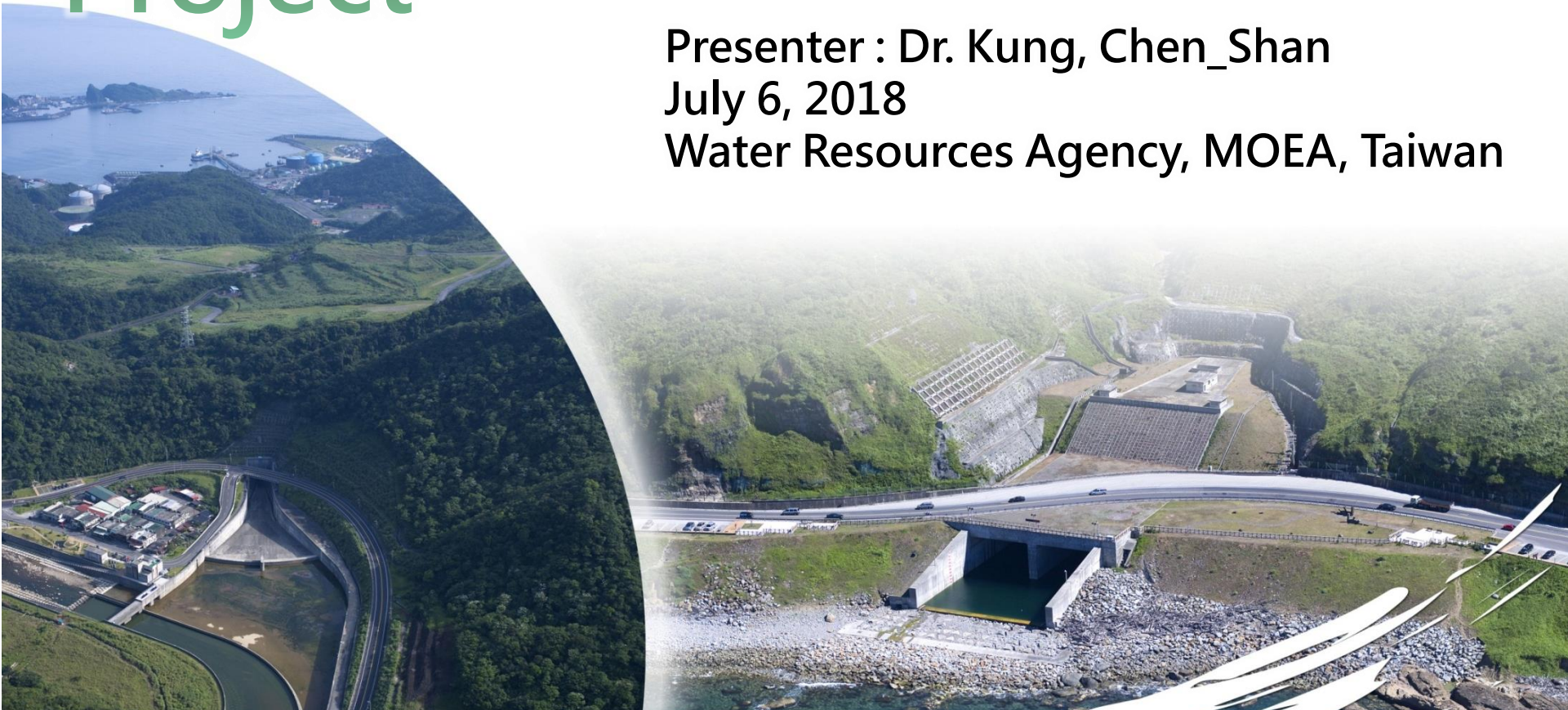


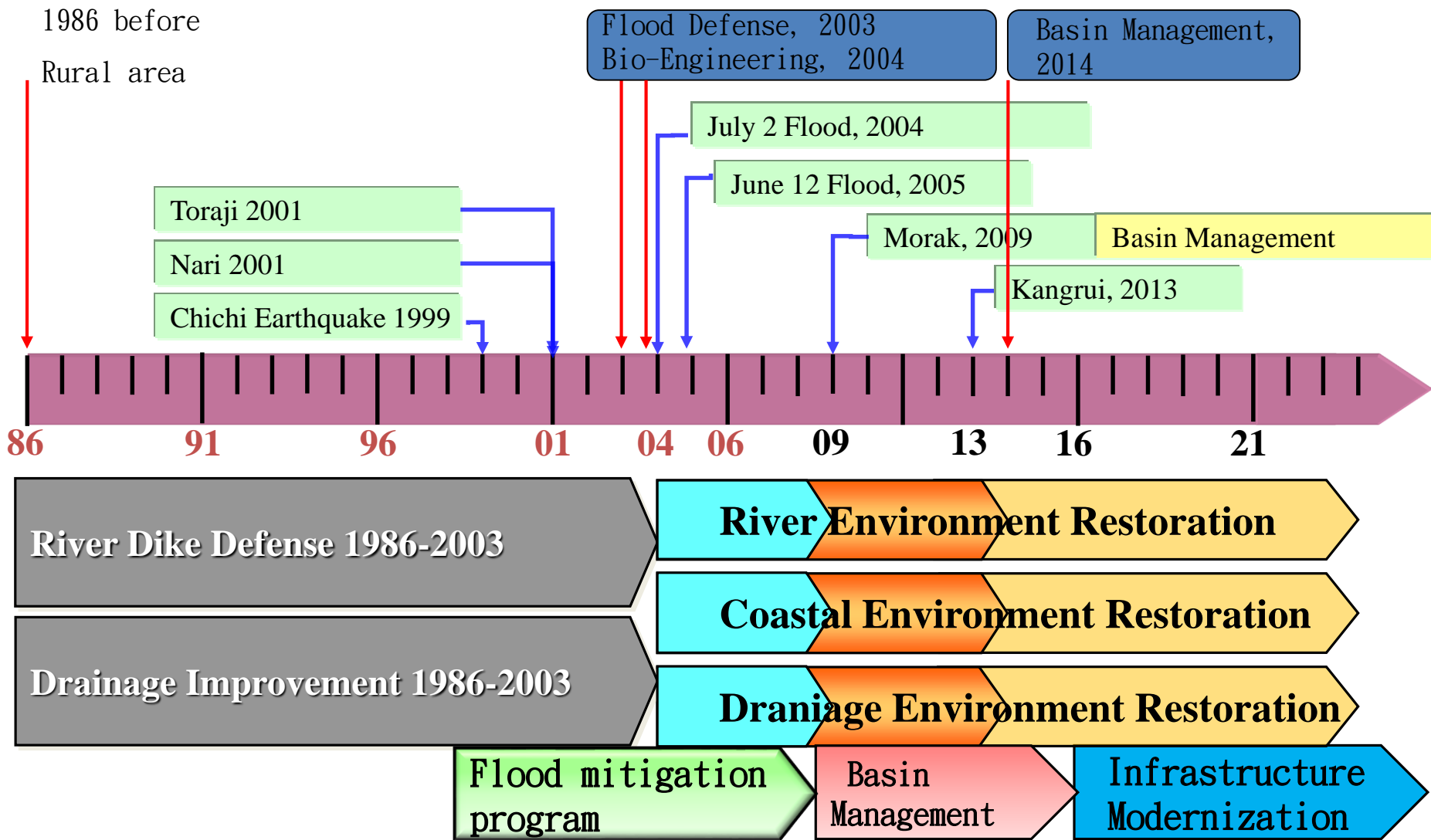
# YuanShanTze flood Diversion Project

Presenter : Dr. Kung, Chen\_Shan  
July 6, 2018  
Water Resources Agency, MOEA, Taiwan

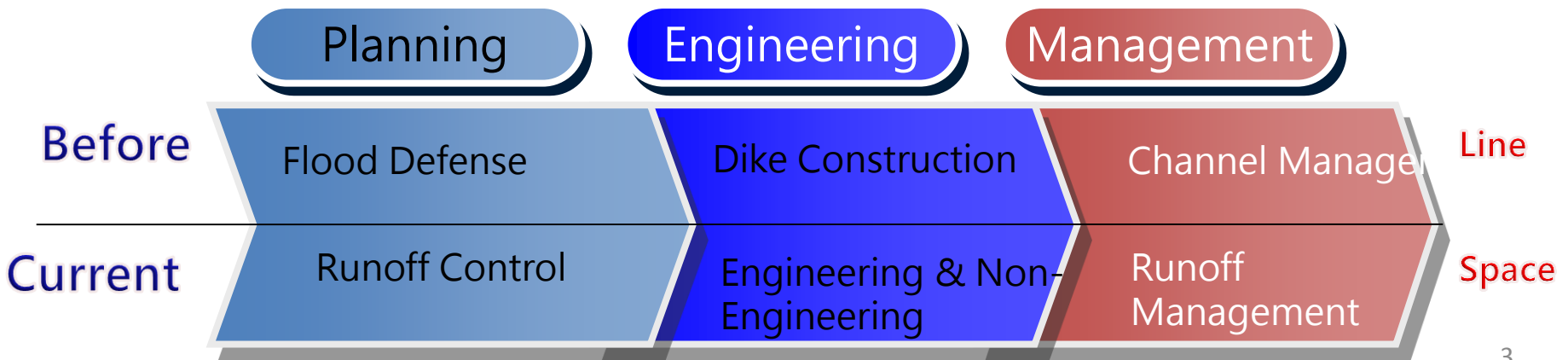
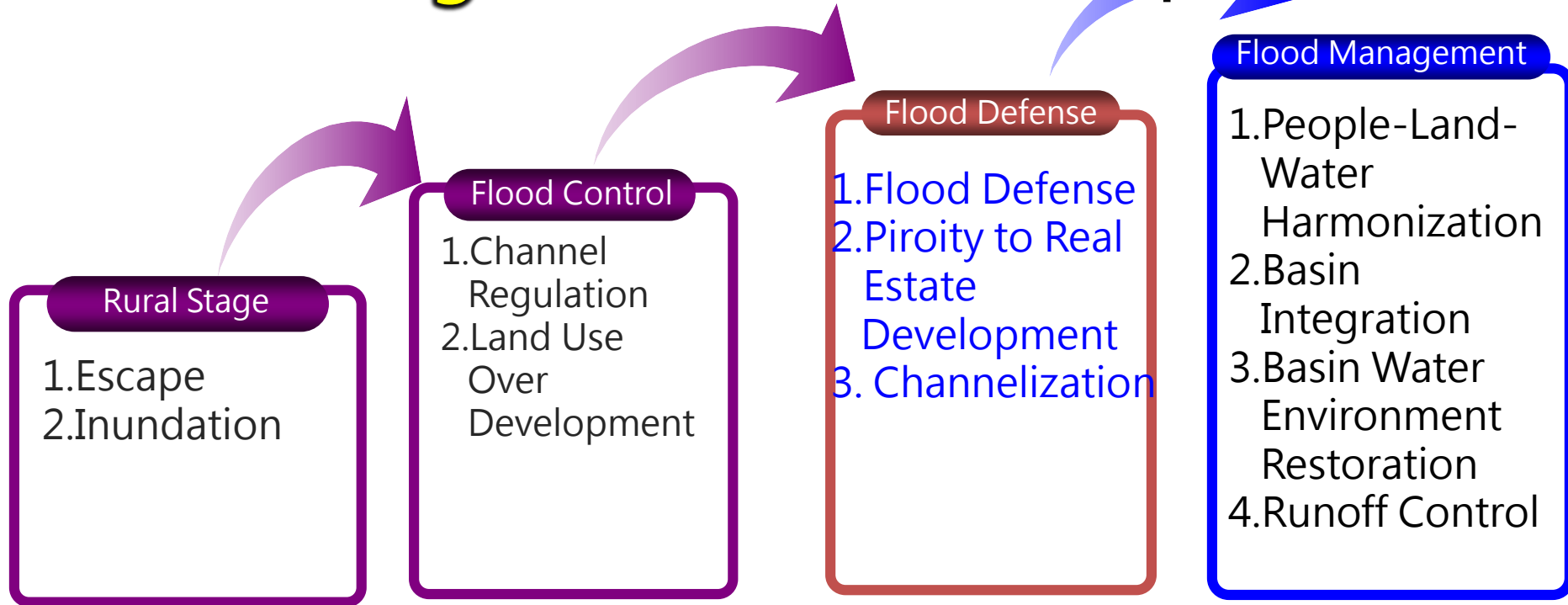


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# Flood Defense Policy



# Basin Management-From Line to Space



# Policy of Flood Defense for Tanshui River Downstream Area

## Tanshui River Catchment

## 淡水河流域圖



- 1998-2006 for Keelung River flood defense work
- YuanShanTze flood Diversion Work

- Flood Defense Work, 1976-1999
- 200 years Flood Defense
- No over flow for 500 years flood



**Keelung River Basin, 491 km<sup>2</sup>, Main Stream 86.4 Km, one of Tributaries of Tanshui River**

# Flood characteristics of Keelung River

Heavy rainfall on the upstream area

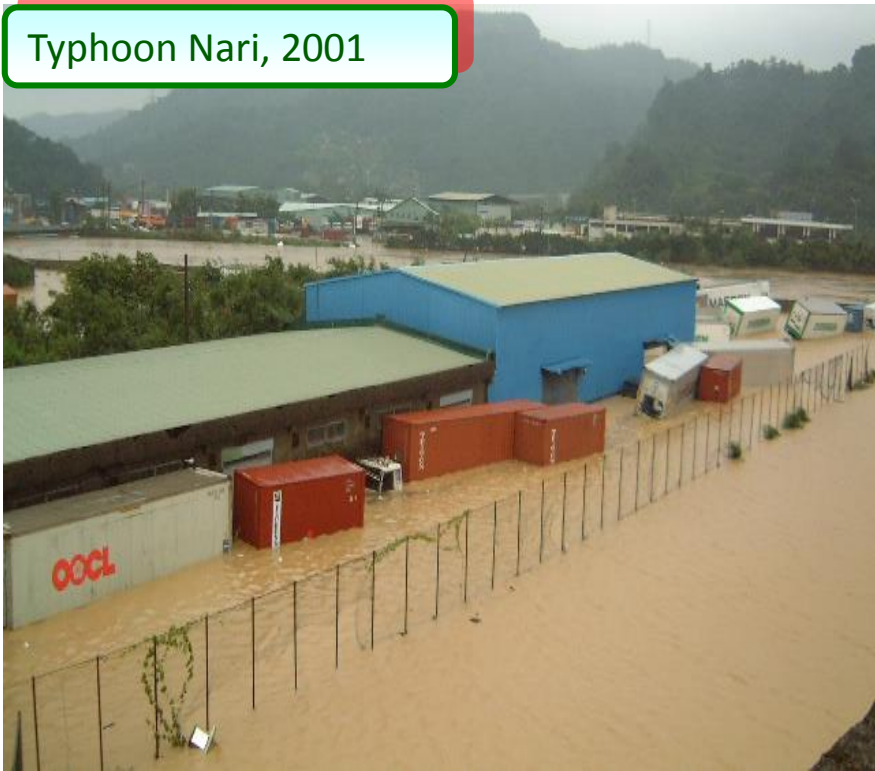
Meandering at middle stream river valley area

Estuary river on the downstream area

Highly urban development on the middle and downstream river valley

River channel was narrowed by human development

Typhoon Nari, 2001



Typhoon Nari, 2001

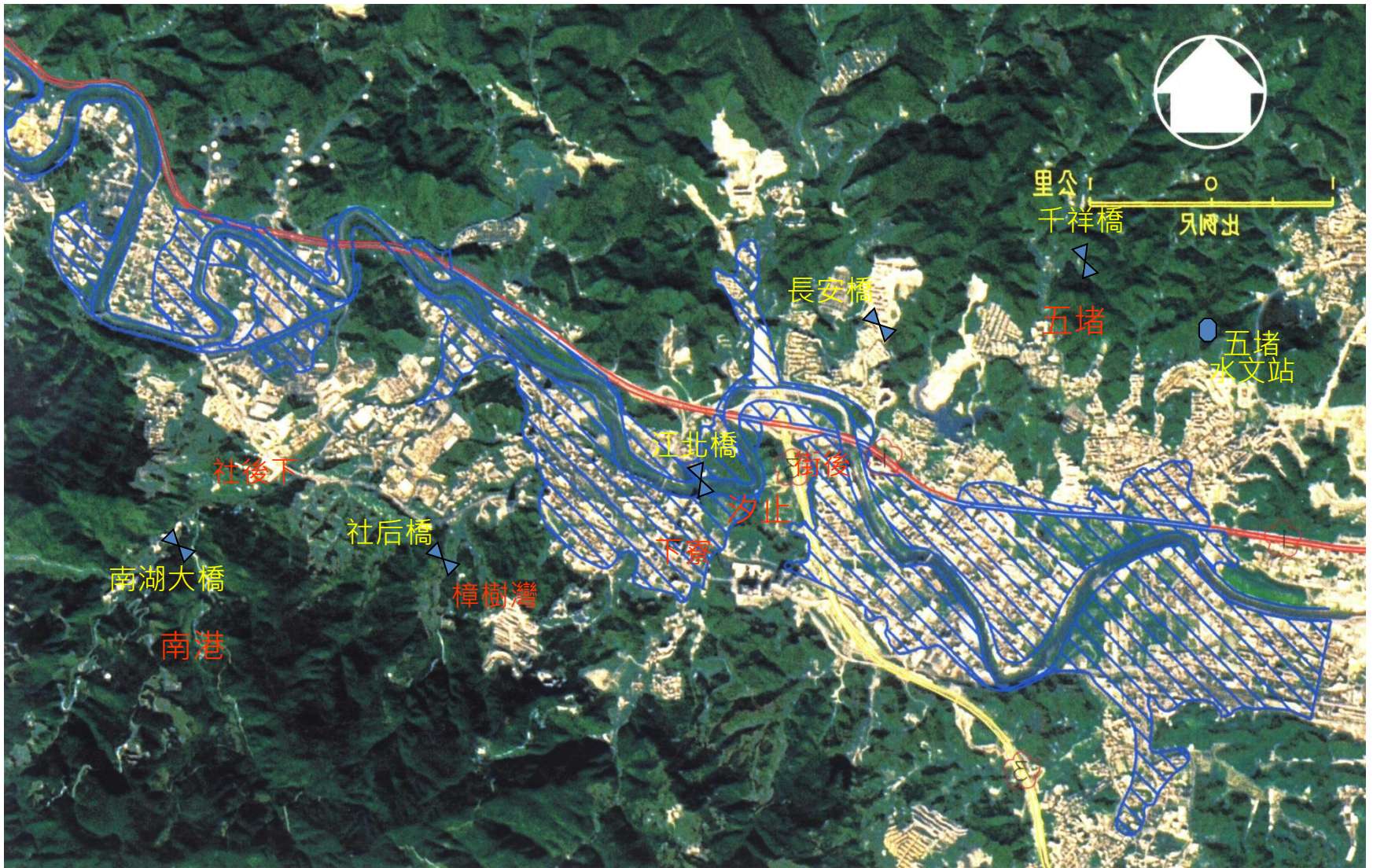


# Flood Disaster of Keelung river

Typhoon Event	Lynen(87)	Ruibe(97)	Barbis(98)	Xangsane (00)	Nari(01)
Inundation Area(Ha)	1,322	636	624	699	4,710
Depth(m)	0.2~7.5	0.5~7.5	0.5~3.8	0.5~7.5	0.3~8.5
Death (Person)	21	0	0	59	64
Damage	US\$ 30 billions				

Typhoon Xangsane, 2000



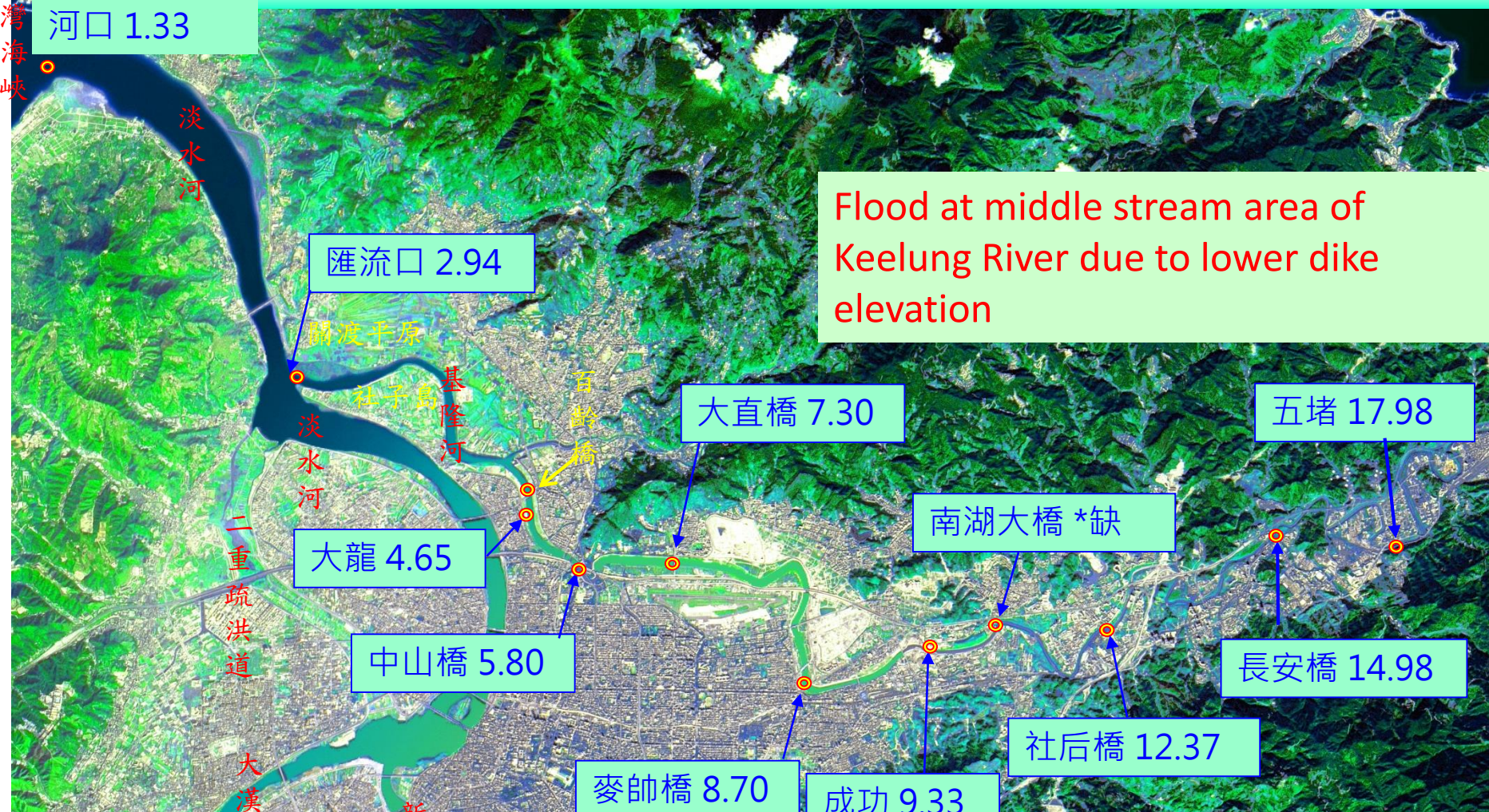


**Flood Area of Typhoon Ruibo and Barbis, 1998**

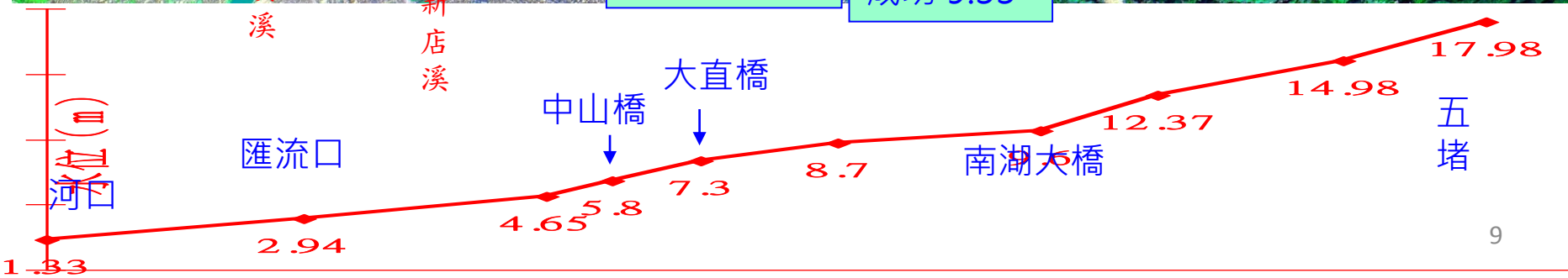


# Maximum Discharge of Typhoon Xangsane $Q=2600 \text{ cms}$

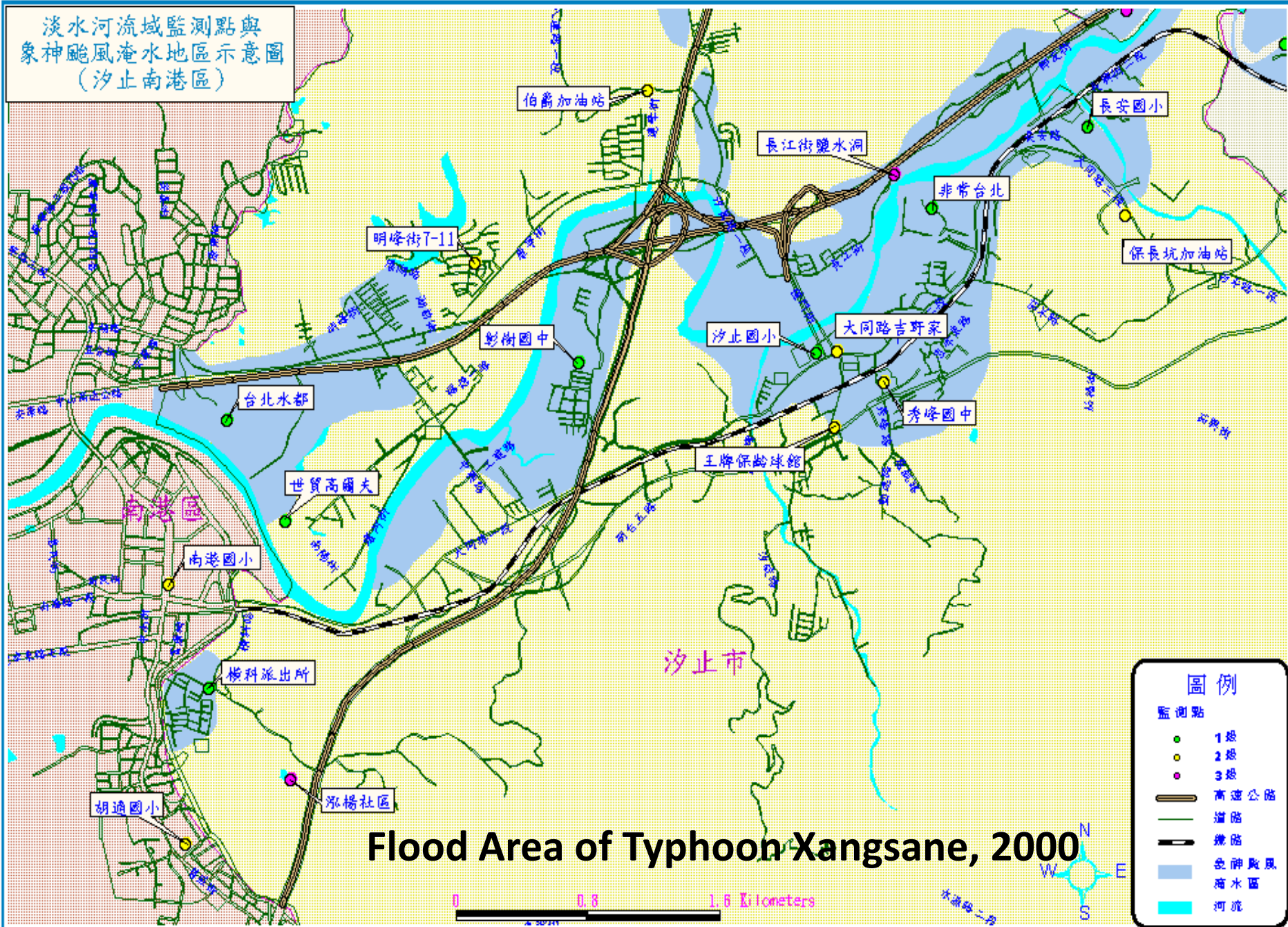
台灣海峽



Flood at middle stream area of Keelung River due to lower dike elevation

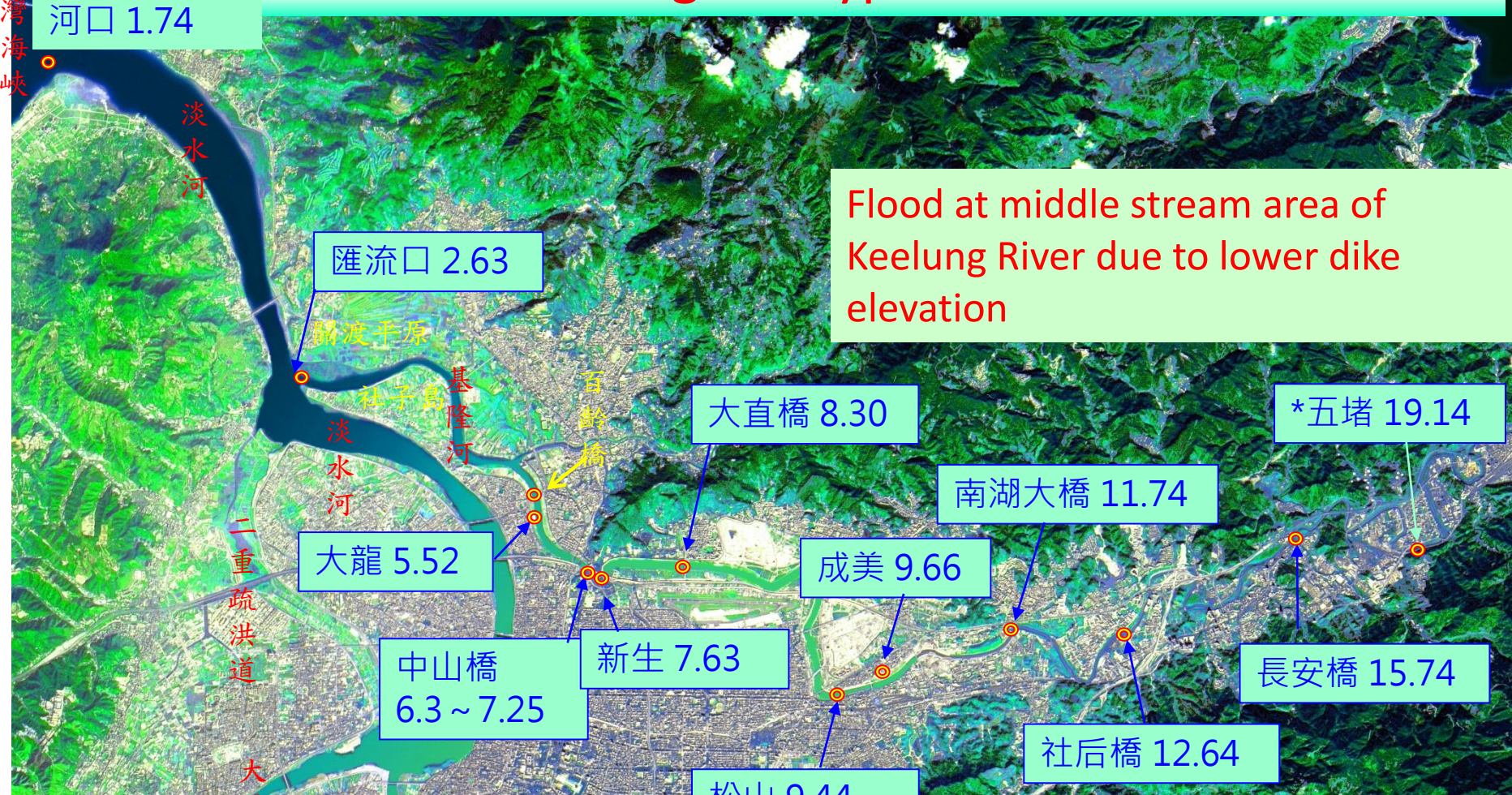


淡水河流域監測點與象神颱風淹水地區示意圖  
(汐止南港區)



# Maximum Discharge of Typhoon Nari $Q=3300 \text{ cms}$

台灣海峽



Flood at middle stream area of Keelung River due to lower dike elevation



**Badu Railway bridge**



**Wudu Railway station**



**Jiangbei Bridge, Xizhi**



**Xangsane Rd, Xizhi**



**Flood of Typhoon Nari on Keelung River**



# Flood Defense Work of Keelung River

**Project Area: Nankang, Xizi, Ruifang, Houdong, Pinxi Districts and Keelung, total length is 59.5 km.**

**Project contents:**

- **YuanShanTze Diversion Work**
- **Dike Work**
- **Drainage and pump station on Tributaries**
- **Bridge modification work**
- **Yuanshan bottom neck improvement work**
- **Flood Warning system**

# Dike improvement Work



Qidu, Dahua (Before)



Baifu (Before)



Qidu, Dahua (After)



Baifu (After)

# Dike Improvement Work



Guogang (Before)



Guogang, Qiaodong (Before)



Guogang (After)



Guogang, Qiaodong (After)



# Dike Improvement Work



Qiaodong (Before)



Beishan (Before)



Qiaodong (After)



Beishan (After)

# YuanShanTze Diversion Work

Diversion  
Principle

Divert  $Q=1310$  cms to East Sea from  $Q=1620$  cms for 200 years flood. Downstream  $q=310$  cms for Base flow.

Main Work

Entrance and Dissipation work  
2.48 Km long Concrete Tunnel with 12 m diameters  
3 check dams with 3 m height and 75 m width

Construction  
Period

Begin June 5, 2002, complete Oct 28, 2005.

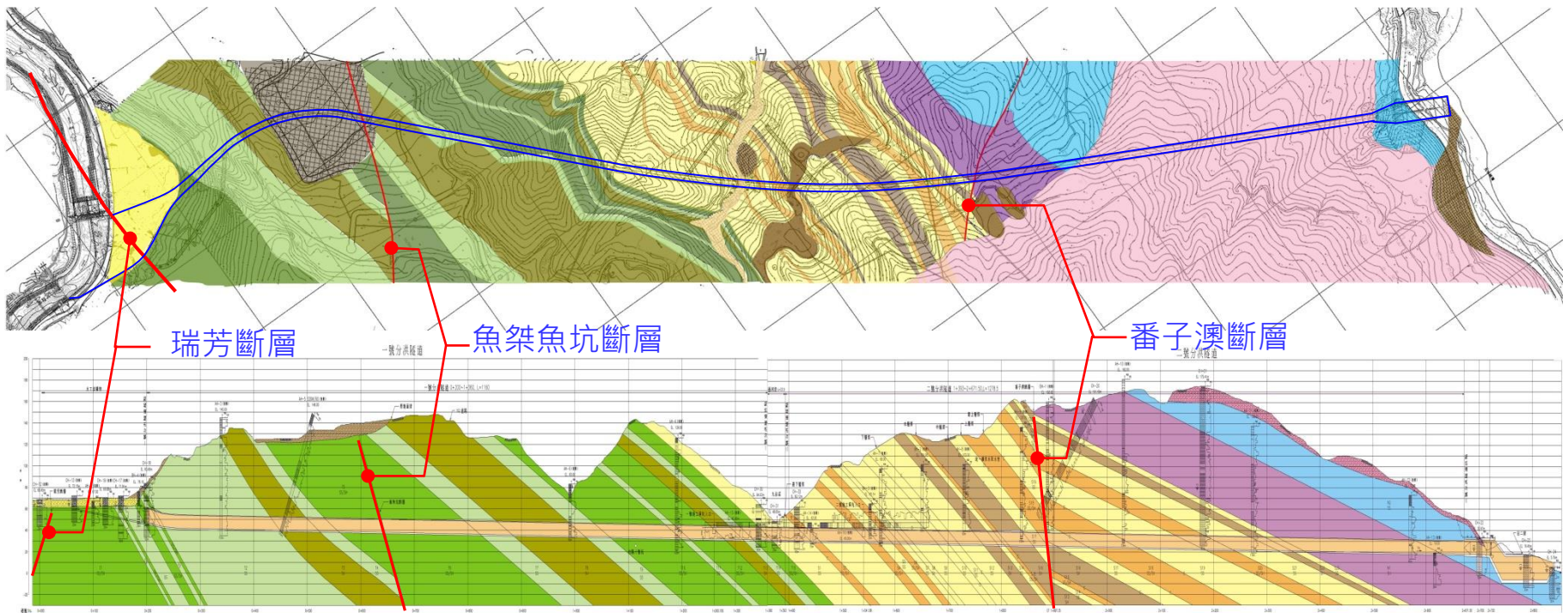
Budget

US\$ 2 billions

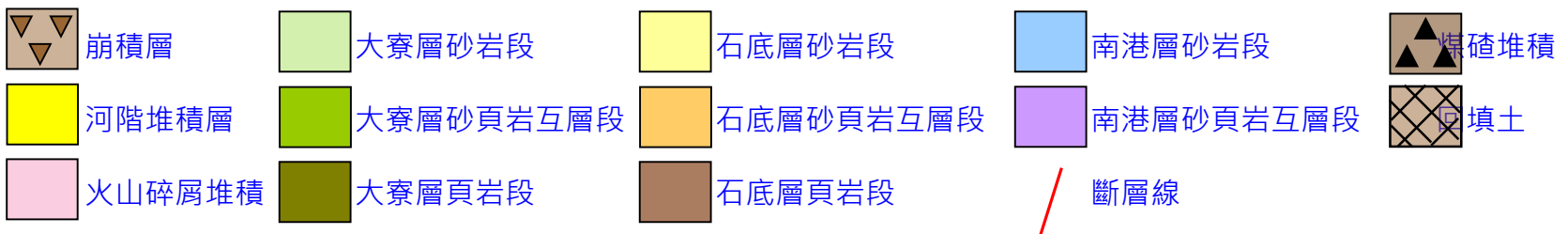
# Layout



# Geological Condition



## 圖 例



# YuanShanTze flood Diversion photographs of progress

Mar,2003-Before the tunnel excavation



Nov,2003-Lining of tunnel



May,2003-The tunnel excavation



May,2003-Completion of tunnel

# YuanShanTze flood Diversion photographs of progress

May,2005-Diversion Weir



Jan,2005-Outlet Construction

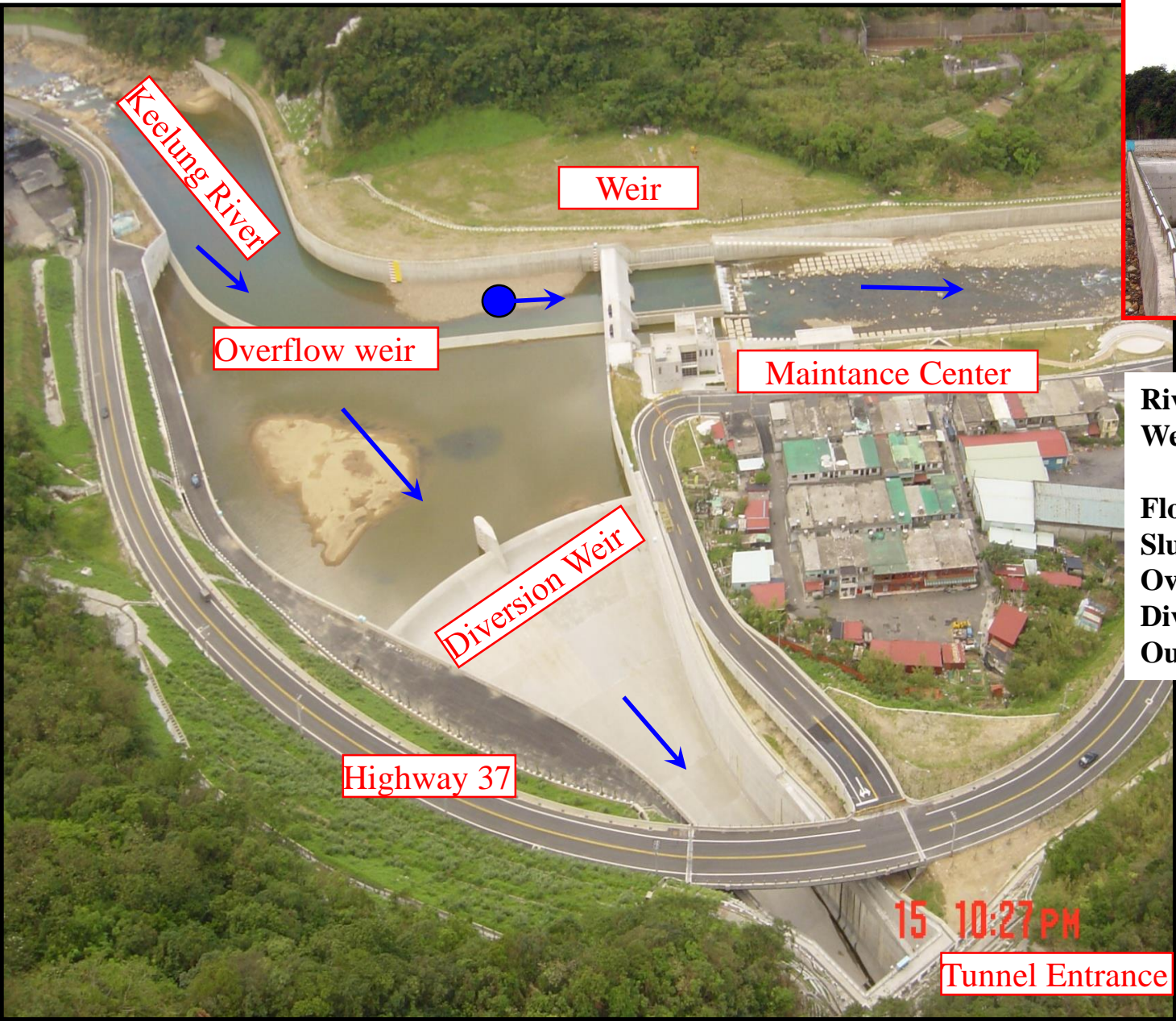


Jan,2005 Completion of downstream weir



Jan,2005-Top of outlet

# Bird View of YuanShanTze Diversion Work



River Bed	EL=60.0M
Weir	H= 8.0M
	L= 30.0M
Flood way	8.0Mx2.5Mx2
Sluice Way	6.0Mx3.0Mx2
Overflow weir	EL=62.5M
Diversion Weir	EL=63.0
Outlet	EL=4.0M

15 10:27 PM

Tunnel Entrance

# After Completion



Bird View of Entrance



Bird View of Outlet





Panoramic View of YuanShanTze Project

One management Center with 3 personal Work

Flood  
operation

1. Automatic Overflow
2. Open Sluiceway for river flushing
3. Close Sluice way when water level to **EL63.0 m, starting overflow**
4. Open Sluice way for water level down to **EL62.5 m, for flushing sand**

Over flow, 2005



Over flow, Sep 01, 2005



# Typhoon Sula



**Aug 1, 2012 PM 2:30**

**water level 62.5M**

# Typhoon Sula



**Aug 2,2012 AM6:30**

**water level 65.0M**

# Typhoon Sula



Aug 2, 2012 AM 6:30

water level 65.0M

# Typhoon Sula



**Aug 2, 2012 AM 6:30**

**water level 65.0M**

# Visiting Program

Feb 19, 2016 Defense University



April 29, 2016 Chungyuan University



May 26, 2016 APEC Group



July 13, 2016 Disaster Prevention Center



## Social-Economic Benefit

**The land price of Xizhi area was lower down and people migrated out of Xizhi due to serious flood from 1999 to 2005.**

**The flood is diminished after YuanShanTze diversion project.**

**The population of Xizhi area was 176,130 from 2002 to 2004. The population was increased to 196,028 after 2005.**

**The house price increase from 38,000/m<sup>2</sup> to 79,400/m<sup>2</sup> from 2005 to 2006.**

**Reduce Dike Construction Cost around US\$ 1.5 Billions**



## Social-Economic Benefit

**44 diversion events until 2017. Total diversion volume is 200 millions m<sup>3</sup>. Reduce downstream flood hazard for 13 years.**

**Up to 1500 people visit YuanShanTze Work per year. Provide education to the ordinary people and young engineers.**

**The economic benefit: around US\$ 1.6 Billions from reducing damage of downstream areas.**



**Thank you for  
your attention**



**Presenter : Dr. Kung Chen Shan**

**July 6, 2018**

**Water Resources Agency, MOEA, Taiwan**