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Improving Water Utility Financial Stability in the Face of Extreme Weather

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Traditional strategies for meeting supply reliability goals typically involve the maintenance of large amounts of infrequently used capacity, an approach that is rapidly becoming less feasible due to the rising costs of rigorous environmental permitting processes. Consequently, many water managers have begun to depend more heavily on demand management programs as a means of ensuring a reliable supply. Certain types of water use, like urban irrigation, can be reduced during times of water stress, decreasing the volume of additional capacity needed to weather these extreme events. While effective, the resulting infrequent and irregular drops in usage also cause large intermittent swings in a utility's revenue stream. As many utilities set prices which aim to return revenue at levels that are roughly in line with costs, large deviations from expected volumetric water sales can result in significant budgetary shortfalls.

In an attempt to mitigate this revenue variability, financial tools such as drought pricing, contingency funds, and third party financial insurance derived from weather-based indices are developed and examined as a means of promoting financial stability for two water providers in the Triangle region of North Carolina (USA), Orange Water and Sewer Authority (OWASA) and the City of Durham. The timing and frequency of water use restrictions over a twenty year period are estimated with a multi-reservoir simulation representing each utility's supply system and demand behavior under both historical and alternative climatic regimes. The financial effects of extreme climatic events are simulated using observed changes to water use patterns and pricing during restriction periods. Combined, these models help estimate the financial risks assumed by a utility when water restrictions are used to ensure adequate supply reliability.

Analysis of the relationship between hydrologic and financial conditions reveals that larger but more frequent revenue losses (as determined by climatic conditions and supply capacity) allow a contingency fund to be more useful as a financial management instrument. Contracts based on weather derivatives are more useful when the infrequency of water use restrictions causes contingency funds to be either too large under normal conditions or too small to have a useful impact when they are needed. Drought surcharges are an effective way to mitigate some of the revenue shortfall resulting from restrictions, but utilities can find it politically difficult to adjust the size of the surcharges to meet financial needs. The tools used here to hedge the adverse financial impacts of water use restrictions can be generalized to any policy used to reduce water stress during extreme events, and will be necessary in the further development of flexible and adaptive water management practices.