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Slow the flow

Controlling the volume and flow of stormwater is key to preventing flash floods. >2

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Watery world: Flash flood at Jalan Tun Razak, Kuala Lumpur, last December.

Draining the rains

Rainwater that rushes into drains and rivers can cause flooding downstream. So why not hold back the water for gradual release, later?

By TAN CHENG LI

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FOR as long as many of us can remember, the Department of Irrigation and Drainage (DID) has always been on a building spree to mitigate floods – drains are constantly widened and rivers straightened so that rainwater that gushes off roof tops and land can be quickly whisked away into streams.

Federal expenditure for flood mitigation keeps ballooning, and yet, many urban centres continue to be inundated during downpours. The thing is, drainage engineering works just cannot keep up with the ever-growing volume of stormwater runoffs that results from intensive land development.

The combination of localised heavy rains, and inadequate drainage and water storage systems to cater for rapid urbanisation is a recipe for flash floods.

"The occurrence of floods is increasing due to land use changes and progress. Whatever we do on land will affect the hydrology of an area. The transformation from pervious surfaces to artificial non-pervious surfaces will increase the runoff rates and volume," says Abu Mutilib Mat Hassan, deputy director at the flood management division at DID.

A DID study has shown that all it takes for flooding to become a problem is for 40% of an area to be cleared. The amount of runoff will double and flow twice as fast. With a yearly rainfall of 2,000mm to 3,000mm – going up to 6,000mm a day and even 100 to 200mm in one to two hours during extreme events – the amount of stormwater that speeds off concrete-paved areas can certainly tax our drainage systems.

Speaking at the Asia Water Resource Expo and Forum in Kuala



As land gets paved-over with concrete, runoffs increase – and drains will have to be constantly widened to divert the stormwater into rivers.



Lumpur last week, Abu Mutilib asserts that structural measures – such as poldering and pumps, flood mitigation dams, retention ponds, diversion drainage and river bund channel improvements – alone are inadequate in preventing floods. He says non-structural measures are also needed, and this includes measures such as emergency response and flood preparedness, as well as land use and development policies. "We need to manage the water cycle as a whole, and give space for the river. This will need the co-operation of planning authorities."

Managing runoffs

Traditionally, we manage stormwater by quickly diverting runoffs from drains into rivers in what is known as the "rapid conveyance" approach – sometimes so rapidly that rivers cannot cope



Messy aftermath: Flash floods in Kuala Lumpur early last month caked this house in Kampung Lembah Jaya Utara, Ampang, in a thick layer of silt. The frequency of floods in urban areas is increasing as drainage systems cannot cope with massive stormwater runoffs.

with the sudden deluge, leading to downstream flooding. Trash and silt which choke drains and rivers worsen the floods, as the flows are impeded.

If the current way of draining stormwater persists, drains and rivers will forever need widening to cater for swollen flows, and often, not fast enough. Abu Mutilib says expenses for flood mitigation has skyrocketed, from RM330mil in the First Malaysia Plan (1966-1970) to RM7.6bil by the Ninth Plan (2006-2010).

Realising the limitations of the rapid conveyance approach, in 2001 DID introduced a new approach in its Urban Stormwater Management Manual (*Manual Saliran Mesra Alam Malaysia*, or MSMA), one that centres around controlling the quantity

and quality of stormwater runoff.

The "control at source" concept essentially delays the time it takes for stormwater to reach streams – a complete turnaround from the rapid conveyance approach. Stormwater is captured first and then gradually released, so there will be no sudden, excessive water flowing to downstream areas. The new method requires all development to meet "zero peak contribution." This means runoffs from the site must be similar to or less than levels before land-clearing took place.

The approach essentially makes developers responsible for limiting stormwater discharges each time they transform a vegetated site into a concrete jungle. If, before, developers merely built drains big

enough to channel stormwater away from their project area, now they have to contain the stormwater instead. This can be achieved by mimicking nature, that is, simulating the natural hydrological cycle by combining infiltration, storage, delayed flow and runoff treatment techniques.

There are two ways to curb excessive stormwater runoff from newly developed site: store it for gradual release later, or allow it to infiltrate the soil.

Storage or detention options include ponds, lakes, wetlands, underground tanks or pipes, and flat roofs that harvest rainwater. Car parks, driveways and other paved surfaces can also be "ponded" to retain water temporarily.

Infiltration and retention tech-

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Engulfed

Floods affected 29,800sqkm of land and 4.8 million people or 22% of the population, in 2010. During downpours, you can get information on flooded sites at publicinfobanjir.water.gov.my.



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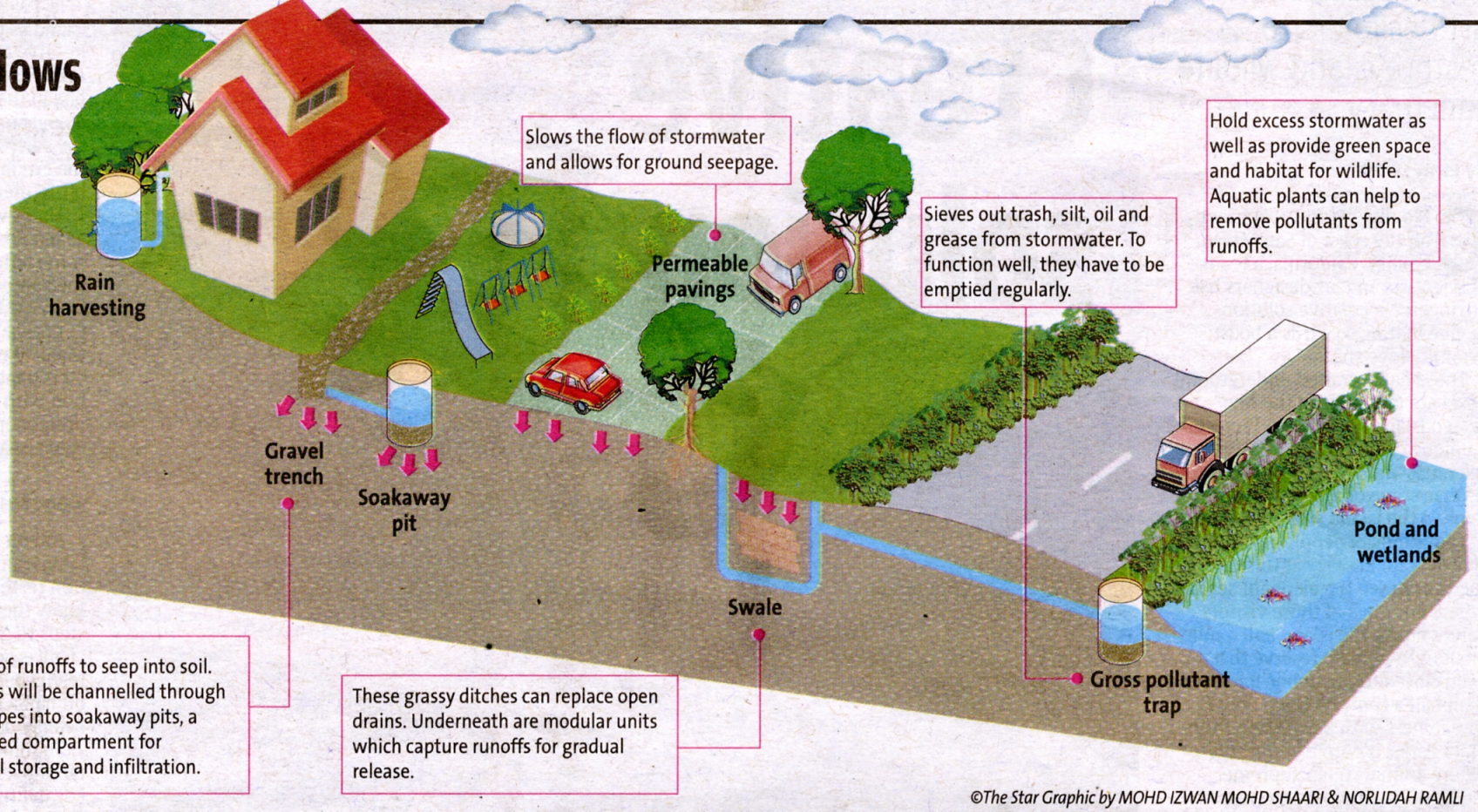
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Rein in the flows

As porous land is paved over, rainwater that once soaks into the ground instead speeds off the land, unhindered. Drains and rivers have to be enlarged to cart away the runoffs but this merely causes flooding elsewhere. A better drainage system is one that does the opposite – it stores and gradually releases stormwater, or allows it to slowly soak into the ground.



Ponds and waterways in residential areas not only serve as recreation spots, but hold stormwater, too.



Sungai Klang looks more like a huge drain rather than a river, as its meandering banks have been straightened and covered with concrete to enable speedy water flows.

niques to be considered are gravel trenches, soakaway pits, submerged pervious drains, permeable pavements, car parks and sidewalks, and swales. Swales may just look like grass-covered depressions in the ground but underneath are containers that temporarily trap stormwater.

Many are unaware that stormwater is one of the largest contributors to river pollution. That is because, as it moves across the land, it picks up everything in its path: fertiliser from farms and gardens; abraded tyres and brake lining from roads; soil, dirt and tar from roads; garbage; and atmospheric fallout (pollutants washed down from the air).

The MSMA addresses this by encouraging measures such as erosion and sediment control during earthworks, and installation of gross pollutant traps along drainage channels.

The benefits of both storage and infiltration strategies extend beyond that of controlling runoffs. Ponds built to catch stormwater provide recreation sites and habitat for wetlands flora and fauna. Some developers have used such ponds as landscape features that add value to their projects. Also, harvesting rainwater makes good use of a resource that would otherwise go down the drain. And stormwater, when allowed to seep underground, will

recharge underground aquifers.

One example of stormwater detention is the network of water-storing pipes beneath the car park of a hospital in Kudat, Sabah. The system stores 150cu.m of water and has solved the flooding problem at the hospital grounds.

"We usually propose underground storage as there is often a lack of land in cities for ponds. It might be more expensive to build but will be cheaper in the long run," says Mubin Mohamad, chief executive officer of Hydro Solutions, which had built the system.

His company also markets the Hydrobrake, a device that can be installed along drains or rivers to control the volume and speed of flows, thus reducing the impact of heavy rains on downstream spots.

Ignored rules

Despite it being a decade old, the MSMA drainage guidelines have not exactly been embraced by all. Fears over higher construction costs and maintenance needs (such as desilting ponds or clearing pollution traps) have stymied its full implementation. Some engineers, developers and local authority staff are still not well-versed with the guidelines.

Some development projects have managed to skirt the MSMA

requirements due to weak enforcement and inconsistent standards practised by the local authorities, which are involved in vetting drainage plans. Currently, there is no penalty for non-compliance as the guidelines are merely administrative requirements under local authorities.

Mubin points to some ambiguities in the guidelines: for instance, the size of developments that will require flood control devices in order to prevent overflows to the neighbouring land.

Some drainage experts suggest a revision of the Street, Drainage and Building Act 1974 and establishment of bylaws, to give more legal bite to the stormwater management rules. They say retention ponds and constructed wetlands should be gazetted as reserved areas to prevent them from being filled up and built over. Proper drainage masterplans are also sorely needed, to replace the present piecemeal plans.

Taking into consideration the various feedback, the DID has recently revised the drainage rules to make them easier to understand and implement. Hopefully, this spells a better way of draining stormwater. And an end to flash floods, as well as a return to naturally meandering rivers, instead of huge, concrete-lined drains.



Aquatic plants cultivated in an engineered wetlands can help purify runoffs.