



Bring Nature to Cities

Deep Forms: Nature Based Solutions

Kongjian Yu

Peking University College of Architecture and Landscape
and Turenscape

2019.10.29 World Bank, at Ningbo

How can we survive?



Over 80% of the Chinese cities suffer air pollution, kills 1.2 million people each year



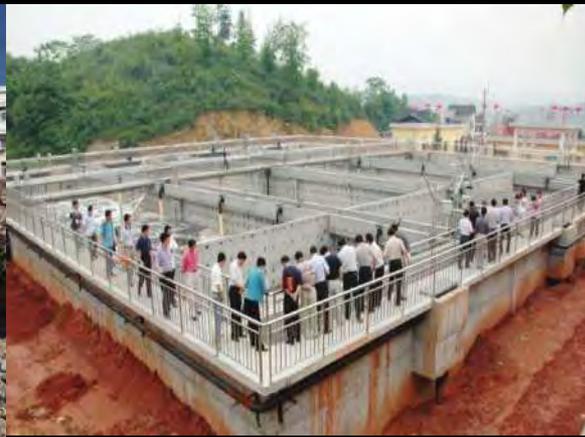
Flood: annual flood damage cost 100 billion US \$

Draught: 400 of 662 cities in shortage of water

Pollution: 75% of the nation's surface water is polluted, 64% of cities' underground water is polluted

Habitat loss: 50% wetland disappeared in the past 50 years

Conventional solutions of single-minded engineering are not sustainable



Alternative---

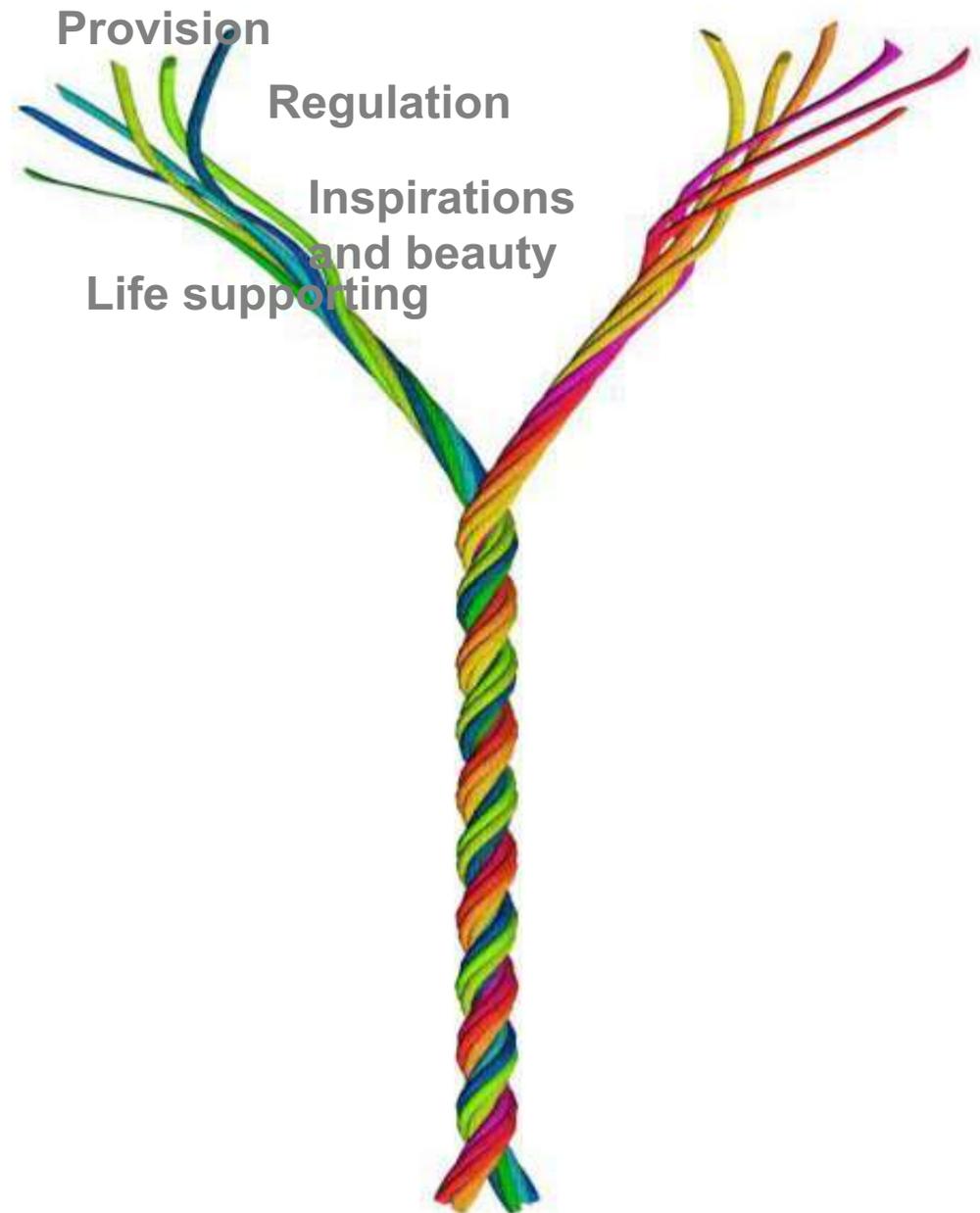
**Nature based solutions:
by planning and
designing landscape as
ecological infrastructures
(Green Infrastructure) to
provide multiple eco-
services:**

Provision

Regulation

Life supporting

**Cultural and spiritual
services**



- **Such solutions result in deep forms that stands in contrast to shallow form, “which has only the surface perceptual order and lacks the solidity of coherent process beneath the surface” (Lyle, 1985).**



Deep form



Shallow form and fake

Two strategies to create the ecological infrastructure, thus deep forms

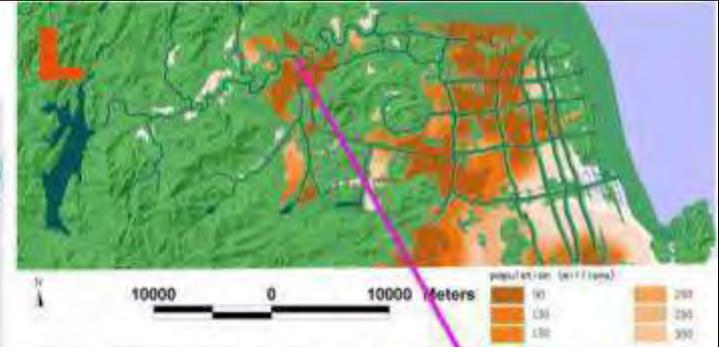
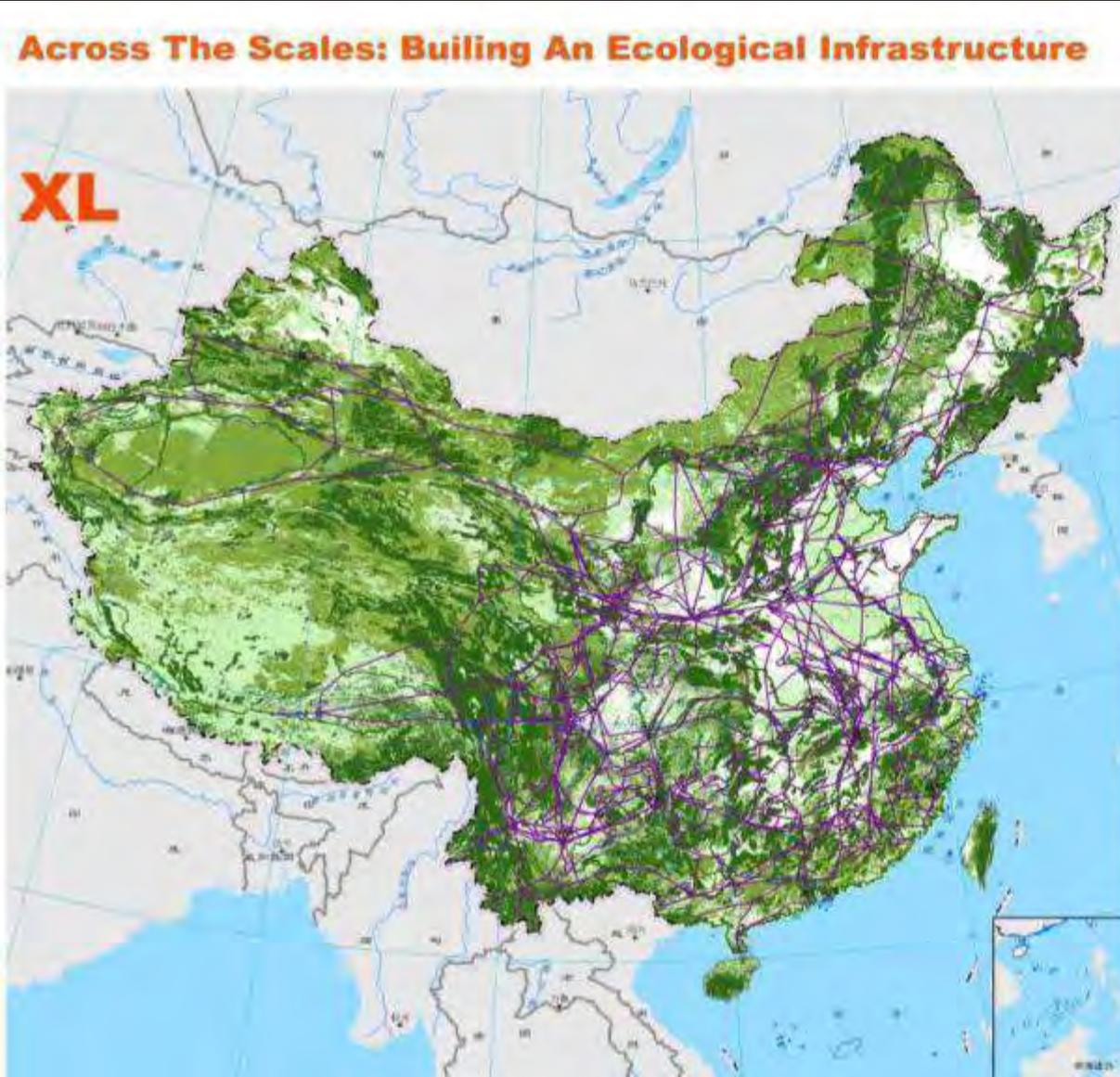
- 1. Planning to create configurative deep forms**
- 2. Design and engineering to create transformative deep forms**

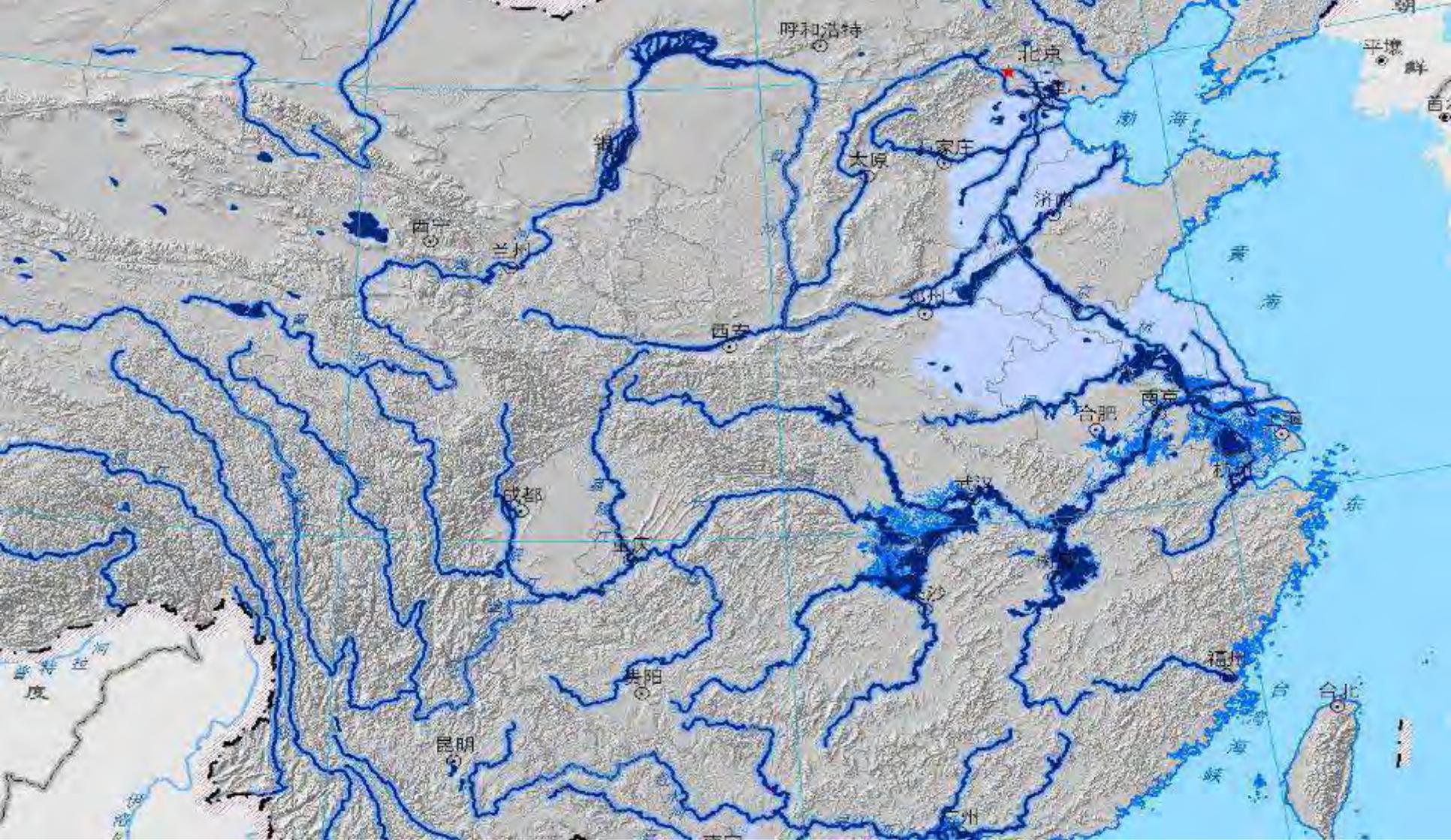
For about 20 years, my team have being testing such solutions in over 200 cities and showcased numerous replicable models for transforming our environment at various scales



1. Planning to create configurative deep forms

Ecological Infrastructure across scales





National water security pattern

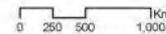
- 1- year flood, 0.8% of the national land;
- 10 -year flood, 2.2% of the national land;
- 50-year-flood , 6.2% of the national land;

洪水淹没区内GDP分布

图例

- ★ 首都
 - ⊙ 城市
 - 国界
 - 省界
 - 海岸线
 - 河流
 - 湖泊
- GDP
- 小于150元/平方公里
 - 150 - 300元/平方公里
 - 大于300元/平方公里

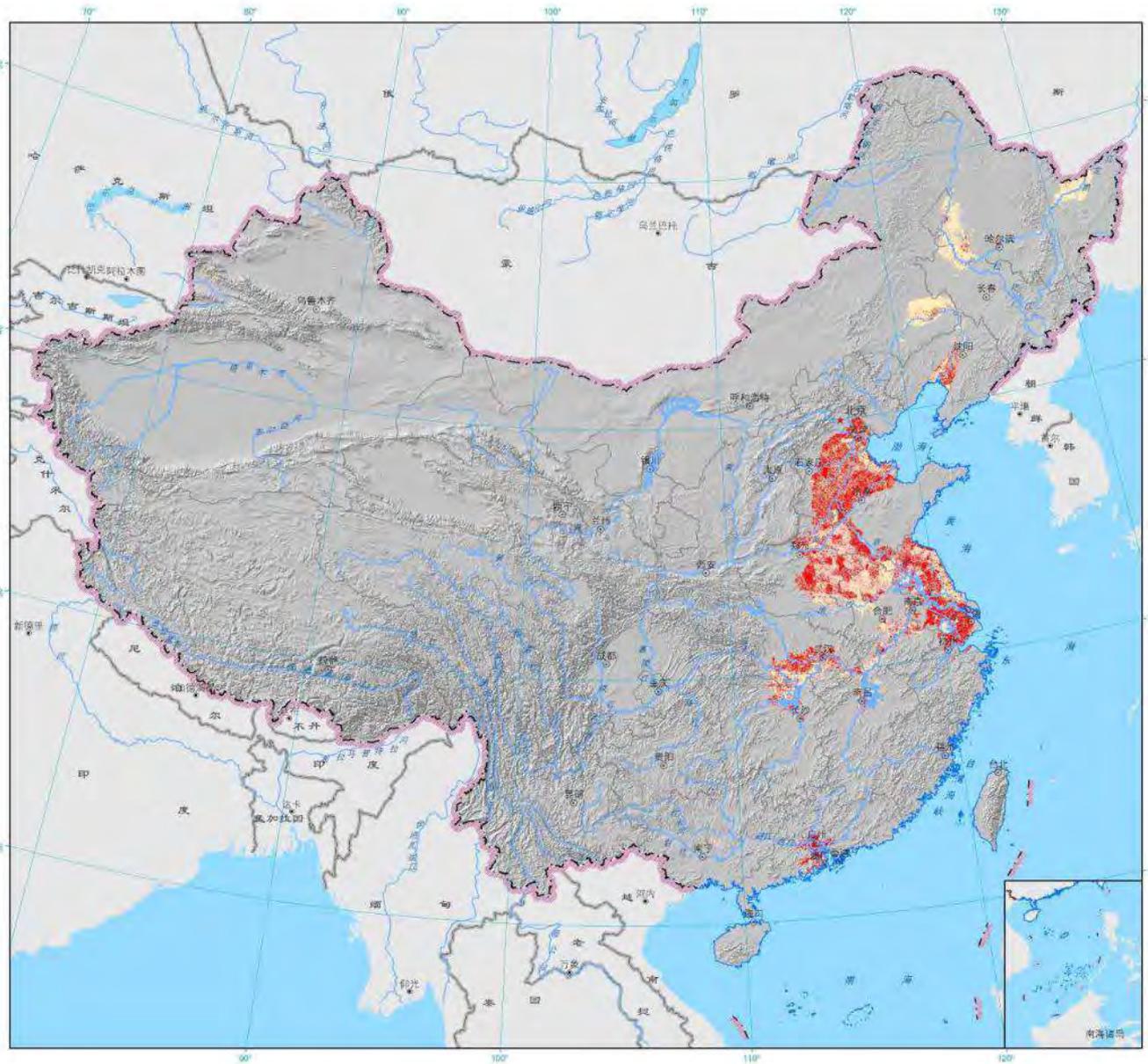
比例尺:



坐标系:
Krasovsky_1940_Albers

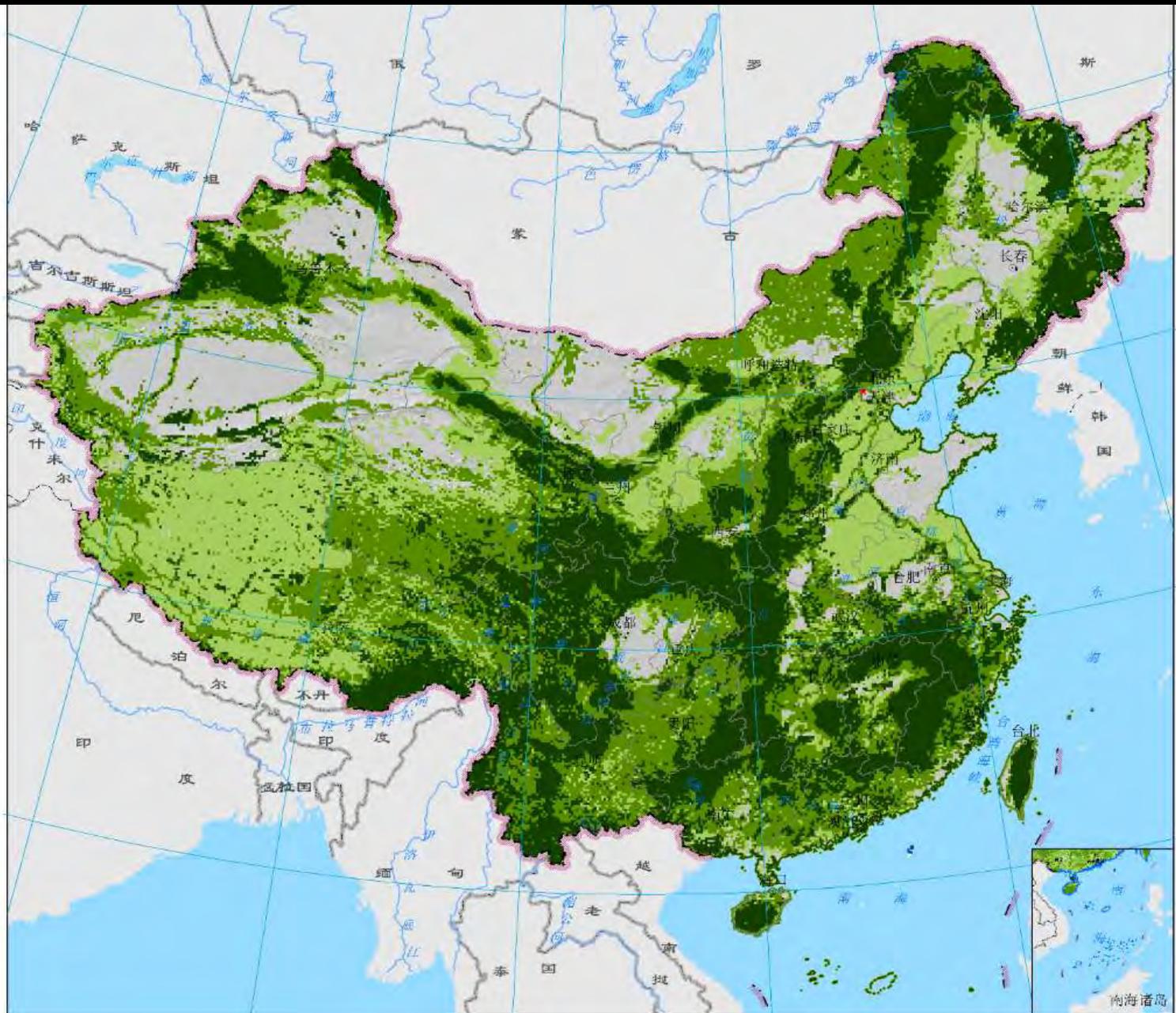
制图单位:
国家环境保护总局
北京大学景观设计学研究院

制图时间:
2007年11月



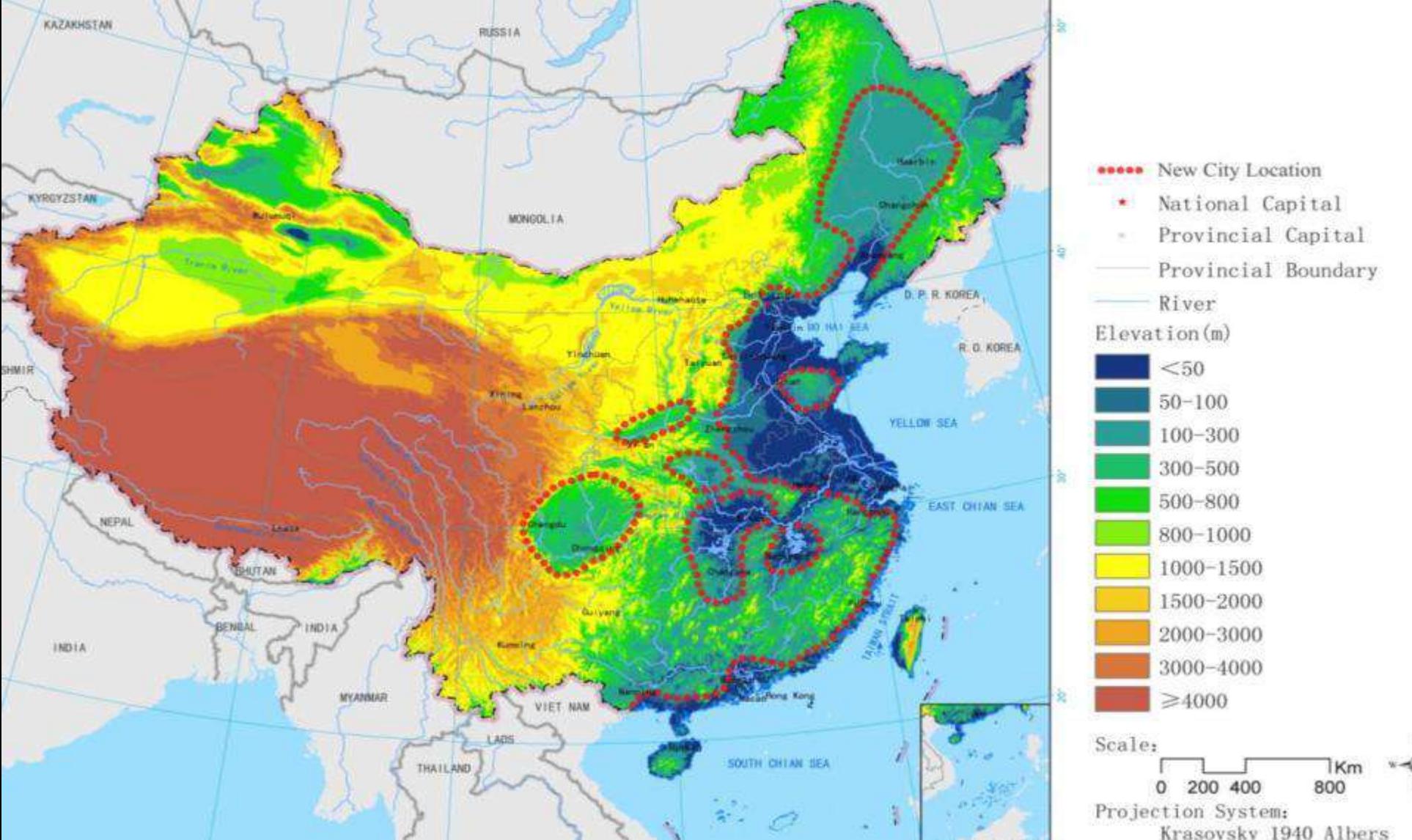
the national Ecological Infrastructure

以为生态安全为核心的
中国国土生态安全格局



- ★ 首都 Capital
- ⊙ 省会城市 Provincial
- 省界 Provincial Bou
- 理想格局 Ideal SP
- 满意格局 Satisfied
- 底线格局 Minimum SP

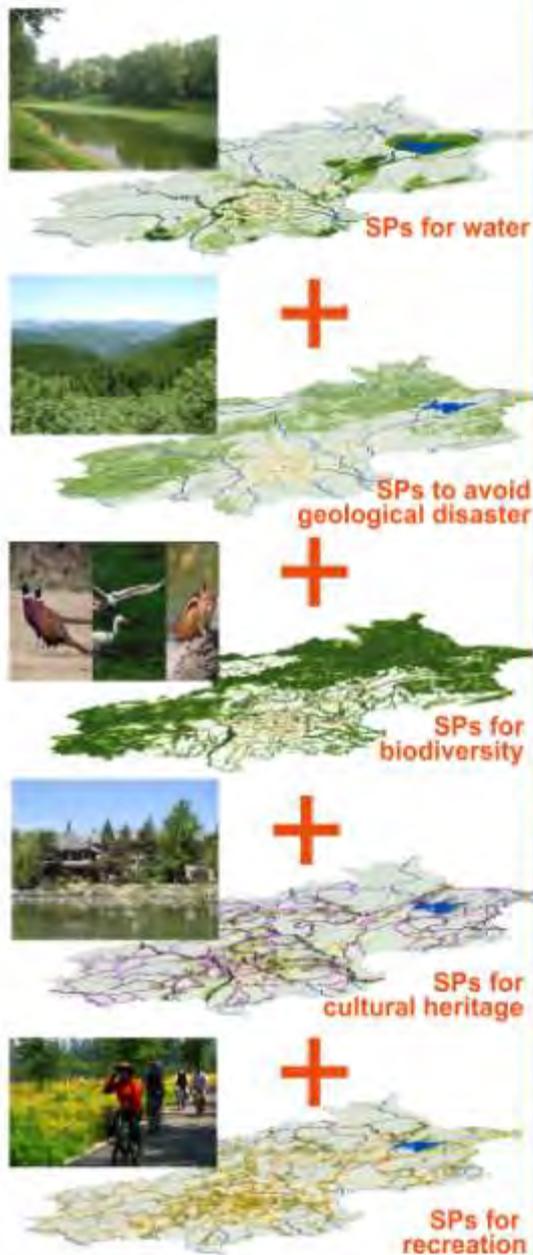
比例尺 Scale:
0 205 410 820 Km
坐标系统 Projection System
Krasovsky_1940_Alber



The Foothills Strategy: where to build another 500 cities for 0.5 billion new immigrants (Kongjian Yu, Capitalizing on foothills: restoring the relationship between people and land. Harvard International Review; Summer 2012, Vol. 34 (1); 40-45)

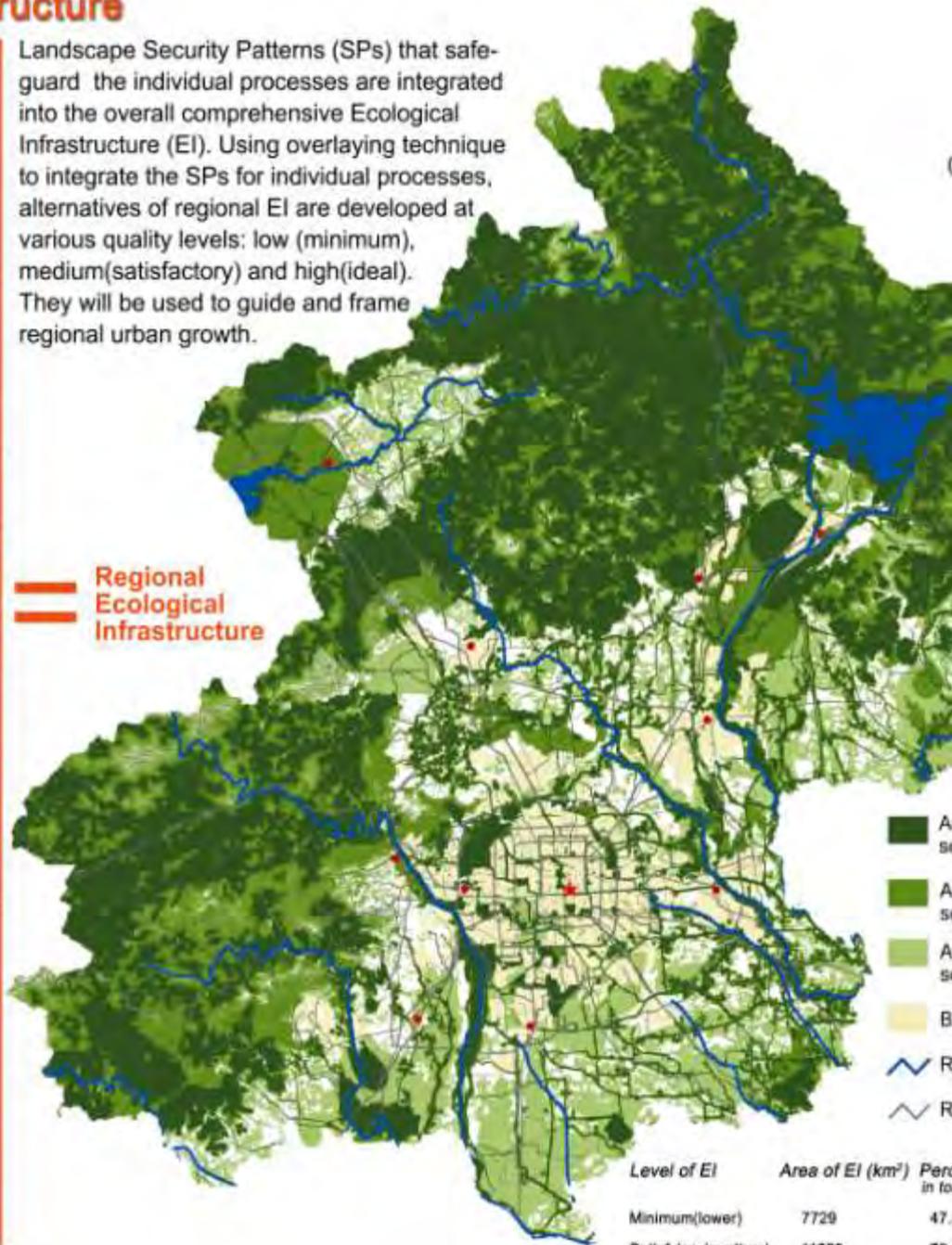
Regional Ecological Infrastructure

Ecological infrastructure



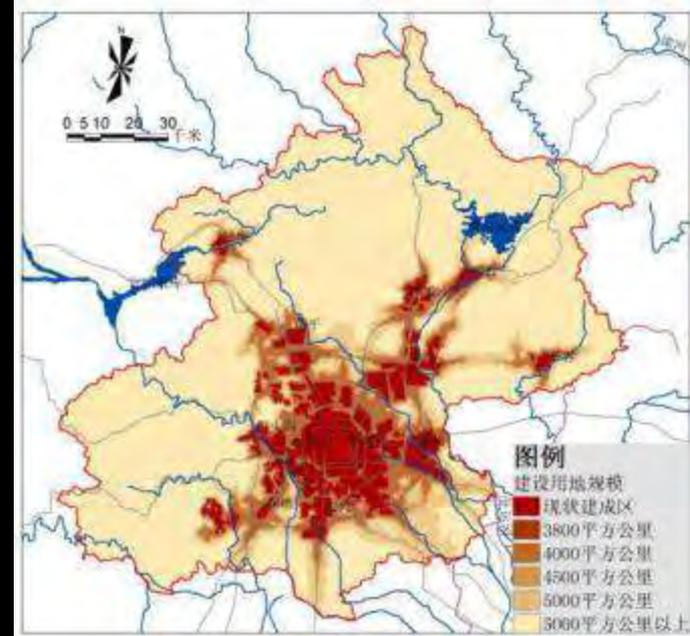
Landscape Security Patterns (SPs) that safeguard the individual processes are integrated into the overall comprehensive Ecological Infrastructure (EI). Using overlaying technique to integrate the SPs for individual processes, alternatives of regional EI are developed at various quality levels: low (minimum), medium (satisfactory) and high (ideal). They will be used to guide and frame regional urban growth.

Regional Ecological Infrastructure

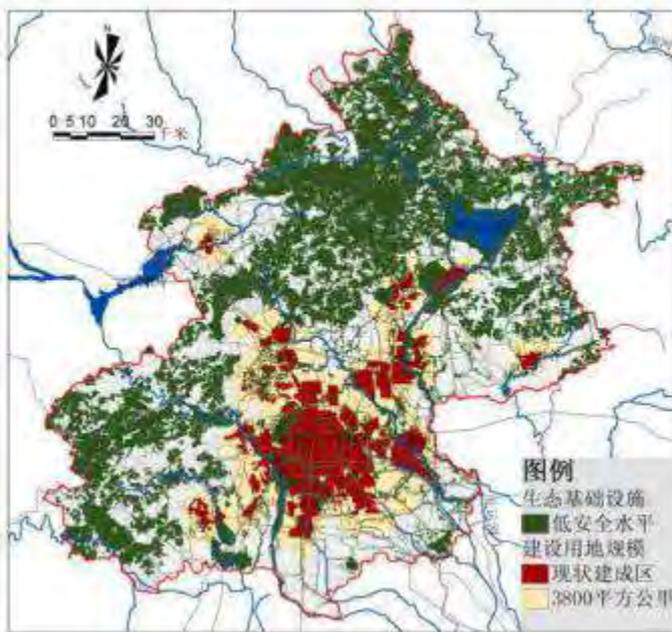


Level of EI	Area of EI (km ²)	Per cent in total
Minimum(lower)	7729	47.0
Satisfying (medium)	11508	70.0
Ideal(higher)	13902	85.0

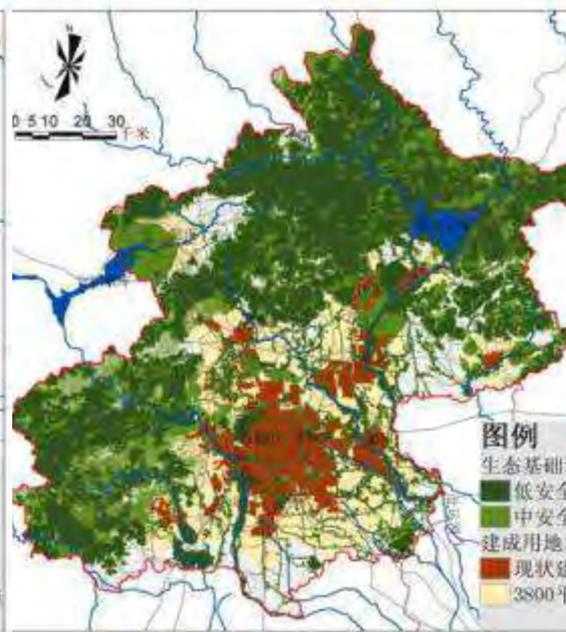
**Landscape leads the way:
Urban growth based on EI**



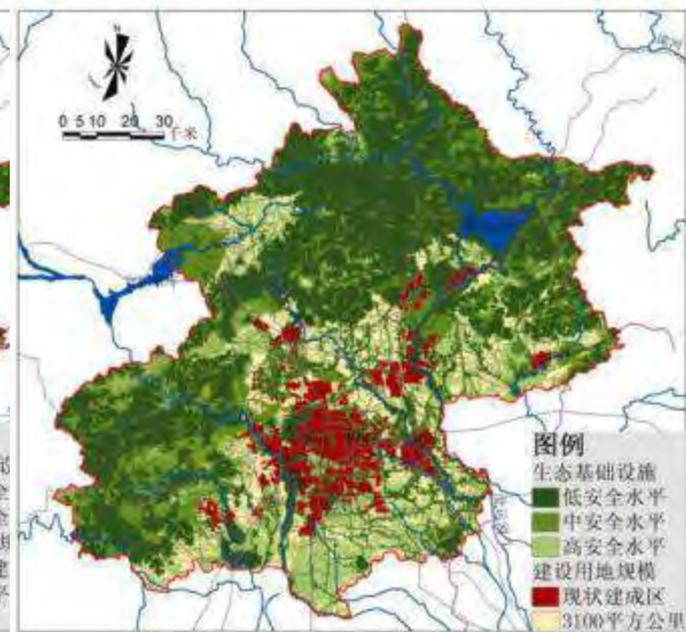
Scenario-1 Sprawl as usual



Scenario-3

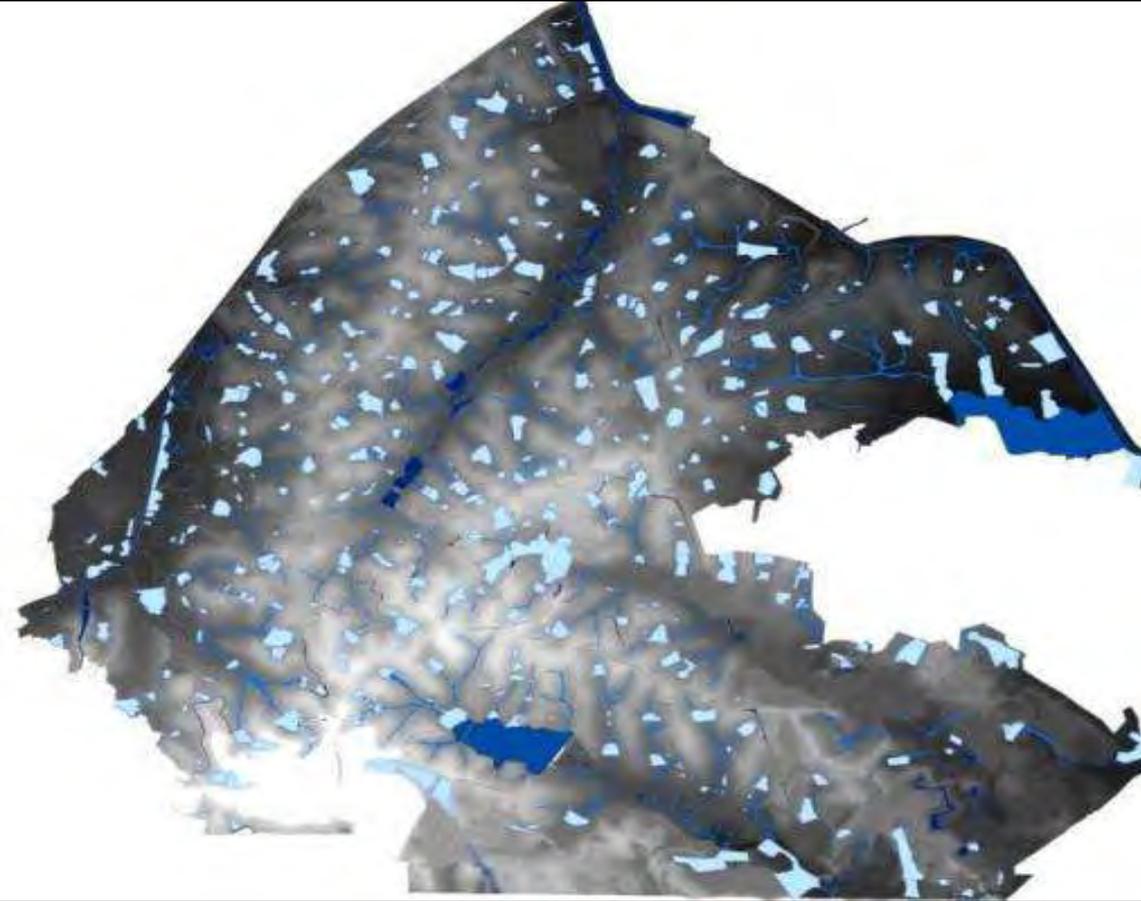


Scenario-4



Scenario-5

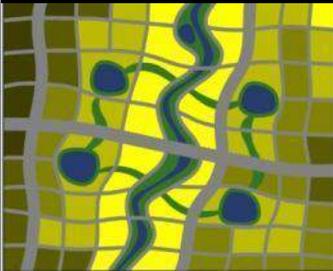
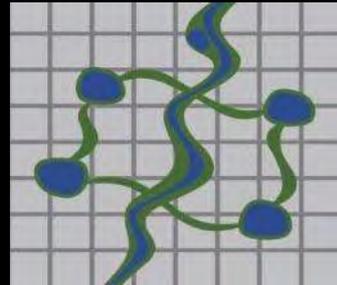
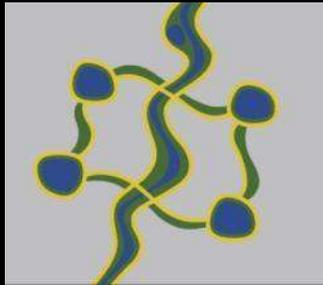
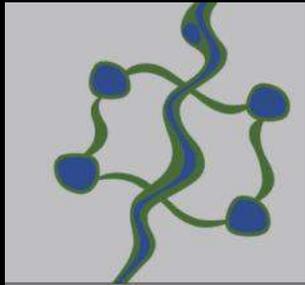
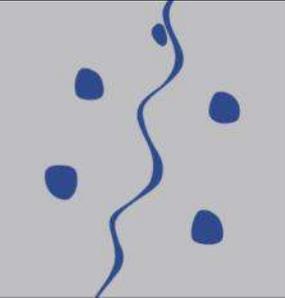
M: urban design based on El



The subtle elevation change on the rolling terrain gives character to the existing water system,



Conventional way of city building



Existing water

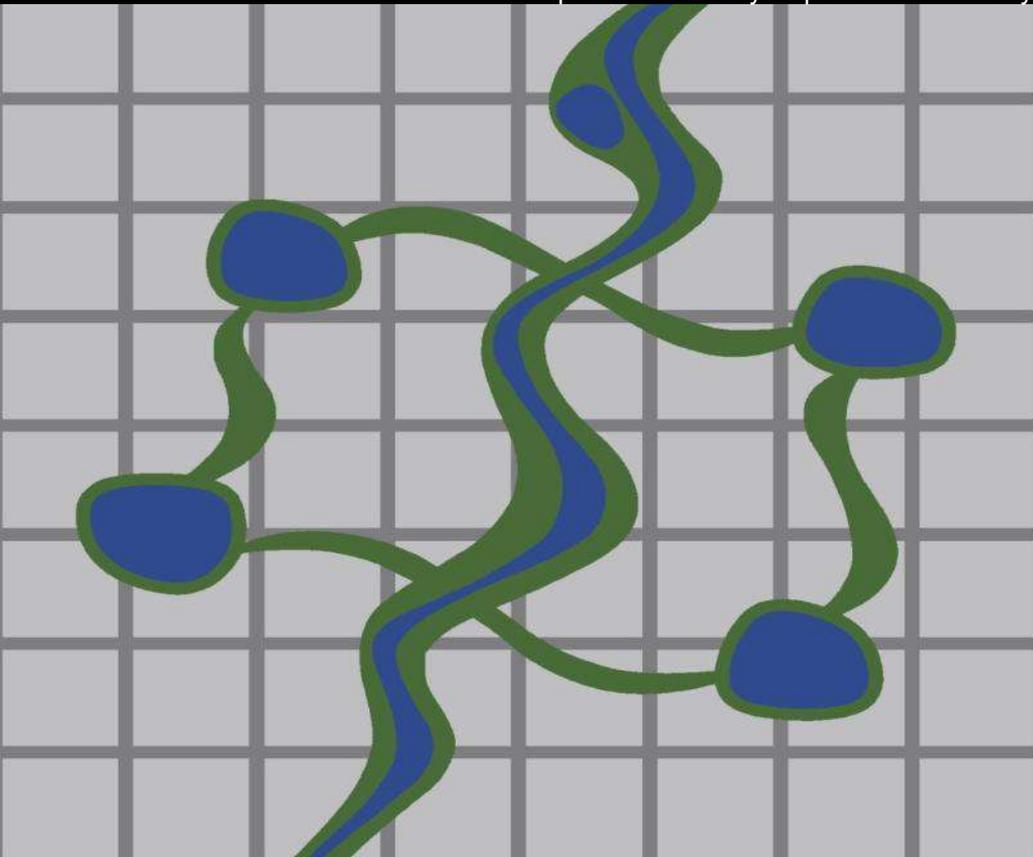
Water based EI based

EI integrated with pedestrian & bicycle paths

EI based circulation City deign based on EI

EI based land

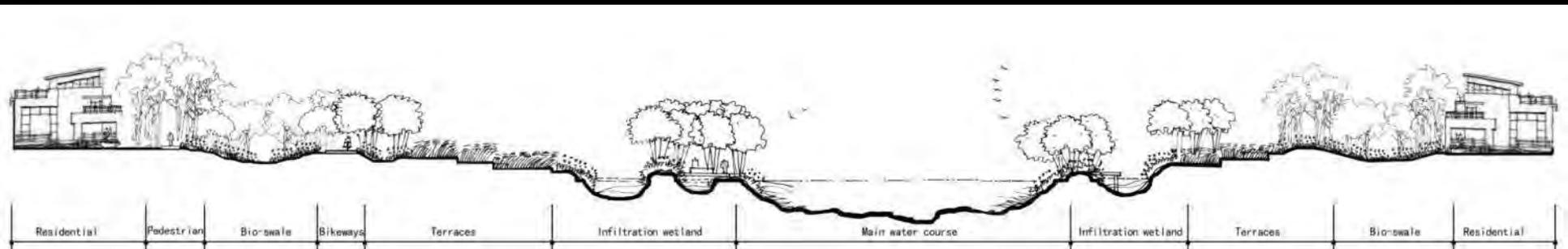
City based on EI



Landscape as infrastructure leading urban development



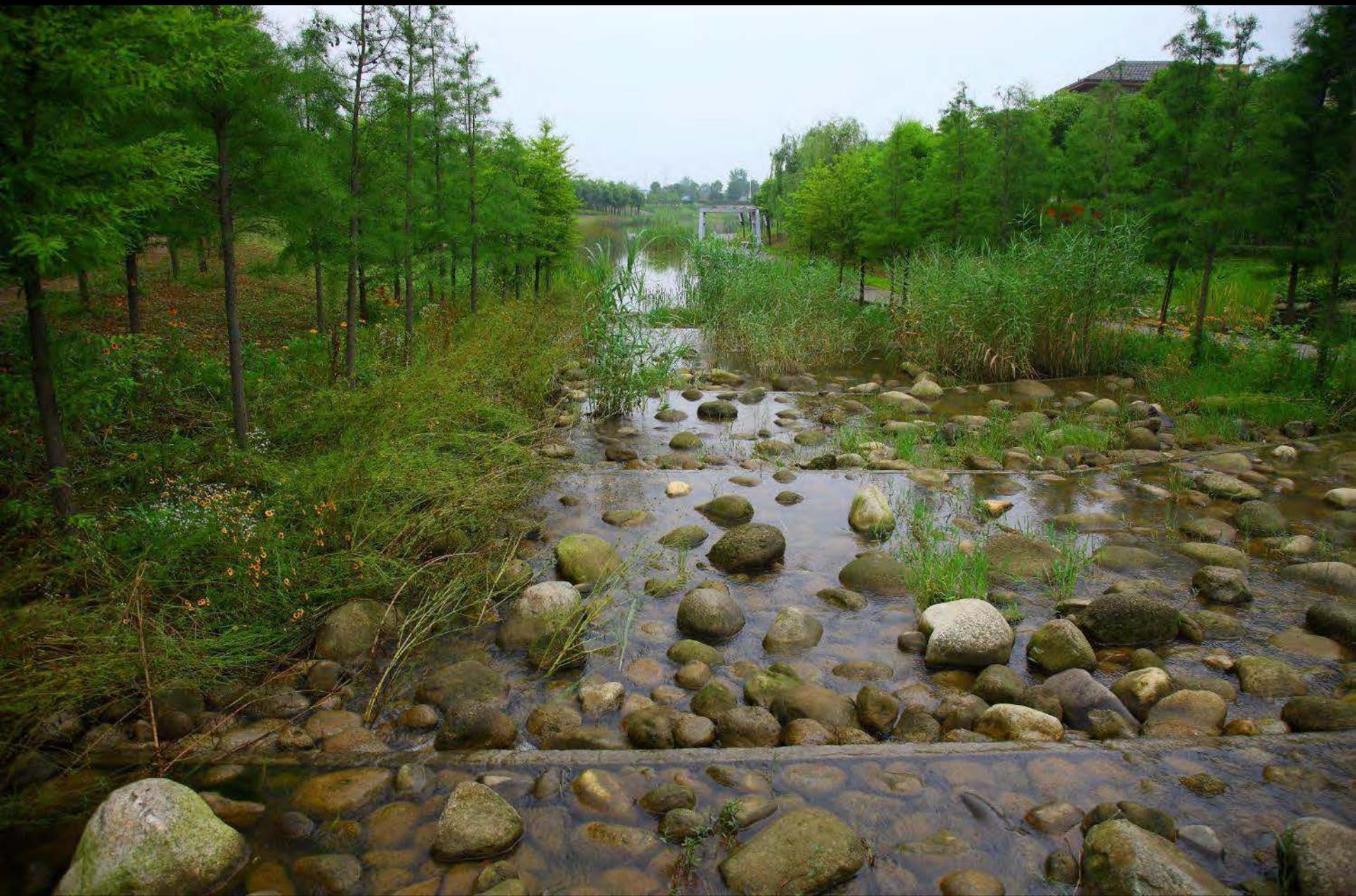
The stormwater collecting and filtering system is the core for the ecological infrastructure of the new town. Three levels of green corridors were developed based that make up an



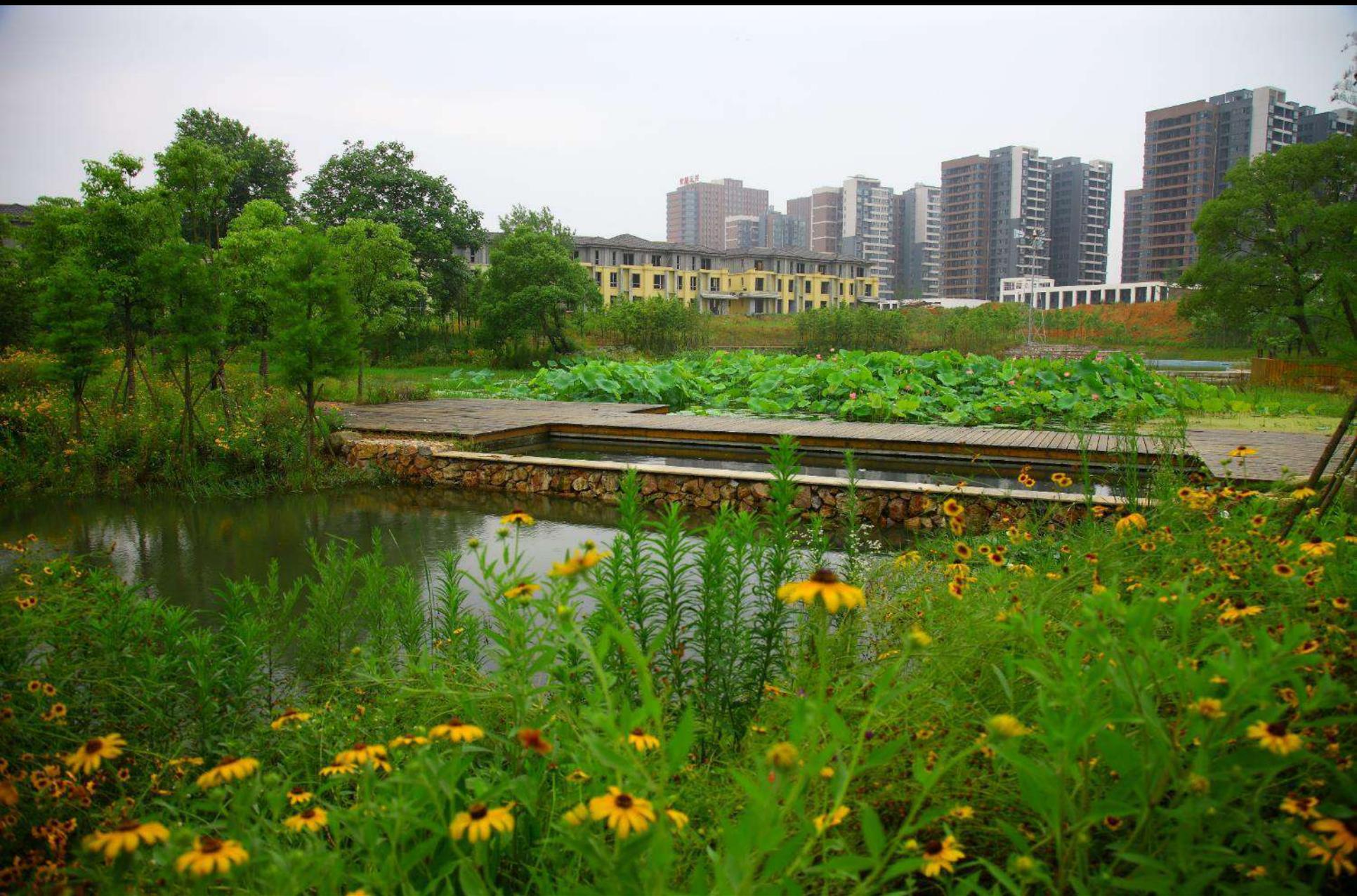




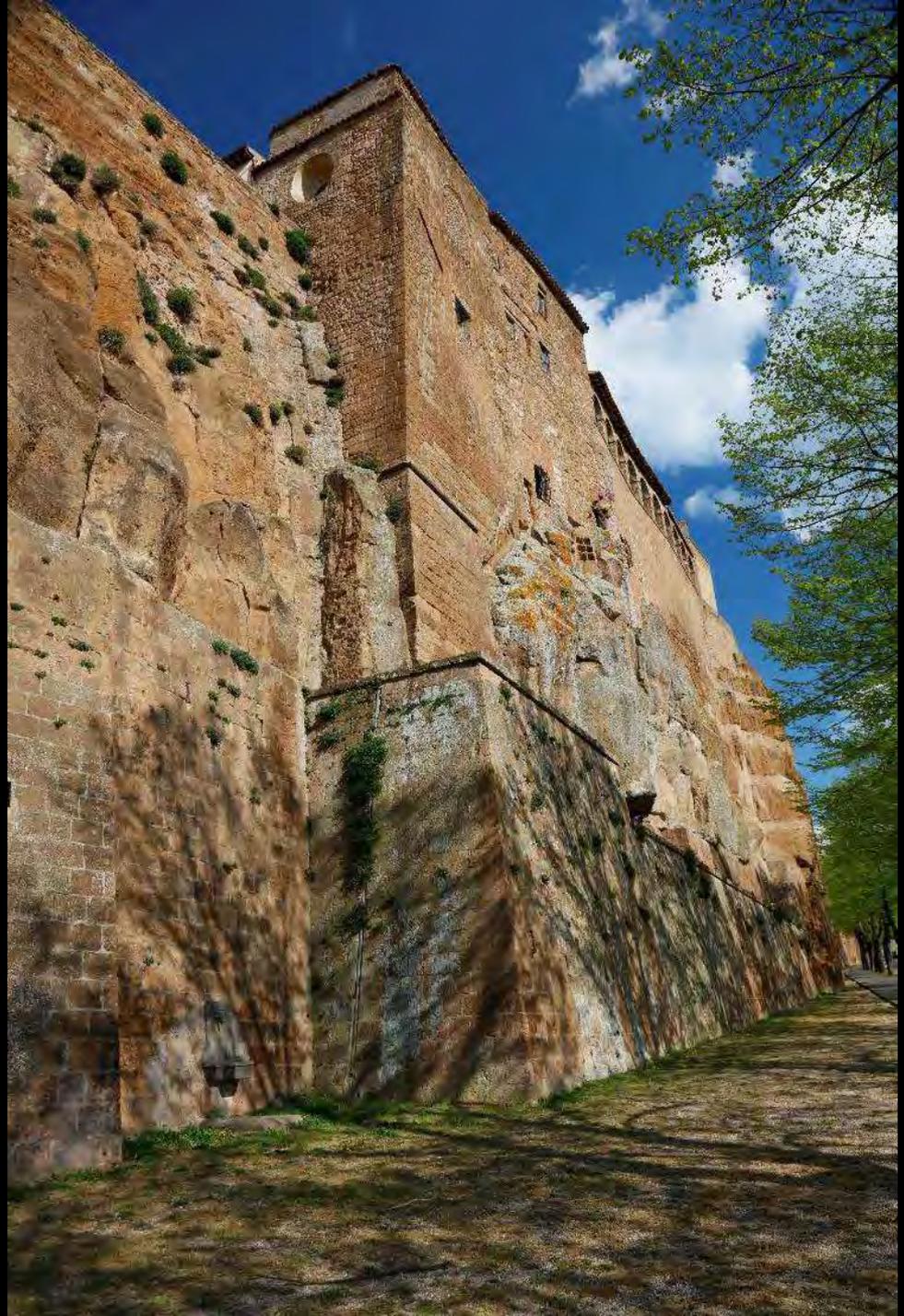








2. Design and engineering to create transformative deep forms

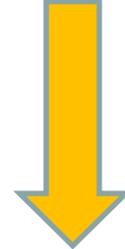
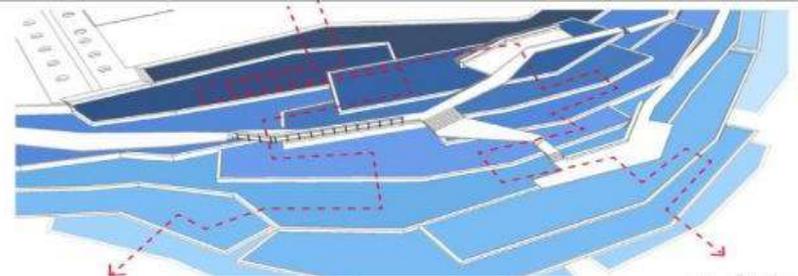


Inspired by the ancient farming wisdom, based on sciences of ecology, replicable terrace module is developed to solve the problem in an inexpensive way

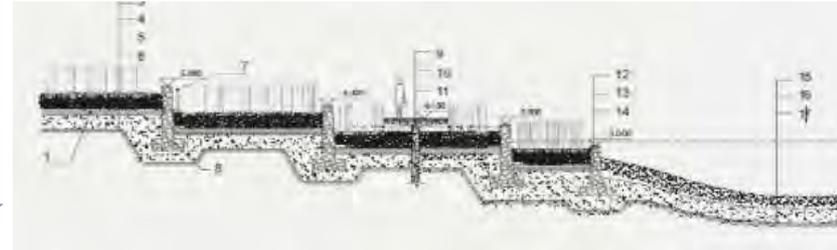
Traditional wisdom



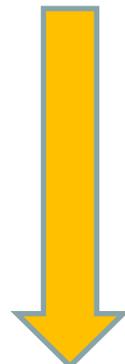
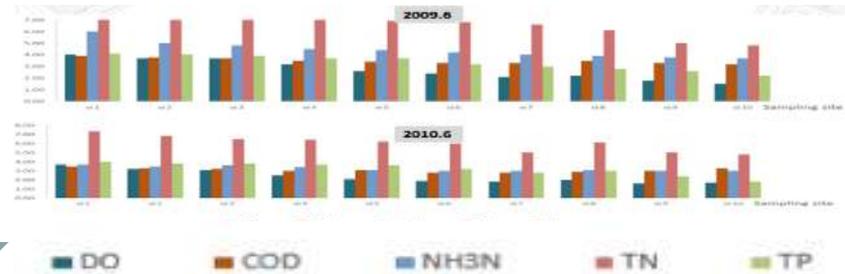
Design abstraction



Quantification



POE test



Replicable modules

• #1 Make Friends with Floods

- *Annual flood damage cost 100 billion US \$, 10 million people live in flood plain.*
- *All Rivers in China are dammed and channelized with concrete flood walls, What can you*



Number of dams (height>15m)
World total: 49,697
China: 25,800
USA: 8,724

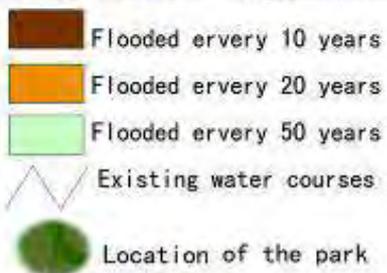
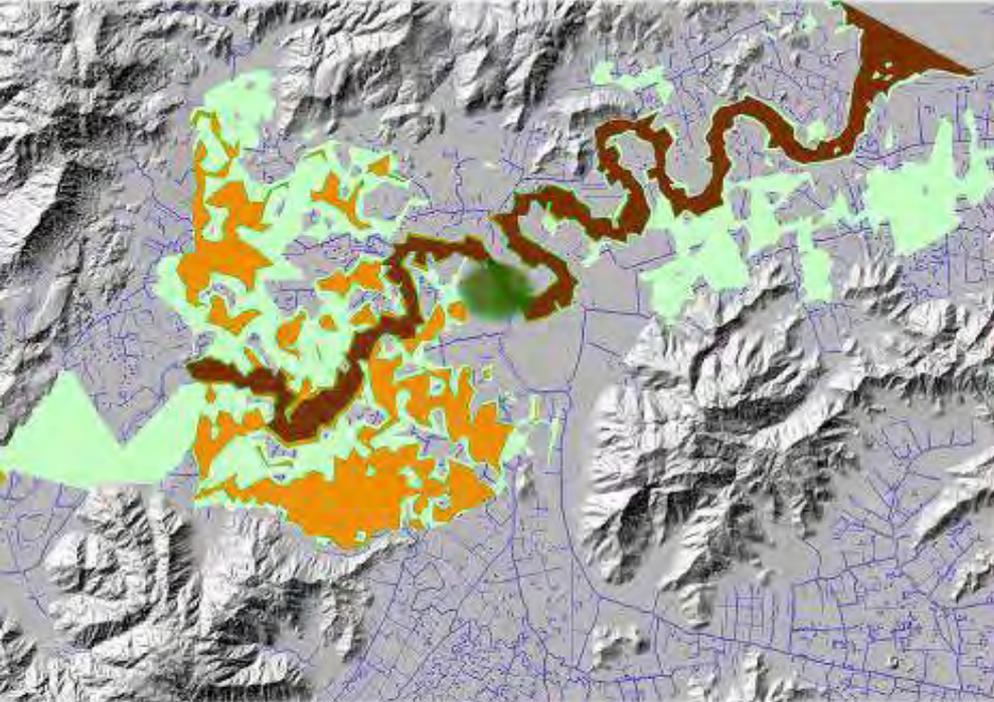
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All Rivers in China are dammed and channelized with concrete flood walls, What can you do?

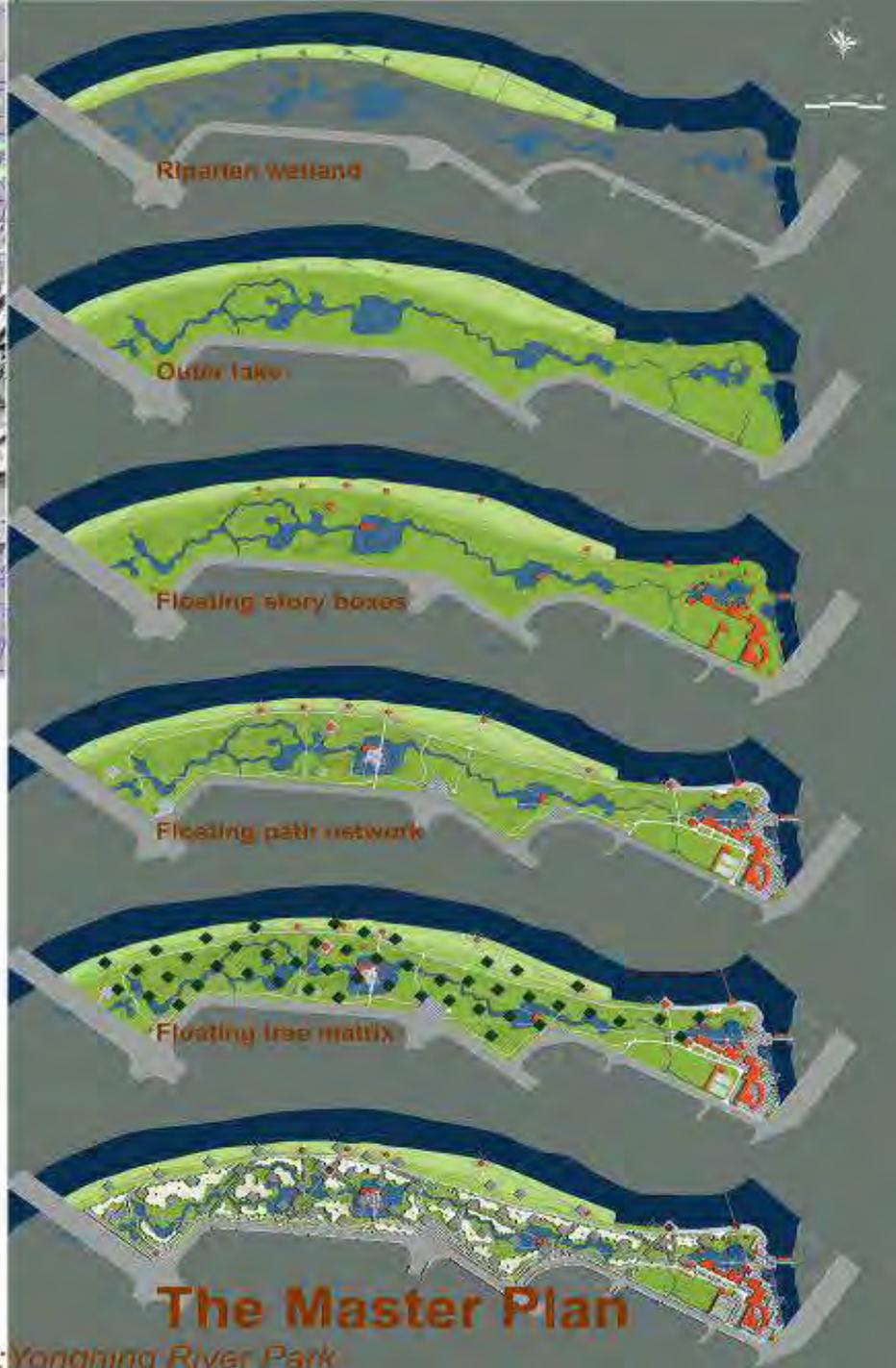




0 2000 4000 Meters

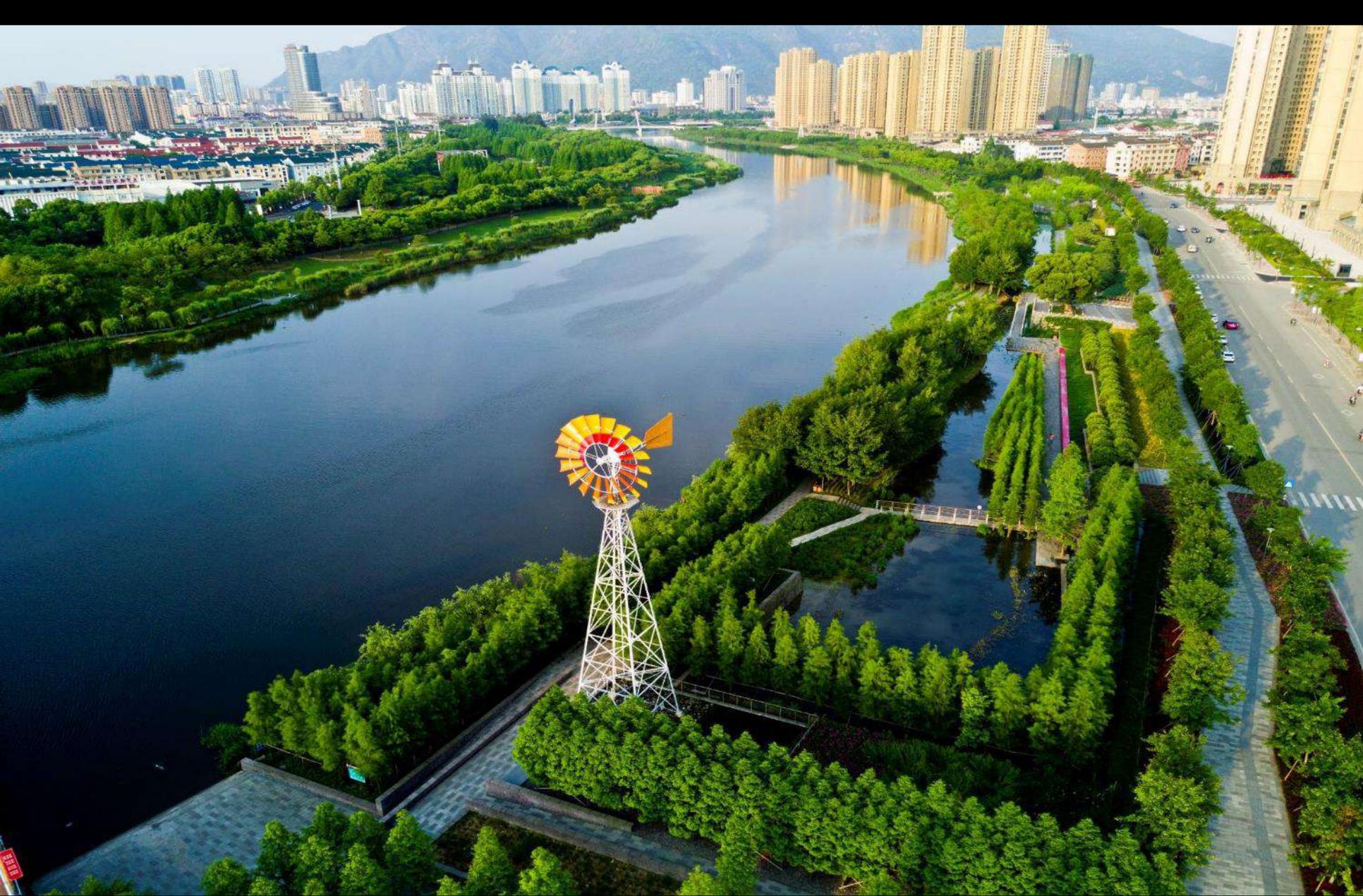
The ecological approach for storm water management was proposed by the landscape architect as an alternative to the commonly used concrete embankment and channelization. This proposal was finally been accepted. As a result, the former engineering approach was stopped, and the concrete lined river was to be ecologically recovered. The Yongning River Park was, therefore, set up an example for ecological recovering of the whole river.

Flood Analysis

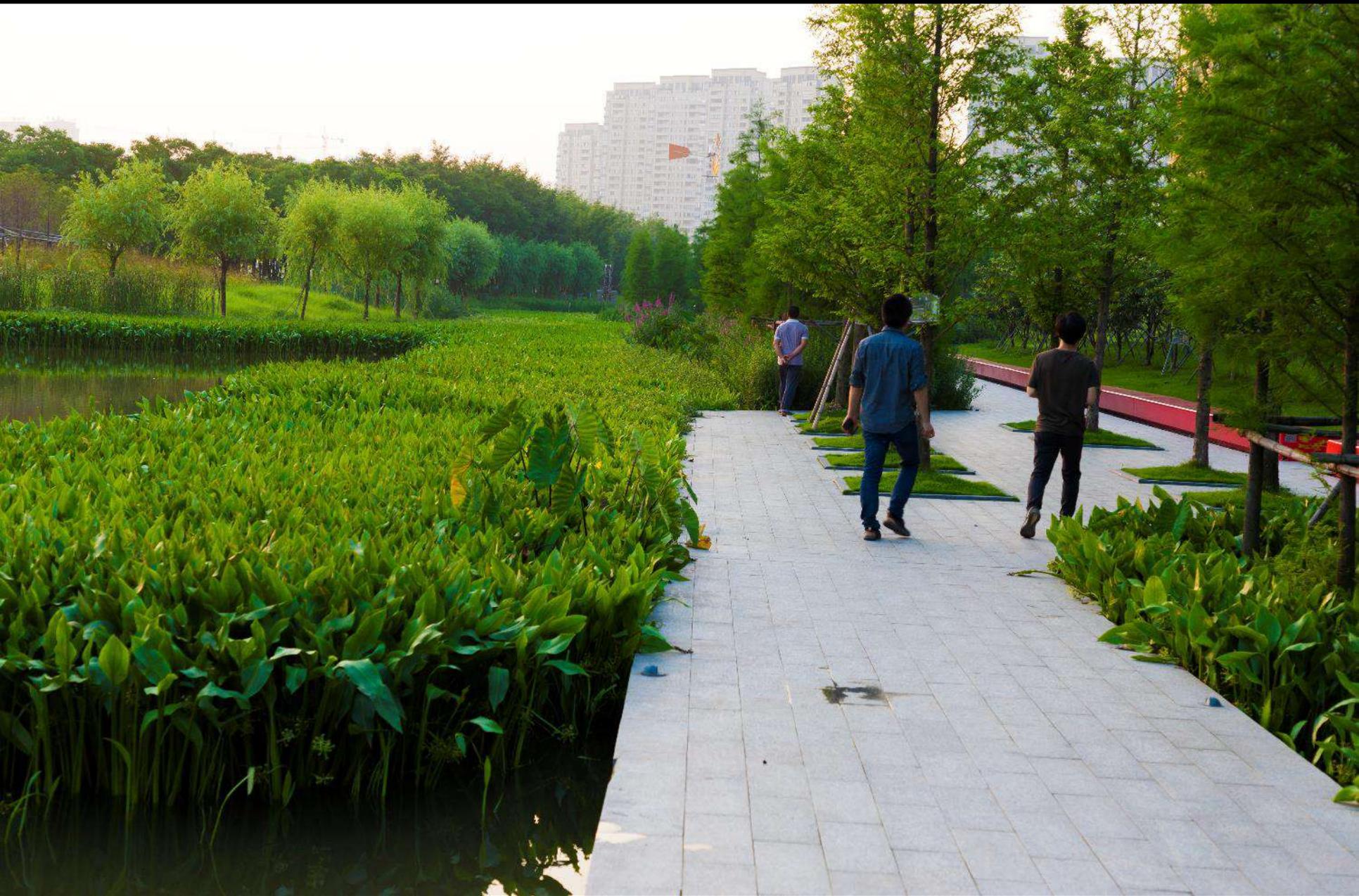


The Master Plan

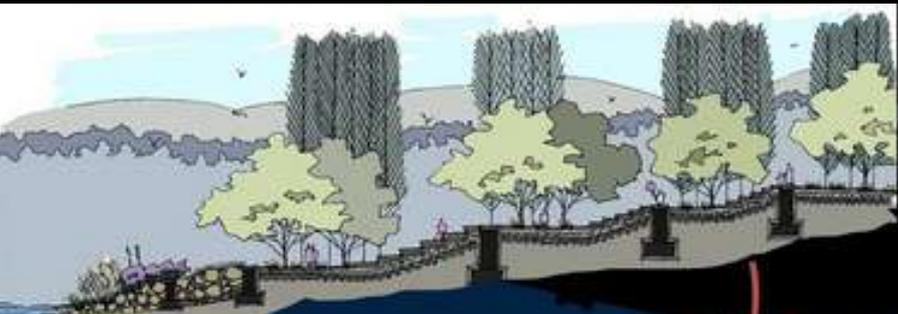
The Floating Gardens: Yongning River Park







Jinhua YAnweizhou: 浙江金华, 燕尾洲公园



海拔 Elevation (M)

34.00-34.99
35.00-35.99
36.00-36.99
37.00-37.99
38.00-38.99
39.00-39.99
40.00-45.99





100年一遇的洪水淹没的实景



20 年一遇

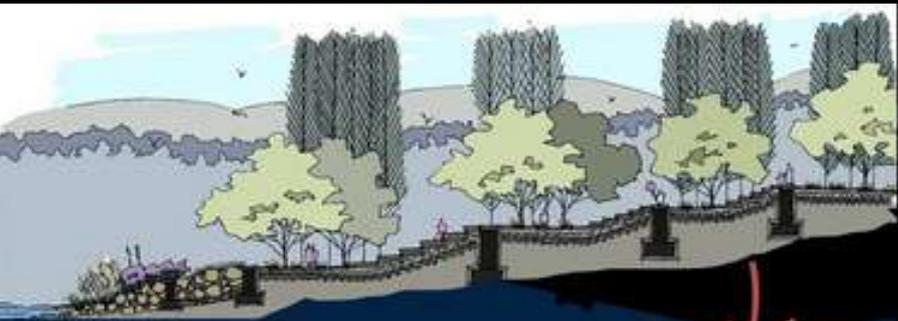




An aerial view of the park during the dry season, note the lush tall grasses covering the terraces on the embankment. The terraces are enriched by silt deposited during the flood season (view is toward the west, photo. September, 2016)



浙江金华，与洪水为友：燕尾洲公园





• *After*





100 Year Flood



20 Year Flood



Dry season



An aerial view of the park during the dry season, note the lush tall grasses covering the terraces on the embankment. The terraces are enriched by silt deposited during the flood season (view is toward the west, photo. September, 2016)



#2 Creating Water Resilient City by Restoring Native Habitats The Mangrove park and wetland Park in the city of Sanya

三亚的系列生态修复工程,由住建部召开现场会, 向全国推广 (之一)

海南三亚红树林公园

通过弹性适应、界面增强和仿生修复等技术, 快速修复红树林栖息地



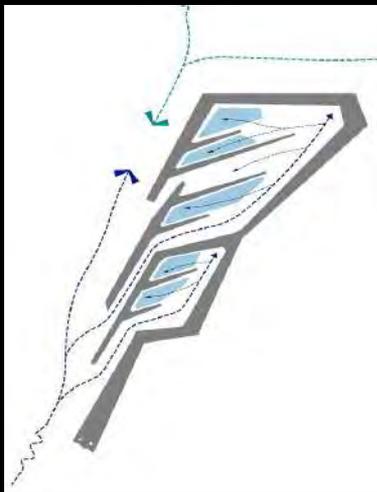
修复之前, 2016



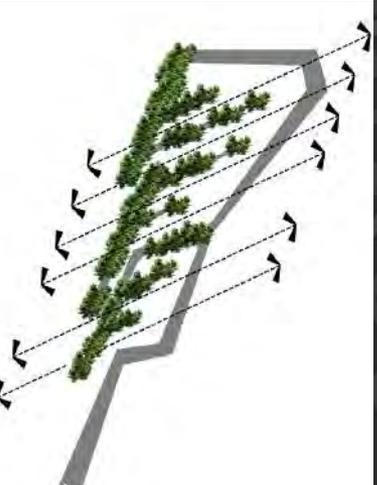
修复之后, 2018



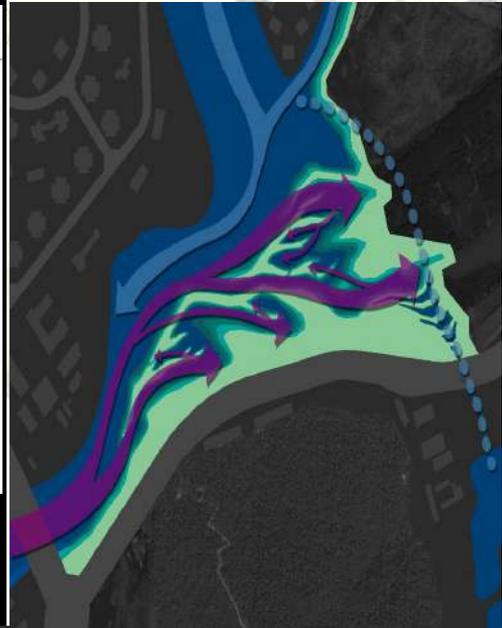




To induct ocean tides and avoid destructive fresh water storm

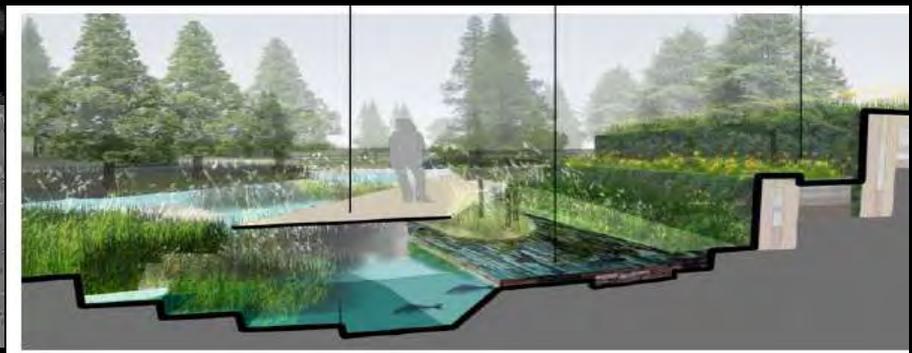
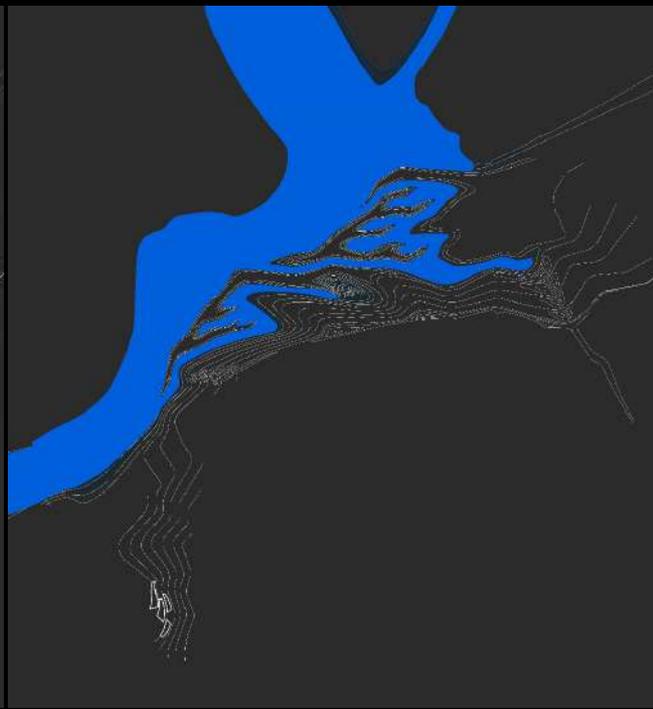
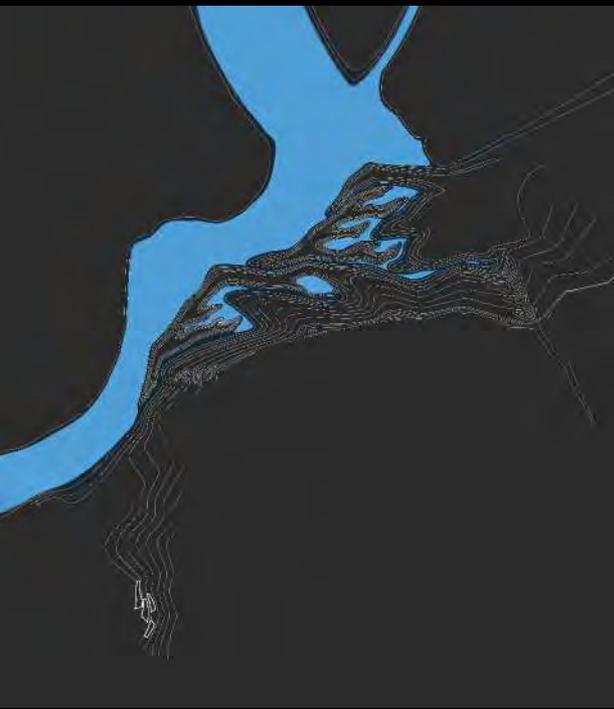


To avoid tropical destructive storm from the sea



1. Main Entrance
2. Sky Walk
3. Terraces
4. Bioswale
5. Resting Place
6. Pavilion
7. Main Path Connected to Urban Greenways
8. Sanya River
9. Urban Artery Road
10. Pedestrian Path

01 Site plan: form follow processes. The designed ecotones of inter-locked fingers help to induct ocean tides, avoid the fresh water flush and destructive tropical storm





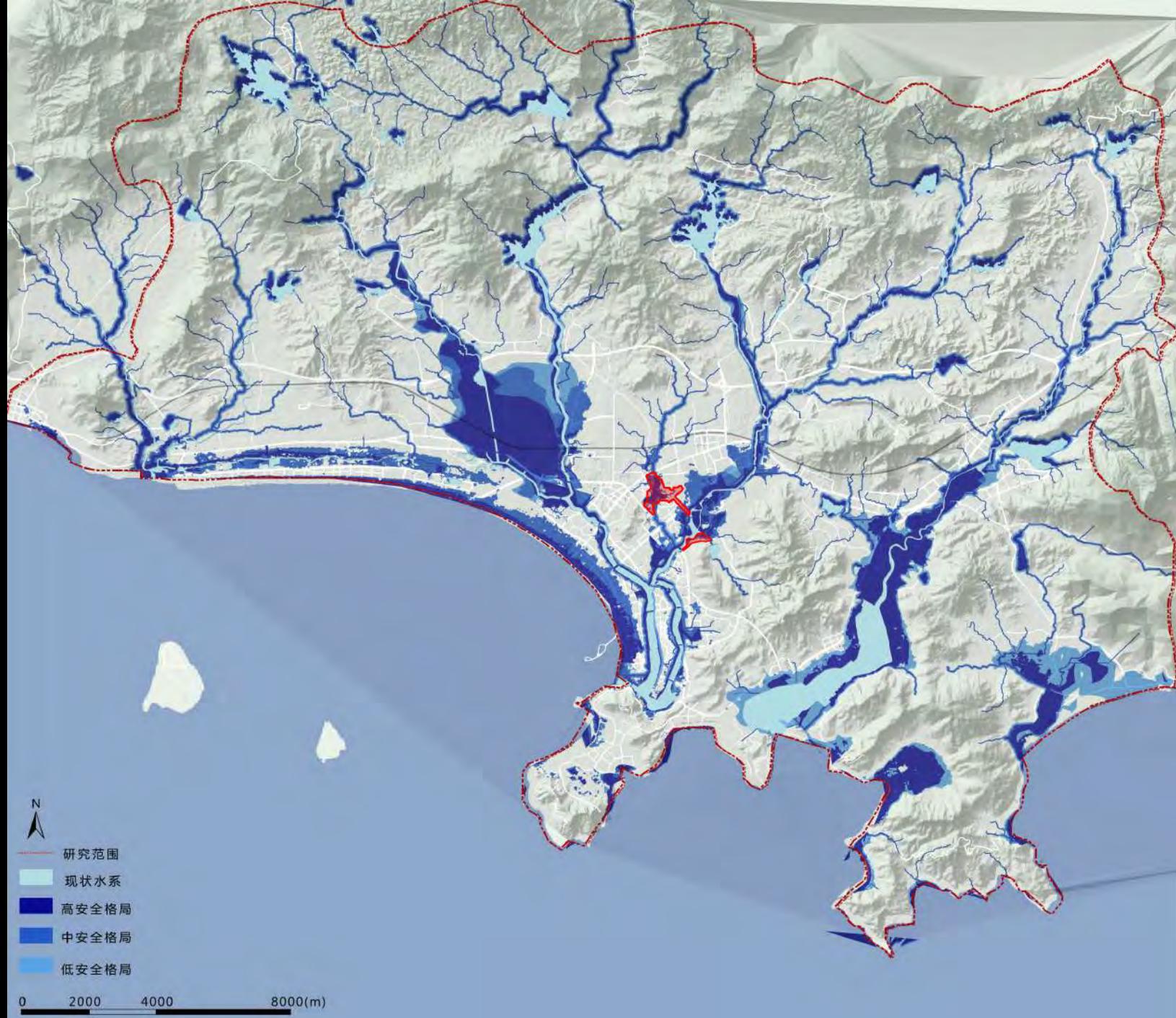






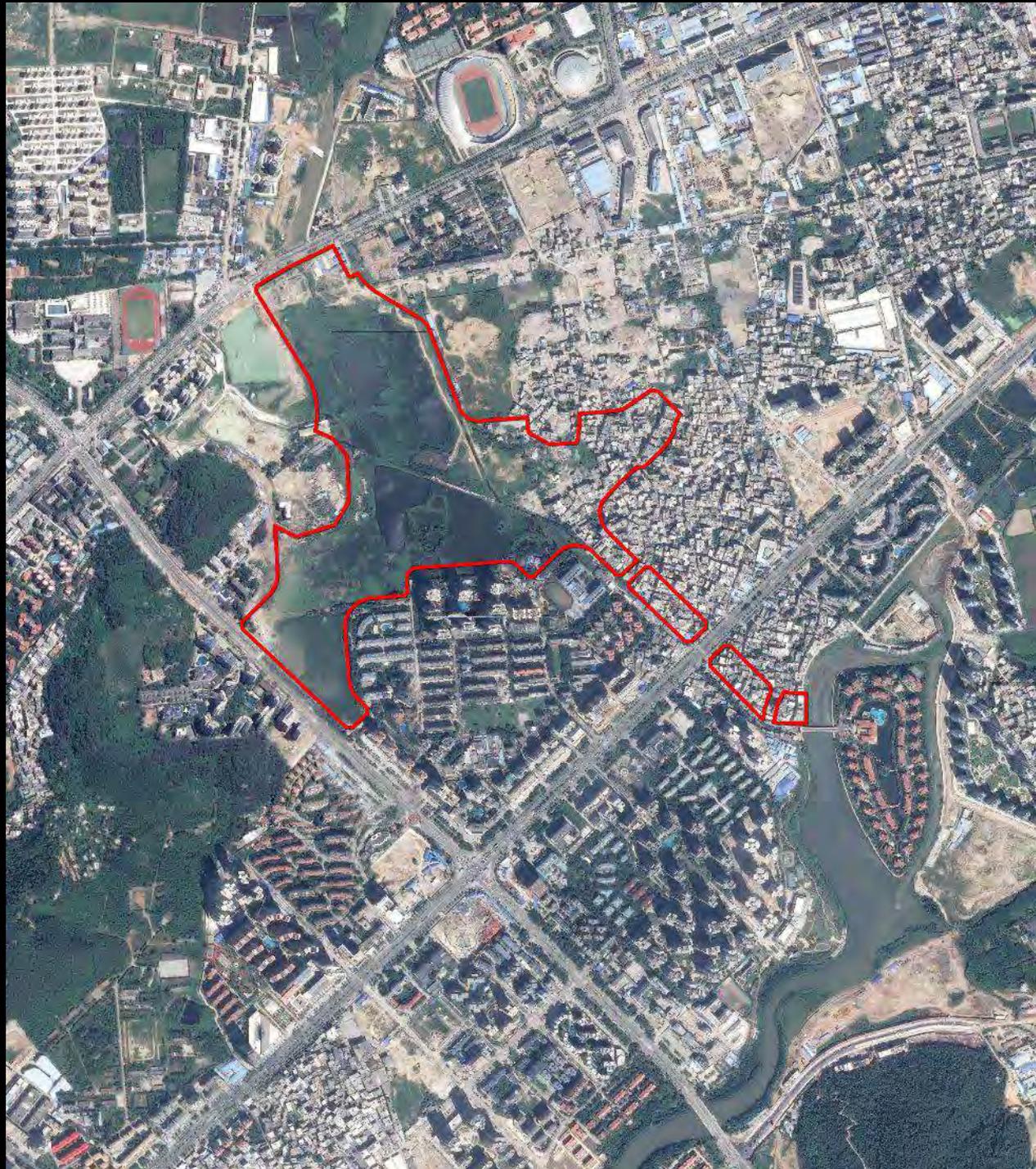


15 The pavilion is designed in such a way so that the harsh sunlight in the middle day can be effectively blocked and the morning and



东岸湿地East bank wetland

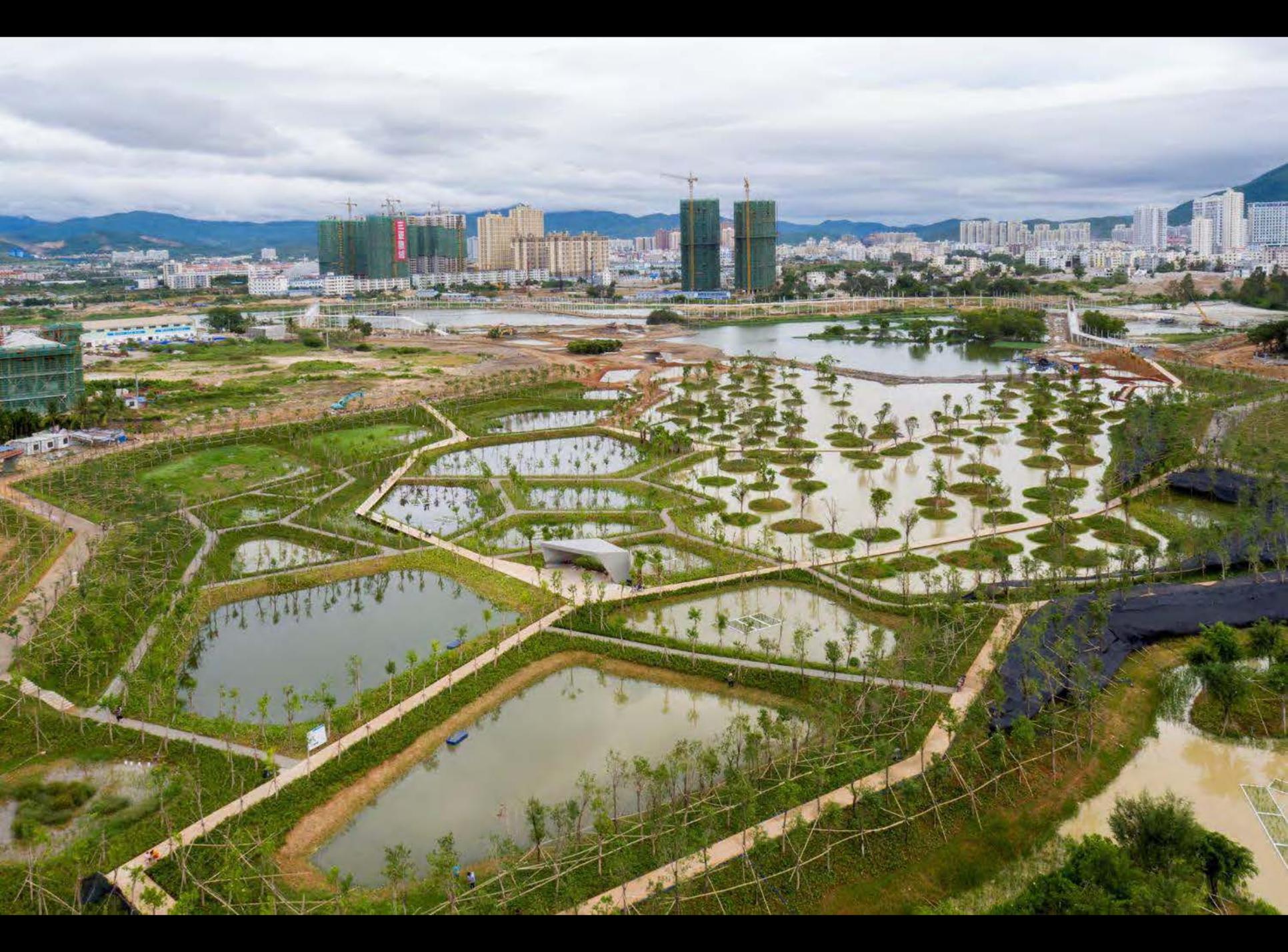






图例

- | | | | |
|---|-------|---|----------|
|  | 城市道路 |  | 1 停车场 |
|  | 陂塘 |  | 2 主入口广场 |
|  | 田地 |  | 3 商业建筑 |
|  | 背景林 |  | 4 景观水面 |
|  | 停车场 |  | 5 特色景观构筑 |
|  | 景观塔 |  | 6 榕树岛 |
|  | 商业建筑 |  | 7 陂塘 |
|  | 主入口广场 |  | 8 景观塔 |
|  | 榕树岛 |  | 9 田地 |
|  | 中央水面 |  | 10 卫生间 |
|  | 入口广场 |  | 11 中央水面 |
|  | 景观构筑 |  | 12 背景林 |
|  | 卫生间 |  | 13 自行车路 |
|  | 景观路 |  | 14 景观主路 |
| | | | 15 次入口广场 |











#4 Minimize Intervention and Maximize Return

Billions of dollars have been spent to turn nature into expensive urban landscapes. What could be the alternatives?



Under the name of safety and “beauty,” we created shallow form or fake forms



The Red Ribbon park, Qinghuangdao City, Hebei Province

Google earth

