



Sustainable Urban Water Cycles

An SNV-organised and facilitated learning event

Sylhet, Bangladesh

4-7 March 2024

[Learning event proceedings | Prepared by Sandra Ryan, Global Technology Advisor – Hydrology, SNV]

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Introduction

This report provides a synthesis of the ‘Sustainable Urban Water Cycles (SUWC)’ learning event held in Sylhet, Bangladesh from 4-7th March 2024 with over 50 participants from SNV program countries of Indonesia, Tanzania, Zambia, Bangladesh, Nepal, Bhutan, India, Vietnam, Netherlands. Participants were from local and national government, local water authorities, and SNV country and global staff.

The SUWC initiative represents an expanded approach, encompassing a broader spectrum of urban services compared to its predecessor, the Urban Sanitation and Hygiene for Health and Development (USHHD) (CWISE and WASH SDG programs), which primarily focused on safely managed sanitation and hygiene services. Nevertheless, the primary objective remains consistent: to instigate systemic transformations at both municipal and national levels. As the WASH SDG program transitions into its concluding phase, concentrating on consolidating acquired knowledge and ensuring service sustainability, this Learning Event served as a timely platform for comprehensive discussions, knowledge aggregation, and the formulation of replicable models.

The learning event focused on four specific aspects of the Urban Water Cycle and what it means to be sustainable in the host country of Bangladesh, integrating urban WASH services, approaches to urban flood management, and the role of solid waste and greywater management in the urban water cycle. It was organised by SNV as part of SNV’s Sustainable Urban Water Cycles Framework Approach and programming.

The purpose of this report is to provide a reference for participants as well as other practitioners, managers, local government, and other actors interested in SNV’s Sustainable Urban Water Cycles (SUWCs) programming. It aims to capture the key content presented by experts, the urban water management in participating countries, challenges, as well as key discussions and reflections generated during the four-day event.

During the three weeks prior to the event participants had engaged in online Egroup forums contributing information on whether their cities have sustainable water cycles, the criteria to determine that, how best to integrate management of the various water cycle components, and which strategies work to engage citizens on the journey that a city decides to take.

It is hoped that this report will also serve as a resource for the broader water sector.

Official opening

Keynote presentations

ISMENE STALPERS, COUNTRY DIRECTOR, SNV IN BANGLADESH

The learning event was opened by Ismene Stalpers welcoming esteemed Bangladesh National and Local Government officials and representatives of the participating countries, giving an overview of the urban water situation and SNVs projects in Bangladesh, which includes FSM, CWISE and WASH SDG programmes and recently initiated a new 12-city 'Transforming Sustainable Urban Water Cycles'- the SUWC programme supported by the Embassy of the Kingdom of the Netherlands in Bangladesh. SNV has signed Memorandum of Understanding (MoU) with National stakeholders- Department of Public Health and Engineering (DPHE), Bangladesh Municipal Development Fund (BMDF) and International Training Network (ITN BUET) to replicate and expand the lessons and models from our programs.

In the three weeks leading up to this event, participants contributed to the moderated email group discussions, and it is hoped that those discussions will drive the conversation during this event. This is the first learning event on SUWCs and beginning of the learning journey. There are many innovation areas in SUWC and many angles and jointly we can advance our knowledge and understanding of the sustainable urban water cycle. While we continue the journey, hopefully the shared learning will contribute to a more sustainable future in each city and area where you work or be the start of many more projects in the countries where SNV works.

MOHAMMAD SHAMIN ALAM, JOINT SECRETARY, POLICY SUPPORT BRANCH (PSB), MINISTRY OF LOCAL GOVERNMENT, RURAL DEVELOPMENT AND COOPERATIVES, BANGLADESH

Mr. Alam highlighted the need to achieve SDG6 access for all. Bangladesh is one of most vulnerable countries to climate change. The 2030 deadline is approaching and there are still many impediments to overcome. He highlighted areas of development needed to achieve the SDGs stressing the need to apply a Systems' Approach to ensure all key parties play their part and is pleased that Sylhet City Corporation (SCC) is leading this type of systems change and hopes more will follow. As a sign that the Local Government Division is committed to implementing change it has increased the annual budget from 14.5Bn -18.3Bn Taka this year. Spending is required to improve the regulatory mechanism. The LGD with support from the Asian Development Bank (ADB), the World Bank (WB) and others has initiated a regulatory mechanism for WASH service delivery. The LGD wants to do more to integrate the thinking and work within Government departments and to update water policies, with support from SNV and other sector stakeholders. It is hoped that this Learning Event will help to continue to push this work. Special thanks to SNV for its support to the Government of Bangladesh to achieve SDG6 and building towards Smart Bangladesh.

PROFESSOR DR MD KABIR HOSSAIN, PRO VICE CHANCELLOR, SHAH JALAL UNIVERSITY OF SCIENCE AND TECHNOLOGY, BANGLADESH

Prof. Hossain is proud to speak about the Sustainable Urban Water Cycle and pleased to be part of this learning event. Urban water is now a global concern with conditions worsening day by day steps need to be taken. Wastewater management, drainage, and solid waste are the main focus. 'Sustainable' is a very important word for developing countries. They need good technology based on scientific research, good time management and honesty (to work efficiently and without corruption), and high construction standards and good quality materials to create high quality sustainable cities. At every stage it is important to maintain quality control.

Over the last 15 years the national Government has focused on making Bangladesh more digital. Now the honourable Prime Minister has set a goal to create 'Smart Bangladesh' by 2041 and this needs to emphasise Sustainability. The Prime Minister has taken steps to ensure this, including involving the Institutes of Science and Technology which is committed to developing technology and research on

sustainable behaviour and business practices. The Government is seeking more discussions to support the development of appropriate policies for technologies.

ABUL MANSUR MD. FAIZULLAH NDC, MANAGING DIRECTOR, BANGLADESH MUNICIPAL DEVELOPMENT FUND

Mr. Faizullah welcomed participants from Bangladesh and new friends from the other countries for coming to Bangladesh to attend this event. He reiterated that Sustainability is a very important word. Programmes and projects must be sustainable both financially and technically (constructions must be safe and not fall down). Urban is the other important word. Bangladesh is the most densely populated country in the world [average population density in Bangladesh is 1329 people per square kilometre, but 38,000 in Dhaka] and a 3.8% per annum growth rate. By 2040 more than half of the total population will be urban exerting huge pressure on the urban municipalities and service providers. He is very pleased that SNV is here to support the urban development in Bangladesh and has signed an MoU with SNV signalling the beginning of a new journey together.

Country governance structure affects the capacity to make improvements. Bangladesh has >330 municipalities, and 12 city corporations. Cities have capacity to respond to urban water challenges, but the A, B, and C municipality categories do not. That is something that needs to be addressed.

Bangladesh faces more calamities every year; abundant water that causes flooding, water scarcity and drought, cyclones, sea level rise etc. but people in Bangladesh have developed resilience to save their lives and minimise their losses. Water does not belong to anyone, it flows and moves between areas and people, so Mayors and other key leaders have the responsibility to take care of that which moves on to others. This learning event will enable views and ideas to be shared, and recommendations to be made that can subsequently be taken to the Government.

CHIEF GUEST, HONOURABLE MAYOR, MD ANZWARUZZAMAN CHOWDHURY SYLHET, CITY CORPORATION, BANGLADESH

Mayor Chowdhury welcomed all guests to Sylhet and this event and gave thanks to SNV for choosing Sylhet to exchange ideas and understanding on what constitutes a sustainable urban water cycle. Sylhet is a spiritual city, known for natural beauty, but many urban challenges can be observed, and institutional changes are needed to address those challenges. Rainfall in SCC is very high and almost the whole city suffers heavy waterlogging every year, and flash floods on top of that occasionally as well. SCC is working to try to minimise the adverse effects. There is a surface water treatment supply system and a solid waste landfill site. SCC is looking to build the change. They are working to develop a private sector sanitary waste system and are planning to introduce sludge management. Officials have visited other countries and best practice facilities elsewhere in Bangladesh and are now implementing best practice in Sylhet too. They are committed to creating a cleaner and smarter city and welcome suggestions for further improvement.

Expectations of participants by country

Participants from each country introduced themselves and shared their expectations of the Learning Event, as summarised below.

Country	Expectations
Tanzania	<ul style="list-style-type: none"> ● To share practical experience, especially the PPP model in Solid Waste Management ● To learn about Sustainable Water Models (There are hard to reach areas in Tanzania and the team hopes to learn ways to reach them) ● To learn how to build infrastructure that doesn't collapse. ● To establish a city twinning programme. The Tanzania team wants to connect with Bangladesh Mayors.

Country	Expectations
Bhutan	<ul style="list-style-type: none"> • To learn about climate resilient infrastructures • To learn about best practice regulatory frameworks (already in practice) • Different challenges in those frameworks • Field visit: want to see what could be adopted in Bhutan.
Nepal	<ul style="list-style-type: none"> • To hear about different country experiences • To learn about techniques that can be adopted • To learn about the integrated cycle, and the integration of policies etc on urban services.
Zambia	<ul style="list-style-type: none"> • To learn about 'systemic thinking' (e.g. to solve the conundrum of lots of water, but limited supply). • To learn about tariff regulations and how to implement them.
Indonesia	<ul style="list-style-type: none"> • To learn good practice from other countries, • To better understand the interlinkages between planning, budgeting, governance, service provision etc. • To learn about Solid Waste Management especially as a water supply risk factor.
Vietnam	<ul style="list-style-type: none"> • To build common understanding of urban complexities and interconnections • To find out more about country experiences and city management.
Bangladesh	<ul style="list-style-type: none"> • To learn how the private sector can be involved in urban water cycle management. • To learn how to ensure cooperation. • To learn more about Water Safety Plans (Bangladesh want to develop these) and land management.
Global team	<ul style="list-style-type: none"> • To find out about country experiences, what works, and which initiatives don't always work.

Country teams and participants had a range of expectations (a broad range and some specifics). It is clear that each part of the SUWC framework approach could have its own learning event. This learning event is intended to provide an overview. It will meet some of the expectations and participants were also advised to make their connections, create 'sister' cities etc to help progress others.

Presentation: SNV's Sustainable Urban Water Cycles Framework Approach

ANTOINETTE KOME, LEARNING EVENT FACILITATOR AND GLOBAL HEAD OF WATER, SNV

Sustainable Urban Water Cycles is one of SNV Water's four framework approaches all of which are built around the concept of Water Security. SNV aims to help cities increase their water security measured via four dimensions: Access and use of water (in quantity, quality, accessibility and reliability), the ability to live in a clean and hygienic environment free from pollution (sanitation, solid waste, grey water and hygiene), an acceptable level of water-related hazards and risks (floods and droughts) and the; quantity, quality and reliability of water resource/s that support the city (water resource security).



Figure 1: Water security and flooding in Sylhet

In Sylhet the flood hazard and risks have received a lot of attention due to last year's disaster, but all four dimensions are relevant and important. The dimensions interact with one another, e.g. a major flood can damage water supply infrastructure (water use), and widespread solid waste contributes to flooding by blocking drainage systems and can also worsen the hazard by contaminants and debris entering flood waters.

SNVs approach to improving the sustainability of urban water cycles has six core components as shown in Figure 2. Though the focus is on the water cycle in the city, a link is made to broader water resource issues in the watershed (the equitable water resource link). Within each of these components a lot of **innovation** is needed to make water cycles sustainable: we need circularity in waste, the ability to store and release water as needed, and people (households and Councils) to be aware of the choices they make (e.g. what it means when they invest in some infrastructure, knowing the expected lifespan and maintenance requirements etc).

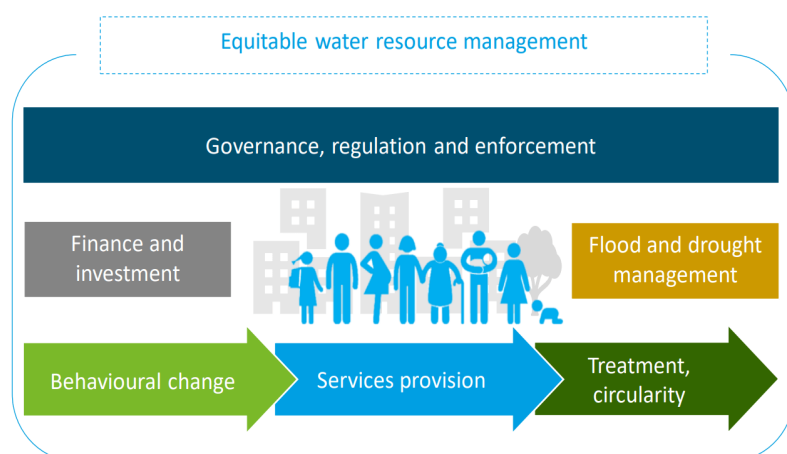


Figure 2: Components of the SUWC Framework Approach

The stars in Figure 3 are just a few of the things where more knowledge and innovation are needed. Priorities for innovation are of course city specific, not everything can be done at the same time. However, with a clear vision and plan cities and municipalities will eventually achieve their goals.

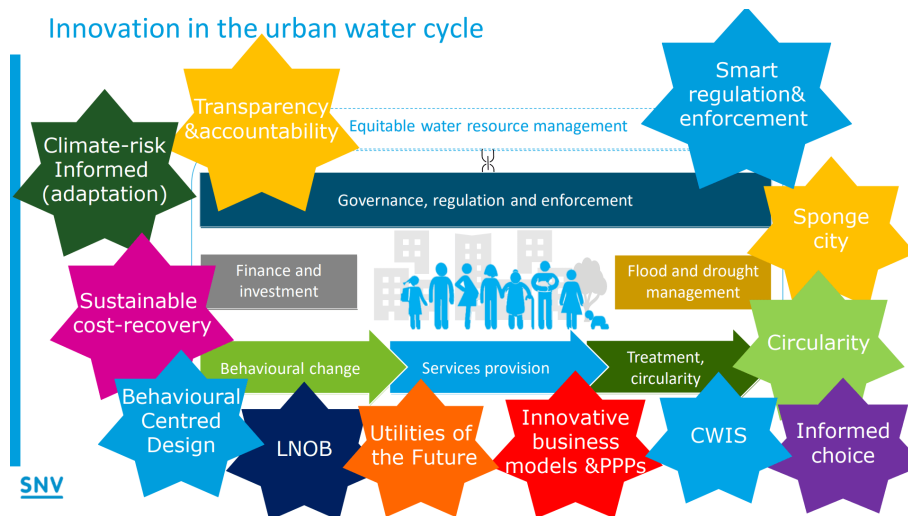
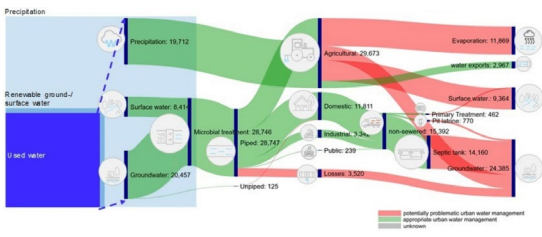
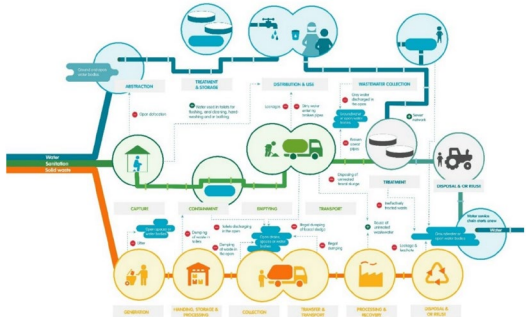


Figure 3: Innovation in the urban water cycle

What is an urban water cycle?

The E-group discussions prior to the event revealed four different perspectives of what an urban water cycle is:

<p>The narrow 'traditional' view of the urban water cycle- the water flow through water supply, wastewater, recycled water and stormwater systems.</p>	
<p>Traditional view plus a focus on urban runoff: the natural water cycle with urban modifications, e.g. contaminated runoff, a big water footprint, long distance water transfers, less evapotranspiration due to hard surfacing.</p>	

<p>Traditional view plus a focus on the resource: consideration of the influence of the broader catchment on a city, e.g. water availability, upstream pollution etc.</p>	 <p>The diagram illustrates the water cycle with the following flows (in units):</p> <ul style="list-style-type: none"> Precipitation: 19,712 Renewable ground/surface water: 8,411 Used water: 20,457 Groundwater: 20,457 Evaporation: 11,889 Agriculture: 29,673 Domestic: 11,811 Public: 229 Industry: 3,520 Water exports: 2,583 Surface water: 9,364 Primary Treatment: 462 Secondary: 776 Non-sewered: 15,392 Septic tank: 14,160 Groundwater: 24,381 Unpipd: 125 <p>Legend: █ potentially problematic urban water management █ appropriate urban water management solutions</p>
<p>An everything-integrated concept: the awareness that within cities water supply, sanitation, grey water, solid waste, drainage, floods and droughts are all connected physically as well as institutionally. Of course it does not mean that everything can be done at the same time; in each city there will be specific entry points for change.</p>	 <p>The diagram shows an integrated urban water cycle with the following components:</p> <ul style="list-style-type: none"> Water Supply: Includes precipitation, surface water, and groundwater. It shows the flow through treatment and distribution networks to residential and commercial buildings. Sanitation & Waste: Shows the collection of wastewater and solid waste from residential and commercial areas. It highlights the connection between wastewater treatment and solid waste management, including the use of grey water and compost. Urban Infrastructure: Illustrates the physical and institutional links between water supply, sanitation, and waste management, showing how they are interconnected in an urban environment.

The way people look at the water cycle is influenced by the problems they face:

- One participant from Australia noted the severity of the Millenium drought, how it triggered many dams to be built, and how one city has 11 dams but 80% of the water resource comes from just one. Australia is therefore very resource focused.
- In Bangladesh cities like Gazipur have grown very fast (formally and informally) and their reality is more concerned about stormwater runoff and urban flooding.
- In contrast in small towns in Kenya, there are still very few paved surfaces so there the focus on runoff is less relevant.
- All country participants recognise that whilst everything is integrated, uncontrolled/poorly managed solid waste makes everything else very difficult to manage. Participants from Bangladesh and India are concerned about chemicals and trash etc all going into the river, whilst participants from Zambia are concerned about waste that impedes infiltration and thus increases flood risk whilst negatively impacting groundwater recharge.

Symptoms of an 'unsustainable' urban water cycle:

When asked to describe what a sustainable urban water cycle means, participants provided examples of problems:

- Water supply shortages due to increasing demand (accelerated urbanisation), deficient aging infrastructure, and a lack of the water resource.
- Services not reaching everyone due to capacity and political factors. Lack of investment and unwillingness to provide to informal areas, but also unwillingness to pay and low tariffs.
- Pollution of surroundings, water bodies, groundwater, due to solid waste, chemicals, wastewater polluting all waters.
- Flooding/waterlogging, due to deficient planning, upstream development, low quality maintenance of the network in the city, construction on water ways.

No one described the water cycle of their city as sustainable; everyone is struggling. It's not just "a lack of city planning". It's simply that the urban growth has been overwhelming. Planners in the the 1960s for

example couldn't imagine how big their cities would become (or how fast some of them would grow). Current leaders and residents have inherited city infrastructure that is not fit for purpose.

To describe what makes an urban water cycle 'sustainable', some participants referred to the need for criteria to help define and track progress. Others suggested specific measures to increase water resources, supply networks, sanitation, greywater, and drainage could help cities get to that situation of greater sustainability. The four dimensions of water security provide a structured way of thinking about sustainability.

- Sufficient amounts of clean water
- Clean environment (free from pollution)
- Meeting needs of everyone and ecosystem
- Acceptable level of disruption of the ecosystem
- In present and future



Figure 4: Four dimensions of water security

Event objectives

The learning event aims to exchange ideas and deepen our understanding of what constitutes a sustainable urban water cycle, and how the different urban services relate to each other.

For this we will explore the current urban water cycle in Asian and African contexts, how different services relate to each, what the equity and sustainability challenges are and how to innovate incrementally.

Figure 5 shows the logic of the learning event and the five blocks of presentations and workshops intended to achieve the learning objectives.



Figure 5: Logic of the workshop

Block 1: Institutional integration of urban WASH services and water

Introduction to block 1

In the Egroup discussion it became clear that there are many different institutional arrangements of the services across the different countries. Rarely one institution is responsible for all: water supply, solid waste chain, sanitation chain, grey water management, floods and droughts. The exception is Bhutan where all these responsibilities are housed within the municipality.

There is no ideal institutional model. Any model is only as good as what it achieves for water security (realizing water security for all in the city in an affordable way). Countries organise themselves in different ways that reflect their own context, and that can change over time as well.

When discussing institutional set-up and how to organise city water management, it easy to fall into buzzwords or generalisations, like “breaking down the siloes”. However, to understand the specific issues and way forward, our wording needs to be more specific and we need to describe the specific issues.


When analysing the institutional set-up we need to consider 4 aspects:

1. The degree of integration (or the integration continuum)
2. The bundling or unbundling of levels or areas of jurisdiction
3. The bundling or unbundling of functions
4. The bundling or unbundling of sectors

1. THE DEGREE OF INTEGRATION

There are pros and cons of ‘bundling’ or ‘unbundling’ service management and operations, and the degree of integration will be unique to each city. Very often the optimum will be somewhere in the middle. The other issue is what aspects should be integrated/coordinated and which should be kept separate.

Table 1: Integration continuum/degree of integration

 The integration continuum/ degree of integration

No contact	Exchange	Coordination	Aligned targets and planning	Joint forces	task	Merged operations
<i><- Less integration</i>						<i>More integration -></i>

2. LEVELS OF JURISDICTION

- Most of the institutions involved in the urban water cycle have a similar jurisdiction, namely the city, but not all. In Zambia, commercial utilities work across multiple cities (regional) to provide water supply and sanitation, but city authorities are responsible for solid waste and drainage;
- In Dhaka, there are two city corporations but only one water and sanitation utility.
- In Mozambique, water and sanitation in towns is the responsibility of the national agency AIAS, whereas solid waste and drainage sits with the towns themselves.
- Some water resource issues will need linkages beyond the city boundaries.

Table 2: Pros and cons of bundling across a bigger area

PROS	CONS
<ul style="list-style-type: none"> • More revenues, so capacity for more staff and technical specialisation (institutions with a small area remit often cannot attract or pay people with specialist skills). • May achieve full cost-recovery. 	<ul style="list-style-type: none"> • Not ‘all children loved’ equally (some areas at risk of neglect). • More bureaucracy. • Institutions with a large area remit can seem impenetrable and distant from the people.

3. BUNDLING FUNCTIONS

Different functions are required within the institutional fabric, e.g. policy maker, regulator, and operator. The most basic requirement is to separate who operates and who regulates, to avoid conflict of interest. There can also be other valid reasons that separate out different institutions. Examples of separated functions are:

- Zambia has a strong national regulator, separated from the operations of water supply and sanitation services, as well as separate environmental and water resource authorities.
- Kathmandu has a specialised autonomous body for asset ownership and creation.
- Bangladesh has the city development authority, a *deconcentrated* entity that is separate to the city authority. A number of issues do not have a clear institutional house at all, e.g. community engagement, occupational health and safety, transparency.

There are also a number of issues which do not have a clear institutional house at all, e.g. community engagement, occupational health and safety, transparency.

Table 3: Pros and cons of bundling across functions

PROS	CONS
<ul style="list-style-type: none"> • Often less costly (things done together). • More outreach capacity. • Often “faster”, fewer decision-makers 	<ul style="list-style-type: none"> • Weaker mechanisms for mutual accountability. Potential conflict of interest. • Less specialisation. • Lack of attention on certain functions (people tend to prioritise). <i>If something is often neglected, then it may require a dedicated institutional house.</i>

4. BUNDLING SECTORS

The most obvious example is the institutional bundling or unbundling of operations of water and sanitation services. Other examples are:

- Participants provided a range of examples of sewered and on-site sanitation services being housed in different entities. This is now changing in Tanzania and Zambia.
- Drainage is sometimes housed with Roads/Highways, not with water or waste services.
- Ultimately all sectors are interlinked in some way, but institutional set-up can’t link everything. Therefore, it is necessary to make decisions on what to bundle, what to keep separate, and how to coordinate planning and operational activities. Bundling some things may be at the expense of alignment with others.

Table 4: Pros and cons of bundling across sectors

PROS	CONS
<ul style="list-style-type: none"> • Greater attention to positive and negative interactions. • Potential cost reductions. • Synchronised planning and implementation. • Cross-subsidies. 	<ul style="list-style-type: none"> • Fewer specialised staff (generalist water staff have been known to forget that sanitation includes On-Site Sanitation as well as sewers). • Less popular issues become marginalised. • No ringfencing, less drive for cost-recovery of individual services.

Participants identified several potential improvements that could be made to the institutional set up in their countries to manage urban water better:

- Role clarity (not even changing roles) just ‘know your role, do your role, and keep each other accountable’. This is a common suggestion.
- Greater alignment and clarity about roles in urban planning;
- Shared data management;
- Shared planning and investment framework;
- More emphasis on regulation, accountability enforcement, and inclusion practices;
- Have a shared horizon or vision for the city;
- Make special efforts that unpopular topics – like on-site sanitation- do not end up being neglected.

Country poster presentations on institutional set-up in each country

Prior to the learning event, country teams were invited to prepare a poster showing the institutional set-up relating to urban water cycles in their country. Each country team presented their poster and national situation with Q&A. During discussions, some teams amended their posters to make clarifications. The country posters (originals and annotated) are available within the Sustainable Urban Water Cycles E-Group system: Sustainable-urban-water-cycles@snwater.groups.io | [Files](#)

COUNTRY POSTER GUIDING QUESTIONS

1. What is the institutional set-up to manage the water supply, sanitation and solid waste service chains?
2. What is the institutional set-up – if any- to manage storm water and grey water?
3. Where do these responsibilities interlink or coordinate?
4. What could be improved?

Clarification of governance terminology:

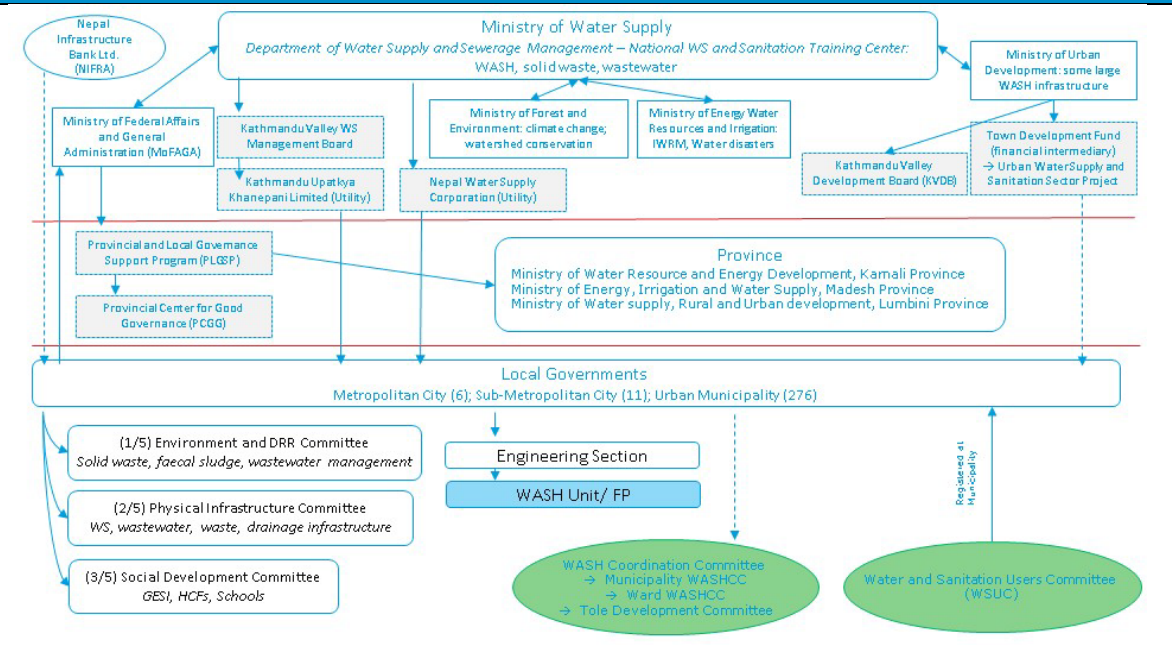
Decentralised= local government is elected and has some autonomy

Deconcentrated= a centralised system with a local branch.



Photo: Presenting Zambia’s urban water cycle institutional set-up.

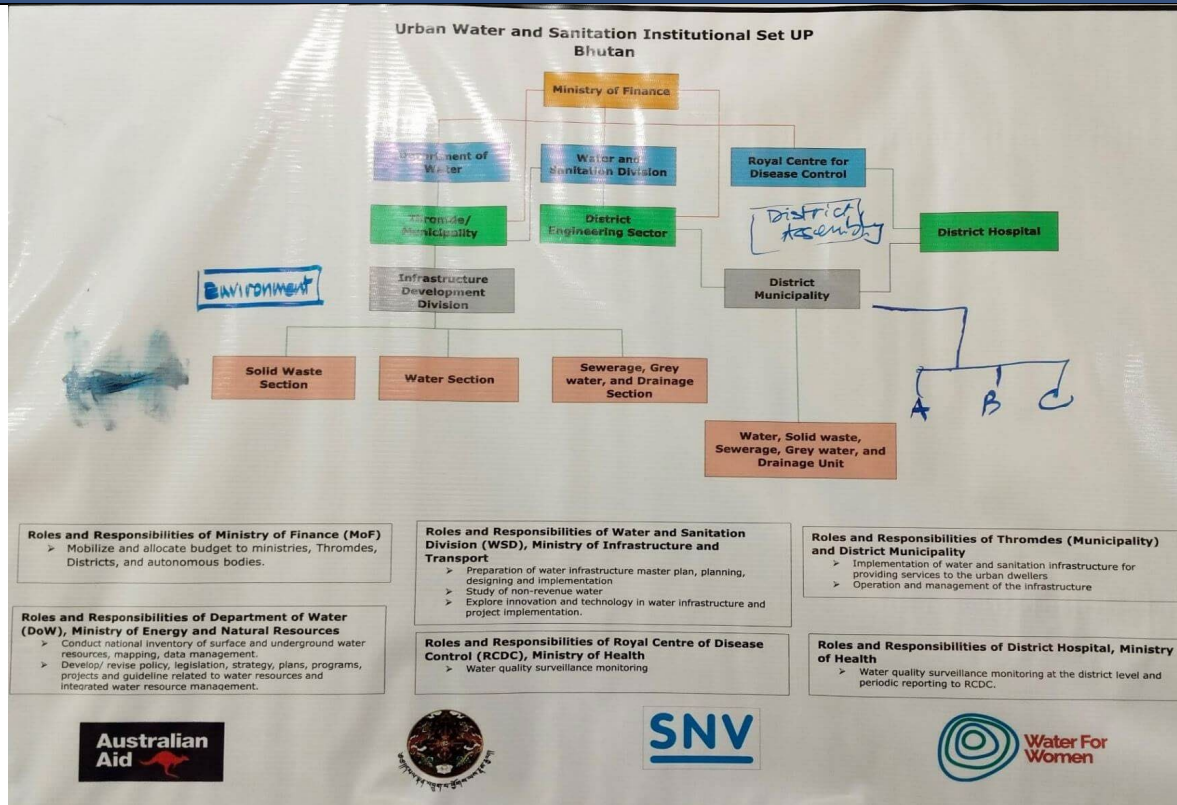
NEPAL



Federal: Nepal has a federal system with three autonomous tiers of government. At the federal level, national ministries should but may not always talk to each other. The various Ministries independently work on topics that should at least be coordinated: WASH, solid waste, and wastewater; Federal Affairs/admin; Forests, climate change, and watershed conservation; IWRM, Irrigation, and water disasters; urban development. Also at the national level, there are semi-autonomous water utilities under the Ministry of Water Supply (the Nepal Water Supply Corporation and the Kathmandu Valley water supply utility which is managed by a board) and financial institutions.

Sub-national: There are 7 provincial governments, 6 metropolitan cities, 11 sub-metropolitan cities, and 276 urban municipalities. Each province has its independent ministerial set up and organises the functions of each ministry as it wishes. The Local Governments are responsible for all aspects of the urban water cycle. Local communities may manage smaller water supply systems via Water Users and Sanitation Committees which have to be registered with the local government. The 'Town Development Fund' (autonomous intermediary institution in the country presently providing debt financing to local governments) provides access to financing but there is a limit to the loans local governments can take and the many smaller cities have to organise and finance their own local delivery.

Nepal is experiencing a common problem shared by other decentralised countries that have been previously centralised, in that they now they have to stitch the institutional structure back together. The group recommends the creation of a single agency/coordination unit that is responsible for helping local level planning, financing, and service delivery.



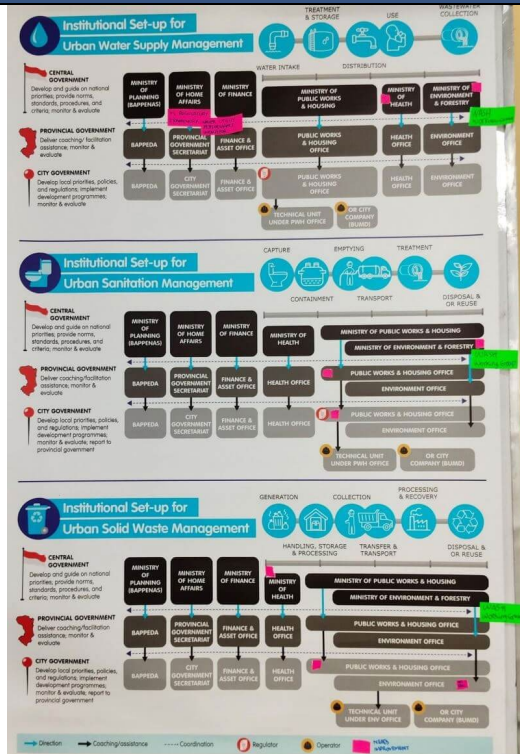
Nationally, water and sanitation is divided into two divisions with many sections, each one has a section head. Implementation is not coordinated.

Districts: Power of the elected people in the District: The elected member identifies the critical issues by consulting with the public, and then they prioritise. They submit needs to the District Office (civil service). D.O completes the technical work, project reports, review of those critical issues etc. Finalisation of projects goes to Ministry of Finance for budgeting. Planning and financing is organised within a five-year master planning cycle. Bhutan is currently in its 13th five-year plan.

Municipalities are divided into zones, each zone has a representative. Disagreements are resolved in the District Assembly and then proposals are submitted to the Ministry of Finance.

Services within the big city municipalities are split up between different sections. In the smaller districts everything is bundled in one session. Planning is done mostly bottom-up. Proposals are submitted to the District for funding. If district doesn't have capacity they refer to technical support, supported by the Ministries.

INDONESIA



Indonesia is a decentralised country and the water supply, sanitation, and solid waste management institutional set up has a clear Central, Provincial, and City Government structure/hierarchy.

Roles:

Central Government: sets targets, norms, and criteria. Central Government is strong, especially the Ministry of National Development Planning who sets the national goals and strategies.

Provincial Government: provides technical support to local government (Province role is now being squeezed in).

City Government: develops local development plans etc depending on the national documents. They report back to the Central level.

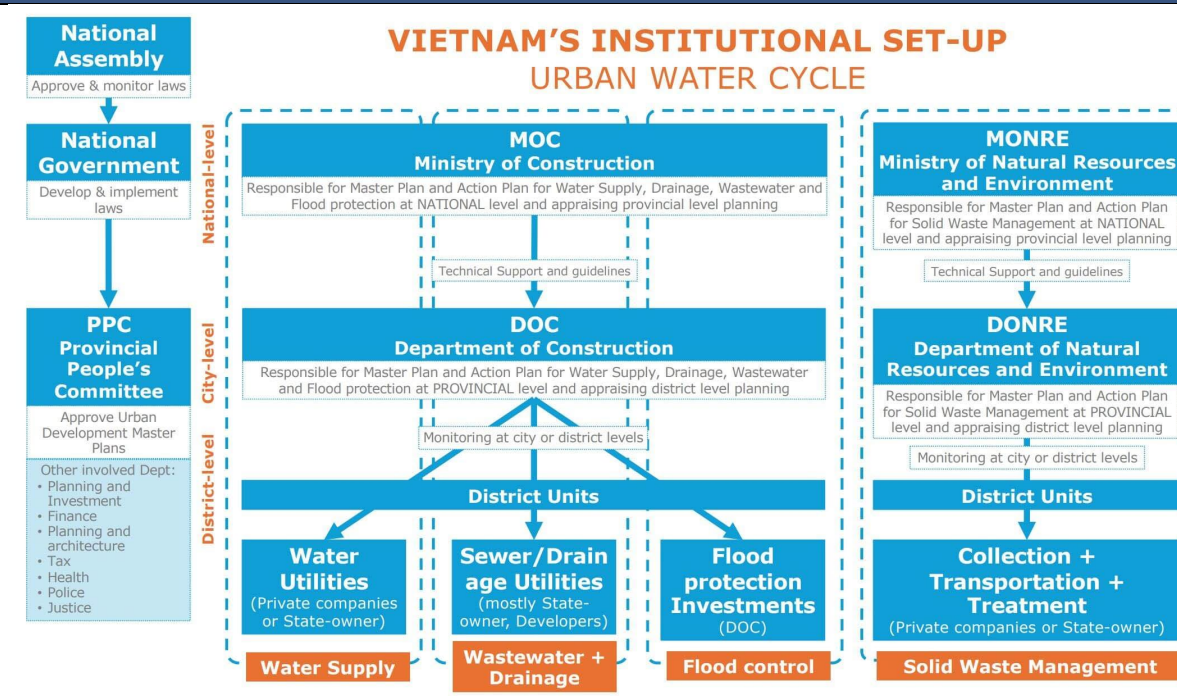
The same ministries are involved in water, sanitation, and health:

- Ministry of Development and Planning – horizontal coordination.
- Ministry of Home Affairs (provides coaching, training, and assistance to Local Government)
- Ministry of Finance – provides the money.
- Ministry of Health - development strategy and SWM (under national strategy)
- Ministry of Public Works and Housing (builds the main infrastructure and operates the systems)
- Ministry of Environment – responsible for pollution (but no enforcement).

Service chains at the local level are generally structured in the same way. There are WASH working groups at all levels.

Different parts of the structure need more improvement. Oversight and enforcement are the key weaknesses.

The National Audit Authority is responsible for making the institutions accountable.



As a communist country, everything is centralised, but there are private sector focussed services.

National level: there is a National Assembly, and a National Government. Two ministries are responsible for water:

- Ministry of Construction - deals with infrastructure.
- Ministry of Natural Resources and Environment (MONRE) - deals with solid waste management etc.

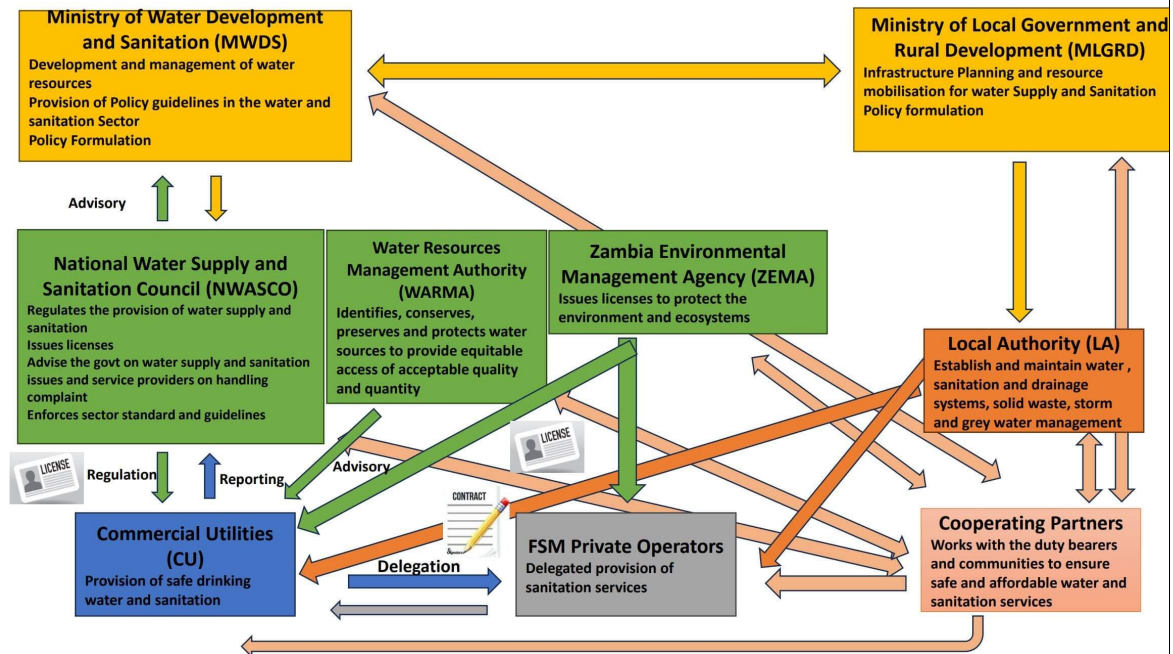
Sub-national local government: Provincial People's Committee (PPC). 65 Provinces (e.g. whole of Hanoi, or one can contain multiple smaller cities). Provinces in Vietnam are very powerful, and Hanoi and HCMC has special status/autonomy. District level can also be size of a small city. Departments at local level do monitoring, contracting etc.

Drainage: 99% septic tanks connected to drains, canals, treatment facility. Treated by a state-owned utility (not sufficient cost recovery). Floods are managed by the Department of Construction.

SWM: similar structure but MONRE in charge. Districts are responsible for collection. Province responsible for treatment. The transfer of SWM knowhow from MoC to MONRE is still a challenge. Services are mostly privatised or state-owned companies. Capacities vary considerably. SWM contracts are for 3 years. Specifications are clear and companies have to demonstrate capacity and state their fees clearly. HHs pay a SWM fee (\$3 per person per year) to the district unit, or in other places they pay direct to the operators. 80% of cost is subsidised by the Government (PPC).

Water supply: tariff has been frozen for 20 years and hardly even covers the operations. Small companies can't afford to invest in anything. People pay by volume (not much). Hanoi – has multiple water supply companies.

Zambia's Institutional Framework of water supply, sanitation and solid waste



At the **policy level**, the two primary government stakeholders are the Ministry of Water Development and Sanitation (MWDS) and the Ministry of Local Government and Rural Development (MLGRD). The MWDS has existed since 2017.

There are **three regulators**: the National Water Supply and Sanitation Council which regulates urban and rural water supply, the Water Resources Management Authority which regulates water resources, and the Zambia Environmental Management Agency (ZEMA) which regulates protections for the environment and ecosystems.

Urban water and sanitation service delivery: Urban water services are delivered by Commercial Utilities, quasi-government entities. Local governments are the majority shareholders and own the assets, hence they are publicly owned utilities. Each province has a utility, and two bigger provinces have multiple utilities. The CEOs of the utilities report to the Ministry of Water. Since decentralisation the heads of Government departments report to the Local Authorities who are under the MLGRD. The Local Authorities have oversight of the utilities but do not have the technical expertise to advise on day-to-day operations, so the regulator is important for overseeing the technical operation of the utility. The government has an important role of making sure the poor are not underserved. The utilities have a mandate to ensure water and sanitation services are delivered. They can contract out to private service providers – for example, they contract private operators to provide desludging services. Private service providers require a business license from the Local Authorities and a service contract with the utilities.

Solid waste management service delivery: Solid waste management is the responsibility of the council. Some councils contract private operators to carry out solid waste management.

TANZANIA

Water supply and sanitation, solid waste management, and stormwater management are each looked after by different government bodies.

At the **policy level**,

- The Ministry of Water and the President's Office Regional Administration and Local Government (PORALG) govern water and sanitation services. The Ministry of Water, through the water sector government program, oversees sector strategy and visioning for water supply and sanitation in the country.
- The PORALG has responsibilities relating to both sanitation and solid waste. The PORALG also monitors the activities of all local government authorities, including solid waste management activities.
- The Ministry of Health sets policy for solid waste and sanitation.
- Finally, the MLHSD and local government town planning authorities develop master plans for all city services including water, sanitation, solid waste and drainage.

Urban water service delivery and

regulation: Urban water utilities deliver water supply services. Local government authorities oversee sanitation and hygiene. Greywater goes into sewers where they exist, otherwise greywater is combined with onsite sanitation systems. The Energy and Water Utilities Regulatory Authority is the regulator for urban water supply.

Solid waste management service delivery and regulation: For solid waste management, communities are responsible for managing solid waste on their premises. Private operators will collect waste and operate recycling facilities. Local government authorities oversee solid waste management services, operate disposal sites, and contract services to private operators. NEMC, under the Department of Environment, carries out environmental audits and enforces compliance with environmental health standards. A Regional Secretariat coordinates advice on all environmental management activities.

Drain management: There are three types of roads based on size – each are managed by a different authority that also looks after its drains. Tanzania roads agency looks after the biggest drains along the highway. Local government authorities manage the drains on medium sized roads. Drains connect to roads less than 15m wide are managed by communities through their councillors. The Ministry of Land and the Ministry of Works are responsible for policy and regulations related to roads and stormwater drains. Local government authorities are responsible for construction and rehabilitation of drains.



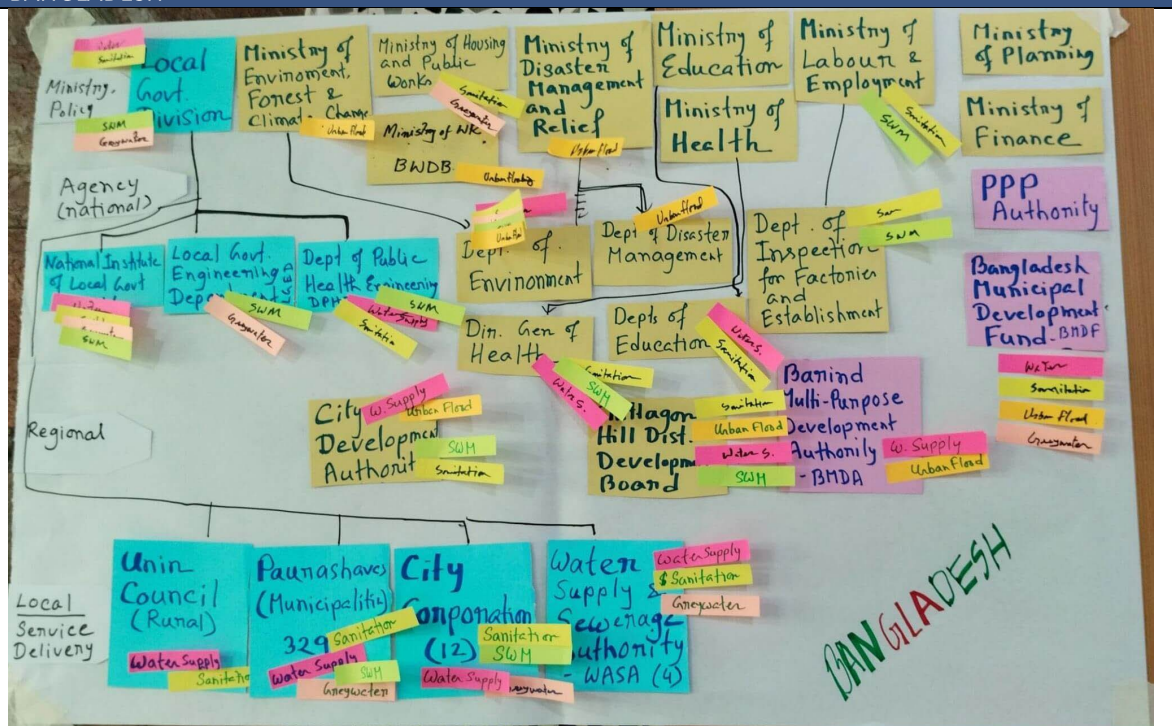
Legislation: The Environmental Management Act relates to sanitation and stormwater. The Public Health Act also relates to sanitation. These and other acts guide the institutional arrangements and responsibilities.

Areas in need of improvement: The creation of stormwater and solid waste regulations; More meaningful climate change integration throughout WASH, solid waste and drainage management, and strengthened collaboration in the implementation of services.

Politicians are interested in SWM because some cities are a tourist area and point of pride so they want the city to appear clean.

The coordination between the drains at the different levels happen at the town master planning level, but issues arise in terms of maintenance and cleaning of drains.

BANGLADESH



At the **policy level**, the Local Government Division contains the National Institute of Local Government, Local Government Engineering Department, and Department of Public Health and Engineering as implementers, and there is also a Policy Support Branch. The Ministry of Environment, Forest and Climate Change set policies for water supply and sanitation. No formal regulatory authority for WASH exists in Bangladesh, but one is being formed for 2024 or 2025. The Ministry of Water Development and Water Development Board manages rivers and flooding issues. The Directorate General of Health Services relates to WASH in HCFs and solid waste management. The Ministry of Finance and Planning controls finances. PPPs also come through this ministry. Finally, the Bangladesh Municipal Development Fund is used for funding improvements at the municipal level.

At the **agency level**, City corporations and municipalities look after all urban services. There are 12 city corporations and more than 300 municipalities. Water Supply and Sewerage Authorities (WASAs) are present in 4 city corporations and look after water and sanitation. Where WASAs are not present, city corporations take WASH responsibilities. WASAs look after greywater as well. Ministry of Local Government and Public Health Department provide support for WASH for local government authorities.

Local government authorities look after drainage. They work with other Ministries like Ministry of Labour on building and maintaining drains. The city development authority is responsible overall city planning which includes water supply, sanitation, flooding and solid waste management. Ministry of Health looks after WASH in healthcare facilities. The Ministry of Education looks after WASH in schools.

Horizontal coordination at the agency level is not strong.

If there is a problem between WASA and City Corporation, a committee within the Cabinet Division led by Secretary of Coordination and Reforms will resolve it. The Prime Minister’s office gets involved in big projects to support with coordination.

Reflections on the country posters – what to take back to your own country

After hearing the poster presentations on institutional arrangements in each country, attendees were asked to summarise inspirations they would like to take back to their own countries

Table 5: Country reflections on poster presentations

Country	Lessons to take back home
Bhutan	<ul style="list-style-type: none"> • Elected bodies are missing from the Bhutan institutional diagram so these should be included. • A separate independent regulatory body to handle conflicts of interest and overlapping mandates is needed for checks and balance. • Delegating service delivery responsibilities through contracts to private operators at local levels could be trialled in Bhutan.
Zambia	<ul style="list-style-type: none"> • Political will is needed on implementing urban water cycle principles. • Strengthen planning and enforcement at local authority levels. • Implement storm water regulations and improved management of stormwater.
Indonesia	<ul style="list-style-type: none"> • Ensure that community members can voice their concerns through bottom-up proposal making process on improvements. • Ensure meaningful participation of community members with WASH planning and budgeting. • Create a regulatory framework for licensing and law enforcement for WASH and SWM. • Improve clarity on provincial roles.
Tanzania	<ul style="list-style-type: none"> • Longer-term contractors for private operators instead of short-term contracts. • Privatised utility services to a greater extent. • Create a single regulator for rural and urban WASH.
Nepal	<ul style="list-style-type: none"> • Create a separate regulatory authority, especially for pollution control. • Develop a drainage master plan that is linked to the road plan and linked to river basin management plans.
Bangladesh	<ul style="list-style-type: none"> • Establish a committee led by the Local Government Division to solve the issues of complex coordination of many ministries and legislation. • Establish a district-level coordination committee to resolve coordination issues at the local level. • Make improvements to data management and sharing systems so that authorities can learn from others and avoid duplication of efforts.

TRY THIS:

Look again at the posters.

- 1) What is similar and what is different in the other countries? Levels- functions- sectors- degree of integration
- 2) Do you see things that are better than in your country? Why?

Think about your own country:

- Are all urban water services given sufficient attention within the existing institutional structure?
- Are all urban residents needs equitably covered by the existing system?
- Are the distinctions between who operates and who regulates strong enough?
- Is the role of the private sector in providing services appropriate (not too small, not too dominant, sufficiently regulated)?

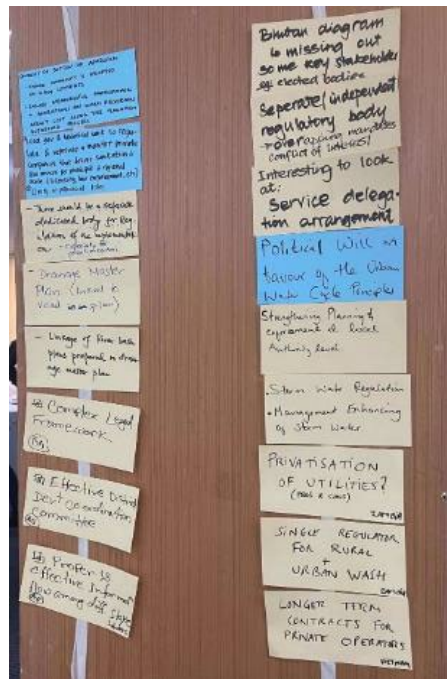


Photo: Reflections by participants

Institutional arrangement Q&A

Following the poster session, there was discussion on the usefulness of creating ministries specifically for water and for climate change. Attendees were asked “should there be a Ministry of Water that is responsible for all things related to water?” Attendees said it could be beneficial because it could:

- result in more resources allocated to water issues;
- result in greater advocacy for water management; and
- could help overloading other ministries with water-related responsibilities that are already stretched too thin.

However, it was also argued that it is less important whether there is a Ministry of Water or not, and more important to have an established and well-resourced regulator that can oversee whichever ministries have water responsibilities. Attendees were similarly asked if it was useful to have a Ministry of Climate for climate change related governance. Attendees made a range of points on this:

- It is beneficial to have a Ministry of Climate because it is difficult for most ministries to understand climate change, so a dedicated ministry could help with interpreting climate information for other parts of government.
- A Ministry of Climate Change might be seen as the implementer of climate change initiatives, but their role should be in coordination rather than being an implementer.
- A Ministry of Climate could help with mainstreaming climate change into other ministries’ work.
- Ministries need help with accessing climate information and how to use it for their work, which a Ministry of Climate Change could help with.
- Maybe it doesn’t need to be a ministry, but rather a secretariat to provide support.
- Ministries already need to link their work to a national framework on adaptation to climate change in Bangladesh, otherwise it won’t get approved, so it’s not necessary to have another ministry to do that.
- **Only two presenting countries mentioned climate change as part of their institutional set-up. Governments are not obliged to have a specific climate change entity, but it is important to understand how climate change is taken into account in Government policy.**

Block 2: Urban water cycle in Bangladesh

Presentation: Bangladesh Urban Service Delivery

SHAHIDUL ISLAM (WATER SECTOR LEADER) AND SUMON ALI (ENGINEERING ADVISOR), SNV IN BANGLADESH

To prepare for the field visits on the following day, Shahidul and Sumon presented an overview of urban water cycle service delivery in Bangladesh.

Bangladesh is experiencing rapid urbanisation, partly driven by the lack of civic infrastructure. 41% of the total population is now living in 12 major cities and there are 329 secondary and small towns. Growth is not even across all areas. Flooding is a regular problem driven by the monsoon climate affecting densely urbanised areas that have little space to accommodate or infiltrate water. Weather patterns are becoming more erratic with more even more intense periods of rainfall during the monsoon, and even outside of the regular monsoon season. Flooded conditions cause many direct problems for people and make it very difficult to perform service delivery. Drainage networks do not work optimally due to building encroachment and the accumulation of solid waste.

The Bangladesh Bureau of Statistics has surveyed solid waste and found that City Corporations and A-Category municipalities each on average each produce over 3 million kilograms of solid waste each year. Food waste is the biggest proportion, comprising 63% of the solid waste.

Flood and drainage services

Floods are a prevalent natural disaster in Bangladesh, impacting both urban and rural areas. The country's geography, with its low-lying delta and numerous rivers, makes it highly susceptible to flooding, exacerbated by climate change and rising sea levels. Hence, flood and drainage services are crucial components of the country's infrastructure, given its susceptibility to regular flooding. Bangladesh experiences both riverine and flash floods, which pose significant challenges to communities, agriculture, infrastructure, and the economy. To address these challenges, Bangladesh has developed extensive flood management and drainage systems over the years. The country has invested in the construction of embankments, flood shelters, and drainage canals to mitigate the impact of floods and protect vulnerable areas. Additionally, early warning systems and disaster preparedness measures have been implemented to minimize loss of life and property during flood events.

Government agencies, such as the Bangladesh Water Development Board (BWDB), play a central role in managing flood and drainage services. They are responsible for the maintenance of embankments, dredging of rivers and canals, and the operation of flood control infrastructure. Non-governmental organizations (NGOs) and international development partners also contribute to flood management efforts through community-based initiatives, capacity building, and the implementation of sustainable drainage solutions.

Despite these efforts, challenges remain, including inadequate funding, population growth, climate change, and encroachment of water bodies. Addressing these challenges requires continued investment in infrastructure, improved governance, community participation, and the integration of climate resilience measures into flood management strategies.

Water supply services

Water supply services in Bangladesh face significant challenges due to rapid urbanization, population growth, and environmental degradation. As per JMP 2023, approximately 2% of Bangladesh's population lacks access to improved water sources. Groundwater depletion and contamination pose serious threats to the country's water supply infrastructure. To address these challenges, the Government of Bangladesh, along with development partners, has implemented various initiatives to improve access to safe drinking water. The installation of deep tube wells, piped water supply systems, and rainwater harvesting facilities has helped increase access to clean water in both urban and rural areas. Additionally, community-led water management programs and awareness campaigns have been launched to promote water conservation and hygiene practices.

Despite these efforts, access to safe drinking water remains a pressing issue in many parts of Bangladesh, particularly in remote and underserved areas. Sustainable solutions, such as integrated water resource management, pollution control measures, and investments in infrastructure and technology, are essential to ensure universal access to safe drinking water and improve the overall health and well-being of the population.

Drinking water

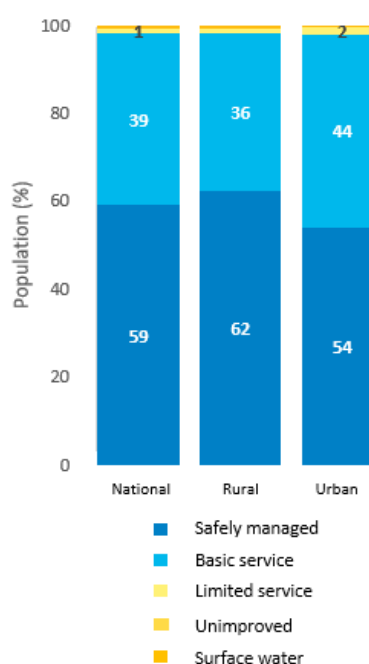


Figure 6: JMP drinking water service ladder (2023)

Solid waste management services

Secondary transfer stations and concrete bins exist that consolidate solid waste at a neighbourhood- or ward-scale. Smaller three-wheeler vehicles and bigger vehicles with compactors are both then used for transporting solid waste to dumping sites. Dumping is done in centralised and decentralised landfills, some of which have uncontrolled dumping where waste is dropped off indiscriminately. Other landfills (sanitary landfills) have more coordinated dumping.

Presentation: Solid waste management

MR MD ALAUDDIN AHMED, ITN-BUET

Solid waste management rules

The Solid Waste Management Rules 2021 is the primary document guiding solid waste management in Bangladesh. Rule 6 identifies a 'waste hierarchy' to be followed for resource recovery in which avoiding the creation of solid waste is the preferred option followed by reducing, reusing, recycling, recovering, and finally (least preferably within the hierarchy) treating waste. The Solid Waste Management Rules also clearly identifies the respective responsibilities of different stakeholders including waste generators and users, institutions, product manufacturers and importers, and local government institutions (rules 7 – 11). Finally, rules 12 and 13 outline an action plan and call for yearly reporting and monitoring mechanisms.

The Solid Waste Management Rules also include **Schedules which provide for standards and instructions related to solid waste:**

Schedule 1 lists household hazardous wastes.

Schedule 2 provides standards for composting processes and products such as the standards for leachate, operating standards of incinerators, and stack emission standards.

Schedule 3 provides instructions for landfills including site selection, distance indicators, pollution prevention measures, outer layers for covering landfills, features of sanitary landfills, instructions for landfill covering, tree planting, approvals, ground and air quality standards around landfills, and more.

Schedule 4 provides standards for waste-to-fuel conversion.

Urban service challenges

There are a number of gaps and areas where **improvement of solid waste management** is needed:

1. Lack of technical expertise – there are actually a lot of staff, but they are not experts. This results in the misallocation of resources and mismanagement of services.
2. Inadequate labour for cleaning services. The staff exist but are limited because they do not have good equipment and have low wages, poor working conditions and weak incentives.
3. The Conservancy sections – who are responsible for solid waste management - have inadequate staff. Class-A municipalities only have one Conservancy Inspector and four Conservancy Supervisors while Class-B and Class-C municipalities only have one Conservancy Inspector and two Conservancy Supervisors.
4. Insufficient and substandard infrastructure and services. Waste collection equipment and vehicles are outdated or insufficient, collection points are scarce, recycling facilities are absent in many places, and there is a need for modern technology for material segregation.
5. Lack of separate fund allocations for solid waste management. Citizens are often reluctant to pay the conservancy tax and there is not a well-defined budgetary allocation for solid waste management.
6. No master plan for solid waste management resulting in fragmentation and inconsistent efforts.
7. Informal nature of waste workers that undermines workers' rights and leads to workforce instability due to high turnover.
8. Low citizen awareness that creates inconsistent adherence to waste segregation, recycling, and responsible disposal.
9. Poor communication to the general public about solid waste management that makes it difficult to secure sufficient funding, support technical expertise and resources.

WASH is a subsector in Bangladesh, not its own sector, so it doesn't attract as much funding. Same with solid waste management. **Other challenges include:**

1. The organisational structure for solid waste management was created a long time ago and now is not aligned with emerging issues;
2. Services are regulated by the local government division, but the regulation mechanisms are insufficient and there is no independent regulatory body.
3. Enforcement is lacking;
4. Low participation of citizens in city planning, so different needs of citizens are not addressed. They don't believe they will be listened to, so can't see the point of engaging;
5. Lack of private sector investment in solid waste management. The private sector is interested in getting involved but has low level of confidence that its investments are secure. Changes in government can rapidly affect contracts;
6. Accountability mechanisms are not fully implemented, and data is not fully utilised so decisions are not evidence-based; and

- Changes in leadership. Leaders are elected, but changes in the leadership impacts everything and new leaders do not always prioritise solid waste management.

Municipalities tend to be even less well-equipped than City Corporations.

Other **difficulties relating to wastewater** to address are:

- There are no standards for greywater or septic tank and soak pit effluent (most septic tanks do not have soak pits. Widespread misconception that soak pits require a large amount of space);
- Greywater reuse is currently not given much attention (no enforcement of 'guidance' on household greywater reuse);
- Effluent from septic tanks typically goes into the drain; and
- Large amounts of water are consumed which generates a lot of greywater.

Field assignments

The workshop participants broke up into four groups to visit locations in and around Sylhet and explore real-life issues relating to the Sustainable Urban Water Cycle. Each group prepared their assignment on the Monday, and spent the Tuesday visiting key stakeholders and observing infrastructure relating to one of the four urban water cycle topics.

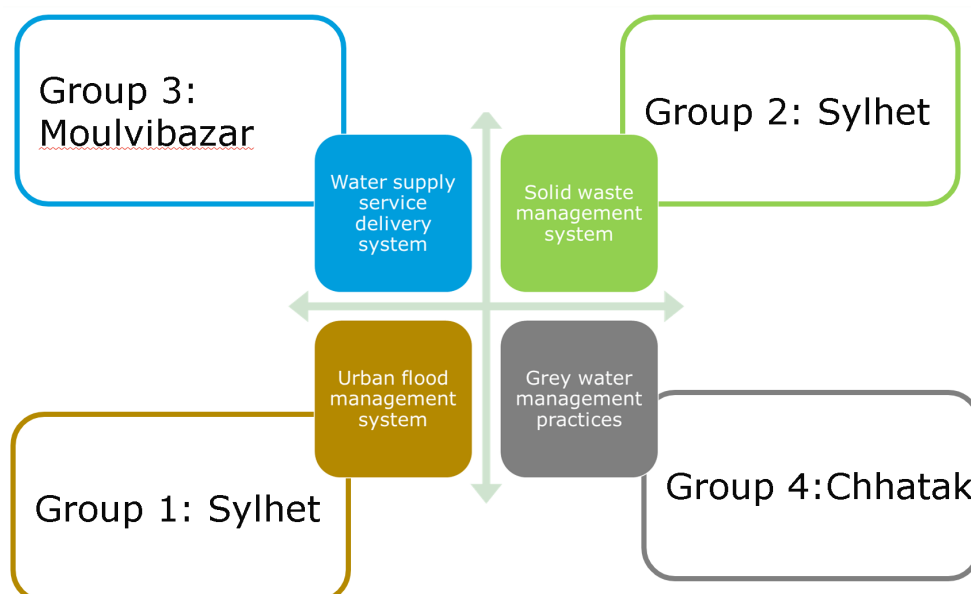


Figure 7: Field visit group topics

Objectives

The objectives for each group were to:

- Meet with stakeholders and observe infrastructure to understand and describe the system of urban services specific to their group.
- Analyse its strengths, weaknesses, opportunities and threats (SWOT analysis);
- Provide modest feedback and recommendations to Bangladeshi partners.

Each group comprised participants from different countries with mixed skillsets. The participants were asked to share their findings through a photo diary, a 2-page case description, a testimony of a key stakeholder, a PowerPoint presentation with impressions and recommendations. These more detailed outputs are available in the Sustainable Urban Water Cycles E-group (available to members): Sustainable-urban-water-cycles@snwater.groups.io | [Files](#)

Field Assignment group 1: Urban flood management

GROUP 1 VISITED SYLHET CITY CORPORATION AND COMMUNITIES AND A SCHOOL IN SYLHET.

Flooding issues: The source of the water for the Surma River (the major river in Sylhet) and its tributaries comes from the mountains in India. Flash flooding happens regularly because of the intensity of rainfall and the surface runoff coming down quickly from the mountains. An extreme flood happened in 2022 which had a high death toll.



Photo: Surma river and a drainage canal.

There is an absence of flood defences around key infrastructure, so important infrastructure gets disrupted which, in 2022, included power systems that were knocked out for a prolonged period.

There was also a severe rainfall event in 2017. There are canals within the city that are full of solid waste as a result of frequent dumping of solid waste into the canals. This contributes to blockages that worsen flooding events.



Photo: Low-income household discussing their experience of flooding

Even though community members are accustomed to flooding, the 2022 flooding was so severe that they needed to evacuate their homes.

Riverside communities on both sides of the river say they do not receive official flood warnings, especially of flash flooding which takes them by surprise.

Flood protection and governance



The current flood management system includes stormwater drains that discharge into the Surma River. There are 23 canals throughout the city with a total length of 104km of primary drainage.

There is a conservancy department and engineering department who are responsible for the construction and O&M of the drains. A building approval committee ensures compliance with building standards. There is budget allocated for regular maintenance of the drains.

Photo: Sylhet District Bangladesh Water Development Board

SWOT analysis:

Strengths:

- CAPEX has been approved for drainage.
- A flood management feasibility study was conducted.
- Leadership is prioritising floodwater management.
- Some equipment is available for drainage cleaning

Weaknesses:

- Low awareness from the citizens about solid waste management.
- Low enforcement of SWM practices
- Inadequate design of existing infrastructure.
- No O&M plan with sufficient budget.
- Coordination needs to be improved.
- Early warning systems only exists at the national level but not at the city level.

Opportunities:

- National plans/priorities for floods which increases access to flooding.
- A WASA was recently established which could help with flood managements, but they are not fully functional yet.
- The national monitoring systems collects flood data that could be used.
- The community awareness is low in places but they are willing to be engaged.
- There is a district coordination platform that can be utilised.

Threats:

- There is limited space for large infrastructure.
- Limited cooperation with Indian counterparts.

Recommendations

- Establish an effective coordination mechanism.
- An integrated master plan on SWM, stormwater and sewers.
- Improved engagement with communities on decision-making.
- Use national data to inform city-level early warning systems. People don't get the right information at the right time from the national level warning systems.
- Flood modelling using climate change data.
- Nature based solutions could be explored further to support a more sustainable drainage system.
- Development of by-laws to strengthen compliance with flood management regulations.

Following the presentation, the audience shared their thoughts and asked questions:

Drainage and flooding Q&A

Comment: A master plan was developed in 2010 but it was not comprehensive. There is a need for a new master plan and to consider the things mentioned in this presentation.

There are 4 elements of flooding: The drains, rivers, where the river outfalls to, and upstream activities in India. During the 2022 flooding, the flood level was 12m. So, if the outlets of the river are overwhelmed by the height of the water, there is no outfall and flooding happens. Behaviour is a challenge in terms of how solid waste is disposed. The City Corporation has a budget to educate community members but there are resourcing limitations for raising awareness.

The early warning system recommendations are important. There should be a committee to warn local people about the threats. The City Corporation is also working on this.

Comment: In the master plans, if a building is known to fall into a flood-prone area, then it should be considered for additional action.

Comment: People in Sylhet are very proactive in engaging with the local government offices. They have been willing to sacrifice their land for government development projects, like roads. People in Sylhet are generous in that way.

Comment: Some parts of Sylhet are very clean. Perhaps these areas could be identified as model parts of the city and we can learn from them about why they are so clean.

Question: Nature based solutions were mentioned as a recommendation? Can you give an example?

Answer: There is a lack of available space to do infiltration and retention technologies. Not much land for ponds that provide for natural retention and they are being filled to make room for more development. There are some small spaces where infiltration technologies could be installed – the challenge is finding any place where there is land where water can be infiltrated. There are some types of pavements that can absorb water. Can the City Corporation make by-laws for building to make space for infiltration?

Comment: Infiltration technologies need to be dug manually. Some places it is not possible to bring in excavation equipment to dig next to the canal. Many of the canals also need to be cleaned manually because it's not possible to bring heavy equipment along the canal for cleaning because of lack of space.

Field Assignment group 2: Solid waste management

GROUP 2 VISITED SYLHET CITY INCLUDING HOUSEHOLDS, A RECYCLING FACILITY AND A LANDFILL.

Overview of solid waste management:

380MT of waste is generated per day. 350MT is collected per day. That means 30MT of waste goes unaccounted for. 650 people and 86 transportation vehicles are used to collect and take waste to a sanitary landfill.

There is one material recovery facility, and an open dumping area.



Photo: Sylhet landfill site.



Photo: Sylhet solid waste collector.

Some people receive monthly payments from a community-based organisation to go door-to-door to collect solid waste and transfer to the Secondary Transfer Station (STS).

Typically, workers do not have equipment or access to personal protective equipment (PPE). There is no segregation of waste at source. No protective equipment for people working with solid waste. The transfer stations are well organised with inspectors, but they don't wear PPE. There is a new sanitary landfill which incorporates recycling practices. Public-private partnerships exist for solid waste management.

Waste picking:



Photo: Waste pickers at the landfill site.

People practice waste picking to recover valuable materials from landfills. Some people have migrated to the city because flooding destroyed their livelihoods. They could not find jobs in the city so they started waste picking. They generate little income doing this and work in very unsafe conditions. They have no equipment or personal protective equipment. They would like to have basic materials from the City Corporation to help with their work.

SWOT analysis:

Strengths:

- Involvement of different people including private sector in solid waste management.
- The financial state of the city seems to be strong so there are opportunities to invest in SWM.
- Some infrastructure, such as 68 solid waste trucks, already exist to safely managed the waste.
- There is also strong leadership, such as the chief waste management officer.

Weaknesses:

- The primary collection system is left to the ward councillors with little oversight from the city.
- The city has little engagement and knowledge of what is happening at the ward level.
- The fee for waste collection remains at the ward level.
- There are no occupational health and safety guidelines.

Opportunities:

- Potential for more collaboration with private sector and local communities.
- There is sufficient land for expansion of facilities at the new landfill.
- There is already a thriving recycling business within the city (but not safe).
- BMDF funds could be used to improve SWM.

Threats:

- Occupational health and safety.
- Solid waste collection staff are not permanent and are paid for only 8 hours of work when they work 14-16 hours.
- No faecal sludge treatment so faecal sludge is mixed with solid waste in drains and canals.
- During the monsoons season and heavy rains, the solid waste is washed into the rivers and canals which causes blockages.

Recommendations:

- The city could consider managing the entire solid waste systems including M&E;
- OHS guidelines could be created for waste workers;
- There is a need for waste segregation at the source or at transfer stations;
- Integrate behaviour change communication into solid waste management plans;
- Encourage organics waste reuse at the household level;
- Digitalize the collection system, fee collection and human resources management;
- Enforce compliance at all steps of solid waste management systems;
- Conduct life cycle costing for the material recovery facility (MRF);
- Develop faecal sludge management systems.

Following the presentation, the audience shared their thoughts and asked questions:

Solid waste management Q&A

Comment: The Sylhet City Corporation could consider a business model for the entire solid waste collection from household to transfer station to disposal. There are three types of waste collection: through councillors, through community-based organisations and through individuals. The individuals need more support. The people picking through waste often come in seasonally, so providing them support is challenging because they are not permanently here.

To have primary source segregation of waste, then we need to double the number of trucks so it is difficult to afford. This is a longer-term goal. There is a good opportunity for organic re-use at the local level.

Comment: The first step for improving solid waste management is to develop a proposal. Sylhet will be a clean city within 5 years because there is a plan for the infrastructure and people are thinking about the problem. Sylhet City Corporation is doing good work in this regard.

Comment: The name of the conservancy department was changed to the waste management department.

Comment: Informal workers are doing waste collection and management work that might amount to millions of Taka of value, but they are not compensated much for it.

Question: What kind of waste characterisation has been done in the city? This would help with planning. 60% of waste is organic waste, but where could other parts of the waste go? For example, could the cement factory use some parts of the waste. It would be useful to identify the market for material recovery facilities.

Answer: To do biogas generation, there needs to be multiple levels of segregation to remove plastics. This can then go to a biodigester for methane production and capture. The plastic proportion of waste is quite high – too high.

Question: There seems to be conflicting information about provisioning personal protective equipment to people sorting waste.

Answer: The SCC is going away from having full body suits for handling waste. Now they are provided with pants and boots, and less on the upper body which people don't like to wear and are not needed anyway. Increasing waste collection can create a challenge because the processing facilities can't process the collected waste quickly enough. So, facilities need to be upgraded too.

In some places, workers don't want to wear PPE, but here they want it. The people picking waste want better PPE and can show the scars from picking.

Question: Leach water from the landfill in Dhaka goes into a pond. Is there any treatment in Sylhet for the leach water from the landfill? In Malaysia, the local government gives money to people who brings in certain types of waste. A big portion of waste in Bangladesh is organic, so if that waste can be re-used it can reduce the overall waste and increase the lifespan of the landfill.

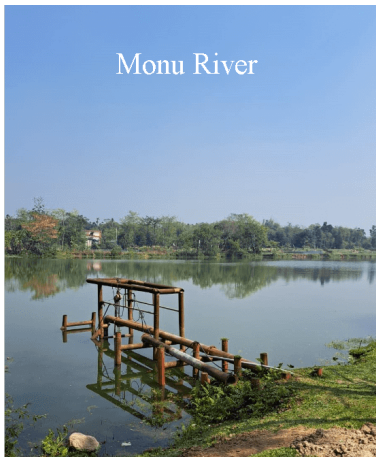
Answer: Yes, there is a leach treatment facility at the Sylhet landfill.

Field Assignment group 3: Water supply service delivery

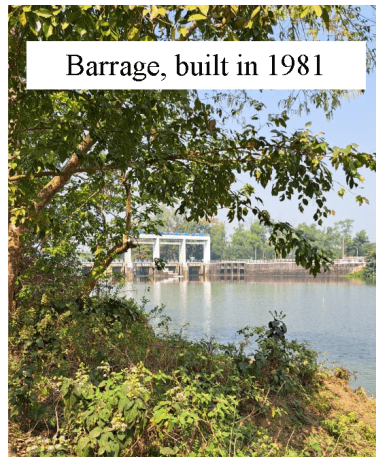
GROUP 3 VISITED MOULVIBAZAR MUNICIPALITY TO INVESTIGATE WATER SUPPLY SERVICE DELIVERY SYSTEM.

Overview of water supply:

Moulvibazar municipality covers an area of 20km². The town's water supply was first built in 1981 and sourced with three tube wells. As of 2024, water is also being sourced from the Manu River because the area is experiencing issues with groundwater depletion.



Monu River



Barrage, built in 1981



Channel for SWTP,
built in 2014

Photo: Intake from the Monu River and surface water treatment plant.

There are known to be pollution issues with the Manu River. However, no water quality analysis is done at the intake and the intake is not protected. India is upstream of the river and controls the flow of the river into the area. Water abstracted for irrigation is currently used without treatment.

The DPHE and the Water Development Board are involved in the ongoing development of water treatment facilities. The Water Development Board also focuses on irrigation, flood management and river protection. They also liaise with India on management of the river. However, the Water Development Board does not have control over water extraction.

Some households are paying 315 taka/year for water which is the minimum amount charged for water.

SWOT analysis:

Strengths:

- Low non-revenue water (10-12%).
- A reservoir pond helps during water shortages.
- Long term staff
- High revenue collection efficiency (92%).
- Public water points for free in low-income areas.
- Clear vision for future water supply improvements.

Weaknesses:

- High sedimentation and turbidity in the rainy season.
- Testing not done at the intake for irrigation.
- Testing is done infrequently at the water treatment plant.
- Unmetered customers.
- No formal inspections for water losses.
- No full cost recovery.
- Limited online data.
- No alternative surface water sources aside the Manu River

Opportunities:

- Potential to reduce energy costs by alternative energy (solar?).
- High population density creates opportunities for markets.
- Possible use of block tariffs based on income.
- Research into recharge options and rainwater harvesting.
- Available land in close proximity to the treatment plant where reservoirs could be constructed.

Threats:

- Indian dam upstream.
- No faecal sludge management structures.
- Depletion of groundwater sources.
- Potential for floods to destroy intake infrastructure.

Recommendations:

- Joint River Commission to expedite agreements on the management of Manu River;
- Enforcement of mechanisms to prevent pollution at the source;
- Identification of recharge zones;
- Develop a faecal sludge management system;
- Create a business model to increase revenue;
- Reconsider tariff mechanisms.

Water supply Q&A

Question: Why does flooding from the Indian dam happen in the dry season? Doesn't it happen in the wet season?

Answer: Because the dam releases water downstream for irrigation in India which flows onward and causes flooding issues in Moulvibazar. But there is some debate about this. There may be many factors involved. It's important to look at water resource management from an integrated perspective.

Comment: Billing data should be stored in a data management system online.

Comment: Moulvibazar is a very clean city and gets a lot of rainwater. There is an opportunity for rainwater harvesting. The river can burst its banks sometimes and cause flooding.

Comment: Water quality is checked only every 3-4 months. And the transmission from the treatment to households is a long distance. So, there should be a recommendation that people practice household water treatment.

Comment: The Water Development Board is the custodian of water per the Water Act. So, the Water Development Board should have formalised authority to regulate water usage.

Comment: Planning should address potential damage to the water supply intake. Water is prioritised in the city so there are plans about how to handle effects of water shortages due to droughts. So, the water planning is considering the effects of climate change.

Comment: Water Safety Planning is established in Moulvibazar through the DPHE. The Water Safety Plan is for water supplied to the customers.

Field Assignment group 4: Greywater management

GROUP 4 VISITED CHHATAK MUNICIPALITY TO MEET WITH LOCAL GOVERNMENT AUTHORITIES, LOCAL MASONS AND COMMUNITIES TO LEARN ABOUT GREYwater MANAGEMENT.

Overview:

Chattak is 10km² in size with a population of about 56,000 people. There is no piped water supply in the city. A new faecal sludge treatment plant and landfill were constructed recently. Cement factories are established in the city.



Photo: Community life around a government-owned pond.

The team visited a low-income community surrounding a government-owned pond in Ward 4. The households located around the pond use the pond for washing clothes, bathing and taking water for ritual ablution. They drink from water collected from a public standpipe connected to a motorised pump. Many drains have little maintenance. For example, a drain of 22 years old, which had never been cleaned and was very clogged. Blockages in the main drains makes it impractical for local communities to spend time unblocking local drains.

Greywater practices, governance and perceptions:

Much of the greywater goes into open drains, the ponds, or into standing puddles mixed with plastic waste. Even large houses that look well-built do not have good greywater management, discharging greywater into the neighbour's compound. Higher-income households in core wards will dispose greywater into septic tanks or into drains. Lower-income households dispose greywater into ponds or onto the land. But lower-income households generate less greywater.

At the government level, greywater is not prioritised. The government is focused on achieving SDG targets. Likewise, at the community level, people are much more interested in the water supply. Greywater will be seen as a "laughing issue". Awareness campaigns are needed to raise demand. There is little interest in greywater reuse because it is perceived to have few pathogens. Households are not motivated to build soakpits for this. The awareness about the need is limited. Lack of space and cost involved are other barriers.



Photo: Greywater and solid waste.

The Bangladesh National Building Code calls for greywater to be disposed into soakwells, however this is little practiced. A Building Approval Committee approves the location of the septic tanks and greywater system but they do not check designs or validate or monitor construction. The government has lack of human resources to monitor greywater. Engineers and builders often advise households to save money by disposing the greywater to drains.

Plumbers and masons don't think about safe greywater disposal. They have no training on greywater management and often advise households to not bother with soakwells and to dispose greywater into the open.



SWOT analysis:

Strengths:

- Institutional Set Up (Mayor/CEO/Counsellor).
- Chattak Paurashava leadership including female counsellor.
- Willingness of community to improve hygiene.
- Willingness of masonry to build greywater infrastructure and quality control.

Weaknesses:

- Low awareness of greywater issues.
- Low prioritisation of greywater management.
- No planning for greywater.
- Weak capacity at governance level.
- Masons not trained.
- No designated outfall for greywater.
- No professional registration of masons or plumbers working on greywater.
- Limited staff with many responsibilities.
- Little female leadership and engagement and voice.

Opportunities:

- 6 out of 9 Wards are still in early urban development stages.
- Huge investments coming in (500K US \$).
- Economic growth (cement factory industry) creates opportunities for public-private partnerships.
- Master Plan can include greywater.
- Registration, certification, and professionalisation of plumbers and masons.
- Surma River is available for disposing greywater into after treatment.
- Research and Development.
- Model Citylink (sgoang).

Threats:

- No budget trickling down.
- Growing population/densification.
- Competing priorities .
- Flood-prone.
- Climate change.
- Plastic pollution in Surma River and in drains.

Recommendations:

Technological options:

- Follow the national building code recommendations for constructing soakwells;
- Check ambient water quality of the ponds;
- Provide safe greywater reuse guidelines to communities;
- Install decentralised treatment of greywater fed from households and businesses through small-bore piping;
- Where possible, lay greywater pipes in the existing drains to make use of available space and avoid creating parallel systems;
- Improved solid waste management is needed to address blockage issues in the drains and solid recovered fuels can be used as an energy source for cement factories;
- Improved floodwater management, for example through swales for reducing flooding rather than concrete drains.

Governance and financing:

- Clarify government staff roles and responsibilities for greywater management;
- Provide training for government staff on greywater management;
- Enforce septic tank and soakpit building code regulations;
- Integrate greywater management into broader urban planning;
- Link greywater planning to donor investments.

Services:

- Formalise masons and plumbers;
- Conduct behaviour change campaigns for masons and plumbers;
- Support quality supervision of construction of greywater systems;
- Strengthen faecal sludge management systems;
- Regular drain cleaning guided by management models for drains.

Behaviours:

- Raise awareness on importance of greywater management for paurashovas, service providers, and households;
- Move away from traditional behaviour change mechanisms towards evidence-based mechanisms;
- Provide guidance for household level greywater management.

Note: the group working on grey water were given a number of technical options sheets, which are available in Appendix 1.

Greywater Q&A:

Question: The groundwater table is high in some areas. In Chattak, is the groundwater table high? If yes, what are the implications for the soakpit? If the groundwater table is high, what should be done?

Answer: In the wet season, the groundwater table is still 20 feet underground. But another option could be to have decentralised treatment where the greywater is piped to an aboveground treatment technology like a constructed wetland.

Comment: Greywater management can improve the performance of other systems. For example, separating greywater from septic tanks might improve the septic tank performance.

Answer: Others have heard that it is a misperception that greywater should be separated from septic tanks.

Comment: A new piped supply will increase greywater substantially so that should be accounted for.

Comment: Currently water is not easily accessible so people use it efficiently. However, in the future as water supply improves, water use efficiency needs to be considered.

Block 3: Approaches to urban flood management

Introduction to block 3

The afternoon of the Wednesday was dedicated to urban flood management. Flood management is a generic term which can refer to different types of flooding (see Figure 8).

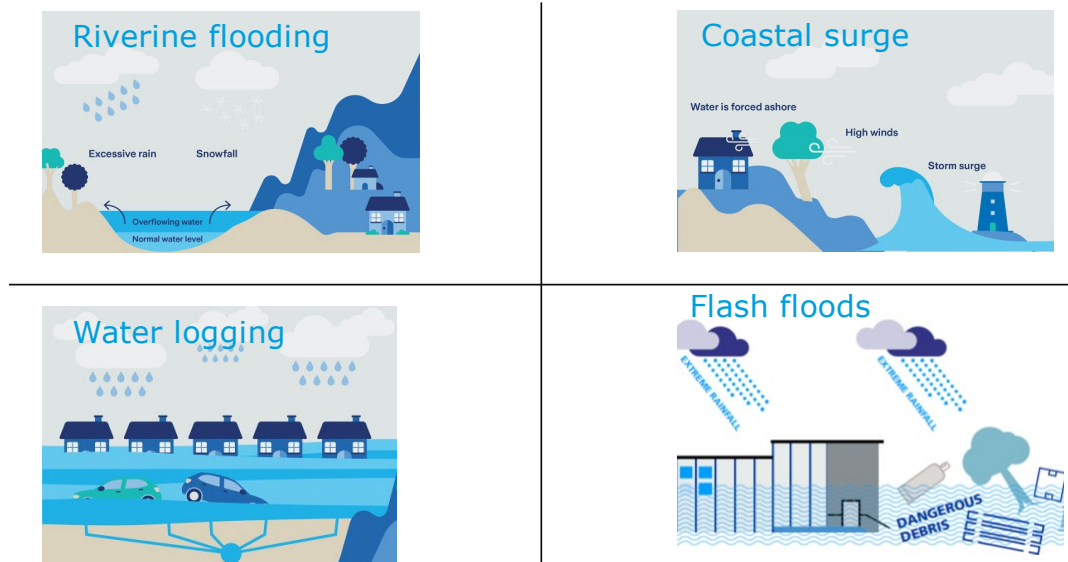


Figure 8: Types of flood

There were three very different presentations on the topic of urban flood management:

1. Perspective outline of the Bangladesh Water Development Board (BWDB), which looks more at the institutional roles in Bangladesh and the bigger picture of flooding in the country.
2. Flood resilience in Vietnam, with examples of sustainable urban drainage at city level
3. Serious gaming, to explore the trade-offs between stakeholders in relation to different urban flood management options.

Presentation: Role of BWDB and focus on 2017 flash flood

AKM SAIFUDDIN, SUPERINTENDING ENGINEER, BANGLADESH WATER DEVELOPMENT BOARD, OFFICE OF THE CHIEF ENGINEER (CIVIL) PLANNING

The presentation was a small snapshot of the work that BWDB undertakes in Bangladesh.

Bangladesh is the gateway to Bay of Bengal where three major river systems (Ganges, Brahmaputra, and Meghna) come together before discharging into the Indian Ocean through the delta. Only 7% of the water are sourced in Bangladesh so they have to rely on cooperation with India and China, and Nepal and Bhutan to manage the other 93%. Inconsistencies between organisations in how a 'river' is defined means the National River Conservation claims there are around 700 rivers in Bangladesh whilst the BWDB considers it closer to 400.

What is not in question is Bangladesh' Hazard Profile. Drought, monsoon flooding, flash flooding, cyclones, and saline intrusion of groundwater are all serious problems. Climate change is disturbing and aggravating the patterns that people are used to and resilient to.

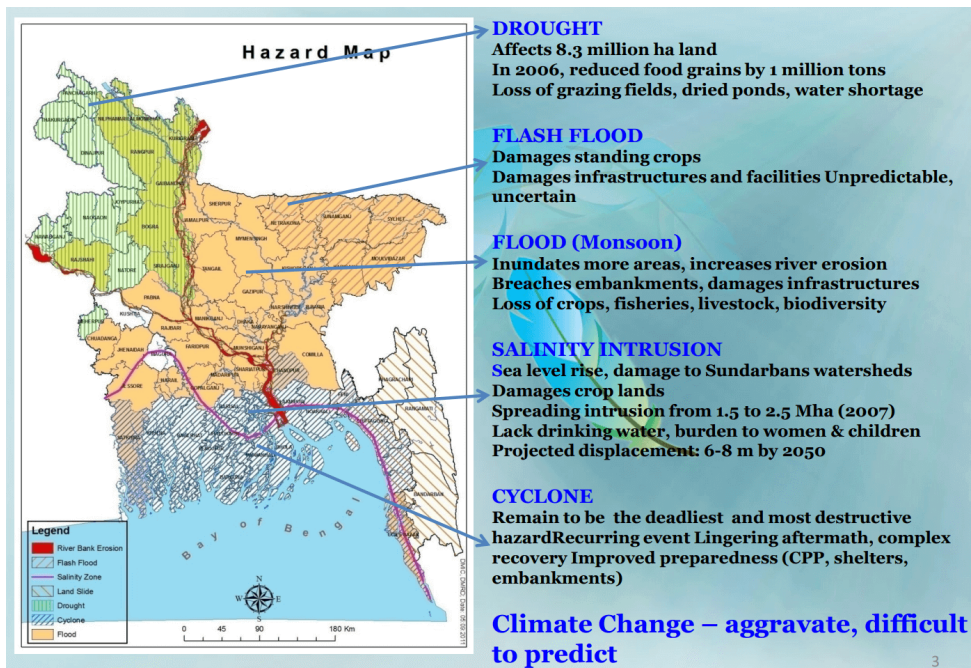


Figure 9: Bangladesh hazard profile

History of water management

A huge flood in 1954/55 was the starting point for managing water in an organised way. At that time the area was part of Pakistan and emergent organisations (WAPDA- Water and Power Development Authority) were set up in that way. 1972, after separation the institutions were re-organised, but many people still refer to the old legacy organisational names.

A lot of technologies applied by BWDB come from the Netherlands. Previously the focus was purely on food production, but now environmental and social issues are taken seriously, and an Environmental Impact Assessment (EIA) is required for all development projects that exceed a threshold (in terms of size/significance).

BWDBs remit includes structural and non-structural activities.

Small Scale Water Resource <1000 ha, LGED

- Structural
 - Flood Management, Drainage and Irrigation project
 - Coastal embankment
 - Dredging/de-siltation to increase conveyance
 - Riverbank Protection
 - Accelerated Land Reclamation
 - Salinity protection
 - Surface water retention (including rain water)
- Non-structural
 - Flood and drought forecasting and Warning (Partnership with ICIMOD, NASA, JAXA, Google)
 - Erosion Prediction
 - Hydrological data collection and survey
 - Capacity development

All these are covered in the BWDB Act-2000

Delta Plan 2100

Development projects are planned and delivered following rules and regulations. The latest of these is the holistic (not just water), **National Delta Plan 2100** (BDP 2100) that the Bangladesh Government approved on September 04, 2018. The aspiration is to achieve a 'safe, climate resilient and prosperous Delta' by 2100. However, since separation in 1972 resources have diminished and BWDBs staff numbers have fallen from 24,368 in 1972, to just 6,257 in 2024.

North-west Bangladesh, where Sylhet is located is call the 'rice basket' as it produces huge quantities of rice. Topographically it has large bowl shaped floodplain depressions known as **Haor**. Boro rice is cultivated in this region and the Haors are rich in aquatic biodiversity, particularly in diverse fish species & migratory birds. Protecting crops in the Haor area is a key concern (need to manage the water through the cropping growth and harvesting cycle). To protect the crops BWDB constructs submersible

embankments, which protect the crops from pre-monsoon flash floods, but they are inundated during monsoon. The timing of the pre-monsoon flash flood is changing resulting in crop damage & hampering livelihoods.



Temporary protective work of Embankment at Sona Morol Haor
 Photo: BWDB work to protect riverbanks from eroding and collapsing.

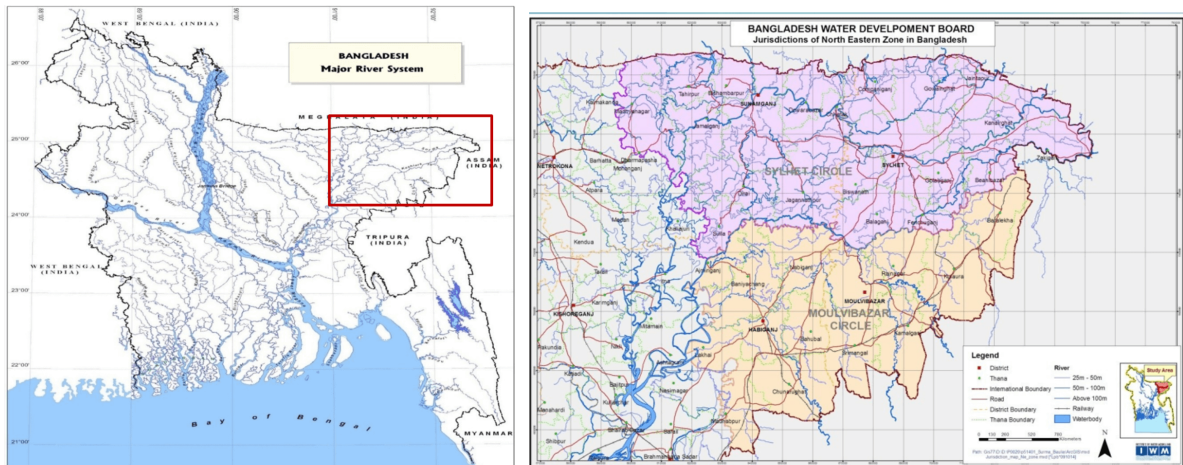


Figure 10: River catchment context of Sylhet city

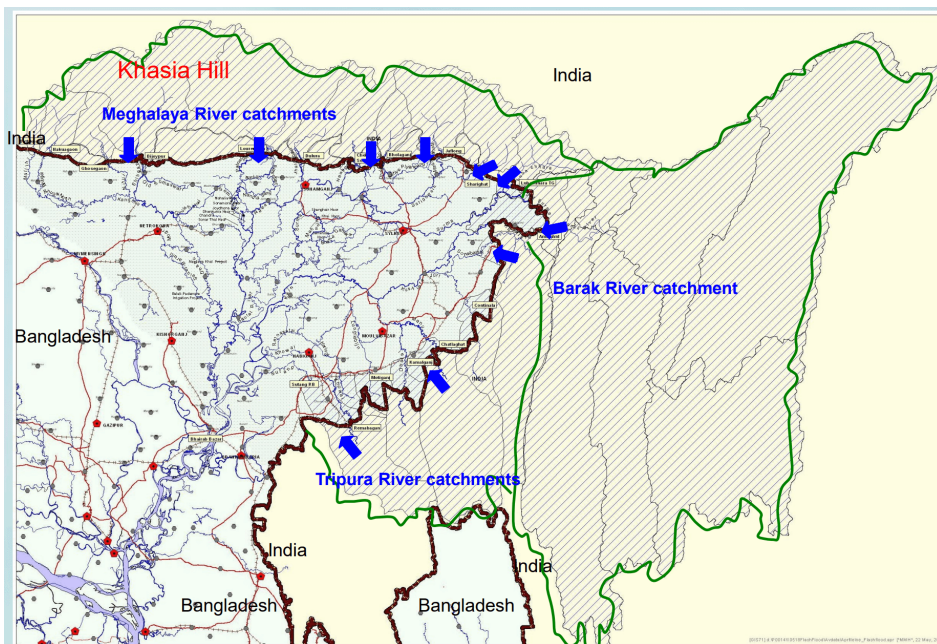


Figure 11: Catchments that contribute to flash floods in Sylhet

The 2017 event occurred in the pre-monsoon. Unprecedented volumes of accumulated rainfall raised the river level by 8m in just four days. The timing, severity, and duration of the flood took everyone by surprise. BWDB has responsibility for flood protection and damage control, but it was an uphill battle to protect the riverbanks. Recognising that in this area there is very little lag between rainfall in the mountains and flash flooding downstream, BWDB understands that flash flood forecasting in the Haor area must be explored.

Realising that not all floods can be protected against, and the floods are starting to occur earlier BWDB is advocating that farmers mitigate the threats from the shift in rainfall patterns by:

- Accept a slightly shorter growing season and harvest sooner before the rains normally come (however, people prefer to take the risk to grow crops to their maximum even though by delaying they could lose the whole harvest). The other problem is a farmer has to find harvesting labour, typically migrants who are either not in the area soon enough or demand high fees. BWDB is slowly introducing combine harvesters – but it will take time;
- Switching to an early harvest variety of Boro crop (yield might be 10-15% less);
- Investing in crop insurance;
- Acknowledge the contribution of fishery in Haor area.

Bangladesh Water Development Board Flooding Q&A:

Question: What do EIA’s consider?

Answer: Modelling water/environmental impacts and social analysis. New concepts come in and they address them.

Question: If a municipality wants to build a treatment plant what is the process?

Answer: First, they submit to the District Office, then there is an inter-ministerial meeting (sit together), then senior leaders agree/MoU etc. It is better not to do it locally. BWDB does not encourage local agreements.

Question: Delta 2100, is the riparian delta being mapped, i.e. to confirm land that must be allocated to non-construction? Is there a long-term plan to mitigate furthering this problem with future growth?

Answer: The government is clear that land for food production can't be given up (even for flood mitigation). The focus is on river protection work.

Question: Is there a continuous dredging programme?

Answer: There is some dredging but there isn't enough resource to do it all.

Question: What are the challenges incorporating climate change in to flood risk planning, and how could they be overcome?

Answer: At the moment BWDB is trying to understand what the trend is. It is difficult now that conditions are changing so much and so quickly.

Presentation: Urban Flood Resilience in Vietnam

VU CANH TOAN, INSTITUTE FOR SOCIAL AND ENVIRONMENTAL TRANSITION (ISET) VIETNAM, (VIRTUAL PRESENTATION)

ISET is a non-profit organisation with a focus on disaster risk reduction, climate change resilience, and water resource management in the urban area.

Nature of the main challenges

- Flooding is one of the most dangerous hazard in Vietnam;
- These are becoming more frequent, **different from past trends, and difficult to predict**;
- Multiple non-climate factors causing increased flood risk and vulnerabilities;
- Urban flooding is a complex problem;
- Flooding and land destabilisation is leading to land subsidence. Some cities are losing up to 4 cm/year (50cm or even more could be lost in the next 20 years);
- Sea level is rising faster than IPCC's projections and heavier rainfall is exceeding the capacity of existing urban infrastructure.

It is easy to blame it all on climate change but there are localised issues that can be addressed. Flood depth can be made worse by urban development in low-lying areas. Urbanisation is giving water no place to go. Development in some lowland areas may increase flood depth in some other areas up to 62cm. In this area, the amount of green area has reduced by 70% since 1990:

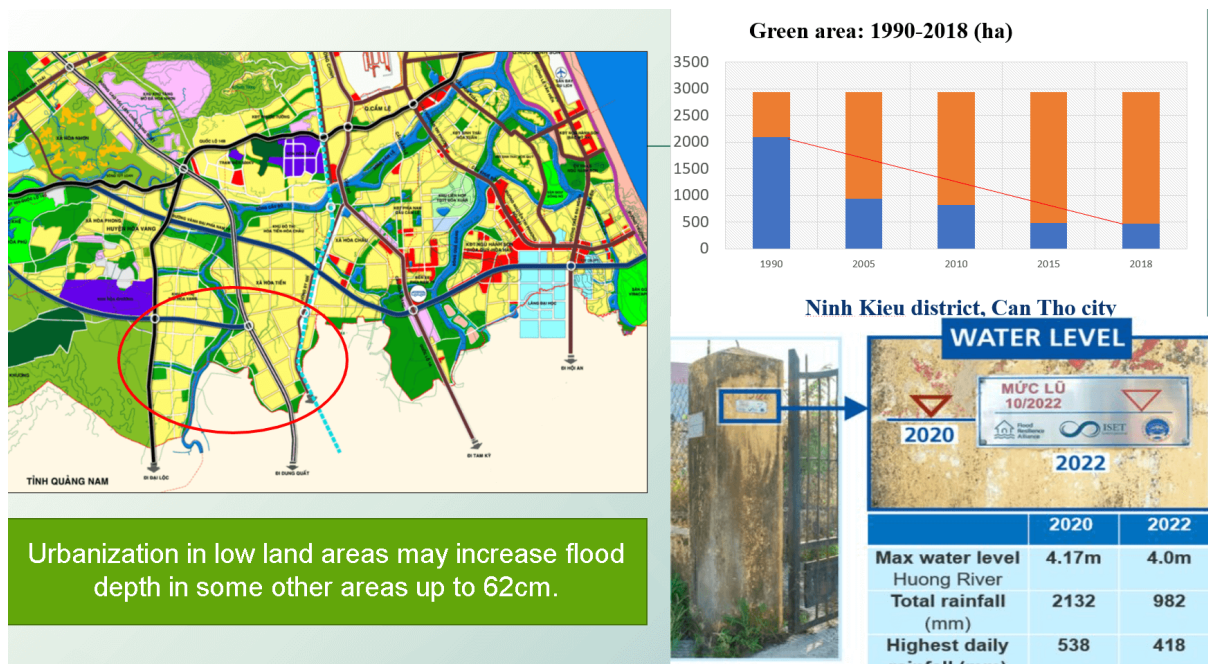


Figure 12: Link between urbanisation in lowland areas and flooding

They compared the rainfall in two different events, and found **the worse event was driven by urbanisation not the rainfall**. Water conditions in cities are also subject to changing conditions in the wider catchments, and heavy rain, beyond the city boundaries.

Current approaches (weaknesses)

- The GoV is trying to use grey infrastructure with fixed standards to solve the problem but this is outdated, oversimplified, and doesn't meet the need to deal with multiple hazards. They are simply trying to more of the same of something that is already not working.
- This approach has no room for flexibility, adaptability, or learning;
- Limited/no attention is paid to root and systemic causes of vulnerability and risks
- Limited or no consideration of future climate change and uncertainty. There is no, or poor back up plans to deal with unexpected situations;
- The focus is on short term response and recovery.

Urban resilience concepts and definition

There are a number of recently emerging frameworks to target urban flood resilience, such as the Urban Resilience Framework promoted by the 100 Resilient Cities programme (although 100RC is no longer active). Quote from the Asian Development Bank:

ADB Urban climate change resilience (UCCR) embraces climate change adaptation, mitigation actions, and disaster risk reduction while recognizing the complexity of rapidly growing urban areas and the uncertainty associated with climate change. This approach places greater emphasis on considering cities as dynamic systems capable of evolving and adapting to survive and even thrive in the face of volatile shocks or stresses.



ISET highlights four **characteristics** that build urban flood resilience (see Figure 13 on next page), and seven qualities of resilient cities:

1. Reflective
2. Resourceful

3. Robust
4. Redundant
5. Flexible
6. Inclusive
7. Integrated

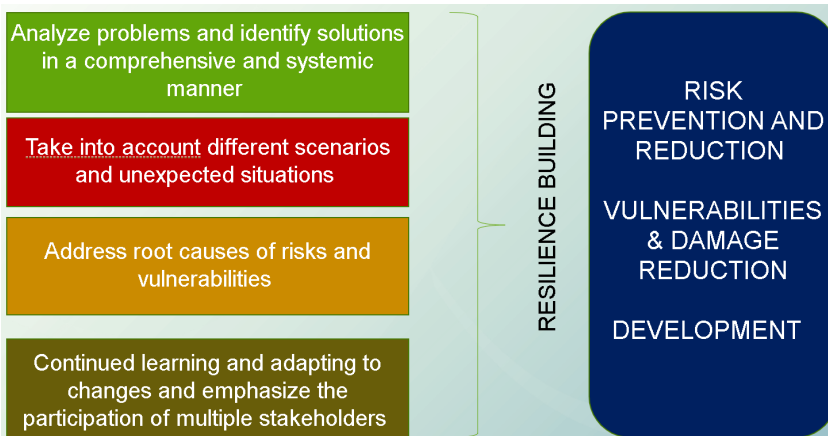


Figure 13: ISET's four characteristics to build urban flood resilience

Specific examples of flood resilient approaches

- Building design, such as pitched roofs;
- Hydrometeorological **early warning** forecasting centres with back up monitoring systems and direct communications to community networks;
- Integrate making space for water into urban planning (the city spent a year working with local stakeholders, using blue and green infrastructure, testing scenarios and city zoning analyses to see to what extent Blue-Green infrastructure could contribute to easing the flood pressure);



Figure 14: Expanding blue-green infrastructure

- Using blue and green infrastructure for flood resilience:
 - Creating urban infiltration-based drainage



- Converting impermeable into permeable surfaces that allow infiltration



- Deliberately allowing non-residential/high value commercial land use function for flooding



Vietnam flood resilience Q&A: *(a lot of interest but limited time)*

Question: How can cities be supported to adopt flexible, adaptive management?

Answer: By looking at the whole system (we cannot increase the level of the embankment) it can be easier to see what else can be done in the future. If capacity is very small, look at city-scale green solutions, masterplan at that bigger level and invest in that. Focus on increasing infiltration and retention.

Presentation: Serious games for strategies for Urban Flood Challenges

WILLEM VAN DEURSEN, CATHARGO (VIRTUAL PRESENTATION)

Rotterdam, Bangkok, and Dhaka share issues that are also shared around the world.

Rotterdam is a port city with the sea on one side and the river Rhine and European hinterland on the other. Parts of the city are below sea level and very vulnerable to higher tides and tidal surges. Sea level is slowly but steadily increasing making it difficult to get water out of the city. Also groundwater is rising to the surface and can't be drained. On top of this the land is subsiding and summertime heat levels are becoming a problem.

In response Rotterdam has its innovative 'Blue Plan' which is essentially to combine different functions of the city with water storage, e.g. using sports grounds and parking garages to store flood water and shifting from fixed to floating houses.

https://unfccc.int/files/adaptation/cancun_adaptation_framework/application/pdf/rotterdam_climate_p roof.pdf



Dealing with chronic flooding is more than an engineering challenge. Planners must learn two lessons:

1. Learn to trust your models and understanding of your city;
2. Learn to **NOT** trust your models. Societal problems (and solutions) can have impacts that are difficult to include in models, and which can significantly affect conditions in real life.

Carthago is a consultancy that has started to roll out a 'Serious Games' approach to help different cities bring people together to 'play' the city resilience game. 'Serious Games' is an analogy for Planning and Policy. The idea is that like a game, city stakeholders have to first understand what the objective of the goal is, who the players are, how players win points, lose points, and ultimately win. Once the basics are understood, game players figure out strategies to win. The same happens in the 'game' of running a city.



Questions that are part of 'Serious Games':

- What does winning mean? (e.g. building a sustainable city). Do we recognise the serious problem we need to solve?
- How do we score points? (e.g. how do we get our policies in place?)
- Where are penalty points (e.g. in Monopoly landing in jail or suffering a bad chance card)
- Who is my opponent and how are they playing the game? In the city game there may be opponents with different intentions or ideas, or allies that are supportive and can provide leverage);
- Are we playing 'Man vs Nature'? If so then we are either playing **Survival Games** 'how to optimise resources to survive in a hostile environment' or **Casino Games** 'how do we manage uncertainty and complexity'?
- Are we playing 'Man vs Man'? Is our opponent other people? Are other interests at odds with the goal of building a sustainable city? Where are the conflicts and differences in stakes? In this case we need to strategize; How do we make sure the right policies are in place? How do we invite others to participate in building sustainable cities? How do we convince stakeholders do the right thing? How do we include local communities, companies and private partners in the planning, decision making and implementation? How do we build coalitions etc – **How do we get other players to be on our team? How would we develop a Game like this?**
- Where is the opportunity for cooperation? How do we build trust between the players? E.g. Civil society - Government.
- Do we have a credible government and authority?

Some real examples (city players with conflicting goals):

<p>Sponge City game: <i>Make space for water vs keep space for buildings.</i></p> <p>Players: Local government • City planning • Department of Land development and real estate • Commercial developers</p> <p>How do players win points? How do players lose points?</p>	<p>Multi-functional city game <i>Underground parking garage / Underground rainwater storage</i></p> <p>Players: Local government • Traffic and parking authorities • Department of public works and sewer • Finance department • Etc</p> <p>How do players win points? How do players lose points?</p>
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<p>Netherlands Storm surge barrier game (the Dutch are very proud of this) <i>Keep the barrier closed to protect people vs keep it open for shipping and make money.</i></p> <p>Players: National Government (wants to keep people safe) • Semi-public Port Authority (wants to make money) • Private Shipping companies • Etc</p> <p>How do players win points? How do players lose points?</p>	
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Challenges in Dhaka city

Characteristics that make dealing with flooding issues hard:



Overpopulation

- Population over **21 million** (34,000 people in 1km²)
- **Traffic congestion**
- **Pressure on resources**
- **Informal settlements**
- **Social and economic disparities**



Weak Administration and Planning

- **Top-down and centralized city governance**
- **Political favoritism** in the administrative processes and decisions
- large land-related databases are **manually recorded and physically filed**



Corruption

- **Bribery and Extortion**
- **Corruption in Construction and Development Projects**
- **Corruption in Land and Property Transactions**
- **Corruption in health, education, business and job sectors**
- **Corruption in Law Enforcement and Judiciary**

On top of this Bangladesh's low elevation (not much land above sea level) and heat makes life even harder. Dhaka suffers prolonged waterlogging (insufficient pumping systems). The city has consumed almost all of its natural wetlands (filling them in to make land for development), but the city needs wetlands, they provide the buffer against flooding. Drainage in the city is disconnected and there is a lot of environmental pollution). It is a very complex problem, also with a housing crisis, job crisis, unplanned transport system, inadequate water supply, solid waste, sanitation systems.



Climate Change

- Elevation in Dhaka ranges between **2 and 13 meters above sea level**
- In 2023 Dhaka experienced the **hottest day in 58 years!** (40.2 degree celcius)
- Intense rainfall and **frequent flooding**



Housing Crisis

- Due to **rapid rural to urban migration**
- **90% of the total housing is provided by private housing sector**
- Leads to **wetland encroachments, violations of predefined land use, illegal plot subdivisions, and increased building heights.**
- **Poor living condition in slum areas**
- **Lack of open space** for playing, recreation and greenery



Inadequate Water Supply

- **80% of the total water supply in Dhaka comes from ground water**
- Leads to **depletion of groundwater level and pollution**
- **25% of the residents face water shortages**



Water Logging

- **Insufficient drainage** and water pumping systems
- **Permanent wetlands have been reduced** from 14% to 4% between 1967 and 2010
- **Unplanned and illegal encroachment of lands**
- **Unplanned underground drainage systems**



Job Crisis

- High unemployment rates **due to massive population and rural migrants**
- **Low-paying, unstable jobs with limited social security benefits and minimal job security.**
- **Salary scale does not align with the price of housing and other basic needs**



Little or no Solid waste management

- **14–17% of the total municipal budget is used for SWM**
- **lack of a waste infrastructure** that is hampered by a narrow road network
- **no door-to-door collection systems**



Environmental Pollution

- The **air quality often exceeding safe limits**, reaching hazardous levels during certain periods.
- **Rivers are heavily polluted** with industrial waste, sewage, and solid waste
- High levels of **heavy metals and contaminants in th soil**
- **High noise levels**, exceeding permissible limits



Unplanned Transport System

- **Inadequate motorized public transport, and disregard of traffic rules.**
- A poor and **insufficient road network**
- **Unplanned flyovers and roadside business**
- **Illegal plying of rickshaw and buses**
- **Drivers having little/no education**



Inadequate Sewerage and Sanitation facilities

- The **underground sewer network covers only 20% of the population.**
- **Poorly or inadequately designed septic tanks and soak pits**
- **Domestic and human waste gets washed into the water bodies during the wet season.**

They played Serious Games in Dhaka and learned some important ‘ways to play the game’:



.....and so many more interventions

How to play the game:

- Remember the objective is to create ‘a sustainable city’ not just a ‘sustainable water cycle’;
- Define the geographic scope of your game (city, sub-zones, wider catchments etc) and bring in extra players (different city officials etc);
- Look at the ‘game intervention cards’. Each card has a price/value. You have to budget focusing on the overall objective of ‘a sustainable city’;
- Brainstorm as many different ways to score points as possible;
- Step away from the pure engineering solutions – look at the wider city vision. Brainstorm and bring people in. Think if the outcome of creating a full set of models could be achieved in other ways, such as improving decision-making processes. Don’t be constrained by the ways things have always been done, think how the system can be improved.
- Choose a collection of cards with your team (the Dhaka players identified 80 different interventions).

Serious Games Q&A:

Question: How can a city like Sylhet combine functions?

Answer: Bring the stakeholders together to explore it.

Question: What comes next after playing the game?

Answer: The purpose of the game is to get the stakeholders talking together, then they can start playing the game ‘for real’.

Question: Sedimentation affecting the city is coming from the Tea Gardens TG (in Sylhet). The Municipality has tried some interventions to trap the silt, negotiating actions with the TG, but it became political because TG is state owned. Political pressure matters a lot. The Game can be good to raise awareness but **how does this relate to political reality?**

Answer: The Game can give insights into why different political sides have their agendas. It also helps the political agents to see the broader perspective. It's not an easy process, the 'solution' doesn't necessarily fall out, but playing the Game creates a safer space to start talking about these things.

Question: Beyond the obvious differences in the cities, are there any patterns between the outcomes of how the game has been played? Opportunities, constraints?

Answer: People are willing to accept and speak out that they are only dealing with a limited aspect of the whole city problem. What we see is that **people begin to see the connections that they need to make** with other departments. The Game helps people start to see where they might be able to compromise a little bit.

Debating game

Participants were put into two opposing teams to debate the Statement:

With current uncertainty due to climate change, urban flooding is better tackled by a large number of small investments than large infrastructure.

The purpose of the game was to encourage participants to explore the ideas emerging from Block 3 and possibly to challenge their own internal views on the topic. Participants were allocated to a team and so were not necessarily debating their own personal view. One team was challenged to argue in favour of the Statement, the other team against. Three participants volunteered to form an 'honourable jury'.

The objective: to convince the jury of the position of the group.

The debating game follows a series of instructions and strict rules:

- The decision of the jury is based on the consistency and coherence of the arguments as well as the response to the arguments of the other group.
- Each team has 3 minutes each to present their arguments without interruption.
- After both teams have argued for 3 minutes the first team counters with 2 more minutes, and the second then follows.
- After both teams have used their total of 5 minutes they both retreat into their teams for 15 minutes to consider the flaws of the opposition and prepare their final counter arguments.
- The debate recommences with a further 2 minutes and then a final 1 minute each.
- The 'Jury' then retreats to consider the quality of the arguments and decide on a winner.

The 'game' was very lively with very passionate arguments from both sides! The text in the table below reflects participants' actual statements as closely as possible.



Photo: Debating game in action.

Statement: A large number of smaller investments is best to tackle the uncertainty of urban flooding under climate change. Round 1:

AGREE	DISAGREE
FIRST 3 MINUTES	
<ul style="list-style-type: none"> • Small scale investments create a lot of opportunity to scale up. • Small scale investments can be context specific. • Locally led climate adaptation. • Bundled small scale investments will deliver impact. • Small scale investments diversify financial and performance risks. • Small scale investments are nimble, allow a phased approach, and failures can be contained and can be improved upon. • Uncertainty is not just about engineering design. Small scale investments can respond to uncertain social and political changes. 	<ul style="list-style-type: none"> • Flooding is a big problem that needs a big solution. • It is easier and cheaper to control one big investment. It's all about focus. • Fewer, large investments are not distracted by dispersed actions. • It is easier and cheaper to deliver maintenance on fewer, large investments. • We always talk about large infrastructure. • Easier to capture political attention in a competitive environment.
SECOND 2 MINUTES	
<ul style="list-style-type: none"> • Large infrastructure is maintained but it's a fallacy to think it's not done in small steps. • Bundling within a large vision is also attractive to political interests. • Smaller investments lead to bigger investments. • Large investments override local needs. 	<ul style="list-style-type: none"> • People don't want a park, they want infrastructure. • One large infra to gain trust and commitment from the local community.

Round 2

AGREE	DISAGREE
FIRST 2 MINUTES	
<ul style="list-style-type: none"> • To paraphrase the Bangladesh PM, “Go small”. • Informed decision-making. • We don’t know the future, we have to take small steps, towards a big vision. • Small is more flexible, and able to respond to people. • The risk appetite can be conservative whilst ambitious. • Small investment does not necessarily imply small infrastructure. • Small scale Blue-Green infrastructure can be tested and then scaled up when it works. 	<ul style="list-style-type: none"> • Small infrastructure is hard work, large infrastructure does not necessarily imply large investment. • Lots of small infrastructure takes up a lot of space. • Small is too local, we need to fix the whole catchment problem. • We are very sure about the solutions. • If one (small investment) fails, they will all fail!!
FINAL 1 MINUTE	
<ul style="list-style-type: none"> • Learn from the small investment in Cambodia, patchwork = beautiful patchwork. • Large investment is why we’re where we are. • Small scale helps stick to 1.5 degree C. 	<ul style="list-style-type: none"> • Money is not a big problem here. • Everyone had a say. • One package, one goal.

Jury deliberation

The jury members explained their reasons for awarding points to each team. Both groups presented compelling arguments, it was not an easy decision!

Agree: The jury appreciated elements that a large number of small investments are typically more people centric, the phased approach enables learning and evolution, and when bundled at scale can have a significant impact.

Disagree: The jury appreciated that managing Operations & Maintenance (O&M) can be easier one a small number of ‘bigger’ investments. The argument that it is usually easier to capture political attention with individual ‘big’ investments is strong, and this type of investment responds to what people think they need.

Ultimate decision: The ‘large number of small investments are more sustainable’ group wins.

Of course, in reality the answer is usually somewhere in the middle and based on the needs of specific circumstances. There are other discussions that could have come out during this exercise.

Block 4: Solid waste and grey water management behaviours

Introduction to block 4

ANTOINETTE KOME, LEARNING EVENT FACILITATOR GLOBAL HEAD OF WATER, SNV

Antoinette introduced Block 4 of the learning event by summarising the preceding week's Egroup discussion on public behaviours relating to the Sustainable Urban Water Cycle. The first part of the discussion focused on which behaviours are considered most problematic:

In general, participants mentioned: 1) rapid urbanisation leading to diverse people come from all over the country arriving with different levels of hygiene practices and how to deal with waste and water; 2) Unregulated drilling of wells was mentioned in many countries, leading to land subsidence. People drill wells sometimes because the piped water supply is not available or not continuous; 3) Encroachment on water bodies. It is difficult to keep people from settling in flood-prone areas and areas we want to keep clear; and 4) The filling of water bodies like ponds to make room for development.

Specific problematic behaviours related to water supply

For water supply, excessive water use was reported frequently. Even if water is cheap, people are not highly willing to pay for water. There are often no meters. Leaking infrastructure, including in the plumbing in the house, loses water, but water tariffs are so low that people don't see the need to fix leaks. Illegal connections happen in multiples countries and there is tampering with meters, leading to 40% non-revenue water in some countries.

Specific problematic behaviours related to sanitation

In regard to sanitation, open defecation continues in many countries. Containments do not comply with building codes and often do not have soak wells. Sometimes the containments are designed to leak or do not have a bottom so liquids seep into the soil. Soak wells are impractical in some areas where the groundwater table is high. Often discharging into drains is the only option. Manual emptying practices or an unwillingness to desludge containments is common. In Bali, some restaurants and cafes discharge directly to the sea or into drains which causes blockages due to large amount of oils and fats.

Specific problematic behaviours related to solid waste

In regard to solid waste, littering is a major problem. Styrofoam used for food packaging and plastic are common sources of pollution. Even in high-income countries like Australia, people are consuming large amounts of packaged water. There is generally low willingness to pay for solid waste management services.

In spite of these well-known issues, changing problematic behaviours is complex. A lot of strategies have already been tried. In the Egroup a number of unsuccessful and potentially successful strategies were mentioned:

Unsuccessful strategies include those that do not engage people in a meaningful way and are not connected with a long-term vision for the city (a scattered approach to BCC). Someone mentioned that beach clean-up campaigns are used but they don't address structural root causes. Partial interventions like motivating households to desludge their septic tanks, but then not supporting services for desludging. Low enforcement of bans, like bans on washing cars during droughts, leads to people ignoring the bans. Political barriers or public barriers like raising water tariffs are challenging to overcome, and public resistance to reuse of blackwater. Often there is no critical mass amongst the public to implement things.

Table 6: Behavioural change strategies

UNSUCCESSFUL	POTENTIALLY SUCCESSFUL
<ul style="list-style-type: none"> ● Not engaging people in a meaningful way ● Short-term/scattered campaigns ● Partial interventions ● Political or public barriers 	<ul style="list-style-type: none"> ● Longer term and coherent ● Engage people meaningfully ● Complete package: awareness, incentives, and enforcement ● Reach all ● Political backing ● Show broader vision of living well in the city

Successful strategies are longer-term and coherent – they address how the behaviours change strategies contribute bigger, longer term change. Communities should be in the driver seat; they are not just the recipient of services. Even higher-income communities don’t have good solid waste management because they are waiting for the government to provide them. So, the idea that householders or communities cannot act without the government providing all the services needs to be changed to one that makes people think it is a shared responsibility. Engage people meaningfully: BCC should include a complete package of awareness, incentives and enforcement that reaches all. There also needs to be political backing and a broader vision of living well in the city. Sometimes BCC campaigns are only targeted at a small bubble of people but should be designed to reach a broader audience. Behaviour change messaging can also be included in early education to teach children and young adults about being good citizens of a country.

Presentation: Solid waste management in Kushtia municipality

RANVER AHMAD, TOWN PLANNER, KUSHTIA MUNICIPALITY, BANGLADESH

Kushtia a Category A municipality and is more than 150 years old. Its area has more than doubled in recent years. There are 21 wards and 62,137 households. 50MT/day waste are generated, but only half of that is collected.

- In 2006 a door-to-door van service was introduced.
- In 2008 composting was piloted at a solid waste plant.
- In 2012 co-composting with faecal sludge began.
- In 2016 the treatment was outsourced to a private operator who sells the composted waste. However, farmers generally want to see a safety certificate before they will buy this compost and good sales requires a lot of marketing and promotion. The agriculture department extension office provides a useful link to the farmer market because the farmers trust them.
- The agriculture department was informed by research in 2017-2018.
- In 2019 there was demonstration of the value of compost to the farmers.

The compost/treatment plant in Kushtia municipality can process 2-3 tons of solid waste/day and 18 cubic meters of faecal sludge per day. There is also a mini-lab for testing parts of the waste.



Solid waste is collected using door-to-door services with vans. Households pay 50 – 100 BDT per month. Ward councillors coordinate with the conservancy section to manage the vans and the door-to-door services. After collecting waste from the homes, the waste is taken to transfer stations, then trucks come and pick it up and take it to the treatment plant. Sometimes the vans deliver waste directly to the plant. There are bigger trucks that pick up waste from markets and deliver it to the plant.



Van service



Van for Kitchen Market



Garbage Truck

Other waste is picked up like saw dust, cow dung, Trichoderma and other materials that help with the composting process. The compost needs about 45 days to mature then there is mechanical segregation to remove plastics. Segregated inorganics are taken to the landfill. The price of the compost is about 7-15BDT/kg depending on the volume. They are working to increase their market for fertilizers which has been challenging. Markets are in Kushtia, Jessore, North Bengal and Chittagong.

Challenges

- 100% of the municipality is not covered, only about 50% is covered because the expanded areas are new.
- Staff are not trained because this is a new practice. There needs to be a training centre.
- There is a lab at the plant, but it has limited capability and needs more resources.
- Marketing is difficult because farmers prefer chemical fertilizers; the compost is often seen to be a weaker alternative.
- The number of people licensed to make and sell compost is small. It's difficult to get the license.
- The composting plant has a capacity gap to manage all the waste coming in and there is not 100% financial recovery.

A number of improvements are needed to enhance the capacity of the co-composting facility and services:

- Improved infrastructure is needed.
- Documentation is done manually and needs to be digitised.
- The financial capacity if the private operator needs to be improved.
- There needs to be better coordination with government.

- A lot of mixed waste is coming into the plant which makes it hard to compost and it has to be put in the landfill, so there needs to be research on alternative techniques for handling mixed solid waste streams.
- There needs to be capacity building program the composting staff and good composting techniques; the government needs this so they can train private operators.
- There has been a pilot to collect plastic waste in bins to separate waste, but householders have been using the bins for other purposes.
- There is a need for guidelines on O&M of the plant; there is an MOU with private operators but there needs to be better guidelines for outsourcing O&M of the plant to a private operator.

Kushtia Solid Waste Management & Composting Q&A

Question: On the problem of people's awareness in general, and that bins have been given to households that haven't been used properly, there is a need for a more systematic behaviour change campaign. Have you explored that?

Answer: With the help of SNV, we have prepared a BCC strategy that involves seminars and workshops and circulation of leaflets on managing solid waste at the household level. It was not sufficient, but we are trying. We are trying micing, messaging on the tv screen, leafleting at the market. There have also been improvements in the central business district areas but it's still difficult elsewhere. The city is also challenged to enforce practices.

Question: Is licensing for selling compost required over the entire country? Also, its often a challenge to have the available space for a composting facility. How did you manage this space issue? Compliance with environmental laws can be challenging, how do you comply with laws and regulations?

Answer: With the help with SNV, we did extensive research on the benefits of composting. A report was published saying that compost can be used for particular agricultural products and has been endorsed by the agricultural department. So, Kushtia has gotten that certification. In Kushtia, the land was acquired about 5km away from the city a long time ago. There is no bad odour from the composting facility, but the landfill has bad smells so it has to be remote. When the composting plant was started in 2008, we followed the appropriate regulations including testing the quality of the compost and got approval through the lab testing of the compost product.

Question: On enforcement, are there any by-laws or other laws for punishing people if they do not follow certain solid waste management practices?

Answer: There is no by-law, but there are penalties that can be made if people do not do solid waste management practices. But it is difficult to enforce. We do not have power to implement fines, every time we have to get other authorities to implement fines which is impractical.

Question: Do you provide any subsidy to the private composting operators?

Answer: Yes, they are given a royalty of 50,000BDT per year.

Question: Regarding the effluent coming from the solid waste, does the municipality have measures to address the effluent? Or does it go into the faecal sludge treatment?

Answer: The faecal sludge treatment has a drying bed, so that receives some of the landfill effluent. The effluent is being tested for its qualities.

Comment: In our legal system, there are two types of codes. For petty crimes, the district magistrate looks after it. Any authority can lodge a complaint for a fine. The district magistrate is sometimes slow to respond. But a case can be lodged by any department of the government. District magistrates are responsible for responding the agency complaints.

Question: Regarding the door-to-door van service, do you encourage the households to do waste segregation? In Indonesia, some cities have tried to do composting, but they have been challenged with marketing as well. Who does the marketing in Bangladesh? Does making a profit justify more investment from government?

Answer: We tried to get households to do waste segregation but it was not successful. So, segregation is now done by the private operators at the plant. The vans are getting different waste from households and markets which are put into different transfer stations. Marketing has been a big challenge. You need help from the agriculture department who has the link with the farmers; otherwise the farmers won't believe you. We go the agriculture department to publish a report to gain their trust. Only then did the market start to develop.

Presentation: Municipal solid waste management: Plastic waste management complexities

MARC PÉREZ CASAS, WATER SECTOR LEADER, SNV IN VIETNAM

This presentation outlines SNVs findings of its feasibility study on plastic waste in Vietnam.

A 2017 study ranked the countries that pollute most into the ocean. Indonesia was second, Vietnam was fourth, and Bangladesh was 10th. 94% of all plastic waste ends up in the ocean, sinking to the bottom damaging marine ecosystems on its way down. The other 6 percent stays around us, on beaches, in rivers, and all around urban areas causing many problems.

The problem of 'mixed plastic'

There are many different types of plastics. They each have a different value chain. There are international codes for polymers, but there are actually hundreds of different polymers. We need to understand what types of plastics we have in a given area.

In Vietnam, the biggest proportion of waste are plastic bags which are not recyclable. The types of plastics in the waste that can be recycled make up only 10% of the plastic waste stream.

In theory, all plastics are recyclable, but a big problem is when a product is made of different types of plastic. A plastic bottle can have three types of plastic (the bottle, the cap, and the label) which all have different value chains. A bag of potato chips (crisps) also has three layers of plastics. If we could separate the layers, they could be recycled, but this is difficult to do.

Plastics is with an 's'

1	2	3	4	5	6	7
PETE	HDPE	PVC	LDPE	PP	PS	OTHER
polyethylene terephthalate	high-density polyethylene	polyvinyl chloride	low-density polyethylene	polypropylene	polystyrene	other plastics including acrylic, polycarbonate, polypropylene, nylon, fiberglass
soft drink bottles, mineral water, fruit juice containers and cooking oil	milk jugs, cleaning bottles, shampoo and shower soaps	plastic pipes, window frames, vinyl siding	plastic bags, food wraps, and the foodstuff	plastic bottles, food containers, the wrappings	plastic furniture, car parts, and all kinds of external bodies of the cars	hard packing, machine housing, audio cassettes, CD cases, vending cups

Hundreds of polymers, colours and applications

Understanding the waste characteristics of a city is important to working out what an appropriate management model could be.

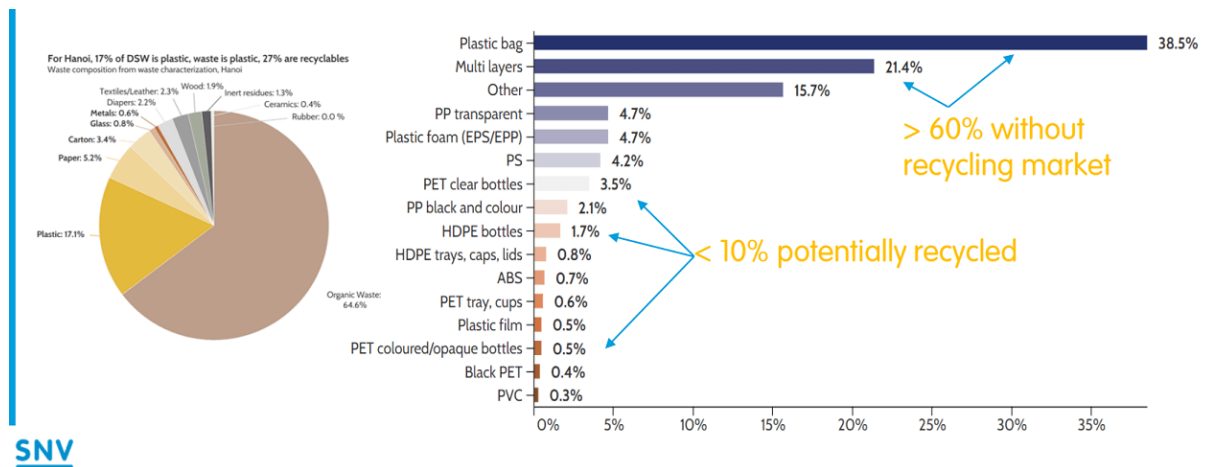


Figure 15: Some types of plastics and recycling potential

Microplastics

Sources of plastic pollution in Vietnam come from littering, but also from plastic recycling processes which create microplastics through shredding, washing and residues. Microplastics are <5mm in size. Primary microplastics are those that were designed to be microplastics, for example inside soaps and lotions. Secondary microplastics are those that are produced later. For example, when you wash clothes with nylon and polyester, the creates microplastics that are released into the greywater.

Solutions: Reduce (refuse), Reuse, Recycle

There is a hierarchy of potential solutions to the plastic solid waste problem (as described by Antoinette Kome in the introduction to Block 3). Consumers 'refusing' plastics (not using them at all or using them less), is the most impactful way to reduce the problem. Plastic products can also be reused either in their current form (e.g. reusing a plastic bottle or a bag many more times instead throwing it away and using a new one) or reused in a more creative way.

They can also be recycled and the plastic used to make a new product. Some countries have deposit return systems where they charge a deposit when you buy a bottle, then you get your deposit back when you return your plastic bottle at a collection point.

Alternatively, they can be co-processed with other waste streams, incinerated, or landfilled.



Why only 9 percent of plastic is recycled

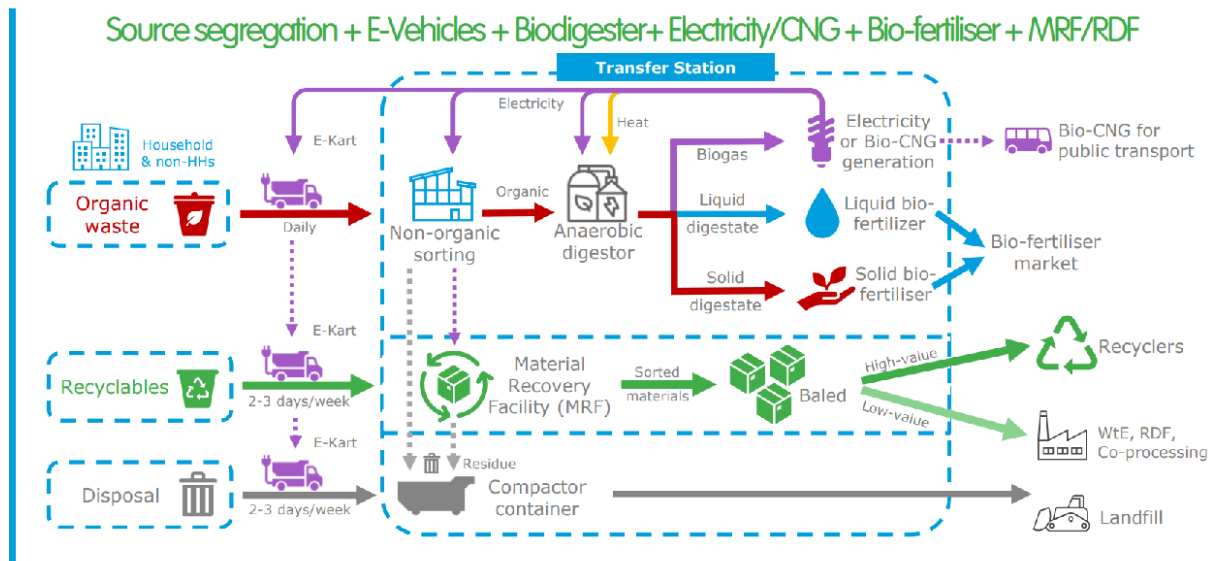
The main reason why most plastic is not recycled is because it is allowed to mix with other waste, it gets dirty, and its value as a product is 'devalued'. This can be solved by enabling 'segregation and sorting' through the waste value chain and connecting to the 'waste market'. This is a system that needs to be promoted within cities. Remember, plastic is a resource.

At a material recovery facility, a centralised facility does the work of segregating materials rather than asking households to do it. Wet and dry (food vs non-food) waste may still be segregated at the household level.



Figure 16: Plastic circular economy

Circular Solid Waste Model



SNV

Figure 17: Circular solid waste model

Challenges with recycling

There are two ways of recycling generally. Mechanical recycling involves putting a plastic into a pellet which is where plastic processing starts. Chemical recycling involves making the plastic go back to its original oil and gas state, but this is difficult and expensive to do. Plastics can also be reused into durable materials by converting the plastic into something else.

Mechanical Recycling

- Back to pellets
- Off-taken by converters
- Technically easy.



Chemical Recycling

- Back to Oil and Gas
- Off-taken by chemical companies
- Costly. Energy intensive



Why plastic matters in the urban water cycle

Plastic pollution is a big problem for the urban water cycle. It litters the environment creating unhygienic living conditions when it mixes with greywater and organic wastes. It litters waterbodies blocking channels and canals and creating a poor environment for aquatic plants and animals, it enters the ocean choking marine animals and damaging marine ecosystems. Arguably an even bigger problem to the large plastic that is very visible, is the 'micro plastic' that is difficult to see but which is entering animals and human bodies as things we consume contain plastic particles. Micro plastics enter the environment during recycling processes (shredding, washing and residues) and when we wash clothes made from plastic fibres like polyester.

Solid waste management policies

Polluter pays

In this context the 'polluter' is viewed as the manufacturer of the plastic that people use. Extended Producers Responsibility (EPR) is a mechanism to make producers pay for the materials (like plastics) that they put into the market. So, for example, Coca-Cola could be charged to cover the costs of waste collection and recycling proportional to the amount of plastic they put into the market or they could provide those services themselves.

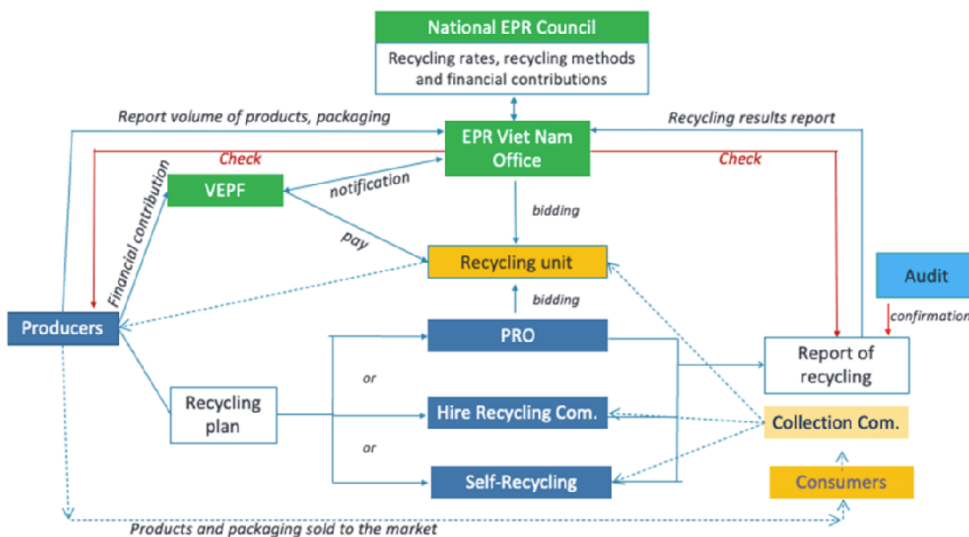


Figure 18: Extended Producers Responsibility (EPR)

Ban plastic?

A hardline approach is the idea to ‘ban all plastic’ because it is such a problem and producing plastic also contributes to Greenhouse Gas Emissions and climate change. However, plastic is very useful. It is cheap to produce and can last a long time which makes it useful. Single-use plastics could be banned. Oxo-degradables could also be banned – these are additives that causes the plastic to break down into microplastics (this is not real ‘biodegradable’). Some countries have implemented these bans.

Plastic Solid Waste Management in Vietnam Q&A:

Comment: If you were to rank the most effective measure to tackled plastic waste, the top one would be banning plastic bags. In Tanzania, they were banned and it was easier than expected.

Comment: People in Bangladesh have invented plastics that are made from local materials and are not environmentally damaging. But I don’t know why it hasn’t been commercialised much.

Comments: Some plastic bags can be made from organics like cassava. Sometimes those plastic bags still have polymers mixed in. And those bags are much more expensive.

Comment: Plastics have reduced GHG emissions in other sectors – for example the lighter weight of plastics has allowed the transportation industry to reduce their emissions significantly. Recycling processes use a lot of energy as well. So, it’s very complicated to determine all the effects on emissions. It depends on your analytical boundary.

Question: There are models of using recycled plastics in road construction – does that create a microplastic problem? Do co-processing recycling facilities cause air pollution problems?

Answer: Plastic shouldn’t be used in roads, because as you have said, the abrasion creates microplastics. Yes, co-processing facilities that incinerate waste with plastic create air pollution.

Question: We are conditioned to think that everything needs to be wrapped in plastic. Is there scope within SNV projects to recondition people (BCC) to not want plastic?

Comment: There is a principle called the Polluter Pays Principle. There is a discussion that certain materials are not recyclable. So, the companies who produce this material should pay for collecting and processing the waste.

Comment: Regarding Endocrine Disrupting Compounds (EDCs) in waste, they end up frequently in wastewater streams. EDCs disrupt the hormonal system of animals (including humans). Fish living in waters high in EDCs have been found to have changed gender. EDCs are also carcinogenic. So as experts of water, we should also consider these EDCs.

Refuse, Reduce, Recycle group exercise

The participants were asked how much plastic on ourselves or surrounding us right now they could have refused, reduced, or recovered/recycled? Participants identified many items. Some are more extreme than others but it clearly shows that there is a lot of potential every day to reduce the demand for plastic and therefore to reduce the quantity of plastic solid waste.

Table 7: Participants reflections - Use of plastics in the vicinity of the learning event

Refuse	Reuse	Recycle
<ul style="list-style-type: none"> • The name tags for our meeting and the phone covers. • The plastic bottles of water. • Cheap, disposable plastic pens. • To use the small bottles of shampoo at the hotel. • Sweets wrapped in plastics. • Plastic wrapping of the shirts. • The plastic ribbon on the bouquet of flowers on the table; refuse the workshop banner. • Handbags/satchels made with plastics. • Clothing with plastics in the buttons or fibres. • Eyeglasses and shoes. 	<ul style="list-style-type: none"> • Cable charger. • Good quality plastic pen. 	<ul style="list-style-type: none"> • Soles of the shoes.

As a conclusion, we should be thinking about innovations that can help us to refuse or reduce our consumption of certain plastic streams.

Understanding urban waste streams

The idea of waste streams is useful for characterising the types of waste a city has to deal with. Municipalities have to deal with many different kinds of waste streams that require different kinds of management. Organics make up a large fraction of the waste volume in low- and middle-income countries as can be seen in the example below from Patuakhali small town in Bangladesh.

Research indicates that the single largest source of solid waste in most urban areas is organics (50%), followed by plastic and then paper. The total waste is also composed of tin cans, glass, electricals, health, and other hazardous materials. Each of these pose different hazards and problems to people and there are different options for managing it.

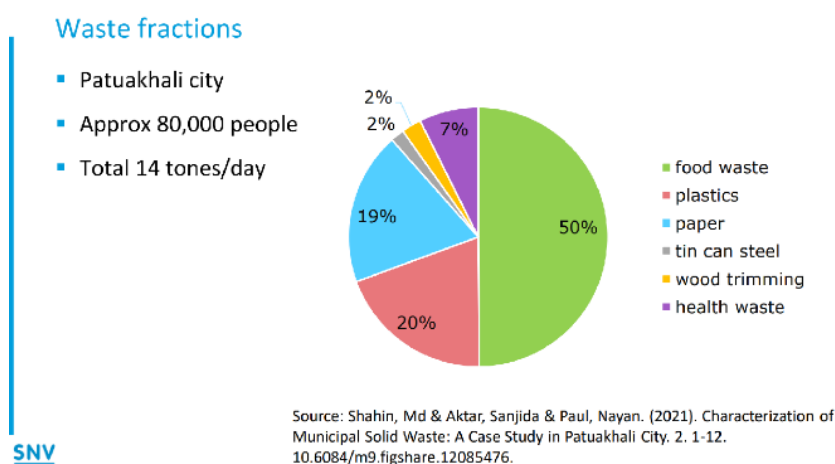


Figure 19: Patuakhali city case example waste fractions

There are different ways to manage solid waste. This is illustrated in the so-called 5Rs: refuse, reduce, reuse, recycle, recover. As illustrated in Figure 20, there is a broad-based consensus that refusing to buy or use 'products' and ultimately preventing them from being produced in the first place has the largest impact. The impact of the five R's declines at each level. Disposal (i.e. to landfill with no treatment/recovery) has the least positive impact (except removing the waste from the vicinity of where people live and removing it from watercourses).

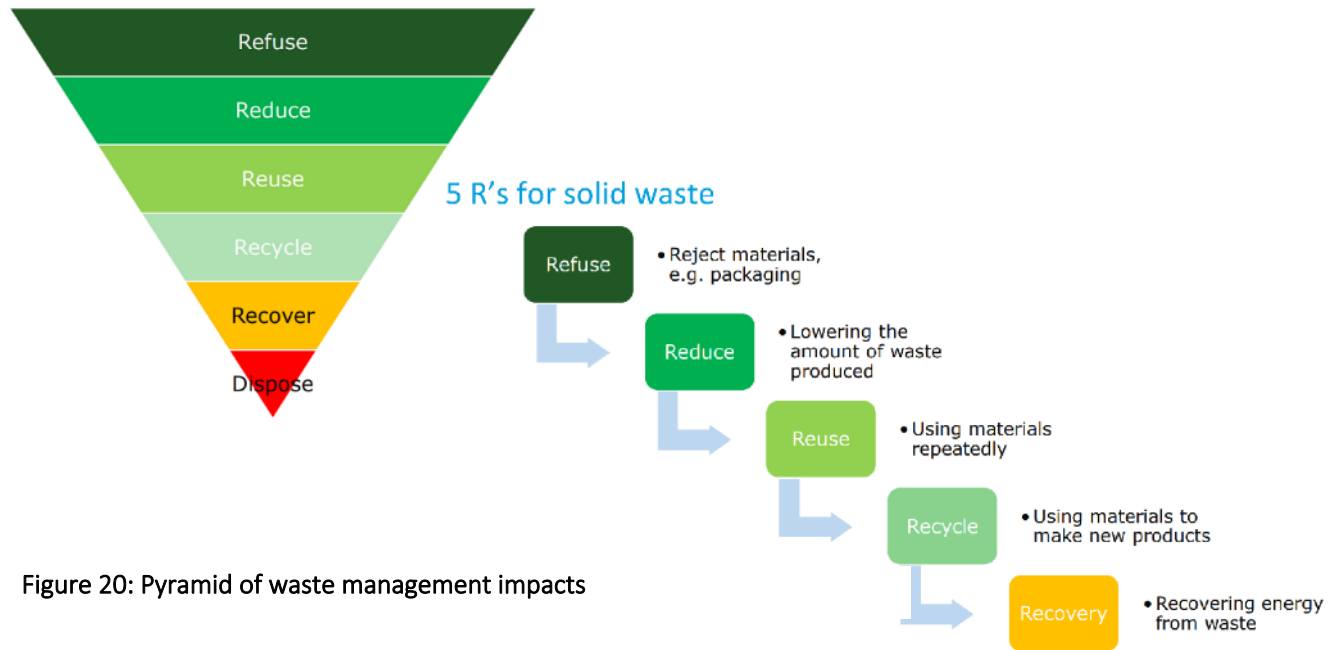


Figure 20: Pyramid of waste management impacts

In the following group activity, the participants were divided into four groups that each looked at one of the following waste streams:

1. Organics
2. Plastics
3. Hazardous/healthcare waste
4. All other remaining waste streams



The groups were guided to select a city that they were familiar with and make a diagram of the waste flows from waste generation to collection to processing. Within that system they identified the pain points and considered where any of the five R's (Refuse, Reduce, Reuse/Repurpose, Recycle) could be applied.

ORGANIC WASTE STREAM GROUP

Overview:

Sylhet City was used for reference. The main sources of organic waste are households, restaurants, markets, slaughterhouses, and food processing facilities. The main destination is the main landfill. There is a secondary transfer station in between, but not all waste goes to the transfer stations. Rickshaws are used to transport organic waste from HHs to the transfer stations. Trucks are then used to transport waste from the transfer stations to the processing facilities.

Pain points:

- Organic waste is mixed with other forms of solid waste, including lots of plastics.
- Very little source segregation. Some people pick out the valuable metals but other solid waste is left.
- Insufficient bins: 30 – 40% of waste goes into open drains and the environment because of insufficient bins and public behaviour.
- Collection vehicles cannot access densely populated areas.

Use of the Rs:

- The “Refuse” principle is difficult to implement because people don’t refuse food. Reducing food waste on the premises is possible, for example through improved storage to prevent wastage. There is some scope to reduce food waste, but little data on food waste.
- Organic waste can be reused to feed livestock.
- Recycling is about making compost either centralised or small-scale at home.
- Bioenergy is possible from food waste (recovery).

PLASTICS WASTE STREAM GROUP

Overview:

Denpasar, Bali was used for reference. 18-20% of solid waste in Denpasar is plastic. There are three types of collection: government services for all sources with some household segregation, private services that service big chain hotels, and community organisations (waste bank) where people bring their waste to a collection point and they receive some payment.

Trucks or three-wheelers are used to transport plastic waste to a transfer station managed by the Government. Waste is segregated at these stations. Non-recyclable waste either goes to landfill or is incinerated.

Pain points:

- Limited source segregation. Waste banks segregate but most households don’t use them.
- Private collection is only available to more affluent households and organisations.
- Mixed collection of different waste streams.
- Sorting is only done for some plastics.

Use of Rs:

- Ban single-use plastics
- Recycling systems could be implemented at waste banks
- Reuse of glass bottles
- Reduce by using reusable bags and tumblers instead of single use plastic bags and cups

MISCELLANEOUS WASTE STREAM GROUP

Overview:

Arusha, Tanzania was used for reference. 30% of waste is mixed waste not belonging to the plastics and organics categories. This includes demolition waste, metals, commercial wood, petroleum waste, and glass.

Pain points:

- At the household there is little segregation, but it has been piloted in some areas. There are agents that will buy glass bottles and containers.
- For e-waste, there are no guidelines on handling e-waste. Some electronics stores will have agents go to households to collect e-waste for recycling or reusing. People also collect e-waste from dump sites.
- Battery acids are often dumped into drains.
- Invisible agents are working to keep the city clean but they are not formalised.

Use of Rs:

- Sometimes people reuse coloured bottles as decorations.
- Glass can be reused if it's not broken at the household level and can be collected.
- Refuse non-rechargeable batteries.
- Some e-waste can be recycled if it's taken to an appropriate facility and useful elements recovered.

HAZARDOUS/HEALTHCARE WASTE STREAM GROUP

Overview:

Nepalgunj, Nepal was used for reference. Healthcare waste is generated at healthcare facilities (HCFs), pharmacies and households. A separate collection of healthcare waste for HCFs is taken to a specialised facility which treats the waste through an autoclave and the waste is recycled. Non-recyclable waste is dumped at the landfill. The waste from pharmacies and households is taken to a central landfill combined with the other waste streams. Each of the facilities also do open burning on premises. Pharmacies and hospitals send expired/unused medications back to the manufacturers who process and dispose them safely.

Pain points:

- There are large amounts of infectious waste because there is no segregation at the sources. So, any normal waste that comes into contact with the infectious waste becomes infectious and need specialised treatment.
- Needles and other medical products at the household are not safely contained and disposed to the normal waste stream
- Open burning is possibly dangerous
- Expired or unused medicines disposed into the normal waste stream.

Use of Rs:

- Refuse (stop) open burning.
- Reduce wasting expired medicines by digitising their expiration dates.
- Practitioners within HCFs can reduce the waste within their practices.
- Recycling can be done if HCF waste is segregated.

Waste streams group work Q&A:

Comment: There can be refusal of foods at the supermarket level if people don't want to be purchase ugly looking vegetables. However, this is conceptually different from the refusal principle as a way of reducing material consumption.

Comment: People could refuse imported foods which require more packaging and materials to transport.

Comment: Food waste in Bangladesh is generated by hotels. That is, food that could have been eaten but is thrown out.

Question: Is there a way that institutional set up could be improved to manage the different waste streams.

Answer: We have seen from other discussions that the regulatory aspect is very important. Could a regulator help with this? In Bangladesh, there is no dedicated person/agency to look after this. It requires more awareness that municipalities are mindful to address this.

Comment: Other ministries are interested in the waste stream, for example a ministry of information and technology might develop guidance on disposing e-waste.

Comment: When looking at segregation of waste in Arusha, the first step was to determine how much it would cost to provide the equipment for segregation. There was willingness amongst the private sector to do recycling, but they wanted to a reduction in the fees that they pay to the local government. So, it needs a business model.

Comment: The more value we try to get out of the waste, the more complicated it gets. If we are expanding on recycling we can gather more revenue. So, it needs a management model for what is trying to be achieved.

Comment: Conservancy should be renamed to solid waste management.

Comment: In terms of regulation, in Zambia there is environmental management agency which grants permits for things like dumping sites. Municipalities need to apply to this. But compliance and enforcement are missing. ZEMA is quite centralised so that don't have a lot of reach into provinces and local areas for enforcement.

Comment: All the services in Tanzania are under the LGAs, but the more they are professionalised, the more they are delegated to other entities. The more we specialise the solid waste services, the more we can unbundle them from the municipality. Like an environmental waste utility.

Comment: In Bangladesh, one agency manages all of the medical waste and separates it. They segregate the infectious and non-infectious waste. Some incineration is happening onsite. The medical waste is not mixed with the municipal waste. Big hospitals in parts of Bangladesh have incinerators but they are often not functioning.

Comment: If unbundling is done and delegated to private sector, oversight is very important.

Comment: In Vietnam there has been privatisation through state-owned companies.

Comment: In Zambia there are healthcare guidelines that say every hospital should have an incinerator. There are 3 kinds of waste: dangerous, semi-dangerous, and non-dangerous. Only non-dangerous waste is put into the municipal landfill so the medical waste is not mixed. Every hospital has a focal person that reports on waste management. If even a single syringe is found in the landfill, there will be an investigation of where it came from.

Comment: A legal issue for medical waste in Bangladesh, according to legislation, is that the municipality is mandated to take care of waste, but it does not say anything about medical waste. Hospitals are meant to manage their own waste, but they often do not. So, some city corporations and municipalities are taking care of this or contracting operators to do it.

Question: Considering the complexity of the waste chain, should there be a company that focuses just on e-waste or just on plastics? It seems quite big for what most municipalities can handle.

Answer: It depends on the collection model in the city. For example, door-to-door or centralised. So, depending on the model you may or may not want to unbundle the services.

Comment: To make the 5Rs diagram more meaningful, we could consider who are the relevant actors of each R. It will create responsibilities for that action. Certain people can or cannot play a role for implementing each action in a given situation. It's not always clear who is doing what and how it is being funded.

Comments: City people – it has to be in education so the next generation can learn about what sort of citizens they need to be.

Block 5: Country groups sessions and wrapping up

World Cafe

The World Café is a group exercise where two representatives of each country pose two urban water cycle challenges that they are facing to participants who 'pitch' their proposed approaches to solve the problems. Participants form 'consultancies' and do a round of interviews. The global team also participated as one of the teams.

Table 8: Summary of challenges and preferred 'solutions'

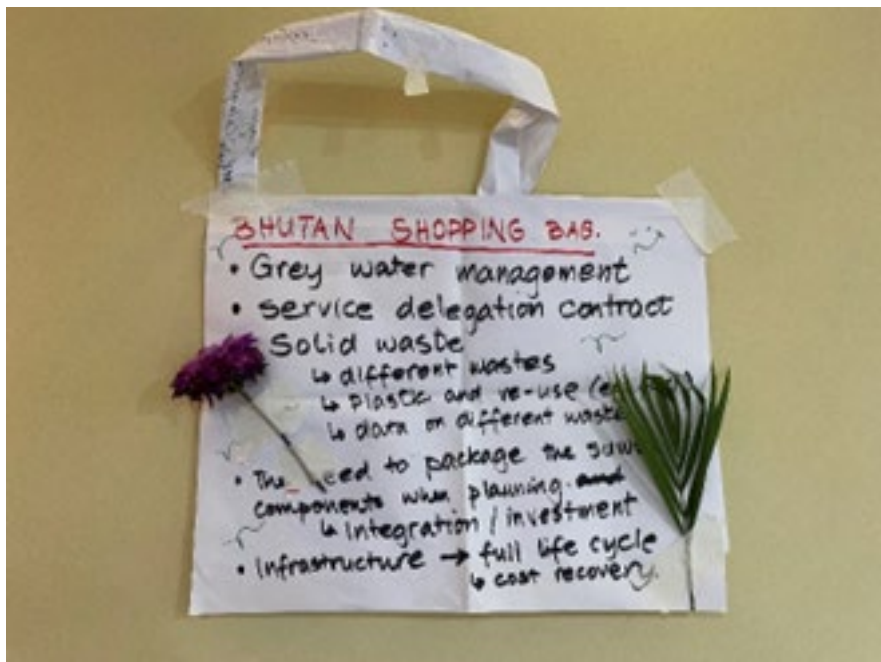
Challenge	Preferred solutions
Bhutan: Solid Waste Management There are no regular SWM collections, disposal is pits at premises, open burning. Landfill? 46km away. Advisers were asked about collection, transport, and disposal options.	Teams gave valuable information. The best advice is to collect waste data (quantify types of waste). Bhutan doesn't do this yet. Other good ideas are to 'zone' waste collection areas, map collection points etc.
Bhutan: Water (supply) management problem	Advice given on how to outsource the distribution network.
Bangladesh: Plastic waste at households	Segregation at household premise. Waste banks at the community level are also a good idea (for separation and income). Pay as you throw system (need to involve the plastic

Challenge	Preferred solutions
	producer companies – get them to contribute financially). Need data, an intensive baseline survey, then make a plan. Incentivise HHs to separate their waste.
Bangladesh: Greywater at households	<p>Greywater management is a very new concept in Bangladesh. First need a plan, get stakeholders to understand.</p> <p>Grease trap model at every household (very cheap, affordable for municipalities), treated water can be reused locally. Collect data (currently no baseline data) so we can plan.</p> <p>Would like to combine the waste bank approach and go for the grease trap approach.</p>
Tanzania: Flood management: slum city in coastal region.	Permeable pavements to absorb flood, bio-pores to increase infiltration (tree roots).
Tanzania: Solid waste (plastic bottles being produced using a material that is difficult to recycle)	Introduce the ‘Polluter-pays’ principle and demand a change in packaging.
Zambia: A town (20M€) waterlogged, flash floods in the area, very high water table. Need solution for climate resilient toilets (a pilot that they hope can be replicated and scaled up).	Urine separation design (Afghanistan), and redesign Indonesian raised toilet design for Zambia. They want to take a very holistic approach, so including drainage as well.
Nepal: Safely managed sanitation	Collect more information on containment, transport. Provide more training to masons on containment etc to improve quality.
Nepal: Waste Segregation?	Undertake formative research. Understand consumers. Introduce bye-laws. Consider alternative day collections.
Nepal: Disaster preparedness and response?	Prepare plans with flood risk hazard maps. Identify vulnerable groups. Build an Early Warning System and train team, awareness campaigns based on flood mapping, alert systems, prevent building homes in flood zones.
Indonesia: Advice on how to better manage greywater (How to manage the Grease/oil as part of solid waste?)	<p>Decide if greywater is to be reused or not. Consider the three types of greywater .</p> <p>Install grease trap on kitchen greywater, then pipe to garden etc; combine septic tank to soak pit (if don’t want to reuse), potential small sewer?</p>
Indonesia: How to manage service delivery of FSM	<p>Understand the value chain, institutional analysis, figure out how to bundle FSM and SWM and explore cross-subsidy options.</p> <p>Organic treatment: >60% waste is organic. Explore biogas technology. Usually needs to be mixed with manure to produce methane.</p>

Challenge	Preferred solutions
<p>Global: How to make an adaptation plan for a city like Sylhet? How to increase urban resilience and measure the results?</p>	<p>Adaptation needs to be context specific: is it an inland/coastal city, population density etc? Received lots of useful information.</p> <p>Important to work with multiple parts of Government and communities. A few specific measures for specific issues were mentioned, as well as blue and green infrastructure.</p>

Country shopping bags

At the end of the learning event participant country teams were asked to consider what they have learned that they will immediately take back to try to apply in their home countries.



BANGLADESH:

1. Work on a governance pattern for segregated waste management;
2. Introduce low-cost technology (e.g. grease traps) at household level;
3. Develop community waste banks for plastic;
4. Long-term BCC on waste management;
5. Introduce exclusive mechanism to manage WASH and Solid Waste under one umbrella (bundled).

BHUTAN:

1. Greywater management;
2. Service delegation contracts;
3. Solid waste: differentiate the types of waste, collect data, target plastic;
4. Package some components of the urban water cycle when planning and integrate investment;
5. Look at the full lifecycle and cost recovery of infrastructure options.

INDONESIA:

1. Delegate service delivery to private sector (wastewater and solid waste), including licensing process;
2. Strengthen interlinkages in the institutional set-up (water supply, wastewater, solid waste)
3. Strengthen BCC on water supply, wastewater, solid waste. Combine with technological options and enforcement;

4. Advice from World Cafe: introduce grease traps etc for greywater management; take steps to engage private sector in solid waste management; examine options for organic waste management.
5. Walk the talk on plastics! Individual responsibility as well!

NEPAL:

1. Collaborative workshop methodology engaging all, where nobody can escape learning;
2. Bangladesh example of Local Government having a dedicated section for waste (Conservancy department);
3. Bangladesh example of Material Recovery Facility;
4. Zambia example of Regulatory Institutional setup;
5. Plastics presentation was inspiring “Plastic is not the devil, single use plastic is”
6. Options to rethink approach to greywater management;
7. Bangladesh example of certification by the Ministry of Agriculture of organic fertiliser produced as part of FSM and joint marketing to farmers.

ZAMBIA:

1. Solid Waste Management separation processing – start small, include transfer stations;
2. Serious Games – to support stakeholder discussions;
3. Multiple ideas on flood management (including rainwater harvesting);
4. Options to deal with greywater (accept it is a problem);
5. Importance of advocacy (dealing with politics, CSOs etc);
6. Higher number of smaller investments is better than one big investment (adaptable, adjustable, and manageable);
7. Flood management it not just about drainage, also storage and infiltration;
8. Investigate the Urban Resilience Framework.

GLOBAL:

1. Nature of floods requires different approaches;
2. There are different types of greywater;
3. The sustainable urban water cycle concept;
4. Emphasis on contextualised solutions;
5. Climate change is very important everywhere;
6. There are multiple kinds of plastic.

Closing remarks

Shahidul Islam, Water Sector Leader Bangladesh, closed the event by giving thanks to Sylhet City Corporation for attending and for their support to make this event happen. Also huge thanks to all who worked hard to organise all aspects of the Learning Event and to all participants for their energy and valuable contributions. It is hoped that everyone has learned a lot and enjoyed the experience. It is important that participants take their shopping bags home and start implementing things that will improve their city water cycles. Thanks to all.

Appendix 1: Greywater technical options

- Chhatak greywater case study
- Greywater case 1 Djenne, Mali
- Greywater case 2 Koulikoro, Mali
- Greywater case 3 Gauteng Province, South Africa
- Greywater case 4 Monteverde, Costa Rica
- Greywater case 5 Kathmandu, Nepal
- Greywater case 6 Jimma, Ethiopia
- Greywater case 7 Pune, India
- Greywater case 8 Nagar, India

Appendix 2: Three-week e-group summary discussion on SUWC

SUMMARY BY ANTOINETTE KOME, GLOBAL SECTOR HEAD OF WATER, SNV

Introduction

The Egroup discussion on Sustainable Urban Water Cycles ran on the snvwater Egroups platform from the 9th of February till the 28th of February. In total there were 58 countries, from 15 countries (Bangladesh, Mali, Tanzania, Switzerland, Bhutan, Australia, Indonesia, Zambia, Vietnam, Austria, Netherlands, Nepal, Laos, Ethiopia and Niger).

The Egroup was organised over a period of 3 weeks and divided in three topic blocks as follows:

Block 1	9-14 of Feb 2024	What forms a Sustainable Urban Water Cycle?
Block 2	15-21 Feb 2024	To integrate or not to integrate? <i>(That's the question)</i>
Block 3	22-28 Feb 2024	How to take inhabitants along?

In each block, guiding questions were asked, but participants were also invited to speak more broadly about the topic or raise issues themselves.

The questions were:

What forms a Sustainable Urban Water Cycle?

1. How would you describe the urban water cycle in your city or the city where you work?
2. Do you consider it is a sustainable urban water cycle? Why?
3. Which criteria would make an urban water cycle sustainable?

To integrate or not to integrate? *(That's the question)*

1. Who is currently responsible for what parts of the urban water cycle in your city?
2. What do you see as the stronger and weaker parts of institutional set-up of the urban water cycle in your city? And why?
3. What should be done to improve the institutional set-up?
4. How will these improvements contribute to greater effectiveness, efficiency, accountability or transparency?

How to take inhabitants along?

1. Which behaviours by city dwellers are most problematic for the sustainability of the water cycle in your city?
2. Which strategies have been tried and been unsuccessful? (you may speak about your city or from your general experience)
3. What do you see as more successful strategies to bring city dwellers along in the changes towards a more sustainable urban water cycle?

The succeeding pages present the summary of the discussions. Original contributions can be found at: <https://snvwater.groups.io/g/Sustainable-urban-water-cycles/messages>

Topic 1: What is a Sustainable Urban Water Cycle?

How to describe an urban water cycle conceptually?

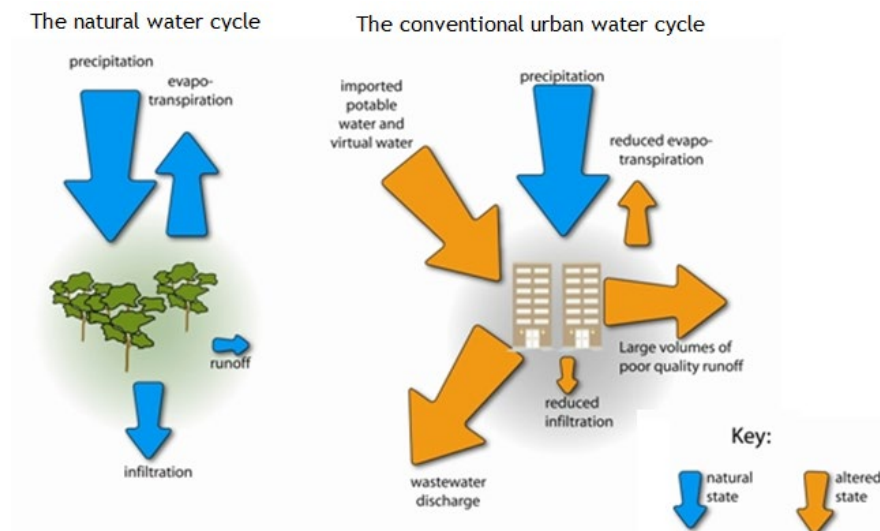
While we asked you to talk about the specific water cycle in your cities, I think it's good to start with the concept as it emerges from the different contributions. There are different concepts:

1. A more [narrow concept of urban water cycle](#). Here it starts with water capture and treatment, goes to distribution to users, collection of waste water, and then treatment/ disposal of waste water (see the picture below adapted from Zhuo Chen et al¹). As you can see, this more narrow concept is still a cycle. The water is taken from the groundwater and river, and it goes back to these sources downstream, being part of the overall hydrological cycle.



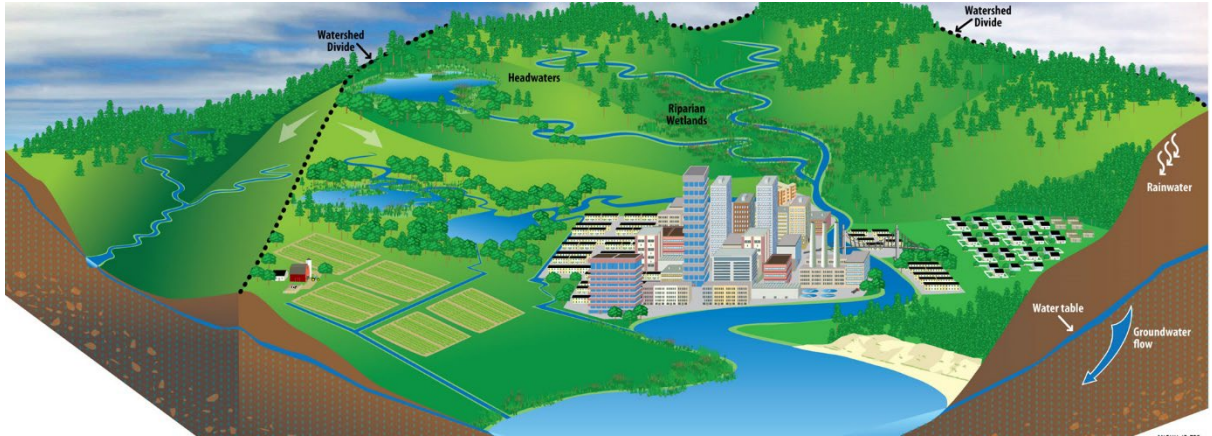
Of course, in practice, it is rarely this neat. For example, not all premises are connected to water supply let alone to sewer. The quality of the treated waste water is not always up to standard, and drainage water also has an impact.

2. [Basic concept of urban water cycle with spotlight on urban run-off](#). This concept of the urban water cycle includes the water supply and waste water management, but puts special emphasis on (polluted) urban run-off and storm water drainage in the city. This is particularly relevant in cities with high levels of paved surfaces, problems of water logging etc. The conventional water cycle picture of SWWM fits in this perspective.



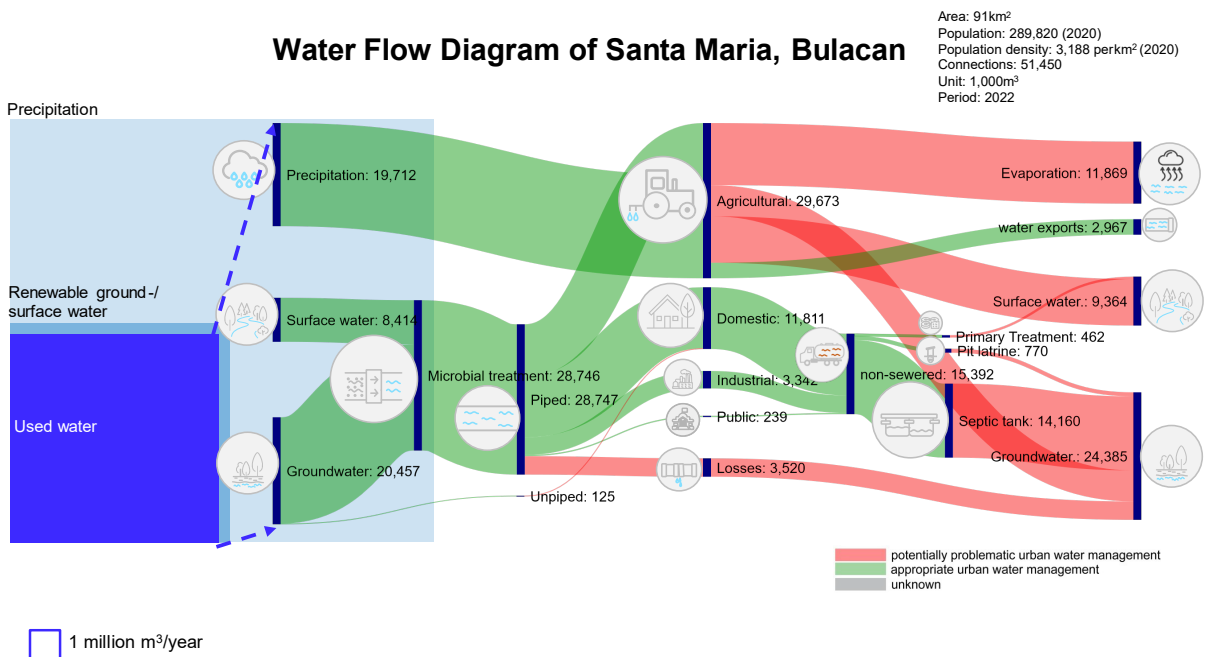
3. [Basic concept of urban water cycle with spotlight on the water resource](#). This is the perspective that historically was taken by organisations focusing on water supply and/or in places where water supply is getting scarce. It includes the water supply and waste water management, as well as a deeper understanding of the water sources. This can evolve around recharge, protection and sometimes even full watershed conservation. Payment for environmental services also links to this perspective.

¹ Zhuo Chen, Guangxue Wu, Yinhu Wu, Qianyuan Wu, Qi Shi, Huu Hao Ngo, Oscar A. Vargas Saucedo, Hong-Ying Hu, Water Eco-Nexus Cycle System (WaterEcoNet) as a key solution for water shortage and water environment problems in urban areas, Water Cycle.

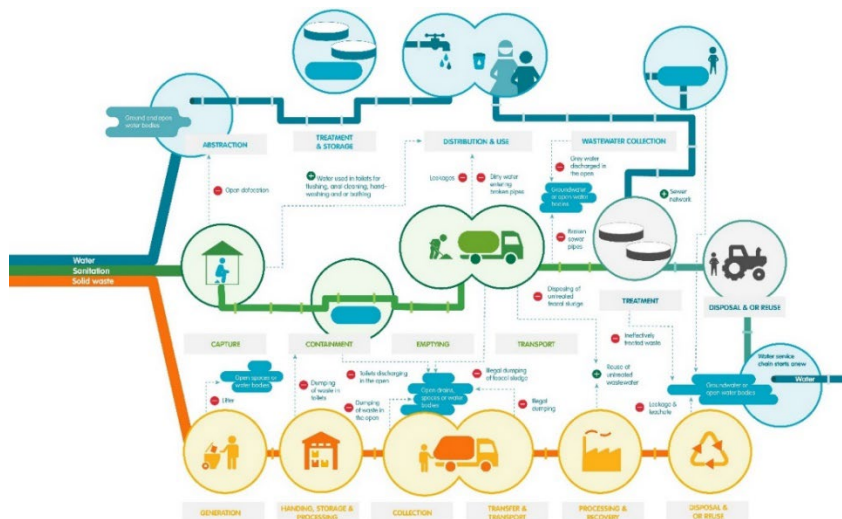


(picture from Mississippi Watershed Management Organisation)

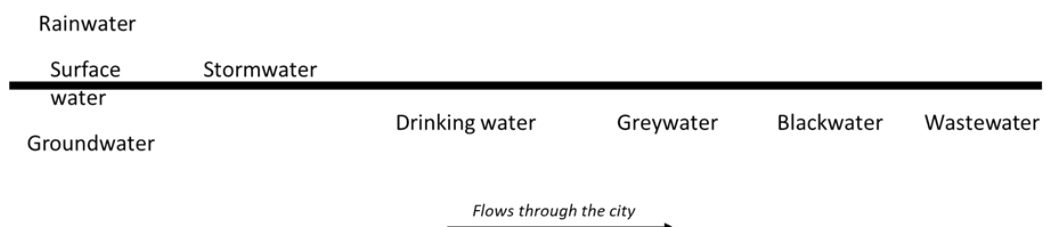
Also the water flow diagramme developed by Dorothee Spuhler and Lukas Bouman at EAWAG, puts a spotlight on the water resource and how it's used. [Digbijoy Dey](#) from Bangladesh shared the diagramme for Dhaka (see the contribution by Digbijoy). (I am sharing below the diagramme from Santa Maria because it includes the link to the available and used water resource).



4. [Everything-integrated urban water cycle concept](#). When the urban water cycle is described at a more abstract level, there is a tendency to include everything : the water source, water supply service chain, sanitation, solid waste service chains, grey water, stormwater. And course it is true that everything is connected. The diagramme shared by [Ingeborg Krukkert](#) from the Netherlands, is an example of this.



Abishek Narayan from Switzerland shared the following diagramme :



Within the [everything-integrated urban water cycle concept](#), the [spotlight often ends up on solid waste](#), because it interferes with drains as well as on-site/ off-site sanitation. Many of you mention these interactions.

How does the urban water cycle currently look like in your different cities?

We probably need a holistic, everything integrated urban water cycle concept to begin with, but for specific cities, we can focus on what is most relevant.

[Jeremy Kohlitz](#) from Sydney (Australia), [Digbijoy](#) from Dhaka (Bangladesh), [Sonja Hofbauer](#) from a town near Vienna (Austria) and [Mahteme Tora](#) from Addis (Ethiopia) all put a [spotlight on the water resource in the urban water cycle](#). In [Sydney](#), the water comes from 11 dams – 80% from one specific dam (Warragamba) – and there is a desalination plant to top up the water supply. In [Dhaka](#), Digijoy shared that 35% comes from surface water and 65% from groundwater. The overall production is ample for the population it's serving. In [greater Vienna](#) there is also sufficient water, coming from the mountains through gravity flow. Additionally there is a back-up supply of infiltration wells along the Danube river.

There are concerns about the impacts of dry years and the unregulated abstraction of ground water for irrigation, hence household measures to allow for greater infiltration are encouraged. Also in [Addis](#), there are large water supply needs requiring a combination of groundwater and surface water. The context is complex due to the altitude of the city affecting water pressure. Big water consumers are encouraged to self-supply from ground water which led to overabstraction and drying wellfields. Additionally Addis has (untreated) wastewater irrigation for the vegetable production. In addition to the re-use of water and nutrients, this contributes to a different cycle: the lifecycle of pathogens...

Yet there are a number of people who put a [spotlight of the water cycle on urban run-off](#), such as [Ruhul Munshi](#) about Gazipur (Bangladesh), [Gem Tshering](#) about Thimphu (Bhutan), [Kabir Rajbhandri](#) about

Kathmandu (Nepal) and [Marc Casas](#) on Hanoi (Vietnam). These are all places with more build-up area. Ruhul shares that in [Gazipur](#) there are few places for infiltration of water. Gem shares that [Thimphu](#) gets flooded with stormwater and surface run-off during every heavy rainfall. The development of the city took place before planning, and it is now difficult to add green spaces. In [Hanoi](#) domestic water is brought from km away from the city, while only a small part of the waste water is treated. Natural lakes within the city have been drained or reduced to expand urbanisation, as a result flooding is common.

Yet in some smaller cities urban run-off is less of a problem because there are still many open unpaved spaces. An example is given by [George Wainaina](#) based in Switzerland, who speaks about a small town in Kenya called Limuru. There are still large areas with vegetation in the town, so infiltration still happens. The challenge is around the quality of on-site sanitation.

However, the [everything-integrated urban water cycle](#) is a reality for many of you. [Proshanto Roy](#) from Dhaka, [Merelin Keka Adhikari](#) from Joypurhat Municipality (Bangladesh), [Rachel Pringle](#) based in Vientiane (Laos), [Malan Abdou Nahiou](#) from Niamey (Niger) and [Afewerk Teklemariam](#) and [Andualem Anteneh](#) writing jointly about Bahir Dar and Kunzila town in Ethiopia, all write about the interconnections and in particular the visible role of solid waste. Proshanto shares that [Dhaka](#) is surrounded by rivers and wetlands, which are affected by polluted run-off and poor on-site sanitation management. Solid waste clogs drains and channels, resulting in stagnated water in the city. Also, in [Joypurhat](#), the conservancy inspector highlights the issues of septic tanks connected to drains, drains clogged and overflowing, as well as large amounts of solid waste. In [Niamey](#), the drains are blocked by sand, plastic waste, and household waste, which leads to flooding. Also, the river carrying debris leads to flooding, while the use of shallow wells poses a health risk due to pollution from on-site sanitation. Both [Bahir Dar city](#) (about 180,000 people) and [Kunzila](#) (about 10,000 people) lay on flat land on the shores of Lake Tana. Bahir Dar takes its water from 38 boreholes and three spring sources, but these sources are insufficient due to population growth as well as lack of metering. The city is flat, and this contributes to water logging, polluted run-off water flows into the Lake Tana and the Blue Nile River. For Kunzila, the source of water supply is a borehole near the lake and the Lake Tana itself. Sanitation is on-site and solid waste management is gradually improving. Still run-off flows back into the Lake Tana. The problem of lake's pollution is obvious. In [Vientiane](#) the river is the source of water supply, but downstreams that same river is heavily polluted by the city. Flooding is a major issue due to poorly maintained drainage as well as the location of some parts of the city.

Do you consider it is a sustainable urban water cycle? Why?

The answers to this question were quite uniform, ranging from [no](#), [not really](#), to [no not at all](#). Only [Sonja](#) from greater Vienna reflected that the system which has been in place for over a hundred years is fairly sustainable for now.

The [reasons why](#) you did not consider the urban water cycle sustainable can be sub-divided in having a problem today and expecting to have a problem tomorrow. The problems you mentioned follow broadly these lines:

1. Problem with shortage of water supply
2. Problem with services not reaching all
3. Problem with pollution of surroundings, water bodies, groundwater
4. Problem with flooding/ water logging

[Matheme](#) talked about the difficulty to find a balance as Addis Ababa is growing and developing quickly. This means the demand for water increases, but on the supply side the infrastructure is ageing, there are leakages, and waste water treatment is inadequate. Several of you ([Ruhul](#), [Gem](#), [Jeremy](#), and [Marc](#)) spoke about the need for recharging groundwater, either to mitigate shortages today or in the future. [Merelin Keka](#) highlighted the fact that services are not ensured for all city dwellers, which is linked to a range of factors. Others emphasised the growing problem of pollution. [Patricia Solorzano](#), based in

Dhaka, spoke about the enormous amounts of solid waste mixing with water and contaminating both surface and ground water. [Ugyen Dorji](#) from Dagana Dzonkag in Bhutan shared how chemicals, trash, and other contaminants in run-off go directly to the rivers and streams, affecting aquatic ecosystems and public health. Also, [Allan Rushokana](#) from Arusha in Tanzania highlighted the importance to consider health aspects in the urban water cycle. [Afewerk, Andualem, and Kabir](#) spoke about pollution, but also flooding. [MD Gift Mbaimbai Monde](#) from Zambia wrote about the factors that impede infiltration as city planning has not considered this during planning. [Rachel](#) spoke about potential future issues for Vientiane, which are not only caused by climate change, but also upstream development of hydropower, as well as uncertainties around development and maintenance of key infrastructure in the city itself.

Which criteria make an urban water cycle sustainable?

There is a wealth of information in the different contributions. I would like to distinguish between:

1. Criteria : when do we say an urban water cycle sustainable
2. Measures : how to get to that situation of greater sustainability



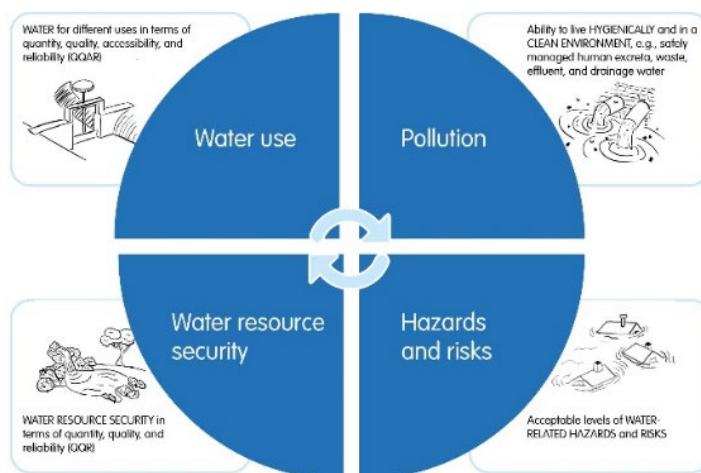
Criteria: when do we say an urban water cycle is sustainable?

Jeremy, Kabir, and Marc point to the need to find a **balance**. [Jeremy](#) and [Kabir](#) define a sustainable urban water cycle as:

an urban water cycle that allows for sufficient amounts of clean water for meeting the needs of everyone and sustaining ecosystems, meeting the wants of society, and does not have economic costs that exceed the ability of society to pay for it, in the present and under future climate change scenarios.

The description provided by [Afewerk](#) and [Andualem](#) echoes this definition. [Marc](#) talks about an acceptable level of disruption of the natural water cycle, considering input, output, and quality of water.

The 'balance perspective' is explicit about water use for people and nature, the sustainability of the water resource as well as different aspects of pollution (sanitation, solid waste, polluted run-off). However, the need to protect people from water-related risks is not as present. Therefore, from SNV's side, we consider four dimensions of water security as criteria for a sustainable urban water cycle.



Measures: how to get to a situation of greater sustainability

Most of you talk about measures, activities that we need to do to make the urban water cycle more sustainable. As [Abishkek](#) explained, measures can be varied. Many people emphasised the need for treatment, recharging of groundwater, and protecting the environment from pollution. [Dorji](#) also raised the need to increase responsible water use. [Gem](#) suggested to distinguish between drinking water and water for other uses, e.g., in construction it is not needed to use water at the quality of drinking water.

MD Gift Moonde wrote about the need to include gray and green development in city planning, and to find solutions for recharge and infiltration. However, he also pointed to the bigger picture, suggesting attention must be paid to development in rural areas to curb the very high rate of urbanisation.

Allan said that measures need to include all aspects and levels. Most people agreed with this, but some suggested to start or prioritise. Digbijoy recommended to prioritise services, in the context of Dhaka, especially on-site and off-site sanitation.

Patricia talked about striking a balance between affordability and cost-recovery, between environment and community needs. Merelin Keka and Rajeev Munankami emphasised that a range of social-organisational measures are needed to arrive at greater sustainability.

Topic 2: To integrate or not to integrate? (That’s the question)

Who is currently responsible for what parts of the urban water cycle in your city?

The institutional set-up for the urban water cycle is a *means to an end*. The objective is to manage the different services (water supply, off-site and on-site sanitation, solid waste) as well as drainage, floods and droughts in a way that provides (long term) water security for all people in the city.

There are few places where one entity is entirely responsible for all parts of the urban water cycle. From the description by Gem Tshering, it seems that Bhutan is the only country where all responsibility lies with the municipality.

Of course, water security is not the only concern a city has, there are also other objectives, roles, and responsibilities. Moreover, urban water intersects with other issues like housing and roads. Therefore, this Egroup is not suggesting that more integration always provides better outcomes. Rather the question is about the *overall institutional architecture*: finding the *right degree of integration across different levels, functions and sectors*. The “degree of integration” is found somewhere along the integration continuum, as in the figure below.

No contact	Exchange	Coordination	Aligned targets and planning	Joint task forces	Merged operations
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More integration →

Below, I will first zoom into what you said about these levels, functions and sectors, and then try to summarise the stronger, weaker parts as well as ideas for improvement.

Levels or areas of jurisdiction

The question about institutional integration across levels is about *the area of jurisdiction of each entity*.

This asks, for example, how much is managed at ward level, how much at city level, or perhaps how much regionally.

In most contributions, we saw that the different institutions operate in a similar jurisdiction, namely that of the *city*. However, in some cases, certain roles are with an entity that works in a smaller (ward) or broader area (region, catchment).

For example, Luckson Simumba, Gift Moond, and Emily Banda from Zambia, shared that commercial water utilities are responsible for water supply and sanitation across multiple cities, whereas solid waste and drainage is with the municipal authority of each city. As in most countries, land is one of the key issues, and this depends on the local government. Moreover, right now, as Luckson explained, commercial utilities report to two ministries: the Ministry of Local Government and the Ministry of Water.

In Dhaka, as explained by [Digbijoy Dey and Proshanto Roy from Bangladesh](#), the Dhaka Water and Sewerage Authority (DWASA) is responsible for water and sewerage, but there are two city corporations (local governments) namely Dhaka North and Dhaka South. The city corporations are responsible for on-site sanitation, drainage, and municipal solid waste. The size of Dhaka (22.2 million people) may be the reason for having two city corporations.

In [Tanzania](#), [Hezron Magambo](#) shared that Urban Water Supply and Sanitation Authorities (WSSAs) are responsible for water supply services, as well as off-site and on-site sanitation services. The city council (local government) is responsible for solid waste management, and certain aspects of sanitation like enforcement of regulations. The responsibility for the drainage system management is shared. The city council is responsible for planning and general maintenance, whereas the road agencies (TANURA and TANROADS) do construction and major repairs. Yet, as [Herieth Manyika](#) explains water resource management sits with the water board. In the case of her region, the Simuyu Region of Tanzania, this is the Lake Victoria Basin Water Board.

In [Mozambique](#), [Horacio Quembo](#) explains, the responsibility for administration of water supply and sewerage infrastructure in medium and smaller towns is with a central government institution (AIAS). AIAS then signed delegated management contracts with private sector to operate the systems in the city. Where needed, AIAS provides technical support.

There may be good reasons to make one institution responsible for a bigger area or to divide responsibilities across multiple institutions in smaller areas. Having a bigger area generally allows for more revenues, cross-subsidies between viable and less viable areas, and for greater technical capacity. However, it may also lead to the neglect of smaller, more remote areas (“not all children are loved equally!”) and bureaucratisation. Smaller entities responsible for a smaller area are expected to be closer to end users, less bureaucratic and more able to respond to the specific local needs or situation. However, they may struggle financially and not have access to all the required technical capacity.

However, if within the urban water cycle different roles and responsibilities are with entities at different levels, this may make coordination and alignment of – for example – investment more difficult. Organisations working in a broader area may feel they need to coordinate with a whole lot of small entities, whereas organisations working in a smaller area may feel that the larger entities are not always responsive to their needs.

Functions

The question about institutional integration across functions is about [efficiency as well as accountability](#). The most well-known example is the discussion about the [separation of policy, regulation and operation of services](#). The idea is that the entity providing the service should not also be the one who regulates the service because that’s a potential conflict of interest (that’s like a student grading his/her own exam). Another reason to house certain functions in a separate entity, may be because it requires [more attention or specialised knowledge](#). In addition to the well-known policy, regulation, operation functions, we also see separation of functions around planning, investment and financing in some countries.

The National Water Supply and Sanitation Council (NWASCO) in [Zambia](#) is an example of a strong national regulator, with a function separate from the operations, investment as well as policy, and also outreach across the country. However, not all countries have a regulator that has effective influence across the entire territory. In some countries or cities, the regulatory function is combined with policy making and housed at the city level. [Digbijoy](#) suggests that for Bangladesh the set-up of a regulatory authority for abstraction, drinking water and sanitation respectively, is a priority.

In [Kathmandu, Nepal](#), as [Sanju Lamichhane](#) describes, the Kathmandu Valley Water Supply Management Board (KVWSMB) is an autonomous government body responsible for the water supply and sewerage

assets in the city. It is responsible for policy development, licencing and monitoring of service providers. Kathmandu Upatyaka Khanepani Limited (KUKL) a public company tasked with the operation and management of water and waste water services. Under KVWSMB there is a specific Project Implementation Directorate that operates as an asset creator and oversees investment projects. However, the Ministry has initiated a process to delineate clearer lines for demarcation between the entities, and with the Federalisation into three tiers of government (Federal, Provincial, Local) further clarity may be needed among levels as well.

The regulatory functions needed for a sustainable urban water cycle go beyond the economic and service regulation of water supply and sewerage utilities. As [Emily](#) describes, Zambia Environment Management Agency (ZEMA) issues licences concerned with environmental and ecosystem protection, whereas the Water Resource Management Authority (WARMA) regulates water resource management for different uses. Both are at the national level.

Also in [Mali](#), [Lassaba Toure](#) shares that there is a focus on policies and a gap in operations and regulation.

In a number of countries, investment is a function which lies with the operator, e.g. the water utility to expand the network or the local government to invest in solid waste. However, as [Patricia Solorzano](#) describes, in [Bangladesh](#) the City Development Authority is a separate, deconcentrated, government agency that approves planning, for example the construction of buildings and adherence of on-site sanitation to the national building code.

In [Hanoi](#), [Hang Dinh Thu](#) explains that investment in drainage is managed by the Department of Construction at the city level, the People's Committee of Hanoi, However, the management is done by the suburban district who signs contracts with a company (public or private). Further budget requirements can be submitted again to the Department of the city.

In [Addis Ababa, Ethiopia](#), [Mahteme Tora](#) explains that there are two entities working on solid waste management: The Department of Sanitation and Beautification has the overall responsibility for the solid waste chain, city cleanliness and environmental hygiene. The Addis Ababa Cleansing Management Agency is responsible for maintaining cleanliness and sanitation in the city, including street cleaning.

[Merelin Keka Adhikari from Bangladesh](#) points out that many of the quality-oriented functions are not sufficiently ensured. These are functions such as public engagement, ensuring occupational health and safety of workers, transparency of decision making, but also data management. The question is whether these functions should be housed separately, or that responsible entities should be held more accountable for such aspects.

Sectors

Institutional integration across sectors is what generally comes to mind when reflecting on the urban water cycle. It is about for example to [bundling or separation of water and sanitation, or sanitation and solid waste](#).

[Abishek Narayan from Switzerland](#) shared two figures from the work that the EAWAG team has been doing on this. The figures show all the potential positive and negative interactions between the water supply, sanitation and solid waste value chains, as well their link with storm and grey water (please have a look back at this message). As you can see [potentially](#) there are a lot of interactions, the challenge for each city and country is to find the appropriate, feasible and priority interaction for their context. Or said otherwise, an institutional architecture that ensures coherence, maximizes synergies and allows for specialisation and efficiencies.

Your contributions show that in many countries water supply and sewerage (off-site sanitation) is housed separately (in a separate entity) from on-site sanitation and solid waste. In some countries, like Zambia and Tanzania, this changed over the past years: the utility has now become responsible for water supply, off-site as well as on-site sanitation. Solid waste tends to remain with the local government in all countries, but drainage can be housed together with roads in some contexts.

For example, [Afewerk Tekelemariam and Andualem Anteneh from Ethiopia](#), explain that in Bahir Dar city there are three entities:

1. Bahir Dar City Water Utility : responsible for water supply and waste water. (It is not clear to me whether this includes the on-site sanitation chain.)
2. Bahir Dar City Road Authority: responsible for construction and maintenance of the drainage network.
3. Bahir Dar City Greenery and Beautification Office: responsible for the full solid waste management chain as well as a clean and aesthetically pleasing environment more generally.

[Abishek](#) zooms in on two small towns in [Uganda](#), Wobulenzi and Kakoogi. In the Ugandan context, water supply is the mandate of the regional umbrella utility, whereas on-site sanitation and solid waste sit with the town council. Storm water drains along highway roads are with the transport department.

Stronger and weaker parts of the current institutional set-up, and potential improvements

You raised a large number of examples responding my question of what the stronger and weaker parts of the current institutional set-up in your city is. All of this is of course context specific and related to the specific institutional arrangements of the city and country. Yet, nearly every contribution refers to role clarity among stakeholders involved as one of the key issues.

The three contributions from [Zambia](#) converge around the point that Zambia has clear policies, a legal framework, dedicated ministries, a strong regulator and increasingly also clear policies for on-site sanitation. Issues that are seen as weaker is the reporting obligations of the commercial utilities to both the ministry of local government as well as water, and the challenges of utilities in finding land for expansion of services. Overlap or lack of clarity around roles in urban planning is related to that. [Emily](#) adds to that the sharing of data. For these reasons, [Luckson](#) is proposing to have just one ministry in charge, while [Emily](#) is suggesting improvements could come from a review of roles and responsibilities, as well as a centralised data system.

At the national level in [Bhutan](#), there is now a new Department of Water under the newly formed Ministry of Energy and Natural resources. This is a positive thing, but with exception of big projects, the investment is proposed by the municipalities and approved by the Ministry of finance, with limited linkage to the line agency (Department of Water). As a result, there are duplications in terms of financial and human resources. This is particularly sensitive because, As [Dorji Ugen](#) shares, the country is facing aging infrastructure. For these reasons, both [Gem and Dorji](#) suggest that there should be a more comprehensive approach to planning, and possibly a policy to strengthen the linkages between national and local level.

From the collaborations on Ethiopia, it is felt that role clarity is generally present, though there is a bit of overlap among agencies in Addis, and in Bahir Dar mutual understanding and coordination could be improved. [Afewerk and Andualem](#) suggest consolidating the three entities (see above) under a single umbrella institution with distinct departments. Their aim is for them to work to a common goal. [Mahteme](#) suggests that coordinated decision making and resource allocation could be achieved by an integrated governance framework that coordinates water supply, sanitation, land use planning and environmental management. He further suggest to keep investing in technological innovations and the adoption of these.

In Dhaka, [Proshanto](#) sees a strong point in the higher-level structures (ministry, department etc.) as well as financial support from the government, but he is concerned about the interministerial coordination and the lack of coordination between the utility and city corporations. [Digbijoy](#) says that in spite of the Institutional Regulatory Framework on Faecal Sludge Management, Dhaka still struggles to find a clear arrangement for on-site sanitation. Also water resource management and environmental agencies are not fully addressing water quantity and quality issues around the city. [Digbijoy](#) feels the main issue here is the lack of accountability, and hence his emphasis on regulation. For this reason, all contributions from Bangladesh align around the need for greater regulation, accountability and enforcement, including around inclusion practices.

In [Vietnam](#) there is a lot of capacity and specialised people working on the city, but the challenge is in the many different roles and levels. Just like [Emily](#) in Zambia, [Hang](#) is also suggesting that better centralised data management could help the city to do better and more transparent planning. She also suggests legislating criteria for resilient cities in water management, in order to hold the different entities accountable for that (not just encourage it).

[Kabir Rajbhandari](#) outlines a range of stronger and weaker points for the context of Nepal. This reflects the reality of these issues which are often multi-faceted. One point to highlight among all this is the need to improve the clarity of roles and responsibilities and invest in longer term infrastructure development plans. In this there should be greater attention to green technologies and development as well as to water quality issues.

In [Tanzania](#), there is a shared feeling that the institutional reforms on on-site sanitation and faecal sludge management have clarified roles and responsibilities in that area. [Hezron](#) points out that the National Water Sector Development Programme and the National Water Investment Plan ensure alignment around priorities. [Herieth](#) adds to this that having strong utilities in place is certainly a positive. More could be improved around inter-institutional collaboration especially between the utility and the city, but also with the wider group of institutions responsible for environment, water resources. Alignment around planning, investment and the role of private sector will help.

[Horacio](#) shares the context of the city of Nampula in which water supply services are managed by the public company FIPAG. As the abstraction was installed in the 1950-1960s when the population of the city was 12 times smaller, water availability is becoming a challenge. Sanitation is separated from water supply and the waste water collection process is not functional. In this context [Horacio](#) feels that an equal and aligned development of both water and sanitation would be beneficial for the city.

Conclusions?

As you can see, the diversity of institutional arrangements, stronger and weaker points as well as directions for improvements is huge. There is no clear recipe for all. I feel that the starting point is to be aware of different possible arrangements and the pros and cons of each. We see a few emerging points such as the importance of having shared longer-term objectives— raised by Hezron and Hang among others, and the importance of coordinated/ aligned spatial planning. The latter of course comes with greater sharing of data.

Topic 3: How to take inhabitants along?

Which behaviours by city dwellers are most problematic for the sustainability of the water cycle in your city?

The range and types of behaviours that you mentioned is very broad and that is just the reality in these cities. Before delving into the specific behaviours, I'd like to highlight one overarching trend that several of you ([Mahteme Tora](#), [Andualem Anteneh](#) and [Afewerk Tekelemariam](#) from Ethiopia, [Sanju Lamichhane](#) and [Kabir Rajbhandari](#) from Nepal and [Emily Banda](#) from Zambia) mention, which is around urbanisation.

The rapid urbanisation leads to informal settlements which do not have all services. Moreover, as Mahteme and Sanju both describe people in these settlements come from diverse cultural backgrounds and rural areas. They have other sanitation habits (10% open defecation says Mahteme) and other practices of water use. The rapid urbanisation also leads to an increase in hard surfaces, without much attention to the need to have green spaces (as Kabir writes), encroachment on water protection areas and unregulated drilling of shallow wells (Emily). This continuous influx of new people into the urban areas is creating an additional complexity for behavioural change interventions.

More generally, we see the following behaviours:

For [drinking water supply](#), practically everybody raised the challenge of excessive water use. This manifests itself in using of drinking water for irrigation, car and pavement washing for example in Ethiopia, Bhutan and Nepal, but also in Australia. Jeremy Kohlitz says that in Australia where the per capita daily consumption is said to be 274 litres. This may be due to very low tariffs, Gem Tshering from Bhutan mentions 4.35 BTN per cubic metre (equiv. 0.048 Euro cents), lack of water meters in buildings. It may also be linked to the idea that water is free and should be free as explained by Horácio Quembo from Mozambique. In Addis, Mahteme explains, people store water due to unreliability of supply. Once the fresh water comes, they dispose this stored water. Ugyen Dorji from Bhutan shares a similar story but adds to this the challenges posed by old leaking infrastructure and the maintenance at premise level. There seems to be a lack of commitment to responsible use of water. Horácio suggests that this attitude is due to the fact that people do not see themselves as active parts of the problem but rather passive victims of the water supply situation. This is exacerbated, as Hang Dinh Thu shares by low water tariffs.

In addition to excessive consumption of water by people with a household connection, there are also issues of tempering with meters and illegal connections Immaculata Senje from Tanzania explains. Anduaem and Afewerk add to this the nighttime theft of water. In their city Bahir Dar, all these behaviours together lead to losses of around 40%.

Saniya Niska from Indonesia shares that in her area water supply is self-supply from ground water abstraction because the regional water company does not cover all administrative districts. As the ground water abstraction is not regulated sufficiently (in practice), this leads on the one hand to unsafe sources and on the other hand to overabstraction. Unregulated drilling of wells is also an issue in Zambia, Bangladesh and in Kathmandu, Nepal. In some areas it leads to land subsidence.

For [sanitation](#), there are a range of issues, starting with the open defecation mentioned above. However, there are also challenge with the quality of containments not complying with building codes. Merelin Keka Adhikari and Proshanto Roy from Bangladesh shares the challenges around incompliance with Bangladesh National Building Code. Septic tanks have no soak well, are connected directly to the drain. Moreover, there are still households using manual emptying of their tanks. Putri Sortaria from Bali in Indonesia describes a similar problem of septic tanks without bottom, which are never desludged. Cafes and restaurants along the beach which do not have proper containment direct discharge into open water.

In Vietnam discharge of less than 5m³ of waste water per day is unregulated, but in practice- Hang writes- many premises, hotels, homestays, food production, discharge without any treatment. Grease from restaurants causes blockage in the sewer and overflows with heavy rainfall. In Hanoi, there are septic tanks with sewer lines to take away the effluent. However, septic tanks which are not emptied, will not provide any pre-treatment. The city built a separate sewer line for waste water, to avoid overflow of combined (rain and waste water) sewer into the lake, but willingness to connect is low. Therefore, the waste water treatment plant built for that purpose is only working at 50% of its design capacity.

Many of you are concerned about the pollution by small and large industries in the cities, many of which discharge liquid waste directly to drains or water bodies. Sometimes this includes hazardous waste or chemicals as Dorji and Mahteme share.

Solid waste is a huge behavioural issue. Practically all of you mention the challenges of littering and indiscriminate disposal: leaving solid waste “here and there”. In many places the solid waste is disposed or ends up in drains, ditched and in water bodies. It is exacerbated by the high use of plastics and Styrofoam as Saniya and Putri describe from Indonesia. Even though some plastics are banned, use remains high. Jeremy adds that in Australia the tap water is safe to drink but households do not trust it and buy bottled water which contributes to the plastic pollution. Putri is concerned that due to inadequate management of plastics a lot still ends up in the ocean.

Solid waste disposal thus complicates drainage, but there are also other issues. Proshanto shares how people with political connections can fill channels and put their construction on top. This is very linked to the overall problem of rapid, uncontrolled urbanisation, where a lot of impervious surfaces are added and very few green spaces. Natural water bodies are filled to get the land for construction.

Emily points to issues upstream in the catchment which also affect the water cycle. People use charcoal to avoid high electricity costs, which in turn accelerates deforestation. This already represents a vast array of behaviours, and you did not even touch upon behaviours related to preparedness for extreme events like floods.

Which strategies have been tried and been unsuccessful? (you may speak about your city or from your general experience)

You are remarkably aligned around what you saw as unsuccessful and more successful engagement. Unsuccessful are short term and/or scattered campaigns, especially those that are top-down or not accompanied by enabling actions to change behaviour and enforcement.

Not engaging people in a meaningful way

Mahteme, Andualem, Afewerk, Kabir and Sanju all described top-down, investment and technology centred interventions which did not effectively engage the people. Or when they did engage the people, they did so passively, not creating responsibility. As Kabir describes, there needs to be a long-term vision of the city, not just patch work here and there. Immaculata shared about house-to-house operations and informers of illegal water usage to report to Authority.

Short term and/or scattered campaigns

Horacio gives the example of the installation of a community engagement department to promote payment for water. It worked for a while, Nampula recorded an increase in water payments, but when the campaign became weak the behaviour also dropped. Patricia shared the example of a 2-3 month solid waste campaign that provided containers for garbage collection in the homes. These containers are now used to store rice. Putri talked about scattered campaigns and lots of beach clean up initiatives.

Partial interventions

Merelin Keka shared how a number of initiatives did not work because they were not comprehensive. The block desludging without a good service to respond, the tariffs without a modality for low-income areas, the occupational health and safety training without budget for implementation. Saniya shared that there were zero-plastics campaigns but weak enforcement on shopkeepers giving out bags. Dorji shared how enforcement and fines around car washing, waste in drains, septic tank leakages have basically been faced persistent public non-compliance.

Political or public barriers

Gem shared how in Bhutan the new water tariff needs to be approved by the municipal committee which consists of elected representatives from the city and vote against increases. Jeremy shared how in the USA the promotion of reuse of waste water (including blackwater) was met with ferocious backlash from the general public. In Dhaka, the water utility still struggles to stop illegal connections to the drain, and the city corporation is facing variable success in preventing construction on water channels.

What do you see as more successful strategies to bring city dwellers along in the changes towards a more sustainable urban water cycle?

From the above it follows that many of you are proposing behavioural change interventions that are:

- Longer term
- Coherent
- Engage people in a meaningful way
- Represent a complete package of awareness, incentives/ enablers as well as enforcement
- Reach all
- Have political backing
- Show a broader vision of living well in the city

You give a number of examples. Mahteme talks about a comprehensive project in Addis that represents not only a huge investment (900m USD) to rehabilitate the rivers, reduce pollution, work on green parks, floods and drought management. But also engages residents, community leaders and local organisations in all stages of the planning and decision making process. Also, Proshanto suggests engaging people in all stages of the process, making sure that the city dweller is not only a service recipient, but also jointly responsible for a sustainable urban water cycle. Emily also says that successful strategies manage to put communities in the driving seat. Patricia and Hang give examples of engaging the broader public in river clean ups or restoring the dead river.

Patricia also suggests that city leaders should lead the change, and they can bring others along. This is somewhat similar to an example given by Putri where in Metro city, the city first started with the engagement of their own staff in the sanitation programme, realising they are also part of the community. Merelin Keka says that a strategy is more successful if the municipality takes a coordinated strategy of awareness raising, assurance of quality of service delivery and law enforcement simultaneously. Andualem and Afewerk also suggest a broad, coherent package of activities.

Dorji raises the importance of longer term broader education and awareness campaigns. Immaculata adds this needs to be frequent, whereas Horacio speaks of a continuous engagement. Hang, Patricia and Gem have a number of specific proposals for their context which include metering in buildings, progressive water tariffs and more focus on circular water, including payment for water resources for all, shorter licences for abstraction and discharge. Among many points which are similar to the above, Kabir also mentions the importance of crisis preparedness behaviours among the public, and the need to work on green spaces.

So, there are plenty of good insights on what can be successful, but also a few words of caution. Jeremy feels that in his context it's difficult for behavioural change to really result in other behaviour. So far only water saving technology adoption has worked. Saniya is conscious that some of the behavioural change may be confined to only a small bubble.



Contact SNV
Parkstraat 83
2514 JG, The Hague
the Netherlands

+31 70 3440 244

water@snv.org
snv.org