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Simulations of Potential Future Effects of Changing Climate and Land Use on the Groundwater Resources of the South Carolina Atlantic Coastal Plain

The Atlantic Coastal Plain aquifers and confining units of South Carolina are composed of crystalline carbonate rocks, sand, clay, silt, and gravel containing large volumes of high-quality groundwater. The aquifers have a long history of use dating back to the earliest days of European settlement in the late 1600s. Although extensive areas of some of the aquifers have or currently (2018) are experiencing groundwater-level declines from large-scale, concentrated pumping centers, large areas of the South Carolina (SC) Atlantic Coastal Plain contain substantial quantities of high-quality groundwater that currently are unused.

Groundwater use from the SC Atlantic Coastal Plain aquifers has increased during the past 70 years as the population has increased along with public supply, industrial, and agricultural water demands. While South Carolina works to increase development of water supplies in response to the population growth, the State is facing a number of unanswered questions regarding availability of future groundwater resources and the best methods to manage these important water sources. Uncertainty regarding future climate variability and related effects on groundwater recharge rates is a concern for South Carolina water managers and regulators.

A groundwater flow model of the entire SC Atlantic Coastal Plain constructed and calibrated to predevelopment through 2015 conditions is used to simulate possible future (2019-2065) groundwater conditions. The groundwater model is paired with a model of past groundwater recharge (1979-2015) that has significantly improved the understanding of recharge processes in the SC Atlantic Coastal Plain. The groundwater model simulates the entire surficial aquifer layer and includes groundwater base flow to a simulated stream network.

The groundwater recharge model is modified to incorporate possible future scenarios of groundwater recharge for the years 2019-2065. These modifications include 2 possible land use/land cover scenarios and 3 possible future scenarios of precipitation and temperature. The land use / land cover and climatic scenarios are incorporated into the groundwater recharge model to produce simulations of possible

future spatially and temporally varying recharge arrays. These recharge arrays are input into the groundwater flow model, and a series of model runs are performed with the results (groundwater levels and water budgets) evaluated. Changes in groundwater levels, water budgets, and stream base flows are quantified and summarized. The modeling tools can be used to simulate alternative scenarios to evaluate their relative impact on groundwater resources of the SC Atlantic Coastal Plain.