



UNITED NATIONS  
UNIVERSITY

**UNU-IAS**

**Water and Urban Initiative**  
**Working Paper Series**  
Number 02 — April 2015



# Understanding the Water and Urban Environment of a Megacity: The Case of Metro Manila, Philippines

**Lilia SD. Raffles** Manila, Philippines

**Ram Krishna Regmi** United Nations University Institute for the Advanced Study of Sustainability,  
Tokyo, Japan

---

## **Water and Urban Initiative**

This working paper series shares findings produced as part of the research activities under the Water and Urban Initiative (WUI), a research project of the United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS). The WUI aims to contribute to sustainable development, focusing on developing countries in Asia, by providing policy tools and an information platform to assist planning and implementing policies for sustainable urban and water environment.

To find out more, please visit [unu.edu/research/water-and-urban-initiative.html](http://unu.edu/research/water-and-urban-initiative.html)

© 2015 United Nations University. All Rights Reserved.

The views expressed in this publication are those of the author(s) and do not necessarily reflect the views of the United Nations University.

## ABSTRACT

This study attempts to understand the complexities of the water and urban environmental situation in a highly urbanized area like Metro Manila, Philippines. This will input to the development of policy tools, databases and models to help improve the urban water environment in developing Asian cities. Metro Manila is a megacity with population exceeding 11.8 million people in 2010 spread over 17 local government units. As a highly urbanized area, Metro Manila experiences environmental problems often associated with urbanization such as air and water pollution, flooding, solid waste management problems and climate change. The complex governance structure of water and the environment combined with deteriorating water and environmental situation makes Metro Manila an ideal pilot area where future initiatives can be modeled.

## 1. Water and Urban Initiative

The Water and Urban Initiative (WUI) Project is a research program being undertaken by the United Nations-Institute for Advanced Study of Sustainability (UNU-IAS) with funding from the Ministry of Environment of Japan. The study aims to help improve urban water environment in developing Asian Cities by developing policy tools, databases and modeling the effect of optimal land use and water treatment facilities that meet both socio-economic and ecological needs. The study focuses on three areas: human health risk reduction, ecosystem conservation and environmental disaster risk mitigation particularly flood impacts. It is being undertaken in four developing Asian Cities, one of which is

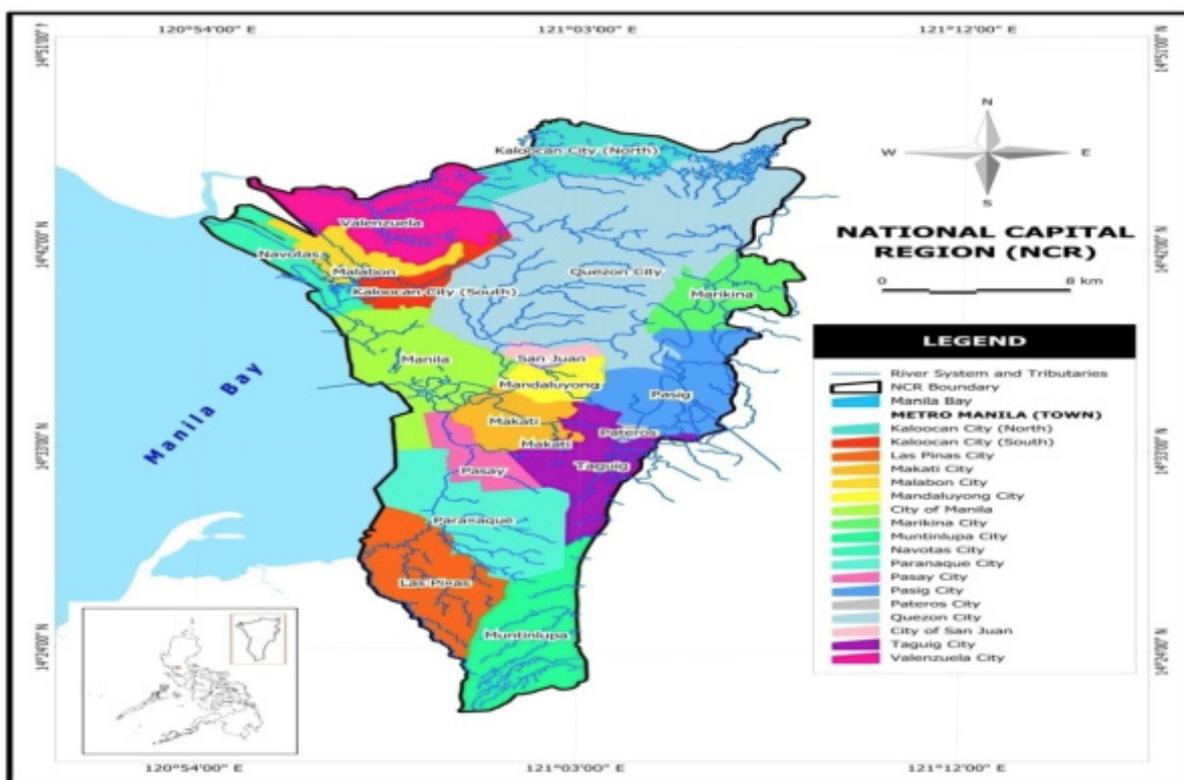
the Metropolitan Manila (Metro Manila) area in the Philippines. This report is part of the initial stage of the project which focuses on the collection of data and information and conduct of literature review and data analysis needed for the development of policy tools, databases and modeling.

## 2. Brief Overview on Metropolitan Manila

The Metropolitan Manila (Metro Manila), otherwise known as the National Capital Region (NCR), is located at 14°40' N 121°3' E. It is composed of sixteen cities and one municipality, divided into four (4) districts with four (4) cities as its centers: First District – City of Manila; Second District – Quezon City, Pasig City, Marikina City, Mandaluyong City and City of San Juan; Third District – Caloocan City, City of Malabon, City of Navotas and Valenzuela City; and Fourth District – Pasay City, Makati City, Parañaque City, Muntinlupa City, Las Piñas City, Municipality of Pateros and Taguig City.

The region is bounded by the Manila Bay in the west, the Laguna de Bay in the south-east, the Sierra Madre Mountain Range in the east and the fertile plains of Central Luzon in the north. It is bounded by several provinces: Bulacan to the north, Rizal to the east, Laguna to the south and Cavite to the southwest.

Metro Manila or the National Capital Region (NCR) has a total land area of 63,600 hectares, approximately 0.21 % of the country's land area of 30 million hectares. Based



on a JICA study, residential areas constituted 44.8 percent of the region's land area in 2006. About 28 percent were open spaces and parks, 12.2 percent commercial, 7.6 percent industrial and 6.9 percent institutional. Metro Manila is considered a highly urbanized city.

It has a population of 11,855,975 based on the 2010 census of population. This accounts for about 13% of the national population of 92,337,852 and about one third of the total urban population. NCR remains to be the most densely populated region in the country. With 186 persons per hectare, NCR is more than 60 times denser than at the national level.

NCR is the top contributor to the national economy. In 2013, NCR shares 36.3 percent in the country's economic output, the largest among all regions. NCR also posted a higher growth in Gross Regional Domestic Product (GRDP) of 9.1 percent from 2012 to 2013 compared to the 7.2 percent growth in the national economy. NCR's economic growth was attributed to the higher growth of the industry sector. The services sector, however, continued to account for the largest share of 80.5 percent in the region's economy in 2013.

### 3. Water Situation in Metro Manila

Four river systems traverse Metro Manila: Marikina River, San Juan River, Parañaque River and Pasig River. Except for the upper reach of the Marikina River which is classified as Class A, all the four river systems were classified as Class C water bodies. This means that they are intended for fishery, for non-contact recreation activities such as boating and for manufacturing processes after treatment. Monitoring of water quality conducted on these river systems, however, showed that they are heavily polluted. Their biochemical oxygen demand (BOD) and dissolved oxygen (DO) were beyond the standard of <7 mg/L and >5 mg/L for Class C waters, respectively, in the last eleven years.

The rivers in Metro Manila drain to Manila Bay, which is located to the west of the metropolis. The Bay is classified as Class SB which means it is intended for contact recreation such as bathing, swimming, skin diving, and similar activities and as spawning areas for bangus (milkfish) and other similar species. Studies, however, show that there is high concentration of heavy metals and other pollutants in the Bay. The Supreme Court issued in 2008 a continuing mandamus for the government to clean-up Manila Bay to bring its water quality to SB level. The Pasig River connects Manila Bay to what is considered as the third largest inland body of water in Southeast Asia, which is the Laguna Lake located at the southeastern portion of Metro Manila.

Due to the poor quality of water in Metro Manila, the region sources its water requirements from Angat Dam, in the nearby province of Bulacan. The raw water is filtered in

La Mesa Dam in Quezon City and distributed to the households by two water concessionaires: the Manila Water and the Maynilad. Sewerage and sanitation services are also provided by the 2 concessionaires. As of December, 2013, sewerage coverage ranged from 12-13% with a sewer network of 740 kilometers.

### 4. Urbanization and Related Environmental Issues

Metro Manila is a highly urbanized area. It is the only region in the country that is 100 percent urban. With urbanization, environmental issues such as solid waste problems, flooding, and air pollution as well as presence of informal settlements are prevalent in the region.

Metro Manila generates over 6,700 tons of solid wastes per day. However, only 5,600 tons (84 percent) are being collected and dumped at the nine (9) dumpsites throughout Metro Manila. The remaining 16 percent goes to the river systems causing the clogging of major waterways, thereby resulting to flooding.

The presence of informal settlers living along the rivers and their tributaries also contributed to the constriction of the drainage areas of Metro Manila, resulting to flooding during heavy rains. These informal settlers also add to the deterioration of the water quality of these water bodies. In Pasig River alone 11,650 informal settler families (77.7 percent) were already relocated from 1998 to 2014.

The increasing population in the metropolis and the rapid development in the area caused the poor quality of ambient air in the region. In 2013, total suspended particulates (TSP) or the amount of dust in the air in Metro Manila (132 ug/Ncm) exceeded the standard level of 90 ug/Ncm by 47 percent. The amount of particulate matters 10 (PM10) is recorded at 74 ug/Ncm during the same year, exceeding the standard of 60 ug/Ncm by 23 percent. The high TSP and PM10 levels were due mainly from vehicular emissions (80 percent) while stationary sources contributed only 20 percent.

In terms of Greenhouse Gas (GHG) emissions, studies conducted using the 2010 base year showed that net emissions for Metro Manila amounted to 23,521.66 gigagrams of carbon dioxide equivalent. The energy sector accounted for 89.27 percent of the total emissions while the waste sector contributed 10.60 percent. The contribution of the industrial, agricultural and land use sectors are insignificant.

### 5. Water and Environmental Governance

The development and management of water resources and the environment can be characterized as complex one with more than 20 agencies performing development and regulatory functions. In addition, the devolution of certain functions to the local government units related to water

and the environment has further made governance a challenge to both the national and local government.

## 6. Current Initiatives

The government is currently undertaking programs and projects geared towards the management and protection of the water and urban environment. These include:

- Pasig River Rehabilitation and Development Program of the Pasig River Rehabilitation Commission (PRCC) involves the relocation/resettlement of informal settler families living along the Pasig River, improvement of the water quality of the river and recovery of the easement for the development of environmental preservation areas and linear parks.
- Implementation of the Manila Bay Coastal Strategy is a response to the continuing mandamus of the Supreme Court for the clean-up of Manila Bay to bring the water quality to the SB level. The Manila Bay region/watershed covers not only the Metro Manila Area but also other neighboring towns and provinces. It is implemented by national and local government units surrounding the Bay.
- Adopt-an-Estero Program is a nationwide program implemented by the Department of Environment and Natural Resources (DENR) to clean esteros or river tributaries draining to the river systems. The DENR enters into a Memorandum of Agreement (MOA) with private sectors like Mc Donalds, Jolibee, SM City, Luzon Expressway, etc. who will adopt and clean a certain portion of the estero or river tributary.
- The Flood Management Master Plan for Metro Manila and Surrounding Areas, which was formulated based on a Flood Risk Study, is now being implemented by the Department of Public Works and Highways (DPWH) and the Metro Manila Development Authority (MMDA) with initial allocation of PhP 5.0 million for dredging and construction of infrastructures such as seawalls.
- Adopt-A-River-Project is one of the components of the River Rehabilitation Program aimed at the improvement of the water quality of Laguna Lake and its watershed, which includes part of Metro Manila. The project involves multi-stakeholders such as local governments and industries in cleaning and protecting the specific portion of river/tributary in their area
- Environmental Management and Pollution Control is a regular program being implemented by the DENR through its Environmental Management Bureau which deals with the implementation of environmental laws, in particular, the Clean Water Act to ensure and sustain a clean and healthy environment.

- Water Resources Regulation Program is a regular initiative of the National Water Resources Board (NWRB), the aim of which is resource regulation by way of water permitting system as provided for in the Water Code of the Philippines

## 7. Conclusions

Given the foregoing situation, Metro Manila offers an ideal pilot area for the on-going WUI initiative. The complex governance structure of water and the environment combined with a deteriorating water and environmental set up makes Metro Manila an ideal model where future initiatives such the development of policy tools like water pollution risk assessment and water quality index, development of databases and modeling the effect of optimal land use and water treatment facilities can be undertaken and effectively implemented.

---

## References

- Department of Environment and Natural Resources (DENR)
- Department of Public Works and Highways (DPWH)
- International Resources Group (IRG). Top-Down Metro Manila Greenhouse Gas (GHG) Inventory, March 2013.
- Laguna Lake Development Authority (LLDA)
- Metro Manila Development Authority (MMDA)
- Metropolitan Waterworks and Sewerage System (MWSS)
- National Census Office (NSO)
- National Statistics Coordination Board (NSCB)
- Pasig River Rehabilitation Commission (PRRC)