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A Case for Ecological Planning

Urban Flooding in Old and New Jakarta

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Images as credited

1. The 2011 flood in Jakarta represented the fifth major flood in the city since 2002 (Photo: Google).

In other words, because Jakarta relies so heavily upon its aquifer to meet the city growing water needs, the city is sinking.

The Problem of Urban Flooding

The problem of urban flooding has been a long-standing concern in delta regions, such as Jakarta and Bangkok, but in recent years also been experienced in unlikely places such as Singapore. In the case of Jakarta, however, the recurring incidence of urban flooding during the rainy season has been elevated from an annual nuisance to crisis proportions. Preventing, or at least mitigating, floods has joined long-standing urban challenges, such as traffic congestion, as a leading problem in megacity management. What is not so apparent in the public debates surrounding urban flooding in Jakarta (and elsewhere) is that this phenomenon is indicative of both more systematic flaws in the overall water management system and the interconnectedness between water management and general urban development strategies. The case of Jakarta is indicative not only of the urban water management problems that many cities are experiencing. To fully understand the overall water management challenges in megacities like Jakarta, it is instructive to examine the flooding problem in its historic context. If nothing else, the historic view provides valuable clues to explain the increased frequency of record urban flooding over the past two decades.

Examining Jakarta's Flooding History

In the first three centuries of Jakarta's existence as the colonial trade, administrative, and finance settlement of Batavia under Dutch control, urban flooding was only an occasionally severe problem. The historical records indicate only four major flood events prior to the past two decades, the first occurring in 1699 and was determined to be the result of excessive tree clearance in the hinterland (which exacerbated runoff) and major rivers being clogged with the residue from sugar cane production. Several more major floods occurred in colonial Batavia (now Jakarta), in 1714 and then in 1854, both involving the overflow of Ciliwung, the main river feeding the delta where Batavia was located. A fourth flood in 1918 (again it was the Ciliwung) prompted some serious reengineering of the urban storm water management system. There was no serious flooding for the next eight decades.

Since 1992, however, there have no less than seven major floods, in 1990, 1995-6, 2002, 2004, 2007, 2009 and 2011, several of which set new records for the extent of their depth and reach throughout Jakarta. The most devastating occurred in 2007 when vast swathes of the megacity were underwater. Given that the colonial city of Batavia and its hinterland were situated in a watershed fed by 13 rivers and their tributaries, it might seem remarkable that major flooding events were so rare in the first 350 years. Even more remarkable, as evidenced in historical records, was that this region, which receives an average of over 1,500 millimetres of annual rainfall, also suffered periodically from water shortages.

The explanation to both of these observations can be discerned in the evolving form and scale of urbanisation over the past four centuries. Batavia began as a compact city where the nearby rivers, especially Ciliwung, had been harnessed in an engineered system of canals. Fed by the rivers, this canal system provided the major transportation network as well as the primary source of water to support urban life. Frequent dredging through tremendous human exertion was necessary to keep these waterways in a navigable condition, to prevent flooding during the rainy season and to ensure sufficient water resources during the dry season. Much of the watershed was harnessed for the agricultural production in Batavia's hinterland through a series of irrigation canals, and this was often a factor in the inadequate supply of water for the urbanised area during the dry season. As the settlement of Batavia expanded southward from its compact fortified enclave in the early-nineteenth century, this precipitated changes in the water management approach. These newly settled areas occupied higher ground and relied more on land-based transport than did the original settlement along the northern coast. There was only a partial extension of the canal system to serve the new suburbs, which were known as Weltevreden. With a growing population needing potable water, there was a shifting reliance from surface to ground water to meet those needs. A modernised transportation system, including the railroad and trolley

lines, coupled with construction of a new shipping port east of the city, led to the reduced maintenance of the original canal system. In several places, canals were filled in to support the new surface roadways. In 1918, the expanded European settlement in a planned community in Weltevreden, known as Menteng, was hit with the worst flooding since the mid-nineteenth century. To protect this developing area, the city engineer devised a plan for a system of flood canals to ring the existing urbanised areas and to tie several of the major rivers that flowed in Batavia. The van Breen plan for the flood canal system began in the early 1920s and was only partially completed by 1942 when World War II and the subsequent occupation by the Japanese military interrupted its construction. After the independence of Indonesia in 1950, no additional work occurred on this project for more than half a century. The unbuilt eastern portion of the flood canal was not started until the devastating floods of recent years.

Fast-forwarding to the 1990s, over the previous four decades since independence in 1950, Jakarta's urbanisation had pushed development across the entire watershed, with little or no integration with the river system. In the case of the Ciliwung River, which traditionally had been the most navigable waterway and which typically handled the largest volume of rainfall, its capacity had been reduced appreciably. Having once spanned nearly 150 metres at its widest, it had in recent years become little more than a modest drainage canal, no greater than 30 metres in width and unable to supply either potable water or suitable protection from excessive rainfall. The encroachment of both planned and unplanned development into the city's river network reduced its capacity to handle storm waters appreciably and added to the debris that kept them permanently clogged and polluted. The flood canal network designed in the 1920s had been sufficient to protect the urbanised area within its boundaries but had no effect on those areas beyond its reach, as urban development expanded deeply in the hinterland and across the entire watershed. And because the eastern portion of the flood canal was not completed until recently, the entire eastern side of Jakarta routinely sustained some of the worst effects of flooding during the rainy season. The completion of the East Flood Canal became a top priority in the wake of the devastating 2007 flood. However, in the context of the overall problems of storm water management in Jakarta, it was at best a partial remedy. As Trisakti University hydrologist Irwin Iskandar noted, the flood canal system, devised by the Dutch in the 1920s and recently completed with the addition of the East Flood Canal, was appropriate when the city spanned an area of 2,500 hectares. Since the Jakarta megacity now encompasses 65,000 hectares, the existing flood canal system only protected less than five percent of the urbanised area. When the 2007 flood swept over much of the city, beyond the inner ring supported by the historic flood canal network, it was evident that a different approach to storm water management was needed.

Revamping the Strategy

Various explanations for the recent spate of record-setting floods in Jakarta point to several potential factors. These include: the capacity of the watershed to handle the annual rain season; the potential impact of sea-level rise (and storm surge) causing higher levels of flood waters along Jakarta's northern coastal area (especially in the 2007 flood); the possibility of urban land subsidence increasing flooding intensity; and the consequences of allowing development in flood-prone areas. Studies suggest that neither sea-level rise nor

2. Thirteen rivers and their tributaries feed through the urbanised area of Jakarta. At the centre, and highlighted, are the Ciliwung-Cidane rivers, which historically have been a major waterway (Image: Ministry of Public Works, Jakarta, Indonesia).

3. In colonial Batavia, a system of canals served the compact settlement its transportation needs and as the major source of water for urban activities (Image: Princeton University Library, libweb5.princeton.edu).

4. The canal system harnessed the rivers in support of agricultural production as well as urban life in colonial Batavia (Photo: Tristan Mostert, http://www.vocwarfare.net/images/batavia-defences).

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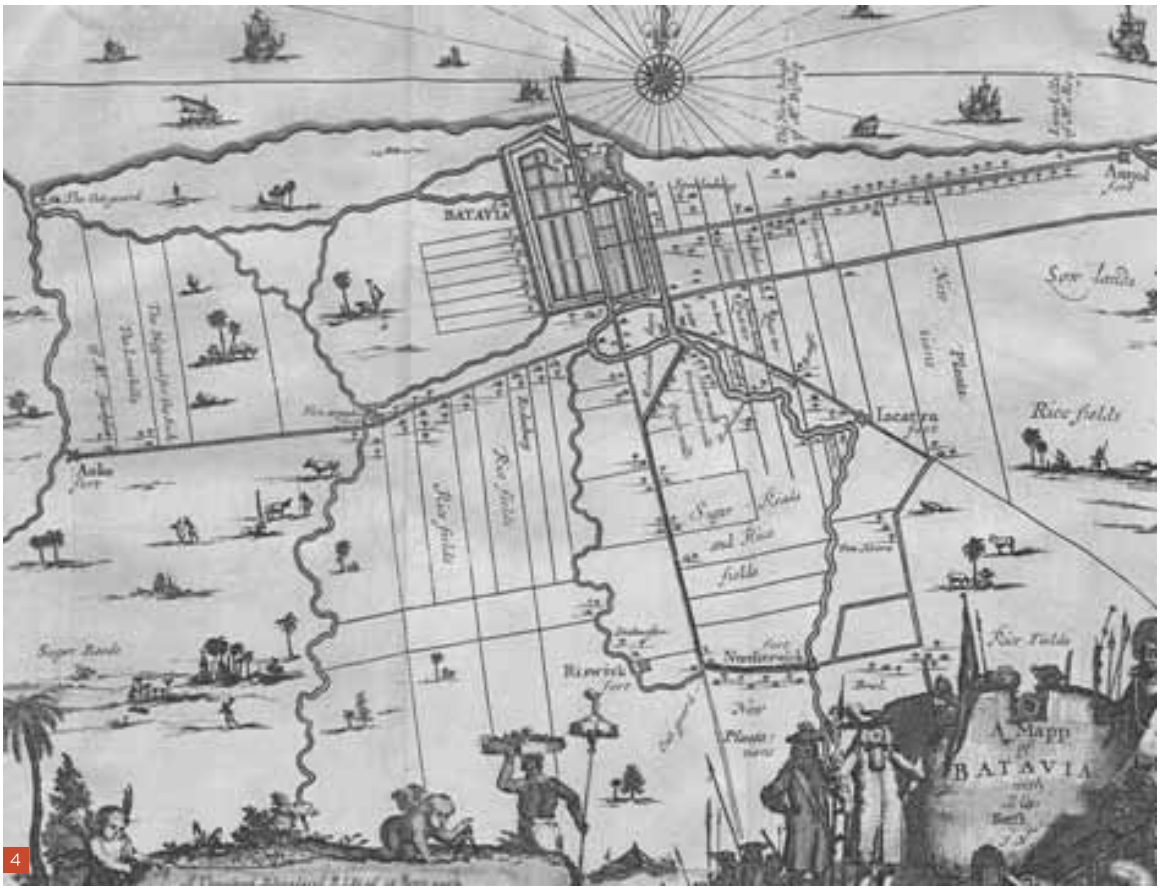
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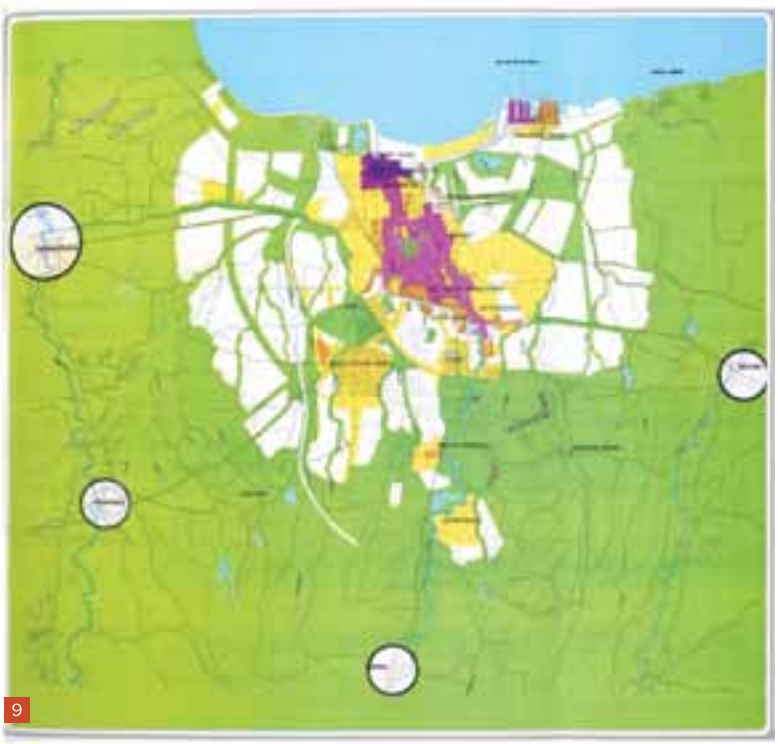
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storm surge contributed to the record of 2007. According to studies of Jakarta's changing topography, land subsidence, owing to excessive use of the subsurface water supply, may have accounted for some of the more catastrophic flood impacts in the northern coastline areas. In other words, because Jakarta relies so heavily upon its aquifer to meet the city's growing water needs, the city is sinking. Another factor was the functioning of the flood canal system. Since the main flood canal had not been completed on the eastern side of the inner city, this area was hit especially hard by the 2007 flood. In the end, however, overwhelming evidence pointed to the inability of the natural waterways to do the job that they were once capable of doing. Now heavily impacted by urbanisation and infrequently dredged to clear upstream and downstream residue, they contribute to flooding rather than help handle the storm water demands. Allowing the city's built environment over the past 60 years to encroach on these waterways destroyed the natural ecological defences of the region.

This city's failure to regulate development in these areas underscores the tendency in urban planning everywhere to ignore the ecological systems upon which a city has been built. Plans and strategies for new urban development typically fail to begin with knowledge of, or respect for, the ecological system within which urbanisation occurs. Respecting urban ecology is not just a matter of preserving open space or adding green elements to the city's landscape. It implies no less than ensuring that all development decisions conform to an understanding of the natural systems within the city and its hinterland, an area typically much greater than any single administrative unit. So this means examining the ecological foundations beyond the political boundaries of urban places.

The noted Scottish-born planner and ecologist, Ian McHarg, referred to this approach to urban planning as "designing with nature". It seems evident from the proliferation of urban flooding in Jakarta and in other delta megacities—from the degradation of surface waters in so many large cities, from the increasing effects of excessive reliance on subsurface water, owing to inadequate usable surface waters, and eventually from the added impacts of sea-level rise—that delays in attending to the fragile ecological foundations of urbanised areas are already showing problematic outcomes. In Jakarta now, there is an effort underway to dredge major waterways to restore both their depth and to push urban settlements back to restore their width. Many other interventions are needed, however, to restore ecological balance to the urbanised areas. A storm water management project undertaken in Singapore's Bishan Park to recreate the original path of the Kallang River is just the sort of ecological restoration model that might be undertaken in cities to reverse the pattern of urban flooding. It is not too late to experiment with various ecological upgrades in megacities in order to restore balance between the built and natural environments, but it all must begin with a commitment among planners and city leaders to regard natural systems as the beginning point for future planning in order to achieve the goal of sustainable urbanism. CG


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5. By the early-twentieth century, the canals remained more for their aesthetic value than functional importance, and this led to reduced emphasis on needed maintenance (Photo: Christopher Silver).

6. The Kali Besar (Grand River) is one of the few remaining pieces of the original city canal system in Jakarta. Only a small part of it remains in Jakarta today and holds stagnant water (Photo: Christopher Silver).

7. Ciliwung River in central Jakarta has been reduced in width and depth as urbanisation has spread over its natural course (Photo: Christopher Silver).

8. The newly completed East Flood Canal completes the original flood canal system designed in the van Breen plan of the early 1920s (Photo: Christopher Silver).

9. This map from the 1965–1985 Master Plan for Jakarta indicated that the areas of Tanggerang, Serpong, Depok, and Bekasi were going to be satellite cities with green areas preserved between. By the 1990s, urbanisation had filled in not only these green areas but also 15 to 20 kilometres beyond them (Image: Jakarta: DKI Jakarta 1966).

10. This flood management initiative for the Kallang River in Singapore's Bishan Park represents an effort to restore the natural ecology of urban areas and allow rivers to follow their own course (Photo: Christopher Silver).