Integrated Urban Water Management - Lessons and Recommendations from Regional Experiences in Latin America, Central Asia, and Africa

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Key Findings

The purpose of this report is to review a set of Integrated Urban Water Management (IUWM) initiatives and pilot studies funded by the World Bank's Water Partnership Program (WPP) in Latin America and the Caribbean, Europe, and Central Asia and sub-Saharan Africa. The key findings are:

New Challenges, New Realities

- Growing cities face increasing challenges affecting the provision of basic urban services. As a result, business-as-usual approaches may be too costly and not resilient to land use changes, climate change, and other future shocks.
- Business-as-usual approaches with traditional engineering solutions are not likely to address the multitude of water issues (flooding and drainage, water supply quality and quantity, sanitation, urban irrigation) that cites face.
- The availability of water for cities in the catchment is shrinking due to land-use changes, demands for irrigation and energy, environmental degradation, climate change, and new urban settlements upstream. Often there is not enough water to satisfy all users.

IUWM: A Valid Tool for Planning, Decision Making, and Implementation

- IUWM is an emerging concept that can be used to complement traditional planning and technological approaches to resolving the existing challenges that affect the provision of services in cities.
- In addition to improved planning and management, the efficiency of securing and sustaining water resources for expanding cities can be increased through the implementation of alternative solutions, such as: (1) innovative technologies planned around new urban clusters, (2) decentralized infrastructure, and (3) diversification of water sources. These alternatives could be sequenced along with traditional infrastructure.
- A detailed understanding of the economic costs of IUWM will help decision makers and planners choose the best and most efficient solution for cities.
- Flexible and adaptive institutional frameworks need to be in place in order to sustain and secure the implementation of IUWM.
- Stakeholder participation is essential to guarantee the sustainability of IUWM.

IUWM Needs Going Forward

- Information and data on access to urban services, river basin hydrology, and the state of urban infrastructure are essential in order to plan IUWM approaches.
- There is a need to develop further research, gather more data, and operationalize IUWM approaches in several pilot cities.
- Support from international donors and already-established professional and academic platforms will help sustain and create a pool of common knowledge on IUWM.
- There is a need to develop analytical work targeted to policy makers so that they can make better assessments of the benefits of traditional versus integrated approaches to water management.

Introduction

According to the United Nations Population Division, the world population is expected to grow by 2.3 billion between 2011 and 2050, reaching 9.3 billion people. Most of the population growth over the next four decades is expected to take place in urban areas, which are predicted to gain 2.6 billion people and reach 6.3 billion inhabitants in 2050. Most of this urban population growth will happen in cities of one million or more residents in the less developed regions of the world (UNDESA 2012).

Green growth in urban areas is linked to the provision of basic services and the management of water resources and supply. The sustainable management and use of water resources, and the provision of quality services to a growing population underpin the future success of the development of cities. They are also important to facilitate economic growth, and are at the core of social and economic development in an urbanizing world.

Supplying water, sanitation, and other basic services to increasingly sprawling cities and growing informal areas represents both a technical and a social challenge. The lack of solid waste collection and its safe disposal affects the capacity of cities to deal with floods by clogging up the drainage. It also presents a risk for human health as well as the environment. The poor maintenance of pit latrines and lack of control of wastewater effluents pollutes water bodies, which in some cases are essential for supplying water to the city. The competition over the same resource between cities and other sectors also has implications at the river basin level.

With the world becoming more urban, the challenges cities face to provide secure and sustainable services for their growing populations are also growing. The process of human concentration in urban areas has important impacts on economic growth, but the risks associated with the lack of urban services can hinder the potential for economic and social development. Traditional technologies and current management and institutional practices are no longer sufficient to meet these challenges. Practitioners and decision makers are in need of tools to help them provide services that meet the needs growing urban populations while respecting other upstream and downstream users as well as the environment.

The emerging concept of Integrated Urban Water Management (IUWM) originates from the complexity of challenges affecting the provision of basic human services (such as water supply) in expanding cities worldwide. IUWM is an approach that seeks to develop efficient and flexible urban water systems by adopting a diversity of existing technologies, management, and institutional practices to supply and secure water for urban areas. The focus of this approach is the integration of planning, management, and stakeholder participation across institutions at each stage. IUWM's view on the urban water cycle is a holistic one by which all components of the cycle (water supply, sanitation, storm water management) are integrated within the wider watershed.

The Water Partnership Program (WPP), a multi-donor trust fund administered by the World Bank and funded by the governments of the Netherlands, the United Kingdom, and Denmark, supports the portfolio of World Bank projects on water by offering technical assistance and analytical work for project preparation and implementation across all water subsectors. Since its inception in 2009, a total of 214 activities in 62 countries have been initiated, representing $19.6 million in grants (WPP 2012).

In the past 3 years, the WPP has dedicated a substantial part of its resources to explore and develop the concept of IUWM through the implementation of a series of projects examining the main challenges and opportunities for IUWM in Latin America and the Caribbean (LCR), Europe and Central Asia (ECA), and sub-Saharan Africa.

This set of regional projects has focused on different but complementary methodological and practical aspects of IUWM. The study emphasized the use of innovative urban technologies in sub-Saharan Africa. In ECA, the WPP funded a project focused on the analysis of the economic costs of IUWM and the valuation of alternative water uses. In LCR, the main focus of the background reports was on the process and development of a theoretical and methodological framework. At the same time, a series of city studies highlighted existing cases of IUWM in the region.

The purpose of this report is to promote the dissemination of cross regional knowledge on IUWM based on the lessons learned from the WPP-funded activities in these three regions. The report also aims to promote the inclusion of IUWM principles in future World Bank urban water projects. Finally, the goal is also to stimulate the debate on IUWM at a global scale and produce evidence of its use and advantages.

The lessons arising from these three regions as well as the conceptual and methodological materials generated from the different projects represent a valuable set of implementation guidelines, good practices, and analytical tools. As such, they can complement and enrich the emerging knowledge and literature on IUWM.

This report is aimed at a general audience of researchers, practitioners, and members of the donor community involved in urban water and sanitation services, water resource management, and urban planning. The findings presented in this report will also interest city leaders and members of local and national agencies in charge of securing the future provision of urban services.

The structure of this report is as follows: chapter 1 introduces the main concepts of IUWM and describes the principal components for the operationalization of IUWM.

Chapter 2 reviews the findings of 10 case studies in three regions: Latin America and the Caribbean, Europe and Central Asia, and sub-Saharan Africa. This chapter also reviews the main aspects of each project and highlights their principal contributions to the general understanding of IUWM. Finally, chapter 3 puts forward a set of recommendations to sustain and enhance the scope of IUWM activities, and describes how the World Bank and its Water Partnership Program can facilitate the piloting, operationalization, and scale up of IUWM.

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CHAPTER 1. CONCEPTUALIZING IUWM

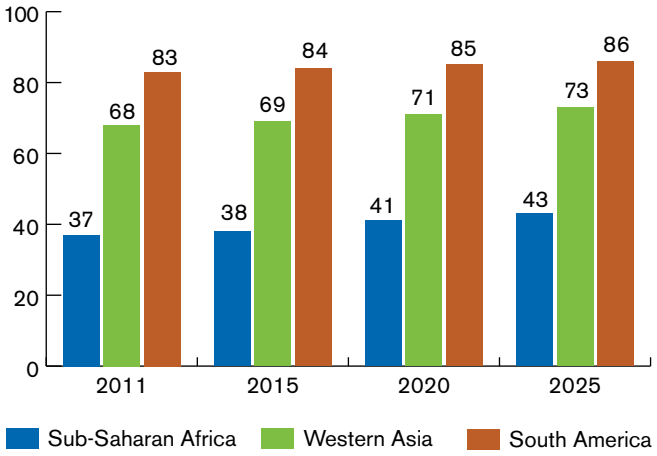
Population growth is a major factor in urbanization processes, and expanding cities can act as engines of economic growth. However, many challenges affect the provision of urban services such as solid waste, water supply, and wastewater collection. The World Bank's Water Partnership Program (WPP) has supported the development of an emerging integrated urban water management (IUWM) framework that can be used to optimize a response to those challenges. The WPP has supported several case studies in Latin America and the Caribbean (LCR), Europe and Central Asia (ECA), and sub-Saharan Africa.

1.1 Setting the Scene: Urbanization and Socioeconomic Development

The world is becoming more urban. According to the 2009 World Development Report, in 1900 only 4.3 percent of the world's population lived in the largest 100 cities, but by 2009 they concentrated almost 10.5 percent of the global population. The United Nations predicts that by 2030 more people will live in cities than in rural areas in every region of the world (UN-HABITAT 2008). In 2011, cities with 1 million inhabitants and more accounted for 40 percent of the world's urban population, and by 2025 they are expected to account for 47 percent. Regionally, Asia is expected to see its population increase by 1.4 billion, Africa by 0.9 billion, and Latin America and the Caribbean by 1.2 billion (UNDESA 2012).

Of the three regions studied, the pattern of urban population growth in South America shows the largest degree of urban concentration, with 83 percent of its current population living in urban areas (figure 1). While sub-Saharan Africa has the lowest degree of urban concentration, the region shows the highest annual growth rates (table 1), and is expected to reach an urbanization rate of 43 percent in 2025. By 2045, the urban population of sub-Saharan Africa will have almost tripled. Western Asia also presents a high degree of urban concentration (68 percent), which is expected to almost double by 2050.

FIGURE 1. URBAN POPULATION GROWTH IN LCR, ECA, AND SUB-SAHARAN AFRICA (PERCENT)



Note: the three regions correspond to UNDESA's definition of regions, which does not exactly correspond to the World Bank's definition but includes the countries included in this study.
Source: UNDESA 2012

The process of human concentration in urban areas has important positive impacts on economic growth as industries and capital converge (Bertinelli and Strobl 2007). Urban growth may concentrate production and income (Jacobsen et al. 2012). For example, the case studies show that the city of Aracaju in Brazil concentrates 56 percent of the GDP for the state of Sergipe (World Bank 2012b), while the city of Baku in Azerbaijan represents around 50 percent of the country's national economy (World Bank 2011). There is ample evidence that properly managed cities are engines of growth.

TABLE 1.
ANNUAL RATES OF URBAN GROWTH FOR SUB-SAHARAN AFRICA, WESTERN ASIA, AND SOUTH AMERICA

Region	Annual Urban Growth Rate (%)			
	2010-2015	2015-2020	2020-2025	2025-2030
Sub-Saharan Africa	3.61	3.53	3.4	3.28
Western Asia	2.47	2.17	1.92	1.71
South America	1.32	1.14	0.96	0.78

Source: UNDESA 2012.

National policies, as well as economic and political institutions can affect the process of urban concentration by encouraging businesses, firms, and workers to cluster around cities and build economies of scale that will make investments more attractive (Henderson 2003; World Development Report 2009).

The important role of cities arises also from their capacity to agglomerate, generate, and sustain economic activities. Cities are able to foster the exchange of ideas and technology, and also stimulate higher levels of economic growth through the concentration of workforce and the attraction of resources. The concentration of population in larger economic poles is also a driving market force that facilitates the exchange of goods and services (World Development Report 2009).

However, increased urban concentration, coupled with a lack of infrastructure creates major constraints and reduces business opportunities by raising transaction costs, which will hinder the viability of future business projects (Kessides 2005).

1.2 Review of Challenges to the Delivery of Urban Services

The environmental, social, and economic challenges affecting cities have rendered obsolete the delivery of urban services through traditional technology models. The spread of informal settlements and chaotic urban growth make the implementation of urban planning difficult. It is important to **recognize the interconnections and interdependencies between urban planning, resource management, and service delivery** if the development of cities is to take place in an efficient, clean, resilient, and equitable manner (World Bank 2012a).

Rapidly expanding populations and their demand for water can overstretch water resources in river basin systems and increase the risk of water scarcity. **Competing uses over water resources** from other settlements within small river basins can affect the current and future availability of water resources in cities. The uncontrolled sprawl of urban areas can also affect water supply through deforestation of river catchments and changes to river hydrology (World Bank 2012b; World Bank 2012e).

The **lack of water supply** can result in the over-extension of the existing water supply infrastructure, creating low-pressure areas in the city's pipes and causing them to burst (Jacobsen et al. 2012; World Bank 2011). Insufficient metering makes it difficult to estimate water consumption and non-revenue water losses. In addition, the lack of proper pricing mechanisms is not conducive to increased water conservation (World Bank 2012b; World Bank 2012f).

Over-extraction of groundwater is posing a threat to the sustainability of aquifers. When water abstraction exceeds natural recharge, groundwater becomes depleted and contaminated surface water–and salt water in coastal areas–can flow into aquifers.

The lack of adequate **connections to sewage systems** and the resulting discharge of untreated domestic and industrial effluent into rivers pollutes water bodies downstream, as well as strategic water resources and natural ecosystems (World Bank 2012c; World Bank 2012d). Surface and groundwater pollution problems result from unsafe, unsecure, and untreated wastewater effluents, and poorly managed and maintained septic tanks (Jacobsen et al. 2012). Water connections made with poor quality materials and deficient management practices are also another potential source of contamination (World Bank 2011).

Recurring **floods and the lack of proper drainage systems** is increasing the damage to physical assets as well as the number of people affected. Old drainage systems cannot keep up with population growth and **uncontrolled urban development such as informal settlements** in coastal areas, natural flood plains, and channel margins, increasing exposure to floods (World Bank 2012c). In coastal cities flooding can be exacerbated by hide tide events and the risk of sea level rise. Additionally, residents who lack adequate connections increasingly rely on insecure sources of water (springs, shallow wells), which are subject to pollution and contamination, especially after flood events (Jacobsen et al. 2012).

Cities are also facing **low efficiency and coverage of solid waste collection systems** and a lack of investment and suitable landfill sites for the safe disposal of solid waste and industrial by-products (World Bank 2011). Low rates of solid waste collection can cause drainage problems, increase the vulnerability to flooding, and threaten surface and underground water quality (World Bank 2012b; World Bank 2012e). These issues can significantly increase health risks.

Climate change and the lack of predictability of extreme weather events (e.g. floods and droughts) will also affect expanding cities. If the challenges affecting urban areas

are to be met it is imperative that planning begin now. Extreme events affect economic development. In addition, climate variability and change discourages investments and economic development thus aggravating poverty.

Institutional fragmentation and lack of coordination across sectors and municipalities is an underlying challenge for the management of urban water services. Fragmented institutional settings shared between municipal, state, and federal levels of government slow down policy implementation and, in some instances, make urban services management and planning inefficient. This lack of coordination at the municipal, regional, and national level creates undefined mandates, roles, and responsibilities, contributing to the poor enforcement of existing regulations (World Bank 2012c; World Bank 2012f).

Utilities operate **aging infrastructure** that is not adequate for supplying the cities of tomorrow. These infrastructures require high capital expenditure and funding; however, the **lack of cost recovery** places a limit on the ability to expand service. In addition, poor maintenance leads to poor continuity of service and inadequate water quality and supply. In sub-Saharan Africa, **non-revenue water** from service providers averages 39 percent, almost twice as much as the best practice of 20 percent. This average hides a wide range of figures. Some utilities have losses that reach as high as 68 percent of their revenues, while utilities in South Africa and Namibia post water losses of only 12 percent of their revenues (Dominguez-Torres 2011).

Coordination and management capacities are hampered by **outdated or inexistent integrated plans** (World Bank 2012b; Jacobsen et al. 2012). The lack of human and financial resources to face the challenges of urban water management impedes the implementation of policy and planning (Jacobsen et al. 2012). The lack of resources hinders the development of infrastructure and affects the sustainability of monitoring and information systems, as well as water quality and hydrologic and meteorological systems. This makes decision-making processes for cities and river basins more difficult (Jacobsen et al. 2012).

1.3 The WPP's Role in Promoting the Implementation of IUWM in the World Bank

The Water Partnership Program (WPP) was set up in 2009 as a multi-donor trust fund with funding from the governments of the Netherlands, the United Kingdom, and Denmark. The goal of the WPP is to address crosscutting issues related to water resources management and development. It was also tasked with supporting the expansion and improvement of social and productive water services in water supply and sanitation, irrigation and drainage, energy, environmental services, and water resources management.

The WPP aims to strengthen the World Bank's water lending projects by providing technical assistance and analysis, and by channeling expert support and applied global knowledge to projects during both the preparation and the implementation phases. It seeks to promote innovative and pragmatic approaches that will secure access to basic needs (water, sanitation, food, and energy) while protecting human, physical, and natural capital from water-related extremes. A goal of the WPP is also to sustain inclusive green growth through water security, supply as well as resource availability and quality.

TABLE 2.
IUWM RESEARCH PROJECTS AND CASE STUDIES FUNDED BY THE WPP (2009-2012)[1]

Region	Case Studies		WPP Disbursements (US$)	Number of WPP Grants
	Country	City		
LCR	Brazil	Aracaju	325,875	1
		Sao Paulo		
	Colombia	Bogota		
	Honduras	Tegucigalpa		
	Paraguay	Asuncion		
ECA	Azerbaijan	Baku	244,157	1
Sub-Saharan Africa*	Cameroon	Douala	372,310	2
	Kenya	Nairobi		
	Uganda	Arua		
	Uganda	Mbale		

Notes: LCR: Latin America and Caribbean Region; ECA: Europe and Central Asia. (*) The project in sub-Saharan Africa also included a diagnostic of challenges and opportunities for IUWM in 31 cities.
Source: The Water Partnership Program (November 2012).

1. This does not include WPP funding for regional IUWM workshops and dissemination activities after June 2012.

The WPP began providing support to IUWM in 2009, offering assistance to the Latin America and the Caribbean region to document the lessons learned in Sao Paulo and other regional cities in dealing with major challenges affecting the supply of water and other basic urban services. An initial grant request was put forward to the WPP and a task team was created to prepare a series of case studies of urban areas with good practices in IUWM, as well as a preliminary methodology for the diagnostic and development of IUWM. Since then, the WPP has supported four projects examining the potential of IUWM in three regions: Latin America and the Caribbean, Europe and Central Asia, and sub-Saharan Africa (table 2).

The WPP's support for IUWM has been carried out through grants allocated to specific activities to mainstream the concept of integrated urban water management in World Bank operations, and for the formulation of case studies in cities focusing on several practical aspects of the implementation of IUWM.

1.4 A Paradigm Shift from Traditional Technology to a Synergistic Relationship between the Urban and Water Sectors

The study carried out in Latin America and the Caribbean under the Blue Water Green Cities initiative sought to develop IUWM as a flexible, participatory, and iterative approach that integrates in a holistic way all components of the urban water cycle (water supply, sanitation, storm water management, and waste management). This integration happens within the city's urban development and in the context of the wider river watershed, helping maximize economic, social, and environmental benefits in an equitable manner (World Bank 2012a).

The IUWM approach in sub-Saharan Africa conceptualized the city's water cycle as a single living organism capable of sustaining a growing number of inhabitants through a continuous and sustainable cycle of interdependent urban services (Jacobsen et al. 2012).

Although varying in scope and aims, the three regional projects sponsored by the WPP have produced a set of different but complementary IUWM approaches. In LCR, the emphasis was on the implementation process and included a strong focus on stakeholder participation. In sub-Saharan Africa, more emphasis was put on alternative planning processes and innovative technical solutions to urban water challenges. In ECA, the focus was on cost benefit analysis and valuation of alternative uses of water. The aim of this section is to reflect upon these different and varying approaches in order to draw general and common knowledge on integrated urban water management.

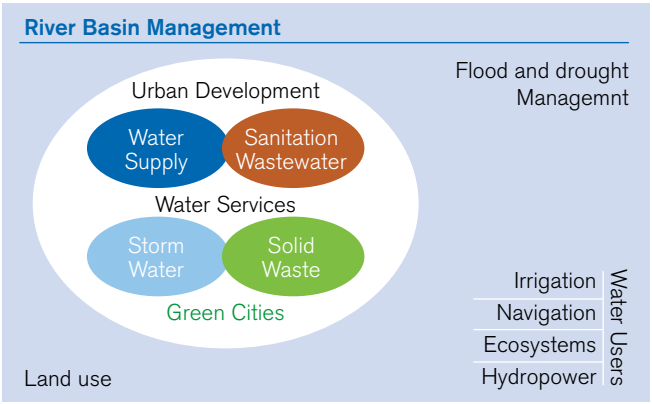
1.4.1 The IUWM Approach

The traditional business-as-usual approach to urban water management has locked-in urban development paths with large-scale infrastructure and technology. The emerging IUWM approach represents a change of paradigm from a traditional set of technologies towards a synergic urban-water relationship (figure 2). The need to incorporate new solutions to traditional engineering structures is not an option anymore. It has become reality because of the fact that urban populations very soon will struggle to find new sources of water. Water is seen as providing a multiplicity of services and uses that can be harnessed through integrated systems. For example, wastewater has added values in the form of water supply, energy or nutrients that can be retrieved by recycling it (Jacobsen et al. 2012).

Urban development is achieved by bringing together the components that affect urban water management: storm water, sanitation, water supply, and solid waste (figure 2). The links between the urban system and the watershed are combined with social participation and management integration to produce optimal social, economic, and environmental outcomes. Managing urban water across different institutions and organizations while allowing all players and end-users to be part of the process ensures the sustainability of the process and its outcomes.

The dependence and impact of cities on the wider watershed is also a fundamental part of integrated urban water management. Sustaining access to water resources for cities must take into account the needs of upstream and downstream users and incorporate planning measures at the watershed level. Additionally, the effects of upstream land-use changes, agriculture or deforestation can alter the hydrological regime (that is, the availability and the quality of water in river catchments) and cause stress on urban water supply systems. Conversely, cities can also have an impact on water quality for downstream users by releasing untreated wastewater effluents, or on water availability by reducing environmental flows (Jacobsen et al. 2012).

FIGURE 2. SIMPLIFIED IUWM CONCEPTUAL MODEL



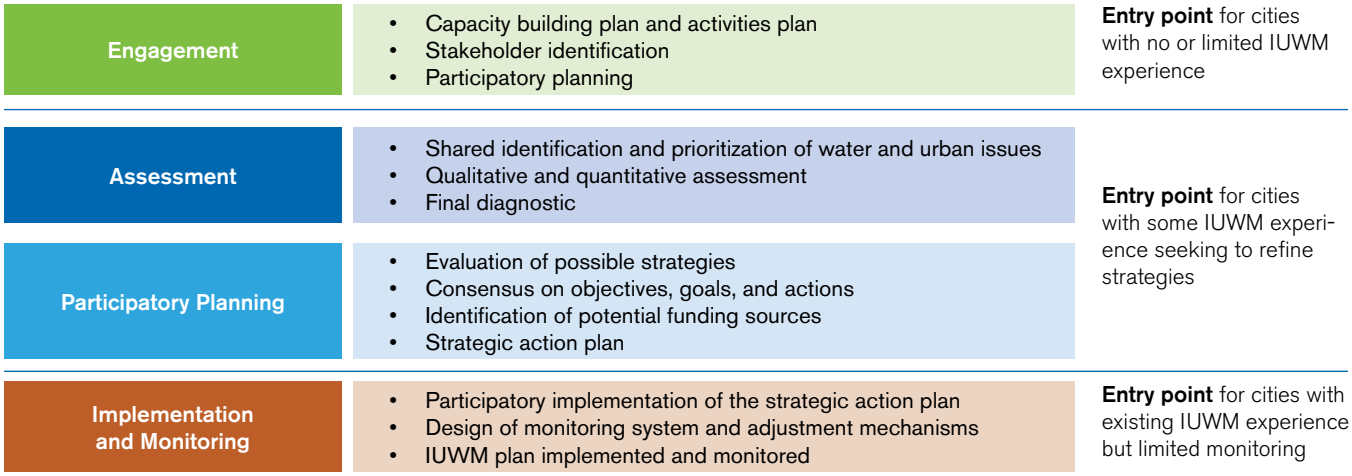
Source: World Bank 2012a based on Porto and Tucci 2010.

BOX 1. GOOD GENERAL PLANNING AND MANAGEMENT PRACTICES FOR IUWM

- IUWM needs to be tailored to the specific and dynamic challenges of each urban area
- IUWM has to incorporate in its scope the different interactions among users in the watershed
- IUWM involves a set of participatory approaches and instruments
- IUWM is not a one-time action, but an iterative, long-term process
- IUWM is as much about institutions and processes as it is about infrastructure and investments
- IUWM must be informed by sound science and technical analysis
- IUWM requires moving away from segmented, linear thinking towards a more interdependent and integrated urban planning
- IUWM seeks to address today's challenges without losing sight of tomorrow's needs.

Source: Based on World Bank 2012a.

FIGURE 3. PHASES FOR THE OPERATIONALIZATION OF IUWM



Source: Based on World Bank 2012a.

Following a set of good planning and management practices (box 1), the overall benefit of adopting the IUWM approach is its capacity to simultaneously consider the interdependent issues concerning water supply in growing urban areas given the multiple challenges of urban and industrial development, preservation of the environment, and climate change, while at the same time taking into account both traditional and alternative water resources (Scandizzo and Abbasov 2012).

Finding inclusive and adaptive technology solutions to provide basic social services will require institutional and management flexibility and innovation. The diversification of solutions to supply water for cities through adaptive systems will improve the cities' water security and will help cope with future uncertainty. Such innovative approaches (e.g. integration of decentralized wastewater treatment systems for different urban areas, groundwater, recycled water, rainwater harvesting or maintenance and improvement of leakage control) could be as good as building a new water reservoir and, in some cases, also cheaper (Eckart et al. 2012a, 2012b; Jacobsen et al. 2012).

Ultimately, IUWM can contribute to better urban water management in the following ways:

- It can provide a more complete analysis to diagnose a city's water issues and prioritize interventions.
- It can improve planning integration and infrastructure sequencing.
- It can inform better engineering practices by providing a more diverse set of options.

1.4.2 Methodology for the Operationalization of IUWM

The work funded by the WPP in Latin America has produced, among other outputs, a methodology for the operationalization of integrated urban water management. This guide establishes a set of phases through which it is possible to plan, develop, and implement an IUWM plan (figure 3). The WPP-funded project in sub-Saharan Africa also emphasized that implementing an IUWM approach needs to be combined with assessment and implementation of different solutions (Jacobsen et al. 2012).

The aim is to present an overall roadmap of the main milestones to be considered when engaging in IUWM for decision-making purposes. It is a step-by-step approach that can be used to guide practitioners in assisting cities and metropolitan areas in developing or strengthening IUWM strategies. Additionally, it can also be used to assist other actors at the municipal or national levels in planning and prioritizing urban investments (World Bank 2012a).

The different phases are designed to respond to the specific challenges of a city and its level of institutional development through a set of different activities.[2] Although the phases are designed for cities for which IUWM is a new concept, the proposed guide for Latin America and the Caribbean allows for several entry points at different steps in the process for cities where IUWM involvement is already somewhat advanced.

1.4.3 Studying the Costs of IUWM Options

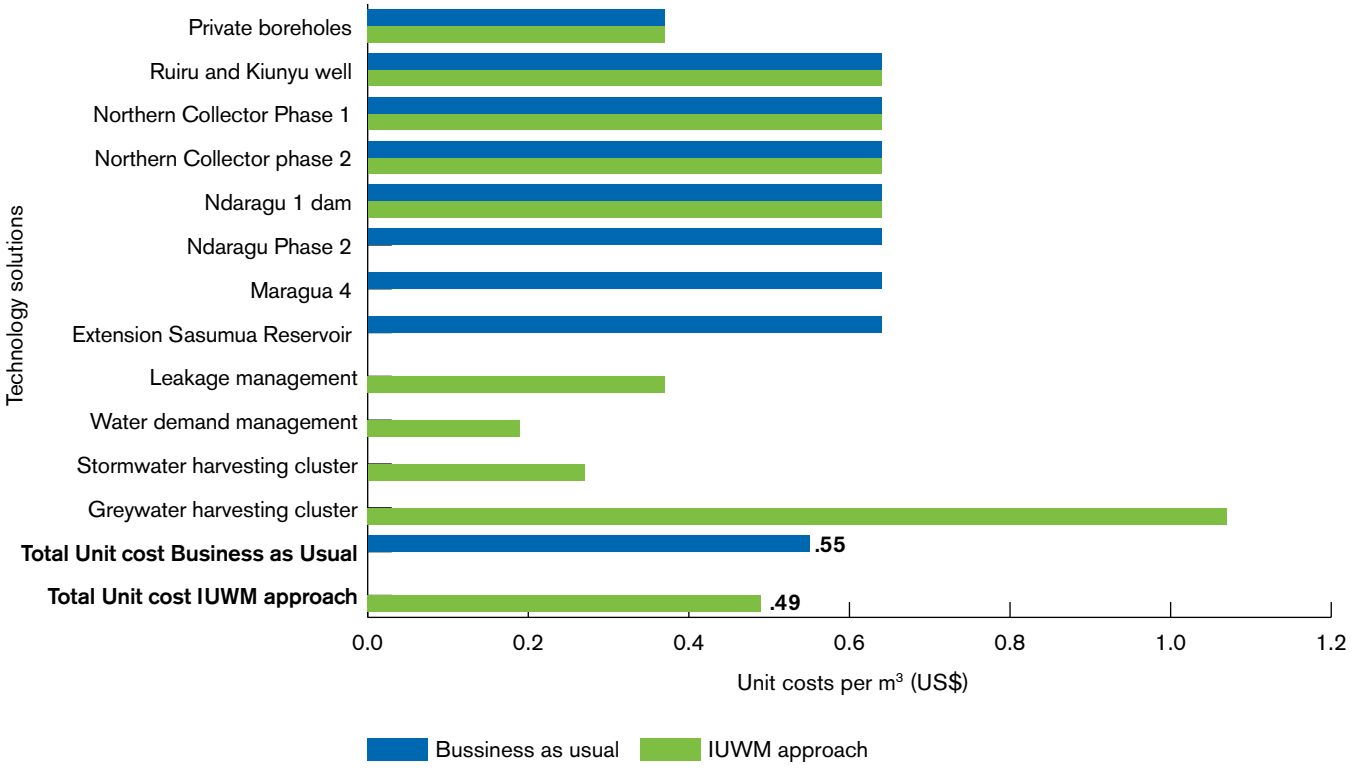
Seeing IUWM as an adaptive framework means finding solutions to problems in a specific case-by-case approach. Studying the initial conditions and diagnosis is essential for the success and effectiveness of IUWM. This implies a thorough understanding of the economic, political, and technical set up of urban water management, as well as the institutional structure.

The identification of potential economic benefits for each proposed technological option will require an understanding of all water-related investments and their linkages, as well as a complete assessment of current and future alternatives for water supply. These first economic assessments will allow the decision makers to form an idea of the financial capacity to implement the proposed option, as well as the timeline and funds needed (Scandizzio and Abbasov 2012).

For the study of Baku, Azerbaijan, the maximization of benefits was derived by estimating the non-use values attributed to water and the benefits that will accrue from improvements in water and sanitation supply and service delivery, wastewater treatment and improvement in efficiencies in the distribution system, and in freshwater and coastal water quality (Scandizzio and Abbasov 2012).[3]

In Nairobi, the activity supported by the WPP concludes that implementing an IUWM strategy for the city should include setting up storm water and greywater harvesting clusters, as well as improving leakage and water demand management (figure 4) (Eckart et al. 2012). The unit costs per cubic meter of the implementation of those IUWM services (in combination with limited traditional infrastructure) are lower than those of the business-as-usual strategy with only traditional water infrastructure, both new reservoirs, and the extension of old ones.

FIGURE 4. UNIT COST OF WATER FROM TRADITIONAL AND IUWM SOLUTIONS FOR NAIROBI

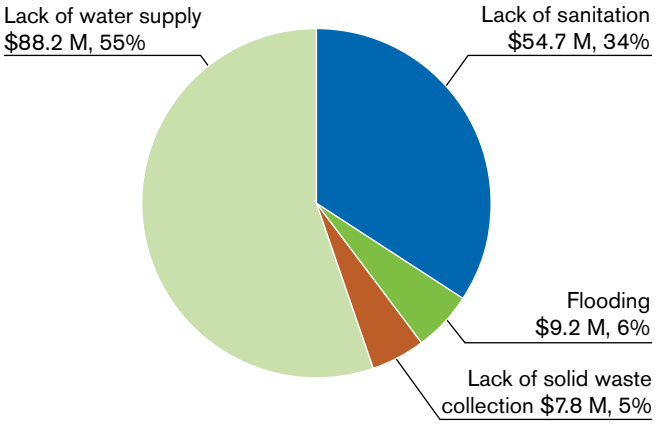


Source: Based on Eckart et al. 2012a.

2. See annex 1 for a more detailed account of the different activities for each phase.
3. See chapter 2 and table 2 in Annex.

A study of the economic cost of deficient urban water services in Honduras highlighted the amount paid by the city of Tegucigalpa for not maintaining and investing in urban services (figure 5). The amount exceeded $160 million or close to 2.5 percent of the country's gross national product (World Bank 2012f).

FIGURE 5. THE ANNUAL ECONOMIC COST OF DEFICIENT URBAN WATER SERVICES IN TEGUCIGALPA, HONDURAS



Source: World Bank 2012f.

1.4.4 Overview of Global IUWM Initiatives

In addition to specific cities that are currently planning and managing integrated urban and water services, there is a growing body of knowledge and global experience about IUWM practices sponsored by several international organizations and research programs.

Project SWITCH (funded by the European Union) involved a consortium of 33 partners, academic and practitioner organizations, and municipalities from 15 countries. This project, which began in 2006 and ended in 2011, focused on developing practical guidelines for the implementation of IUWM solutions for the city of the future. It included research projects on technology options, training toolkits, and demonstration projects in 12 cities in 4 continents. This project's positive impact was sustained by learning alliances specifically created to provide key stakeholders with a decision-making platform for the definition and formulation of strategic urban plans.

The Global Water Partnership (GWP) was founded in 1996 by the World Bank, the United Nations Development Programme, and the Swedish International Development Coordination Agency to foster research and practice in integrated water resource management (IWRM). This initiative represents a major milestone in ensuring the development of IWRM principles at the transboundary, country, and also urban level. It includes more than 50 country partners and more than 1,000 formal partner organizations. The GWP Toolbox and technical publications is a general repository of IWRM and IUWM knowledge and practices.[4]

The International Water Association (IWA) and its *Cities of the Future* program were set up as one of the IWA's key programs to ensure water security for the cities of the world. The harmonized and re-engineered design of cities to minimize the use of natural resources and the impact on the environment is linked with an increase in coverage of water and sanitation. With this program, IWA aims to help cities, utilities, and the consulting and research community to work together in order to create robust, sustainable, and resilient responses to the changes cities are facing.

The Local Governments for Sustainability organization (ICLEI) is an association of cities and local governments dedicated to sustainable development. ICLEI brings together 12 mega-cities, 100 super-cities and urban regions, 450 large cities, and 450 small and medium-sized cities and towns in 84 countries. This association was founded in 1990 and its goals are to promote local action for global sustainability and support cities to become sustainable, resilient, and resource efficient by building smart infrastructures and connecting local leaders and urban communities to achieve global sustainability and green economic growth.

In Australia, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) has funded collaborative research on IUWM undertaken by professional groups, research organizations, and national universities. Their research focuses on providing and improving technologies for efficient urban delivery and distribution of water, as well as the implementation of safe and efficient sustainable water production systems (from wastewater, storm, and roof water). Their focus also includes research and assistance for urban planners, managers, and policy makers to better understand the transitional processes towards alternative and sustainable water systems for cities.

4. See, for instance, Technical Background Paper No.16 on Integrated Urban Water Management by Bahri (2012).

CHAPTER 2. OVERVIEW OF IUWM PROJECTS IN THREE REGIONS

The WPP has funded activities on integrated urban water management in Latin American and the Caribbean (LCR), Europe and Central Asia (ECA), and sub-Saharan Africa. The initiative in Latin America and the Caribbean focused on the IUWM implementation process and served to develop a conceptual framework and implementation guide for integrated urban water management. It also studied five cases where different challenges have undermined the capacities of local and national governments to provide sustainable urban services, as well as social and environmental benefits for the targeted populations. In Europe and Central Asia, the focus was on formulating an IUWM strategy for Baku, Azerbaijan, that included a study of the willingness to pay for improved water services and a cost-benefit analysis (CBA) strategy. In four cases studied in sub-Saharan Africa, the project emphasized alternative planning processes and different technical and cost solutions for supplying water and providing wastewater services following IUWM strategies. This chapter provides more details on each of these activities.

2.1 Latin America and the Caribbean: Conceptualizing IUWM and its Operationalization

The support provided in Latin America and the Caribbean helped define the conceptual model for integrated urban water management and design an operational methodology for cities wishing to develop IUWM strategies. The purpose of this exercise was to articulate the concept of IUWM and the linkage between urban water services, urban development, and river basin considerations, and to ground it in specific case studies.

The first step was to test the preparation of a preliminary methodology to assess and evaluate IUWM alternatives in several urban areas. This framework was develop to serve as operational guidance for the strategic implementation of IUWM, and to be used as an overall roadmap of the main milestones to be considered when engaging in IUWM for decision-making purposes (World Bank 2012a).

The selection of cities in LCR had as its aim to facilitate the sharing of cross and intra-regional experience on integrated urban water management. It was based on the following criteria (World Bank 2012a):

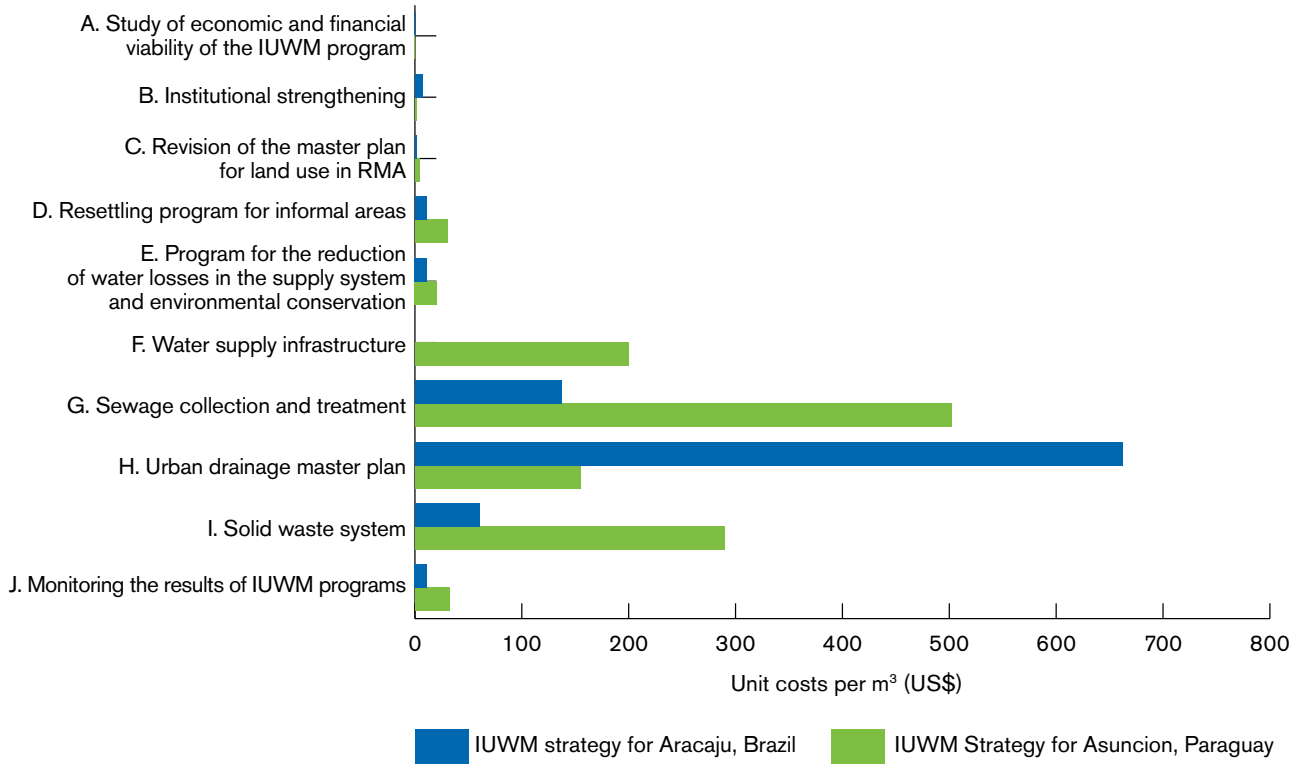
- Current client engagement in the city;
- The potential scope for replication of the study;
- The typology of institutional complexity;
- The size of the city;
- Regional representation; and
- Typology of vulnerability and risk.

2.1.1 Using Case Studies to Highlight IUWM Challenges and Good Practices

The WPP's support was formulated under the Blue Water – Green Cities initiative, which helped create a knowledge base to assist municipal actors in addressing urban water challenges by working across sectors. These case studies focused on specific challenges and solutions that reinforced institutional and planning structures aimed at sustaining IUWM practices.

The calculation of costs associated with IUWM activities is also an essential element for assessing and planning future IUWM options. Part of the IUWM study for Aracaju, Brazil, and Asuncion, Paraguay, created cost estimates for IUWM activities in these two cities (figure 6). These cost estimates present important intervals of variation due to

FIGURE 6. COST ESTIMATE OF IUWM ACTIVITIES IN ARACAJU, BRAZIL, AND ASUNCION, PARAGUAY



Note: See annex 2 for detailed costs for each city.
Source: Based on World Bank 2012b; World Bank 2012c.

local conditions in each city and would need to be revised during the preparation of the terms of reference for the project. However, they represent an invaluable first take on the economic and financial viability of IUWM in these cities.

2.1.2 Highlighting Good IUWM Practices in Latin America and the Caribbean

The case studies undertaken in LCR provided lessons that illustrate successful practices to achieve sustainable and secure service provision in cities.

The city of Sao Paulo, Brazil, enacted innovative laws to overcome existing silos in urban water management. The aim of the 2007 State Complementary Law was to coordinate water management among the State government, the municipalities and the utilities. The law also created a State Water Council for water supply and sanitation. Cross-municipal coordination efforts improved with the Macro-Metropolis Plan, a long-term plan to provide water to the Metropolitan Region of Sao Paulo. Federal growth and development plans (loans and grants) that created key infrastructures for water supply, housing, and urban upgrading also helped support the multi-sector and multi-actor initiatives to achieve integrated urban water management at the state and municipal level (World Bank 2012e).

In Bogota, Colombia, coordinated action between the central and local governments helped address wastewater management problems and legislation. The central government issued a strategic plan for the environmental management of the Bogota River that included the construction of small wastewater treatment plants (WWTPs), environmental restoration projects, flood control works, and a program for the management of the city's wastewater (that upgraded the current Salitre WWTP and a created a new plant). A signed agreement between the municipal authority, the regional environmental agency and the public water utility helped to define the roles and responsibilities of each entity based on national directives (World Bank 2012d).

Innovative and inclusive multi-sector solutions for urban water management in Tegucigalpa, Honduras, have come from coalitions between government actors and civil society. A holistic environmental approach has made possible the preservation of ecosystems that are essential for the city's water supply sources. This approach relies on a scheme of payments for ecosystem services to finance a number of activities to conserve land and water quality. The financing is raised through water tariffs in (World Bank 2012f).

Additionally, after a drought in 2010, a coalition of economic interests and concerned stakeholders created an organization

to lobby the government to build a new water reservoir. With the help of the World Bank-funded initiative in Tegucigalpa, this organization received just-in-time technical support to extend the scope of its activities beyond traditional water resources management. The project was also able to support the finalization of an urban water strategy that included a study and technical analyses of various options to solve the current water crisis (World Bank 2012f).

2.2 Europe and Central Asia: Planning Infrastructure and Valuing Non-use Water Services for IUWM Activities in Baku, Azerbaijan

In Europe and Central Asia, the WPP supported the development of an IUWM strategy for the city of Baku in Azerbaijan, and analyzed the economic viability of the strategy based on a detailed study of infrastructure options for supplying water to the city, an analysis of the valuation of water by the population, and a CBA of several interventions (Scandizzo and Abbasov 2012).

The Greater Baku Area (GBA) extends over 2,528 square kilometers and comprises eleven districts in the cities of Baku and Sumgayit, as well as part of the Absheron District. By the end of 2010, it had an estimated population of 3,019,192 inhabitants and had grown by about half a million since 1998 (World Bank 2011).

Most water sources for GBA are polluted. The Samur River, a main source of water, is highly polluted with oil. Sulphates often exceed the maximum allowed concentration by 4 to 5 times. The other two important water sources, the Kura and Araz rivers, form the largest transboundary river network in the South Caucasus. Most of the small streams of the Kura basin are highly polluted by the mining industry over the past 50 years in Azerbaijan and Armenia. Although, recently, many of these operations have stopped, the mines continue to be sources of pollution. With 11 million people living in the catchment area, these rivers are also organically polluted by the discharge of municipal waste (Scandizzo and Abbasov 2012).

Integrated urban water management in GBA is of special significance for three reasons (World Bank 2011). First, the availability and management of water resources are critical because of natural conditions arising from low precipitation, high evaporation rates, and the complex interconnection of different types and origins of water sources. Second, demographic pressure is especially high due to explosive urban growth, but also to the continuing importance of agricultural and industrial activities, all heavy users of water and all to a large extent responsible for the increase in pollution. Third, in the past, water resources have been mainly developed in order to accommodate the increasing population and economic activity, with little attention to environmental deterioration and recreational uses of water.

2.2.1 Economic Evaluation of Water Services in Baku

Calculating the value of water as an economic resource and planning water management measures that maximize the creation of value for water services from the point of view of users is a useful tool for addressing the problem of inadequate water supply (Scandizzo and Abbasov 2012). The economic evaluation of water services in the Baku area aimed at integrating the non-use values of water into water resource planning. It also investigated how to use economic incentives to increase the quantity and quality of water consumed to satisfy competing demands, and how much it would cost (Scandizzo and Abbasov 2012).

A survey of the local community was carried out to ascertain their views regarding water use and the services provided by water. The survey was used to place a value on these uses, which is important to maximize the impact of specific water-related investments. The preferences of the respondents with respect to alternative water uses and their willingness to pay[5] for a set of alternatives and improvements in the quantity and quality of water supply where established following different combinations of activities and services related to the rehabilitation of water supply in GBA (Scandizzo and Abbasov 2012) (see annex 4).

2.2.2 Cost of IUWM Strategies for Baku[6]

The study of the IUWM options for the city of Baku was based on a water infrastructure planning model (WEAP) built to analyze four scenarios of how supply and demand gaps could be closed and come up with alternatives for the allocation of additional drinking water. The aim of this exercise was to assist planners and decision makers by informing the selection and sequencing of policy decisions and investment plans based on the results of the model (World Bank 2011).

The identification of potential economic benefits and proposed methodologies for their estimation requires a thorough understanding of all the water-related investments in the GBA and their linkages. For this particular study, and based on a preliminary assessment, the maximization of benefits was derived from estimating benefits that will accrue

5. The uses of water can be associated with the provision of goods (e.g. drinking water, irrigation water) and services (e.g. hydroelectricity generation or recreational uses) to agriculture, industry, and households. The values people assign directly and indirectly to these goods and services are reflected in their willingness to pay (WTP) (Scandizzo and Abbasov 2012).
6. See annex 3 for more detail on the additional costs of IUWM strategies in Baku.

from improvements in: i) the provision of water supply and sanitation services, ii) wastewater treatment, iii) efficiencies in transmission and distribution of water, iv) water losses in the network, v) freshwater and coastal water quality, and vi) property values (Scandizzo and Abbasov 2012).

The development of the water sector in the GBA for the period 2010-2025 was based on four scenarios: (i) business as usual, (ii) 50 percent efficiency improvement, (iii) 50 percent reduction in diversions from Samur, and (iv) a combination of (ii) and (iii). A set of 10 development goals to be achieved by 2025 was selected from the principles underlying sector laws, regulations, and government programs, as well as through one-on-one consultations with stakeholders (World Bank 2011) (table 3).

According to the findings, the highest priority to improve the performance of water services in the GBA is the rehabilitation of the water distribution network, which requires short-term investments. If these short-term investments are not made, the benefits of the large water supply projects underway will be negligible. Similarly, unless the sewerage and storm water networks are rehabilitated, the benefits of investments in wastewater treatment and disposal will not be sustainable (table 4).

2.3 Sub-Saharan Africa: Planning Innovative Technology Strategies and Assessing Challenges and Opportunities for IUWM

The WPP funded an integrated urban water management project in sub-Saharan Africa that included a detailed diagnostic of 31 cities (see annex 5), a study of knowledge, attitudes, and practices (KAP) of IUWM, and pilot studies. The project also entailed an assessment of the potential opportunities, new technologies, and costs of IUWM in Nairobi (Kenya). Mbale and Arua (Uganda), and Douala (Cameroon).

TABLE 3.
SECTOR DEVELOPMENT GOALS FOR GBA

	Sector Development Goal	Target			
		2010	2015	2020	2025
1	Population with 24/7 service (%)	60	90	100	100
2	Area with adequate pressure (%)	10	50	100	100
3	Reliable water at tap (%)	20	80	100	100
4	Sewerage coverage (%)	80	95	100	100
5	Pollution in Baku Bay (BOD)	High	Medium	Low	None
6	Flooding (Ha)	1000	500	50	10
7	Urban development (Units)	100	1000	5000	8000
8	Environment (Ha degraded)	10000	9000	8000	7000
9	Solid waste (% in landfill)	60	80	100	100
10	Financial sustainability (%)	50	75	100	100

Source: World Bank 2011.

TABLE 4. WATER SUPPLY NETWORK REHABILITATION INVESTMENTS IN GBA

Component	Cost US$ million	Short Term US$ million	Comments Short term
Water Pipes	194	20	Cleaning, service connections
Water Pumps	84	36	Replace oldest pumps
Reservoirs	30	17	Rehabilitate
Sewer Pipes	75	15	Mechanical cleaning
Sewer Pumps	30	20	Replace (PS1&2)
Drainage	45	20	Mechanical cleaning and cross connections
Modernization	25	25	Measuring, modeling, SCADA
Total	483	153	

Source: World Bank 2011.

2.3.1 Background Study of 31 Cities in Africa

Background research on the attitudes, knowledge, and practices of water managers and city officials with respect to integrated urban water management, as well as in-depth analysis of 31 cities through data analysis, mapping, and the construction of an IUWM Index for sub-Saharan Africa helped identify the main challenges and opportunities for IUWM in Africa.

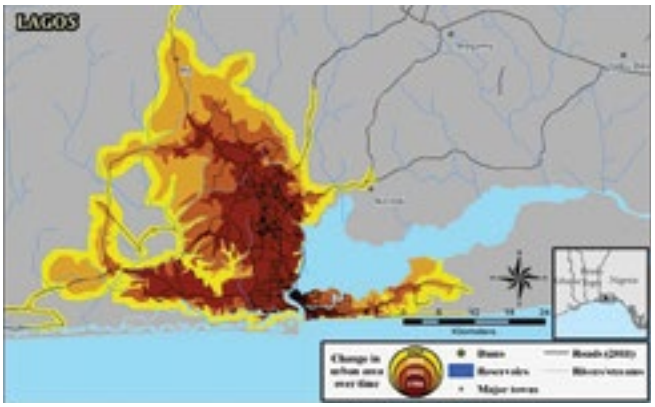
The cities included in the study were chosen on the basis of population growth rates, size, and presence of World Bank projects. The study corroborates the notion that urbanization in sub-Saharan Africa is happening fast. Of the 31 cities, 20 are growing at an annual rate of more than 3 percent and four (Yaoundé, Kumasi, Luanda, and Abuja) have posted annual growth rates of more than 5 percent (Jacobsen et al. 2012).

According to the study, improvements in access to basic services are needed in all of the cities. Access to improved sanitation averaged 53.6 percent in the 31 cities, while access to solid waste disposal averages 51.7 percent and the collection rate ranges can be as low as 20 percent in some cities (Closas et al. forthcoming). Additionally, although a growing population means increased demand for basic water supply, the infrastructure in many sub-Saharan cities is old and non-functioning. The average individual residential water consumption for the 31 cities studied is 65.7 liters per capita per day, but for 13 of those cities the daily residential water consumption is lower than 50 liters, the minimum basic water requirement for personal and domestic uses recognized by the United Nations and the World Health Organization.

Following the work done in Latin America and the Caribbean, a composite IUWM Index was constructed for sub-Saharan cities to describe the capacity of these 31 cities and the challenges they face with respect to integrated urban water management. The index aggregates several multidimensional concepts linked with urbanization, governance and institutions, solid waste, water resources and supply, sanitation, and flood management. Each city was placed in a matrix reflecting the different levels of opportunities and challenges for IUWM, creating a range of situations to anticipate the challenges for developing and implementing IUWM in each city (Jacobsen et al. 2012).

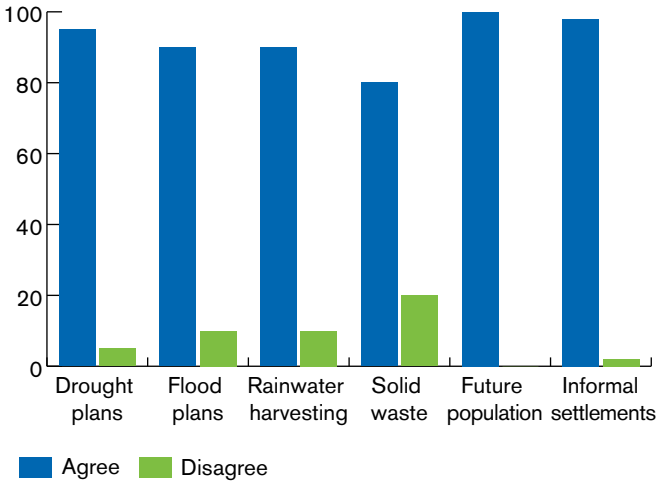
Visualizing and predicting urban growth, and the size and location of future development areas are valuable tools for looking at differences in urbanization processes. They can also help visualize water management spatially, linking it to future urban planning (figure 7).

FIGURE 7. MAP OF THE EVOLUTION OF URBAN SPREAD IN LAGOS, NIGERIA (1986 – 2025)



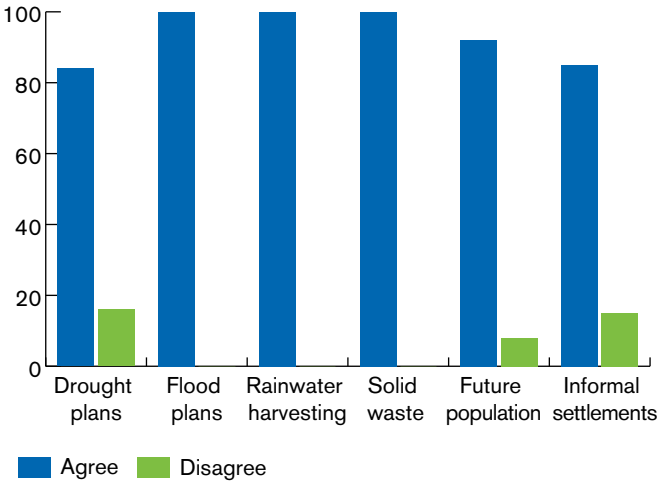
Source: Jacobsen et al. 2012.

FIGURE 8A. WATER OPERATORS: ISSUES THAT SHOULD BE INCLUDED IN FUTURE PLANS (PERCENT)



Source: Jacobsen et al. 2012.

FIGURE 8B. MUNICIPALITIES: ISSUES THAT SHOULD BE INCLUDED IN FUTURE PLANS (PERCENT)



2.3.2. A Study of IUWM Knowledge, Attitudes, and Practices (KAP)

The results of a KAP survey of 13 municipalities and 24 water operators in 28 countries reflect their interest in developing and incorporating more aspects of integrated urban water management into their current and future planning practices (figure 8a and 8b). However, they also highlighted the need for more investment, technical support and assistance, capacity building, and knowledge sharing.

Utilities and municipalities agree on the fact that issues such as flood risk and water metering should be included in future urban management plans. More than 90 percent of the cities and 60 percent of the utilities strongly believe that flood risk areas are a priority for planning, and 90 percent of utilities and 80 percent of the cities strongly agree with including water meters as part of their strategic and master plans (Closas et al. forthcoming).

2.3.3 IUWM Approaches to Diversify Water Resources in Four Cities

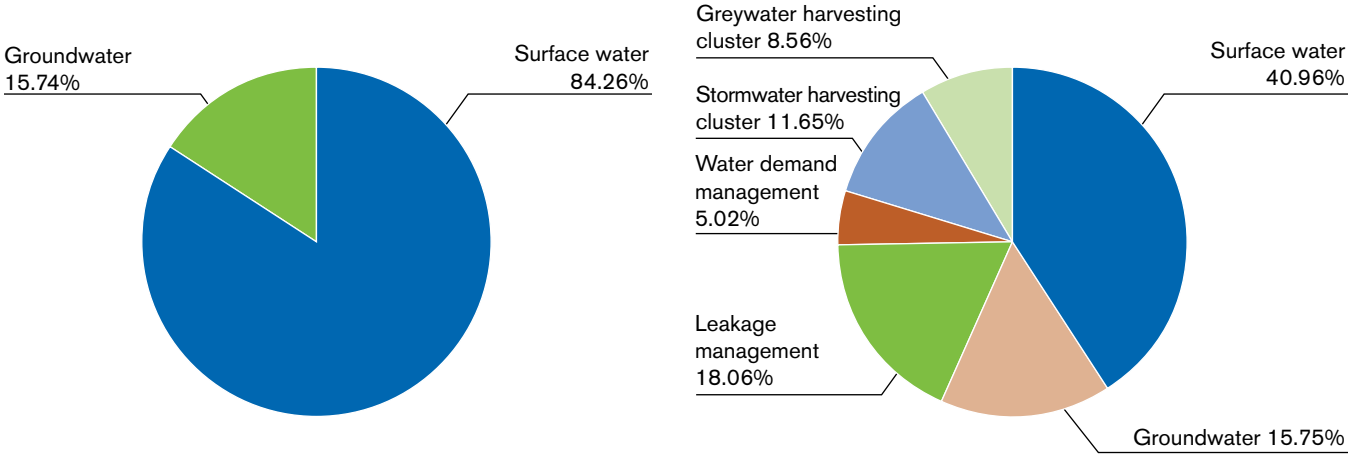
Assessing the gap between future water demand and supply in **Nairobi**, Kenya (population: 3.4 million) presents significant challenges because of the uncertainty related to the impact of climate change on the availability of water (Jacobsen et al. 2012). Population projections and economic growth paint an unclear future, making it hard to predict what will happen and what infrastructure will be needed.

In the case of Nairobi, it is possible to highlight the difference in water supply options between a traditional infrastructure plan (i.e. increase the availability of surface water through reservoirs and by tapping into groundwater sources) and a flexible and diverse IUWM approach (figure 9). The uncertainty about future water supply, growth, and availability raises the importance of implementing adaptive and flexible systems to reduce the city's reliance on only one type of water resource. The marginal increase of proposed IUWM solutions has to be considered holistically, as a unique system. The combination and sequencing of integrated urban water solutions is essential to sustain and improve urban water in the medium and long term.

In **Mbale**, Uganda (91,800 people), water availability has been compromised by competing uses for water in upstream catchments. Inadequate sanitation, dysfunctional pit latrines, and lack of access to sanitation in peri-urban areas and settlements upstream are threatening current surface and underground water reserves (Eckart et al. 2012b; Jacobsen et al. 2012).

In order to sustain the city's growth and secure water supply, the solutions proposed for Mbale involve the diversification of water sources. A combination of surface water, groundwater, and greywater sources has been proposed for new urban clusters. The use of decentralized wastewater systems (DEWATS) and soil-aquifer treatment (SAT) could address the problem of public acceptance of greywater reuse through infiltration and groundwater recharge. Additionally, solutions at the micro watershed level need to be accompanied with a strong and wider watershed program as well as an early and continuous process of stakeholder participation.

FIGURE 9. NEW SUPPLY OF WATER FOR NAIROBI UNDER THE TRADITIONAL INFRASTRUCTURE PARADIGM (LEFT) AND THE IUWM 'CLUSTER' APPROACH (RIGHT)



Source: Eckart et al. 2012.

In **Arua**, Uganda (59,400 people), unauthorized abstractions and pollution from upstream settlements are a major threat to the city's water supply. Additionally, the existing water supply system is overstretched and the water treatment plant is strained by river turbidity and the lack of a reliable supply of power. Complicating matters further, the poor management of septic tanks pollutes groundwater (Eckart et al. 2012c; Jacobsen et al. 2012).

In Arua, IUWM can help promote spatial development based on decentralized water treatment services organized around urban clusters, which can be more cost effective than traditional surface water treatment structures on the Nile River, 40 kilometers away. These clusters for decentralized urban storm water, greywater reuse, and leakage management can guarantee reliability and quality of service. The abstraction of local groundwater resources can become an important source for the city but protecting it from pollution from poor sanitation facilities is essential. The use of DEWATS to treat wastewater and the combination of treated surface water at the cluster level can provide potable water supply for the city (Jacobsen et al. 2012).

In **Douala**, Cameroon (2.1 million people), low-lying urban areas are affected by contamination of a shallow water table and susceptibility to flooding due to increased runoff and discharge peaks during rainfall. The lack of maintenance and improvements of urban drainage system has a negative impact on the capacity for flood management. Moreover, the lack of improved sanitation causes severe health risks and pollutes the shallow groundwater resources.

The assessment of Douala emphasized the challenge of incorporating stakeholders early in the process in order to ensure the stability and long-term success of the IUWM approach. The involvement of end-users and a wide range of stakeholders can help address political economy barriers to IUWM solutions. A combination of infrastructure investment to improve sanitation access, drainage, and solid waste collection to reduce the risk of water-related diseases is recommended. However, strengthening local capacities at the city/arrondissement level is required so that local authorities can participate more fully in project design and management (Jacobsen et al. 2012).

CHAPTER 3.
IUWM: THE WAY FORWARD

A number of valuable global lessons and overall strategies can be extracted from the case studies and projects in the three regions. The operationalization of IUWM and the knowledge that is being generated need to be continued and expanded. This can be done through additional research, capacity building, and the practical application of the IUWM approach to more cases..

3.1 Lessons for IUWM at a Global Scale

The WPP-funded activities in integrated urban water management have produced relevant insights on the challenges and opportunities for the development of IUWM as a feasible and viable practice to sustain and secure urban water (table 5). The need to draw lessons from already established research and practice is essential in order to continue developing the approach and shaping it to the different institutional, political, economic, financial, social, and environmental contexts of the developing countries.

3.1.1 Varying Global Challenges and Opportunities for IUWM

An IUWM approach that from the beginning focuses on the integration of water supply, sanitation, and drainage with urban planning, and takes into account water resources as well as IUWM principles such as "water fit-for-purpose", may provide an opportunity to avoid infrastructure lock-in in expensive traditional solutions. However, the development of IUWM practices can be challenged if rigid institutional frameworks, traditional technologies, and non-integrated urban plans have already been laid out, slowing down the process of adaptation towards a more integrated urban water management framework (table 5). Additionally, the lack of funding and the size of some cities sometimes does not allow for economies of scale. Poor data and information on urban services can also present a challenge for the study of the IUWM potential in cities.

Cities are important economic engines and financial centers, attracting people and economic activity, and resulting in urban sprawl, thus opening a larger window of opportunity to implement IUWM approaches. They can also concentrate political and economic institutions, which can be used to leverage funds and capital and also disseminate good practices based on their successful model.

In an enabling institutional and organizational environment, the main opportunities for developing IUWM approaches lie in newly-built or planned areas where land may still be available and where integrated urban water management principles can be followed. Rapidly expanding cities also have the potential for on-demand construction, adopting technological innovations and new planning schemes. This makes them more flexible and adaptive to new urban forms.

TABLE 5. CHALLENGES AND OPPORTUNITIES AFFECTING IUWM IN URBAN AREAS

	Challenges	Opportunities
Infrastructure	(i) Old infrastructure (ii) Possible planning of traditional technologies already laid out	(i) IUWM approach in to-be-built areas, where land is available (ii) Expanding built areas can incorporate IUWM principles (iii) Flexibility of urban design and high potential for technology innovation
Investment	(i) Lack of funding (ii) City size does not allow economies of scale	(i) Urban growth attracting increasing economies of scale and economic growth
Institutions	(i) Mature and complex institutions (ii) Lack of institutional flexibility (iii) Multi-jurisdiction of metropolitan areas	(i) Concentration of political and economic power can attract funding and disseminate good practices

Source: Authors.

3.1.2 Major Implementation Challenges

A set of solutions for the sustainable and secure management of water and other services in cities can be put together based on the lessons learned (table 6). However, several challenges and knowledge gaps can affect the future development of IUWM. These include economic and investment challenges, institutional challenges, and information gaps.

Economic and Investment Challenges
The economic evaluation and cost-benefit analysis of IUWM solutions will need to be extended but also tailored to fit each individual case. Sound economic models and analysis are required to test the viability of IUWM approaches compared to traditional technologies. It will also be necessary to secure funds from the government, especially in cases where local governments lack the funds or capacity to leverage capital investments.

Institutional Challenges
Developing the institutions for integrated urban water management is one, if not the, limiting factor for its proper implementation. The same way the IUWM approach provides adaptive solutions to urban challenges, city organizations and institutions in charge of urban and water management need to find ways to accommodate these precepts and adapt their structures to the requirements of IUWM.

Stakeholder knowledge and awareness are also necessary. However, aligning institutional goals and strategies within complex systems of local and national governance is essential to ensure the success of IUWM approaches. Dealing with different organizational structures, various jurisdictional levels within metropolitan areas, fragmented institutions, and in some cases, dissonant interests will be a determining factor for the development of IUWM.

Information Gaps
Climate change will affect river hydrology in the future and little information is available about future climate at the city level. River basins are a relevant intermediary level from which to provide information about basin hydrology and how urban water resources will be affected by climate change. Modeling river basin hydrology in Africa, for instance, is challenging due to lack of data and disparities of modeled results (Jacobsen et al. 2012).

TABLE 6. OVERALL STRATEGIES TO ACHIEVE IUWM

Principles	Tools	Benefits
Sustainable urban development	(i) Balance densification and impervious areas; (ii) planning of green spaces linked to urban water management; (iii) restrictions and economic incentives to protect of municipal water basin; (iv) incentives for the construction of green buildings	Quality of life; environmental protection; sustainability of urban water services
Preservation of water supply sources	(i) Regulate and enforce land use in the water basin; (ii) use of command and control mechanisms, economic incentives, payment for environmental services; (iii) increase diversity of water sources within city and catchment (e.g. rainwater, groundwater, wastewater reuse)	Conservation of water quality; reduction of health risks; reduction of water insecurity; better allocation of water resources among users
Conservation and efficiency of water use by controlling demand	(i) Metering water use; (ii) use of a sustainable tariff structure; (iii) reduction of financial and physical losses; (iv) incentives for new appliances and equipment to reduce demand; (v) incentives for water reuse; (vi) education for water use	Eliminate the need of new water sources; reduction of energy use; reduction of sewage volume both for collection and treatment; reduction of the risk of water shortages
Improvement of sanitation services	(i) Incentives for household connections; (ii) incentives for industrial and agriculture reuse; (iii) reuse in urban irrigation of green spaces; (v) decentralized wastewater treatment systems	Better environmental conditions; restoration of rivers and lakes; reduction of the risk of groundwater contamination
Sustainable storm water management	(i) On-site measures of infiltration and green building practices; (ii) storage and reduction of runoff; (iii) good practices to improve water quality; (iv) rules and practices integrated to urban land use and environment	Flood frequency reduction; water quality improvement; erosion control; reduction of damages and hazards

TABLE 6. OVERALL STRATEGIES TO ACHIEVE IUWM (CONT'D)

Principles	Tools	Benefits
Sustainable solid waste and sediment control management	(i) Implementation of recycling practices; (ii) implementation of charging for the service by volume or weight in order to decrease waste; (iii) control of civil construction waste; (iv) control of sediments in construction sites; (v) disincentives for the use of plastic bags and plastic containers	Reduction of disposal sites; reduction of costs in solid waste collection and disposal; environmental protection and improved water quality; reduction of costs in drainage maintenance; reduction of flood risks; reduction of health risks
Institutional practices	(i) Integration of services in one institution; (ii) development of master plans (urban, water, sanitation); (iii) revision of building codes; (iv) stimulate cost recovery practices; (v) enforceable laws and regulations; (vi) environmental certification; (vii) public participation; (viii) capacity building	Improvement of services; adoption of cost-efficient technologies; reduction of investment needs; reduction of operational and maintenance costs; environmental protection; improvement in quality of life

Source: Based on World Bank 2010.

At the city level, the lack of sound data on the state of infrastructure, access to services or an accurate population census can affect the development of IUWM. In an urban context, policymaking, regulation, and the provision of water and sanitation services are interconnected processes that, to be carried out successfully, must bring together a number of actors. This entails not only enhancing communication between sectors (including energy production, agriculture, industry, water supply and sanitation, urban planning, and environmental protection), but also between different actors.

Decision-makers need good and reliable information and data in order to plan and manage cities and urban services. Project feasibility studies, diagnosis, and assessment also rely on quality data. This information is essential for good management, but there are some gaps as well as a lack of agreed standards, which make analysis difficult at the level of the city.

3.2 The Role of the World Bank in Supporting IUWM

The survey of water managers and city planners showed that key stakeholders perceive IUWM as a relevant issue but that they need technical expertise, capacity building, and funding (Jacobsen et al. 2012).

The World Bank and its Water Partnership Program (WPP) can be instrumental in the implementation and scaling up efforts. Through the three regional activities, the WPP has laid the foundation for mainstreaming IUWM in World Bank projects and programs.

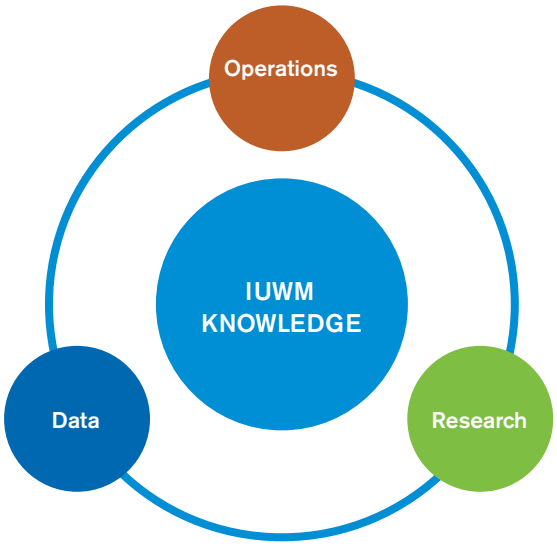
While the World Bank can provide capital for the implementation of the IUWM approach, it can only do so if the client countries prioritize IUWM and request support to address urban water challenges. Additional studies showing the economic benefits of IUWM, as well as the implementation of pilot projects to showcase results could demonstrate to governments that these investments are more efficient and more sustainable than traditional approaches. Learning from best practices and experiences around the globe is also crucial in scaling up efforts. Addressing the economic, institutional, and knowledge challenges in an interlinked way can maintain and increase the momentum for IUWM.

3.2.1 Addressing Complex Challenges

The large extent of natural and social challenges and different institutional and political settings affecting cities represents an opportunity for the World Bank to take a comprehensive and gradual approach to develop structural and non-structural interventions (World Bank 2010).

The conceptual framework and guidelines for operationalization as well as the case studies in many cities have already increased the interest in IUWM in several countries. For example, in Nairobi the government is considering using part of a World Bank loan to implement IUWM principles in pilot projects. In Sao Paulo, a $234 million integrated water management project started in 2010 aims at protecting and maintaining the quality and reliability of metropolitan water resources, improving the quality of life of poor communities in urban river basins, and strengthening institutional capacity, management and coordination in water resources, pollution, land-use policy, and basic service provision.

FIGURE 10. SUSTAINING KNOWLEDGE GENERATION FOR IUWM



Source: Authors.

The implementation of IUWM projects in selected cities should be given priority as a means of gathering data and establishing a pool of case studies to showcase IUWM. Sustaining projects, research, and data collection will also ensure that IUWM knowledge is used in future projects (figure 10).

3.3.2 Sustaining IUWM Practices Internationally

The coordination and implementation of learning alliances for IUWM with existing programs within international or regional organizations will support the development of training capacities and research, and ensure that IUWM reaches the experts in charge of planning and provision of urban services. By collaborating with established international programs, such as the IWA Cities of the Future Program or ICLEI, the World Bank can help sustain and expand existing IUWM practices across the world.

Promoting and encouraging the exchange of knowledge about IUWM best practices will help disseminate information about the benefits and potential of IUWM among city leaders, planners, and managers. The role of the World Bank is to document good practices and support specific client requests for investments or technical assistance (World Bank 2010).

3.3.3 Operationalizing IUWM: Learning by Doing

Fostering Knowledge and Results

Fostering research on different IUWM technology options and their economic costs will support project feasibility. Developing sound economic models to analyze the cost of IUWM alternatives compared to traditional technologies will also help decision-makers and planners to choose sustainable and viable infrastructure options for their cities.

The need to develop guidelines on how to approach institutional and policy processes to revise current urban plans and make them more adaptive will also require more research. The fact that there is no one unique way to achieve IUWM implies that each case study and project will be different and that technology and policy solutions will have to be tailored to fit each city.

Reaching out to other regions and incorporating IUWM into more projects will require research on the development of fit-for-purpose technologies that is specifically designed and conducted for particular cases. It will also be necessary to further investigate the adaptation of current traditional technology systems in expanding cities, and the costs of retrofitting existing water supply systems to innovative IUWM approaches.

The World Bank can complement its direct engagement through facilitation, training, and strong technical assistance to ensure that cities do not focus only on traditional infrastructure needs. In some other instances, World Bank involvement can focus on specific technical assistance to make city planners aware of international best practices and provide specific support in selected areas where weaknesses are apparent (World Bank 2010).

The further development of IUWM can also be ensured by bringing together and maintaining a group of IUWM experts and practitioners to provide support and technical know-how to countries wishing to incorporate integrated urban water management into the design of their projects. Also essential to increasing and maintain awareness about integrated urban water management is the dissemination of information about IUWM projects sponsored by the Water Partnership Program.

Strengthening Managerial Functions

The rationale for World Bank involvement in future IUWM projects arises from the complexity of the challenges affecting growing cities. Tackling these challenges will require flexible and interdisciplinary teams, strengthening financial commitments for future projects, and extending the scope of projects to incorporate IUWM approaches. Additionally, new project guidelines and terms of reference will have to incorporate the evaluation and assessment of IUWM approaches

Providing on-site IUWM training for city and water managers at the national and local level can also strengthen the development of integrated management functions and future technical assistance for clients.

The World Bank's position as a leading IUWM practitioner can be solidified in the regions by sponsoring more water

resources and supply projects that focus on IUWM and are carried out in cooperation with projects focused on the urban sector. Working together with urban planners and establishing common frameworks for action in order to break internal and external silos will be essential to promote urban innovation and to move from the traditional infrastructure paradigm to a more inclusive and adaptive one.

3.3.4 Building Capacities and Improving Strategic Alignment

The work carried out in sub-Saharan Africa shows some of the benefits of integrating stakeholder participation from the beginning. In Nairobi, for example, WPP activities resulted in an increased interest in exploring alternative water resources for the city, in revising the building code to enable rainwater harvesting, and in considering greywater and wastewater reuse (Jacobsen et al. 2012). However, the experience from LCR reveals that at least 18 months are needed for stakeholders to coalesce around a common strategy for IUWM.

Stakeholder participation and support from local authorities and national governments are essential. The projects carried out in sub-Saharan Africa reaffirm the importance of stakeholder participation to the success of IUWM initiatives (Jacobsen et al. 2012).

It is also important that local, regional, and national institutions support the development of IUWM projects in a coordinated and strategic fashion. For instance, the central government needs to be involved in integrating planning practices and solving conflicts over riparian uses, even in cases where political control has been turned over to regional or local governments. Ministries and local agencies can work together to improve the success and sustainability of projects by further integrating legislative frameworks and river basin plans to make them more adaptive and able to incorporate IUWM practices.

3.3.5 Sustainable Cities and Green Growth

To meet the urgent development needs of the world's poor, growth that is environmentally, economically, and socially sustainable as well as inclusive is vital. Cities can be one of the most important avenues for growth by providing jobs and attracting talent and investments to a geographic area. They can also spur productivity growth by opening up economic opportunities, markets, communication, and the supply of capital and skills (World Bank 2012g).

The challenges facing increasingly expanding and dense urban areas can come from a lack of vision and planning. Integrating the design and infrastructure of future built-up areas and the access to basic services with sustainable policy and management plans will reduce uncontrolled urban growth and its negative environmental and social consequences.

The move towards an efficient, clean, resilient, and equitable model of urban growth will ensure the equitable provision of services in the future, and also result in the sustainable and efficient use of natural resources. The World Bank's green growth vision fosters just this kind of development.

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ANNEX 1 - DETAILED PHASES FOR THE OPERATIONALIZATION OF IUWM

The figures below show the different phases of the process of putting integrated urban water management into operation. Each phase is divided into 4 sub-phases and the different steps and main activities for each sub-phase are listed (Source World Bank (a) and World Bank 2012a).

PHASE 1. ENGAGEMENT

Objectives	• Identify stakeholders and foster commitment • Establish adequate participatory mechanisms • Present IUWM and ascertain interest of key • Provide initial training on IUWM
Activities	• Create a Stakeholder Engagement Plan • Conduct a first workshop to interact with stakeholders, present the scope and limit of the Bank's support and define the process for following phases
Tools	• Traditional Planning : Capacity Assessment, Needs Assessment • Stakeholder Engagement: Stakeholder Assessment and Analysis, Stakeholder Engagement Plan • Hybrid: Shared Vision Planning
Outcomes & Outputs	• Stakeholders identified and committed • Plan of Activities drafted and first assessment organized • Capacity Building Plan designed

Source: Based on World Bank (a) and World Bank 2012a.

The aim of the **ENGAGEMENT** phase is to identify the government levels and main stakeholders that will have to be involved in the process of developing an IUWM strategy. This engagement phase seeks the commitment of the entire community for the preparation of the plan as well as their involvement during the implementation stages of the IUWM strategy.

The Africa IUWM study by Jacobsen et al. (2012) highlights the importance of including stakeholders in the initial steps of integrated urban water management, as well as the importance of providing a forum to assess alternative solutions. The results of a survey of water managers and city officials on their knowledge, attitudes, and practices (KAP survey) with respect to IUWM show that key local stakeholders perceive it as relevant, and that urban water management plans need to include a wider range of issues.

The **ASSESSMENT** phase is designed to identify problems affecting the delivery of urban services at the local level. Based on qualitative and quantitative assessments of the situation, the output of this phase will be a final diagnostic of the challenges, capacities, and strategies to achieve integrated urban water management.

The **PARTICIPATORY PLANNING** phase focuses on the evaluation and validation of IUWM strategies formulated during the assessment phase. This will be take place through a series of participative meetings aimed at strengthening institutional coordination and participation. The meetings will also serve to discuss options and foster the commitment of participating stakeholders. The output of this phase is a reviewed strategy, which will include investment priorities and potential funding sources.

PHASE 2. ASSESSMENT

Objectives	• Develop a common understanding of the challenges linked with water in the Metropolitan Area • Identify and prioritize the issues or main urban challenges • Evaluate the consequences of inaction
Activities	• Identify existing studies and data • Conduct qualititave and quantitative assessment • Draft and validate diagnostic study • Evaluate the economic cost of inaction • Continue providing training to stakeholders as needed
Tools	• Traditional Planning :Institutional and Regulatory Assessment, Environmental Assessment, Economic and Financial Assessment, Social Impact Assessment • Technical Modelling studies: Water balance, Water pollution, Land use, Drainage, Characterization of the Urban Area • Qualitative Matrices of Issues • Indicators for Diagnostic and Assessment • Stakeholder Engagement: Participatory Diagnostic
Outcomes & Outputs	• Main issues and strategies identified • Final Diagnostic drafted and validated

Source: Based on World Bank (a) and World Bank 2012a.

PHASE 3. PARTICIPATORY PLANNING

Objectives	• Evaluate possible strategies within the institutional, social, economic and technical settings • Develop a consensus around short-, middle- and long-term activities in order to improve IUWM
Activities	• Prioritize the identified issues • Set objectives, goals and actions • Analyze and compare scenarios • Draft and validate a Strategic Action Plan
Tools	• Stakeholder Engagement: Preliminary Strategic Plan of Action, Strategic Report, Strategic urban Water Plan • Participatory Strategic Planning
Outcomes & Outputs	• Strategic Action Plan finalized and validated • All stakeholders informed about IUWM agreed strategy • Potential funding sources identified for short-term activites

Source: Based on World Bank (a) and World Bank 2012a.

PHASE 4. IMPLEMENTATION AND MONITORING

Objectives	• Successfully implement the projects defined in the IUWM Strategic Action Plan • Monitor and review implementation progress and adjust as needed
Activities	• Implement the projects according to the strategic plan • Design the monitoring system in a participatory manner • Monitor results and develop adjustment mechanisms • Document monitoring of Strategic Action Plan • Perform yearly evaluation of the urban development and achieved goals
Tools	• Urban water impacts and goals Indicators • Results framework
Outcomes & Outputs	• IUWM implemented and monitored.

Source: Based on World Bank (a) and World Bank 2012a.

The IUWM study of Baku, Azerbaijan, contains relevant information and a detailed analysis of the different values attributed to water by the population, which revealed the different productivity and values of water. This study investigated how Baku's residents deal with the problem of inadequate water supply by choosing a variety of arrangements to increase the quantity and quality of the water consumed.

Finally, the IUWM strategy and action plan are implemented during the **IMPLEMENTATION AND MONITORING** phase. Throughout the development of this phase it is crucial to monitor the results and to undertake a periodic review of the strategies with respect to main institutional changes, and economic and technical constraints.

ANNEX 2 - COMPARATIVE COSTS OF IUWM STRATEGIES FOR ARACAJU, BRAZIL, AND ASUNCION, PARAGUAY

The table below shows a comparison of the cost of implementing IUWM strategies in the cities of Aracaju, Brazil, and Asuncion, Paraguay, based on the calculations for the investment on each of the phases of the Action Plan

Activities	IUWM Strategy for Aracaju, Brazil		IUWM Strategy for Asuncion, Paraguay	
	Cost ('000 US$)*	Subtotal ('000 US$)*	Cost ('000 US$)	Subtotal ('000 US$)
A. Study of economic and financial viability of the IUWM Program		**161**		**100**
A.1 –Economic and financial viability study	161		100	
B. Institutional strengthening		**697**		**1,150**
B.1 – Proposal to improve institutional structure	64		140	
B.2 – Institutional structure	43		90	
B.3 – Human resources training	161		120	
B.4 – Information system for urban water	429		800	
C. Revision of the Master plan for land use in RMA		**161**		**450**
C.1 – Master Plan for land use in RMA	107		250	
C.2 – Municipal strengthening and modernization of the municipal structures of land use management	54		200	
D. Resettling program for informal areas		**10,879**		**30,300**
D.1 – Evaluation of informal settlements in sensitive areas	161		300	
D.2 – Elimination of informal settlements in sensitive areas	10,718		30,000	
E. Program for the reduction of water losses in the water supply system and environmental conservation		**1,125**		**20,600**
E.1 – Program for the reduction of physical water losses in the water supply system	536		20,000	
E.2 – Program for water conservation	268		300	
E.3 – Program for conservation of water sources	322		300	
F. Water Supply Infrastructure				**200,500**
F.1 – Assessment of current plans			500	
F.2 – Water supply infrastructure and water treatment plant			200,000	

Activities	IUWM Strategy for Aracaju, Brazil		IUWM Strategy for Asuncion, Paraguay	
	Cost ('000 US$)*	Subtotal ('000 US$)*	Cost ('000 US$)	Subtotal ('000 US$)
G. Sewage collection and treatment		**137,190**		**502,000**
G.1. – Revision of Sewage Plan of RMA	2,144		2,000	
G.2 – Extension of the sewage collection system and treatment for RMA	135,047		500,000	
H. Urban drainage master plan		**66,184**		**155,000**
H.1 – Urban drainage plan: non-structural measures and cadaster	268		2,000	
H.2 – Urban drainage plan: structural measures	1,608		3,000	
H.3 – Development of institutional, structural and non-structural measures for urban drainage control	64,308		150,000	
I. Solid waste system		**6,056**		**29,000**
I.1 – Solid waste plan	536		1,500	
I.2 – Development of solid waste final disposal system	3,751		20,000	
I.3 – Improvement of the collection system for normal and special waste	268		1,000	
I.4 – Development of a solid waste recycling system	429		1,500	
I.5 – Improvement of affected areas by poor solid waste disposal	1,072		5,000	
J. Monitoring of results of IUWM programs		**1,125**		**3,200**
J.1 – Development of indicators	54		200	
J.2 – Monitoring of indicators	536		1,500	
J.3 – Revision of strategy	536		1,500	
TOTAL		**223,577**		**787,455**

* *Note:* Costs in US$ for Aracaju are based on average mid-year exchange rate US$/Reais based on the arithmetic average of the bid and offer rates published in the daily bulletins, from January to June 2012. Source: Brazil Central Bank.
Source: Based on World Bank 2012a; World Bank 2012b.

ANNEX 3 - CAPITAL COSTS OF IUWM IN BAKU, AZERBAIJAN

The table below shows the capital costs of IUWM in US$, estimated on the basis of investment outlays and non-routine maintenance/replacement costs. These data were estimated from project files and maintenance statistics available at the World Bank's Azerbaijan office.

Sector	Year 1	Year 2	Year 3
Wastewater Management (WW)			
Demolitions and Excavations	16,622,253.98	9,812,532.37	34,957,146.45
Item for Lift stations	3,311,729.61	1,962,506.45	6,991,429.34
Cabin, electric and telephone conduits and associated services	2,416,405.70	1,401,790.34	4,993,878.06
Domestic water supply and sewerage networks and associated services	4,743,763.56	2,803,580.68	9,987,756.13
Equipment Costs	10,098,141.64	5,607,161.35	19,975,512.26
Other Costs	11,390,242.95	6,448,235.58	21,699,725.19
Sub-total WW	48,582,537.58	28,035,806.64	98,605,447.43
Potable water			
Demolitions and Excavations	28,728,275.71	17,660,220.27	60,241,865.55
Item for Lift stations	5,745,655.12	4,549,735.16	12,129,716.37
Cabin, electric and telephone conduits and associated services	2,872,827.56	1,702,416.28	6,064,858.25
Domestic water supply and sewerage networks and associated services	2,872,827.56	2,150,340.29	6,064,858.25
Equipment Costs	11,491,310.23	6,809,665.39	24,259,432.87
Other Costs	6,194,217.60	3,404,832.69	12,129,716.37
Sub-total Potable Water	57,905,113.89	36,277,210.21	120,890,447.65
Environmental program			
Excavation or dredging	9,752,587.18	5,779,310.92	20,588,795.16
Dig and dump	7,314,440.42	4,334,483.19	15,441,596.34
Pump and treatment	7,314,440.42	4,334,483.19	15,441,596.34
Sub-total Environmental program	24,381,468.02	14,448,277.31	51,471,987.97
TOTAL	**130,869,119.49**	**78,761,294.16**	**270,967,882.93**

Note: Currency exchange AZN/US$ calculated as the mid-year daily average currency exchange rate for January-June 2012. 1US$ = 0.7861 AZN
Source: Scandizzo and Abbasov 2012.

ANNEX 4 - RESULTS OF THE STUDY OF NON-USE VALUES OF WATER IN BAKU, AZERBAIJAN

A survey was carried out in Baku as part of the WPP-funded activities to improve the quality and reliability of water supply, establish effective sanitation services, and expand the range of environmental benefits for coastal and inland water. The survey campaign lasted about six weeks and a total of 2,155 questionnaires were completed.

The interviewees, who comprised a cross section of water users, were asked if they would agree to an increase in their monthly water bill to contribute to investments to-wards improving water supply, wastewater treatment, and environmental conservation.

The options for new infrastructure provided in the survey ranged from a traditional water supply network to a fully integrated multifunctional model (water management and waterfront use). Survey questions were also designed to find out how respondents form their expectations on the use of water and whether those expectations satisfy broad hypotheses of economic rationality (coordination between ends and means, consistency, pursuit of individual and communal benefits, awareness of alternative options, search for information and knowledge).

The results of the survey show an average willingness to pay (WTP) an increased tariff for an immediate improvement in water supply services (24-hour supply) of about US$19 (table 1). The average WTP drops to $11.60 for a long-term 10-year investment with a 20 percent probability of failure. This WTP can be interpreted as the risk premium that users would be willing to pay to avoid further service deterioration. The willingness to pay for service improvements extends to wastewater disposal, both in the immediate action scenario and that including uncertainty and delayed investments.

TABLE 1.
SURVEY RESULTS FOR THE WTP FOR IMPROVED WATER SERVICES IN BAKU, AZERBAIJAN (IN US$ PER MONTH)

	Average	Variance	Mode	Std. Dv.
Willingness to pay for 24/7 water availability with adequate pressure and high quality	19.24	67.17	12.72	9.24
Willingness to pay for 24/7 water availability with adequate pressure and high quality, but only after 10 years with an 80% probability of success (and 20% probability of failure)	11.60	9.98	10.18	3.55
Willingness to pay for better wastewater disposal services	8.13	35.19	0.00	6.69
Willingness to pay for better wastewater disposal services, but only after 10 years with a 50% probability of success (and 50% probability of failure)	4.81	36.27	0.00	6.79
Willingness to pay for better wastewater disposal services, but only after 10 years with an 80% probability of success (and 20% probability of failure)	6.62	211.72	0.00	16.41
Willingness to pay via a monthly credit scheme	2.08	0.30	2.54	1.63

Note: Std. Dv. = Standard Deviation. Currency exchange AZN/US$ calculated as the mid-year daily average currency exchange rate for January-June 2012. 1US$ = 0.7861 AZN
Source: Based on Scandizzo and Abbasov 2012.

ANNEX 5 - LIST OF 31 CITIES IN SUB-SAHARAN AFRICA

The following table presents the list of 31 cities studied in the diagnostic of challenges and opportunities for IUWM in sub-Saharan Africa. The cities were selected based on whether they fulfilled some or all of the following criteria: (1) population growth rate (more than 3 percent annual growth rate); (2) number of inhabitants; and (3) World Bank presence.

No	Country	City	Population ('000 inhabitants)	Population growth rate 1995-2000	Selection criteria*
1	Angola	Luanda	4,775	5.87	P,G
2	Benin	Cotonou	841	2.82	WB
3	Burkina Faso	Ouagadougou	1,324	7.02	WB
4	Cameroon	Douala	2,108	4.56	P,G,WB
5	Cameroon	Yaoundé	1,787	5.45	G,WB
6	Democratic Republic of Congo	Kinshasa	9,052	4.18	P,G,WB
7		Lubumbashi	1,544	4.06	G,WB
8		Mbuji-Mayi	1,489	4.47	G,WB
9	Rep. of Congo	Brazzaville	1,505	4.19	G,WB
10	Côte d'Ivoire	Abidjan	4,175	3.29	P,G
11	Ethiopia	Addis Ababa	3,453	2.06	P,WB
12	Ghana	Accra	2,332	3.27	P,G,WB
13		Kumasi	1,826	5.04	G
14	Guinea	Conakry	1,645	3.30	G,WB
15	Kenya	Nairobi	3,363	4.08	P,G,WB
16	Malawi	Blantyre	733	N/A	WB
17		Lilongwe	866	4.75	G,WB
18	Mozambique	Maputo	1,655	1.37	P,WB
19	Nigeria	Lagos	10,572	3.93	P,G,WB
20		Abuja	1,994	8.93	P,G
21		Ibadan	2,835	2.39	P
22		Kano	3,393	2.23	P
23	Senegal	Dakar	2,856	3.66	P,G
24	South Africa	Johannesburg	3,618	2.38	P
25		Cape Town	3,357	2.52	P
26		Durban	2,839	2.33	P
27	Sudan	Al-Khartoum	5,185	2.53	P
28	Tanzania	Dar es Salaam	2,498	4.77	P,G,WB
29	Uganda	Kampala	1,597	3.72	G
30	Zambia	Lusaka	1,421	4.30	G,WB
31	Zimbabwe	Harare	1,663	1.30	WB

Note: Selection criteria: P=population size; G=growth rate; WB=World Bank presence.
Source: Jacobsen et al. 2012.

ANNEX 6 - LIST OF REPORTS FROM WPP-FUNDED REGIONAL IUWM ACTIVITIES

The reports listed below have been produced as a result of the IUWM activity in the Latin America and Caribbean region. More information on the Blue Water – Green Cities initiative can be found on the World Bank website (http://www.worldbank.org/laciuwm).

- World Bank 2012. Integrated Urban Water Management Case Study: Aracaju, Blue Water – Green Cities, The World Bank.
- World Bank 2012. Integrated Urban Water Management Case Study: Asunción, Blue Water – Green Cities, The World Bank.
- World Bank 2012. Integrated Urban Water Management Case Study: Bogota, Blue Water Green Cities, The World Bank.
- World Bank 2012. Integrated Urban Water Management Case Study: Sao Paulo, Blue Water Green Cities, The World Bank.
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