Chapter 3

Water security and green growth in Cebu, Philippines

Chapter 3 examines water security and its potential benefits for green growth in the Province of Cebu. This chapter is structured into the following four sections: 1) Water security issues in Metro Cebu; 2) Water supply and sanitation; 3) Urban resilience to floods; and 4) Water governance. This chapter benefited from discussions at the 5th OECD Knowledge-Sharing Workshop on Urban Green Growth in Dynamic Asia, held in Cebu on 9-10 December 2015 and supported by the OECD Knowledge Sharing Alliance.

Key findings

- **Water security is a cornerstone of urban green growth strategies for Cebu.** The entire Province and in particular Metro Cebu area face great water challenges, including increasing water demand in a context of diminishing resources, relative inefficiency of the water distribution network, and suboptimal coverage of the water supply and sanitation infrastructure, leading to quality issues in surface and ground water. Floods also periodically occur in some areas of Metro Cebu. These are accentuated by rapid urbanisation, economic growth and climate change, which increase the pressure on water resources and infrastructure.
- **Strategies need to be diversified to effectively address water supply and sanitation challenges.** Non-revenue water is at 25%; and 80% of grey water (i.e. wastewater without human wastes) receives no treatment. Water demand is also expected to triple by 2040. These issues put greater strain on the current infrastructure and these need to be addressed urgently. While investing in "grey" infrastructure (i.e. dams, reservoirs) and diversifying sources of water supply in the long-term are critical, exploring complementary or alternative policy strategies, in particular green infrastructure, demand-side management tools, and smart technologies can provide greater flexibility and alleviate the demand for "grey" infrastructure.
- **Comprehensive strategies to address water-related risks need to be urgently developed.** Climate change impacts and socio-economic changes are likely to increase the exposure of the Province to such risks. 43% of households in Metro Cebu do not benefit from a drainage system and rainfall can be intense during the monsoon season. In addition, existing drainage infrastructure tends to be both insufficient and inefficient. The Local Government Units (LGUs) most affected by floods are Mandaue, Talisay, Danao and Cebu City. Most LGUs first need to design robust Disaster Risk Reduction and Management strategies informed by a thorough assessment of vulnerability to floods under different scenarios, in particular critical infrastructure such as power utilities, landfills and water treatment stations. Strategies to ensure resilient land-use and mechanisms to enhance the resilience of businesses and industries should also be explored at the local level.
- **Water governance** in Cebu is complex and at the heart of challenges that LGUs need to address in this sector. Municipal fragmentation, lack of relevant scale for investment, lack of incentives for co-operation, lack of staff, difficulties in raising tariffs, and limited information sharing are issues observed in Cebu, as in many OECD cities. While the creation of the Mega Cebu Development Authority and the Provincial Water Resources Authority is an opportunity to address the territorial and sectoral fragmentation of water responsibilities, the proper means and power to harmonise regulations, reform tariffs and charges, and technical capacities – including data collection – should be further secured. The responsibilities and use of financial resources between the national government and LGUs should also be further aligned to achieve common goals: the national government for instance could financially support metropolitan-wide water projects with high fixed costs.

Introduction: Water security issues in Metro Cebu

Water supply, sanitation and disaster risk reduction are critical strategic development sectors in the Philippines, in both urban and rural areas. The World Health Organisation (WHO) – United Nations Children's Fund (UNICEF) Joint Monitoring Programme (JMP) reported that 93% of urban population and 92% of rural populations have access to

drinking water (JMP, 2012). However, the quality of water supply has not kept pace with the growing population in the last few decades (ADB, 2013a). According to the JMP March 2012 Report, only 43% of the country's population has access to water piped into private houses (Level III) (61% in urban areas and 25% in rural areas) while others are served by stand-alone water points (Level I) or piped water with a communal water points (Level II). In addition, the country faces severe water scarcity issues, adding to the pressure put on water resources and systems. ADB (2013) identifies the following persistent problems in water supply: i) institutional fragmentation; ii) weak sector planning and monitoring due to lack of sector information; iii) poor performance of many water utilities; iv) low public and private sector investment and limited access to financing for service expansion; and v) inadequate support for poor urban communities and rural water utilities.

Water sanitation also presents major challenges. The Clean Water Act of 2004 requires LGUs and water districts to create septage management programmes in areas without sewerage systems. However, most LGUs and water districts have lacked the capacity, technical knowledge, or funds to take action since the passage of the Act. Existing industrial waste and wastewater treatment systems, and private septic tank desludging services often do not meet environmental standards in the Philippines (ADB, 2013a). The JMP March 2012 Report indicates that while 74% of the country's population had access to sanitation facilities in 2010 (79% in urban areas and 69% in rural areas), the quality of sanitation is suboptimal. Few households in the Philippines are connected to a sewerage network, and the majority of households with toilets are connected to septic tanks that are poorly designed or maintained, therefore most effluent is likely to be discharged without treatment. This contributes to the pollution of surface and ground water. Problems include i) lack of policies and effective governance and regulation, ii) low levels of awareness and political will for improving sanitation; iii) inadequate funds for financing infrastructure; and iv) lack of sanitation capacity (ADB, 2013a).

Water-related disasters (e.g. typhoons, floods) are recurrent and severe in the Philippines. The country has one of the lowest water-related disaster resilience of the Asia-Pacific region and one of the highest ratios of fatalities per 1 000 inhabitants (ADB, 2013b). In November 2013, Super Typhoon Haiyan became a Category 5 typhoon, the strongest ever recorded at the time, with wind gusts in excess of 300 kilometres per hour and an associated storm surge that reached a high of 3.5 metres along some coastlines with more vulnerable bathometric profiles. More than6 300 people were killed, over two million were left homeless, and over 13 million people were affected in the Philippines. It caused about USD 15 billion in damages, equivalent to 5% of the Philippines' total GDP in 2013. An equivalent level of damage to the United States of America's economy would amount to USD 850-900 billion in damages, an amount four times greater than that caused by Hurricane Katrina in 2011.

This chapter demonstrates that Cebu Province is affected by water-related risks for which there is an urgent need for Metro Cebu to enhance its water security. Water security is defined as "the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production, coupled with an acceptable level of water-related risks to people, environments and economies" (Grey and Sadoff, 2007). It is also understood as the management of four water risks: scarcity, floods, pollution and freshwater ecosystem resilience (OECD, 2013). Because of its significant long-term economic, environmental and social dimensions, addressing challenges related to access to water, water sanitation and water-related disasters is of utmost importance and is a

critical lever for green growth. This chapter reports on specific water security issues faced in Cebu and proposes policy recommendations for a more sustainable management of water.

Developing diverse policy instruments for water supply and sanitation in Cebu

The water supply and sanitation (WSS) issues faced by the Province of Cebu illustrate the country-level trends introduced above. These include increasing water demand in a context of diminishing resources, relative inefficiency of the water distribution network, and suboptimal coverage of the water supply and sanitation infrastructure, leading to quality issues in surface and ground water. These trends are particularly acute in the Metro Cebu area, and are accentuated by the rapid urbanisation and economic development patterns of the metropolitan region. These water challenges contain both environmental (e.g. depletion of local water resources, untreated wastewater) and economic dimensions, (e.g. cost of inaction to catch up with expanding infrastructure needs, water losses, lack of resilience to floods) and in this regard, are critical green growth obstacles. While there is increasing recognition, in particular by the Metro Cebu Development Co-ordinating Board (MCDCB), of the urgent need to tackle these problems in order to ensure the sustainable long-term development of the Province, this section proposes alternative or complementary policy recommendations to the existing WSS strategies, following OECD and non-OECD countries and cities' experience in this sector.

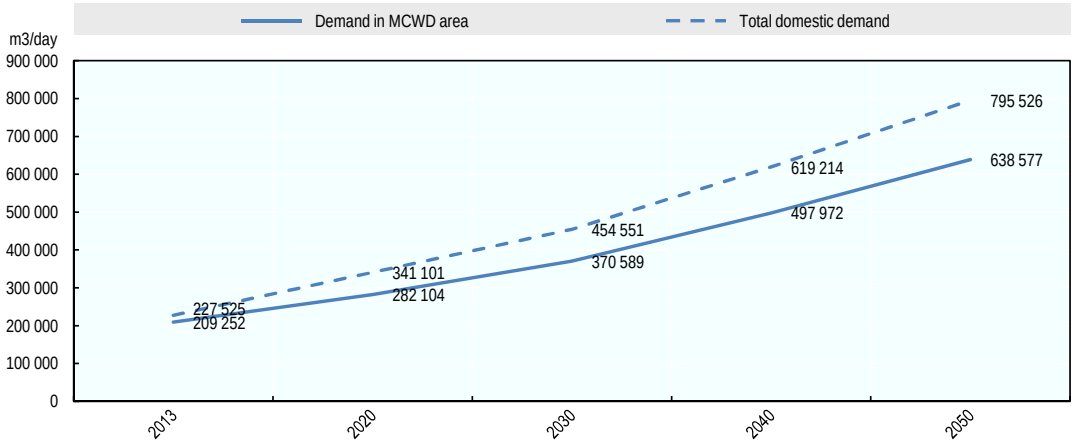
Some of the data presented in this chapter refer to the Metro Cebu Water District (MCWD). MCWD is a corporatised entity delivering water supply and sanitation services to the following jurisdictions of Metro Cebu: four cities – Cebu City, Talisay, Mandaue and Lapu-Lapu – and four municipalities – Consolacion, Liloan, Compostela and Cordova – covering in total eight LGUs among the 13 LGUs of Metro Cebu. However, MCWD only serves 57% of the population (1.2 million residents) in its franchise area, the remaining population being served by Community Water Associations or private suppliers (JICA and MCDCB, 2015). Water supply and sanitation in the five other LGUs of the metropolitan areas is either undertaken by LGUs or by private suppliers. MCWD is not unique in the Philippines. The existence of water districts originated in the Provincial Water Utilities Act of 1973, which created the Local Water Utilities Association (LWUA) – Water District concept, encouraging LGUs to transfer their water supply systems to water districts, on a similar model as MCWD (ADB, 2013a). The data presented below will often reflect the fragmentation of water suppliers and the lack of harmonised and available information across all areas of Metro Cebu (see section 4 for a discussion on data in the water sector).

Water supply and sanitation challenges in Cebu

Cebu faces increasing water demand in a context of diminishing resources. In Metro Cebu, there is a shortage of supply of over 153 000 cubic metres per day (m3/day) of potable water for residents, businesses, and farmers. In addition, projected total water demand in the Metro Cebu area is expected to almost triple from 227 225 m3/day in 2013 to 651 825 m3/day in 2040, requiring water authorities and suppliers to fulfil a potential gap of 437 000 m3/day by then (Figure 3.1). MCWD area accounts for most of the water demand of Metro Cebu. Residential consumption exerts most pressure on local water demand, as commercial and industrial activities only account for 12.7% of water supply in MCWD area. Per capita domestic water consumption is at 161 litres per day in 2013

among the population served by MCWD, 119 litres per day in non-MCWD areas in northern Metro Cebu (Danao City) and 147 litres per day in non-MCWD areas in southern Metro Cebu (Carcar, Minglanilla, Naga and San Fernando). The increasing pressure on local water resources is mostly put on ground water, which account for 98% of water supply in MCWD service area, against 2% from surface water (e.g. dams, reservoirs).

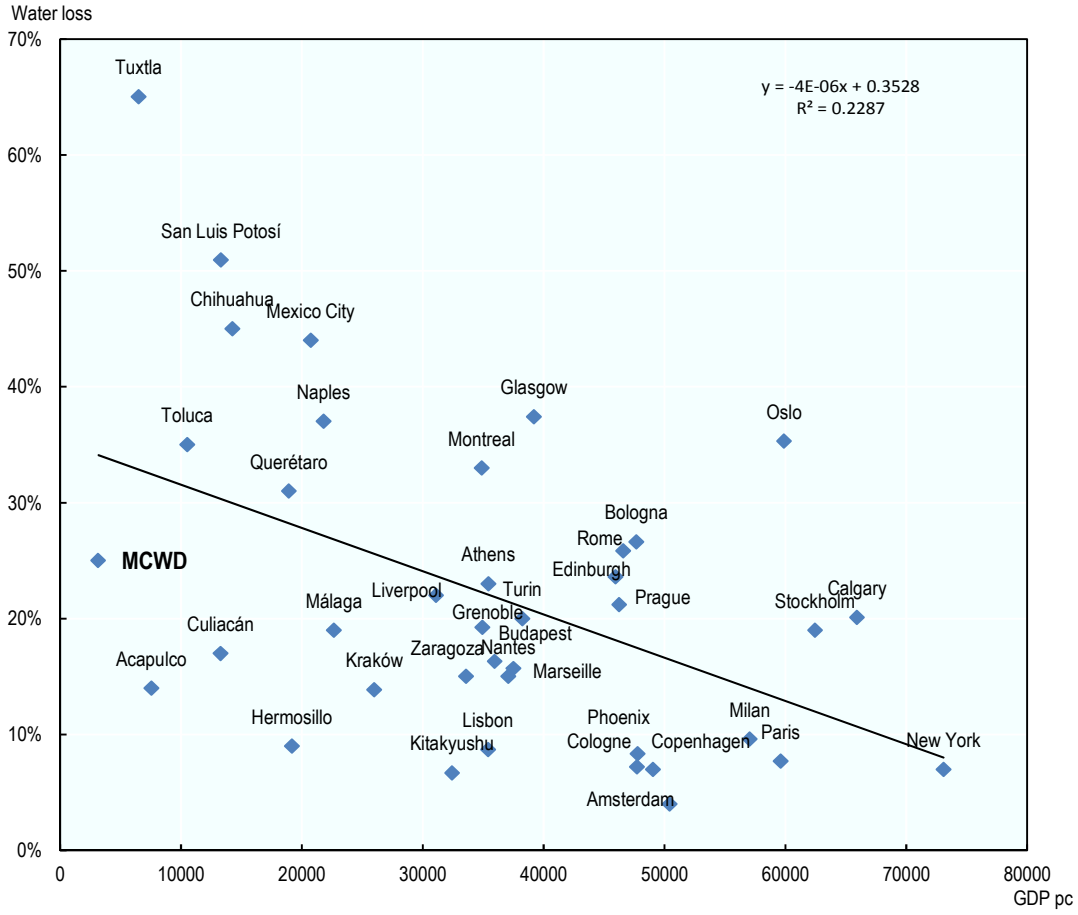
Figure 3.1. **Projected water demand in Metro Cebu (2013-2050)**



Source: JICA and MCDCB (2015), "Roadmap Study for Sustainable Urban Development in Metro Cebu", Cebu, the Philippines.

Water distribution networks are relatively inefficient. Unaccounted-for-water (UFW) accounted for 23% of total water supply in MCWD service area in 2016. This figure falls in line with trends observed in other cities, in comparison to the GDP per capita of MCWD compared to OECD cities (Figure 3.2). In addition, local authorities are making good progress in reducing UFW: in 2010, the share was at 30.8% (JICA and MCDCB, 2015). There is no data for LGUs outside MCWD service area, and considering that LGUs often perform lower than water districts (ADB, 2013a), unaccounted-for-water in the whole Metro Cebu may be higher. In addition, the figure for MCWD should not hide the fact that MCWD only serves 56% of the population in its franchise area, and that the water systems in place for the remaining population may be less efficient. The poor coverage of MCWD's services can be partly explained by the cost of extending pipe infrastructure and the difficulty to build new infrastructure in already urbanised areas, which complicates procedures such as obtaining excavation permits from the Department of Public Works and Highway (DPWH).

Figure 3.2. **Water losses and GDP per capita in MCWD and selected OECD cities**



Source: Adapted from OECD (2016), *Water Governance in Cities*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264251090-en.

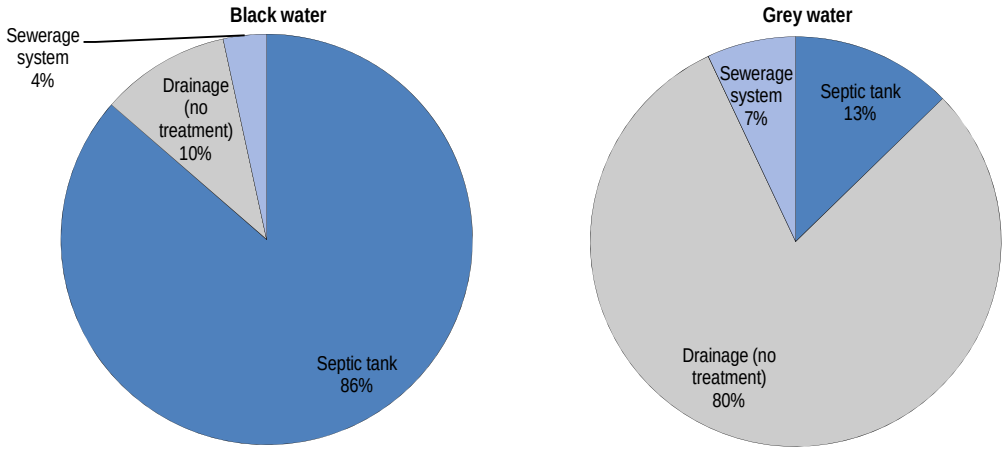
Water is supplied through a diversity of means, and only a fraction of the total population is served through a private piped connection (Level III). Only 12.5% of drinking water is supplied through pipe connections in Metro Cebu, while 68.9% is supplied through water refilling stations. 49.9% of water used for purposes other than drinking is supplied through pipe connections. Public taps, wells (public, households', neighbours'), bottled water, rain and freshwater are the other sources of water supply in Metro Cebu. These figures reflect a general preference for commercially purchased water over pipe water, due to the poor quality and coverage of the piped system, as mentioned previously. This is slightly lower than national average, as 61% of urban areas in the Philippines are served through a Level III connection (ADB, 2013a). In Danao City and Carcar City, only 40% and 39% of the total population is served by piped water, respectively. There is no data in other non-MCWD service areas (JICA and MCDCB, 2013). Although the water in MCWD's piped connections is potable, its quality seems suboptimal: a survey indicated that most households' satisfaction regarding water quantity, quality, pressure, and continuity (i.e. hours of supply) are only "average" (JICA and MCDCB, 2015). In addition, a growing number of private wells are being built, for residential (88% of households in Metro Cebu own a well), commercial and industrial activities (many commercial and industrial establishments indeed possess their own well

to supply their needs). The number of private wells in the MCWD service area is estimated at around 25 000, of which only around 1 000 are registered (JICA and MCDCB, 2015). This can be partly explained by the fact that registration to the National Water Resources Board (NWRB) is mandatory for wells used for domestic purposes and for business and industrial purposes (according to the Water Code of the Philippines). NWRB, located in Manila, also faces difficulties in fulfilling its oversight duties across entire country.

Cebu suffers from salinity intrusion of the freshwater aquifer, due to over-exploitation of groundwater. Salinity was measured at 250 mg/TDS (total dissolved solids) near Fuente Osmena Circle, 2 kilometres inland from the Cebu Strait. Lapu-Lapu City, Mandaue and Talisay are the most affected LGUs (JICA and MCDCB, 2015). Salinity intrusion into groundwater aquifers makes it difficult to use for drinking purposes. Desalination is a possible response, but desalination processes are hardly financially achievable, but have been experimented in Cebu. The manufacturer of water treatment equipment Mactan Rock supplies MCWD with desalinated water in Mactan Island. Their subsidiary, Pilipinas Water Resources Inc, also provides desalinated water for establishments in the SRP (South Road Properties) (Citi di Mare, SM Seaside City) and produces an excess as the developments in SRP are limited. Additionally, some major resorts, such as Shangri-la, use desalination technology for their own water supply. Continued saltwater intrusion of lower-lying areas near the coast due to sea level rise (and over-extraction of groundwater), is expected to result in the contamination of up to 25% of all abstraction wells by 2025 (JICA and MCDCB, 2015). In general, saltwater intrusion is one of the major challenges facing the country's water resources and also affects Davao City and certain areas of Metro Manila (ADB, 2013a).

Finally, surface and groundwater are also polluted by human waste, due to a lack of proper sanitation system. Currently, there is no centralised sewerage system but MCWD opened its first septage treatment plant in Cordova which serves Cordova and Lapulapu City. The plant has been operational since August 2016. MCWD has plans of opening up to three additional septage treatment plants with the assistance of JICA as recommended in the Roadmap Study. Region VII is one of the regions with the lowest percentage of households with sanitary toilets (79.9%), according to the Annual Poverty Indicator Survey (ADB, 2013a). The majority of Metro Cebu population (80.4%) owns pour-flush toilets, the remaining population uses flush toilets (4.4%), pit latrines (8.7%) or do not have any toilet at all (6.5%). Only 3.4% of households evacuate black water (i.e. wastewater with human wastes) through sewers, while 86% is evacuated into septic tanks and 10% through drainage and therefore have no treatment. In addition, only 7% of grey water (i.e. wastewater without human wastes) is evacuated through sewerage, most being evacuated through drainage with no treatment (80%) or into septic tanks (13%) (Figure 3.3). In preparation for MCWD's expanding septage programme, all but one LGUs within MCWD's franchise area have passed resolutions requiring residents to desludge (or empty) septic tanks. However in practice around half of the households in Metro Cebu have never removed sludge from the tanks, resulting in pipe clogging and further sanitation issues. Domestic wastewater therefore largely goes untreated into groundwater or public canals and drainage systems, and eventually into rivers and other water bodies, creating not only public health risks but also further issues to use local water resources for water supply. High levels of Escherichia coli, nitrate (NO_3) and phosphate have been measured in ground water. Butuanon River's biochemical oxygen demand (BOD) was recently measured at 70 mg/L, while the international standard is set at 10 mg/L (JICA and MCDCB, 2015).

Figure 3.3. **Treatment of black and grey water in Metro Cebu**



Source: JICA and MCDCB (2015), "Roadmap Study for Sustainable Urban Development in Metro Cebu", Cebu, the Philippines.

Current roadmap for water supply and sanitation in Metro Cebu

Authorities in Cebu have long been aware of a 'quiet' crisis affecting its limited freshwater resources. In 1999, the Water Resources Centre at the University of San Carlos in Cebu requested assistance from the Royal Netherlands Embassy and this resulted in the Water Remind Project (2003-2008). One of the main policies that emerged from that partnership was the Water Resources Management Action Plan for Central Cebu (2005-2030) (WRMA Plan). In 2015, the MCDCB presented a study on the 'Impacts of Groundwater Extraction' and commissioned a further study to analyse the water tariff structure and existing institutional structures as the basis for policy recommendations moving forward.

In addition, the *Roadmap Study* prepared by JICA and MCDCB includes a study and action plan for water supply and sanitation for Metro Cebu, with a vision to 2050. The Roadmap underscores the need to improve and develop basic "grey" infrastructure (i.e. dams, reservoirs) and diversify sources of water supply in the long-term, in order to meet the challenges described above. The main elements of the Roadmap are listed in Table 3.1. A feasibility study for the construction of dams and the creation for a Green Loop were identified as priority projects by the MCDCB. In addition, a pilot septage treatment plant has been built in Cebu City by Amcon Inc. with funding from JICA. The LGU is considering turning over to MCWD as part of a plan to build a 'cluster' of seven decentralised septage treatment plants throughout all of Metro Cebu. In this plan however the MCWD would not be responsible for taking care of septage in the LGUs outside of their franchise area.

Table 3.1. **JICA-MCDCB roadmap for water supply and sanitation in Metro Cebu**

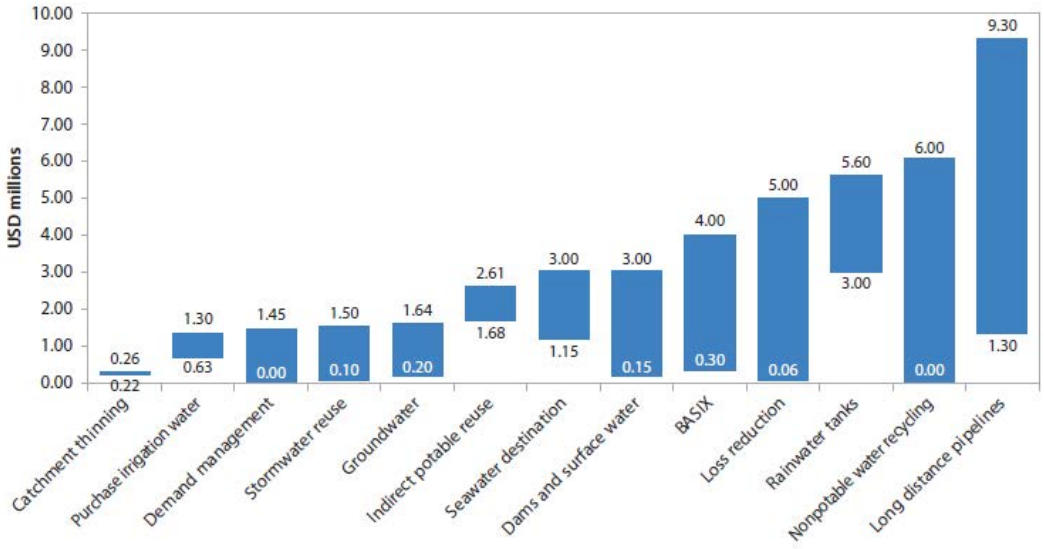
	Water supply	Sanitation
Short-term	• Developing projects to build new water supply facilities (e.g. reservoirs, pump stations, well development) • Construction of Mananga II dam	• Construction of septage treatment plant • Improvement of inappropriate septic tanks • Construction of wastewater treatment facility in development areas
Medium-term	• Construction of Kotkot and Lusaran dams • Study for groundwater exploitation • Reduction of non-revenue water	• Construction of a centralised sewerage system • Promotion of ecological sanitation technologies
Long-term	• Development of surface water and groundwater in the northern and southern areas of Cebu • Construction of a desalination plant • Reduction of non-revenue water • Groundwater recharge • Use of recycled water	• Expansion of current sewerage systems

Source: JICA and MCDCB (2015), "Roadmap Study for Sustainable Urban Development in Metro Cebu", Cebu, the Philippines.

While investing in "grey" infrastructure (i.e. dams, reservoirs) and diversifying sources of water supply in the long-term are critical given the great infrastructure gap in the Province, exploring complementary – or alternative –options will be useful to optimise the investment. Indeed, the cost of dams, reservoirs and new pipelines can be high compared to other solutions. A study on Australia's water supply options has shown that long distance pipelines are very costly, while stormwater reuse, catchment thinning and demand management are amongst the least expensive alternatives (Figure 3.4). In addition, grey infrastructures are less flexible, an aspect which is non negligible in the context of such a fast-changing metropolitan area as Metro Cebu. The geological conditions of Cebu (soft land) also create risks of landslides and make the construction of large-scale infrastructure such as dams more difficult. LGUs in Cebu should therefore explore cost-efficient options to alleviate the demand for "grey" infrastructure, in particular:

- Green infrastructure can ensure water conservation and purification, reducing the need for surface water infrastructure and treatment facilities;
- Economic instruments can also be used to manage demand, reduce consumption and generate revenues to expand the quantity and quality of piped infrastructure and sanitation systems, and thereby support the infrastructure projects of the JICA-MCDCB Roadmap Study; and
- Innovative technologies, in particular smart city tools, can progressively help to enhance the performance of water infrastructure.

Figure 3.4. **Direct cost of alternative water supply options**



Source: Marsden Jacob Associates (2006), "Securing Australia's Urban Water Supplies: Opportunities and Impediments. A discussion paper prepared for the Department of the Prime Minister and Cabinet", www.environment.gov.au.

Developing green infrastructure for water conservation and purification

The current strategy in Cebu – shifting from groundwater use to surface water resources – is a process that has also been followed in many OECD cities in the past. However, water and ecosystem conservation strategies are now getting more attention and benefitting from larger investments in the OECD areas (OECD, 2015a). This is also relevant in the case of developing cities, where the alteration of natural hydrological systems results in an increased run-off rate and volume; decreased infiltration and groundwater recharge base flow; deterioration of water quality in streams, rivers, and shallow groundwater; and loss of natural habitat and biodiversity (OECD, 2015a) – all of which are affecting Cebu. Climate change is also projected to cause adverse impacts on freshwater species diversity and water quality as a result of an increase in water temperature and changes in the physical, chemical and biological properties of lakes and rivers (Intergovernmental Panel on Climate Change, 2007).

"Green" infrastructure, in this regard, can also support water supply and sanitation strategies in Cebu. Green infrastructures are defined as "a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services (OECD, 2015a). It incorporates green spaces (or blue if aquatic ecosystems are concerned) and other physical features in terrestrial (including coastal) and marine areas" (European Commission, 2013). The benefits of green infrastructures are increasingly well-documented. The Nature Conservancy (2014) has computed that if cities invested in watershed conservation, 700 million people could receive better-quality water and water utilities could save USD 890 million a year in water-treatment costs. Watershed conservation may be particularly relevant to low-income cities that cannot afford the capital, and operation and maintenance (O&M) costs of built infrastructures (OECD, 2015a), and is therefore something on which Cebu must concentrate efforts.

A watershed is an area of land that drains rainwater into one location such as stream, lake or wetland, supplying drinking water, water for agriculture and manufacturing, and providing habitat to numerous species of plants and animals. Thus these water bodies are crucial for Metro Cebu and must be properly managed and protected. The Central Cebu Protected Landscape (CCPL) was constituted in 2007 under Republic Act No. 9486, and covers a consolidated area of 28, 312 hectares consisting of Buhisan Watershed Forest Reserve, Mananga Watershed Forest Reserve, Sudlon National Park, Central Cebu National Park and the Kotkot-Lusaran Watershed Forest Reserve located in the cities of Cebu, Talisay, Toledo and Danao and in the municipalities of Minglanilla, Consolacion, Liloan, Compostela and Balamban (Metro Cebu, 2016). The regional office of the Department of Environment and Natural Resources of the Central Visayas (DENR-7) is responsible for the management and conservation of the watersheds. The CCPL Protected Area Management Board is directed by the regional director, and the conservation project is supervised by the chief of the Provincial Environment Natural Resource Office (PENRO, part of DENR). However the CCPL still lacks the adequate resources to administer such large natural areas. It has currently has five organic employees, three contractual workers and third party warm bodies or labourers, who are poorly equipped, and requires more funds to function properly (Granert, 2017).

Furthermore, protection, conservation and management of CCPL should be a joint effort through the co-operation of the DENR-7 with local government units (LGUs), non-government organisations (NGOs), business sectors, but especially civil society organisations (CSOs) and local communities. The DENR should continue raising public awareness, furthering and reinforcing the 'dalaw and turo' (visit and teach) programme, that aims to teach and promote environmental messages on nature conservation, especially in the communities living near the watersheds. The DENR could also formalise co-operation with local inhabitants, taking inspiration from the DENR in the Cordillera Administrative Region, north of Luzon. In order to protect a watershed, the DENR-CAR signed a Memorandum of Agreement (MOA) with a homeowners association of the watershed area's inhabitants (Baguio City, 2016). The MOA stipulates that the occupants will not expand into determined areas and mandates that the occupants will maintain their structures for residential purposes and will be prohibited from transferring their rights over the allocated lots. It also provides that a core group will be formed to monitor the strict compliance of the association to the terms and conditions of the MOA, submit annual report on the compliance of the individual members, report any intrusion by squatters in the watershed and in co-ordination with the city government and the DENR-CAR will undertake an annual tree-planting programme to reforest what remains of the watershed. Indeed, reforestation with the support of local communities should be promoted. Forests in the watershed areas are fragmented, but could help to protect these natural assets, as they constitute a natural barrier, and trees limit the erosion of the soil.

Green infrastructures can bring multiple benefits that can help to address not only water supply issues through conservation but also water sanitation issues, while increasing resilience to floods (see next section for this last point). For instance, wetland construction or restoration not only provides water supply but also helps to purify water, ensures biological control, water temperature control, flood resilience and protection of ecosystems. Dams, in comparison, provide water supply and water temperature control, but separate facilities are needed to purify water and ensure biological control (OECD, 2015a). In addition, green infrastructures are cost-effective options; they do not necessarily substitute the need for basic grey infrastructure, but can prevent to some extent or postpone the cost of building and extending grey infrastructures. They are also

more flexible and can be put in place more quickly, which is non negligible considering that socio-economic trends and climate change impacts are subject to considerable uncertainty. The following examples from OECD cities are worth mentioning (OECD, 2015a):

- In Philadelphia, the proposed eco-friendly "sponge-like" water system involving new forms of drainage (green roofs, wetlands, repaving with porous materials) would cost USD 2 billion, less than half as much as a conventional upgrade of the current pipe and basin system (WEF, 2014); achieving a similar level of service through an additional wastewater treatment plant would be 4 or 5 times more expensive at USD 8-10 billion (Walton, 2012).
- In Australia, a pilot project funded by Queensland Urban Utilities in partnership with SEQ Catchments to repair 500 metres of eroded riparian corridors near the Beaudesert Sewage Treatment Plant in the Logan River catchment can achieve the same level of environmental performance as upgrading the treatment plant at a lower cost.

A first type of green infrastructure that should be developed in Cebu is **decentralised rainwater collection and drainage systems in residences, public buildings and industrial areas.** Local authorities can more aggressively promote the installation of rainwater tanks (e.g. roof run-off collectors) and pervious surfaces, in particular. In addition to the obvious benefits they bring in terms of flood resilience, decentralised rainwater collection and drainage systems help to minimise pollution, as rainwater gets more heavily polluted when it flows over long distances on dry streets, pavements, or parking lots. In Cebu, significant amounts of garbage are discharged in the streets, and this aggravates the problem. Such infrastructure also improves the quality of water returned to the environment; pervious surfaces in particular allow rainwater to trickle through the ground and recharge aquifers, which should help to tackle the issue of aquifer depletion in the Province. They can also alleviate the need to build and extend sewerage and treatment infrastructure, and this is also a means to harness private capital: local authorities should indeed design mechanisms to incite property and land developers to participate directly in the construction of such infrastructure (OECD, 2015a) and therefore alleviate MCWD's and LGU's pressure to extend pipe infrastructure. Finally, such infrastructure would be even more useful in low-income communities with no access to water distribution and treatment networks; rainwater collection systems provide opportunities for direct use (e.g. toilet flushing) and decrease the need or at least the cost of transporting water (OECD, 2015a). In India, for instance, the State of Tamil Nadu has made eco-efficient approaches compulsory for new buildings to reduce depletion of its groundwater. Not only do households use the rainwater as an alternative source of supply, but it is also used to replenish groundwater. In Chennai, the groundwater table has risen 3 to 6 metres since households began to use rainwater and reduced groundwater extraction (UN ESCAP and UN HABITAT, 2015).

Generally speaking, **large green spaces and retention ponds** also offer similar benefits as decentralised rainwater collection and drainage systems: by catching rainwater and run-off, they help to recharge local aquifers and also, ensure natural water purification, decreasing the need for water treatment if such water is to be re-used for supply. In Cebu, such green spaces need to be preserved outside and inside urban areas, and more should be created over vacant land. In addition, they provide opportunities to create recreational areas and preserve biodiversity, if well managed.

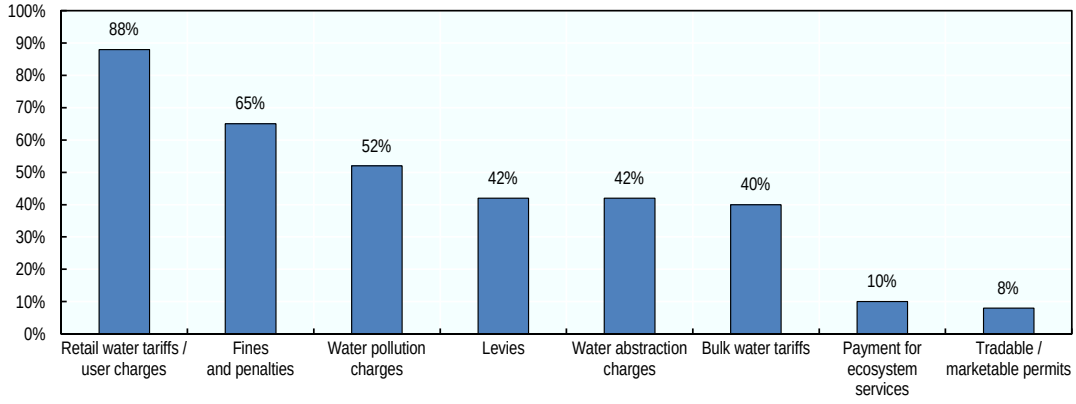
Decentralised rainwater collection and drainage systems, and green spaces should be, in particular, developed on vacant land and green field projects where this is easier to undertake. Considering the expansion of the metropolitan area and the lack of space that has already started to contain urban development, it is urgent for local authorities to start implementing such solutions. In higher density areas, installing green infrastructure is more difficult, but nonetheless achievable. The examples of Malmo, Philadelphia and Portland have shown that it is possible to increase the quantity of permeable surfaces in urban centres (OECD, 2015a). In Cebu, considering that numerous constructions are taking place at the moment, there are opportunities for such infrastructure even in urban areas, in and on buildings. Urban areas of Metro Cebu also possess 10.9% of vacant land considered not hazardous and suitable for development, mostly concentrated in Lapu-Lapu, Danao and Carcar. There is also a certain area of undeveloped land which is considered hazardous (76% of total undeveloped land of Metro Cebu). Such sites could be ideal candidates for the development of green spaces and retention ponds serving water supply, sanitation and flood resilience purposes, and connected to existing infrastructures and settlements in safe urban areas. The proper regulations and incentives must, however, be put in place to ensure implementation of such measures (see section below on pricing instruments).

Finally, integrating grey and green infrastructure needs to be ensured to maximise the benefit of green infrastructure, noting that the demand/supply gap for water in Cebu is forecasted to reach 437, 000 m3 per day in 2050 (JICA and MCDCB, 2015) and non-grey infrastructures alone therefore cannot meet this increasing water demand. In short, non-grey infrastructures need to be developed in complementarity. This should also be reflected in the role of the upcoming Commission for Water Resources and Water Supply Management under the MCDA.

Managing demand, behaviours and water revenues through pricing mechanisms

An important set of instruments to manage water supply and sanitation is pricing mechanisms. Pricing mechanisms can be effective means to rationalise consumption and manage demand, therefore easing pressure on water resources use and treatment facilities, while saving costs and raising revenues that can be used for building new water infrastructure and local capacities. OECD cities tend to use a range of economic instruments for urban water management, in particular retail water tariffs, user charges, fines and penalties, water pollution charges and levies (Figure 3.5). MCWD and other local authorities on water supply and sanitation in Metro Cebu make some use of such instruments but should however expand them. They would come as great complement of the large infrastructure projects recommended in the JICA-MCDCB *Roadmap Study*.

Figure 3.5. **Use of economic instruments for urban water management in OECD countries**



Source: OECD (2016), Water Governance in Cities, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264251090-en.

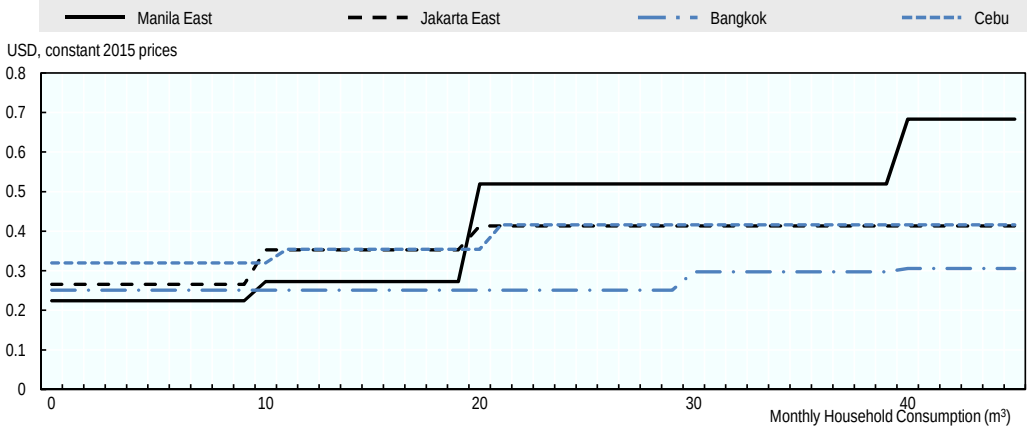
Generating higher revenues through water tariffs

Water tariffs are in use in Cebu but only limitedly and should be used more systematically. In the Philippines, many water utilities face financial difficulties because tariffs are too low to recover costs (ADB, 2013a). In terms of water sanitation, most households in Cebu particularly do not pay for septage service although MCWD plans to incorporate the cost of desludging into bills. MCWD and other LGUs of Metro Cebu, that have the authority to manage water tariffs, should enhance efforts to develop tariff for existing sanitation services and most importantly to finance and recover cost of construction of wastewater treatment plants. In terms of water supply, MCWD has adopted a block tariff structure that allows collecting revenue according to the amount of water consumed, with higher tariffs applied to larger consumers. Recently, tariff rates for the first 10 cubic meters consumed were raised by 12% to PHP 15, but residents that consume less than 30 cubic meters still benefit from subsidised rates,[1] the current cost of production from groundwater pumping being around PHP 21 per cubic meter. MCWD and other LGUs of Metro Cebu providing water supply should explore options to increase water tariffs for large consumers, especially commercial and industrial facilities. This could serve as a way to reduce excessive consumption and better manage water demands. The block tariff structure could be sharper for these large consumers, especially considering that water consumption is set to increase as economic development takes place in the Province. Such tariff increase could, in this regard, factor in the water scarcity situation in Cebu. In Manila East for instance, there is a significant leap of water tariffs for large consumers (Figure 3.6). Other LGUs in Metro Cebu should follow a similar approach. Upgrading water tariff to cost-recovery levels would encourage water utilities to borrow to finance urban infrastructure projects but also similarly encourage commercial banks and government financial institutions to lend. In contrast, the national government should adopt a common methodology for tariff review in the Philippines to facilitate such measures at the subnational level, and to further encourage investments in the water sector (ADB, 2013a).

By way of example, the Metropolitan Waterworks and Sewerage System (MWSS), in charge of water privatisation in Metro Manila, has for instance created targets and tariffs for the sanitation and sewerage programmes of the two private concessionaires of the capital city (ADB, 2013a). In Dumaguete City, the LGU enacted the required legislation to obligate households to desludge septic tanks regularly. The water district manages the

facility and collects user fees from service connections that are included in monthly water bills, thus raising sufficient revenue to cover operation and maintenance expenses, and to recover capital investments over a reasonable timeframe. Fees are collected from unconnected households directly. According to both LGU and water district officials in Dumaguete, households now spend less on desludging compared to the fees charged by private operators, and have the added comfort of knowing that such waste is treated in a manner consistent with environmental regulations (ADB, 2013a). Another good case in point is Metro Vancouver, where water sales (37%) and sewer levy (27%) account for the major share of local revenues, showing the financial return that can be build out of supply and sanitation services (see Chapter 4 for more details on local revenues in Metro Vancouver). Metro Cebu should draw lessons from these examples to implement policies aiming to increase water tariffs, while working on cutting costs and optimising water treatment and supply process in order to stay competitive and so that larger customers do not turn to private suppliers, on which LGUs and the metropolitan authority should also put more pressure with stricter controls and regulations, as it is suggested further.

Figure 3.6. **Water tariff structure in selected ASEAN-5 cities**



Source: Manila Water (n.d.), www.manilawater.com/downloadables/2015%20tariff%20table%20june%201,%202015.jpg (accessed 3 July 2015); PT Aetra Air Jakarta (Aetra) (2012), "Info Tariff Aetra", www.aetra.co.id/uploads/info_tarif_aetra/tarif_air_aetra_2007.pdf; Metropolitan Waterworks Authority (n.d.), www.mwa.co.th/ewtadmin/ewt/mwa_internet_eng/ewt_news.php?nid=309 (accessed 3 July 2015).

To avoid block water tariff and higher tariffs for large consumers harming poor households, MCWD and LGUs of Metro Cebu will also need to adopt flexible strategies in terms of water pricing. Also, a connected customer who sells water to an unconnected neighbour should not be penalised with a rising block tariff. As a matter of fact, 4.3% of water use for drinking and 10.5% of water used for other purposes are collected from neighbours' taps and wells in Metro Cebu[2] (JICA and MCDCB, 2015). It is therefore recommended that the number of persons served by a connection be noted on each water bill, and that the water bill for a shared connection between neighbours be adjusted to reflect it (ADB, 2014). The generation and use of water-related revenues to be invested back in water supply and sanitation systems will also require all LGUs to adopt separate budget accounts (i.e. also called ring-fencing mechanism). Ring-fencing entails separating activities, assets and revenues of a specific sector – here water – from other sectors managed by LGUs. Ring-fencing leads to more accurate information that can be

used for making decisions about resources allocation, management and operational changes and improvements, and tariffs (Water and Sanitation Programme, 2009).

Making stronger use of water-related charges

Local authorities should make stronger use of water abstraction and pollution charges. In particular, there is no existing regulation from the National Water Resources Board (NWRB) to charge for private groundwater pumping in the Philippines. This encourages unsustainable consumption of water resources and opportunities to raise water revenues for MCWD and LGUs are missed, especially considering that the number of private wells is increasing at a fast rate in Cebu. This is also particularly important considering that such non-piped water collection systems (i.e. public wells, households' own wells, neighbours' wells and taps) account for 9.2% of sources of drinking water in Metro Cebu, and 33.4% of sources of water used for other purposes (JICA and MCDCB, 2015). In other words, the impact of MCWD block tariff policy only applies to a portion of the population and is not sufficient per se to raise high revenues and shape behaviour in the whole metropolitan area. Permits for water extraction should be carefully analysed by the relevant authority, taking into consideration aquifer capacities and projected water demand, and prices should be set taking into account water scarcity. The quantity of water extracted must be metered and priced accordingly. Such revenue from charges should also be used to finance other projects in the water sector, such as the construction of the Lusaran dam and the extension of pipe infrastructure. The National Water Resources Board (NWRB) has responsibilities over such matters but is currently delivering permits without such careful local analysis. The NWRB should therefore work more closely with local water authorities to regulate private water use with such economic instruments. As a matter of fact, it would also be appropriate to transfer such competency from NWRB to a local authority, for instance the newly created Cebu Provincial Water Resources Authority (PWRA) (see Section below on Water Governance). Progressively, the recourse to groundwater pumping by households and industries should be eradicated and replaced by pipe infrastructure.

Austin, Texas, also recently created through an Ordinance in the Austin City Code a "Water Well Fee" of USD 7.50 per month for all households operating and drilling a well or installing a water well pump (Austin Water, n.d.). In Southeast Asia, Bangkok stands out as a good example of use of regulations to tackle groundwater extraction. The national government and the Metropolitan Waterworks Authority for instance managed to significantly reduce groundwater extraction in the late 2000s by forbidding groundwater extraction in sensitive areas, by creating license and charging regulations, coupled with strict enforcement policies and awareness campaigns (OECD, 2015b). MCWD could adopt similar strategies for wells located within 100 metres of a pipe connection as such installation is illegal. A more moderate strategy including a fee could be set up for households and businesses using wells beyond 100 metres of a pipe connection and who are less able to access water. In addition, local authorities should explore opportunities to raise complementary charges. The City of Sacramento, California, has adopted a range of fees and charges, such as storm water drainage service fee, wastewater service fee and water development fee that can be consulted in the City Fee Database (City of Sacramento website).

Local authorities should also make stronger use of water-related taxes. Taxes can be an effective instrument to address negative externalities that affect water demand and availability, or the costs of water security (OECD, 2015a). In Cebu, there is little or no use of such economic instruments. In particular, in the case of water supply and

sanitation, local authorities should develop land-development taxes (i.e. as land-value capture taxes) to cover for the cost of new needs for urban water management. The construction of new piped connections, septic tanks and wastewater treatment plants should be partly financed using such taxes to be applied to buildings benefitting from such services, in particular large industrial, commercial and residential estates, connected to municipal water distribution and treatment networks, including future sewerage infrastructure. Such taxes based on polluter-pay principles encourage water conservation and treatment at source instead of building large-scale facilities. Such taxes could be part of a carrot and stick mechanism: for instance, rebates on such taxes could be created for landowners developing individual rainwater catchment infrastructure, or septic tanks, as further incentives to develop green infrastructure. New York City has adopted interesting water re-use incentives (Box 3.1). There is high potential in Cebu for such policies as much of the land is privately owned, especially by large real estate conglomerates (e.g. SM Group) which could significantly contribute to raise water revenues. The case of Casablanca also offers a good example of such policy and has shown that it can even be tied to objectives of expanding water access to poor communities (Box 3.2). Such land-value capture tools however require a proper regime for land ownership and fiscal capacities (OECD, 2015a).

Box 3.1. **New York City's Comprehensive Water Reuse Program**

New York City's Comprehensive Water Reuse Program offers a 25% reduction on water and sewer charges for buildings that maintain a Comprehensive Water Reuse System (CWRS). A CWRS building may capture, treat and recycle blackwater (i.e. sanitary wastewater) or greywater (i.e. wastewater from lavatories, showers and clothes washers). The CWRS must achieve a 25% reduction in a building's baseline demand for potable water. Program rules establish a baseline of 60 gallons per person per day for residential buildings and 10 gallons per employee per day for indoor use in an office building.

Since its inception in 2004, this program has created an effective indirect subsidy for private water reuse systems. It has been estimated that for a large mixed residential and commercial water user, participation in the program would reduce operating costs by more than USD 1 million a year by 2012 and close to USD 3 million a year by 2015.

Source: NYC Environmental Protection (n.a.), "Comprehensive Water Reuse Program: Application and Instructions", www.nyc.gov/html/dep/pdf/waterreuse.pdf (accessed June 2017).

Box 3.2. **The financial contribution of land development taxes: Casablanca, Morocco**

Casablanca is characterised by rapid urbanisation; its population is expected to grow from 3.5 million to 5 million to 2030. Extending the water network, securing access to the resource and protecting it against frequent floods are serious concerns for the local authority, which needs to finance these projects.

The city defined a new investment programme in 2007 and contracted Lydec, a subsidiary of Suez Environnement, to provide WSS services and mitigate flood risks. Revenues from user tariffs cover operational and maintenance costs and the renewal of existing assets (accounting for 70% of total cost over the last decade).

Box 3.2. **The financial contribution of land development taxes: Casablanca, Morocco** *(continued)*

A dedicated account (*fonds de travaux*) covers the remaining costs (essentially land acquisition, network extension and social connections). Financed mainly by contributions from property developers, it has financed a growing share of total investment, from 7% in 2004 to 54% in 2014.

Property developers also cover the costs of connecting to the network and in-house equipment. Their contribution varies depending on the type of housing (social housing, villas, hotels and industrial zones), and they pay additional costs for developments that do not feature in the master plan. Contributions are waived when the developments take place in underprivileged neighbourhoods and slums. Special conditions have also been set to adjust the contribution to the pace of urban expansion, and to harness major urban developments.

The contribution is a share of the price of property when sold, ranging from 0.7% of the selling cost for social housing to 1.3% for luxury apartments and buildings.

Source: OECD (2015a), *Water and Cities*, *Ensuring Sustainable Futures*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264230149-en.

The case of low-income communities and water economic instruments

Water-related tariffs (as shown in the case of shared connections), taxes and charges must be carefully used on low-income communities. A critical issue that the Province of Cebu is facing is the need to expand coverage of water distribution systems, and in particular piped infrastructure which only account for 12.5% of water used for drinking and 49.9% of water used for other purposes. MCWD plans to add 70 km of pipes by 2020 and cover 80% of the population. To date however, many low-income communities remain excluded from such service. One of the major obstacles to their expansion is the cost of connection, which is set at PHP 4 500 by MWCD. In addition, households need to pay a deposit fee of PHP 1 500. Field studies suggest that many people cannot afford to pay for this connection fee (ADB, 2014), forcing them to opt for alternative water supply systems which may be less efficient, less standardised and/or more expensive (e.g. buying water from a neighbour is usually more expensive that piped water). In addition, it prevents the water utility operators from controlling consumption accurately and raising revenues. Thus, while this type of charge, as explained previously, is overall useful to raise revenues and finance the development of water infrastructure, it can be counter-productive with regards to inclusiveness objectives. Consequently, connection fees should be eradicated for poor households only, and increased water tariffs (especially for large consumers, as discussed previously) could be used to make up for the economic losses. The case of Viet Nam, in particular the cities of Hai Phong, Binh Buong and Ho Chi Minh City, has shown that the abolishment of connection fees can bring positive benefits (ADB, 2014). An alternative could be to subsidise connection fees for low-income households, as was done in Phnom Penh, Cambodia.

Integrating progressively advanced technological solutions for water supply and sanitation in Cebu

Green infrastructure and economic instruments to improve the management of water supply and sanitation in Cebu should also be combined with technological innovation. **Smart water infrastructures (SMW)**, in particular, should be part of the roadmap for WSS in Cebu. The International Telecommunication (ITU) defines smart water

management in cities as the attempt to alleviate challenges in urban water management by incorporating ICT products, solutions and systems in water management and sanitation (ITU, 2014). In particular, SMW provides benefits in terms of real-time data production, collection and analysis, and can enhance water quality and reliability, ensure proper management of green infrastructures, decrease water losses due to leakage, reduce operational costs, and improve customer control and choice (ITU, 2014). Although still fragmented, the smart water market is booming: Lloyd Owen estimates that global sales for smart water systems ranged from USD 500 000 to USD 1 billion in 2009-10; they are forecasted to rise between USD 5 billion and USD 16 billion by 2020. Smart water systems accounted for approximately 0.5%-0.9% of the global water hardware market in 2010 and look set to account for 2.9%-9.4% of the market by 2020 (OECD, 2012).

Smart water infrastructures should be included early on in the development of new infrastructures in Cebu. There will be opportunities indeed to insert monitoring devices for leakages, for instance, during the construction of new pipes and dams. Local authorities and private companies should not miss the current window of opportunity to couple "traditional" water infrastructure with SMW. The following smart water technologies could be particularly useful in the case of Cebu and should be applied to the infrastructure the JICA-MCDCB *Roadmap Study* recommended to build:

- Smart meters are the most widely adopted type of smart water infrastructure. Such metres, installed in households or in water distribution networks, can inform utility companies about leakages and help to reduce non-revenue water. They can also help customers to get information and control their individual consumption, and create a new relationship between water users and suppliers. Finally, they provide data about water consumption to the utility company and can help to refine demand forecasts and design more tailored water tariffs (OECD, 2015a).
- Pollution detectors can help local authorities monitor the quality of water in various sensitive areas, such as rivers, reservoirs, dams, and identify sources of pollution.
- Data modelling software can help to predict river and rainwater flows, and thereby improve infrastructure design. In Hamburg, the SYNOPSE projects involved developing different precipitation models and comparing the resultant digital series with real rainfall data.

Local authorities in Cebu also need to start installing advanced technological water supply and sanitation facilities. In particular, they should consider expanding desalination and used water reclamation technologies to increase water supply capacities and ease water stress in the Province. A desalination plant was built in Cebu and currently sells water at less than PHP 40 per cubic metre, which is encouraging. Solar-powered technologies have also been tested with success and show the potential of such innovation. Singapore offers an excellent example of the benefits of such technologies. The nation-state suffered from high water stress due to water scarcity until the 1990s, and decided to undertake an ambitious programme called the "Four National Taps", based on desalination, reclamation of used water, water imports and rainwater collection and storage. The support of the national government in such projects would be critical, owing to the high fixed costs of building such technologies.

Assessing and enhancing Cebu's flood resilience

Cebu's flood and typhoon risk

Floods are one of the water-related risks faced by Cebu Province. They routinely occur during the monsoon season between June and November, although average precipitation is not as high as in many other Asian cities.[3] They may also be the result of storm surges caused by typhoons, as was the case in 2013 during the super typhoon Haiyan/Yolanda, which caused many poor people to suffer from a loss of homes and livelihood opportunities (e.g. fisheries) particularly along the northern coastline. A number of other factors suggest that some areas in the Province are exposed to floods (JICA and MCDCB, 2015):

- In Metro Cebu area, it is estimated that around 42.6% of households do not have drainage systems in their neighbourhood. This figure hides significant imbalance in drainage infrastructure across LGUs: while in Cebu City, for instance, 21.1% of households do not have a drainage facility in their neighbourhood, in Lapu-Lapu City and San Fernando as much as 69.9% and 69.5% do not, respectively.
- In addition, the quality of drainage infrastructure is often suboptimal: around 21% of households with drainage facilities have reported them in bad or very bad conditions, and 62% in average condition. As reported in the drainage master plan study, drainage that was inspected revealed that more than 50% of the drainage lines are either silted or clogged by garbage. Many rivers and creeks are also filled with garbage discharged by informal settlers along riverbanks.
- Rivers in the Metro Cebu have become constricted to construction of structures on top of them.

The LGUs most affected by floods are Mandaue, Talisay, Danao and Cebu City, although only a share of households have actually experienced floods in these areas (JICA and MCDCB, 2015).[4] Another estimate made by the JICA-MCDCB study in 2015 revealed that a significant share of coastal areas, including in Metro Cebu, faces moderate flood exposure. These low lying areas extend a few kilometres inland from the coast and represent about 8% of Cebu City's total land area. Despite the small area, this land hosts approximately two-thirds of the population (JICA and MCDCB, 2015). In addition, the risk of floods is not static and the following parameters suggest that Cebu may be increasingly vulnerable to floods:

- Urbanisation and demographic growth may put a growing number of people at risk. This is even more likely if poverty in urban areas increases, which means more people with low protection and capacity to sustain a disaster are at risk;
- Economic growth, industrialisation and the increasing number of businesses and infrastructure implies that a larger number of assets can be damaged by a natural disaster, causing significant economic losses and undermining Cebu's economic growth without proper preparedness and insurance mechanisms;
- Climate change is likely to increase the Province's exposure to floods: some simulation tools already show that in 2ºC and 4ºC increase scenarios, the island of Mactan and the coastal areas in Metro Cebu will be flooded due to sea level rise, in a business-as-usual scenario.[5] Extreme weather events such as more severe droughts and deluges due to climate change are also more likely to occur in the

future. Although super typhoon Haiyan/Yolanda did not hit Cebu as hard as the Eastern Visayas Islands, there is no guarantee future typhoons will not primarily hit Cebu;

- Poor urban planning, lack of infrastructure and adaptive capacities are also factors of vulnerability. The increase in the share of impervious surfaces and the loss or alteration of natural hydrological systems decrease the absorption capacity of Cebu and also aquifer recharge rate, as mentioned previously. However, there is no accurate data on urban expansion and loss of natural assets in and around Metro Cebu. Settlements in flood-prone areas and coastal reclamation are also determinants of vulnerability. Obstruction of waterways owing to open dumping of solid waste and the lack of drainage and polder infrastructure in Cebu also suggest the Province's resilience is low, and is particularly vulnerable to a large-scale natural event.

If not properly tackled, such disasters can result in human losses and high economic damages. Typhoon Haiyan/Yolanda, which primarily hit the Eastern Visayas Region, near the Central Visayas Region where Cebu Province is located, is estimated to have caused economic losses at USD 13 billion. Sea level rise will also create additional costs: for instance, shoreline retreat in the United States is projected to cost between USD 270 billion and USD 475 billion for each metre of sea-level rise (OECD, 2010). Floods can also have negative consequences on the environment, if it spreads solid waste and hazardous substances which are openly dumped in a city; typhoons can also destroy mangrove forests and the whole ecosystems relying on them.

Developing robust DRRM plans at the metropolitan scale

LGUs challenges in developing DRRM plans

At the national level, the 2010 Republic Act 10121 (RA 10121) on Disaster Risk Reduction Management (DRRM) and the Disaster Risk Reduction Management Plan 2011-2028 guide resilience efforts in the country. In Cebu City, the Office for Disaster Risk Reduction and Emergency Management of Cebu was created in 2013 in order to apply national strategies. Its objectives are to i) mitigate the potential effects of the various hazards and vulnerabilities that might impact the Province; ii) implement measures aimed at preserving life and property, further minimising casualties and damages; iii) respond and manage effectively to the needs of the affected population and local jurisdictions during emergencies; and iv) provide a recovery system aimed at returning to normalcy from the consequences of natural and human-induced disasters that may impact the Province of Cebu.

In practice, however, many LGUs have not been able to craft DRRM plans (and CLUPs) or have designed weak plans which do not support a robust strategy against floods or other natural disasters. This is partly due to a lack of technical capacities and a short-sighted vision of disaster resilience. Not all LGUs possess a permanent DRRM Office, and the DRRM officers are usually not properly trained and come from the Mayor's Office, without having any specific expertise. They suffer from a lack of assistance from the national government on how to prepare the plans. Consequently many LGUs settle for a very weak DRRM plan to fulfil the conditions to receive the 5% share of the IRA, but do not build robust DRRM strategies.

Metropolitan scale DRRM planning will complement LGUs efforts

Metropolitan scale DRRM planning will greatly help LGUs in this regard. JICA and MCDCB have already developed a Roadmap for Stormwater Management in Metro Cebu, with a vision to 2050 (Table 3.2). A Stormwater Drainage Master Plan for Metro Cebu, based on the JICA-MCDCB study, is also currently in preparation with financial support of DPWH Central Office. With the Master Plan, LGUs will be able to effectively design and implement their own DRRM plans and ensure coherence with other LGUs.

Table 3.2. **JICA-MCDCB Roadmap for stormwater management in Metro Cebu**

Timeframe	Measures for stormwater management
Short-term	• Implementation of a Comprehensive Study for "A Metro Cebu Integrated Flood and Drainage System (MCIFDS) Master Plan • Cleaning rivers, creeks and drainages • Construction of small-scale rainwater storage facilities
Medium-term	• Construction of drainage facilities based on MCIFDS • River improvement projects • Embankment in inundation places in rural areas
Long-term	• River improvement projects • Construction of large-scale rainwater storage facilities

Source: JICA and MCDCB (2015), "Roadmap Study for Sustainable Urban Development in Metro Cebu", Cebu, the Philippines.

Another ongoing example is the collaboration between Cebu Province, MCDCB, the University of San Carlos and GIDRM/GIZ to facilitate the integration of scientific data in local DRRM planning through the development of a province wide multi-hazard suitability map. The suitability map supports evidence-based decision-making in local planning and budgeting (Box 3.3). There are also efforts of the Cebu Province, MCDCB and GIDRM/GIZ to jointly assist LGUs in the development and alignment of local DRRM and CCA plans. This improves their chances to access national resilience funding, such as the People Survival Fund (PSF), and implement identified DRRM priorities.

Box 3.3. **Suitability Mapping: Evidence-based and risk-informed decision making in local planning and budgeting**

In many countries specifically mandated national agencies and their national and international non-state partners make available to local governments a rich body of information on climate change and natural hazards. Mandated agencies support local governments in benefitting from this rich wealth of information by supporting in accessing, understanding, utilising and integrating this information most strategically into decision-making processes.

In support of these mandates, the GIDRM/GIZ, the Philippine National Economic Planning Agency (Neda) Region 8 and two Philippine provinces collaborated in developing a process template that helps aggregate and directly link climate and natural hazard related data from multiple sources into one aggregate surface. The suitability map approach works primarily with

Box 3.3. **Suitability Mapping: Evidence-based and risk-informed decision making in local planning and budgeting** *(continued)*

official local data sources and climate projections, complemented with local, national and international open data sources where available and when appropriate.

A standard suitability map covers 6 natural hazards: Rain and earthquake induced landslide, typhoon, storm surge, tsunami and fresh water flooding, weighed according to the statistical probability and the severity of their occurrence. Climate change adaptation wise it is based on a medium emission scenario using 3 global climate assumption scenarios, up to 2050. The standard resolution outlay is 1:100 000 for provinces and 1:50 000 for urban areas. The standard parameters can be adjusted based on the specific interests and contexts including the availability of data.

The special feature of the suitability map is that it translates scientific-statistical data on natural hazards and climate change into a percentage of expected damage per year. This translation in economic categories is more intuitive and facilitates the utilisation of disaster risk reduction and management (DRRM) information. It was originally developed in the aftermath of typhoon Yolanda to guide LGUs in identifying safer places for normal residential buildings. For Cebu Province, selected agricultural crops were added. Suitability mapping, above all, is not an approach to generate more data, but an approach to help consolidate and translate existing data for actual use in political decision-making.

Source: Deutsche Gesellschaft für International Zusammenarbeit (GIZ) GmbH (2015), "Residential Building Suitability Map for Leyte Island, the Philippines", www.preventionweb.net/publications/view/47118.

DRRM plans must be informed by comprehensive data on infrastructure, assets and land vulnerability

All LGUs in Metro Cebu must adopt a more comprehensive approach to flood vulnerability assessment to identify current weaknesses. The first step of any flood resilience action plan is to adopt a comprehensive approach that identifies current weaknesses. Weather and climate events, exposure (location, topography, sprawling urban development) and vulnerability (the propensity of people, infrastructure and assets to be affected) are indeed all factors of flood risk (IPCC, 2012). They are often the result of skewed development processes associated with, for example, environmental degradation, rapid and unplanned urbanisation in hazardous areas, and limited options of livelihoods for the poor (IPCC, 2012). JICA made substantial efforts to produce knowledge on Cebu's vulnerability to floods, but much remains to be done as most data produced focused on some infrastructure only and do not tackle other aspects of vulnerability. For instance, there is no estimate of the potential economic and social damages of a flood or of a typhoon. The lack of knowledge on factors of vulnerability may explain why local authorities have mostly focused on disaster response so far. To improve risk resilience in Cebu, more precise risk assessment measures also need to be in place. Currently, risks are not always measured in terms of risk probability and impact. However, including data on risk probability and impact would provide for a more comprehensive approach in tackling vulnerability. This can help LGUs implement more targeted policy measures.

LGUs in Cebu should assess and map the vulnerability of residents, businesses and infrastructure based on the recent and potential impacts of a flood or a typhoon on infrastructure and the local economy. Assessment of potential future damages is critical to factor in climate change impacts on the resilience of Cebu. The Paris region

(Ile-de-France) offers a good practice of flood vulnerability assessment, in this regard. The national government has successfully involved governmental and relevant non-governmental stakeholders to assess the potential impacts of a 100-year flood6 on infrastructure (power distribution, local transport systems, water supply and heat distribution), hospital and school capacities and operations, government buildings and operations, and business and economic performance. For each of the critical urban utility systems, a map of vulnerability has been created and helps to visualise more clearly the different types and different urban areas at risk (Box 3.4). The same OECD study (OECD, 2014b) that reports on these initiatives in the Paris region also details methodologies to calculate the macroeconomic and microeconomic impacts of a flood event. LGUs in Cebu could use them as guides to strengthen their flood and typhoon risk assessment mechanisms. The national government and an organisation such as Earthquake Megacities Initiative (EMI), based in Quezon City, could provide assistance through frequent capacity-building training on vulnerability assessment.

LGUs in Cebu could also take example from Bogor, Indonesia: local authorities have collected data on families to assess their vulnerability to floods (i.e. if they have been affected and how much assets lost in the past) and have built GIS maps of vulnerability. A comprehensive plan has been designed based on such data and also tackles preparedness aspects on the ground, in schools in particular. Such data will provide useful information for the Metro Cebu Integrated Flood and Drainage System Master Plan and each LGU's DRRM plan. It is also critical to collect data and design a plan at the watershed level and integrate it with strategies in Metro Cebu, since floods have a strong urban-rural linkage (many low-lying areas of Metro Cebu are affected by flash floods originating in mountainous areas such as Lusaran, for instance). The newly created Provincial Water Resources Authority (PWRA) could play a critical role in this regard, but this will require an acknowledgement of its role in the legislation (see Section 4).

Box 3.4. **Flood vulnerability assessment in the Seine Basin region (Paris Ile-de-France)**

By dint of its location at the confluence of the various Seine tributaries, Île-de-France and its heartlands are particularly vulnerable to a major Seine flood. Extensive flooding of underground spaces and cellars in the urban area and its impact on critical networks, including electricity, water, communications and transport, means that major flooding would have effects beyond the flood-prone area. The various works carried out since the beginning of the 2000s by the General Secretariat of the Paris Defence and Security Zone (*Secrétariat Général de la Zone de Défense et de Sécurité de Paris*, SGZDSP) have made it possible to actively involve network operators and other stakeholders in the flooding issue and to evaluate a number of impacts as follows, under a 100-year flood scenario:

- Power distribution would be substantially affected with almost one-quarter of power sub-stations either flooded or cut off as a precaution (DRIEE, 2012). ERDF, the French electricity distribution network operator, estimates that, in an extreme case, more than 1.5 million domestic and business customers, including 377 000 in Paris, would experience power cuts as a result. The area that would potentially be affected by the power cut is around 50% greater than the flooded area.

Box 3.4. **Flood vulnerability assessment in the Seine Basin region (Paris Ile-de-France)** *(continued)*

- A significant proportion of public transport could be affected with almost 140 of the 250 kilometres of the underground network closed as a precaution. The rail termini of Lyon, Austerlitz and Saint-Lazare are also in the flood-prone area and would experience service disruption.
- The road network could be closed at many points: the bridges across the Seine would be closed to traffic, due to their weakened structure, making it impossible to travel from the right to the left bank. Five motorways and several major highways, especially along the Seine, would also be inaccessible.
- The drinking water supply could be disrupted in the outskirts of Paris where more than 5 million customers could suffer extended water cuts and 1.3 million a deterioration in quality in the worst case scenario. It is estimated in total that the power outages, water cuts and the disruption to transport networks would have significant impacts on the daily lives of over 5 million people. For each of the critical urban utility systems, a map of vulnerability has been created and helps to visualise more clearly the different types and different urban areas at risk.
- Flooding is a direct concern for 55 700 businesses and 622 000 jobs in the floodplain (IAU, 2011). The businesses' premises and means of production may be damaged and some or all of their stock destroyed. Consequential operating losses may also be exacerbated by disruption to the electricity, communications and water services; outages will also affect a more extensive area and, therefore, many more businesses. Heavy disruption to the metropolitan public transport network will also prevent many workers from getting to work. Small and medium-sized enterprises (SMEs) account for 85% of businesses in the flood-prone area, and a persistent flood and its consequences could severely affect them. Moreover, the activities in these business quarters focus on computerised services, finance and business services, all areas for which functional telecommunications systems are essential. The impact of major flooding on tourism could also be serious, as this sector is the source of many jobs in the region. 13% of hotel rooms in the region are in the flood-prone area, of which 30% are in an area of electrical vulnerability.
- All of the water treatment plants in the Paris urban area are alongside the river, and the protection measures in place could be overtopped, not only causing them to stop working and therefore discharge effluent directly into the river, but also flooding effluent storage areas. More than 40 million m^3 of untreated water was discharged directly into the natural environment due to Hurricane Sandy (Kenward et al., 2012).

Source: OECD (2014b), "Assessment and recommendations" in *Seine Basin, Île-de-France, 2014: Resilience to Major Floods*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264208728-4-en; DRIEE (2012), "Approvisionnement électrique du Grand Paris", Seminar, 6 March 2012, www.driee.ile-de-france.developpementdurable.gouv.fr/IMG/pdf/Seminaire_du_6_mars_2012_-_Presentations_Approvisionnement_electrique_du_Grand_Paris__cle2dcb2f-1.pdf; IAU (2011), "Économie francilienne: Quelle robustesse face à une inondation majeure?", *Note rapide Économie*, No. 534, Institut d'Aménagement et d'Urbanisme, Paris, https://www.iau-idf.fr/savoir-faire/nos-travaux/edition/economie-francilienne-quelle-robustesse-face-a-une-inondation-majeure.html; Kenward et al. (2012), "Sewage Overflows from Hurricane Sandy, Climate Central, Princeton", New Jersey, www.climatecentral.org/pdfs/Sewage.pdf.

Green infrastructure: the connections between WSS and stormwater management

In the past decades, the development of hydraulic infrastructures, improved flood risk management plans and better risk preparedness (among other efforts) have allowed many OECD countries to reduce their flood risk vulnerability, despite increased exposure from economic growth and urbanisation. However, recognition of the limitations of such traditional,

engineer-based approaches to flood control has led to the gradual emergence of a new paradigm over the last 10-15 years, based on a more integrated and landscape-based approach to flood risk management and a stronger emphasis on ecosystem-friendly strategies (OECD, 2015a). "Green infrastructures" in this regard contribute both to water supply and sanitation, as elaborated previously, and also flood resilience.

Despite traditional facilities being necessary for Cebu, it is also worthwhile to look for complementary and more flexible infrastructure options, taking into account climate change. Green infrastructures in particular are more adaptive solutions that allow "making space for water", a concept increasingly popular and widely adopted in flood-prone countries such as the Netherlands. Such an example can be found in the city of Portland, Oregon (United States). One of its key policies, in the city's 2005 Watershed Management Plan (PWMP), is the use of plants and soil to slow, filter and infiltrate runoff close to its source, in a way that strengthens and mimics natural functions/processes (OECD, 2012). In Malmö (Sweden), a system has been put in place to drain rainwater from rooftops and other impervious surfaces and channel it through canals, ditches, ponds and wetlands before it arrives in a sub-surface conventional sewer system. The objective was to avoid further overflow in the traditional drainage network (Naumann et al., 2011). Therefore, while the potential of green infrastructures is recognised, it is also important to note that traditional approaches, combined with adaptive green infrastructures, provide complementarities that could tackle the issue of flood management more effectively.

In Cebu, local authorities have already started to recognise the importance of green infrastructures. Many existing drainage pipes are located underground and therefore not easy to maintain, and for this reason tree planting activities have been organised, as some trees flourish on wet terrain, having draining properties and thus helping absorbing groundwater seepage. However, they only take place at a small scale and do not have much impact yet. Local authorities should explore the relevance and feasibility to build the following green infrastructure in combination with the traditional "grey" infrastructure prescribed in the JICA-MCDCB Roadmap Study:

- **Large-scale rainwater retention facilities:** water retention ponds, wetlands, and river and creek catchment areas should be created in both urban and rural areas: depending on the origins of water run-off, this could be an efficient and cheap policy option for Cebu. The use of agriculture soil for water retention should also be promoted. This will require a strategic management that includes both rural and urban areas of Cebu Province. In Metro Cebu, the JICA-MCDCB *Roadmap Study* recommends the creation of large-scale rainwater storage facilities, in particular river and creek catchment areas, although it is difficult to find proper space due to urbanisation (JICA and MCDCB, 2015). There may however be opportunities on vacant land in urban areas, especially those identified as unfit for urbanisation (see Section 2). Wetlands and reservoirs are currently protected through Environmental Impact Assessment (EIA) methods, and some of them benefit from the status of "protected areas" and registered under the National Integrated Protected Area System (NIPAS) Act. Zoning regulations issued by LGUs are also means utilised to safeguard such areas from development;
- **Household rainwater storage facilities:** Republic Act 6716 "Water Wells, Rainwater Collectors, and Spring Development" (1989) requires the Department of Public Works and Highways to construct rainwater collectors and develop springs in every barangay (similar to a subdivision of a city). Republic Act 7160 providing the Local Government Code (1991) extended the requirement to local governments. Such measure is therefore already encouraged at the household level in Cebu, but the implementation is plagued with difficulties, despite petition from the civil society.

MCDCB and the future MCDA, if created, should create ordinances making it mandatory for each household. Economic instruments could support such objectives (see Section 2); and

- **Permeable pavements.** Installing semi-permeable surfaces on secondary roads and pavements and newly developed ones can also yield high retention rates.

Economic instruments could be used to facilitate the implementation of such infrastructures, as already explained in the previous section. Land-value capture tools could be used in development that occurs in flood-prone areas. Strict land-use regulations should however be applied in catchment areas, wetlands and retention ponds if such infrastructures are to be created. Likewise, a tax could be created on impervious surfaces, such as large commercial and industrial spaces and parking lots. Such mechanisms are already in place in France, for instance (Box 3.5). Installing green infrastructure will also require local authorities to make a significant effort in producing data on local water resources and dynamics. Indeed, in order to create the right infrastructure in the right locations, capacities to measure, compute and model river flows will be necessary (see OECD, 2015a).

Box 3.5. **Financing urban rainwater management in France**

The failure to manage rainwater properly affects the capacity of French local authorities to achieve the "good ecological status" mandated by the European Water Framework Directive. Thanks to a dedicated fiscal instrument introduced in 2011, French local authorities have the capacity to set up a new public service dedicated to urban rainwater management. This new service can be financed in full or in part by earmarked revenues from a dedicated tax.

The tax is based on impervious surfaces, in urban areas or future development areas, whether or not the surfaces are connected to a drainage system. It is paid by the owner of the land or property, when the property is larger than a minimal area set by the local authority. The tax rate is set by the local government and cannot exceed EUR 1 square metre per year (EUR/m2/year). It can be reduced, in full or in part, where facilities are in place to reduce run-off; the reduction is meant to reflect the decreased run-off. Several adjacent property owners can join the mechanism, if they build and operate a common facility.

This new tax principally aims to create incentives for managing rainwater close to the source and limiting run-off by implementing measures that mitigate the consequences of impervious surfaces. It also aims to raise revenues, earmarked for long-term urban rainwater management. In the long term, the revenues generated by the tax are bound to decrease as the objectives are met – a trend that local authorities need to anticipate and factor in.

Local authorities have the opportunity when engaging in feasibility studies to reflect on the level of ambition of their urban rainwater management policy and the policy packages (zoning, standards, information, tax, etc.) they wish to implement. Stakeholder consultation should feature prominently in the process.

Source: OECD (2015a), *Water and Cities, Ensuring Sustainable Futures*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264230149-en; CERTU (2012), "Taxe pour la gestion des eaux pluviales urbaines", Ministère de l'Écologie, du Développement durable, des Transports et du Logement, Paris.

Flood-resilient land-use and building codes for Cebu

Land-use should be recognised as an anchor of diverse strategies to enhance Cebu's resilience to floods. Land-use policies can first of all avoid settlements in flood-prone areas. The Civil Code of the Philippines (Republic Act 386) provides that "the banks of rivers and streams, even in case they are of private ownership, are subject throughout their entire length and within a zone of three meters along their margins, to the easement of public use in the general interest of navigation, floatage, fishing and salvage." The

Water Code and the National Building Code of the Philippines provide similar regulations. The Forestry Reform Code also protects mangrove forests and swamplands from development by 20 metres. In practice however this is not implemented and it is very unclear how LGUs identify flood-prone areas beyond these broad national regulations, and therefore the land-use decisions may be inappropriate in this regard. There is no specific office to deal with this particular issue. From this perspective, risk screening should be applied to areas where new development is likely to occur, and land-use regulations (e.g. zoning, building permits) could be used to create disincentives to develop such lands to avoid creating new zones at risk. In France, local prevention plans delineate areas at various levels of risk based on previous floods, but also according to predictions for the future. These measures should reinforce or complement economic interests (e.g. tourism) by taking flood risks into account.

Building codes and local development plans should also contain regulations to encourage flood-resilient design and the use of green infrastructure. In Bangkok for instance, a Floor-Area-Ration (FAR) Bonus System was set up for developers who build rainwater storage facilities and green spaces juxtaposing the new building. If the capacity of the rainwater storage is not less than 1 m^3 per 50 m^2 of the project area, the extra FAR will be 5%. The extra FAR can be increased proportionally up to 20% of the restricted FAR, if the capacity is more than 1 m^3 per 50 m^2 (OECD, 2015b). LGUs and the national government, if its involvement is necessary, could consider amending current regulations to integrate such carrot and stick mechanisms.

The benefits of insurance mechanisms and business resilience strategies

Insuring disaster-related losses must be a critical instrument of flood resilience, complementing infrastructure protection and flood-resilient urban planning. Compensating farmers when their land is flooded can for instance be more cost-effective than building dykes, which are less flexible and may become ill-adapted to future risks (OECD, 2015a). The mega disaster Haiyan/Yolanda typhoon, which caused economic damage estimated at USD 13 billion in 2013, revealed weaknesses in the insurance schemes for disasters, which were insufficient to recover from the damage. The scarcity of disaster funds that could be paid immediately to damaged parties, the insufficiency of finance schemes that could cope with large-scale restoration and the lack of funds for the most vulnerable communities and parties were particularly pointed out. As a result, many companies went bankrupt and the rural poor were hit hardly by the typhoon (Government of Japan, 2015). These weaknesses are observed at the national level and could also affect Cebu Province in case of major flood or typhoon.

In the recent years, a number of proposals to enhance the resilience of the Philippines' economy to natural disasters were formulated under the leadership of a few international organisations (Government of Japan, 2015):

- A **Catastrophe Bond** ("CAT-BOND") and a **Catastrophe Deferred Drawdown Option** (CDDO), proposed by the World Bank, aims to provide immediate assistance at the early recovery stage directly after a disaster. Similarly, a stand-by-loan mechanism called **SECURE** (Stand-by Emergency Credit for Urgent Recovery) was proposed by JICA to fund needs immediately after a disaster.
- To protect the private sector, a compulsory catastrophe insurance pool for small and medium-sized enterprises and medium-sized residential units has been proposed by the Philippine Insurers and Reinsurers Association (PIRA).

A **business continuity management (BCM) credit rating system** was set up to provide a signal to the insurance and the credit market on the resilience of private companies, thereby creating an incentives for them to enhance the resilience of their own facilities through business continuity plans;

- Finally, complementary insurance scheme for Local Government Units (LGUs) are being explored and developed, and could directly benefit LGUs in Cebu Province. LGUs can receive cash payments from the Government Service Insurance System (GSIS) two to three weeks after a disaster. Recently, the United Nations Office for Disaster Risk Reduction (UNISDR) has partnered with global insurance companies Willis Re and Munich Re to propose the **Philippines Risk and Insurance Scheme for Municipalities (PRISM)** to the Philippines government. The objective of PRISM is to provide a fast track way of budgetary support to LGUs through payments made not based on actual losses – which can take days or weeks to calculate – but rather when specific triggers are met, such as a certain level of rainfall. This should help to unlock and channel funds to LGUs much more quickly and increase the response capacity at the local level. However, the adoption of such a scheme by the government has not yet been confirmed.

Such measures would be critical to recover and unlock resources after a disaster but government authorities must also make sure that reconstruction efforts do not perpetuate past mistakes that make infrastructure vulnerable. In this regard, risk-financing mechanisms could be combined with risk reduction mechanisms: more incentives could be given to developers and builders to "build back better" (e.g. by increasing access to public transport, nearby shopping centres, restaurants and recreational opportunities, and providing green public spaces) after a disaster, to avoid simply rebuilding and exposing housing to the same risks. The national government could subsidise insurance compensations or provide matching funds based on such efforts (OECD, 2014a).

In addition, there is a need to reform the insurance market to integrate disaster risk insurance mechanisms directly in the development process. Currently, insurance premiums are not based on actual risks but based on a flat rate which is not affordable to many developers. Developing insurance premiums against natural disasters, based on actual risks, would be a win-win situation, as it would help to protect both the economy and private assets. This would also help to generalise the purchase of such insurance premiums, as currently insurance scheme are only delivered to a few developers on a case-by-case basis. This will require efforts to develop data on vulnerability, as mentioned previously. Also, such premiums could be provided in CLUPs and would give incentives to private developers to recognise the importance of such plans.

Business continuity planning and awareness efforts should also be scaled up. In particular, all LGUs and MCDCB could raise awareness on the above insurance schemes and help companies develop their own business continuity plans. The Greater London Authority has developed a Business Preparedness Checklist available online, and a five-step strategy to assist the private sector in business continuity planning. This includes: i) analyse the business; ii) assess the risks; iii) plan and prepare; iv) communicate the plan; and v) test the plan. Each of the five strategies is adapted according to the size of the business at risk (small, medium or large). The Greater London Authority also features key actions to be taken in case of a shock, and pools knowledge on best practices for urban resilience worldwide (Greater London Authority, n.d.). In Florida, the Business Continuity Information Network helps to connect businesses and their employees with local governments before and during a disaster. It allows the

company to stay connected after a disaster, to share critical reports about facilities and monitor the condition of the community where the business operates (Business Continuity Information Network, n.d.). Local authorities in Cebu can learn from such examples and replicate similar mechanisms to enhance the resilience of its economy.

Developing innovative financing options for enhancing Cebu's flood resilience

Strategies to unlock finance for UR-DRM are critical. The budget of the 13 LGUs in Metro Cebu is PHP 3.4 billion in total in 2014, which is low compared to the registered population. There are opportunities first to raise own revenue, which only account for 31% of total local revenue on average, in particular tariffs and user charges that can simultaneously promote green growth objectives. In addition, the national government's transfers should be better aligned with green growth objectives. Attracting private investment should also be emphasised: FDI inflows have been lower in the Philippines than in all other countries of the Southeast Asian region, in particular because of the strong restrictiveness imposed by the government. Restrictions could be loosened in opportunity areas for green growth and Public-Private Partnerships should be encouraged at the subnational level.

An option for Cebu is to explore local private finance. It is not known precisely what percentage of Cebu's climate-resilient infrastructure investments are being made with local sources of private finance or through domestic capital markets. However, it is clear that Cebu's political and community leadership understands the importance of forming public-private partnerships, and is actively embracing collaborative actions and building coalitions between the private and public sectors with full civil society engagement for that purpose, as evidenced by the continuous dialogue taking place among local stakeholders in the government, private sector and civil society represented on the MCDCB. A possible further role of the MCDCB is to increase the banking and investment communities' awareness of the role they can play in supporting climate-resilient investments and initiatives. Businesses and the investors who finance them realise that they can't operate profitably in isolation from their surrounding environments and labour forces, and know they depend on public services like roads and the electric power grid to function normally. They increasingly realise that they have as much as, if not more, to lose in disasters than Cebu's citizens. The MCDCB can function as a catalyst in this regard to increase the awareness of local business leaders and investors and connect the public and private sectors.

Another innovative way to attract UR-DRM funding is a new form of financing called social impact investment. Through an environmental branding of its projects aiming to improve resilience, Cebu could attract 'impact investors' who may be willing to invest in UR-DRM in Cebu. It appears that Cebu's current political leadership has already begun to pursue this type of innovative financing approach. It would be useful for the governments in Cebu to increase transparency by disclosing fiscal situations in an internationally comparative way.

Enhance disaster response through local community engagement

In developing countries, floods tend to disproportionately affect the urban poor and deepen poverty and inequalities. The urban poor tend to settle in vulnerable areas such as canals and riverbanks. In Metro Cebu, poor communities can be found near the shoreline and at the estuary of rivers, which are also exposed to floods. At the same time, the important role that is played by communities and individuals acting as "first responders"

of natural disasters should be emphasised. During the Great Hanshin Earthquake of 1991 in Kobe, Japan, more than 27 100 people were rescued by their neighbours, as compared with only 7 900 by the Kobe Fire Department (IFRC). The 2011 mega flood in Bangkok also showed the critical importance of community engagement to limit the damage of such a disaster and to compensate for the lack of capacity of local and national governments to respond to such large-scale emergency situation. Local community engagement should therefore be an important element of Cebu's resilience strategies, in order to avoid disproportionate impact on the poor and to mobilise a broader spectrum of the civil society in disaster preparedness and response.

Mechanisms to allow civil society organisations (CSOs) to participate in the design of disaster action plans should be reinforced, so that they can make contributions based on their knowledge and experience of practical and viable community-based responses to disasters. Local authorities could encourage the establishment of community-based resilience committees at the district level and provide them with capacity-building training. With other technical and logistical support, they could carry out simple vulnerability assessments and develop threat or risk maps, and establish some priorities among actions to enhance their resilience. These could then be proposed to MCDCB (or the future MCDA) and the provincial government for approval and funding. An example of community-based input system is offered by the city of Kitakyushu (Japan), which had also experienced periodic flood disasters. The city developed co-ordinated response mechanisms between civil society and local government. The local government set up frequent meetings with citizens living in vulnerable urban areas to exchange information and experience on both sides ("shared learning dialogues"). It allowed the city to come up with improved safety measures for residents, and raise awareness about the need to settle in safer areas of the city.

Schools and churches that offer large open spaces that can act as emergency shelters are natural centres for community action and organisation, especially in Cebu and the Philippines, When it comes to building greater resilience and adaptive capacity to prepare for, respond to and recover from shocks and crisis, physical and social assets and attributes go hand in hand. A major threat to flood resilience is a lack of social capital on the ground, which can lead to inaction when a disaster occurs. School programmes and religious centres can raise awareness of flood risks, and include practical workshops to build knowledge on how to manage floods at the household and community levels. They can also serve as efficient communication channels assisting district administrations, and provincial and national governments. If they deploy early warning systems in the neighbourhoods where they are located, they can inform the population about the imminence of a flood. Likewise, they can be critical "first responders" and "safe havens" to complement local authorities' action to protect local communities and assets in case of disaster.

Enhancing governance in the water sector

The quality of the water governance system in place in the Province of Cebu is a critical implementation parameter for existing strategies and the recommendations contained in this chapter. The scope and responsibilities of municipal, metropolitan and provincial water government bodies, their capacity to monitor, manage and reform water supply, sanitation and resilience systems, and co-ordination with the national government agencies and departments are critical governance aspects to be addressed.

Creating and empowering metropolitan and provincial water government bodies

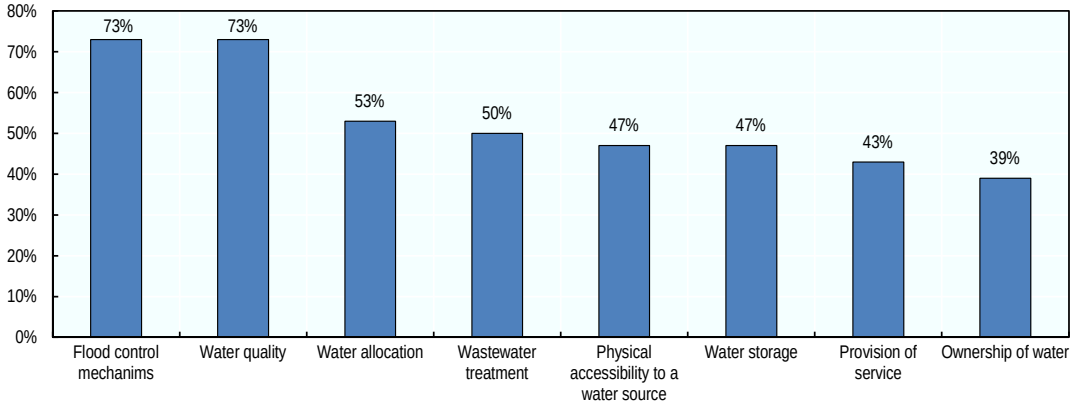
Typical water governance problems of cities between 1.5 and 5 million inhabitants in the OECD area are municipal fragmentation, lack of relevant scale for investment, lack of incentives for co-operation, lack of staff, difficulties in raising tariffs, and limited information sharing (OECD, 2016). Very similar issues are found in Metro Cebu and beyond at the scale of the Province and constrain the ability of LGUs to effectively manage water resources and risks.

Territorial fragmentation is the first type of governance challenge observed in Cebu. Metro Cebu Water District (MCWD) covers eight LGUs of the Metro Cebu. The five other LGUs constituting Metro Cebu are therefore managed by a different authority operating completely separately, either the LGU alone, the LGU in co-operation with water associations, private service providers, or by a private service provider alone. Even in the MCWD service area, MCWD is supported by complementary water associations or private vendors, and only supplies 56% of the population (JICA and MCDCB, 2015). The impact of such fragmentation should be carefully analysed, in particular on economies of scale. Overall, the cost of production tends to be lower for non-integrated districts, due to lower need for costly hard infrastructure (e.g. water pipelines), but potential gains from increased production are larger for integrated districts. In addition, increased scale of operations for a single water operator is likely to improve access to financing (ADB, 2013a).

Apart from these economic considerations, the fragmentation of water utilities in Cebu creates management failures and incapacities. The population of Metro Cebu benefits from the same hydrological resources but their use is uncoordinated: there is no metropolitan authority supervising the management of water systems at the scale of the entire urban area. This mismatch has consequences on the effectiveness of service delivery and investment, and contributes to the unsustainable increase in water consumption. Such disorganisation indeed implies fragmentation of financial and technical capacities, a lack of data and vision at the metropolitan scale, and also regulatory obstacles for metropolitan investment. Moreover, systematising water pricing mechanisms between the different suppliers can be employed as a way to encourage water conservation by consumers.

Territorial fragmentation may also be an obstacle when considering water management in co-operation with rural areas, which is necessary in many cases. A survey of OECD cities showed that flood control mitigation and water quality often generate interdependencies between rural and urban areas, along other parameters (Figure 3.7). LGUs in the Province of Cebu should recognise the potential need to expand the metropolitan governance of water into adjacent rural areas. This is already the case regarding current plans to build dams and reservoirs, but other challenges should be considered. Flood control mechanisms and the preservation of watersheds, in particular, have strong urban-rural linkages in Cebu. Currently, there is no government body to address DRRM at the watershed level and there is no watershed management plan (for water supply and sanitation) that integrates the whole ecosystem boundaries "from ridge to reef". MCWD for instance only covers part of Metro Cebu and the corresponding watershed. The Department of Natural Resources and Environment (DENR) is also supposed to be involved in the management of watersheds, considering its oversight responsibilities, but it lacks capacities to do so. The issue also lies in the absence of a legal framework to address water challenges at such a scale specifically.

Figure 3.7. **Issues generating interdependencies between cities and surrounding areas in OECD cities**



Note: Results based on a sample of 30 respondents who indicated the issues as being "very important" and "important"

Source: OECD (2016), *Water Governance in Cities*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264251090-en.

Water governance in Cebu is also affected by high **sectoral fragmentation of water-related tasks** and raises obstacles for the adoption of holistic approaches for water management. A survey of OECD cities revealed that 50% of those examined reported this aspect as a prominent obstacle to policy coherence (OECD, 2016). In fact, in the case of Cebu, all water authorities mentioned above mainly manage water supply. For example, MCWD has not been actively engaged in septage and sewage until recently. There is almost no centralised water sanitation system, since septic tanks are the primary means of wastewater sanitation. However, in 2016, MCWD has launched a Septage Management Program in the city of Lapu-Lapu, after the city approved its septage and sewerage management ordinance in 2015. MCWD also established a septage treatment plant in Cordova town with a capacity of 150 cubic meters of sludge per day.[7] A more comprehensive approach at the metropolitan level is needed for all the water providers including MCWD, where services such as access to potable water (in light of the increasing demand), septage and sewerage management as well as reduction of loss of non-revenue water are considered altogether.

Flood management also requires concerted and coherent efforts across government agencies at each level of government. Some LGUs have recently created DRRM offices, but others have not and several departments may share the main responsibilities in this field (e.g. Planning and Development Office, Engineering Office, Building Office, Economic Affairs), due in particular to loose national policy framework on this matter. This means that there is no co-ordinated legislation and infrastructure to optimise together water supply, sanitation and flood resilience systems. Such sectoral fragmentations at national and subnational levels limit incentives for the diffusion of comprehensive water management solutions. More generally, the lack of co-operation between water bodies and other departments can be problematic: who is in charge of – or accountable for – a particular issue is not always clear, especially when the issue cuts across such domains as urban planning, the environment and economic development. For instance, it is difficult to know how permeable surfaces used for parking slots or streets should be defined in the context of urban drainage – as water related equipment or as transport infrastructures?

Who is in charge of managing them? Who is responsible for failures (OECD, 2015a)? An example of overlapping responsibilities and its negative consequences is the management of the river system in Metro Cebu, which has no clearly defined agency in charge for both the overall river system (e.g. LGUs, DPWH, DENR) and even within each LGU (e.g. Municipal Engineering Office, Environment Office) (JICA an MCDCB, 2015).

The lack of policy framework for WSS and flood resilience, and the lack of metropolitan water governance body are also reflected in the **unclear allocation of responsibilities between government corporations (LWUA, MCWD) and LGUs.** Local experts in Cebu have reported several times the uncertainty about who is supposed to undertake the different aspects of water management, i.e. planning, financing, operations, data monitoring etc. For instance, efforts have been made to regulate wastewater pricing in Cebu but problems of co-ordination and unclear allocation of responsibilities between different stakeholders have created difficulties. Generally speaking, this hinders policy preparation and implementation for WSS and flood resilience.

The territorial and sectoral fragmentation at the metropolitan and watershed levels can be tackled by the creation and empowerment of governance bodies that encompass wider territories than existing institutions (i.e. MCWD, LGUs). Recent developments in the institutional landscape of Cebu precisely go into this direction and offer opportunities to reform in depth the inefficient water governance system currently in place. Indeed, the creation of the **Provincial Water Resources Authority (PWRA)** in 2016, on the one hand, and the submission of the **Mega Cebu Development Authority (MCDA)** Act to the Congress (in 2016 as well), on the other hand, are timely decisions. One of the objectives of the PWRA in particular is to create a Cebu Water Code, inspired by the Water Codes of California and of Singapore. It could be an opportunity to recognise the need to address water management at the watershed level, to encourage water governance across jurisdictions when necessary and to develop a vision for the whole Province with concrete objectives of improvement of water supply and sanitation systems, and of enhancement of flood resilience, all supported by investment plans in the short, medium and long terms.

The MCDA, if created, will be supported by several corporations, including a Water District for the 13 LGUs of Metro Cebu (JICA and MCDCB, 2015). The Water District will have responsibilities in water supply and sanitation, and drainage, in particular "Water, septage and sewerage, and storm water management, which includes the formulation and implementation of policies, standards, plans, programmes and projects for water supply and water resources management; integrated storm water management, drainage and flood control; and septage and sewerage management system". The creation and empowerment of MCDA would fall in line with the national government's previous attempts to reform water governance in the Philippines, through the Angara Bill or Water Sector Reform Act 2011.

In the current context, there is however no certainty that these institutions will sufficiently help to tackle the water governance issues in Cebu. The creation of the MCDA is suspended to the decision of the Congress and the responsibilities and resources of the PWRA remain unclear. Government authorities should make sure that both entities have sufficient capacities to manage water resources and risks in Cebu, in particular:

- The ability to issue metro-wide or provincial ordinances and regulations on most matters that affect water supply, sanitation and DRRM in Cebu. For instance,

permits for groundwater extractions could be managed by the PWRA that has an oversight responsibility on the entire watershed, or if deemed appropriate, such responsibility could be incumbent to MCDA. A smart allocation of responsibilities between PWRA and MCDA is necessary so that there is no governance failure. PWRA should only have authority on matters in MCDA's jurisdictions when the issue may affect the whole watershed. MCDA's Water district and PWRA should also closely collaborate to ensure smooth co-ordination with other provincial departments. MCWD for instance regularly faces difficulties in obtaining excavation permits from DPWH to expand the water pipe infrastructure, and PWRA could help to raise awareness to other provincial departments on the need to increase Level III connections in the Province and deliver such permits quickly;

- The necessary funds to enforce regulations and to implement projects. This can be achieved through increased water revenues (see discussion in Section 1), further transfers or direct support from the national government (see discussion below), and in the case of Metro Cebu a significant share of budget allocation from MCDA. Currently, LGUs in Metro Cebu tend to not pay enough attention to water issues and do not have a holistic approach of water management. The creation of a metro-wide corporation supported by a supra-municipal authority should help to bring the water agenda upfront; and
- Technical capacities to formulate comprehensive water management strategies and projects. This includes dispositions to monitor and analyse data at the scale of the provincial and metropolitan areas. Such technical capacities can be increased through larger funds, but also technical assistance from higher levels of government (see discussion below). For instance, the national sewerage and septage management programme of the national government includes a mechanism for local projects to be supported at 30% by the central government, but LGUs in Cebu lack capacities to propose sound and credible projects for application. In terms of urban resilience, the PWRA and MCDA should also integrate and make greater use of the League of DRRM Officers existing in Cebu, and which is constituted of representatives from each LGU. The League is a form of knowledge-sharing and collaboration platform: for instance, a mechanism for sharing assets in case of disaster (e.g. human resources, technical knowledge) was created within its framework. As each member has a position in Cebu's LGUs, PWRA and MCDA should rely on these officers to increase capacity with the objective of ensuring that each LGU designs robust DRRM plans, and to integrate them coherently in metropolitan, watershed and provincial DRRM plans.

Metropolitan areas in other parts of the world can be a good inspiration for MCDCB and LGUs in building a metro-wide water authority and in understanding its potential benefits. The cases of Barcelona, Nantes and Vancouver are particularly inspiring, as well as Singapore which showed that institutional reforms are often necessary to design and implement comprehensive water management policies (Box 3.6). The case of Singapore also showed that metropolitan arrangements for water management also encourage innovation. The Public Utilities Board (PUB) which manages the different aspects of water management also leads the Environment and Water Programme Office (EWI), an inter-agency created in 2006 that promotes research and development in the water sector, and which notably aims to reinforce the water cycle system put in place in Singapore and combines water supply, sanitation and stormwater facilities together. These examples are also relevant for the PWRA, as they show the benefits of

integrated governance and management of water systems across multiple jurisdictions or at the watershed level.

Box 3.6. **Examples of metropolitan water governance**

Area Metropolitana Barcelona, Spain

The metropolitan area of Barcelona is formed by 36 municipalities of which Barcelona is the largest. From a hydrological point of view, the 36 municipalities are managed as a unique territory by the Metropolitan Authority (AMB). The AMB has regulatory and statutory authority. In the water sector the AMB approves regulations governing the integrated water cycle (supply, purification, distribution and sanitation) and the discharge of wastewater to the metropolitan sewage. It also approves tax ordinance to regulate the fees connected with the services and carries out administrative activities. The AMB has jurisdiction over most of these activities, which promotes integrated management of water supply and sanitation in the metropolitan area.

In the metropolitan area, there are seven wastewater treatment plants and three reclaimed water plants. Managing urban waters at the metropolitan level has fostered an integrated perspective of the water cycle level, as well as shared infrastructure and expenses. The AMB encourages customers' involvement to learn about different territorial needs and expectations. Next steps for AMB include looking at alternative sources for water and strengthening the water cycle management. Aguas de Barcelona was created in 2013, jointly with a large metropolitan utility, to manage drinking, reclaimed and wastewater for all the metropolitan territory.

Nantes Métropole, France

Nantes Métropole has prerogatives over the water policy in the 24 municipalities of its territory. This policy covers the entire water cycle: drinking water and collective sewage and wastewater, but also restoration of aquatic environments and storm water management. Since 2001, Nantes Métropole has been managing infrastructure that supplies drinking water and sanitation for nearly 600 000 inhabitants and chose the mix of management models in its territory. Nantes Métropole is in charge of the organisation of general public water services (collective and non-collective), and has the title of Organising Authority that sets the level of tariffs, defines the pricing policy for water and sanitation, and evaluates operators' performance.

Metro Vancouver, Canada

Metro Vancouver: the regional government, operating under the name "Metro Vancouver", provides services through four corporate entities, one of which is the Greater Vancouver Water District. It has a role in watershed management, water treatment, water transmission, wholesale distribution to municipalities, monitoring and reporting on Metro Vancouver water quality, and planning for Metro Vancouver water system's sustainability.

Singapore

Institutionally, the Public Utilities Board (PUB) currently manages the entire water cycle of Singapore. Earlier, PUB was responsible for managing potable water, electricity and gas. On 1 April 2001, the responsibilities for sewerage and drainage were transferred to PUB from the Ministry of Environment. This transfer allowed PUB to develop and implement a holistic policy, which included protection and expansion of water sources, stormwater management, desalination, demand management, community-driven programmes, catchment management, outsourcing to private sector specific activities which are not core to its mission, and public education and awareness programmes.

Source: OECD (2016), *Water Governance in Cities*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264251090-en; OECD (2015a), *Water and Cities*, *Ensuring Sustainable Futures*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264230149-en; Marest, P., Blanche, M., Guillard, M., Gouriten, Y., L'Honoré, O. and Perrouin, J-L. (2012) "Sustainable water management, the choices of Nantes Métropole" (article provided by the respondent of the Survey); Tortajada, C. (2006), "Water management in Singapore", *International Journal of Water Resources Development,* Routledge, Vol. 22, pp. 227-240.

The problem of sectoral fragmentation is also a consequence of institutional fragmentation at the national level: indeed, the National Water Resources Board (NWRD), the Department of Environment and Natural Resources (DENR), the Department of Public Works and Housing (DPWH) (which controls the Local Water Utilities Association, LWUA), the Department of Health (DOH) and the National Housing Authority (NHA) are all major stakeholders involved in water governance in the Philippines and affecting water management in Cebu. The co-ordination between these governmental bodies is weak, although the problem is well-recognised (ADB, 2013a). In addition, some issues do not benefit from sufficient attention: the only unit at the DOH addressing sanitation issues is the Environmental and Occupational Health Office of the National Disease Control and Prevention Centre, the mandate of which in sanitation is limited to policy formulation and monitoring of laws and policies (ADB, 2013a). This lack of institutional clarity and leadership is an obstacle to the creation of clear water policy frameworks (for supply, sanitation and flood resilience) for the entire country including clear allocation of responsibilities at the local level. The creation of a National Water Resources Management Office to manage water more comprehensively and effectively was in discussion recently, but no concrete action has been taken by the national government hitherto.

Devolving the proper responsibilities at the local level and enhancing vertical co-ordination

Water management in Cebu is also characterised by a vertical fragmentation of responsibilities and a lack of co-operation across levels of governments, which is a major obstacle to sound management of water resources and risks. Similarly to OECD cities, national legislations typically define cities' responsibilities, powers and, crucially, revenue sources, but attention to the basic legislative framework for cities is overlooked. In the Philippines, the Clean Water Act was adopted in 2006 and the National Sewerage and Septage Programme is in development, but there is no specific legislative framework for water supply, sanitation and flood resilience in cities (ADB, 2014), despite the existence of the Local Water Utilities Administration (LWUA) that supervises the various local water utilities of the country, and is attached to the Office of the President. In addition, there is a lack of water policy at the national law that comprehensively addresses supply, sanitation and flood issues. LGUs therefore do not have sound legislative framework and necessary financial support to ensure water security.

While the national government should improve its strategy for water security and clarify the role to be played by LGUs, a critical issue lies in the financial resources to support the necessary infrastructure projects. As mentioned previously, LGUs must raise revenues from water services, but this will not be sufficient especially to finance large projects such as the Lusaran dam, and the numerous responsibilities that they take on currently. MCWD in particular had been given more responsibilities than previous waterworks utilities but without proper investment capacities to achieve its objectives. Proper allocation of resources should be devolved at the same time as a policy framework for urban water supply, sanitation and flood resilience is made available nationally. In addition, the national government should also support LGUs' efforts more directly. Currently, there is no subsidy from the central government to LGUs in Metro Cebu for water projects. Such financial support would be particularly helpful to support some large infrastructure projects with high fixed costs such as dams, desalination and wastewater

treatment plans, and solar-powered water systems. The expansion of pipe infrastructure or reduction of non-revenue water could also be the object of specific development programmes financed by the national government, since these are also costly undertakings. The PWRA and MCDA could be privileged recipient as they can encourage holistic and cross-jurisdictional projects and therefore deliver higher impacts. In addition, it can be a solution to circumvent the fact that the national government cannot legally invest directly in territories administered by independent cities (i.e. Cebu City, Lapu-Lapu and Mandaue). The central government should also help subnational governments increase their capacity to attract external sources of finance. Neither the Province nor cities and municipalities have the power to issue green bonds, for instance, while a study has recently shown that stormwater and water supply are the two most attractive sectors and are increasingly growing in the fixed income market (DuPont et al, 2015).

In parallel, the national government can develop programmes to empower LGUs if competences are new and their capacity is limited. When dealing with new competences in water, as a result of early stages of decentralisation, subnational governments may indeed lack expertise. Central governments may "empower" subnational ones through capacity building tools that favour learning and dialogue (e.g. contracts across levels of governments) (OECD, 2016). This is particularly critical for flood risk assessment. While there are national laws for DRRM and climate change adaptation to be mainstreamed in CLUPs, in practice this is not achieved because of a lack of technical capacities at the municipal level and lack of awareness about national plans. As mentioned previously, many LGUs do not develop robust DRRM plans but instead just settle with weak plans to fulfil the conditions to receive the 5% share of the IRA. The national government should create mechanisms for technical assistance not only targeted at municipalities individually but also encouraging metropolitan and provincial wide action. It could also directly finance such capacity-building activities.

Finally, in some cases the sheer allocation of responsibilities should be carefully assessed, and PWRA and MCDA should be considered as good candidates to undertake some responsibilities that so far lie in the hands of the national government. Indeed, because of the complex situation on the ground, the national government lacks the specific knowledge about Cebu that would help to make proper decisions. National agencies also have inadequate financial and technical capacity for their oversight roles: LWUA monitors more than 500 water districts, at least half of which have less than 3 000 service connections. The NWRB has to oversee several thousand domestic water service providers such as the private developers, homeowners' association, water co-operatives, and other small water utilities, and the Department of Interior and Local Government (DLIG) oversees about 1 000 LGU-run water utilities (ADB, 2013a). A good example is the uncontrolled extraction of groundwater from private tiers that leads to a dangerous depletion of water resources in Cebu. The National Water Resources Board is the agency responsible for delivering such permits but in practice is loosely regulating the process, without assessing the capacity of local aquifers. Many persons and businesses easily get an extraction permit from NWRB, even though they dig within 100 metres of a pipe connection, which is illegal. This is one of the responsibilities that should be devolved to the PWRA or to the future Water District of MCDA. Other competencies, if they do not affect water management beyond the provincial level, could be delegated to LGUs in Cebu. It would fit well in the portfolio of the PWRA or 'MCDA's Water District, and would allow for a holistic management of water by such authorities.

The data challenge: monitoring and evaluation for a better management of water resources and risks

Managing water requires a good monitoring system. Currently, local authorities in Cebu possess too little data to understand the policy and investment needs, which results in a lack of incentives to act and potentially wasteful investment. Lack of up-to-date, integrated, harmonised, and comprehensive data on the sector continues to handicap both planning of developed water and sanitation infrastructure, and assessment of development gaps, in Cebu and in the Philippines (ADB, 2013a). Most existing data in Cebu have been produced through the JICA-MCDCB Roadmap study and focus on the Metro Cebu area. The following data issues, for instance, are critical:

- Lack of accurate water consumption data in all areas of Metro Cebu;
- Lack of data on unaccounted-for-water or non-revenue water outside MCWD service area;
- Lack of accurate data on the quality and continuity of water supply;
- Lack of data on the number of wells and abstraction of ground water;
- Lack of accurate data on the number of households possessing septic tanks; and
- Lack of data on past and potential economic damage of floods.

One reason for the lack of accurate data, not only in Cebu Province but also generally speaking in the Philippines, is the presence of many different water service providers (WSPs), including water districts, community-based small-scale WSPs such as co-operatives, rural waterworks and sanitation associations (RWSAs), barangay water and sanitation associations (BWSAs), homeowners associations, and property developers that supply water. A majority of them are not registered with the NWRB, nor are they attached to a national agency (ADB, 2013a). The lack of technical capacities and the fragmentation of responsibilities in WSS and disaster risk management (horizontally and vertically) are also responsible for these issues. The future MCDA and its Water District, in this perspective, will be instrumental in regulating and raising capacities to produce and monitor comprehensive data on WSS and flood vulnerability at the scale of Metro Cebu. It should ensure that the above challenges are tackled and that performance standards or monitoring and benchmarking performance be set up for water utilities. Such standards should also be established by the national government for the whole country (ADB, 2013a), and reiterated in the Cebu Water Code in preparation by the PWRA. Requiring WSPs to collect accurate and comprehensive data on water will be an option to raise awareness on the real cost and benefits of WSS policies and investment for better decision making.

Stakeholder engagement

Many of the WSS and flood / typhoon problems discussed previously are already well known of LGUs in Cebu Province. In fact, one of the most important governance elements to address is the lack of awareness among the population about the solutions to poor water management and the lack of popularity of some reforms among policymakers. Many laws and regulations also go in the right directions but are not well implemented. Increases in water tariffs, for instance, are often unpopular among citizens and therefore elected officials are unwilling to touch upon this aspect. However, sustainable consumption, and financially sound water utilities will have positive green growth

benefits by increasing the capacity of service providers, in the long term, to improve coverage and quality of centralised water systems. Also, raising awareness is critical to implement such measures as decentralised rainwater collection systems and generally speaking reduce unnecessary water consumption in households.

In this regard, it is extremely important that LGU officials including MCDCB / MCDA, and PWRA take a leadership role in raising general public awareness about water supply, sanitation and resilience issues. A civil society more aware of the threats of water scarcity, water pollution and climate change impacts will be a powerful incentive for political leaders to encourage and implement ambitious water development programmes.

Conclusion: Strengthening the water governance system and support a more comprehensive approach to water management

The Province of Cebu is facing great challenges in the water sector, in particular water scarcity in a context of increasing consumption due to population and economic growth, low coverage and efficiency of water distribution systems, sanitation issues affecting surface and ground water resources, and periodic floods. This chapter has demonstrated that the three aspects of supply, sanitation and resilience to floods are closely interrelated, and that policy synergies can be found to address water management in a comprehensive manner. Green infrastructures, for instance, provide ecosystem services which can help to refill groundwater, which ensure quality of water and increase the absorption capacity of urban areas in case of floods (Table 3.3). LGUs in Cebu should consider these options alongside or as alternative of harder and more costly infrastructure projects prescribed in the JICA-MCDCB Roadmap Study (e.g. dams). While dams, reservoirs, wastewater treatment plants are necessary given the high infrastructure gap in the Province, local authorities should be careful not to overinvest in such solutions, given their high cost and low flexibility. Green infrastructure, and also economic instruments and Information and Communication Technologies (ICT) (i.e. smart city tools) are more flexible, often cheaper and quicker solutions for water management. The case of Singapore also shows how green infrastructures can complement advanced technologies in creating a "water loop" that encourage water conservation and protection of ecosystems.

Table 3.3. **Green infrastructure solutions for water resource management**

Green infrastructure solution	Urban water management issue							
	WSS (including drought)	Water quality regulation			Moderation of extreme events (floods)			Protection of ecosystems
		water purification	biological control	water temperature	reverine flood control	urban stormwater	coastal flood (storm)	
demand management	x							x
local processing of black or grey water	x	x	x					
wetlands restoration/conservation	x	x	x	x	x			x
constructing wetlands	x	x	x	x	x			x
water harvesting	x					x		
green spaces	x	x		x		x		x
permeable pavements	x	x				x		x
green roofs						x		x
protecting/restoring mangroves, coastal							x	x
Corresponding grey infrastructure (primary								
dams, groundwater pumping	x			x				
dams, levees				x	x			
water distribution systems	x							
water treatment plant		x	x					
urban stormwater infrastructure						x		
sea walls							x	

Source: OECD (2015a), *Water and Cities: Ensuring Sustainable Futures*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264230149-en.

The links uniting the different aspects of water management call for a better integration of water authorities and responsibilities in Cebu but more generally speaking in the Philippines. The high sectoral fragmentation of water-related task and the fragmentation of water "jurisdictions" between water districts, LGUs, private providers, local associations etc. prevent quick and efficient reforms in water tariffs and charges, investment in large-scale supply and sanitation infrastructure, solid data collection mechanism at the provincial and metropolitan levels, and a holistic approach to flood resilience. For these reasons, all levels of government must be involved in reforming the water sector. In Cebu, PWRA and MCDA appear to be good candidates to promote such approach to water security at the watershed and metropolitan scales, and tackle the great challenges coming ahead for Cebu.

Main policy recommendations

- Develop and encourage **green infrastructures** more aggressively, such as rainwater collectors on buildings and retention ponds, green spaces in vacant land deemed unsuitable for development.
- Make greater use of **economic instruments to manage water demand**, such as increased block water tariffs, charges for water abstraction, and carrot and stick mechanisms to encourage developers and households to build or use green infrastructures.
- In parallel, adopt a specific economic instrument strategy for low-income households, in particular **abolish connection fees**, to expand standardised pipe infrastructure.
- Progressively install **smart water technologies**, in particular smart water metres, pollution sensors in water streams and runoff simulation tools to assess flood risk.
- **Scale up efforts to build robust DRRM plans in Cebu's LGUs, supported by a thorough assessment of the vulnerability** of businesses, industries, critical infrastructure and low-income households to floods. Develop corresponding flood risk maps and under different flood scenarios.
- **Establish a protection and rehabilitation plan for Cebu's watersheds**, which are vital in providing a sustainable water supply to the urban area, **by increasing the** human, material and financial **means of the Central Cebu Protected Landscape** and **through co-operation with local communities.**
- Take a stronger leadership in **promoting strategies for the resilience of businesses and industries**, such as continuity plans, regular communication channels on assets and employers at risk, and local insurance mechanisms, with the support of the national government and international organisation.
- Ensure, through PWRA and MCDA, means to **regulate and harmonise water governance in Cebu**, in particular flood control mechanisms, tariffs and charges (e.g. water abstraction), water production and supply, and water sanitation, and supported by **investment plans**.
- Clarify and build more coherence and synergies between water supply, sanitation, and resilience **policy frameworks** at the national level. Set up **national mechanisms for financial subsidies** to large infrastructure projects in Cebu such as dams, wastewater and desalination plants, solar-powered water systems, and expansion of pipe connections.
- Develop **metropolitan and provincial capacities to produce, collect and harmonise data on water supply, sanitation and flood risk**.

Notes

1. www.philstar.com/cebu-news/2014/12/02/1398190/mcwds-new-water-rates-take-effect-january-1.
2. The JICA-MDCDCB Roadmap study provides the figures for neighbours' wells and taps together, so the specific figure for neighbours' taps is unknown.
3. The average precipitation during this period is around 148 mm per month, against a mean of 105 mm per month year-round. In comparison, the average precipitation in London is around 50 mm per month. This is however lower than other Asian cities such as Tokyo (127 mm per month), Singapore (195 mm per month), and Bangkok (137 mm per month).
4. This information is based on a sample survey undertaken by JICA for the JICA-MCDCB Roadmap Study (2015). It is based on data referring to how many households (in percentage) experience flooding every year in each LGU of Metro Cebu.
5. http://choices.climatecentral.org/#12/10.3070/123.9222?compare=temperatures&carbon-end-yr=2100&scenario-a=warming-4&scenario-b=warming-2
6. A 100-year flood refers to a flood that statistically has 1% chance of occurring in any given year.
7. A JICA grant package is making it possible for MCWD to replicate the project through the rest of its service area. The grant will provide three septage treatment facilities that will serve the remaining 6 LGU's under MCWD service areas namely Cebu City, Talisay City, Mandaue City, Consolacion, Liloan and Compostela. The programme is still under the feasibility stages with completion set for 2019.

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