Sustainable Well Yield Determinations Using Conductivity Probes on Active Wells

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The major source of drinking water for the island of Saipan is groundwater pumped from the karst (fractured limestone) aquifers by the local water utility, the Commonwealth Utilities Corporation (CUC). The most productive (most heavily pumped) well fields on Saipan are located over the basal lens aquifers, where the fresh water lens floats on salt water. Poor well construction (penetration through the fresh water lens), poor pump placement (too far below dynamic water levels), and over pumping have resulted in salt water intrusion at individual wells and well fields. The volume-weighted chloride ion concentration from the total amount of water pumped from wells on Saipan is about 1,100 mg/l, well above the USEPA recommended limit of 250 mg/l. In fact, the chloride ion concentration at individual wells can on occasions exceed 3,000 mg/l.

In order to improve the quality of the water pumped from the basal lens aquifers on Saipan, a reliable method needs to be developed to determine the sustainable yield for individual wells, while minimizing the chloride ion concentration. This project proposes to use conductivity probes in active production wells to measure electrical conductance (EC) of groundwater in three wells, to determine the highest sustainable yield while trying to keep the chloride ion concentration below 250 mg/l. The probes will also be used to determine the drawdown at each well, so that the pump intake can be placed at the highest possible elevation. This project also addresses the critical State water quality issue regarding a baseline for season and usage related changes in salinity in drinking water production wells.

Three active production wells in one well field will be studied simultaneously in the following manner: A 1-1/4 inch diameter sounding tube will be installed such that it penetrates the well cap and extends to 5 feet above the bottom of the hole. The sounding tube will be screened from 5 feet above the static water level to the bottom end of the sounding tube. A conductivity, temperature, depth (CTD) probe will be lowered into the sounding tube to measure and record the conductivity profile of the well during static conditions and compared with the profile measured later during pumping conditions. Recording conductivity values in two adjacent wells will help determine how pumping rates in one well affects nearby production wells.

The ultimate goal of the study are to develop a method to optimize the pump rate and pump depth setting for individual wells to minimize chloride ion concentration in the groundwater delivered to customers on Saipan..

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