

Boulder Spring Sampled 2013-2014

Site Information

Boulder Spring emerges from the north/west side of Sulphur Island in Seminole State Forest (SSF). The discharge was measured by SJRWMD in 2003, 2005 and again in 2008. The mean discharge was 0.23 and 0.32 cubic feet per second (cfs) putting it in category as a fifth magnitude. Water flows from under a tree and forms a small pool with a sizable boulder in the middle of the pool. Several small vents and seepages along the run contribute to the flow of the spring run. The riparian zone consists of a normal, expected community comprising of native plants, trees, and shrubs with minimal human disturbance. The spring run flows through heavily shaded woods, with sandy bottom for approximately 0.3 mile until it enters Sulphur Run.

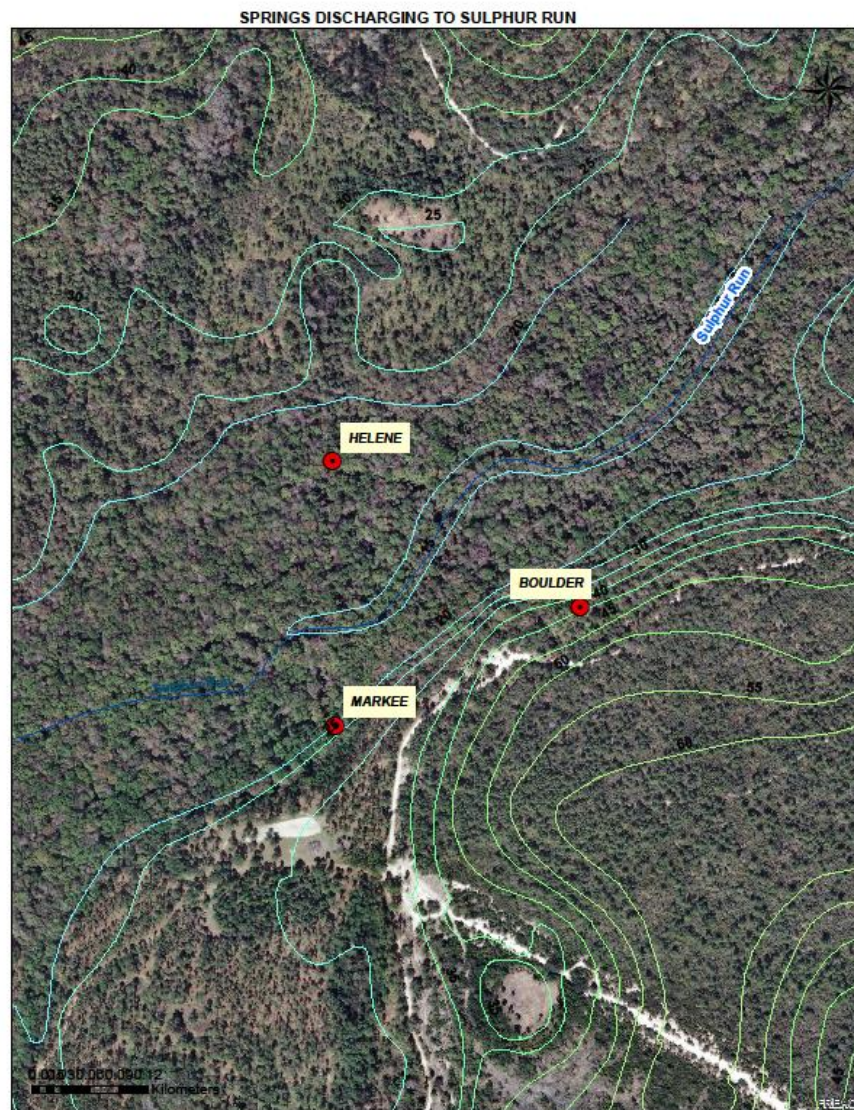


Figure 1-Bo. Location of Boulder Spring in State Forest in Lake County

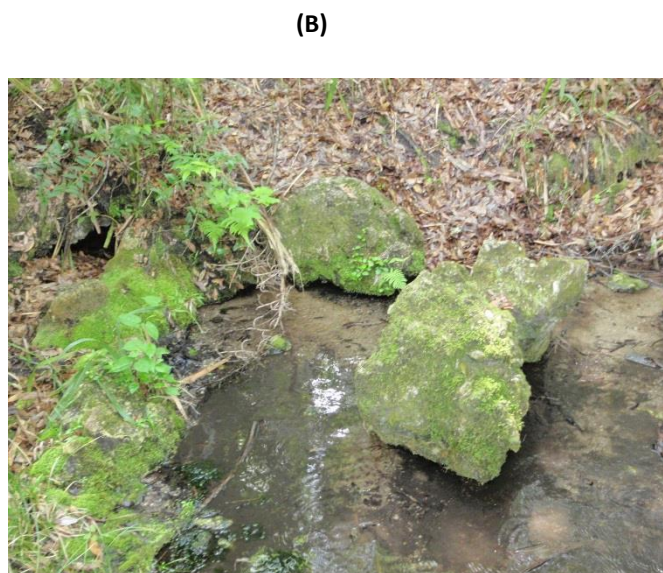


Figure 2-Bo. Boulder Spring Run (A) and Spring Vent (B)

Results

Water Quality

Water quality was fairly constant throughout all four sampling events (Table 1-Bo). Water was collected from the small pool near the head of the spring after oxygen had already mixed with water, explaining elevated dissolved oxygen (DO). Sucralose was not detected and boron results were within the expected range. Nitrate/nitrite (NO_{3+2}) results were all detected but were fairly low suggesting that human activities have slight impact on water source of the spring. There are only three NO_{3+2} results. Due to sample contamination, the January 15 sample result was not valid. All other nutrients were also low. There is not sufficient data to calculate annual geometric means for NO_{3+2} for Boulder Spring, however, all three sample results indicate that NO_{3+2} limit is well within the springs water criteria rule 62-302.531(2)(b)2 which states: "For spring vents, the applicable numeric interpretation of the narrative nutrient criterion ...is 0.35 mg/L of nitrate/nitrite as an annual geometric mean, not to be exceeded more than once in any three calendar year period." Conductivity readings vary slightly between 959 and 1016 $\mu\text{mhos/cm}$.

Water quality results are very comparable to data collected by SJRWMD and Lake County in 2004 and 2005. The more recent data show a slightly lower concentrations of NO_{3+2} , TP, TDS and pH, with alkalinity data a little higher.

Table 1-Bo. Water Quality Results for Boulder Spring

Date Sampled	7/17/2013	10/8/2013	1/15/2014	4/15/2014
pH	6.97	6.69	7.22	7.06
DO mg/L	5.8	5.94	7.3	6.1
DO %	66.3	69.5	85.2	71
Specific Conductance (µmhos/cm)	959	1016	1003	1014
Water temperature (°C)	22.8	22.99	22.88	22.7
Fecal Coliform (cfu/100mL)	2 U	2 U	2 U	2 U
Enterococci (cfu/100mL)	n/a	410	n/a	n/a
Turbidity (NTU)	0.2	0.3	0.35	0.3
Alkalinity (mg CaCO ₃ /L)	130	132	132	127
Chloride (mg Cl/L)	110	110	110	110
Color true (PCU)	3.2 I	2.7 I	2.5 U	2.7
Fluoride (mg/L)	0.25	0.26	0.26	0.27
Sulfate (mg SO ₄ /L)	210	210	210	220
TDS (mg/L)	605	594	596 A	577
TSS (mg/L)	3 I	3 I	3 I	3 I
Ammonia (mg N/L)	0.002 U	0.002 I	0.003 I	0.002 U
Nitrite/Nitrate (mg N/L)	0.039	0.052	n/a	0.058
Total Phosphorous (mg P/L)	0.071	0.13	0.094	0.074
Total Kjeldahl Nitrogen (mg N/L)	0.084 I	0.13 I	0.13 I	0.11 I
Organic Carbon (mg C/L)	1.2	1.2	0.87	1.1
Ortho-phosphate (mg P/L)	0.065	0.068	0.097	0.067
Sucralose (µg/L)	0.010 U	n/a	n/a	n/a
Calcium (mg/L)	102	101	105	99.2
Magnesium (mg/L)	26.6	26.8	27.9	26.5
Potassium (mg/L)	2.7	2.7	2.6	2.6
Sodium (mg/L)	63.5	61	n/a	n/a
Boron (µg/L)	43.7	39.8	41	43

A- Value reported is the mean of two or more determinations

I- The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

U - Indicates that the compound was analyzed for but not detected.

n/a -not collected or not reported due to data quality concerns

Habitat Assessment

The HA score was 133 on January 15, 2014. All secondary parameters reflected the optimal conditions which indicates natural condition and minimal human impact. Three macroinvertebrate habitats were present: snags, leaf packs, and aquatic vegetation including moss which was very prominent especially around boils but also throughout the spring run. The run was shallow but well defined with consistent flow with mostly sandy bottom and some accumulation of detritus.

Aquatic Macroinvertebrate Community

A total of 12 macroinvertebrate taxa were identified (Table 2-Bo) in a subsample of 296 individuals collected on January 15, 2014. The dominant taxon was the amphipod, *Gammarus sp.* (133 individuals, 44.9% of the

subsample) followed by a snail, *Floridobia* sp. (98 individuals, 33.1% of the subsample). A sensitive taxa, *Lype diversa*, was identified.

This taxa list dominated by amphipods and snails is to be expected for a 5th magnitude spring. Although presence of caddisflies, odonates, beetles, and true flies is manifestation of good macroinvertebrate habitats and good water quality in the spring run. The preponderance of gammarid amphipods is probably a reflection of the abundance of moss, which is a good habitat for them.

Table 2-Bo. Macroinvertebrate Data for Boulder Spring Run

Phylum	Class	Order	Family	Genus and Species	# of taxa
Annelida	Hirudinea	Rhynchobdellida	Glossiphoniidae		1
Arthropoda	Insecta	Coleoptera	Scirtidae	Scirtes sp.	1
		Diptera	Chironomidae	Djalmabatista pulcher	1
		Hymenoptera			4
		Odonata	Coenagrionidae	Argia sp.	8
			Aeshnidae		1
		Trichoptera	Psychomyiidae	Lype diversa	5
	Crustacea	Amphipoda	Hyalellidae	Hyalella azteca	27
			Gammaridae	Gammarus sp.	133
Mollusca	Gastropoda	Basommatophora	Ancylidae		4
		Mesogastropoda	Hydrobiidae	Floridobia sp.	98
			Pleuroceridae	Pleurocera sp.	13

Periphyton Survey

There was no periphyton around the boil or along the spring run.

Linear Vegetation Survey

Several plants were identified growing within the spring run: *Hydrocotyle*, *Lemna*, *Rhynchospora* spp., *Samolus parviflorus*, and *Cicuta mexicana*. The system was dominated by a moss growing along the shallow bottom of spring run and along banks covering heavily all surfaces like rocks and snags.

Summary

Boulder Spring is a fifth magnitude spring located within Seminole State Forest. It is surrounded by natural area with minimal human disturbance. The spring's discharge and water quality are consistent throughout a year. Water quality meets surface water criteria specified in Chapter 62.302, F.A.C. The plant and macroinvertebrate community are normal for small springs and spring run systems.

Acknowledgement

Thank you to Dana Denson, Macroinvertebrate Biology Coordinator with Reedy Creek Improvement District, for his help with macroinvertebrate data interpretation. In addition, Dana Denson and Andrew K. Rasmunssen, Ph.D. with Florida A&M University, noted that Boulder Spring run and Sharks Tooth Spring run represent the southernmost record of the caddisfly, *Lype diversa*. Prior to this record, the southernmost extent of its range in Florida was Mormon Branch and a nearby unnamed stream in Marion County.