



Hydrological Modeling of Atoll Islands in the Federated States of Micronesia



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Water shortages pose a serious concern to the inhabitants of atoll islands. Small size and isolation translate into entire island populations being subjected to the stresses of drought and difficult, expensive, and sometimes untimely aid operations. Under normal conditions, water demand is met by rooftop rain catchment. Prolonged droughts, such as those associated with El Niño, however, exhaust water storage, leaving residents dependent on groundwater or imported water. This project meets the need of developing “an accurate and practical saltwater intrusion and groundwater evaluation model(s) for low islands in the FSM”, as recommended by the WERI Advisory Council, which met on Pohnpei, October 23, 2006.

The best emergency source of water is groundwater, but on most islands groundwater is not utilized or the use of it is not systematic. Atoll aquifers have thin freshwater lenses immediately underlain by saltwater. High permeability and near sea-level elevation make the aquifer susceptible to saltwater intrusion and even depletion of the freshwater lens during times of limited or no recharge. The unique characteristics of atoll island aquifers, such as the thick transition zones between freshwater and saltwater, render traditional coastal aquifer models inappropriate. The development of computer groundwater modeling tools to analyze the atoll island aquifer system, and training on how to use these tools, will aid FSM island leaders and water resource managers in establishing sustainable and practical groundwater extraction practices.

This project will engage a multi-disciplinary team composed of a hydrogeologist, an

anthropologist, a GIS specialist, and a graduate research assistant. The process of fulfilling the objectives has partially been accomplished. Intense literature study has been performed, and will continue to be performed, and the first stages of constructing a groundwater model have already been accomplished. The current proposal will enable the completion of the project.

The construction of the models requires values from published data and additional data gathered during field tests on several atoll islands. Ulithi Atoll, Yap State, FSM, was visited by the investigators August 2-13 2006, and another trip to the same atoll is planned for January 2007. A trip to Pingelap Atoll, Pohnpei State, FSM, is envisioned for the summer of 2007. Both of these atolls have readily available field data that will be vital in the model calibration process, to be undertaken shortly.

Groundwater modeling development will continue as the models are calibrated and simulations are run to calculate the effects of various extraction and recharge scenarios on the freshwater lens. Accompanying the state-of-the-art numerical computer model will be a simpler, analytical model using rainfall, soil, and evaporation data in GIS format, which will be calibrated by the more complex numerical model. This simple analytical model will be a useful tool for predicting the volume and thickness of the freshwater lens for a given atoll island. Finally, all information, results, and tools will be relayed to the leaders and water resource managers of the islands.

