SALTWATER INTRUSION IN THE SURFICIAL AQUIFER ON ST. CATHERINES ISLAND, GEORGIA

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St. Catherines Island is located along the Georgia coast and consists of a Pleistocene core surrounded by Holocene salt marsh and ridge and swale deposits. Since 2011, hydraulic head and chemical data have been collected from the surficial aquifer along an E-W transect of six monitoring wells ranging in depth from 5-8 meters. Two additional transects were added in 2016, creating a network of 18 wells. Data from the original 6-wells reveal that unusually high tides periodically drive saltwater into the surficial aquifer. The pulses of saltwater intrusion are much more pronounced on the marsh-side of the island relative to the ocean side, indicating the presence of permeable pathways within the shallow aquifer. Preliminary data from the new wells installed in 2016 show anomalously high chloride concentrations at select locations within the island, supporting the hypothesis that saltwater is intruding along preferred pathways. Analysis of old topographic maps of the island show a linear alignment of former freshwater ponds and marshes that coincide with regional joint trends. Historical records indicate these former freshwater bodies were fed by artesian springs whose source was the regional carbonate aquifer. In addition, ground penetrating radar and electrical resistivity profiles reveal sag structures in the surficial aquifer. Prior to major pumping withdrawals from the regional aquifer, artesian water flowed upward along joint and fault traces, creating artesian springs at the surface. Solution cavities eventually developed in the carbonate aquifer, some of which collapsed causing sag structures in the overlying layers. It is hypothesized that the observed saltwater intrusion events on St. Catherines are driven by unusually high tides, allowing saltwater to flow into the surficial aquifer through solution collapse features that have propagated to the surface. In the future, vertical well nests will be installed to help delineate the saltwater movement within the aquifer.

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