

Into the Golden Year of Lake Basin Management in Laguna de Bay, Philippines

Adelina C. Santos-Borja

1. Introduction

In 2004, the Experiences and Lessons Learned in the Management of Laguna de Bay was prepared as one of the contributions to the GEF-funded project entitled “Towards a Lake Basin Management Initiative: Sharing Lessons and Experiences from GEF and non-GEF Lake Basin Management Projects.” It covered 28 lakes from 5 continents, with varying environmental, socio-economic and political conditions as well as different management mechanisms and strategies.

The following year, in 2005, the International Lake Environment Committee Foundation (ILEC) published a comprehensive report on *Managing Lakes and their Basins for Sustainable Use: A Report for Lake Basin Managers and Stakeholders*, wherein the lessons in managing the 28 lakes were picked up.

The Laguna de Bay Brief, as it was called during the implementation of the said project, was also published (Santos-Borja and Nepomuceno, 2006), which emphasized the institutional development and change for lake basin management. It covered a period of 35 years from the initial operation of the Laguna Lake Development Authority in 1969 through Republic Act 4850 (1966), as amended by Presidential Decree 813 and Executive Order 927. In the succeeding years until 2019, the Laguna Lake Development Authority celebrated an important milestone, its 50th year anniversary, not to mention that it is still the only lake basin management authority in the Philippines. Another wave of institutional development and change has happened in the last 15 years. The most prominent were the passage of Republic Act 9275 (R.A. 9275), more commonly known as the Clean Water Act, the directive of the President of the Philippines to transform Laguna de Bay into an economic zone and to give priority entitlements to fishermen, and the concerted efforts among the lead agencies of government, led by the Department of Environment and Natural Resources to clean Manila Bay and rehabilitate the Pasig River and Laguna de Bay. Likewise, the keen interest of local and international research institutions to conduct research in Laguna de Bay grew at a very encouraging pace, paving the way for a more science-based policies in the protection and conservation of the Laguna de Bay basin’s resources. This paper updates the earlier Experiences and Lessons Learned in the Management of Laguna de Bay by highlighting these recent developments in the last 15 years.

2. Downscaling ILBM in the Laguna de Bay Basin

2.1. The Enabling Environment

The approval by the Philippine Congress of Republic Act 9275 – *An Act Providing for a Comprehensive Water Quality Management and for other Purposes*, simply known as the Philippine Clean Water Act of 2004, paved the way for the development of a more participative approach in the protection and management of the country’s water resources. One of its ten policies is the formulation of a holistic national program of water quality management that

recognizes that water quality management issues cannot be separated from concerns about water sources and ecological protection, water supply, public health and quality of life.

A Water Quality Management System was specified which requires the designation of certain areas as water quality management areas using appropriate physiographic units such as watershed, river basins or water resources regions (Article 5, Section 1). As stated, the management area shall be governed by a governing board composed of representatives of mayors and governors of member local government units (LGUs), and representatives of relevant national government agencies, duly registered nongovernmental organizations, the water utility sector, and the business sector. The prominence given to local government officials is in line with Republic Act 7150 or the Local Government Code, which further strengthens the powers of governors and mayors to organize local development councils in each province, city or town and encourages the appointment of an Environment and Natural Resources Officer, respectively.

In cognizance of Republic Act 4850 or the law that created the Laguna Lake Development Authority, as amended by Presidential Decree 813 and further strengthened by Executive Order 927, the Laguna de Bay Region was designated as one water quality management area (WQMA), wherein the standards and wastewater charge system promulgated under the Clean Water Act shall be enforced in the said area. As such, the Laguna de Bay Region takes prominence as the first WQMA to be declared under R.A. 9275.

A WQMA Governing Board was created as the Administrator of the Laguna de Bay Region through LLDA Board Resolution No. 304 Series of 2006. It consists of the existing members of the LLDA Board as specified in the law that created the LLDA with the inclusion of two members from the water utilities sector and civil society. The LLDA Board specified that the latter should be the Federation of River Basin Organizations.

The Implementing Rules and Regulations of the Clean Water Act was promulgated and adopted by the Department of Environment and Natural Resources (DENR) in coordination with the Committee on Environment and Natural Resources of the Philippine Senate and the Committee on Ecology of the House of Representatives and other concerned agencies through DENR Administrative Order No. 2005-10. The specific functions of the WQMA Governing Board are stipulated in Section 5, of which two of the most significant functions not fully exercised by the LLDA Board of Directors are: 1) to formulate strategies to coordinate the policies/regulations/local legislation necessary for the implementation of the Act in accordance with the established framework, and 2) to monitor and facilitate the compliance of local governments with the WQMA Action Plan.

2.2 A more responsive ILBM strategy in a sub-watershed scale

The institutionalization of a sub-WQMA Board and Watershed Management Council

The Laguna de Bay Region extends beyond the lake's basin (Santos-Borja and Nepomuceno, 2006). With the inclusion of the 900 km² lake, its total area is about 4780 km² as compared to the total basin area of 3820 km². Nonetheless, the management area is huge wherein several institutions also exert their respective mandate on the management of the basin's resources. In particular are the local government units from the provincial to the barangay level (smallest

political unit in the Philippines). Each of the twenty-four (24) watersheds is host to several towns and cities with varying land use that impact on the water quality of the tributary rivers and eventually on the lake.

Thus, the LLDA Board of Directors has passed a resolution declaring each of the 24 sub-watersheds as sub-water quality management areas or sub-WQMA's. Consequently, a Sub-WQMA Board must be organized in each sub-WQMA to coordinate policies and formulate strategies for the effective implementation of the Clean Water Act as well as monitor the compliance with the action plan.

With some similarities in the representation in the LLDA WQMA Board, the sub-WQMA board is composed of the following:

- a) The mayor of each Local Government Unit (LGU) in a sub-watershed
- b) The LLDA General Manager
- c) The River Council or a legally recognized Non-Government Organization (NGOs) that is accredited by the LGU.
- d) A representative from the Water utility sector
- e) A representative from the business sector

Technical Secretariat

The technical secretariat provides assistance and support to the Board and the Council. It is composed of the Department Heads of Planning, Environment, and the offices in charge of Health and Sanitation and Engineering, as well as professionals in various environment-related disciplines.

The LLDA Board Resolution No. 304 further expanded the participation of various stakeholders in each sub-watershed through the creation of a Watershed Management Council (WMC) in each sub-WQMA. This underscores the importance of understanding the connection between the lake and the watershed in order to manage water quality. The WMC is composed of the sub-WQMA Board, the multi-sectoral group and the technical secretariat with the following tasks:

- a) To formulate an integrated Watershed Management Plan in the sub-watershed.
- b) To harmonize Land Use Plans among LGUs within each sub basin.
- c) To mainstreaming integrated watershed management into LGU plans program and policies.
- d) To develop and implement an effective and efficient Water Quality Monitoring Plan for various water bodies in the sub-watershed.
- e) To develop sustainable funding mechanisms for watershed rehabilitation , improvement and conservation.

An integrated watershed management framework was formulated to guide the council (Figure 1).

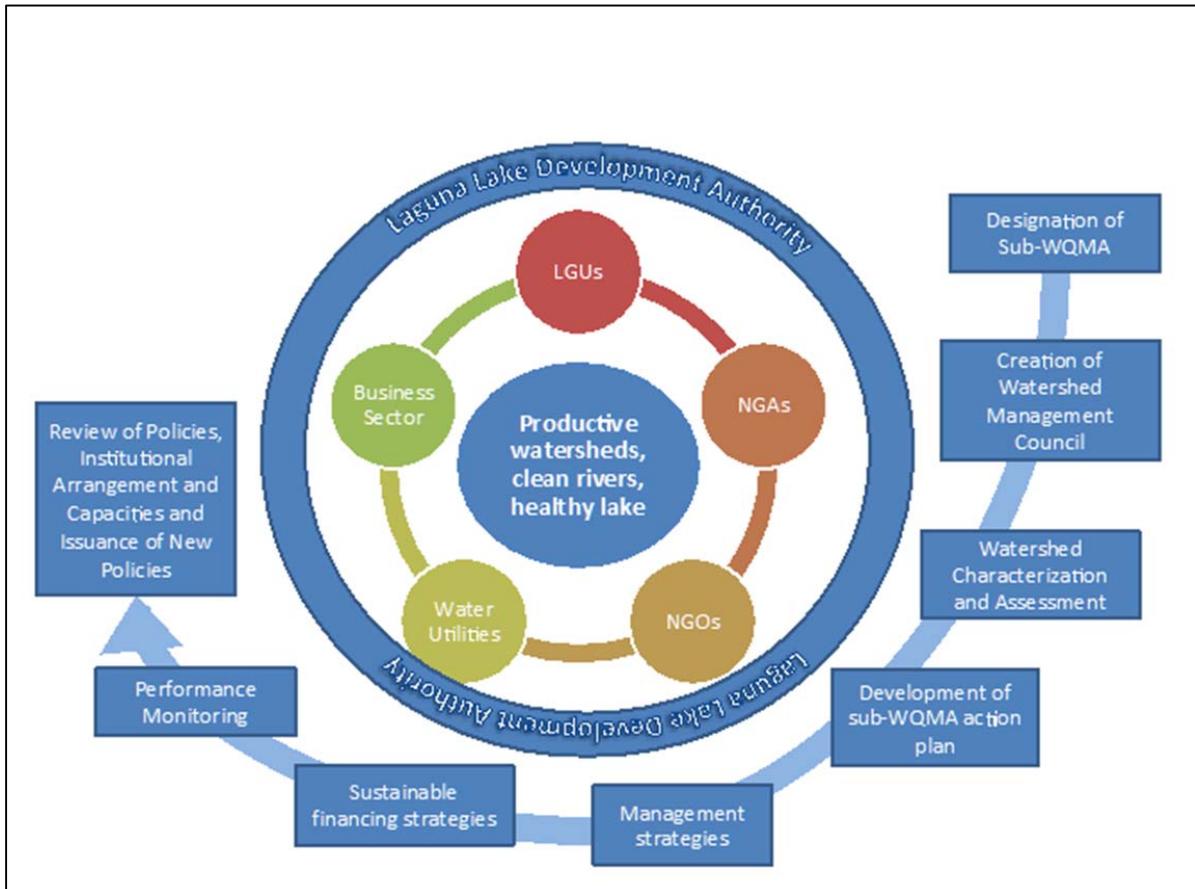


Figure 1. The Integrated Watershed Management Framework

The LLDA provides a minimum funding amount of Two Hundred Thousand Philippine Pesos (PHP 200,000) to jumpstart the activities of the Council in each sub-WQMA.

2.3 Learning from the First Sub-WQMA

The Sta. Rosa sub-watershed which is host to four (4) LGUs was the first sub-WQMA to be organized. The Municipality of Silang is located in the upstream, while the cities of Santa Rosa, Cabuyao and Biñan are in the midstream and downstream.

This sub-watershed has undergone tremendous land conversion from agricultural farms to industrial estates, notably in Santa Rosa City. The fast-paced development in the city has attracted big businesses and it became their manufacturing hub. It was even branded as the “Detroit” of the region because almost all of the prominent car industries have moved to Santa Rosa. Likewise, plush residential areas and commercial establishments were developed. In due time, Sta. Rosa City became a first class city.

Faced with development pressures, one of the major beverage manufacturing industries in the city teamed up with the World Wildlife Fund for Nature to study the water sustainability of the city. This prompted the local government officials to issue an Environment Code and a Land developer's guidebook. Both pioneering activities earned awards and distinction for the City and this has attracted local and foreign development and research institutions to conduct studies in collaboration with the City's environment office that generated scientific data. The sub-watershed became a living laboratory for Environmental Management and Governance (Santos-Borja, 2017). These data were used in the assessment of the state of the environment in the whole sub-watershed.

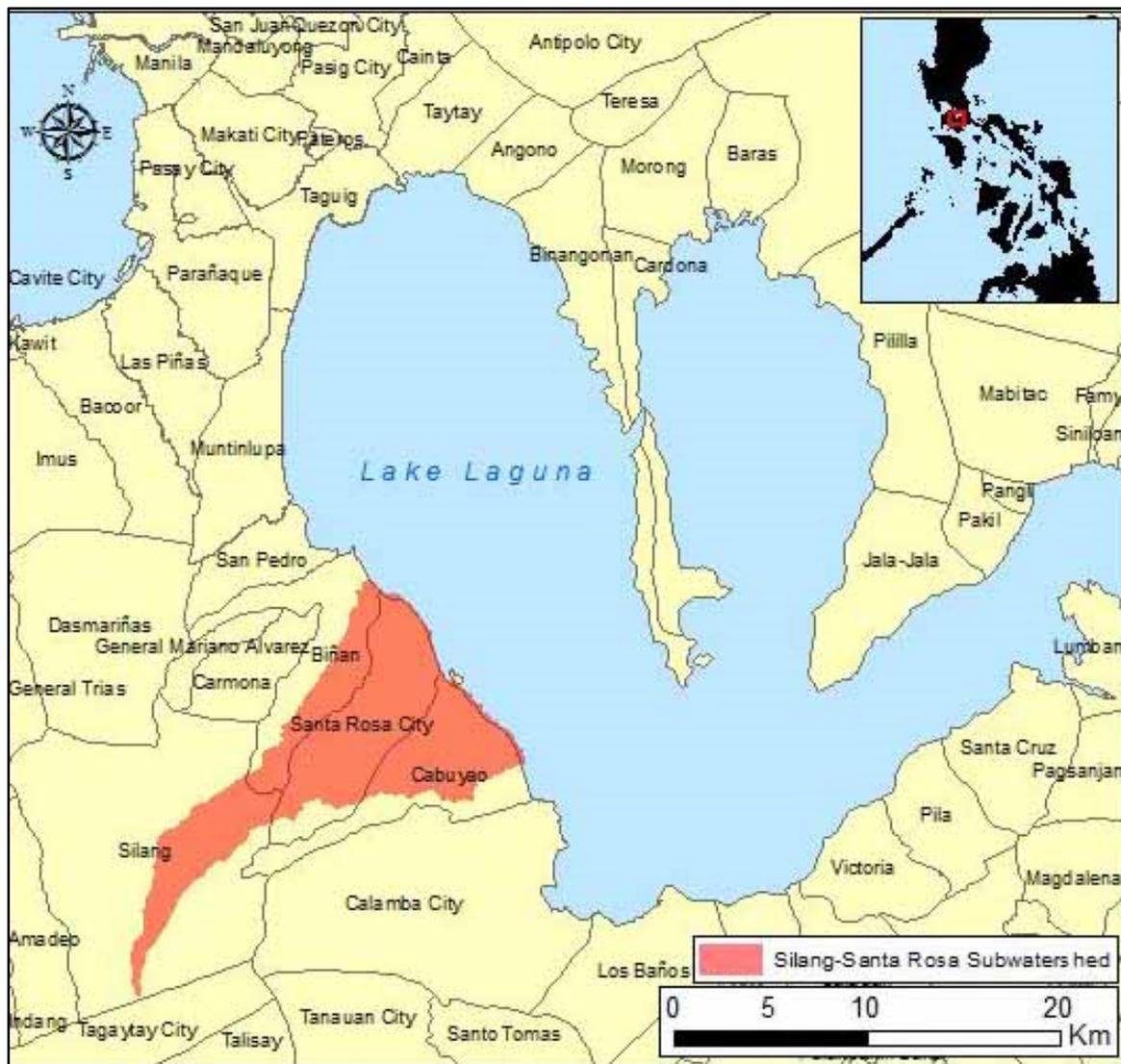


Figure 2. The Sta. Rosa sub-watershed

The cities of Cabuyao and Biñan followed suit and eventually, the upstream Municipality of Silang, which is basically an agricultural municipality is now developing fast and has opened its doors to many business opportunities outside of agriculture. This has alerted the environment officials of Sta. Rosa since one of the significant findings in the studies conducted was if a business as usual scenario will prevail, flooding will be aggravated in the downstream areas. Likewise, earlier studies have shown that the agricultural practice of Silang, particularly in inter-cropping has significant contribution in minimizing erosion.

In 2014, while the organization of the sub-WQMA Board and Council were still in progress, a Memorandum of Agreement (MOA) for the Implementation of an Integrated Watershed Management Program was signed by the four mayors and the LLDA General Manager. The sub-WQMA Board and the Council was officially organized in 2017 and the oath-taking ceremony was formalized at the LLDA Office.



Figure 3. Oath-taking ceremony of the Watershed Management Council

Of the five major tasks of the Watershed Management Council, the harmonization of the land use plans of the four LGU's is by far, the most challenging. Attempts were made in the early 2000's by the LLDA to open the minds of the LGU's planning officers on the importance of harmonization and its contribution towards a sustainable use of the sub-watershed's resources. The message was conveyed well but harmonization of the land use plan didn't happen due to political, economic and institutional constraints. Succeeding initiatives towards this goal followed through foreign-funded studies wherein a series of participatory land-use planning was conducted aided with more sophisticated technology through the use of satellite images, Geographic Information System and modeling. A harmonized land use plan is still to be designed but there was progress in terms of common aspiration and understanding through the WMC, which now serves as a platform for continuous dialogue and joined efforts for the improvement of the environment and the water quality of the rivers. An action plan jointly prepared by the council and approved by the sub-WQMA Board serves as a guiding document.

Through an on-going project of the Research Institute for Humanity and Nature (Japan) in the sub-watershed, a stakeholders' assembly was organized in collaboration with the Watershed Management Council on November 8, 2018 for the following objectives:

- Share the status of collective actions: what has been achieved and what will be the way forward;
- Involve more stakeholders in watershed governance;
- Launch a platform for continued stakeholder involvement.

More than 200 participants representing various sectors in the watershed participated.



Figure 4. The LLDA General Manager giving a keynote speech during the Stakeholders' Assembly

In recognition of the achievements of the Sta. Rosa Watershed Management Council, they were conferred with the Dangal ng Lawa Award (Pride of the Lake Award) in March 2019. This was during the World Water Week observance in the Philippines jointly organized by the private sector, government agencies and non-government organizations.



Figure 5. The Sta. Rosa WMC officials received the “Dangal ng Lawa” Award

The initiatives in the Sta. Rosa sub-watershed are now being duplicated in the other sub-watersheds of Laguna de Bay.

3. The dynamics of aquaculture operation in the lake

A Fishery Zoning and Management Plan (ZOMAP) was initially formulated and implemented in Laguna de Bay in 1983 to address the uncontrolled proliferation of fishpens and fishcages, most of which were owned by businessmen. This has created serious conflicts between the businessmen and the fishermen who are into the traditional form of fishing, as well as negative environmental impacts (Santos-Borja,1997, Santos-Borja and Nepomuceno,2006). Due to implementation issues, the original ZOMAP was revised in 1996, 1999 and until recently in 2019. The latter came about due to the directive of the then newly elected President of the Philippines in 2016, in his first State of the Nation Address, that ***“Laguna de Bay shall be transformed into a vibrant economic zone showcasing ecotourism by addressing the negative impact of watershed destruction, land conversion and pollution.....the poor fishermen will have priority in its entitlements.”*** In some of his speeches, he mentioned that whenever the airplane he is riding would pass over the lake, he could see big structures occupying the traditional fishing ground of fishermen, thus depriving them substantially of their source of livelihood.

Some prominent members of the House of Representatives and the then Secretary of the Department of Environment and Natural Resources advocated for a “zero fish pen policy” in the lake.

Unlike in the 1980’s and 1990’s wherein there was a very serious conflict between the businessmen who owned big fish pens and the fishermen, the two groups closed ranks and made a united front on the continuous aquaculture business in the lake. Their argument was based on food security issues and negative economic impacts, especially on the fishermen. Prominent leaders of the fishermen belonging to the Fisheries and Aquatic Resource Management Council (FARMC), have expressed during the consultation meetings that their conflict with the businessmen operating big fish pens no longer exist. They get their livelihood either as a fish pen caretaker or as an owner of a fish cage. Also, according to them, through time, they have learned the business and are now gaining economically as a fish cage owner. Increase in the price of fish was also cited as a valid reason for the continuous operation of fish pens and fish cages in the lake. Eventually, the “zero fish pen policy” didn’t materialize. Instead, the response of the Laguna Lake Development Authority was to review the carrying capacity of the lake that was used as basis of the ZOMAP in 1996. The 1999 revision was on the location of fishpen belts but still maintaining the carrying capacity as of 1996.

The carrying capacity of the lake for aquaculture

The methodology developed by Centeno et al. in 1987 was again used by the LLDA’s Technical Working Group (TWG) in determining the carrying capacity of the lake for aquaculture. The basic data used was the primary productivity of the lake covering a ten-year period from 1997 to 2016. The procedure and the computed carrying capacity were reviewed and validated by well-known scientists in the Philippines (Figure 6). They also acknowledged that in the absence of any new methodology and the use of first-hand data gave them as well as the TWG the confidence to rely on the new carrying capacity, expressed in terms of the area of the lake that can be used for aquaculture.



Figure 6. Focused Group Discussion with experts on the Carrying Capacity of the lake For Aquaculture

The computed carrying capacity is 9,200 hectares (92 km²), which is equivalent to almost 10% of the surface area of Laguna de Bay at 90,000 hectares (900 km²). It coincided with Rule 51.1 of the Implementing Rules and Regulations of Republic Act 8550, otherwise known as the Philippine Fisheries Code. It states that not over 10% of the suitable water surface area of all lakes and rivers shall be allotted for aquaculture purposes and the stocking density and feeding requirement shall be controlled and determined by its carrying capacity.

The new carrying capacity is less than the previous carrying capacity of 15,000 hectares (150 km²). In response to the Philippine President's directive to give priority entitlements to fishermen, 60% or 5,520 hectares is allotted for fishermen, giving more opportunities for traditional fishermen to venture into aquaculture either as an individual or as an organization. The remaining 40% or 3,680 hectares is allotted to businessmen. From a maximum size of 50 hectares per fish pen, it was reduced to 20 hectares. For fish cages the area varies from 200 m² to a maximum area of one 10,000 m² or one hectare only.

Series of consultations were conducted with the local government officials of the lakeshore towns and cities, the association of fish pen operators and fish cage operators, the Fisheries and Aquatic Resource and Management Council, the academe and research institutions and the National Government Agencies. Succeeding consultations with the fishery sector followed due to some issues on the maximum size of a fish pen, alignment with the fish pen belt and the fish cage belt. The affected sector insisted on maintaining their aquaculture structure in the 1999 belt and in return, they will remove whatever excess area they have. These issues even reached the Office of the Philippine President (OP).

Eventually, the layout of the 2019 Zoning and Management Plan was drawn (Figure 7), basically following the alignment in the 1999 ZOMAP, also with specific technical descriptions on the size of each aquaculture structure and the mandatory navigational lanes in between the structures and the fish pen and fish cage belts. This is in accordance with the approved policy by the LLDA Board of Directors, i.e. Board Resolution 540 Series of 2018, "Revising the Laguna de Bay Fishery Zoning and Management Plan (ZOMAP) of 1999, Setting Sustainable and Equitable Allocation Mechanisms, Declaring Certain Acts as Prohibited and for Other Purpose." The implementing rules and regulations were also approved by virtue of Board Resolution 561, Series of 2019

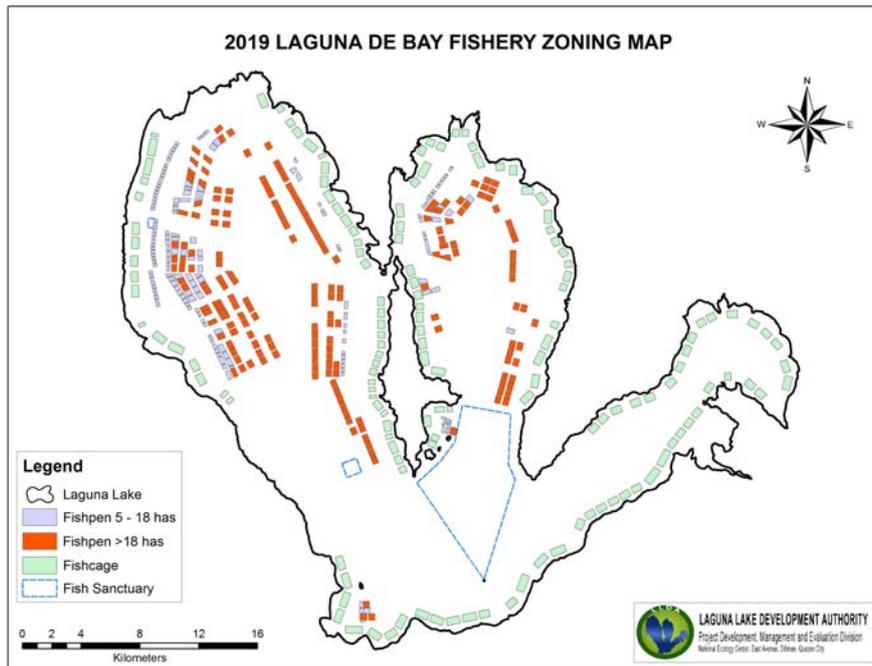


Figure 7. Layout of fish fishpens, fishcages and navigational lanes

The fish pen fee remains at PHP6,000 per hectare (about USD120) and the fish cage fee remains at PHP4,200 (around USD85). Likewise, the sharing scheme of the collected fees is as follows:

- 60% is retained by LLDA
 - 5% goes to the Project Development Fund of LLDA
 - 35% is shared with the local government units (LGU), further subdivide into:
 - 25% is shared with the lakeshore municipalities and cities
 - 5% is shared with the lakeshore barangays
 - 5% is shared with the lakeshore provinces

The LGU shares must be used for activities related to environmental protection and management. The Project Development Fund managed by the LLDA can be accessed by sectors engaged in projects that would improve the environmental condition of the lake and the tributary rivers.

4. Increasing Demand on the Environmental Services of Laguna de Bay

Laguna de Bay is a multiple use resource with fisheries as its dominant use. The use of the lake's water for domestic water supply by the year 2000 was already envisioned in the pioneering water resources development study in the 1970's by SOGREAH (1974). This came about a few years later than the projected year. In August 2009, the Laguna Lake Development Authority granted a water abstraction permit to Maynilad Water Services Inc. (MWSI or simply Maynilad). The initial abstraction rate is 100 million liters per day (MLD), which will gradually increase to a maximum of 300 MLD for domestic consumption. Treatment of domestic wastewater is required in their concession agreement with the Philippine Government. These treatment facilities located

in service areas within the Laguna de Bay region are subject to the environmental rules and regulations that the LLDA implements. The abstraction point is at the West Bay of the lake, specifically off Barangay Putatan in Muntinlupa City. The Putatan Treatment Plant was formally unveiled in February 2011, to supply the domestic water requirement of the West Zone of the Greater Manila Area, some of which is part of the Laguna de Bay Region and four towns in the Province of Cavite which are all outside the Laguna de Bay Region.

Considering the eutrophic to hyper-eutrophic condition of Laguna de Bay, state of the art treatment facilities were put up, incorporating reverse osmosis whenever there is saltwater intrusion into the lake. This phenomenon happens in the lake during the dry season when the lake level becomes lower than Manila Bay.

Almost seven years later, the other water concessionaire, Manila Water Company, Inc. (MWCI or simply Manila Water) was also granted by the LLDA with a water abstraction permit for 100 MLD off Cardona Rizal, a lakeshore town in the Central Bay of the lake. It became fully operational in May 2019, initially at a capacity of 50 MLD until it reached its full capacity of 100 MLD. The service area is in the East Zone, wherein all the towns and cities are within the Laguna de Bay Region. The LLDA is responsible in monitoring the compliance of their wastewater treatment plants to the effluent standards. A severe water crisis was experienced in the Greater Manila and Metro Manila area towards the end of the 1st Quarter of 2019. The principal source of surface water of both concessionaires is the Angat Dam, which almost ran dry. The severely affected consumers are those in the East Zone serviced by MWSI. The consumers in the West Zone were continuously supplied with water by Maynilad, but the supply was regulated in terms of daily allocation. The saving grace of Maynilad was Laguna de Bay. Their foresight to abstract water from the lake was a crucial factor in providing the much-needed water during the water crisis. At the time of the water crisis, Manila Water was yet to operate their water treatment plant, which was finally realized in May 2019.

The water crisis triggered the renewed interest of the National Government to seriously focus on declaring Laguna de Bay as a primary source of raw water for domestic supply, while other raw water sources are being developed. In particular is the Metropolitan Waterworks and Sewerage System (MWSS), the government agency created in 1971 through Republic Act 6234. It is mandated to ensure an uninterrupted and adequate supply and distribution of potable water for domestic and other purposes and the proper operation and maintenance of sewerage systems in its service area, which includes the whole of Metro Manila and parts of Cavite and Rizal.

During the 43rd Cabinet meeting presided by the President of the Philippines on November 6, 2019, the MWSS Administrator expressed his recommendation to declare Laguna de Bay as a “vital source of water” that needs to be protected, considering that another water crisis may happen in the succeeding years. The LLDA is open to this declaration, with reference to the Philippine Water Code wherein it was stated that domestic use takes priority from all other uses. However, such declaration and its implementation should be supported by policies, rules and regulations, geared towards the improvement of the water quality of the lake from Class C (for fisheries and other compatible uses) to Class B (source of raw water for domestic supply which requires treatment). The most challenging environmental condition that Maynilad experienced is the periodic occurrence of algal bloom and the taste and odor problem that goes with it. The most severe occurrence occurred in 2019, starting from the latter part of April which extends until July

2019. There was mild El Nino, and this condition coupled with the hyper-eutrophic nature of the lake, brought the worst in terms of algal bloom. The most severely affected are the lakeshore towns of Taguig and Muntinlupa (Figure 8). This condition further exacerbated the Metro Manila water crisis.

Sporadic increase in the Manganese level of the lake that caused severe discoloration was also experienced. Mitigation and control measures are needed to be put in place with expediency, considering that lakes in general react slowly to any intervention efforts. The solutions are not short-term in nature like nutrient control and management, which would require a closer review of the existing water quality criteria and effluent standards for nitrate and phosphate. A more stringent set of criteria may require an upgrade of the existing wastewater treatment facilities of the different industries in the Laguna de Region.

Aside from the two water concessionaires, the LLDA is receiving applications of other private groups for water abstraction either from the lake or from the tributary rivers. Thus, of immediate need is to determine the water balance of the lake and to determine how much can be allocated for various uses, without compromising the need of the ecosystem. A Focused Group Discussion with experts had already been initiated with the target of conducting the study as a priority project in 2020.



Figure 8. Severe algal bloom and water hyacinth infestation at the intake channel of the Putatan Water Treatment Plant in Muntinlupa City.

For the first time in the history of LLDA, it has received a substantial budget allocation from the National Government in its 50th year of existence to fund studies and projects needed to improve the environmental status of the lake and to address the various demands for its environmental goods and services.

Note: The views expressed here are those of the author, and do not necessarily represent those of the Laguna Lake Development Authority.

References

- Centeno J. D., Santiago A. E. & Santos-Borja A. C. (1987) The carrying capacity for aquaculture of Laguna de Bay, Philippines. Paper presented at 7th International Symposium, North American Lake Management Society, Orlando, Florida, USA 3–6 November, 1987.
- Department of Environment and Natural Resources (DENR) Administrative Order No. 2005-10. Implementing Rules and Regulations of the Philippine Clean Water Act (Republic Act 9275). Approved by the DENR Secretary on May 16, 2005.
- Executive Order 927. Further Defining Certain Functions and Powers of the Laguna Lake Development Authority. Issued on December 16, 1983 by the President of the Philippines.
- ILEC. 2005. Managing Lakes and their Basins for Sustainable Use: A Report for Lake Basin Managers and Stakeholders. International Lake Environment Committee Foundation, Kusatsu, Japan.
- LLDA Board Resolution 304, Series of 2006. Establishment of the Laguna de Bay Region Water Quality Management Area Governing Board. Approved on November 28, 2006.
- LLDA Board Resolution 540, Series of 2018. Revising the Laguna de Bay Fishery Zoning and Management Plan (ZOMAP) of 1999, Setting Sustainable and Equitable Allocation Mechanisms, Declaring Certain Acts as Prohibited and for Other Purpose.
- LLDA Board Resolution 561, Series of 2019. Rules and Regulations Implementing BR 540 Series of 2019.
- Presidential Decree 813. Amending Certain Sections of R.A.4850, Otherwise known as the Laguna Lake Development Authority Act of 1966. Approved on October 17, 1975 by the President of the Philippines.
- Republic Act 4850. An Act Creating the Laguna Lake Development Authority, Prescribing its Powers, Functions and Duties, Providing Funds therefor, and for other Purposes. Approved on July 18, 1966 by the Philippine Congress and the President of the Philippines.
- Republic Act 6234. An Act Creating the Metropolitan Waterworks and Sewerage System and Dissolving the National Waterworks and Sewerage Authority, and for Other Purposes.
- Republic Act 8550. An Act Providing for the Development, Management and Conservation of the Fisheries and Aquatic Resources, Integrating All Laws Pertinent Thereto, and for Other Purposes.
- Republic Act 9275. An Act Providing for a Comprehensive Water Quality Management and for other Purposes. Approved by the Philippine Congress and the President of the Philippines on March 22, 2004.
- Santos-Borja A. C. (1997) The zoning and management plan of Laguna de Bay for fisheries. Paper Presented at the 7th International Conference on the Conservation and Management of Lakes, 27–31 October 1997, San Martin de Los Andes, Argentina.
- Santos-Borja, A.C. and D.N.Nepomuceno. 2006. Laguna de Bay: Institutional development and change for lake basin management. 2006. *Lakes & Reservoirs, Research & Management Journal*. 11 (4): 257-270.
- Santos-Borja, A.C. The Silang-Santa. Rosa Sub-watershed, A Living Laboratory for Environmental Management and Governance. Presented at the International Workshop on River and Groundwater Pollution in the Silang-Santa Rosa Sub-watershed. Research Institute for Humanity and Nature, Japan, March 22, 2017.
- Societe Grenebloise D'Etudes et D'Applications Hydrauliques (SOGREAH). (1974) Laguna de Bay Water Resources Development Study. Final Report. UNDP, ADB. Philippines.

<https://www.cnnphilippines.com/news/2019/11/7/mwss-laguna-lake-vital-source-cabinet-meeting.html>