



WATER SENSITIVE CITIES: A GLOBAL SOUTH FRAMING



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Executive summary

Cities in developing countries of Asia and Africa are experiencing historically unparalleled rapid urban growth and expansion in an unprecedented unplanned manner (except perhaps in China). Inequity is magnified as never before.

- A vast majority of current and future residents of these cities will reside in congested unauthorized settlements (which are later regularized and then measures are explored to provide them with water supply, sewerage/septage and storm-water infrastructure and services).
- Most cities do not have adequate infrastructure for water supply, sewerage/septage management and storm-water drainage. Where such infrastructure exists, its operations and functionality remain a challenge.
- Cities are precariously poised in terms of addressing their growing dependence on water supply from far-off rivers and reservoirs and addressing the issue of pollution of their waterbodies (lakes and rivers). Groundwater sources are polluted and drying up at an alarming rate. Small rivers and waterbodies are also drying up on account of increased extraction of water.

There is an urgent need to address the emerging crisis of urban water supply, used water/wastewater and storm-water management—from an inclusion, rights and justice perspective.

Unfortunately, a normative techno-managerial approach dominates much of the current thinking around urban water, wastewater and drainage challenges for cities of the Global South. Often this approach is borrowed from research and discourse developed in Australia and Europe.

While there is nothing wrong in a normative approach for addressing urban water and used water/wastewater challenges, the interventions have to be contextualized to cities of the Global South. If this is not done, not only are the outcomes likely to fall short of expectations, there is also a risk that the interventions may inflict more damage than good.

Groundwater recharge in public places may not work in increasing groundwater recharge where it is most needed, risking pollution of aquifers (when recharge is done in public places where there is no control over pollutant load entering the groundwater) or even raising water tables to uncomfortable levels in some instances. Similarly, it is now recognized that faecal sludge management needs an inclusive and equity framework (City Wide Inclusive Sanitation).

When undertaken as a policy and programme, new investments for “water-sensitive cities” may end up supporting the status quo or could even worsen the fate of the informal and unplanned settlements and less privileged urban dwellers.

Framework

Goal

Cities commit to a “just and equitable access, use, reuse” of water supply, to sewerage/septage and storm-water management.

This implies that the framework recognizes inequity in urban settlements as the basis of planning and designing interventions for water-sensitive cities. There is no “leap frogging” possible without addressing infrastructure deficiencies, specially for the less privileged residents of our cities. Climate change impacts everyone, yet the less privileged may get impacted more severely. We need to strengthen urban planning and not look for only design interventions, place making and beautification as outcomes of water-sensitive cities.

Principles

- **Larger and long-term vision (firmly rooted in the equity, rights and justice goals).** This applies not just to projects but in inter-city and urban–rural contextualization of interventions.
- **Climate change exacerbates already existing water scarcity and flooding risks of cities.** Mitigation measures should not further inequity.
- **"Design" consciously for Equity and Justice.** Abandon a normative, techno-managerial approach to "design" interventions for water-sensitive cities.
- **Reducing conflicts.** Recognize existing and future conflicts around water and waste. Address them to the extent possible in programmes and policy.
- **Improving functionality and efficiency of grey and green infrastructure.**

Global South Water-Sensitive Cities Index

In addition to all measures taken for improving blue–green infrastructure of cities to make cities liveable and water secure (undertaking aquifer mapping and recharge measures, green infrastructure development, and mapping a city's water balance), the following measures need to be taken up for cities to qualify as water-sensitive cities:

- **Functional infrastructure and services:** Fix all existing non-functional water, sanitation and storm-water infrastructure and services to improve efficacy and treatment outcomes.
- **Functional and inclusive infrastructure for unserved areas:** Additional grey infrastructure and services may be needed for unserved informal urban settlements that now dominate the urban landscape of cities of the Global South.
- **Substantial reuse of treated wastewater and biosolids:** Reduce wastewater footprint and increase the reuse of treated biosolids and treated wastewater in a manner that is just and equitable. This may include all measures for reuse and recharge of groundwater and prevention of pollution of groundwater, lakes and rivers inside or outside city limits.
- **Mitigating in situ urban flooding:** Conserving rainwater wherever possible and keeping it as contamination free as possible. Enhancing storm-water drainage dimensions/norms to address in situ urban flooding in cities (where built-up area has reduced groundwater recharge potential) that is witnessed in normal rainfall periods as well as in high intensity climate change induced episodes.

Any index of water-sensitive cities index framing must show what is being done against these four outcomes.

Global South Water Sensitive Cities Framework

I. Unbundling the water-sensitive cities discourse

A normative thinking—that sees population growth, economy and climate change as driving forces—dominates the origin of the water-sensitive cities discourse/framework. The focus of this discourse originating from the Global North is that we move beyond an infrastructure focussed “conventional” approach of the last century. This approach is described as:

“the rapid pace and scale of urban growth, combined with the impacts of climate change and economic development, is challenging the capacity of existing water systems to provide the world’s cities with clean water and sanitation, and healthy and safe urban environments. There is now widespread agreement that conventional water management approaches are ill-equipped to meet the diverse and complex needs of cities. These infrastructure and governance systems remain largely influenced by twentieth century solutions and experience, which are typically characterized by fragmentation and technologically dominant solutions.”¹

A rapid urban population growth, economy and climate change variables may certainly be impacting cities everywhere, but perhaps its intensity and its formal or informal typology is very different in context of the Global South. There is also a risk of Malthusian determinism in assuming that population growth per se is the determining factor for all urbanization problems.

While there is no denying that any form of urbanization will yield externalities of waste, inequity in urbanization can be a significant contribution to water and used water management challenges of our cities. A political economic framework of analysis when applied to understanding water and waste in cities helps us better frame any perspective of water-sensitive cities, climate-resilient cities, and several other such discourse that are being developed today.

From discourse to framework: Water-sensitive cities

Monash University in Australia coined the term “water-sensitive cities” and described it as follows:

A water-sensitive city of the future is a place where people want to live and work. It is a place that:

- serves as a potential water supply catchment, providing a range of different water sources at a range of different scales, and for a range of different uses;
- provides ecosystem services and a healthy natural environment, thereby offering a range of social, ecological, and economic benefits; and
- consists of water-sensitive communities where citizens have the knowledge and desire to make wise choices about water, are actively engaged in decision-making, and demonstrate positive behaviours such as conserving water at home and not tipping chemicals down the drain.²

The discourse further constructs a linear presentation of movement describing a desirable direction: from water, sewerage and storm-water infrastructure provisioning to governance for efficient water use, equity in access to water and wastewater, citizen participation and water literacy, improving equity and liveability of the already planned cities. This discourse is developed into a framework to reach the desired “water-sensitive city”. Qualitative indicators are then defined for achieving seven goals/outcomes of a water-sensitive city.



¹ Transforming Cities through Water-Sensitive Principles and Practices; Tony H.F. Wong, Briony C. Rogers, and Rebekah R. Brown

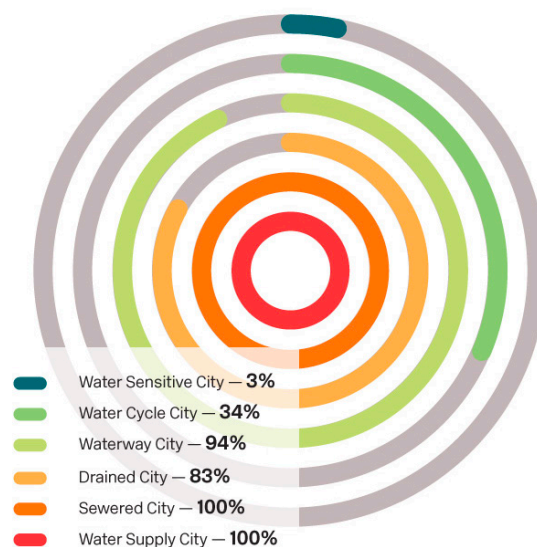
² Water Sensitive Cities Vision : <https://watersensitvecities.org.au/what-is-a-water-sensitive-city/#:-:text=It%20is%20a%20place%20that,ecological%2C%20and%20economic%20benefits%3B%20and>

The water-sensitive cities framework emerging from the Global North countries (Europe and Australia) has as its foundation cities that have planned urban development with a statutory legal entitlement to housing and basic infrastructure (including water, wastewater and drainage) for all residents of their cities. The core aims of urban planning have been substantially achieved and access to water and sanitation is realized as a de facto human right of all residents.

A water-sensitive city in the developed country context aims at achieving second-generation outcomes—higher standards and more effective standards of water conservation and wastewater management (nutrient removal, carbon sequestration, energy extraction and methane reduction), and adaptation to water stress and/or urban flooding accruing from climate change impact—creating a safer, sustainable and attractive urban liveable environment, a city that becomes an attractive destination for housing, tourism and businesses.

Existence of good quality grey infrastructure is at the core of a water-sensitive cities. The diagrammatic representation below shows how the existence of basic infrastructure of 100 per cent water supply, sewerage and more than 80 per cent drainage forms the basis for the water-sensitive cities discourse in developed countries. Does this condition exist for developing countries of global south?

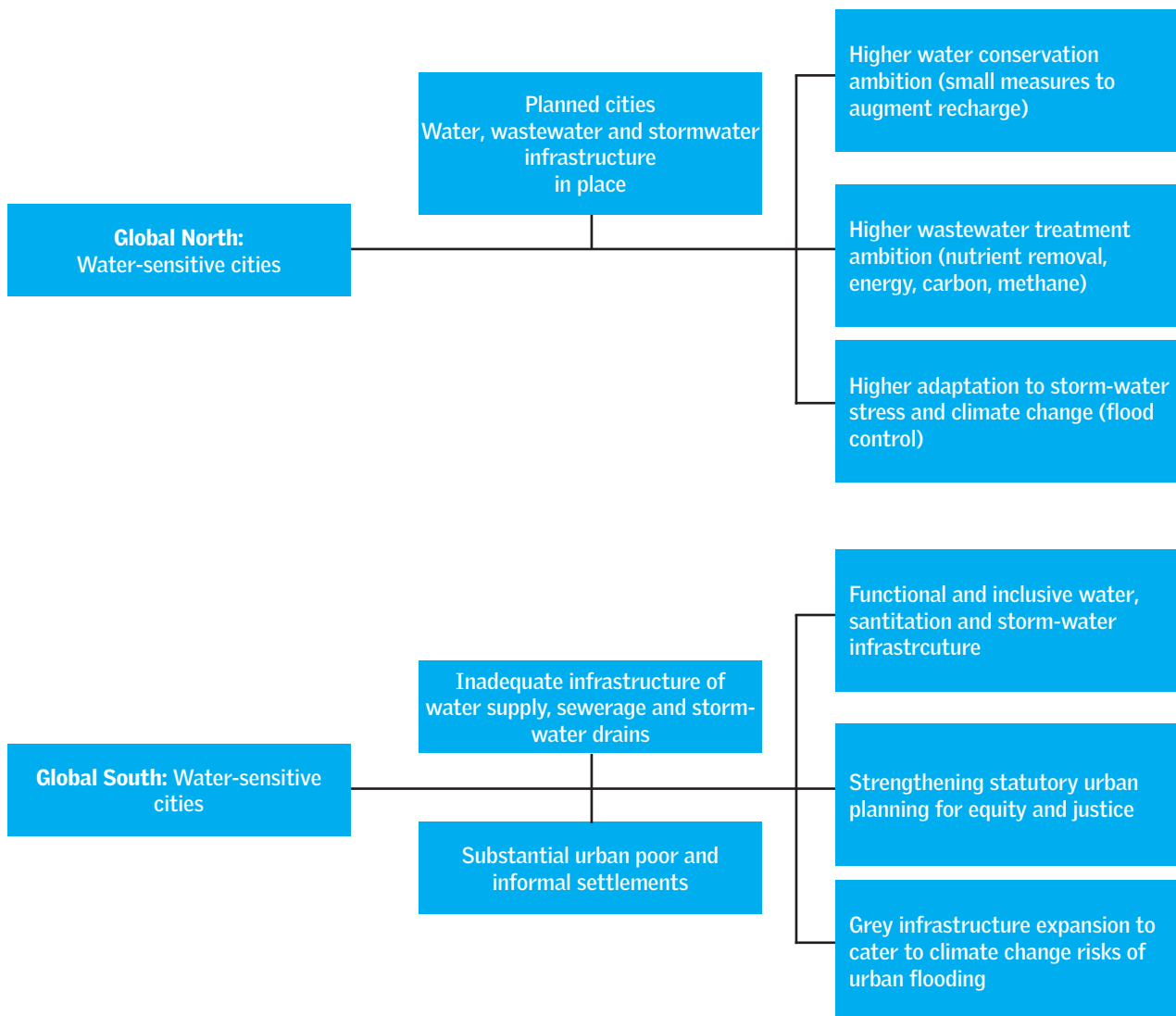
City-state position



The urbanization trend in the Global North is very different from that in the Global South. Rapid population growth is witnessed in cities of the Global South cities, which are grappling with an urban expansion that is unplanned and highly iniquitous. Priorities of our cities are improving access to basic services of water supply and wastewater and drainage management for the less privileged informal settlements that house as much as 50 per cent of our urban population in large cities, if not more.

Hence even though the rationale for water-sensitive cities may be the same for the Global North and the Global South cities, the goal, principles and desirable outcome priorities, will be completely different.

Context and priorities



II. Context matters: Why the need for a Global South Framing

A water-sensitive cities framework for Global South cities should aim at achieving outcomes and impacts that are relevant for the context and challenges of cities of the Global South.

Aggregating existing urban water, sanitation and storm-water "service-level benchmarks"³ will not help in defining "water-sensitive cities". These are aggregated numbers and do not account for varying infrastructure and service levels for less privileged areas. They also tend to endorse the expansion of existing centralized systems demanding massive capital investments, that may not work for all and often fail in the context of poorly financed urban local bodies of global south.

Urban built environment

Cities of the Global South are witnessing not only rapid urbanization but also congested and dense urban habitations. Cities like Bengaluru have grown from 100 sq. km to 800 sq. km. Delhi has outgrown its state limit, into four neighbouring cities. The dense built footprint of our cities is creating an urban watershed/catchment that in normal rainfall periods generates large volumes of runoff that is difficult to retain for ground water recharge or other water-sensitive urban design and planning (WSUDP) measures.

Growing urban inequity and lack of urban planning

The principles and practise of urban planning are falling apart as more Indian cities are expanding into informal settlements and gated cities. Norms of urban planning are being loosened even in planned areas, leading to higher density of residents and pressure on existing water and sewerage infrastructure.

Builder and real estate led urban planning is creating a crisis of provision of basic infrastructure along with negative social impacts. Cities are living beyond the availability and supply of water from rivers and groundwater. Built-up areas in cities are flouting urban planning norms. Heavy infrastructure development in cities, including underground parking and metros, is destroying aquifers and groundwater-recharge potential.

These are not issues in the Global North. In the context of the Global South, it translates into two things. First, the pressing need for more grey infrastructure to meet the water supply, sanitation, wastewater and storm-water drainage requirements of informal settlements that now constitute as much as 50 per cent or more of the population in several cities. Second, there is an urgency to ensure that benefits of any new green infrastructure (of lakes and waterbodies rejuvenation and groundwater recharge) are shared with informal settlements/inhabitants through cross-subsidy of water and sanitation services. To justify any water sensitive city interventions.

Statutory urban planning provides a legislative entitlement to housing and basic services for urban dwellers. With concrete definition of entitlements, infrastructure and service-level provisioning for a 20-year time frame within a city and for a regional urban agglomeration, it remains the last recourse to basic entitlements for urban dwellers. Unfortunately urban planning instruments and entitlements are being diluted over time in the name of redundancy of urban planning itself.

Sub-optimally functioning existing infrastructure

Small- and medium-sized cities lack sanitation and drainage infrastructure. Combined sewers that also drain storm water overflow in the monsoons. Very few Indian cities have 24 x 7 water supply. No Indian city is 100 per cent seweraged or treats all its sewage and septage. The functionality of existing sanitation infrastructure (seweraged and non-seweraged systems) remains a challenge for cities of the Global South.

There cannot be a water-sensitive city where basic infrastructure is either not there or is there but is not functional.

³ Service Level Benchmarks, MoUD, 2010, <https://mohua.gov.in/upload/uploadfiles/files/Flyer.pdf>

Climate change impacting cities of the Global South

Tropical monsoons with short intense periods of rainfall followed by dry spells are only experienced in South Asia and a few other places. Combined sewerage and drainage infrastructure of our cities is unable to deal with even short spells of normal rainfall. Creating separate drainage systems in congested urban settlements is often constrained. In periods of heavy rainfall, as was witnessed in Bengaluru in 2022, roads become drainage channels. The worst impacted by this are the informal settlements and slums.

High-intensity rainfall attributable to climate change, coupled with the high built environment is creating the need for more storm-water drainage infrastructure. Storm-water drainage norms are being revised upwards in Indian cities. The norms have been revised for cities of UK as well.⁴

Our cities are facing the twin challenges of consecutive water scarcity and urban flooding. We need more grey infrastructure, specially in unplanned and informal settlements, to ensure access to and equity of water, sanitation and storm-water drainage.

Water conflicts

Water is a contested domain. We have a range of water conflicts including inter cities and intra city, rural–urban, agriculture–industry–domestic water priorities.

Water conservation and groundwater recharge as well as decentralized non-sewered septage treatment systems are difficult to implement in congested informal settlements and slums. These must therefore be prioritized in the more planned settlements where this is possible.

Who benefits from improvement in stock of water resources, its quality and quantity, and who stands to lose, must be carefully understood. Reducing the city water and wastewater footprint as a long-term goal will impact reduction of water conflicts, provided this is deliberately planned and not expected to happen by default.

“Design thinking” cannot replace urban planning

The Global North “water-sensitive cities” framework assumes that cities need more and more green-blue infrastructure and not grey infrastructure, coupled with smart urban design elements that will leapfrog our cities to a higher stage of water and wastewater management, making our cities more liveable.

While implanting the developed countries framework on cities of the Global South, we forget that the developed country cities are all planned cities with an urban planning framework that has ensured a rational density of housing, road layout and provision of water and sewerage lines as foundation blocks of urbanisation.

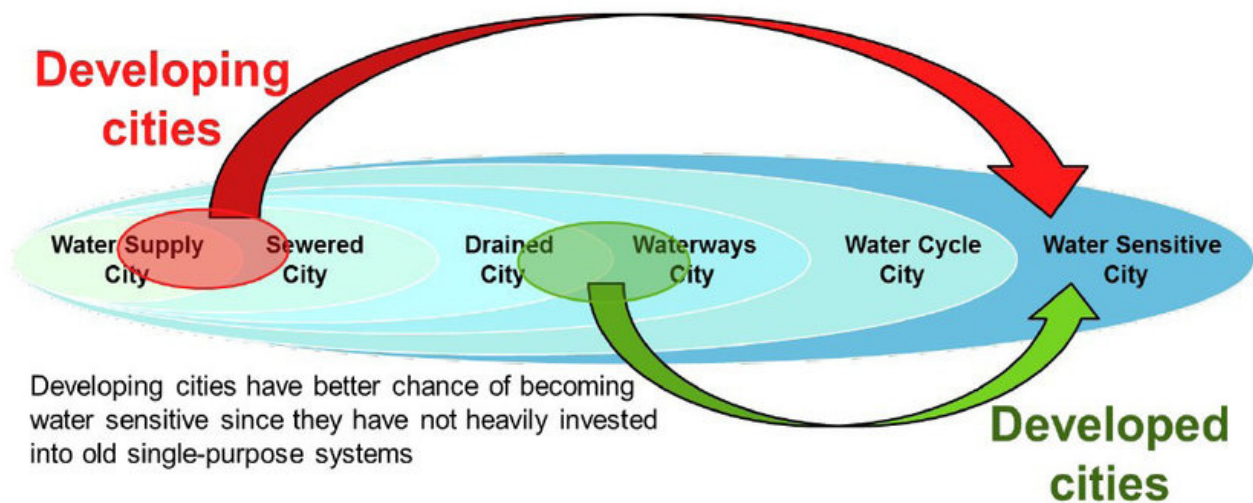
Cities of Global North are now going forward by accommodating incremental improvements in urban design to cater to higher water conservation and recharge, wastewater and storm-water management as part of their well planned urbanization. This option of incremental recharge as well as improved drainage is at best limited for cities of the Global South because of the large informal dense urban settlements unless we substantially open up the already dense informal settlements and conform to some level of urban planning norms.

⁴ Based on intensive research across the globe as well as those reported through IPCC, it has been established that global warming induced climate change is causing a change in rainfall precipitation pattern. Various studies in India including those by IMD also strengthen above changing pattern. It is established that rise in atmospheric temperature lead to intensifying Earth Hydrologic Cycle causing short duration heavy intensity precipitations. Each 1°C rise in atmospheric temperature leads to a 7 per cent increase in water vapour in the atmosphere. Countries like the UK have already recommended an increase of 20 per cent in the design storm runoff to account for change in rainfall patterns due to climate change.
<https://cpheeo.gov.in//cms/manual-on-storm-water-drainage-systems---2019.php>

"Leapfrogging" fallacy

Stretching a linear evolution of the water-sensitive cities discourse overlooks the context of Global South cities. It assumes that a leapfrogging opportunity exists for cities of the Global South to somehow jump from a lack of infrastructure to a water-sensitive city outcome. There is an implicit assumption that cities can somehow do everything from infrastructure to governance, and benefit from technology and design solutions, to become water-sensitive cities. It sees the lack of grey infrastructure as an advantage and ignores the absence of urban planning in the cities of Global South, where the potential for green blue infrastructure creation has been compromised.

Developing countries, where infrastructure and institutions are not well established, are more flexible and conducive to contemporary urban water solutions. It is often for this reason that cities in developing countries are well-placed to leapfrog directly to a water-sensitive city rather than the organic evolution of urban water infrastructure and institution we see in many cities in developed countries.⁵



The Framework

A Global South water-sensitive cities framework must start from improving what exists. Functionality and efficiency of existing systems of water supply, wastewater and storm-water management is important. The framework must emphasize the primacy of urban planning and the need to enforce planning norms that will allow for improved water-sensitive designs. It must also recognize that water is a contested domain that needs to be addressed from the inclusivity and justice lens. Any interventions for improvement, including climate change resilience, must not worsen existing inequity.

Goal

Cities commit to a "just and equitable access, use, reuse" of water supply, to sewerage/septage and storm-water management. This implies that the framework recognizes inequity in urban settlements as the basis of planning and designing interventions for water-sensitive cities. There is no "leapfrogging" possible without addressing infrastructure deficiencies, especially for the less privileged residents of our cities. Climate change impacts everyone, yet the less privileged may get impacted more severely. We need to strengthen urban planning and not look for only design interventions, place making and beautification as outcomes of water-sensitive cities.

⁵ Tony Wong, CEO, CRC for Water Sensitive Cities, 2013 <https://watersensitivecities.org.au/content/leap-frogging-water-sensitive-cities-developing-nations/>

Rationale

- *Those parts of the city that are densely populated and unplanned and cannot conserve water should not be expected to undertake groundwater recharge. They are supplied piped water. They are also served with sewerage/septage infrastructure and services that are affordable and inclusive.*
- *Economically better-off settlements that are usually planned and have the means to undertake recharge measures do so, and reduce their dependence on piped water supply. They also manage their septage in a decentralized manner, without loading the sewerage system to the extent possible.*
- *Habitat, biodiversity and environmental impacts are also important. However for the purpose of a water-sensitive cities framework as a planning and design guide for action by urban local bodies, these are too large domains to incorporate into one framework and hence not included here.*
- *Reducing the urban water and wastewater footprint on rural areas in India and elsewhere, where a large population still depends on agriculture, is an important aim of water-sensitive cities of the Global South. Most large Indian cities draw water from faraway rivers and reservoirs, often impacting rural areas and their claim on groundwater and rivers, and their large volumes of used water/wastewater production impacting rural areas.*

Principles

- **Larger and long-term vision (firmly rooted in the equity, rights and justice goals), not as projects.** Inter-city and urban–rural contextualization of interventions.
 - o **Strengthen statutory urban planning:** Development plans/city Master plans and Regional plans, provide a legislative entitlement for the under privileged to the city. It can go a long way in identifying the balance of grey and green infrastructure required for a city. Short-term programmes and missions cannot replace long-term urban planning and must not undermine planning.
 - o **Commit to increasing grey infrastructure for unserved habitations and populations:** For safe, assured and sustainable wastewater and stormwater infrastructure and services.
 - o **Avoid beautification as the sole aim** of restoration of green–blue infrastructure of cities.
- **Climate change exacerbates already existing water scarcity and flooding risks of cities. Mitigation measures should not further inequity.**
 - o **Recognize existing limits to water supply side management.**
 - o **Enhancing statutory norms for storm-water drainage** (size and design of drainage). To address increased urban storm water runoff.
 - o **Carefully planning and monitoring** groundwater recharge.
 - o **Mitigate measures** that may negatively impact the less privileged slums and informal settlements (evictions and denial of access).
- **"Design" consciously for equity and justice.** Abandon a normative, techno-managerial approach to "design" interventions for water-sensitive cities. Equity doesn't arise automatically from designing green interventions per se, but when they have been designed keeping in mind how inclusive and just these are for less privileged residents of a city.
 - o Benefits of improved city climate from blue–green infrastructure of shade trees, waterbodies as well as improved livelihoods and cultural ecosystem services are immense and difficult to quantify. **Even the urban poor benefit from having public blue and green spaces provided they aren't excluded from them** (chargeable access to public places or denial of their livelihoods based on the public asset).
 - o **Transparency and participation.** The rationale and decision-making for all interventions, planning and design measures of a water-sensitive city should be in public domain for consultation.
- **Reducing conflicts.** Recognize existing and future conflicts around water and waste. Address them to the extent possible in policy and in planning first, before addressing them through projects and interventions.
 - o **Reducing the city water and wastewater footprint** as a long-term goal will impact reduction of water conflicts.
 - o Benefits of groundwater recharge and improved financial health of an urban water utility (improved efficiency, reduction of electricity, pumping and supply maintenance costs) accrue to a city. **Any additional benefits should be shared** with economically less privileged residents of the city.

- **Improving functionality and efficiency of grey and green infrastructure**
 - **Prioritize operations and maintenance** of both grey and green infrastructure. Not just on creation of more infrastructure.
 - **Improve operational efficiency of existing grey infrastructure**—drainage and wastewater treatment plants. We cannot simply add small interventions/projects in the name of water-sensitive cities and ignore the existing systems failures and inefficiencies.
 - **Reuse treated water and biosolids.** Emphasis has to be on reuse, not just treatment.

Global South Water Sensitive Cities Index

In addition to all measures taken for improving blue–green infrastructure of cities for making the cities liveable and water secure (undertaking aquifer mapping and recharge measures, green infrastructure development, mapping a city water balance), the following measures need to be taken up for cities to qualify as water-sensitive cities:

- **Functional infrastructure and services.** Fix all existing non-functional water, sanitation and storm-water infrastructure and services. To improve efficacy and treatment outcomes.
- **Functional and inclusive infrastructure for unserved areas.** Additional grey infrastructure and services will be needed for unserved informal urban settlements, that now dominate the urban landscape of cities of global south.
- **Substantial reuse of treated wastewater and biosolids.** Reduced wastewater footprint and reuse of treated biosolids (for agriculture) and treated wastewater. This may include all measures for reuse and recharge of groundwater and prevention of pollution of groundwater, lakes and rivers inside or outside the city limits.
- **Mitigating in situ urban flooding.** Enhanced storm-water drainage dimensions/norms to address in-situ urban flooding in cities (where built-up areas have reduced groundwater recharge potential) that is witnessed in normal rainfall periods as well as in high-intensity climate change-induced episodes. Conserving rainwater wherever possible, and keeping it as contamination free as possible.

Any index of water-sensitive cities index framing must show what is being done against these four outcomes under the larger goal of water-sensitive cities: "Cities commit to and equitable and just to Access, Use, Re-Use of water supply, sewerage/septage and storm water management".

Outcomes

- Combination of centralized and decentralized sanitation and wastewater infrastructure proposed and/or implemented in the city.
- Water, wastewater and drainage infrastructure and service delivery shortfalls in less privileged settlements assessed, priorities defined, planning done. Addressed incrementally and substantially.
- Storm-water drainage norms and design parameters reviewed/incorporated in new DPRs and plans for city infrastructure upgradation.
- Enhanced city water planning for water security. Aquifer mapping, water recharge policy and programme strategies developed and implemented.
- Energy-saving outcome. Rainwater recharge. Reduction of electricity/energy in pumping of water supply from far off rivers and reservoirs
- Pollution abatement in surface and groundwater.
- Reuse of treated wastewater and biosolids within and outside the city limits and in rural areas.
- Improved efficiency and operations of existing wastewater treatment plants. Operations and maintenance priority, not just new capital infrastructure creation.
- Replacement/substitution of water supply with groundwater. Reduction of electricity/energy incurred by the urban water utility/authority, in pumping of water supply from far off rivers and reservoirs.
- Reuse of treated wastewater and biosolids within and outside the city limits.
- Knowledge and awareness of water-sensitive city interventions. Open source platforms, information systems and feedback loops. Allow for knowledge and awareness for planning future interventions.

Impacts

- Improved urban liveability. Especially for the less privileged urban residents and migrants.
- Improved accountability of service providers
- Integrity of the water and nutrient cycle improves.



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