’s new** (about 5 minutes each)

* **Approve License Plate Grant Proposal (Dark Water III**): Seán McGlynn and Bob Deyle
  + This is an extension of the current project plus 4 more green water events, including DNA and color analysis. There are no dye tests.
  + We submit invoices to the grant program and they pay the contractor
  + The grant proposal submission was approved unanimously.
  + Everyone is encouraged to buy springs license plates.
* Provide input on Leon County’s RFP for the Wastewater Facility Engineering Plan – Debbie Lightsey, Pam Hall, Bob Deyle
  + The RFP is out for review.
  + Meetings to review the proposals were cancelled by Irma.
  + It may be done by an existing County engineering firm. It would be preferred to open this to more firms.
  + Provide input on the wastewater plan RFP at the BMAP OSTDS committee Tuesday, October 17, 2:00 PM, Woodville Community Center, 8000 Old Woodville Rd.
  + Debbie Lightsey, Pam Hall and Bob Deyle will draft a letter for EC approval. The motion was made by Tom Taylor, seconded Bob Henderson and approved unanimously
* Strategy for advocating wildlife passage at FDOT October 24 public meeting re Capital Circle SW improvements – Debbie Lightsey
  + The Oct 24 public meeting on the Capital Circle SW project will address the question of whether there should be a bridge or culverts for connections between the lakes on each side of the road.
    - This needs to be seen as a public interest project. We need paddlers, Native Plant Society and others to support this.
  + Debbie will work with the neighborhood association to encourage them to support the bridge. There are opportunities for environmental protection, recreational use, etc. There may be some local opposition to the bridge.
  + Kent Weimer has been taking a lead on this.
  + Sean will speak for WSA, Debbie for the Neighborhood Association, Gail Fishman for the Native Plant Society.
  + FDOT has completed the 60% complete plan and has started on the 90% plan.
  + Get the airport involved because of bird impacts. Megan Doherty will get us a contact at the airport.
  + There is a policy calling for state of the art stormwater treatment for this project and this needs to be honored. The definitions have changed over the last 15 years.
  + This is forest service land and has been through the NEPA process.
* Live Gator Cam at Wakulla Springs: <http://wakullasprings.org/gatorcam/>
* Springshed Updates – Cal Jamison
  + - There is nothing unexpected happening.
    - The hurricane pulled the water out of the bay. Creeks didn’t change much, a little increase.
    - The water is darker.
    - Debbie’s lake went up.
* Springs Roundtable: Bart Bibler (chair) and Seán McGlynn
  + - The Springs Council meeting was last week. They are doing a strategic plan and have an advocacy committee.
    - They are preparing BMPs.
    - They have spent $30,000 on legal fees.
    - They are actively involved in the Suwannee River BMAP.
    - We can work with them to get results.
    - Jim Stevenson has been our representative. Sean and Bart went to the last meeting. We need to have a formal representative.
* Discontinuation of flow metering in Wakulla Cave System – Bob Deyle, Seán McGlynn
  + - Gauges will be monitored by the WMD rather than USGS.
    - Average flow is 405 MGD over 10 years.
    - Real time data is valuable to divers’ planning.
* Land use in the unconfined aquifer areas – Gail Fishman
  + - There are survey stakes up and there are for sale signs.
    - The widening will be across the road from the airport and waste treatment plant.
* Karst Symposium, FSU – Seán McGlynn
  + - Dr. Ming wants us to be involved in November.
* Follow-up on the closure of Highway 61 south of Hwy 267 – Chuck Hess
  + - DEP has agreed to the dedication of the new road alignment and acceptance of the dedication of the road.
    - Unless the pavement is removed there is a loss of park land. Other parks have not had roads actually vacated.
    - This would use state money not County money.
    - This is Randy’s project.
    - The Wakulla County Commission gave David authority to negotiate.
    - This will be discussed at the next WSA meetings.
* Work with FDOT, FDEP and FWC for better highway stormwater solutions.
  + - We need to have the 319 group get involved early in the design process to influence the treatment.
    - There may be Blueprint funds to augment treatment.
    - Once the locations are set it is hard to change. We need to work with the WMD on their karst area highway project stormwater policies. There is a stormwater institute at UCF that is developing the science to support new solutions.
    - There will be 3 new treatment ponds on the Capital Circle SW.
    - BAM ponds need to be deeper and wider.
    - This can be a good topic for the FSU karst symposium. Invite the UCF and DOT folks.
    - Bob Knight has done wetlands solutions around the state.

Appendix A

**Draft Agenda 09/15/17**

**9:00 Opening**

Welcome and meeting agenda review (Seán McGlynn)

Introductions (Board)

Secretary Minutes (Tom Taylor)

Treasurer Report(Bob Henderson)

**9:10 Park Status Update -** Jim Stevenson

**9:30 Committee Reports from Retreat**

1. Committee on recommendations for reformulating the board, board meetings, memberships, bylaws, et cetera: Ryan Smart (chair) Howard Kessler and Bob Henderson.
2. Educate the Public/Advocate on behalf of the Alliance: Gail Fishman (chair), Ryan Smart, Debbie Lightsey, Bob Deyle, Bob Henderson, Howard Kessler, and Jim Stevenson
3. Land Acquisition/Management: Rob Williams (chair), Ryan Smart, Cal Jamison, and Albert Gregory.
4. Water Quality: Bart Bibler (chair), Bob Deyle, Seán McGlynn, and Cal Jamison.
5. Water Quantity: Bart Bibler (chair) and Cal Jamison.
6. Advancing Science/Research: Sean McGlynn (chair), Bob Deyle, and Cal Jamison.
7. Ecosystem Restoration: Bob Deyle (Chair), Gail Fishman, Seán McGlynn, and Rob Williams
8. Comment letter to the Water Management District (SWIM): Seán McGlynn and Bob Deyle,
9. Solicit funds from Alliance for the administrative fund: Tom Taylor and Bob Henderson

**10:30 What’s new** (about 5 minutes each)

* Approve License Plate Grant Proposal (Dark Water III): Seán McGlynn and Bob Deyle
* Provide input on Leon County’s RFP for the Wastewater Facility Engineering Plan – Debbie Lightsey, Pam Hall, Bob Deyle
* Strategy for lobbying our legislative delegation to support full funding for Florida Forever using Amendment 1 funds – Rob Williams
* Strategy for advocating wildlife passage at FDOT October 24 public meeting re Capital Circle SW improvements – Debbie Lightsey
* Introducing Carlos Herd at the WMD, replacing Nick Wooten, who will be missed
* Live Gator Cam at Wakulla Springs: <http://wakullasprings.org/gatorcam/>
* Springs Roundtable: Bart Bibler (chair) and Seán McGlynn
* Springshed Updates – Cal Jamison
* Legislative Update: Ryan Smart, President of 1000 Friends of Florida
* Springs Roundtable: Bart Bibler (chair) and Seán McGlynn
* Live Gator Cam at Wakulla Springs: <http://wakullasprings.org/gatorcam/>
* Website and Social Media, Updates – Tom Taylor
* Discontinuation of flow metering in Wakulla Cave System – Bob Deyle, Seán McGlynn
* Wildlife passage, FDOT public meeting, bridge vs culverts, October 24– Debbie Lightsey,
* Land use in the unconfined aquifer areas – Gail Fishman
* Karst Symposium, FSU – Seán McGlynn
* Land Acquisition – Cal Jamison, Rob Williams
* Follow-up on the closure of Highway 61 south of Hwy 267 – Chuck Hess
* Solutions from FDOT, FDEP and FWC for better highway solutions– Tom Taylor

**11:30   Wakulla Springs BMAP / OSTDS update** – Bob Deyle, Tom Taylor, Debbie Lightsey

**11:55 Items from the floor**

**12:00 Adjourn**

Appendix B

**Board Advisors and Guests**

\* Indicates 9-15-17 Participants

Board Members

Bart Bibler \*

Bob Deyle \*

Gail Fishman \*

Albert Gregory \*

Bob Henderson \*

Cal Jamison \*

Howard Kessler

Debbie Lightsey \*

Sean McGlynn \*

Ryan Smart

Jim Stevenson \*

Tom Taylor \*

Rob Williams \*

Guests

Kathleen Coates \*

Megan Doherty \*

Mark Heidecker \*

Johnny Richardson \*

WSA Advisors

Anthony Gaudio

Pam Hall

Julie Harrington

Chuck Hess \*

Todd Kincaid

Bob Knight

Terrance McCaffrey

Pam McVety

Dan Pennington

Bob Thompson

Appendix C

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Financial Statement** | | |  |  |  |
|  | **Wakulla Springs Alliance** | | | |  |  |
|  | **For Period Ended** | | |  |  |  |
|  | **August 31, 2017** | | |  |  |  |
| **INCOME** | **Budget** | **In-Kind** | **Current Month** | **Y-T-D Trans** |  | **Checking Account** |
| Fund Balance (January 1, 2017) | 3854.46 |  |  | 3854.46 | BFB | 3854.46 |
| Palmetto Tours |  |  |  | 581.00 | Income | 831.00 |
| Board Member Contributions (4) |  |  |  | 250.00 | Expense | 756.25 |
| Other Donations |  |  |  |  | Grant |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  | EFB | 3929.21 |
| Subtotal | 0.00 | 0.00 | 0.00 | 831.00 |  |  |
| **TOTAL** | **3854.46** | **0.00** | **0.00** | **4685.46** |  |  |
|  |  |  |  |  |  |  |
| **EXPENDITURES** |  |  |  |  | Rest |  |
| Secretary Expenses |  |  |  |  | **Unrest** | 3929.21 |
| Web Support |  |  |  | 325.00 |  |  |
| Corporate Filing Fee | 61.25 |  |  | 61.25 |  |  |
| Grants |  |  |  | 200.00 | Bank Statement | 3929.21 |
| Board Workshop |  |  | 170.00 | 170.00 | Checks not |  |
|  |  |  |  |  | Recorded |  |
| **RESERVES** |  |  |  |  |  |  |
|  |  |  |  |  | Deposits not |  |
|  |  |  |  |  | Recorded |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  | Due to/from |  |
|  |  |  |  |  | Projects Fund |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  | EFB | 3929.21 |
| **TOTAL** | **61.25** | **0.00** | **170.00** | **756.25** | (Overage) | 0.00 |
|  |  |  |  |  |  |  |
| Copy of ROBERTK1   |  | | --- | |  | |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Appendix D

**Wakulla Springs Alliance   
Water Quality Work Group Proposed Priorities 8/14/17**

**Short-Term (1-year) Priorities**

1. Follow up on the Blueprint Intergovernmental Agency (IA) Comprehensive Wastewater Treatment Facilities Plan (CWTF) for Leon County:
   1. Review and comment on CWTF Plan RFP and consultant report
   2. Oppose any new central sewer extensions outside Urban Service Area until CWTF Plan is completed
2. Ensure equal public financial support to homeowners and businesses for OSTDS nitrate mitigation
3. Require connections to new and existing central sewer in all jurisdictions.
4. Encourage Leon and Wakulla counties to adopt and enforce necessary ordinances to implement comprehensive plan policies governing wastewater treatment for new development and redevelopment
5. Participate in BMAP OSTDS remediation plan development (due July 2018)
6. Assess effectiveness of existing local fertilizer ordinances and state agricultural BMPs and advocate more effective measures as needed
7. Promote adoption of local storm water treatment standards within Wakulla Springs Primary Focus Areas that minimize nitrogen loading to Upper Floridan Aquifer

**Long-Term (2-5 year) Priorities**

1. Seek ways to move forward to attain advanced wastewater treatment at all remaining WWTFs within springshed
2. Support funding by Blueprint IA for Wastewater Treatment Finance Plan and Management and Operations Plan and monitor implementation
3. Seek financial and political support for a comprehensive wastewater facilities and management plan for Wakulla County
4. Keep abreast of BMAP updates, and publicly financed applications for funding for sewer projects, septic tank mitigation projects and their implementation
5. Keep abreast of state legislation concerning springs

Appendix E

Wakulla Springs Alliance   
**Ecosystem Restoration Work Group Proposed Priorities**Working Draft 8/18/17

**Ecosystem Focus Priorities**

1. Wakulla spring and river ecosystems
2. Springshed ecosystems: Upland, wetland, and aquatic ecosystems within Wakulla springshed which may affect water quality conditions in Wakulla spring and river ecosystems

**Short-Term (1-year) Priorities**

1. Spring and river ecosystem restoration:
   1. Submerged aquatic vegetation (SAV) pilot project **[overlaps with Advancing Science and Research]**
2. Springshed ecosystems
   1. Identify how and when we should get involved in Capital Circle SW highway widening project to advocate for protection of Wakulla Spring and River ecosystem
   2. Review annual update of Wakulla State Forest Management Plan through participation in Wakulla SF Liaison Committee meetings

**Long-Term (2-5 year) Priorities**

1. Spring and river ecosystem restoration
   1. Undertake multi-year program of SAV revegetation
   2. Review invertebrate and fish surveys and determine what if anything else is needed **[overlaps with Advancing Science and Research]**
   3. Document aquatic ecosystem changes over time **[overlaps with Advancing Science and Research]**
2. Springshed ecosystems
   1. Identify major infrastructure projects that may impact springshed ecosystems
   2. Advocate for preserving existing native biological communities to the greatest extent possible within Wakulla springshed
   3. Support FDAC and USDA programs for private property sustainable silviculture restoration BMPs
   4. Support sustainable forestry practices that minimize erosion and nutrient runoff
   5. Continue to participate in reviews of annual update of Wakulla State Forest Management Plan through participation in the Wakulla State Forest Liaison Committee meetings

Appendix F

**WSA SWIM Plan Comments**

*Wakulla Springs Alliance*

TO: Mr. Paul Thorpe, Northwest Florida Water Management District

FROM: Seán McGlynn, Chair, and Robert Deyle, Vice Chair

DATE: August 20, 2017

RE: *St. Marks River and Apalachee Bay Surface Water Improvement and Management Plan*

On behalf of the Wakulla Springs Alliance Board of Directors we are submitting these comments on the July 2017 draft *St. Marks River and Apalachee Bay Surface Water Improvement and Management Plan*. We also wish to convey our endorsement of the comments submitted by Rob Williams on behalf of the Apalachee Audubon Society.

We want to thank you for including Lake Lafayette as a geographic focus area under the Sub-basin Restoration Plans priority in the draft plan. Please likewise add the Spring Creek Springs Group as a geographic focus area in the tables on pages 45, 49 and 57 as well as designating it Table 4-3 as a priority project. However, we would also like to suggest that a separate priority project, a Lake Lafayette and Spring Creek Basin Plans, be created as a Sub-basin Restoration Plan priority, similar to what was done for Lake Jackson in the Ochlockonee River and Bay draft plan. This would provide the impetus for the restoration and preservation of both the Lafayette ad Spring Creek basins.

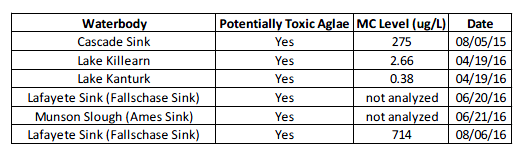
Section 2.2.3 Spring and Karst Features

1. We suggest including a discussion of the Florida Aquifer Vulnerability Assessment system with a figure depicting the Leon County and Wakulla County maps and/or a FAVA map for the entire watershed. The text should note that Leon and Wakulla County maps were utilized in designating the Primary Focus Areas for prioritizing septic tank remediation in the Wakulla Basin Area Management Plan. A map depicting the PFAs also should be included in the plan in an appropriate section, either here or in section 3.1.1 (see comment #8 below).
2. Page 11 - We recommend revising the fourth paragraph to include the additions indicated here:

The tidally influenced Spring Creek Springs Group includes 14 known submarine springs, including four major vents. Most vents discharge into the mouth of Spring Creek before it reaches the Gulf of Mexico. Discharge includes both saltwater and freshwater components. The average freshwater flow, based on USGS estimates, was 417 cfs during the period of June 2007-June 2010. Spring flow may exhibit short periods of reversal at high tide. During sustained dry conditions, flow at the Spring Creek springs may cease when salt water within the cave system blocks freshwater flow. This condition appears to be associated with a diversion of groundwater flow and increase in discharge a Wakulla Spring which is hydrologically connected to the Spring Creek Springs (Davis and Verdi 2013). When the Spring Creeks Springs cease to flow or reverse, tannic water from Lost Creek flows north into Wakulla Springs. This can have dramatic water quality impacts on Wakulla Springs causing nitrate concentrations to decrease and true color to increase (Dryer, 2015; McGlynn and Deyle, 2017).

Section 3.1.1 Impaired Waters

1. We recommend changing the title of this section to something broader such as “Impaired Waters and Other Water Quality Problems”
   1. Several of the lakes in the watershed do not meet state Class III surface water standards but have not been declared impaired for all of those parameters.
   2. Cyanotoxins have been recorded at concentrations that exceed standards in some states. These are not yet regulated by EPA or the State of Florida but they pose potential environmental and public health risks and deserve some attention (see comment #4)
   3. Reduced visibility in Wakulla Spring has emerged as a problem since the mid-1990s that affects both recreational use (glass-bottom boat tours) and the ecosystem (reduced photic zone depth). This needs to be addressed to setup the water clarity objectives in section 4.1.6 (see comments #19-20)
2. This section should acknowledge findings of cyanotoxin pollution of some lakes in the watershed. Leon County (2016) reports that FDEP documented the presence of both the cyanobacterium (“bluegreen algae”) *Microcystis* and associated cyanotoxins (microcystins) in Lake Munson in 2013. Samples analyzed in 2015 and 2016 for McGlynn Laboratories Inc., by GreenLabs Inc., found *Microcytis* present in several sinkhole lakes within the Wakulla springshed, including Lake Lafayette and Lake Munson, both of which have been demonstrated through dye trace studies to be hydrologically connected to Wakulla Spring (see table). The World Health Organization (WHO) set a safe drinking water limit for microcystins for humans at 1.5 ug/L. The algae in Lake Killearn had almost twice this level of toxin. The Cascade Sink (next to A.J. Henry Pond in the Cameron Chase Subdivision) had over 180 times the toxic threshold, and Lafayette Sink exceeded it over 450 times. While the USEPA has not yet promulgated harmful algae drinking water quality standards, they have issued a drinking water health advisory for microcystins recommending levels at or below 0.3 ug/L in drinking water for children pre-school age and younger (less than six years old) (USEPA, 2015). For school-age children through adults, the recommended level for drinking water is at or below 1.6 ug/L. Owners of private wells near and down-gradient from these lakes may be at risk when cyanotoxins are this high in sinkhole lakes.



Source: Sean McGlynn, personal communication, August 19, 2017.

Twenty-two U.S. states have promulgated regulations governing cyanobacteria and cyanotoxins in recreational waters that call for beach closures for microcystin at levels in the range of 6 to 20 ug/L. The Cascade Sink and Lafayette Sink (August 2016) levels exceed the upper bound of those standards by 14 and 36 times respectively.

1. Draft text to address reduced visibility in Wakulla Spring:

More prolonged periods of “dark water” conditions in Wakulla Spring have almost completely curtailed operation of glass-bottom boat tours, one of the major recreational attractions of the spring (H.T. Odum Florida Springs Institute, 2014). More prolonged dark water conditions also have altered the light environment for submerged aquatic vegetation (SAV) in the spring and may have contributed to the slow recovery of native SAV species following the decline of invasive hydrilla and the retreat of algal mats following reduced nitrate inputs from the T. P. Smith wastewater treatment plant in Tallahassee (McGlynn and Deyle, 2017). Changes in the dynamics of the Wakulla Spring-Spring Creek springs system (Davis and Verdi, 2014) have resulted in tannic inflows from the Lost Creek swallet flowing north to Wakulla Spring, prolonging the “brown dark water” conditions that naturally occur after periods of prolonged rainfall. During periods when tannic inflows cease the spring appears green rather than returning to its aqua-blue “clear” condition. Spectralradiometry and analyses of chlorophyll and true color conducted by McGlynn Laboratories, Inc. under contract with the Wakulla Springs Alliance have demonstrated that the green color arises from chlorophyll and phaeophytin (degraded chlorophyll) flowing into the spring from the aquifer (McGlynn and Deyle, 2017). The sources of that color have not yet been determined.

1. This section should include mention in the text that the Upper Wakulla River has been designated as impaired for nutrients (biology) and include the Upper Wakulla River in Figure 3-1. It is listed as having a TMDL in Table 3- 1, and the TMDL document states that FDEP declared it impaired for biology in 2008 (Gilbert, 2012, p. 1).
2. Table 3-1 should include the TMDL adopted by EPA in 2012 for Upper Lake Lafayette for total phosphorus (Leon County, 2016)
3. Page 24, ¶2, line 9 – “(Figure 3-2)” should be “(Figure 3-3)”.
4. Page 24, ¶4: Connecting septic tanks to central sewer systems is not always the most cost-effective solution nor is it always consistent with local planning goals, objectives, and policies. The Tallahassee-Leon County Comprehensive Plan restricts sewer services to the designated Urban Services Area (USA). Extending sewer lines beyond the USA will spur sprawl development that may adversely affect environmentally sensitive areas and have other unintended consequences. In June 2017 the Tallahassee Leon County Intergovernmental Agency Board voted to move forward with a comprehensive Wastewater Facilities Engineering Plan. No projects to connect septic systems outside the USA to new central sewers should be funded until that plan has been completed. The description of the OSTDS mitigation initiative also is not entirely accurate

We therefore suggest making the following changes to paragraph 4 and that you include a figure depicting the locations of the Primary Focus Areas in this section:

To further reduce nitrogen loading, FDEP, in collaboration with Leon and Wakulla counties, ~~and~~ the City of Tallahassee, ~~in coordination with~~ the ~~FDEP,~~ NWFWMD, ~~and~~ the Florida Department of Health (FDOH), and stakeholder groups, ~~are implementing~~ is developing a ~~coordinated in initiative~~ a plan to reduce~~d~~ nitrate~~pollutant~~ loading from onsite sewage treatment and disposal systems (OSTDS) ~~throughout the watershed,~~ within ~~emphasis on~~ the Primary Focus Areas of the Upper Wakulla River and Wakulla Spring BMAP area (see Figure 3-X). Some initial ~~P~~projects ~~are being~~ have been initiated ~~funded and implemented~~ to connect existing septic systems to central sewer systems within the Tallahassee-Leon County Urban Services Area and the service areas of existing central sewers in Wakulla County. Where connection to central sewer is not feasible or consistent with local comprehensive plan policies, pilot projects have begun ~~efforts are being made~~ to deploy alternative advanced ~~passive~~ OSTDS technologies that achieve substantially greater pollutant removal than conventional systems. In June 2017, the Tallahassee Leon Intergovernmental Agency Board voted to move forward with a comprehensive Wastewater Facilities Engineering Plan that will identify the most cost-effective nitrogen-removing treatment alternatives to conventional OSTDSs for treating and disposing of domestic wastewater produced by new and existing development in specific locations in the unincorporated areas of Leon County.

We recommend adding a table that follows Figure 3-2 and Table 3-1 that reports the recent water quality trends for each of the water bodies for which TMDLs have been set and/or for state regulated pollutants (chlorophyll a, total nitrogen, and total phosphorus) in the major lakes to provide a sense for the water quality status of these water bodies. At present, current trend data for TMDL parameters are only provided in the text for the Upper Wakulla River/Wakulla Spring (Figure 3-3 and accompanying text).

Data are available from the Leon County *2016 Water Quality Report* at [http://cms.leoncountyfl.gov/Home/Departments/Public-Works/Engineering-Services/Stormwater-](http://cms.leoncountyfl.gov/Home/Departments/Public-Works/Engineering-Services/Stormwater-Management/Water-Quality-Data) [Management/Water-Quality-Data](http://cms.leoncountyfl.gov/Home/Departments/Public-Works/Engineering-Services/Stormwater-Management/Water-Quality-Data). Those data show that FDEP standards for chlorophyll a, total nitrogen, and total phosphorus have been exceeded in most of the last 3 or 4 years for which data are available in the three largest sinkhole lakes in Leon County: Lake Jackson, Lake Lafayette, and Lake Munson. Throughout 2016 algal blooms were persistent in the ULL, all above the maximum Numeric Nutrient Criteria level indicating water quality impairment (Seán McGlynn unpublished data). Lake Munson also has consistently exceeded its TMDL criteria for turbidity and BOD as well as state standards for lead. Munson Slough has consistently exceeded TMDL limits for nitrogen, phosphorus, and ammonia, the new state standard for *E. coli*, and the state standard for lead.

Section 3.1.2 Pollution Sources

1. Page 25, ¶4 – Qualify the finding regarding water quality in Lake Munson by the recent water quality conditions documented in our preceding comment #9.
2. Page 26, ¶2 – Add acknowledgement that despite completion of the Weems Pond treatment system for storm water entering Lake Lafayette, water quality in the lake continues to exceed state Class III water quality standards as well as TMDL limits as documented above in our comment #9. Note also that Blueprint staff have informed us that the Cascades Park alum treatment system was over designed and does not operate at the typical flow rates experienced at the facility. Algae blooms are common in the Cascades park ponds, while Lake Munson continues to exceed Class III water quality standards as well as its TMDL limits. Note also that the 2010- 2011 drawdown treatment of Lake Munson without sediment removal proved ineffective in mitigating high levels of nutrients in the lake (Leon County, 2016).

EPA’s National Recommended Water Quality Criteria for free (recoverable) aluminum in freshwater ecosystems with pHs of 6.5-9.0 are a Criterion Maximum Concentration (CMC) of 750 ug/L and Criterion Continuous Concentration (CCC) of 87 CCC (<https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table>). Florida does not regulate aluminum in Class III freshwater bodies. The aluminum standard for Class II predominantly marine waters is LE 1.5 mg/L as is the standard for Class II water bodies (62-

302.530 FAC).

1. Page 28, ¶4 -The description of the advanced wastewater treatment improvements should be checked with Sondra Lee, plant operator. Based on a recent tour she gave to Wakulla Springs Alliance members I believe the deep bed denitrifying filters were used only during the interim prior to installing the new biological nitrogen removal basins.

14. Table 3-2 (pp. 28-29)

* 1. Spell out “RIB,” i.e. “Rapid infiltration basin”
  2. It would be informative to include a brief description of the nitrogen removal technology in place in each and/or the applicable nitrogen discharge permit limit for each WWTP

Section 3.2 Natural Systems

1. Page 31, ¶2 – Loper et al.’s (2005) possible attribution of the apple snail demise to the presence of hydrilla appears to not be the whole story. We suggest revising the paragraph to something like the following:

As described by FDEP (2012), the upper reach of the Wakulla River and Wakulla Spring have~~has~~ experienced significant ecological impacts due to elevated nitrate levels~~the water quality issues described above~~. Extensive growth of the non-native aquatic plant~~s~~ hydrilla (Hydrilla verticillata) and proliferation of algal~~e~~ mats diminished native plant cover and stressed aquatic species. ~~Hydrilla (Hydrilla verticillata) growth substantially impacted the ecosystem and may have contributed to the disappearance of native apple snails (Pomacea paludosa) and the limpkin (Aramus guarauna) population that feeds on them (Loper et al. 2005).~~ Intensive efforts were ~~have been~~ undertaken to remove hydrilla, including chemical treatment and mechanical harvesting. Increased numbers of manatees utilizing the spring, particularly during the winter months, ~~has contributed to~~ substantially increased grazing pressure.

Following full-scale deployment of Tallahassee’s upgraded Thomas P. Smith wastewater treatment plant (WWTP) in November 2012, the hydrilla did not recover from manatee grazing during the winter of 2012-13. No herbicide treatment was required in spring 2013 and none has been required since. Manatee numbers subsequently declined coincident with the decrease in hydrilla coverage. Herbicide treatment to control hydrilla also adversely affected native submerged aquatic vegetation (SAV) and likely promoted the proliferation of algal mats (Savery, 2005). However, algal mat coverage also has declined since the winter of 2012-13, likely a result in part of reduced nitrate inputs from the T. P. Smith WWTP.

Loper et al. (2005) hypothesized that the proliferation of hydrilla may have contributed to the decline of the apple snail and with it the limpkin, presumably because it displaced native SAV species preferred by the snails. The initial stressor, however, was prolonged high water in the river in 1994 which drowned most of the snail eggs (Savery, 2014). Hydrilla was first observed in the state park in April 1997 and proliferated rapidly thereafter (Savery, 2005). The state park began herbicide treatments in 2002 and began to reintroduce snails in 2003, releasing snails each year through 2007 and again in 2012 (Savery, 2005; Wakulla Springs State Park, 2014). Apple snail recovery has been modest based on egg cluster surveys conducted since 2006 (see chart provide by WSSP park biologist Patty Wilbur, 2016) despite the substantial decline in hydrilla since winter 2012-2013, suggesting that some other factor(s) may still be suppressing the snails. Continued widespread algal mats, dominated by the blue-green algae (cyanobacterium) *Lyngbya* may play a role because of low food value and perhaps because of its release of cyanotoxins which apple snails may bioaccumulate (Wilde e t al., 2005).

**Egg Cluster Counts**

**Late May + Early July + Mid August**

2,500

2,000

1,500

1,000

500

-

2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016

Section 4.1.1 Nonpoint Source Pollution Abatement

1. Page 33 - Stormwater Retrofit: We recommend that the following addition be made to paragraph 2:

Implementation may include a mixture of traditional and nonstructural approaches. There are numerous methods of stormwater management and treatment, among which are wet and dry detention ponds, infiltration systems, stormwater harvesting, wetland treatment systems, stormwater separator units, vegetated swales and buffers, pervious pavement, bioretention, vegetated swales and buffers, ditch blocks, green roofs, and chemical (alum) treatment. Experience with alum treatment facilities in the St. Marks watershed suggests that chemical treatment alone may be insufficient to remediate highly eutrophic lakes impacted by urban stormwater. Specific measures employed depend on site conditions, including soils, water table conditions, flow, intended uses, and available land area. Where feasible, constructed wetlands should be the primary/preferred treatment measure either as stand-alone systems or as a supplement to existing alum facilities to provide enhanced stormwater treatment. Optimally, a treatment train approach is employed, addressing hydrology and water quality treatment across a basin. Implementation is best accomplished within a wider, watershed context that incorporates initiatives such as Florida Friendly Landscaping (section 373.185, F.S.) and public outreach and awareness.

Section 4.1.2 Wastewater Management and Treatment Improvements

1. Page 37 - Septic to Sewer Connections:
   1. This discussion should acknowledge that extension of sewer in Tallahassee-Leon County also is constrained by comprehensive plan policies which restrict sewer service to the designated Urban Service Area. Extension of sewer outside the USA will promote sprawl and densification in areas currently designated for low density residential land use.
   2. Revise or delete the last sentence of paragraph 3 if the count of 4,200 units includes the proposed Woodville sewer project. That project is on hold until completion of the recently funded comprehensive Wastewater Facilities Engineering Plan (see comment #8 above).
2. Page 37 - Advanced Onsite Systems: The first sentence of this subsection should be revised to say “Where extension of sewer service is not economically feasible due to the spatial distribution of rural populations or constrained by land use policies limiting infrastructure to the Tallahassee-Leon County Urban Services Area, there is potential for installation of advanced onsite systems that achieve water quality treatment surpassing that provided by conventional systems. The comprehensive Wastewater Facilities Engineering Plan approved by the Tallahassee Leon Intergovernmental Agency Board in June 2017 will identify the most cost-effective nitrogen-removing treatment alternatives to conventional OSTDSs for treating and disposing of domestic wastewater produced by new and existing development in specific locations in the unincorporated areas of Leon County.

Section 4.1.3 Ecological Restoration

1. Page 39 – The discussion of Stream Restoration also should address the need for restoration of native submerged aquatic vegetation communities in Wakulla Spring and the upper Wakulla River. For example: “Restoration of native submerged aquatic vegetation (predominantly *Sagittaria kurziana* and *Vallisneria americana* but other species as well such as *Potamogeton illinoensis* and *Najas guadalupensis*) is needed in the upper Wakulla River, Wakulla Spring basin, and Sally Ward Run to repopulate large areas of bare sediment that have likely resulted from the combined effects of herbicide treatment for hydrilla, proliferation of algal mats, and more recent retreat of algal mats associated with reduced nitrate inputs.”
2. Page 39 - In the discussion of Lake Restoration, revise the last sentence to say “Additionally, lake drawdowns and natural drydown events can be used as opportunities to remove contaminated and/or enriched sediments, thus removing legacy pollutants including those that contribute to continuing water quality degradation associated with blooms of algae and cyanobacteria and heavy vmetals, as well as to promote oxidation of organic sediments and to improve vegetation conditions.”

Section 4.1.6 Needs and Recommendations for Further Analysis

1. Page 40, second bullet edit to say “Evaluate the effects of land use and management on water quality with implications for spring water visibility~~clarity~~.” The problem is not lack of clarity due to turbidity, it is low visibility and a shallow photic zone due to dissolved color from tannins and from chlorophyll and phaeophytin. See suggested setup in section 3.1.1 (comment #4).
2. Table 4-2, p. 41, 5th objective – Edit to say “Gain understanding of variables that affect water visibility~~clarity~~ in Wakulla Spring and clarity Apalachee Bay”

Section 4.2 Implementation

1. Table 4-2, p. 42 – References to “the ecology” of Wakulla Spring and the upper Wakulla River and of the St. Marks River should be to their ecosystems. “Ecology” means “the scientific analysis and study of interactions among organisms and their environment” and is not a synonym for “ecosystem.” Similar edits should be made in the blue sidebar charts throughout section 4.3.

Section 4.3 Priorities

24. Table 4.3, p. 44

* 1. Add Lake Restoration as a separate project: WQ, NS, and EDU (see comment #23)
  2. Modify the “Woodville Karst Springs” project listing to include the word “Plain” and to address both water quality and ecosystems, i.e. “Woodville Karst Plain Springs Water Quality and Ecosystem Protection and Enhancement.” Doing so sets up the SAV restoration initiative for Wakulla Spring, Sally Ward Spring, and the upper Wakulla River. Also, check the “EDU” column under Watershed Priorities for this project.

1. Page 45 – Add a new project heading: “Lake Restoration”
   1. Scope of Work
      1. Identify sinkhole lakes that are the principal sources of chlorophyll and phaeophytin responsible for prolonged "dark water" conditions in Wakulla Spring
      2. Evaluate the effectiveness of current stormwater treatment systems in remediating high ambient nutrient levels and associated blooms of algae and cyanobacteria in sinkhole lakes in Tallahassee and Leon County including Killearn Chain of Lakes, Lake Lafayette, Lake Munson, and what others? (see also comment #24(a)(i))
      3. Drawdown/drydown lakes for sediment removal to remove legacy nutrient enrichment pollutants in lakes identified as sources of chlorophyll and phaeophytin responsible for prolonged "dark water" conditions in Wakulla Spring where current stormwater treatment methods are not sufficient to remediate high ambient nutrient levels and associated blooms of algae and cyanobacteria
      4. Monitor lake sediment and water quality before and after implementation, as well as trends in Wakulla Spring chlorophyll and phaeophytin, optical quality, and PAR extinction
      5. Analyze data to identify sediment and water quality trends in treated lakes and water quality, optical water quality, and photosynthetically active radiation (PAR) extinction in Wakulla Spring.
   2. Outcomes/Products
      1. Improved lake water quality and ecosystems
      2. Improved Wakulla Springs visibility, PAR availability, and ecosystem quality
   3. Watershed Priorities
      1. Water Quality
      2. Natural Systems
   4. Supporting Priorities: Legacy pollutants, including within the sediments of lakes Munson and Lafayette
   5. Objectives
      1. Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs.
      2. Reduce nutrient and other pollutant concentrations in lakes.
      3. “Gain understanding of variables that affect ~~water clarity~~ visibility in Wakulla Spring and water clarity in Apalachee Bay.”
      4. Restore ecology of Wakulla Spring and the upper Wakulla River.
      5. Protect and restore the ecology of the St. Marks River.
   6. Lead Entities
      1. Leon County
      2. Wakulla Springs Alliance
      3. Apalachee Audubon
   7. Geographic Focus Areas: Lakes Jackson, Munson, and Lafayette
   8. Planning Level Cost Estimate: TBD
2. Page 45 - Stormwater Planning and Retrofit
   1. Scope of Work: Add
      1. Evaluate the effectiveness of current stormwater treatment systems in remediating high ambient nutrient levels and associated blooms of algae and cyanobacteria in sinkhole lakes in Tallahassee and Leon County including Killearn Chain of Lakes, Lake Lafayette, Lake Munson, Cascade Sink next to A.J. Henry Pond in the Cameron Chase Subdivision (see also comment

#23(a)(ii))

* 1. Under Objectives revise “Gain understanding . . .” to read “Gain understanding of variables that affect

~~water clarity~~ visibility in Wakulla Spring and water clarity in Apalachee Bay.”

* 1. Under Lead Entities add Wakulla Springs Alliance

1. Page 46 – Septic Tank Abatement: Delete Objective to “Gain understanding . . .” Dark water conditions are not caused by excess nutrients and, therefore, are not linked to septic tank abatement.
2. Page 47 – Advanced Onsite Treatment Systems: Ditto.
3. Page 48 – Revise subsection title as above: “Woodville Karst Plain Springs Water Quality and Ecosystem Protection and Enhancement
   1. Under Scope of Work
      1. Add drawdown/drydown lakes for sediment removal to remove legacy nutrient enrichment pollutants linked to reduced visibility in Wakulla Spring
      2. Change “habitat restoration” to “submerged aquatic vegetation restoration”
   2. Under Lead Entities add Wakulla Springs Alliance
   3. Under Geographic Focus Areas
      1. Edit as follows: “Woodville Karst Plain springs and their springsheds, including, but not limited

to:”

* + 1. Add Lost Creek as a separate focus area OR modify “Spring Creek Springs Group” to say “Spring Creek Springs Group and Lost Creek”

1. Page 49 – Agriculture and Silviculture BMPs
   1. Under Supporting Priorities add “Wakulla Springs and the Wakulla River plus St. Marks River”
   2. Under Objectives add
      1. “Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs”
      2. “Restore ~~ecology~~ ecosystem of Wakulla Spring and the upper Wakulla River”
   3. Under Geographic Focus Areas add “Wakulla Spring BMAP area”
2. Page 55 – Strategic Land Conservation
   1. Under Scope of Work reference the “Wakulla Springs Protection Zone project”
   2. Under Supporting Priorities add “Wakulla Springs and the Wakulla River plus St. Marks River”
   3. Under Objectives add
      1. “Meet or exceed the BMAP goal for the upper Wakulla River and Wakulla Springs
      2. Restore ~~ecology~~ ecosystem of Wakulla Spring and the upper Wakulla River”
3. Page 56 – Watershed Stewardship Initiative: Why is Wakulla Springs Alliance included under Lead Entities? This is not something the Alliance currently does.
4. Page 57 – We recommend adding the Spring Creek Springs Group to the list of Geographic Focus Areas for Sub- basin Restoration Plans to signal the need to address the effects of sea level rise on that spring system.
5. Page 58 – Wastewater Treatment and Management Improvements: Delete Objective to “Gain understanding . .

.” Dark water conditions are not caused by excess nutrients and, therefore, are not linked to septic tank abatement.

Section 4.5 Funding Sources

1. Footnote 1 in the “Eligibility” column heading is missing.

References Cited

Darby, Philip C. et al. 1997. Ecological Studies of Apple Snails (Pomacea paludosa, SAY). Gainesville, FL: University of Florida. file:///C:/Users/Owner/Documents/Wakulla%20Springs/Plants%20&%20Wildlife/Apple%20Snails/Darby%20et%20al.%2 0(1997).Ecological%20Studies%20of%20Apple%20Snails%20(P.%20paludosa).pdf.

Denson, Dana. n.d. “Channeled Apple Snails Invade Numerous Florida Waterbodies. Accessed 08-02-17 at <http://blpa.net/downloads/snailsPomacea_canaliculata_-_for_newsletter.html>.

Drizd, Lara Kristen. 2011. Aspects of the Abundance, Density, and Movement of Apple Snails Relative to Invasive Submerged Aquatic Plants in a Central Florida Lake. Master’s Thesis. University of Florida. <http://ufdc.ufl.edu/UFE0043504/00001>.

Dyer, Scott Barrett. 2015. Dye Tracing Investigates Conduit Connections Between Lost Creek Swallet, Spring Creek Springs and the Leon Sinks – Wakulla Cave System. Master’s Thesis. Tallahassee, FL: Florida State University. <http://fsu.digital.flvc.org/islandora/object/fsu%3A291277>.

Gilbert, Douglas. 2012. Final Nutrient (Biology) TMDL for the Upper Wakulla River (WBID 1006). Tallahassee, FL: Florida Department of Environmental Protection Watershed Evaluation and TMDL Section. <http://www.dep.state.fl.us/water/tmdl/docs/tmdls/final/gp1/upper-wakulla-river-nutr-tmdl.pdf>.

Howard T. Odum Florida Springs Institute. 2014. Wakulla Spring Restoration Plan. [http://floridaspringsinstitute.org/Resources/Documents/2014.08%20V3%20Wakulla%20Restoration%20Plan.pdf.](http://floridaspringsinstitute.org/Resources/Documents/2014.08%20V3%20Wakulla%20Restoration%20Plan.pdf)

Leon County. 2016. 2016 Water Quality Report. [http://cms.leoncountyfl.gov/Home/Departments/Public-](http://cms.leoncountyfl.gov/Home/Departments/Public-Works/Engineering-Services/Stormwater-Management/Water-Quality-Data) [Works/Engineering-Services/Stormwater-Management/Water-Quality-Data](http://cms.leoncountyfl.gov/Home/Departments/Public-Works/Engineering-Services/Stormwater-Management/Water-Quality-Data).

McGlynn, Seán E. and Robert E. Deyle. 2017. Wakulla Spring Dark Water: Causes and Sources Phase I. <http://wakullaspringsalliance.org/wp-content/uploads/2017/02/WSA-Dark-Water-Project.Phase-I.04-21-17.pdf>.

Monette, Dean, Markwith, Scott, Ewe, Sharon, and Matt Dinkins. 2005. “Vegetation Community Relationship with *Pomacea paludosa* and *Pomacea maculata* in Lake Okeechobee Florida.” [https://conference.ifas.ufl.edu/GEER2015/Documents/Speaker%20Presentations/SESSION%2039/1645\_Monette\_Dean.](https://conference.ifas.ufl.edu/GEER2015/Documents/Speaker%20Presentations/SESSION%2039/1645_Monette_Dean.pdf) [pdf.](https://conference.ifas.ufl.edu/GEER2015/Documents/Speaker%20Presentations/SESSION%2039/1645_Monette_Dean.pdf)

Savery, Scott. 2005. Appendix D. History of Hydrilla Removal Efforts at Wakulla Springs. In Loper, David E. et al. Degradation of Water Quality and Wakulla Springs, Florida: Assessment and Recommendations. [http://ufdc.ufl.edu/UF00094056/00002.](http://ufdc.ufl.edu/UF00094056/00002)

Savery, Scott. 2014. Retired Wakulla Springs State Park biologist. Personal communication, April 7.

USEPA. 2015. Drinking Water Health Advisory Documents for Cyanobacterial Toxins. [https://www.epa.gov/ground-](https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisory-documents-cyanobacterial-toxins) [water-and-drinking-water/drinking-water-health-advisory-documents-cyanobacterial-toxins](https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisory-documents-cyanobacterial-toxins).

Wakulla Springs State Park. 2014. “Apple Snail Release Program.”

Wilde, Susan B., et al. 2005. “Avian Vacuolar Myelinopathy Linked to Exotic Aquatic Plants and a Novel Cyanobacterial Species.” Wiley InterScience, DOI 10.1002/tox.2011 11. [www.interscience.wiley.com.](http://www.interscience.wiley.com/)