

Technical Fact Sheet SJ2014-FS2

**Upper Floridan Aquifer Potentiometric Surface Maps in the
St. Johns River Water Management District, Florida
May and September 2012**



Technical Fact Sheet SJ2014-FS2

Upper Floridan Aquifer Potentiometric Surface Maps in the St. Johns River Water Management District, Florida May and September 2012

Don Boniol and Jill Andrea Stokes

The St. Johns River Water Management District (SJRWMD) maps the Upper Floridan aquifer (UFA) potentiometric surface near the end of the dry and wet seasons (May and September, respectively) to depict the approximate annual low and high UFA water level conditions. Potentiometric surface maps are generalized on a regional scale to portray water levels in a dynamic hydrogeologic system taking into account the variations in monitoring well depths and UFA open hole intervals, the variable effects of groundwater withdrawals, and changing climatic conditions.

The potentiometric surface is based on hydraulic principles and is a representation of the potential energy that is available to move groundwater in a confined aquifer. The UFA potentiometric level is the altitude to which water rises in a properly constructed well cased in the confined UFA due to the hydraulic pressure in the aquifer. When a borehole is drilled into the confined UFA, the pressure in the aquifer causes the water to rise up the borehole above the top of the UFA limestone until the pressure exerted on the water in the borehole equals the pressure in the aquifer. Water would flow out of the well onto the land surface if the pressure head is greater than the land surface elevation, resulting in a free-flowing artesian well. In contrast, the UFA is unconfined in localized areas of western SJRWMD where UFA limestones are at or near land surface. In these areas, water in an UFA well exists under atmospheric pressure. Depths to the potentiometric surface do not represent appropriate depths for UFA water wells. Instead, UFA wells must be completed with the open hole in the UFA carbonate formation, with depths and open hole into the aquifer based primarily on local geologic conditions.

SJRWMD utilized the ISATIS geostatistical software by Geovariances to map the May and September 2012 UFA potentiometric surfaces. The data used for the May and September 2012 maps are the average of daily water level values from 308 and 312 monitoring wells in SJRWMD, respectively, and additional data in surrounding areas from other water management

districts. A variogram model with a short-range stable structure and a long-range spherical structure was derived from the spatial analysis of the water level data. The variogram model was used to estimate potentiometric level values at unsampled locations in the raster domain (150 meter grid cell size), using a 150 kilometer (93.2 mile) circular search neighborhood. Cross validation procedures that compare the predicted values to the measured values verified that the model produced accurate estimation results.

UFA potentiometric levels reflect the balance between recharge to, storage, and discharge from the aquifer. The potentiometric levels are influenced by regional geology, physical and hydraulic properties of the UFA carbonate rocks, climatic cycles of varying duration and magnitude, local and regional groundwater withdrawals, and man-made changes in the landscape that affect runoff and recharge. Groundwater flow is down gradient from potentiometric highs to potentiometric lows. Major potentiometric highs in the Keystone Heights area of north-central Florida and in the Green Swamp area of central Florida are separated by the relatively flat potentiometric saddle in central Marion County. Springs and areas of diffuse upward leakage along the St. Johns, Ocklawaha, and Wekiva rivers and in coastal areas naturally discharge water from the UFA and are depicted as lows or depressions in the potentiometric surface.

SJRWMD also reports monthly UFA water level percentile ranks to show how UFA water levels in any month of interest compare to the UFA potentiometric levels for all months since 1998, which encompasses periods of extreme wet and dry climatic conditions. The May 2012 UFA water levels were at the 3rd percentile rank, near record lows due to the cumulative rainfall deficits in the preceding years and a dry winter and spring prior to May 2012. After the summer wet season with above-average rainfall, September 2012 UFA water levels recovered to average water level conditions with a 53rd percentile ranking.

The May and September 2012 UFA potentiometric maps and geospatial data can be downloaded from *floridaswater.com* (under the “Online tools, GIS, data” tab).



