THE CITY WATER
RESILIENCE APPROACH

CITY CHARACTERISATION REPORT

MEXICO CITY

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

The City Water Resilience Approach (CWRA) helps cities plan and implement actions to build resilient urban water systems. A critical first step in this process is understanding the local water system, and the factors that contribute to or detract from resilience.

This report details research undertaken in Mexico City with the goals to:

1. Define the city water basin including natural basin(s), the urban water system and its governance structure, and the interdependencies with other systems; and
2. Identify the factors contributing to the resilience of the city water system and those increasing its vulnerability.

In developing this characterisation report, the Arup team collected desktop data on the biophysical characteristics of the basin and key actors in the water system. Arup then undertook a field mission in Mexico City 14–25 May 2018 to build on the desktop work by engaging in-person with stakeholders.

MEXICO CITY'S WATER SYSTEM

Mexico City, the capital of the United Mexican States, is located in the valley of Mexico, a highlands plateau situated surrounded by volcanoes and mountains in the centre of the country. The 8.9 million inhabitants of the city limits, comprised of 47% men and 53% women, live in the urban areas that occupy 41% of the total area of the city. Producing 15.8% of Mexico's gross domestic product, Mexico City is the greatest contributor to the country's industrial and service GDPs. Key actors at the national, state, and local governments are active in the management of water resources in Mexico City. The drinking water for Mexico City comes from groundwater (60%), the Magdalena River, and the Lerma-Cutzamala System. Mexico City's 26 operating wastewater treatment plans only have a capacity of 2.2 m^3/s. The new Atotonilco Wastewater Treatment Plant will soon be fully operational. It is estimated that this new plant will be able to purify the wastewater of a population up to 12.6 million. Mexico City's large-scale, complex drainage system includes stormwater (rainwater), grey water (water re-use), and black water (sewage).

KEY STAKEHOLDERS

Mexico City Metropolitan Area (MCMA) has multiple layers of public institutions within the water sector performing various roles. The National Water Commission (CONAUGA), under the Ministry of the Environment and Natural Resources (SEMARNAT), operates at a national level providing delivery of water to the service area. CONAUGA is also involved at the base-level across the country, Ciudad de Mexico (CDMX) is responsible for potable water, wastewater collection and disposal services for MCMA.

Mexico's federal district water operator SACMEX (Sistema de Aguas de la Ciudad de México), under the authority of the country's environment ministry SEMARNAT, has the mission to provide potable water, drainage, sewage, waste water treatment and water reuse. SACMEX supplies 98% of MCMA with drinking water and distributes water through seven independent

macro-sectors. Private companies are given fixed term service contracts to provide support services for commercial purposes regarding subsidized water, billing, metering, etc. National Association of Water and Sanitation Utilities (ANEAS), together with potable water operators of the country, support the increase of efficiency in the provision of services.

SHOCKS AND STRESSES

Many of the major shocks and stresses were already identified by local citizens as having a current impact on their city. These shocks and stresses included

- Water scarcity
- Water quality
- Shortfall of critical infrastructure
- Inadequate governance
- Extreme weather
- Groundwater depletion/over exploitation
- Social issues such as crime and lack of community cohesion

A combination of the above list of shocks and stresses has led to Mexico being one of the largest consumers of bottled water globally with 71-91% of the country's inhabitants consuming bottled instead of tap water.

BUILDING RESILIENCE

Through engagement with Mexico City stakeholders, it was identified that resilience engineering, citizen communication and engagement along with strengthening local governance would all positively contribute to the resilience of the city's urban water system.

Through engagement with Mexico City stakeholders, it was identified that there are a series of factors that would positively contribute to the resilience of the city's urban water system.

Some of the most frequently mentioned were:

- "Rainwater Harvesting" as it could have a direct impact on the general water scarcity issues of the city, and more in particular on the most vulnerable communities.
- "Increasing Community Engagement" by improving communications from government and NGOs to improve the understanding and culture of water in Mexican society. Also, a better understanding of water issues and a culture of water stewardship could increase water savings.
- "Nature-Based Solutions" and blue and green infrastructure that have already been implemented in Mexico City, have demonstrated that they can have a very good impact in flood reduction and flood management.

To achieve this, one of the main focuses of the CWRA is to understand who the city engages not just within the basin it belongs to but also the other sectors that rely on water and that influence the use of water. The key interdependencies between the water system and city systems identified within Mexico City are Urban Planning, Transportation systems, Energy and Social Impact for vulnerable communities.

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BACKGROUND

Mexico City, the capital of the United Mexican States, is located in the valley of Mexico, a highlands plateau situated surrounded by volcanoes and mountains in the centre of the country. Mexico City sites at an altitude of 2,200 meters above sea level and encompasses 1,485 km^2, which represents 0.08% of the total area of Mexico. This report examines the greater area of Mexico City.

Mexico City Metropolitan Area (MCMA) faces numerous complex resilience challenges as it is susceptible to various biophysical and socioeconomic risks due to accelerated population growth and urban development as well as its geographic location, and climate change. The biophysical stresses include floods, heat waves, droughts, and earthquakes; the consequences of which directly affect mobility, housing, and the urban water system, the latter being a high priority. (Ministry of Environment of Mexico City, 2016).

Mexico City, surrounded by mountain ranges

POPULATION

The 8.9 million inhabitants of the city limits, comprised of 47% men and 53% women, live in the urban areas that occupy 41% of the total area of the city (INEGI , 2018). The southern part of the city (59%) is classified as a conservation area (thus environmentally protected) and is located mainly in the Xochimilco, Tlahuac, and Milpa Alta municipalities (SEDEMA, 2018) (PAOT, 1998) The broader Mexico City Metropolitan Area (MCMA) has a population closer to 21 million (Fox, 2018). Mexico City has a diverse population of locals and immigrants and expatriates from all of the world, particularly the Americas. It has the largest population of U.S. citizens outside the United States itself (Wikipedia, n.d.).

ECONOMY

Producing 15.8% of Mexico's gross domestic product, Mexico City is the greatest contributor to the country's industrial and service GDPs. (Wikipedia, n.d.) It is one of the most important economic hubs within all of Latin America. Mexico has an economy of $2.4 Trillion USD, making it the 11th largest in the world (CIA, 2018).

GOVERNANCE

Key actors at the national, state, and local governments are active in the management of water resources in Mexico City, as outlined in Figure 1 (Rosales, 2014). The national government has an independent unit of the Ministry of the Environment and Natural Resources (SEMARNAT) called the National Water Commission (CONAGUA—previously CNA). Established in 1989 as a national and regional organisation, CONAGUA manages Mexico's administration of water systems. At both national and state levels, it is a technical institution responsible for national level water resources planning, financing, and services including wastewater discharges over 37 hydrological regions. CONAGUA also forms basin councils, which are its legislative branches. There are 26 basin councils created from representatives of relevant ministries, state and municipal representatives, civil society, users, and citizens, etc. (OECD, 2013)

For services, the 37 hydrological regions are grouped into thirteen hydrological administrative units or river basin organizations (RBOs), which are managed by basin agencies called Organismos de Cuenca (Rosales, 2014). Each Organismos de Cuenca has an advisory board comprising of representatives from many different ministries.

Mexico City was previously known as a Federal District with many of the autonomous powers granted at the state level; in 2016 the term changed from Federal District to Ciudad de México (CDMX) (Wikipedia, n.d.). The executive powers and responsibility of public administration at this level are vested in the head of government, who is the 'Mayor of Mexico City' (previously the 'Governor of the Federal District') but whose powers are much bigger than an actual mayor (Wikipedia, n.d.).

At the local level, MCMA is made up of 16 municipalities, each with its own mayor and local responsibilities, but which do not include water governance.

The overall responsibility for the supply of drinking water, drainage, sewage, and wastewater treatment and reuse rests with the Mexico City water utility SACMEX. Created in 2003, SACMEX aims to supply and distribute potable water and drainage services to Mexico City residents with the needed quantity, quality and efficiency while contributing to the adequate use of existing infrastructure and fostering a culture modern use that guarantees a sustainable water supply.

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RESEARCH METHODOLOGY

Engagement with Mexico City occurred over three stages:

STAGE 1	The first step was desktop data collection on the biophysical characteristics of the basin and identification of key water governance actors. This research determined the following topic groups for fieldwork discussions in MCMA: urban planning, transport (and mobility), social vulnerability, the environment, and ecosystems.
STAGE 2	Arup's fieldwork in Mexico City 14-18 May 2018 focused on a better understanding of the local water systems, their limits, interdependencies, and the actors involved in the various water governance processes. - The visit included organising a Water Governance Workshop, in which Arup and Stockholm International Water Institute (SIWI) worked with local stakeholders to understand the water system of Mexico City and its related water governance processes. - The fieldwork also included a quick assessment of the water system's resilience to identify areas of improvement. - Overall, 45 representatives from 36 institutions participated in the 11 activities during this trip. Institutions from Mexico City's water governance process included public sector, private sector, academia, and civil society.
STAGE 3	This 'Wave 1' city report was created by combining the desktop study and the fieldwork results to provide a clear picture of the city's basin, its key stakeholders, its shocks and stresses, and its factors of resilience.

Engagement with 'Wave 1' cities included a two week field mission, where workshops, focus groups and interviews were conducted.

Engagement with 'Wave 2' cities included remote support to city partners where surveys and interviews were conducted.

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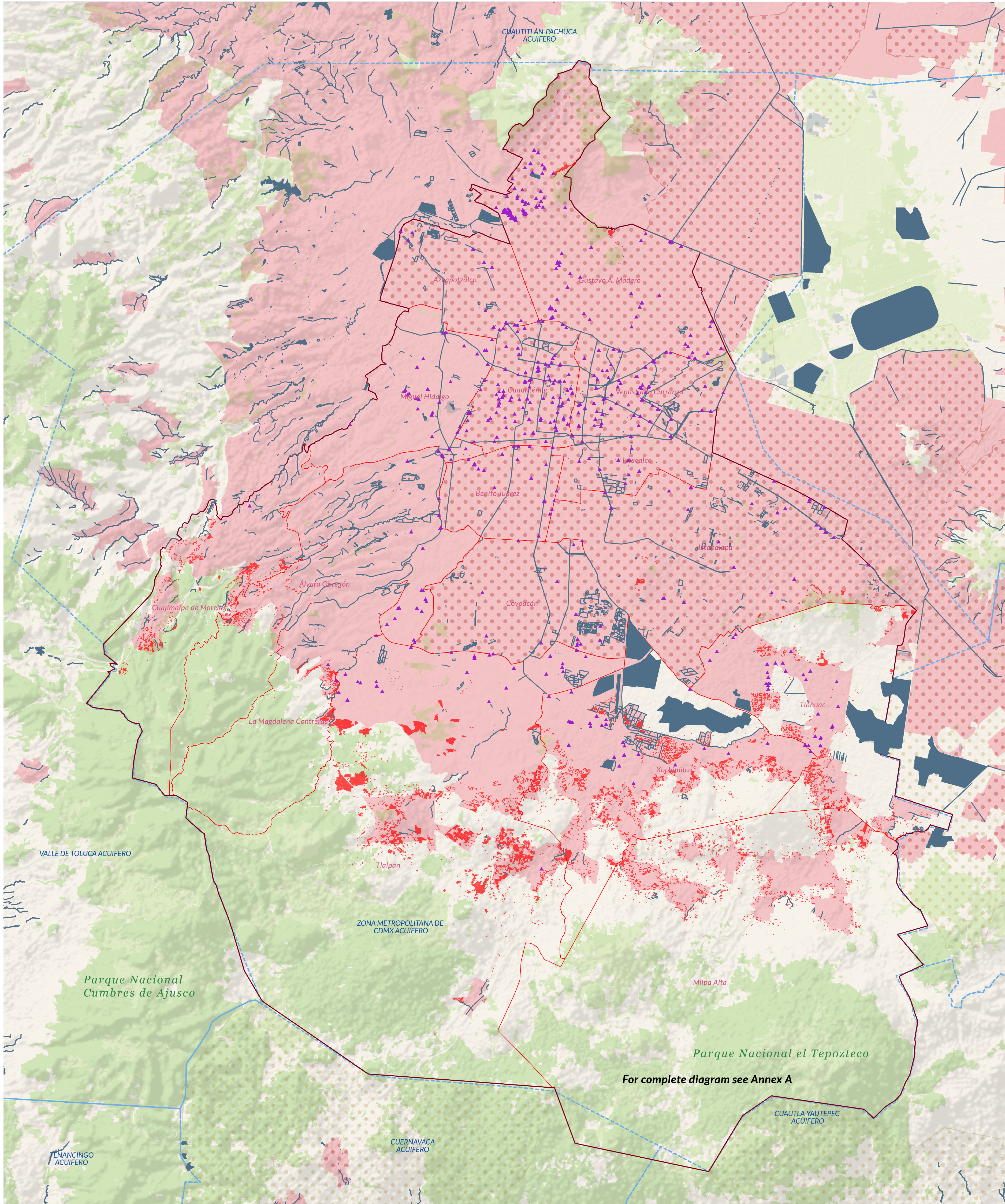
UNDERSTANDING MEXICO CITY'S WATER SYSTEM



Mexico City basin map

A water basin is considered the most functional geographical and governmental unit to administer water (Agua, 2018). Understanding the geographical and hydrological systems is critical to understanding Mexico City's urban water system.

Located at an altitude of ~ 2,000 meters (m) above sea level, the area that now holds Mexico City was originally a system of lakes in a flat valley bed of sediments, clays, silt, and sand surrounded by steep mountainous slopes. Water runoff flows from the surrounding mountains collected to create lakes. Due to differences in altitude, the region has very diverse weather conditions ranging from a humid and rainy climate in the mountainous area to a dry and hot climate in the lower areas.

In the Mexico City Metropolitan Area (MCMA), the precipitation varies from 600 to 1,500 millimetres (mm) annually with most occurring between June and October. This water continues its course through the regional water cycle through evaporation (75%), runoff via canals and rivers (11%) or infiltration in the soil (14%) (Deltares, 2015).

These characteristics combined with the urban and social pressures of one of the largest metropolitan areas in the world, has created an extremely complex hydrological situation in Mexico City which has severely altered its original water cycle.

WATER SUPPLY

On average Mexico City inhabitants consume 327 litres of water daily an average flow of 32.5 cubic meters per second (m^3/s). SACMEX supplies 98% of MCMA with drinking water; the remaining 2% depend on mobile or stationary tanks for water. SACMEX distributes water through seven independent macro-sectors, further divided into a total of 336 sectors or circuits allowing a greater efficiency of water distribution.

The drinking water for Mexico City comes from groundwater (60%), the Magdalena River, and the Lerma-Cutzamala System, which includes the upper basin of the Cutzmala River through aqueducts from dams located in the states of Michoacán and Mexico.

BLACK AND SURFACE WATER

Mexico City's large-scale, complex drainage system includes stormwater (rainwater), grey water (water reuse), and black water (sewage). The drainage system (with 124 km of open channels, 52.3 km of piped rivers, and four artificial exits) extends from the Mexico Valley basin to the neighbouring state of Hidalgo, several kilometres to the north outside of the urbanized basin.

Originally, the Great Drainage Canal handled the drainage for MCMA; however, the gradual collapse of subsoil dramatically reduced the canal's capacity until eventually subsidence reversed its slope rendering it useless. Since then, Mexico City has been building its Deep Drainage System, which involves a series of dams and tunnels with the combined capacity of circa 15 million m^3. Both systems were designed to transport water to the surface and very little of it w n. The estimated capacity of the tunnel is 150 m^3/s (Engel, Jokiel, Kraljevic, Geiger, & Smith, 2011). This new drainage tunnel will provide an alternative to the Emisor Central Tunnel, thereby reducing the flood risks in MCMA. Overflooding of sewers has been an issue for the area.

WASTEWATER

Mexico City's 26 operating wastewater treatment plans only have a capacity of 2.2 m^3/s— far less than the average water supply flow. Since these plants were not operating at full capacity until very recently, only around 15% of the wastewater inflow was treated. Of the effluent that was treated, approximately 10% was reused and 7% was set aside for industry and agriculture uses. The remaining 83% was dedicated for public spaces, in other words reused to water flora in parks and keep fountains flowing.

The new Atotonilco Wastewater Treatment Plant will soon be fully operational. The plant has been designed for a maximum flow in rainy season of 50 m^3/s and 35 m^3/s in the low season. (Acciona Agua, n.d.) It is estimated that this new plant will be able to purify the wastewater of a population up to 12.6 million, which is a significant improvement.

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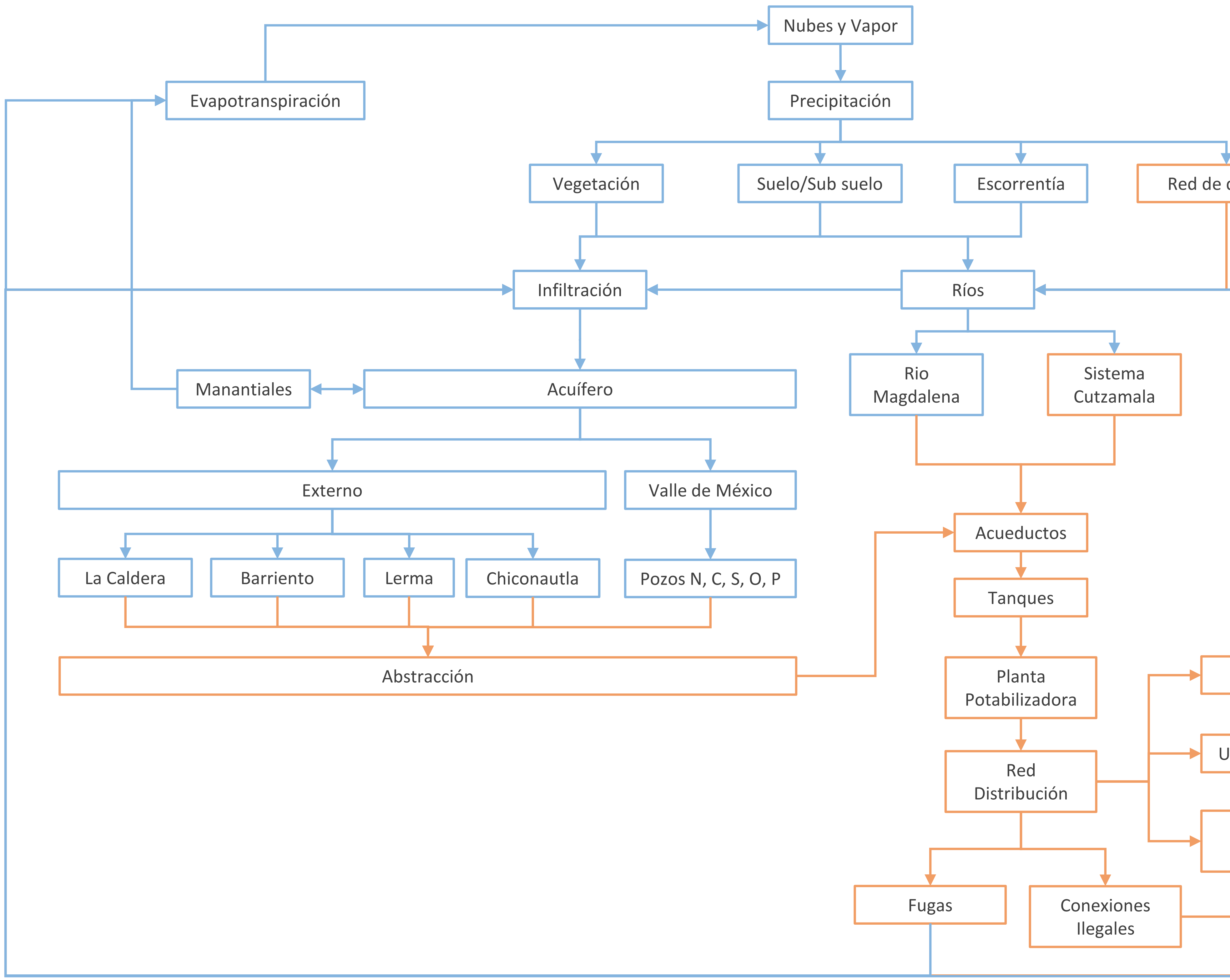
ENGAGEMENT WITH KEY STAKEHOLDERS

Annex A shows the diagram of the Mexico City's water cycle used during the Governance Workshop as well as the Water Governance Diagram for the Country of Mexico, developed by the OECD.



For complete diagram see Annex B

STAKEHOLDER COMMENTARY

BASIC SERVICE PROVISIONS

MCMA's institutional arrangement of water supply and sanitation system is complex with overlap of functions among various entities. It is operated through wide range of public institutions:

- The National Water Commission (CONAGUA) under the Ministry of the Environment and Natural Resources (SEMARNAT) at the national level.
- Comisión de Aguas del Estado de México (CAEM) and Sistema de Aguas de la Ciudad de México (SACMEX) at the state level.

CONAGUA is responsible for providing delivery of water to the service area, operation of deeper water supply wells, etc. Water management in Mexico is based on the 13 hydrological-administrative regions in which the country was divided. These regions are conformed by grouping of basins, conserving in their integration complete municipalities. For the optimal performance of its functions, CONAGUA has a basin organization in each of them. The Ciudad de Mexico (CDMX) is placed on the Mexico Basin Organism (OCAVM).

CDMX manages potable water and wastewater collection and disposal services for MCMA. The CAEM manages 23 decentralized municipal entities including one municipality with communal autonomous providers. (Rosales, 2014).

When CDMX (then the Federal District) became self-governed in 1997, it restructured SACMEX from a decentralized financially autonomous public company to a financially legally non-autonomous entity.

Private companies are now given fixed-term service contracts to provide support services for the commercialization of subsidized water, such as distribution, metering, billing, customer support, etc. (Engel, Jokiel, Kraljevic, Geiger, & Smith, 2011).

National Association of Water and Sanitation Utilities (ANEAS) gather the potable water operators of the country, whose basic objective is to support the increase of efficiency in the provision of services, as well as to promote the level of professionalization and autonomy of human capital.

RISK MANAGEMENT

The Ministry of Health (SALUD) monitors water quality standards and the Ministry of Finance and Public Credit (SHCP) is responsible for fund allocation to the sector. (Krucková and Turner, 2017).

Each state in Mexico has a State Water Commission who is responsible for the development of regional projects of the state, and implementation of decentralized programmes in the sector etc. For CDMX, it is Comisión del Agua del Estado México (CAEM).

Private companies are also responsible for maintaining and repairing leakages in secondary water and sewage network in their respective service areas. (Engel, Jokiel, Kraljevic, Geiger, & Smith, 2011).

ENVIRONMENT

SEMARNAT is one of the secretaries of state that make up the so-called legal cabinet of the President of Mexico. It is the office of the federal executive power responsible for the guarantee of sustainable development and environmental balance. It is responsible for designing, planning, executing and coordinating public policies on natural resources, ecology, environmental sanitation, water, fisheries and urban sustainability (Wikipedia, n.d.).

Environmental Protection Federal Attorney Office (PROFEPA) is the agency in charge of the care and preservation of the environment throughout the country, as well as the inspection and monitoring of compliance with laws for environmental protection. PROFEPA is a decentralized body of SEMARNAT (Wikipedia, n.d.).

Other relevant stakeholders for the preservation of the environment are Technical Committees for Groundwater (COTAS) and National Forestry Commission (CONAFOR).

ECONOMIC & SOCIO-CULTURAL

In addition to these government actors, the private sector, civil society organisations, scientists, and community residents are stakeholders in the city's water resources. Additionally, several stakeholders are outside the city limits since Mexico City extracts water from neighbouring basins, such as Lerma, to meet its water demands. Below is a list of other national ministries that impact water:

- Ministry of Social Development (SEDESOL)
- Ministry of Energy (SENER)
- Ministry of the Economy (ME)
- Ministry of Agriculture, Livestock, Rural Development, Fishing and Food Supply (SAGAPRA)
- Federal Electricity Commission (CFE)
- Mexican Technological Institute for Water (IMTA)

KEY PROGRAMMES

Some key existing projects and programmes related to water and resilience have been identified below:

1. Resilience and Water Security for the Valley of Mexico: Funded by the World Bank at 200 million USD, this six-year programme with the Government of Mexico will create a systemwide water security and resilience strategy for the Valley of Mexico to unify the Cutzamala Water Supply System, Mexico City, and the Lerma-Chapala-Santiago Basin and improve the system reliability and resources management of the Valley of Mexico's groundwater (World Bank, 2015), (World Bank, 2018).

- For the last two years the World Bank has supported the Valley of Mexico in building water planning capacity for the basin, including the Cutzamala aqueduct system. The new water planning approach promotes water security using innovative tools to facilitate decision-making for building robustness in grey and green infrastructure.
- The formulation of the strategies will include: assessment of water balances, development of hydraulic models for Mexico City and Cutzamala, application of the climate uncertainty decision-tree, and prioritization of investments.

2. Mexico City Resilience Strategy: As part of the 100 Resilient Cities network, Mexico City launched its resilience strategy in September 2016 (Ministry of Environment of Mexico City, 2016). The strategy's five pillars include one to 'promote water resilience as a new paradigm to manage water in the Mexico Basin'. This pillar has four goals and twelve specific actions for implementation.

- As part of the Mexico City Resilience Strategy, Deltares, and the Metropolitan Autonomous University (UAM) are working to restore the water system of the heritage area of Mexico City. The project consists of two phases: understanding the area's water system and developing a water resilience plan that includes concrete interventions for improving the water system (Ministry of Environment of Mexico City, 2016).

3. Agua 'Water Information' Portal: Started in 2004 by the Fund for Communication and Environmental Education, Agua.org.mx is dedicated to sharing of materials (legislation, books, publications, weather and hydrological data, etc.) related to water and its management in Mexico. It currently hosts over 40,000 books and other resources (Agua, 2018).

Workshop with key stakeholders to understand local shocks, stresses and programmes

Case study
Isla Urbana

Because half the world's population now live in cities, creating sustainable urban water systems has a great impact on environmental and social issues. To ensure a future with access to clean water, innovative water saving technologies need to be enacted on a large scale now.

Rainwater harvesting systems promote sustainable water management practices, mitigate the city's flooding problems, relieve poverty, reduce carbon emissions, and provide a reliable source of water for Mexico City and rest of the country.

Isla Urbana is a local NGO that has designed an environmentally, socially, and economically sustainable rainwater harvesting system that collects and cleans rainwater for households, schools, and health clinics. The system is inexpensive, easy to install, and provides individual residences with about 40% of their water supply year-round. Implemented on a large scale throughout Mexico City, this simple technology could provide 30% of the city's water supply and could help give a sustainable source of water to the 12 million Mexicans with no access to clean water. (Isla Urbana, n.d.)

Since 2009 Isla Urbana has installed more than 7,600 systems, with more than 53,500 beneficiaries and over 330 million of litres harvested. (Isla Urbana, n.d.)

Isla Urbana's goal is not only to install systems but also to make sure people are empowered to use the system to access a clean and constant water supply. The NGO's success depends on contextual and social adaptation as much as its formal design of the product.

Rainwater harvesting system in Mexico City

credit: Isla Urbana (IslaUrbana.org)

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CHARACTERISING RESILIENCE

Mexico City

credit: Armando Argandar

CRITICAL INTERDEPENDENCIES

The fieldwork carried out in Mexico City identified a series of interdependencies between the water system and other critical urban systems.

URBAN PLANNING

The lack of coordination and planning in relation to the urban development of the city, as well as the increasing informal settlements, has a significant impact on the water cycle in terms of increased water demand, uncontrolled abstraction, reduced ability to recharge, and increase in risk of flooding.

TRANSPORT

Floods in Mexico City are more frequent and more severe every year, hindering both the mobility of its citizens and the city's ability to function through impacts to the transportation system—both roads and public transport options. This recurrent shock significantly and negatively damages the economy of the city and the inhabitants' livelihoods.

ENERGY

Water abstraction and conveyance from other neighbouring water basins to Mexico City uses significant energy. SACMEX is the largest consumer of power in the region and one of the largest in the country.

SOCIAL IMPACT FOR VULNERABLE COMMUNITIES

A common characteristic of all the interdependencies described above, is that they directly or indirectly impact society in general and particularly the most vulnerable communities in Mexico City. Inequality has contributed to social conflicts and riots that could easily increase if the situation worsens.

KEY SHOCKS AND STRESSES

When analysing current vulnerabilities and understanding future risks scenarios for Mexico City, many shocks and stresses were identified as already impacting citizens. The most mentioned by the different stakeholders during fieldwork have been gathered below.

Water scarcity

Other shocks and stresses from this list relate back to the lack of access to water. For example, some of the most vulnerable communities in the Iztapalapa sector don't have access to running potable water and rely on water supplied by water trucks (pipas). Pipas can take up to three weeks to fulfil water from requests that have been placed.

Water quality

Concerns around the quality of potable water coming from the tap was a constant theme. The lack of trust of the municipal utility's water quality has made Mexico one of the highest bottled water consumers globally, with 71-98% of the country's inhabitants consuming bottled instead of tap water.

Lack of community cohesion

Social tension and a breakdown in community cohesion were identified as a crucial stress due to very unequal access to water.

Crime

Water trucks can result in mafias that prioritize the household distribution of water depending on bribes or sometimes even in exchange for sex. Violent situations and riots also occurred in the weeks after the 2017 earthquake due to lack of access to water.

Groundwater depletion / over-exploitation

In relation to the ecosystems, the most mentioned stress in the fieldwork was the overexploitation of the aquifer and all related issues. Current estimates suggest the Mexico City Basin aquifer is over exploited by 297% (Deltares, 2015). All the rainwater that falls inside the basin is drained out of the urbanized area, preventing the local aquifer from recharging.

Subsidence

Groundwater depletion causes soil layers to collapse and compact, which is intensified from increased urbanization. Some areas like the airport and the Historic Centre sink at a rate of more than 80 mm annually.

Shortfall of critical infrastructure

The main stresses identified regarding infrastructure were linked to the lack of maintenance and ageing infrastructure. Amongst other issues, ageing infrastructure is responsible for leakage water losses of ~ 40% of the water supplied. Given water scarcity, this is a serious issue.

Habitat loss

This stress to the ecosystem is from shortfall of the waste water infrastructure, particularly the untreated wastewater returned to the water cycle, thereby polluting water bodies and degrading habitats—sometimes resulting in their loss altogether.

Overview of Mexico City and its green spaces

Inadequate governance
All the groups mentioned different aspects of this stress—lack of vision/strategy, corruption, lack of transparency, poor planning, and inappropriate policy and enforcement. The result has been a dearth of projects implemented to improve the urban water system. The lack of appropriate laws and available financing regarding implementation of innovative projects needs to be fixed. The communication between agencies and teams needs to improve and be more fluid with decisions made more transparently to combat concerns around corruption.

Extreme weather
Between 1980 and 2013 hydro-meteorological disasters (rains, floods, winds, hailstorms) caused an economic impact of USD $32.4 million and directly affected 50,000 people. Mexico City has also experienced geological disasters such as landslides and earthquakes.

KEY FACTORS OF RESILIENCE

The fieldwork highlighted how participants found it much easier to identify shocks and stresses than to explain factors of resilience—specific things that helped them to overcome those shocks and stresses. Below are some of the factors of resilience identified by Mexico City stakeholders.

Rainwater harvesting
Rainwater harvesting is one of the activities that was constantly mentioned as a crucial factor of resilience to fight the lack of access to water in the most vulnerable communities. More details are available regarding the Case Study in this report.

Increasing community engagement
The lack of understanding or culture of water in Mexican society has negatively affected the water cycle. Increasing communications from the government and NGOs to communities, creating platforms for communities to share experiences and difficulties, and educating youth through school programmes would help to overcome this problem. A better understanding of water issues and a culture of water stewardship could increase water savings.

Water recycling
Water recycling is seen as a solution that tackles many different stresses for Mexico City: overexploitation of the aquifer, sewerage treatment, and consumption reduction of potable water.

Ecosystems recovery programmes
There is serious interest in implementing more ecosystems recovery programmes to reconnect people with water and nature and to improve the natural aquifer recharge and runoff management. Projects like the Vuelta a la Ciudad Lacustre (return to Lacustrine City) and the regeneration of Lake Texcoco have been well received.

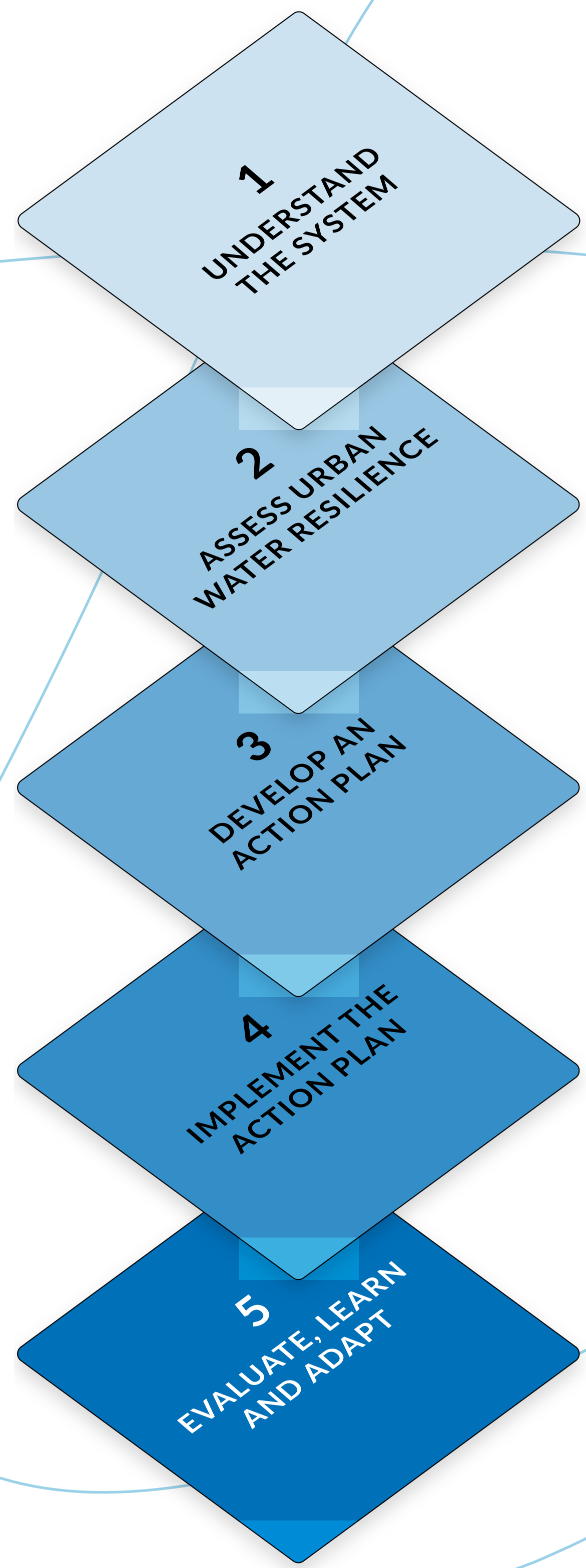
Water tariffs / smart meters
Effective demand reduction can come from implementing water meters or smart water tariffs.

Nature-based solutions
Concerning floods, the use of blue and green infrastructure as in the regeneration of Parque de la Viga, Parque Lira, or Barranca del Muerto, are opportunities to reduce the stormwater runoff and to locally manage surface water.

Data collection and availability
Transparent governance requires having more integrated and participatory approaches and incorporating innovative solutions. To achieve this, better and more frequent data collection is required. The results need to be made available and easy to access for all relevant stakeholders.

6

REFLECTIONS ON THE CITY WATER RESILIENCE APPROACH (CWRA)



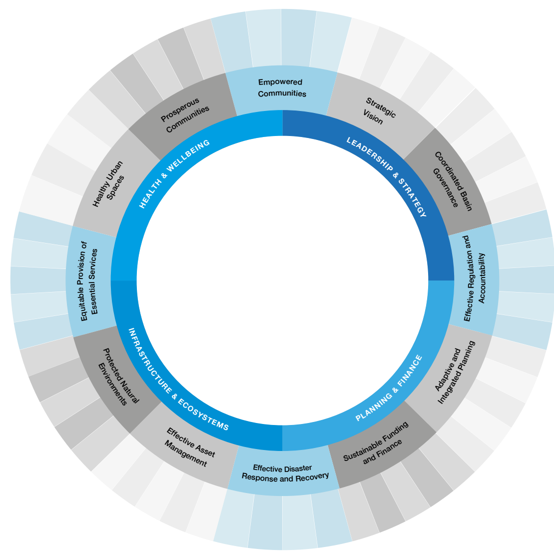
PERSPECTIVES ON THE CWRF ASSESSMENT TOOL

Generally, the City Water Resilience Framework (CWRF) was well received and easily understood by all the different focus groups and people interviewed in Mexico City. Most participants felt the framework provided value by clarifying the basin and its governance and to assessing its resilience. It was much appreciated that the four dimensions of the assessment tool cover the water cycle from all perspectives, including many human factors that had never been considered in the past.

It was also noted that some of the CWRF's outputs already exist, and thus steps must be taken to avoid duplicated work.

Key takeaways include the following:

- Ideas and proposals about how a framework like this could be implemented and who should lead it varied. However, everyone considered it fundamental that such an initiative be supported by relevant decision-makers and experts from the city and the basin level and across disciplines. The **Mexico Basin Organism (OCAVM)** was often identified as the appropriate body to adopt and lead the framework because it consists of representatives from many different areas. OCAVM is also dependant and has a direct link with the **National Water Commission (CONAGUA)** responsible for water resources at a national level, which is a very powerful link for implementation.
- Most participants agreed that implementing the framework should happen within four years. It was often emphasised that the 'definition of the basin' and the resilience assessment should have a balance between level of effort required and level of detail of the results. The phrase 'quick but good enough' was frequently used to describe the preferred path forward.
- The methodology of implementing the assessment tool was a key topic of discussion. Participants agreed the methodology should blend quantitative and qualitative indicators and should be a participatory process expanding beyond the water sector. Capturing what water resilience would really mean for a city would involve outreach to a wide variety of people. However, this realisation raised concerns about the amount of effort required to do the assessment correctly given limited resources.
- Effective Provision of Critical Services and Effective Management of Interdependencies were identified as key goals for Mexico City based on commentary on the CWRF.
- At times, participants had difficulties in understanding the definitions of the twelve goals—highlighting the need for self-explanatory language and possibly specific examples of potential indictors that could be included under each goal.
- The value of flexibility was mentioned regarding different aspects of the assessment tool. Some participants suggested a certain level of flexibility with the indicators would better align the tool with the characteristics of different cities. A similar view was shared on indicator evaluation as the 'good' and 'bad' limits could vary depending on the maturity of the city's water system or its level of resilience.
- A principal value of the framework that participants identified was the potential to bring together many different organisations and stakeholders from the city and water sectors for a multi-perspective understanding of the urban water system and its interdependencies.
- Finally, participants recognized that for the full value of the tool to be implemented, its findings would need to be presented in a simple, clear, and visual way for decision makers and others to easily grasp the key messages. Participants believed it could be quite powerful to combine indicators and goals in different ways to illustrate varying results.



Regarding the resilience assessment that comes out of the framework, participants valued an action-focused assessment approach over a purely evaluation assessment. The CWRF approach was valued for collecting qualitative and quantitative data, collating opinions from diverse stakeholders, and comparing it against international standards. Participants felt the CWRF would help decision makers select the right options for a politically driven approach by blending 'bottom up' and 'top-down' methods. Such an assessment would help leaders create a better, more inclusive water management plan. Participants further believed CWRF created holistic solutions that could best leverage funding and engagement with different development banks and multilateral organisations.

PERSPECTIVES ON WATERSHARE

Early drafts of the WaterShare digital tool were received positively. The workshop in Mexico City focused on better understanding the governance tool's key objectives and its potential, functionality, and usability. The tool was appreciated for providing a large range of water related information with different levels of detail for planning purposes in a single location that could be easily shared.

However, it was noted that different layers of information might be restricted to a smaller group of stakeholders. How the tool could be managed remained an open debate at the end of the workshop partially from the recognition that managing it could be a very important and time-consuming task, at least initially. Some of the potentially useful governance tool functionalities identified were:

- A City Water Cycle Flow Chart to map the connections to:
  - relevant organisational data and goals
  - strategic documents for specific areas of the city's water cycle
  - potential shocks and stresses to the water cycle
  - a library of preparedness plans and adaptation solutions for specific shocks and stresses
- A library and sharing platform for identifying pilot projects and innovative ideas

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- National Commission of Water (CONAGUA)
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- Ministry of Mobility (SEMOVI)
- Natural Resources Commission (CORENA)
- World Resources Institute (WRI)

International Organisations
- World Bank
- Inter-American Development Bank

Private Sector
- Veolia

Scientific Community
- Engineering Institute (National Autonomous University of Mexico)
- World Wildlife Fund (WWF)
- University of Massachusetts
- University of Cincinnati

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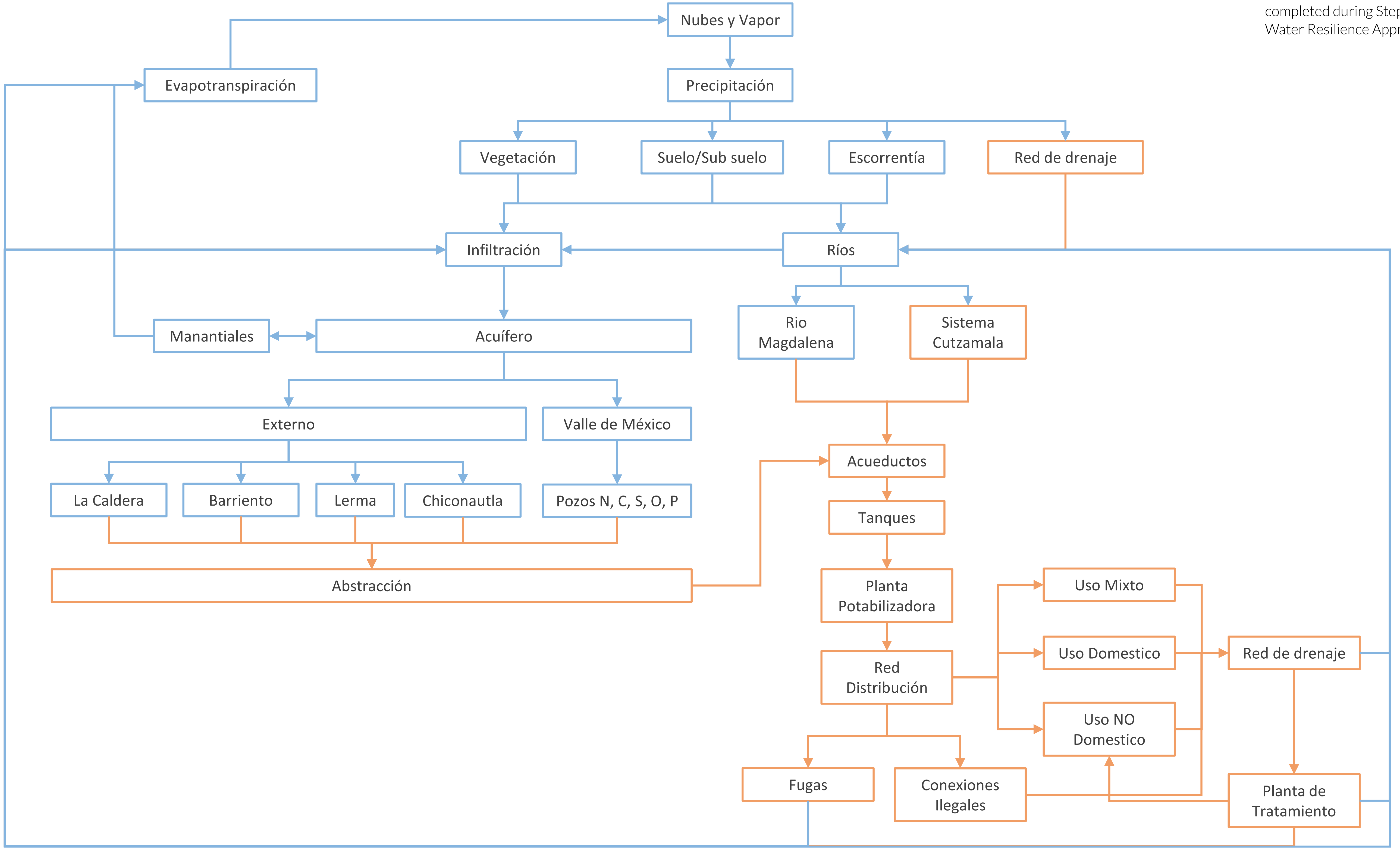
ANNEX A: WATER CYCLE MAP

Due to the broad number and complexities of the water stakeholder network within Mexico City's basin, a water governance diagram was not agreed upon during the governance workshop. Please note, this exercise should be completed during Step 1 of the City Water Resilience Approach.



ANNEX B : STAKEHOLDER MATRIX

Stakeholder matrix for Mexico City (OECD, 2013).