1960

2012

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Flood Prone Areas & Flash Flood

3 key Strategies for flood management

Multi-Prone Drainage Solution

Other Measures

Conclusion

We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment.

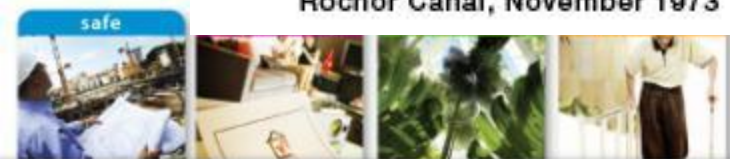Braddell Road, December 1978

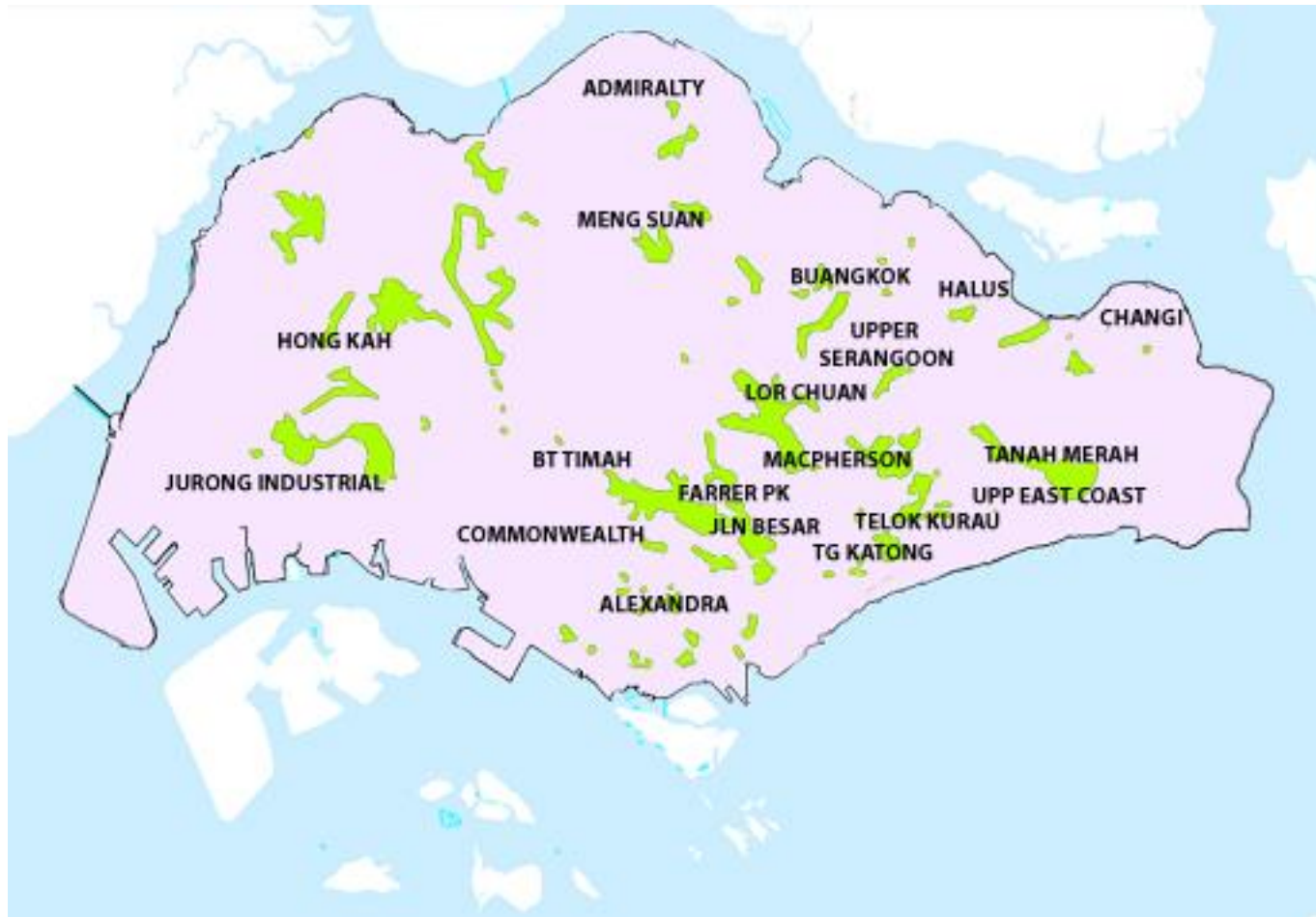Newton Circus, December 1969

Rochor Canal, November 1973

Bideford Road, December 1969

Flood Prone Areas in 60s & 70s ~ 3200 ha

8,000km of Drains, Rivers and Canals channel rainwater into reservoirs or sea
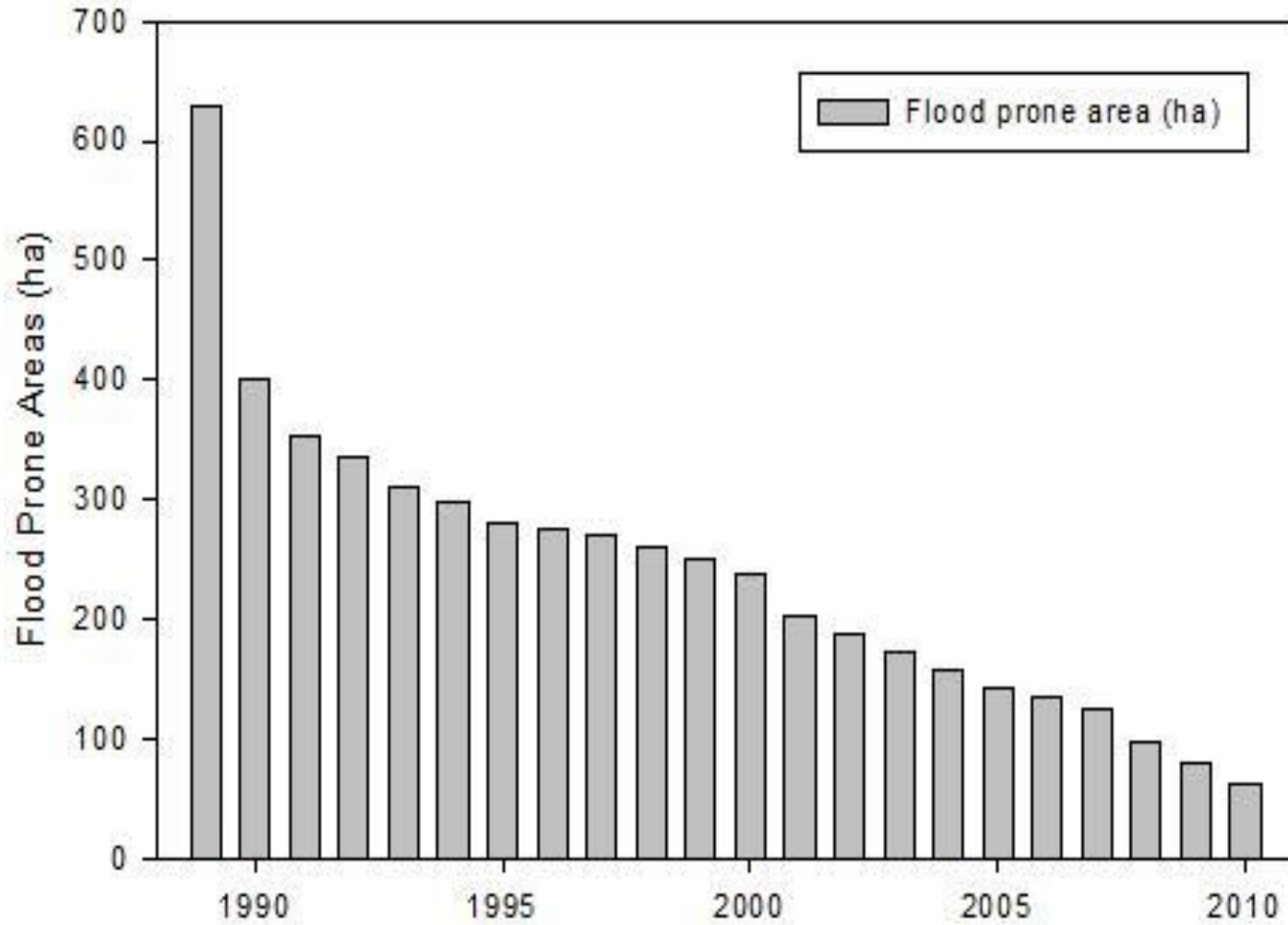

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Flood Prone Areas in 2012
~ 40ha

Reduction in Flood Prone Area over Years

Flash Flood in the Recent Years

In 1960s and 1970s, Singapore experienced wide-spread flooding during the monsoon seasons, especially in the city centre, which was built on relatively low-lying land.

Singapore has been relieved of prolonged floods as the drainage can cope. However, extremely heavy rainfall in the recent years can exceed the capacity of the drains. Hence, flash floods – small and localised floods that come and go quickly, may occur

Flash Flood in the Recent Years

<u>4 Nov 2013</u>
Western Sunset Drive / Sunset Square (Junction)
Depth: 100mm/Width: 2 lanes
Length: 50m
Passable to traffic

Western Lorong Kismis
Depth: 100mm/Width: 2 lanes
Length: 50m
Passable to traffic

Western Slip road from Clementi Road to Ulu Pandan Road
Depth: 200mm/Width: 3 lanes
Length: 50m
1 lane impassable for 15 mins

Flash Flood in the Recent Years

<u>4 Nov 2013</u>
Western Dunearn Road (Yarwood Ave to Binjai Park)
Depth: 150mm/Width: 2 lanes
Length: 30m
Passable to traffic

Western Clementi Ave 4 / Commowealth Ave West (Junction)
Depth: 150mm/Width: 1 lane
Length: 40m
Passable to traffic

<u>3 Nov 2013</u>
Eastern Chai Chee Rd / New Upper Changi Rd
Depth: 300mm/Width: 2 lanes
Length: 30m
2 lanes impassable for 10 mins

Flash Flood in the Recent Years

30 Oct 2013
Eastern Chai Chee Rd near junction of New Upper Changi Rd
Depth: 300mm/Width: 2 lanes
Length: 100m
2 lanes impassable at Chai Chee Road for 15 mins

Eastern ECP Slip Road towards City at Bedok South Ave 1
Depth: 150mm/Width: 2 lanes
Length: 50m
Passable to traffic

28 Oct 2013
Eastern Chai Chee Rd near junction of New Upper Changi Rd
Depth: 300mm/Width: 2 lanes
Length: 100 m
2 lanes impassable at Chai Chee Road for 20 mins

1 **Providing adequate drainage ahead of new developments**

Prior to any new land development, PUB works with agencies such as URA, HDB and the LTA to map out necessary drainage measures.

In addition, to ensure that roads are built to the required levels for flood protection and drainage systems along the roads are adequate.

2 Implementing flood protection measures

To provide additional flood protection measures, PUB has put in place a Code of Practice on Surface Water Drainage that stipulates drainage requirements. This includes minimum platform and crest levels for buildings and entrances to underground facilities (e.g. basement carparks, underground MRT stations, etc).

PUB also work closely with building owners to advise on appropriate measures to protect the buildings from floods.

3. **Continuous drainage improvement in flood prone areas**

It includes widening and deepening of drains and canals to ensure adequacy of the drainage. For low-lying areas, drainage improvement projects are effective only if the surrounding ground level is also raised.

For existing low-lying and flood-prone roads, the road levels would be raised during drainage upgrading works or road upgrading works. When an area is for redevelopment, PUB will review the drainage system and raise the building and road levels.

(i) Source SOLUTIONS

Facilitating the implementation of measures to slow down runoff

The feature helps to retain or slow down water runoff, and reduce the volume of water in the drainage system during heavy rain. Eg, a detention tank built at Tyersall Avenue to temporarily store excess rainwater from the drains along Holland Road. After the rain subsides, the water will be pumped back to the drains for subsequent discharge into the Reservoir.

When the drain overflows during heavy storms, the excess water goes into the detention tank next to the drain. After the storm, the water stored in the tank is pumped back into the drainage.

(ii) RECEPTOR SOLUTIONS

Measures to protect buildings from flash floods

The Code of Practice (COP) on Surface Water Drainage specifies minimum drainage requirements such as min height of platform, land reclamation and crest levels for new developments.

To meet the challenges of greater weather uncertainties and increasing urbanisation, the revised COP 2013 to require new developments to slow down the runoff that would be discharged into the public drainage system during heavy storms.

Photo: Raised platform

(iii) Pathway SOLUTIONS

Expanding Drain and building of new canals

Over the coming years, PUB will carry out more projects to improve drainage infrastructure and increase flood protection. These include increasing the capacity of 6 major canals at Bukit Timah, Geylang River, Alexandra Canal, Rochor Canal, Sungei Bedok and Sungei Kallang by 30 to 45%.

e.g. Bukit Timah and Stamford Diversion Canals
The first 2 diversion canals were built in 1972 and 1991 at the Bukit Timah catchment. These have helped to alleviate the perennial flooding problem in Bukit Timah. Works are ongoing to upgrade the Bukit Timah 1st Diversion Canal.
A new diversion canal will also be built at the upstream of Stamford Canal catchment to divert rainwater from more than 1/3 of the catchment to the Singapore River. Together with the new detention tank, the diversion canal will enhance the drainage capacity of the Stamford Canal catchment.

Buildings

Buildings can add structural measures such as humps and flood barriers to protect their basement levels from floodwaters. They can also link the water-level sensors in the basement carparks to their alarm systems in order to warn their users of flooding.

Residential Premises

Apart from storing belongings on high levels, home-owners in the low-lying areas can look into having floor boards or sand bags on standby.

Water Level Sensors / CCTVs

Water Level Sensors
158 water level sensors around Singapore for monitoring of the drainage system. Updated every 10 min, the sensors provide data on water levels in the drains & canals to enhance the monitoring of real-time conditions during heavy storm.

CCTVs
Located in areas like Orchard, CBD, Bukit Timah, Upper Thomson, AMK, Little India, Queenstown, etc, to provide up-to-date pictures of the conditions. Updated every 5 min.

Subscribe to SMS Alerts

<u>Heavy Rain Warning</u>
Subscribers will receive an SMS alert from NEA whenever heavy rain is expected. The alert will include location of the rain and tidal change data.
The Heavy Rain Warning information is also available on NEA websites.

<u>High Water Level Alert</u>
The 158 sensors in key canals and drains are used to track the water levels. Subscribers will receive progressive SMS alerts if the water level in the selected canal rises above 50%, 75%, 90% and 100%.

Other Flood Protection Measures

Interactive Map, search by building or street name.

http://app.pub.gov.sg/WaterLevel/LargeMap.aspx

24 hr Hotline
Building and residential owners can contact PUB via 1800-2846600

NEA Radio Broadcasts
The latest weather reports, including heavy rain warnings, available over radio broadcasts or through NEA weather forecast hotline at 6542 7788.

Marina Barrage

Singapore's Latest Downtown Icon

Marina Barrage for Flood Control

The Marina Barrage is part of a comprehensive flood control system to alleviate flooding in the low-lying areas such as Chinatown, Jalan Besar and Geylang.

During heavy rain, the series of 9 crest gates at the dam will be activated to release excess storm water into the sea during low tide .

During high tide, giant pumps will drain excess storm water into the sea.

The change in the climate is one of the prime factors for the flash flood.

More has to be done to improve the drainage but the long term solution

is to reduce carbon emission and going green for the construction

sector would be a step forward in the right direction.

Thank you

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