Development of Optimum Operational Management Strategies for the Saipan Water Distribution System

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The Government of the Commonwealth Northern Marianas Islands (CNMI) has invested a large amount of funds to improve Saipan's water distribution system but delivery problems still exist. A stated goal of the CNMI government is to provide 24-hour water to all residents served by the Commonwealth Utility Corporation (CUC) water system. This goal will be unattainable until the CUC has a complete knowledge of their water delivery capabilities and operation.

Over the years the CUC water distribution system has grown and new wells have been added to the system. This physical expansion has been well documented but improvements in the hydraulic characteristics and delivery capabilities of the entire system have never been fully examined.

The Saipan water distribution system has been divided into 12 sub-regions. Each region is expected to operate somewhat independently. However, due to inadequate inflow to the system, system leakage, and lack of knowledge of system behavior, the system is unable to provide 24-hour water services to all customers. WERI researchers have developed computerized models of each of the 12 sub-regions of the CUC water system using the Haestad WaterCad water system modeling program. They also developed a Source, Transmission and Storage model of the Saipan Water System. This includes a Skeleton of the existing 12-region water system models that are joined together at the boundary points. The next step, addressed by this study, was to examine various system operational schemes in order to find an optimum way to transfer source water to the customer.

The project, now completed, provides a better understanding of the adequacy of the existing well, pump and storage facilities to cope with fluctuations in daily demands and provide sufficient flows to maintain 24 hour water to all areas of the system. It also highlights the most efficient means of moving water from water supply rich regions to those that have supply shortages.

The project was split into two phases. The first phase finalized the skeleton of each Saipan's sub-water system. We worked closely with CUC Engineering staff to ensure all included components, e.g., pipes, tanks, wells and reservoirs were correctly modeled and matched field data. The second phase will determined the optimum system operation. This phase was accomplished in close consultation with CUC staff engineers. First the model was operated in steady state mode and the response of the system during critical times was examined to determine if the system could meet the required demands and, if not, what changes in either operation or physical make up of the system were required to solve the problems. Next, the model was operated in extended time simulation mode to examine storage tank operations. The response of the storage tanks during critical times was examined to determine if all of the tanks were operating in an optimal manner and, if not, what changes in either operation or physical make up of the system were necessary to improve tank operations.