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Briefing: Creating sustainable urban water systems

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Managing urban water infrastructure is conventionally the professional domain of engineers. As urban water systems are placed under increasing pressure due to population growth, rapid urbanisation and climate change, the provision of water and sanitation services to cities has become a wicked problem. As such it cannot be adequately addressed by engineers alone, and requires greater attention from urban designers and planners. The move to sustainable urban water systems will involve greater attention to decentralised and distributed technologies such as rainwater harvesting and water reuse. Water sensitive urban design should be encouraged, to promote the integration of drainage, habitat, ecosystems, water supply and sanitation in cities.

Controlling the flow of water through cities has been a critical feature of modern urban development. Managing water in cities has been thought of as a technically tractable problem. Providing clean drinking water, removing sewage and draining surface water are vital urban functions and the design, implementation and maintenance of these systems have been largely the responsibility of engineers. As with most engineering systems, urban water systems are effectively invisible when they are successful and only come to wider public attention when they fail. Engineers have been highly successful in delivering centralised urban water systems that underpin good public health and modern lifestyles. However, pressures of population growth and increasing demand, hydrological limits on water resources, and climate change have moved water management from a technically tractable problem to be solved by engineers out of sight, to a wicked problem requiring much greater engagement between planners, designers, engineers, politicians and the public.

Water has become a highly visible and contentious issue in cities around the world. Provision of continuous water allowed for the development of technologies and practices, such as frequent laundering using automatic washing machines, that create demand for water that goes far beyond basic hygiene needs. Sub-urban form centred on private gardens, and public realm design based on perennially green lawns create further demand that is increasingly difficult to meet from limited water resources. The 'predict-and-provide' engineering model of water provision is no longer tenable as conventional resources are fully exploited and alternatives such as desalination and water recycling attract controversy. Increasing areas of hard surfaces in cities by paving and infilling green space has resulted in higher runoff during rainstorms, placing unanticipated pressure on drainage networks. Urban sprawl into flood-prone areas stretches the capacity for engineering systems to provide meaningful flood protection. Population growth increases demand and drives the process of urban expansion into flood

plains. Climate change makes all of this more complicated as more erratic and extreme rainfall patterns make water systems more difficult to design and manage – increased frequency of both droughts and floods is likely in many cities in the future.

Water management in cities is now a wicked problem. Engineering models alone are insufficient to deliver safe and sustainable water systems. Conventional approaches to water focus on centralised water utilities with limited attention given to individual buildings or households, and very little scope for managing water at intermediate scales. Innovations such as Water Sensitive Urban Design, Sustainable Urban Drainage Systems, water reuse and rainwater harvesting demonstrate the need to think about urban water management across different scales, from the household, to the development, neighbourhood and community sub-catchments, to the city and its hydrological region. Sustainable urban water systems require institutions, technologies, regulation, public engagement and business models that operate across scales. Urban designers and planners have a clear and growing role in working alongside engineers, entrepreneurs, policy makers and communities to make this happen.

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