Flood Control of Wastewater Service in Tokyo

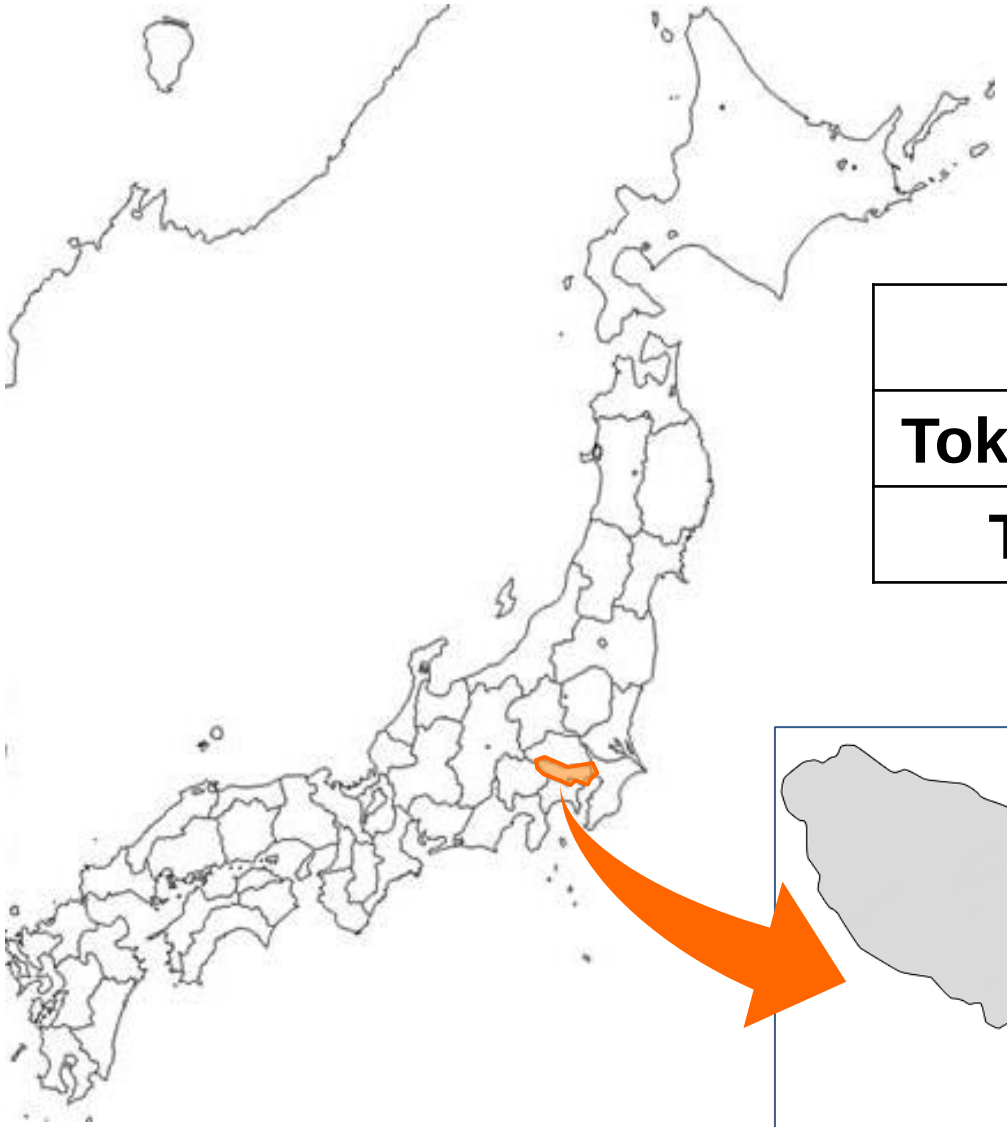
TIWEF 2020

Second Tachiai River Pipe (Shinagawa Ward) already used as a temporary storage

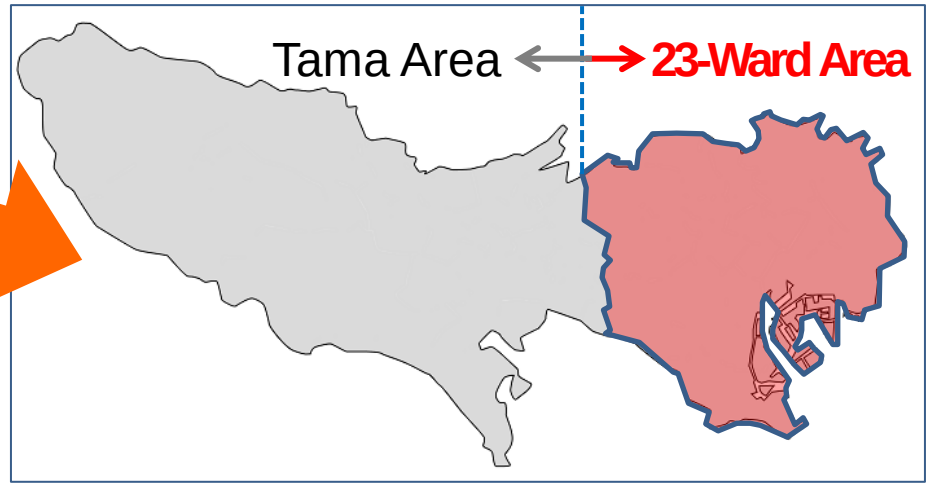
Yoshinari Nakajima

JSWA

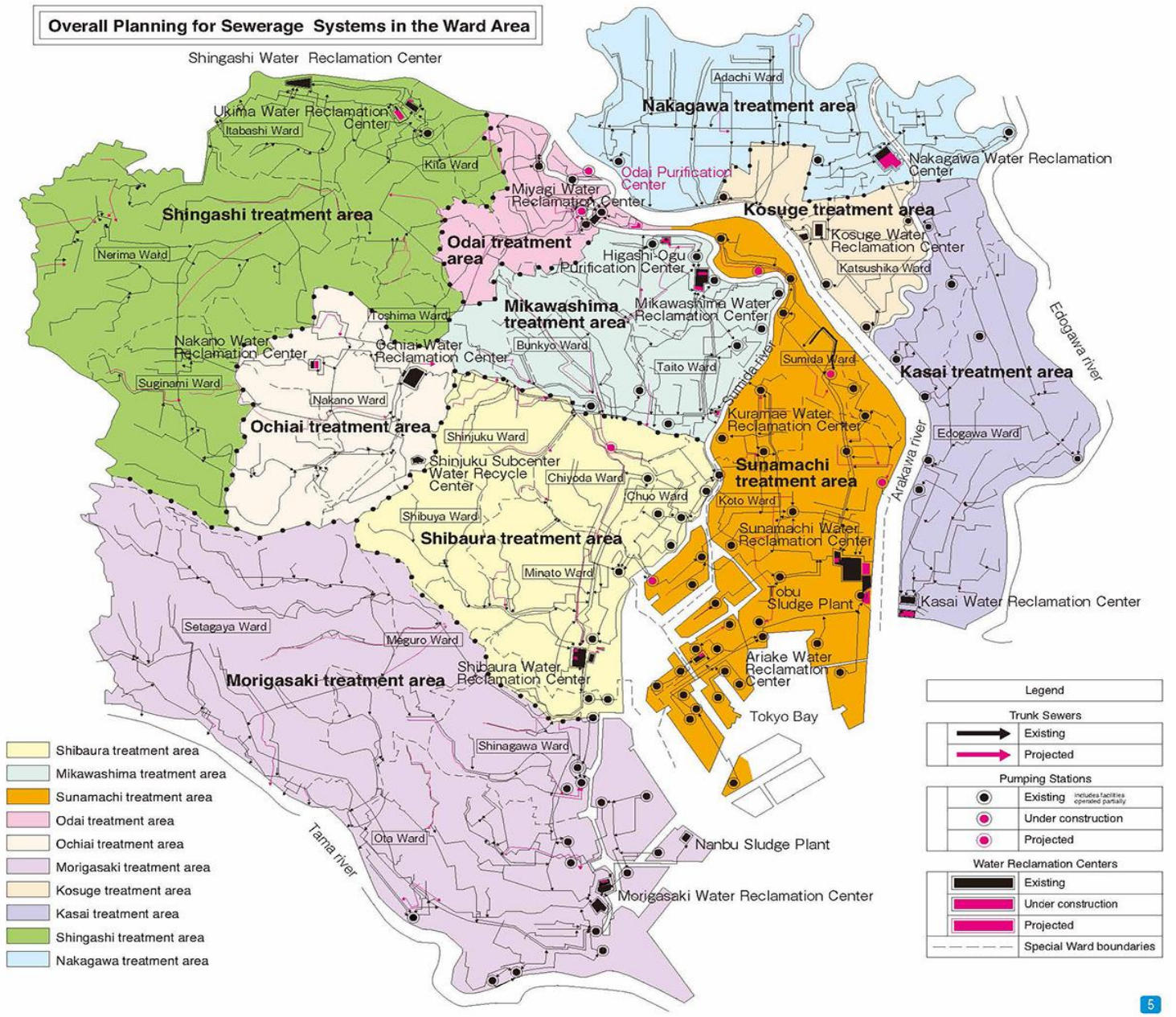
Tokyo Downtown: 23-Ward Area



City	Area	Population
Tokyo 23-W	630km^2	9.7 million
Taipei	270km^2	2.6 million



Overview of Sewerage Plan & Facilities



Design population: 8,692,000

Sewered area: 57,839 ha

pumping stations: 91

WWTPs: 16

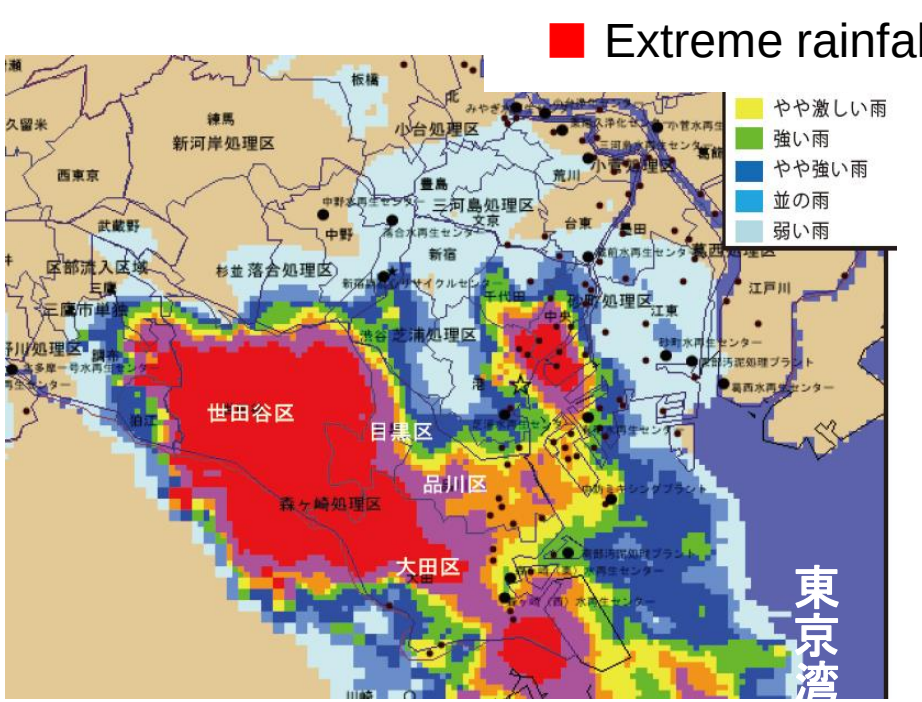
Design flow: 6,090,000 m^3/d

Sewer length: 16,112 km

As of March 2019

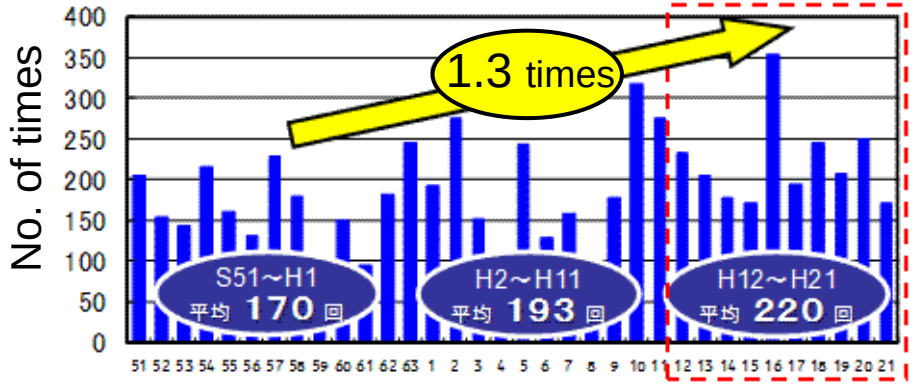
Rainfall Intensification in Tokyo

- Rising frequency of rainfalls over 50mm/h
- Very heavy rain in a short period of time

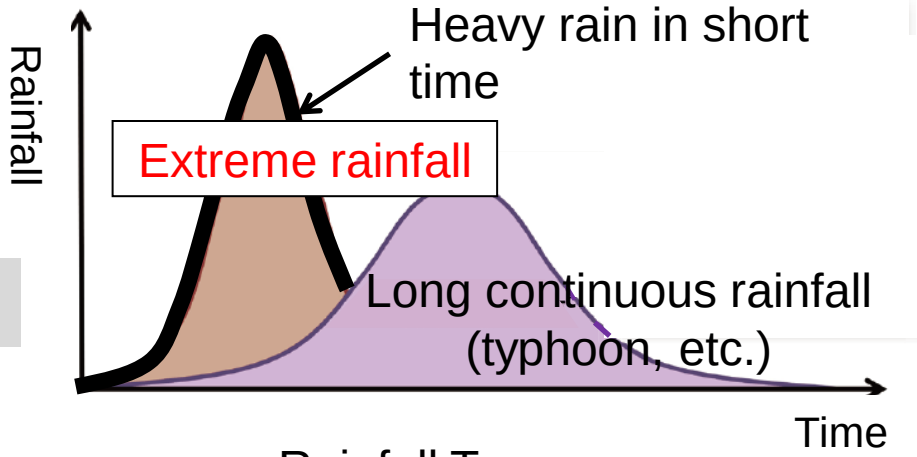


July 23, 2013)

Over 700 houses flooded



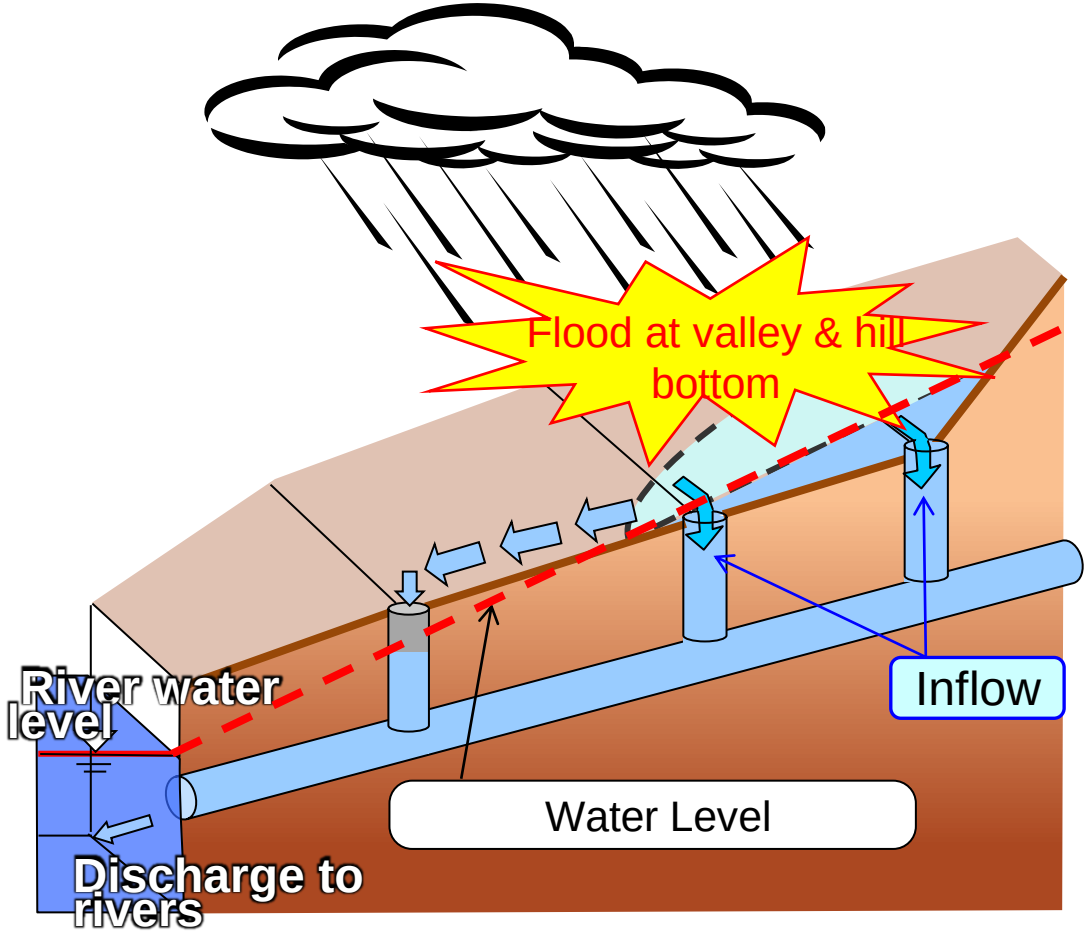
Annual frequency of rainfall over 50mm/hr
(Source: Japan Meteorological Agency)



Rainfall Types

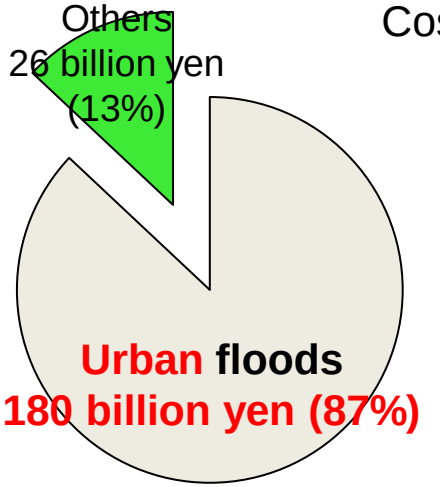
Floods in Tokyo

○ Most are urban floods in recent years.



How it happens

July 23, 2013

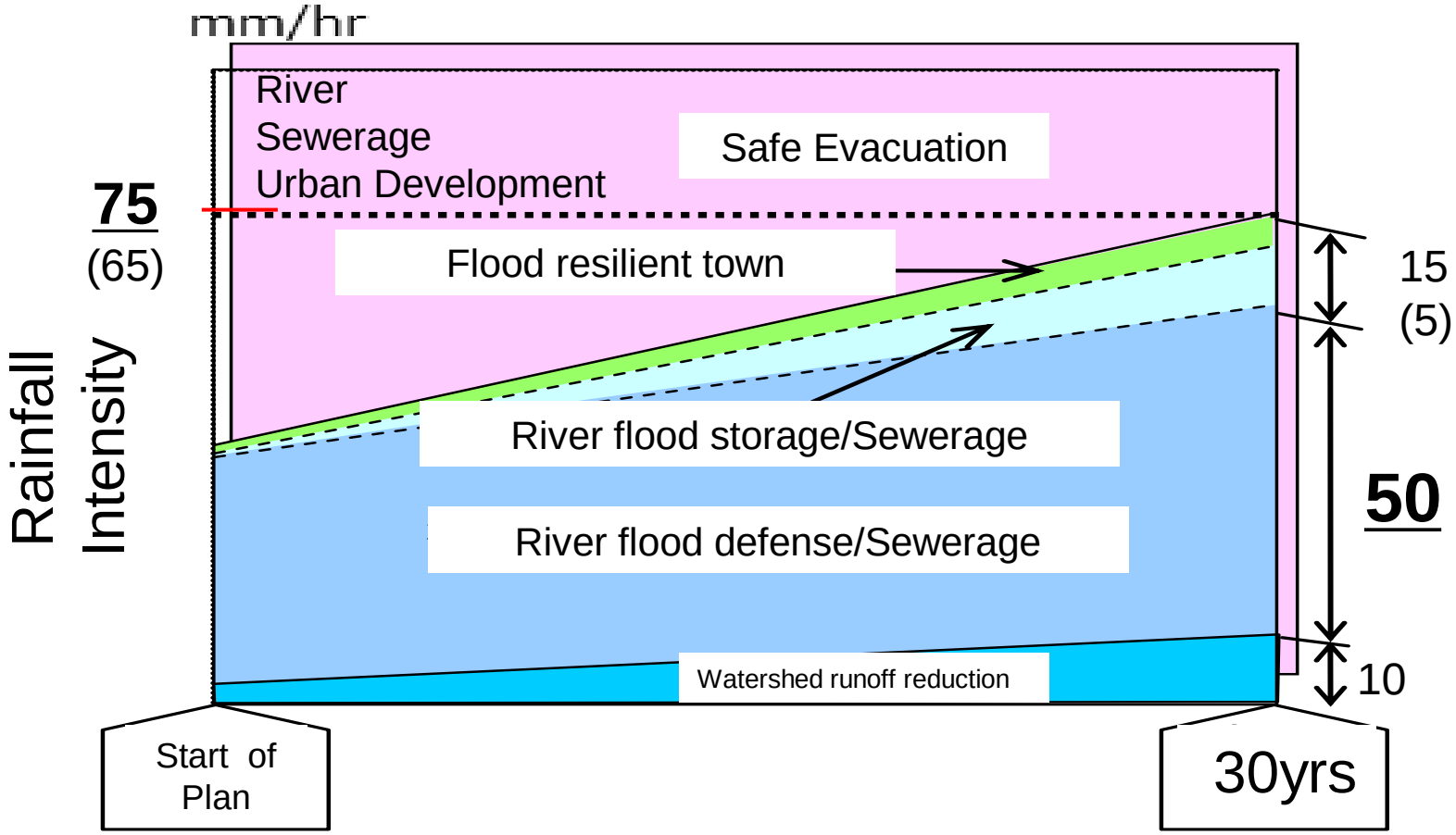


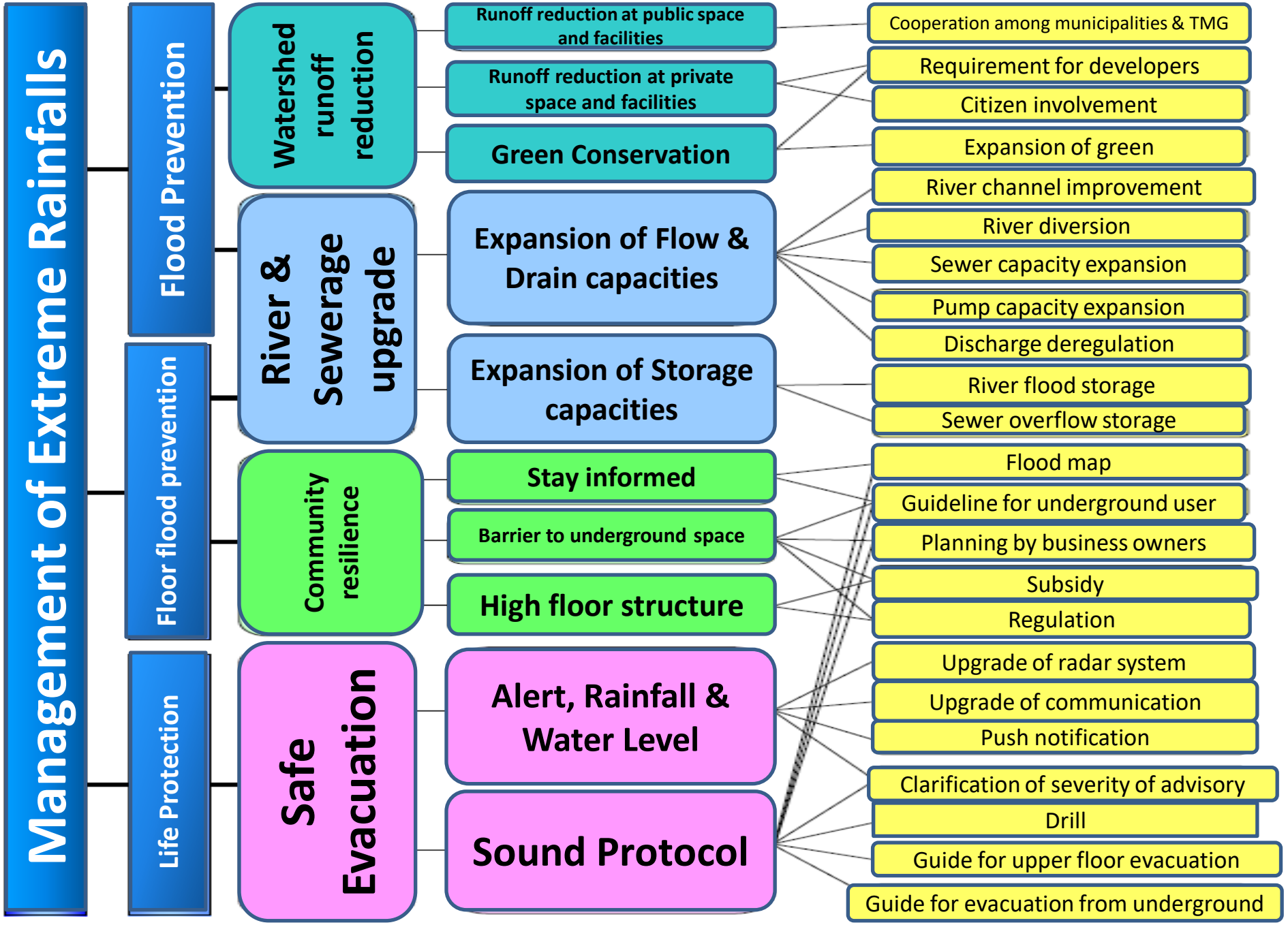
Cost of Flooding in Tokyo

*10-year total from FY1999 to 2008
(Source: Flood Statistics)

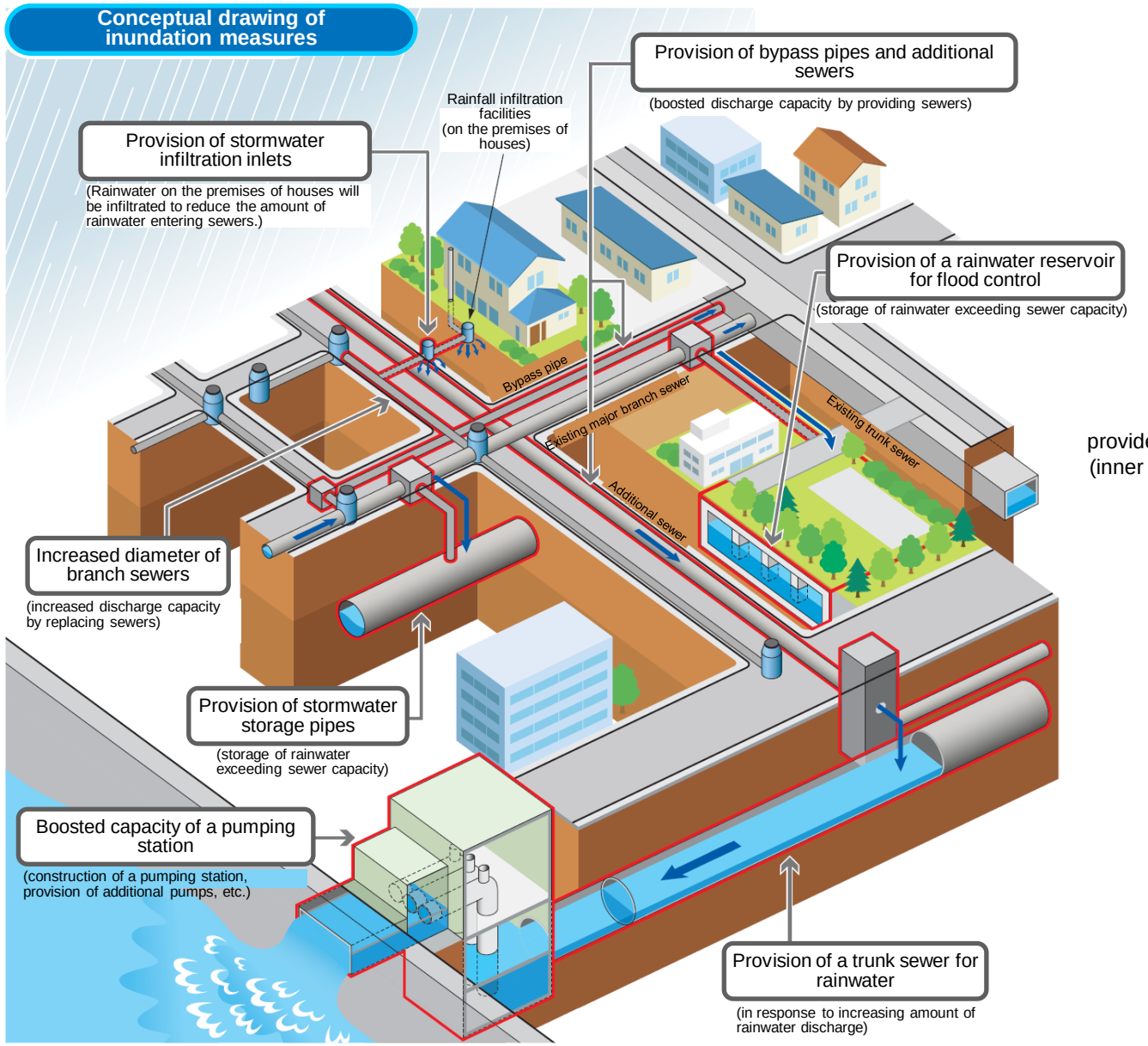
Goals of Flood Control and Responsibilities

- No flood for 60mm/h
- No floor flood for 20-year storm, 75mm/h in downtown & 65mm/h in western suburb
- Life protection for over the planed storms




Management of Extreme Rainfalls
Flood Prevention
Floor flood prevention
Life Protection
Watershed runoff reduction
River & Sewerage upgrade
Community resilience
Safe Evacuation
Runoff reduction at public space and facilities
Runoff reduction at private space and facilities
Green Conservation
Expansion of Flow & Drain capacities
Expansion of Storage capacities
Stay informed
Barrier to underground space
High floor structure
Alert, Rainfall & Water Level
Sound Protocol
Cooperation among municipalities & TMG
Requirement for developers
Citizen involvement
Expansion of green
River channel improvement
River diversion
Sewer capacity expansion
Pump capacity expansion
Discharge deregulation
River flood storage
Sewer overflow storage
Flood map
Guideline for underground user
Planning by business owners
Subsidy
Regulation
Upgrade of radar system
Upgrade of communication
Push notification
Clarification of severity of advisory
Drill
Guide for upper floor evacuation
Guide for evacuation from underground

Adaptation by Structural Solutions

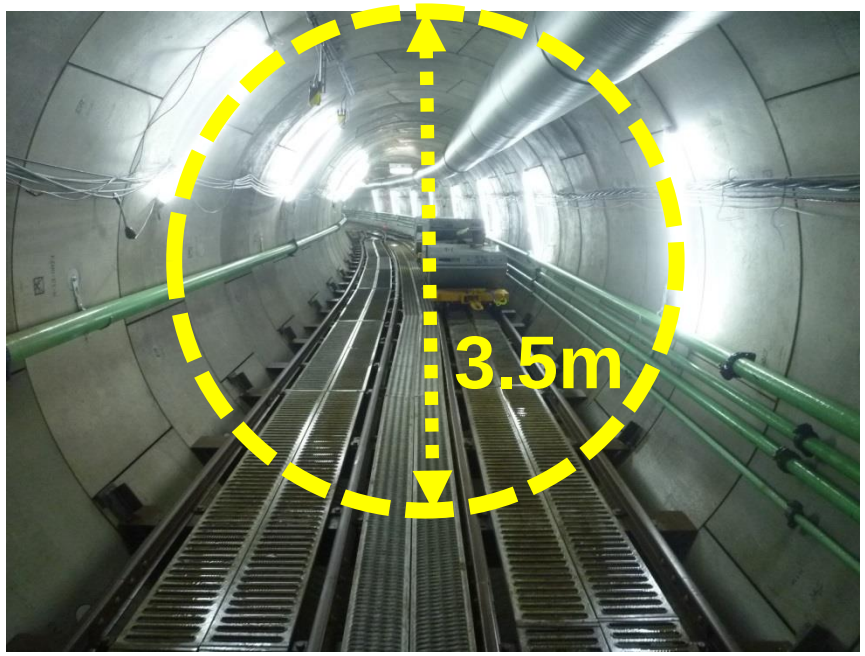


▲ Wada Yayoi Trunk Sewer
provided along the Kanda River, which floods extensively
(inner diameter of 8.5 m; storage capacity of 150,000 m^3)

▲ Minamisuna Rainwater Reservoir
with multiple dwelling units above for
the effective use of space
(storage capacity of 25,000 m^3)

Structural Solutions

- Build sewerage facilities for 50 mm/h rainfalls
- Increase the capacity to 75 mm/h for extensive **underground shopping streets** & **areas where severe damage occurred**



Sewer for storing rainwater
(Tagara and Sakuragawa, Nerima Ward)

Pumps for rainwater
(Kamiya, Kita Ward)

Structural Solutions

I – 1 Priority to drain 50 mm/hr rainfall events

i. Valley & Hill Bottom

ii. Sewer-shed for shallow depth trunks

I – 2 Priority to severely flooded areas from 50 mm/hr or over

iii. Upgrade for 50 mm/h or over

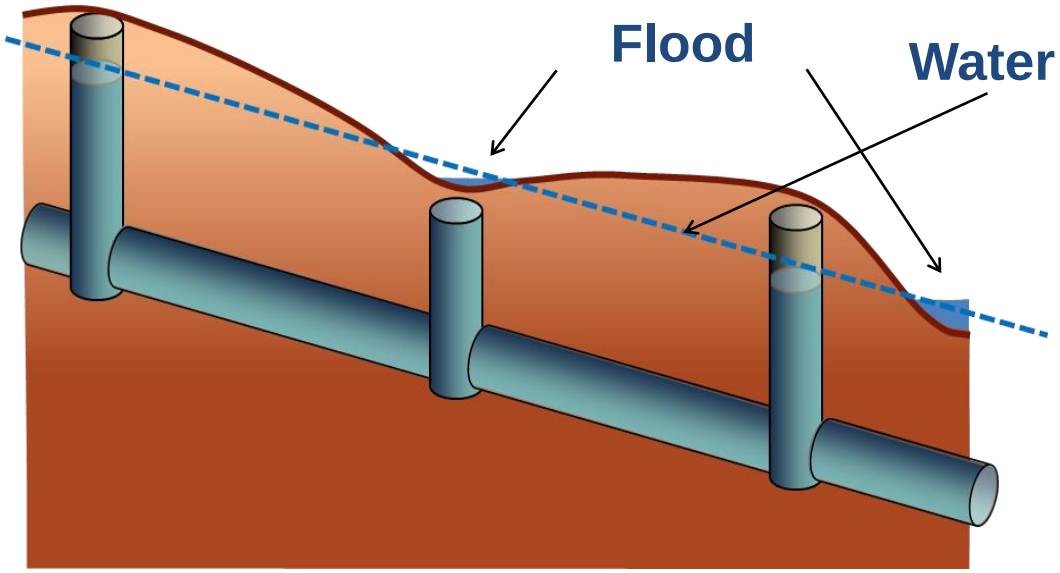
I – 3 Priority to drain 75 mm/hr

iv. Augmentation of shallow depth trunks

v. Extensive underground shopping streets

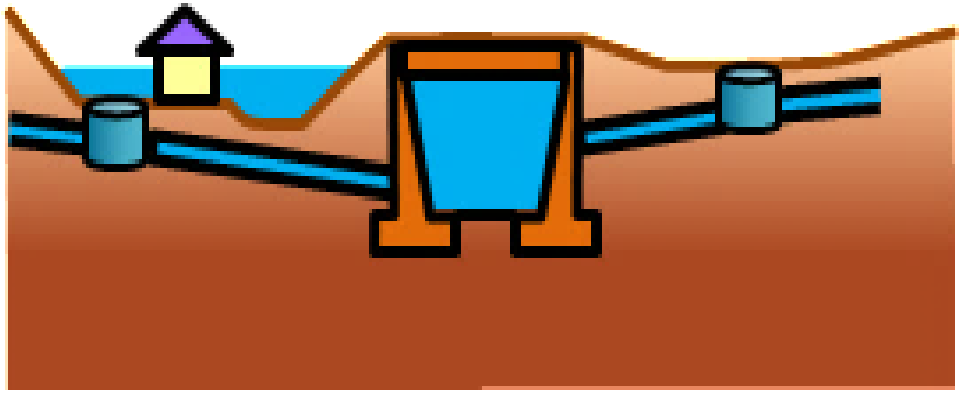
Priority to drain 50 mm/h

HBs & Vs



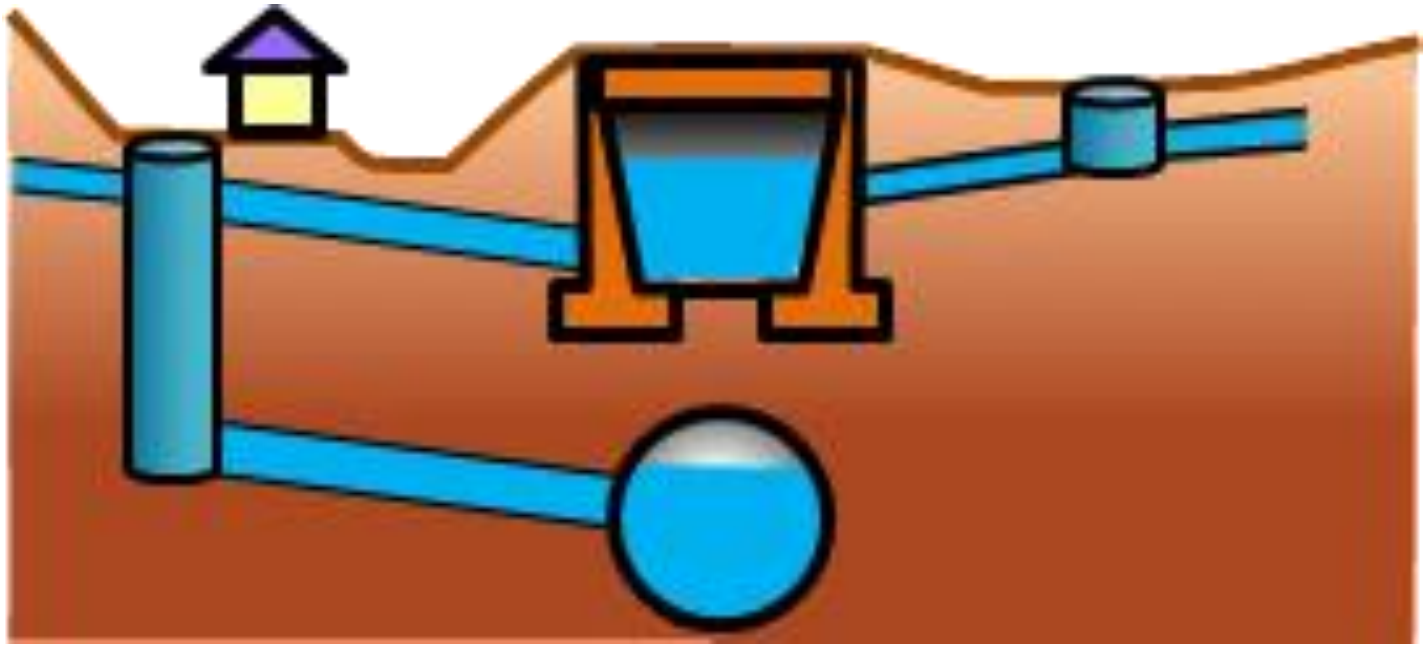
Sewer surcharge and flooding at valley & hill bottom

Sewer-shed of shallow trunks



Surcharged shallow trunk cause backflow to collectors leading to floods at valleys.

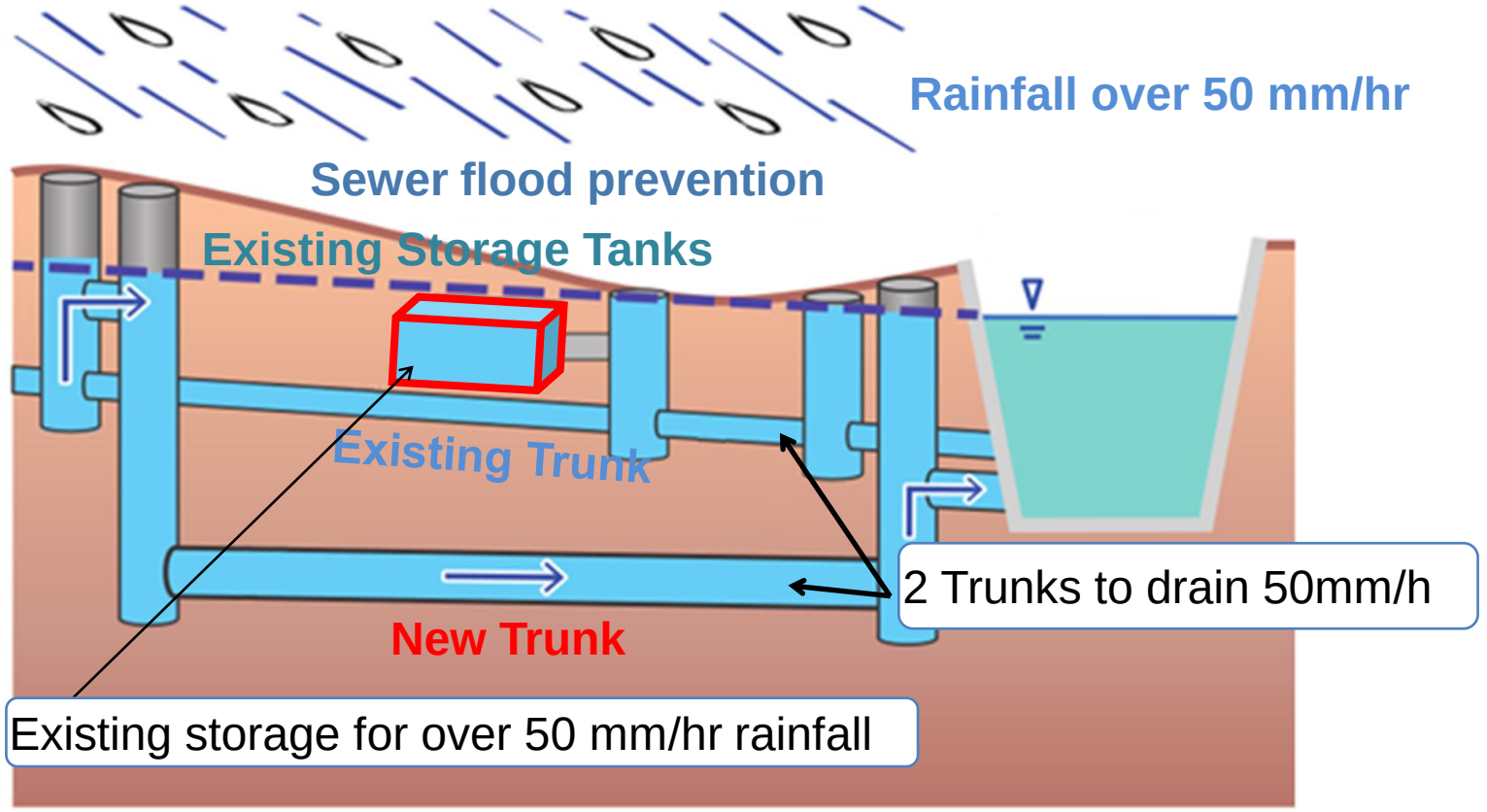
Solution to shallow trunks



Install a new trunk to prevent surcharge and flooding

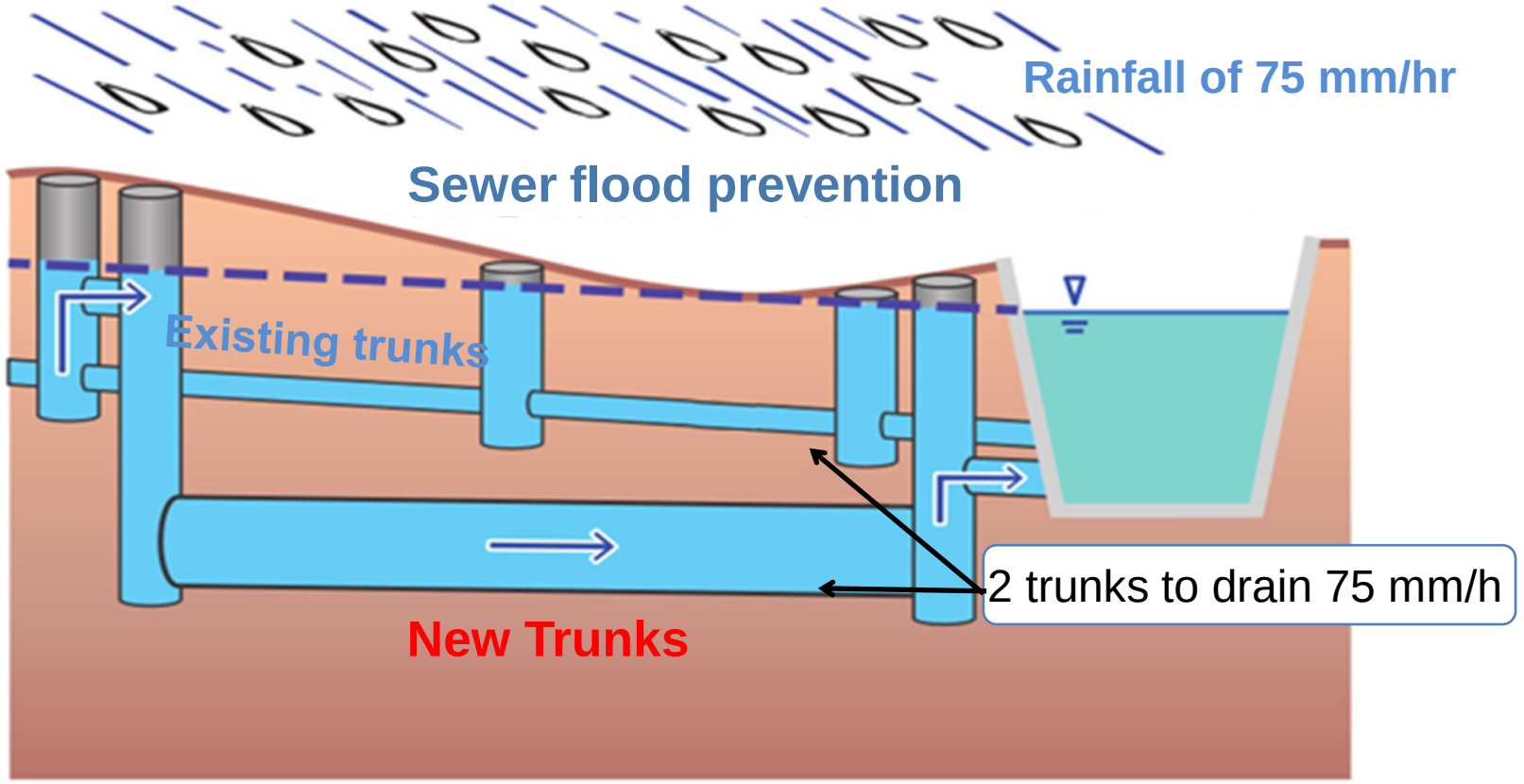
To drain 50 mm/h or over

- New trunks complement existing facilities to reduce flooding even from rainfall with 50 mm/h or over
- Expedite completion of planned projects ASAP



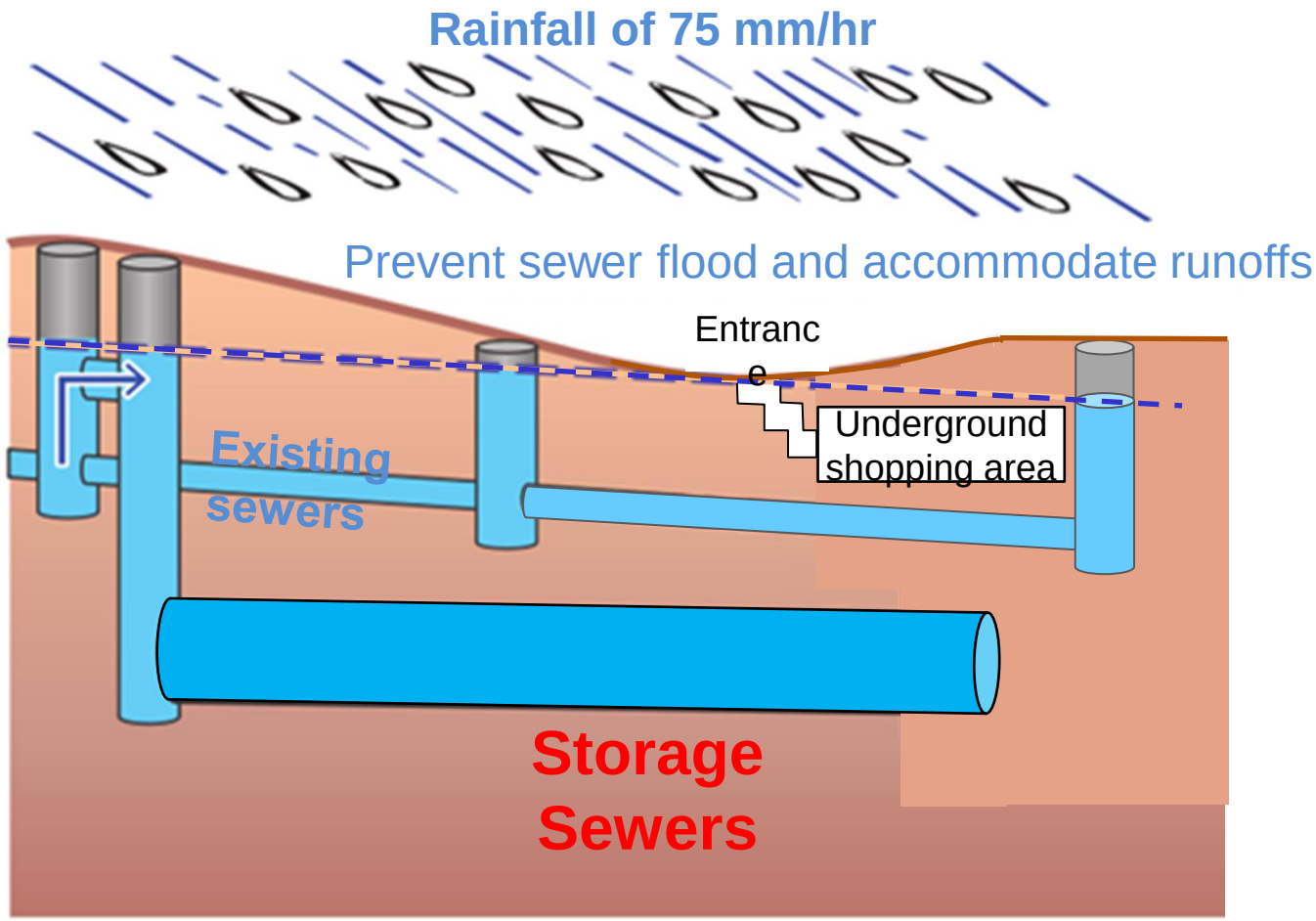
To drain 75mm /h; flooded areas with 50mm/h sewer capacity

○ Build facilities that prevent sewer flood from 75mm/h rainfall



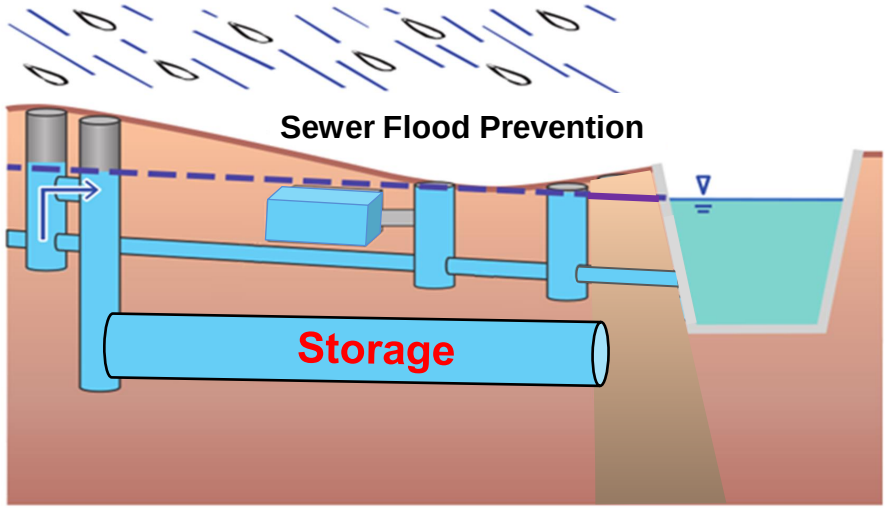
To drain 75mm/h; underground shopping streets

- Build facilities to prevent runoffs from entering underground shopping streets from 75 mm/hr rainfalls

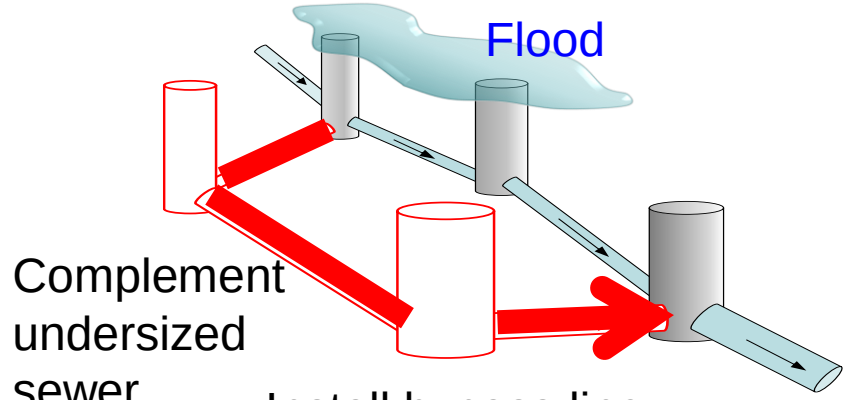


Other Solutions

- Storage by uncommissioned trunk sewers
- Install small bypass line
- Install catch basins in partnership with road authority



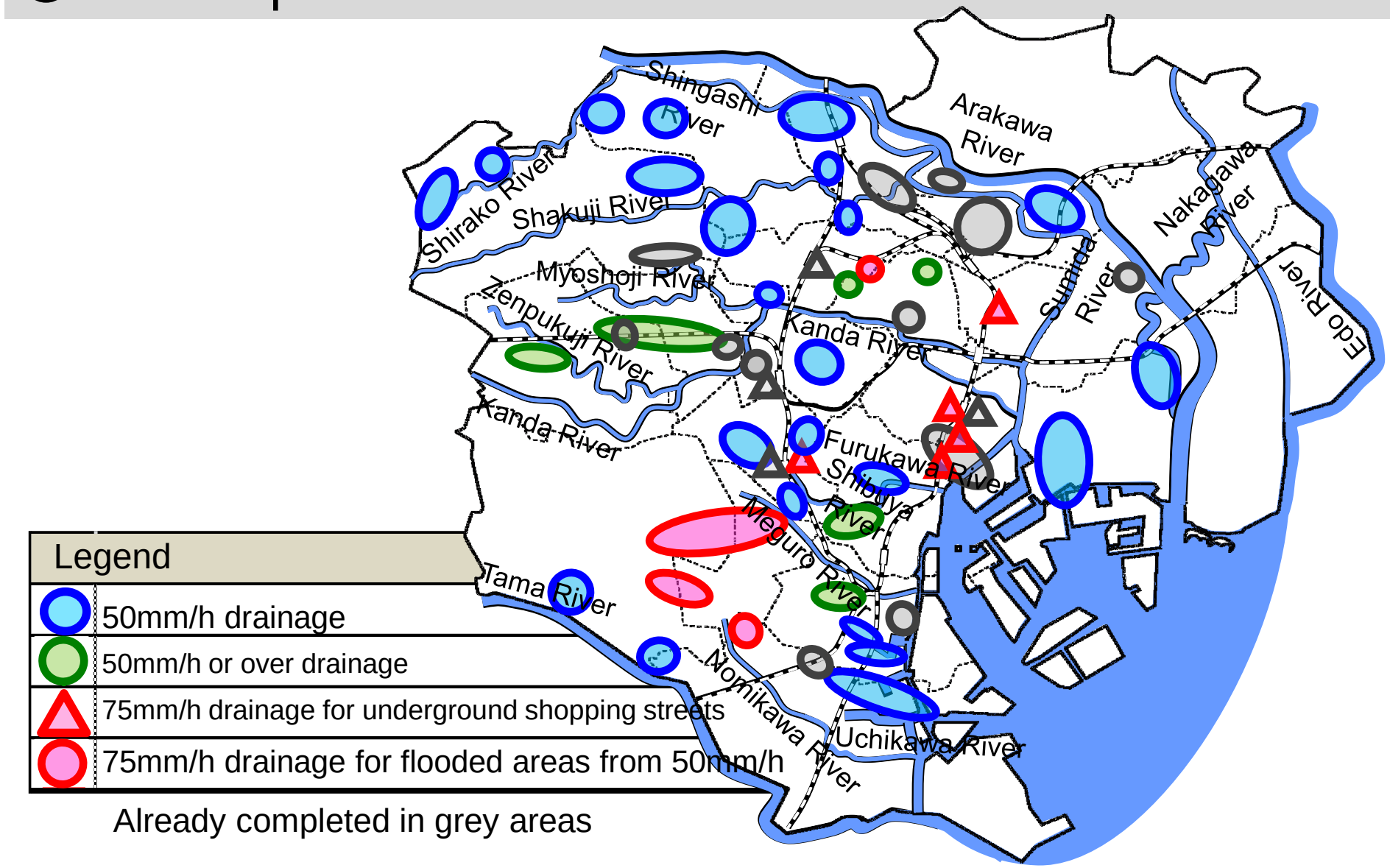
Where sewer discharge is regulated due to uncompleted river flood defense



Additional catch basins

Project Sites

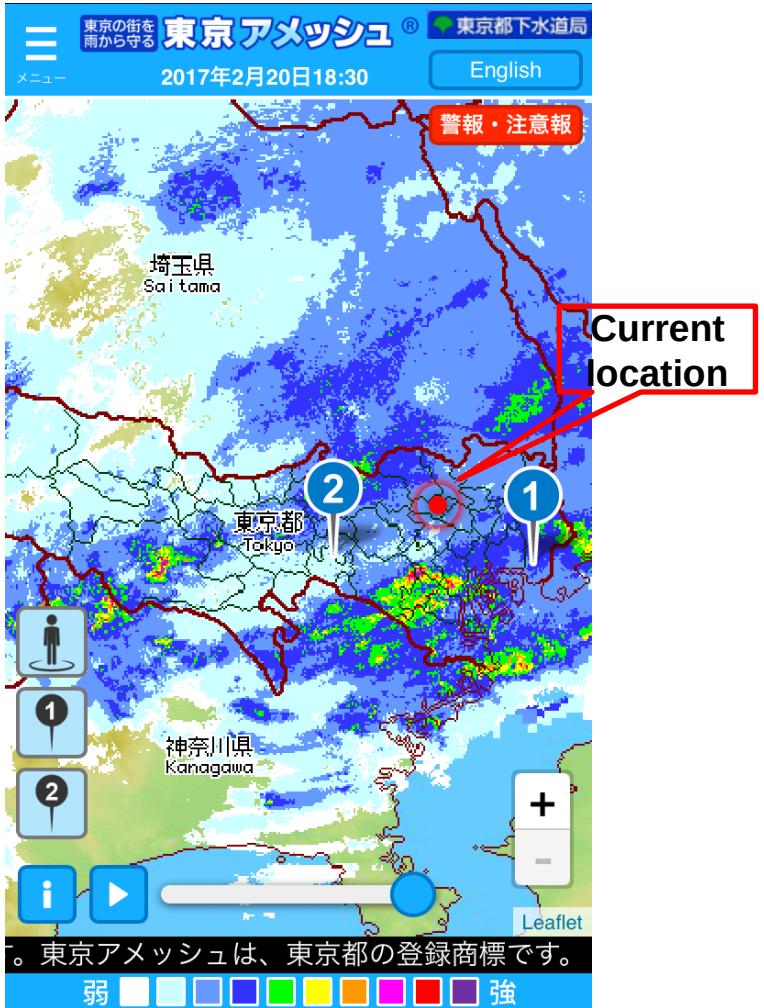
○ 16 completed out of 54



Nonstructural solution 1

○ Facilitate citizen evacuation to reduce damages

- “Tokyo Amesh”; highly accurate rainfall gauge system



April 2016: Upgrade to the latest radar

- **Display mesh: 500 m ⇒ 150 m**
- **Rain strength: 8 levels ⇒10 levels**

April 2017: **distribution of smartphone version**

- **Better usability and visibility**
- **GPS function to display the current location**

Nonstructural solution 2

- Publication of flood maps in corporation with river administrators
- In case of Kanda River with most floods, Japanese record high rainfall intensity was used

Flood map for Kanda River basin (revised)

Target rainfall

Before revision: 2000 Tokai Torrential Rain
Maximum rainfall: 114 mm/h
Total rainfall: 589 mm

After revision: assumed maximum precipitation
Maximum rainfall: 153 mm/h
Total rainfall: 690 mm

Thanks for your attention.

This presentation was made possible by courtesy of Sewerage Bureau, Tokyo Metropolitan Government.