

"Through the Roof" Monitoring Water Quality In Manatee Springs

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Abstract

Manatee Springs is a first magnitude spring near the City of Chiefland in Levy County, Florida, and the centerpiece of Manatee Springs State Park. In April of 2001, a local mining company initiated the process of obtaining permits to mine 160 acres on its property that is adjacent to the state park and a high density subdivision. Significant local opposition to the mine mounted including public protests and rallies that were covered by the media.

In its permit application, the mining company utilized a map of Manatee Springs Cave system generated in the 1980s. Subsequent exploration of the cave system had identified conduits branching to the north and east toward the proposed mine site; however, most of these conduits do not allow divers to penetrate into the aquifer system very far. The exception is the "Blue Water Tunnel" named because it remains clear when other conduits in the cave system are not. A serious sand restriction had precluded further mapping of this conduit using back-mounted tanks; however, cave divers utilizing side-mounted tanks pushed the restriction and added several hundred feet to the survey. This new survey data indicated the conduit trends to the northeast toward the proposed mine site which contains a large karst feature.

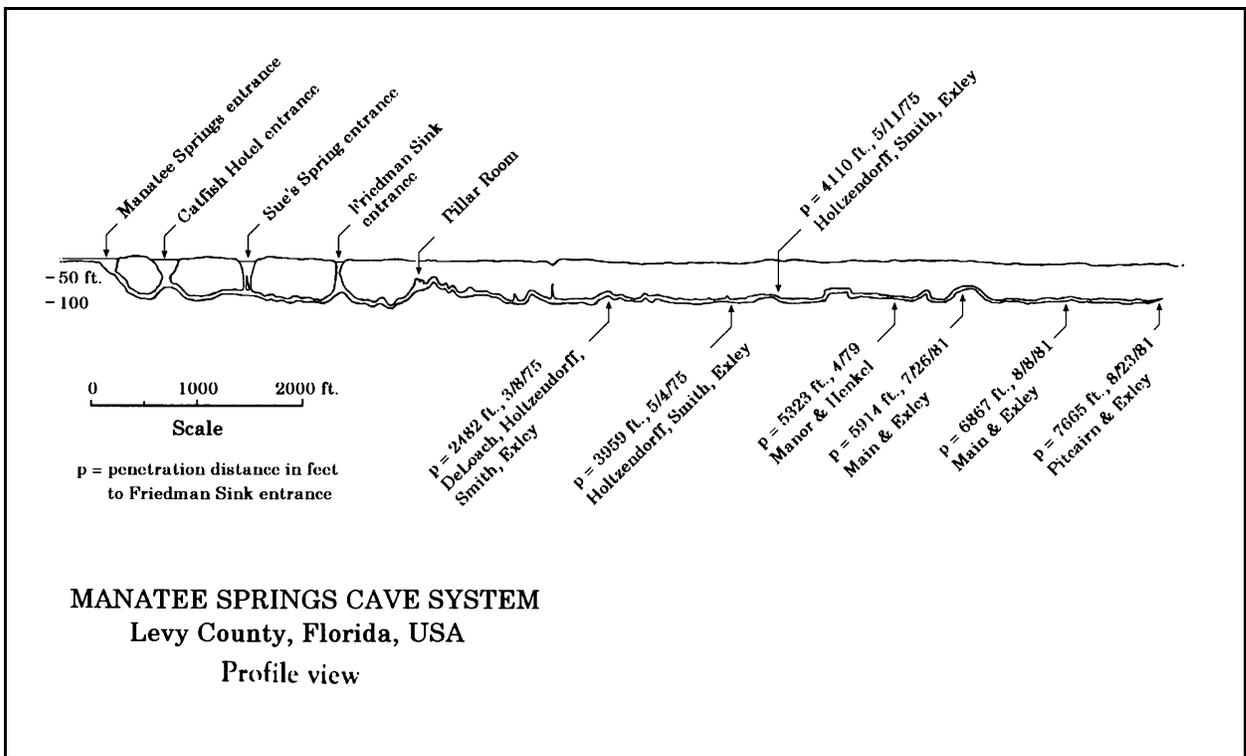
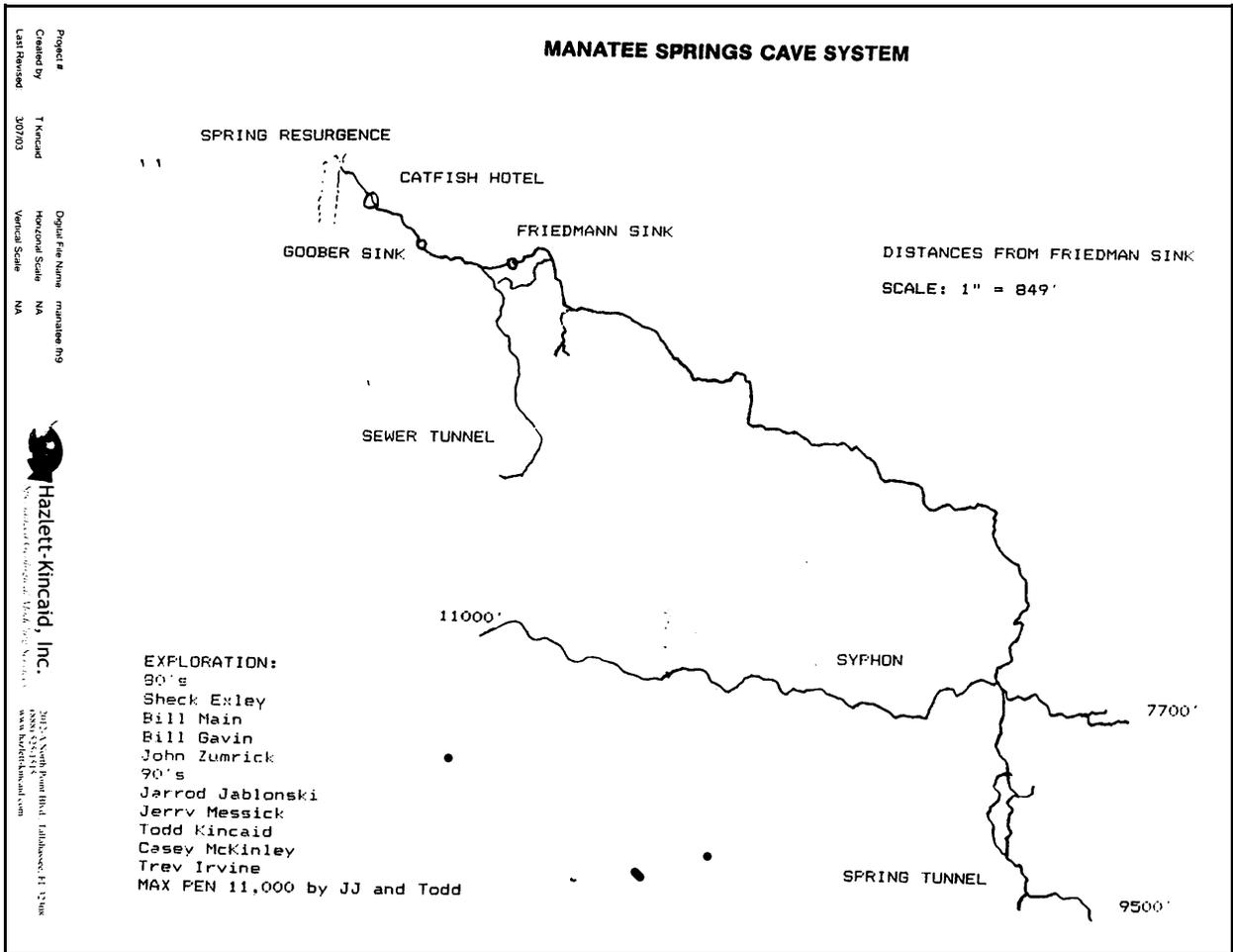
Upon receipt of the additional cave survey data, the Park management coordinated with the cave diving community to have water qual-

ity samples obtained from Manatee Springs and the conduits providing flow to the spring. In August of 2001, 12 cave divers obtained water samples from nine locations within the cave system. These samples were analyzed by the Department of Environmental Protection's Chemistry Lab for the following parameters: pH, temperature, conductivity, turbidity (NTU) and nitrate/nitrite (nitrate). Subsequently, in April of 2002, the Suwannee River Water Management District collected water samples from the conduits and split them with the United States Geological Survey. In addition to standard parameters, isotopic analyses are being performed by the U.S. Geological Survey on these samples.

The data obtained from the sampling of the cave conduit system indicates significant differences in water quality in the individual contributing conduits. Nitrate concentrations in the Blue Water Tunnel were found to be nearly four times greater than those in other conduits in the cave system. These data and the potential to gain insight into the flow dynamics of the cave system including possibly being able to identify sub-basins within Manatee Springs' springshed supported the installation of monitoring wells into the conduits contributing flow to the spring. Another factor considered in the installation of the conduit monitoring wells was the expense and logistics as well as the potential danger to cave divers in obtaining frequent samples from the various conduits.

In April of 2003, the land surface locations for monitoring wells that would intersect the conduits: Sewer Tunnel, Blue Water Tunnel,





Manatee Springs				
Field ID	Date Sampled	Analysis	Result	Units
#1 HEADSPRING	8/12/2001	TURBIDITY	0.55	NTU
#1 HEADSPRING	8/12/2001	W-NO2NO3	1.7	mg N/L
#2 SEWER TUNNEL	8/12/2001	TURBIDITY	3.8	NTU
#2 SEWER TUNNEL	8/12/2001	W-NO2NO3	1.3	mg N/L
#3 MILK TUNNEL	8/12/2001	TURBIDITY	0.5	NTU
#3 MILK TUNNEL	8/12/2001	W-NO2NO3	1.4	mg N/L
#4 BLUE WATER TUNNEL	8/12/2001	TURBIDITY	0.1	NTU
#4 BLUE WATER TUNNEL	8/12/2001	W-NO2NO3	4.5	mg N/L
#5 UPSTREAM MAIN TUNNEL	8/12/2001	TURBIDITY	0.2	NTU
#5 UPSTREAM MAIN TUNNEL	8/12/2001	W-NO2NO3	1.4	mg N/L
#6 SNACK BAR TUNNEL	8/12/2001	TURBIDITY	0.25	NTU
#6 SNACK BAR TUNNEL	8/12/2001	W-NO2NO3	1.7	mg N/L
#7 SUE SINK	8/12/2001	TURBIDITY	0.5	NTU
#7 SUE SINK	8/12/2001	W-NO2NO3	1.5	mg N/L
#8 CCC TUNNEL	8/12/2001	TURBIDITY	0.5	NTU
#8 CCC TUNNEL	8/12/2001	W-NO2NO3	1.2	mg N/L
#9 GEOTHERMAL VENTS	8/12/2001	W-NO2NO3	0.86	mg N/L

and the Main Tunnel were obtained utilizing cave divers and radio location techniques. By the end of May 2003, the Florida Geological Survey completed the drilling and monitoring well installation into the three conduits.

Water quality probes, sampling tubes, and flow meters have been purchased for each of the conduit monitoring wells and are to be installed in the near future. Once in place, real-time water quality and flow information can be obtained continuously.



About the Author

Tom Greenhalgh is a Professional Geologist with the Florida Geological Survey's Hydrogeology Program where he focuses on springs research. He obtained a BS in Geology from Florida State in 1984 and began a career in environmental consulting conducting contamination assessments at petroleum and hazardous waste sites. In 1988, he began working for the Department of Environmental Regulation in Petroleum Reimbursement and a year later moved to the Petroleum Cleanup. In 1991, he joined the Pesticides Section where he performed ground water environmental

fates studies on pesticides known and/or suspected to contaminate ground and surface water and served on the Pesticide Registration and Evaluation Committee. In 1997, he was transferred to the Bureau of Watershed Assessment to work on Total Maximum Daily Loads where he focused on the nitrate contamination in the Suwannee River Basin.

Outside of work, he enjoys outdoor activities including hunting, fishing, and diving for artifacts. In addition, he is a weekend farmer and is working diligently to restore native longleaf habitat on the family's farm in Suwannee County, Florida.