Estimating the Natural Limits of the Northern Guam Lens Aquifer: A First Step Toward Sustainable Management

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The Northern Guam Lens Aquifer (NGLA) provides 80% of Guam's drinking water. The anticipated addition of US Marine Corps activities will require additional production, while ongoing economic growth will increase demand as well. Policy-makers and water managers want to know what volumes of water can be sustainably withdrawn from various parts of the aquifer, and how increased withdrawal will affect salinity. The extent to which quantity and quality might be optimized, however, is ultimately constrained by the *natural limits* on aquifer recharge, storage, and water quality imposed by climatic and geologic conditions. This study is therefore directed at estimating the *maximum natural capacity* (superseding the obsolete concept of *sustainable yield*) of the NGLA to provide a baseline against which to evaluate future proposals for holistic sustainable management approaches.

The objectives of the respective phases of this project are:

(1) Data acquisition and literature review of published and emerging research regarding spatial and temporal distributions and trends of rainfall and salinity in the NGLA by WERI, USGS and others;

(2) Study of meteorological and geological phenomena that might control or influence the observed rates and amounts of rainfall, infiltration, storage, flow, and salinity; and

(3) Analyses of spatial and time-series data on rainfall, groundwater levels, specific conductivity, chloride concentrations, and production rates from existing wells within the NGLA; and

(4) Application of a groundwater model to estimate the maximum production that could be attained from an optimum set of strategically spaced shallow-draft vertical wells producing at specified maximum acceptable values of salinity, under specified natural conditions (*e.g.*, long-term average rainfall, vs. historic wet and drought conditions)

(5) Development of a production function that estimates the relationships between quantity and quality that might be produced by an ideal production system (i.e., one that would produce maximum quantity for a given quality or maximum quality for a given quantity).