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Assessing Impacts of Climate and Land Use Change on Water Supply in the Catawba-Wateree Watershed to Guide Conservation Investments toward Greater Resiliency

The Catawba-Wateree watershed in North Carolina and South Carolina is faced with many pressing water resource management challenges. Key among these challenges are the needs of 18 drinking water utilities to (1) meet long-term and often competing water demands from a growing population under changing climate conditions and (2) protect water quality in their rivers, streams, and reservoirs from the effects of growth and development. Changes in land use and land cover that will accompany population growth could impact water availability within the watershed in multiple ways, including reduced reliability of baseflow, increased sediment load, and increased evapotranspiration. Climate change is expected to further exacerbate the impacts of land use change. In combination, land use and climate change could generate a steadily growing imbalance between water demand and available supply within the watershed. This study aimed first to assess the relative impacts of climate and land use change on water supply resiliency across the Catawba-Wateree watershed to understand the dominant drivers and spatially varying relationship between these drivers. A second goal was to determine the extent to which future impacts on water supply can be mitigated through land conservation efforts focusing on geographic “hot spots” within a watershed, i.e., locations where impacts are disproportionately large and land use change is the dominant driver. The study approach used a spatially explicit hydrologic model to simulate streamflow under current and future land use, climate, and water use conditions for NHDPlus catchments across the watershed. For each catchment, changes in flow characteristics and sediment load were compared between baseline/current conditions and each future scenario by a range of metrics. Future scenario results were further compared to determine where, and the extent to which, land use change impacts are exacerbated by climate change impacts for different hydrologic characteristics. Catchments (or groups of hydrologically connected catchments) were then ranked by weighted metrics to reveal defined geographic areas (i.e., hot spots) that contribute disproportionately to the deterioration of water availability and quality within the watershed and where land use change is the dominant driver. The identified hot spots are locations where concentrated management options, such as land conservation, could be instituted to prevent losses to drinking water utilities in terms of availability and quality of supplies. In combination with an economic cost-benefit

analysis, the study results offer guidance where land conservation investments may provide the greatest benefit to water supply resiliency under future climate conditions.