

INTEGRATED RIVER MANAGEMENT MODELS: IMPLICATIONS FOR
COLLABORATIVE GOVERNANCE AND MANAGEMENT OF THE ANGAT
RIVER BASIN, PHILIPPINES

by

THERESA ASLIN FRESCO

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ABSTRACT

As the main municipal water source for Metro Manila's 12 million residents, supplier of irrigation water to 26,791 hectares of farmland in Pampanga and Bulacan provinces, flood control for downstream municipalities and provider of 10% of the nation's hydroelectricity, the Angat River Basin is of prime socioeconomic importance to Luzon, the central island and economic centre of the Philippines.

According to the National Irrigation Administration (NIA), the Manila Waterworks and Sewerage Board (MWSS) and the National Power Corporation (NPC), future water requirements for domestic, commercial and industrial purposes on Luzon Island show remarkable increases. In addition to the challenges of climate change, longer droughts and intense weather events, the already stressed Angat River is projected to face increased water demand due to rural to urban migration into Metro Manila, projected doubling of population in Bulacan Province in the next decade, increased industrialization and increased demand for hydroelectricity.

Given the complexity, breadth of competing uses and interrelated nature of natural systems such as river basins, collaborative governance has been an effective strategy to grapple with the challenges of fragmented and siloed agencies dealing with water management. In order to provide insight on a potential response to these challenges of governance in the Angat River system, this study seeks to explore existing, international case studies of collaborative governance models, their implications and potential recommendations for Angat's management.

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LIST OF ACRONYMS

AAWB	Ayuquila- Armeria Watershed Board
AAWC	Ayuquila- Armeria Watershed Commission
ADB	Asian Development Bank
AMRIS	Angat Maasin River Irrigation System
ARMB	Angat River Management Board
AWSOP	Angat Water Supply Optimization Project
BENRO	Bulacan Environment and Natural Resource Office
BIC	Barangay Information Centre
BSTFAD	Bulacan Special Task Force on Ancestral Domain
BSWM	Bureau of Soils and Water Management
CALABRAZON	Cavite, Laguna, Batangas, Rizal and Quezon provinces in Luzon (Region IV-A).
CBO	Community Based Organization
CBWM	Community Based Watershed Management
CENRO	City Environment and Natural Resource Office
CHS	Centre for Human Settlements
CIDA	Centre for Human Settlements
CPU	Central Philippine University
DAEE	Departamento de Agua e Energia Eletrica (Brazilian Water Resource Agency)
DENR	Department of Natural Resources
DPWH	Department of Works and Highways
DRBSM	Direccion de la Reserva de la Biosfera Sierra de Manantlan (Directorate of the Sierra de Manantlan Biosphere Reserve)
EO	Executive Order
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agriculture Organization

FEHIDRO	Sao Paulo State Water Resources Fund
GIS	Geographic Information Systems
IEC	Information, Education and Communications
IMECBIO	Instituto Manantlan de Ecologia y Conservacion de la Biodiversidad (Manantlan Institute for Ecology and Biodiversity Conservation)
IPRA	Indigenous People's Rights Act
IWMC	Iloilo Watershed Management Council
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
KAPAWA	Katilingban Sang mga Pumuluyo sa Watershed sang Maasin
KSPFI	Kahublagan Sang Pamimalay Foundation
LGC	Local Government Code
LGU	Local Government Unit
LWUA	Local Water Utilities Administration
MENRO	Municipal Environment and Natural Resource Office
MGD	Millennium Development Goals
MIWD	Metro Iloilo Water District
MOA	Memorandum of Understanding
MRC	Municipal River Council
MTPDP	Medium Term Philippines Development Plan
MWSS	Metropolitan Waterworks and Sewerage System
NAPACOR	National Power Corporation
NCIP	National Commission on Indigenous Peoples
NEDA	National Economic Development Agency
NGO	Non-governmental Organization
NIA	National Irrigation Agency
NWRB	National Water Resources Board
PA21	Philippine Agenda 21

PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services Administration
PCSD	Philippine Council for Sustainable Development
PENRO	Provincial Environment and Natural Resource Office
PIA	Philippine Information Agency
PMSA	Municipality of Santo Andre
PNP	Philippine National Police
PO	People's Organization
PPDO	Provincial Planning and Development Office
RBC	River Basin Committee
RBCO	River Basin Control Office
RBO	River Basin Office
RDC	Regional Development Office
SPMA	Sao Paulo Metropolitan Region
TAWMB	Tigum-Aganan Watershed Management Board
TWG	Technical Working Group
UBC	University of British Columbia
UN	United Nations
UNU	United Nations University
WBA	Water Basin Committee
WPA	Water Protection Area

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DEDICATION

This project is dedicated to all those who continue to work tirelessly to protect the remaining water resources in the Philippines – from the national to the barangay level, government and non-government – your dedication and efforts have inspired this work.

1 INTRODUCTION: CONTEXT AND RATIONALE

Scarcity, degradation, depletion, wastage and mismanagement – all these describe the conditions which our country's water resources are in today. This is our 'water war' and all of us who have stakes in our water resources must therefore act now to ensure that we win this war.

-Mario B. Lamberte

President of the Philippine Institute for Development Studies (PIDS)

From *Winning the Water War*.

The Philippines is endowed with plentiful water resources, but their state is often described as a paradox of abundance and scarcity. The country's resources include 421 major river basins in 119 watersheds, 61 major lakes, 20,200 million cubic meters of groundwater and 2400 millimetres of runoff from rainfall annually. Despite this abundance, studies estimate as much as 50% of the population still do not have adequate and sustained access to potable water (UNESCAP 2011). This situation is also set to worsen with projections showing that, under a low economic growth scenario, water availability deficits will occur in the regions of Pasig-Laguna, Pampanga, Agno, Bicol, Cagayan, Jalaar, Ilog-Hilabangan, all the regions in Luzon and the island of Cebu in Visayas by the year 2025 (World Bank 2003). With rapid rural to urban migration especially in centres such as Metro Manila, expanding industrialization as well as the intensification of climate change, the urgency of formulating solutions to address water management has become even more pressing.

This study focuses on the current challenges facing the Angat River, a sub-basin of the larger Pampanga River Basin located in Bulacan province. As a supplier of 97% of the drinking water for Metro Manila's 12 million residents, irrigation for 26,791 hectares of farmland across 20 towns in Bulacan and Pampanga provinces, 5% of Luzon Island's electricity, downstream flood control and domestic and industrial uses for the 11 municipalities that lie along its banks, the Angat River is of prime socioeconomic importance to the Philippines. Though there have been various studies and projects pertaining to the optimization of Angat waters and the beginnings of an Integrated Water Resource Management (IWRM) planning process for the Pampanga River Basin, the sustainability of the Angat River system and its vital socioeconomic context has not been fully addressed. In order to provide insight on how the Angat River's current challenges could be addressed, this study seeks to explore the potential for collaborative

governance to be used in Angat River's management drawing best practices and processes from national and international case studies.

1.1 Project Objectives and Research Questions

This project mobilizes information obtained during a summer internship and field studio in the Philippines (see section 1.4 on research methodology), an extensive review of secondary literature and information received from water management professionals in order to engage with current practical solutions related to the Angat River Basin's management. This work contributes to these current solutions by exploring collaborative governance applications used nationally and internationally especially at the smaller, more localized sub-basin level. This is significant given the current approach to Angat River's management, which is examined at a broader scale through the management of the larger Pampanga River Basin. Broadly, this project seeks to achieve the following objectives:

- To explore existing, international and national case studies and Philippine examples of collaborative governance in watershed management,
- To analyze the implications of current collaborative governance models for management of the Angat River Basin, and,
- To provide recommendations for further research and action-oriented projects for collaborative governance in the Angat River Basin.

It also seeks to answer the overarching question *how can collaborative governance work as a mechanism for the management of Angat River?*

This can be broken down into five more specific questions:

1. *Given the context of the Angat River Basin and its various competitive uses, what are the lessons that may be gleaned from some existing examples of collaborative governance models used in similar contexts?*
2. *What are the implications of these collaborative governance models for the Angat River Basin?*
3. *How will these potential collaborative governance models involve and connect with the competing uses and unique issues facing the Angat River Basin (e.g., influence of Metro Manila and its domestic water demand, growth of informal settlements in Bulacan and illegal water connections, the potential privatization of Angat Dam)?*

4. *How do these implications relate to the current role and capacity of Local Government Units (LGUs) at the municipal and barangay (village) levels?*
5. *What are some areas for further research and projects regarding collaborative governance and watershed management in the Angat River Basin?*

In order to address these objectives and research questions, an extensive literature review was conducted to determine collaborative governance frameworks used in water management and to analyze various national and international case studies applying these frameworks. This literature was then used to formulate recommendations for Angat River's management in light of the current creation of the Pampanga River Basin's IWRM plan. Using various research methods – content analysis of public and internal government documents, informational interviews with water experts and drawing from internship and field research experiences working with the Bulacan Provincial Planning and Development Office (PPDO) and the Municipality of Plaridel – data on Angat River and rivers with similar contexts was collected. The implications of the international case studies reviewed were then assessed in relation to their relevance to the Angat River context and then formulated into best practices, processes and recommendations. A more in-depth discussion of these research methods and procedures is provided in the Research Methodology section of this project report.

The findings of this project aim to provide recommendations for the Bulacan Provincial Planning and Development Office (PPDO), the client recipient and one of the key provincial departments tasked with environmental management of the Angat River Basin.

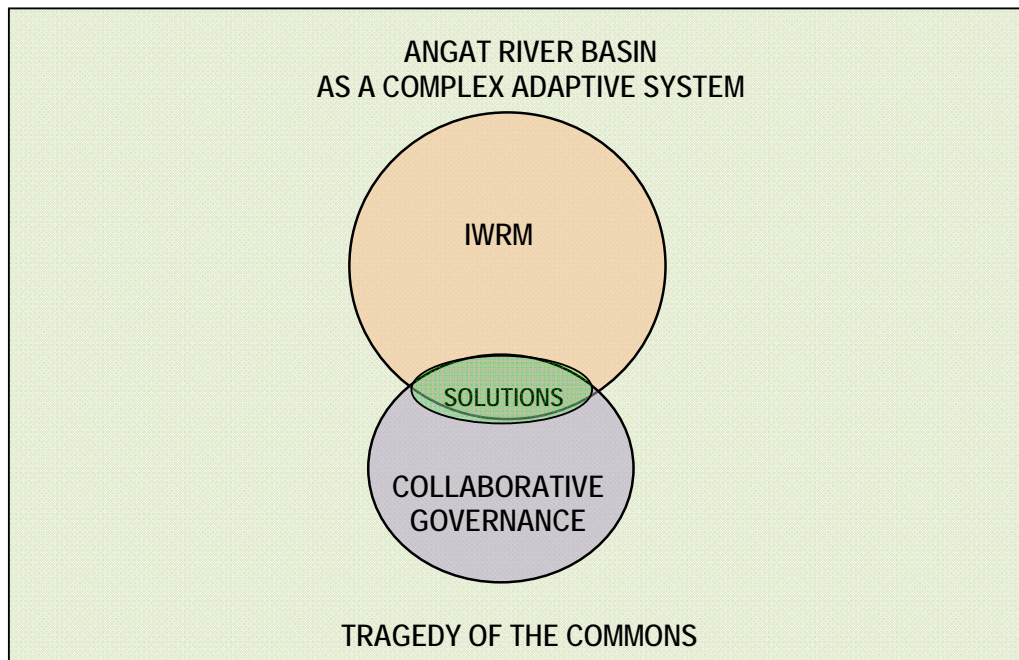
1.2 Theoretical Framework: An Introduction to Key Concepts and Terms

In order to appropriately frame the problems of competing uses, climate change and other challenges facing the Angat River Basin, this section begins with a description of the “tragedy of the commons” and “complex adaptive systems” theory to provide a theoretical pretext for the solutions of IWRM and collaborative governance. Both of these initial concepts acknowledge the complexity of the Angat River Basin as a natural system which adapts and evolves by incorporating feedback it receives from its environment. Because traditional management systems and structures have not integrated these notions of flexibility, complexity and adaptation, solutions produced have been simplified and isolated from the natural systems they oversee causing inaccuracy in the system projections. Though newer management approaches such as IWRM and collaborative governance do touch on these issues, how it can be incorporated in their practical application is elusive. Thus, an initial discussion of these concepts is necessary in order to frame an approach of how these tools could be effectively used in the Angat River Basin context.

This definition of terms section is then followed by a discussion of the current approach of Integrated Water Resources Management (IWRM) being pursued for the Angat River Basin and a potential solution of collaborative governance. Given that IWRM is useful as a conceptual approach to water management, its practical application has remained vague due to a number of factors including the lack of methods for distributive governance (Biswas 2004; Hooper 2003). Thus, collaborative governance with its application to complex adaptive systems theory (Connick and Innes 2003; Innes and Booher 1999) is proposed as a potential approach and application of IWRM.

These theoretical frameworks are represented schematically in Figure 1.1 where the square represents the Angat River as a complex adaptive system currently experiencing a ‘tragedy of the commons’ encompassing the two solutions of IWRM and collaborative governance. Overall, the reference of the Angat River as a system underlies the way in which the two potential solutions are approached. This study will focus primarily on where the two tools of IWRM and collaborative governance intersect (shaded green area) and the implications of this for protecting the sustainability of the Angat River.

Figure 1.1: Conceptual Framework



1.2.1 Tragedy of the Commons

The challenge of competing uses and over extraction in the Angat River Basin are an example of Hardin's 'tragedy of the commons' (1968) which describes the dilemma arising from multiple individuals acting independently in their own self-interest in the use of a finite, common resource. Like the Angat River, each person's use of a 'common pool' resource system subtracts resource units from the quantity of units available to others. Conventional analysis of this dilemma has justified the need for centralized control of resources but has often resulted in the opposite of what is predicted - accelerating resource depletion and creating problems of corruption and inefficiency (Ostrom 2008). Top-down management and regulation systems therefore are not a panacea and often stalemates are created due to the perception of only 'one' solution to the problem. Ostrom (2009) proposes the need to recognize institutional diversity and the creation of institutions that match the complexity of the system involved. She further claims that 'all efforts to organize collective action. . . must address a common set of problems [such as] coping with free-riding, solving commitment problems, arranging for the supply of new institutions and monitoring individual compliance with sets of rules' (Ostrom 1990). More specifically, Ostrom finds that groups that were able to organize and govern their behaviour were successfully marked by the following design principles:

1. Group boundaries are clearly defined.
2. Rules governing the use of collective goods are well matched to local needs and conditions.
3. Most individuals affected by these rules can participate in modifying the rules.
4. The right of community members to devise their own rules is respected by external authorities.
5. A system for monitoring member's behaviour exists; the community members themselves undertake this monitoring.
6. A graduated system of sanctions is used.
7. Community members have access to low-cost conflict resolution mechanisms.
8. For common pool resources that are parts of larger systems; appropriation, provision, monitoring, enforcement, conflict resolution and governance activities are organized in multiple layers of next enterprises.

Angat management design principles need to demonstrate the above elements. Thus, the tragedy of the commons is a useful lens for this study to adequately frame the problems currently facing the Angat River as well as a direction and framework for potential solutions.

1.2.2 Complex Adaptive Systems Theory

In addition to the view that the Angat River and its challenges are a 'tragedy of the commons', it is also helpful to use a framework relating to its state as a natural and complex system (Connick and Innes 2003; Innes and Booher 1999). Complex systems theory considers nature as an evolutionary process made distinguishable by adaptive cycles that are nested at scales of increasing size which result in uncertainty, non-linearity and self-organization (Holling and Gunderson 2002; Holling et al 2002; Plummer and Armitage 2007). In these adaptive cycles, learning occurs when individual agents or components of the system are networked and experiment with various responses to its environment. Actions that fail are discarded and those that succeed further persist and develop by feeding back into the system allowing it to evolve.

Like natural systems, this framework of complexity can also apply to social, institutional or physical systems, which can also undergo the same process of evolution, learning and adaptation in uncertain, changing environments (Capra 1996). Like natural systems, they can also respond proactively to stresses, demands and information from the environment and

unanticipated consequences of their own internal dynamics which can allow them to move to higher levels of performance (Connick and Innes 2003).

However, this paradigm is not the current approach to natural resource management (Connick and Innes 2003; Holling and Meffe 1996; Innes and Booher 1999). As Holling and Meffe (1996) describe, current institutional approaches isolate them from the natural system due to an inflexible structure based on command and control management. In this approach, target variables that are assumed to be well-bounded, linear and relatively simple, are defined and then successfully controlled. However, when these methods are applied to a complex, nonlinear, unpredictable system such as a river basin, typical predicted outcomes are rarely obtained and social and economic repercussions result (Holling and Meffe 1996). This has further resulted in institutions and agencies being less resilient to cope with changes in a natural system, including any impending ecological collapse.

Using a complex adaptive system framework in order to understand both the Angat River Basin system as well as its political, socio-economic and institutional context, this project proposes Holling's assertion that '... the process of developing policies and investments for sustainability requires a world view that integrates ecological with economic with institutional with evolutionary theory. ...overcom[ing] disconnects due to limitations of each field' (Holling et al 2002: 10). This integration in turn, creates a case for both integrated water resource management (IWRM) and collaborative governance (Connick and Innes 2003; Innes 1999; Innes and Booher 1999) (discussed in the sections 1.2.3 and 1.2.4). When coupled with complex adaptive systems theory, IWRM and collaborative governance approaches have the ability to change the direction of complex, uncertain, evolving situations and help stakeholders move toward higher levels of social and environmental performance. This is accomplished when inter-disciplinary leaders in the system learn how to work together and develop an innovative, viable, flexible and adaptable set of long-term strategies for action (Innes and Booher 1999).

1.2.3 Integrated Water Resources Management (IWRM)

Like the holistic, interconnected reality of ecological systems, IWRM transitions more traditional, sectoral approaches to a more collaborative and integrated approach to water management. The Global Water Partnership (GWP) defines IWRM as 'a process which promotes the

coordinated development and management of water, land and related resources in order to maximize economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment.' (GWP 2010). This approach encompasses multiple uses, holistic management (including supply and demand for water), multiple perspectives (including economic, social and environmental) and a participatory approach (including all those who have a stake in water resources).

Though this definition serves as a useful conceptual framework, its implementation has been elusive (Jonker n.d., Biswas 2004), fraught with problems relating primarily to lack of political will, lack of workable methods of distributive governance, the role of law, stakeholder participation as well as specific hydrological, socio-political and economic conditions affecting application (Hooper 2003). IWRM must recognize aspects such as the overtly political nature of its decision making processes (Allan 2003), the spiritual and cultural aspects of water (Rahaman and Varis 2003) and the importance of incorporating human welfare and poverty reduction (Merrey et al 2005) into its design and implementation.

Given these complicated issues related to application, this study understands IWRM as '... an approach, a perspective, a way of looking at problems and how to solve them' (Van der Zaag 2005: 868). Thus, it examines the intersection of IWRM and collaborative governance and more specifically, how collaborative governance can serve as a mechanism to achieve aspects of IWRM. To this end, in addition to the acknowledgement of IWRM's foundational principles, it examines how these larger goals can be achieved through a planning process. The Global Water Partnership suggests this planning process encompasses seven steps (Figure 1.2) – establishing status and overall goals, building commitment to reform process, analysing gaps, preparing a strategy and action plan, building commitment to actions, implementing frameworks and monitoring and evaluating progress. In addition to serving as the mechanism to achieve IWRM's basic principles, collaborative governance also serves as a foundational medium for achieving all aspects of the planning cycle given its methods of consensus decision making and involvement for all relevant stakeholders. This is discussed further in the following section.

Figure 1.2: IWRM Planning Cycle



Source: Global Water Partnership website 2010.

1.2.4 Collaborative Governance

Given its principles of inclusivity, consensus decision making, trust building and stakeholder engagement, collaborative governance can serve as a mechanism to achieve IWRM goals. As stated at the Third World Water Forum in Kyoto, Japan:

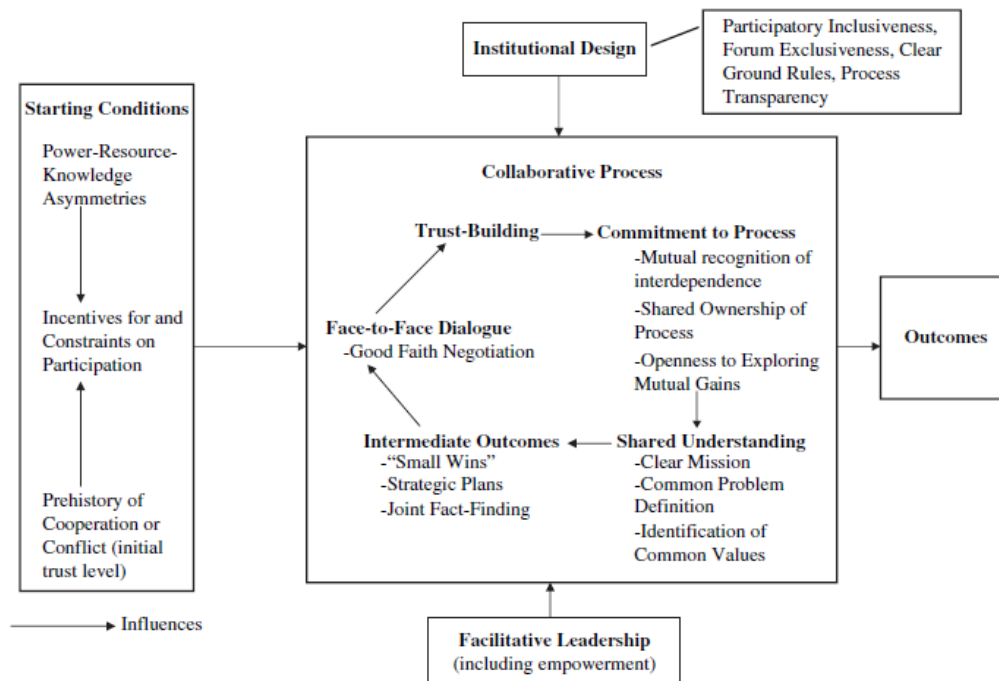
'...the key issues confronting most countries today is that of effective *governance*, improved *capacity*, and adequate *financing* to address the increasing challenge of satisfying human and environmental requirements for water. We face a *governance crisis*, rather than a water crisis. Water governance is putting IWRM with river and lake basin management and public participation as critically important elements, into practice' (World Water Council 2003).

Collaborative governance refers to a form of governance where state and non-state stakeholders engage in a collaborative decision making process in order to address public policy problems that may not be easily addressed by one organization or sector (Ansell and Gash 2008; Bingham, L.B. et al 2005; Freeman 1997; Jung et al 2009; Huxham 2000; Innes and Booher 2003; Mandell 1999). This often includes a formal, consensus-oriented and deliberative process (Ansell and Gash 2008) and is often useful in complex, adaptive systems

where problems are inter-jurisdictional and multi-sectoral (Connick and Innes 2003; Innes and Booher 1999; Plummer and Armitage 2007).

According to Ansell and Gash (2008), a model of collaborative governance has four broad variables – starting conditions, institutional design, leadership and collaborative process as represented in Figure 1.3.

Figure 1.3: Model of Collaborative Governance.



Source: Ansell and Gash 2008: 550.

In this model, collaborative process which includes face-to-face dialogue, trust building, commitment to process, shared understanding and intermediate outcomes lie at the core of collaborative governance with starting conditions, institutional design and leadership variables serving as contributions to context or the process itself. The collaborative governance process is also illustrated as a highly iterative and non-linear cycle demonstrating its capacity to incorporate the self-organization, flexibility, adaptability and resilience inherent in the complex adaptive systems they often manage (Connick and Innes 2003; Innes 1999; Innes and Booher 1999).

Incorporating consensus decision making through a broad group of stakeholders, collaborative governance encourages participants to learn, interact and challenge assumptions, fosters creativity and involves many kinds of high-quality information (Connick and Innes 2003: 180). Through this process, social and political capital are built even in the absence of formal agreements, innovative solutions are created, resulting successful agreements are of high quality, changes in attitudes, behaviours and actions become apparent and wide ranging networks form (Brody 2003; Connick and Innes 2003: 181).

In light of IWRM's principles emphasizing multiple uses, holistic management, multiple perspectives and participation, collaborative governance and its process serve as a mechanism to achieve these larger goals in practice. Given the Angat River Basin's wide array of competing uses and challenges, this approach is a useful tool to engage all relevant stakeholders such as citizens, organizations and government institutions, facilitating the potential for innovative and diversified solutions, high quality management agreements through consensus and the pooling of resources and other assets to achieve common goals.

1.2.5 Watersheds, Catchments and Basins

The concepts of watershed, catchments and basins mentioned in this project pertain to the definitions outlined by Rola and Francisco, where a watershed is the divide between two areas drained by different river systems. This not only refers to the divide itself but also the natural drainage areas within that boundary (2004: 11). A catchment and basin refers to the natural drainage areas within the boundary defined by the watershed divide. The terms watershed and catchment can be used interchangeably but basin, or river basin, most often refers to a region drained by a larger river system implying a very large watershed or catchment (2004: 11). In this project, an example of this reference is the larger context of the Pampanga River Basin of which the Angat River Sub-basin is a part.

1.3 Study Relevance and Rationale

Given the fundamental importance of the Angat River system and its complex and wide array of challenges threatening its sustainability, this study seeks to contribute to potential governance solutions. This includes the proposal of collaborative governance as a mechanism to effectively grapple with the 'tragedy of the commons' problem in the watershed, as well as the more than thirty fragmented agencies, still operating in silos when dealing with river and water management.

Collaborative governance has been successfully implemented for watersheds in the US (eg. Bonnell and Koontz 2007; Born and Genskow 2000; Brunner et al 2005; Connick and Innes 2003 ; Imperial 2005; Innes and Booher 2003; Ryan and Bidwell 2008; Sabatier et al 2005; Scholtz and Stiffel 2005), Canada (eg. Bakker 2007a, 2007b; Calbick et al 2004; Cohen 2011; Ferreyra 2006) and developing nations (eg. Montero et al. 2006; Sneddon 2002, 2003; Salas 2008; Vendramini et al 2011).

Though IWRM has been institutionalized as an integrated strategy for river management at the national and regional levels in the Philippines, there is a lack of information on its approach to governance and more specifically, the role and capacity of the Local Government Units (LGUs) at the smaller, more localized scale at the sub-basin level. As many violations of river management and enforcement occur at the local level, it is important that the capacity (e.g., knowledge, training, financial compensation) of the province, municipalities and barangays to implement these mandates is considered.

Using national and international case studies, this project seeks to explore best practices and processes for collaborative governance and water resource planning and provide a set of recommendations on their application to the Angat River context.

1.4 Research Methodology

In order to place the researcher within the research, this section aims to provide an overview of the project's inspiration, methods employed, rationale for literature selected and limitations.

1.4.1 Project Inspiration

The inspiration for this project began during a 2010 summer internship with the Provincial Planning and Development Office (PPDO) of Bulacan and a field studio involving capacity building work with the municipality of Plaridel. My research and work for Bulacan's PPDO, arranged by my internship and project supervisor Dr. L. Angeles focused primarily on topics of sustainable development, climate change adaptation and mitigation, waste management, water conservation, forest management and restoration and Geographic Information Systems (GIS) and how these could be incorporated in Bulacan's Comprehensive Physical Framework Plan. Through my work with its three divisions – Plans and Programs, Research, Monitoring and Evaluation and Databank and Statistics Divisions – I was exposed to the realities of Bulacan's ecosystem health including that of the Angat River Basin. I was also exposed to the province's planning, legislative and political contexts and mandates as well as attended several Sangguniang Panlalawigan (Provincial Council) and municipal land use plan meetings.

My internship was sandwiched by a field studio course based in the Bulacan municipality of Plaridel. As part of the School of Community and Regional Planning's 2010 Philippine Summer Field Studio course¹, I worked with a team of students and the Municipality of Plaridel's Environment and Natural Resources Office (MENRO) on the implementation of various solid waste management strategies and best practices in environmental leadership. This involved training the MENRO staff on topics of sustainable waste management and its link to climate change, peak oil and food security and developing a workshop in order to disseminate this new knowledge to *barangay kapitans* (village leaders), *kagawads* (councilors), and *barangay tanods* (police/watchman). As one of the 11 upstream and downstream municipalities along the Angat River, I was able to understand some of the challenges that municipal and barangay leaders faced with respect to water management and enforcement, especially in the areas of waste

¹ PLAN 545 (Philippine Planning Studio course) in 2010 was led by SCARP faculty member, Dr. L. Angeles. A video summarizing the student work during the 2010 Summer Field Studio in Plaridel was completed and can be screened online - <http://www.youtube.com/watch?v=kYDvGdQu9K0>.

disposal and pollution regulations, upstream-downstream relationships, and the impacts of pollution on the citizens within the expanding informal settlements along the riverbank.

Both experiences were invaluable with respect to exposing me to the planning, legal, political, socioeconomic and institutional contexts, as well as the more personalized and localized contexts of communities and individuals. It is through these interactions that I realized the stark realities of water scarcity in the Philippines and the more pressing need for the situation of Angat River to be exposed and acted upon.

1.4.2 Methods

This study is exploratory in nature and uses a comparative literature approach. Literature used was primarily secondary sources including academic literature, news and journal articles and internal government documents. The leads gathered during the internship and course work completed with the Bulacan PPDO and the municipality of Plaridel greatly contributed to the accumulation of these resources. Two primary methods were used to collect data and information. First, a literature review was done to inform and shape the study objectives. Many of the sources provided by staff at the PPDO were internal documents. Second, informational interviews were conducted with key contacts in the water governance field. These interviews were mainly informational in nature and used in order to obtain information on international case studies, best practices in the field and academic resources.

Due to the expansive amount of literature on the concepts of collaborative governance, IWRM, complex adaptive systems and river basin management as well as the timeline for project completion, only literature leads from the PPDO and Plaridel staff, water experts interviewed and the project supervisor were used. The authors used are current leaders in the field of river basin management and were chosen on the basis of how they integrated the concepts of collaborative governance, IWRM and complex adaptive systems and proposed solutions for practice. Case studies were chosen based on how similar their contexts were to the Angat River Basin and their relevance to applicable best practices and processes. Overall, this project intends to be a starting point in the search for solutions and does not claim to be comprehensive in scope.

1.4.3 Limitations of Project Data

Though the researcher made a concerted effort to obtain up-to-date information on case studies and contextual documents on the Angat River, there are several limitations to the project data. Firstly, given the sole use of secondary sources, the project does have the potential to be missing information that may have otherwise been attained by using an empirical, primary data collection method involving community-based surveys and interviews with other relevant stakeholders in the Philippines. Though I tried to base my data collection methods on information that local residents and government workers gave to me, there is a focus on 'expert' opinions. This not only overshadows solutions that are relevant at the local level but it also focuses on the limited 'bigger picture' of water resources rather than the more localized, short-term issues such as irrigation or drinking water shortages. Secondly, since more recent sources of information on the state of the Angat River were not accessible, some of the information provided in this project may be out of date. This is especially true with respect to the planning process for the Pampanga River Basin. Though the date of the most recent Pampanga River Basin study completed by the Japan International Cooperation Agency (JICA) and the Philippine Water Resource Board is January 2011, there are many planning initiatives that the NWRB was planning to implement by the beginning of 2012. Therefore, further research is necessary to follow up on these outcomes. Thirdly, inconsistencies were found in the information and data sets gathered from different agencies. To address this, data that was consistent in most reports and gathered from empirical sources was utilized where possible.

1.5 Project Organization

This project is organized into five sections. The first section introduces the project focus, intent, scope, theoretical framework and research methodology. The second section discusses the Angat River Basin context in more detail including its competing uses, institutional, legal, planning and political contexts as well as the potential privatization of Angat Dam. The third section then introduces three international case studies of collaborative governance in practice and their lessons learned. The fourth section will analyze these lessons learned and their implications for the Angat River Basin. Finally, section five will present conclusions and potential recommendations for the PPDO based on findings from the case studies.

2 CASE STUDY BACKGROUND

This section begins with an overview of the state of water and water governance in the country and aims to introduce the Angat River in terms of its geographical and physical characteristics, socioeconomic influences, competing uses, institutional, legislative, planning and political contexts including the potential privatization of Angat Dam.

2.1 The State of Water in the Philippines

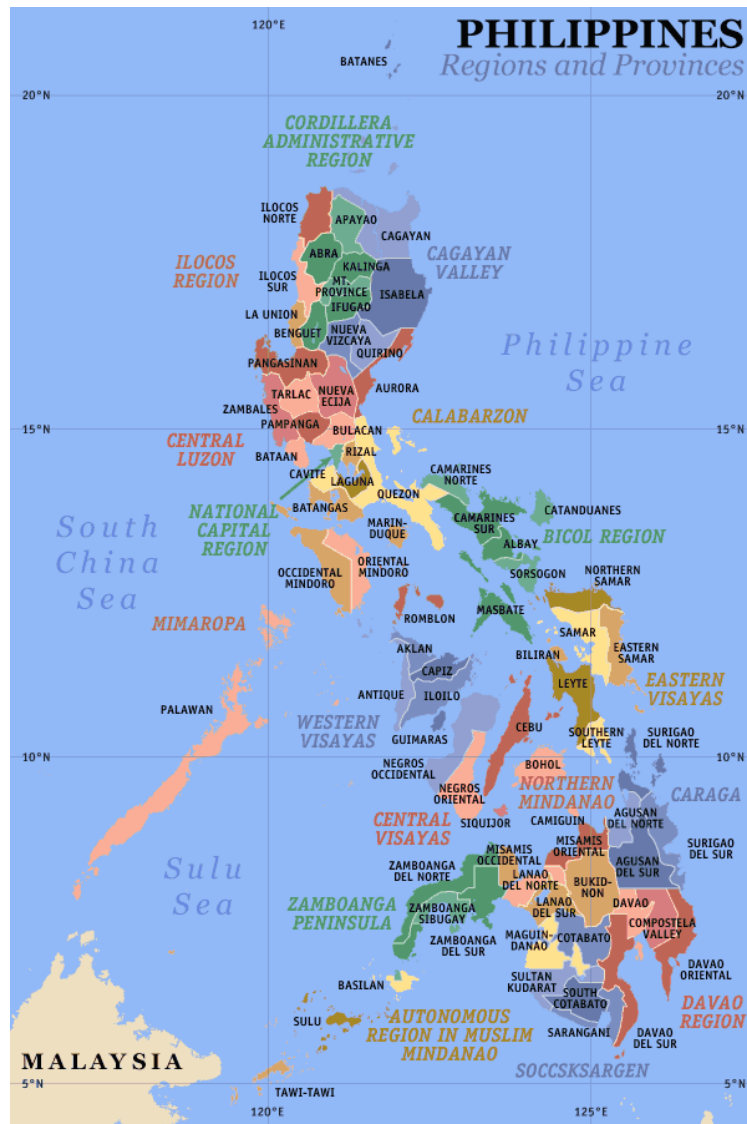
The Philippines is an archipelago of 7,107 islands in Southeast Asia with a total land area of 300,000 km². Its two principal islands of Luzon and Mindanao make up 80% of this land base. The country is usually divided into three clusters of islands with Luzon to the north, Mindanao to the south and Visayas in the centre (see Figure 2.1). As of 2007, the Philippine population has increased to 88.5 million people with more than half of the population residing in Luzon (primarily in the regions of Metro Manila and CALABRAZON²) (NSO 2007). With a current growth rate of 2.71%, the population is projected to reach 100 million in 14 years. Though economic activity is becoming increasingly service oriented employing 52% of the labour force, it also has a high percentage of agricultural (33%) and industrial activity (15%) (CIA 2010: website), especially in the area of food manufacturing (World Bank 2003). In the mid-2000s, the GDP per capita is \$4321 US; 46% of the population live below \$2/day and 20% of households have no access to improved water supply (UNDP 2005 as cited in Kho and Agsaoay-Sano n.d.: 1).

The rapid increases in population, especially in the urban areas of Luzon, as well as growing industrialization, have severely impacted the country's water resources. Mismanagement, watershed degradation, domestic discharge, industrial wastewater and agricultural runoff have rendered 180 of the 421 river basins biologically dead (Rola et al. 2005: 8) leaving only 36% of the major river systems as potential sources of drinking water (World Bank 2003: 3). In addition, up to 58% of groundwater resources, which have a potential supply of 20,200 million cubic meters (mcm) per year, are contaminated with coliform or salt water intrusion in the coastal areas (World Bank 2003:3; PPDO 2010: 6). As a result, despite the abundant supply

² CALABRAZON (Region IV-A) consists of five provinces, Cavite, Laguna, Batangas, Rizal and Quezon. As of the 2007 Census, the CALABRAZON region has a population of 11,757,755 surpassing that of Metro Manila at 11,547,959.

from surface water (estimated at 125,790 mcm per year) and groundwater, the Philippines ranks among the lowest in freshwater availability per capita at 1,907 cubic meters compared with the average of 7,045 cubic meters worldwide and 3,668 cubic meters in Asia (ADB 2009; Kho and Agsaoay-Sano n.d: 2.; World Bank 2003: 6). In addition, the Philippines is projected to hold the highest withdrawal rates among all Southeast Asian countries (Seckler et al 1998 as cited in Rola et al. 2005: 2) with water demand in Metro Manila alone reaching 5000 million litres per day (MLD) in 2010 to 8000 MLD projected for 2025. With Manila's current source, Angat Reservoir, at a capacity of 5962 MLD, this water shortfall is estimated to reach as high as 50% (ADB 2009: 30).

Figure 2.1: Map of the Philippines Regions and Provinces.



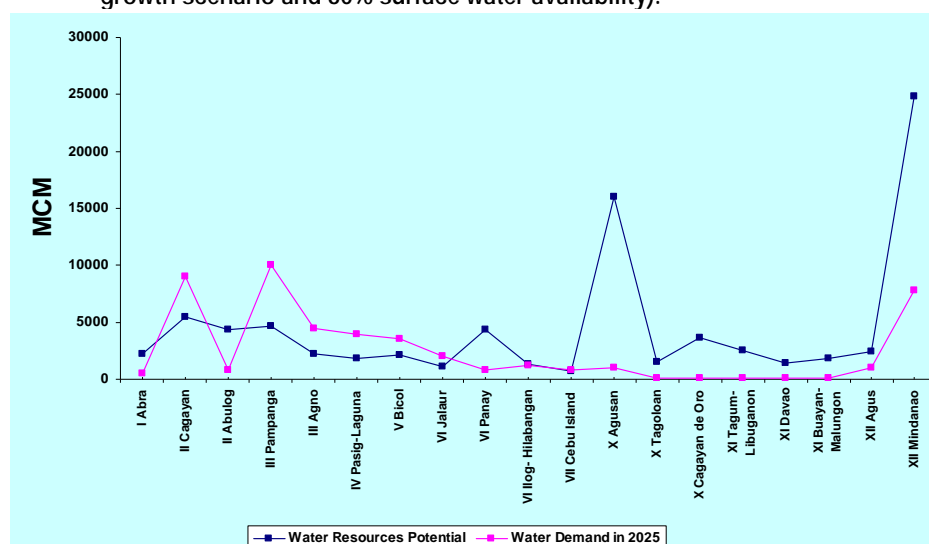
Source: Reproduced from Mapsofnet website 2011.

Table 2.1: Southeast Asia: water supply and demand

Country	Total Annual Water Resources (AWR) Km3 1990 data	Total Withdrawals (DWR) Km3			
		1990		2025 ¹	
		DWR	percent of AWR	DWR	percent of AWR
Cambodia	498.1	0.6	0	0.8	0
Indonesia	2530.0	17.5	1	24.2	1
Malaysia	456.0	13.7	3	18.6	4
Myanmar	1082.0	4.2	0	5.4	0
Philippines	323.0	41.7	13	49.8	15
Vietnam	376.0	27.6	7	31.2	8

Source: Reproduced from Rola et al. (2005: 3).

Table 2.2: Water Potential and Demand by River Basin (diagram assumes a low economic growth scenario and 80% surface water availability).



Source: Reproduced from JICA (1998) as cited in World Bank (2003: 5).

These stark water projections will also be exacerbated by climate change and extreme weather events (Climate Change Commission 2009; Godilano 2010; Jose and Cruz 1999; Lasco 2003; Rincon 2008; Villarin et al. 2008; Yap 2009) as demonstrated in the recent water shortages of 2010. The particularly long dry spell during El Nino in July 2010 led to record breaking water levels in the Angat Reservoir, Metro Manila's primary source of water. Residents were receiving water supply for less than 6 hours per day with some having no water at all (UNESCAP 2011: 7). In addition to droughts, the Philippines lies along a typhoon belt making it susceptible to storms originating from the western Pacific Ocean and the South China Sea. These storms have already increased in frequency and intensity as seen with typhoons 'Ondoy'

in 2009, 'Pepeng' (International name: Parma) and Juan in 2010 causing mass casualties, water contamination and shortages and other damages due to flooding.

Figure 2.2: Images of 2009 Typhoon Ondoy flooding and water shortages in 2010



Source: Reproduced from UNESCAP (2011: 7-9).

2.2 The Angat River Basin

Nested within the larger Pampanga River Basin (7,978 km²), the Angat River is the largest river located in the province of Bulacan and lies 40 kilometers north of Manila (see Figure 2.3). The watershed area is bounded by Umiray River in the northeast, the Kanan River in the southeast and the Marikina River in the south. It is approximately 153 kilometres long with a catchment area of 1085 km² and estimated volume of 8.6 million cubic meters collecting run-off from its main tributaries, Matulid and Maputi rivers (JICA 2002). According to the DENR's catchment scale³, the Angat River is defined as an inter-regional watershed. The Angat River flows westerly beginning in the Sierra Madre mountains through the lowland plains of Bulacan, into the Angat Reservoir and finally into Manila Bay (JICA 2011). Along the way, it snakes through

Table 2. Definition of catchment^a scales (in sq km)

River basin	Over 1,000	Interregional
Large watershed	500 – 1,000	Regional, interprovincial
Medium watershed	100 – 500	Provincial
Small watershed	10 – 100	Provincial/municipal
Micro watershed	Under 10	Municipal/barangay

^a Based on DENR's definition, *catchment* is interchangeably used with the term *watershed*. See the definition of terms in Chapter 1, this volume.

11 municipalities- Angat, Baliwag, Bustos, Dona Remedios Trinidad, Norzagaray, Pulilan, Calumpit, San Rafael, Plaridel, Paombong and Hagonoy and through the traditional territory of the Dumagat Indigenous peoples (PPDO 2010) (for municipal profiles, see Appendix 1).

The climate of the Angat River Basin is classified as Type I by PAGASA and is characterized by a dry season from November to April and wet season during the rest of the year. The average annual precipitation is approximately 2155 millimetres per year with 83% of this concentrated in the rainy season from May to October (JICA 2011: 3).

Under several proclamations, the Angat River Basin has been declared a national protected area (The Angat Watershed Reservation), which is one of the last remaining, well-forested watersheds in the country (NAPACOR 2010). It is managed by the National Power Corporation (NAPACOR), a public corporation that also oversees the Angat Dam and Reservoir.

Figure 2.3: Map of Central Luzon and Bulacan Province.



Source: Reproduced from Province of Bulacan website 2011.

2.3 Key Challenges Facing the Angat River Basin

2.3.1 Competing Uses

Given its size and location, the Angat River Basin encompasses a number of upstream and downstream uses vital to the province of Bulacan, as well as Metro Manila. As regulated by the Department of Environment and Natural Resources (DENR), the upstream portion of Angat River falls under Recreation Water Class I use which is intended for 'primary contact' recreation such as bathing, swimming and diving. The downstream portion falls under Fishery Water and Recreational Class II which is intended for the propagation and growth of fish and other aquatic resources, boating and manufacturing processes after treatment (DENR 2005 as cited in PPDO 2010: 47). In addition, the Angat River supplies the diversion waters for Ipo and Bustos dams (Province of Bulacan 2008) and is a significant resource for Bulacan's growing industrial and resource extraction sector (e.g., fishing, quarrying, mining and logging) (PPDO 2010). Unpermitted uses are also significant, including the River's importance to the growing number of informal settlements resulting from slum relocation in Manila and rapid population growth from the northern, more rural areas of the province (PPDO 2010). Examples of these uses were observed during my field course in Plaridel, where informal settlements along the Angat River used the waters for sewerage and waste disposal but also for livelihoods such as fishing and kangkong (water spinach) farming (see Figures 2.4 and 2.5). Many of the residents noticed the effects of these practices on health, especially for children and the elderly.

Figure 2.4: Informal settlement in Barangay Banga I, Plaridel with garbage disposal and kangkong farming next to each other.



Source: Author.

Figure 2.5: Informal settlements across from Barangay Banga I settlement along the Angat River



Source: Author.

The Angat Reservoir, located upstream, encompasses a set of more specific and diversified uses including:

- 97% of Metro Manila's drinking water distributed by the Metropolitan Waterworks and Sewerage System (MWSS),
- Irrigation for 26,791 hectares of farmland in Pampanga and Bulacan provinces allocated by National Irrigation Association (NIA),
- 5% of Luzon's hydropower (218,000 kWh) produced by National Power Corporation (NAPACOR),
- Environmental protection for the Angat Reservoir by the Department of Environment and Natural Resources (DENR), and,
- Downstream flood control.

According to the Philippine Water Code (NWRB 1976), water users are required to have permits to attain water rights provided by the NWRB. For the Angat Reservoir, these water rights can be broken down as follows:

Table 2.3: Water Allocations for the Angat Reservoir.

Total capacity of Angat Reservoir = <u>69 cubic meters per second (cm³/s)/year</u>		
WATER USER	ALLOCATION	USE
MWSS	31 cm ³ /s/year	<i>Domestic</i> – 97% of Metro Manila's drinking water (includes 22 cm/s water right from NWRB and 9 cm/s from the UATP)
NIA	36 cm ³ /s/year	<i>Irrigation</i> for 26,791 hectares of farmland
DENR	2 cm ³ /s	<i>Minimum Stream Inflow</i> – for environmental protection
NAPACOR	0 cm ³ /s	<i>Hydroelectricity generation</i> considered 'non-consumptive'

Source: Adapted from Tabios and David (2004: 111).

Although Metro Manila currently has the greatest allocation, they initially had no water rights in the Angat Reservoir. However, during a severe drought in 1998, they were granted temporary water rights by the NWRB. Over time, these rights became permanent due to the needs of a rapidly growing population and eventually the amount of water once allocated to NIA for irrigation was reduced from 40 cm/s to 36 cm/s with 4 cm/s given to Metro Manila (Bedore 2011). In addition, as stated in the Philippine Water Code and 'rule curve' policy for Angat Reservoir, Metro Manila's domestic use has priority over all other uses during emergencies and water shortages (Bird et al 2009; NWRB 1976; Tabios and David 2004) (see Appendix 2). This results in severe losses especially in the agricultural sector and although any appropriation decisions must result in compensation to the affected sectors, many of these cases still remain unresolved (Bedore 2011).

Metro Manila's increasing demand for water has also been largely favoured in the development of water infrastructure projects for Angat River and Reservoir which have focused primarily on the optimization of supply. Over the last 30 years, foreign loans from the Asian Development Bank (ADB), World Bank, Japan Bank for International Cooperation (JICA) and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ, formerly GTZ), as well as subsidies from the national government have aided the MWSS in the provision of water supply and sanitation to Manila (ADB 2004). The largest of these projects include the Angat Water Supply

Optimization Project (AWSOP) and the Umiray-Angat Transbasin Project (UATP). The AWSOP completed in the 1990s aimed to construct supply, treatment and distribution facilities that would utilize an additional abstraction of 15 cm/s to satisfy water demand in Manila until 1996. The UATP completed in 1998, supplements this supply with an additional 9 cm/s through a 13.1 km diversion tunnel from the Umiray River to the Angat Reservoir (ADB 2004). This project aimed to satisfy Manila's water demand until 2000. In addition to the appropriation of water rights from NIA, the MWSS was also authorized by the NWRB to withdraw water which was allocated for power generation at 15 cm/s. Their diversion of waters from Angat Dam required them to build an auxiliary power plant to compensate for the power loss to the National Power Corporation (ADB 2004). However, despite the billions of pesos of loans and investment, as well as the appropriation of rights from other stakeholders during drought events, the Angat Reservoir supply of water for Metro Manila still falls short to meet the growing demand, with no new supply projects in sight.

This dependence on the Angat River as a major source of water for the country's economic centre is also a growing concern in light of the rapid population and economic growth of the bedroom communities of Pampanga and Bulacan, where the Angat River flows. With the improved transport corridors between these provinces and Manila (Carino 2006), population in Bulacan boomed at a rate of 3.30% between 2000 and 2007 with a population totalling approximately 3 million people (PPDO 2010). This rate was faster than the 2.36% growth of the region and faster than the country's growth rate of 2.04% (PPDO 2010). This in addition to accelerated industrialization has increased the demand for water supply in the province.

However, although the Angat River is geographically located in Bulacan, its residents do not possess water rights for domestic or municipal uses and rely solely on groundwater resources. Excessive extraction, as well as pollution from agriculture and industrial sources, has had a significant negative impact on the quality of this water source. High rates of coliform contamination and saltwater intrusion have exceeded the Philippines National Standards for Drinking Water (PNSDW) and over extraction has led to land subsidence and depression cones in aquifers (PPDO 2010; World Bank 2003; JICA 2011). Given these conditions, new sources of water are greatly needed to satisfy Bulacan's growing demand in order to avoid further extraction (legally or illegally) from the Angat River. Although the AWSOP initially included funding for a Bulacan Bulk Water Project (12 km transmission line to supply Bulacan with water) (see Table 2.4), this initiative was cancelled in 1995 with MWSS reporting that

'physical provisions [were] made to allow connection of a transmission line to be constructed at a future date' (ADB 2004: 4). To date this project has not been reviewed or implemented.

Figure 2.6: Map of Angat River Optimization Projects.



Source: Reproduced from Asian Development Bank (2004: vii).

Table 2.4: Angat Water Supply Optimization Project Components and Funding Sources.

Appraisal Component	External Funding	
	Appraisal	Actual
Part A: Auxiliary power plant	ADB	ADB
Part B: Tunnel	World Bank	World Bank
Part C: Aqueduct	World Bank	World Bank
Part D: Water treatment plant	ADB	ADB
Part E: Reservoir and aqueduct	JBIC	JBIC
Part F1: Distribution mains (420 km), pumping stations	JBIC	JBIC and ADB
Part F2: Tertiary mains (100 km), connections (345,000)	ADB	ADB
Part G: Telemetry system	ADB	ADB
Part H: Bulacan bulk main	World Bank	Cancelled
Part I: Accelerated Nonrevenue Water Reduction Program	None	ADB

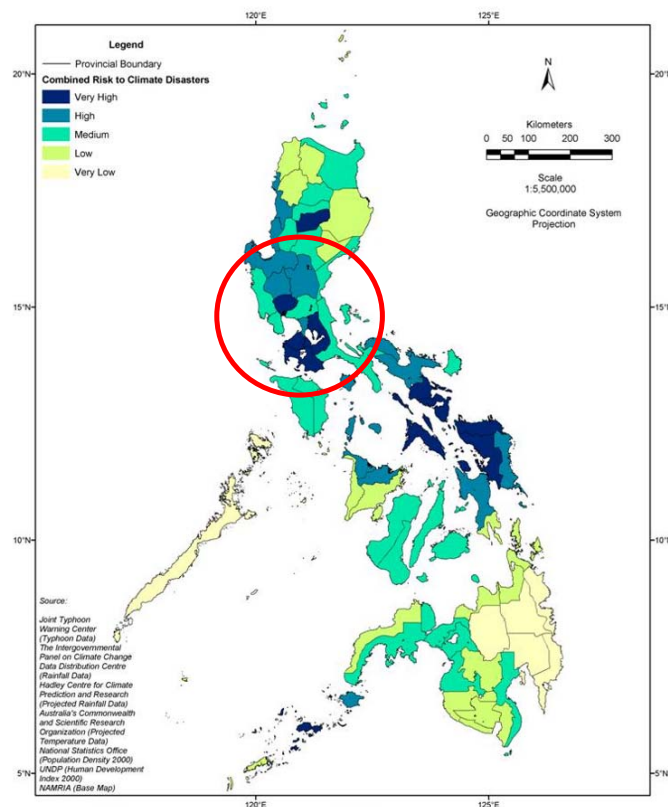
ADB = Asian Development Bank, JBIC = Japan Bank for International Cooperation.
Source: Asian Development Bank.

Source: Reproduced from Asian Development Bank (2004: 2).

2.3.2 Climate Change Impacts

As seen in the aftermath of drought and typhoon events of 2010, the effects of climate change will directly impact the availability and quality of water resources. As projected by the Manila Observatory and the Department of Environment and Natural Resources (DENR), Central Luzon is at high risk for climate disasters such as increased typhoons, droughts caused by El Nino and increases in temperature (Jose and Cruz 1999; Manila Observatory and DENR 2005; see Figure 2.7). These in turn will manifest in changes in hydrological and crop water regimes, shortages in reservoir inflow (Jose and Cruz 1999), deterioration of groundwater quality due to saltwater intrusion, changes in streamflow and groundwater recharge and the sedimentation of reservoirs (Rincon and Virtucio 2008:17). In light of the projected increase in population, industrialization and water demand for both Bulacan and Metro Manila in the next decade, these impacts are of grave concern given the current stress of competing uses already apparent in the Angat Reservoir.

Figure 2.7: Combined Risk to Climate Disasters in the Philippines (Central Luzon highlighted).



Source: Reproduced from Manila Observatory and DENR (2005).

2.4 Institutional, Legislative and Planning Contexts

This section provides further context for water in the Philippines and introduces the institutional arrangements and legislative and planning frameworks related to its management and governance.

2.4.1 Institutional Arrangements

Within the Philippine government, responsibilities related to water resources remain fragmented and uncoordinated with over 30 agencies overseeing areas of planning, management, assessment, infrastructure, water quality and sanitation, flood control, irrigation and project financing (see Figure 2.6). This section aims to identify these agencies, their roles and responsibilities and how they relate to each other. This can be summarized in the following table:

Table 2.5: Government Agencies with Water Resources-related Responsibilities and Enabling Law.

UNIT OF GOVERNMENT	LINE BUREAU OR CONCERNED AGENCY	ENABLING LAW	RESPONSIBILITIES/CONCERNS REALTED TO WATER
National Economic Development Authority (NEDA)	Infrastructure Staff	Executive Order 230 (1987)	Formulates and recommends for approval policies on water resources.
	Regional Development Councils		Sets direction of economic and social development in region through which regional development efforts are coordinated. Coordinates development planning and policy formulation.
	Investment Coordination Committee/NEDA Board		Evaluates/appraises/approves major development projects and policies.
Department of Public Works and Highways (DPWH)	Metropolitan Waterworks and Sewerage System (MWSS)	Republic Act No. 6234	Constructs, maintains and operates domestic/municipal water supply and sewerage projects in Metro Manila and contiguous areas including watershed management.

	Bureau of Research and Standards (BRS)	IRR of NEDA Board Res. No. 4(1994)	Undertakes hydrological surveys and data collection.
	Project Management Office (PMO) – Major Flood Control Projects (PMO-MFCP)		Manages the planning, design, construction, organization and maintenance of major flood control projects.
	PMO-Small Water Impounding Projects (PMO-SWIM)		Manages the planning, design, construction, organization and maintenance of locally-funded and foreign assisted SWIM projects.
Department of Agriculture (DOA)	National Irrigation Administration (NIA)	Republic Act No. 3601 (1963)	Undertakes program-oriented and comprehensive water resources projects for irrigation purposes, as well as concomitant activities such as flood control, drainage, land reclamation, hydropower development, watershed management, etc.
	Bureau of Soils and Water Management (BSWM)	Republic Act No. 8435 (1997)	Undertakes assessment, development and conservation of existing and potential soil and water sources for agriculture; undertakes cloud seeding activities.
	Bureau of Fisheries and Aquatic Resources (BFAR)	Republic Act No. 8550 (1998)	Formulates plans for the proper management, accelerated development and proper utilization of the country's fisheries and aquatic resources.
Department of Energy (DOE)	National Power Corporation (NAPACOR)	Republic Act No. 6395 (NPC Charter) EO 224 (1987)	Develops electric power generation facilities including hydroelectric and geothermal power; constructs dams, reservoirs, diversion facilities and plants and watershed management . (emphasis added).
	National Electrification Administration (NEA)	Republic Act No. 6038 (1969)	Promotes, encourages, and assists public service entities to achieve service objectives, implements micro-hydro projects.
Department of Health (DOH)	Environmental Health Services (EHS)	IRR of NEDA Board Resolution No. 4 (1994)	Responsible for water supply and sanitation programs and strategies to forestall environment-related diseases.
	Bureau of Research Laboratories (BRL)		Monitors quality of drinking water.

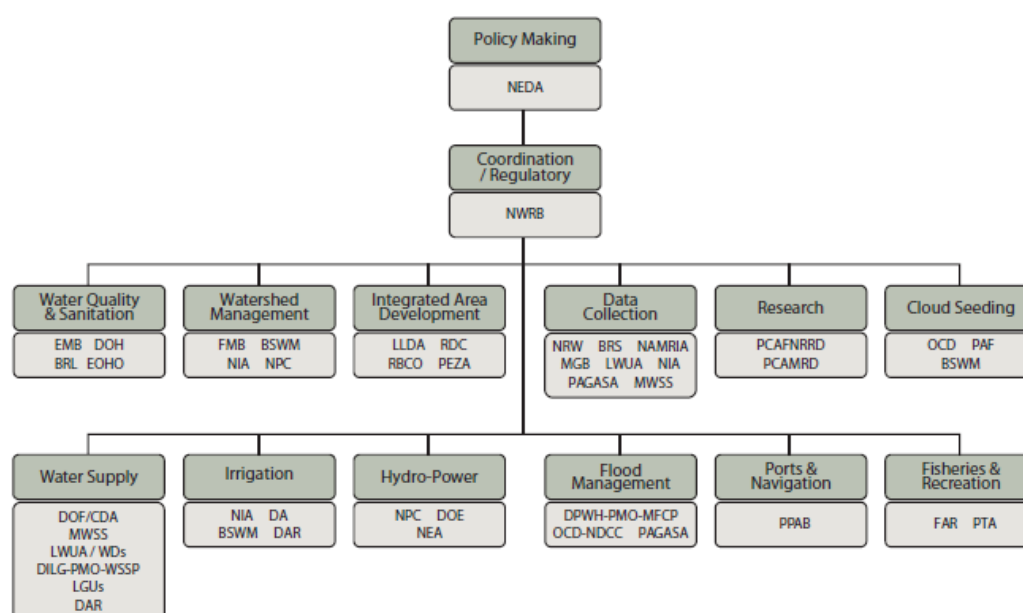
	Local Water Utilities Administration (LWUA)	Presidential Decree No. 198 – Provincial Water Utilities Act (1973)	Specialized lending institution for promoting, developing, regulating and financing water utilities, excluding Metro Manila.
Department of Environment and Natural Resources (DENR)	National Water Resource Board (NWRB)	Republic Act No. 2677; EO No. 123 (2002); Presidential Decree No. 1067 – Water Code of the Philippines (1976)	Coordinates among water-related agencies and regulates water activities in the country; supervises and regulates operation of water utilities outside jurisdiction of LWUA and MWSS; formulates and recommends policies on water resources. Responsible for water resources management including licensing.
	Environmental Management Bureau (EMB)	Executive Order No. 192 (1987)	Formulates environment quality standards for water, air, and, noise and radiation; approves environmental impact statements and issues Environmental Compliance Certificates.
	Mines and Geo-Science Bureau (MGSB)		Manages, develops, and conserves the country's mineral resources; monitors and maps groundwater resources.
	Forest Management Bureau (FMB)		Formulates and recommends policies and programs for the effective protection, development, management and conservation of forestlands and watersheds.
	Protected Areas and Wildlife Bureau (PAWB)		Undertakes the protection and conservation of natural wetlands such as lakes, marshes, swamps, etc.
	River Basin Control Office (RBCO)	EO No. 510 (2006)	Plans for the development and management of the country's river basins.
	National Mapping and Resources Inventory Authority (NAMRIA)	Administrative Order No. 31 (1988) Executive Order 192 (1987)	Responsible for integrated surveys, mapping, charting, oceanography, land classification, aerial photography, remote sensing, etc.

	Laguna Lake Development Authority (LLDA)	Republic Act No. 4850; Presidential Decree 813 in (1975); EO No. 927 (1983); EO No. 149 (1993)	Responsible for regional water resources development and management in the Laguna Lake catchment area.
Department of Science and Technology (DOST)	Philippines Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)	Executive Order No. 128 (1987)	Disseminates atmospheric, geophysical and astronomical data for use by economic sectors, the scientific and engineering communities, and the general public.
	Philippine Council for Agriculture, Forestry and Natural Resource Research and Development (PCARRD)	Established 1972	Formulates national agricultural, forestry and natural resources research and development programs on multi-disciplinary, inter-agency approach for the various commodities including water resources.
Department of the Interior and Local Government (DILG)	Water Supply and Sanitation Program Management Office under the Office of Project Development Services		Supports the provision of water supply and sanitation services by LGUs
Local Government Units (LGUs)	Provincial Governments	Republic Act no. 7160 – Local Government Code (1991)	Promote the development of infrastructure including irrigation, water supply, electric power and roads.
	Municipal and Barangay Governments		Promote municipal and barangay water supply and sanitation, watershed and other programs.
Department of National Defence (DND)	Office of Civil Defence (OCD)	Presidential Decree No. 1 series (1972)	Monitors safety of dams and other water resources projects; prepares and supports the general public in emergencies.
	Philippine Air Force (PAF)	Executive Order No. 94	Undertakes rain enhancement through cloud seeding.
Department of Transportation and Communication (DTC)	Philippine Ports Authority (PPA)	Executive Order No. 159 (1987)	Plans, develops, operates and maintains ports and port facilities.

Department of Tourism (DOT)	Philippine Tourism Authority (PTA)	Presidential Decree 189 and 564 (1973)	Promotes and develops the recreational use of water resources. Operates Boracay water utility.
Department of Trade and Industry	Board of Investments	Department Order No. 11-47	Proponents of the CALABARZON integrated area study, covering water resources, among other aspects.
	Philippine Economic Zone Authority (PEZA)		Responsible for the promotion and management of economic zones including the regulation of water utilities operating within economic zones.
Department of Social Welfare and Development (DSWD)			Implements the government's flagship anti-poverty project – 'Kapit-Bisig Laban sa Kahirapan' – Comprehensive and Integrated Delivery of Social Services (KALA-HI-CIDSS) which includes water system construction in priority municipalities.
Department of Agrarian Reform	Foreign Assisted Projects (FAP) Office Support Services Office (SSO)	Republic Act No. 6657 (1998)	Lead implementing agency of Comprehensive Agrarian Reform Program (CARP) and orchestrates the delivery of support services to farmer-beneficiaries in the KALAHIZR Zones, an expanded agrarian reform communities composed of a cluster of contiguous land-reformed barangays.
Philippine National Oil Company		EO No. 223(1997)	To exercise jurisdiction, control, management, protection, development and rehabilitation of watershed reserves.
Joint Executive-Legislative Water Crisis Commission		Republic Act No. 8041 – National Water Crisis Act (1995)	To address the water crisis, including supply, distribution, finance, privatization of state-run water facilities, protection and conservation of watersheds and the waste and pilferage of water.

Source: Adapted from NEDA (2010: 21-25) and Elazegui (2004: 87-88).

Figure 2.8: Functional Chart of Water Related Agencies in the Philippines.



Source: Reproduced from NEDA (2010: 26).

The overall responsibility for the coordination of these agencies involved in water resources development and management at the national level lies with the National Water Resources Board (NWRB). Their jurisdictional powers, functions and duties include: (1) formulating policies and guidelines on water resources development and management; (2) effecting cross-sector and inter-departmental coordination of water resources development activities; (3) granting or issuing water permits and certificates; (4) advising NEDA on matters relating to water resources development plans, programs and projects; and (5) exercising jurisdiction over disputes concerning water allocation and utilization.

As illustrated in Figure 2.8, NWRB's as well as other sector policy goals and directions are formulated by the NEDA. These goals are created in consultation with the public, municipal, barangay (village level) and provincial governments, NGOs and civil society groups and are incorporated into the Philippine Development Plan (formerly the Medium Term Philippine Development Plan (MTPDP)). Upon approval by the President, the PDP is then implemented by NEDA through regional development plans created by Regional Development Councils (RDCs) who are also responsible for investment programming and project monitoring. These

plans and programs are then presented to the provincial, municipal, city⁴ and barangay planning and development offices. Within provincial, municipal and city governments, many of the duties related to water management and enforcement are carried out by their respective Provincial and Municipal Environmental and Natural Resource Offices (PENRO and MENRO). Although PENROs exist in all capital towns and cities within all provinces, not all municipalities have a MENRO as its creation and operation is not mandatory under the 1991 Local Government Code. In the absence of a MENRO, municipalities implement water-related duties through their Municipal Planning and Development Office (MPDO). However, the latest Philippine Development Plan (2011-2016) is mandating PENRO and MENRO offices mandatory in order to improve environmental and natural resource management (see section 2.4.3).

Due to the weak and fragmented institutional framework for natural resource management, governments at all levels have faced a number of challenges in making water management policies work. NEDA argues these challenges stem from several factors including: (1) the lack of a national government department responsible for translating government's policies, strategies and goals into a comprehensive water supply program; (2) the lack of coordination between agencies and within urban and rural areas of municipalities; (3) unreliable data; (4) the absence of systematic and regular monitoring of sector activities and (5) not enough changes in government agency programs to specifically develop the capabilities of the LGUs to perform devolved function as stipulated in the Local Government Code of 1991 (e.g., establishing and operating water utilities, financing capital and operation and maintenance costs, tariff setting, regulation, etc) (NEDA 2010: 28). These issues in turn have created an absence of cross-sectoral water resource plans that integrate water and land-use activities or water quality and quantity management of surface and groundwater.

⁴ The Local Government Code (1991) defines municipalities and cities as different entities on the basis of population size and area. Cities have a population of at least 150,000 and/or an area of 100 km². Municipalities have a population of at least 25,000 and around 50 km² in area. Both cities and municipalities are governed by a mayor but a city's council is a *Sangguniang Panlungsod* and a municipality's council is a *Sangguniang Bayan*. Municipalities are also divided by class depending on their average annual income (in pesos) during the last 3 calendar years:

1 st class	P50,000,000 or more
2 nd class	P40,000,000 or more but less than P50,000,000
3 rd class	P30,000,000 or more but less than P40,000,000
4 th class	P20,000,000 or more but less than P30,000,000
5 th class	P10,000,000 or more but less than P20,000,000
6 th class	Below P10,000,000

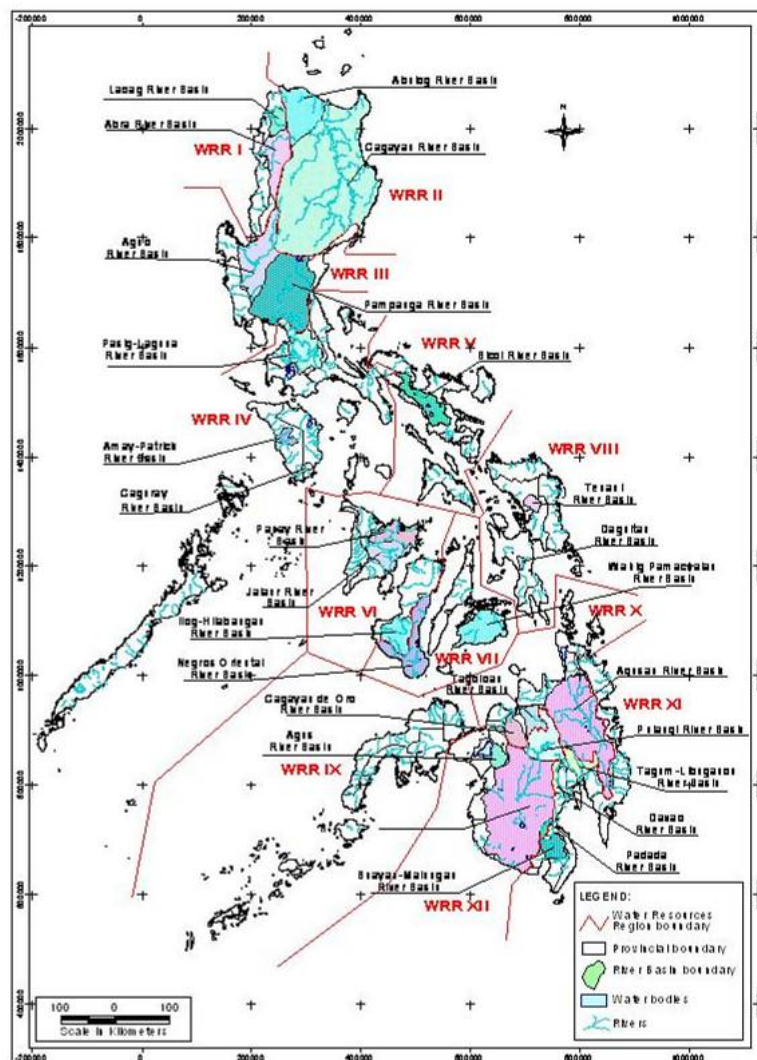
In order to address some of these issues, the mandates stated in the MTPDP for 2004-2011 focused on an IWRM and river basin approach to water resource management, the strengthening of the NWRB as a coordinating and regulatory agency under the DENR, and the development of a River Basin Control Office (RBCO) and River Basin Offices (RBOs). The RBCO serves as the lead government agency for integrated planning, management, rehabilitation and development of the country's river basins, serves as an oversight office in the implementation of IWRM and Integrated River Basin Management Plans, provides the national policy coordination for LGUs and NGOs in the development and sustainability of river basins and recommends approvals and funding and serves as a central fund administrator for the river basin appropriations provided under the DENR budget (Tuddao 2006: 2). The RBCO oversees the RBOs created within the 12 water resource regions demarcated by the NWRB (see Figure 2.9). As of 2006, five types of RBOs have been created:

- ◆ Authority (such as the Laguna Lake Development Authority);
- ◆ Commission (such as the Pasig River Rehabilitation Commission);
- ◆ Council (such as the Cagayan de Oro River Basin, and Lake Lanao Watershed Protection and Development Councils);
- ◆ Project Management Office (PMO) (such as the Bicol River Basin PMO, the Cotabato-Agusan River Basin Development PMO and the Cagayan River PMO); and,
- ◆ Inter-agency Committee (such as the Manila Bay River Basin Coordinating Committee and the Mindanao River Basin Task Force).

(Cabrido 2009, as cited in Tuddao 2009:2).

Each RBO is guided by the National IWRM Framework Plan and is tasked to formulate its own water resource management plan specific to its river basin context (more on this in section 2.4.3).

Figure 2.9: Water Resource Regions (WRRs).



Source: Reproduced from National Water Resource Board website 2011.

2.4.2 Legislative Framework

As with the institutional structure for water resources, the legislative and regulatory environment is also fragmented. Though most of the legislation pertaining to water resource management can be found within the jurisdictions of the DENR, they are spread out among various agencies and bureaus such as the National Water Resource Board (NWRB), the Environment Management Bureau (EMB), the Mines and Geo-Science Bureau (MGSB), the Forest Management Bureau (FMB), the Protected Areas and Wildlife Bureau (PAWB), the River Basin Control Office (RBCO) and the National Mapping and Resources Inventory

Authority (NAMRIA). With respect to water resources, NWRB, LWUA and the LGUs are the primary regulatory agencies.

DENR's activities in environmental and natural resource management are guided by the following overarching laws: the Philippine Environmental Policy (PD No. 1151) (1977); Philippine Environment Code (PD No. 1152) (1977); The Philippine National Strategy for Sustainable Development (1989) and National Action Plan for Sustainable Development (Philippine Agenda 21) (1996). These laws, enabling legislation for agency and department functions (see Table 2.5) and other watershed and environmental resource management policies and laws (Table 2.6) are summarized below as the guiding forces for water resources management and development in the country (for a complete list of Major Environment and Natural Resource Laws and Regulations see Appendix 3):

Table 2.6: Laws and Policies for Water Environment in the Philippines.

LAW/POLICY	OBJECTIVE
The Water Code (1976)	To govern the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources
Sanitation Code of the Philippines (PD 856) (1976)	To prescribe sanitation requirements for food establishments and refuse collections and disposal system of cities and municipalities
National Water and Air Pollution Control Commission Act (1976)	To create the national water and air pollution commission (established in the Office of the President) in order to identify potential sources and prevent pollution in both airsheds and water bodies
The Philippine Environmental Policy (PD 1151) (1977)	To protect the right of the people to a healthy environment through a requirement of environmental impact assessments and statements.
The Environment Code of the Philippines (PD 1152) (1977)	Prescribes management guidelines aimed to protect and improve the quality of water resources through classification of surface waters, establishment of water quality standards, protection and improvement of quality and responsibilities for surveillance and mitigation of pollution incidents.
Philippine Environmental Impact System (1978)	To establish an environmental impact statement system, including other environmental management related measures
Philippine Constitution (1987)	Establishes basic principles of water resources development and management and

	asserts all waters of the Philippines belong to the State.
Revised Effluent Regulation (DAO 35) (1990)	These rules and regulations shall apply to all industrial and municipal wastewater effluent.
Revised Water Usage and Classification Water Quality Criteria (DAO 34)	To classify all bodies of water and comply with the water quality criteria.
Toxic and Hazardous and Nuclear Waste Act (RA 6969) (1993)	To control of Toxic Substances and Hazardous and Nuclear Waste
Indigenous Peoples Rights Act (1997)	To recognize, protect and promote the rights of indigenous cultural communities/indigenous people, creating a national commission of indigenous people, establishing implementing mechanisms, appropriating funds and for other purposes. This Act also outline the rights to ancestral domains and rights to ownership and development of natural resources including water.
Forestry Code (1998)	To provide for the development, management and conservation of the fisheries and aquatic resources, integrating all laws pertinent thereto
Ecological Solid Waste Management Act (RA 9003) (2000)	Republic Act 9003 provides a systematic, comprehensive, and ecological solid waste management program in the country.
Implementation of Philippine National Standard for Drinking Water (2000)	To plan, develop and manage the marine and coastal resources of Manila Bay and its surrounding areas through partnership. Launched by the GEF/UNDP/IMO
Revised Industrial Ecowatch System (DOA 2003-26 Series) (2003)	Eco-watch rates industries according to color-coded scale and intends to provide pressure to induce industries not to pollute. This program will give recognition to industries through rating system that they have complied with environmental laws, attained significant improvement and environment friendly processes over a period of time
Creating the Environment Partnership Program to support Industry Self-Regulation towards Improved Environmental Protection (DAO 2003-14 Series) (2004)	To promote sustainable development by encouraging the business and/or industrial sector to engage in environmental improvement activities and advance self-regulation and mandatory compliance with environmental standards.
The Clean Water Act (PD 9275) (2004)	To protect, abate and control pollution of water, air and land for more effective utilization of the resources.

Creation of River Basin Council Office (EO 510) (2006)	RBCO was created to prepare the Integrated River Management and Development Master Plan, promote equitable access to potable water, efficient distribution and effective use, rationalize the various river basin projects, develop master flood control plans for river basin projects and rationalize and prioritize reforestation in watersheds.
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Source: Asian Development Bank 2009: 106-108; Chan Robles Virtual Law Library 2006; Water Environment Partnership Asia website 2012.

With these fragmented laws and policies implemented by over 30 agencies, many policies and programs still remain uncoordinated, redundant and ineffective. In addition, legislation is also influenced by and should be consistent with various global laws which the Philippines had ratified such as Agenda 21, the Millennium Development Goals (MDGs) and the UN Convention on the Right to Water.

At the more local level, the Local Government Code (LGC) (1991), though not environmentally focused, has greatly influenced the roles of LGUs in natural resource management. Created in the post-Marcos era, marked by a legacy of centralization in a multi-ethnic, multi-religious, multi-lingual and archipelagic country, the LGC became 'the national legal framework that provid[ed] mechanisms for substantiating the democratization philosophy of the 1986 Philippine Constitution' (Angeles and Magno 2004: 211). Aside from the clamour from local governments and civil society support, decentralization was also largely influenced by international agencies, donors and financial institutions that argued it would improve project and program efficiency. Given the Philippines' reliance on foreign capital to finance public sector investment and a ballooning deficit, the government was unable to resist these pressures towards decentralization and thus the LGC was ratified in 1991 (Angeles and Magno 2004: 220). As such, it aimed to achieve people empowerment and international competitiveness through decentralization, democratic consultation, full cost recovery and social equity.

The LGC has two mechanisms in achieving decentralization. First is the process of devolution of national government powers and authority to the LGUs and second is the administrative decentralization of authority by central government agencies to their regional or field offices. Reminiscent of its early proponents, national departments are also supposed to partner with academic institutions and foreign donors to assist the LGUs in their new functions by improving

their technical efficiency. With respect to DENR functions, the following responsibilities are devolved to the local level (including the regulation of watershed):

- ◆ Regulation of environmental impacts of Small and Medium Enterprises under *Kalakalan* 20 Law;
- ◆ Regulation of fishing in municipal water;
- ◆ Regulation of minor mineral extraction like small-scale mining and certain scales of quarrying and sand and gravel gathering;
- ◆ Solid waste management under the Ecological Solid Waste Management Act;
- ◆ Regulation of watersheds;
- ◆ Greenbelt and tree park development;
- ◆ Implementing pollution control and environmental protection laws and,
- ◆ Farmer-level integrated social forestry.

(ADB 2008).

The DENR still remains the primary government agency but LGUs now act as active partners in these areas and in the implementation of projects.

Though the LGC and its approach to decentralization of environmental functions are effective in theory, its practice or actual implementation has resulted in numerous problems. Firstly, the legislation itself has numerous gaps that prevent the full devolution of natural resource management responsibilities to the LGUs. In addition, the LGC does not have sanctions for any party involved if the devolution is not complete, giving them no incentive to go through the process. Consequently, less than half of LGUs have devolved the functions stipulated in the Code (ADB 2008). Secondly, many LGUs lack the technical and managerial capacity to design, implement, maintain and evaluate their new functions and programs. There is no follow up support through the DENR regional offices and no additional revenues to support any devolved functions. Since local development projects have little to no return on investment, they are often not given much attention by the LGUs themselves or the private sector that could potentially provide support (ADB 2008). Thirdly, administrative intricacies also exist, such as the lack of office space, increased overhead costs, high salaries of national agency staff devolved to LGUs, non-acceptance of devolved personnel, displacement of devolved personnel and the local political climate.

These issues with LGC implementation in turn have affected and presented challenges to water resource management activities. This is especially the case with devolved functions such as managing and improving water quality, the preparation of compliance schemes with higher levels plans such as the Water Quality Management Area Action Plan or Ecological Solid Waste Management Plan, the enforcement of water quality protection and pollution laws and the procurement of funds for water related projects. This is largely linked to the lack of technical expertise and capacity of the LGUs to carry out these duties. For example, these responsibilities are supposed to be implemented by an environmental and natural resources office; however, the LGC states that for municipal and barangays, these departments are not mandatory (although this has been recently addressed by the current PDP 2011-2016). Since smaller municipalities are given less Internal Revenue Allotment (IRA) from the national government to carry out their functions, they are usually unable to afford the creation of this new department. In this case, duties are added to those of the Municipal Planning and Development Office (MPDO) which may lack the expertise and human resources necessary to successfully implement these tasks. With respect to enforcement of water protection laws, the LGC authorizes municipalities to penalize, by ordinance, the violation of fishery laws. However, it is vague on other issues of jurisdiction over municipal waters, such as the enforcement of pollution control laws and the regulation of other resource-utilization activities. Given that the violation of pollution laws usually exist at the village level, the provisions of an older law (Presidential Decree 1160 (1997)) gives barangay captains, councillors and *tanods* (barangay watchmen/police) the authority to effect arrest of violators. However, according to Rola and Tabien, these duties as well as the establishment of fines and penalties are not found to exist at the barangay level (Rola and Tabien 2001: 61).

2.4.3 Planning Framework

The responsibility of coordination and planning for water resource development and management is vested in the NWRB. The following are the foundational plans that guide water resource management and development in the country and the Angat River Basin:

Table 2.7: Major Plans and Plan Objectives for the Angat River Basin.

WATER RESOURCE MANAGEMENT PLANS	PLAN OBJECTIVES
Master Plan on Water Resources Management (1998)	Assessed water resources and availability in the Philippines. Proposed the 12 Water Resource Regions (WRRs) units through which all water resource planning would be undertaken (Figure 2.7).
National Water Vision (2000)	Created by a multi-stakeholder process, the Vision states, "By the year 2025, water resources in the Philippines are used efficiently, allocated equitably and managed in a sustainable way, with provision for water-related disasters.'
National IWRM Framework (2006)	Guides stakeholders involved in water resources management at different levels, to prepare their respective IWRM plans, update/enhance their existing IWRM related plans or make IWRM an integral part of their development plans/programs.
Philippine Development Plan 2011-2016 (2010)	Outlines the socioeconomic and developmental priorities of the country.
Region III Regional Development Plan – 2011-2016 (2010) ⁵	Outlines specific development directions for the region based on its socioeconomic context consistent with the national PDP.

⁵ At the time this project was written, NEDA had not publicly released the Region III Development Plan on their website.

Bulacan Development and Physical Framework Plan 2008-2017	A primary technical document that provides an overall vision for Bulacan, provides the development context, translates the vision into strategies for achieving goals, objectives and targets, identifies strategic programs, projects and activities and links the network of national, regional, provincial and local level plans.
Study on IWRM for Poverty Alleviation and Economic Development in the Pampanga River Basin (2011)	Implements the requirement for river basin management plans mandated by the National IWRM Framework. Outlines an IWRM approach for the Pampanga River Basin.

Source: National Water Resources Board website 2011; National Water Resources Board 2005: 138-144.

The NWRB has been conducting studies and planning initiatives for water resources since the 1990s. Their first Master Plan Study on Water Resources (1998) assessed all resources in the Philippines and prioritized them into 12 water resource regions (WRRs) based on hydrological boundaries. These boundaries are now the geographic units used for planning and assessment. Based on the National Water Vision created through a multi-stakeholder process in 2000, the NWRB created the National IWRM Framework Plan in 2006. This framework operationalizes the MTPDP 2004-2010 mandate for IWRM and river basin planning and serves as a guide for stakeholders to create or amend their respective IWRM plans. It also aims to enable and encourage a wider adoption and localization of IWRM across stakeholders and levels.

The most recent of these river basin planning processes is for the Pampanga River Basin IWRM Plan for Poverty Alleviation and Economic Development of which Angat River is a sub-basin. The Plan was completed by JICA in 2011. Its four principles were to focus on the integrated and holistic approach crossing multi-water sectors, the adaptive response to future dynamic changes of socio-economic and natural conditions, the involvement of stakeholders at every stage and step of plan formulation and implementation of water-related projects and the broader focus points such as fairness, economical effect, efficiency and sustainability of the water-related projects (JICA 2011: Executive Summary 1). It also aimed to transfer relevant

skills and technologies on IWRM to the personnel of the NWRB and other concerned organizations.

The Plan outlined 84 projects to be implemented by 2025 in six different sectors: Agriculture/Irrigation and Fishery, Municipal Water Supply, Sanitation and Sewerage, Flood and Sediment Disaster Management, Watershed Management, Water-related Environment Management and Inter-sector Water Resources Development, Allocation and Distribution. Of the six sectors, projects related to Municipal Water Supply, Watershed Management and Water-related Environment Management are prioritized for immediate implementation between 2011 and 2015. These projects include short and long term bulk water supply systems for both Bulacan and Pampanga provinces,⁶ strengthening and full recovery of the Angat-Umiray system, construction/provision of sanitary toilets for whole river basin, sustaining the ongoing regular program for watershed management and dealing with contamination of surface, ground and coastal waters. The Plan also includes an assessment of potential negative impacts of the proposed projects. For both the bulk water system construction and recovery of the Angat-Umiray system, involuntary settlement of socially vulnerable groups such as Indigenous peoples has been identified.

The Plan also includes a proposal for the organizational setup, establishment and proposed legislative framework (including suggested financial allocation) of a River Basin Committee (RBC) under the RDC for Region III for leading IWRM in the Pampanga Basin. The RBC will be composed of:

- ◆ *Committee* - formulates the policy and framework for the IWRM Plan and directs the Technical Working Group (TWG) members for implementation. The Committee will involve relevant provincial governors and the representative of the TWG and NGOs.
- ◆ *Secretariat* – supports the Committee. This will be NEDA Region III.
- ◆ *Technical Working Group* – formulates the details of the IWRM Plan and monitors project implementation. TWG members will be from relevant national government agencies or their regional offices, NGOs and private firms.

⁶ As stated in the Plan, 'poverty alleviation' and 'economic development' are adopted as the principle visions by which 'all development scenarios. . . shall be oriented' (JICA 2011: Executive Summary 6). As such, projects including the bulk water supply for the Pampanga River Basin will principally support the major industries of the region, manufacturing and agriculture 'which produce the Gross Value Added of more than 50%' (JICA 2011: Executive Summary 6). Though this recognizes the economic priorities of the provinces, it fails to recognize the dire state of dwindling groundwater supply used for drinking water (outlined in section 2.1) in Bulacan and Pampanga.

The IWRM Plan for the Pampanga River Basin alongside plans at the national, regional, municipal/city and barangay levels thus interact with the Bulacan Development and Physical Framework Plan which links multi-level objectives with the development context, objectives and socio-economic directions for the province. With respect to the Angat River Basin sub-basin context, this plan provides important contextual issues that higher level plans may not take into account.

2.4.4 Political Context

Given the political nature of water resource planning issues in the Philippines, it is important to outline some of the influencing factors of the political environment in Bulacan. The current leader of the province is Governor Wilhelmino Sy-Alvarado who was the former vice-governor of the previous governor, Joselito 'Jonjon' Mendoza. As an advocate for environmental protection in his political platform, Governor Sy-Alvarado is keen on solving the pressing issues facing the Angat River Basin as well as other environmentally sensitive areas in Bulacan. To this end, the 2011 Revised Environmental Code of Bulacan (Resolution No. 186-S 11) was passed by the Sanguniang Panglalawigan (Provincial Council) and signed by the Governor in July 2011. This provincial ordinance is mandated to 'further boost and strengthen local governance in the protection and preservation of the environment and natural resources' by including all devolved functions and projects at the municipal and barangay level (Velez, *Manila Bulletin online*, 14 July 2011). This has helped with monitoring and enforcement against environmentally harmful activities such as destructive mining practices in the Sierra Madre rainforest which Bulacan has ordered to halt through national DENR (Gamon and Balbin 2011). These endeavours have also won Governor Sy-Alvarado the prestigious UNESCO-sponsored Father Neri Satur Award for Environmental Heroism for 2012 (Gamos 2012).

In partnership with the Governor, two environmentally progressive department heads are leading the way to ensure that environmental sustainability is incorporated into Bulacan's development including that of the Angat River Basin. Bulacan's Environmental and Natural Resource Office (BENRO) headed by lawyer and former university law professor Rustico 'Teddy' Belen, is currently pursuing eco-tourism initiatives for the Angat River Watershed such as a complex, water park and wildlife haven through the towns of Bustos and Angat and an eco-heritage park celebrating the Inang Filipina shrine in the town of Pandi (Lazaro 2012a; 2012b). To address growing concerns with pollution bylaw violations, BENRO has partnered

with the Philippine telecommunications company, Globe, National Capital Region and Region 3 DENR offices, New York based non-profit Blacksmith Institute and Sony Ericson to set up the 'Globe Green Line' - a 24/7 facility concerned citizens can use to call, text or send camera phone photos to report violations (Blacksmith Institute 2011).

The Provincial Planning and Development Department (PPDO) of Bulacan is also working towards realizing these sustainable development initiatives in its participatory planning and synchronized investment programming processes. As a result of this mutual support between the province and the municipalities and systematic interface between provincial and municipal development planning efforts, Bulacan province, through the work of the PPDO and its department head Arlene Pascual (appointed in 2001) has become a nationally recognized model for participatory development planning and investment programming. The PPDO has regularly hosted visitors from other provincial PPDOs from Luzon, Visayas and Mindanao who are interested in knowing more about their operations. In addition, as Carino observes, 'the PPDO has become the 'think tank' of the provincial government because of its significant role that it plays in decision-making, strategy formulation and even program monitoring' (2006: 4). It is also the first provincial planning office to have a GIS facility within its Data Bank and Statistics Division. Building on its first participatory planning process for the Bulacan Strategic Development Plan (BSDP) in 2001-2002 and its role as capacity builder for local governments (especially in the creation of Municipal/City Land Use Plans), the PPDO has continued working with local governments, NGOs and the private sector and incorporating their concerns within provincial priorities. The fruits of these efforts are now reflected in what Governor Sy-Alvarado and BENRO are currently pursuing with respect to environmental advocacy as many stakeholders' concerns from the first planning process in 2001 were related to environmental sustainability and protection of ecologically significant areas such as the Angat River Watershed, Biak na Bato park and the Sierra Madre rainforest (Carino 2006: 24). The Regional Development Council of Region 3 has also organized in May 2012, the Pampanga River Basin Committee (PRBC) with Governor Sy-Alvarado as Vice-chairman and Chair of the Infrastructure Committee, an important role that has implications for re-scaling watershed and river governance and management, as discussed in Section 5 of this report.

Thus, the PPDO acts as an important convener and facilitator for all stakeholders within all levels and sectors. Building on these established relationships and their participation in the planning process, a more cooperative and shared sense of initiative toward provincial goals is

created bettering the likelihood of their implementation. With respect to the inter-jurisdictional, inter-sectoral nature of the issues facing the Angat River Basin, the existence and role of such a department is crucial.

2.4.5 The Privatization of Angat Dam

Until the ratification of Republic Act 9136 or the Electric Power Industry Reform Act (EPIRA) in 2001, management of both hydroelectric power plants as well as their respective watersheds (under Proclamation No. 71 series of 1927) were under the jurisdiction of the National Power Corporation (NAPACOR/NPC), a public corporation under the Department of Energy. However, with the introduction of EPIRA, the electric power industry was mandated to undergo privatization, 'including the privatization of the assets of the NPC, the transition to the desired competitive structure and the definition of responsibilities of the various government agencies and private entities' (Arellano Law Foundation). The Act also created the Power Sector Assets and Liabilities Management Corporation (PSLAM) which was tasked with auctioning off dams for privatization. Following this mandate, PSLAM began the bidding process for Angat Hydroelectric Power Plant and Dam on January 11th, 2010 awarding the deal to the Korea Water Resources Corporation or K-Water, which gave the highest bid at US \$440.80 million on April 28, 2010 (Sun Star Manila 2010). Immediately following the bidding process however, a petition was filed by the Freedom and Debt Coalition, IDEALS Inc., Akbayan Citizen's Action Party, the Alliance of Progressive Labour, and Party-List Representative Walden Bello asking the Supreme Court to issue a temporary restraining order against PSALM and the privatization deal on the grounds that the process was in violation of the Constitution, law and due process. More specifically, the petitioners accused PSALM of acting with 'grave abuse of discretion' when conducting the bidding since it did not adequately inform the public about the sale and that it was held 'under circumstances that demonstrate a clear and wanton violation of the petitioners' right to water and other guarantees under the law and the Constitution including its national patrimony provisions.' (Dizon, *Philippine Daily Inquirer online*, 26 March 2011). In addition, public terms and conditions of the sale and the identities and qualifications of the bidders including K-Water were also not publicly accessible. On May 5th, 2010, the Supreme Court decided the petition to be 'sufficient in form and substance' and issued a status quo ante order to prevent the awarding of the Angat Hydroelectric Power Plant and Dam to K-Water which is still in effect at present (GMA News 2010).

MWSS and Maynilad Water Services Inc. also raised concerns about the dangers with privatizing Metro Manila's primary source of potable water (Basilio Jr. 2010). In addition to its operation of the hydroelectric plant, NAPACOR is also responsible for the release of water into Angat Reservoir adhering to provisions provided by the NWRB. Given MWSS' domestic water rights in the Reservoir, it has released a proposal for the take over of Angat Dam's operations from NAPACOR. This proposal is also supported by Maynilad (private water concessionaire for Metro Manila) since both MWSS and Maynilad would be at the mercy of K-Water's profit-driven water release policies should privatization occur. Other water rights holders such as NIA have also raised concerns with respect to potentially higher irrigation costs (News Central 2010). Therefore, in light of the intense and politically influential opposition of the NGOs, MWSS and Maynilad and PSLAM's legislated mandate for privatization, it will be interesting to see the Supreme Court's ruling on the future management of Metro Manila's primary water source, its effect on water rights holders within Angat Reservoir and the overall management of the watershed which is currently a legislated mandate of the public NAPACOR.

Figure 2.10: Members from the Freedom from Debt Coalition (FDC) host a forum against the sale of Angat Dam in Meycauayan, Bulacan on April 25, 2010.



Source: Francisco 2010 (online source).

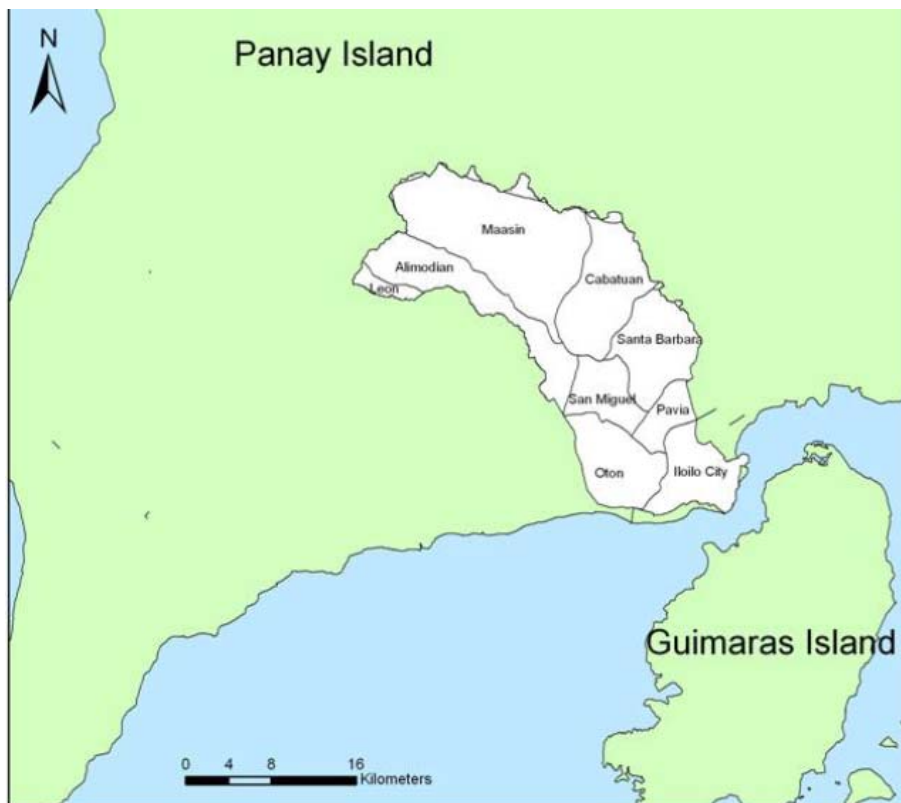
3 **EXAMPLES OF COLLABORATIVE GOVERNANCE IN WATERSHED MANAGEMENT**

In order to gain some insight on potential solutions for these complex issues within the Angat River Basin, this section explores three case studies of collaborative governance in watershed management and lessons learned. These case studies are the Tigum-Aganan Watershed in Iloilo, Philippines, the Ayuquila River Basin in Mexico and the Billings Reservoir in Santo Andre, Brazil.

3.1 **Tigum-Aganan Watershed, Iloilo**

The Tigum-Aganan Watershed is located in the Province of Iloilo, one of the four provinces on Panay Island in the Visayas region of the central part of the Philippines. It has an area of 433.6 km² and consists of four sub-watersheds: the Tigum (213.3 km²), Aganan (21.6 km²), Maasin and Jaro (16.7 km²) (Salas 2008). As suggested by its name, the watershed consists of the Tigum and Aganan Rivers that converge at Pavia, flow through the City of Iloilo, Iloilo Strait and empty into the Jaro River. The watershed contains a coastal section which is part of the estuarine Iloilo River Basin. Overflows from the Aganan River feed its tributaries which are used for irrigating 75% of the farmland in the town of Oton. The Tigum-Aganan Watershed also passes through eight municipalities and one city (see Figure 3.1) and is managed by a multi-stakeholder coalition, the Tigum-Aganan Watershed Management Board (TAWMB) through a Memorandum of Understanding. The TAWMB is part of 3 watershed boards in the province that are overseen by the Iloilo Watershed Management Council (IWMC). The establishment of both the watershed boards and the IWMC represent a 13 year story of defining and building multi-sectoral and multi-level groups of stakeholders in Iloilo while facing some of the challenges with water in the province.

Figure 3.1: Municipalities in the Tigum-Aganan Watershed.



Source: Reproduced from Miller et al (2009: 16).

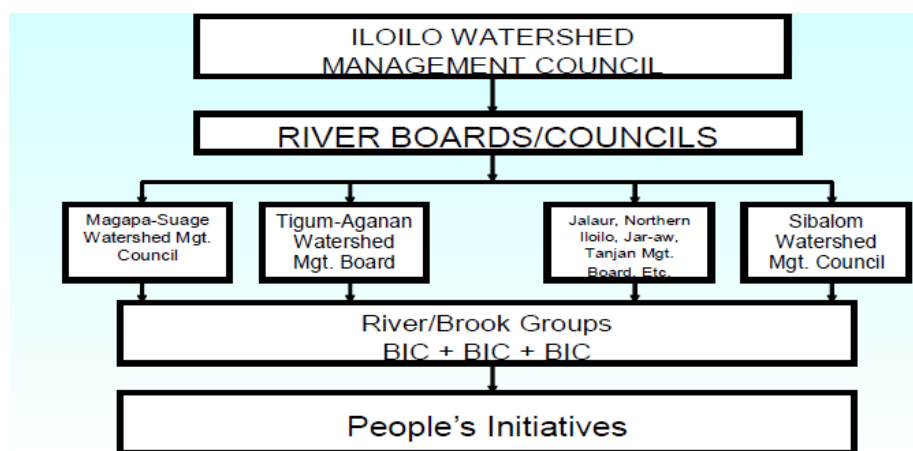
With a growing population of 400,000 and its role as the commercial, cultural and intellectual hub of Western Visayas, Iloilo faces a number of challenges with respect to water. These issues primarily relate to the upstream and downstream relationships in the Tigum-Aganan Watershed. Though the province sources its potable water from the upland Maasin sub-watershed, downstream residents are often subject to shortages and other issues such as poor water quality, lack of sanitation, increasing siltation, groundwater contamination, saltwater intrusion in aquifers, catastrophic floods and droughts and natural hazards such as landslides and erosion due to illegal logging and agricultural activity in the uplands (Miller et al 2009). In addition, the river's productivity has been compromised by headwater surges, pollution from mining, riverbank erosion, destruction of fish habitat and the impacts of urban growth. Thus, issues such as exploitation of resources, social injustice, indigenous welfare, problematic governance and rural poverty have become embedded in the management of the Tigum-Aganan Watershed (Miller et al. 2009: 15).

In light of these challenges, several responses were implemented including the rehabilitation and reforestation of the Maasin Sub-Watershed which created the impetus for collaboration between stakeholders (Salas 2004). As the main source of potable water for a rapidly growing Iloilo City, citizens grew concerned about the intensification of agriculture and illegal logging activities happening in the upland which resulted in poor water quality and intermittent faucet flow. To assess the problem, an NGO, *Kahublagan San Panimalay Foundation* conducted a feasibility study on rehabilitation in 1992. The study found that given the rate of denudation, water supply would not meet demand in the next decade (Salas 2008). In response, Governor Arthur Defensor made watershed rehabilitation the priority of the province and the “Save the Maasin” movement was born (Salas 2004). To supervise and assist the movement, a Task Force for the Rehabilitation of the Maasin Watershed was created planting 500 hectares of trees by 1995. In addition, given the scale of the project and the need to keep citizens informed and active, the Task Force launched a massive information, education and communication (IEC) campaign using local newspapers, radio stations, TV news and sitcoms to generate public awareness and support for the watershed projects. The local radio show became especially popular and successfully reached communities throughout the province. With this critical mass of informed and committed citizens, the Task Force was able to raise a significant amount of funding from civil society, different levels of government and international organizations (see Appendix 4 for funding details). From 1995, the DENR joined the Task Force and contributed 60 million pesos (\$US 1,400,000) to the creation of a plantation of 3000 hectares (2100 trees per hectare) by 1997. Instead of hiring outside workers for the 2 year contract, the DENR contracted services to a federation of 16 people’s organizations led by the NGO *Kahublagan*, called *Katilingban Sang mga Pumuluyo sa Watershed sang Maasin* (organization of communities in the Maasin Watershed) which became KAPAWA (literally meaning ‘the light’). With KAPAWA representing the Task Force, the DENR offered a second contract for the plantation’s maintenance over the next 5 years.

On October 2, 2000, the Provincial Council of Iloilo issued and passed Ordinance No. 2000-41 creating the Iloilo Watershed Management Council (IWMC) which became responsible for conservation, development, utilization and protection of the province’s watersheds, resolving conflicting interests, promoting awareness about issues in the watersheds and attaining resources to enhance institutional capacity (Salas 2004). Under the IWMC, four watershed boards were also created representing the branches of larger river basins: the Tigum-Aganan Watershed Management Board (TAWMB), the Magada-Suage Watershed Management

Council, the Jalaur, Northern Iloilo, Jar-aw, Tanjan Management Board and the Sibalom-Baguingin Watershed Management Board.

Figure 3.2: Iloilo Watershed Management Board Structure.



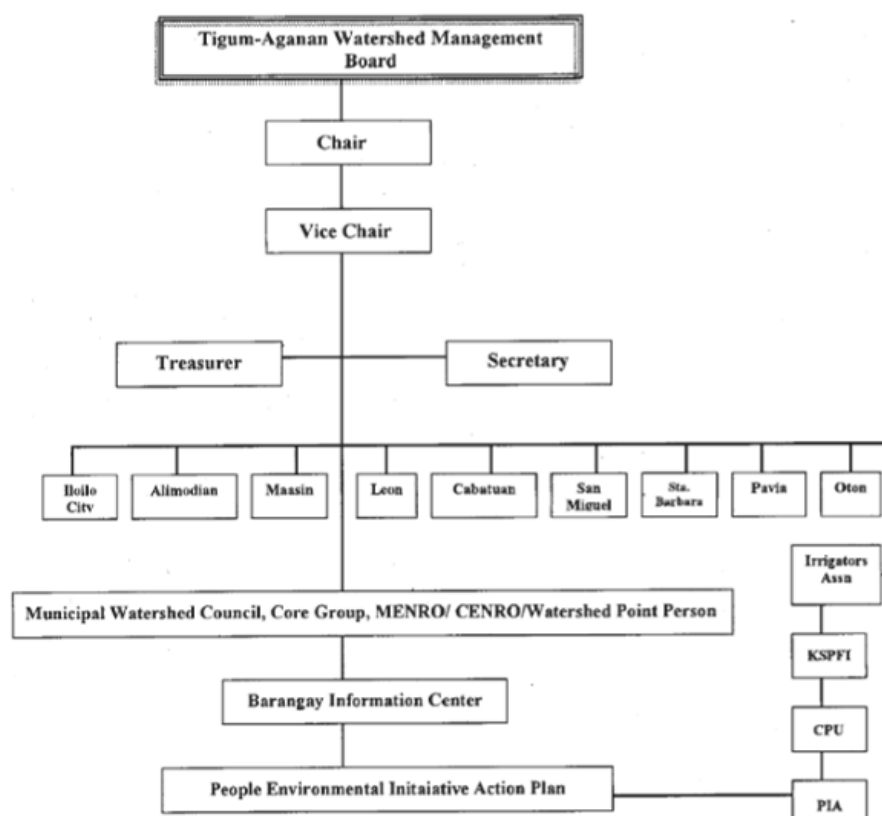
Source: Reproduced from Salas (2004: 222).

Building on the multi-stakeholder relationships created in the 1990s with the Maasin rehabilitation, the IWMC membership was also multi-sectoral and multi-tiered. Members included the Iloilo provincial committee on the environment, League of Municipalities, the National Irrigation Association, the Philippine Information Agency, the Metro Iloilo Water District (MIWD), Department of Public Works and Highways (DPWH), Department of Education, NEDA, the Philippine National Police (PNP), Iloilo Business Club, the Kahublagan Sang Pamimalay Foundation and KAPAWA. Technical advice to the IWMC was provided by the Technical Working Group (TWG) composed of members from DENR, NIA, DPWH, Kahublagan, the Department of Agriculture, Department of Agrarian Reform and the MIWD.

At the watershed level, the TAWMB municipalities, who also oversee the Maasin sub-watershed, are responsible for the planning and implementation of watershed projects, technical application, decision making, programming, monitoring and evaluation of watersheds, including watershed projects in municipal Annual Investment Plans (AIP) and consolidating these projects as part of the annual action plan of the TAWMB. In addition, other stakeholders such as the Irrigators Associations, the Kahublagan NGO (KSPFI), Central Philippine University (CPU) and the Philippine Information Agency (PIA) link between the TAWMB and the communities for grassroots organizing and information dissemination on the ground. One member also liaises with the IWMC Technical Working Group (see Appendix 5) to keep

TAWMB technically proficient. Thus, given this set up, TAWMB municipal members educate their respective municipal watershed councils or MENRO/CENROs on projects and initiatives, municipal watershed and environmental executives inform their respective barangays and barangay leaders educate those at the community level through Barangay Information Centres (BICs) (see Table 3.1).

Figure 3.3: Tigum-Aganan Watershed Management Board organization chart.



Source: Reproduced from Salas (2008: 84).

Table 3.1: Responsibilities for Watershed Management groups in Iloilo

Area	Managing Body	Responsibility
Regional	Regional Development Council Water Committee of Region VI ^a	Monitoring and evaluation of water programs, policy advocacy, information dissemination, and support for the creation of multisectoral watershed management groups in the region.
Provincial	Iloilo Watershed Management Council (IWMC)	Policy formulation, fundraising, actuation, networking.
Watershed	Watershed Management Board	Planning, actuation, technical application, decisionmaking, programming, watershed monitoring and evaluation.
Municipal	Municipal Watershed Council or the watershed core group ^b	Implementation, participation in planning, consolidation, facilitation of technical services and information dissemination to barangays.
Barangay	Barangay Information Center	Provision of information to people's initiatives, whether individual or group. Conduct of community mapping and water planning exercises.
Households or the neighborhood	People's Initiative	Participation in community mapping, water planning. Access of information, demand for technical services. Decision and initiation of action.

Source: Reproduced from Salas (2004: 222).

3.1.1 Lessons Learned from Tigum-Aganan

Given its location and similar context, the Tigum-Aganan Watershed story holds a number of applicable lessons for the Angat River Basin. These lessons learned can be summarized in five areas: (1) utilization of provisions in the Local Government Code and related legislation; (2) creation of a strong information, education and communications (IEC) strategy; (3) adoption of a localized management approach; (4) establishment of a collaborative governance structure; and (5) creation of a sustainable funding model based on environmental services fees.

Utilization of provisions in the Local Government Code and related legislation

Under the leadership of both the governor and the NGO Kahublagan, citizens, communities and municipalities were mobilized to solve issues affecting the Tigum-Aganan Watershed. With the creation of the multi-stakeholder Task Force for Maasin Watershed Rehabilitation and the IWMC, Governor Arthur Defensor invoked several provisions in the Local Government Code as well as Philippine Agenda 21 (PA21), the country's legislation overseeing sustainable development. The Task Force and its eventual merger to the IWMC emulated PA 21's

definition of sustainable development which is described as communities stimulating their local economies, building partnerships between business, government and civil society and pursuing development anchored on natural systems (PCSD 2012). In addition, the formalization of the IWMC in 2000 built on two national Memoranda Orders, No. 399 (passed in 1996) which required government agencies and LGUs to align their plans and policies with Philippine Agenda 21 and No. 47 (passed in 1999) which required LGUs to formulate and implement their respective sustainable integrated development plans (Salas 2004). Since sustainable development was a necessary component of ensuring watershed rehabilitation and resilience, plans at the provincial, watershed and municipal levels incorporated sustainable development principles.

The adoption of collaborative sustainable development and natural systems management also dovetailed with LGU provisions and responsibilities for environment and natural resource management and protection stated in the Local Government Code. Environmental powers devolved to the LGUs in 1991 included safeguarding and conserving natural resources, uplands, minerals, marine resources and forests, the protection of inhabitants from harm due to man-made or natural disasters and calamities, the protection of the environment and the imposition of penalties for acts that endanger natural systems and the establishment, maintenance, protection and conservation of communal forests, watersheds, tree parks, greenbelts and mangroves. The creation of the IWMC, three watershed councils, municipal watershed councils and the barangay information centres acted on these mandates as well as took advantage of provisions that enables LGUs, NGOs and POs to collaborate. As Section 35 of the LGC states, LGUs 'may enter into joint ventures and such other cooperative arrangements with people's and nongovernmental organizations to engage in the delivery of certain basic services, capability-building and livelihood projects and to develop local enterprises designed to improve productivity and income, diversify agriculture, spur rural industrialization, *promote ecological balance*, and enhance the economic and social well-being of the people' (emphasis added) (LGC 1991, Sec 35). Provisions in Section 36 also allow for financial and technical assistance to POs and NGOs for 'economic, socially-oriented, environmental or cultural projects to be implemented within its territorial jurisdiction' (LGC 1991, Sec 36). Contracting Kahublagan and KAPAWA to manage and oversee the Maasin forest rehabilitation project demonstrates the Province of Iloilo taking advantage of these acts in order to mobilize citizens and get them actively involved in caring for their natural resources with government support.

Creation of a strong information, education and communications (IEC) strategy

One of the major successes with the Tigum-Aganan Watershed management strategy was the mobilization of all stakeholders in both in the uplands and downstream at all stages of the planning and implementation process (Salas 2004). Given the scale of management at the watershed level and limited capacity to personally reach all communities, the creation of a robust, effective and continuous information, education and communications (IEC) strategy was essential. To do this, the province of Iloilo in partnership with the Philippine Information Agency (PIA) utilized all forms of media from print to radio and television. Because of its accessibility, the radio programs became the most popular information and education medium reaching the number one and two spots on AM and FM bands respectively (Salas 2004: 221). They not only reported on the progress on the watershed's rehabilitation strategy but also educated and engaged citizens with a 'school on air' program and call-in segments to voice their concerns. This bridged the communications gap between decision makers at all levels and upstream and downstream communities who were experiencing direct effects of the watershed's degradation. It also created scientific literacy among all stakeholders increasing the awareness of the danger or benefits from a damaged or a protected resource (Salas 2008: 93). Armed with this new understanding of the Tigum-Aganan Watershed, NGOs and POs were able to effectively mobilize citizens to take part in its restoration and everyday management. They even made grassroots information campaigns more fun and personalized such as the creation of T-shirts stating 'I live in the Tigum-Aganan Watershed' (Salas 2008: 82). The continuous nature of the IEC's strategy also helped maintain the importance of sustained management given the voluntary nature of participation. This feedback loop of information flow created the community resilience needed to cope with some of the adverse impacts of unprotected resources and damaging externalities (Salas 2008).

Adoption of a localized management approach

One of the best assets LGUs have with respect to watershed management and protection is their knowledge of ecological conditions on the ground. Thus, it is at this scale where the delicate balance between resource use and conservation can be realized and the creation of a strategy relevant to its stakeholders can be implemented. Partnering with NGO Kahublagan and KAPAWA, Governor Defensor was able to successfully incorporate this localized approach by engaging and empowering citizens to participate in the planning process and

implementation of the Maasin Watershed rehabilitation strategy. This led to the creation of the Tigum-Aganana Watershed Management Board which incorporated these partnerships into the collaborative management structure that included civil society, municipalities in the watershed, their respective barangays, irrigation associations, Central Philippine University (CPU) and the Philippine Information Agency (PIA) (see Figure 3.3). Citizens were educated and informed through a continuous IEC strategy and were also empowered to create a People Environmental Initiative Action Plan which fed into the plans at the municipal, watershed and provincial levels. Through their local knowledge, educational information and the Barangay Information Centres (BICs) and technical support provided by Kahublaga, KAPAWA and CPU, the Plan provided a means through which citizens could have their concerns heard and their ideas realized. This sense of ownership in the process resulted in their continual engagement and role in the implementation of various projects at the ground level. Provided that participation was completely voluntary, this level of interest was crucial for any of initiatives to succeed.

Establishment of a Collaborative Governance Structure

Indicative of the integrated nature of Tigum-Aganana Watershed system, its governance structure was also multi-sectoral and multi-tiered representing all present interests and uses (see Figure 3.2 and Appendix 5). In addition, both top-down and bottom-up governance approaches were used ensuring that local concerns were represented and incorporated into the planning process and implementation of solutions. This led to some successful outcomes for the watershed. Firstly, the partnerships created through collaboration resulted in more funding reaches leading to the successful implementation of the social-agro-forestry project in the Maasin sub-watershed. Because of the different levels of government involved, larger international funding and loans were accessible in addition to pooled funding from municipalities and fundraising efforts from citizens. A traditional and siloed approach to governance would have likely left many municipalities to fend for themselves, leaving poorer communities at a disadvantage for not being 'credit-worthy'. Secondly, since much of the funding provided was dedicated to community organizing, a strong set of social networks were created bridging government with civil society and constituents. This has resulted in behaviour change among stakeholders, successful monitoring and evaluation programs at the grassroots level and increasingly relevant policies and programs. This would also likely enhance enforcement given the raised awareness and ownership over issues in the watershed. Finally, due to the feedback loops created between constituents, civil society and government, citizens

became more educated about the resources they depend on for their well-being and livelihoods. With this increased capacity, solutions have become more robust and creative increasing their likelihood for success with such complex problems. Given the unpredictability of natural systems like watersheds, this also increases the communities' and institution's resilience to disasters. As Salas explains, this could have been the only way to effectively solve problems, as 'water and watershed resources can only be protected by the stakeholders' themselves (Salas 2008: 93).

Sustainable funding model based on environmental services fees

Because the dependency on outside funding for watershed initiatives was not sustainable, the IWMC utilized provisions in the LGC to charge environmental service fees to users in the watershed. One of the primary water users was the Metro Iloilo Water District (MIWD) which extracted water from the Maasin watershed in order to provide potable water to Iloilo City residents. The legal basis for charging the MIWD for this service were found in Sections 289, 386(b), 291 and 293 of the LGC which mandates the sharing of 'natural wealth' within 'the Philippine Territorial jurisdiction' through fees or charges (Francisco 2004: 35) (see Appendix 6 for full text). This translated to 1% of MIWD's gross revenue which was collected and used in the protection of the Maasin Watershed and other development projects in the area. Other tools used for implementing the environmental services fees are summarized in Table 3.2.

Table 3.2: Tools for payment for environmental services applied in the Tigum-Aganan watershed.

DIMENSION	TOOLS	EXTENT OF APPLICATION IN TIGUM-AGANAN
Social	Education to strengthen social capital	5
	Participation for empowerment	3
	Formal venues available for communities to negotiate or claim rights	3
Economic	Organization of environmental services providers/keepers	3
	Basis to pay	5
	Instruments of agreements	5
	Presence of a broker who links the providers/keepers	4

	with buyers	
	Local venue/platform for information dissemination	4
	Transparency of information	3
	Service provider for information/knowledge	5
	Informed providers/keepers	5
Political	Clear statement of objectives at all levels	1
	Clear indicators for reaching the objective	1
	Means of checking and measuring indicators	1
	Mechanism for equitable sharing of resources	1
	Mechanism for accountability	1

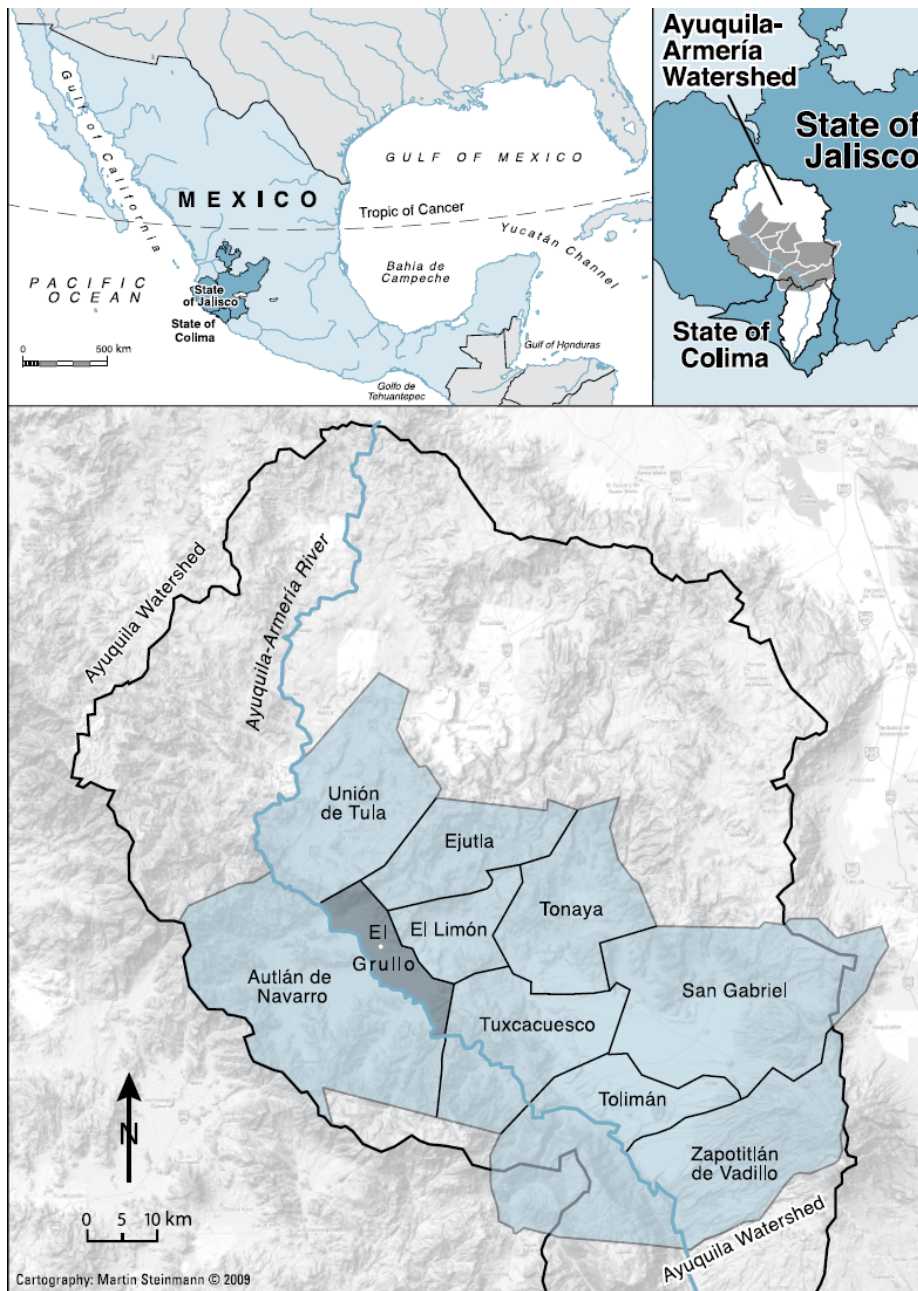
Source: Adapted from Salas (2008: 96).

3.2 Ayuquila River Basin, Mexico

The Ayuquila-Armeria River system is one of the most important river systems in western Mexico. With a basin area of 9803 km² and length of 294 km, it crosses the two states of Jalisco and Colima and consists of three sub-basins: the Ayuquila River, the Tuxcacuexco River and the Armeria River (see Figure 3.5). The Ayuquila River rises in the upper basin converging with the Tuxcacuexco to form the Armeria River, which flows south discharging into the Pacific Ocean (Montero et al 2006). Approximately 550,000 people live in the basin within 22 municipalities. It also contains five protected natural areas, a high diversity of native and threatened species and three large dams at Tacotan, Trigomil and Corcovado (UNU 2008). These dams provide irrigation to 54,000 has of farmland in Jalisco and Colima.

The Ayuquila River Sub-basin flows through 10 municipalities and forms the north eastern boundary of the Sierra de Manantlan Biosphere Reserve, which is part of the international network of reserves within UNESCO's Man and Biosphere Program. The upland contains fertile plains which are dedicated to intensive agriculture of primarily sugar cane and processing activities at the Ingenio Melchor Ocampo sugar refinery. The downstream terrain is not suitable for large-scale agriculture and communities here depend mainly on subsistence farming and fishing. Because of these different uses and activities in the Ayuquila Sub-basin, the economic benefits are not evenly spread between the upstream and downstream areas. Upland municipalities such as Autlan and El Grullo have profited from the export of sugar cane, watermelon, tomato and chilli crops whereas downstream communities have higher incidences of poverty relying on subsistence farming and fishing (UNU 2008). In addition, they have often suffered the effects of upstream activities such as water pollution from sugar cane processing and untreated sewage damaging aquatic life, livelihoods and creating health issues for residents and livestock. Given the importance of the Ingenio Melchor Ocampo sugar refinery and the lack of awareness of these downstream effects, many of the initial complaints from the communities were ignored. However, these tensions and protests over pollution became the catalyst for a series of events leading to the formation of the Inter-Municipal Initiative for the Integrated Management of the Ayuquila River Basin.

Figure 3.4: The Ayuquila-Armeria River Basin and the 10 municipalities of the lower Ayuquila River Basin, Mexico.



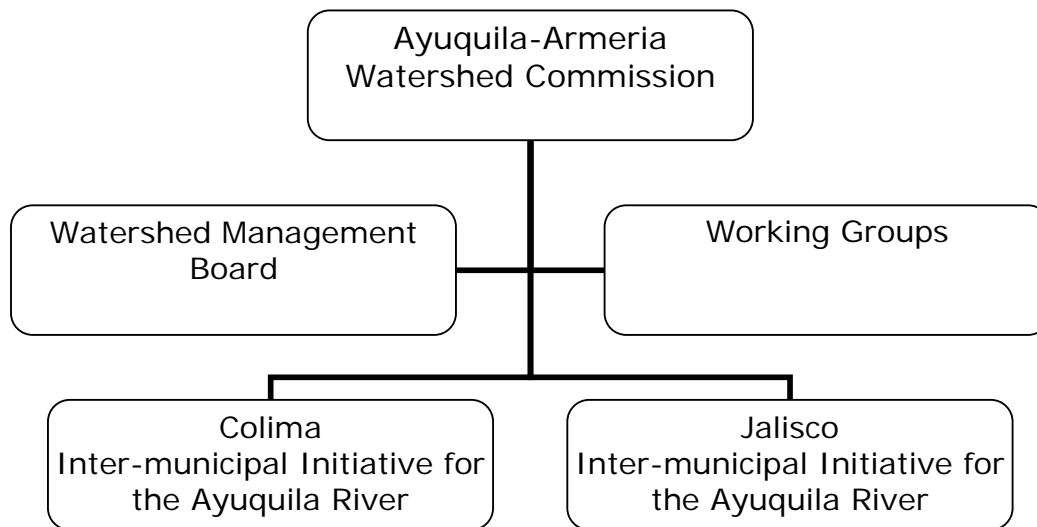
Source: de la Porte et al. 2009: 64.

In response to the protests from downstream residents, two institutions used their technical and research capacity to support the pollution cases and to find concrete solutions. The *Instituto Manantlan de Ecología y Conservación de la Biodiversidad* (Manantlan Institute for Ecology and Biodiversity Conservation – IMECBIO) from the University of Guadalajara led the way with an environmental assessment and set of clean up guidelines for the river in 1989. This led to

the federal government's creation of the *Direccion de la Reserva de la Biosfera Sierra de Manantlan* (Directorate of the Sierra de Manantlan Biosphere Reserve – DRBSM) in 1993 to administer the protected area from a local office and the Ayuquila protection boards which provided a medium for downstream residents to voice their concerns. The DRBSM and IMECBIO also collaborated with the Federal Ministry of Social Development, the Jalisco state government and various municipal governments to develop a participatory planning process to define priorities for action towards poverty reduction in which water quality played a significant role.

With these new forums for participation, the downstream communities, with the help of DRBSM and IMECBIO, took further action and organized themselves into 'river defence committees' where they took part in a regional environmental education program. Through this program, they not only learned the scientific basis of pollution impacts but also how to use this evidence to submit their complaints to government formally. These efforts resulted in the Ayuquila River clean-up becoming a regional priority for Jalisco in 1997 and the national establishment of the Ayuquila- Armeria Watershed Commission (AAWC) in 1998 (see Figure 3.6). The AAWC included representatives from the National Water Commission, Jalisco and Colima state governments and water user representatives from agriculture, industry, ranching, fishing and urban water services (UNHABITAT 2006). Under the provisions of the 1992 National Water Law which supports the creation of watershed councils, the AAWC is responsible for the balance of supply and demand for different uses, contamination prevention and clean up, the conservation, preservation and enhancement of ecosystems, efficient and sustainable use of water and educating communities about water as a vital resource (Dourojeanni and Jouravlev 2002, cited in De la Porte et al. 2009: 63). However, despite these mandates, the councils do not have the legal status and authority to manage their finances, employ staff, sign agreements or undertake studies (de la Porte et al. 2009). To address this, the AAWC created a Watershed Management Board (AAWB) which operated with financial support from Jalisco, Colima state governments and the federal government (although funding resources are currently insufficient). In addition, the AAWC established four working groups for water planning, sanitation, integrated watershed management and information sharing. Together with the AAWB, the AAWC has accomplished several outcomes including a construction plan for a fourth dam for irrigation, the establishment of minimum ecological flow for the Ayuquila-Armeria Basin and draft terms of reference for a proposed watershed management plan (De la Porte et al. 2009; UNHABITAT 2006).

Figure 3.5: Ayuquila-Armeria Watershed Commission structure.



Source: Table created by author; adapted from Montero et al. (2006).

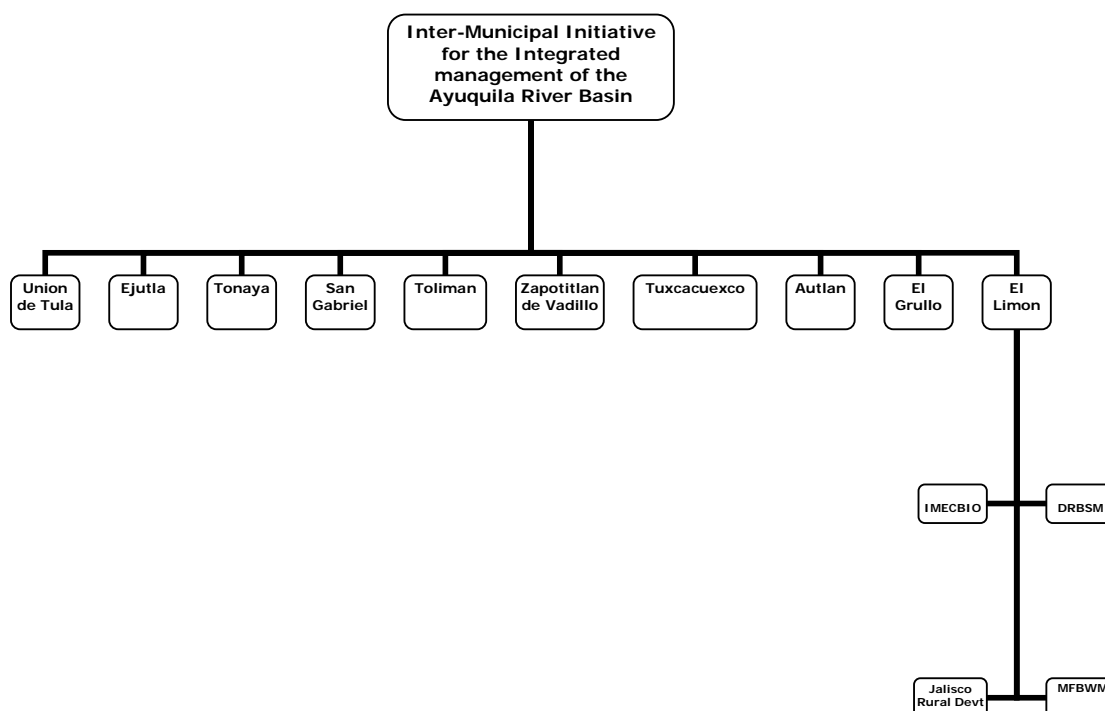
Although these outcomes were successful addressing issues at the larger watershed scale, the AAWC failed to fully engage stakeholders at the local level. Municipalities were represented but only for consultation and had no decision making powers in the formulation of plans or projects (de la Porte et al. 2009). As a result, did not address the pressing local issues of water supply and wastewater treatment. It wasn't until one of the sugar refinery's molasses tanks ruptured in 1998, that water pollution was directly addressed within government. Devastating the ecosystem and livelihoods of downstream residents in both Jalisco and Colima, the spill sparked violent protests against the sugar refinery. Though the government responded by fining Incampo and changing their effluent standards, the municipalities realized that a sub-basin, collaborative approach was needed for effective, longer term river management in light of AAWC's failure to address local concerns in the past. Thus, in July 2001, a letter of intent for joint implementation of environmental management projects was signed and the Inter-municipal Initiative for the Integrated Management of the Ayuquila River Basin (Iniciativa Intermunicipal para la Gestion Integral de la Cuenca del Rio Ayuquila) was born. The initiative included 10 municipalities in Jalisco (Autlan, Ejutla, El Grullo, El Limon, San Gabriel, Toliman, Tonaya, Tuxcacuesco, Union de Tula and Zapotitlan de Vadillo) (see Figure 3.5), local offices of the Sierra de Manantlan Biosphere Reserve and the Jalisco State Secretariat, IMECBIO from the University of Guadalajara and civil society group Manantlan Foundation for the Biodiversity of Western Mexico (Fundacio Manantlan para la Bioversidad de Occidente)⁷ (see Figure 3.6).

⁷ Another inter-municipal initiative also exists in Colima but the two initiatives have not formally been joined.

The group was also formally incorporated into the Ayuquila-Armeria Watershed Commission in the same year with voting rights enabling them to coordinate with Colima state initiatives. To finance the initiative, a trust fund was set up in August 2001 with contributions from the Federal Ministry of the Environment and Natural Resources, the Jalisco state government and the participating municipalities.

The mission of the initiative is to form an association of municipalities, which counts on the participation and support of local citizens, develop institutional capacity to improve the standard of living through effective environmental management, incorporate local initiatives and receive coordinated support from federal, state and municipal governments' (Montero et al 2006: 306). It also identifies six strategic actions to address the environmental problems in the central part of the Ayuquila Basin as spatial planning, public participation, strengthening the institutional capacity of local governments, solid waste management, restoration of headwaters and environmental conservation in the uplands (Montero et al 2006: 306). In order to ensure its resilience, given the limited three-year political term at the municipal level, the initiative also seeks to 'professionalize environmental management' by employing civil servants who aren't tied to political administrations. In addition, to ensure new municipal leaders continue to support the initiative as well as create cohesion among the different municipalities, IMECBIO arranged a series of learning workshops and ten-day trip to the Credit river basin in Ontario, Canada and Wisconsin, United States for newly elected mayors. The trip allowed them to see an inter-municipal governance mechanism in action as well as exchange information with their North American counterparts on various issues and challenges facing their respective river basins. As a result of these efforts, participation among municipalities has been consistent and the initiative has become the national model for collaboration winning Mexico's National Award for Local Government and Management (financed by the Centre for Economic Research and Education and the Ford Foundation) in 2005.

Figure 3.6: Inter-municipal Initiative for the Integrated Management of the Ayuquila River Basin Organization Chart.



Source: Table created by author; adapted from Montero et al. (2006).

Overall, the inter-municipal initiative has had a significant impact on the region not only reducing overall pollution levels from industry and urban upland areas but also improving local economic conditions in the downstream communities and improving public health. Other outcomes include:

- The implementation of municipal programmes for household solid waste separation and recycling reducing the amount of solid waste produced by 20% from 2000,
- Greater public awareness through the establishment of an environmental education program in 2003 reaching 10,000 people per year,
- Greater public participation through the organization of civil society groups and schools for projects such as headwater and bank restoration,
- The increase of social capital through environmental education programme and formation of civil society groups (comprising of over 2000 participants),
- Improved availability of information on environmental problems as well as their linkages to social and economic development at the municipal level, and

- The resilience and flexibility of the trust fund which has increased in value from \$US 100,000 in 2003 to \$US 400,000 in 2006 due to effective communication with the Jalisco state congress and other strategic partnerships.

3.2.1 Lessons Learned from Ayuquila

With similar lessons as those learned in Tigum-Aganan River Basin, the Inter-Municipal Initiative for the Integrated Management of the Ayuquila River Basin provides some important insights with respect to the implementation of collaborative governance inclusive of stakeholders at the local level. These include the (1) utilization of legislation, (2) creation of an environmental education program, (3) adoption of a localized and collaborative approach, and (4) incorporation of institutions as facilitators.

Utilization of legislation

As demonstrated with the formation of the Tigum-Aganan Watershed management initiative, leaders saw an opportunity to invoke provisions in decentralization policies that devolved environmental management functions to the municipal level. In the case of Mexico, initial attempts of decentralization were amendments made to Article 115 of the Mexican Constitution in 1983. These amendments transferred the responsibilities for drinking water, sewerage and wastewater and solid waste management to municipalities. In 1992, regions further delegated the management of water, sanitation and wastewater treatment services through the State Ecology and Environmental Protection Law. However, as with the Philippine case, local governments had limited financial resources, limited trained staff in specialized areas, weak institutional and legal frameworks and limited and incomplete information for decision making with respect to environmental management. These limitations were addressed in 1999 with further amendments to Article 115 of the Constitution. This permitted local governments to engage in partnerships and joint provisions of public services in order to increase efficiency (Montero 2006). This was further supported by the 1992 National Water Law which contained provisions for watershed councils within hydrological boundaries, their responsibilities and auxiliary organizations which supported their establishment (de la Porte et al. 2009). Furthermore, in 1995, the National Water Law framework mandated the Ministry of Environment and Natural Resources to absorb the National Water Commission and the

Ministry of Fisheries creating the context for a more collaborative approach to water management.

Utilizing the provisions stated in these laws, initially eight municipalities (located upstream and downstream) informally partnered with IMECBIO to form 'river defence committees' to launch formal complaints about pollution from the sugar refinery. These partnerships intensified with the molasses spill disaster leading to a formal letter of intent for an expanded partnership between ten municipalities, the Jalisco state government, federal agencies, the DRBSM and IMECBIO. Given the various agencies, level of government and institutions involved and the role of IMECBIO in capacity building, these partnerships allowed for an increase in operational and institutional capacity for environmental management in municipalities as well as diversified funding channels for the initiative.

Creation of an environmental education program

In order for citizens in the upstream and downstream communities to understand the ecological and social linkages of pollution in the Ayuquila River Basin, IMECBIO created and implemented an environmental education program (Castillo et al 2002; Montero et al. 2006). As a university research institution, IMECBIO used its scientific findings not only to raise awareness of water issues among the population but also to provide concrete solutions to municipalities. It also aimed to empower citizens by engaging them in the planning process and providing opportunities to apply their knowledge through restoration and monitoring activities. An example of these projects was the municipal programmes for household waste separation and recycling which successfully reduced solid waste up to 60 per cent in some municipalities. In addition to improving cleanliness and establishing the link between solid waste management and water quality, the programmes demonstrated innovative and inclusive management structures for the recycling centres. In two cases, the municipalities administered the centres but one was managed in partnership with a local entrepreneur and the other by a peasant women's cooperative (Montero et al. 2006). Other projects have encouraged the formation of civil society groups and school programs which have increased public participation and social capital overall. This has had a marked effect on the river's condition improving health and economic activities downstream as well as restoring historic cultural activities such as the Ayuquila River Environmental Festival which resumes the custom of bathing in the river during Easter week (Montero 2006: 307).

In addition to the ecological and social benefits of IMECBIO's continuous education program, it has also enabled the initiative to remain resilient in the midst of changing political leaders and conflicts among political parties (Montero 2006: 307). For example, in 2003, five out of the eight municipalities participating in the initiative changed political leadership after the elections. However, because of the wide public support of the initiative, the new mayors voluntarily continued the project. Although the lack of an institutionalized collaborative agreement still remains a concern, the active nature of its citizenry has successfully secured the commitment of leaders in the short term.

Adoption of a localized and collaborative approach

Though the national government responded to the protests of downstream citizens by creating the Ayuquila-Armeria River Basin Committee in 1998, its approach remained largely regional failing to address the concerns of stakeholders at the local level. This gave rise to the need of a management structure at the sub-basin level of the Ayuquila River where government could best respond to local needs. Thus, motivated by the positive and effective experiences of partnerships forged by IMECBIO through its 'river defence committees', municipalities, institutions and civil society groups took it upon themselves to form a more localized, collaborative management structure. This approach empowered citizens through environmental education and participation in public policy definition and design as well as built the institutional and technical capacities of municipal governments through the research and scientific expertise of IMECBIO.

Given that communities depended on the river for their livelihoods, the incorporation of their knowledge and concerns within national and regional policies was also vital to ensure they remained relevant to their economic and social contexts. This was addressed with the inclusion of the DRBSM (under the National Commission for Protected Natural Areas) and the Jalisco State Rural Development Secretariat within the initiative's structure. In addition, the initiative's formal adoption into the Ayuquila-Armeria Watershed Commission as a voting member gave municipalities a stake in the decision making processes at the higher levels of government. These collaborations also created new opportunities for strategic partnerships and funding opportunities. The initiative's trust fund for example, received money from national, state and municipal levels of government as well as international institutions and aid agencies (capitalizing on IMECBIO's relationships with international universities). As a result, the fund

reached US\$400,000 in 2006 from US\$100,000 in 2003. This was due in part to the initiative's effective communication with Jalisco's state congress as well as its utilization of economies of scale and new collaborative bargaining power (Montero et al. 2006).

Incorporation of institutions as facilitators

The success of the inter-municipal initiative for the Ayuquila River Basin was largely due to the facilitative and capacity building role of IMECBIO from the University of Guadalajara. As one of the first actors to respond to the concerns of the downstream residents, IMECBIO used its research capacity and knowledge to educate municipalities and citizens and contribute to potential solutions. Working at the local level, this was accomplished primarily through its environmental education program and formation of civil society groups to undertake restoration and sub-basin monitoring projects in the Ayuquila River Basin. Within local governments, IMECBIO represents the research and capacity building arm for the inter-municipal initiative aiming to build institutional capacity for environmental management.

In addition to these education and capacity building initiatives, IMECBIO also leveraged its neutral, institutional position to bring warring stakeholders together in collaborative partnerships. For example, after the devastating molasses spill in 1998, IMECBIO utilized its international networks to bring in experts from Cuba to help with solutions for clean-up. In consultation with these experts, they also encouraged a collaborative approach to formulating solutions for the harmful practices of effluent discharge. This engaged representatives from the sugar refinery, the National Water Commission, Las Paredes Communal Landholdings, Irrigation Associations, sugarcane producers and rural farmers (UNHABITAT 2006). By facilitating between these stakeholders, an innovative solution was proposed to recycle both processing and irrigation waters using irrigation channels rather than the river. IMECBIO played a similar facilitative role in partnership with DRBSM bringing government and municipalities together in 'river defence committees'. This provided an avenue for citizens to voice their concerns more formally rather than through more radical methods of civil disobedience (Graf et al. 1996). As a result of these partnership building efforts, all parties in the Ayuquila River Basin have changed their more confrontational approaches to each other and now use more institutional mechanisms to communicate with one another. This has opened up numerous opportunities with respect to problem solving, policy formulation and funding by broadening perspectives and giving all a voice at the table. Though changing leadership and political support still remains a challenge,

having IMECBIO as an anchor between government and citizens has largely contributed to the resilience of the initiative.

3.3 Billings Reservoir, Santo Andre, Sao Paulo, Brazil

The Billings Reservoir is located on the southern edge of the Sao Paulo Metropolitan Area (SPMA) in Brazil. It is part of the regional Alto-Tiete River Basin and Billings-Tamaduetei sub-basin (see Figure 3.7). It covers an area of 127 km² and passes through eight municipalities: Sao Paulo, Diadema, Sao Caetano do Sul, Maua, Ribeirao Pires, Rio Grande de Serra, Sao Bernardo do Campo and Santo Andre (CHS UBC n.d.) (see Figure 3.8). The Billings Reservoir supplies drinking water for approximately 1.2 million residents within the SPMA and is also used for recreation, flood control and energy generation for the Billings Dam (van Horen 2001: 210).

As one of the world's most populated urban agglomerations and Brazil's economic and industrial centre, growth and development in the SPMA have greatly impacted water quality and availability. The region currently has a population of 18 million people spread among 39 municipalities, 36 of them within the Alto-Tiete River Basin. With a history of highly centralized, top-down master planning prior to democratization in the 1980s, many policy tools were inadequate to guide the rapid urban growth within the SPMA during the population boom of the 1950s (van Horen 2001: 210). For example, federal and state laws had strict guidelines for development deterring landowners from developing their lands. Thus, many lots that lay vacant became the sites for rapidly expanding informal settlements or *favelas*⁸ which now house more than 30 per cent of the SPMA's population (UBC 2010: 15). Approximately one million of these residents are located in environmentally sensitive areas such as watersheds (Municipality of Santo Andre and UBC 2005: 1) and lack basic services such as sewerage, wastewater treatment and garbage collection. This contributes to the pollution of these areas with solid waste and domestic effluent comprising two-thirds of water contamination in the Alto-Tiete Basin (Jacobi 1997 as cited in de Castro and McNaughton 2003: 2).

On a smaller scale, this is echoed within the Billings Reservoir part of which is situated in the municipality of Santo Andre, located on the fringe of the SPMA. As a major player in Brazil's

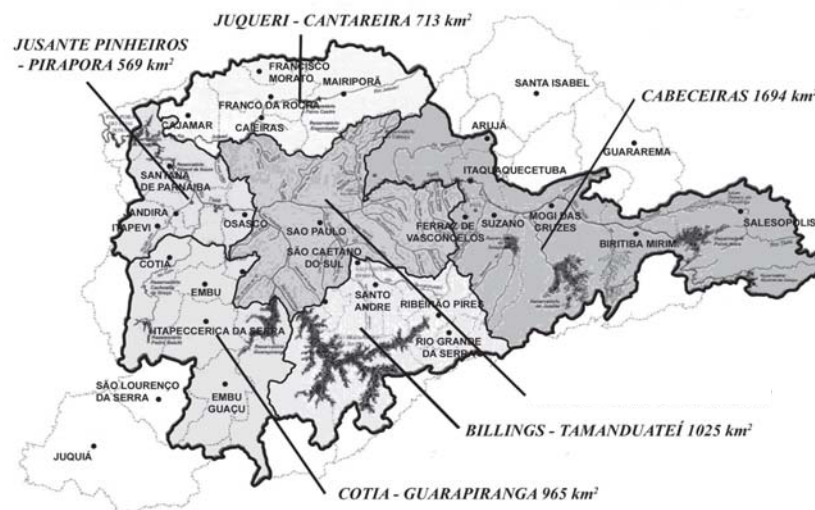
⁸ *Favela* is the Portuguese word for 'slums' and squatter settlements.

economic development during the 1950s, Santo Andre experienced rapid and poorly managed urban growth and decline resulting in 10% of its population (approximately 67,000 people) living in *favelas* (van Horen 2001: 212) along the watershed. Despite provisions for protection within federal and state legislation such as the establishment of Watershed Protection Areas (WPAs), growth of informal and semi-formal settlements continued to rise. In an effort to solve the serious administrative and planning challenges posed by these settlements, Santo Andre's mayor, Celso Daniel, drew on his networks and approached the University of British Columbia's (UBC) Centre for Human Settlements (CHS) in 1997 to explore the potential for a capacity building project on watershed planning (UBC 2010: 3). This resulted in the formation of the Community Based Watershed Management (CBWM) project⁹ which was funded by the Canadian International Development Agency (CIDA) and led by the Municipality of Santo Andre (PMSA) and the CHS in collaboration with ten other institutions representing regional and local governments in Canada and Brazil, civil society and university institutions¹⁰. The project aimed to develop institutional capacity for adaptive management of Santo Andre's watershed on the basis of both environmental and social principles. To do this, it proposed a multi-stakeholder, collaborative planning approach as an alternative to the top-down, regulation-centred models traditionally used in Brazil. In addition, the project proposed to make municipal management of watersheds inclusive of informal settlers making policies more effective, participatory and responsive to their needs (Municipality of Santo Andre and UBC 2005: 4).

⁹ Community Based Watershed Management in Santo Andre, Brazil Project Website: <http://www.chs.ubc.ca/brazil/index.html>

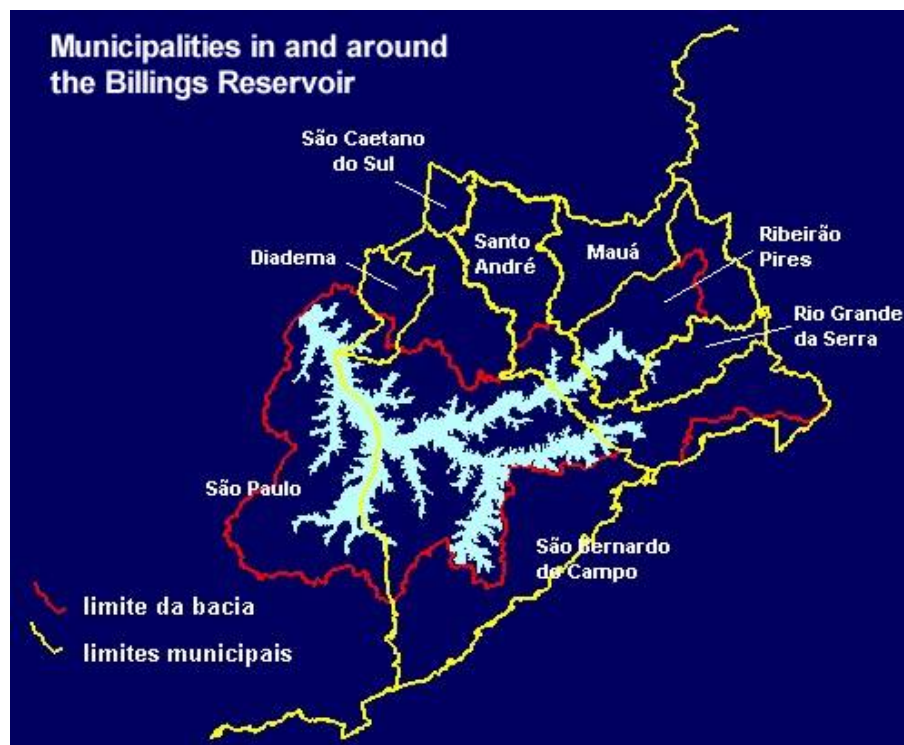
¹⁰ Collaborating institutions included Consorcio dos Municipios da Regiao ABC (Municipal Consortium of the ABC Region), Cidade e Democracia (City and Democracy, NGO), Universidade de Sao Paulo (University of Sao Paulo), Camara Regional do ABC (ABC Regional Consortium), Institute for Resources and the Environment (University of British Columbia), Institute for Dispute Resolution (University of Victoria), Greater Vancouver Regional District, City of Vancouver, Canada's National Round Table for the Environment and the Economy and the Fraser Basin Council.

Figure 3.7: The Alto-Tiete Watershed



Source: Reproduced from UBC (2010: 14).

Figure 3.8: Municipalities in and around the Billings watershed.



Source: Reproduced from CHS UBC, (n.d.).

The CBWM project also incorporated and built on many contextual factors such as the history of decentralized watershed management, the proliferation of informal settlements and participatory processes and networks such as those in the budgeting process in Brazil.

Watershed management prior to the 1980s was highly centralized and focused on planning tools such as master planning and legal regulatory mechanisms to control growth patterns (van Horen 2001: 210). This legislative framework included the Water Protection Law (1975) which designated Water Protection Areas (WPAs) and Laws No. 898 (1975) and No. 1172 (1976) which restricted land uses and occupation within WPAs as well as centralized the control of finances and legislative power at federal and state levels. This framework made it impossible for local governments to formulate and effectively implement land use guidelines within their jurisdictions and facilitated the growth of informal settlements especially in municipalities such as Santo Andre where 61 percent of its area is within the WPA (van Horen 2001: 213). With the approval of the new Constitution in 1988, urban management was decentralized back to the municipalities and the federal government was required to create a national water resource management system (Kemper et al 2005: 19).

Other watershed management laws followed such as State Laws No. 7663 (1991) which decentralized water resource management to Water Basin Committees (WBCs) representative of local and state governments and civil society organizations and No. 9034 (1994) which required municipalities to formulate emergency, environmental and sustainable development plans at the water basin level with approval by the WBCs. Emergency plans outlined the restoration of the watershed and environmental plans were coupled with the creation of a socio-economic development plan. The Watershed Protection Law (1975) was also amended in 1997 into the National Water Law which incorporated the Dublin principles presented at the World Summit in Rio de Janeiro in 1992¹¹. These principles were also reflected in the State Water Resources Policy (1991) which aims to provide water availability and quality by embracing integrated water management, encourages the use of river basins as the planning unit, recognizes water as a finite and fragile resource, recognizes water as an economic good and promotes decentralized and participatory management (Kemper et al 2005: 19). Finally the Water Source Protection Law created in 1997 recognized the ineffectiveness of prohibition and policing measures for protecting water supply sources and proposed an inter-sectoral approach joining the management of water with environmental aspects such as land use.

¹¹ The 1992 Dublin Principles are as follows: (1) Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment, (2) Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels, (3) Water play a central part in the provision, management and safeguarding of water, (4) Water is a public good and has a social and economic value in all its competing uses, and, (5) Integrated water resources management is based on the equitable and efficient management and sustainable use of water (Global Water Partnership website 2012).

Following these decentralization policies, a series of state and basin-focused institutional bodies were created to further implement the State Water Resource Policy:

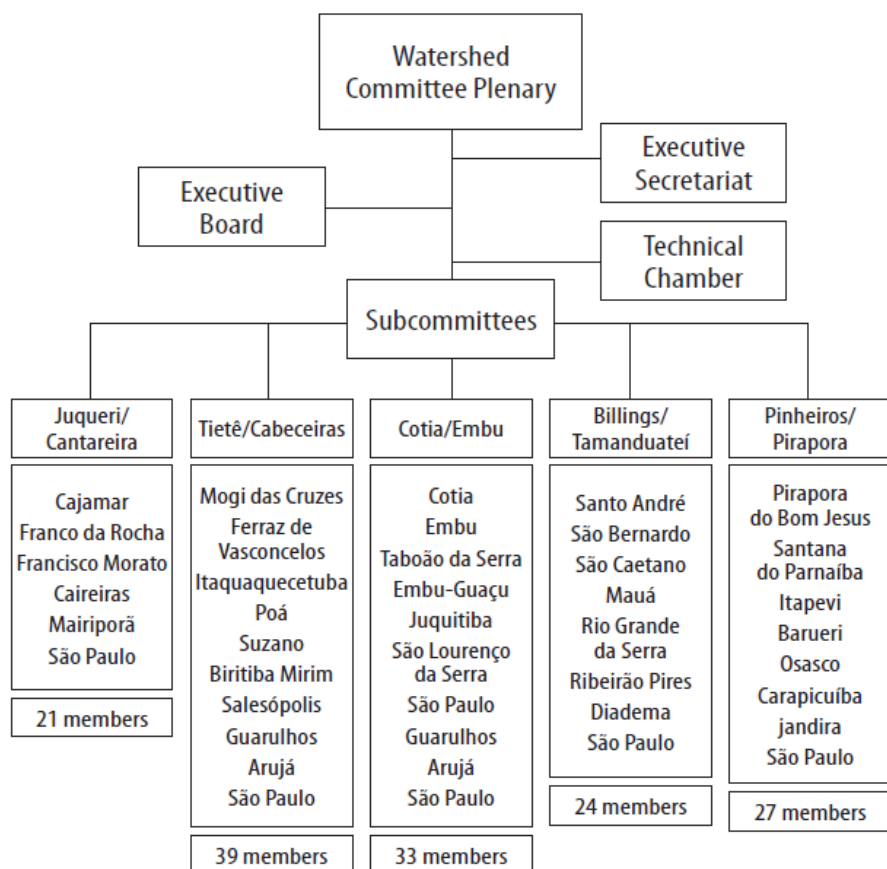
- ◆ *Sao Paulo Water Resource Council* – a deliberative, multi-stakeholder body that supervises and regulates the state water resource management system,
- ◆ *The Council's Executive Secretariat* – the technical body in charge of elaborating the state water resources plan and promotes institutional integration among water related institutions,
- ◆ *State Water Management Agency* – oversees water use and pollution control,
- ◆ *Alto-Tiete Basin Committee* – a deliberative, multi-stakeholder body with decision making and regulatory power. The Committee (Plenary) has 48 members with 16 state government representatives, 16 municipal representatives and 16 civil society representatives, all with equal voting rights (UBC 2010: 16). It serves as an arena for negotiations and participatory decision-making and is responsible for promoting debates on matters related to water resource management, engaging stakeholders and organizations, mediating conflict resolution processes around water use, approving and following up on sub-basin water management plans and establishing user-fee structures and mechanisms and other financing schemes for projects. The Technical Chamber (consisting of Plenary members) provides support to the Plenary on issues of water resource planning and management, drainage and flood control, underground water and water use and sanitation. The Executive Secretariat is coordinated by State representative and is responsible for integrating actions, setting up and facilitating meetings and providing studies and gathering data (UBC 2010: 18). The Committee is divided into 5 sub-committees representing its sub-basins: Cortia/Guaraprianga, Billings-Tamanduatei, Tiete-Cabeceiras, Juqueri-Cantareira and Pinheiros-Pirapora (Kemper et al 2005: 20) (see Figure 3.10).
- ◆ *Billings-Tamaduatei Subcommittee* – a multi-stakeholder body that is responsible for the management of water resource protection and restoration, the implementation of the State Water Source Protection Law (1997) and the development of sustainable development plans.

(Kemper et al 2005: 19).

The planning framework guiding the Alto-Tiete Committee consists of two documents: the Relatorio Zero which provides an overview of the watershed and the Upper Tiete Watershed Plan (Plano de Bacia do alto Tiete) which gives a more comprehensive review of long-term planning and management objectives through an integrated water resource management lens

(UBC 2010: 19). Although some programs and projects would require financing from various external agencies (including international aid agencies), it largely relies on its own funding from the State Water Resources Fund (FEHIDRO). However, this fund still falls short evident in the dependence of the Technical Chamber on the federal water resource management agency (Departamento de Agua e Energia Eletrica - DAEE) for technical expertise and assistance (Kemper et al. 2005: 21). According to Kemper et al., the more successful, dynamic and locally relevant project are within the jurisdiction of the Billings-Tamanduatei subcommittee (2005: 21).

Figure 3.9: Alto-Tiete Basin Committee Structure.



Source: Reproduced from UBC (2010: 19).

With an approach based on community participation and learning-by-doing, the CBWM project built on the Billings-Tamaduatei subcommittee's strong base of municipal coordination, other regional connections as the ABC Region Inter-municipal Consortium¹² and more marginalized populations such as informal settlement residents, women, youth and the unemployed in the sub-basin's assessment and planning process. Stakeholders were engaged both formally and informally through workshops, budget councils, public meetings multi-stakeholder meetings and separate meetings between individual stakeholder groups and municipal authorities. Community leadership was also built among marginalized groups to ensure their inclusion through a pilot project in Parque Andreense (van Horen 2001: 215). Linking these stakeholder groups with existing municipal programming such as settlement upgrading, environmental monitoring and environmental education, the Project created a CBWM and Land Use Settlement Framework through a robust planning process (van Horen 2001: 220). These outputs not only recognize the diversity and complexity of the existing settlements but also that informal settlement growth is inevitable and unlike the policing and slum clearance policies of the past, this approach aims to guide future land use, settlement and watershed management. This includes working with Santo Andre's strategy to physically and socio-economically integrate *favelas* into the city. In addition, the link between socioeconomic issues and environmental protection are highlighted through environmental education implemented by community leaders in conjunction with other established and recognized social programs. In coordination with restoration of infrastructure and establishment of tenure, community based environmental initiatives such as solid waste management and monitoring have been established. Incentives for these initiatives link to community needs such as training and credit support for economically viable enterprises such as community based recycling and clean and safe drinking water. In order to fund these activities, the community has also established an environmental fund from taxes, property taxes and fines from environmental violators (van Horen 2001: 219).

¹² The Consortium is an informal collaboration of political leadership from 7 cities in the SPMA including Santo Andre, Sao Bernardo do Campo, Sao Caaetano, Diadema, Maua, Ribeirao Pires and Rio Grande da Serra. The Consortium aims to develop coordinated, proactive strategies to pre-empt the negative impacts of macroeconomic restructuring in Brazil and maintain the ABC Region's dominance as an economic centre (van Horen 2010: 212).

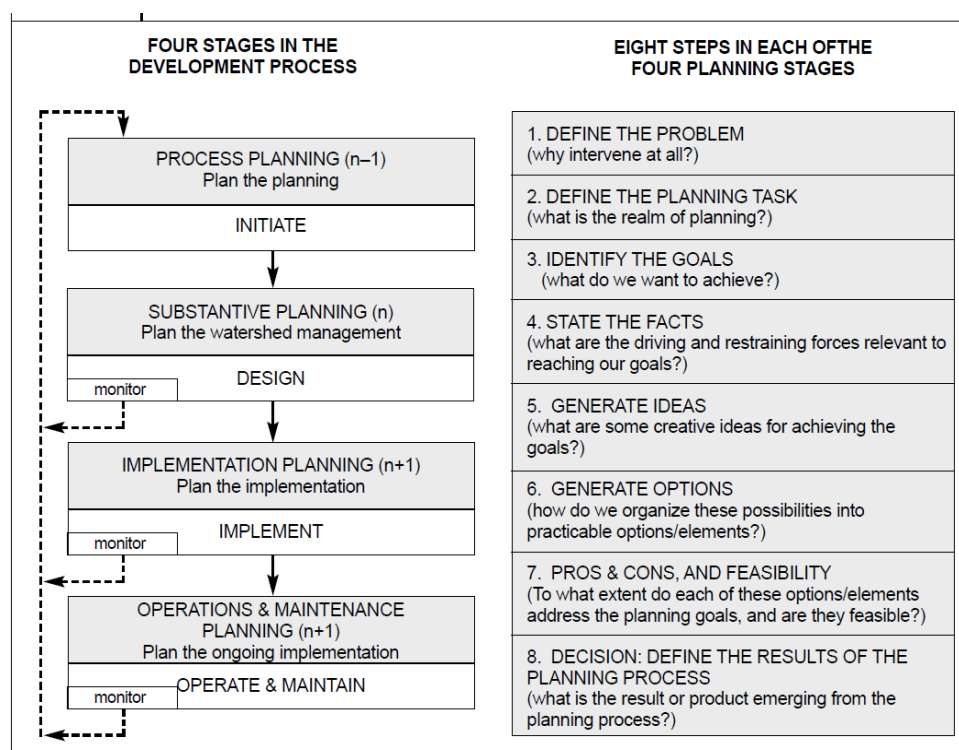
3.3.1 Lessons Learned from the Billings Reservoir

Though the CBWM project case study differs in context due to the implementation being led by a foreign university and research institution, it still provides a number of useful lessons for collaborative governance and watershed management building on those learned in the Tigum-Aganan and Ayuquila Watersheds. These include (1) the incorporation of marginalized populations in the planning and implementation process; (2) recognition and incorporation of informal settlements into watershed management strategies; (3) the role of institutions as facilitators and (4) partners and adoption of a localized and collaborative approach.

Incorporation of marginalized populations in the planning and implementation process

In light of the ineffectiveness of the centralized watershed management policies that focused on legal regulatory mechanisms to control growth, policing and little public participation, the CBWM project built on many decentralized laws that recognized the importance of local watershed management as well as the reality of informal settlements in these areas. Thus, the project's main goals were to incorporate a participatory approach that included marginalized populations often left out of the planning and implementation process such as informal settlement residents, women and youth and create a watershed management framework that would build the capacity of Santo Andre municipality to manage the Billings Reservoir. To reach these goals, the CBWM project involved a vast network of stakeholders from Canada and Brazil including state, municipal and regional government representatives, NGOs, the private sector and universities of Sao Paulo, British Columbia and Victoria in Canada. To reach more marginalized groups, pilot projects forming community leader coalitions such as the *Camara Tecnica* in Parque Andreense were implemented as well as utilizing existing participatory networks such as those used in budgeting. Facilitated by researchers and practitioners from UBC, stakeholders participated in a planning process that first assessed the issues within the Billings Reservoir, its ecological condition and the goals the participants wanted to achieve (see Figure 3.11). All stakeholders had an equal voice ensuring that their feedback and concerns were incorporated into the process.

Figure 3.10: Planning steps within each stage of the watershed management process.



Source: Reproduced from van Horen (2001: 221).

This resulted in a community based watershed management framework that combined current municipal social programmes and strategies already in place in the *favelas* with the social and environmental goals discussed in the multi-stakeholder planning process. Municipal programmes integrated were Santo Andre's *favela* upgrading strategy, micro-credit for informal enterprises, adult vocational training and community health programmes. By linking these existing strategies with environmental education, solid waste management and water monitoring projects, the CBWM project demonstrated how a cleaner environment improved quality of life and health in the informal settlement areas and could create innovative enterprise opportunities such as recycling and other services for residents. Marginalized stakeholders also played a key role in implementation of key projects. For example, community leaders in *Camara Technica* were responsible for coordinating community environmental monitoring in conjunction with the water and sanitation company SEMASA (van Horen 2001: 219). This not only created a sense of ownership over goals suggested in the planning process but also built trust among the informal settlement community and the municipality of Santo Andre (Municipality of Santo Andre and UBC 2005: 40). This increased the sustainability of these programmes as well as provided Santo Andre with a link to stakeholders who could aid in

project assessment on the ground. As these relationships and collaborative ventures strengthen, all municipalities dependent on the Billings Reservoir will benefit from the improved water quality and decrease in major pollution issues at the source.

Recognition and incorporation of informal settlements into watershed management strategies

One of the outcomes from decentralization of policy in the 1980s was the recognition that an emphasis on policing and penalization of informal settlements in environmentally sensitive areas was ineffective in suppressing their growth. This influenced Santo Andre's integrated strategy for urban poverty reduction which aimed to reduce social exclusion by facilitating the physical and socioeconomic integration of *favelas* into the city (van Horen 2001: 218). The CBWM project took these programmes one step further by incorporating the participation of marginalized populations such as informal settlers into the watershed planning process in which their settlements were an integral part. By recognizing the growth of informal settlements as inevitable in a burgeoning metropolis such as the SPMA, the CBWM organized community leaders into groups and ensured their voices were represented in the development of the CBWM framework. In addition, their immediate needs and concerns such as tenure were addressed ensuring security and furthering the sense of ownership over the land. This recognition of legitimacy and empowerment in the decision making process furthered the incentive to take care of the watershed as well as included their unique perspectives in the visioning of how it could be done. This participatory approach and integration of the *favelas* therefore, utilized and maximized the potential for more on-the-ground knowledge to be incorporated into solutions to the complex problems in the Billings Reservoir as well as built a sense of 'ownership' for decisions made increasing the motivation for implementing them (Municipality of Santo Andre and UBC 2005: 41).

The role of universities as facilitators and partners

As seen in the Ayuquila River Basin example in Mexico, the potential of universities and research institutions in formulating solutions and mediating conflicts in watersheds cannot be underestimated. In the case of the Billings Reservoir and the municipality of Santo Andre, these networks drew on the research capital and expertise of both academics and practitioners well versed in watershed management and collaborative governance. Building on the

socioeconomic context of the Santo Andre, Brazilian environmental and water policy and history of collaborative processes in the area, the Centre of Human Settlements (CHS) at the University of British Columbia (UBC) and the University of Sao Paulo implemented action-research and a participatory planning process in the assessment of the watershed and the development of a community based watershed management framework. To harness the knowledge and perspectives of the community including marginalized populations such as women and youth, various strategies were employed based on social principles. The use of storytelling and theatre for example were utilized to gather information which was then incorporated into the larger planning process. The integration of these newer techniques of engagement not only enabled the project to tap into these more marginalized networks but also built the capacity of Santo Andre to repeat the process and continue its trust and relationship building more effectively. In addition, because of the neutral nature of these institutions, both UBC and the University of Sao Paulo were able to mediate between other stakeholders such as NGOs, civil society, the private sector and state and local governments within the planning process. This demonstrates the importance and the success of an institutional facilitator in the process of collaboration and relationship building. Finally, the partnership with UBC also increased the diversity of funding and resources available to Santo Andre such as the project grant from the Canadian International Development Agency (CIDA) and participation of Canadian NGOs and regional governments.

The adoption of a localized and collaborative approach

As with the examples of the Tigum-Aganan and Ayuquila River Basins, a localized and collaborative approach was the most effective approach to watershed management in that it brings the decision making and planning processes to those 'on the ground' and with a direct stake in the resource and is more representative of the interests in the watershed. As seen with the failure of centralized environmental policy in Brazil prior to the 1980s, the case of Santo Andre highlights the dynamism and success of more localized, sub-committee approaches such as that in the Billings Reservoir. The CBWM project built on this approach by incorporating informal settlers and other marginalized populations. In addition, the project also addresses the socioeconomic issues facing these communities in addition to the environmental problems within the watershed. By integrating these populations and programmes into the watershed management process, another range of interests were represented in addition to other stakeholders further drawing on another dimension of knowledge and perspective for

solutions. This ensures the relevance and applicability of the framework for watershed planning in the future.

4 **IMPLICATIONS FOR THE ANGAT RIVER BASIN**

The lessons learned in the applied examples of collaborative governance in the Tigum-Aganan Watershed, the Ayuquila River Basin and the Billings Reservoir have several implications for the management of the Angat River Basin. These implications can be summarized in the following themes: (1) collaborative governance, (2) rescaling governance and localized watershed management, (3) legislation, (4) inclusion of informal settlements and marginalized populations, (5) education and information dissemination, and, (6) funding.

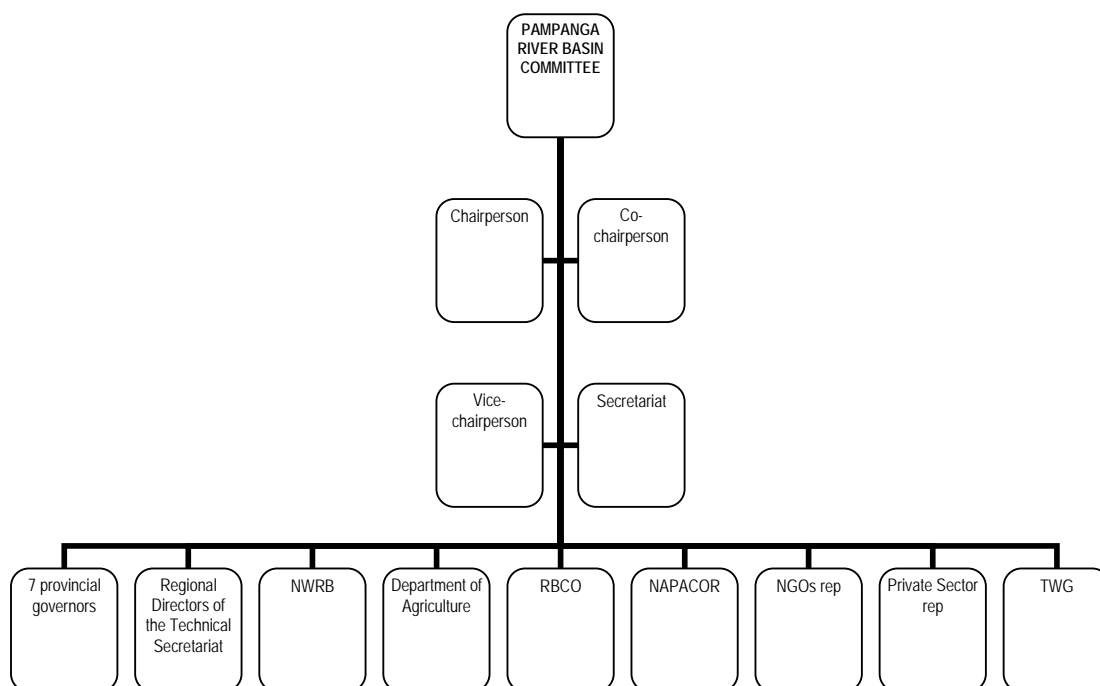
Collaborative Governance

As seen in all the collaborative governance examples explored, the roles of watershed management boards or councils created were critical and indicative of the integrated nature of the river basin systems themselves with multi-sectoral and multi-tiered governance structures representative of all present interests and uses. Stakeholders included national, provincial, regional and local governments (including the barangay/village level), NGOs, People's Organizations (POs), universities, the private sector and marginalized populations such as informal settlement leaders, women and youth. In addition, as illustrated in the Tigum-Aganan Watershed Management Board (TAWMB) example, top-down and bottom-up approaches were effectively utilized ensuring citizen concerns were represented and incorporated into the planning and decision making processes. Funding from both government and international development agencies facilitated collaboration not only by financing projects but more importantly by enabling community organizing that strengthened existing POs and NGOs, forging new social networks between government and civil society. This resulted in widespread awareness and support for issues and challenges in the watershed, feedback loops between constituents, civil society groups and government and increased local capacity to formulate creative, diverse resilient solutions.

The current governance context of river basin management in the Philippines focuses on the national River Basin Control Office (RBCO) and regional River Basin Offices (RBOs), which are responsible for the integrated planning, rehabilitation and development of the country's 12 water resource regions established by the NWRB. These responsibilities include the implementation of IWRM basin plans, national policy coordination for LGUs and NGOs in the

development and sustainability of river basins, the recommendation of approvals and funding and administering funds for the river basin appropriations provided under the DENR budget (Tuddao 2006: 2). Planning related to the Angat River Basin is currently being undertaken in this context but at the much larger scale of the Pampanga River Basin. According to the 2011 JICA study and recommendations for the Pampanga River Basin IWRM planning process, the proposed institutional set up for its management includes the establishment of a River Basin Committee (RBC). The RBC would be responsible for the formulation of the framework and policy of the IWRM Plan and coordination and direction of the Technical Working Group (TWG) which would execute the Plan's implementation (JICA 2011: 4). The RBC would be established under the existing Regional Development Council (RDC) of Region III with NEDA as the Secretariat. Members of the Pampanga RBC would include 7 provincial governors (though JICA did not specify which provinces would be represented), regional directors of the technical secretariat as well as representatives from the NWRB, Department of Agriculture, RBCO, NAPACOR, NGOs and the private sector (JICA 2011: 75) (see Figure 4.1). TWG members would include relevant national and regional line agencies, NGOs and private firms (JICA 2011: 4). Final decisions including the draft IWRM plans would be formulated by consensus by the Pampanga RBC and the TWG (see Table 4.1).

Figure 4.1: Pampanga River Basin Committee structure.



Source: Reproduced from JICA (2011: 75).

Table 4.1: Hierarchies and Functions of Stakeholders

Hierarchy/Expected Members	Function
1. Core stakeholders <ul style="list-style-type: none"> Steering Committee members Technical Working Group members 	<ul style="list-style-type: none"> To make the final decisions on consensus. To bring forward the problems and needs for IWRM. To propose the draft plan on IWRM.
2. Stakeholders (representatives at entire basin level) <ul style="list-style-type: none"> Related governmental organizations Related organizations (water users association, fisherman's association, water supply company, power supply company, etc.) Representatives of local level stakeholders Representatives of association of indigenous people, woman's association, and religious association, etc. Representatives of LGUs in Metro Manila Representatives of LGUs related to water transmission to reservoirs in the basin NGO Academes Others, if necessary 	<ul style="list-style-type: none"> To bring forward the problems and needs of IWRM. To propose the draft plan on IWRM.
3 Other stakeholders <ul style="list-style-type: none"> Other stakeholders who are not included in the stakeholders of the above items 1 to 2. 	<ul style="list-style-type: none"> To disclose information through the internet, etc.

Source: Reproduced from JICA (2011: 46).

Although the proposed model for the Pampanga River Basin's management incorporates an inter-sectoral and multi-tiered approach based on hydrological boundaries, its structure does not include a more systematic mechanism to incorporate feedback from citizens on the ground, particularly at the local scale, i.e., municipal and barangay levels. The range of NGOs and other civil society organizations in the area are represented by only one person on the Pampanga RBC decision making body. Given the number of communities in the larger context of the Pampanga Basin, this is not representative of the range of citizen interests especially in the unique context of the Angat River sub-basin. In addition, other stakeholders such as indigenous peoples and academe do not have a role in the decision making process in either the RBC or the TWG and instead are only informants on the problems and needs of IWRM (see Table 4.1). In May 2012, the Regional Development Council for Region 3 organized the Pampanga River Basin Committee (PRBC) with Governor Sy-Alvarado as PRBC Vice-chairman and Chair of the Infrastructure Committee. Governor Sy-Alvarado's role is important for its implications for re-scaling watershed and river governance and management. As will be argued in the next section, adopting a rescaled governance structure localized approach at the Angat River sub-basin scale would entail a Bulacan-wide governance structure to address water resource issues at the provincial and sub-basin scales.

As seen in the examples of applied collaborative governance explored in this project, a participatory approach involving academe and marginalized groups such as indigenous

peoples, youth, women and informal settlers were vital to ensure the relevancy of solutions to the complex issues in the watershed. Universities and researchers were also key in their roles as facilitators and capacity builders at the local level. However, in light of JICA's recommendations for the institutional set-up of the Pampanga RBC, the focus for solutions appears to be at the higher levels of decision-making – provincial, regional and national – with local interests in the hands of the one NGO representative and 7 provincial governors. This scale not only neglects to tap into the knowledge of basin conditions at the local level and utilize the capacity of local communities to implement solutions but also neglects to address challenges inherent in inter-provincial and municipal and provincial cooperation. As Rola et al. (2005) explain, the involvement of local communities and institutions in all aspects of watershed management enables more creative and relevant solutions that take into account their unique social, economic and environmental conditions and values. Their inclusion also creates a sense of ownership increasing the likelihood of sustained involvement in the objectives of river basin IWRM plans (Rola et. al. 2005: 17-18).

Re-scaling Governance and Localized Watershed Management

As seen in the examples of Tigum-Aganan, the Ayuquila and Billings Reservoir, a local, sub-basin scale was the most effective with respect to watershed management. Because of the linkages communities have with the watershed at the local level, this scale of planning allows them to participate in creating, implementing and monitoring solutions. In addition, the relationship between land use, competing uses, human impacts and water conditions is easier to establish at the sub-basin scale (Rola et al 2004: 29). Planning for larger watersheds presents difficulties in isolating the impacts of natural phenomena from anthropogenic causes, as well as monitoring upstream and downstream relationships (Rola et al 2005: 30). Thus, NWRB's approach to planning at the larger Pampanga River Basin scale presents challenges to the effective management of the Angat River Basin. Despite the importance of the Angat River Basin to the province of Bulacan and Metro Manila, the recommendations and proposal for Pampanga's IWRM Plan is not inclusive of stakeholders unique to the Angat sub-basin scale. This is worrisome since solutions will be devised with the emphasis on the larger basin area. Solutions to pressing issues such as drinking water for Metro Manila and Bulacan may be overshadowed by other competing interests between municipalities, provinces and regional offices within the Pampanga Basin as well as between civil society, NGOs and the private sector. Though more localized solutions could still be subject to those planned within the water

resource region of Pampanga, planning at the Angat River sub-basin scale would ensure that issues are addressed, stakeholders are consulted and creative and relevant solutions are created for its particular context.

If a more localized approach at the Angat River sub-basin scale were adopted, stakeholders consulted would extend outside those proposed in the JICA study for the Pampanga River Basin IWRM Plan as demonstrated in Table 4.2.

Table 4.2: Proposed stakeholders for the Angat River Basin governance and planning process.

STAKEHOLDERS FOR THE ANGAT RIVER BASIN	
NATIONAL	NAPACOR MWSS NIA DENR RBCO
REGIONAL	NEDA-Region 3 DENR – Region 3, Bulacan office RBC
PROVINCIAL	Province of Bulacan Bulacan Provincial Government – Governor's Office and Provincial Council BENRO PPDO Bulacan Special Task Force on Ancestral Domain (BSTFAD) Dumagat Provincial Consultative Body of Bulacan
LOCAL-MUNICIPAL	Angat Baliwag Bustos Dona Remedios Trinidad Norzagaray Pulilan Calumpit San Rafael Plaridel Paombong Hagonoy

LOCAL-BARANGAY ¹³	<p>Angat</p> <ul style="list-style-type: none"> Niugan Donacion Taboc Sulucan Marungko Santo Cristo Laog Banaba Binagbag Baybay <p>San Rafael</p> <ul style="list-style-type: none"> Tambubong Caingin Pantubig Lico Poblacion Libis Talacsan Moronquillo Pulo <p>Bustos</p> <ul style="list-style-type: none"> Tibagan Tanawan Bonga Mayor Poblacion San Pedro Cambaog <p>Pulilan</p> <ul style="list-style-type: none"> Dampol 2nd-A Dampol 2nd-B Tibag, Dampol 1st Lumbac Poblacion Paltao Longos Santo Cristo, Taal <p>Plaridel</p> <ul style="list-style-type: none"> Rueda Dampol Sipat Lumangbayan Agnaya
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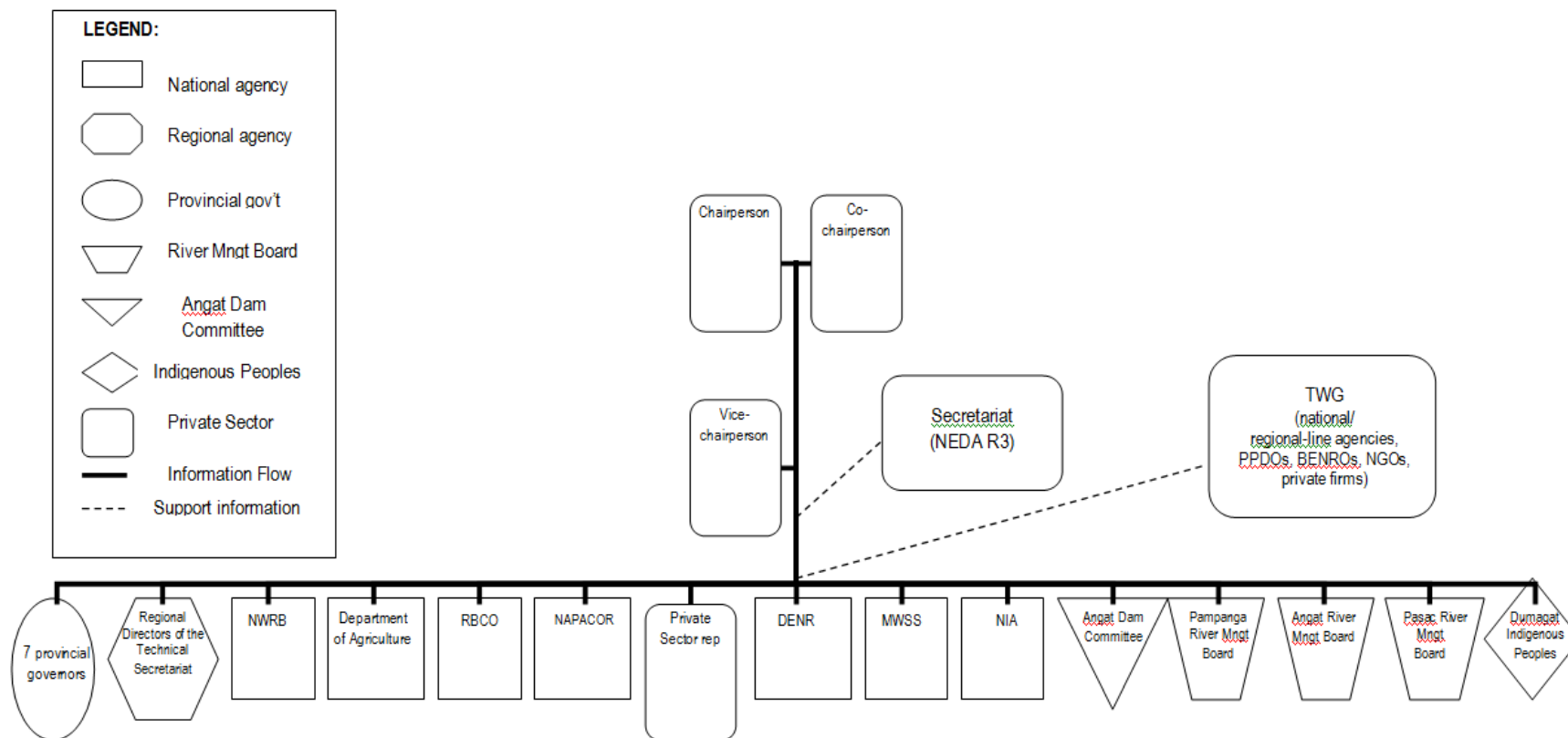
¹³ Due to limited geographical information, this list is incomplete and only lists barangays for 7 of the 11 municipalities along Angat.

	Poblacion Parulan Calianin Banga 1 st Banga 2 nd Calumpit Iba Este Ibe O'Este Caniogan Santo Nino Corazon Sucol Poblacion Calizon Bulusan Santa Lucia Meyto Hagonoy Pugad Tibaguin Santa Elena San Pablo San Pedro Abulalas Carillo
INDIGENOUS PEOPLES	Dumagat peoples
NGOs	Dangal ng Bulakan Foundation EcoWaste Coalition Sagip Sierra Madre Environmental Society Inc (SSMERSI) Diocese Ecological and Environmental Program Earth Lovers Volunteer (ELV) Global Water Partnership Philippine Watershed Management Coalition Farmer cooperatives Fisherfolk cooperatives
UNIVERSITIES	Bulacan State University De La Salle University
PRIVATE SECTOR	Food processing Mining Cement processing Marble processing Pyrotechnics Garment making

Source: Author's summary based on data from Appendix 1.

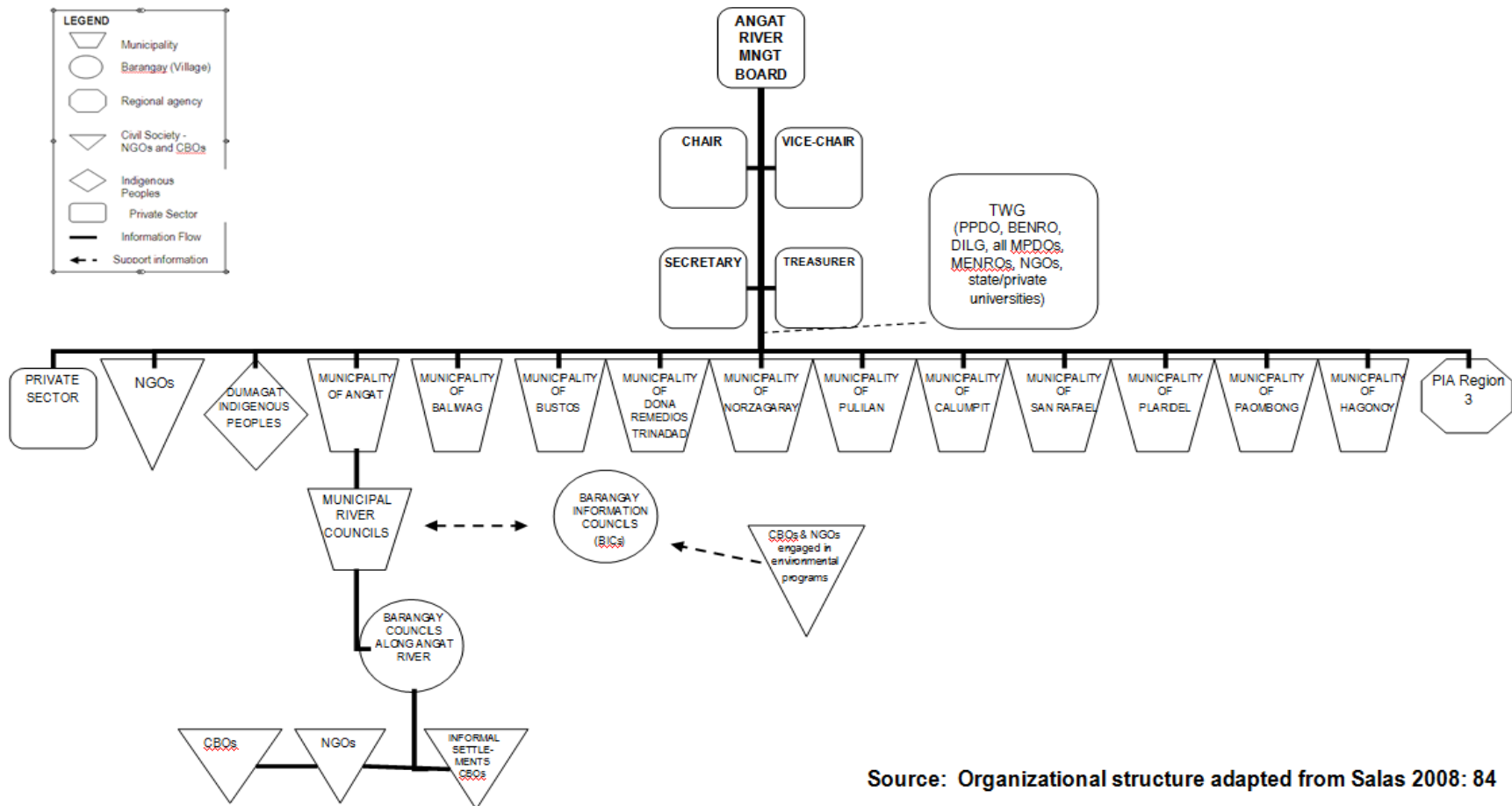
Similar to the Tigum-Aganan context, these stakeholders could be effectively organized into a more localized management board that could connect with the proposed Pampanga River Basin Committee (RBC). The Pampanga River Basin consists of 3 sub-basins: the Pampanga, Angat and Pasac river systems, thus 3 watershed management boards could be created and collaborate at larger scale, corresponding to the larger basin-wide Pampanga RBC. This would not only allow for the engagement and participation of local governments and village level leaders but also citizens, civil society, academe, informal settlers and indigenous peoples. Community level programs could be run by NGOs and information, education and communication campaigns could be tailored and focused on issues pertaining to each sub-basin's context. The needs and interests of each sub-basin would also be represented in higher level decision making with seats on the Pampanga RBC (see Figures 4.2 and 4.3).

Figure 4.2: Proposed Pampanga River Basin Committee Structure.



Source: Adapted from JICA (2011: 75).

Figure 4.3: Proposed Angat River Management Board Structure.



Source: Organizational structure adapted from Salas 2008: 84

The Angat River Management Board (ARMB) under the leadership of the Provincial Government of Bulacan would engage the 11 municipalities along the Angat River, the Province of Bulacan's Planning and Development Office (PPDO) and Environment and Natural Resource Office (BENRO) as well as the Dumagat Indigenous leaders, representatives of NGOs, and national and regional universities that are interested in river and watershed management issues, such as Bulacan State University and De La Salle University.¹⁴ Municipal River Councils (MRCs) would be created within each municipality's planning or environmental office (MENRO). These MRCs would mobilize environmental and planning staff, as well as staff involved in social welfare and development programs, especially those pertaining to informal settlements in the municipality. Through these networks, informal settlements and their leaders would be incorporated in the planning processes led by the MRCs. To inform the MRCs, barangays would create a Barangay Information Centre (BIC) as the point of contact with those at the community level. The BICs can be managed and run by barangay officials in partnership with NGOs and academe. Information, education and communication materials would be available and citizens would be able to provide their input via planning processes facilitated by barangay officials, academe members or leaders from local NGOs. This structure in coordination with the Pampanga RBC, ensures that feedback loops are created from the grassroots, community level to the municipal, provincial and regional levels ensuring all voices are heard and that plans are coordinated and relevant to issues and challenges on the ground. In addition, the involvement of citizens at the local level in the planning process builds trust and social capital with local governments and other stakeholders as well as fosters a sense of ownership and sustained involvement. Given their direct interaction and 'in-time' knowledge of the Angat River, their insights and involvement in the implementation, monitoring and evaluation of initiatives would ensure the maximum effectiveness of programming.

The proposed revised structure of the Pampanga RBC in addition to the ARMB also accounts for the importance of Angat Dam. Providing 97 percent of the drinking for Metro Manila, 10 percent of Luzon's electricity, irrigation for farms in Pampanga and Bulacan and flood control for communities downstream, the issues related to the management of Angat Dam warrant a special committee for its stakeholders. Represented in the proposed Pampanga RBC structure,

¹⁴ The Bulacan State University (BulSU) and De La Salle University (DLSU-Manila) are working with the UBC Centre for Human Settlements-School of Community Regional Planning on an international partnership research project, "Collaborative Governance of Urbanizing Watersheds" focusing on Angat Region (see Angeles 2011). The three-year research project is funded by the Social Science and Humanities Research Council (SSHRC) of Canada under its Partnership Development Grant 2012-2015, the Provincial Government of Bulacan, BulSU, DLSU and UBC.

the 'Angat Dam Committee' includes water right holders in the Angat Reservoir (NAPOCOR, MWSS, NIA, DENR) as well as representatives from the proposed ARMB. Because of the integrated nature of Angat Dam, the Angat Watershed Reservation and the rest of the Angat River Basin, the incorporation of the ARMB ensures interests and livelihoods of the local communities downstream are heard and community water management initiatives are considered especially with respect to the release of waters from Angat Dam. The Angat Dam Committee is also located within the wider scale of the Pampanga RBC to ensure consistency with higher level basin planning processes.

Legislation

As demonstrated in all the collaborative governance examples discussed, leaders utilized relevant decentralized provisions that enabled local governments to collaborate and partner with other stakeholders in the management of natural resources such as water. With respect to the Angat River Basin context, the 1991 Local Government Code (LGC) provides several provisions that would enable the 11 municipalities along its banks to collaborate with the province of Bulacan and other stakeholders at various scales in order to govern and manage the basin. As stated in Section 35, LGUs may 'enter into joint ventures and such other cooperative arrangements with people's and nongovernmental organizations to engage in the delivery of certain basic services, capacity-building and livelihood projects and to develop local enterprises designed to improve productivity and income, diversify agriculture, spur rural industrialization, promote ecological balance, and enhance the economic and social well-being of the people' (LGC 1991, Sec 35). Section 36 states that financial and technical assistance may be provided to POs and NGOs for 'economic, socially-oriented, environmental or cultural projects to be implemented within its territorial jurisdiction' (LGC 1991, Sec 36).

In addition to these provisions in the LGC, provincial ordinances were effective in providing the legal basis for the creation of a watershed council as demonstrated in the province of Iloilo and the establishment of the Iloilo Watershed Management Council (IWMC). With the Angat River Basin and its adjacent municipalities situated in the province of Bulacan, such an ordinance would be useful to facilitate the creation of the proposed Angat River Management Board (ARMB). As exemplified by the IWMC, this dovetails with Philippine Agenda 21's definition of sustainable development described as communities stimulating their local economies, building partnerships between business, government and civil society and pursuing development

anchored on natural systems (PCSD website 2012). More specifically, the creation of the ARMB would align with two memoranda in the PA21 (Memoranda Orders No. 399/1996 and 47/1999) which require government agencies and LGUs to align their plans and policies with Philippine Agenda 21 and for LGUs to formulate and implement their respective sustainable integrated development plans (Salas 2004: 217). As sustainable development is embedded in watershed management and rehabilitation, planning at the provincial, basin and local levels would inevitably incorporate these principles. Overall, an opportunity exists for the Province of Bulacan to take advantage of this legislative context in order to mobilize citizens, local governments and civil society and get them actively involved in the rehabilitation and management of the Angat River.

Inclusion of Informal Settlements and Marginalized Populations

A key lesson explored in the example of the Billings Reservoir in Brazil is the importance of including informal settlements and other marginalized populations in the watershed planning process. With the rapidly expanding population of Metro Manila and improved transport access to Bulacan, the province is quickly becoming the bedroom community of the country's National Capital Region, Metropolitan Manila. As such, more affordable market housing is increasing in Bulacan municipalities, as well as informal settlements along the banks of the Angat River from both this in-migration and resettlement from Metro Manila. With no access to basic services such as sanitation, waste water or garbage collection, these areas are a large contributor to pollution in the Basin. Drawing from the lessons learned in the Billings Reservoir, incorporating these communities in the planning process is possible using a more localized, collaborative governance model as illustrated in Figure 4.3. The model of the Angat River Management Board (ARMB) would incorporate informal settlers in the Municipal Watershed Council processes. These inter-sectoral councils would have to include staff from MENRO, Municipal Planning and Development Office (MPDO) and Municipal Social Welfare and Development Office (MSWDO). Building on social and economic programs and initiatives already at work in the informal settlements, community residents would have the opportunity to organize themselves into leadership groups to represent their concerns in Angat's planning process and be directly involved in the decision making processes at the municipal level. The feedback gathered here would feed into municipal plans for Angat's management and in turn inform plans made within the larger Pampanga River Basin Committee.

In addition to the communities within the informal settlements, other marginalized populations such as the Dumagat Indigenous peoples also need to be incorporated in the ARMB structure. This is consistent with the recognition, protection and promotion of the rights of indigenous cultural communities stated in the Indigenous People's Rights Act (IPRA - Republic Act No. 8371/1997). The IPRA also legislates their participation in decisions affecting services such as education and health, recognizes their rights to their ancestral domains, their right to manage and conserve natural resources and the establishment of the Ancestral Domains Fund which contributes 130,000,000 pesos to cover the compensation for expropriated lands, delineation and development of their ancestral domains (IPRA Sec. 71). Given this legislative context, the ARMB structure incorporates the Dumagat Indigenous Peoples alongside the 11 municipalities of the Angat River Basin given their stake in the Sierra Madre Mountain area of the watershed. As with the inclusion of the informal settlers, the Dumagat peoples will have their voice incorporated in the plans at the Angat River sub-basin level. In addition, in order to be consistent with provincial level programs, groups such as the Bulacan Special Task Force on Ancestral Domain (BSTFAD) and the Dumagat Provincial Consultative Body of Bulacan may be consulted and included in these discussions to build on existing initiatives or projects.

Education and Information Dissemination

One of successful elements of all the watershed management strategies explored were linked to their ability to mobilize upstream and downstream stakeholders in the planning and implementation processes through robust information, education and communication programs. Given the scale of management and limited capacity for the implementing bodies to reach all communities, an effective and continuous environmental education and awareness program was essential. This was achieved through partnerships with national communication entities such as the Philippine Information Agency (PIA), academic research institutions such as IMECBIO in Mexico and informal settlement upgrading programs such as those in Santo Andre, Brazil. Through the PIA, the Tigum-Aganan Watershed Management Board (TAWMB) was able to utilize all forms of media such as print, radio and television with access to a wide audience throughout the watershed. With varying accessibility to print and television, radio became the most popular medium for information and education about the watershed's issues. Programming included reporting on the progress of rehabilitation programs and educating and engaging citizens with a 'school on air' program that included call-in segments allowing callers to voice their concerns to decision makers (Salas 2004: 220). In addition to bridging the

communications gap between local officials on the TAWMB and citizen listeners, this information, education and communications strategy improved scientific literacy among the communities enabling NGOs and POs to effectively mobilize concerned citizens in restoration, management and information programs (Salas 2008: 93). Given the voluntary nature of participation in these programs, the continuous nature of this education program was crucial to foster sustained interest and engagement.

In the Ayuquila River Basin, IMECBIO, a research institution from the University of Guadalajara, played a key facilitative role building the capacity of municipal governments to form solutions to pollution issues in the watershed and educating and engaging upstream and downstream communities through an environmental education program (Castillo et al 2002; Montero et al 2006). Given its knowledge and research expertise, IMECBIO used its scientific findings to achieve these objectives. In addition, they empowered citizens by providing opportunities to apply their knowledge in the planning process as well as restoration and monitoring activities. Through these efforts, communities recognized both the ecological and social linkages of pollution evidenced in the creation of programs that reduced solid waste, innovative and inclusive partnerships in the establishment of recycling centres, the formation of civil society groups focused on maintaining the health of the watershed and promoting school-based environmental education programs. Most importantly however, IMECBIO's involvement in building the capacity of citizens has resulted in wide public support of Ayuquila's watershed management strategy and the resilience of the Ayuquila Watershed Commission in the midst of changing political leaders and conflicts among political parties (Montero 2006: 207).

The incorporation of environmental education within *favela* upgrading programs achieved similar results as described in the case of Santo Andre. As with both the Tigum-Aganan and Ayuquila examples, these programs raised the awareness of the links between community health and well-being and the management of the Billings Reservoir. These resulted in the formation of civil society groups such as *Camara Technica* and community led initiatives such as solid waste management programs and community based environmental monitoring. These linkages between social and infrastructure development with watershed management ensured that all aspects of community health were addressed and transcended the siloed nature of programming prior to the participation and capacity building of the informal settlement communities.

In light of these lessons gleaned from the three contexts explored, the implications for the Angat River Basin have been incorporated into the proposed models for the Pampanga River Basin Committee (RBC) and the Angat River Management Board (ARMB) (Figures 4.2 and 4.3). Like the TAWMB structure, the ARMB incorporates the Philippine Information Agency (PIA), and regional and national universities, such as Bulacan State University (BuSU) and De La Salle University (DLSU), so far the two institutions of higher education that have expressed interest in doing research, institution and capacity-building with the Bulacan provincial government and the 11 municipalities along the Angat River (see Angeles 2011). In due time, more colleges and universities, as well as elementary and high schools could be involved in developing environmental programs on Angat River. Unlike JICA's recommended structure for the Pampanga RBC, the inclusion of these institutions at the local level ensures that the research capacity and knowledge of academic institutions and citizens on the ground is utilized to build the capacity of local governments and civil society groups. Their involvement in the ARMB also creates a feedback loop between traditional, local, academic and governmental knowledge maximizing the opportunities for more resilient and creative solutions. The inclusion of the PIA enables the ARMB to tap into its resources and networks in order to develop a basin-wide information, education and communications campaign. Developing these initiatives at the local and community level ensures that the campaigns and outreach strategies are relevant to the issues within the municipalities and communities in the sub-basins of the Pampanga River and that social capital is created and strengthened through these new networks.

In addition, incorporating universities and research institutions within the structure of the river management boards and within the Technical Working Group (TWG) of the Pampanga RBC increases the operational and institutional capacities of these bodies at the basin and local level as well as empowers citizens and civil society at the grassroots. By sharing current research and teaching communities and local governments the science and technical aspects of watershed management, projects and initiatives can be implemented by stakeholders in contact with the watershed, giving communities the tools to solve the issues that directly affecting their livelihoods and health. Also, as seen in the Ayuquila Basin and Santo Andre examples, universities serve as effective facilitators between government, communities and the private sector, presenting new and cooperative ways to address problems and resolve heated conflicts.

Funding

With the unreliability of external financial resources, the Iloilo Watershed Management Board (IWMC), Tigum-Aganan Watershed Management Board (TAWMB) and the Ayuquila Watershed Commission (AWC) came up with unique solutions to internally fund rehabilitation and water management projects. Given the collaborative nature of the IWMC and TAWMB structures, pooled municipal resources were a significant source of funding as well as national and international aid funding which was initially provided during the rehabilitation of the Maasin Watershed. To obtain further sustainable sources of revenue, the IWMC charged environmental service fees to large scale users in the watersheds by utilizing provisions in the Local Government Code (LGC). One of these users was the Metro Iloilo Water District (MIWD) which extracted water from the Maasin sub-basin in order to provide potable water to Iloilo City. Utilizing Sections 289, 386(b), 291 and 293 of the LGC, IWMC charged MIWD 1% of their gross revenue which was used for the protection and development of the Maasin sub-basin (Francisco 2004: 35, Appendix 6). This is similar to the funding strategy in the municipality of Santo Andre which utilized its power to impose, fees, charges and taxes as well as fines for environmental violations. At the more local level, the TAWMB obtained funding from its citizens, NGOs and POs who organized fundraising activities for smaller scale, community based initiatives. Because of the success of its information, education and communications strategy, these activities were successful and furthered the sense of ownership among the communities.

In the Ayuquila Basin, the AWC utilized its institutional networks and partnerships with the University of Guadalajara's research institution, IMECBIO and the federal government's biosphere reserve management arm, DRBSM, in order to diversify its revenue sources. With DRBSM's connection to the internationally recognized UNESCO Man and Biosphere Program through Sierra de Manantlan Biosphere Reserve and IMECBIO's international academic networks, funding and other forms of technical or research support for the management of the Ayuquila River were provided.

There are several implications from these examples that can be applied to the context of the Angat River Basin. Firstly, given the number of large scale users in the Angat River and more specifically, the Angat Reservoir, environmental user fees could be a significant form of revenue for projects implemented by a watershed management body such as the ARMB or the Pampanga RBC. With the collaboration of municipalities and participation of the Province of

Bulacan, these management bodies could utilize the provisions in the LGC which mandate the sharing of 'natural wealth' within 'the Philippine Territorial jurisdiction' through fees or charges (Francisco 2004: 35). Other fees or charges could pertain to effluent discharge for private industries in the Pampanga River and its sub-basins. Secondly, given the localized nature of the ARMB, fundraising activities could be implemented within the municipalities. There has already been evidence of this facilitated by the Province of Bulacan's Environmental Office (BENRO) in efforts to raise funds for the Province's environmental protection and preservation programs and development projects including those in the Angat River Basin (Lazaro 2011). In addition to these province-wide initiatives, more fun, personalized, community led fundraising campaigns can also be created such as the grassroots initiative that sold T-shirts to residents stating 'I live in the Tigum-Aganan Watershed' (Salas 2008: 82). Finally, given the key roles of Bulacan State and De La Salle Universities in the current international research partnership with the University of British Columbia, funded by the Canadian federal research agency SSHRC with counterpart funding from provincial government and Philippine university partners, broader national and international academic networks can be utilized in the form of research grants or technical assistance. For example, this international research partnership considers not only the specific action research and capacity building needs in creating effective legal-institutional frameworks in the Angat Basin region, but also linking these needs with wider watershed and land use sustainability and climate risks adaptation in the long-term. Though not always concerned with revenue-generation, academic institutions have the comparative advantage in terms of access to knowledge and human resources such as practitioners and students and can mobilize them to aid in capacity building and operational activities at the local level. Because compensation is not always financial for these activities, this can be a cost effective solution to managing information, education or communication campaigns.

The funding model currently under consideration in the 2011 JICA study suggests that the total investment cost of projects related to Pampanga's IWRM Plan (approximately 70.1 billion pesos) be fully recovered through the collection of water service charges (JICA 2011: 6) and additional funding from the DENR (75). Though idealistically these two strategies would result in full cost recovery, the Study also recognizes the reality of 'materializ[ing] the financial sustainability for the Pampanga River Basin IWRM is one of the biggest challenges' (JICA 2011: 75). Thus, by incorporating the lessons learned in the three examples explored in this project, additional funding opportunities can be created in the rescaling and inclusion of localized water management strategies. Enabling the collaboration of municipal and provincial

governments, academic institutions, NGOs, civil society and citizens, not only facilitates the pooling of resources but also takes advantage of new collective bargaining power in the securitization of loans or other forms of international/national aid for specific projects or the operation and maintenance of the Pampanga RBC and ARMB.

5 RECOMMENDATIONS AND CONCLUSIONS

Having explored the implications of the three case studies on collaborative governance in practice, this section provides recommendations for the PPDO based on these findings as well as attempts to answer the primary and subsidiary research questions posed at the beginning of this project. It also suggests some future project ideas and areas of research with respect to collaborative governance and its application in the Angat River Basin.

5.1 Recommendations for the PPDO

Based on the best practices and implications explored in the applied collaborative governance examples of the Tigum-Aganan Watershed, the Ayuquila River Basin and the Billings Reservoir, six recommendations were formulated for the Bulacan Planning and Development Office (PPDO) related to its key role in implementing collaborative governance and integrated management in the Angat River Basin. These include: (1) coordinating municipalities and other stakeholders, (2) including river basin management in capacity building activities, (3) lobbying for a more localized sub-basin management approach, (4) utilizing provisions in the Local Government Code and the Philippine Development Plan, and, (5) mobilizing knowledge and resources for the Angat River Basin planning and management.

Coordinating municipalities and other stakeholders

Tasked with planning the sustainable development of Bulacan, the PPDO plays a key role in coordinating plans, sectors, municipal governments and other stakeholders in overall provincial development planning consistent with national and international legislative frameworks. In addition, because of the PPDO's limited position to implement policy (which was decentralized to the municipalities in 1991 via the LGC), one of its main activities is capacity building among municipalities especially in the formulation of their Municipal Land Use Plans (LUPs). With a legacy of participatory and synchronized planning in the province, as well as active participation and support of mayors, municipal councils and local NGOs, the PPDO has formed long-standing cooperative and productive relationships that could easily be tapped for Angat River governance and management. This is a very strategic position given the needed support and partnership between the 11 municipalities along the Angat River in a collaborative governance and management structure. The PPDO can serve as an informational and coordinating body

eliciting the 'buy-in' of affected municipalities as well as distinguishing a strategic municipal leader to champion the process.

During my internship and field studio work, this role was initiated by Mayor Tessie Vistan of the Municipality of Plaridel who headed the ad hoc Angat River Management group. Because of her influence and support among her fellow municipal leaders as well as her strategic position within her last term in office, Mayor Vistan began a conversation about building a coalition of municipalities along Angat River in order address the challenges presented by pollution and mismanagement. Though these ideas were never put into practice, the PPDO could utilize its knowledge of municipal partners and incentivize municipal champions like Mayor Vistan whose jurisdictions are within the Angat River Basin.

Including river basin management in capacity building activities

Since the 1991 Local Government Code (LGC) has decentralized regulatory powers to municipalities, the PPDO's mandates largely focus on capacity building with local governments to realize objectives set out in the province's various plans. Because watershed management is an inevitable part of land use planning in the 11 municipalities along the Angat River Basin, it follows that the PPDO include this and informational resources in its capacity building activities. Examples of provincial plans that address these issues include Bulacan's Comprehensive and Physical Framework Plan and the proposed Pampanga River Basin IWRM Plan which assess environmental and natural resource characteristics in these areas. By providing informational resources on the state of the Angat River Basin through the PPDO's research and GIS capability, municipalities can better coordinate their development and land use activities to support its rehabilitation and sustainability as well as recognize the importance of coordinating with other municipalities in their initiatives.

Lobbying for a more localized sub-basin management approach

As seen in the examples of collaborative governance explored in this project, localized sub-basin management was the most effective approach in ensuring the rehabilitation and sustainability of the watershed. The PPDO plays a key role in working with BENRO, the Sangguniang Panlalawigan (Provincial Council), the Governor and Vice-Governor to lobby for this approach in the management of the Angat River Basin. Given the challenges of competing

interests, solutions formulated at the more local level would ensure their relevancy and sustainability given the ground knowledge and stake of these communities in the Basin. Support for a management body such as the Angat River Management Board (ARMB) proposed in this project would be essential to coordinate with the higher level Pampanga River Basin Committee. In light of the Governor Sy-Alvarado's environmental agenda that has received national recognition and local support, these initiatives dovetail with the direction of many current projects already being undertaken in the Basin.

Utilizing provisions in the Local Government Code

As discussed in the previous section, several provisions in the Local Government Code exist to facilitate the collaboration between the province, local governments and other stakeholders to manage the Angat River Basin. Relevant sections include:

- ◆ *Section 35* - which enables LGUs to enter into joint ventures and cooperative arrangements with POs and NGOs to deliver basic services, engage in capacity building and livelihood projects and to develop local enterprises, and,
- ◆ *Section 36* – which states that financial and technical assistance may be provided to POs and NGOs for economic, socially-oriented, environmental or cultural projects (LGC 1991).

The BENRO and PPDO can jointly raise awareness of these provisions and their applicability to the management of the Angat River Basin when engaging municipalities in capacity building initiatives. In addition, the PPDO can play a supportive role by proposing ordinances for the creation of an Angat River Management Board to the Governor, Vice-Governor and Provincial Council.

Mobilizing knowledge and resources for Angat River Basin planning and management

Through its various planning processes, the PPDO has access to a large amount of data and resources regarding the social, economic and environmental state of the province. It is also one of the few provincial planning departments in the Philippines that have a GIS division. Thus, the PPDO can play a supportive role by utilizing these resources and data gathering hubs to formulate plans and a management scheme for the Angat River Basin. In addition, mobilizing its university and research partners would also aid in ensuring plans incorporate up-to-date and accurate data.

5.2 Revisiting the Project Research Questions

The primary research question posed at the beginning of this project was *how can collaborative governance work as a mechanism for the management of Angat River?*

In light of the implications of the three case studies explored, collaborative governance provides an approach that is consistent with the integrated nature of the issues facing the Angat River Basin. As illustrated in the proposed Angat River Management Board structure in Figure 4.3 (see page 90), it is a tool to bring all those who have a stake in the Basin to the decision making table including marginalized populations. This not only results in creating a sense of ownership but also increases the creativity, relevancy and resiliency of solutions. It also builds trust and social capital among all stakeholders involved bridging the gap between citizens, civil society and local government and bringing in new and diverse forms of funding. Using this in a more localized context, contrasts the more “siloed approach” ineffectively used in the past. By bringing this kind of mechanism to the sub-basin, local scale, capacity building within local governments and among citizens and civil society is possible, empowering them to manage and solve problems at the level they are created.

Subsidiary Question #1 and 2: Given the context of the Angat River Basin and its various competitive uses, what are the lessons that may be gleaned from some existing examples of collaborative governance models used in similar contexts? What are the implications of these collaborative governance models for the Angat River?

The examples of the Tigum-Aganan and Ayuquila Watershed and Billings Reservoir illustrated the similar contexts as the Angat River Basin. All were vital sources of water for nearby communities for domestic uses and livelihoods as well as for industry, irrigation, hydroelectricity production and environmental protection. As discussed in Sections 3 and 4, the lessons gleaned from these examples were based in their localized collaborative governance approach to river basin management. These cases utilized provisions in enabling legislation such as the Local Government Code to create partnerships between municipalities, other government sectors, NGOs, POs, citizens and universities and form management boards and councils to address issues within the watersheds. As illustrated in the example in the Billings Reservoir in Brazil, marginalized communities such as informal settlements, women and youth were also engaged. In order to build the capacity of local governments, civil society organizations and citizens and keep them informed of new developments, all examples also stressed the

importance of a robust information, education and communications campaign using media channels suitable to the target population. This not only raised the scientific literacy of communities with respect to water issues but also engaged and empowered them in the implementation, monitoring and evaluation aspects of local projects. This led to more grassroots, autonomous funding models such as fundraising campaigns and municipal revenue allotments to river basin rehabilitation and protection projects. Overall, it was through the localization of management that these efforts were realized and that solutions were tailored and targeted to the specific context of the communities with a direct stake in the river basins. The implications of this approach for the Angat River Basin is the establishment of a local board such as the Angat River Management Board (ARMB) to coordinate with the higher level or scale of the Pampanga River Basin Committee (see Figures 4.2 and 4.3).

Subsidiary Question #3: How will these potential collaborative governance models involve and connect with the competing uses and unique issues facing the Angat River Basin (e.g., influence of Metro Manila and its domestic water demand, growth of informal settlement in Bulacan and illegal water connections, the potential privatization of Angat Dam)?

A more localized model such as the Angat River Management Board (ARMB) would allow the 11 municipalities along its banks, NGOs, the private sector, informal settlements and provincial and regional departments to coordinate their decisions and pool their resources and knowledge together. This would not only increase social and political capital but also potential voting power in negotiations with powerhouses such as Metro Manila Development Authority and other stakeholders (e.g. Manila Waterworks and Sewerage Services, National Power Corporation, National Water Resource Board, etc.) involved in decision-making on natural resources such as water. In addition, with this model, informal settlement communities are included in the decision making process. By partnering informal settlement leaders with local government environmental, planning and social development representatives already implementing projects in these areas, growth can be mitigated and create less impacts on the Angat River Basin.

Though the privatization of Angat Dam is within national jurisdiction, the ARMB could partner with other national departments that have rights in the Angat Reservoir such as NAPOCOR, DENR or MWSS. This partnership could be used to propose a new management scheme for

Angat Dam building on proposals by the MWSS and explore the potential for public-private partnerships with NAPOCOR. Given its increased lobbying power, the ARMB could also stand in solidarity with more advocacy oriented groups such as the Freedom from Debt Coalition which successfully launched a legal challenge that opposed the privatization of Angat Dam on the grounds of Constitutional rights.

Subsidiary Question #4: How do these implications relate to the current role and capacity of Local Government Units (LGUs) at the municipal and barangay (village) levels?

One of the biggest challenges for many LGUs in implementing their mandates is the lack of capacity and expertise to do so. A more collaborative approach to management of the Angat River Basin would address this by increasing access to resources, expertise and funding as demonstrated in the three case studies explored in this project. Given the inter-sectoral and multi-tiered nature of a body such as the ARMB, LGUs would have access to the resources and capacity building potential of universities, research institutions and technical NGOs. This would enable LGUs to become more capable of addressing river basin and environmental challenges within their jurisdictions and enable them to partner with experts to formulate solutions for wider basin issues. In addition, partnership among LGUs and NGOs for natural resource management projects enables them to access funding as stated in Section 35 and 36 of the Local Government Code as well as join their resources together with partnering municipalities. However, although this addresses aspects of funding on the project level, other areas such as increased environmental enforcement at the barangay level or MENRO departmental funding requires the resources and intervention of DENR or NEDA.

5.3 Areas of Future Research and Projects

This project serves to be only the starting point of discussion regarding the potential for collaborative governance in the management of the Angat River Basin. There is an enormous potential for future research and projects in this area as well as its connection to collaborative governance and IWRM literature internationally. With respect to the Angat River Basin, a more detailed research project on the feasibility and potential implementation of a localized management approach such as the ARMB would be an interesting counterpoint to the current formation of the Pampanga River Basin Committee (as outline in the 2011 JICA Study on the Pampanga River Basin IWRM Plan) by NWRB, NEDA and the River Basin Control Office. In

addition, an analysis and evaluation of the Pampanga RBC formation and planning process would also shed light on its potential strengths, weaknesses, opportunities and threats. Research on potential funding schemes for the RBC and ARMB is also needed to enable them to better determine the feasibility and extent of its mandates.

With respect to further research in the Philippines and internationally, more case studies on the application of collaborative governance and IWRM theory in practice is needed, especially with respect to its applicability at the community level. Thus, any community level and/or longitudinal research involving the implementation and future impacts of these approaches to river basin management would be invaluable to the water resource management sector.

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[wds.worldbank.org/external/default/WDSPContentServer/WDSP/IB/2004/05/24/000012009_20040524135608/Rendered/PDF/282970PH0Environment0monitor.pdf](http://www-wds.worldbank.org/external/default/WDSPContentServer/WDSP/IB/2004/05/24/000012009_20040524135608/Rendered/PDF/282970PH0Environment0monitor.pdf)

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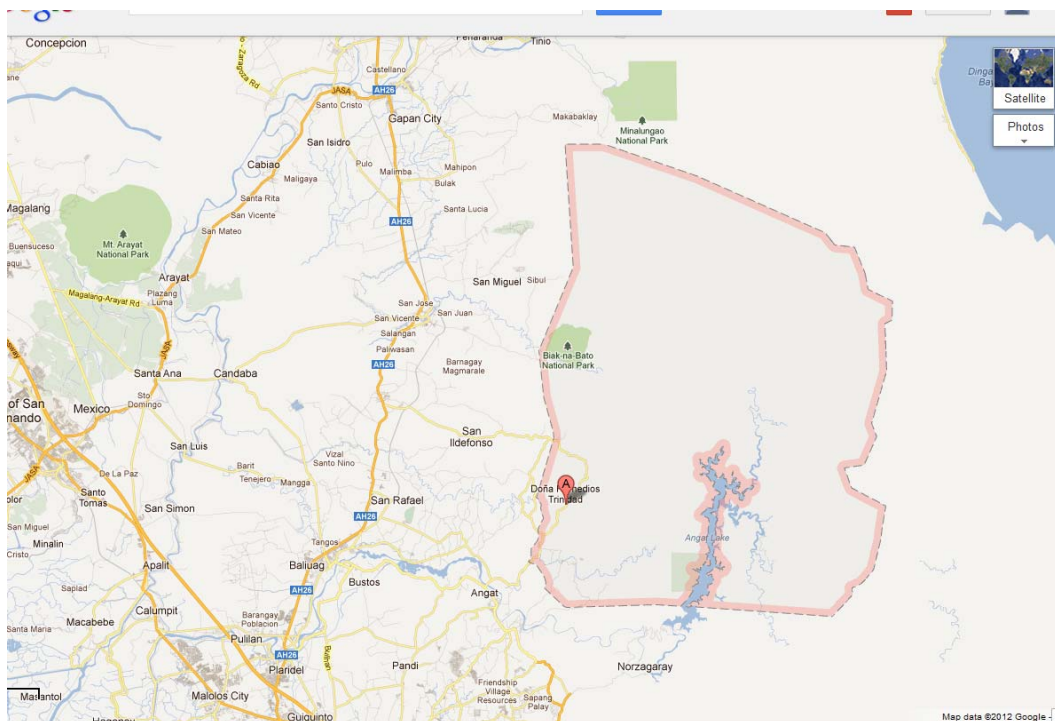
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APPENDIX 1

Angat River Municipality Profiles

RURAL MUNICIPALITY OF DONA REMEDIOS TRINIDAD



MAP:

http://maps.google.ca/maps?hl=en&cp=6&q=2e&xhr=t&q=norzagaray&bav=on.2.or.r_gc.rpw.r_cp.r_qf,.cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

- 1st class rural municipality
- Population = 19,086 (2007)
- Households = 2808
- Land Area = 93,296 ha (largest municipality in Bulacan)
- Barangays = 8
 - Flat terrain
 - 66.81% agricultural, 10.42% residential, 2.48% industrial, 0.89% commercial, 1.05% other
 - 2.06% land of Bulacan

POPULATION CENSUS OF DONA REMEDIOS TRINIDAD		
Census	Population	Rate
1995	11,194	--
2000	13,636	4.33%
2007	19,086	4.75%

Watershed:

- DRT contains the Angat Lake and Watershed Reservation, Biak-na-Bato National Park

- The Angat River begins here in the Sierra Madre Mountain Reserve
- No information about barangays near watershed provided

Commerce and Industry

Major Industries:

Farming, livestock raising and marble

Major Products:

Fruits and Vegetables

Indigenous/Raw Materials Available:

Coconut and yantok

Political Subdivision

Doña Remedios Trinidad is politically subdivided into the following 8 [barangays](#):

- | | |
|--------------|--------------------|
| 1. Bayabas | 5. Kalawakan |
| 2. Camachile | 6. Pulong Sampalok |
| 3. Camachin | 7. Sapang Bulak |
| 4. Kabayunan | 8. Talbak |

Contact Information

Municipal Officials:

Mayor Ronaldo T. Flores

Vice Mayor Jayvie C. Manalo

Mailing Address:

Engr. Susan B. de Guzman

Municipal Planning and Development Office

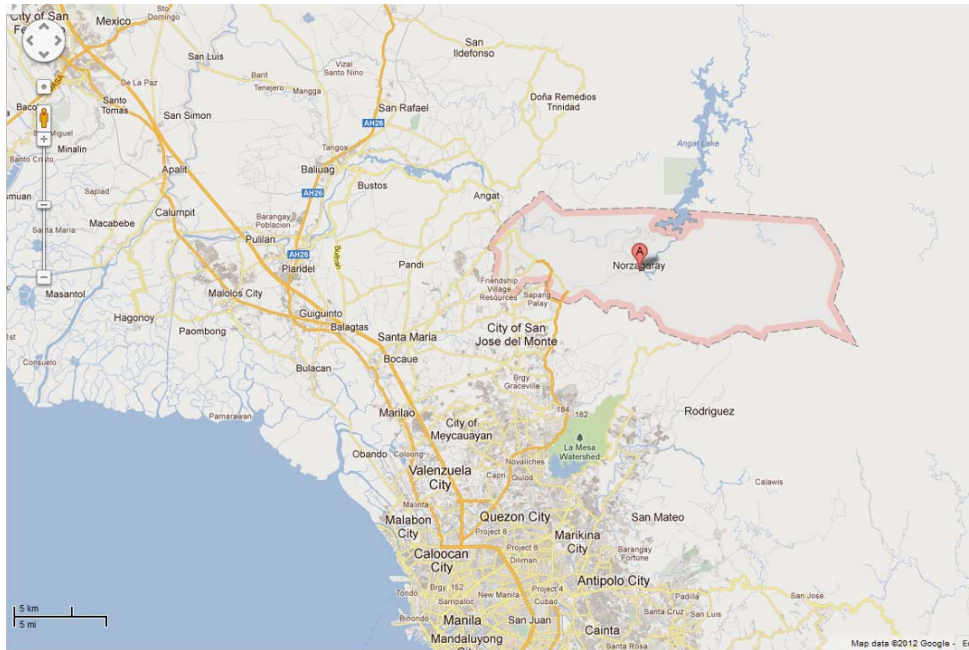
MUNICIPAL GOVERNMENT OF DOÑA REMEDIOS TRINIDAD, BULACAN

Doña Remedios Trinidad, Bulacan 3009 Philippines

Contact Nos:

Tel: +63(918) 9081519

MUNICIPALITY OF NORZAGARAY



MAP:

http://maps.google.ca/maps?hl=en&cp=6&q=norzagaray&bav=on.2,or.r_gc.r_pw.r_cp.r_qf,.cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

(Source: Bulacan Government Website - <http://www.bulacan.gov.ph/norzagaray/index.php>
Wikipedia - http://en.wikipedia.org/wiki/Norzagaray,_Bulacan)

- 1st class municipality
- Population = 105,470 (2007)
- Land Area = 28.852 ha
- Barangays = 13

POPULATION CENSUS OF NORZAGARAY		
Census	Population	Rate
1995	51,015	--
2000	76,978	9.23%
2007	105,470	4.44%

Watersheds:

- Angat River (where Ipo Dam and Angat Hydroelectric Plant and Dam is located)
- In the Angat River Watershed Reservation – lots of tourism here

Commerce and Industry

Major Industries:

Cement, Marble/Marble Processing, Food/Food Processing, Pyrotechnics

Major Products:

Bakeries, Processed meat and Agricultural products

Indigenous/Raw Materials Available:

Cement and Marble

Political Subdivision

Norzagaray is politically subdivided into the following 13 [barangays](#):

- | | |
|---------------------------------|-----------------|
| 1. Bangkal | 8. Partida |
| 2. Baraka | 9. Pinagtulayan |
| 3. Bigte | 10. Poblacion |
| 4. Bitungol | 11. San Lorenzo |
| 5. Friendship Village Resources | 12. San Mateo |
| 6. Matictic | 13. Tigbe |
| 7. Minuyan | |

Contact Information**Municipal Officials:**

Mayor Feliciano P. Legaspi

Vice Mayor Rogelio P. Santos, Jr.

Mailing Address:

Ms. Yolanda C. Ervas

Municipal Planning and Development Office

MUNICIPAL GOVERNMENT OF NORZAGARAY, BULACAN

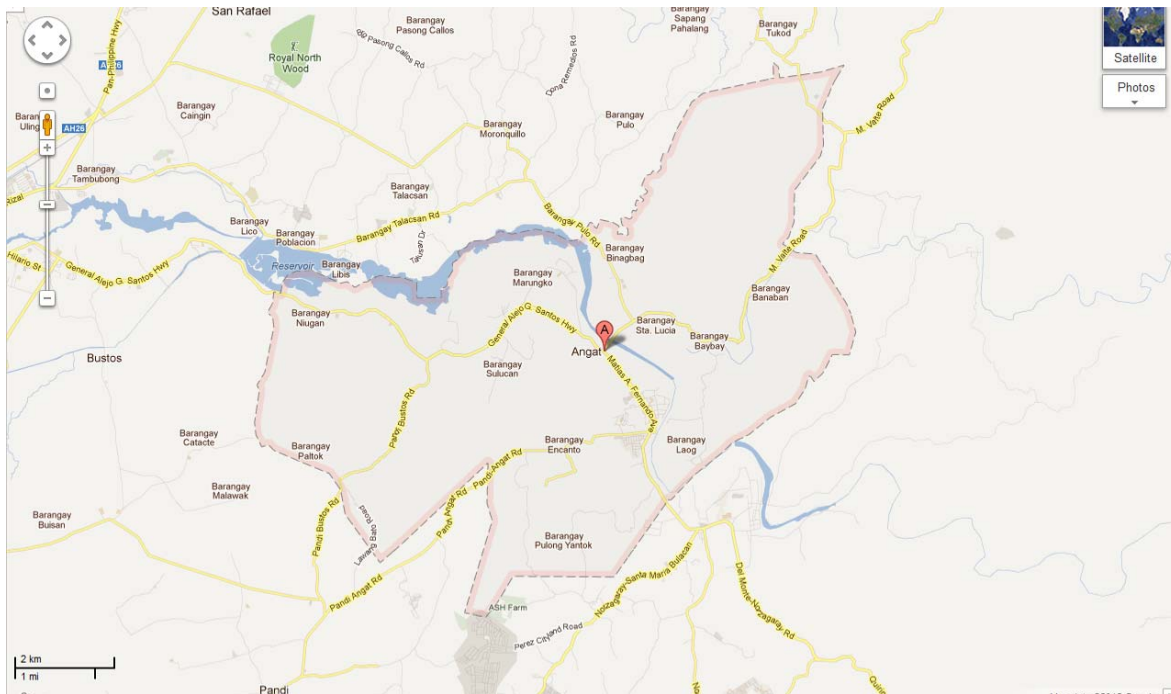
Norzagaray, Bulacan 3013 Philippines

Contact Nos:

Tel: +63(44) 694-1715; 694-1566

Fax: +63(44) 694-0626

MUNICIPALITY OF ANGAT



MAP:

http://maps.google.ca/maps?hl=en&cp=6&q=Angat,Bulacan&id=2e&xhr=t&q=norzagaray&bav=on.2,or.r_gc.r_pw.r_cp.r_qf.,cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

(Source: Bulacan Government Website - <http://www.bulacan.gov.ph/angat/index.php>
Wikipedia - http://en.wikipedia.org/wiki/Angat,_Bulacan)

- 2nd class municipality
- Population = 53,117 (2007)
- Land Area = 7400 ha
- Barangays = 16

POPULATION CENSUS OF ANGAT		
Census	Population	Rate
1995	39,037	--
2000	46,033	3.60%
2007	53,117	1.99%

Watersheds:

- Contains the Angat Reservoir

Barangays near Angat River:

- Niugan
- Donacion
- Taboc
- Sulucan
- Marungko
- Santo Cristo
- Laog
- Banaba
- Binagbag
- Baybay

Commerce and Industry**Major Industries:**

Farming, poultry and livestock raising, concrete aggregates, marble, business manufacturing, garments

Major Products:

Rice, Vegetables

Indigenous/Raw Materials Available:

Gravel and Sand, Marble, Silica

Political Subdivision

Angat is politically subdivided into the following 16 [barangays](#):

- | | |
|-------------|-------------------------------------|
| 1. Banaban | 9. Paltok |
| 2. Baybay | 10. Pulong Yantok |
| 3. Binagbag | 11. San Roque (formerly Poblacion) |
| 4. Donacion | 12. Santa Cruz (formerly Poblacion) |
| 5. Encanto | 13. Santa Lucia |
| 6. Laog | 14. Santo Cristo |
| 7. Marungko | 15. Sulucan |
| 8. Niugan | 16. Taboc |

Contact Information**Municipal Officials:**

Mayor Gilberto C. Santos

Vice Mayor Leonardo R. de Leon

Mailing Address:

Mrs. Belen S. Avestruz

Municipal Planning and Development Office

MUNICIPAL GOVERNMENT OF ANGAT, BULACAN

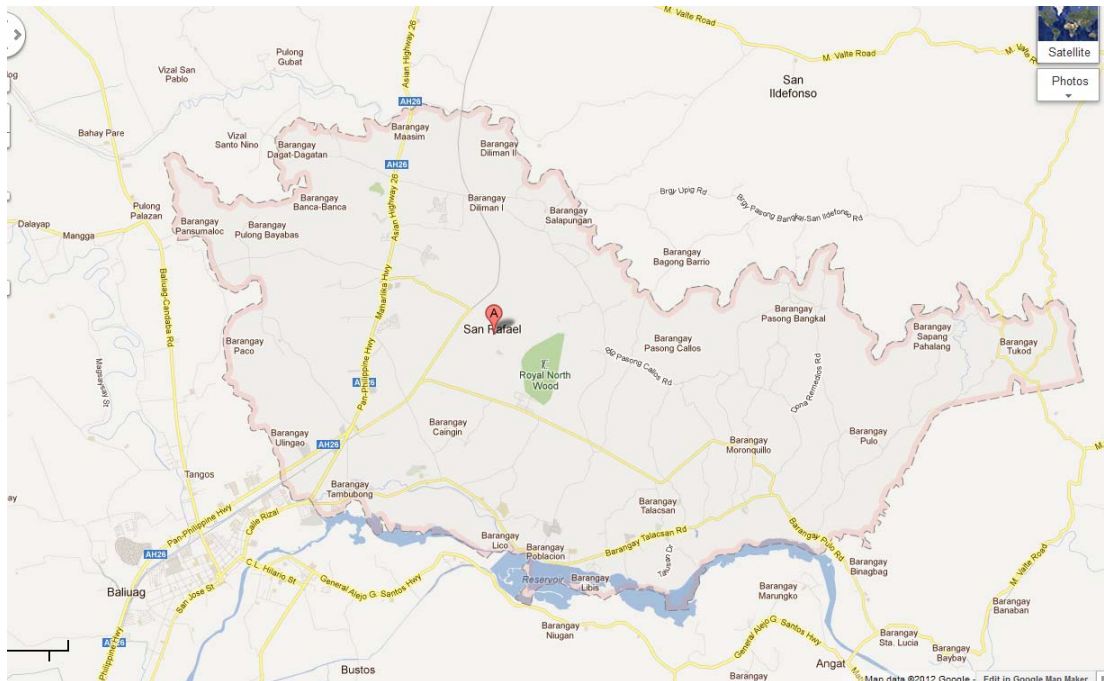
Poblacion, Angat, Bulacan 3012 Philippines

Contact Nos:

Tel: +63(44) 671-0873; 671-1274

Fax: +63(44) 671-165

MUNICIPALITY OF SAN RAFAEL



MAP:

http://maps.google.ca/maps?hl=en&cp=6&q=San Rafael, Bulacan&id=2e&xhr=t&q=norzagaray&bav=on.2,or.r_gc.r_pw.r_cp.r_qf.,cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

(Source: Bulacan Government Website- <http://www.bulacan.gov.ph/sanrafael/index.php>
Wikipedia- http://en.wikipedia.org/wiki/San_Rafael,_Bulacan)

- 1st class municipality
- Population = 85,284 (2007)
- Land Area = 15,243 ha
- Barangays = 34

POPULATION CENSUS OF SAN RAFAEL		
Census	Population	Rate
1995	58,387	--
2000	69,770	3.90%
2007	85,284	2.81%

Watersheds:

- Angat River

Barangays near Angat River:

- Tambubong
- Caingin
- Pantubig
- Lico

- Poblacion
- Libis
- Talacsan
- Moronquillo
- Pulo

Commerce and Industry

Major Industries:

Farming, livestock, fishing

Major Products:

Bakeries, Native Delicacies, Balut, Processed Meat and Rice

Political Subdivision

San Rafael is politically subdivided into the following 34 [barangays](#):

- | | |
|-------------------|---------------------|
| 1. Banca-Banca | 18. Pantubig |
| 2. BMA – Balagtas | 19. Pasong Bangkal |
| 3. Caingin | 20. Pasong Callos |
| 4. Capihan | 21. Pasong Intsik |
| 5. Coral na Bato | 22. Pinacpinacan |
| 6. Cruz na Daan | 23. Poblacion |
| 7. Dagat-Dagatan | 24. Pulo |
| 8. Diliman I | 25. Pulong Bayabas |
| 9. Diliman II | 26. Salapungan |
| 10. Libis | 27. Sampaloc |
| 11. Lico | 28. San Agustin |
| 12. Maasim | 29. San Roque |
| 13. Mabalas-Balas | 30. Sapang Pahalang |
| 14. Maguinao | 31. Talacsan |
| 15. Maronquillo | 32. Tambubong |
| 16. Paco | 33. Tukod |
| 17. Pansumaloc | 34. Ulingao |

Contact Information

Municipal Officials:

Mayor Lorna C. Silverio

Vice Mayor Cipriano D. Violago, Jr.

Mailing Address:

Ms. Teresita G. Valero

Municipal Planning and Development Office

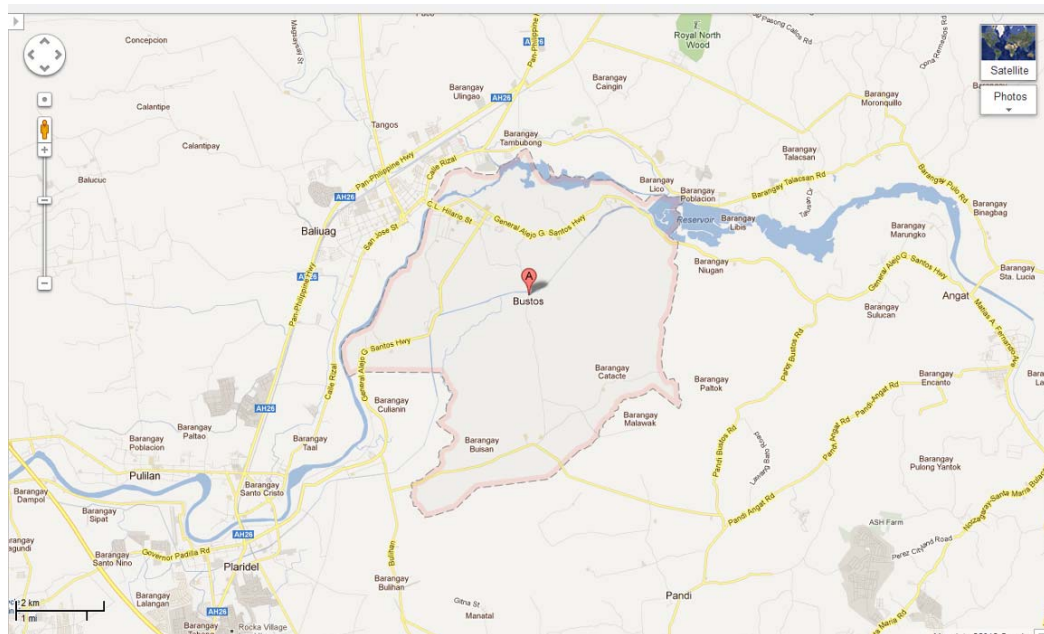
MUNICIPAL GOVERNMENT OF SAN RAFAEL, BULACAN

San Rafael, Bulacan 3008 Philippines

Contact Nos: Tel: +63(44) 492-1110; 902-0092

Fax: +63(44) 492-1036

MUNICIPALITY OF BUSTOS



MAP:

http://maps.google.ca/maps?hl=en&cp=6&q=2e&xhr=t&q=norzagaray&bav=on.2,or.r_gc.r_pw.r_cp.r_qf.,cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

- 2nd class municipality
- Population = 60,681 (2007)
- Households = 9799
- Land Area = 6999 ha
- Barangays = 14

POPULATION CENSUS OF BUSTOS		
Census	Population	Rate
1995	41,372	--
2000	47,091	2.82%
2007	60,681	3.56%

Watershed:

- Contains part of the Angat River Reservoir
- Angat River flows over the north and west boundaries of Bustos
- Contains Bustos Dam

Barangays near Angat River and Reservoir:

- Tibagan
- Tanawan

- Bonga Mayor
- Poblacion
- San Pedro
- Cambaog

Commerce and Industry

Major Industries:

Farming, RTW, food repacking

Major Products:

Bags, Local Delicacies, Food Processing, Rice

Political Subdivision

Bustos is politically subdivided into the following 14 [barangays](#)

- | | |
|-----------------|---------------|
| 1. Bonga Mayor | 8. Malamig |
| 2. Bonga Menor | 9. Malawak |
| 3. Buisan | 10. Poblacion |
| 4. Camachilihan | 11. San Pedro |
| 5. Cambaog | 12. Talampas |
| 6. Catacte | 13. Tanawan |
| 7. Liciada | 14. Tibagan |

Contact Information

Municipal Officials:

Mayor Arnel F. Mendoza

Vice Mayor Leonida L. Rivera

Mailing Address:

Engr. Higinio Boday

Municipal Planning & Development Office

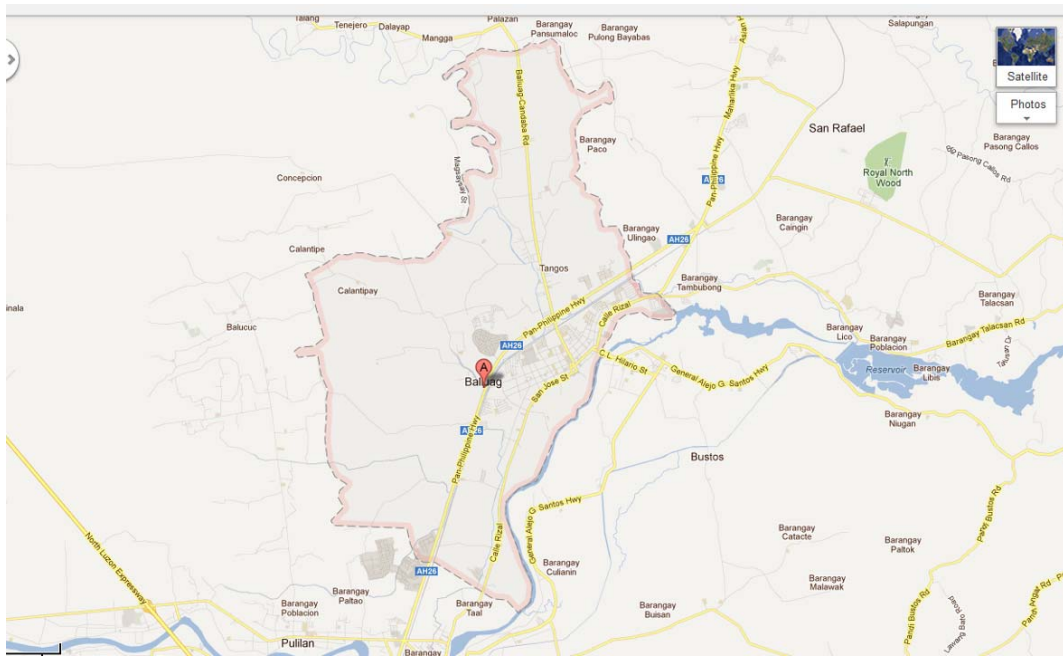
MUNICIPAL GOVERNMENT OF BUSTOS, BULACAN

Bustos, Bulacan 3007 Philippines

Contact Nos:

Tel: +63(44) 617-1035; 766-2543

MUNICIPALITY OF BALIUAG



MAP:

http://maps.google.ca/maps?hl=en&cp=6&q=2e&xhr=t&q=norzagaray&bav=on.2,or.r_gc.r_pw.r_cp.r_qf.,cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

=

- 1st class municipality
- Population = 136,982 (2007)
- Households = 25,050
- Land Area = 4505 ha
- Barangays = 27

POPULATION CENSUS OF BALIUAG		
Census	Population	Rate
1995	103,054	--
2000	119,675	3.26%
2007	136,982	1.88%

Watershed:

- Angat River (no information about barangays near river)

Commerce and Industry

Major Industries:

Furniture, Garments, Gifts/Houseware/Decors, Pyrotechnics

Major Products:

Bakeries, Native Delicacies

Baliuag is the major commerce, transportation, entertainment and educational center of Northern Bulacan.

Political Subdivision

Baliuag is politically subdivided into the following 27 [barangays](#):

- | | |
|------------------|-------------------------|
| 1. Bagong Nayon | 15. San Jose |
| 2. Barangca | 16. San Roque |
| 3. Calantipay | 17. Santa Barbara |
| 4. Catulinan | 18. Santo Cristo |
| 5. Concepcion | 19. Santo Niño |
| 6. Hinukay | 20. Subic |
| 7. Makinabang | 21. Sullivan |
| 8. Matangtubig | 22. Tangos |
| 9. Pagala | 23. Tarcen |
| 10. Paitan | 24. Tiaong |
| 11. Piel | 25. Tibag |
| 12. Pinagbarilan | 26. Tilapayong |
| 13. Poblacion | 27. Virgen delos Flores |
| 14. Sabang | |

Contact Information

Municipal Officials:

Mayor Romeo M. Estrella

Vice Mayor Antonio S. Patawaran

Mailing Address:

Engr. Nemencio M. de Leon

Municipal Planning and Development Office

MUNICIPAL GOVERNMENT OF BALIUAG, BULACAN

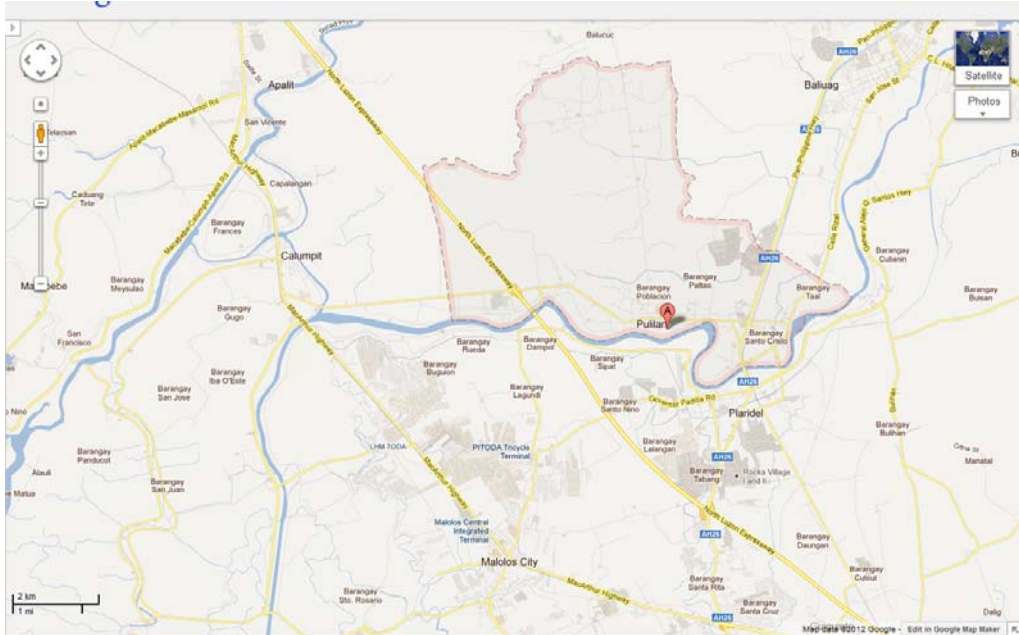
Baliuag, Bulacan 3006 Philippines

Contact Nos:

Tel: +63(44) 673-3762

Fax: +63(44) 766-3240

MUNICIPALITY OF PULILAN



MAP:

http://maps.google.ca/maps?hl=en&cp=6&gs_id=2e&xhr=t&q=norzagaray&bav=on.2,or.gc.rpw.r_cp.r_qf,.cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=w1

BASIC FACTS:

(Source: Bulacan Government Website- <http://www.bulacan.gov.ph/pulilan/index.php>)

Wikipedia- <http://en.wikipedia.org/wiki/Pulilan>)

- 1st class municipality
- Population = 85,008 (2007)
- Land Area = 3989 ha
- Barangays = 19

POPULATION CENSUS OF PULILAN		
Census	Population	Rate
1995	59,682	--
2000	68,188	2.90%
2007	85,008	3.09%

Watersheds:

- Angat River (where Angat Hydroelectric Plant and Dam is located)

Barangays near Angat River:

- Dampol 2nd-A
- Dampon 2nd-B

- Tibag, Dampol 1st
- Lumbac
- Poblacion
- Paltao
- Longos
- Santo Cristo, Taal

Commerce and Industry

Major Industries:

Flowers/Ornamental Plants, Food/Food Processing, Garments, Gifts/Houseware/Decors, Marble/Marble Processing, Poultry and Hog Raising, Furniture

Major Products:

Bakeries and Bakeshops, Native Delicacies, Balut, Sweets, Rice

Political Subdivision

Pulilan is politically subdivided into the following 19 [barangays](#):

- | | |
|-------------------|---------------------|
| 1. Balatong A | 11. Paltao |
| 2. Balatong B | 12. Penabatan |
| 3. Cutcot | 13. Poblacion |
| 4. Dampol 1st | 14. Santa Peregrina |
| 5. Dampol 2nd – A | 15. Santo Cristo |
| 6. Dampol 2nd – B | 16. Taal |
| 7. Dulong Malabon | 17. Tabon |
| 8. Inaon | 18. Tenejeros |
| 9. Longos | 19. Tibag |
| 10. Lumbac | |

Contact Information

Municipal Officials:

Mayor Vicente B. Esguerra, Sr.

Vice Mayor Elpidio C. Castillo

Internet Addresses:

Websites: www.bulacan.gov.ph/pulilan

Email: ecc23@mozcom.com

Mailing Address:

Mr. Leovigildo S. Garcia

Municipal Planning and Development Office

MUNICIPAL GOVERNMENT OF PULILAN, BULACAN

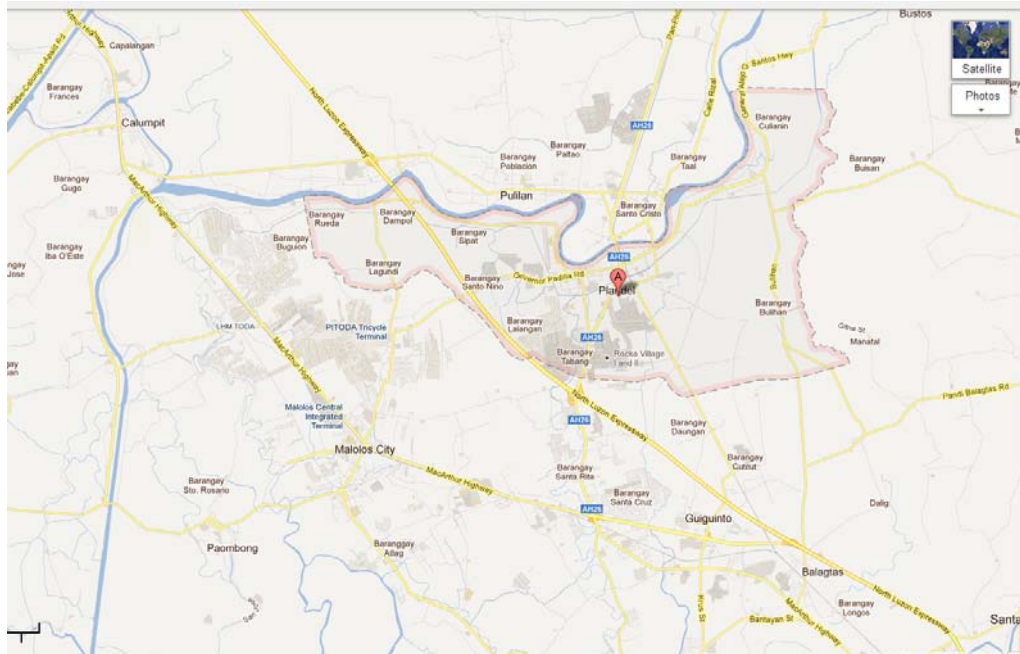
Poblacion, Pulilan, Bulacan 3005 Philippines

Contact Nos:

Tel: +63(44) 676-0276; 676-3573

Fax: +63(44) 795-0128

MUNICIPALITY OF PLARIDEL



MAP:

http://maps.google.ca/maps?hl=en&cp=6&q=2e&xhr=t&q=norzagaray&bav=on.2,or.r_gc.r_pw.r_cp.r_qf.,cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

(Source: Bulacan Government Website- <http://www.bulacan.gov.ph/plaridel/index.php>
Wikipedia - http://en.wikipedia.org/wiki/Plaridel,_Bulacan)

- 1st class municipality
- Population = 99,817 (2007)
- Land Area = 3244 ha
- Barangays = 19

POPULATION CENSUS OF SAN RAFAEL		
Census	Population	Rate
1995	66,355	--
2000	80,481	4.23%
2007	99,817	3.01 %

Watersheds:

- Angat River

Barangays near Angat River:

- Rueda
- Dampol
- Sipat
- Lumangbayan
- Agnaya

- Poblacion
- Parulan
- Culianin
- (Banga 1st)
- (Banga 2nd)

Commerce and Industry

Major Industries:

Farming, poultry/livestock raising, garments and food processing

Major Products:

Bakeries and Bakeshops, Fish Product

Industrial Estates:

Grand Industrial Estate

Address: Parulao, Plaridel

Tel. No: +63(44) 662-3861

Political Subdivision

Political Subdivision

Plaridel is politically subdivided into the following 19 [barangays](#):

- | | |
|------------------|------------------|
| 1. Agnaya | 11. Lumang Bayan |
| 2. Bagong Silang | 12. Parulan |
| 3. Banga 1st | 13. Poblacion |
| 4. Banga 2nd | 14. Rueda |
| 5. Bintog | 15. San Jose |
| 6. Bulihan | 16. Santa Ines |
| 7. Culianin | 17. Santo Niño |
| 8. Dampol | 18. Sipat |
| 9. Lagundi | 19. Tabang |
| 10. Lalangan | |

Contact Information

Municipal Officials:

Mayor Anastacia R. Vistan

Vice Mayor Leonilo I. Yap

Mailing Address:

Engr. Reynaldo E. Alvaro

Municipal Planning and Development Office

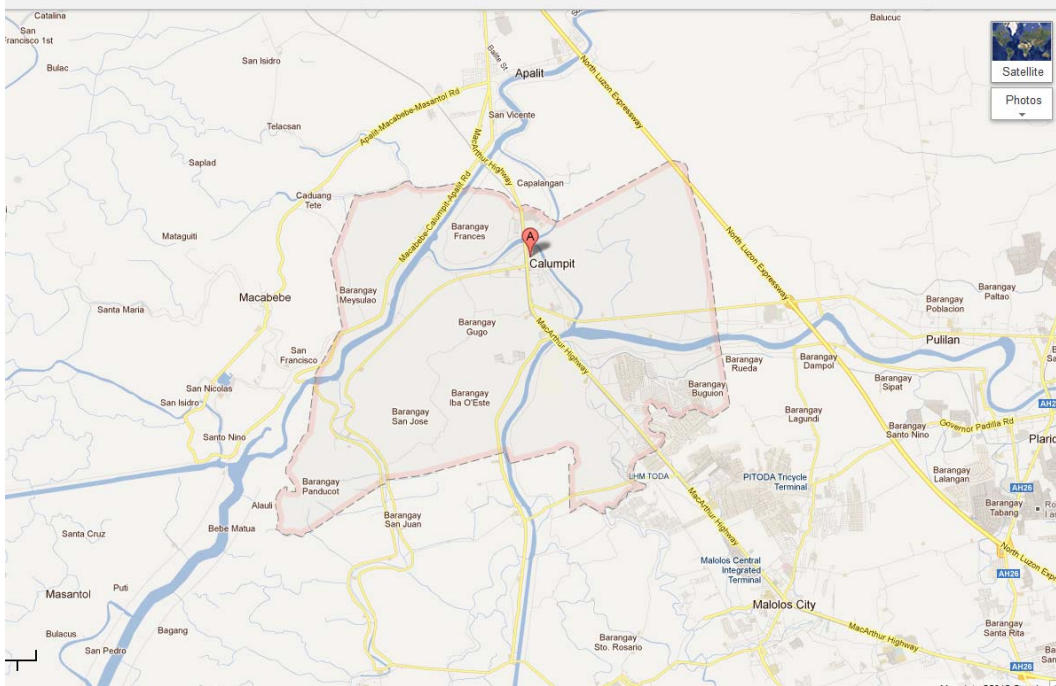
MUNICIPAL GOVERNMENT OF PLARIDEL, BULACAN

Poblacion, Plaridel, Bulacan 3004 Philippines

Contact Nos: Tel: +63(44) 670-2673

Fax: +63(44) 795-0366 to 67

MUNICIPALITY OF CALUMPIT



MAP:

http://maps.google.ca/maps?hl=en&cp=6&gs_id=2e&xhr=t&q=norzagaray&bav=on.2,or_r_gc_r_pw.r_cp.r_qf.,cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

- 1st class municipality
- Population = 98,017 (2007)
- Households = 16,167
- Land Area = 5625 ha
 - Flat terrain
 - 66.81% agricultural, 10.42% residential, 2.48% industrial, 0.89% commercial, 1.05% other
 - 2.06% land of Bulacan

POPULATION CENSUS OF CALUMPIT		
Census	Population	Rate
1995	70,839	--
2000	81,113	2.95%
2007	98,017	2.65%

Watersheds:

- Angat and Pampanga Rivers converge here

Barangays near Angat and Pampanga Confluence:

- Iba Este
- Ibe O'Este
- Caniogan
- Santo Nino

- Corazon
- Sucol
- Poblacion
- Calizon
- Bulusan
- Santa Lucia
- Meyto

Commerce and Industry

Major Industries:

Farming, ceramics, pottery, and ornamental plants

Major Products:

Handicrafts, Pottery, Religious Articles

Industrial Estates:

Bulacan Agro-Industrial Subdivision

Address: Pio Cruzcosa, Calumpit, Bulacan

Matrix Inc.

Contact Person: Jun Herrera and Ben Juakin

Tel. No: +63(2) 374-2584; 371-9702 to 04; 371-9706; 372-3206

Fax. No: +63(2) 371-9707

Political Subdivision

Calumpit is politically subdivided into the following 29 barangays:

- | | |
|-----------------|------------------|
| 1. Balite | 16. Meyto |
| 2. Balungao | 17. Palimbang |
| 3. Buguion | 18. Panducot |
| 4. Bulusan | 19. Pio Cruzcosa |
| 5. Calizon | 20. Poblacion |
| 6. Calumpang | 21. Pungo |
| 7. Caniogan | 22. San Jose |
| 8. Corazon | 23. San Marcos |
| 9. Frances | 24. San Miguel |
| 10. Gatbuca | 25. Santa Lucia |
| 11. Gugo | 26. Santo Niño |
| 12. Iba Este | 27. Sapang Bayan |
| 13. Iba O' Este | 28. Sergio Bayan |
| 14. Longos | 29. Sucol |
| 15. Meysulao | |

Contact Information:

Municipal Officials:

Mayor James P. de Jesus

Vice Mayor Zacarias C. Candelaria

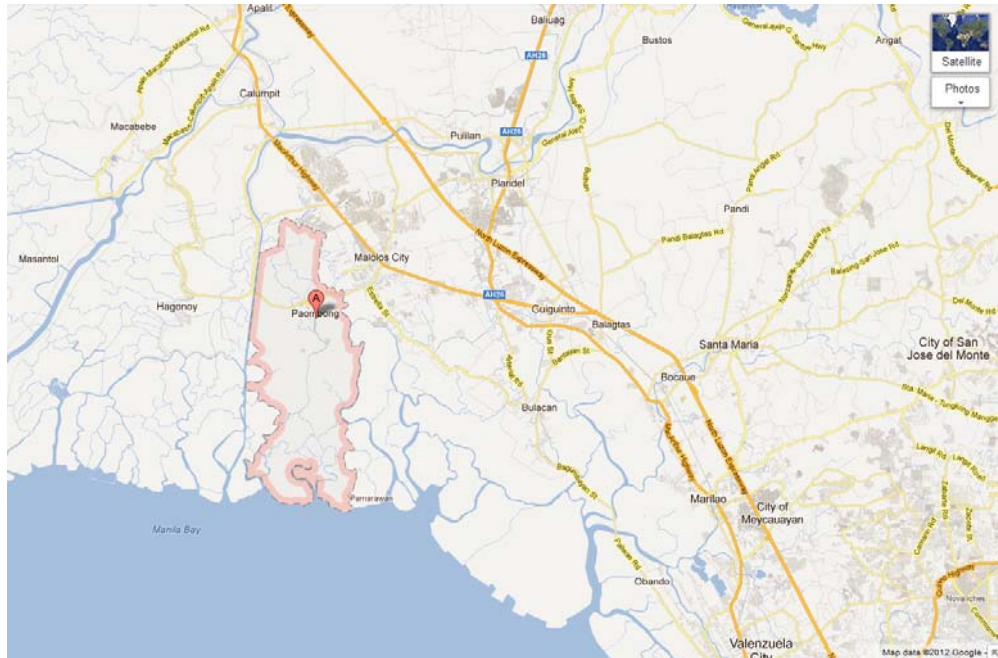
Internet Addresses:

Email: mpdo@mozcom.com

Ms. Avelina C. Vicente

Municipal Planning and Development
Office

MUNICIPALITY OF PAOMBONG



MAP:

http://maps.google.ca/maps?hl=en&cp=6&gs_id=2e&xhr=t&q=norzagaray&bav=on.2,or.r_gc.r_pw.r_cp.r_qf.,cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

(Source: Bulacan Government Website- <http://www.bulacan.gov.ph/paombong/index.php>
Wikipedia - http://en.wikipedia.org/wiki/Paombong,_Bulacan)

- 3RD class municipality
- Population = 53,510 (2007)
- Land Area = 4634 ha
- Barangays = 14

POPULATION CENSUS OF PAOMBONG		
Census	Population	Rate
1995	33,149	--
2000	41,077	4.71%
2007	53,510	3.71%

Watersheds:

- Angat and Pampanga join at Calumpit and flow alongside Paombong into Manila Bay
- Paombong has various tributaries of Angat River flowing through the municipality

Commerce and Industry

Major Industries:

Food/Food Processing, Aquaculture, Flowers/Ornamental Plants, Garments

Major Products:

Metal products, Vinegar, Nipa, Fish products

Political Subdivision

Paombong is politically subdivided into the following 14 [barangays](#):

- | | |
|-------------------|-------------------|
| 1. Binakod | 8. San Isidro 2nd |
| 2. Kapitangan | 9. San Jose |
| 3. Malumot | 10. San Roque |
| 4. Masukol | 11. San Vicente |
| 5. Pinalagdan | 12. Santa Cruz |
| 6. Poblacion | 13. Santo Niño |
| 7. San Isidro 1st | 14. Santo Rosario |

Contact Information

Municipal Officials:

Mayor Donato D. Marcos

Vice Mayor Marisa J. Ramos

Mailing Address:

Arch. Melchor DG. Robles

Municipal Planning and Development Office

MUNICIPAL GOVERNMENT OF PAOMBONG, BULACAN

Poblacion, Paombong, Bulacan 3001 Philippines

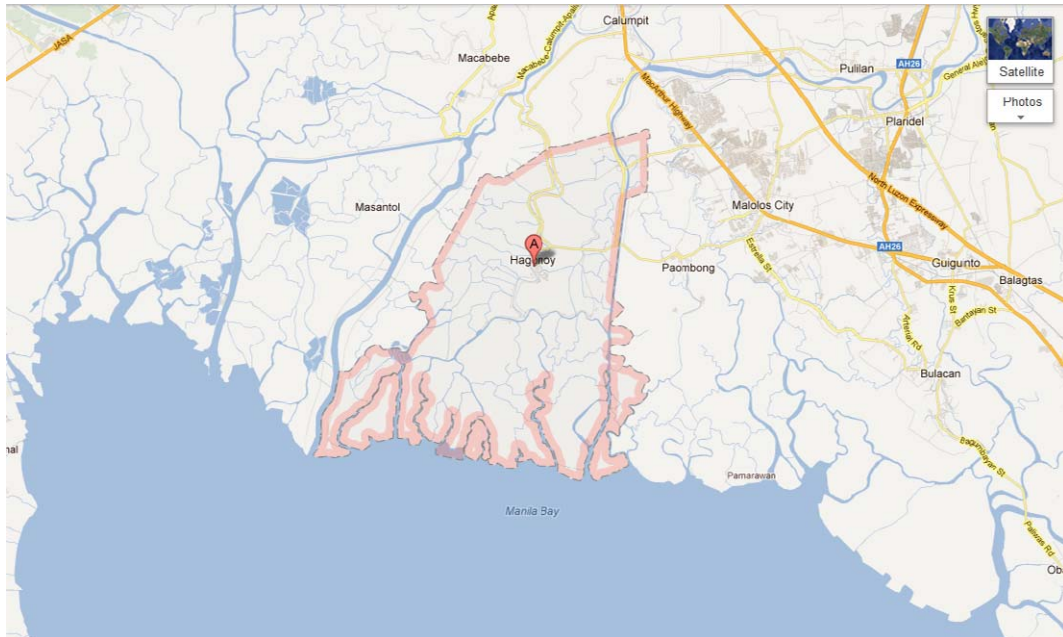
Contact Nos:

Tel: +63(44) 665-2679; 791-3200

Fax: +63(44) 665-1204

MUNICIPALITY OF HAGONOY

<http://www.hagonoybulacan.gov.ph/about/education.asp>



MAP:

http://maps.google.ca/maps?hl=en&cp=6&q=norzagaray&bav=on.2,or.r_gc.r_pw.r_cp.r_qf.,cf.osb&biw=1280&bih=880&um=1&ie=UTF-8&sa=N&tab=wl

BASIC FACTS:

- 1st class municipality
- Population = 126,329 (2007)
- Land area = 10,310 ha
- Barangays = 26

POPULATION CENSUS OF HAGONoy		
Census	Population	Rate
1995	99,423	--
2000	111,425	2.48%
2007	126,329	1.75%

Watershed:

- Angat and Pampanga River converge at Calumpit and flow past Hagonoy in the east

Barangays near Angat-Pampanga River:

- Pugad
- Tibaguin
- Santa Elena
- San Pablo
- San Pedro
- Abulalas
- Carillo

Commerce and Industry

Major Industries:

Fishing, food processing and garments
(a fishing town)

Major Products:

Prawns, Milkfish (Bangus), Other Fishes and Crustaceans, Garments and Apparel, Toys and Giftware

Indigenous and Raw Materials:

Bamboo and Sasa leaves

Political Subdivision

Hagonoy is politically subdivided into the following 26 [barangays](#)

- | | |
|--------------------|--------------------------|
| 1. Abulalas | 14. San Nicolas |
| 2. Carillo | 15. San Pablo |
| 3. Iba | 16. San Pascual |
| 4. Iba-Ibayo | 17. San Pedro |
| 5. Mercado | 18. San Roque |
| 6. Palapat | 19. San Sebastian |
| 7. Pugad | 20. Santa Cruz |
| 8. Sagrada Familia | 21. Santa Elena |
| 9. San Agustin | 22. Santa Monica |
| 10. San Isidro | 23. Santo Niño (formerly |
| 11. San Jose | Poblacion) |
| 12. San Juan | 24. Santo Rosario |
| 13. San Miguel | 25. Tampok |
| | 26. Tibaguin |

Contact Information

Municipal Officials:

Mayor Angel L. Cruz, Jr.
Vice Mayor Reynaldo O. Santos

Internet Addresses:

Website: <http://www.hagonoybulacan.gov.ph/>

Email: agonoy@bul.info.com.ph

Mailing Address:

Mr. Marvin M. Reyes
Municipal Planning and Development Office
MUNICIPAL GOVERNMENT OF HAGONoy, BULACAN
Poblacion, Hagonoy, Bulacan 3002 Philippines

Contact Nos: Tel: +63(44) 793-5378

Fax: +63(44) 793-0016

APPENDIX 2

Water uses in order of preference (NWRB Water Code 1976)

- 1 **Irrigation** – utilization of water for producing agricultural crops.
- 2 **Power Generation** – utilization of water for producing electrical or mechanical power.
- 3 **Fisheries** – utilization of water for propagation and culture of fish as a commercial enterprise.
- 4 **Domestic** – utilization of water for drinking, washing, bathing, cooking or other household needs, home gardens, and watering of lawns and domestic animals.
- 5 **Livestock Raising** – utilization of water for large herds or flocks of animals raised as a commercial enterprise.
- 6 **Industrial Use** – utilization of water in factories, industrial plants and mines, including the use of water as an ingredient of a finished product.
- 7 **Recreation** – utilization of water for swimming pools, bath houses, boating, water skiing, golf courses and other similar facilities in resorts and other places of recreation.
- 8 **Other Uses**

APPENDIX 3

Major Environment and Natural Resources Laws and Regulations

Title/Description	Year Issued
General Environment and Natural Resources	
EO 406: Philippine Economic-Environmental and Natural Resource Accounting (PEENRA) System	1997
EO 192: Reorganizing the Department of Environment and Natural Resources	1987
PD 1151: Philippine Environmental Policy, declaring it a continuous policy of the state to provide the people with a healthy environment	1977
PD 1152: Philippine Environmental Code, outlining the state policy for the management of air and water quality and land use, natural resource management and conservation, waste management, etc.	1977
PD 984: Pollution Control Law of 1976, mandating the creation of the National Pollution Control Commission and setting a national policy of preventing, abating, and controlling the pollution of water, air, and land, for more effective use of resources	1976
Forestry	
EO 318: Promoting Sustainable Forest Management in the Philippines	2004
RA 9175: Chain Saw Act of 2002, regulating the ownership, possession, sale, importation, and use of chainsaws and penalizing violations	2002
RA 8048: Coconut Preservation Act of 1995, providing for the regulation of the cutting of coconut trees, their replenishment, and other purposes	1995
EO 277: Amending the Revised Forestry Code PD 705 by increasing the forest charges on timber and other forest products	1987
PD 705: Revised Forestry Code	1985
BP 701: Amending section 36 of the Revised Forestry Code (PD 705)	1984

Title/Description	Year Issued
PD 1775: Amending section 80 of the Revised Forestry Code (PD 705) prohibiting the cutting, destroying, or injuring of planted or growing trees, flowering plants and shrubs, or plants of scenic value along public roads, in plazas, parks, schools premises, or any other public pleasure ground	1981
RA 3572: Prohibiting the cutting of tindalo, akle, and molave trees under certain conditions, and penalizing violations	1929
Agriculture	
EO 481: Promoting and developing organic agriculture in the Philippines	2005
RA 8532: Amending section 63 of the Comprehensive Agrarian Reform Program (CARP) Law of 1988 (RA 6657), providing an augmentation fund for the program	1998
RA 8435: Agriculture and Fisheries Modernization Act of 1997, prescribing urgent measures to modernize the agriculture and fishery sectors, make them more profitable, and prepare them for the challenges of globalization through a adequate, focused, and rational delivery of services, and appropriating funds for that purpose	1997
RA 7907: Amending the Code of Agrarian Reform in the Philippines (RA 3844), as amended	1995
RA 7881: Amending certain provisions of the Comprehensive Agrarian Reform Law of 1988 (RA 6657)	1995
RA 7905: Strengthening the implementation of the Comprehensive Agrarian Reform Program, and for other purposes	1995
RA 6657: Comprehensive Agrarian Reform Law of 1988	1988
EO 229: Providing for the mechanism for the implementation of the Comprehensive Agrarian Reform Program	1987
PD 2: Proclaiming the entire country a land reform area	1972
PD 27: Decreeing the emancipation of tenants from the bondage of the soil, transferring to them the ownership of the land they till, and providing the instruments and mechanism therefor	1972

Title/Description	Year Issued
Fisheries	
RA 8550: Philippine Fisheries Code of 1998, providing for the development, management, and conservation of fisheries and aquatic resources, integrating all laws pertinent thereto, and for other purposes	1998
DAO 03, s. 1998: Implementing rules and regulations for the Philippine Fisheries Code of 1998 (RA 8550)	1998
RA 8435: Agriculture and Fisheries Modernization Act	1997
BP 58: Amending the law prohibiting the catching, sale, offer to sell, or purchase of the fish species <i>Gobiidae (ipon)</i> (RA 5474), as amended by RA 6145	1980
PD 979: Providing for the revision of the Marine Pollution Decree of 1974 (PD 600)	1976
PD 601: Revised Coast Guard Law	1974
Mining	
EO 689: Transferring back the Philippine Mining Development Corporation from the Office of the President to the Department of Environment and Natural Resources	2007
DAO 16, s. 2005: Amending the revised implementing rules and regulations (DAO 96-40) for the Philippine Mining Act of 1995 (RA 7942), as amended, providing for exploration permits for financial or technical assistance in the conduct of mineral exploration, and for other purposes	2005
DAO 07, s. 2005: Amending chapter XVIII of the revised implementing rules and regulations (DAO 96-40) for the Philippine Mining Act of 1995 (RA 7942), as amended, providing for the establishment of a Final Mine Rehabilitation and Decommissioning Fund	2005
DAO 61, s. 2000: Amending the revised implementing rules and regulations (Amendment to DAO 96-40 [DAO 99-57]) for the Philippine Mining Act of 1995 (RA 7942)	2000

Title/Description	Year Issued
DAO 25, s. 1996: Amending section 257 of the implementing rules and regulations for the Philippine Mining Act of 1995 (RA 7942)	1996
DAO 40, s. 1996: Revised implementing rules and regulations for the Philippine Mining Act of 1995 (RA 7942)	1996
DAO 23, s. 1995: Implementing rules and regulations for the Philippine Mining Act of 1995 (RA 7942)	1995
RA 7942: Philippine Mining Act of 1995, instituting a new system of mineral resources exploration, development, use, and conservation	1995
DAO 34, s. 1992: Implementing rules and regulations for the People's Small-Scale Mining Act of 1991 (RA 7076)	1992
RA 7076: People's Small-Scale Mining Act	1991
DAO 85, s. 1990: Revised implementing rules and regulations for the Mine Waste Tailings Damage Law (PD 1251), as amended, imposing mine waste and tailings fees on operating mining companies to compensate for damages to private landowners, and for other purposes	1990
Coastal and Marine	
DAO 2007-28: Institutionalizing the Manila Bay Environmental Management Project within the DENR through the implementation of the operational plan for the Manila Bay Coastal Strategy	2007
EO 533: Adopting the Integrated Coastal Management Strategy	2006
DAO 2004-24: Revised rules and regulations for the administration and management of foreshore lands	2004
DAO 2002-08: Coastal Environment Program, establishing the Coastal and Marine Management Office as the national coordinating office for all coastal and marine environment activities	2002

Title/Description	Year Issued
Ecotourism	
EO 111: National Ecotourism Strategy, creating the National Ecotourism Development Council (NEDC) and requiring the preparation of a National Ecotourism Strategy (NES) to guide the development of ecotourism in the country	1999
Protected Areas and Biodiversity	
EO 578: Establishing the National Policy on Biological Diversity, prescribing its implementation throughout the country, particularly in the Sulu-Sulawesi Marine Ecosystem and the Verde Island Passage Marine Corridor	2006
RA 9147: Wildlife Resources Conservation and Protection Act, providing for the conservation and protection of wildlife resources and their habitats, appropriating funds therefor, and for other purposes	2001
RA 9072: National Caves and Cave Resources Management Act, to manage and protect caves and cave resources, and for other purposes	2001
DAO 44, s. 2000: Amending certain provisions of DAO 96-29 and providing specific guidelines for the Establishment and Management of Community-Based Projects within Protected Areas	2000
DAO 20, s. 1996: Implementing rules and regulations for the prospecting of biological and genetic resources	1996
DAO 31, s. 1996: Amending section 61 of the implementing rules and regulations (DAO 25, s. 1992) for the National Integrated Protected Areas Act of 1992 (RA 7586)	1996
EO 247: Prescribing guidelines and establishing a regulatory framework for the prospecting of biological and genetic resources, their by-products and derivatives, for scientific and commercial purposes, and for other purposes	1995
DAO 25, s. 1992: Implementing rules and regulations for the National Integrated Protected Areas System Act of 1992 (RA 7586)	1992
RA 7586: National Integrated Protected Areas System Act of 1992	1992

Title/Description	Year Issued
DAO 48, s. 1991: Establishing a national list of rare, endangered, threatened, vulnerable, indeterminate, and insufficiently known species of Philippine wild birds, mammals, and reptiles	1991
PD 1219, as amended by PD 1698 (1980); Coral Resources Development and Conservation Decree	1977
Water Resources	
EO 510: Creating the River Basin Control Office	2006
DAO 2005-10: Prescribing the implementing rules and regulations for the Clean Water Act	2005
EO 387: Transferring the Local Water Utilities Administration from the Office of the President to the Department of Public Works and Highways (DPWH) and strengthening the supervision of the Metropolitan Waterworks and Sewerage System by the DPWH secretary	2004
EO 359: Creating the Bicol River Basin project management office and defining its scope of authority	2004
RA 9275: Clean Water Act of 2004	2004
RA 8041: National Water Crisis Act of 1995	1995
PD 979: Marine Pollution Decree of 1976	1976
PD 1067: Water Code of the Philippines	1976
PD 856: Sanitation Code of the Philippines, setting the required activities in managing sewerage and corresponding systems	1975
PD 274: Pertaining to the preservation, beautification, improvement, and gainful use of the Pasig River, providing for the regulation and control of pollution of the river and its banks to enhance its socioeconomic usefulness	1973

Title/Description	Year Issued
RA 4850, as amended by PD 813, EO 927: Creating the Laguna Lake Development Authority to accelerate the development and balanced growth of the Laguna de Bay region with due regard and adequate provisions for environmental management	1966
Air Quality	
DAO 2000-81: Implementing rules and regulations for the Clean Air Act of 1999 (RA 8749)	2000
RA 8749: Clean Air Act of 1999, amending sections 57–66 provisions on air pollution control of PD 984; expanded the scope of activity of DENR by mandating the formulation of the Integrated Air Quality Improvement Framework	1999
Energy	
RA 9367: Biofuels Act of 2006, directing the use of biofuels, establishing the biofuels program for this purpose, appropriating funds therefor, and for other purposes	2007
EO 290: Implementing the Natural Gas Vehicle Program for Public Transport	2004
RA 9136: Electric Power Industry Reform Act (EPIRA), stressing the development and use of indigenous and renewable energy resources to reduce the country's dependence on imported oil and coal for power generation	2001
Climate Change	
DAO 2005-17: Prescribing the implementing rules and regulations for EO 320	2005
EO 320: Designating the DENR as the national authority for the Clean Development Mechanism (CDM)	2004
Toxic Substances and Hazardous Wastes	
DAO 29: Implementing rules and regulations for the Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (RA 6969)	1992

Title/Description	Year Issued
RA 6969: Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990, regulating the importation, processing, manufacture, sale, distribution, use, and disposal of chemical substances and mixtures that present unreasonable risk to public health and the environment	1990
Oil Pollution	
RA 9483: Oil Pollution Compensation Act of 2007, providing for the implementation of the provisions of the 1992 International Convention on Civil Liability for Oil Pollution Damage and the 1992 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, providing penalties for violations thereof, and for other purposes	2007
Environmental Impact Statement	
DAO 2003-30: Prescribing the implementing rules and regulations for the EIS System, further clarifying the coverage of the EIS System, and providing two criteria to be considered in determining the scope of the EIS System, namely: (i) the nature of the project and its potential to cause significant negative environmental impact, and (ii) the sensitivity or vulnerability of environmental resources in the project area.	2003
AO 42: Streamlining ECC application processing and approval by specifying the endorsing official, approving authority, and processing timeframe for ECPs, projects within ECAs, and projects not covered by the EIS System	2002
PD 1586: EIS System Law, limiting the application of EIA to environmentally critical projects or projects in environmentally critical areas	1978
Solid Waste Management	
DAO 2001-34: Implementing rules and regulations for the Ecological Solid Waste Management Act of 2000 (RA 9003)	2001
RA 9003: Ecological Solid Waste Management Act of 2000, establishing local solid waste management boards to develop 10-year solid waste management plans and oversee their implementation, and calling for the institutionalization of a national program to manage the transfer, transport, processing, and disposal of solid waste in the country	2000

APPENDIX 4

Funding breakdown for the Task Force for Maasin Watershed Rehabilitation		
DONOR	AMOUNT	ACTIVITIES
Civil Societies	P500,000	None specified
Province of Iloilo	P500,000	None specified
Through DENR:		
Asian Development Bank (ADB)	P1,778,450	Survey, mapping and planning
Overseas Economic Cooperation Fund (OECF) Japan	P44,268,143	Community site development activities in 2,685 hectares
	P4,833,000	Community organizing
	P2,610,635	Monitoring and evaluation
OECF loan	P1,884,294	For covering 100 hectares
	P41,000	Establishment of 20,000 m ² of vegetative strips
National Government	P9,473,936	Forest rehabilitation of 1070 hectares
	P2,479,000	Community organizing
Metro Iloilo Water District (MIWD)	P1,000,000	Watershed protection activities
NEDA	P3,700,000	Construction of 2850 m ³ of structural measures (GABION)
	P1,400,000	Conduct of 3 research studies
	P573,000	Establishment of 53,900 m ² of vegetative measures

(Francisco 2004: 32).

APPENDIX 5

Supporting the Council is a Technical Working Group whose members come from agencies helping the tasks of the IWMC. The following are the members stated in the Ordinance:

1. Committee on Environment, Sangguniang Panlalawigan—
Province of Iloilo
2. PENRO
3. PPDO
4. Office of the Provincial Agriculturist
5. League of Municipalities
6. City of Iloilo
7. Committee on Environment, City of Iloilo
8. National Irrigation Administration
9. Philippine Information Agency—Provincial Office, Iloilo
10. Metro Iloilo Water District
11. Department of Public Works and Highways
12. Department of Agrarian Reform
13. Philippine National Police
14. Kahublagan Sang Panimalay Fnd., Inc. (NGO member)
15. KAPAWA-Maasin (PO member)

(Salas 2004: 236)

APPENDIX 6

Legal basis for the collection of Maasin's share of the water district's revenue (Local Government Code)

Section 289. Local government units shall have an equitable share in the proceeds derived from the utilization and development of national wealth within their respective areas, including sharing the same with inhabitants by way of direct benefits."

Article 386 (b). The term Natural Wealth shall mean all natural resources situated within the Philippine Territorial jurisdiction including lands of public domain, waters, minerals, coal, petroleum, oils, potential energy forces, gas, and oil deposits, forest products, wildlife, flora and fauna, fishery and aquatic resources, and all quarry products.

Section 291. Share of the local government from any government agency or government-owned and -controlled corporation engaged in the utilization and development of national wealth based on the following formula, whichever, will produce a higher share for the LGU:

- One percent of the gross sales or receipts from the preceding calendar year; or
- 40 percent of mining taxes, realties, forestry and fishery charges, and such other taxes, fees or charges, including related surcharge interest of fines the government agency or owned or controlled corporation would have paid if it were not otherwise exempt.

Section 293. Remittances of the share of LGU. The share of the LGU from the utilization and development of national wealth shall be remitted in accordance with section 286 of this Code. Provided, however, that in the case of any government agency or government-owned or controlled corporation engaged in the utilization and development of the national wealth, such shall be directly remitted to the provincial, cities, municipal, or barangay treasurer concerned within five days—after the end of each quarter.

(Francisco 2004: 35).