

# Third Flood Risk Management and Urban Resilience Workshop



MANAGING THE RISKS OF DISASTERS IN EAST ASIA AND THE PACIFIC

June 3–5, 2014  
Manila, the Philippines  
**WORKSHOP PROCEEDINGS**



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Laguna de Bay, Philippines - November 8, 2013: Typhoon Haiyan's, an equivalent category 5 hurricane, endangering 25 million Filipinos in its path as it unleashed its fury. The hurricane is one of the biggest to ever hit land according to scientists.  
Photo: © Herman Lumanog | Dreamstime.com

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## Acronyms and Abbreviations

ADB	Asian Development Bank
AusAID	Australian Agency for International Development
C3	Command , Communication and Control Center
C4D	Collaboration for Development
CCA	climate change adaptation
CCTV	closed-circuit television
CDP	Comprehensive Development Plan
DENR	Department of Environment and Natural Resources
DOST	Department of Science and Technology
DPWH	Department of Public Works and Highways
DRM	disaster risk management
DRR	disaster risk reduction
DRRM	disaster risk reduction and management
DWASA	Dhaka Water Supply and Sewerage Authority
EWS	early warning system
FCIC	Flood Control Information Center
FEET	Family Emergency Evacuation Time
FFWC	Flood Forecasting Warning Center
FMIS	Flood Management Information System
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	geographic information system
GDP	gross domestic product
GMMA	Greater Metro Manila Area
GPS	Global Positioning System
IFRM	integrated flood risk management
IFSAR	Interferometric Synthetic Aperture Reader
IUFRM COP	Community of Practice on Integrated Urban Flood Risk Management
JICA	Japan International Cooperation Agency
LGU	local government unit
LIDAR	Light Detection Imagery and Ranging
MLIT	Ministry of Land, Infrastructure, Transport and Tourism (Japan)
MMDA	Metropolitan Manila Development Authority
MMDRRMC	Metro Manila Disaster Risk Reduction Management Council
MMFRMMP	Metro Manila Flood Risk Management Master Plan
NGO	nongovernmental organization
NOAH	Nationwide Operational Assessment of Hazards
PAGASA	Philippine Atmospheric Geophysical and Astronomical Services Administration
PROGEP	Stormwater Management and Climate Change Adaptation Project

## Acknowledgements

This report summarizes the presentations and discussions that took place as part of the Third Flood Risk Management and Urban Resilience Workshop in Manila, the Philippines, in June 2014.

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Workshop proceedings and presentations are available on the GFDRR website ([www.gfdr.org](http://www.gfdr.org)).



Jakarta, Indonesia – December 22, 2012: Traffic scene at Thamrin Street Jakarta caused by a 30 cm flood.  
Photo: Herianus | Thinkstock.com

# SUMMARY

**T**he Third Flood Risk Management and Urban Resilience Workshop brought together over 70 officials, experts, and representatives from development and partner agencies in more than 10 countries in East Asia, South Asia, and Africa. The first day focused on operational knowledge and lessons learned from implementing flood risk management and urban resilience programs in the Philippines as well as Bangladesh, China, Indonesia, Japan, Senegal, and Thailand. The second day consisted of field visits to the Metropolitan Manila Development Authority (MMDA), Pasig City, and Marikina City, which were designed to showcase investments in structural and nonstructural flood risk management measures. The third (half) day was dedicated to reflecting on the presented case studies and site visits and to discussing the needs and opportunities for sustained knowledge exchange within the Community of Practice on Integrated Urban Flood Risk Management (IUFM COP).

**The key messages of the workshop fall under four main themes:**

1. *Combination.* An integrated and long-term approach to flood risks requires a combination of structural and nonstructural measures, which must be designed to cope with a changing and uncertain future.
2. *Communication.* Communication of the disaster risk is critical to informed decision making. Communities and other stakeholders must have access to accurate information that is appropriately conveyed.
3. *Coordination.* Effective planning and implementation of programs requires vertical coordination between different levels of government, horizontal coordination across agencies, and broad coordination among government, the private sector, donors, beneficiaries/recipients, and other stakeholders.
4. *Commitment.* Successful integrated flood risk management involves the commitment of national and local leaders to ensure that the

strategic and long-term vision of programs can be realized.

## Highlights

**In the opening session, all speakers stressed the importance of integrated flood risk management.** Mayor Maria Belen A. Eusebio described the severe impact on Pasig City of past flood events, particularly Ondoy (Ketsana) in 2009, and explained how these experiences strengthened the city's resolve to become more resilient. She stressed the importance of investing in disaster prevention and resilience, emphasizing that the expense is "a small price to pay in the long term." Mr. Motoo Konishi, the World Bank country director for the Philippines, talked about the needs of the poor and vulnerable, who are disproportionately affected by natural hazards. He pointed out that the most difficult aspects of implementing flood risk management projects are not technical but rather social, including resettlement, community participation, and improvement of livelihoods. Secretary Rogelio L. Singson of the Department of Public Works and Highways (DPWH) addressed both technical and social aspects in his discussion of the Metro Manila Flood Risk Management Master Plan (MMFRMMP). He stressed the importance of planning and the value of a strategic and integrated master plan with set priorities and actions. "Every peso invested in these priority actions is worth it," he maintained.

**During session 1, participants heard about the importance of engaging local communities and implementing agencies.** Dr. Mahar Lagmay of the Department of Science and Technology (DOST) reminded the audience that "every Filipino has the right to information, whether poor or rich." This information has to be accurate in order to be useful. Technology can help to provide more accurate information, but accuracy alone is not enough. Stakeholders must be able to gain access to that information, and they must have the knowledge and tools to make informed decisions. Vice Mayor



Jose Fabian Cadiz of Marikina City and Mayor Eusebio of Pasig City provided examples of efforts by their respective cities to strengthen their disaster and climate resilience. Their presentations conveyed a positive message about the many opportunities available for building urban resilience and improving the lives of local communities. The field visits to both cities on the second day reinforced this message by showcasing concrete investments in hazard monitoring, institution building, and capacity building that help local authorities better prepare for, respond to, and recover from disasters.

**Session 2 focused on the challenges encountered—and solutions adopted—by countries and cities around the world that are implementing integrated urban flood risk management projects.** In part 1, Assistant Secretary Catalina Cabral of DPWH and Mr. Kenichiro Tachi of the Japanese Ministry of Land, Infrastructure, Transport and Tourism (MLIT) echoed the messages from the opening session about the importance of planning. Assistant Secretary Cabral described major DPWH programs on flood risk management and explained the status of priority measures under the MMFRMMP. Mr. Tachi gave an overview of Japan's comprehensive flood management planning process, which includes consultation with stakeholders at different levels. As part of a case study, this method was applied to the Chao Phraya River basin in a project that engaged an especially broad group of stakeholders.

**Parts 2 and 3 of session 2 focused on the impacts of urbanization and how to plan for the future.**

In Part 2, examples from Indonesia and Senegal were used to demonstrate some of the challenges linked to rapid growth of urban population, including lack of drainage and solid waste management infrastructure, capacity, and maintenance; informal settlements; and lack of preparedness in flood risk management. Ms. Eli Sari of Daerah Khusus Ibukota Public Works and Ms. Suryani Amin of the World Bank office in Jakarta, Indonesia, described some of the problems Jakarta is facing, including subsidence. The presenters explained how the World Bank-supported Urgent Flood Risk Mitigation project is addressing these challenges through priority engineered and non-engineered actions, but they indicated that more needs to be done in the long term. Ms. Marie Ndaw of the Dakar Municipal Development Agency in Senegal described current efforts under the Stormwater Management and Climate Change Adaptation Project, including the development of a master plan for drainage, and also described efforts by social facilitators and nongovernmental organizations (NGOs) to sensitize communities about the planned works.

In part 3 of session 2, Mr. Mikio Ishiwatari of the World Bank showed how informal settlements in hazardous areas significantly increase risks to natural hazards, often resulting in tragic loss of life as well as physical, economic, and social damages. In many cases, specific hazard events have spurred discussions about hazard

zones and have encouraged settlement in safer areas. But as memories of past events fade and structural flood mitigation measures provide people with a sense of security, settlement resumes in areas that can be affected by floods or tsunamis. The lesson here is that cities must plan for the future and ensure that regulations, processes, and community engagement in disaster risk management (DRM) are sustained over the years. The importance of forward-looking DRM was also described by Ms. Yuanyuan Cheng, who talked about the challenges of rapid growth in the Chinese city of Jingdezhen over the next decades, and the attendant challenge of deciding what flood risk infrastructure the city should finance. She explained that the decision making focused on the optimal set of investments, which would balance what the city can afford with the level of residual risk it can effectively manage. Finally, Mr. Abul Kashem of the Dhaka Water Supply and Sewerage Authority and Mr. Mohammad Rahman of the Dhaka North City Corporation talked about the difficulty of ensuring that Bangladesh's drainage system keeps pace with the city's expansion and increasing intensity of flooding. They pointed to the need for upgrading and better coordination among agencies, as well as the importance of improved flood risk forecasting on both national and city scales.

**Session 3 provided an opportunity for a deeper discussion of flood risk management in Metro Manila and in Jakarta.** Ms. Dolores Hipolito of DPWH highlighted some of the challenges in preparing and implementing the MMFRMMP, including (1) the number of cities and agencies involved; (2) the need for a high-level champion, like Secretary Singson; (3) the need for structural and nonstructural measures that complement one another; (4) the need to secure funding for maintenance and investment at the local level; and (5) the need for awareness and participation at the community level. Mr. Bambang Kayatnan, Mr. Edi Harahap, and Mr. Bambang Surya Putra of the Jakarta Disaster Management Agency shared experiences from Indonesia. They described some of the nonstructural measures Jakarta is implementing, including investing in a flood information management system and developing flood contingency plans at the village (*kelurahan*) level. Results from Jakarta show that contingency planning at the community level can be

an effective way of engaging communities, building their capacities and awareness, and strengthening resilience for the long term.

**The field visits to MMDA as well as to Pasig and Marikina in the Philippines provided real-life examples of structural and nonstructural investments in flood risk management.** Ms. Maxima Quiambao, director of the Flood Control and Sewage Management Office, described efforts by her office to manage flood risk across Metro Manila, including dredging of channels and cleanup of public markets. The importance of working with local government units (LGUs) for maintenance and operations was raised. The participants also learned about the Flood Control Information Center and the Disaster Risk Reduction and Management Operation Center, which provide weather information and real-time monitoring of flood events in Metro Manila. Site visits to flood control centers in Pasig and Marikina and a number of pumping stations at the barangay (community) level provided examples of concrete investments in urban resilience, and clearly demonstrated the commitment of the local authorities to making their communities more disaster resilient.

**Session 4 was dedicated to reflections on the presented case studies and site visits, and to discussions about the need and opportunities for sustained knowledge exchange within the community of practice.** There was a clear demand from the participants for sustained capacity building and knowledge sharing, as well as interest in the proposed IUFRCOP as presented by Mr. Bob McDonald and Ms. Yuka Yabashi of the Tokyo Distance Learning Center. This online platform, run on the World Bank Collaboration for Development platform, will be open to workshop participants; other officials, practitioners, experts, and interested parties will be invited to join and share their knowledge. Specific learning activities that reflect the community's interests and requirements—webinars, online-chats with experts, and moderated online discussions—will be held. A survey about potential modes of interaction and content was shared and collected at the workshop. The survey results, along with the discussion during the workshop of participants' needs, will aid in the development and evolution of the IUFRCOP.

## Outcomes and Next Steps

**Sharing of the Philippine experience was essential for the successful delivery of this regional workshop.** DPWH and MMDA were represented in past workshops in Jakarta (2012) and Seoul (2013). Indeed, it was in response to Secretary Singson's presentation in Seoul (on the work being done by DPWH) that participants sought to showcase the Philippine experience in flood risk management in the third workshop. This year, DPWH and MMDA played a crucial role in developing the agenda, and— together with the local governments of Pasig and Marikina—served as key resources for the participants. The Philippines has been at the forefront of efforts to build disaster resilience, and its leadership and commitment to knowledge sharing can serve as a model among the Asian countries.

**A feedback survey was shared with the participants at the end of the workshop, with 57 anonymous responses.** There were some 60 registered participants. On the first day, the number of participants reached 100. The average rating for the overall quality of the content of the workshop, including presentations and site visits, was 4.15 out of 5. More than half of participants rated the workshop's direct relevance to their current work or functions as 5, the highest possible rating. Similarly, over 70 percent of participants indicated that their technical knowledge, as well as their knowledge of the other countries' experiences, had improved. Most highly rated were the session 4 workshop reflections, session 1 on the Philippine experience, and the field trips on the second day of the workshop. Among presentations, those on Project NOAH (Nationwide Operational Assessment of Hazards), MMDA, Pasig City, and lessons from Japan were rated as most interesting and relevant to the needs of the participants.

**Overall, 89 percent of participants would recommend this type of workshop to their colleagues.**

The participants indicated strong interest in making use of the knowledge acquired at the workshop or in following up on workshop recommendations, whether by applying lessons learned, participating in a community of practice, or sharing knowledge with their supervisors, peers, or communities. The feedback survey clearly indicated participants' interest in continuous learning, whether through targeted technical training, workshops, or communities of practice.

**The active engagement of the participants during the presentations, site visits, and discussions demonstrated their strong interest in learning more about approaches to integrated urban flood risk management.**

The workshop called attention to the impossibility of addressing urban flood risk management separately from other pertinent issues related to the sustainability of urban development, people's economic opportunities, and long-term livelihoods needs. The participants indicated particular interest in learning more about hazard mapping and use of geographic information systems (GIS), sharing of information through open source systems, urban drainage and solid waste management, resettlement, and community participation, among others.

**The proposed IUFRRM COP has the potential to become a practical tool and a platform for engagement.**

Currently under development as a collaboration between the World Bank and the Tokyo Distance Learning Center, this platform will be open to participants of any of the three Flood Risk Management and Urban Resilience workshops, along with other interested parties wishing to get involved and to share their knowledge. Specific learning activities, including webinars, online chats with experts, and moderated online discussions will be offered, depending on the community's interests and needs.

# Background

## The Flood Risk Management and Urban Resilience Workshop Series

The series is part of the Flood Risk Management and Urban Resilience in Southeast Asia technical assistance program, which is being implemented by the World Bank Disaster Risk Management Team in the East Asia and Pacific region, with funding from the government of the Republic of Korea through the Global Facility for Disaster Reduction and Recovery (GFDRR). Relying on peer-to-peer and other sharing of technical knowledge, this program aims to strengthen the capacity of the national and sub-national agencies involved in water and flood risk management and urban planning. The goal of the workshop series is to foster an international community of practice consisting of practitioners, officials, experts, partners, and other stakeholders.

The First Flood Risk Management and Urban Resilience Workshop (May 2–3, 2012) was held in Jakarta and focused on the principles of integrated urban flood risk management, flood risk assessment methods, flood preparedness mapping in Indonesia, and regional examples of structural and nonstructural measures for managing flood risk. The Second Flood Risk Management and Urban Resilience Workshop (May 28–29, 2013) was held in Seoul and focused on balancing of structural and nonstructural measures; challenges in making flood risk data widely accessible to stakeholders; innovative (green) approaches to reducing flood risk losses; community-based approaches to enhancing resilience and managing flood risk; early warning, monitoring, and control systems; and lessons learned from Korea. The Third Flood Risk Management and Urban Resilience Workshop (June 3–5, 2014) took place in Manila and focused on practical and operational knowledge and lessons learned—from the Philippines and other countries, including Bangladesh, China, Indonesia, Japan, Senegal, and Thailand—about implementing flood risk management programs and projects that successfully make use of policy, strategy, planning, the institutional setting, and multi-stakeholder engagement.

## The Impact of Flooding in East Asia and the Pacific

**Globally, floods are the most common among all natural disasters and the cause of widespread devastation, economic damages, and loss of human lives.**<sup>1</sup> In the past 30 years, the East Asia and Pacific region accounted for about 40 percent of the total number of floods worldwide. From 2000 to 2011, floods and storms in the region caused an estimated US\$23 billion in losses. In just the last five years, mega-flood events affected cities around the world, including Bangkok, Hanoi, Ho Chi Minh City, Jakarta, Metropolitan Manila, Mumbai, Ulaanbaatar, Vientiane, and Dakar—most of which contribute substantially to the gross domestic product (GDP) of the country in which they are located. Thus these floods have taken a heavy economic toll in the region.

**In addition to causing tragic loss of life and economic losses, floods have long-term consequences, particularly among the poor who live in vulnerable areas. Loss of education opportunities, increased risk of disease, and reduced nutrition multiply the hardships these people face, and hence undermine countries' progress toward development goals.** In almost all disaster events, the vulnerable segments of the population experience the worst effects; their lives are disrupted and they are forced into deeper levels of indebtedness and poverty. With limited or no access to basic services (clean water, sanitation, health care), the poor are disproportionately vulnerable to the impacts of disasters. Moreover, their lack of assets and resources, coupled with limited access to finance and appropriate disaster response mechanisms, impedes their ability to respond and quickly recover their livelihoods. As the 2014 World Bank Development Report notes, these shocks can make it impossible for people to break the cycle of poverty.<sup>2</sup>

<sup>1</sup> World Bank, *Cities and Flooding: A Guide to Integrated Flood Risk Management for the 21st Century* (Washington, DC: World Bank, 2012).

<sup>2</sup> World Bank, *World Development Report 2014: Risk and Opportunity—Managing Risk for Development* (Washington, DC: World Bank, 2013).

**Both the recent history of extreme flooding around the world and the growing impacts of climate change are forcing us to rethink how we can effectively deal with hazardous flood events.**

Fast-paced urbanization in East Asia is increasing the region's vulnerability to disasters, as higher concentrations of people and assets locate in dangerous areas. In many cases, the resulting disasters are symptomatic of uncontrolled urban sprawl, poor planning and building standards, environmental degradation, and weak enforcement and governance practice, as well as decades of underinvestment in building, operating, and maintaining basic infrastructure (such as drainage). These trends are turning cities into disaster hot spots.

### **Integrated Flood Risk Management and Urban Resilience**

An integrated strategy for managing flood risk relies on both structural and nonstructural measures that are designed to cope with a changing and uncertain

future. Actions to reduce flood risk need to employ tools and techniques to extrapolate current trends and drivers into the future, assess alternative scenarios, and build strategic, integrated approaches across different sectors. Only an integrated and strategic approach can bring the desired long-term benefits to the population.

Managing disaster and climate change risks has become a pivotal strategy for eliminating poverty and increasing shared prosperity among nations. Nowadays, flood risk management is part of a broader global agenda to strengthen cities' disaster and climate resilience. Urban resilience has many facets, including risk assessment and risk-based land-use planning, standards, and building codes; climate adaptation and investments; public awareness and participation; and institutional and financing arrangements in line with good governance principles.<sup>3</sup>

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<sup>3</sup> World Bank, *Building Urban Resilience: Principles, Tools and Practice* (Washington, DC: World Bank, 2013).

# OPENING AND WELCOME REMARKS

## Welcome Remarks

**Chair: Mr. Ousmane Dione**, *Sector Manager, Sustainable Development Unit, the World Bank Manila Country Office*

The third and final workshop on flood risk management and urban resilience in Southeast Asia brings together many countries from the region. It provides a great opportunity to learn about different experiences, and participants should be able to carry a lot of information back home with them and to learn from each other about strategies to improve flood risk management in the future.



**Hon. Mayor Maria Belen A. Eusebio**, *City of Pasig, Metro Manila, the Philippines*

*Mayor Maria Belen A. Eusebio welcomed the representatives of the international community to the green City of Pasig. She also thanked the organizers of this event—the World Bank, the government of Korea, and GFDRR for choosing Pasig City to host this workshop.*



Disaster management is a need that the city government of Pasig has always appreciated. In the view of the city's former mayor, Roberto "Bobby" Eusebio, protecting constituents during calamities, whether natural or man-made, is a basic service that needs to be provided. Unfortunately, natural hazards seem to be growing increasingly severe. Typhoons, monsoons, floods, earthquake, volcanic eruptions, and tornadoes have cost billions of pesos; they have also led to loss of life and the displacement of thousands. Now is the time for an effective and solid program for disaster preparedness, mitigation, and management.

In 2009, Pasig City experienced the painful and life-changing effects of Typhoon Ondoy (international

name Ketsana). Since then, the city has passionately and single-mindedly sought to implement advanced disaster mitigation measures. Its residents have vowed not to let a disaster such as Ondoy happen again.

To lessen the impact of disaster on people and property, there is a need for long-term investment, starting with disaster awareness and preparedness at the barangay level. The city government has started teaching people about disaster preparedness and management via a series of workshops in each barangay, and it has conducted intensive information campaigns in schools, hospitals, and other government facilities in the city. It has also made substantial

investments in emergency and flood control equipment, including cutting-edge technology for monitoring facilities. Expensive as these investments were, the price was a small one for effective disaster protection and prevention. Currently the city is prepared, and basic services will be continued in the event of a calamity.

The city government has made sure that residents have the knowledge they need to be self-sufficient during an emergency and make optimum use of available resources until the situation stabilizes. There is much that could be done to improve systems and programs, but in the future disaster preparedness will be a way of life. The government is working toward a disaster-resilient Pasig City one step at a time.

**Mr. Motoo Konishi**, *Philippines Country Director, the World Bank*

The World Bank's Manila office has been impressed by the Philippines' continuous contribution to the regional and global agenda on urban resilience and flood risk management. In Southeast Asia, floods are the most frequent natural disasters, and they cause widespread devastation, economic damage, and loss of human lives. In the last 30 years, East Asia and the Pacific accounted for about 40 percent of the total number of floods worldwide. From 2000 to 2011, floods and storms in the region caused an estimated US\$23 billion in losses.

The long-term consequences of floods, such as loss of educational and economic opportunity, spread of disease, and reduced nutrition, can erode progress toward development goals. These consequences hit the most vulnerable groups the hardest, disrupting their lives and pushing them further into debt and poverty.

The city joins its neighbors—from East Asia, Indonesia, Lao People's Democratic Republic, Mongolia, Thailand, Vietnam, China, Sri Lanka, Bangladesh, Vanuatu, Solomon Islands, Myanmar, Senegal, and other Philippine cities—in looking forward to sharing knowledge at this workshop and learning about potential collaborative activities for participating countries. This workshop will also help establish a community of leaders and practitioners interested in moving toward more integrated and strategic flood risk management. The presence of national agencies such as the Department of Public Works and Highways and the Metropolitan Manila Development Authority provides an avenue for integrated tasking among local government units as all concerned prepare for the effects of climate change.



Both the recent flooding around the world and the impacts of climate change are forcing us to rethink how to deal with hazardous events effectively. Fast-paced urbanization, which is concentrating people and assets in hazard-prone areas, is increasing populations' vulnerability. In many cases, disasters are symptomatic of uncontrolled urban sprawl, poor planning and building standards, weak enforcement and governance practices, and decades of underinvestment in building, operating, and maintaining basic infrastructure, such as drainage. These trends are turning cities into disaster hot spots.

Nowadays, flood risk management is part of a broader global agenda to strengthen the disaster and climate resilience of cities. Urban resilience has many facets, including risk assessment; risk-based land-use planning, standards, and building codes; risk reduction investments; public awareness and engagement; and institutional and financing arrangements in line with

good governance principles. A key part of managing flood risk and achieving urban resilience involves balancing of flood mitigation measures; because risks may change in the future as urbanization and climate change accelerate, measures designed to be flexible and to work over the long term are needed.

The Philippines has taken a leading role in efforts to build disaster resilience. Some of these efforts have also been supported by the World Bank. The Metro Manila Flood Risk Management Master Plan (MMFRMMP), for example, has been developed by the Philippine government with support from the World Bank and GFDRR. Based on a detailed flood risk assessment, the plan proposes a 25-year investment program with engineering and non-engineering measures. To ensure that implementation of this

large infrastructure program does not harm people's quality of life, the World Bank has also been supporting the Philippines' efforts to address housing issues.

The biggest challenge in implementing the MMFRMMP, and the one that will take the most time, is not a technical or engineering challenge; it is the human or social challenge of relocating people away from danger zones, changing the public's behavior, and improving solid waste management.

This knowledge-sharing workshop is an important step toward advancing the application of an integrated and strategic approach to flood risk management and operationalization of urban resilience principles.

## Keynote Address

**Hon. Rogelio L. Singson**, *Secretary, Department of Public Works and Highways, the Philippines*

On average, some 20 typhoons per year affect the country with varying intensities and paths. If a super typhoon like Haiyan were to hit the Greater Metro Manila Area, it could potentially affect 17 million people and reduce Philippine GDP overnight by close to 3 percent. This has a significant impact on the economy.

In the latter part of 2010, a few months after President Benigno Aquino III had assumed office, members of his cabinet decided to address flooding in Metro Manila in a more scientific and permanent manner. A technical working group was formed to develop the Metro Manila Flood Risk Management Master Plan. In September 2012, the National Economic and Development Authority approved the master plan, which focused on the following causes of flooding: first, the loss of watershed in the Sierra Madre mountain range, as a result of which the volume of

rainwater reaching the Metro Manila area exceeds the Pasig River's carrying capacity, thus causing the riverbanks to overflow; second, drainage capacity constraints, which are due to obstructions created by the many informal settlers on the river channels (a result of urbanization); and third, the presence of communities living on low-lying floodplains along the Laguna Lake and Manila Bay.

The MMFRMMP offers a long-term solution to flooding in the Greater Manila area. It contains structural and nonstructural measures that will provide sustainable flood management up to a designated safety level and serve as the government flood management road map until 2035. Structural interventions include a major water impounding dam, retarding basins, drainage improvement, river wall construction, dredging, desilting, seawall construction, upgrading of existing pumping stations, and road dikes, among



others. The nonstructural interventions include flood modelling, forecasting and warning systems, a community awareness and information campaign, and the resettlement of over 100,000 families living in informal settlements along the vulnerable waterways (for about 20,000 families, relocation will be immediate). As the MMFRMMP is being implemented, the building designs of classrooms, health facilities, and other public buildings will be upgraded to increase the structural resilience of this critical infrastructure.

## Results of Past Workshops and Current Objectives

**Ms. Eiko Wataya**, *Disaster Risk Management Team, the World Bank*

At last year's workshop in Seoul, Secretary Singson delivered an impressive presentation on the Metro Manila Flood Risk Management Master Plan and the Philippine experience in flood risk management. Based on discussions at the workshop and feedback survey, it was clear that workshop participants wanted to learn more about flood risk management in this country. This is why the third workshop is being held here in Manila.

This is the final workshop of a technical assistance program, entitled Flood Risk Management and Urban Resiliency in Southeast Asia. This program is highly relevant for this region, which is vulnerable to a wide range of disaster and climate risks and which is undergoing rapid urbanization. The program was supported by the National Emergency Management Agency of Korea and GFDRR.

At the first two workshops, experts shared knowledge and experience about flood risk management projects being implemented in various countries, especially projects using integrated or innovative approaches. Practitioners described the challenges and opportunities associated with these projects, as well as specific solutions being developed. Such

Key policy decisions that have been made include investment in a flood risk reduction and resiliency program; adoption of an integrated water resource management approach; adoption of a river basin approach; adoption of a "make room for the river" philosophy, carried out through relocation of informal settlers; and provision of funding support for both structural and nonstructural mitigation measures.



discussions were beneficial in sharing practice on how countries could continue to mainstream resiliency into development as well as how organizations involved in managing flood risk could enhance cooperation with one another.

Building on these efforts, the Manila workshop focuses on sharing practical and operational experiences for strengthening resiliency. Discussions will cover implementation on the ground, from concept to execution, as well as strategy, planning, the institutional setting, and stakeholders' engagement. The workshop will also provide an opportunity to network and connect with representatives from participating countries to facilitate access to knowledge and experience that are critical for meeting today's challenges in many Asian cities.

Hopefully, this workshop will facilitate a deeper discussion of ongoing practices and in this way improve the collective understanding of this important topic. Hopefully, too, the networks being developed here today will continue to support future knowledge exchange.

# PRESENTATION SUMMARIES



Marikina City, Philippines - August 7, 2012: Heavy monsoon rain that pounded the country and paralyzed the schools, government offices and financial sectors of the nations capital that causes several thousands to flee their homes. Photo: Thinkstock.com

## Session 1

### The Philippine Experience—National and Local Policies and Strategies in Mainstreaming Disaster Resilience into the Urban Context

**Chair: Ms. Dolores Hipolito**, *Project Manager, Flood Control Management Office, Flood Control Management Cluster, Department of Public Works and Highways, the Philippines*

#### Project NOAH and the Utilization of New Technology for Flood Risk Mitigation in the Philippines

**Dr. Mahar Lagmay**, *Department of Science and Technology, the Philippines*

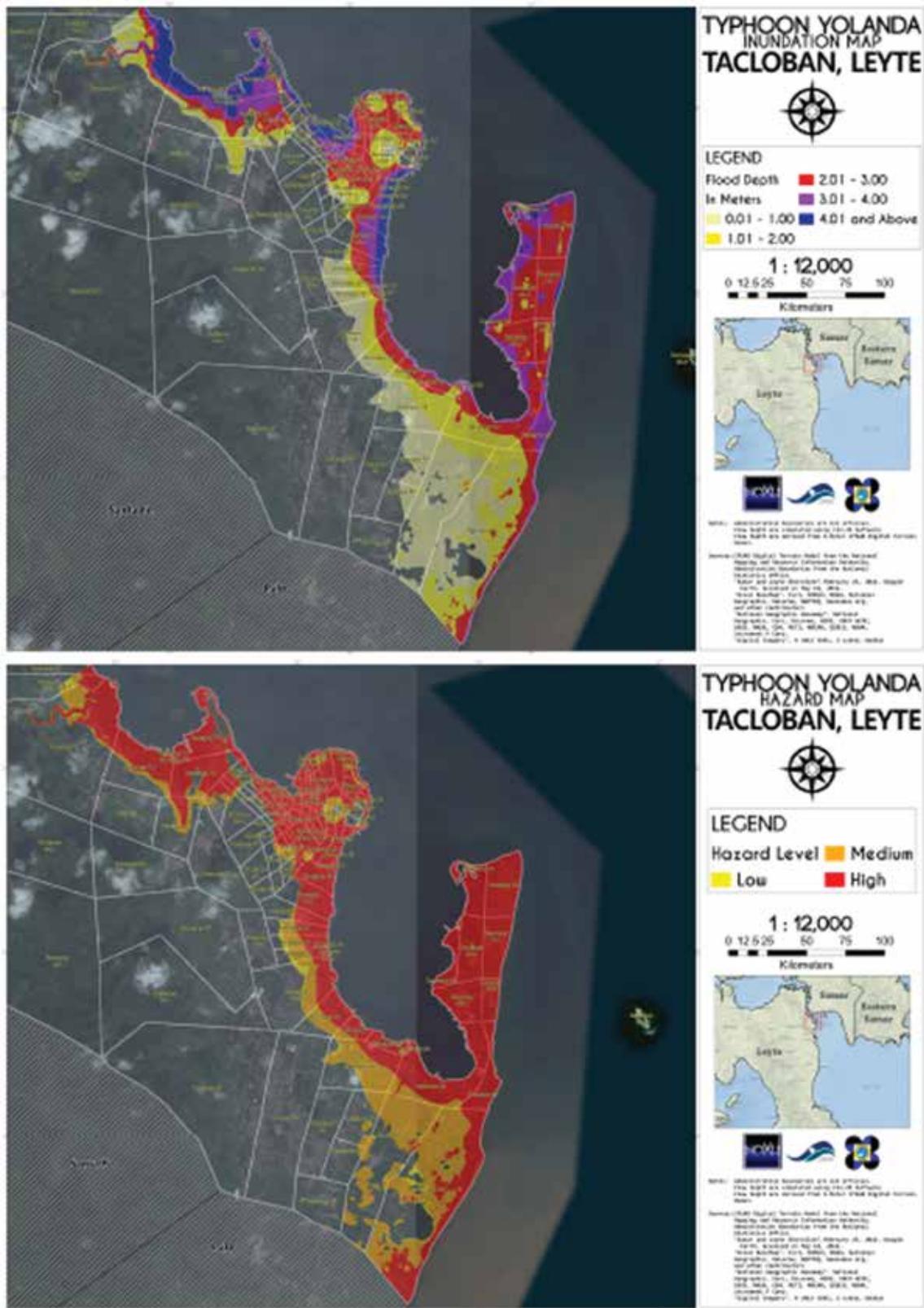
Disaster response must be based on good information and access to accurate, understandable, reliable, and timely maps. Maps show people where to go when there is a hazard warning, and they are the basis for post-disaster investments and rebuilding; without good maps, disasters will continue to cause loss of life and property. The challenge of producing and sharing accurate, high-resolution topographic maps is being met through LIDAR (Light Detection Imagery and Ranging) and IFSAR (Interferometric Synthetic Aperture Radar) technology. These maps are validated in the field or based on field evidence, with active participation by various stakeholders such as academic institutions and civil society groups.

A few weeks after Typhoon Yolanda devastated the central Philippines, LIDAR was used to produce high-resolution topographic maps of 171 cities and municipalities prioritized for recovery. The maps, which were made available on a special website, are being used to identify both high-risk areas and areas that are appropriate for relocation; they also make clear where resiliency and mitigation measures would be most beneficial.



Other maps being used in disaster mitigation efforts show storm surge inundation in Palo, Tanauan, Tolosa, Tacloban (see Figure 1) and Dulag in the Province of Leyte; these are available in various formats through DOST's Project NOAH. DOST has also worked with the Mines and Geosciences Bureau to make available enhanced hazard maps that identify more safe sites.

The key messages are as follows: (1) accurate, reliable, and up-to-date maps must be produced and made available to the public; (2) high-resolution and detailed maps for communities, especially in flood-prone barangays, are needed to properly address flooding problems; (3) hazards and disasters are not entirely a “natural” problem but are also compounded by the human failure to address them—for instance, excessive groundwater extraction by various establishments has led to subsidence in Metro Manila of 5cm per year; (4) when informing people about their own safety, it is important to understand their psychology and mind set, and to use appropriate communication strategies; and (5) news outlets and other media can be used to disseminate information.



**Figure 1.** Inundation and hazard maps for Tacloban, Leyte, the Philippines.

Source: Mahar Lagmay, Philippine DOST.

## Strengthening Marikina City's Disaster Risk Reduction and Management System through Technology

**Hon. Jose Fabian Cadiz**, Vice Mayor of Marikina City, the Philippines

In 2009, when Marikina City was struck by Typhoon Ondoy (Ketsana), and again in 2012, when it was struck by Habagat (a Southwest monsoon that inundated the city with 23m flood waters), the city was in constant communication with Dr. Mahar Lagmay of DOST. His information was used to take proper action; consequently, no lives were lost.

Marikina City is nestled in the Marikina River valley between two ridges. Upstream is the Marikina watershed area, where the river starts; 8km of the river traverses the city. During Typhoon Ondoy, 70 percent of the city was flooded, while during Habagat, it was 40 percent. In the five years since Ondoy's devastation, Marikina has slowly recovered, and the city government has started programs to make the river more resilient to flooding and disasters.

Of course, flood is not the only natural hazard to concern Marikina City. A strong earthquake may occur at any time along the West Valley fault line that passes through the western part of the city; a damaging earthquake could also occur along another fault line in the eastern part of the city. Because of this risk, the city government has prepared communities and families to react properly to disaster situations. Through the Family Emergency Evacuation Time, or FEET, program, families are assigned to a specific evacuation center.

A video presentation<sup>4</sup> highlighted the city's disaster risk reduction and management (DRRM) system, with a focus on (1) prevention and mitigation, (2) preparedness, (3) response and recovery, and (4) rehabilitation.

<sup>4</sup> The video presentation can be accessed on GFDRR website: <https://www.gfdr.org/node/28257>



1. *Prevention and mitigation.* The city conducts profiling of risks through hazard mapping, vulnerability and capacity assessment, and resource mapping. It has established a community-based monitoring system that indicates the elements at risk. Disaster mitigation measures are integrated and mainstreamed in the city's Comprehensive Development Plan and land-use plan, which are both approved by the city council through an ordinance. A zoning ordinance was passed that establishes a 96m easement from the center of the river and a 3m easement from creeks as preventive measures.

Civil society groups and the private sector actively participate in the DRRM program. There is an enhanced contingency plan for flooding and earthquake, part of which is the early warning system (EWS) with a water-level monitoring system and installed rain and wind gauges. With the help of Project NOAH, there is real-time monitoring of rain intensity in the watershed area using Doppler radar. The city will soon have its own localized weather station for a more accurate forecast and timely interventions. Marikina is now receiving technical assistance from the World Bank to develop a disaster risk financing capability, which would address the need for insurance for hazards such as tropical cyclones and earthquakes. Regarding environmental management, local ordinances were passed that regulate the use of plastic bags, encourage biking, establish material recovery facilities, and conduct tree planting, among other provisions.

2. *Preparedness.* Barangay officials were trained in formulating a local DRRM plan and in carrying

out basic emergency response, including search and rescue operations. The Marikina DRRM council was also established and meets regularly. Its secretariat, the Marikina DRRM Office, is responsible for implementing and coordinating disaster management programs. It has likewise approved the local DRRM plan and formulated a hazard-specific contingency plan.

3. *Response.* As part of the EWS, the city has siren activation for flooding every time the water level reaches 15m, with a corresponding alarm for

each new level. In addition, the city uses social media for public advisories and has a text messaging alert system designed to forward emergency and/or warning text messages to any mobile phone.

4. *Recovery and rehabilitation.* Through an executive order, an infrastructure audit team was created to inspect and assess government buildings' structural integrity and ability to withstand any catastrophe.

### Pasig the Green City: Flood Risk Management and Urban Resiliency

**Hon. Maria Belen A. Eusebio**, *Mayor of Pasig City, the Philippines*

With over 749,000 residents, Pasig City is the eighth-largest city in the Philippines. It is traversed by the rivers of Pasig and Marikina and is highly vulnerable to flooding. In 2007, the Pasig City Green Program was crafted to promote sustainable development growth in the city.

In 2009, Typhoon Ondoy struck Pasig, leaving 499 houses completely destroyed and affecting 200,000 people. The city government responded immediately by setting up evacuation centers, relief-goods distribution centers, and satellite hospitals. Calamity assistance and housing programs were simultaneously initiated.

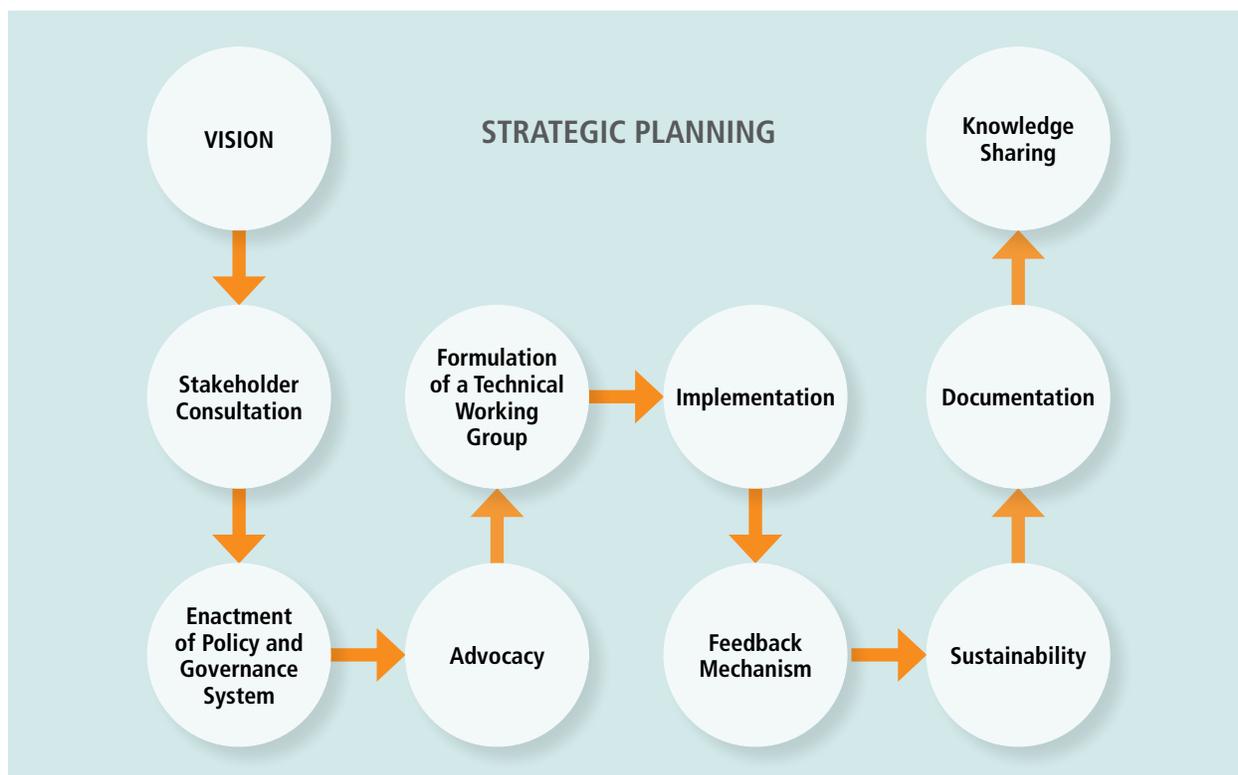
This experience paved the way for the city government to change its strategic plan for mitigating the effects of climate change and hazard events. Using both bottom-up and top-down approaches, the city consulted with the different stakeholders to develop a climate change adaptation (CCA) and DRRM framework. Feedback mechanisms for stakeholders are now institutionalized, an arrangement that encourages participation, creates a sense of ownership, and builds partnerships and alliances as well as

policy support (see the schematic representation of the strategic planning process in Figure 2).

Disaster mitigation measures include 23 pumping stations, nine flood control gates, various river dikes and revetment walls, and an improved drainage system. A communication command and control center that uses state-of-the-art technology to monitor critical areas, especially during natural disasters, has been established in the city office. The city now has access to emergency vehicles and advanced equipment, early warning devices, Global Positioning System (GPS), rapid earthquake damage assessment software, vehicle tracking, and the PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration) radio link. It is also maximizing the use of social media for typhoon-related advisories.

Long-term development plans in Pasig City include capacity building at the community level in the areas of rescue, disaster preparedness, rehabilitation, and risk reduction. Various environmental programs have been implemented, such as solid waste management, green livelihood for women (through





**Figure 2. Pasig City strategic planning**

Source: Maria Belen A. Eusebio, Pasig City.

handicrafts made from water hyacinth), green police (who enforce environmental laws and ordinances), and urban greening. Thousands of informal settlers have been relocated away from waterways and critical areas and have been provided with training and livelihood as well as facilities for proper sanitation and hygiene. CCA and DRRM have been mainstreamed in the city’s comprehensive water and land-use plan, which is also embedded in the city ordinances and investment plan.

Pasig City has earned national recognition for disaster risk preparedness: it has received the president’s award for an outstanding local government program,

been recognized by the Partnership for Clean Air for bike days and carless Sundays, been chosen best city in disaster risk reduction and management, and been chosen the best-prepared local government unit in Metro Manila. Recently, the city was a recipient of the international award for livable communities.

Pasig City will go beyond being merely a green city by taking the best approaches to sustainable development and environmental management. It will always aim to improve the quality of life for its residents. It will serve as a model for the rest of the Philippines in new and innovative governance and as a resilient community.



### Summary of Discussions

- **Commenting on land-use and DRM plans integration**, Vice Mayor Cadiz explained that the DRRM plan is already incorporated in the Comprehensive Land Use Plan. The areas that are at high risk for flooding, earthquake, and landslide, and thus not suitable for residential use, have been identified. Built zones considered not vulnerable to hazards have also been identified for commercial and industrial uses. Mayor Eusebio emphasized that Pasig City is keen on preserving the competitive advantage of its commercial business district. It is currently updating its comprehensive land-use and water plan. The city has a completely built-up area and only about 5 percent of total land area is considered vacant land.
- **Discussing relocation of informal settlers away from waterways**, Vice Mayor Cadiz mentioned that families living within the 96m easement from the center of the river were relocated in government housing projects in the provinces. Mayor Eusebio added that Pasig City has built housing units to provide in-city relocation of informal settlers so that they will have better access to basic social services. It also has provided housing outside the city (province) through an agreement with the host province in which Pasig City provides basic facilities. National agencies have also extended assistance to the city to support this arrangement.
- **Citing the importance of making weather information accessible to the public**, Dr. Lagmay explained that DOST traveled throughout the country to inform the LGUs about the information DOST had available. The LGUs were trained in how to communicate the information at the community level. One of Project NOAH's components is hazard information tri-media (TV, radio, and social media). The project has a 24/7 dedicated channel on DOST TV that streams weather and disaster information to the smallest units of the community, such as individuals and families.
- **Speaking about integrating support for industry with concern for pollution**, Mayor Eusebio emphasized that Pasig City has observed a massive decline in industrial zones, while residential commercial areas have emerged. Some 250 hectares of industrial zones remain, but these are expected to be transformed into mixed-use development. Pollution generated by industries is also being monitored by the city environment and natural resource office.

## Session 2 (Part 1)

### Examples of International Practice on Flood Risk Management and Mainstreaming Disaster Resilience into Urban Projects

**Chair: Mr. Hayato Nakamura**, *Project Formulation Advisor, Japan International Cooperation Agency*

#### DPWH Flood Risk Management and Resiliency Program

**Assistant Secretary Catalina Cabral**, *Department of Public Works and Highways, the Philippines*

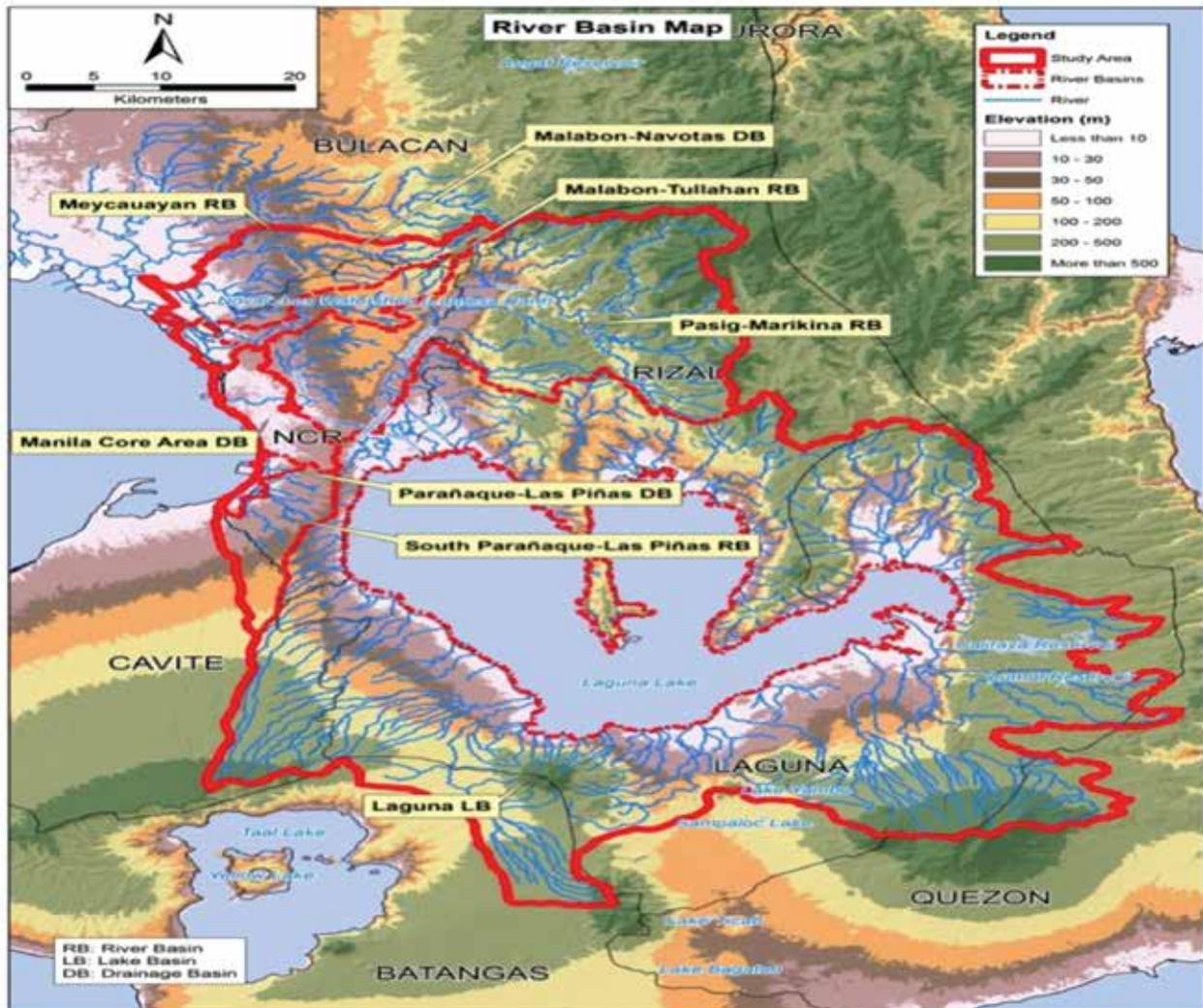
DPWH is at the forefront of mitigating the impacts of water-related hazards in the Philippines and in this role works closely with other national agencies. Its mandate is to plan, design, construct, and maintain not only national roads and bridges but also the flood control system in 18 major rivers and about 120 others.

The DPWH's Flood Risk Management and Resiliency Program seeks to protect lives and properties against major floods and other calamities. Two strategies are used to achieve this goal. The first is embodied in the River Basin Approach for Effective Flood Control Program, which was adopted in preparing the master plan and feasibility study for flood and water resource management. DPWH is already in the process of implementing the Flood Risk Management Master Plan for Metro Manila and surrounding areas (Figure 3). DPWH's target date for completing the master plan and feasibility studies of the 18 major rivers is 2016. It has submitted to the Office of the President a proposed Water Sector Restructuring Plan adopting an integrated water resources management approach in a convergence program with the Department of Agriculture, Department of Agrarian Reform,



Department of Environment and Natural Resources, and the National Irrigation Administration. It also upgraded engineering design standards for flood control, drainage, and slope protection works.

The Flood Risk Management and Resiliency Program's second strategy is to design and construct disaster-resilient public infrastructure in the following ways: (1) by implementing the structural resiliency program in new construction and in reconstruction of damaged infrastructures—for example upgrading roads and bridges, school buildings, hospitals, public housing, and other infrastructure facilities, especially those facing the coastline; (2) by recovering right-of-way of critical national roads and bridges and upgrading their design to ensure flood-free access at all times; (3) by identifying public facilities as safe "shelter centers" in disaster-prone municipalities, and establishing an emergency command center and evacuation facility; (4) by using geohazard maps and NOAA data for infrastructure planning and disaster risk reduction (DRR) measures; and (5) by strictly enforcing water easement laws, relocating informal settlers and structures on waterways, and establishing no-build zones.



**Figure 3.** Master plan for flood management in Metro Manila and surrounding areas

Notes: Total area: 4,354 km<sup>2</sup>, total population: 17.1 million. Based on Pasig-Marikina basin and Laguna Lake basin.

Source: Catalina Cabral, Philippine DPWH.

Under the master plan, there are 11 structural mitigation measures that have been identified for a total investment of 351.718 billion. This includes, among others, the Pasig-Marikina River improvement and dam construction, Meycauayan River improvement, and Malabon-Tullahan River improvement. Projects under the master plan are prioritized according to the severity of floods as well as the risks, area, and duration, and also take into account the project's technical, social, and environmental viability.

Aside from the master plan for Metro Manila, there is also a Flood Risk Management Project. Carried out with the assistance of the Japan International

Cooperation Agency (JICA), the project is building revetment structures along the Cagayan River, a river dike in the Tagoloan River, and two off-site retarding basins along the Imus River.

Typhoon Haiyan's total damage and losses amounted to 571.11 billion, while estimated reconstruction needs were 360.89 billion. The typhoon affected 4.1 million families and killed 6,069 people. As a result of the experience with Haiyan, the Philippines and DPWH have upgraded the design standards of all infrastructure—not only of roads and bridges, but also school buildings and evacuation centers.

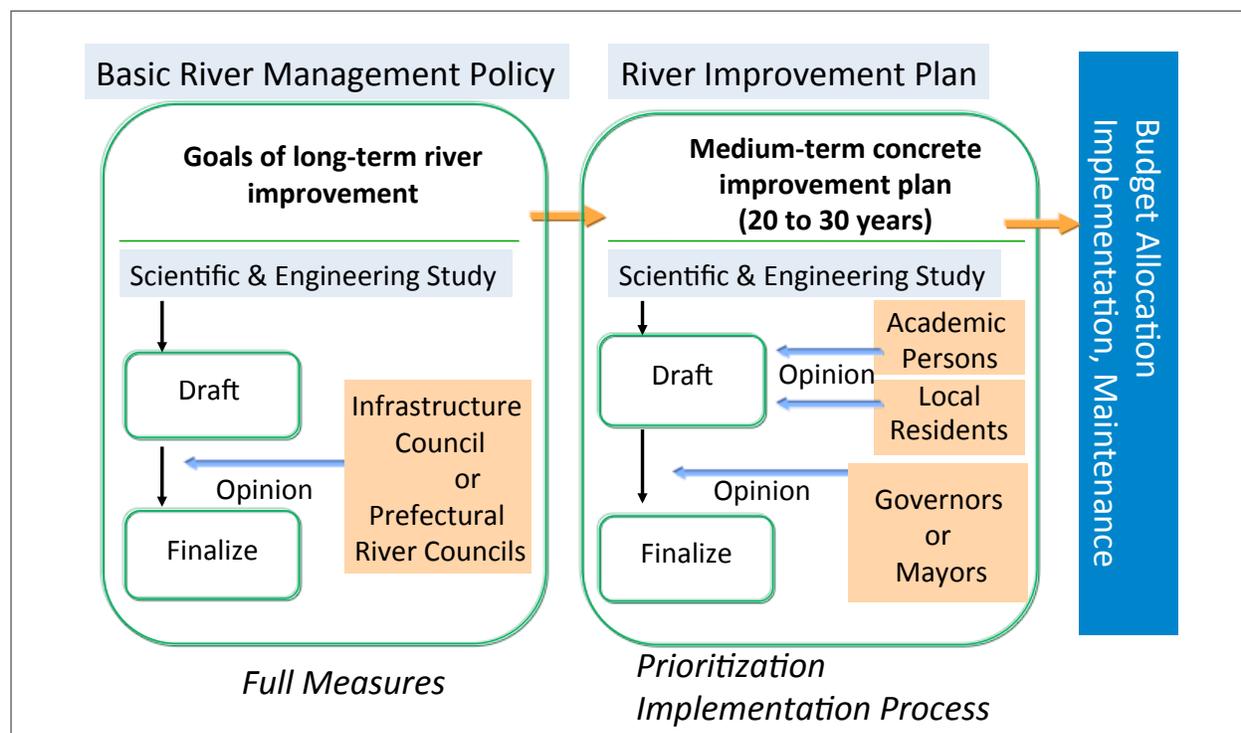
### Application of a Science- and Engineering-Based Comprehensive Flood Management Planning Method to the Chao Phraya River Basin, Thailand

**Mr. Kenichiro Tachi**, Senior Deputy Director, International Affairs Office, River Planning Division, Water and Disaster Management Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan



Japan is a flood-prone country, and its tendency to flood affects its assets and population. In order to address flooding, Japan has developed a flood management system that focuses on prevention, emergency response, and recovery. It has also developed a basin-based comprehensive flood risk management plan, and it uses a combination of structural and non-structural flood mitigation measures. In Japan's experience, investing in an effective flood management system has led to more sustained and stable economic growth.

Japan's Framework for Flood Management Planning is prescribed under the country's River Law, which outlines both long-term goals for river improvement and a medium-term (20- to 30-year) concrete improvement plan (see Figure 4). Both long-term and medium-term planning is based on analysis by scientists and engineers. Consensus building with local residents, academic institutions, and government officials was done during the planning stage. Using this approach facilitates a continuous budget allocation.

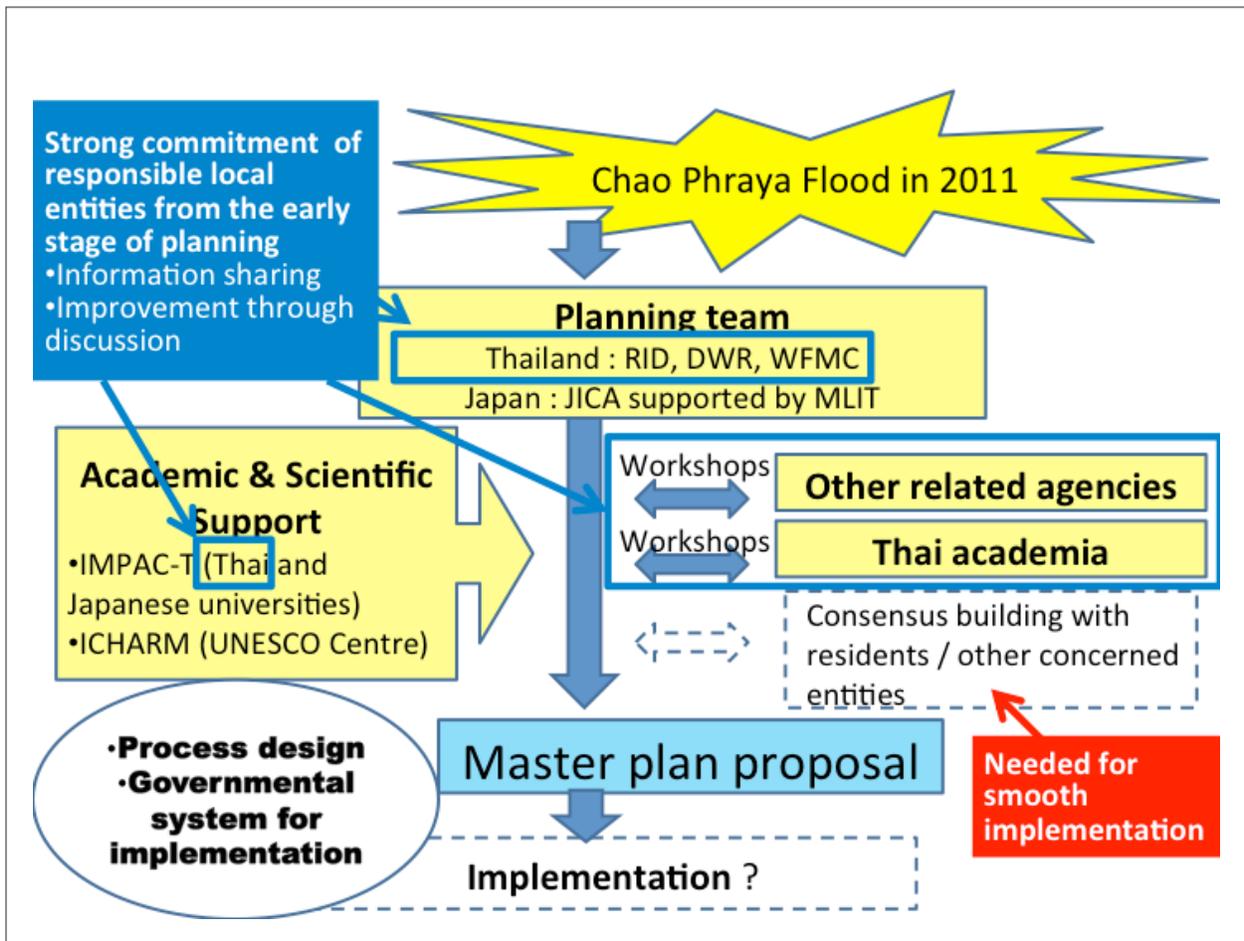


**Figure 4.** Framework for flood management planning under the River Law

Source: Kenichiro Tachi, Japan MLIT.

This planning method was also applied to the Chao Phraya River basin in Thailand when severe flooding was experienced in 2011. After formation of the planning team, comprising relevant Thai agencies (the Royal Irrigation Department, the Department of Water Resources, and the Water and Flood Management Committee) and JICA, a master plan was developed to address proper flood management. One important feature of this plan was its use of a combination of hard and soft measures to control inundation and to minimize damage.

The plan has been successfully implemented, with inundation controlled and a reduction in damage to the economic zones around Bangkok. The key to successful implementation is the strong commitment of responsible local entities from the early stages of planning. (The steps involved in moving from planning to implementation are shown in Figure 5.) However, it is challenging to build consensus with local residents and government officials, and to pass legislation that secures implementation.



**Figure 5.** From planning process to implementation

Note: RID = Royal Irrigation Department; DWR = Department of Water Resources; WFMC = Water and Flood Management Committee; IMPAC-T = Integrated Study on Hydro-Meteorological Prediction and Adaptation to Climate Change in Thailand; ICHARM = International Centre for Water Hazard and Risk Management.

Source: Kenichiro Tachi, Japan MLIT.



### Summary of Discussions

- **Speaking about improving the lead time for flood forecasting**, Assistant Secretary Cabral explained that Project NOAH, which was developed by DOST, provides LGUs with a six-hour warning time. The warning can be communicated through various media. The EWS is also part of the local DRRM plans of each local government unit. Color coding is being used in rainfall forecasting.
- **Regarding the need to ensure intercommunity management and consensus building**, Assistant Secretary Cabral remarked that intercommunity management is one of the most difficult parts of flood control. Every time DPWH constructs big flood control structures, it starts at the feasibility study stage, which involves communication and dialogue with the local stakeholders and LGUs. Local stakeholders are also part of the project implementation. Moreover, media is used to communicate the positive effects of the project. If there is opposition to an infrastructure project, further dialogue takes place to secure the LGU's approval before the project is executed. Mitigation measures such as relocation and financial assistance to the affected residents are being implemented, and social and environmental experts are employed to help communicate plans and programs. Mr. Tachi added that the diversion channel they constructed has caused a dispute and added years to the project.
- **Speaking about operations and maintenance of flood control structures**, Assistant Secretary Cabral explained that government provides the budget for maintenance, operations, and sustainability. To ensure that the budget department understands the project, DPWH explains the plan, targets, outputs, and outcomes. In terms of institutional arrangements, each national agency and LGU has to allocate its own maintenance funds.
- **Concerning solid waste management**, Assistant Secretary Cabral explained that the Department of Environment and Natural Resources (DENR) is in charge of this area. The challenge for DPWH is to clear the waterways of any obstruction, such as garbage, in order to increase the conveyance capacity of rivers. It remains a challenge for the DENR to enforce solid waste management law at the LGU level.
- **In summary**, the discussion highlighted four important elements of flood risk management across different countries: a combination of soft (nonstructural) and hard (structural) mitigation measures; communication about risks and hazards from scientific and engineering agencies, and public access to data; coordination across various agencies involved in flood control management; and the commitment of all stakeholders.

## Session 2 (Part 2)

### Examples of International Practice on Flood Risk Management and Mainstreaming Disaster Resilience into Urban Projects

**Chair: Dr. Glenn Tabios**, *Executive Director, National Hydraulics and Research Center*

#### Strengthening Flood Risk Management in Jakarta

**Ms. Eli Menawan Sari**, *Project Management Office Staff, Daerah Khusus Ibukota, Public Works, Indonesia*

**Ms. Suryani Amin**, *Disaster Risk Management Team, the World Bank*

Jakarta is located on low-lying ground—currently 40 percent of the city is below mean sea level—and it is at risk of floods and tidal events because of its proximity to the sea and its exposure to tropical storms. Contributing to Jakarta’s risk are rapid urbanization and population growth, which have permitted encroachment on or development of critical catchment areas, as well as poor spatial planning and improper waste disposal, which has led to increased rainwater runoff and fewer natural storm water retention areas.

The last major flood in Jakarta was in February 2007. This event affected more than 2.6 million people, forced the evacuation of 340,000, killed over 70, and caused the widespread outbreak of disease. Total financial and economic losses from this flood are estimated at US\$900 million. In the last 10 years, floods in the area have grown more severe, and they



are expected to become more frequent and to cause greater damage in the future.

As far back as the 1970s, the government sought to address the problem of flooding and developed a master plan for managing flood risk. But implementation of the plan was slow, and maintenance of existing infrastructure was minimal. In 2012, to improve flood management, Jakarta has launched the Jakarta Urgent Flood Mitigation Project/Jakarta Emergency Dredging Initiative Project (JUFMP/JEDI Project). The five-year project involves dredging, embankment repair, and construction of 15 high-priority floodways, canals, and retention ponds. Technical assistance, including support to improve flood management information systems and institutional coordination for operations and maintenance between responsible agencies, is also part of the project.

## Stormwater Management and Climate Change Adaptation Project

**Ms. Marie Ndaw**, *Technical Director, Dakar Municipal Development Agency, Senegal*



Recurrent flooding is one of the most serious problems that Senegal has been facing over the last years (Figure 6 lists some of the causes of flooding). At the end of August 2009, heavy rainfall caused serious flooding in Senegal, particularly in Dakar. The flooding affected some 360,000 people and caused losses and damages amounting to US\$104 million<sup>5</sup>.

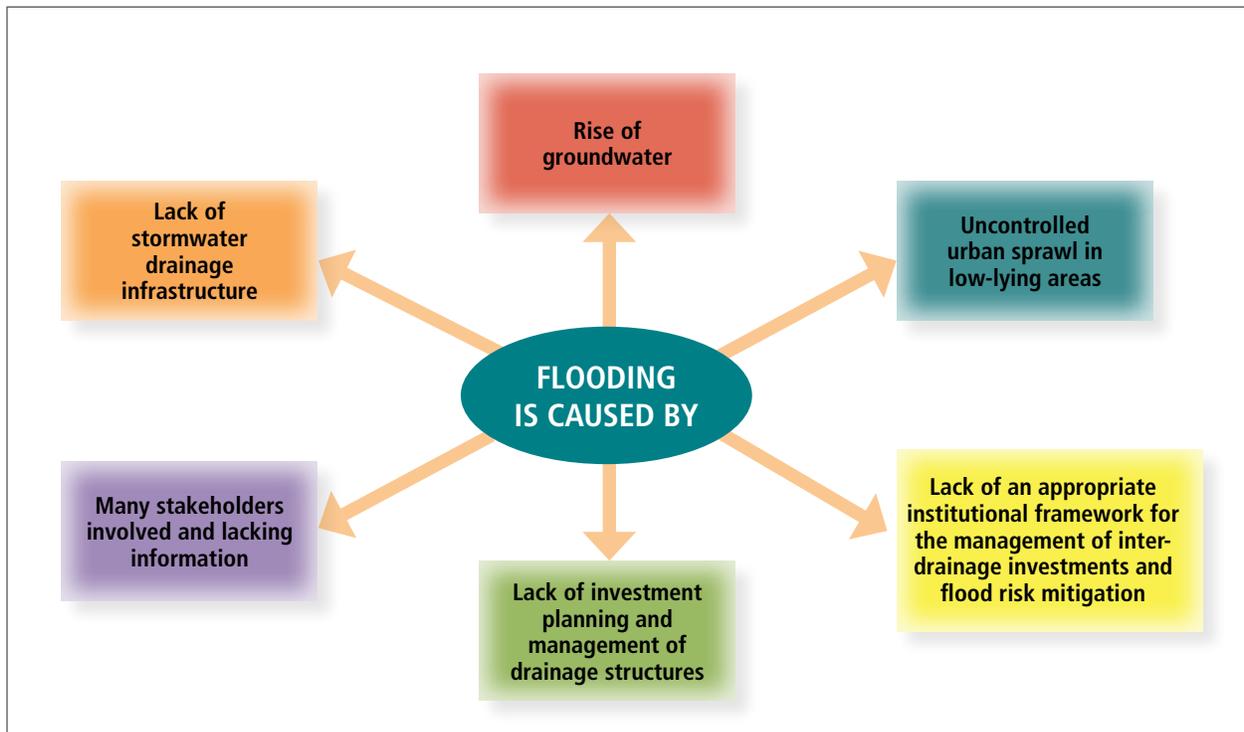
In response, an urban development project called the Stormwater Management and Climate Change Adaptation Project, or PROGEP, was implemented. Using an integrated approach based on a combination of structural and nonstructural measures, the five-year project aims to reduce the risk of flooding in Dakar's peri-urban areas and to protect people living there.

Currently, the project has completed the environmental and social surveys, resettlement action plans, and master plan for storm drainage. Going forward, the project will (among other things) carry out technical studies for detailed urban management plans in the cities of Pikine and Guediawaye, provide funds for sanitation works, and develop strategies to mitigate flood risk and vulnerability to climate change that integrate urban planning and management. It will also seek to sensitize the community and other actors about flood prevention measures and adaptation to climate change; engage in capacity building; and disseminate information.

As a result of implementing the project, Senegal has learned to systematize environmental impact studies; strengthened its mechanisms for monitoring and forecasting flood; harmonized interventions by, and strengthened the synergy between, the various government and private sector actors; and initiated inter-municipal management of basins and stormwater works.

<sup>5</sup> Post Disaster Needs Assessment (PDNA). Urban flooding in Dakar in 2009. Available from GFDRR website: <https://www.gfdr.org/senegalpdna2009>.





**Figure 6.** Examples of different causes of flooding in Senegal

Source: Marie Ndaw, Senegal Dakar Municipal Development Agency.

## Summary of Discussions

- **Commenting on strategies for publicizing flood risk management projects to the communities,** Ms. Ndaw mentioned that one component of the Dakar Stormwater Management and Climate Change Adaptation Project seeks to involve the community in reducing flood risk and adapting to climate change. This strategy uses capacity building activities and recruits NGOs and facilitators to discuss the project with the community. Ms. Ndaw acknowledged that there was some disagreement about infrastructure projects, but emphasized that the institutional system in place allows discussion and consensus building with key project stakeholders.
- **Speaking about the implementation of Senegal's CCA activities,** Ms. Ndaw explained that

Dakar is a peninsula and thus threatened by the rising sea level. For this reason CCA must be integrated in flood management planning. Ms. Ndaw clarified that two types of drainage systems are used in Senegal: one that works by means of a pump, and one that relies on gravity.

- **Discussing the relocation of affected families,** Ms. Amin said that in Jakarta there are about 500,000 people living along the river who are expected to be resettled in government-developed vertical houses, although space is a problem. Community members were consulted in the resettlement planning process. Ms. Ndaw added that Dakar had a resettlement framework and action plan that provided compensation to affected people.

## Session 2 (Part 3)

### Examples of International Practice on Flood Risk Management and Mainstreaming Disaster Resilience into Urban Projects

Chair: **Mr. Ramon Alikpala**, *Be Secure Project, Chief of Party, U.S. Agency for International Development*

#### Lessons from the Great East Japan Earthquake

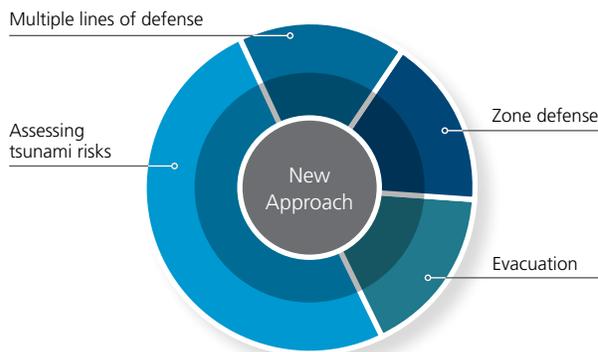
**Mr. Mikio Ishiwatari**, *Senior Water and Sanitation Specialist, the World Bank*



Japan is prone to strong earthquakes and resulting tsunamis; these hazards occur about every 30 to 40 years. In 2011, the Great East Japan Earthquake took the lives of more than 51,000 people as a tsunami struck the coastal communities. The experience of this disaster offers the following six key lessons: (1) urbanization has increased vulnerability to disasters, so that larger numbers of people are affected when a disaster occurs; (2) relocation is an effective way to reduce exposure, but implementation is a challenge; (3) relocation is not a substitute for continued regulation of development, especially in high-risk areas; (4) community involvement in DRM is critical for minimizing damage; (5) hazard maps are used as guides and to facilitate prompt evacuation, but they can also give people a false sense of security and cause them to underestimate the disaster's impact; and (6) greenbelts can mitigate damage from small tsunamis, sea winds, or sands.

The new approach to managing tsunami risk has shifted away from building a single line of defense, such as tsunami dikes, and instead uses multiple lines of defense that combine structural measures (e.g., roads and secondary dikes) with nonstructural measures (e.g., land-use regulation, measures for quick and safe evacuation, and risk assessment based on local conditions, including industry, commercial activities, history, and culture, public awareness, etc.). The approach is illustrated in Figure 7.

The government is taking a cross-sectoral recovery approach covering infrastructure, urban planning, and economic activities. However, one of the major challenges is building consensus, especially when some residents want to rebuild their homes on the original sites, while others want to move to higher and safer ground. As the local governments and communities recover from the devastation of the tsunami, support from the central government, academic institutions, civil society organizations, and NGOs is very important. In sum, while integrating DRM in urban planning and relocation programs can be very effective, implementation remains a challenge because some people still prefer to live in high-risk areas.



**Figure 7. New approach to managing tsunami risk**  
Source: Mikio Ishiwatari, the World Bank.

## Combining Structural and Nonstructural Measures to Reduce Flood Risks in Jingdezhen City, China

**Ms. Cheng Yuanyuan**, *Project Management Unit, Jiangxi Wuxikou Integrated Flood Management Project, China*



In 2003, China's Ministry of Water Resources and National Flood Control and Drought Resistance Headquarters called for a shift from flood control to flood management—an approach that includes harmonious coexistence with floods. Urban flooding remains a problem in China today, and Chinese cities—including Jingdezhen City—are looking for innovative and cost-effective ways to improve flood management.

Home to 500,000 people, Jingdezhen suffers from frequent flooding and has an ineffective flood management system, low national flood control standards, and weak urban storm drainage infrastructure. The Jingdezhen dike project, carried out from 1998 to 2012, was intended to protect against a 1-in-20-year flood, but that is insufficient. The current national standards require flood protection against a 1-in-100-year flood event.

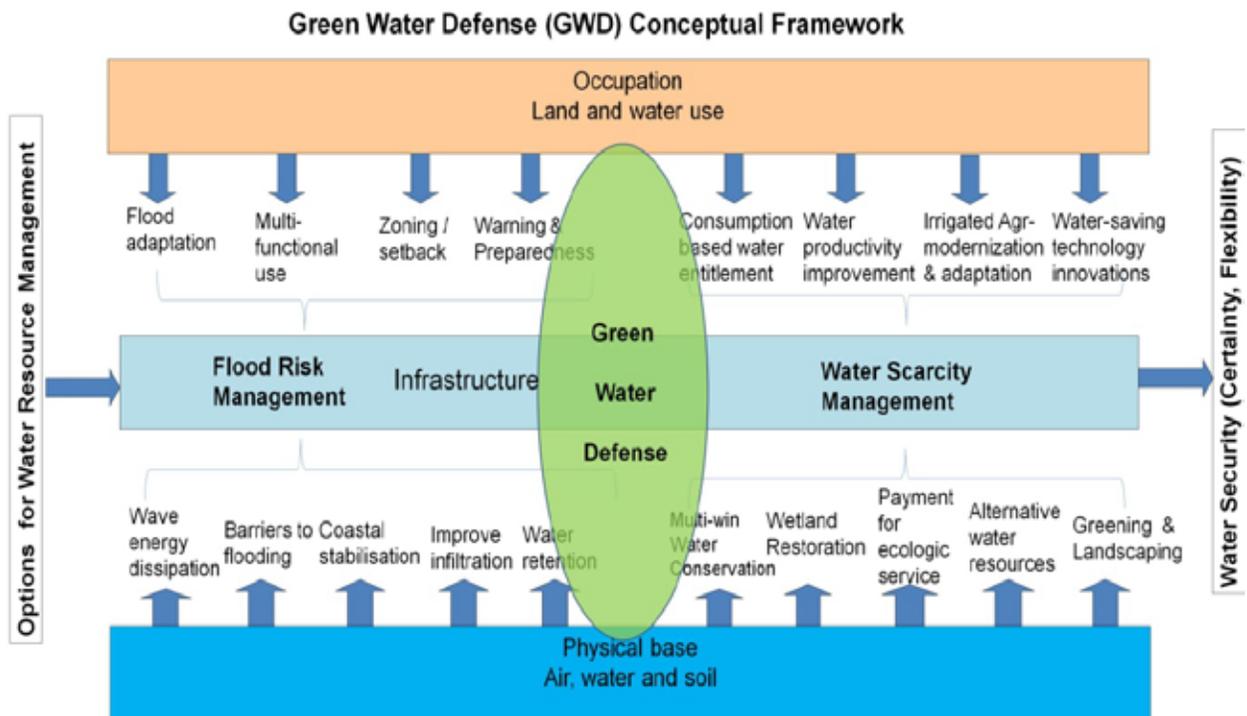
To meet the current standard, the Jiangxi Wuxikou Integrated Flood Management Project (2013–2019) is being implemented. Several investment options were considered by the project team before members decided to proceed with raising the height of the city dikes, building the Wuxikou Dam, and establishing an integrated flood risk management (IFRM) system. Together these measures will protect the city from a 100-year flood event. This set of options was chosen because the measures are considered cost-effective, will have a limited environmental impact, and make the resettlement of residents manageable.

The Jiangxi Wuxikou Integrated Flood Management Project uses a combination of structural and

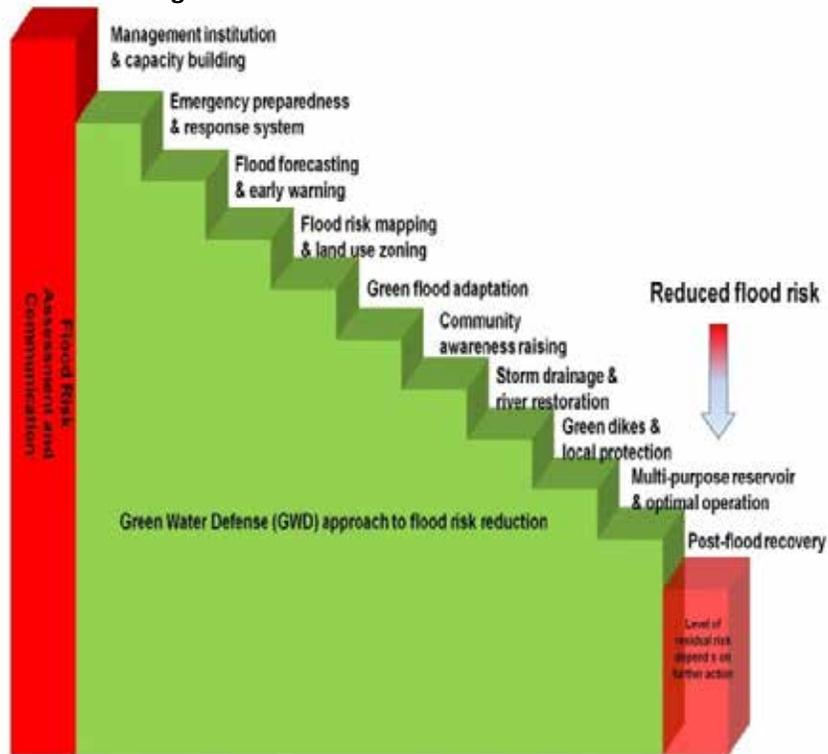
nonstructural measures, including the establishment of an IFRM system for Jingdezhen City, to reduce the flood risk in the Jingdezhen central urban area. The nonstructural measures are particularly important for managing residual risks that remain after the structural measures have been implemented and for mitigating the impact of flood events with return periods of more than 50 years. These nonstructural measures are also less costly and faster to implement than structural measures.

In Chinese cities, one of the important innovations for addressing floods is the green water defense approach, which is an adaptive management approach that seeks to spatially integrate natural forces and human interventions, to balance incentive-based and supply-driven measures, and to sustainably provide water services and manage related climate risks (see Figure 8).

The following lessons have been learned from the Jingdezhen project experience: (1) it is important to understand the flood risk and decide on a risk reduction strategy and targets; (2) in addressing flood risk, structural and nonstructural measures should be combined; (3) analysis and prioritization of flood management options should take into account cost-effectiveness as well as environmental and social impact (externalities); (4) measures should be designed for optimal effectiveness and sustainability; and (5) problems with implementation should be addressed as they arise.



**Application of the green water defense approach: buying down risk through cost-effective green water defense measures**



**Figure 8.** The green water defense approach and application

Source: World Bank, *Grow in Concert with Nature: Sustaining East Asia's Water Resources through Green Water Defense* (Washington, DC: World Bank, 2012).

## Flood Risk Management and Urban Resilience in Bangladesh

**Mr. Md. Abul Kashem**, *Chief Engineer, Dhaka Water Supply and Sewerage Authority, Bangladesh*



Dhaka City, the capital of Bangladesh, is a rapidly growing megacity. Its rapid growth means that more people and assets are moving into urban areas, and this creates problems with water supply, sanitation, and drainage. Major floods in Dhaka in 1998 and 2004 were attributed to structural problems (e.g., inadequate drainage, insufficient pumping) and nonstructural problems (e.g., inadequate interagency cooperation). Though a variety of laws and policies are in place to address the problem of flooding, they are fragmented and require integration if they are to be effective.

The Dhaka Water Supply and Sewerage Authority (DWASA), established in 1963, is in charge of managing water supply, treatment and disposal of domestic and industrial sewage, and stormwater drainage. DWASA is now in the process of finalizing a drainage master plan for Dhaka City that addresses most of

the flooding issues. The Dhaka City Corporation is also involved in drainage management.

If the construction of urban drainage infrastructure in Dhaka is to account for changing rainfall and storm intensity patterns resulting from climate change, the design and planning of the drainage system will need to be reviewed. Factoring in climate change, Dhaka City will require a 12 percent increase in pump capacity and a 7 percent increase in retarding pond area. For these goals to be met, hydrological modellers and climate scientists will need to collaborate.

The drainage master plan for Dhaka addresses flooding problems, particularly in Dhaka City, through flood mitigation options, urban planning, risk mapping, and application of resiliency measures such as installation of early warning systems and community awareness building.

## Flood Risk Management and Urban Resilience in Bangladesh

**Mr. Mohammad Arifur Rahman**, *Superintendent Engineer, Dhaka North City Corporation, Bangladesh*



Flood mitigation efforts in Dhaka, a megacity at high risk of flooding, make use of both structural and nonstructural measures. Structural measures include for example the construction of embankments and hydraulic infrastructure. Nonstructural measures include the establishment of the Flood Forecasting and Warning Centre, or FFWC, which uses a mathematical model (the FFWC Super Model) to produce monsoon flood forecasts with a lead time of 24, 48, and 72 hours. These forecasts play an important role in urban flood management.

Longer-range forecasts are also important, and efforts are under way to apply technology from the Climate Forecasting Application Network to produce 4- to 14-day forecasts. These forecasts will help farmers decide whether to harvest crops early to avoid major crop losses and whether to transplant rice crops; allow communities to take action to protect and save assets, infrastructure, livestock, and fisheries, and to plan response activities; and allow communities to take preventive measures against waterborne disease.

A number of important lessons have been learned from Dhaka's experience in managing flood risk:

- Safety is possible even when floods are very frequent.
- A flood management strategy to reduce vulnerability uses advanced analytical tools such as economic and urban growth modelling, flood modelling, damage modelling, and response modelling.
- Compartmentalization as a flood control technique can be effective when communities' wishes are taken into account.

- Coastal embankments and drainage structures are very effective, though drainage congestion can occur at some coastal polders due to siltation of the outfall channels.
- Decision support systems are important for monitoring of flood management systems.
- Flash flood can be reduced if appropriate measures are taken to increase the conveyance capacity of the river systems.
- Bridges and culverts should have adequate clearance for navigation.
- Flood-proofing measures, where feasible, may be implemented to reduce flood damage.

Some recommendations for further progress in managing flood risk in Dhaka include the following:

- Reassess and redesign the flood embankments, including submergible embankments in the northeast region.
- Undertake an integrated approach to river management that would cover dredging of the navigational routes and river bank protection.
- Redesign national highways, railways, and other key infrastructure.
- Reassess surface water and groundwater resources to account for climate change scenarios; incorporate findings in National Water Management Plan policies.
- Develop systems for early forecasting/warning of storm surge inundation.
- Reengineer the coastal polders by phases to address sea-level rise and storm surge for the safety of coastal communities.

- Build new cyclone shelters in the newly defined high-risk areas, especially in the Barisal and Khulna Divisions.
- Develop groundwater modelling to understand and manage salinity intrusion in the coastal region.
- Address knowledge gaps—from downscaling of the climate model to considerations of glacial melt or blending of meteorological science with hydrology—and build needed capacity.
- Promote regional cooperation at the basin level for predicting climate change impacts, devising adaptation measures, sharing knowledge, and developing resources.
- Use existing models, which are capable of forecasting storm surge-induced flooding, as the basis for regional cooperation.



### Summary of Discussions

- **Speaking about the effectiveness of EWSs in the community**, Mr. Rahman said that the government is very aware of its responsibility to disseminate information about weather and issue weather forecasts. Communities now have become more cautious. NGOs are present in the community and they help in disseminating warnings.
- **Speaking about advisories for adverse weather or events**, Mr. Rahman explained that people who do not comply with the warning advisories are not sanctioned by the government.

## Session 3

### Examples of Implementing Flood Risk Management Programs— Examples of Metro Manila and Jakarta

#### Group A: Philippines

**Facilitator: Ms. Catherine Vidar**, Disaster Risk Management Specialist, the World Bank

#### Metro Manila Flood Risk Management Master Plan Recommendations, Prioritization, and Implementation

**Ms. Dolores Hipolito**, *Project Manager, Flood Control Management Office, Flood Control Management Cluster, Department of Public Works and Highways, the Philippines*

The Philippines' Republic Act 10121, or the Disaster Risk Reduction and Management Act of 2010, stipulates the integration of DRRM in local development processes and plans. This law mandates that all local government units establish a DRRM office to coordinate and ensure implementation of DRRM programs. The DRRM office also serves as secretariat to the local DRRM council, which is responsible for evaluating and approving DRRM plans.

Both the national government and the community are important in maintaining structural measures to mitigate flooding. Building communities' capacities in and awareness of flood management helps to ensure disaster resiliency.

The Metro Manila master plan had to meet several challenges, including coverage of a very large area (16 cities), varying flood causes with varying solutions, waterways clogged by garbage, difficulty in preventing illegal garbage dumping, and lack of community commitment in waterways maintenance. A number of lessons have been learned as the plan is implemented:

- Balancing and combining structural and non-structural flood mitigation measures to produce a complementary intervention are key to protecting lives and properties against hazards. But the best combination may vary according to a country's situation.
- Structural and nonstructural measures should be evaluated based on their responsiveness, cost-effectiveness, and social and environmental impacts.
- Structural measures are costly if the local community does not have the means for maintenance. Community members may need to build capacity to become competent in maintenance and logistics. They should be aware that they can mobilize the private sector to assist with or carry out maintenance, and that national agencies and local communities may have joint responsibility for maintenance.



## Summary of Discussions

- **In the Netherlands**, the government focuses on nonstructural measures more than on structural, as it is cheaper to compensate farmers for flooded land than to construct physical barriers to flooding.
- **In Sri Lanka**, one of the most effective structural mitigation measures is a wetland or retarding basin, although communities should take into consideration its detrimental impact on the environment.
- **In Senegal**, people adapt to the seasonal changes along the coast to optimize the coast's use and benefits. During high flows, communities leave the area for safety; during low flows, they use the land for agriculture.
- **Flood risk is not separate from other environmental issues** that confront cities. It is important to harness all possible solutions to flooding across all levels of governance.
- **Relocating families** to safer and higher ground is critical for saving lives. However, relocation to an area outside the city that offers basic services and economic opportunities may not be feasible. Since so many people must share limited space in the city, it is essential to make use of all available interventions to mitigate the risk of flood.
- Just as DPWH is implementing the master plan for Metro Manila, communities are encouraged to prepare their own plans to address their own issues. The national-level plan should work in concert with the community-based plan to address flooding problems in the metropolis.

## Group B: Indonesia

**Facilitator: Mr. Denis Jordy**, Senior Environmental Specialist, the World Bank

### Flood Contingency Plan at Kelurahan Level

**Mr. Bambang Musyawardana Kayatnan**, *Director of Jakarta Province Disaster Management Agency*

**Mr. Edi Junaedi Harahap**, *Head of Informatics and Controlling, Jakarta Province Disaster Management Agency*

An evaluation of the flooding in Jakarta in January 2013 showed that DRM capacity at the village level needed to be strengthened, specifically by means of a flood contingency plan that would address evacuation, early warnings, and village-level emergency command structure. The steps in preparing a contingency plan are presented in Figure 9.

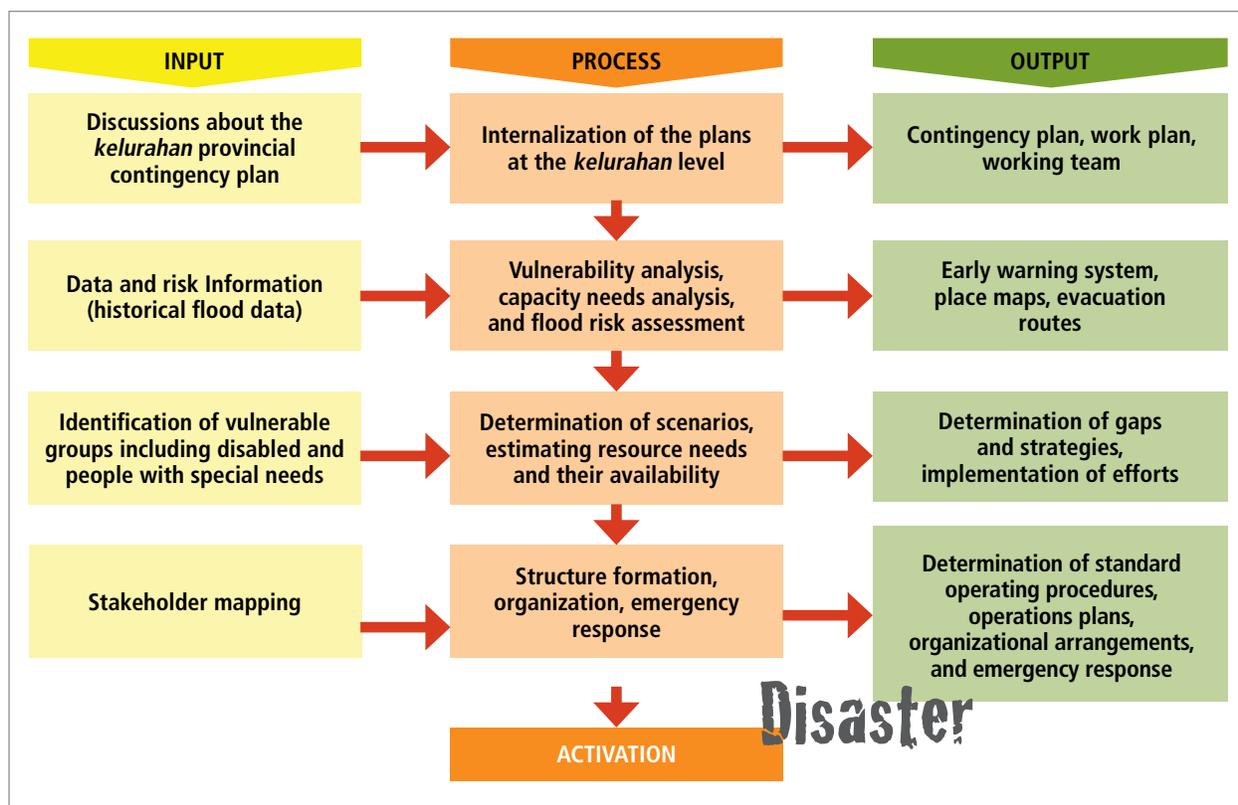
To date, 54 out of 124 flood-prone kelurahan in Jakarta have completed their plans. Elements of the plan were tested during the 2014 flood. The villages that had plans in place fared better than those that did not, demonstrating the effectiveness of increasing disaster preparedness at the village level.

### Agency Flood Information Management System in Jakarta

**Mr. Bambang Surya Putra**, *Informatics Section Head, Jakarta Province Disaster Management Agency*

In response to the problem of flooding, the Jakarta Province Disaster Management Agency has developed a contingency plan in consultation with key community leaders. The plan is based on flood data and information (history) as well as information about the vulnerable groups affected and other stakeholders. The contingency plan will be successful if there is a strong commitment by the people in the community and the private sector.

A key role in managing flood risk in Indonesia is also played by the Flood Management Information System (FMIS), which was developed under the technical assistance component of the Jakarta Urgent Flood Mitigation Project. FMIS provides accurate and timely information before, during, and after a disaster. The establishment of FMIS has helped in preparedness, risk mitigation, monitoring, recovery, and response.



**Figure 9.** Steps in preparing contingency plans

Source: Mr. Edi Junaedi Harahap, BNPB, Indonesia.

Key factors in the success of the FMIS are access to accurate information, use of technologies like GIS, smooth communication between national and local levels, active participation of stakeholders, availability of emergency hotlines, an organized database system, and leaders' commitment to flood management. Media is also being monitored as part of FMIS.



## Field Visit: The Metro Manila Development Authority

At the Metro Manila Development Authority, the participants visited the headquarters building and two MMDA facilities—the Metrobase and the Flood Control Information Center. Afterwards, participants visited a pumping station located in Taguig City.

**Welcome by Ms. Corazon T. Jimenez**, General Manager of Metro Manila Development Authority, the Philippines

### Flood and Sewerage Management in Metro Manila

**Engr. Maxima M. Quiambao**, Director of Flood Control and Sewerage Management Office, Metro Manila Development Authority, the Philippines

Director Quiambao showed a video presentation on flood and sewerage management in Metro Manila that described the different flood issues; highlighted the areas prone to flooding; and described causes of, challenges surrounding, and the government's response to flooding. The MMDA envisions that by 2016, Metro Manila will be flood resilient.

The current drainage system in Metro Manila comprises 689km of waterways (rivers, creeks, and open canal), 59km of drainage mains (outfalls and interceptors), and 897km of drainage laterals along major thoroughfares. Most of these drainage systems are clogged by garbage, silt, water hyacinth, and other debris.

To clear the waterways of any obstructions, MMDA performs regular manual and mechanical dredging,

desilting of drainage mains and interceptors, and declogging. In 2011, MMDA started the *Estero Blitz*, an intensified clean-up operation covering selected creeks (*esteros*) in the metropolis; Table 1 shows progress under the four “blitzes” conducted to date. The campaign likewise involves dredging, debris removal, a medical mission, and seminars on solid waste management, health, and sanitation. Another flood control measure being implemented by the MMDA is the establishment, rehabilitation, and maintenance of pumping stations in strategic areas of Metro Manila.

Important nonstructural measures applied by MMDA include the organization of Flood Control Bayanhan Zone Alliances, comprising various stakeholders in 10 identified flood-prone areas. The alliances are community-based groups, made up of local community members, the private sector, NGOs, national agencies, and LGUs. Their goal is to reduce disaster risk, and they are also trained to respond to and assist during an actual disaster. The MMDA chairperson regularly coordinates and meets with the Metro Manila Disaster Risk Reduction Management Council (MMDRRMC).

INDICATORS	BLITZ 1	BLITZ 2	BLITZ 3	BLITZ 4
	August 8 – September 8, 2011	February 6 – March 30, 2012	May 28 – Aug 26, 2013	April 4 – May 28, 2014
Numbers of <i>esteros</i> covered	45	42	42	12
Total length of <i>esteros</i> cleaned (linear meters)	75,000	94,123	65,000	5,115
Volume of garbage collected (cubic meters)	7,383	6,402	4,336	6,468
No. of truck trips	1,150	951	632	1,018

**Table 1. Progress under the Estero Blitz campaign**

Source: Maxima M. Quiambao, MMDA.



Field visit to the Taquig City pumping station.



## MMDA Flood Control Information Center

**Mr. Ramon Santiago**, *Officer in Charge, Flood Control Information Center, Metro Manila Development Authority, the Philippines*

In August 2012, the Flood Control Information Center (FCIC) and Disaster Risk Reduction and Management Operation Center were established to provide the Philippine public with hazard information and warnings, especially in times of inclement weather. The FCIC also serves as an operations coordination and control facility for MMDA and MMDRRMC during severe weather and emergencies. The FCIC supports decision making, communications, and links among various groups during critical situations, serves as an information and knowledge center for MMDA and other clients on hydrometeorological concerns, and provides public safety advisories and warning.

Once a potential hazard is being monitored, the FCIC disseminates this information to different media groups, agencies, LGUs, and others. These groups draw on this information and other support tools as part of a process of ensuring that there is appropriate action or service in the affected community. There is also a feedback mechanism in place for around-the-clock hazard monitoring.

The FCIC follows PAGASA's and Project NOAH's weather forecasting and uses their warnings as the basis for its own assessments and actions. For

example, heavy rainfall warnings based on PAGASA are shown in Table 2. The FCIC uses SMS (text messaging) along with other information and communication technologies to issue its public advisories. In addition to monitoring local weather agencies, FCIC also monitors and logs on to other weather agency's websites, including U.S. websites, the Central Weather Bureau of Taiwan, Fleet Numerical Meteorology and Oceanography Center of Japan, among others.

In the future, FCIC seeks to do the following: (1) address latency of information, which affects the timeliness and credibility of advisories; (2) establish near-real-time links to a data source to trigger timely action and response; (3) improve the platform for plotting and sharing information and actions that can be viewed by numerous stakeholders; and (4) improve the archiving and reporting application to aid flood control programming.

## Greater Metro Manila Area READY Project

**Ms. Josefina J. Faulan**, *Director, Metropolitan Development Planning Service, Metro Manila Development Authority, the Philippines*

The AusAid-assisted Greater Metro Manila Area (GMMA) READY Project aims to decrease the area's vulnerability to natural hazards and increase its resilience by strengthening the capacities of the LGUs, concerned national government agencies, academic

Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)		
RAINFALL VALUES (mm)	MEANING	WARNING LEVEL
Rainfall of <b>7.5 to 15 mm per hour</b> has fallen or is expected to fall and most likely to continue for the next 3 hours.	Community <b>AWARENESS</b> <b>FLOODING</b> is <b>POSSIBLE</b> in low lying areas and near river channels. For flooded areas, <b>receding of flood</b> is <b>expected</b> due to less rainfall.	<b>Advisory</b> 
Rainfall of <b>more than 15mm up to 30mm within 1 hour</b> has fallen or is expected to fall or if continuous rainfall for the past 3 hours is more than <b>45mm to 65mm</b> and most likely to continue for the next 3hours.	Community <b>PREPAREDNESS</b> <b>FLOODING</b> is <b>THREATENING</b> in low lying areas and near river channels. If flooding occurs, expect a <b>recession of flooding</b> due to less rainfall.	<b>Alert</b> 
Rainfall of <b>more than 30mm within 1 hour</b> has fallen or is expected to fall or if continuous rainfall for the <b>past 3 hours is more than 65mm</b> and most likely to continue for the next 3 hours.	Community <b>RESPONSE</b> <b>SERIOUS FLOODING</b> is <b>EXPECTED</b> . Take necessary precautionary measures	<b>Action</b> 
<b>Disclaimer:</b> Rainfall threshold values are arbitrary and may vary depending on the area of concern. These will be refined as soon as more data become available.		

**Table 2. Heavy rainfall warning levels**

Source: Ramon Santiago, MMDA.

institutions, and civil society organizations to manage disaster and climate change risks.

The project has five components, the fourth of which is being implemented by MMDA. This component involves mainstreaming of DRM/CCA in local land-use and development plans as well as in regulatory processes for Metro Manila and other select GMMA LGUs. Its major task is assessing the sensitivity of the Regional Physical Framework Plan of Metro Manila 1996–2016 to DRM and CCA.

Several capacity-building activities relevant to project implementation have been conducted, including a seminar-forum on DRM and CCA, a seminar on the guidelines for mainstreaming DRR and CCA in sub-national development and land-use plans, a learning event on earthquake risk management, a seminar-workshop on hazard and vulnerability assessment, a learning event on an exposure database, and others. The cities of Caloocan and Las Piñas were among the LGUs piloting this project.

### Summary of Discussions

- **Clarifying a point about using and maintaining flood control equipment,** Director Quiambao explained that the MMDA assists the LGUs by lending equipment and operators. The national government has allotted ₱1.6 billion exclusively for the maintenance of flood control facilities and equipment.
- **Commenting on flooding in the Metro Manila underpasses,** Director Quiambao explained that the MMDA and LGU together use the mobile submersible pump and fire trucks to help drain the floodwaters.
- **In terms of funding for repair and maintenance of pumping stations,** Director Quiambao said that MMDA also received funding through the national government.



Visit and presentation in the MMDA Metrobase Facility.

### Visit and Presentation in the MMDA Metrobase Facility

**Ms. Goddes Hope S. Oliveros**, *Metrobase, Public Relations Officer, Public Concerns and Responses Management Unit, Metropolitan Manila Development Authority, the Philippines*

The MMDA Command, Control and Communication Center, or the Metrobase, is the nerve center of MMDA: it houses a hotline, radio communication system for traffic enforcers, traffic digital signalization system, a social media unit, and 150 surveillance cameras, some of them high-resolution fiber-optic instruments.

The Metrobase uses CCTV (closed-circuit television) cameras installed in strategic areas in Metro Manila to monitor traffic, including vehicular accidents; to count vehicles; and to monitor the activities of its own traffic enforcers. The cameras are also used to monitor flooding.

With the huge volume of information generated, a separate unit is in charge of analyzing data. For instance, data on the number of accidents happening in a particular area are reported to the chair, who will then convey the information to proper authorities.



### Visit and Presentation in the MMDA Flood Control Information Center

**Mr. Ramon Santiago**, *Officer in Charge, Flood Control Information Center, Metropolitan Manila Development Authority, the Philippines*

The FCIC is a support unit for all decision makers. Its staff report to Director Quimbao of the Flood Control unit and to the chairperson who heads the MMDRRMC. The FCIC uses web-based tools and has communication links with LGUs, volunteers, and other agencies in order to provide sound advice to decision makers. Likewise, it provides an oversight function to other MMDA units and assists in mobilizing other units to help. Accurate and reliable weather information is important for LGUs, especially with regard to evacuation. Inaccurate evacuation instructions could cost the government millions of pesos.



Visit and presentation in the MMDA Flood Control Information Center.

## Field Visit: Marikina City

Workshop participants visited the Command Center of Marikina City at the Marikina City Hall as well as a number of pumping station sites.

**Ms. Kristin Roxas**, City Disaster Risk Management Officer, City Disaster Risk Reduction and Management Office, the Philippines



The Marikina DRRM Office was officially established in 2012. In accordance with the DRRM law, the city allocates 5 percent of its total revenue to disaster risk reduction response and management, of which 70 percent goes toward preparedness and mitigation and 30 percent toward quick response.

Marikina City has installed 100 CCTV cameras in strategic locations to analyze flooding and traffic and to count vehicles. Complementing the weather information provided by Project NOAH and PAGASA is the city's own early warning system, which relies in part on rain gauges installed in the upstream area or in the Marikina watershed. During severe weather, these rain gauges are used in calculating rainfall and water levels. Radio communication is used to gather and transmit information from the personnel handling the rain gauges to the personnel in charge of the floodgates.

All information generated in the Command Center, such as rising water levels, is communicated to the

city mayor and other officials for appropriate decision making—cancellation of classes, preemptive evacuation, etc. In times of disaster, all 63 DRRM Office personnel are supplemented by a resource pool of 300 and by 2,000 employees and barangay officials who can be mobilized to respond as needed. The Command Center has its own dispatch units working in partnership with national agencies like the Philippine National Police, the Bureau of Fire, and the traffic unit; this arrangement allows for quick response in emergencies.

Located near two major fault lines, the city is at risk of earthquake, and it relies on the Rapid Earthquake Damage Assessment System (REDAS) to assess and estimate potential damage to infrastructures that an earthquake could cause. The city has already performed the “walk the fault” exercise for the faults transecting Marikina and made markings to fault areas. A central field hospital has also been established for use when there are large numbers of casualties such as after an earthquake or other disaster. The hospital features emergency room, ambulance port, ward rooms, operating room, and mobile equipment. It can accommodate approximately 2,000 injured victims. The number of hospital personnel can be augmented by other nearby private and government hospitals if needed.

All the city's 16 barangays have emergency operation centers that are open 24 hours a day. Active community participation can aid in managing disaster response, and in order to educate and inform the community, DRRM campaigns are carried out in schools and other community venues.

## Field Visit: Pasig City

The participants visited the Pasig City Command Center at Pasig City Hall as well as a number of Pasig's pumping stations.

**Mr. Ritche Angeles**, City Disaster Risk Reduction and Management Officer, Pasig City, Philippines

Pasig City's Emergency Operation Center, or Command, Communication and Control (C3) System, serves as the nerve center of the city. The operation center continuously monitors weather and dispatches units during emergencies. It has 35 personnel for the morning shift and 10 personnel in the evening. This is on top of other personnel from other departments, such as fire and police.

Complementing PAGASA's weather information and warning system, the Command Center makes its own localized forecasts by comparing all possible typhoon tracks and probabilities calculated by local and international weather agencies. Comparing all the probabilities allows the city to determine the worst-case scenario among the eight computer-generated forecast tracks, and to use this as the basis for issuing color-coded alert warnings to constituents.

As part of its efforts to manage flood risk, Pasig City has installed 230 CCTV fiber-optic cameras in strategic areas, including schools, public markets, pumping stations, floodgates, road networks, and other facilities. Three major flood-prone areas—Santolan, Ortigas-Rosario, and Bambang—now are equipped with sirens to send an alarm signal during an emergency. A public address system has been established to broadcast advisories, and a social media unit is in charge of responding to calls and inquiries from the public. The city has also constructed 23 pumping stations.

Pasig City, the MMDA, and neighboring LGUs' information systems are not linked, and their actions, especially monitoring and responding to the traffic situation, are often not coordinated. Out of respect for political boundaries, the city seeks permission from the other LGUs' DRRM or related office before it responds.



Participants visiting the Pasig City Command Center.



## Session 4 (Part 1)

### Reflections on the Workshop—Learning from Day 1 and Day 2

Facilitator: **Ms. Lilian de la Vega**, *Workshop Moderator*

*Workshop participants were divided by country and asked to answer the guide questions. Each group presented a report on lessons learned from site visits and workshop presentations. The guide questions were as follows:*

1. *What case study presentation did you find most interesting? Why?*
2. *What site visit did you find most interesting? Why?*
3. *What challenges facing your project are similar to the ones presented at the workshop?*

#### Interesting Presentations

The following are selected responses to the first question:

- The most interest presentations were those on Marikina City and Jakarta, which addressed the relocation of people away from danger zones, waterways, and tributaries. In many instances, the lack of available land leads to relocation outside the city.
- The most interesting presentations were about the economic costs of disaster management and sustainable development, as well as the ongoing investment in disaster risk reduction by the Philippines.
- The presentation on China's Jiangxi Wuxikou Integrated Flood Management Project, which combines structural and nonstructural measures to reduce flood risks, was most interesting. It is important to take into consideration economic, social, and environmental constraints in designing flood control measures.
- Dr. Mahar Lagmay's presentation about new technology for flood risk management in the

Philippines was most interesting. The participants learned how to use GIS as a tool in planning and decision making. This was particularly interesting for the Senegal participants, as Dakar does not have such tools and technology for risk mapping.

- The most interesting presentation was Dr. Lagmay's on mapping, awareness raising, and mitigation techniques. This information is very important for informed decision making and initiatives.
- Mayor Eusebio's presentation on Pasig City's flood risk management system was most interesting. Combining technology, knowledge, and political will are crucial to making a flood management program a success.
- The presentation about Bangladesh's urban drainage infrastructure was most interesting, because it reflected real problems faced by many Asian cities.
- Most interesting was the presentation on the Chao Phraya River basin in Thailand, which addressed the application of science and technology and comprehensive planning to flood management. This is a good example of a river basin approach, which is similar to what is being carried out in the Philippines.
- The most interesting presentation described lessons from the Great East Japan Earthquake. Rehabilitation efforts are being implemented successfully, with results seen after a year of implementation.

#### Interesting Site Visit

The following are selected responses to the second question:

- The site visit to Pasig City was interesting, particularly the pumping station, which eased flooding

during the recent inundation due to the south-east monsoon.

- Visiting different pumping stations and learning about how they are managed was most interesting. For Senegal, pumping stations are a new technology for managing floods.
- The site visit to the Marikina City DRRM Office was most interesting, especially the live CCTV camera monitoring system and its use in emergency management. Participants could watch on live TV monitors as emergency personnel responded to a person who collapsed on the sidewalk.
- The visit to the Taguig City pumping station, where a large volume of water hyacinth was obstructing the river and hindering the flow of water, was most interesting. This is an example of close links between environmental and flood risk management issues.
- The visit to the MMDA office was interesting. Participants could observe the real-time monitoring system and good coordination between agencies.

## Challenges

The following are selected responses to the third question:

- The river basin integrated approach being applied in the Chao Phraya River basin could also be applied in Mindanao, Philippines, as the two



areas have similarly complex topography - specifically the connection between low-lying and hilly areas.

- Community participation in flood management is a significant challenge.
- The construction of two major flood control structures along Laguna Lake, which will greatly affect the flooding situation in the First District of Laguna (Metro Manila's neighboring province), poses a challenge.
- Jakarta resembles Pasig City in that both have had experience with program activities, planning, and regulations, and both face the challenge of maintaining consistency in policy implementation.
- Balancing structural and nonstructural measures is a challenge. Strategies being used in China's integrated flood management are relevant to Senegal because they combine structural and nonstructural measures.
- It will be challenging to integrate the national with the local land-use plans and also to handle zoning properly. When new national development is planned, the needs and characteristics of local development will also need to be taken into account.
- In the Philippines, challenges arise because the policies of the national government and LGUs may be in conflict, particularly where implementing the DRRM law is concerned.

## Session 4 (Part 2)

### Reflections on the Workshop—Defining Needs and Opportunities

Facilitator: **Ms. Lilian de la Vega**, *Workshop Moderator*

The discussion was facilitated by the following guiding questions:

1. *What technical assistance and knowledge would you need for your project, city, and/or country?*
2. *What would you like to learn from your peers or international experts?*
3. *What knowledge or technical expertise can you share with your peers?*

The following are selected responses to the first question:

- **Vanuatu** needs assistance from the Philippines with its flood monitoring system, including software and structure.
- **The Philippines** needs technical assistance for three-dimensional flood modelling (similar to what is being done in the Netherlands). It also needs access to open source software; a tutorial or manual on flood modelling; the latest geographic designs and construction, technology, and innovations being used in other countries; a plan for upgrading and maintaining flood control equipment; laws on environmental protection, particularly for bodies of water; and assistance with and proper coordination of the national agencies handling different programs, plans, case studies, and international trainings for the LGUs.
- **China** needs relevant information from different countries and training/capacity building in new technology (e.g., hydraulic modelling and GIS).
- **Mongolia** needs to build capacity, especially for local and provincial staffs; it also needs new flood management technologies and tools.
- **Myanmar** needs to undertake architectural design of flood management structures, to map

hazards and resources, to establish an EWS, and to construct rainwater gauges.

- **Sri Lanka** needs to develop a flood risk management master plan.
- The **Solomon Islands** needs hazard maps and GIS.
- **Senegal** needs to design an integrated urban master plan and to put an EWS in place; it also needs to conduct digital elevation modelling, improve its institutional arrangements, fund and maintain drainage systems, involve communities in flood risk management, and manage the urban basin and urban wetlands.

The following are selected responses to the second question:

- **Participants from the Philippines** would like to learn to use 3-D flood modelling technology and to carry out innovative approaches and methodologies for flood management; they would also like information on allocating budgets and on sources of funds available to cities.
- **Participants from China** would like to learn how to improve nonstructural measures such as community training in rescue operation, especially at the local and community level.
- **Participants from Mongolia** would like to learn how to improve nonstructural measures and how to engage local communities in planning and implementing the flood mitigation process.
- **Participants from Myanmar** would like to learn about EWS sensors and information transmission.
- **Participants from Sri Lanka** would like to learn about how to implement a flood management plan, and specifically about involving communities.

- **Participants from Senegal** would like to learn about experiences with resettlement and compensation of affected people.

The following are selected responses to the third question:

- **Participants from the Philippines** can share data gained in flood management; agrometeorology technology; and experiences with program implementation, feasibility studies, problems faced and effective responses, and models of strong political will as exemplified by key leaders.

- **Participants from China** can share their experience using both structural and nonstructural measures in flood management.

- **Participants from Mongolia** can share experiences in project implementation and lessons learned.

- **Participants from Sri Lanka** can share environmentally and economically sound wetland management system and hydrological studies.

## Community of Practice on Integrated Urban Flood Risk Management

**Ms. Yuka Yabashi**, *Operations Analyst, Tokyo Distance Learning Center, the World Bank*

**Mr. Robert McDonald**, *Senior Knowledge Management Assistant, Tokyo Distance Learning Center, the World Bank*



A community of practice is a group of people who share a concern or passion for something that they do, and learn how to do it better by interacting regularly.

In the course of 2014, a community of practice on integrated urban flood risk management will be opened to practitioners, policy makers, experts, and those interested in management of flooding in the context of cities. Community interaction will be facilitated through an online platform running on the World Bank Collaboration for Development (C4D) platform. The community will be able to engage in online discussion and questions, document sharing, collaborative editing, blogs, and projects, as well as

events such as face-to-face workshops, video conference-based workshops, and webinars. At the end of this workshop, a survey will be shared with the participants to help identify the needs and interests of community of practice members.

A successful example of a community of practice is the “Learning from Mega-disasters” group, whose platform currently runs on the C4D platform. This group has about 1,000 members who share information about large-scale disasters and discuss related topics and who participate in online panel discussion, collaborative information gathering, new reports, etc. The group is very active and members enjoy exchanging knowledge and good practice.

# WORKSHOP HIGHLIGHTS AND NEXT STEPS

**Ms. Zuzana Stanton-Geddes**, *Operations Analyst, Disaster Risk Management Team, the World Bank*



**The key messages of the workshop fall under four main themes: combination, communication, coordination, and commitment:**

- **Combination.** An integrated and long-term approach to flood risks, one designed to cope with a changing and uncertain future, must combine structural and nonstructural measures.
- **Communication.** Decision makers and communities need access to accurate information that is appropriately communicated so they can make informed decisions.
- **Coordination.** Effective planning and implementation of programs requires vertical coordination between different levels of government, horizontal coordination across agencies, and broad coordination among government, the private sector, donors, beneficiaries/recipients, and other stakeholders.
- **Commitment.** Successful integrated flood risk management involves the commitment of national and local leaders to ensure that the strategic and long-term vision of programs can be realized.

**In the opening session, all speakers stressed the importance of an integrated approach to flood risk management.** Mayor Maria Belen A. Eusebio explained that Pasig City has been severely affected by past flood events, particularly Ondoy (Ketsana) in 2009, and that these experiences have strengthened the city's resolve to improve its resilience. She stressed the importance of investing in disaster prevention and

resilience, emphasizing that the expense is “a small price to pay in the long term.” Mr. Motoo Konishi, the World Bank country director for the Philippines, talked about the needs of the poor and vulnerable, who are disproportionately affected by natural hazards. He pointed out that the most difficult aspects of flood risk management projects are not technical but rather social, including resettlement, community participation, and improvement of livelihoods. Secretary Rogelio L. Singson of DPWH addressed both social and technical aspects in his discussion of the Metro Manila Flood Risk Management Master Plan. He stressed the importance of planning and the value of having a strategic and integrated master plan with set priorities and actions. “Every peso invested in these priority actions is worth it,” he maintained.

**During session 1, participants heard about the importance of engaging local communities and implementing agencies.** Dr. Mahar Lagmay of DOST reminded the audience that “every Filipino has the right to information, whether poor or rich.” Information has to be accurate in order to be useful. Technology can help in producing more accurate information, but accuracy by itself is not enough. Stakeholders must be able to gain access to information, and must have the knowledge and tools to make informed decisions. Vice Mayor Jose Fabian Cadiz of Marikina City and Mayor Eusebio of Pasig City provided examples of efforts their respective cities are pursuing to strengthen their disaster and climate resilience. Their presentations conveyed a positive message about the many opportunities available for building urban resilience and improving the lives of local communities. The field visits to both

cities on the second day reinforced this message by showcasing concrete investments in hazard monitoring, as well as institution and capacity building, that help local authorities prepare for, respond to, and recover from disasters.

**Session 2 focused on the challenges encountered—and solutions adopted—by countries and cities around the world that are implementing integrated urban flood risk management projects.** In part 1, Assistant Secretary Catalina Cabral of DPWH and Mr. Kenichiro Tachi of MLIT echoed the messages from the opening session about the importance of planning. Assistant Secretary Cabral described major DPWH programs on flood risk management and explained the status of priority measures under the MMFRMMP. Mr. Tachi gave an overview of Japan’s comprehensive flood management planning process, which includes consultation with stakeholders at different levels. As part of a case study, this method was applied to the Chao Phraya River basin in a project that engaged an especially broad group of stakeholders.

**Parts 2 and 3 of session 2 focused on the impacts of urbanization and how to plan for the future.** In part 2, examples from Indonesia and Senegal were used to demonstrate some of the challenges linked to rapid growth of urban population, including lack of drainage and solid waste management infrastructure, capacity, and maintenance; informal settlers; and lack of preparedness in flood risk management. Ms. Eli Sari of Daerah Khusus Ibukota Public Works and Ms. Suryani Amin of the World Bank Jakarta office described some of the problems Jakarta is facing, including subsidence. The presenters explained how the World Bank–supported Urgent Flood Risk Mitigation project is addressing these challenges through priority engineered and non-engineered actions, but they indicated that more needs to be done in the long term. Ms. Marie Ndaw of the Dakar Municipal Development Agency in Senegal described current efforts under the Stormwater Management and Climate Change Adaptation Project, including the development of a master plan for drainage and efforts by social facilitators and NGOs to sensitize communities about the planned works.

**In Part 3,** Mr. Mikio Ishiwatari of the World Bank showed how informal settlements in hazardous areas

significantly increase risks to natural hazards, often resulting in tragic loss of life as well as physical, economic, and social damages. In many cases, specific hazard events have spurred discussions and have encouraged settlement in safer areas. But as memories of past events fade and structural flood mitigation measures provide people with a sense of security, settlement resumes in areas that can be affected by floods or tsunamis. The lesson here is that cities must plan for the future and ensure that regulations, processes, and community engagement in DRM are sustained over the years. Ms. Yuanyuan Cheng talked about the challenges of rapid growth in the Chinese city of Jingdezhen over the next decades, and the attendant challenge of deciding what flood risk infrastructure the city should finance. She explained that the decision making focused on the optimal set of investments, which would balance what the city can afford with the level of residual risk it can effectively manage. Mr. Abul Kashem of the Dhaka Water Supply and Sewerage Authority and Mr. Mohammad Rahman of the Dhaka North City Corporation talked about the difficulty of ensuring that Bangladesh’s drainage system keeps pace with the city’s expansion and increasing intensity of flooding. They pointed to the need for upgrading and better coordination among agencies, as well as the importance of improved flood risk forecasting on both national and city scales.

**Session 3 provided an opportunity for a deeper discussion of flood risk management in Metro Manila and in Jakarta.** Ms. Dolores Hipolito of DPWH highlighted some of the challenges in preparing and implementing the MMFRMMP, including (1) the number of cities and agencies involved; (2) the need to have a high-level champion, like Secretary Singson; (3) the need for complementary structural and nonstructural measures; (4) the need to secure funding for maintenance and investment at the local level; and (5) the need for awareness and participation at the community level. Mr. Bambang Kayatnan, Mr. Edi Harahap, and Mr. Bambang Surya Putra of the Jakarta Disaster Management Agency shared experience from Indonesia. They described some of the nonstructural measures Jakarta is implementing, including investing in a flood information management system and developing flood contingency plans at the village (*kelurahan*) level. Results from Jakarta

show that contingency planning can be an effective way of engaging communities, building their capacities and awareness, and strengthening resilience for the long term.

**The field visits to MMDA as well as to Pasig and Marikina in the Philippines provided real-life examples of structural and nonstructural investments in flood risk management investment.**

Ms. Maxima Quiambao, director of the Flood Control and Sewage Management Office, described efforts by her office to manage flood risk across Metro Manila, including dredging of channels and cleanup of public markets. The importance of working with LGUs for maintenance and operations was raised. The participants also learned about the Flood Control Information Center and the Disaster Risk Reduction and Management Operation Center, which provide weather information and real-time monitoring of flood events in Metro Manila. Site visits to flood control centers in Pasig and Marikina Cities and a number of pumping stations at the barangay level provided examples of concrete investments in urban resilience, and clearly demonstrated the commitment of the local authorities to making their communities more disaster resilient.

**Session 4 was dedicated to reflections on the presented case studies and site visits, and to discussions about the need and opportunities for sustained knowledge exchange within the**

**community of practice.** There was a clear demand from the participants for sustained capacity building and knowledge sharing, as well as interest in the proposed IUFM COP as presented by Mr. Bob McDonald and Ms. Yuka Yabashi of the Tokyo Distance Learning Center. This online platform, run on the World Bank Collaboration for Development platform, will be open to workshop participants; other officials, practitioners, experts, and interested parties will be invited to join and share their knowledge. Specific learning activities that reflect the community's interests and needs—webinars, online-chats with experts, and moderated online discussions—will be offered.

**Sharing of the Philippine experience was essential for the successful delivery of this regional workshop.**

DPWH and MMDA were represented in past workshops in Jakarta (2012) and Seoul (2013). Indeed, it was in response to Secretary Singson's presentation in Seoul (on the work being done by DPWH) that participants sought to showcase the Philippine experience in flood risk management in the third workshop. This year, DPWH and MMDA played a crucial role in developing the agenda and— together with the local governments of Pasig and Marikina—served as key resources for the participants. The Philippines has been at the forefront of efforts to build disaster resilience, and its leadership and commitment to knowledge sharing can serve as a model among the Asian countries.

## ANNEX 1: Workshop Agenda

Day 1 (June 3, 2014): National and Local Flood Risk Management and Urban Resilience Programs	
8:30–9:00	<i>Registration</i>
9:00–9:45	<b>Opening and Introductions</b> Chair: <b>Mr. Ousmane Dione</b> , Sector Manager, Sustainable Development Unit
	Welcome Remarks (as city host)   <b>Hon. Mayor Maria Belen A. Eusebio</b> , City of Pasig
	Welcome Remarks: Building Resilience to Urban Flooding Risk   <b>Mr. Motoo Konishi</b> , Philippines Country Director, the World Bank
	Keynote Address   <b>Hon. Rogelio Singson</b> , Secretary, DPWH
	Results of Past Workshops and Objectives   <b>Ms. Eiko Wataya</b> , Disaster Risk Management Team, the World Bank Agenda Summary   <b>Ms. Lilian de la Vega</b> , Workshop Moderator
9:45–9:55	<i>Break</i>
9:55–11:30	<b>Session 1: The Philippine Experience—National and Local Policies and Strategies in Mainstreaming Disaster Resilience into the Urban Context</b> Chair: <b>Ms. Dolores Hipolito</b> , Project Manager, Flood Control Management Office, Flood Control Management Cluster, DPWH, the Philippines
	<b>Presentation:</b> DOST Project NOAH and the Utilization of New Technology for Flood Risk Mitigation in the Philippines   <b>Dr. Mahar Lagmay</b> , Department of Science and Technology
	<b>Presentation:</b> Strengthening Marikina City's Disaster Risk Reduction and Management System through Technology   <b>Hon. Jose Fabian Cadiz</b> , Vice Mayor of Marikina City
	<b>Presentation:</b> Pasig the Green City: Flood Risk Management and Urban Resiliency   <b>Hon. Maria Belen A. Eusebio</b> , Mayor of Pasig City Panel with Q&A from audience
11:30–12:30	<b>Session 2 (Part 1): Examples of International Practice on Flood Risk Management and Mainstreaming Disaster Resilience into Urban Projects</b> Chair: <b>Mr. Hayato Nakamura</b> , Project Formulation Advisor, JICA
	<b>Presentation:</b> DPWH Flood Risk Management and Resiliency Program   <b>Asst. Secretary Catalina Cabral</b> , DPWH
	<b>Presentation:</b> Application of Science and Engineering-Based Comprehensive Flood Management Planning Method to Chao Phraya River Basin, Thailand   <b>Mr. Kenichiro Tachi</b> , Senior Deputy Director, International Affairs Office, River Planning Division, Water and Disaster Management Bureau, MLIT Panel with Q&A from the audience
12:30–13:30	<i>Lunch</i>
13:30–14:30	<b>Session 2 (Part 2): Examples of International Practice on Flood Risk Management and Mainstreaming Disaster Resilience into Urban Projects</b> Chair: <b>Dr. Glenn Tabios</b> , Executive Director, National Hydraulics and Research Center
	<b>Presentation:</b> Strengthening Flood Risk Management in Jakarta   <b>Ms. Eli Menawan Sari</b> , Project Management Office Staff, Daerah Khusus Ibukota, Public Works, Indonesia <b>Ms. Suryani Amin</b> , Disaster Risk Management Team, the World Bank, Indonesia
	<b>Presentation:</b> Stormwater Management and Climate Change Adaptation Project   <b>Ms. Marie Ndaw</b> , Technical Director, Dakar Municipal Development Agency, Senegal Panel discussion with Q&A from audience
14:30–14:45	<i>Break</i>

Day 1 (June 3, 2014): National and Local Flood Risk Management and Urban Resilience Programs (cont.)							
	<p><b>Session 2 (Part 3): Examples of International Practice on Flood Risk Management and Mainstreaming Disaster Resilience into Urban Projects</b></p> <p>Chair: <b>Mr. Ramon Alikpala</b>, Be Secure Project, Chief of Party, U.S. Agency for International Development</p>						
14:45–16:00	<table border="1"> <tr> <td> <p><b>Presentation:</b> Lessons from the Great East Japan Earthquake</p> </td> <td> <p><b>Mr. Mikio Ishiwatari</b>, Senior Water and Sanitation Specialist, the World Bank</p> </td> </tr> <tr> <td> <p><b>Presentation:</b> Combining Structural and Non-structural Measures to Reduce Flood Risks in Jingdezhen City, China</p> </td> <td> <p><b>Ms. Cheng Yuanyuan</b>, Project Management Unit, Jiangxi Wuxikou Integrated Flood Management Project</p> </td> </tr> <tr> <td> <p><b>Presentation:</b> Flood Risk Management and Urban Resilience in Bangladesh</p> </td> <td> <p><b>Mr. Md. Abul Kashem</b>, Chief Engineer, Dhaka Water Supply and Sewerage Authority</p> <p><b>Mr. Mohammad Arifur Rahman</b>, Superintendent Engineer, Dhaka North City Corporation</p> </td> </tr> </table> <p>Panel discussion with Q&amp;A from audience</p>	<p><b>Presentation:</b> Lessons from the Great East Japan Earthquake</p>	<p><b>Mr. Mikio Ishiwatari</b>, Senior Water and Sanitation Specialist, the World Bank</p>	<p><b>Presentation:</b> Combining Structural and Non-structural Measures to Reduce Flood Risks in Jingdezhen City, China</p>	<p><b>Ms. Cheng Yuanyuan</b>, Project Management Unit, Jiangxi Wuxikou Integrated Flood Management Project</p>	<p><b>Presentation:</b> Flood Risk Management and Urban Resilience in Bangladesh</p>	<p><b>Mr. Md. Abul Kashem</b>, Chief Engineer, Dhaka Water Supply and Sewerage Authority</p> <p><b>Mr. Mohammad Arifur Rahman</b>, Superintendent Engineer, Dhaka North City Corporation</p>
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16:00–16:10	<i>Break</i>						
	<p><b>Session 3: Breakout session—Group Discussions on Implementing Flood Risk Management and Urban Resilience Projects</b></p> <p>Facilitator: <b>Ms. Lilian de la Vega</b>, Workshop Moderator</p>						
16:10–17:25	<table border="1"> <tr> <td> <p><b>Group A: Philippines</b></p> <p>Metro Manila Flood Risk Management Master Plan Recommendations, Prioritization, and Implementation</p> <p><b>Ms. Dolores Hipolito</b>, Project Manager, Flood Control Management Office, Flood Control Management Cluster, DPWH</p> <p>Facilitator: <b>Ms. Cathy Vidar</b>, DRM Specialist, the World Bank</p> </td> <td> <p><b>Group B: Indonesia</b></p> <p>Flood Contingency Plan at Kelurahan Level</p> <p><b>Mr. Bambang Musyawardana Kayatnan</b>, Director of Jakarta Disaster Management Agency, and <b>Mr. Edi Junaedi Harahap</b>, Head of Informatics and Controlling in Jakarta Disaster Management Agency</p> <p>Flood Information Management System in Jakarta</p> <p><b>Mr. Bambang Surya Putra</b>, Informatics Section Head, Jakarta Province Disaster Management Agency.</p> <p>Facilitator: <b>Mr. Denis Jordy</b>, Senior Environmental Specialist, the World Bank</p> </td> </tr> </table> <p>Joint group wrap-up and presentation of group discussions by the facilitators</p>	<p><b>Group A: Philippines</b></p> <p>Metro Manila Flood Risk Management Master Plan Recommendations, Prioritization, and Implementation</p> <p><b>Ms. Dolores Hipolito</b>, Project Manager, Flood Control Management Office, Flood Control Management Cluster, DPWH</p> <p>Facilitator: <b>Ms. Cathy Vidar</b>, DRM Specialist, the World Bank</p>	<p><b>Group B: Indonesia</b></p> <p>Flood Contingency Plan at Kelurahan Level</p> <p><b>Mr. Bambang Musyawardana Kayatnan</b>, Director of Jakarta Disaster Management Agency, and <b>Mr. Edi Junaedi Harahap</b>, Head of Informatics and Controlling in Jakarta Disaster Management Agency</p> <p>Flood Information Management System in Jakarta</p> <p><b>Mr. Bambang Surya Putra</b>, Informatics Section Head, Jakarta Province Disaster Management Agency.</p> <p>Facilitator: <b>Mr. Denis Jordy</b>, Senior Environmental Specialist, the World Bank</p>				
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17:25–17:30	<i>Agenda for the next day (Workshop Moderator)</i>						
18:00–19:30	<i>Welcome reception at the hotel</i>						
Day 2 (June 4, 2014): Field Trip: Implementation in Practice							
8:00	1. Departure from hotel and travel to Metropolitan Manila Development Authority						
8:30–11.00	<p><b>Briefing at MMDA</b></p> <ol style="list-style-type: none"> <li>1. Metrobase</li> <li>2. MMDA Flood Control Information Center</li> <li>3. Effective Flood Control Operation System</li> </ol>						
11:00–12:00	<i>Lunch (at MMDA)</i>						
12:00–14:00	<b>MMDA site visit</b>						
14:00–14:30	Travel to Marikina/Pasig (Groups A and B)						
14:30–16:30	<p><b>Site visits</b> to LGU facilities in Metro Manila</p> <p><b>Group A: Marikina City</b></p> <p><b>Group B: Pasig City</b></p>						
16:30–17:00	<i>Travel back to hotel</i>						

Day 3 (June 5, 2014): Solving Today's Problems: What Did We Learn?	
9:00–9:05	<i>Agenda for the day (Workshop Moderator)</i>
9:05–10:05	<b>Session 4 (Part 1): Reflections on Workshop: Learning from Day1 and Day 2</b> Facilitator: <b>Ms. Lilian de la Vega</b> , Workshop Moderator
	<b>Question:</b> What case study presentation did you find most interesting? Why?
	<b>Question:</b> What site visit did you find most interesting? Why?
	<b>Question:</b> What challenges facing your project are similar to the ones presented at the workshop? Group presentations and discussion
10:05–10:20	<i>Break</i>
10:20–12:30	<b>Session 4 (Part 2): Reflections on Workshop: Defining Needs and Opportunities</b> Facilitator: <b>Ms. Lilian de la Vega</b> , Workshop Moderator
	<b>Question:</b> What technical assistance and knowledge would you need for your project, city, and/or country?
	<b>Question:</b> What would you like to learn from your peers or international experts?
	<b>Question:</b> What knowledge or technical expertise can you share with your peers? Group presentations and discussion
	<b>Presentation:</b> Community of Practice on Integrated Urban Flood Risk Management
	Open Forum
12:30–1:00	Workshop Summary: Highlights and Next Steps, <b>Ms. Zuzana Stanton-Geddes</b> , Disaster Risk Management Team, the World Bank
1:00–2:00	<i>Lunch</i>

Workshop venue: Discovery Suites Hotel, Manila, Philippines



Manila, Philippines – August 12, 2012: The floods left at least 66 people dead and affected up to 2.68 million people in Manila and surrounding provinces, with more than 440,000 fleeing to evacuation centers. Photo: Paula Bronstein/Getty Images.





**MANAGING THE RISKS OF DISASTERS IN EAST ASIA AND THE PACIFIC**

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