Groundwater Study in South Florida

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The overall population growth leads to water quality challenges including the allocation of scarce natural resources, especially water, and development pressures on natural ecosystems (Simenstad et al. 2005; EDR 2013). Groundwater is the main source of water supply in Florida, which is at risk due to the high demands on available water, and the high levels of nutrients flowing into the water system. Therefore, it is important to protect groundwater resources. As the demand for water increases, additional data and study about local groundwater resources is needed to manage and develop the water supply effectively. This article explains major phases of conducting groundwater studies, based on Florida's groundwater resources.

1. Hydrogeological study

The first step in groundwater study is to understand the interrelationships of Florida's geology and groundwater, karst activities and groundwater, and surface water and groundwater.

The landforms, geology, and the hydrogeology of Florida have been shaped by the sea (Schmidt 1997; Metz, 1995). The ocean levels have risen and fallen over the last 5 million years, causing alternating periods of inundation of the Florida peninsula. About 20,000 years ago when sea level was much lower Florida went from a narrow peninsula almost entirely covered by oceans to one that was about twice as wide as today (Schmidt 1997; Metz, 1995; Bittner et al., 2017).

Central Florida is underlain by three principal hydrogeologic units. The uppermost water-bearing unit is the surficial aquifer system (SAS), which is underlain by the intermediate aquifer system/intermediate confining unit. The SAS is located at the surface of Florida and the thickness ranges from almost a 100 to more than 400 ft (SFWMD 2001). The lowermost hydrogeologic unit is the Floridan aquifer system (FAS), which consists of the Upper Floridan aquifer, as many as three middle confining units, and the Lower Floridan aquifer (Bush and Johnston 1988; Wilson and Gerhart, 1982).

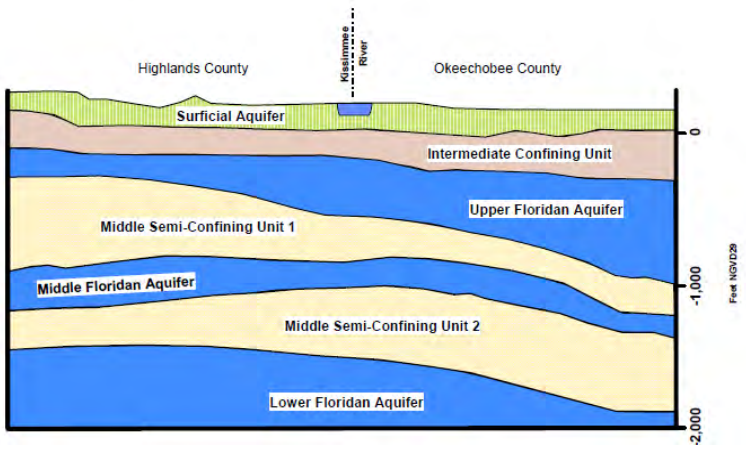

Figure 1. Schematic cross-section through lower Kissimmee River Basin

2. Water level and quality Data

Availability of water level and water quality data is very important. These data are usually derived from the publications, documents, and files of the USGS, South Florida Water Management District (SFWMD), Southwest Florida Water Management District (SWFWMD), Florida Geological Survey (FGS), Florida Department of Environmental Protection (FDEP), and the reports prepared by private consultants.

Water-level data from a network of wells are used to construct generalized potentiometric surface maps of the aquifer. These maps are then used to develop and verify the numerical models of the area.

3. Numerical Modeling Tool

Comprehensive assessment tools such as numerical simulation models are necessary to make decisions in allocating water resources efficiently. The models will need to be developed for such purposes.

The first step of modeling is to develop a conceptual model. The conceptual modeling framework reflects the fundamental hydrogeological concepts. Ideally, the initial conceptual model is to be created in the simplest form able to simulate the key identified processes with complexities added when necessary. Various numerical models are available. Amongst those models, MODFLOW is one of the most reliable and widely used groundwater simulation codes in groundwater level simulation utilizing finite difference methods (Harbaugh et al., 2000). This model can simulate the groundwater conditions within the aquifer and incorporates estimated pumping stresses, density-dependent flow, temperature dependence, and a detailed hydrogeologic framework. The verified model will be considered as the base model, and it will be used for further analysis of potential alternative scenarios and evaluation of their impacts on hydrology and water quality.

Questions, contact Dr. Golmohammadi at g.golmohammadi@ufl.edu.

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