

## Water Budget Development for Local Council Management

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*Local initiatives in developing Watershed Councils are emerging in the Philippines where water is recognized as a resource under threat from over extraction, quality loss, and extreme fluctuations. Six municipalities in eastern Bohol cover the Carood Watershed yet implementing their own resource management plans. Basic technical knowledge of water and relations with land use planning are limited though generally desired. Information gathered from different government sources give an initial area water budget. Local government is drawing on this knowledge of the local environment to engage more effectively in the long-term management of the resources in addressing social and environmental concerns. Stakeholders are working through six steps, putting together a local understanding: (1) development from high school climatic knowledge, (2) network of community rain gauges, (3) municipal forum development, (4) shared water-related municipal concerns, (5) data analysis and water budget, and (6) review of land use planning as impacting water management.*

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### **Introduction**

Access to clean and adequate water remains a perennial problem in the Philippines. The challenge to improve the quality of its surface, ground, and coastal waters has not diminished. In a recent World Bank report<sup>1</sup>, the National Capital Region (Metro Manila), the Central Luzon, the Southern Tagalog, and the Central Visayas regions were identified as critical areas in terms of water quality and quantity. This in part can be linked to the weak enforcement of water-related laws, inadequate government resources, poor database and poor cooperation between the different agencies and local government units (LGUs).

Bohol is an island located in the Central Visayas region. The province has an area of 4,117 km<sup>2</sup> with a population of over one million people. Bohol is made up of 47 municipalities and one city. It is a low-lying island, basically limestone with notable karst landscape and unusual Gunung Sewu (Kegel or Cone) type karst particularly in the southern half of the island.

Bohol is one of the first provinces in the country that enacted the Local Government Code. The Local Government Code decentralizes some functions of the national government to the local government, particularly the management of natural resources. By 1998, the province had an environmental code that served as a guide for management of the environment and resources. In the same year, the province started to put in place support systems for the implementation of its resource utilization programs.

However, even with the province's management systems in place, water quality has continued to deteriorate. This in part is a result of the development programs in the area. And while the water in the catchments and streams are con-

stantly subjected to various stresses, resource management plans at the municipal level has failed to respond. This may be the reason Bohol is identified as one of the major hot spot in the country in terms of having high total dissolved solids (TDS).

High TDS concentration in Bohol can be attributed to its Karst geology; however, this can be further aggravated by sewage and agricultural run-off. There is little that could be done with natural sources of TDS, but responding to and controlling man-made sources is a management and planning issue.

The local government is developing the technical and administrative capacity to manage its resources and gaining experiences in monitoring and evaluating water resources around the island and areas with potentially high TDS concentrations.

The work described below is focused on explaining further how different data gathered can be use beyond its present format; where data on precipitation (P) and discharge (Q) are applied to broader areas and also used to calculate evapotranspiration (ET). The effort is to make the basic equation of  $P-Q=ET$  a working reality for the Carood Watershed Management Council<sup>2</sup> (CWMC) and to contextualize the different watershed concerns they have and thereafter identify more effective action. The overall relation of governance in the area, as well as the exchanges of the three central municipal governments and possibly three other peripheral municipalities sharing the watershed is strengthened through a six-step process.

## Six Steps Process

The effort is to try to pull together the information and complement what is lacking through basic data gathering and analysis and also to work both with local government and communities that could most effectively utilize such information. The map below shows how information are put together for community and local government and provide basic analysis for discussion.

### 1. **Development from high school climatic knowledge.**

The basic high school knowledge of Philippine climate illustrates the different wet and dry seasonal patterns of the country with an average number and severity of 20 typhoons passing through Visayas and Luzon each year. This maybe limited but it is sufficient enough to provide a good basis for building local understanding of climatic and hydrologic systems.

Bohol belongs to the Type IV group Corona Classification where rainfall is more or less evenly distributed throughout the whole year. In Bohol, the driest month is April with 174.1 mm; wettest month is December with 497.1 mm; and annual rainfall of 1,655.9 mm based on the 1991-1995 PAGASA<sup>3</sup> data. With the increasing severity of El Niño-La Niñas and local impact, it is easy to build on this basic knowledge and understand with people the more detailed rainfall data gathered in Bohol over the years by different institutions.

There are 12 major watersheds identified in the province; Carood being the fifth largest with an area of 205 km<sup>2</sup>. Twenty-three manual rain gauge stations are installed and are being monitored by various institutions and agency, i.e. PAGASA, CVSCAFT<sup>4</sup>, and NIA<sup>5</sup>. Twelve of which are active and fifteen are located within major watersheds. If these are recorded and measured throughout the year, it can give a valuable record over time as to what the actual weather pattern is and the seasonal variances of the area.

### 2. **A network of community rain gauges.** The process of engaging community in the actual rainfall measurements helped in forming an initial water budget for the Carood watershed. Rainfall observers are identified from the community and are tasked to record and monitor rain gauge measurements found within their area. Initial training on the basic concept of hydrological cycle and measurements and their interrelationships provided community with the basic knowledge and its potential integration into broader management planning.

The network of gauges gives the rainfall distribution in the area (Isohyet map). Data collected from these rain gauges are more specific than the general climatic classifications. These form of data can give better input, for instance, into the development of new crops and helpful in understanding the potential impact of future El Niño in the area.

The understanding of the interplay between land, forest, water, and human interaction is important as it provides the basis for actualising the watershed as a management unit.

### 3. **Municipal forum development.** At the municipal level, people recognize watershed as a unit that needs focal management. They are usually engaged in land use planning in relation to land cover. Water as a resource is often times overlooked. The issues and concerns identified within land and water are sometimes dealt with separately and the integration of these is limited.

The convergence of municipalities in Carood through the CWMC process is based on three basic realizations: the boundaries of Carood crosses six municipalities and these six municipalities need to work together for the sustainability of their resources; that effective management also entails meeting the basic needs of their community; and that many others rely on the ecological services provided by these watersheds and therefore the need to protect it. The CWMC is composed of representatives from community, local and provincial planning officers, academes and NGOs. This process is sustained through the information and knowledge shared within fora engagement where collective decisions and specific steps in addressing issues and concerns is achieved. In turn, the information drawn from the municipal fora is fed into the national for broader integration and action.

### 4. **Shared water-related municipal concerns.** Carood supports six municipalities, with at least 60,000 households (5.7% of the provincial population) living mostly on farming in the uplands and lowlands and fishing and aquaculture in the coastal areas. Communities in the uplands, lowland, or coastal areas have very specific constraints and particular concerns that need to be understood.

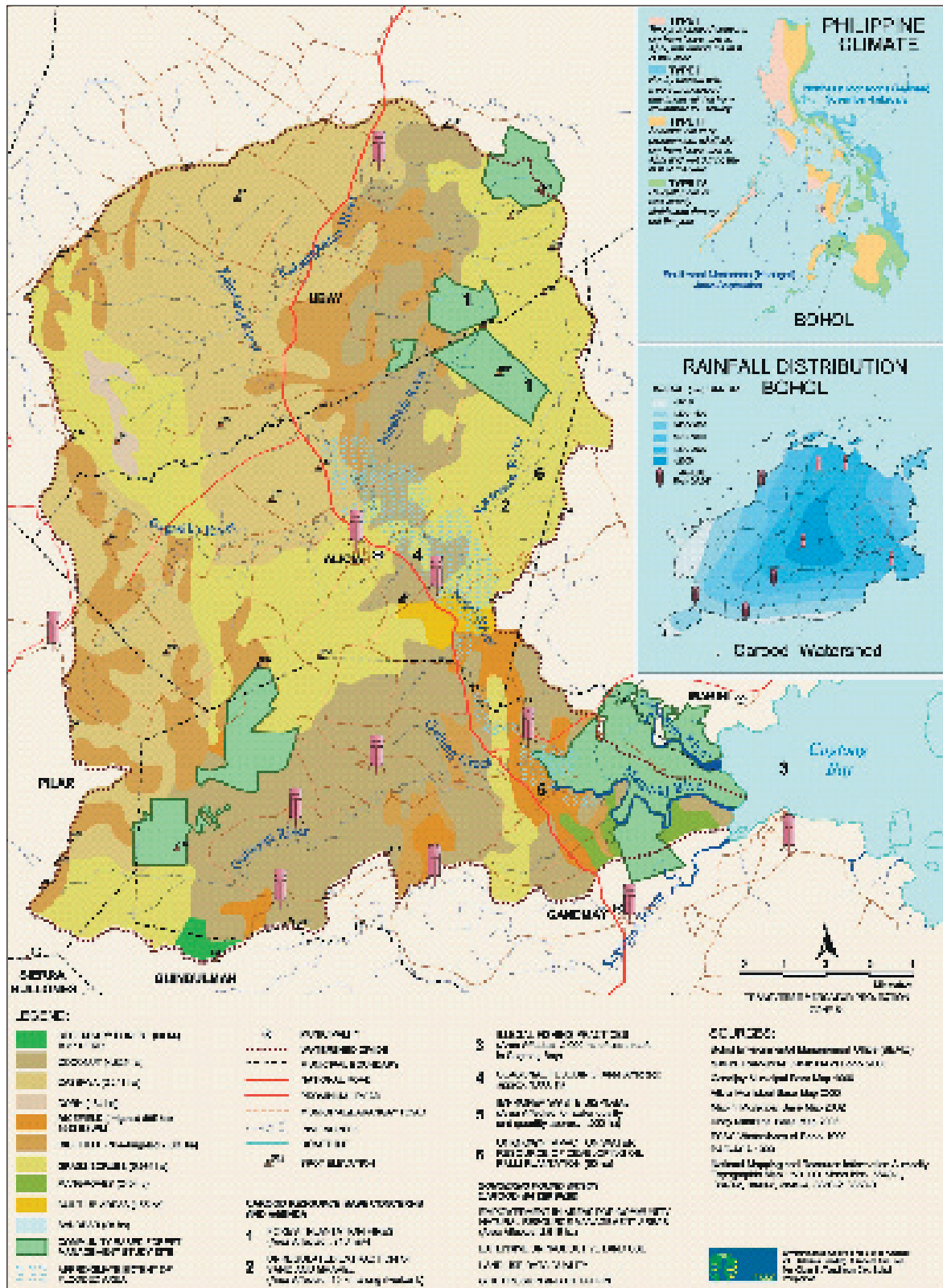
Carood is faced with several issues (see Figure 1) concerning resource management that are being tackled strategically through the CWMC process. Through visual presentation, municipalities understand the depth, extent and overlap of these concerns.

Flooding is one of the major concerns of the CWMC. It occurs between the months of July to December and affects about 20 barangays in the Carood. If these events are a fact of life communities in the affected areas have to live with, through the CWMC they are finding out if uncontrolled activities in the upland aggravating the situation.

### 5. **Data analysis and water budget.** There is no government rainfall (P) record generated within the Carood watershed. However, there are PAGASA manual rainfall records in two watersheds immediately west and south of Carood. Given that they are reflective of the higher rainfall that occurs in this part of the larger Carood Watershed, these data were used along with local rain gauges to produce the rainfall pattern (Isohyet Map).

The water budget is calculated using the ratio of (P) and discharge (Q) in the lower sub-catchment and is further used along with the calculated (P) for the area-estimated evapotranspiration (ET). From these data, an initial water budget is derived for the catchment. However, vegeta-

Figure 1. Carood Watershed, Bohol, Visayas, Philippines



tion, topography and slope, and soil elements are not yet considered in this initial calculation.

6. **Review of land use planning as impacting water management.** The current land use data in Carood gives a simple overview of the basic landscape of the watershed. However, it is too generalized and do not relate to the actual land use in the watershed and needs further validation and updating in order to give more coherence between old datasets and actual land use so that further planning does identify the actual changes needed. Also, the precipitation, infiltration, evapotranspiration, and runoff for both hilly and flat areas need to be considered and also the different rates for each vegetation type for managing the on-going problems.

Establishing land and water interplay is critical to provide better basis for the development of water resource management plans. In Carood, a great percentage of the land is unutilized; over 50% is grass and scrub lands with very limited grazing or used for a seasonal corn crop. Though often identified as a source of cassava production, it is not the case and the area needs an integrated approach that local government can facilitate.

### Lesson Learned

As watershed management becomes a broad level engagement for better land and water use, several steps can be taken to improve both local awareness and capacity to respond to the growing need to come up with better management options.

The realization that the rainfall range recorded over the last 20 years and the major events that took place over the same time period are normal occurrences, facilitate stakeholders in recognizing that weather and climatic events follow a pattern. This knowledge enables stakeholders to plan an action that would prevent or reduce, where possible, the impacts of the event, and help understand the process and requirements for recovery.

Even though the datasets is very limited to be able to develop a rainfall distribution chart (Isohyet) for the island, the data is still informative and can still help in developing

a water budget. This is a critical step in building capacities within municipality.

Part of the broad preparation and learning that complements this is engaging the community in the data gathering process. This process helps in setting up the context that enables local governments to work together in the same watershed and opens the discussion of common issues that may directly or indirectly relate to their specific area within the watershed. This eventually builds their capacity to work together and slowly establish the importance and the ability to incorporate their understanding of the issues in developing long-term strategies.

### Notes

- <sup>1</sup> World Bank Report (2003). Philippines Environment Monitor: Water Quality.
- <sup>2</sup> Carood Watershed Management Council (CWMC) was formed in November 2002 resulting into formal collaboration of stakeholders for watershed management.
- <sup>3</sup> Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) is the lead institute for meteorological and oceanographic research.
- <sup>4</sup> Central Visayas College of Agriculture, Fishery, and Technology (CVSCAFT) is the state college in the Visayan region undertaking specialized research on water and water resource management.
- <sup>5</sup> National Irrigation Administration (NIA) is a national agency responsible for developing agriculture-related infrastructure.

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