

URBAN KARST MANAGEMENT SULPHUR SPRINGS AND THE BLUE SINK COMPLEX

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LOCATION

Sulphur Springs is located in the City of Tampa and discharges water into the Hillsborough River from an apparent drainage area of approximately 50 mi². The Blue Sink complex is located within the Curiosity Creek/Sulphur Springs subbasin of the Hillsborough River. The Curiosity Creek subbasin is a closed basin with a drainage area of approximately 4 mi² ending at the Blue Sink; the Blue Sink complex, a series of sinkholes located on the east side of the of the creek, previously accepted large volumes of water. At elevated stages in Curiosity Creek, the surface water discharges into a constructed storm water retention pond known as the F-100C pond on the southern end of the Blue Sink.

BACKGROUND

Rapid urbanization has occurred throughout the basin and has significantly stressed the local hydrologic environment. Prior to the 1970's, storm water in Curiosity Creek flowed south to the Blue Sink complex where the surface water entered Blue Sink and traveled through solution channels in the Upper Floridan Aquifer to Sulphur Springs and then into the Hillsborough River. The estimated intake capacity of the Blue Sink was 60 mgd prior to urbanization. Larger storm-water flows continued southward of Blue Sink into a retention area where the surface water entered other sinkholes. Large rainfall events in 1960 and 1979 exceeded the sinkhole flow capacity and caused extensive flooding in the Forest Hills area.

In the mid-1970's, trash and debris accumulated in the sinkholes and reduced the flow capacity of Blue Sink. In 1974, a storm-water retention pond at the edge of Blue Sink collapsed during a storm and partially blocked the sinkhole, preventing water from draining out of the creek basin. By 1985, the sinkhole and underground channel were completely blocked. The City of Tampa subsequently installed a pump system to manage the storm water in the Forest Hills area. Schreuder, Inc. (SI) has been investigating options to restore the Blue Sink complex back to its natural state and restore the groundwater flow to Sulphur Springs.

HYDROLOGIC SYSTEM

Sulphur Springs is a second magnitude spring which is located on the north bank of the Hillsborough River. The average flow of the spring is 38 cfs (25 mgd). The spring is contained in a concrete pool about 90 feet in diameter. The outlet is equipped with two slide gates, so the spring level can be lowered for cleaning and maintenance.

The hydrogeology of the area consists of a surficial cover of sand or silty sand with a thickness of 5-20 feet. The sand overlies a layer of blue-gray marine clay with a thickness between 10-15 feet. Beneath the clay is weathered limestone of the Tampa Limestone Formation and marine limestone of the Suwannee Formation. The Tampa Limestone and Suwannee Formations comprise the top of the

Floridan Aquifer. The clay layer serves as a confining layer for the Upper Floridan Aquifer.

Numerous sinkholes have penetrated the clay layer in the area. Three major sinkholes occur directly north of Sulphur Springs. These sinkholes are Alaska Sink, Orchid Sink, and Poinsettia Sink (also called Trinity or Jasmine Sink). Many of the sinkholes to the north of Sulphur Springs have been used as storm-water discharge basins by the City of Tampa and local businesses.

REGIONAL STRESS TEST

To evaluate the hydraulic connection between Sulphur Springs and the Blue Sink complex in Forest Hills, SI installed 15 monitoring wells before conducting a regional stress test. The network was developed to delineate the groundwater flow regime through thorough analysis of the discontinuities in the potentiometric surface. Continuous water-level data have been collected throughout the area to further understand the effects of seasonal fluctuations and storm events on the flow system.

A regional stress test was performed on January 24, 2002. The Sulphur Springs pool-water elevation was lowered six feet and a drop in the potentiometric surface elevation was measured as the pressure in the system was reduced by lowering the head in the spring pool. Fifteen Upper Floridan Aquifer monitoring wells and three surface-water locations were monitored for the duration of the five-day test.

The maximum water level drop of 6.3 ft was measured in the Sulphur Springs pool. A 4.3-ft and a 3.0-ft water level drop were measured in the Orchid Sink and Poinsettia Sink monitoring wells, respectively. As the water-level drawdown propagated up-gradient and stabilized, a maximum change of 0.3 ft was mea-

sured at Ewanowski Spring, up stream along Curiosity Creek from Blue Sink and the most northern data collection location in the study area.

The blockage of the Blue Sink complex was reflected in the water-level response to the pressure drop measured in the monitoring wells. An abrupt gradient change was measured in the Blue Sink complex and Honda Land monitoring wells south of the blockage. The blockage in the Upper Floridan Aquifer causes the surface-water and groundwater to be impounded and not flow toward Sulphur Springs as it had done prior to the rapid urbanization of the area.

FUTURE INVESTIGATION SCOPE

The retention-pond failure and the increased storm-water runoff in the Blue Sink Complex, compounded by lowered flow velocities through the system due to these events, have reduced the feasibility of restoring the system to its natural state. SI concluded that removal of the blockage at the Blue Sink complex is not economically feasible currently, and so the primary focus of the investigation has shifted to the southern portion of the Curiosity Creek/Sulphur Springs subbasin. Numerous sinks in the southern portion of the area are still connected to the Sulphur Springs flow system and need to be preserved. One option currently being investigated to restore the flow to Sulphur Springs from the Blue Sink complex is through direct recharge into Orchid Sink after the water has undergone wetland treatment at the F-100C storm-water pond. This sink is down gradient and currently is connected to the groundwater flow system discharging at Sulphur Springs.