Flood Mitigation by Adaptive Use of Urban Infrastructure

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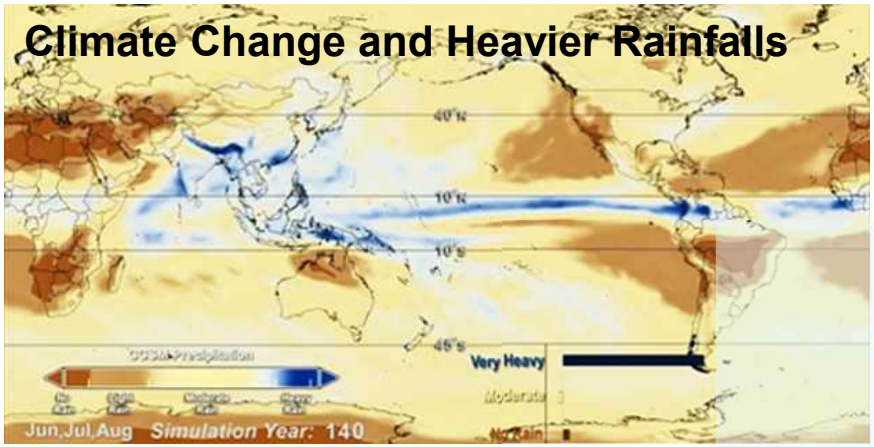
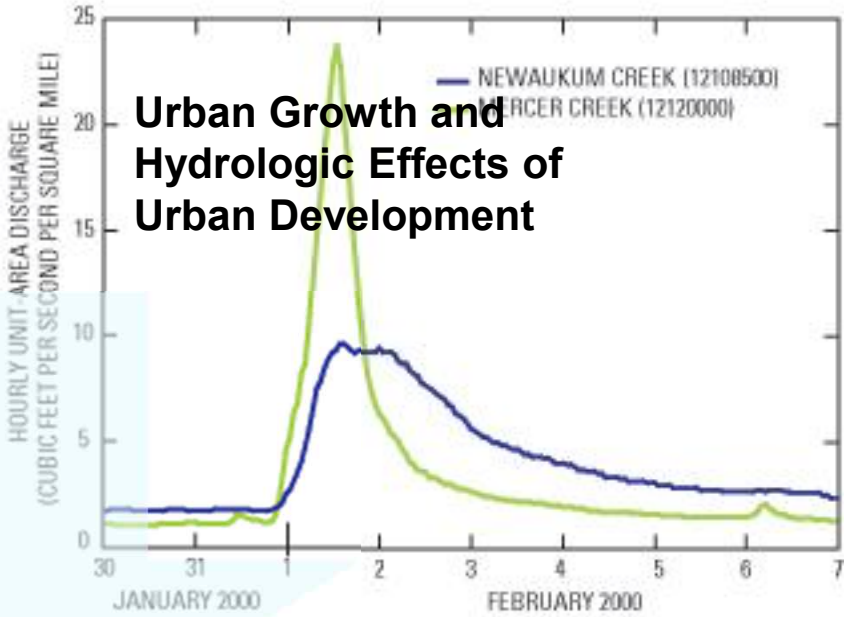
Climate Change and Urban Flooding



Source: NASA, 2013



Source: USGS, 2003


Beijing, China in Jul. 2012


Atlanta, U.S. in Sept. 2009


Ayutthaya Province, Thailand, Oct. 2011

Climate Change and Urban Flooding

No Exception in Korea

More precipitation by fewer more intense events!


Sejong-Ro in Seoul, 2010


Seocho in Seoul, 2011


Gunsan City in Korea, 2012

Losses due to Natural Hazards in Korea

89% damages originated from storm (61.3%) and flood (28.0%)

within the recent 10 years (1998~2007)

Climate Change and Urban Flooding

How about Busan, Korea?

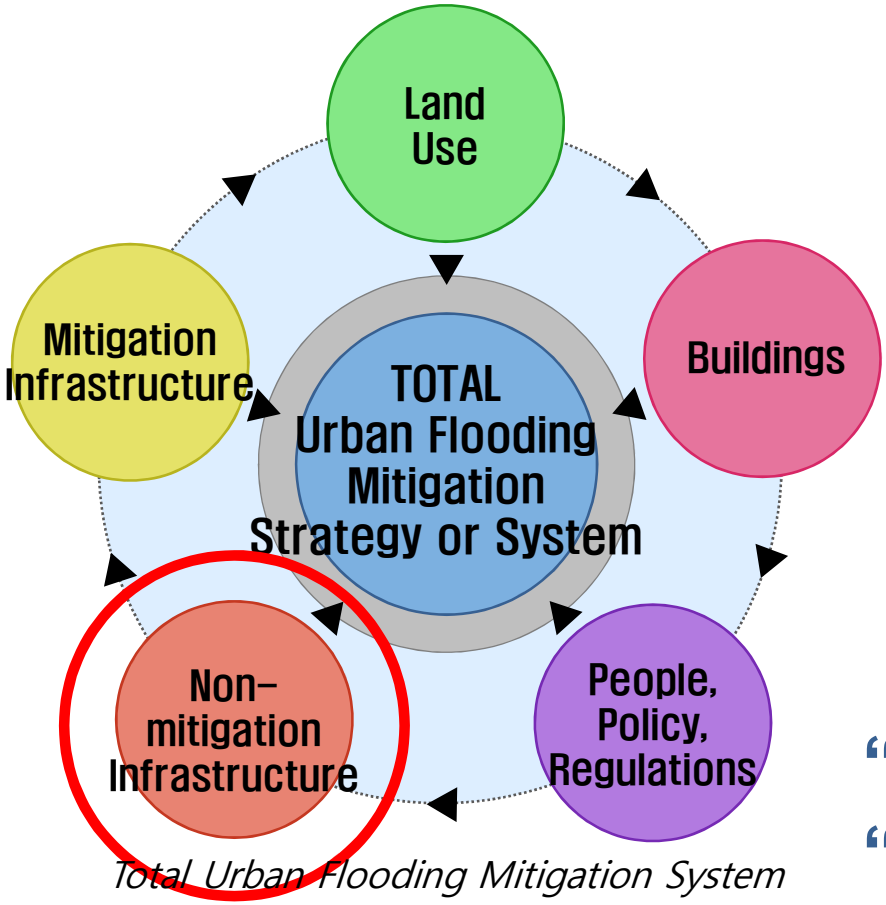
Korea's second largest city after Seoul (3.5million)
Located on the southeastern tip of the Korean peninsula
Situated between the two rivers (Nakdong and Suyeong)
Districts separated and surrounded by mountains

Flooding Problem? Change from Safer to Vulnerable City

4 people killed by flooding near Oncheon urban stream on Aug. 2014

TUFM Strategy

Total Urban Flooding Mitigation Strategy



Total Urban Flooding Mitigation System

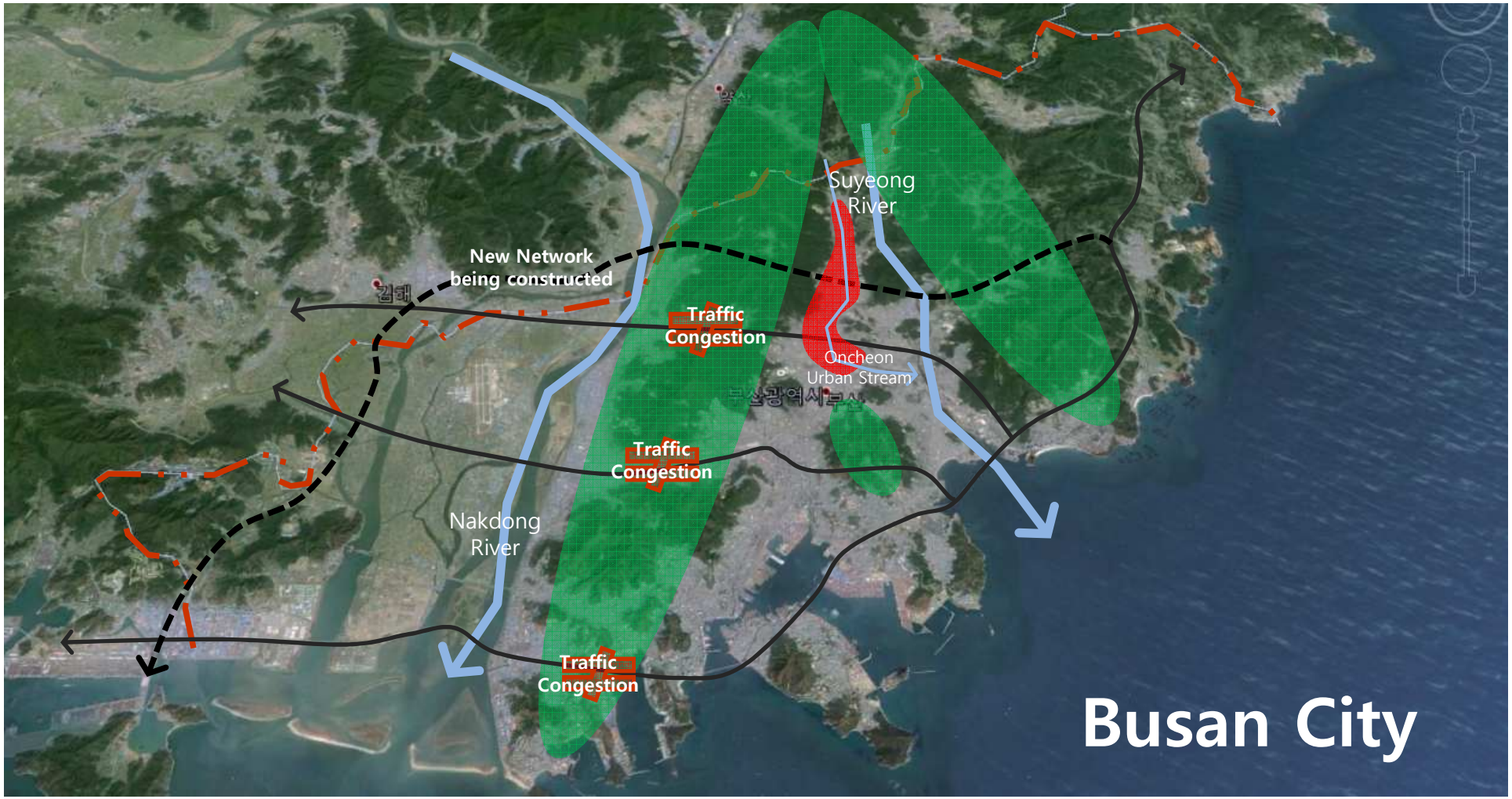
National Urban Disaster Prevention Research Center

"Not only urban drainage infrastructure but also every integral part of the city is to make contribution"

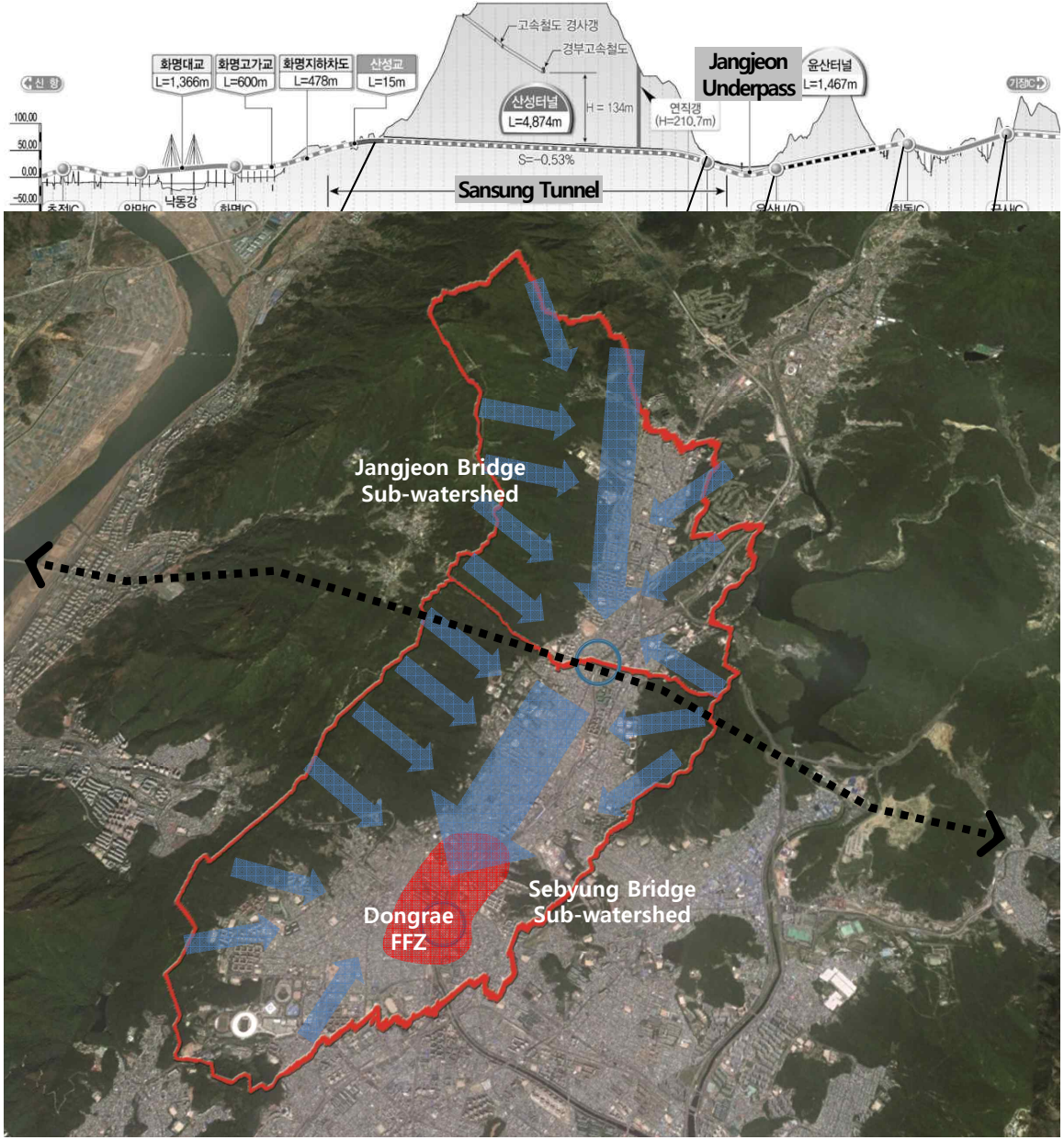
"How about roads?"
"Below or Above the roads?"

Road Networks in Busan

Well developed north-south road networks
Insufficient west-east networks → fourth one being constructed



Road Networks in Busan



New network passing under the vulnerable area near Oncheon urban stream

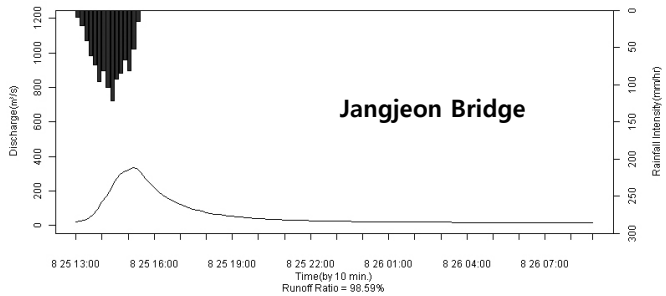
"Any chance to mitigate the flooding problem?"

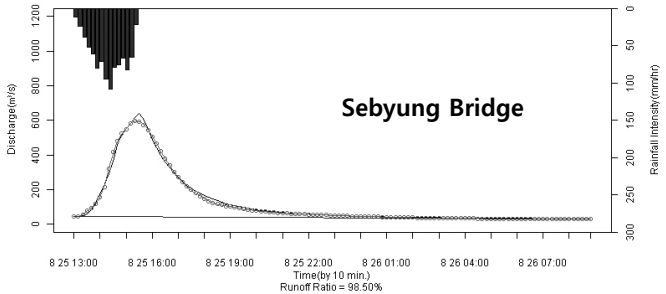
Adaptive Use of the Network

Hydrological Characteristics of Oncheon Watershed

Oncheon Urban Stream

- Branch of the Suyeong River
- Total Length: 14.85 ㎞
- Watershed Area : 56.28 ㎢
- Gradient
  - Origin to Jangjeon Bridge : 1/100
  - Jangjeon Bridge to Sebyung Bridge : 1/300
  - Sebyung Bridge to Suyeong River : 1/1,400





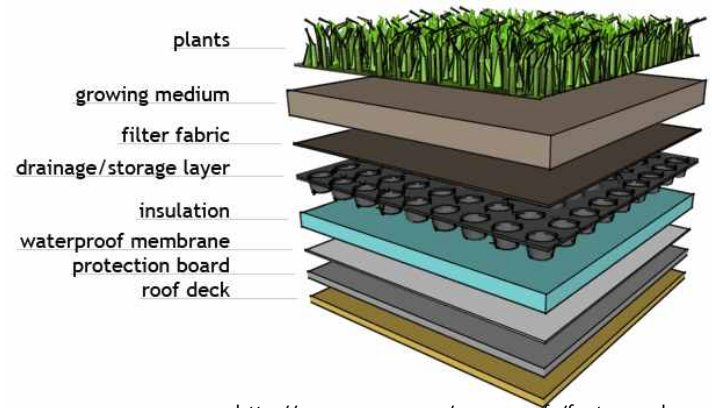
Adaptive Use of the Network

Scheme for Flooding Mitigation (J. Biddle et al., 2008)

Slow it down

Spread it out

Soak it in



http://greengarage.ca/greenroofs/features.php

http://www.doremihouse.com/bbs/b_humor/196557

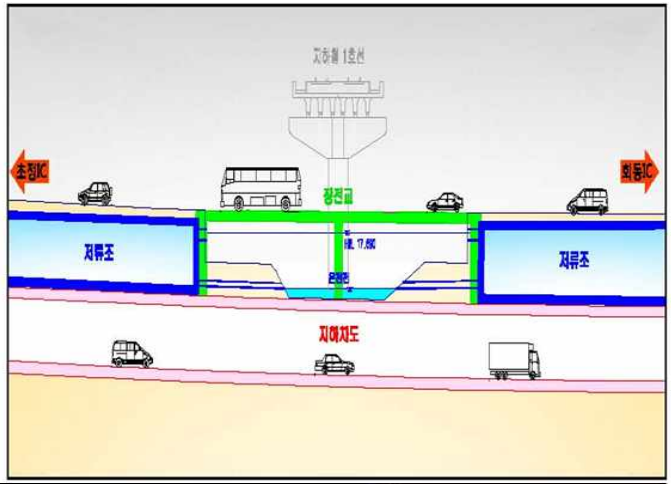
J.Biddle et al., 2008)

How to Secure the Land and Money?

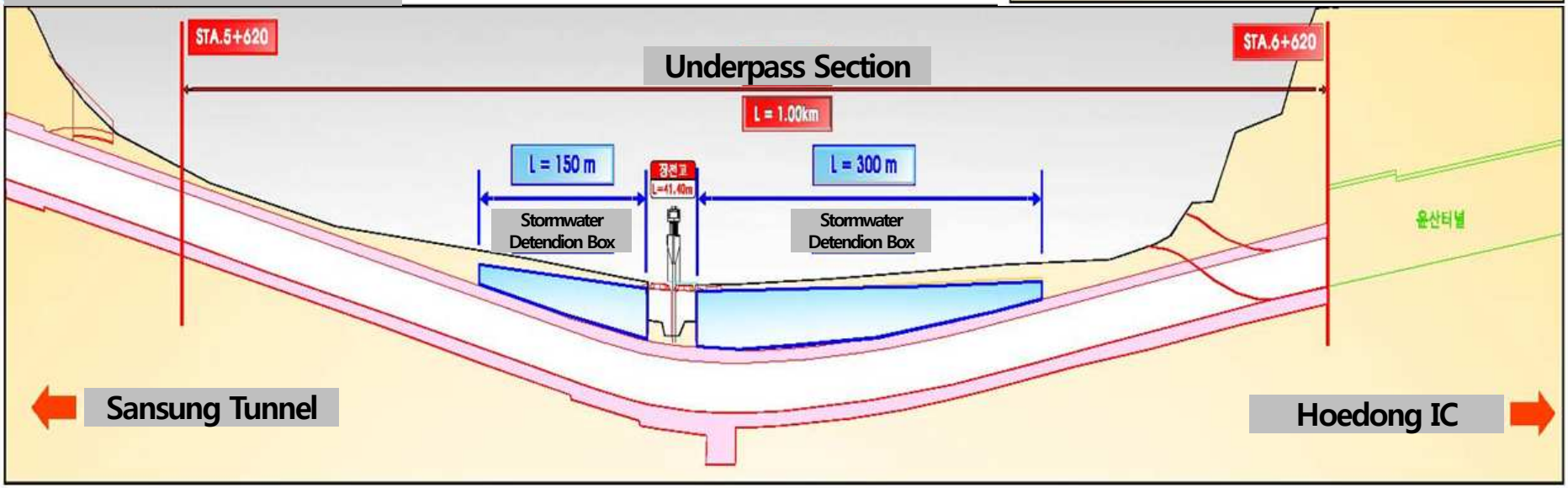
Adaptive Use of the Network

Let's Use the Space above the Network!

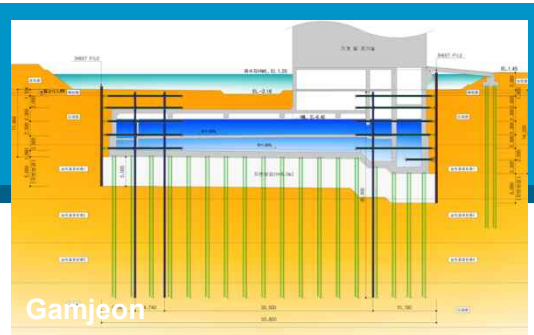
- Location : Near the Jangjeon Bridge
- Dimension : L=450m, W=20m, H=5m
- Storage Volume : approx. 40,000 ton
- Cost : 5 million US dollar (addition to the underpass construction costs)



Cross Section



Benefits



Flood Risk Mitigation

Best Location to be!

- The lowest point above the Sebyung Bridge Sub-watershed

Rainwater Harvest and Reuse

Rainwater Harvesting during ordinary times

- Harvest ground water from the tunnels and rainwater and reuse it for maintaining the stream
- annually 0.5 million US dollar saving expected

Construction Cost Saving

Location	Volume (ton)	Cost (million U.S. Dollar)	
Olympic Park	18,200	9.5	Completed
Busan Univ.	22,600	9.9	Completed
Gamjeon	17,400	29	Under construction
Samsung Market	7,000	10	Under construction
Suyeong Elementary School	18,000	21	Under construction