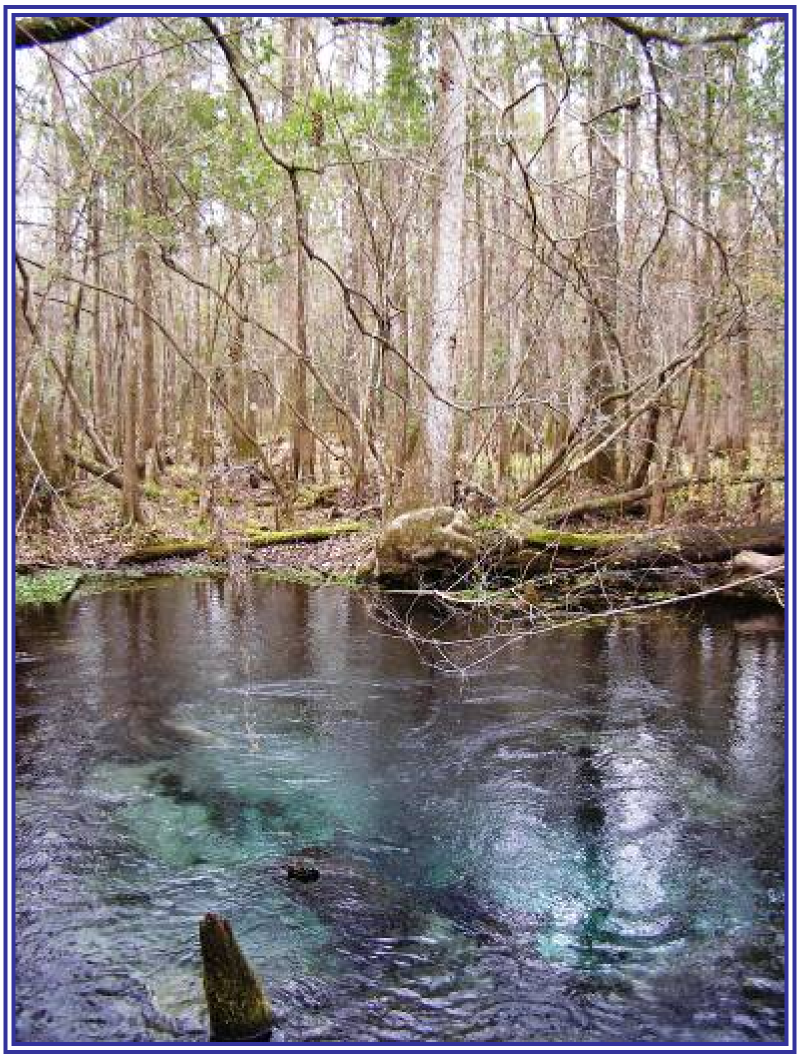
# St. Marks River and Wakulla River Springs Inventory
# Leon and Wakulla Counties, Florida

## Water Resources Special Report 06-03



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## Acknowledgements

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# INTRODUCTION

## Purpose and Scope

In 2001, the Florida Legislature funded the first phase of the Florida Springs Initiative (FSI) to study and preserve the quality of Florida's springs. The Florida Department of Environmental Protection (FDEP), administrator of FSI funding, has contracted with the Northwest Florida Water Management District (NWFWMD) to monitor first magnitude springs within the District, delineate springsheds and perform other research regarding spring water quality and distribution. The 2005 Florida Legislature continued funding and FDEP requested project proposals for additional work. The NWFWMD proposed completion of a thorough spring inventory located in the St.Marks/Wakulla River watershed. Although the basin was visited in the Florida Bureau of Geology (now the Florida Geological Survey) Bulletin 31 "Springs of Florida" (revised, 1977), local sources and the experience of NWFWMD and Florida Geological Survey (FGS) staff indicated the presence of many more springs discharging to the St. Marks and Wakulla rivers.

The St. Marks and Wakulla Springs inventory was performed under FDEP contract GW245 (amended July 2005) during the period of September 2005 through June 2006. The scope of work included researching a variety of sources for spring locations then visiting each spring to collect photographs, differentially corrected GPS position and field water quality measurements. NWFMWD staff also took instantaneous discharge measurements at springs appearing second magnitude or larger. Project deliverables consist of this report.

## Area of Investigation

The St. Marks River originates in east Leon County, FL near the town of Capitola. At its headwaters the St. Marks River appears to be little more than a collection of connected wetlands. As the river continues south it picks up the drainage from swamps located in the surrounding area and flow increases to a recognizable dark-water creek by the time the St. Marks crosses U.S. Highway 27. The character of the river remains much the same until it collects the discharge from Horn Spring and Chicken Branch Spring approximately ten kilometers downstream from Tram Road. The combined discharge from these two second-magnitude springs provides the majority of the base flow for the upper St. Marks River and allows the navigation of the river with a canoe or kayak. At Natural Bridge, the St. Marks River is taken by a swallet and resurges at the St. Marks Rise one kilometer to the south where its flow is greatly augmented by groundwater discharge. Discharge measurements collected by NWFWMD staff indicate that, on average, only 24 percent of the discharge at the river rise is contributed by inflow at the Natural Bridge swallet.

Wakulla Springs is located near the western edge of the Woodville Karst Plain area, which includes southeastern Leon County and eastern Wakulla County. The headspring rises dramatically from the surrounding pine flatwoods, forming the Wakulla River and flowing nine miles before merging with the St. Marks River. The first three miles of the river course are located in Wakulla Springs State Park and inaccessible to the public with the exception of a guided riverboat tour near the headspring. Access to the numerous small springs located within the park should be coordinated with park staff.

## Hydrologic Setting

In Jefferson, Leon and Wakulla counties, the Floridan Aquifer consists of the Miocene St. Marks Formation, the Oligocene Suwannee Limestone, and the Eocene Ocala Limestone (Scott 2001). The thickness of the aquifer increases from 305 to 822 meters, north to south, however only the first hundred meters are utilized due to high availability in the upper aquifer and increased mineralization and lower availability of the aquifer beginning in the Ocala Limestone (Pratt et al. 1996). Miller (1986) separated the Floridan Aquifer into an upper and lower component in the vicinity of the study area based on an order-of-magnitude change in transmissivity values. The limestone units comprising the uppermost Floridan Aquifer in the study area are the primary source of consumptive use and consist of the St. Marks Formation and the Suwannee Limestone (Pratt et al. 1996). Both units are of varying thickness within the study area due to karst and channel erosion features (Hendry and Sproul 1966).

North of the Cody Escarpment, an east-west trending physiographic feature of modest relief created by the erosion of sediments at a higher stand of sea level, the Floridan Aquifer transitions from unconfined to semi-confined with the addition of the Miocene Torreya and Pliocene Miccosukee Formations, clastic units of variable thickness and low permeability. Where present, these clastic units may contain minor surficial and intermediate aquifers; however, they primarily function as aquitards - restricting local recharge to the Floridan Aquifer. Where the Torreya and Miccosukee Formations are thick, transmissivity of the underlying Floridan Aquifer decreases precipitously due to slower dissolution of the limestone matrix (Miller 1986). There are a few notable locations in the St. Marks Basin where the clastic units are breached by sinkholes, directly connecting the Floridan Aquifer to the surface. These sinks are concentrated in the vicinity of Lake Miccosukee and collectively take in the surface drainage for most of the tributaries to the St. Marks River. The tributaries - including Lloyd Creek, Burnt Mill Creek, Still Creek, and Hall Branch - were originally complete surface features whose channels were lowered and captured by erosion and solution of the underlying limestone. The broad shallow lakes of the region, including Jackson, Iamonia, Lafayette, and Miccosukee, are likely former surface streams enlarged laterally by sinkhole formation (Yon, 1966).

The area of south Leon County, southwest Jefferson County and east Wakulla County - where the limestone units comprising the Floridan Aquifer are only covered, if at all, by a thin veneer of permeable Pleistocene sands - was first termed the Woodville Karst Plain by Hendy and Sproul (1966). The Woodville Karst Plain is characterized by high groundwater recharge rates of 38 to 50 centimeters per year (Bush and Johnson, 1988), abundant sinkholes, and few surface drainage features in the upland areas.

A ground water contribution zone for the St. Marks and Wakulla River basins interpreted from the 1996 USGS potentiometric surface map is depicted in **Figure 3** but is subject to change under different hydrologic conditions. It is bounded by ground water contribution zones for the Wacissa River to the east, the Spring Creek springs group to the west, and regional down-gradient ground water flow to the south.

**Figure 1: Location of Woodville Karst Plain**

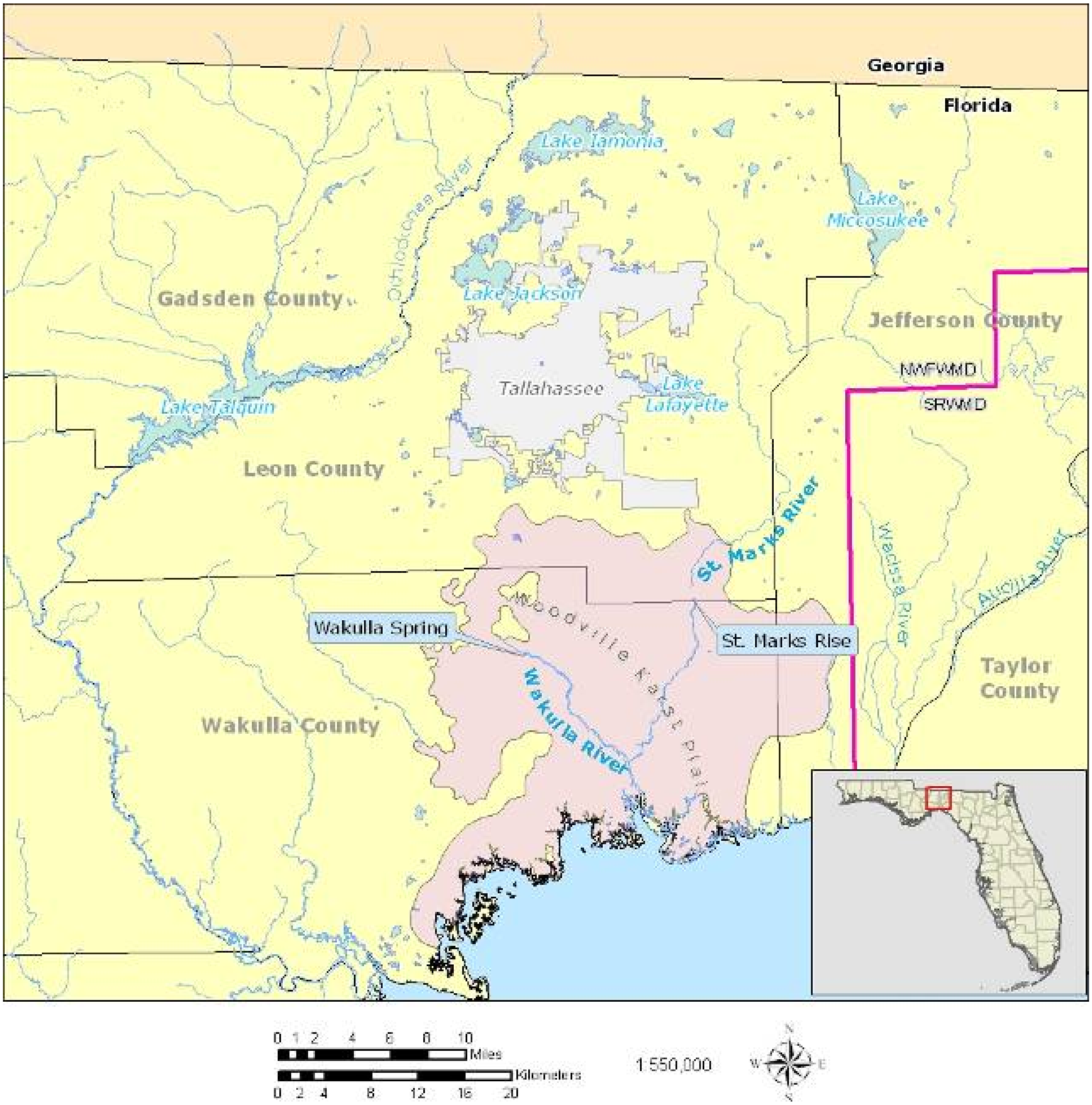
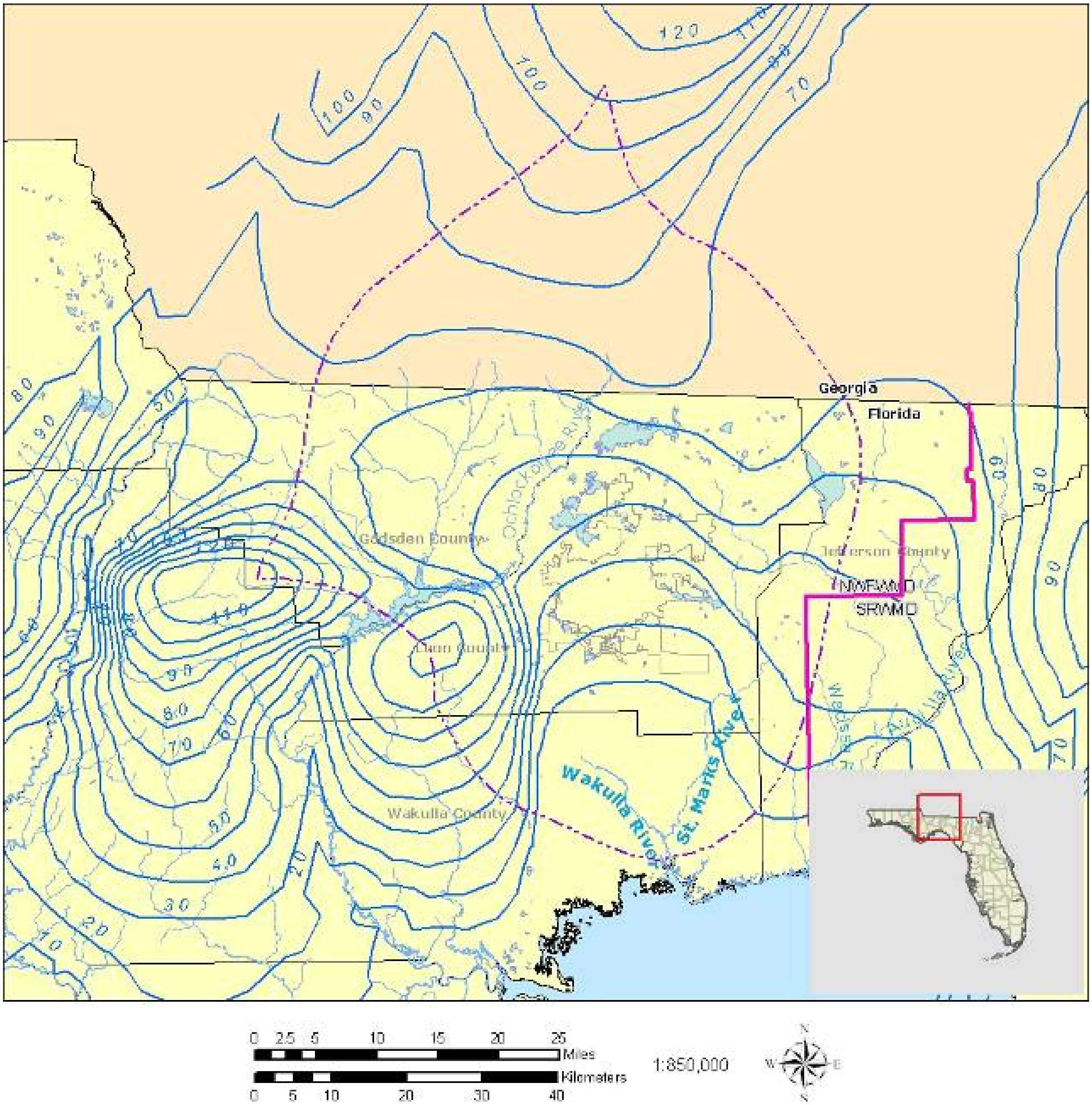


**Figure 2: St. Marks/Wakulla River Surface Water Basin**

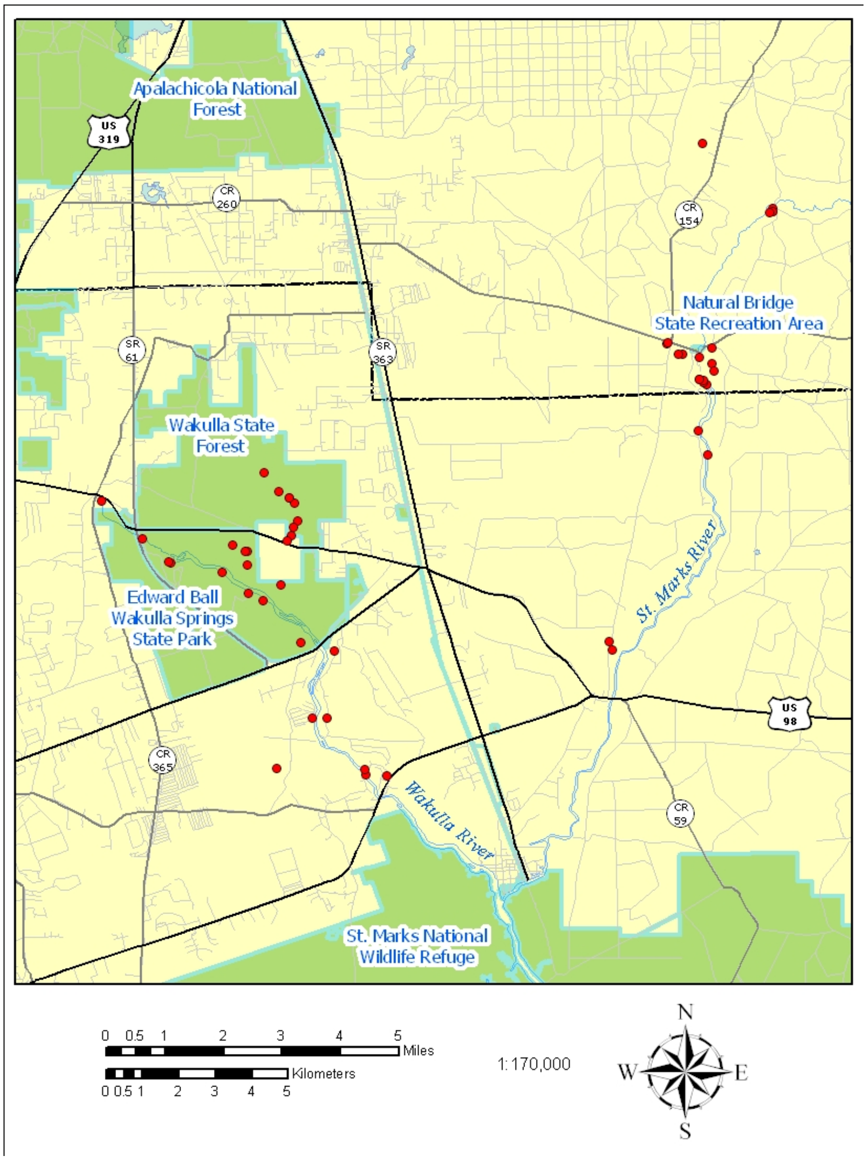
**Figure 3: St. Marks/Wakulla River Groundwater Contribution Area**



**ST.MARKS/WAKULLA RIVER BASIN SPRINGS**

A total of 51 springs and karst windows were identified in the St. Marks/Wakulla River basin (**Figure 4**). Springs in the St. Marks/Wakulla River basin include those with typical fissure-type vents and those that incorporate areas of diffuse, upward percolation of ground water into pools and runs. According to the Florida Springs Classification System and Glossary, Florida Geological Survey Special Publication Number 2, flow through an exposed conduit in the Floridan Aquifer is considered a karst window and not a spring (Copeland 2003). Therefore, several features historically noted as springs, though included in this report, should not be considered springs: including River Sink (Kini Spring), Go-Between, Rhodes Springs (1-4), Natural Bridge Spring, and River Rise Spring #3 and #4. Karst windows, however, remain valuable natural resources and worthy of conservation. Specific data, photographs and descriptions of individual springs and karst windows are provided in **Appendix A**.

**Figure 4: St. Marks/Wakulla River Spring and Large Karst Window Locations**



## Precipitation and Discharge

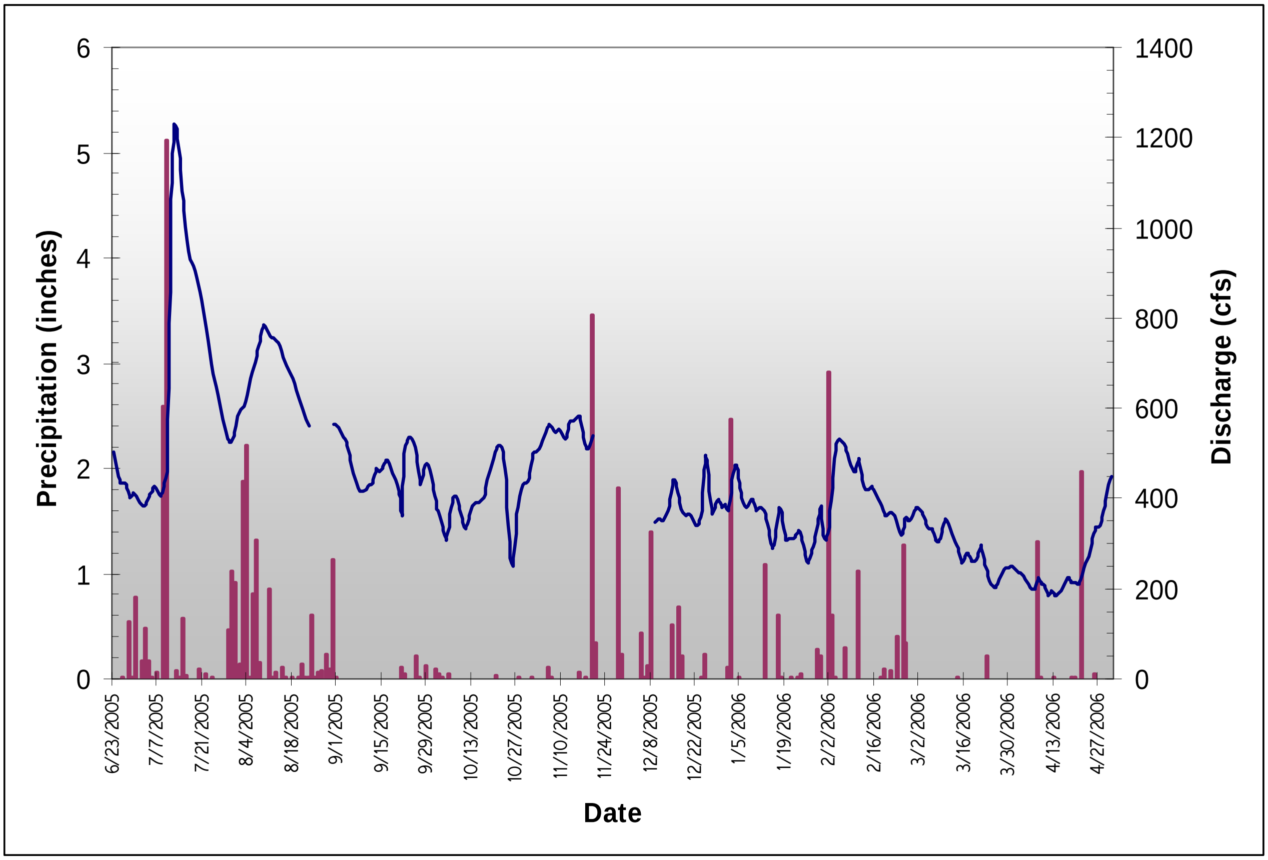
During the period of the spring inventory along the Wakulla and St. Marks rivers, surface water flow conditions played a significant role. During times of elevated stage, the springs located within or adjacent to the river channel were difficult to locate. Part of the purpose of the inventory was to provide accurate position data so springs can be relocated, even under unfavorable conditions. The study period (July 2005 to June 2006) was a period of below average precipitation and average discharge. NWFWMD Ground Water Bureau staff made site visits to the 54 springs and made discharge and field water quality measurements where possible. The discharge measurements are presented in **Table 1**.

**Table 1 – Spring and Karst Window Discharge Measurements**

| Spring Name | Date | Time | Discharge (cfs) |
|---|---|---|---|
| Chimney Spring | 2/22/2006 | 15:33 | 0.06 |
| Rock Spring | 2/22/2006 | 15:58 | 0.06 |
| Sweet Bay Spring | 2/22/2006 | 9:10 | 0.07 |
| Mysterious Waters Spring | 3/16/2006 | 13:50 | 0.32 |
| McBride Spring #4 | 3/9/2006 | 12:01 | 0.38 |
| Palmetto Springs | 2/22/2006 | 11:43 | 0.39 |
| Turn Around Spring | 2/22/2006 | 14:53 | 0.56 |
| Indian Spring | 3/10/2006 | 11:10 | 0.59 |
| River Plantation Spring #2 | 3/16/2006 | 16:19 | 0.68 |
| Wakulla Sulfur Spring #2 | 9/15/2005 | 16:43 | 0.69 |
| Tiger Hammock Spring | 9/15/2005 | 10:49 | 0.84 |
| St. Marks Sulfur Spring #3 | 5/19/2006 | 15:53 | 1.08 |
| River Plantation Spring #1 | 3/16/2006 | 11:18 | 1.49 |
| Homestead Spring | 2/22/2006 | 10:58 | 1.80 |
| Northside Springs | 2/22/2006 | 9:43 | 2.04 |
| River Rise Slough | 3/21/2006 | 13:50 | 2.48 |
| Wakulla Sulfur Spring #1 | 9/15/2005 | 14:41 | 3.15 |
| Newport Spring | 5/19/2006 | 17:00 | 3.58 |
| McBride Spring | 3/10/2006 | 13:20 | 4.66 |
| Darrel Spring | 3/21/2006 | 12:18 | 5.60 |
| No-Name Spring | 2/22/2006 | 16:35 | 6.19 |
| Little Horn Spring | 12/14/2005 | 16:11 | 6.50 |
| Rhodes Spring #2b | 9/9/2005 | 11:50 | 7.94 |
| Rhodes Spring #2a | 9/9/2005 | 11:25 | 10.6 |
| Sally Ward Spring | 11/18/2005 | 10:40 | 12.5 |
| Horn Spring | 12/14/2005 | 15:50 | 12.5 |
| Chicken Branch Spring | 2/9/2006 | 14:07 | 23.1 |
| Elly Spring | 3/21/2006 | 15:40 | 33.1 |
| Natural Bridge Spring | 7/7/2006 | 14:09 | 73.2 |
| St. Marks River Rise | 11/1/2005 | 10:50 | 433 |
| Wakulla Spring | 11/18/2005 | 14:19 | 598 |

**Figure 5** illustrates the Wakulla Spring Main Vent discharge measured by the Florida Geological Survey operated Falmouth velocity meter and precipitation measured at the NWFWMD Wakulla Springs station.

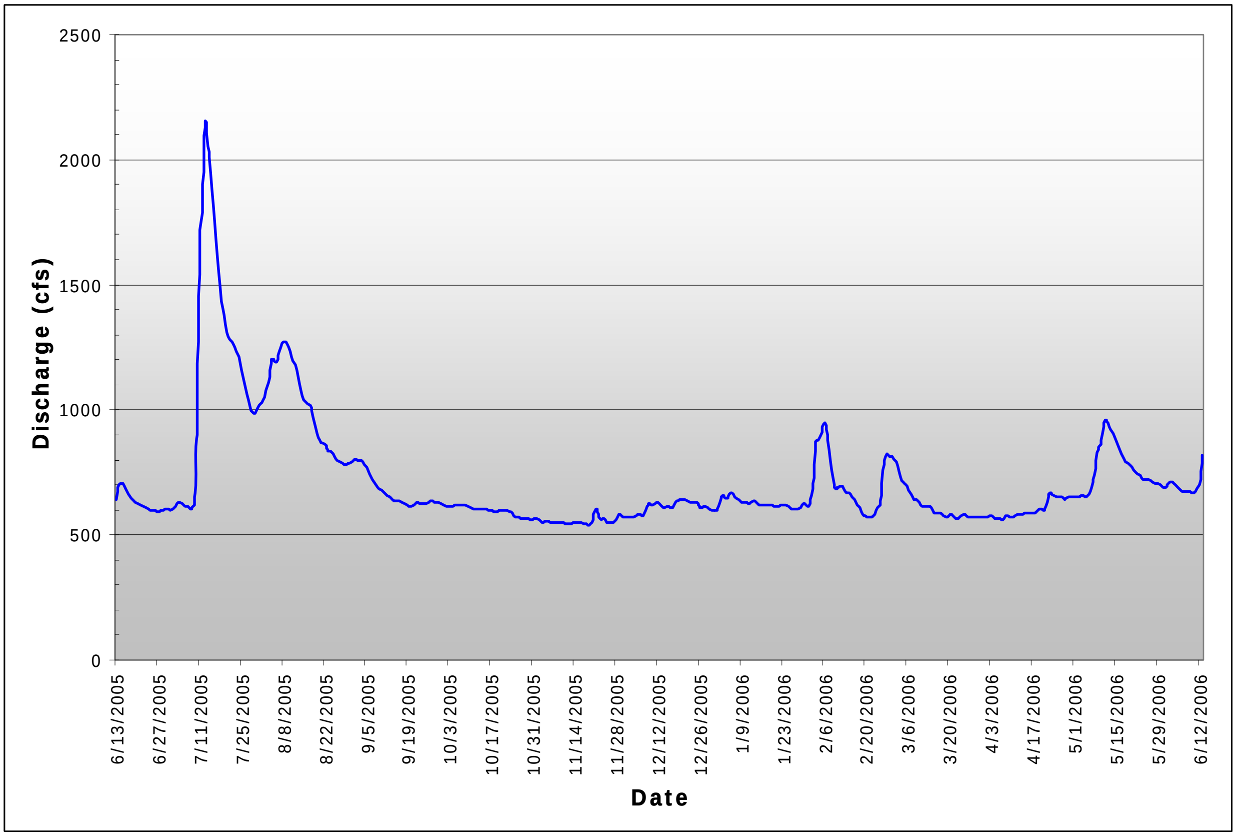
**Figure 5: Wakulla Springs - Precipitation and Discharge**




Discharge measurements recorded during the study period show that the Wakulla Springs discharge averaged 434 cfs with a median value of 404 cfs. Peak flow was measured in association with Hurricane Dennis in July 2005. **Figure 6** displays the St. Marks River discharge at the USGS Newport station calculated from a stage rating curve. An average discharge of 716 cfs with a median value of 628 cfs was recorded during the study period

The system has two first magnitude springs (discharge >= 100 cfs), Wakulla Spring and St. Marks River Rise. Five second magnitude springs were measured (>10 to 100 cfs discharge). Eleven springs are classified as third magnitude (>1 to 10 cfs), eight are classified as fourth magnitude (>100 gpm to 1 cfs) and three are classified as fifth magnitude (>10 to 100 gpm). Some of the springs not measured may also fall into the third magnitude or lower categories. A total discharge of 1247 cfs was measured during the study period for the St. Marks/Wakulla springs inventory.

**Figure 6: St. Marks River Discharge at USGS Newport Station**



## Water Quality

As part of the spring inventory process, field water quality measurements were made during site visits where possible. Measurements were made for water temperature (degrees C), dissolved oxygen (mg/L), pH (standard units), and specific conductivity (μS/cm). The results of these measurements are presented in **Table 2**.

**Table 2 – Spring and Karst Window Field Water Quality Measurements**

| NWF ID | Spring Name | Date | Temperature (Celsius) | Conductivity (uS/cm) | pH (su) | Dissolved $O_2$ (mg/L) |
|---|---|---|---|---|---|---|
| 9073 | Chicken Branch Spring | 2/9/2006 | 19.7 | 244 | 7.3 | 2.09 |
| 9342 | Chimney Spring | 2/22/2006 | 19.1 | 452 | 7.1 | 7.18 |
| 7944 | Darrel Spring | 3/21/2006 | 20.0 | 265 | 7.3 | 2.12 |
| 9351 | Deer Spring | 3/9/2006 | 18.2 | 409 | 7.2 | 4.17 |
| 9376 | Elly Run Spring | 3/21/2006 | 21.7 | 263 | 6.7 | 2.19 |
| 7945 | Elly Spring | 3/21/2006 | 19.5 | 243 | 7.3 | 1.19 |
| 9352 | Hawk's Cry Spring | 3/9/2006 | 20.3 | 319 | 7.2 | 5.60 |
| 9338 | Homestead Spring | 2/22/2006 | 20.3 | 324 | 7.4 | 1.05 |
| 7938 | Horn Spring | 12/14/2005 | 20.0 | 270 | 7.6 | 2.01 |
| 9359 | Ibis Glade Spring | 3/9/2006 | 19.9 | 356 | 7.2 | 2.53 |
| 7935 | Indian Spring | 3/10/2006 | 20.5 | 302 | 7.5 | 4.22 |
| 9328 | Little Horn Spring #1 | 12/14/2005 | 20.0 | 261 | 7.6 | 1.39 |
| 9329 | Little Horn Spring #2 | 12/14/2005 | 20.0 | 267 | 7.6 | 0.52 |
| 9330 | Little Horn Spring #3 | 12/14/2005 | 20.1 | 264 | 7.6 | 0.80 |
| 9356 | Lolly Spring | 3/9/2006 | 20.0 | 337 | 7.1 | 3.15 |
| 9362 | McBride Spring | 3/10/2006 | 19.9 | 343 | 7.4 | 2.18 |
| 9361 | McBride Spring #2 | 3/9/2006 | 19.8 | 345 | 7.4 | 7.20 |
| 9360 | McBride Spring #3 | 3/9/2006 | 19.3 | 355 | 7.1 | 1.44 |
| 9354 | McBride Spring #4 | 3/9/2006 | 19.9 | 314 | 7.3 | 4.64 |
| 9369 | Mysterious Waters Spring | 3/16/2006 | 17.9 | 481 | 6.8 | 1.96 |
| 7939 | Natural Bridge Spring | 7/7/2006 | 20.1 | 303 | 7.2 | 0.71 |
| 7936 | Newport Spring | 5/19/2006 | 20.3 | 464 | 7.2 | 0.53 |
| 9344 | No-Name Spring | 2/22/2006 | 20.1 | 326 | 7.2 | 0.97 |
| 9336 | Northside Spring #1 | 2/22/2006 | 19.7 | 350 | 7.1 | 2.87 |
| 9337 | Northside Spring #2 | 2/22/2006 | 19.6 | 350 | 7.1 | 2.56 |
| 9339 | Palmetto Spring | 2/22/2006 | 19.8 | 307 | 7.2 | 2.04 |
| 7940 | Rhodes Spring #1 | 7/7/2006 | 21.7 | 285 | 7.5 | 4.40 |
| 7941 | Rhodes Spring #2a | 3/21/2006 | 19.6 | 258 | 6.8 | 0.09 |
| 9331 | Rhodes Spring #2b | 11/1/2005 | 20.7 | 294 | 7.5 | 0.21 |
| 7942 | Rhodes Spring #4 | 7/7/2006 | 20.4 | 285 | 7.5 | 1.57 |
| 9367 | River Plantation Spring #1 | 3/16/2006 | 18.7 | 396 | 6.6 | 2.74 |
| 9368 | River Plantation Spring #2 | 3/16/2006 | 18.2 | 498 | 6.9 | 3.54 |
| 9371 | River Rise Spring #1 | 3/21/2006 | 19.7 | 263 | 7.2 | 1.30 |
| 9372 | River Rise Spring #2 | 3/21/2006 | 19.6 | 248 | 7.3 | 3.44 |
| 9373 | River Rise Spring #3 | 3/21/2006 | 19.7 | 261 | 7.2 | 1.83 |
| 9374 | River Rise Spring #4 | 3/21/2006 | 19.8 | 261 | 7.3 | 2.57 |
| 9343 | Rock Spring | 2/22/2006 | 18.6 | 439 | 6.9 | 2.08 |
| 9358 | Root Spring | 3/9/2006 | 19.8 | 341 | 7.1 | 4.12 |
| 774 | Sally Ward Spring | 4/17/2006 | 19.7 | 323 | 7.3 | 2.18 |
| 7943 | St. Marks River Rise | 11/1/2005 | 20.1 | 286 | 7.5 | 1.99 |
| 9398 | St. Marks Sulfur Spring #1 | 5/19/2006 | 20.3 | 364 | 7.3 | 0.43 |
| 9399 | St. Marks Sulfur Spring #2 | 5/19/2006 | 20.5 | 375 | 7.3 | 0.46 |
| 9400 | St. Marks Sulfur Spring #3 | 5/19/2006 | 20.5 | 462 | 7.2 | 0.60 |
| 9335 | Sweet Bay Spring | 2/22/2006 | 18.2 | 359 | 7.1 | 2.16 |
| 9324 | Tiger Hammock Spring | 9/15/2005 | 20.8 | 375 | 7.6 | 4.25 |
| 9341 | Turn Around Spring | 2/22/2006 | 19.0 | 406 | 6.8 | 2.25 |
| 749 | Wakulla Spring | 11/18/2005 | 19.2 | 310 | 7.5 | 1.18 |
| 9325 | Wakulla Sulfur Spring #1 | 9/15/2005 | 20.5 | 3650 | 7.3 | 0.30 |
| 9326 | Wakulla Sulfur Spring #2 | 9/15/2005 | 20.5 | 1789 | 7.5 | 0.51 |
| 9327 | Wakulla Sulfur Spring #3 | 9/15/2005 | 21.4 | 2448 | 7.6 | 4.79 |
| 9340 | Westside Spring | 2/22/2006 | 19.1 | 463 | 6.8 | 1.18 |

Temperature can be highly variable in surface water dependent on atmospheric conditions. Ground water temperatures tend to be much more stable. For instance, long-term water temperature readings at Wakulla Springs reveal that the temperature typically has a median value of 20.79 degrees C (n=4120, mean=20.77, stdev=0.11). The median temperature of the St. Marks/Wakulla springs, 19.8 degrees C (n=51, mean=19.8, stdev=0.8) compares well with this typical Floridan Aquifer value.

A surface water body with a dissolved oxygen (DO) value of less than 5.0 mg/L is considered impaired. The longer ground water remains in the aquifer, however, the DO concentration becomes lower due to oxidation reactions with the matrix material and the lack of re-aeration from the atmosphere or biologic sources. DO values in Floridan Aquifer wells recently sampled in the Wakulla/St. Marks spring basins have a median value of 3.31 mg/L (n=66, mean=3.85, stdev=2.89). The median DO value for the St. Marks/Wakulla springs is 2.08 mg/L (n=51, mean=2.31, stdev=1.71). The lower DO values measured for the springs indicate a longer average residence time in the aquifer for the spring discharge compared to ground water in the Floridan Aquifer wells. This implies that the wells are located within or closer to the recharge/contribution areas for the springs.

The spring pH values indicate that the water is well buffered. This is typical of water that has remained in the Floridan Aquifer for any length of time. The dissolution of limestone by acidic rain water raises the pH of the water and creates the characteristic karst topography of the Woodville Karst Plain. The median pH value for the Floridan Aquifer wells is 7.4 standard units (n=66, mean=7.3, stdev=0.2). The median value of the St. Marks/Wakulla River Springs is 7.2 standard units (n=51, mean=7.2, stdev=0.3).

Specific conductivity is a measure of the ion content of water. Rain water and surface water not influenced by ground water input usually have a specific conductivity value less than 50 μS/cm when not impaired by non-point sources. The median specific conductivity value for Floridan Aquifer wells is 286 μS/cm (n=66, mean=289, stdev=53). The median specific conductivity of the St. Marks/Wakulla springs is 341 μS/cm (n=51, mean=485, stdev=603).

The lower pH values and higher specific conductivity values in comparison to the Floridan Aquifer wells indicate the springs are more mineralized and more highly buffered. Because the Floridan Aquifer well chemistry indicates location within the recharge zone for the St. Marks/Wakulla springs, land use within the St. Marks/Wakulla spring basins has the potential to adversely affect spring water quality.

## CONCLUSIONS

- *Ground water contributes a significant portion of the St. Marks/Wakulla springs discharge and water quality.*

- *The quality of water discharged from the St. Marks/Wakulla springs is predominantly determined by the quality of ground water in the Floridan Aquifer.*

- *Water quality in the Floridan Aquifer and the springs' discharge is vulnerable to land use activities in the contribution zone. The springs are particularly vulnerable to those activities proximal to them.*

- *There are at least 51 Floridan Aquifer springs located in the St. Marks/Wakulla River basin. There may be more springs that can be distinguished under lower stage conditions.*

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## APPENDIX A: ST. MARKS RIVER AND WAKULLA RIVER SPRINGS INVENTORY

**Table 3. St. Marks/Wakulla Spring and Karst Window Location Coordinates (WGS84)**

| NWF ID | Spring Name | Latitude | Longitude |
|---|---|---|---|
| 9073 | Chicken Branch Spring | 30.3357674 | -84.1485548 |
| 9342 | Chimney Spring | 30.2273580 | -84.2809440 |
| 7944 | Darrel Spring | 30.2797861 | -84.1506500 |
| 9351 | Deer Spring | 30.2570444 | -84.2756111 |
| 9376 | Elly Run Spring | 30.2776167 | -84.1467500 |
| 7945 | Elly Spring | 30.2803833 | -84.1479833 |
| 9352 | Hawk's Cry Spring | 30.2505000 | -84.2686500 |
| 9338 | Homestead Spring | 30.2343700 | -84.2812000 |
| 7938 | Horn Spring | 30.3192472 | -84.1288028 |
| 9359 | Ibis Glade Spring | 30.2449125 | -84.2664944 |
| 7935 | Indian Spring | 30.2507959 | -84.3221020 |
| 9328 | Little Horn Spring #1 | 30.3183972 | -84.1290917 |
| 9329 | Little Horn Spring #2 | 30.3184889 | -84.1287889 |
| 9330 | Little Horn Spring #3 | 30.3180750 | -84.1299361 |
| 9356 | Lolly Spring | 30.2491417 | -84.2670892 |
| 9362 | McBride Spring | 30.2399591 | -84.2694859 |
| 9361 | McBride Spring #2 | 30.2411517 | -84.2683803 |
| 9360 | McBride Spring #3 | 30.2433407 | -84.2676758 |
| 9354 | McBride Spring #4 | 30.2523408 | -84.2716998 |
| 9369 | Mysterious Waters Spring | 30.1961000 | -84.2637333 |
| 7939 | Natural Bridge Spring | 30.2851167 | -84.1471833 |
| 7936 | Newport Spring | 30.2131333 | -84.1787333 |
| 9344 | No-Name Spring | 30.2148139 | -84.2665056 |
| 9336 | Northside Spring #1 | 30.2375900 | -84.2810600 |
| 9337 | Northside Spring #2 | 30.2375100 | -84.2814900 |
| 9339 | Palmetto Spring | 30.2290700 | -84.2716100 |
| 7940 | Rhodes Spring #1 | 30.2838167 | -84.1553500 |
| 7941 | Rhodes Spring #2a | 30.2863944 | -84.1600306 |
| 9331 | Rhodes Spring #2b | 30.2866778 | -84.1598225 |
| 7942 | Rhodes Spring #4 | 30.2835500 | -84.1573167 |
| 9367 | River Plantation Spring #1 | 30.2123833 | -84.2569667 |
| 9368 | River Plantation Spring #2 | 30.1958833 | -84.2594833 |
| 9371 | River Rise Spring #1 | 30.2765167 | -84.1482500 |
| 9372 | River Rise Spring #2 | 30.2770333 | -84.1482333 |
| 9373 | River Rise Spring #3 | 30.2773333 | -84.1510000 |
| 9374 | River Rise Spring #4 | 30.2774167 | -84.1511167 |
| 9343 | Rock Spring | 30.2253000 | -84.2767800 |
| 9358 | Root Spring | 30.2505500 | -84.2685560 |
| 774 | Sally Ward Spring | 30.2414000 | -84.3108000 |
| 7943 | St. Marks River Rise | 30.2760500 | -84.1488711 |
| 9398 | St. Marks Sulfur Spring #1 | 30.2646167 | -84.1515667 |
| 9399 | St. Marks Sulfur Spring #2 | 30.2585833 | -84.1490667 |
| 9400 | St. Marks Sulfur Spring #3 | 30.2111333 | -84.1777000 |
| 9335 | Sweet Bay Spring | 30.2392000 | -84.2850200 |
| 9324 | Tiger Hammock Spring | 30.1836670 | -84.2741170 |
| 9341 | Turn Around Spring | 30.2324800 | -84.2884500 |
| 749 | Wakulla Spring | 30.2352028 | -84.3029056 |
| 9325 | Wakulla Sulfur Spring #1 | 30.1816330 | -84.2486500 |
| 9326 | Wakulla Sulfur Spring #2 | 30.1828830 | -84.2491000 |
| 9327 | Wakulla Sulfur Spring #3 | 30.1811170 | -84.2427330 |
| 9340 | Westside Spring | 30.2354500 | -84.3034700 |

**Table 4. Spring and Karst Window Descriptions**

| Spring Name | Description |
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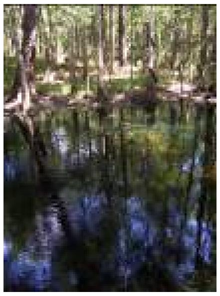
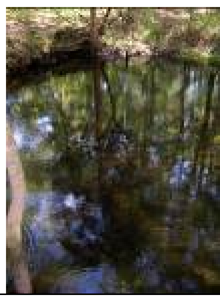
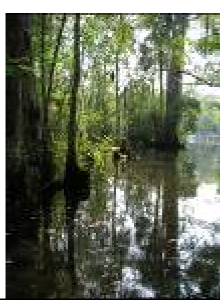
| Rhodes Spring #2a  | Rhodes Spring #2a is the southern of the two springs located near the southwest corner of the intersection of Natural Bridge Rd and Old Plank Rd. The spring discharges from a 12-foot deep fissure in the limestone at the bottom of the spring pool. From there, flow continues to the east, merges with the discharge from #2b after ~50 feet and continues to the east 300 feet to a swallet just west of Old Plank Road. |
| Rhodes Spring #2b  | Rhodes Spring #2b is located ~100 feet north of #2a and discharges from a vent located a the bottom of a small limestone ledge on the north side of the spring pool. Maximum depth recorded in the vent is 11 feet. The spring then flows south ~80 feet to combine with the flow from Spring #2a. |
| Tiger Hammock Spring  | Tiger Hammock Spring is located ~0.2 mile west of where its run crosses Tiger Hammock Road. The spring emerges from several sediment and woody debris laden vents near the center of a round depression in the surrounding pine flat woods. The run then continues 1.25 miles to the Wakulla River, joining just below the power line right of way midway between CR365 and US98. |
| Wakulla Sulfur Spring #1  | This spring is located on the north side of the Wakulla River 1/2 mile above the US98 bridge. The spring pool lies at the head of a short run to the Wakulla River and, unlike some of the other springs in this area, the banks rise steeply about 2 feet to the surrounding hardwood hammock woods. The spring appears to discharge from a small sand dusted limestone crevasse near the center of its pool. The pool is circular, approximately 40 feet wide and at times of better water clarity the halocline between the denser, high dissolved mineral spring water and the river water can be seen below the surface. A gentle surface boil is visible at low tides. |

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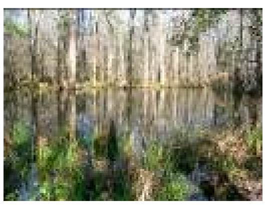
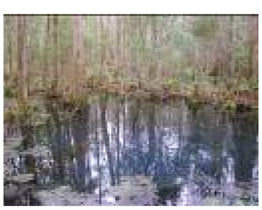
| Wakulla Sulfur Spring #3<br> | This spring cluster is a collection of widely distributed sand boils, seeps and small springs located just north of US98 on the east side of the Wakulla River - all coalescing into a single run that joins the river about a quarter mile above the US98 bridge. The run entrance is marked by a relict brick chimney. Like the other springs near the lower bridge, this spring has a high dissolved mineral content and a noticeable sulfur smell. |
| Wakulla Sulfur Spring #2<br> | This cluster of seeps and small springs, the largest of which forms a small pool approximately 6 feet wide and 3 feet deep, is located on the east side of the Wakulla River 1/2 mile north of the US98 bridge and just upstream of Unnamed Spring #2. The spring run from the main discharge area curves to the west and south before joining the river. |
| Chicken Branch Spring<br> | Chicken Branch Spring is located approximately 0.7 mile north of the crossing of Old Plank Road and Chicken Branch. Private property surrounds the spring and access is limited to a difficult paddle through thick cypress/tupelo wetlands from Old Plank Road. The spring discharges from a 50-foot wide pool into the surrounding wetlands, where the spring water spreads out into a broad floodplain. Maximum depth in the spring pool is approximately 40 feet near the center of the pool. The spring is in pristine condition with the exception of several 55-gallon drums and scattered refuse from a nearby hunt camp. Aquatic vegetation includes tape grass and red ludwigia.......wildlife is abundant in this remote area. |
| Sweet Bay Spring<br> | Sweet Bay Spring is located within Wakulla Springs State Park and is named after the large sweet bay trees found in the vicinity. The spring vent lies approximately 260 feet east of the multiuse trail in the northern portion of the park. The spring discharges from a sediment and woody debris laden vent, 6 feet in depth, near the center of a small pool. From there the spring flows to the east and combines with other seeps and springs, eventually joining McBride Slough. The spring is clear of algae and aquatic plants but is resplendent with lilies, periphyton and ferns. |
| Northside Spring #1<br> | Northside Spring #1 is the eastern spring and the larger of an adjacent pair located approximately 1400 feet east-southeast of Sweet Bay Spring. The spring pool is circular, approximately 30 feet wide, and 15 feet in depth over the vent. Because of its depth the spring is a deep blue, but the vent is still visible as a three foot wide crevasse in the limestone bottom. The discharge from this spring spreads out into the low wetlands surrounding the spring and joins with that of Northside Spring #2. Algae and aquatic plants are abundant in the spring and its run. Two discharge measurements were conducted at more channelized section of the spring run and represent a composite of the two spring's flow. |

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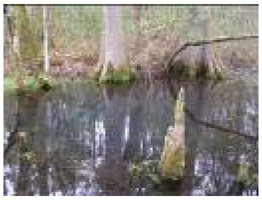
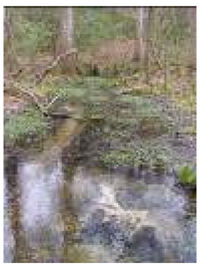
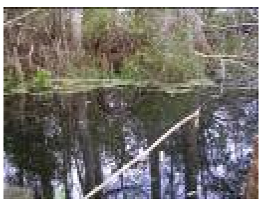
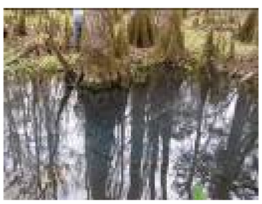
| Northside Spring #2<br> | Northside Spring #2 is located about 100 feet west of Northside Spring #1. It is a smaller spring with less obvious discharge, but still forms a clear pool. The pool is approximately 10 feet wide with a depth of 6 feet near the center. The vent appears to discharge from beneath a pile of leafy and woody debris clear of the silt that covers the rest of the bottom of the pool. |
| Homestead Spring<br> | Homestead Spring derives its name from a nearby hog farm and probable former residence. The spring consists of a small number of vents and seeps at the head of a short run that joins the flow from the other springs in this area. The largest vent is located beneath a moss covered fallen tree and is approximately five feet in depth. The spring is located about 275 feet northwest of the multi-use trail. |
| Palmetto Spring<br> | Palmetto Spring is a small pristine spring with two discharge points at the base of a low rise into the surrounding palmetto covered flatwoods. The upstream vent discharges into a six-foot wide pool with a depth of three feet. The pool overflows down a little cascade forming a short run to a second vent that discharges from beneath a set of tree roots. The combined flow continues approximately 400 feet to McBride's Slough. |
| West Side Spring<br> | West Side Spring is located on the western edge of Wakulla Spring. While no outflow is visible at the spring, the water chemistry is significantly different from that of Wakulla Spring and there is an area of cleared organic silt that may represent a ground water discharge point. The spring vent appears to be located at the bottom of a steep-sided hole approximately 18 feet deep and covered with woody debris. The spring is separated from Wakulla by a small island to the east. To the west, the bank consists of low wetlands rising to hardwoods. |
| Turn Around Spring<br> | Turn Around Spring is named after its location near the downstream extent of the Wakulla Springs tour boat route. Turn Around Spring is located just 50 feet from the Wakulla River on the south side. The spring discharges from several vents, the largest of which is located at the center of the spring pool at a depth of six feet. The pool is approximately 12 feet in diameter and surrounded by the Wakulla River floodplain. |

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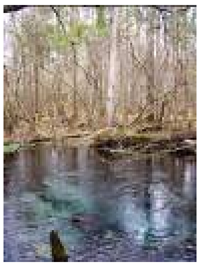
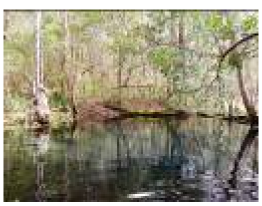
| Chimney Spring  | Chimney Spring consists of a grouping of small sand boils and seeps at the base of a low limestone bluff along the south bank of the Wakulla River. The discharge points coalesce into a small spring run that continues approximately 300 feet to the Wakulla River. Numerous karst chimneys and windows are evident in the limestone above the spring. |
| Rock Spring  | Like Chimney Spring, Rock Spring is formed of several sand boils and seeps along a low limestone bluff. The bluff appears to be a consistent feature along the south bank of the Wakulla River during its course through the state park. It is likely that several more collections of small discharge areas are located along this feature. |
| No Name Spring  | No Name Spring is a beautiful third magnitude spring located near the downstream limit of Wakulla Springs State Park. The spring discharges from a crevasse in limestone near the center of the spring pool and pushes a prominent surface boil. The spring then spreads out into a wide, shallow 1100-foot long run to the Wakulla River. The pool is approximately 20 feet in diameter with a maximum depth at the vent of 8 feet. The spring discharge is sufficient to clear the pool of sediment and aquatic vegetation, but algae and aquatic plants are abundant in the spring run. |
| Deer Spring  | Deer Spring consists of a broad area of diffuse discharge with several small spring vents located just north of the Wakulla State Forest multi-use trail crossing with McBride Slough. The noticeable spring vents are concentrated towards the northern end of McBride Slough near a hummocky area in the surrounding pine forest. At times of low rainfall the cypress-tupelo swamp surrounding the spring area is striking in its water clarity. Typically, wetlands similar to this have dark, tea-colored water due to the infusion of humic acids from decaying wetland vegetation. The water clarity of the Deer Springs swamp is caused by the continual flushing of ground water through the swamp, preventing the water from properly "brewing". |
| McBride Spring #4  | McBride Spring #4 is located 300 feet east of the crossing of the Wakulla State Forest with McBride Slough. The spring discharges from a north-facing limestone vent at a depth of 8 feet into a 30-foot wide pool. From there, the spring flows into a swallet 100 feet to the west. A gentle whirlpool is evident above the swallet as debris slowly circling above the opening. The spring is clear of aquatic vegetation with the exception of algae in the spring run. |

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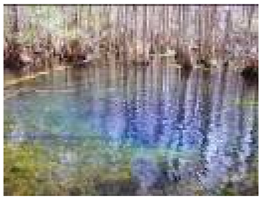
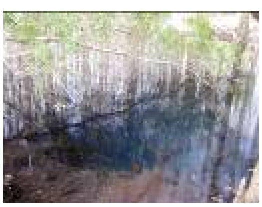
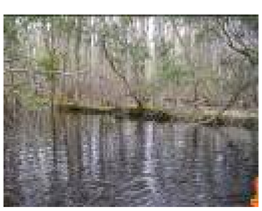
| Hawk's Cry Spring  | Hawk's Cry Spring is located on the eastern edge of McBride Slough 900 feet east of the WSF multi-use trail. The spring vent consists of a large limestone cave 12 feet below the water surface in an clear, open area within the surrounding cypress-tupelo wetland. While no observable flow was visible coming from the spring, the vent is clear of the silt and algae that covers the rest of the bottom surface. |
| Lolly Spring  | Lolly Spring discharges from a vent approximately 15 feet in depth through a tangle of fallen algae covered woody debris. A slight surface boil is visible over the vent. Several small ancillary vents are located in the bottom of the spring pool, which is 40 feet in diameter. The spring is located on the east side of McBride Slough. The land surface rises from the spring's edge to planted pine flatwoods. A fallen cypress log provides a convenient platform to observe the vent. Algae, periphyton, and red ludwigia are abundant. |
| Root Spring  | This small spring is located beneath a collection of willow tree roots just northeast of Hawk's Cry Spring. A small surface boil and silt free area identify the discharge point. |
| Ibis Glade Spring  | Ibis Glade Spring discharges from a small debris-laden vent in a round pool on the eastern side of McBride Slough approximately one half mile above SR 267. Maximum depth in the vent was measured at six feet. The spring is surrounded by a dense grove of moss-draped tupelo, river elm, and sweet bay. No surface boil is visible but the vent is clear of silt and algae. The spring discharges into several meandering fingers that run a short distance to McBride Slough. |
| McBride Spring #3  | McBride Spring #3 is located in a deep pool near the center of McBride Slough. The pool appears to be 40 feet wide with a maximum depth of 16 feet at the vent. Due to the discharge from this spring, McBride Slough is navigable (with a few potential portages, depending on water level) by canoe or kayak from the SR 267 bridge. Several large logs cover the vent and obscure its geometry. The spring is bordered to the north by a moss covered nursery log raising a few young sweet bay trees. |

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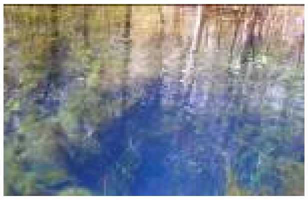
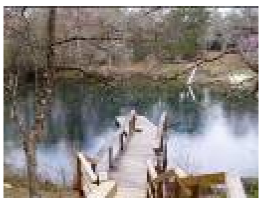
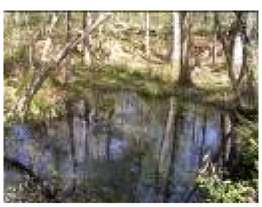
| McBride Spring #2  | This spring is located almost exactly at the border of the Wakulla State Forest with the private property to the south, near the center of McBride Slough. The spring appears to discharge from two vents in two adjacent pools free of the emergent aquatic vegetation abundant in this part of the slough. |
| McBride Spring  | McBride Spring is located just 250 feet north of SR 267 on the west side of McBride Slough. The spring can be found by following McBride Slough north and looking for the first clear area on the left. The spring is surrounded by private property but is accessible from the SR 267 bridge. The small spring pool belies the large vent opening, currently partially covered with a limestone boulder. The vent leads to a large underwater cavern that, in the past, was a destination for local divers. The spring has a moderate surface boil directly over the spring vent. To the west, the spring is bordered by the landowner's camp. |
| Indian Spring  | Indian Spring is located 450 feet south of SR 267 approximately 3/4 mile west of the entrance to Wakulla Springs State Park. The spring is surrounded by YMCA Camp Indian Springs and is primarily used as a recreation area for summer camp. The spring vent is located on the northeast side of the pool beneath a pier. The vent opening is beneath a visible limestone ledge 10 feet below the water surface and opens to a conduit system connected to Wakulla Spring. While the discharge from this spring is relatively small, divers have reported significant flow-through several hundred feet into the conduit. |
| Sally Ward Spring  | Just inside the entrance for Wakulla Springs State Park, Sally Ward Spring is located adjacent to a small clearing. From there the spring runs 0.7 mile to the Wakulla River approximately 600 feet downstream of Wakulla Spring. The spring vent is located about 70 feet to the northeast of the clearing and descends to a depth of 18 feet. This spring is connected to a cavern system that has also been intensively mapped by WKPP divers. The spring is typically overrun with aquatic plants, mostly hydrilla with some tape grass. |
| River Plantation Spring #1  | River Plantation Spring is located between two lots just to the west of River Plantation Road approximately 0.40 mile south of the north gate. The spring discharges from a collection of vents in the limestone bottom of the spring pool. The spring vents are located beneath an overhanging limestone boulder that provides an excellent platform for observation of the spring discharge. The pool is shallow, about three feet deep, and 20 feet in diameter. After exiting the pool, the spring discharge flows west in a shallow run to the Wakulla River. Red ludwigia and tape grass are abundant in the spring run. |

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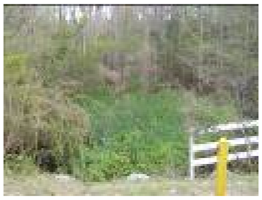
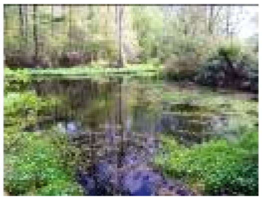
| River Plantation Spring #2  | This spring consists of an area of diffuse discharge through soft and muddy sediments. The cumulative discharge coalesces into a spring run that travels 1/2 mile west to the Wakulla River. The spring run is wide and swampy with abundant emergent vegetation until it reaches River Plantation Road, where it becomes more channelized until reaching the floodplain of the Wakulla River. |
| Mysterious Waters Spring  | Mysterious Waters Spring is located 100 feet west of the Wakulla River just south of the Mysterious Waters neighborhood boat dock. The spring emerges from a tangle of sand dusted roots beneath a sweet bay tree and discharges to a small, silt-laden pool. From there, the spring flows in a shallow, swift run to the still floodplain pools bordering this stretch of the Wakulla River. The land surrounding this spring is in private ownership. |
| River Rise Spring #1  | This spring is one of a series of springs located near the St. Marks River Rise that discharge to a 0.5-mile long spring run. The spring discharges from beneath several algae covered logs into a small pool adjacent to the west bank of the Darrel Spring run. There is a noticeable surface boil above the spring vent. The banks rise steeply 4 feet to the surrounding flatwoods. |
| River Rise Spring #2  | River Rise Spring #2 discharges from a vent beneath a limestone ledge on the west side of the spring pool approximately 32 feet below the water surface. The spring pool is round with a diameter of approximately 30 feet. The bank near the vent slopes gently up to the surrounding property but elsewhere is steep and about 6 feet high. The spring flows down a short run to join with the Darrel Spring run. No surface boil is visible, however a strong current can be observed in the spring run. |
| River Rise Spring #3  | River Rise Spring #3 discharges near the center of a water hyacinth fringed pool and pushes a noticeable surface boil. The pool is approximately 60 feet in diameter and leads to a meandering spring run through wetlands to a swallet several hundred feet away. Maximum depth recorded in the spring is about 10 feet. The discharge from a small spring, River Rise Spring #4, enters the spring pool past a collapsed limestone wall on the west side. |

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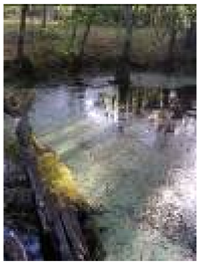
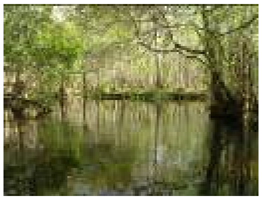
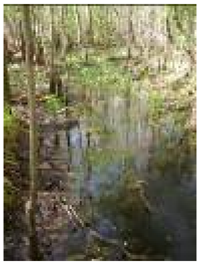
| River Rise Spring #4<br> | River Rise Spring #4 is located within a small 20-foot diameter round pool and discharges into River Rise Spring #3. The surface of the spring is still and mostly covered with duckweed, but there is a small but noticeable outflow to the Spring #3 pool. |
| Elly Spring<br> | Elly Spring is a second-magnitude spring located at the head of a 0.5-mile long run that joins the St. Marks River just downstream from the river rise. Elly Spring is tucked away in the broad floodplain for the St. Marks River and is surrounded by dense cypress, tupelo, sweet bay, and water elm wetlands. The spring discharges at a depth of 18 feet from a four-foot wide crevasse in the limestone bottom of the spring pool. The water is clear but tannic and visibility is barely sufficient to see the spring vent. The spring run curves to the south shortly after leaving the pool and remains shallow during its course to the St. Marks River. Approximately 300 feet downstream from the spring, the west bank of the run has been stabilized by a concrete wall. The wall continues for two hundred feet and eventually forms an alcove around a swallet that appears to be taking in at least half of Elly Spring's discharge. Thereafter the spring run is characterized by thick mats of hydrilla and water hyacinth. On older DOT road maps and USGS topographic quadrangles this spring is identified as Rhodes Springs; however, the Rhodes Spring Group is located to the west on the opposite side of Natural Bridge. Identified as Unknown Spring #2 in FGS Bulletin 31 Rev. |
| Elly Run Spring<br> | Ground water discharges in this area from seeps and a handful of small vents in the muddy banks of Elly Spring run. Spring vents are noticeable as small silt plumes in still water and form small caves beneath root material. This area of discharge is located approximately halfway down Elly Spring run on the east bank. |
| St. Marks Sulfur Spring #1<br> | St. Marks Sulfur Spring #1 is located on the west bank of the St. Marks River approximately 1400 meters downstream from the St. Marks Rise. The spring is surrounded by a dense growth of water hyacinth and hydrilla and the remnants of a former dock slope down to the water's surface just next to the spring. The spring discharge pushes a small clearing in the aquatic vegetation with a slight surface boil. The spring has a very strong sulfur smell and white, stringy bacteria can be seen growing over nearby vegetation. |

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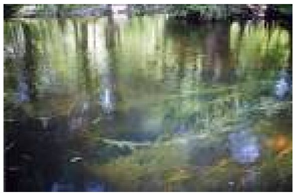
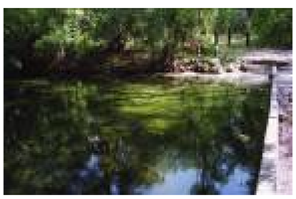
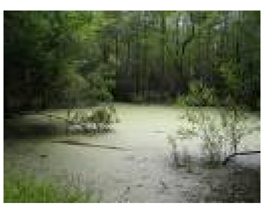
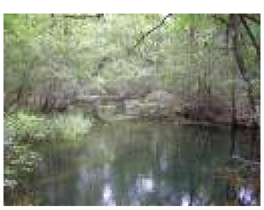
| St. Marks Sulfur Spring #2<br> | This spring is located near the center of the St. Marks River channel approximately 2.1 km downstream of the St. Marks Rise. Discharge is sufficient to cause a surface disturbance and displace the darker river water. The spring discharges from a meter-wide vertical crack in the limestone river channel and has cleared a small swath through the surrounding hydrilla. The spring can be located by the strong sulfur smell and the long trail of sulfur bacteria covering the vegetation downstream of the spring. Maximum depth in the spring is approximately two meters. |
| St. Marks Sulfur Spring #3<br> | St. Marks Sulfur Spring #3 discharges from a central vent, approx. 0.5 meter wide and one meter deep, and several smaller vents and seeps located along its spring run. The spring pool is shallow, usually only 0.2 meters deep, and covered by the same white sulfur bacteria present at the the other springs in the locale. The bacteria is easily disturbed from its substrate and turns over to a orange-rust color when it settles back down. After approximately 100 meters, the spring discharge joins the run from Newport Spring and continues another 200 meters to the St. Marks River. |
| Newport Spring<br> | The combined discharge of Newport Spring and St. Marks Sulfur Spring #3 flow to the west side of the St. Marks River approximately 1100 meters north of Newport Bridge (US98). Newport Spring is located 500 meters up the spring run, staying to the left at the fork with Sulfur Spring #3. Alternatively, the spring can be reached by traveling north on Old Magnolia Road 1400 meters from US98. Newport Spring discharges from a 6 meter wide horizontal crevasse in the St. Marks Formation below a concrete retaining wall. Depth measured at the vent is approximately 2 meters. The spring pool is approximately 23 meters across at the widest point. The banks are steep but stable with the exception of significant erosion occurring near the retaining wall. An impoundment of limestone boulders has been placed at the downstream end to elevate the spring pool. As with the other springs in the surrounding area, Newport Spring has a strong sulfur smell and is supporting a prominent bacteria colony - particularly around the impoundment. |
| Rhodes Spring #1<br> | Rhodes Spring #1, like the other members of the Rhodes group, is a karst window providing a glimpse into the subterranean flow of the Floridan Aquifer. Rhodes #1 discharges from a limestone vent into a 60-foot diameter pool that flows in a shallow run to a swallet 300 feet downstream. A depth of 10 feet was recorded at the spring vent. The window is surrounded by a small Red Maple, Sweet Bay, and Cypress populated floodplain leading up to recovering pine and palmetto flatwoods. The karst window is surrounded by private property. |
| Rhodes Spring #4<br> | Rhodes Spring #4 is located southwest of Rhodes Spring #1. It too is a karst window with the discharge from the spring vent traveling approximately 450 feet to a swallet. The vent is located at the southwest end of a circular pool, 40 feet in diameter, with a depth of 16 feet. |

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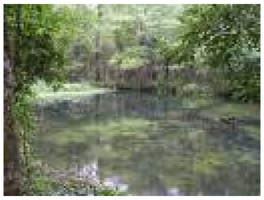
| Natural Bridge Spring  | Natural Bridge Spring is a karst window located to the east of the St. Marks River swallet at Natural Bridge. The spring rises from a deep (approximately 30 feet) and flows along a winding limestone channel to a swallet 450 yards downstream. Just downstream of the spring vent, a small distributary meanders across a low cypress floodplain to join with the St. Marks River 400 yards above Natural Bridge. The spring vent is home to several large fallen logs and aquatic plants are common in calmer areas along the spring run. The karst window is surrounded by private property; however, the swallet can easily be seen from Natural Bridge Road. |