



LiDAR-based Delineation & Hydrologic Modeling of Southern and Central Guam Watersheds



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Watersheds as hydrologic units define geographic boundaries used for natural resource management and for hydrologic and related modeling. A "ridge-to-reef" (watershed)-approach to management of natural resources, especially freshwater resources, has been promoted since the establishment of the Clean Water Action Plan (CWAP) for Guam - Unified Watershed Assessment in 1998 to restore and protect freshwater resources. The CWAP includes a watershed map and a list of all watersheds categorized by need for restoration. Northern Guam covered by a limestone plateau with no defined surface flow is considered one watershed, whereas Southern and Central Guam are divided into 19 watersheds according to a NRCS classification outlined in the CWAP. Over the last decade, considerable efforts through erosion modeling and actual restoration projects have been made and are still on-going to improve water quality in priority watersheds. A number of water resources projects of critical need have been identified at the Advisory Council Meetings of the Water and Environmental Research Institute of the Western Pacific (WERI) over the past years. Many of these projects focus on surface water quality and quantity and are watershed-based. The modeling of fresh water resources is nowadays usually done entirely or at least in parts using a geographic information system (GIS). Currently, two data sets outlining watershed boundaries are available in GIS format. One is based on USGS topographic maps, the other one on a 10-meter by 10-meter resolution digital elevation model (DEM). In 2007, the Government of Guam acquired high-resolution Light Detection and Ranging (LiDAR) data for the entire island of Guam. Few watersheds and drainage basins have been delineated using LiDAR data, but only on a project by project basis. No attempts have been made to update all of Guam's watershed and sub-watershed boundaries using LiDAR despite the

need to have more accurate boundaries that are also consistent with other LiDAR-derived data such as slope or a relief.

This project proposes to create an updated comprehensive hydrologic GIS dataset that includes watershed characteristics in addition to terrain characteristics using 2007 LiDAR data. Such high-resolution and up-to-date geospatial information is going to be a vital resource for researchers, managers, technical staff and others.

The specific objectives of the project are to:

1. Utilize LiDAR data to create a hydrologic model of Southern and Central Guam that includes watershed and sub-watershed boundaries, flow direction, flow accumulation, river delineation, as well as terrain characteristics, such as slope and aspect;
2. Survey major culverts and drainage points along the coast and highways;
3. Calculate geometric parameters (area, length) and label watersheds and rivers;
4. Prepare report including a tutorial for the hydrologic model and its applications;
5. Incorporate data into a web-based educational application and information server;
6. Conduct a half-day workshop for government agencies working on watershed management and surface water monitoring.

This project provides important base data for hydrologic and other modeling and defines geographical boundaries for management purposes in conservation efforts. The data set will be made readily available to all entities involved in watershed-related work on Guam through direct distribution, a website, and a workshop on the applications. The utilization of this new data set as a widely-available standard will ensure consistency within and across projects.