Geography and Public Planning: **The Sta. Rosa Watershed, a case study in inter-local, public-private sector resource management**

Edgardo Tongson

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For comments, suggestions and further inquiries, please contact:
Room 334, School of Economics, University of the Philippines, Diliman, Quezon City
+632-927-8009 +632-927-9686 loc.334 http://www.hdn.org.ph

Geography and Public Planning: The Sta. Rosa Watershed, a case study in inter-local, public-private sector resource management

Edgardo E Tongson†

†Consultant for Water Resources Development
WWF-Philippines
Email: etongson@wwf.org.ph

Abstract

Most cities and urbanizing areas in the Philippines are not prepared to address short and long term impacts from flooding, water scarcity and wastes. Using the case of the Santa Rosa watershed, we described the changing hydrology brought about by population increases, changing land uses and changing climate. These hydrologic changes will affect water supplies, public health, food security and intensify natural disasters such as flooding, land subsidence and land slides to many areas – including areas thought to be less vulnerable. The lack of stable, accountable, scale-relevant institutions are largely to blame for failures in public planning. Planning at watershed scales to address water externalities offers more holistic and cost-effective solutions compared to conventional approaches. To respond to this challenge, we looked at current legislations, institutional gaps, past attempts and lessons in watershed planning. The study examines the local dynamics, inter-local, public-private sector resource management of the Sta. Rosa Watershed by reviewing history of cooperation, interests, politics, perceptions and capacities. As a way forward, the Clean Water Act provides a decentralized framework where LGUs could prepare and align watershed plans with local plans and site development activities. Finally, we abstract lessons based on what works and does not work in mobilizing stakeholders to respond to watershed scale issues.

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Acronyms

CALABARZON	Cavite, Laguna, Batangas, Rizal and Quezon Economic Corridor
CLUP	Comprehensive Land Use plans
DPWH	Department of Public Works and Highways
DILG	Department of Interior and Local Government
DENR	Department of Environment and Natural Resources
DOH	Department of Health
EMB	Environmental Management Bureau
HLURB	Housing and Land Use Regulatory Board
IWRM	Integrated Water Resources Management
LGU	Local Government Unit
LISCOP	Laguna de Bay Institutional Strengthening and Community Participation
NEDA	National Economic Development Authority
NIA	National Irrigation Administration
NPC, NAPOCOR	National Power Corporation
LLDA	Laguna Lake Development Authority
LWUA	Local Water Utilities Administration
MENRO	Municipal Environment and Natural Resources Office
MMDA	Metro Manila Development Authority
NWRB	National Water Resources Management Board
PAGASA	Philippine Atmospheric, Geophysical & Astronomical Services Administration
S3R2	Save Silang-Santa Rosa River
USAID	United States Agency for International Aid
WWF	World Wide Fund for Nature

1. Introduction

The devastating floods from Typhoon Ondoy in 2009 reveal the state of unpreparedness of our cities such as Matro Manila to extreme weather events. Mountainous and upland areas surrounding Metro Manila, that should be zoned as natural areas or areas under controlled development, are losing their watershed functions. These areas which used to provide a range of important ecological services, such as recharging downstream aquifers, flood regulation, water purification, nutrient cycling and supplying water flows during dry months, have been deforested and degraded.

The floods and drought in the past 20 years are now being described as the “new normal” with many experts predicting that the worse has yet to come. Failure to plan and prepare for these events can be traced to the lack of stable and accountable institutions that would provide continuity in public planning and policies.

The Santa Rosa Watershed, being close to Metropolitan Manila, has similarly felt the stress associated with urbanization and industrialization, not only within its boundary but also from its neighboring towns. Rapid population growth, intensive land development and landform changes have reduced its natural capacity to retain water and hold rainfall during rainy days. It has resulted in wide flooding, water pollution and emerging water scarcities.

The Climate Change scenario for Laguna predicts a decrease in rainfall from 20 to 30% in dry months by 2020 and by 34% by 2050 and a maximum of 1 meter rise in sea levels (PAGASA 2010). Climate change will pose additional burden as it affects water availability and increase flood risks to downstream communities.

The pressing issues are overshadowed by the bigger questions on where and how will present developments draw its freshwater? How and where will it dispose its wastes? How to address flooding? How can sustainability and best practices be mainstreamed? What are the institutional arrangements that need to be put in place to ensure holistic and integrated management of freshwater and watersheds? What will be roles and functions of National Agencies, LGUs, water districts, and other water users? What have we learned so far?

This study will examine the *inter-local, public-private sector resource management of the Sta. Rosa Watershed*. It describes the institutional arrangements at play (e.g. rules, processes, the vertical and horizontal organization of agencies, the organization of state and non-state agents, if any); their rationale, and the conditions which they evolve and remain responsive. Finally, we propose how institutional arrangements can be improved and abstract some lessons in moving forward.

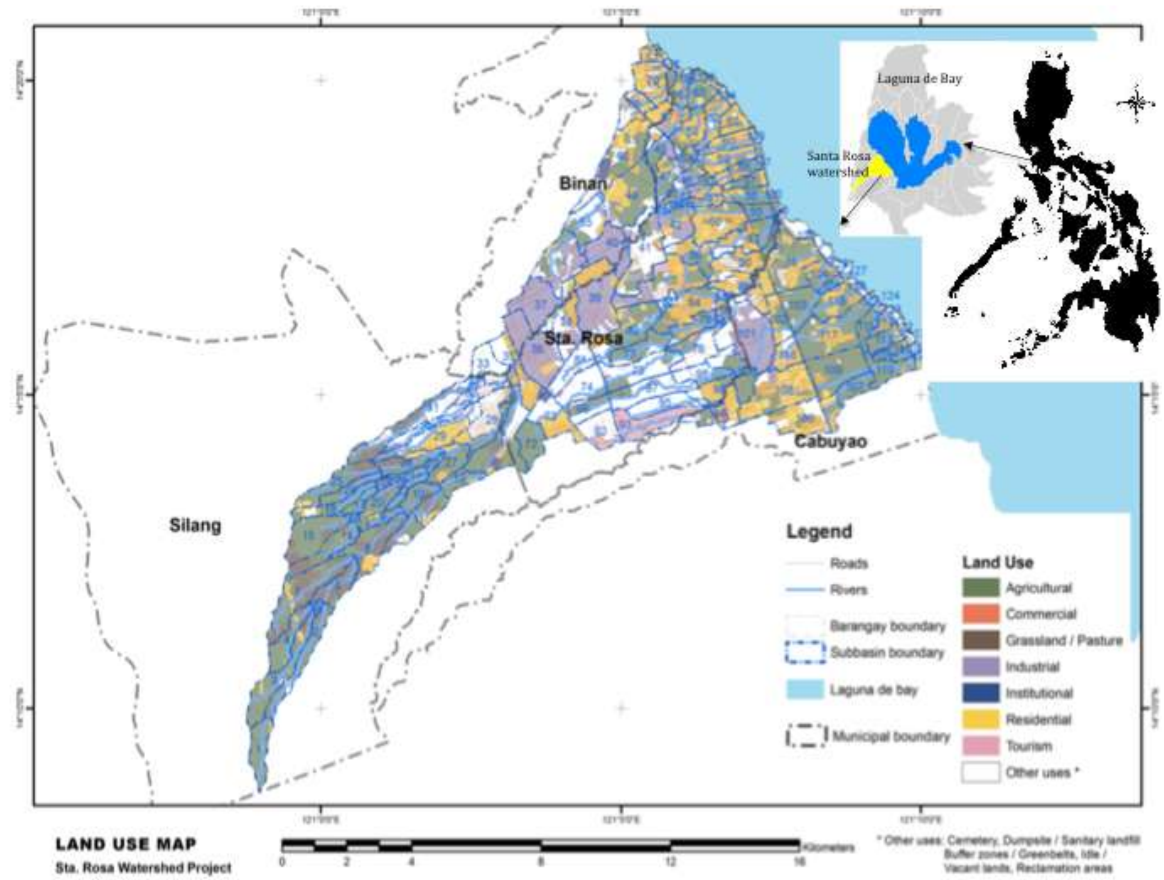


Fig. 1 Map of Santa Rosa Watershed showing political and watershed boundaries

1.1 Physical Setting

The Sta. Rosa River Basin is one of twenty-four watersheds surrounding the Laguna de Bay. The watershed is located approximately between 14º 08’ and 14º 21’ North Latitude and between 120º 59’ and 121º 10’ East Longitude. The watershed has an area of about 120 km^2 comprising 4.1% of the Laguna Lake Basin. It is one of four elongated basins emanating from the Tagaytay ridge and draining towards Laguna Lake. The watershed has a population of 570,000 and covers practically the whole City of Sta. Rosa and Cabuyao municipality, the southern part of Biñan and several eastern barangays of the municipality of Silang, Cavite.

2. Flooding

Flooding is an inter-municipal problem shared by Binan, Santa Rosa and Cabuyao towns. Flooding occurs due to excessive runoff from upland areas or from rising lake levels as in the 2009 Ondoy floods. Fig. 2Error! Reference source not found. presents the flood risk map of the lower Santa Rosa watershed prepared after Typhoon Ondoy.

During moderate to heavy rains, the Santa Rosa River overflows its banks due to large volume of runoff coming from its watershed and its inadequate capacity. Flooding is further aggravated by the inadequate capacity of the city's drainage system to convey local runoff to the waterways. The irrigation system in Bgy Macabling, now heritage structures, served as conduit for stormwater in the absence of formal drainage systems. A network of canals that used to flood rice paddies is flooding surrounding residential subdivisions.

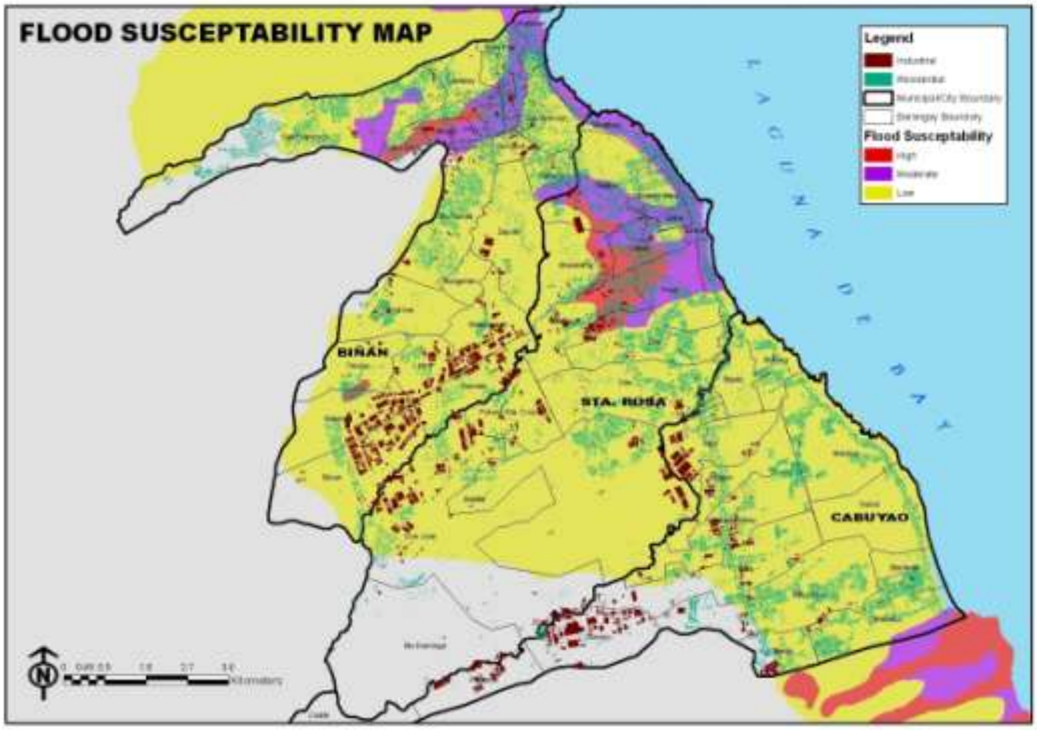


Fig. 2 Flood Risk Map of lower Santa Rosa Watershed

The high risk areas (red zone) are located downstream from the Macabling irrigation weir. Eighty-five percent (85%) of the peak flood waters entering the weir originates from Silang Municipality. Moderate flooding (in purple) along a segment of the Santa Rosa river extends to Binan City.

The experience in flood master planning has been reactive. Most towns aspiring to become cities often lack the foresight to handle complex problems brought by urbanization, such as solid wastes, water pollution, flooding and water scarcity.

For flooding, flood master plans will need to address not only current capacities of drainage structures but also future capacity requirements due to upstream urbanization. Silang plays a major role in basin wide planning. Deforestation, soil erosion and conversion of permeable lands into permeable surfaces (roads, houses, parking lots and other structures) reduce the natural capacity of the land to retain rainwater which results to flooding in lower areas.

Flood mitigation plans should encompass basin-wide structural and non-structural solutions. Structural solutions include retention/detention ponds, infiltration ponds, vegetative strips, sediment basins, check dams and flood impounding systems. Drainage pipes crossing towns and cities in lower Santa Rosa watershed should be compatible in size and capacity and sized appropriately to anticipate changes in land uses and surface water runoff. Non-structural solutions should complement structural interventions. This will require harmonizing land use plans, flood zone regulations, subdivision and building codes and installing inter-LGU early flood warning systems.

3. Groundwater Resources

The groundwater resources in the western bay of Laguna Lake are reported to be fair to extensive. Following the surface gradient, the groundwater flows northeast from the Taal caldera in the general direction of Laguna Lake.

The hydrogeology of Santa Rosa watershed is characterized by both unconfined and confined aquifers. The unconfined aquifer is found in the alluvium areas in the plains near the lake. These alluvium areas are tapped by shallow wells, mostly for domestic use.

Several layers of confined aquifers can be found at greater depths (>100 m). A confined aquifer is an aquifer bounded above and below by clayey layers having lower permeability, called aquitards. Aquitards and upward hydraulic pressure protect water below them from above ground contaminants.

Recharge to unconfined aquifers occurs via percolation to the water table. In contrast, recharge to confined aquifers by percolation from the surface occurs only at the upstream end of the confined aquifer, where the geologic formation containing the aquifer is exposed to the earth's surface.

Topography exerts an important influence on groundwater flow. The Santa Rosa landscape can be divided into areas of recharge and areas of discharge (or production). The recharge zone lies west of the fault line and forms part of the elevated plateau of the Silang Municipality. Here, the dominant land cover is agriculture, grasslands and shrub lands. These lands are permeable which allows rainfall to infiltrate and percolate into the groundwater.

The alluvial plain east of the Marikina fault line is the discharge or the production zone. The aquifer capacity within the production zone is calculated at 15 BCM (Billion Cubic Meters), assuming an area of 24,940 hectares, depth of 300 m and average soil porosity of 20%.

The recharge rate is the amount of water that replenishes the groundwater in a given year. More recent water balance studies for the Binan, Santa Rosa and San Cristobal basins indicate recharge rates of 24, 38, and 44 MCM/year respectively (Rojas (2011), Rojas (2009), Rojas (2008).

For the three (3) basins, the total recharge rate is 106 MCM/year. This provides the theoretical limit to groundwater abstraction. The domestic, commercial, institutional and industrial water demand was estimated to range from 68.76 to 92.03 MCM/year (Table 1**)**. The volume of water rights is 178 MCM/yr, which exceed recharge rates by 68%.

Table 1 Comparative summary of Minimum and Maximum Annual Demand, Recharge Rates and Volume of Water Permits Allocated, MCM/yr

Town	**Min**	**Max**	**Recharge**	**Volume Granted (NWRB 2010)**
Binan	13.82	19.21	24	28.19
Cabuyao	18.71	22.92		31.43
Santa Rosa	16.80	22.28	38	45.29
Silang	1.71	2.53		8.17
Calamba	17.71	25.09	44	65.42
Total	68.76	92.03	106	178.50

The 92 MCM/yr demand figure, while falling within recharge limits, represent the lower range of demand estimates. Actual demand may be higher as not all wells are registered. Also, no verification is made as to submitted reports to NWRB.

The top 5 of 45 companies account for 68% of industrial demand for water. The dense clustering of wells, especially among residential and industrial wells, may result in competition and lowering of the water table **(**Fig.). A cone of depression describes the tendency for groundwater to flow downward towards the deepest well in a well cluster.

Previous studies referred to lowering of groundwater tables from over pumping by NIA wells way back in the 70's and 80's. With urbanization, experts predict a shortage of groundwater in the region (Haman 1996, Rollan 2009a).

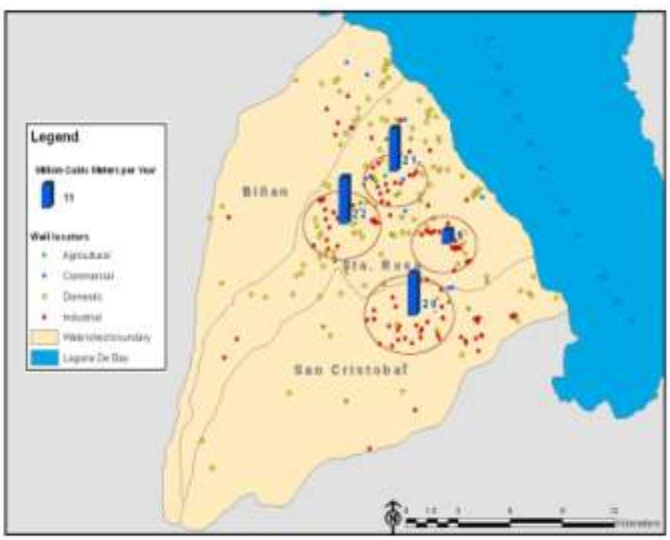


Fig. 3 Four Candidate Sites for Cones of Depression and Total Volume of Granted Permits, in MCM/year.

4. Water Quality

Santa Rosa River is classified as a Class C water body by the DENR. Based on DENR Administrative Order No. 34 (Revised Water Usage and Classification), the beneficial uses of a surface water classified as Class C include fishery water for the propagation and growth of fish and other aquatic resources; recreational water class II (for boating, etc.), and as Industrial Water Supply Class I (for manufacturing processes after treatment).

City consultants undertook water quality sampling in 13 stations along the Santa Rosa river in 2010 and 2011. The results show that Dissolved Oxygen (DO) consistently failed the standard for Class C waters for all 13 stations tested. Sampling results for coliform failed by a wide margin in all the 6 stations tested (TCGI 2011).

From the Macabling Dam to the mouth of the Santa Rosa River, water quality progressively deteriorates as pollution loadings from the watershed and drainage outfalls enter the river. The low DO concentration and high coliform counts are reflective of the contribution of untreated domestic wastewater, commercial and industrial wastes and solid wastes entering Santa Rosa River.

WWF assessed the public wells used or drinking in Santa Rosa City and Binan City in 2009 and 2010 respectively. The parameters tested were total coliform and e-coli following the Philippine National Drinking Standards (Rollan 2009b, Rollan 2010). There are 1,866 public wells servicing 8465 households in Santa Rosa. Only 1104 or 60% is used for drinking, while the rest is used for washing. Of the 77 wells tested, 6 or 7.8% failed the tests. In Binan, there are 676 wells servicing 1655 households. Only 17% of the wells are used for drinking. 11 of 47 sampled wells (23%) failed the tests. Upon investigation many wells were observed to be poorly maintained, have cracked bases and are susceptible to flooding. Others are built on or beside canals, near toilets, piggery farms and other point sources of pollution.

Surface and groundwater pollution in Santa Rosa have serious consequences on public health. Upper respiratory tract infection is the leading cause of morbidity in Santa Rosa with a rate of 13,852 per 100,000 as recorded by the Health Office in 2007. Other diseases attributed to poor water quality are diarrhea, acute gastritis, and skin diseases. Acute water diarrhea is consistently listed in the top five leading causes of morbidity in the city. Being exposed to dirty water may also be a possible cause of allergic dermatitis.

4.1 Pollution Load Modeling

Previous studies by LLDA indicate that 60% of the pollution in the Santa Rosa River comes from domestic wastes. Pollution load modeling based on population of 530,000 is estimated at 3,665 Metric Tons per year, assuming 50 grams per capita-day and 60% septage efficiency. The Santa Rosa City is presently commissioning an Engineering Study for Flood Control and Combined Drainage/Sewerage System (TCGI 2011).

5. Land Use Change and Impacts to Downstream Hydrology

Changes in the land use upstream affect hydrology processes including the quantity and quality of water draining to downstream communities. The Municipality of Silang of the Province of Cavite support the headwaters of seven sub-basins – four of which including the Santa Rosa River Basin drain towards Laguna Lake, while three others drain towards Manila Bay.

Water retention is affected by both vegetation and permeable soils. A forested watershed retains more storm water in its soil, understory litter and rough surface and slowly releases the water after rain has stopped. A bare watershed will exhibit a faster time to peak and faster recession while increasing flood volumes. Both vegetatio and soil permeability are affected by land developments.

Comparisons of peak floods between pre-development (agricultural) and post-development (residential) conditions show 25% average increase in peak floods for 2, 5, 10, 25, 50 and 100 year return intervals (Sherwood 1986). Studies further indicate that even low levels of urbanization (5-10% imperviousness), stream ecosystems begin to rapidly decline (Schueler 1994).

5.1 Future Land Use of Silang

The future scenario of land uses in Silang is relevant to anticipating the effects to flooding downstream. The CLUP of Silang shows the headwater of the Santa Rosa watershed located northeast of Silang as zoned for built-up areas (in yellow in right map) **(**Fig. **)**. This will allow agricultural, shrub lands and grasslands to become subdivisions, industrial parks, roads and other built up uses.

Assuming zoning plans are fully realized, the built up areas will expand from 30% to 50% of the total land area, while agricultural land will decrease from 60% to 38%. The resulting changes in storm water flows shows a slight increase in runoff from 62.8% to 65.5% of rainfall. While groundwater recharge will be reduced from 13.2% to 11.5% of rainfall. Flood modeling in the seven sub-basins of Silang show future increases in runoff volumes by magnitudes of 2% to 20% and -5% to 11% in peak floods respectively. Negative values in peak floods show land conversion in lower parts may actually attenuate flash flooding at the basin outlet.

5.2 Implications on Downstream Flooding

Among the seven Silang sub-basins, model simulation shows the Santa Rosa sub-basin having the greatest increase of 20% in flood discharges and 11% in peak floods from current levels, assuming a 25-year storm return period. This scenario is expected to worsen flooding in downtown Santa Rosa.

The cost of flooding in terms of lost investments, relocation, deteriorating land values and pollution of groundwater supplies to the City of Santa Rosa can be significant. While the Flood Master Plan of Santa Rosa City recommends dredging and widening of the Sta Rosa, Malusak and Caingan rivers, unregulated land conversion upstream will likely overwhelm the capacities of these structures in the long-term.

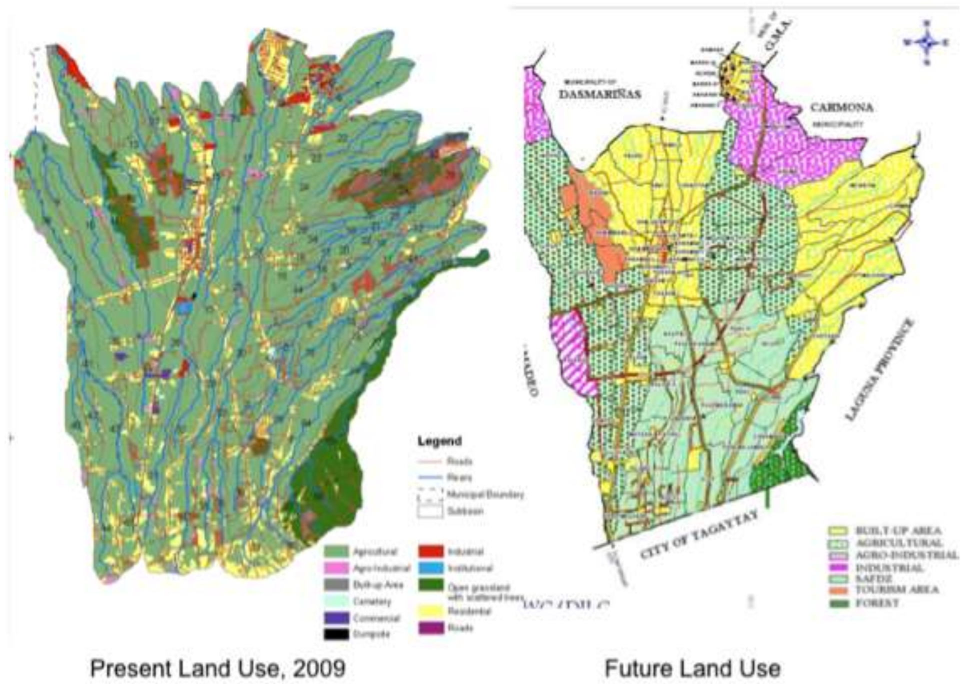


Fig. 4 Present Land Use (Left) and Future Zoning Map (Right) of Silang. Source: SPOT Imagery 2008 (left), Silang Municipal Planning Office (right)

6. Chronology of Water Legislations in the Philippines

Institutions are defined as "the humanly devised constraints that structure human interaction. They are made up of formal constraints (e.g., rules, laws, constitutions), informal constraints (e.g., norms of behavior, conventions, self-imposed codes of conduct), and their enforcement characteristics. Together they define the incentive structure of societies and specifically economies" (North, 1994).

In this section, we generalize how laws, reflecting the contextual challenges of the period in which they are crafted, are able to adapt through time - progressing from unregulated and abundant supply conditions, resource constraints and supply limitations, state ownership of waters, setting standards, limits and formulating rules, to finally adapting and reworking the institutions to enforce the new rules and regulations. These shifts are evident in the historical evolution of our current water laws, as summarized in Table 2.

Table 2 Chronology of Water Laws Passed

1866	Spanish Law on Waters
1889	Civil Code of the Philippines
1912	Act No 2152. The Irrigation Act
1936	Commonwealth Act No. 146 (as amended November 1936) creating

	the Public Service Commission
1949	Civil Code of the Philippines, RA 386
1966	RA 4850 creating the Laguna Lake Development Authority
1973	Provincial Water Utilities Act, PD193
1975	Revised Forestry Code, PD 705
1976	PD 1067 Water Code of the Philippines
1976	Pollution Control Law, PD984
1977	PD 1206 transfers powers of Board of Power and Waterworks to National Water Resources Council
1978	Philippine Environmental Code
1986	1986 Philippine Constitution
1987	EO 124 renames NWRC to National Water Resource Board
1990	DENR DAO-34 establishes a water classification system for beneficial use DENR DAO-35 prescribes maximum limits of municipal and industrial discharges into water according to classification
1991	Local Government Code
1995	National Water Crisis Act, RA 8041
2004	Philippine Clean Water Act of 2004
2005	DAO 2005-23 Adoption and Implementation of Collaborative Approach to Watershed Management
2010	Disaster Risk Reduction and Management Act, RA10121

6.1 Water Legislations in the Philippines

6.1.1 Early Legislations (Spanish period to 1986)

At the turn of the 20th Century until the early 70's, the watersheds in the country were relatively intact. Water was abundant and used mainly to irrigate crops, haciendas and plantations. Customary laws equate the right to use water with land ownership, which is communal in nature. Land, including those above and below its surface, is considered as owned by the gods and the spirits and is merely held by people in stewardship. Insofar as early peoples are concerned, land and the resources found therein constitute one integrated ecosystem.

The Spanish laws on waters was grounded on the Regalian doctrine, which provides that ownership and control over natural resources belong to the State. The dominant principle underlying Spanish water laws was the riparian doctrine, which attached water rights to ownership of land. Water rights were both private and public in nature. Rights to water resources can only be acquired through a grant given by the State. However, it also recognized the principle of acquisitive prescription in the use of public waters. This period marked the beginning of the transfer of control over natural commons including water resources from communities to the State.

The American-installed civil government perpetuated the dual nature of water ownership, and introduced the concepts of priority of appropriation and beneficial use. Priority of application defines who can claim the right to use public waters, that is, the one who appropriated it earlier has a prior and better right. Beneficial use measures and limits these rights to enjoyment of benefits to the rights holder. During the American period, water rights were appropriated to support state investments in infrastructure projects.

In 1949, after the Philippines became an independent state, Congress passed the Civil Code of the Philippines. The Code affirms the right of riparian owners to the flow of water passing through its natural channels for private ownership, subject however, to the qualification that upstream owners should not exercise their water rights to the prejudice of the rights legally acquired by those of the lower estates.

The Water Code of 1976 expressly repealed the provisions of the Civil Code, the Spanish laws and other earlier laws regarding water rights. From 1977 onwards, the Water Code consolidated all statutory rules on water rights and uses, applicable everywhere in the country and applying to everyone. The Code required claimants of customary rights to register and formalize their rights. Those without formal rights have no legal standing to seek redress for adverse claims to customary water resources.

Environmental Decline (mid 80's to Present)

Commercial logging and mining brought prosperity to the country but also brought rapid declines in forest cover. The period was marked by environmental disasters such Ormoc floods, from which the environmental movement was born. The 1992 Rio accord on Sustainable Development spurred enactment of a number environment laws in the Philippines, many of which were passed to establish protected areas, protect watersheds, minimize water pollution and to expand environmental responsibilities to public offices. More recent laws were formulated to mitigate impacts from natural disasters and recognized threats from global warming and climate change.

The Local Government Code of 1991 decentralized broad scope of powers and functions from the central government to local government units (LGUs) consistent with the policy of developing autonomous and self-reliant LGUs. The Code devolved several aspects of governance and the delivery of basic services in health, food, and water. The Code specifically grants LGUs responsibility over the development of surface and groundwater resources within their boundaries.

We discussed how earlier laws evolved and responded to opportunities and threats from a changing environment. The next section deals with an overview of past experiences in watershed planning, its limitations and lessons to be drawn.

7. Public Planning Using Watershed Approaches

A watershed is a delineated area of land from which rainwater can drain, as surface run-off via a specific stream or river system before discharging into a river, lake or sea. Watershed management is the process of guiding land use and other resource uses in a watershed to provide goods and services without adversely affecting soil and water resources.

Natural watersheds are the best adaptation tool to extreme weather events brought about by Climate Change. However, the United Nations, in their Millennium Ecosystem Report of 2000, reported the global loss of watersheds and degradation of services they provide to humanity.

Ecosystem-based management is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. Ecosystem- based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors . . . (McLeod et al., 2005).

Watershed planning takes a broad ecosystem approach using the surface water divide or watersheds as the management boundary. Within a watershed, human interaction with the water cycle needs to be managed to sustain the watershed services to benefit present and future generations. This section deals with vertically integrated planning approaches to foster actions at lower levels where they matter most.

7.1 What have we learned so far in watershed planning?

River basin planning is not new. There are 421 principal river basins in 119 proclaimed watersheds, 19 of which are identified as major river basins. Watershed plans were developed for many of the major river basins and flood plains. Most plans outlined risks and actions in areas impacted by dam releases or by natural flooding (e.g. Agusan, Pampanga, Cagayan River, Agno, Bicol). Various foreign assisted projects funded research, data gathering, modeling and preparation of master plans. However, these watershed plans were confronted with institutional hurdles.

Some of the hurdles and lessons in watershed planning are summarized below:

> First, there was no coherent alignment and translation of watershed plans into lower level plans where site based actions matter most. There is no elaboration of watershed targets and strategies into municipal/city-wide policies, ordinances, plans and further into site-based management guidelines and management practices.
>
> Second, watershed planning is not explicitly presented in present planning guidelines and templates prepared by the HLURB for use by LGU planners, or their consultants. The HLURB published guidelines for preparing Comprehensive Development Plans and Comprehensive Land Use Plans in 2007.
>
> Third, land use policies do not require development controls for upstream LGUs with regards to aquifer zoning, converting permeable areas, flood neutral land development, and others. Since downstream LGUs benefit from these controls, there is no framework for upstream LGUs to negotiate for equitable sharing of costs and benefits from controlled development.
>
> Fourth, there is no policy on how to form scale-relevant watershed institutions spanning towns/cities, provinces and even regions except as voluntary arrangements among LGUs.

7.2. A Cohering Approach to Watershed Planning

Fig 5 Hierarchy of watershed plans

The hierarchy of watershed plans is presented in Fig

7.2.1 Watershed Plans

Watershed plans should provide watershed policy and direction for: (1) ecological integrity and carrying capacity, (2) the protection of rivers, green space planning, (3) management of water quantity and quality, (4) stormwater management, (5) aquifer and groundwater management, (6) disaster risk management, (7) fisheries management, (8) rehabilitation programs, (9) framework for implementation of watershed policies and programs, (10) regional opportunities/constraints and (11) servicing needs/i.e. water supply and sewerage.

7.2.2 Sub-watershed Plans

Sub-watershed Plans will detail and implement specific sub-watershed targets and objectives, to establish: (1) natural system linkages and functions, (2) surface and groundwater quantity and quality management, (3) enhancement, rehabilitation of natural features, (4) areas suitable for development, (5) best management practices for incorporation into subdivision designs, building codes; (6) specific implementation schemes and responsibilities for all recommendations, (7) best management practices for sustainable drainage systems, open space areas and green space corridors, (8) outline directives for storm water management plans and other studies/designs for specific areas within the sub-watershed and (9) outline future monitoring requirements.

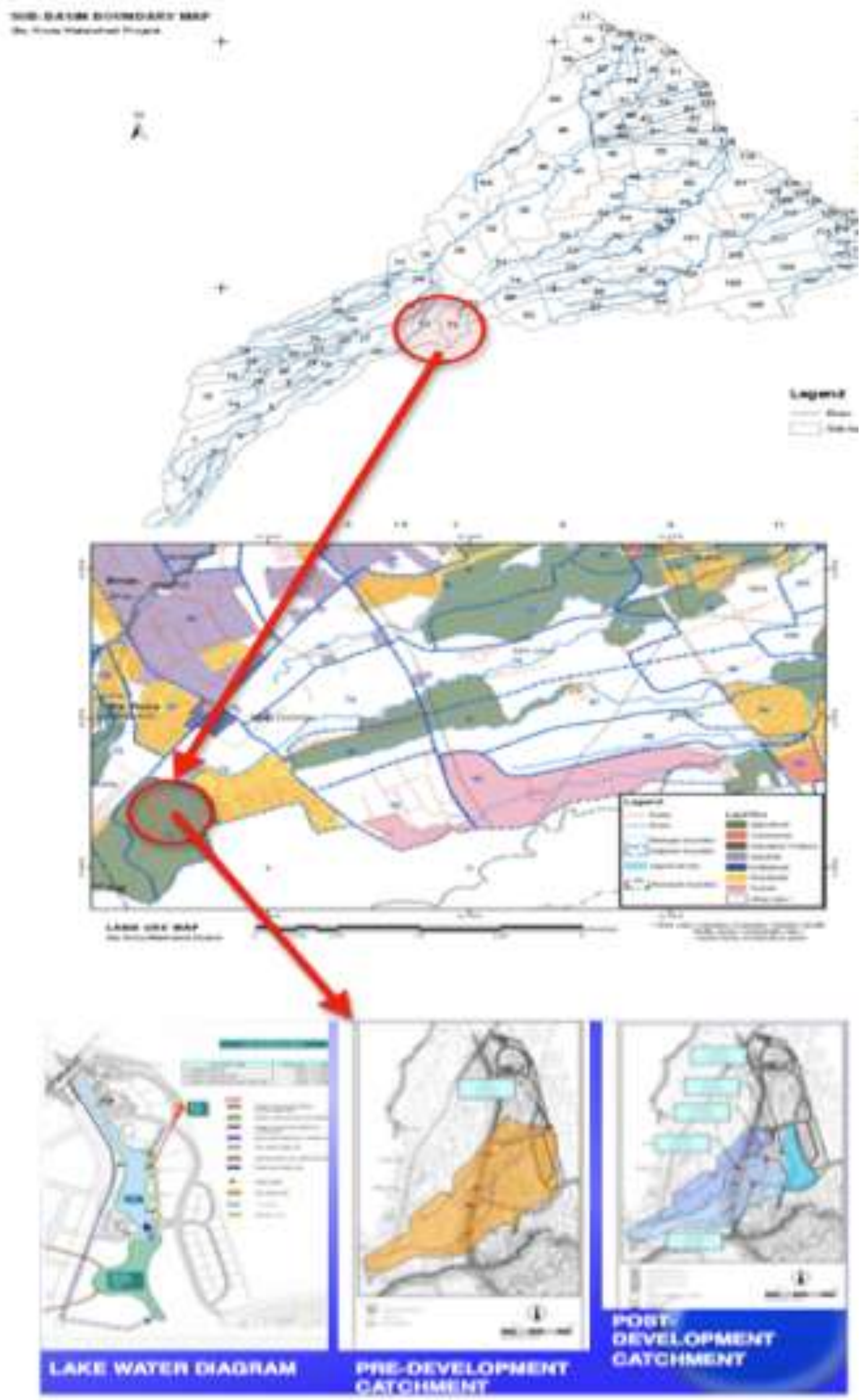
7.2.3 Site Management Plans

Site Management Plans will (1) present the designs of specific management practices, subdivision drainage designs, details of enhancement or rehabilitation programs, (2) demonstrate compatibility of designs with sub-watershed plans and recommendations, (3) requirement for permits and applications for construction approvals**,** (4) requirement for clearances of draft plans prior to detailed plans, (5) include environmental impact assessments, (6) will detail design, operation and maintenance of stormwater best management practices.

7.2.2 Interfaces with Land use Plans

Land use planning is required to increase infiltration, reduce exposure to flood hazard, and to reduce run off into urban areas. Land use planning needs to be carried out in the context of the whole catchment. If the catchment boundary crosses governance boundaries (e.g. with river basins) then cross-border planning and zoning will normally be required. The plan will delineate and zoning recharge areas/aquifer zones to limit conversion of permeable lands and requiring water sensitive land uses; zone flood risk using flood modeling with return periods to determine appropriate development uses with reference to vulnerability of such uses and value of infrastructure at risk; require building codes to restrict the increase of impermeable surfaces and to require land developers to conform to best management practices.

Fig. 6 shows example of before-and after-project lake design in Santa Rosa in relation to sub-watershed and watershed drainage system. Future residential developments and a central business district in the sub-watershed will result in increased runoff which is expected to increase runoff downstream into the river channel of the Cabuyao river. To mitigate future flood impacts, the developer designed a 1.4 ha lake to detain stormwater from built up areas to be later released to the creek when flood has subsided.



Source: Lake diagram courtesy of Ayala Land Inc.

Fig. 6 Site Development Plan in relation to Watershed drainage

8. Institutional Diagnosis

8.1 Water Code of the Philippines

PD 1067 of 1976 otherwise known as the Water Code of the Philippines is the governing law in the management of water resources. Water use regulation is vested with the National Water Resources Board. The NWRB is the apex body in the water sector. It is responsible for the administration and enforcement of the Water code and has policy-making, regulatory and quasi-judicial functions. It is vested with huge powers and responsibilities over water rights, allocation, use and regulates all kinds of alterations of water bodies and their hydrological processes. A summary of the salient features of the Water code is presented in Table 3.

Table 3 Salient Features of the Philippine Water Code of 1976 and IRR

	Nature of Provision	Source
Level of Decentralization	Water Rights Applications and approval delegated to offices, ie. DPWH District Eng'r, NIA Prov'l, NPC reg'l Mgrs , LWUA	Art 10
Nature of Water Rights	Priority in time, seniority in rights	Art 22, 24
Compensation	Payment for alteration, non-fulfillment or cancellation of rights	Art 24, 30
Adaptive management	Water use may curtailed when there is diminution of water due to natural causes	Art 36, 27
Water Use Priorities	Domestic/Municipal Water Uses as priority	Art 30
Flood Neutral Development	Owner of higher estate cannot increase the natural flow Lower estates obliged to receive natural flows, but not man-made flows	Art 50
Sustainable water use	Investigative studies on wells as to safe yield, beneficial use, adverse effects to other users, environmental effects, contamination to aquifers	IRR Sec 10-C
	Setting standards for beneficial use	Art 16, 18, 20, 21
Carrying capacity for GW	Spacing between wells	Sec 42- l
	New well should not result in more than 2m drawdown in existing wells	Sec 43-A
	Groundwater mining may be allowed provided that the life of the groundwater reservoir system is maintained for at least 50 years.	Sec 43-D
	Minimum stream flows for Environment	Art 66, Sec 44
Flood	Flood Plain mgt Committee (DPWH, NPC, DILG,	Sec 36

Management	NIA, NWRC) - To provide guidelines for local governments in the formulation of regulatory ordinances regarding floodplain use and occupancy;	
Sus Financing	Water Charges for diverted/extracted water	Sec 7

The Water Code contains some of the essential sustainability aspects, such as: maintenance of base flows, issuance of rights based on water availability, well spacing, environmental impact assessments, curtailment of water uses based on natural causes and flood neutral development. The level of decentralization is limited to national agencies and its lower offices, e.g. DPWH, NIA, NAPOCOR, LWUA, Water Districts.

8.2 Weaknesses in Administration and Enforcement of the Water Code

Although the Water Code has been in effect for almost three decades, compliance
with the permit requirements is low. According to the NWRB, extraction rates are understated by as much as 30% and approximately only 40% of users have the requisite water permits and pay the annual fees and charges. Further, an ordinary citizen would not know where to go to get a permit, or that a permit is required, or that NWRB even exists.

Prior to approving a water permit for diversion/extraction, the NWRB is responsible to gather the following information:

The approximate seasonal discharge of the water sources;
The amount of water already appropriated for beneficial use;
The water requirement of the applicant as determined from standards of beneficial use prescribed by the Board;
Possible adverse effects on existing grantees/permittees or public/private interest including mitigating measures;
Environmental effects;
Land-use economics;

The conduct of periodic studies to support decisions to award rights based on available water can be expensive. NWRB neither has the manpower nor resources to conduct studies.

8.3 Institutional Gaps and Recommendations

We summarize a number of institutional hurdles in integrating watershed and water resources management at a watershed scale.

First, the policy tools and instruments that are necessary for managing water resources are not decentralized but remains with national agencies, i.e. NWRB. However, the NWRB does not have field offices or personnel in the provinces or municipalities which means there is no monitoring or enforcement of the permit requirement.

Second, there is no reliable hydrologic information to support decision-making as to water resources and disaster risk management. The prospect of climate change suggests the need to document water withdrawals, consumptive uses, natural variations in stream flows and groundwater levels. The information would be useful in providing the basis for reducing future disputes and to support allocation decisions including permit approvals and provision for environmental flows. Efficient storage, quick retrieval of information and simplicity in reporting systems would be valuable.

Third, watershed management requires dealing with different LGUs that are run like "kingdoms" which tend to be unwieldy.

Fourth, faced with fiscal deficits, the national government views water charges as a revenue generating mechanism. The Code requires water charges to revert to the National Treasury.

Given the institutional hurdles, we propose amendments to adapt the code to current demands and to future climate change scenarios. Major improvements can be made on the following:

Groundwater Use. To conform with sustainability criteria for groundwater use, Sec 43-D should be amended to limit groundwater abstraction no higher than recharge rates.

Flood Neutral Development. LGUs should legislate localized subdivision and/or building codes to require flood neutral development as a long-term solution to flooding. Art 50 of the Water Code could be elaborated to reflect this proposal by updating its corresponding IRR.

Decentralized Watershed Governance. Finally, decentralized watershed and water governance means co-management arrangements be made with LGUs. Current modalities are limited to deputation arrangements with no sharing of powers and mandates.

Financial Sustainability. Finally, the Local Government Code allows LGUs to have a share in the natural wealth (in this case water resources). LGUs should be allowed to benefit from fees from water charges (Sec 7).

9. Dynamics of Institutions in the Santa Rosa Watershed

9.1. Common Pool Resources and Governance Institutions

Freshwater resources are classified as common pool resources because they share two important characteristics: (1) exclusion or control of access of potential users is difficult, (2) each user is capable of subtracting from the welfare of other users.

For example, the *de facto* open access of water resources means any user can divert water from rivers or drill a well anywhere and that it will be difficult to monitor every user. Second, the subtractability problem means less water is available to downstream communities when upstream users over pump or diversifies river flows for off-stream use.

Social Capital in Agrarian Societies

The Philippines was a pioneer in involving farmers in irrigation planning and management building on a centuries-old tradition of local communities developing and managing small irrigation systems. Separated by geography, distinct ethnic groupings have emerged with a common set of values, such as *pakikisama* and *hiya*. These characteristics define the Filipino social system and influence the nature of participation in any community activity, including those related to irrigation, planting and harvesting. It is common for family members and neighbors to freely give their help. Water harvesting practices reflect more traditional, local-level social norms. For example, indigenous farmers in the Cordillera region have long established ways to formulate and enforce rules in water use and in the protection of watersheds as evidenced by the *muyong* system. For indigenous groups, land and water resources contain spirits and the fruits from nature should be shared with one another and for the next generation. Removing customary control over water resources transfer of water rights to external agents, such as mining companies, is strongly resisted by these communities.

The theory of the commons has undergone major transformations over the years, starting from the "tragedy of the commons" model to small scale, community-based systems. Studies have documented how self-organization and self-regulation by communities are able to solve the exclusion and subtractability problems of the commons (Ostrom 1990, Wade 1994, Baland & Platteau 1996, Agrawal 2002).

However, community based resource management has been shown to be vulnerable to external drivers and often insufficient to deal with problems. From this base, several theories are advanced on the kind and type of institutions needed to address commons that are larger, more complex, involving multiple resources and user groups (Ostrom et al 1994, Young 2002:149, Berkes 2006).

We contend that the evolution of scale-relevant governance institutions is dynamic, marked by distinct phases - progressing from unregulated and abundant supply conditions, recognition of resource constraints and externalities, setting limits and rules on resource use, to creating institutions to enforce the rules and regulations.

The governance of water resources can be described as a continuum: from self-regulated, community-based management of water resources in one end, to state-created utilities supplying water to a city populated by millions in another. In between these two ends, governance systems can be confusing often marked by conflicts, oftentimes between local norms over water use in one end and state administered utilities and water rights in the other.

What is lacking with watershed institutions is a clear legal framework that specifies the roles and responsibilities, rights and obligations of stakeholders, the levels of decentralization, vertical integration and horizontal coordination, and the processes and means for good water governance.

9.2 Evolving Rule-making in the Santa Rosa watershed

Using the Santa Rosa watershed case as an example, we explain drivers and the conditions that drive the evolution of scale-relevant institutions in Santa Rosa. This evolving process is marked by four distinct periods, namely: 1) Era of abundant water resources (1700-1990), 2) recognition of scarcity problems (1990-2000), and 3) search for scale-relevant regulations and institutions (2000 –present).

9.2.1 Era of abundant water resources (1700-1990)

During the post-war era, until the 1970s, the towns people in three towns of Binan, Cabuyao and Santa Rosa were largely dependent on basic agriculture and family-owned enterprises for livelihood. Large tracts of land, known as "friar" lands, were planted to rice and sugar. To boost year-round agricultural production, groundwater pumping complemented rainfed agriculture.

Conflicts Over *Matang Tubig* Spring: Missing the Bigger Picture

In 1688, Biñan, together with Barrio *Bukol* (Santa Rosa, before separation from Biñan) separated from Cabuyao. After a series of renaming, separation of barrios to become independent towns, Barrio *Bukol* was politically emancipated as the municipality of Santa Rosa. The three towns occupy a floodplain with good climate and soils suitable to farm crops, which led to its establishment as an "encomienda" in 1571. The Franciscans arrived and carved out haciendas and the area became popularly known as friar lands. Cabuyao retained within its municipal boundary the upland barangay of Casile where the *Matang Tubig* Spring feeds into the Diezmo River. Water from this spring, reported at 700-1000 lps, used to irrigate the vast sugar plantations in Canlubang. Together with Bucal spring in Calamba, the Matang Tubig spring is the only viable source of surface water in the First District of Laguna (aside from Laguna Lake). With large-scale developments taking place in Santa Rosa, new sources of water are required. The original settlers are suspicious of outsiders visiting their spring. Conflicting rights and overlapping claims by water clamants to *Matang Tubig* spring have yet to be resolved in court. The larger threat to the spring however is the loss of recharge due to land conversion in the eastern barangays of Silang. Neither Silang nor Cabuyao LGU is attending to this larger issue.

The National Irrigation Administration shifted from groundwater to surface water use when over pumping for irrigation depleted water tables. To maximize surface water use, NIA built the Macabling weir in Santa Rosa City to impound storm water from higher Silang, then distributed these by gravity to rice paddy areas through a network of canals. These structures which sustained rice agriculture have become *de facto* informal drainage systems for lower Santa Rosa.

9.2.2 Decline in Environmental Quality (1990-2000)

During the Ramos years (1992-1998), fiscal incentives and no-strike policies attracted industries to locate in Laguna. With close proximity to Metro Manila, the Laguna towns underwent rapid transformation. It is in the agricultural provinces of Manila's extended metropolitan region where an industrializing and globalizing economy is driving major transformations in the social, economic and political spheres. The process of urbanization resulted in the encroachment of urban land uses and employment into rural settings.

Liberal policies stimulated land markets that led to changes in land uses, transfer in land ownership, outmigration and in-migration. Large swathes of irrigated agricultural land have been converted into a variety of urban and industrial use. Changes in land ownership altered traditional management of communal land and water resources.

The groundwater resources map of the Philippines identified the coastal towns in the western Laguna de Bay as a water abundant region. As industries located in Laguna in the early 1990's, water use shifted from agriculture to industrial. The number of water-dependent industries grew as a result of good infrastructure, favorable investment policies and proximity to Manila.
At this time, water issues were beginning to surface. Over abstraction of groundwater is compounded by problems related to water quality.

During a WWF wellhead survey in 2010, long time residents near the lake observed the loss of free flowing artesian wells. Owners of shallow tube wells complained of poor water quality and blamed new wells competing with old wells. Poorer households are disadvantaged as they cannot afford to drill deeper to draw cleaner water. Land subsidence from over-pumping is suspected based on observed protruding well tubes and cracked bases.

The recognition by LGUs of the water problem is evident in the Comprehensive Land Use Plans crafted in 2000 by the three towns. The aim is "to make available clean potable water in all houses and business establishments, and to ensure water security by protecting the watershed and groundwater resources of the municipality".

9.2.3 Institutional Responses (2000 –present).

A number of environmental legislations were passed by the LGUs during this period. The city of Sta. Rosa has so far has the most updated local environmental policies and regulations that support national legislations on environmental protection and management. Since 1999, the City has passed 13 environmental legislations and instruments, the latest of which is the City Environmental code of 2011. This code looks at land, air, water, waste and co-management arrangements with national and regional offices. During the public hearings, the larger corporations welcomed the new regulations. This is a paradigm shift compared in the past where companies resisted laws regulating their actions.

Other municipalities like Cabuyao, Laguna and Silang, Cavite have yet to systematically organize their local ordinances in support of national legislations for easy retrieval and reference of these laws. The Municipality of Silang organized two environmental summits and attempted to draft its environmental code in 2009 and establishment of the MENRO office. The process was aborted by the election ban two months before the May 2010 elections.

High donor interest to fund LGU projects within the Santa Rosa Watershed indicates high level of confidence in the leadership of these LGUs. Under World Bank funding, the LGUs of Binan, Santa Rosa and Cabuyao prepared their respective land use plans. The World Bank-funded LISCOP project implemented by LLDA provided a grant and loan component for institutional strengthening and establishment of sanitary landfills. The USAID funded a wastewater treatment facility for the City Public Market of Santa Rosa City.

9.3. Public-Private Cooperation through River Rehabilitation Councils

In 1997, the LLDA played a key role in mobilizing the stakeholders, namely the private sector, Municipal/City Environmental and Natural Resources Officers from each watershed town, Rotary Club, and local residents when it organized the Save-Silang-Santa-Rosa-River Foundation (S3R2), an NGO whose mission was to rehabilitate the Santa Rosa River. Active member companies were the Coca-Cola Bottlers Plant in Santa Rosa, Toyota Auto Parts, Laguna Techno Park and many others. Plant executives from the Coca-Cola Bottlers Corporation took over the helm of the foundation for more than a decade.

Corporate social responsibility was the driving force behind private sector efforts in Santa Rosa. Various pursuits in river rehabilitation – tree planting, clean up drives, school campaigns – marked the activities of companies operating in the watershed. The corporate members, assisted by the LGU MENRO offices, mobilized volunteers to haul river wastes in three zones throughout the 27 km stretch of the Santa Rosa River.

Tree planting was done in Zone 1 of the Silang stretch of the river which suffer from eroding banks. Companies implemented their own appropriate environmental strategy in Zone 2 where heavy industries operate. In Zone 3, where population is dense and domestic waste of communities spill into the canals and waterways, the S3R2 members pioneered the environmental army concept where volunteer fishermen trained by the LLDA patrolled and policed the area of polluters. Later the LGUs, through the initiation of their MENROs, set up their own environmental army though the barangay local government and schools.

Under an “Adopt-a-Barangay” campaign, the member companies planted trees along riverbanks to mitigate erosion. They coordinated with schools and with the Girl Scouts of the Philippines to raise awareness, mobilize students to monitor and collect wastes in particular sections of the river.

Source: The river runs freely again. http://www.philstar.com/Article.aspx?articleld=135210

9.4. Stakeholder Dynamics

9.4.1 Stakeholder Perceptions

Stakeholder perceptions on which sectors have “rights” to resources and which agencies should make policies are important inputs to designing co-management institutions.

In 2005, the Laguna de Bay Environmental Action Planning (LEAP) project of the LLDA conducted a stakeholder analysis using Focus Group Discussions (FGD) to assess stakeholders interests and perceptions on institutions, stakeholder inter-relations, affinity to land and water resources, and readiness to be involved in watershed management. The FGDs were held in each LGU with participants from municipal/city officials, basic sectors, water district, private sector, NGOs and private individuals.

Common among the participating municipalities is the perception that LLDA and the LGU as institutions that are relevant, important and having high influence in terms of policy and decision-making vis-à-vis watershed resources conservation and management. In terms of prior rights, the local stakeholders perceive low pre-existing rights to the use of watershed resources. This may mean that as communities are being urbanized and becoming heterogenous, there is gradual detachment of sense of belonging to the natural environment among its stakeholders.

The real state developers, golf courses, business establishments and industry group are perceived to be the profit-oriented and whose activities are potential threats to the watershed. In the city of Santa Rosa, the S3R2 river council is surprisingly noted as highly influential and important where decisions on the use and management of the watershed are concerned.

The LEAP report concludes that, given the encouraging perception on the government institutions (DENR, LLDA) and their roles in the rationale management of the watershed, an opportunity for working closer with LGUs is presented (LLDA 2005).

9.4.2 WWF Institutional Capacity Study

In 2010, WWF commissioned a study to assess current capacities, mandates of local stakeholders in relation to watershed and water resources management. The objective was to design watershed institutions that will address scale issues and coordinate vertical linkages with national/regional agencies. Interviews were arranged with three (3) mayors, eleven (11) local officials, S3R2 President, water utilities (Laguna Water Co., Manila Water, Cabuyao Water) and national agencies such as the DPWH, DENR and NWRB. The findings show regulatory powers over surface waters was delegated by NWRB to LLDA, while NWRB retains jurisdiction over groundwater. Water quality is being monitored by LLDA, Water Districts and Municipal Health Offices.

The LGUs that were interviewed were reported to have limited or no capacity to exercise water resource or watershed management alone or even jointly with other LGUs. The activities of the S3R2 are limited to cleaning up and rehabilitating the Santa Rosa river.

With Clean Water Act as the legal framework, the study recommended the creation of an Integrated Watershed and Water Resource Management Council, strengthening the participation of the private sector through the S3R2 Foundation, adoption of an Integrated Water Resource Management Plan and Framework and Capacity Building of the LGUs to formulate and implement the IWRM Plan. (Demigillo 2010).

9.4.3 Politics of Scale, Position, Place

While the projects implemented by the private sector and the LGUs are laudable, their impacts are limited. Cash et al (2006) summarizes three challenges facing water resources management as ignorance of scales, mismatch and plurality.

Ignorance of scales is failure to understand water resources as part of larger complex ecological systems. Mismatch means the solutions do not correspond to the scale in which the problem occurs. While plurality is a constraint imposed by a large number and variety of publics - their value systems, power bases, and cultures - that makes consensus-building and compliance to rules unwieldy.

The trans-boundary nature of watersheds and inter-local water resources management raises questions on how politics, given local government autonomy, are played out which may either enable or hinder the development of watershed institutions. Experience tells us that local autonomy, or its interpretation by LGUs, can constrain attempts by meso-level bodies, such as MMDA and LLDA, to standardize and enforce laws across political boundaries.

9.5 "Politics" Mapping of Stakeholders

The "politics" at play are important considerations in inter-local dynamics. How do power differences – based on position, place and scale – among actors in a watershed enable or constrain agreements and formation of meso-level watershed institutions? These questions are central in ongoing efforts and discussions in promoting inter-local, public-private cooperative arrangements in the Santa Rosa watershed. To identify incentives for different actors to develop agreements and participate in watershed institutions, it is useful to map stakeholder interests and corresponding power base from which to propel those interests (Table 4).

Lebel et al (2005) distinguishes the different forms of politics as politics of scale, position and place. "Politics" of scale or level refers to higher state or regional offices that hold the legal mandate and oversight over lower level units of the organization. The politics of place is played out through the downhill flow of water which creates asymmetry among potential users, with "first-come-first served" enjoyed by upstream communities. The politics of position refers to special characteristics not found in the politics of scale or place. These can be income, development status, population or land area.

Table 4 Mapping Political Bases of Stakeholders in the Santa Rosa Watershed

Actors	Scale	Place	Position
LLDA	√ (1)		
Silang LGU		√ (2)	
Santa Rosa LGU			√√ (3,4)
Cabuyao LGU			√(3)
Binan LGU			√(3)
Private Sector			√(5)

(1) LLDA has wide legal jurisdiction ("politics of scale") over the 24 watersheds within Laguna Lake. Its authority includes regulation of surface waters, water pollution, pollution charging, and

approval of development permits. However, it lacks the resources to perform its mandate. There is no national budget appropriation given to LLDA which derives its revenues from pollution charges and surface water permits. Ultimately, LLDA will have to depend on LGU resources to finance investments in the watershed.

(2) Silang, a 1st class Municipality, is located upstream where it hosts the headwaters to seven (7) watersheds in Laguna and Cavite. It has the advantage of being the first user of water resources ("politics of place"). It maintains vast agricultural land that is the recharge area of the watershed. Its land use affects downstream hydrology including flooding in lower Santa Rosa. Silang, whose economy is derived from agriculture, is the poorest member among the watershed towns. As it aspires to be like its neighbors, can it leverage its position to extract agreements with downstream towns?

(3) The towns of Santa Rosa, Binan and Cabuyao host a large number of business locators that drive the economic growth in the CALABARZON. Significant revenues from real property taxes, business permits qualified these towns to become new cities (Cabuyao has a pending bill in Congress). The cities depend on recharge from Silang for their groundwater supply. City officials are increasingly under public scrutiny as they grapple with complex problems affecting their constituents, e.g. drinking water, wastes, drainage, slums. Because of their wealth, these towns benefit from the politics of "position".

(4) Santa Rosa City occupies the largest area in the watershed ("politics of position"). The city would benefit the most from watershed actions. In terms of capacities and environmental activism, Santa Rosa City scores high with the highest number of watershed activities and ordinances.

(5) The private sector drives the economy in the watershed. A number of big-name corporations, e.g. Coke, Asia Brewery, Toyota, are involved in river rehabilitation through the S3R2. Their financial clout, expertise and advanced practices in environmental management are bargaining strengths (politics of "position").

From the mapping exercise, we deduce that politics based on scale, position, or place, are derived from different bases and held by different actors. Four out of six derive their power from "positions", while Silang and LLDA derive their power from "place" and "scale" respectively.

How different actors will leverage their power in order to achieve their strategic interests is part of the drama of the commons that has yet to unfold in Santa Rosa.

10. Towards Developing Decentralized Watershed Institutions in Santa Rosa: The Missing Link in IWRM

10.1 Vertical Integration

A major premise of the devolution theory is the argument that local water users have the strongest incentive to manage that resource more efficiently and sustainably than the centrally financed government agency because of better local supervision (Meinzen-Dick & Knox, 1999). The subsidiarity principle means allowing decisions affecting people's welfare to be made at the lowest levels of organization. Co-management has emerged to be the more popular institutional arrangement resulting from negotiated agreements between local and state actors (Young 2006).

The relevant agencies and that will take part in administrative/co-management agreements with the Santa Rosa watershed institution are presented in Table 5.

Table 5 Relevant Functions Proposed for Co-Management Agreements

Co-Managed Functions	Agency	Governing law
Performing water balances to determine available/allocable water	NWRB	PD1067
Issuing Rights to abstract ground water for water supply	NWRB	PD1067
Issuing Rights to divert surface water for water supply	LLDA	EO 927
Regulating beneficial uses of water	NWRB	PD1067
Adjudication of disputes relating to the appropriation, utilization, exploitation, development, control and conservation, and protection of waters.	NWRB	PD1067
Stream level monitoring Flood Control Engineering	DPWH	
Charging fees for groundwater uses	NWRB	PD1067
Watershed Planning and Mgt	LLDA	EO 510
Charging fees for diverting surface water, effluent discharges	LLDA	RA 4850 EO 927 Clean Water Act
Designating water quality areas, monitoring water quality (surface and ground)	LLDA, DENR, NWRB, DOH	Clean Water Act
Flood Neutral development	NWRB LLDA	PD1067 EO510
Forest Protection	DENR-CENRO	PD704
Toxic Waste	DENR-EMB	RA6969
Physical Framework Plans	Provincial LGU	

10.1.1 Environmental Code of Santa Rosa City

In July 2011, the City of Santa Rosa passed its City Environmental Code which covers land, air, water, wastes and energy. Recognizing the limited efficiency of central governments in managing land, water and air resources, the Code empowers the City Mayor to enter into administrative agreements with the NWRB, LTFRB, EMB, LLDA, etc. The code enjoins its mayor to enter into partnerships with neighboring municipalities/cities in jointly managing floods and groundwater resources.

To maintain and ensure floodwaters are conveyed within the design capacity of hydraulic structures, the City of Santa Rosa legislated flood neutral development through its City Environmental Code of 2011. Art V, Sec 50 states:

> Article V, Sec 50. **Methods/measures to address problems of recharge and flooding**. To address the problems of recharge and flooding in the City, contractors, developers and/or planners shall incorporate in their development plans provisions for retention ponds, detention ponds, rain gardens and/or swales insofar as these are appropriate in the area being developed.

The code will require land developers to build runoff controls in their sites to ensure that peak discharges and flood volumes before development are not exceeded. However, these controls must be in place not only in Santa Rosa but throughout the watershed to address the cumulative impacts of urban land uses on stream stability, downstream flooding and water quality.

These controls will complement future plans by the City to prepare a Flood Master Plan in order to install a modern drainage system in lower parts of town. These investments will require significant amounts of money. The useful life of these future investments will not optimized unless best management practices and structural controls are made part of land use practices throughout the watershed.

10.2 Horizontal Cooperation

Within any basin there will inevitably be conflicting demands and uses for water. Watershed institutions will require horizontal cooperation between LGUs, sectoral offices and water user groups within a catchment. The purpose of horizontal cooperation is to ensure the rules are developed in a participatory manner and that compliance is enforced and monitored. For the Santa Rosa watershed institution, the relevant agencies or groups that need to be represented in Table 6.

Table 6 List of Watershed Stakeholders

LGUs	Binan, Santa Rosa, Cabuyao, Silang (ENRO, Planning, Health, Eng’g) Barangays
Agriculture	Silang farmer coop
Industry/Comm’l	Laguna Techno-park Business Groups S3R2 NGO
Heavy users of water	Coca Cola, Asia Brewery, Nestle, San Miguel Corp, Gilbeys
Property Developers	Ayala Land, Greenfield, ETON, etc
Homeowner Associations	
Irrigation	NIA, Macabling Irrigators Group
Water supplies Wastewater treatment	Laguna Water Corp.
NGOs	Santa Rosa based NGOs

10.3 Philippine Clean Water Act of 2004 (RA 9275)

Republic Act No. 9275 otherwise known as "Philippine Clean Water Act of 2004" provides the legal framework for the governance, organizational structure, financing arrangements and process for delineating a Water Quality Management Area and formulation of a clean water program.

The institutional "best fit" to enable the formation of more accountable watershed institutions is found in the Clean Water Act. The salient features of the Clean Water Act are summarized in Table 7.

Table 7 Salient Features of Clean Water Act

Subject	Scope	Source Provision
Water Quality Management Area boundary	Watershed, river basins or water resources regions Designated by NWRB thru DENR DAO	IRR Sec 5
WQMA Action Plan	Sewerage, septage, schedule of compliance, goals, targets & strategies, info & education program, resources needed and sources, enforcement procedures, rewards & incentives	
Laguna de Bay	Laguna Lake as WQMA, LLDA as WQMB	Sec 5.10
Board Members	LGU, NGAs, NGOs, water utility, business association, DENR as chair	Sec 5.3
Stakeholders with common interest	PAMB, FARMC, FMA, MOAs, watershed councils, LGUs, RDC's, academe, IPs	Sec 5.1.5 (IRR)
Priority	Areas where water quality has exceeded water quality standards	
Data requirements	Topographic, land use, political maps; water sampling results, runoff, discharge, water level, other water related data, threats, socio-economic, infrastructure, water supply, sanitation, sewerage	DENR Manual
Processing	Pollution load modeling/calculations, plot WQMA boundaries	
WQMB functions	Water quality Status report, prepare WQMA Action Plan; harmonize policies, laws	
Sewage collection, treatment and disposal	By water concessionaires for Metro Manila, Highly Urbanized Cities By DPWH in coordination with DENR, DoH for non-HUCs	Sec 8
Funding	Area Water Quality Management Funded from wastewater charges/fees	Sec 9
Carrying capacity of receiving water body	Allocation of effluent quotas in the discharge permits to attain water quality standards of receiving bodies	Sec 14
Scope of Coverage	Natural, man-made bodies of fresh, brackish,	Art 2 - oo

of Water Body Definition	saline waters including aquifers, groundwater, springs, etc.	

Deputation Powers of the NWRB

The Philippine Water Code vests with national government, through the NWRB, with vast powers in the development and management of water resources. The problem is that the national government has little capacity to enforce rules dealing with a large number of water users, big and small, with regards to their actions over a wide area. Launching effective enforcement actions under national oversight will be very expensive.

To strengthen its enforcement and administrative capacities, the NWRB deputized several agencies (NIA, DPWH, NPC and Water Districts) to perform some of its functions. In some cases, the NWRB deputized the LGUs (Sta Fe Municipality, Bantayan, Madridejos in Cebu). NWRB agreed to joint groundwater monitoring with Quezon City and San Juan and entering into agreements with Palawan, Naga City, Davao City and Davao City water District. The obligations of the LGU include requirement for drilling applicants of a business permit and accreditation with the NWRB; monitor well drilling; collect data on well users and undertake information campaign among groundwater users.

10.4 Recap and Conclusion

Using the Santa Rosa Case, we described the changing hydrology confronting most watersheds brought about by population increases, land use change and changing climate. These changes will affect domestic water supplies, agricultural production, hydropower generation and intensify natural disasters such as flooding and land slides to many areas – including areas historically imagined to be less vulnerable. To respond to this set of formidable challenges, we looked at current legislations and past attempts and lessons in watershed management particularly on weaknesses in management integration and the institutional hurdles. We examined dynamics of local stakeholders, their history of cooperation, interests, politics, perceptions and capacities.

We propose a co-management structure for integrated water and watershed management and a process of adaptive governance at the watershed level. The IWRM framework provides the platform for integrated management. The governing structures, to be effective, will require horizontal and vertical linkages to reach out to different stakeholders- both local and national. A list of stakeholders and administrative arrangements are presented in the Santa Rosa case.

The institutional fit to enable the formation of more accountable watershed institutions is found in the Clean Water Act. We discussed its salient features and how watershed management institutions can be structured around this law.

10.5 Lessons

1. The "Business Case" of Watershed Management. Mayors will not participate in watershed activities unless the proportionate benefits from doing so (versus cost of participating) are quantified and made clear to them. The flood master plan can be made as starting point. But the savings and synergy should be made clear so each town can decide on whether to proceed as a group or individually.

2. Start with Low-Hanging Fruits. Not all LGUs, and departments within a watershed, have the same interest, motivation and capability in environmental management. The project worked more closely with Santa Rosa because of the interest shown by staff and affinity with the mayor and harmonious relations with the SB members. The waning interest of the rest can be explained by the relatively smaller areas covered by these towns in the watershed, and fewer benefits that accrue to their favor.

3. Finding Thematic Champions within LGUs. Proposed solutions are matched to an environmental "champion" within the LGU, followed by piggy-backing of the water and watershed agenda with the office. For example, the formulation of the Flood Master Plan and DED was pushed through the City Planning Office of Santa Rosa. While the formulation of water provisions in the City Environmental Code was driven by the City Environmental Office.

4. Watershed Hierarchal Planning Templates. The alignment of watershed goals, sub-basin targets, site-management plans, building and subdivision codes and property development guidelines will require development of planning templates and hydrological databases. These are not presently provided by the HLURB planning templates and CLUP guidebooks.

5. Role of the LLDA as Watershed Institution. LLDA will need to enunciate a clear vision for the lake, decentralize watershed management through the Clean Water act; require LGU planners to adhere to planning templates; provide technical expertise; install Monitoring & Evaluation systems including LGU compliance mechanisms.

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