Cascading Floodspace

Rebalancing flood prevention through spatial design interventions

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Part 1

INTRODUCTION

A floodplain ... where water bless and curse

Part 2

THEORY

A middle ground ... where floods yield and relent

Part 3

DESIGN

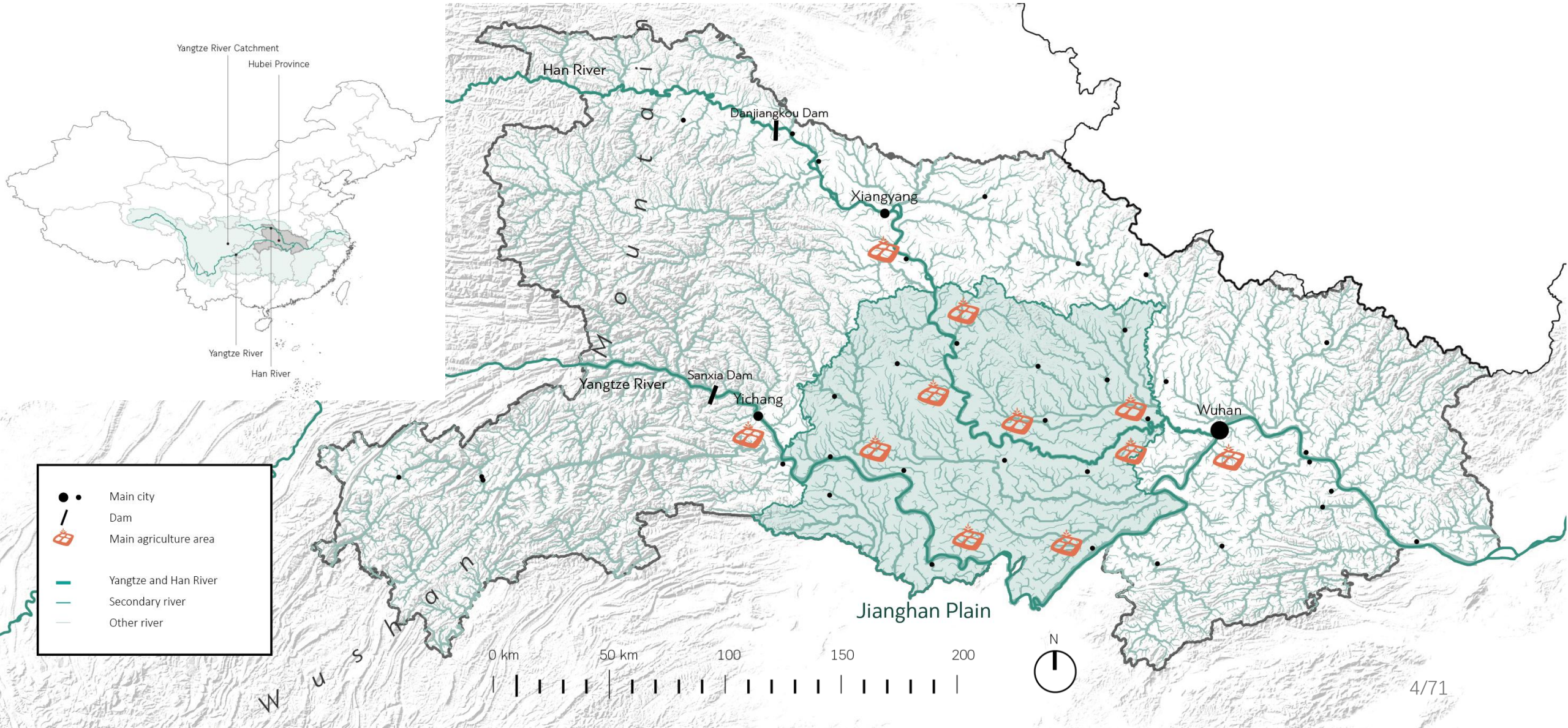
A cascading room ... where lives adapt and cultivate

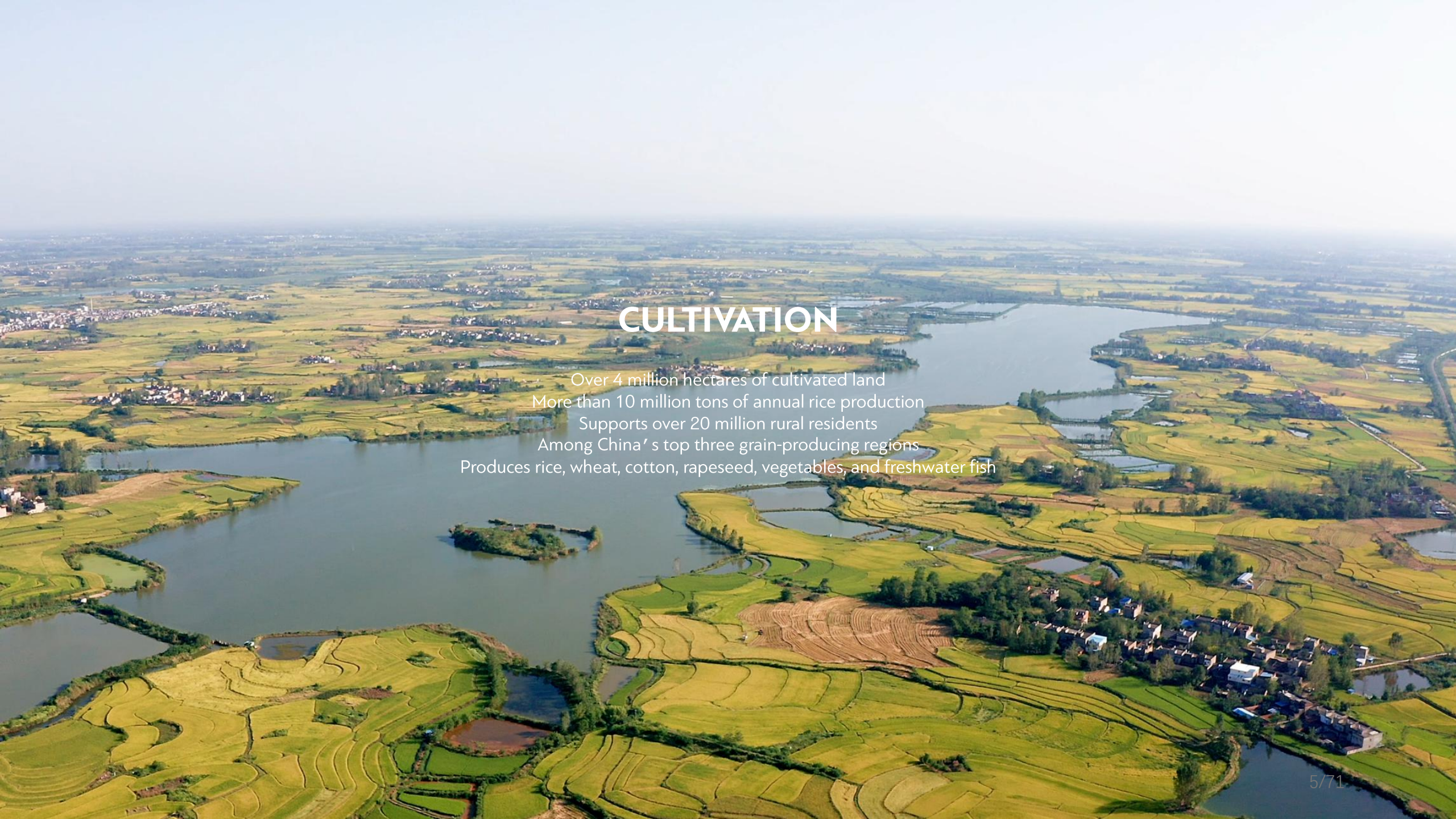
Part 1

INTRODUCTION

A floodplain ... where water bless and curse

LOCATION OF THE PROJECT





CULTIVATION

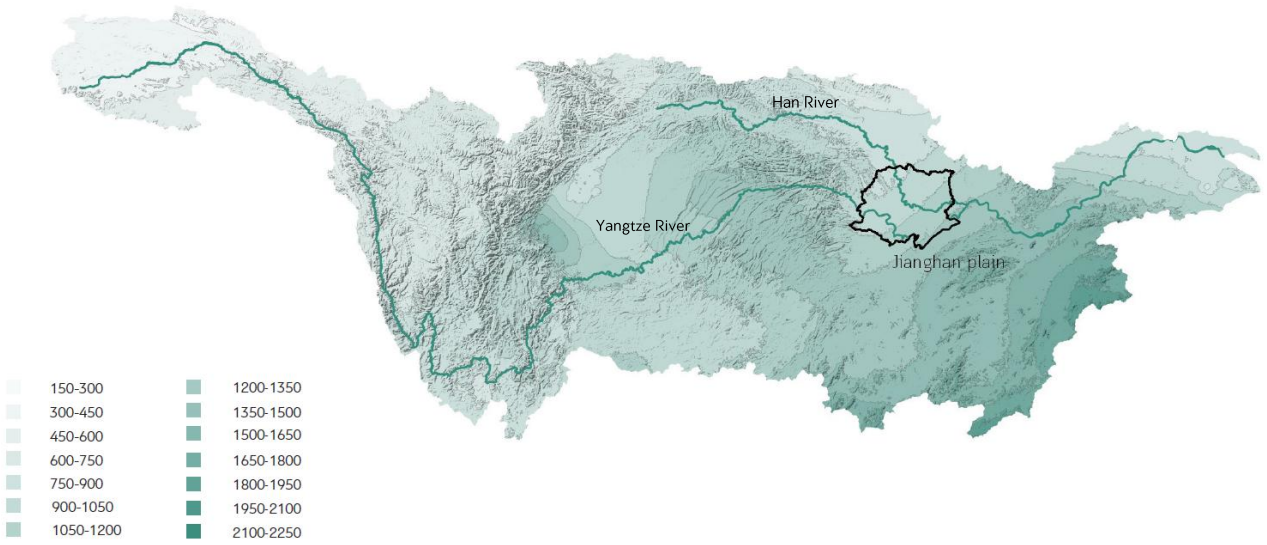
Over 4 million hectares of cultivated land
More than 10 million tons of annual rice production
Supports over 20 million rural residents
Among China′s top three grain-producing regions
Produces rice, wheat, cotton, rapeseed, vegetables, and freshwater fish

FLOOD

19 times in last 100 years

Flood in 1998
21.2 million hectares of land being influenced
223 million people involved
3004 death
23 billion of US dollar loss

CLIMATE & RAINY SEASON



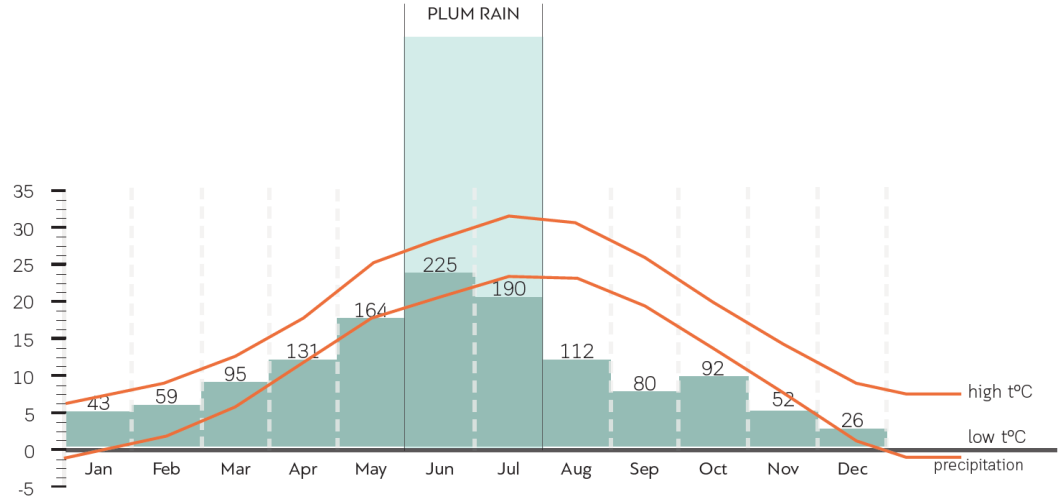
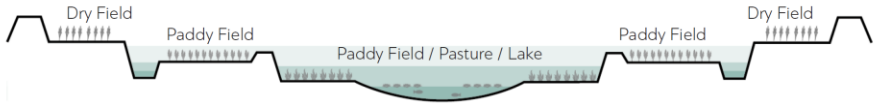


Fig.1.4. Temperature and precipitation in Hubei Province

INDIGENOUS SOLUTION FOR FLOOD

Weiyuan system



MODERN FLOOD DEFENSE SYSTEM

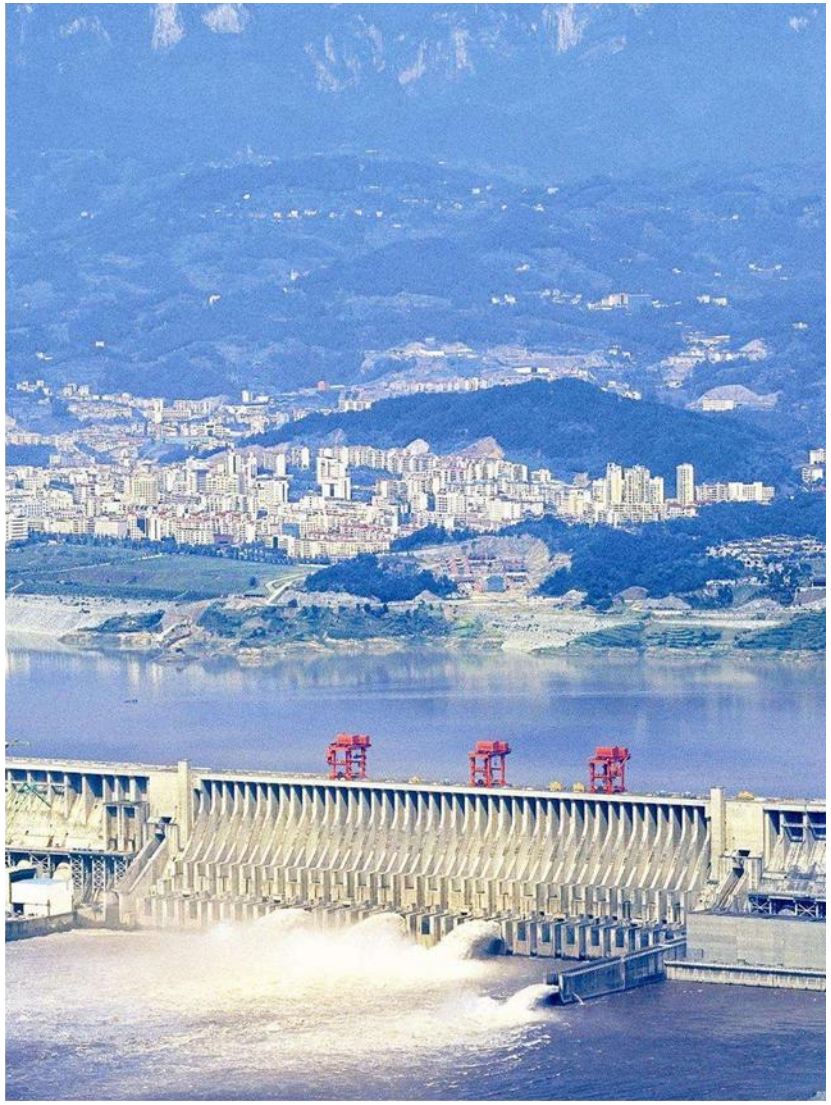
Dikes, dams, and flood storage area

DIKES

Since 1400

FLOOD STORAGE AREA

Since 1950

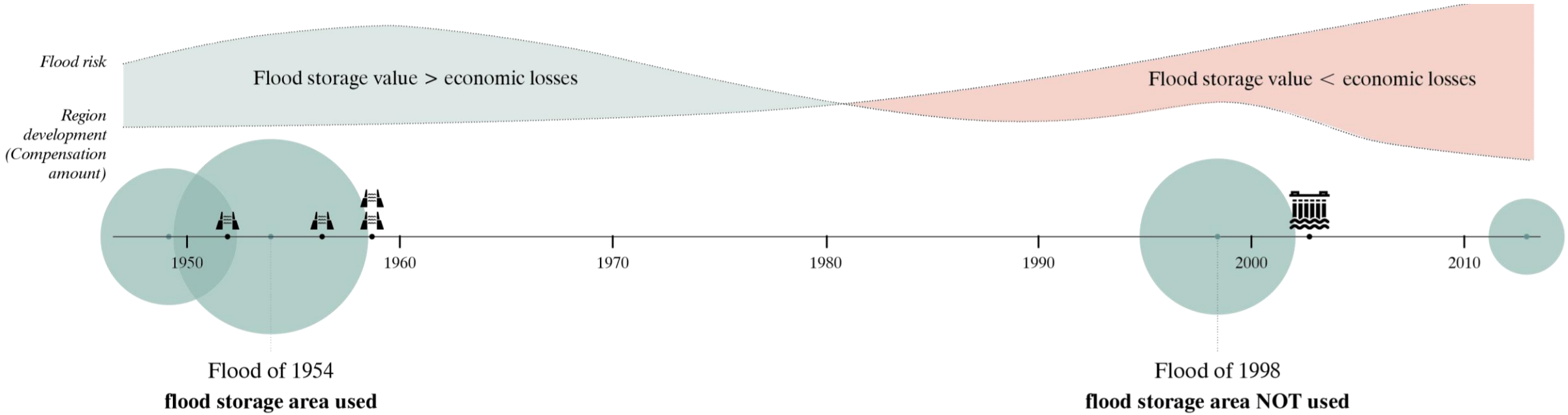


THREE GORGES DAM

Since 2001

MODERN FLOOD DEFENSE SYSTEM

Dysfunctional flood storage area



Emergency transfer of residents of the Jing River flood storage area in 1998

1644 Injured
99 death
2 billion RMB loss

FLOOD IN 1998

21.2 million hectares of land being influenced
223 million people involved
3004 death
23 billion of US dollar loss

0 Flood Storage Area being used

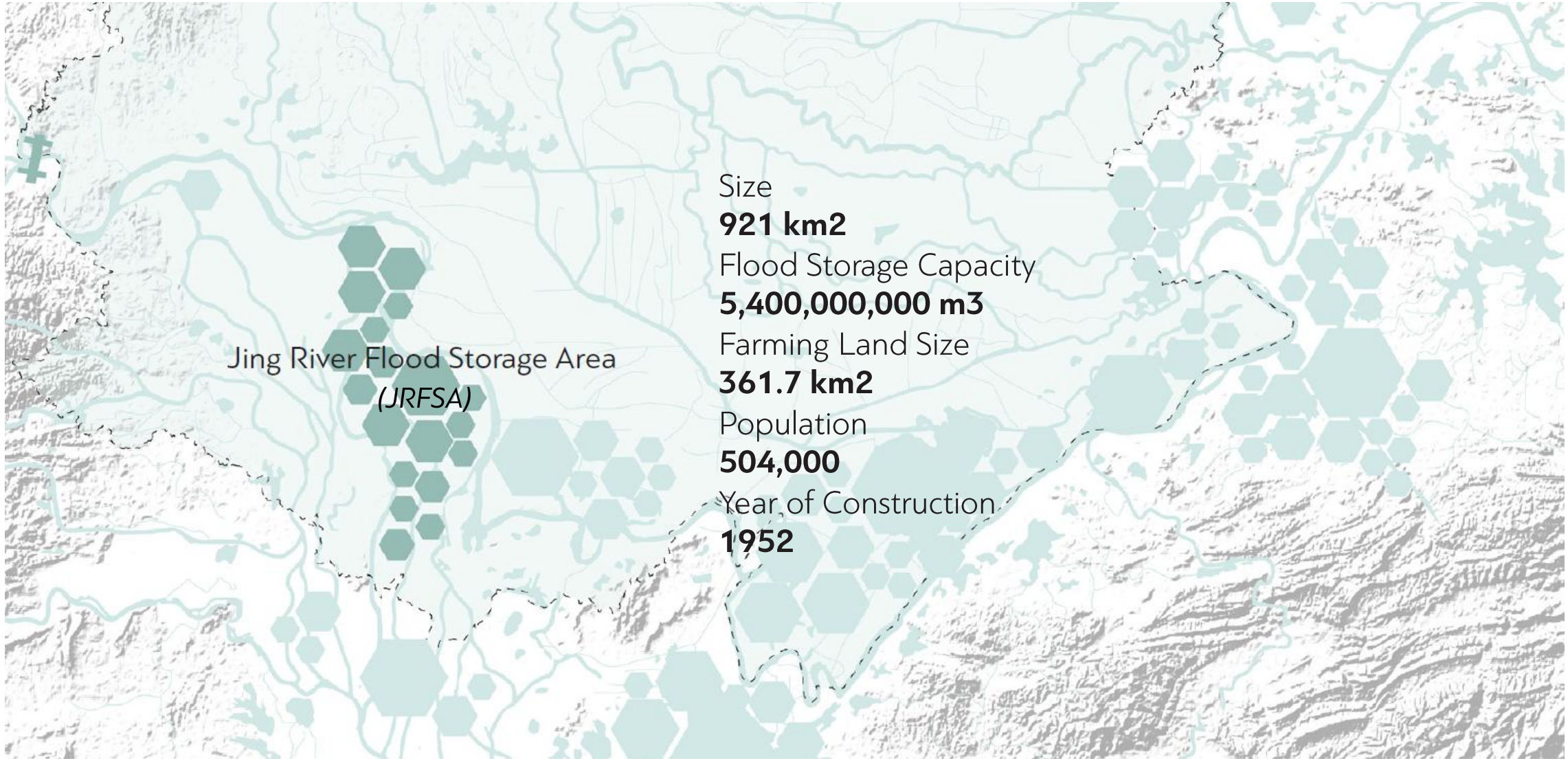
Part 2

THEORY

A middle ground ... where floods yield and relent

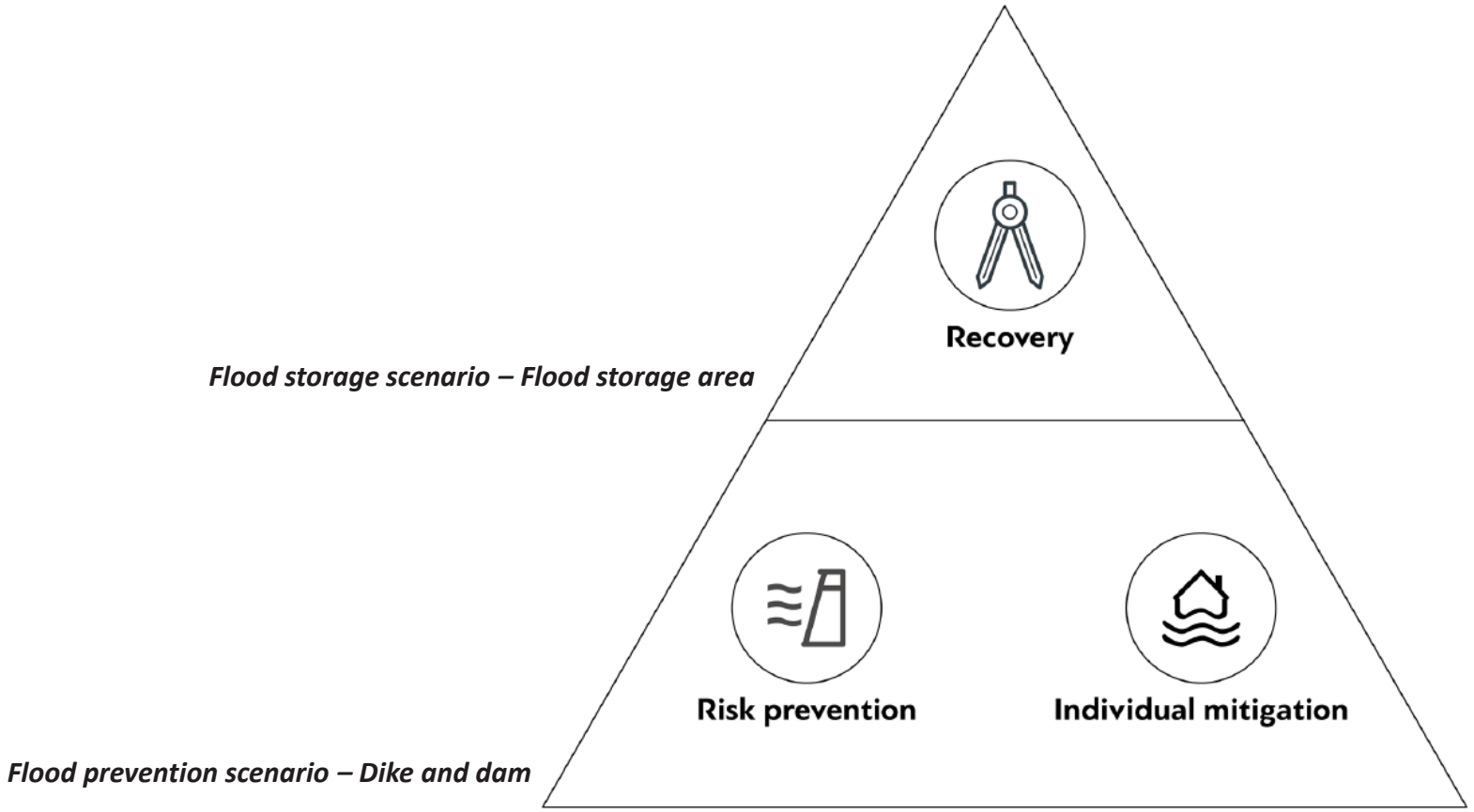
RESEARCH AREA

Jing River Flood Storage Area (JRFSA)



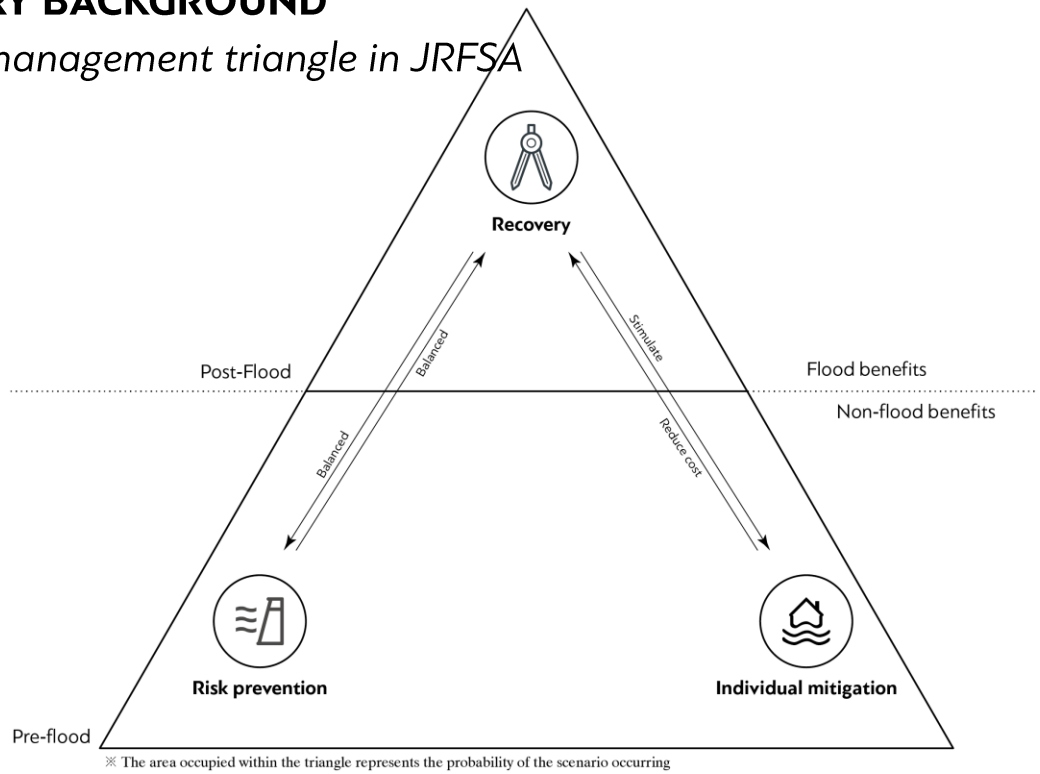
THEORY BACKGROUND

Flood management triangle



THEORY BACKGROUND

Flood management triangle in JRFSA



※ The area occupied within the triangle represents the probability of the scenario occurring

1952 - **1954**

1952: The construction of Jing River Flood Storage Area

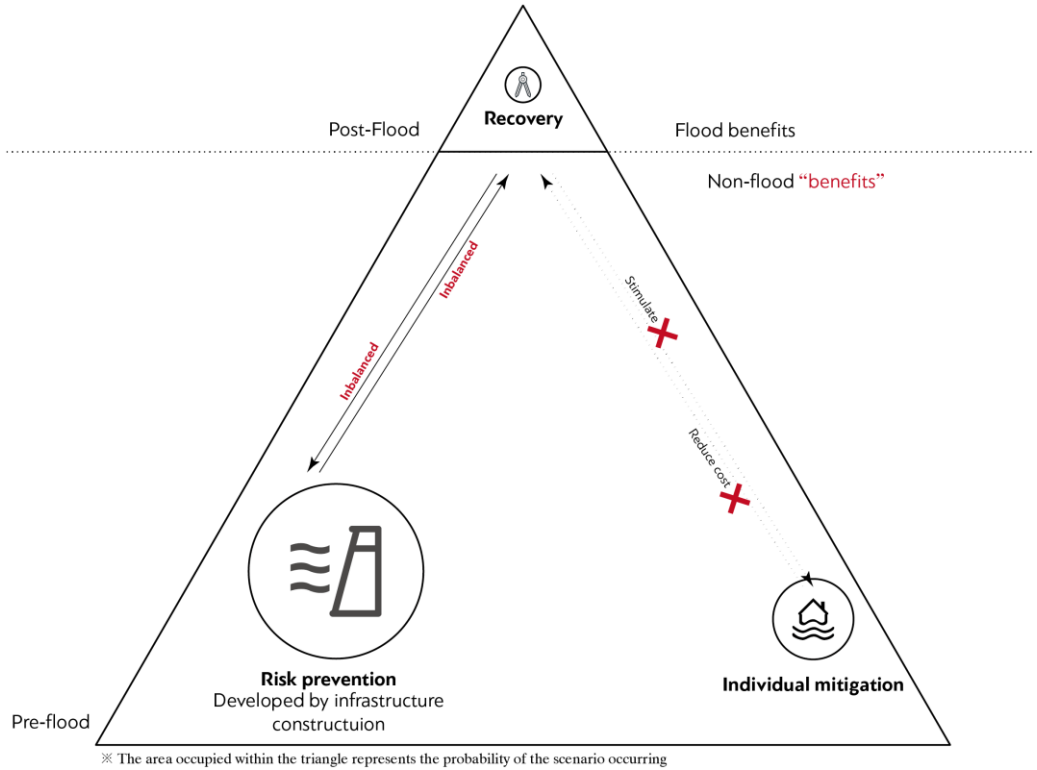
1954: The only time the Jing River Flood Storage Area was used

Flood benefits

- Flood awareness
- Ecological value in floodspace
- Nutrients from Sediments

Non-flood benefits

- Agriculture development
- Population increase



※ The area occupied within the triangle represents the probability of the scenario occurring

1954 - **2025**

1954: The only time the Jing River Flood Storage Area was used

2025: The floodplain was not used even during the great flood of 1998

Flood benefits

- ~~Flood awareness~~ → Lack of individual-level flood mitigation
- ~~Ecological value in floodspace~~ → Ecological diversity loss
- ~~Nutrients from Sediments~~ → Excessive use of fertilisers

Non-flood "benefits"

- Uncontrolled agriculture development
- Uncontrolled Population increase

RESEARCH QUESTION

*How can a design framework for a **flood-adaptable landscape** contribute to rebalancing flood prevention, mitigation, and recovery of **agricultural, biodiversity, recreation and living spaces**?*

SUB-QUESTION

***Flood storage dysfunction** - How has the existing flood control infrastructure shaped the spatial rigidity and functional imbalance within the flood storage area?*

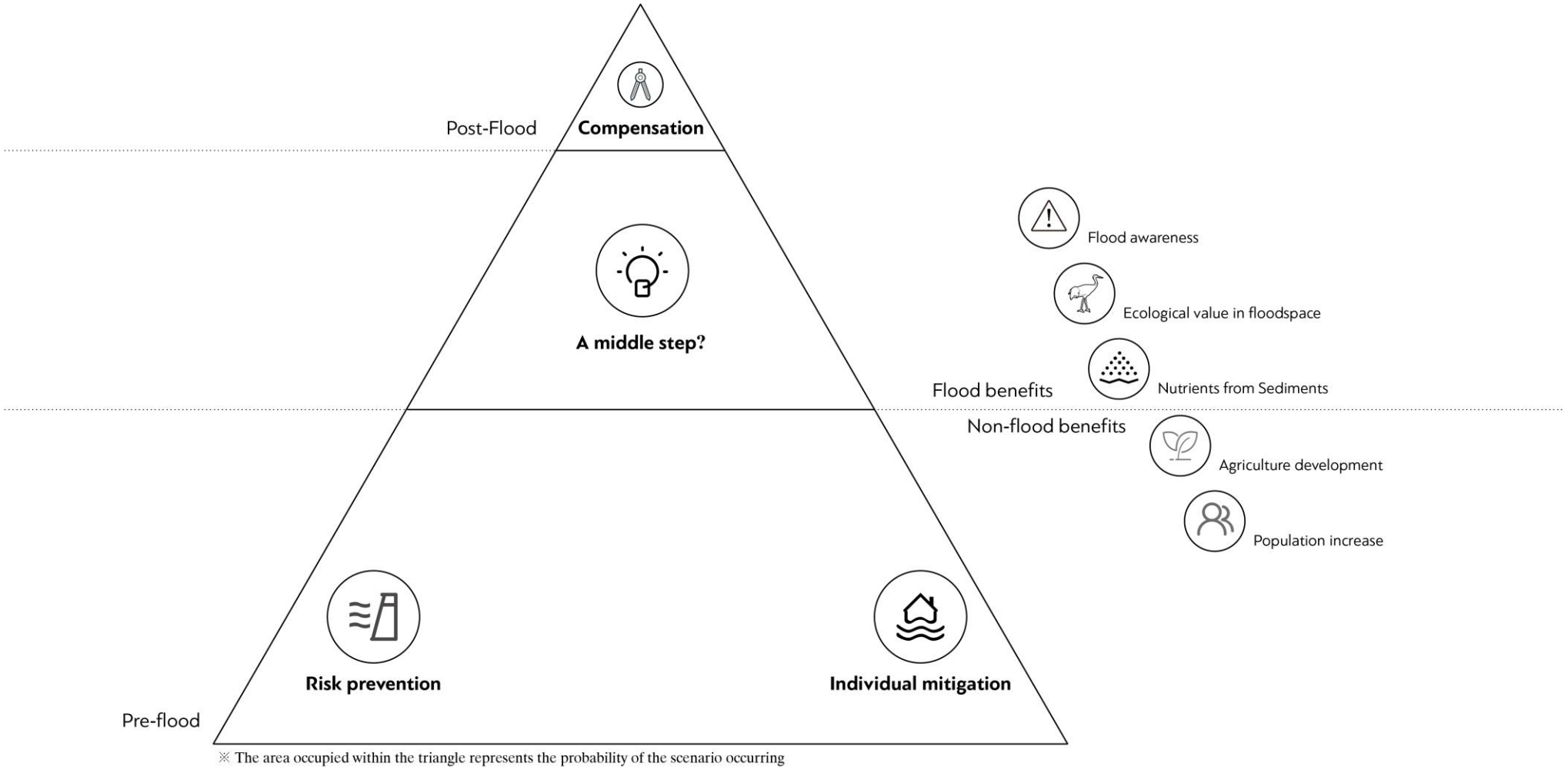
***Socio and eco** - What socio-spatial and ecological consequences have emerged in the JRFSA due to the long-term avoidance of floodwater entry?*

***Livelihood and awareness** - In what ways has the disconnection between local inhabitants and the landscape weakened long-term resilience and awareness of flood risk?*

***Landscape value** - To what extent does the current single-scenario flood management approach contribute to the decline in multifunctionality of the landscape?*

THEORY BACKGROUND

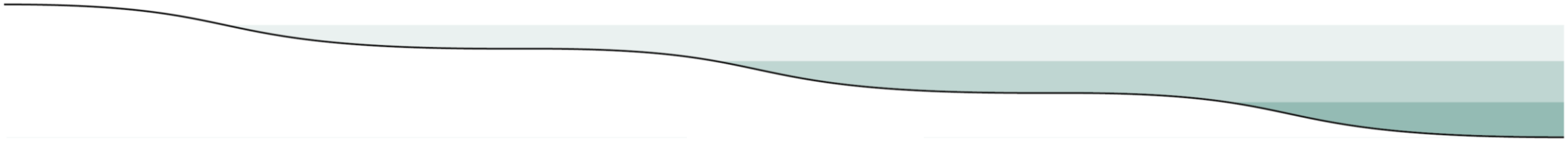
Flood management triangle in JRFSA



Proposal for the Future

DESIGN CONCEPT

Cascading floodspace



A Cascading Floodspace

A spatial design framework that organizes flood storage areas into multiple adaptive layers based on topography, flood frequency, and land use compatibility. Instead of treating the flood zone as a single-use, binary space, it introduces a gradated system that balances flood prevention, ecological recovery, and productive land use through layered inundation and management strategies.

Part 3

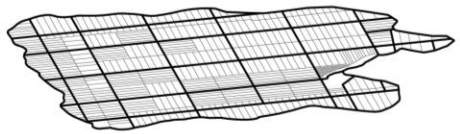
DESIGN

A cascading room ... where lives adapt and cultivate

SCALE

New York Central Park, US

Beemster, Netherlands



Design scale
Basin 2, China

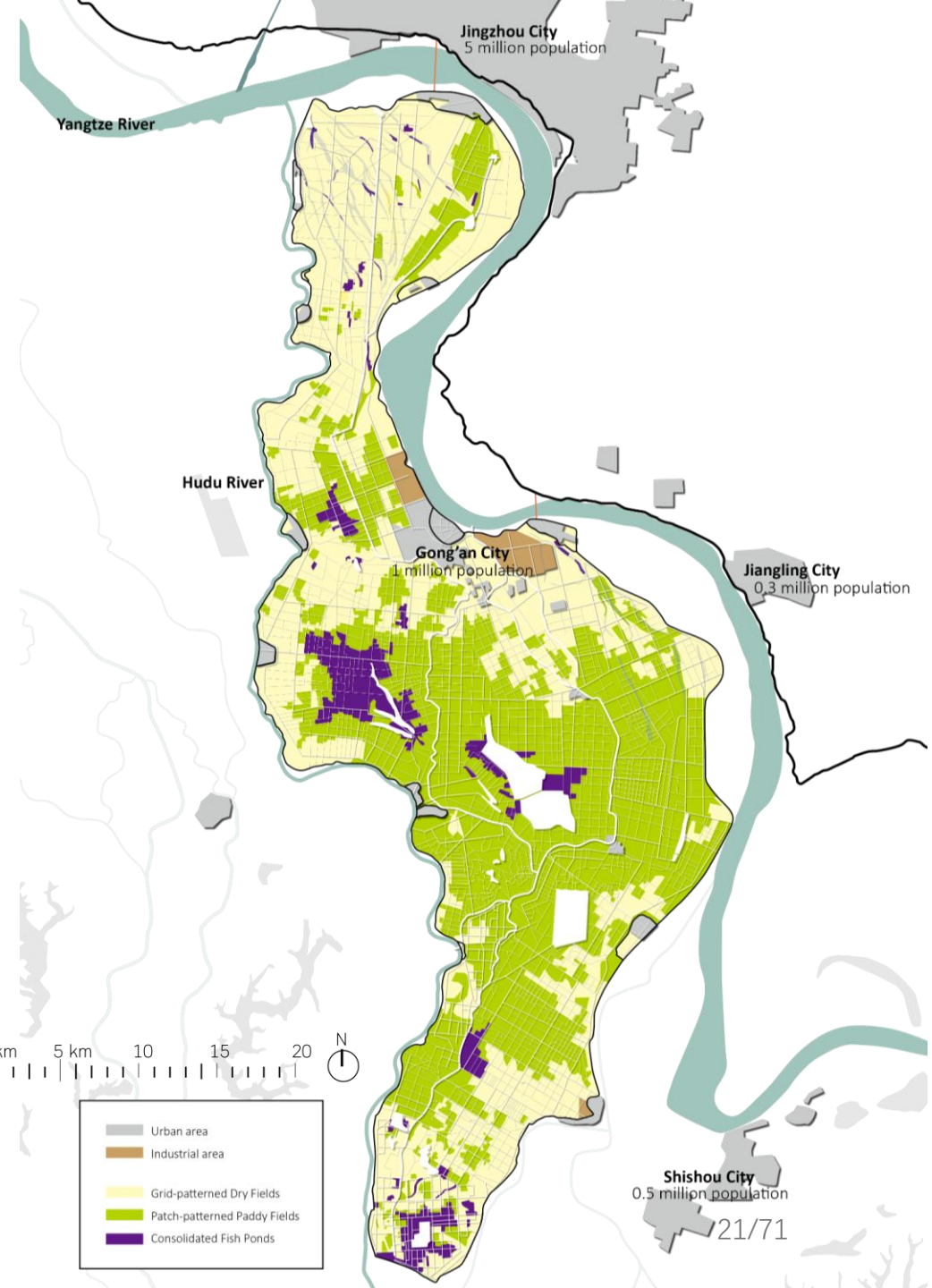
Management scale
Jing River Flood Storage Area, China

EXISTING LANDSCAPE

Dry Field

Paddy Field

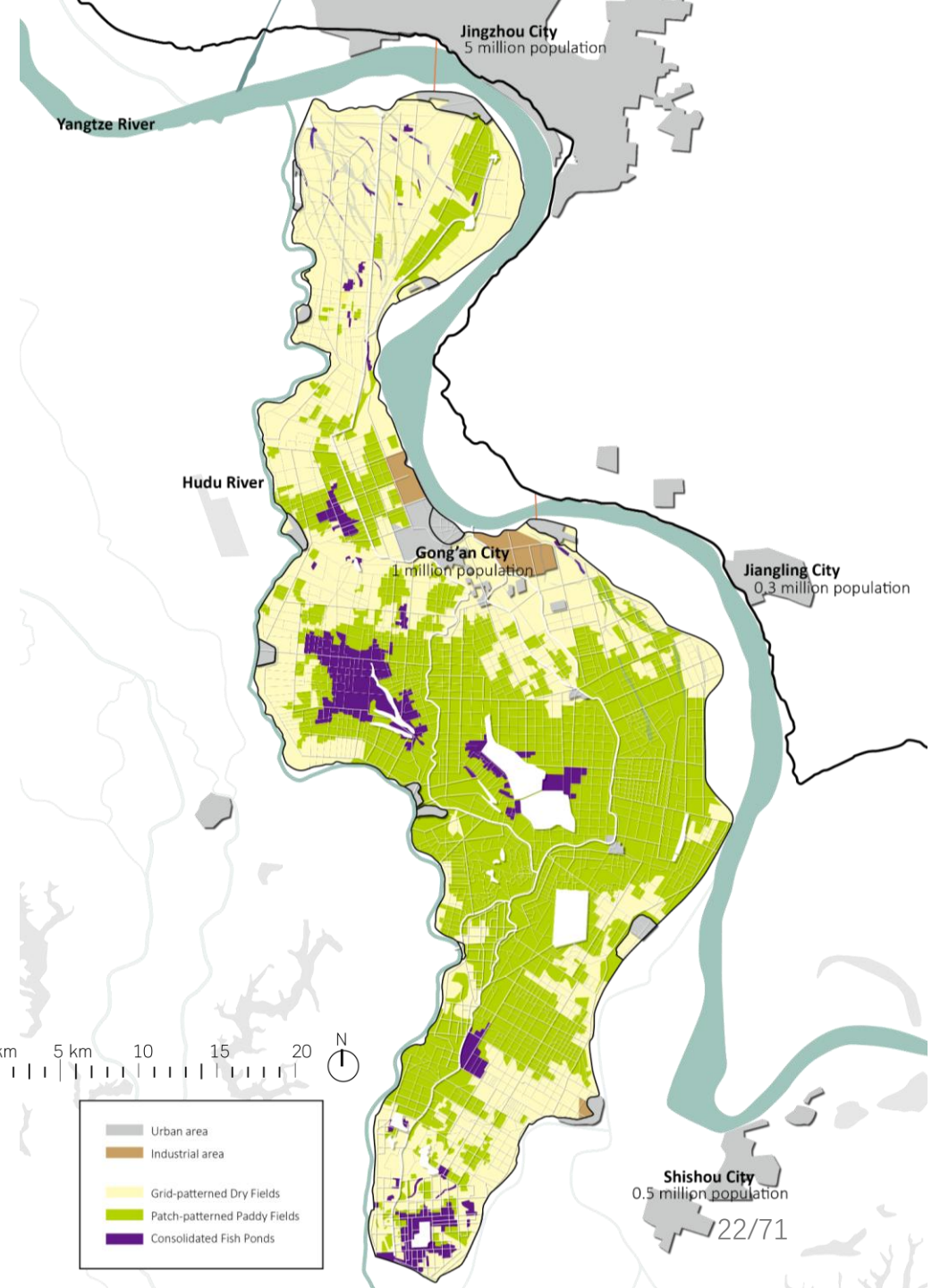
Fishing Pond



EXISTING LANDSCAPE

Gong′ an City

Rural settlements



RESEARCH AREA

Jing River Flood Storage Area (JRFSA)

STAKEHOLDER & VALUES

values

F — Flood prevention

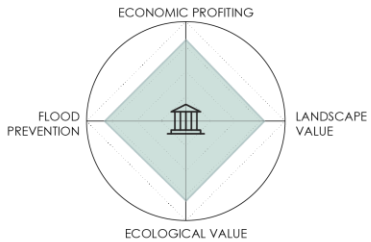
E — Economic profitting

C — Ecological value

L — Landscape value

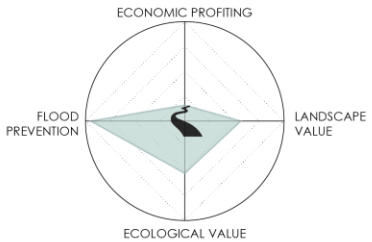
stakeholders

Coordinator



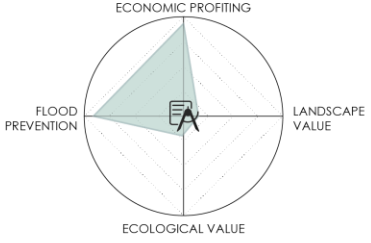
the Hubei Provincial Government
Gong'an County Government
Urban residents in JRFSA

Downstream Beneficiary



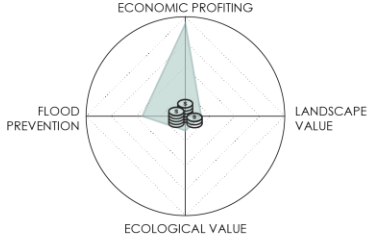
Wuhan City and other major downstream cities

Realist



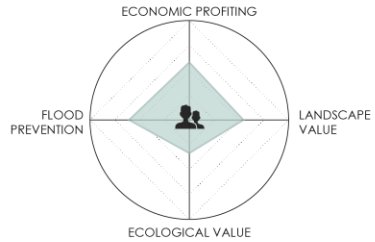
Commercial banks
Agricultural cooperatives

Developer



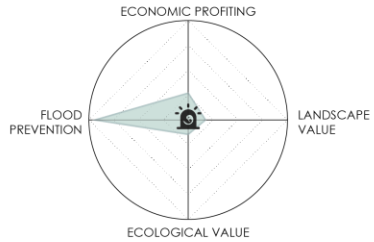
Agricultural individual contractors
Agricultural company contractors
Agricultural product processing enterprises
Residents of safety platforms in JRFSA
Local non-agricultural enterprises

Expector



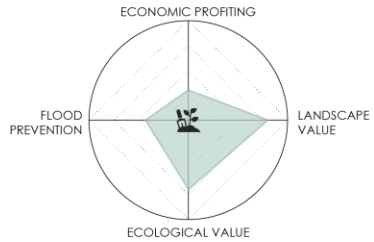
local farmers

Protector

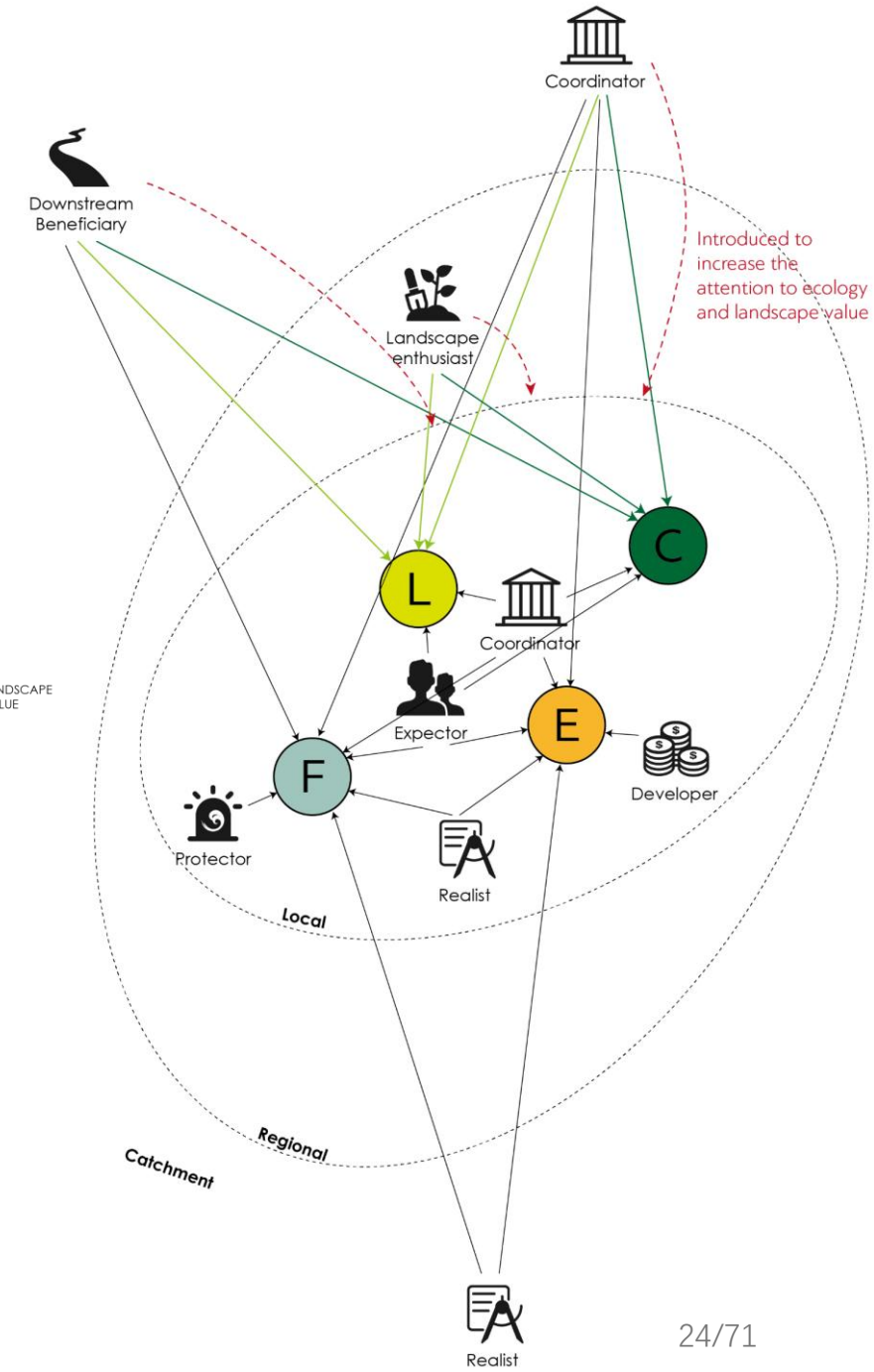


the Flood Control and Drought Relief Headquarters
the Gong'an City Fire and Rescue Brigade
the Jing River Flood Retention Area Project Management Bureau

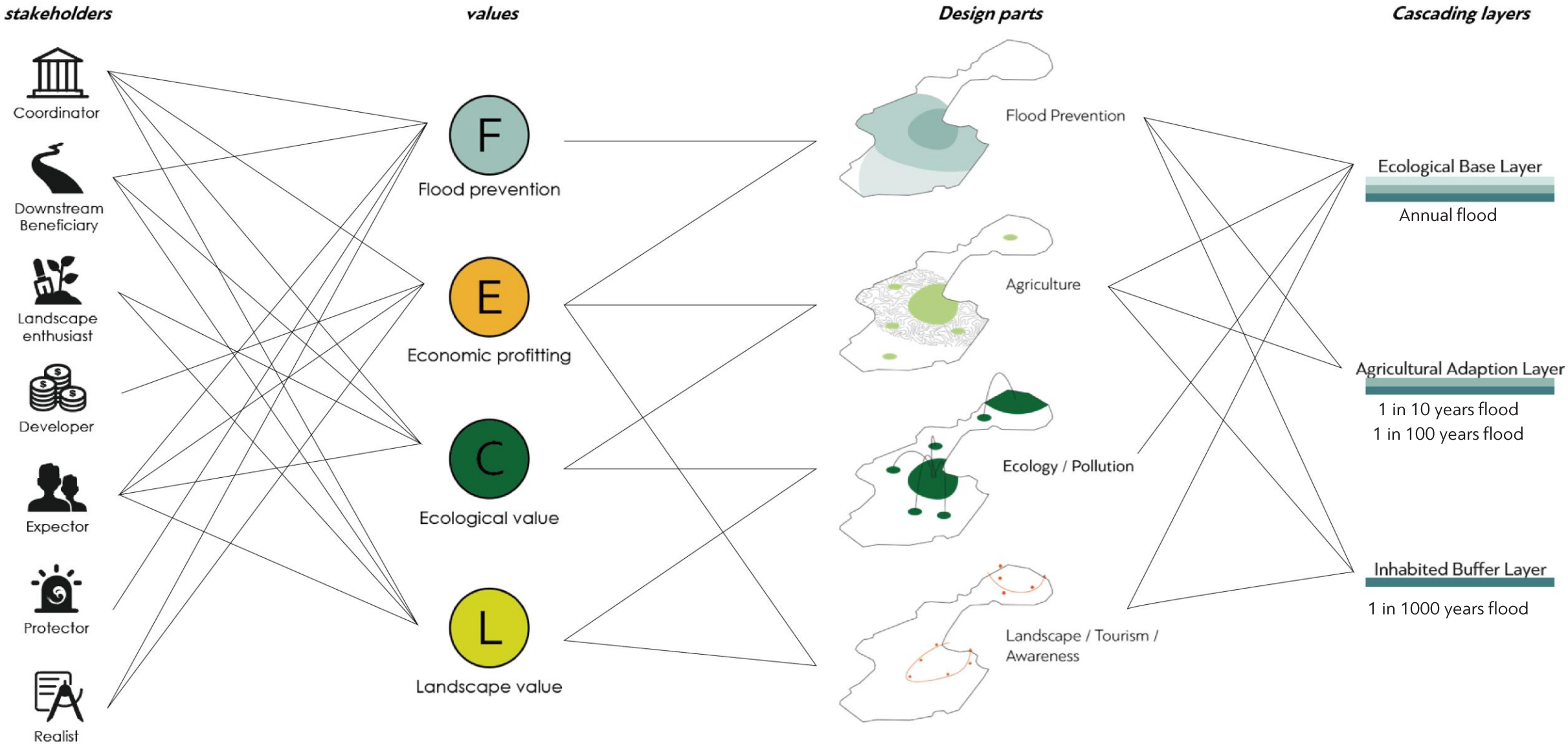
Landscape enthusiast



Jingzhou Municipal Government
Jingzhou Ecological and Environmental Bureau
local flora and fauna



GENERATION OF DESIGN STRUCTURES

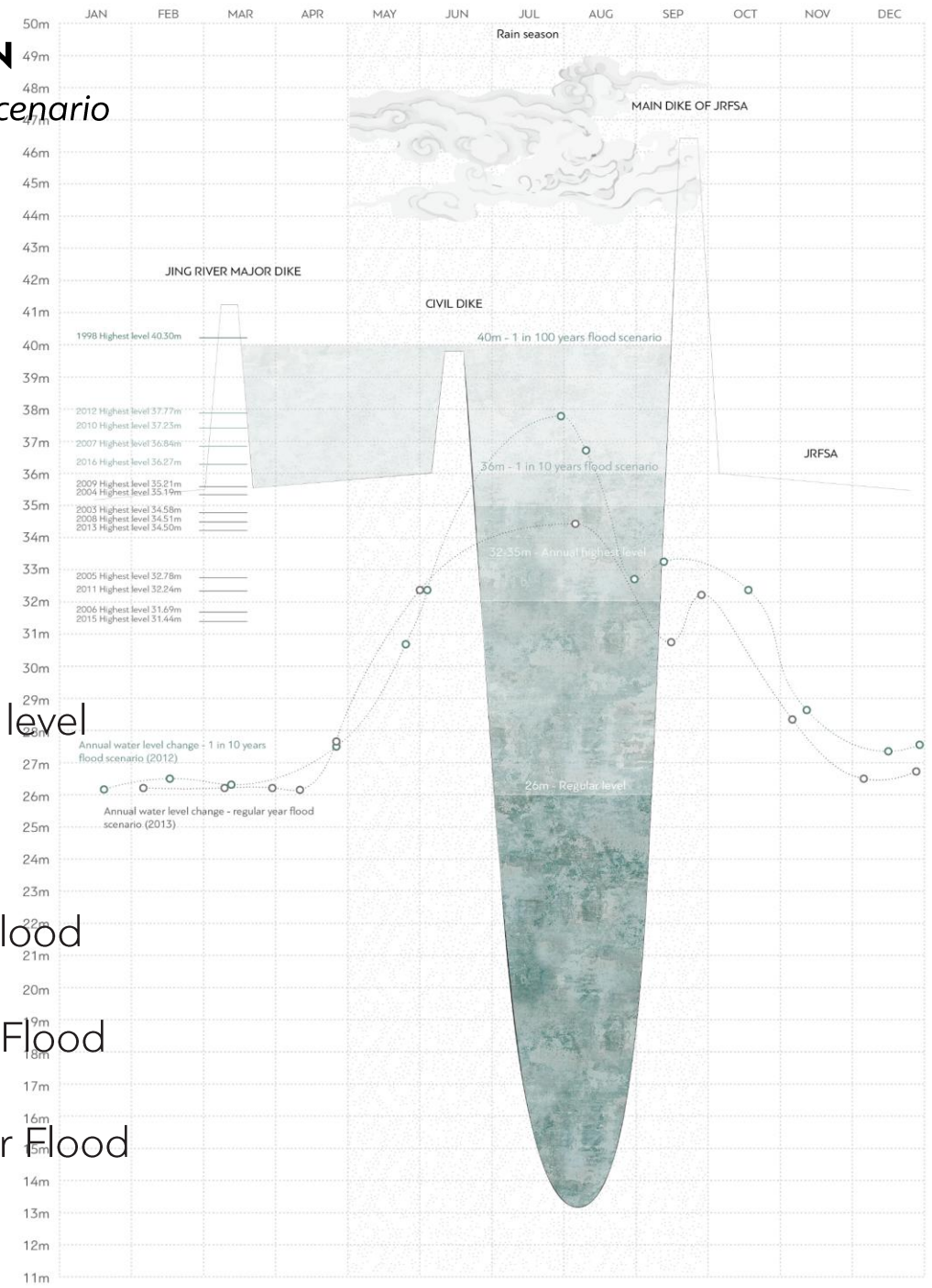


Design Part

FLOOD PREVENTION

FLOOD PREVENTION

Flood level and flood scenario



Regular water level

26m

Annual Flood

32m-35m

1-in-10-year Flood

36m

1-in-100-year Flood

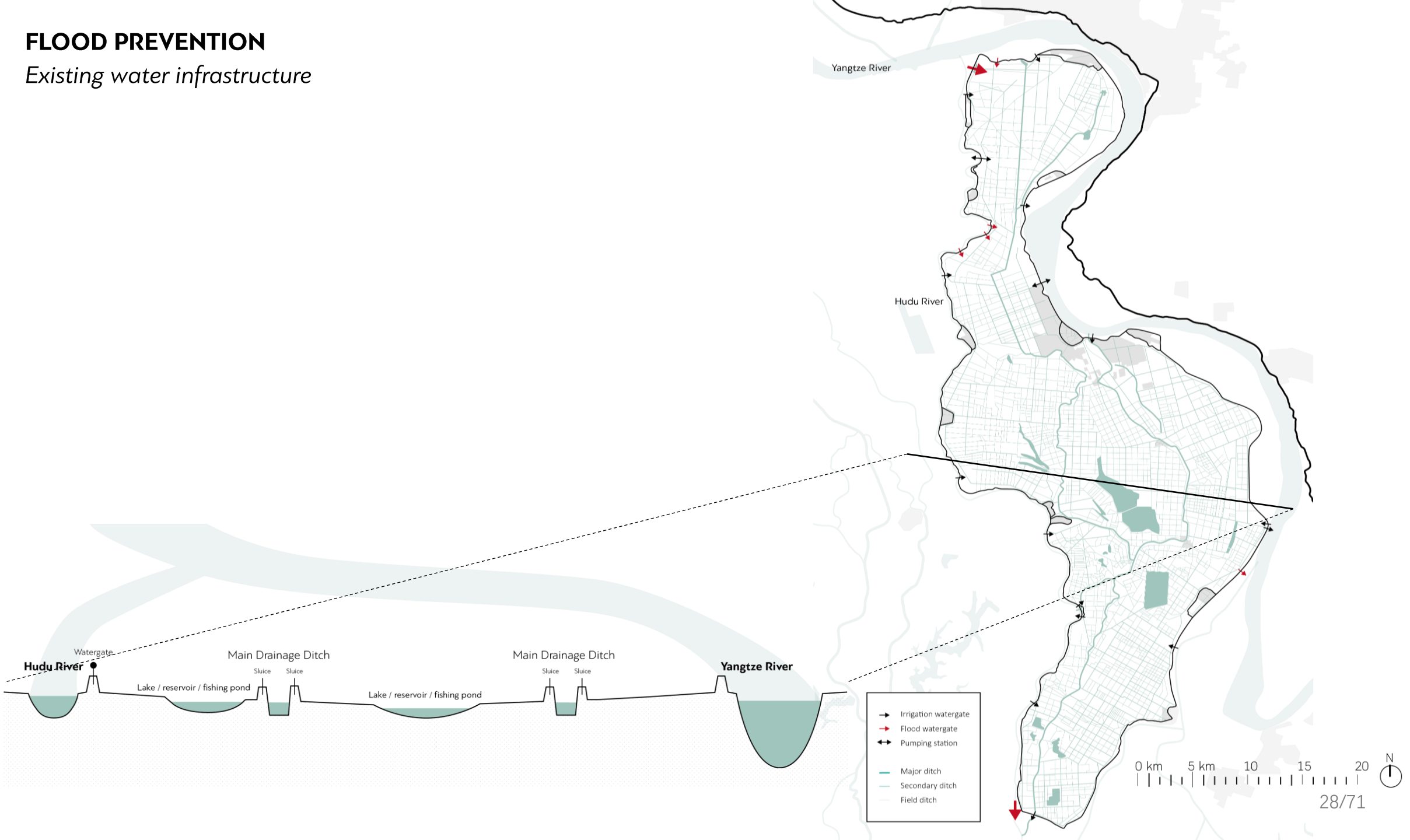
38m

1-in-1000-year Flood

40m

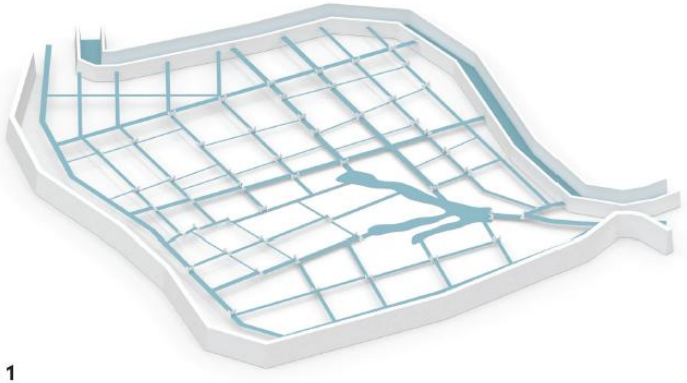
FLOOD PREVENTION

Existing water infrastructure



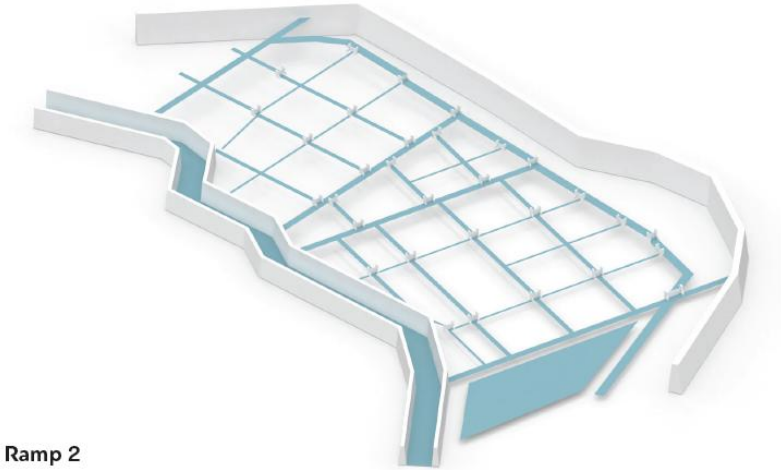
FLOOD PREVENTION

Terrain model



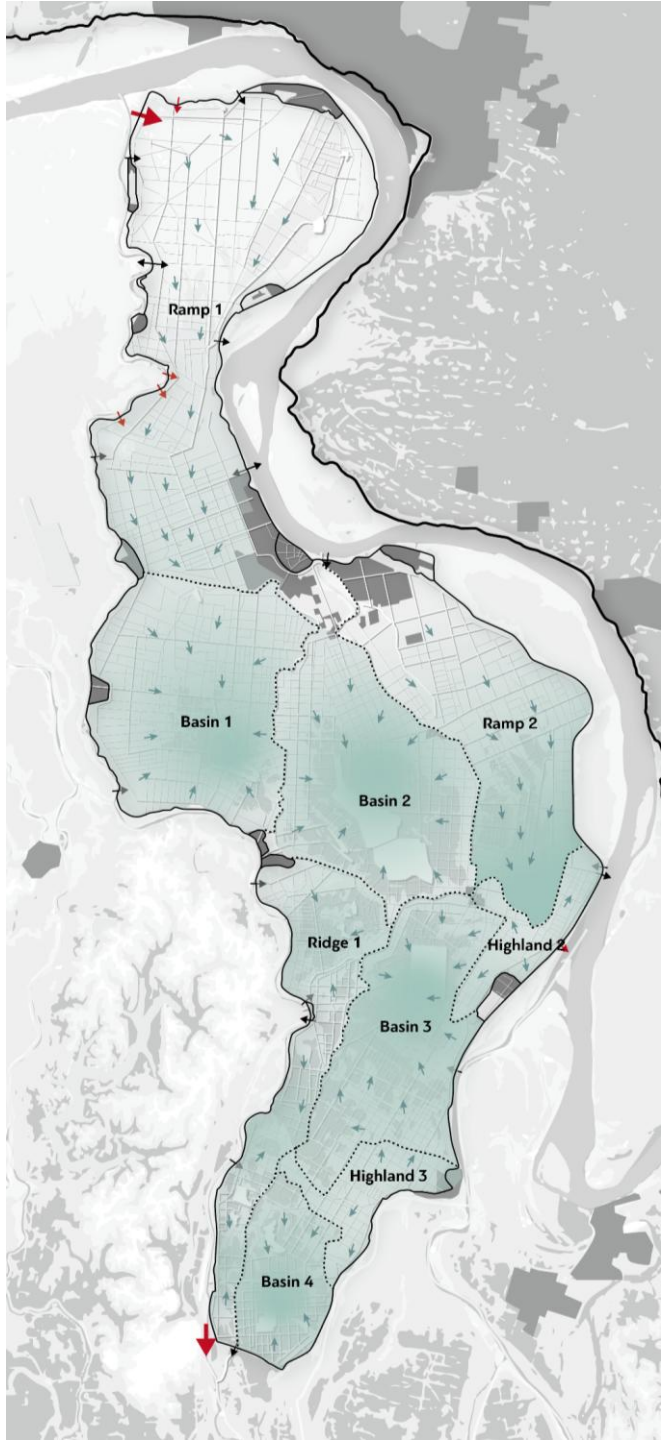
Basin 1

A typical example of basin. This type of region presents a "high all around and low in the center" closed form, with good water collection characteristics. When floods occur, water naturally converges toward the lowest point in the terrain, making it the ideal storage unit for water.



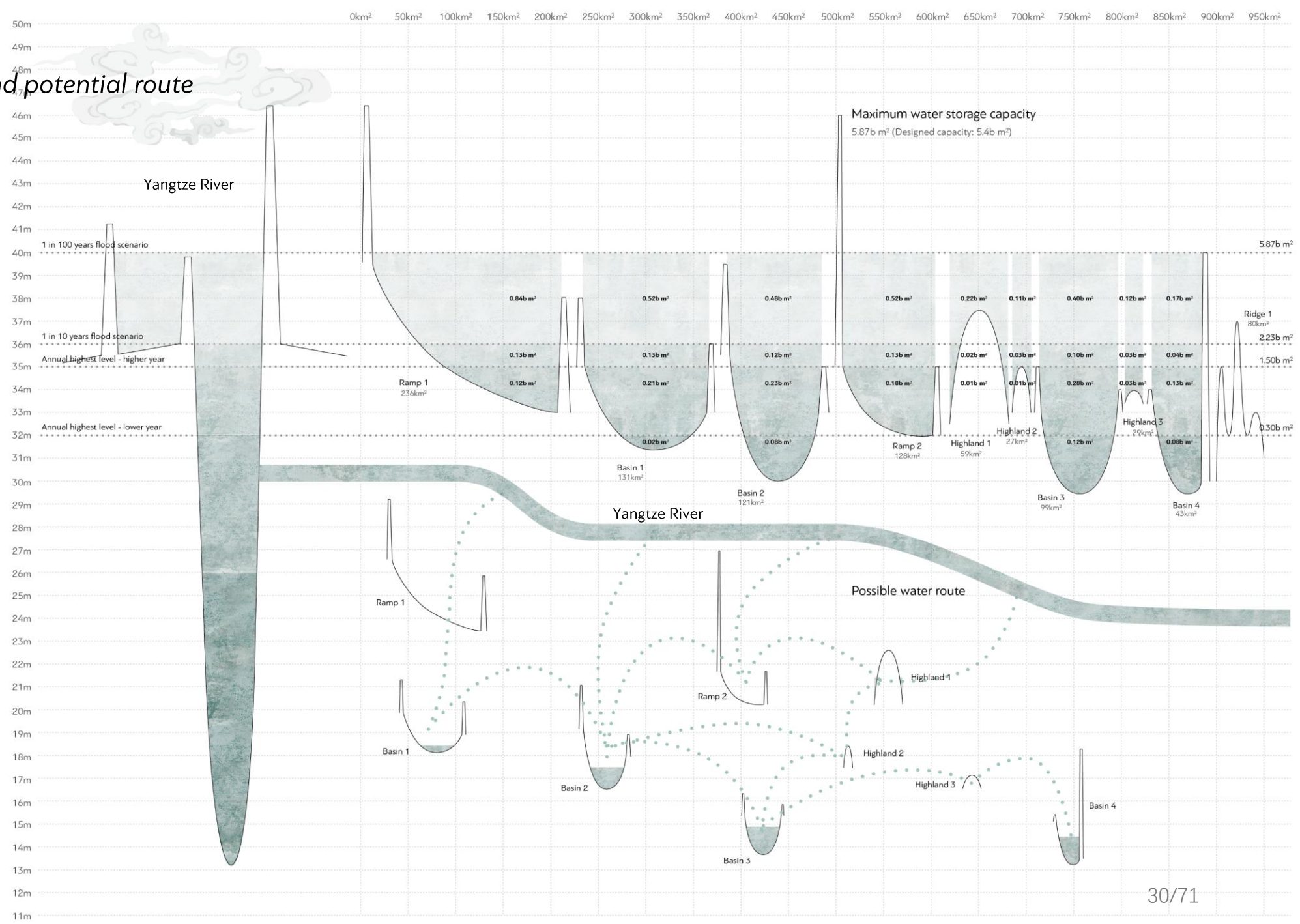
Ramp 2

A typical example of ramp. This type of region exhibits a single-direction gradient decrease in elevation. When water enters from higher areas, the entire region will be exposed to water flow, quickly resulting in widespread flooding. However, when water enters from lower areas, it allows for gradient-based flood storage, which is beneficial for implementing a "tiered storage" strategy.



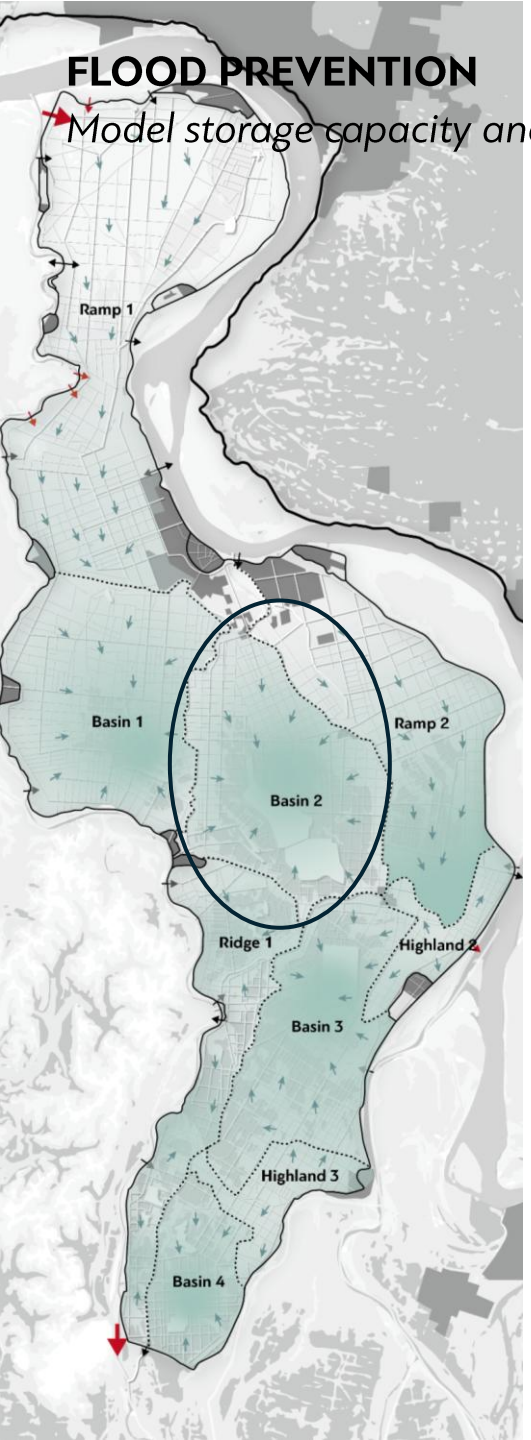
FLOOD PREVENTION

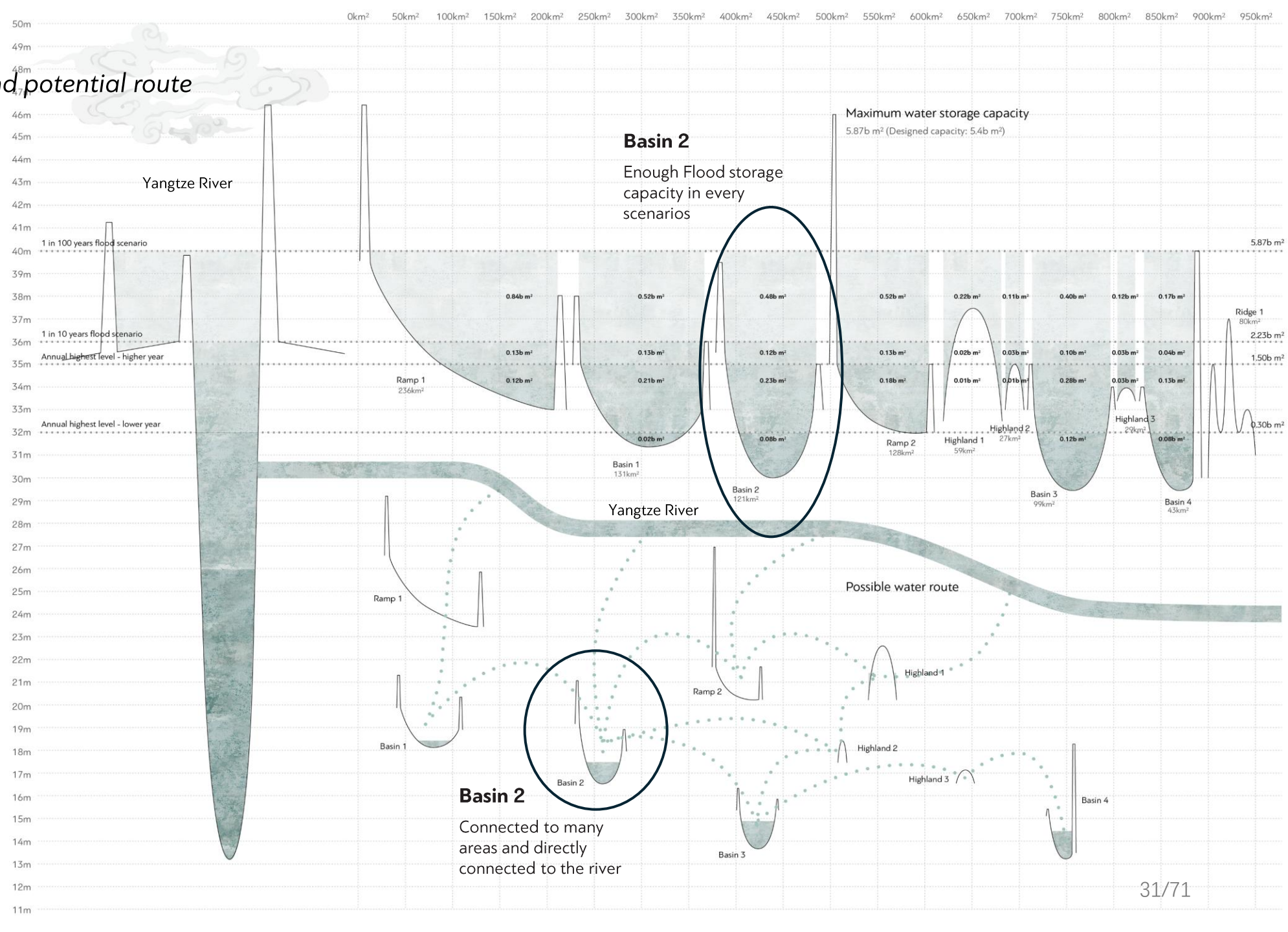
Model storage capacity and potential route



FLOOD PREVENTION

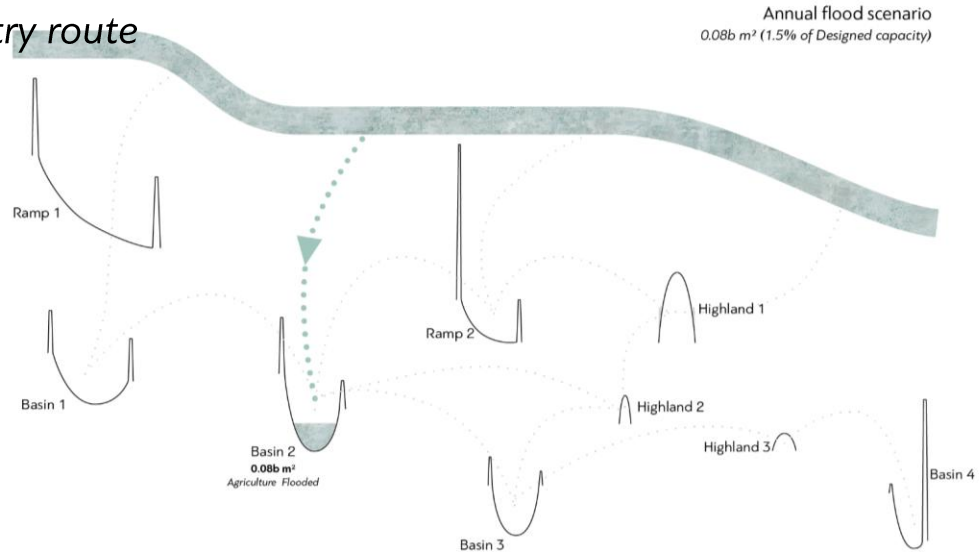
Model storage capacity and potential route

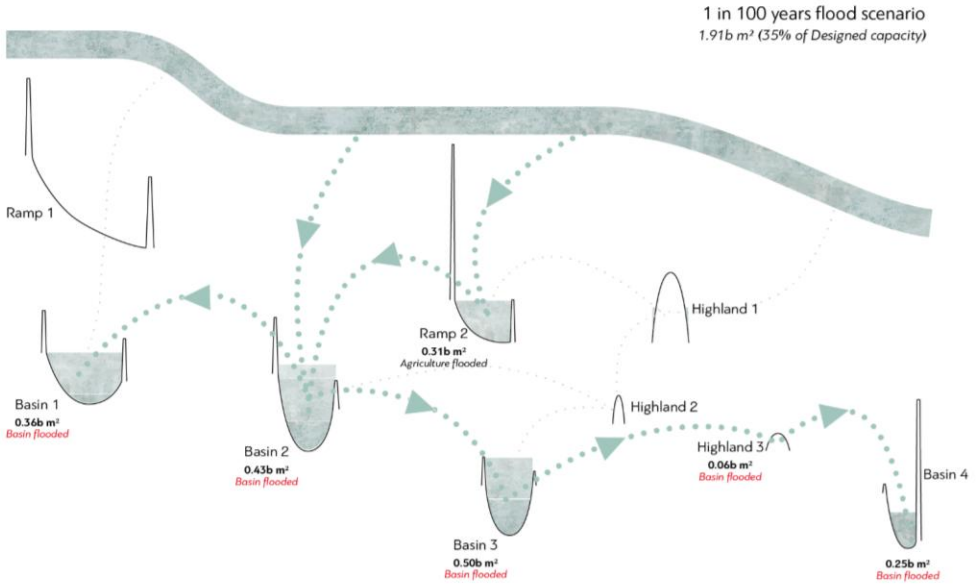


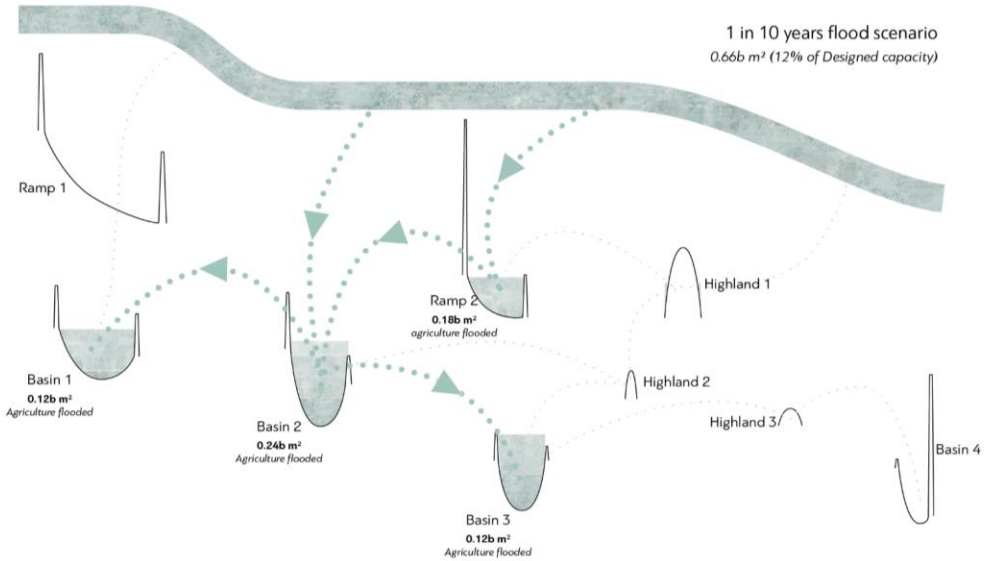


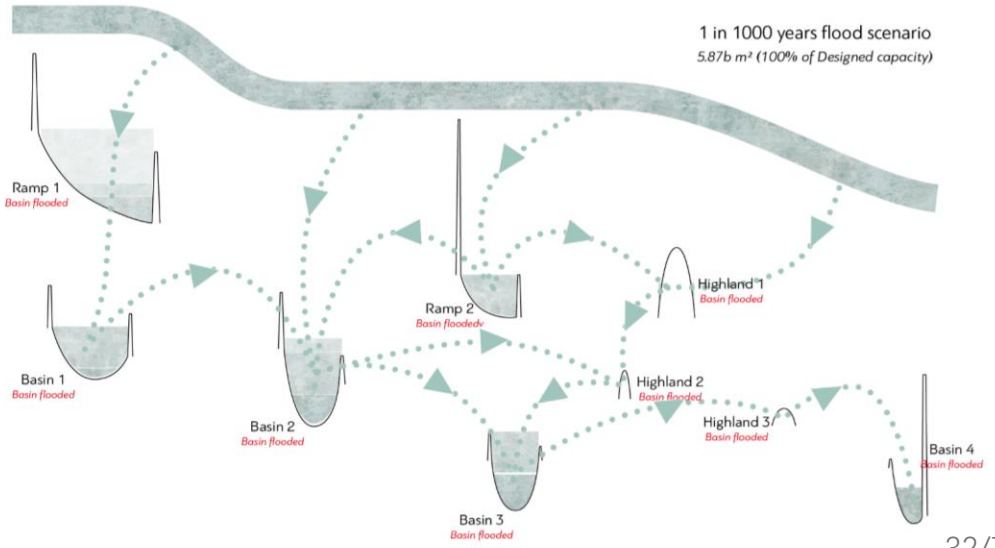
FLOOD PREVENTION

Flood entry route



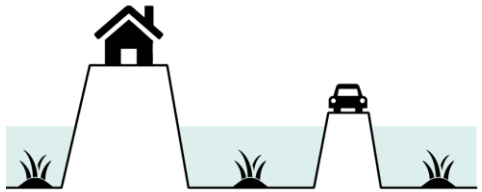






FLOOD PREVENTION

Flood scenario and flooded area



Agriculture flooded

Only agricultural areas are flooded, while settlements and main roads remain dry.

All Area flooded

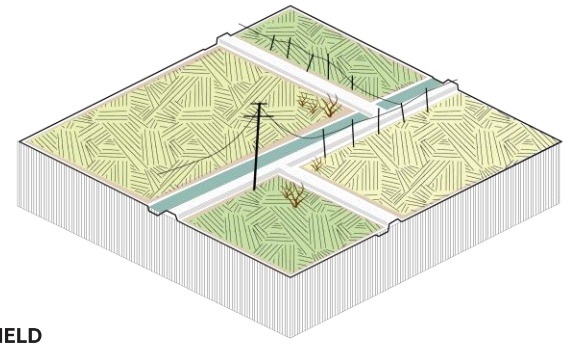
The entire area, including settlements and transportation facilities, is completely submerged.

Design Part

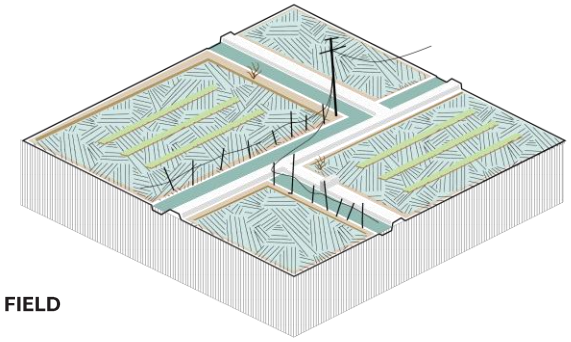
AGRICULTURE

AGRICULTURE

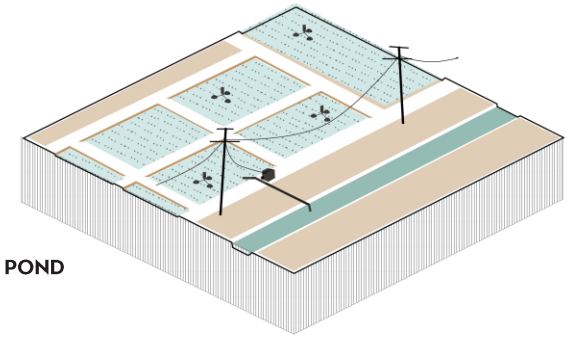
Existing agriculture patterns



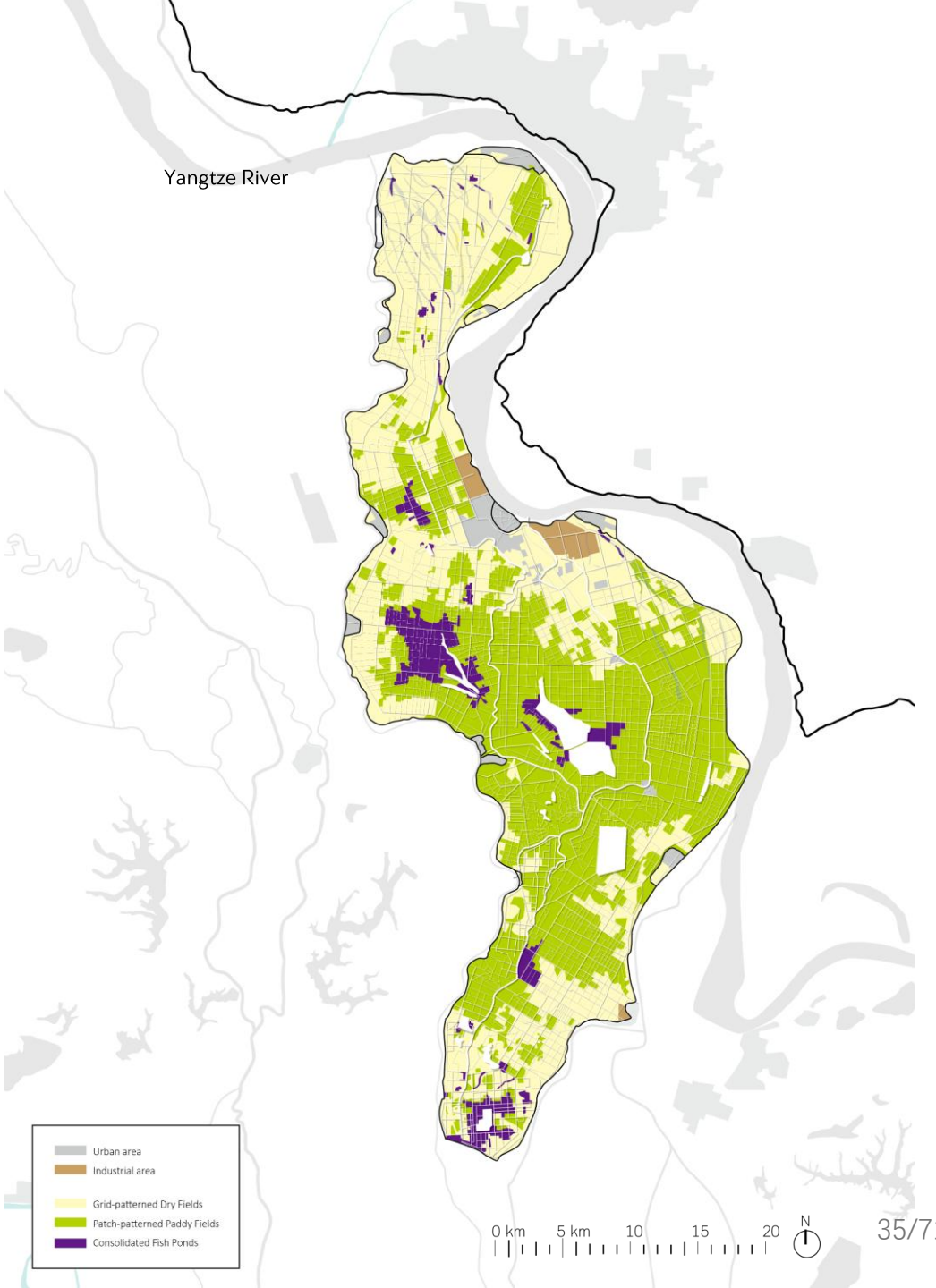
DRY FIELD



PADDY FIELD



FISHING POND



AGRICULTURE

Strategies and proposed agriculture patterns

Annual Flood Symbiosis (AFS)

Annual Flood Symbiosis focuses **on adapting to yearly flooding rather than resisting it**. Inspired by the traditional weiyuan system, it promotes diverse, low-impact land uses like grazing, green manure, and wetland crops to balance ecology, economy, and culture, making it ideal as a pilot zone for transformation.

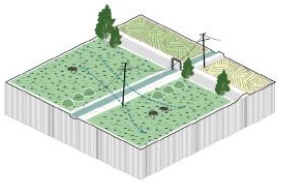
Flood Storage Adaptation (FSA)

Flood Storage Adaptation focuses on areas with **moderate flood risk**, aiming to **reduce damage while maintaining farming**. It uses a compartmentalized layout to control flooding and relies on adaptive infrastructure to support recovery and ongoing use.

Ecological Modification and Diversification (EMD)

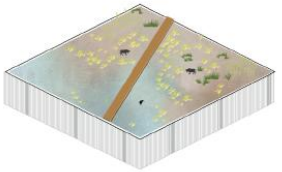
Ecological Modification and Diversification targets areas with **rare flooding**, focusing on **long-term ecological and agricultural development**. It promotes biodiversity, mixed cropping, and community-based initiatives to build a resilient and multifunctional rural landscape.

Annual Flood symbiosis



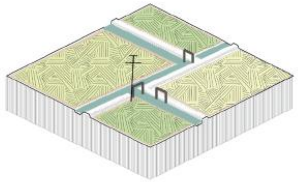
Pasture

Aquaculture

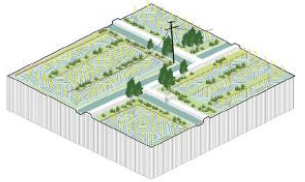


Floodplain wild farming

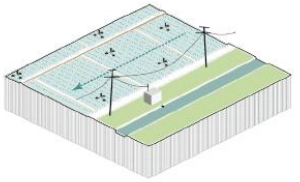
Flood storage adaptation



Adaptive dry field

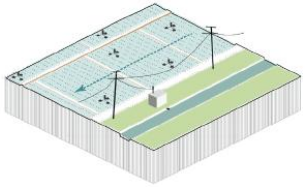


Ecological paddy field

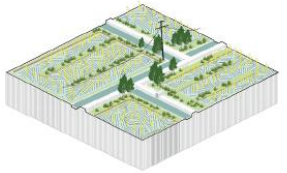


Adaptive fishing pond

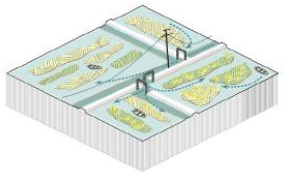
Ecological modification and diversify



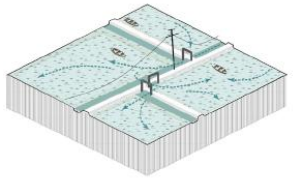
Adaptive fishing pond



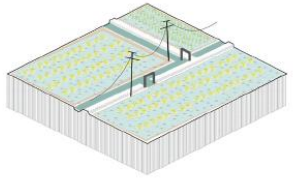
Ecological paddy field



Floating agriculture



Aquatic planting

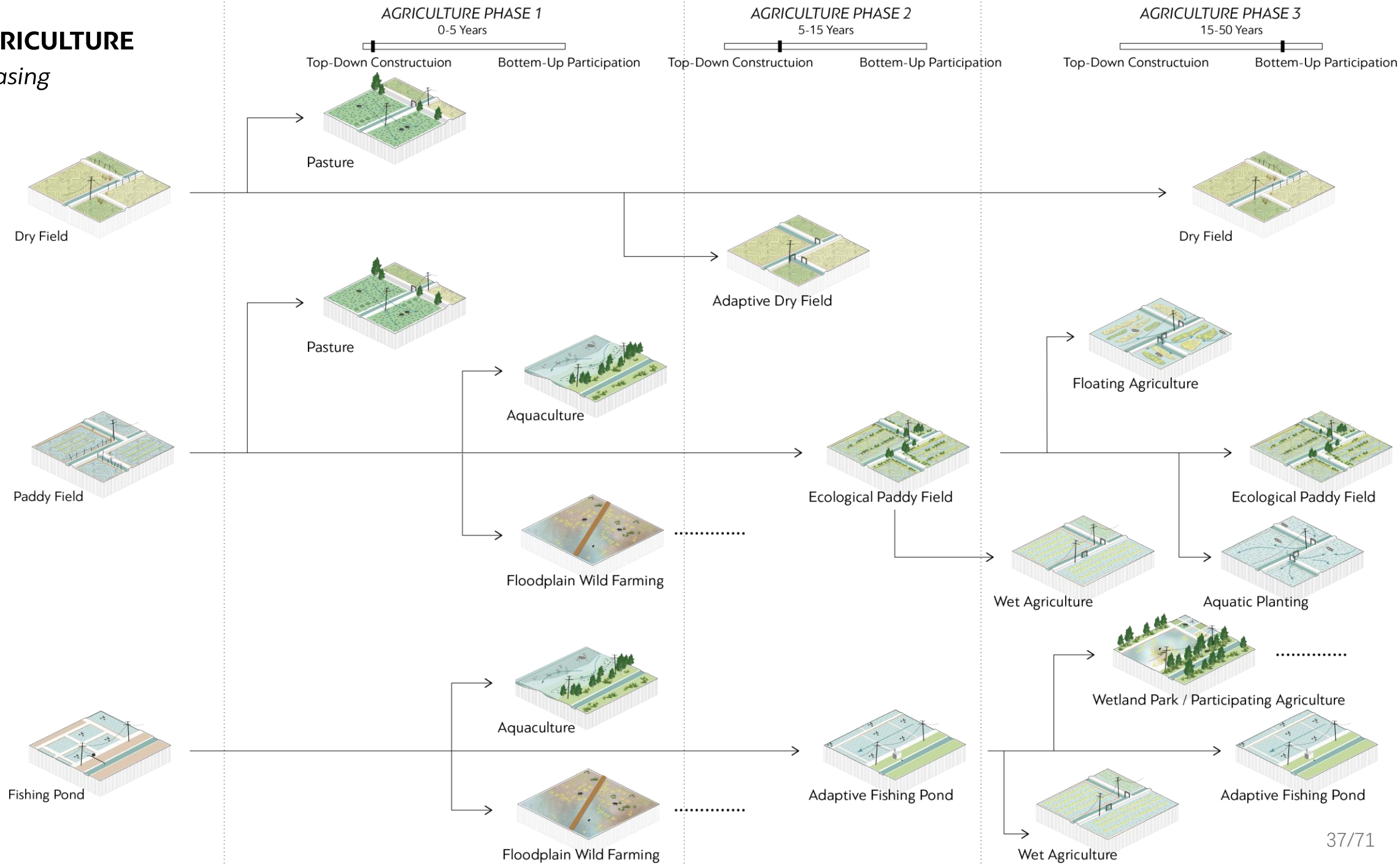


Wet agriculture

Wetland park / Participating agriculture

AGRICULTURE

Phasing



AGRICULTURE

Visualization of annual flood symbiosis

Fig.3.17. Visualization of Annual Flood Symbiosis

AGRICULTURE

Visualization of flood storage adaptation

Fig.3.18 Visualization of Flood Storage Adaptation

AGRICULTURE

Visualization of ecological modification and diversification

Fig.3.19. Ecological Modification and Diversification

Design Part

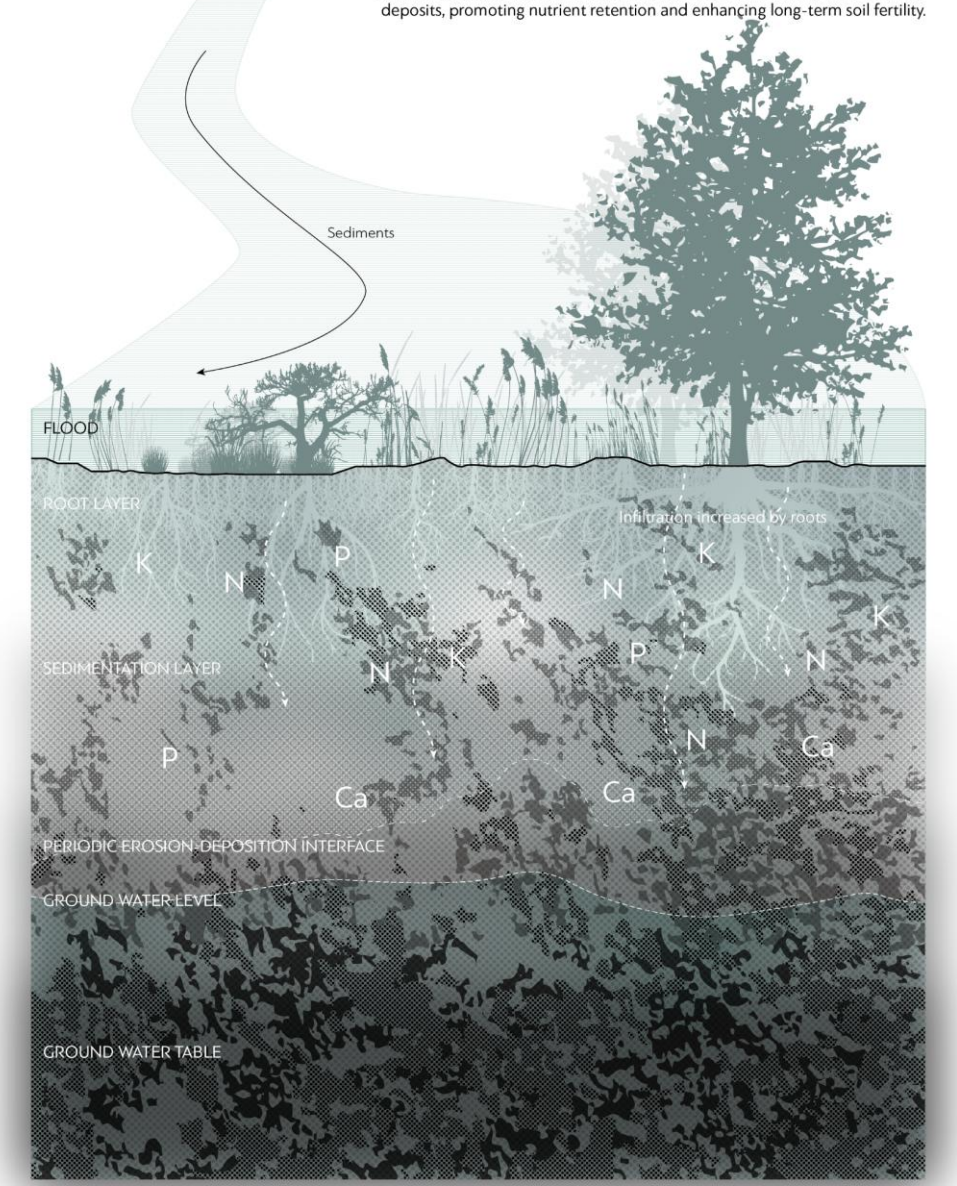
ECOLOGY / POLLUTION

ECOLOGY / POLLUTION

Sediments and nutrients

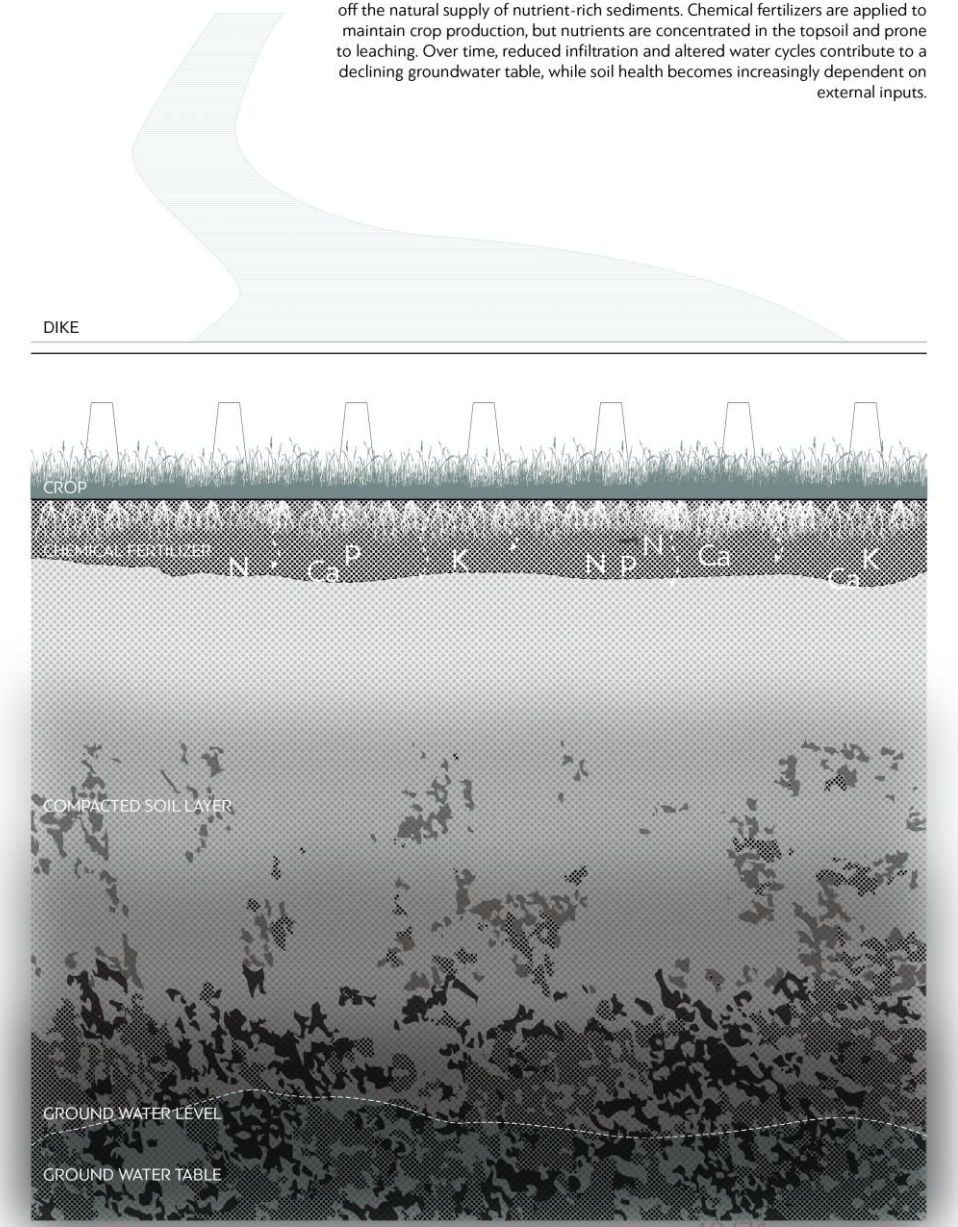
FLOOD AS FERTILIZER

Seasonal floodwaters deposit fine sediments above the groundwater table, enriched with essential nutrients such as nitrogen (N), phosphorus (P), potassium (K), and calcium (Ca). Well-developed plant root systems help stabilize these deposits, promoting nutrient retention and enhancing long-term soil fertility.



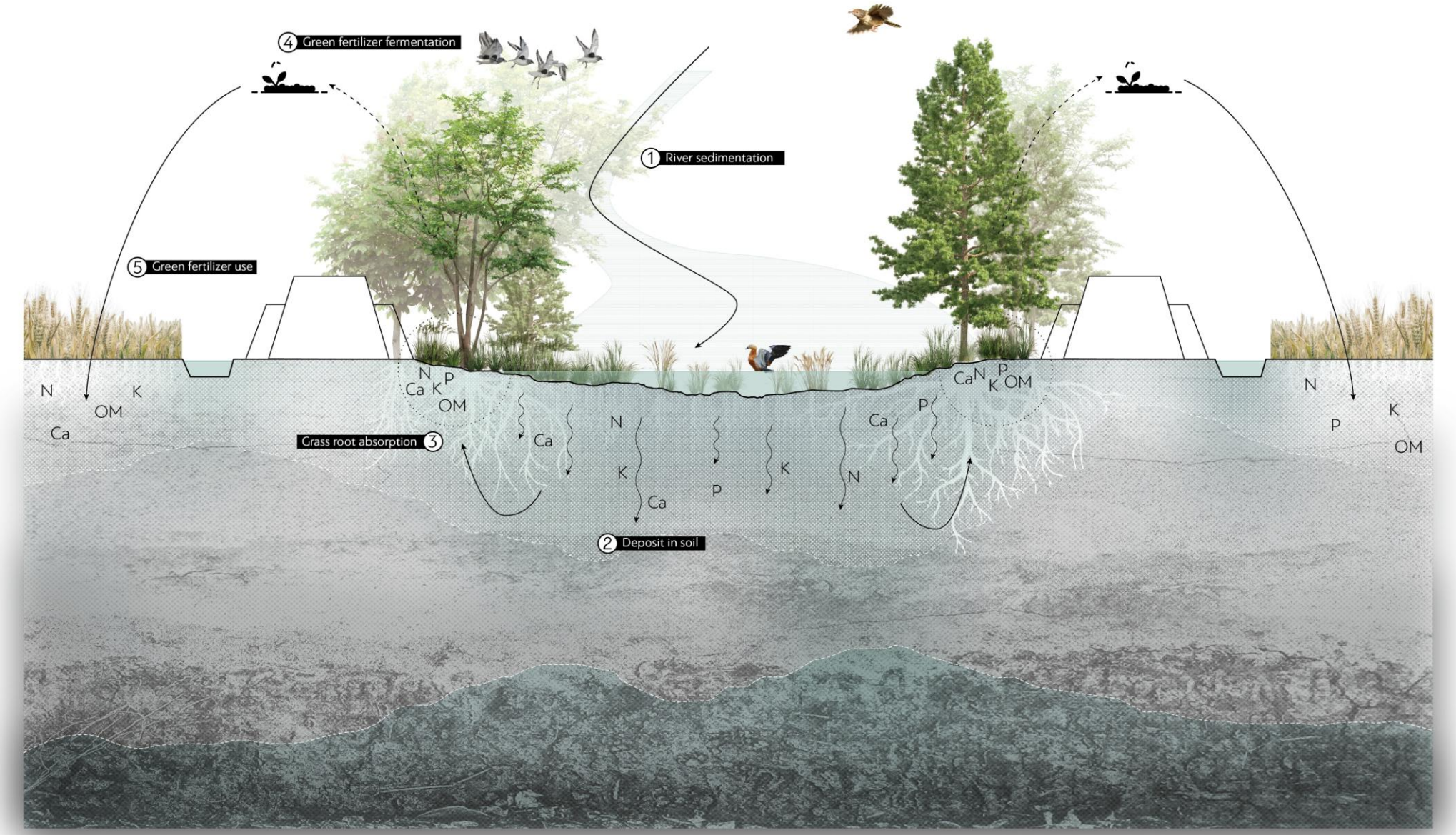
DISRUPTED SEDIMENTATION

Following the construction of dikes, floodwaters no longer reach the field, cutting off the natural supply of nutrient-rich sediments. Chemical fertilizers are applied to maintain crop production, but nutrients are concentrated in the topsoil and prone to leaching. Over time, reduced infiltration and altered water cycles contribute to a declining groundwater table, while soil health becomes increasingly dependent on external inputs.



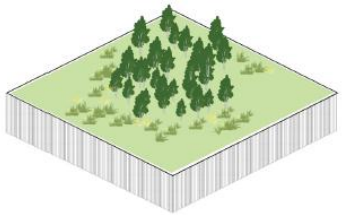
ECOLOGY / POLLUTION

New nutrients cycle with green fertilizer

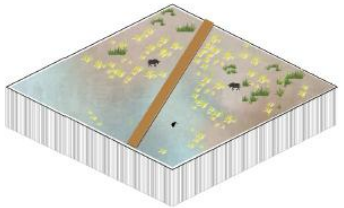


ECOLOGY / POLLUTION

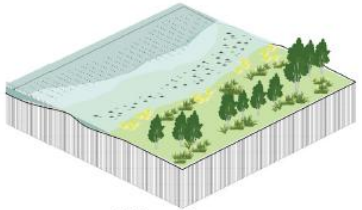
Habitats



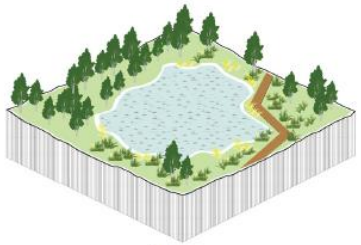
Forest



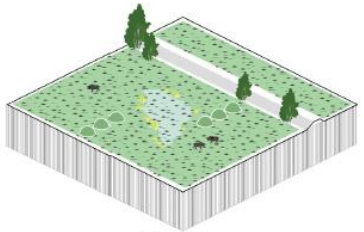
Floodplain



Waterfront



Lake



Pasture

ECOLOGY / POLLUTION

Visualization of marshland and pasture

Fig.3.25. Visualization of pasture and marshland

ECOLOGY / POLLUTION

Visualization of overflown lake and forest

Fig. 4.26 Visualization of overflown lake and forest

Design Part

LANDSCAPE / TOURISM / AWARENESS

LANDSCAPE / TOURISM / AWARENESS

Two routes, two entrances, two different eras

Flood Heritage

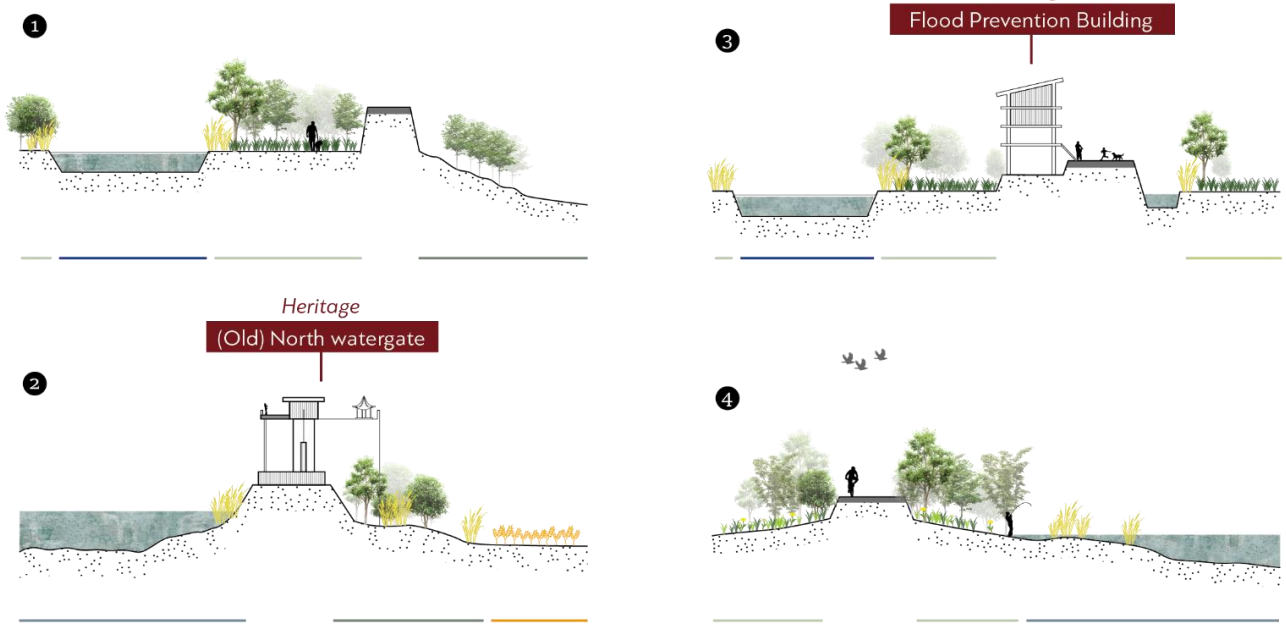
Flood escape buildings

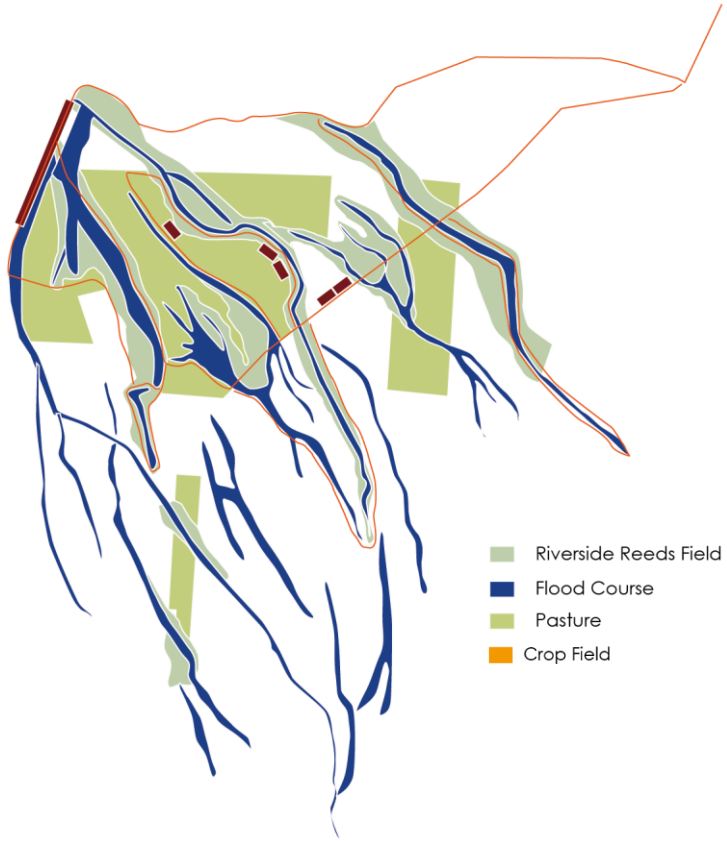
Old north watergate

LANDSCAPE / TOURISM / AWARENESS

Landscape types

Flood heritage route

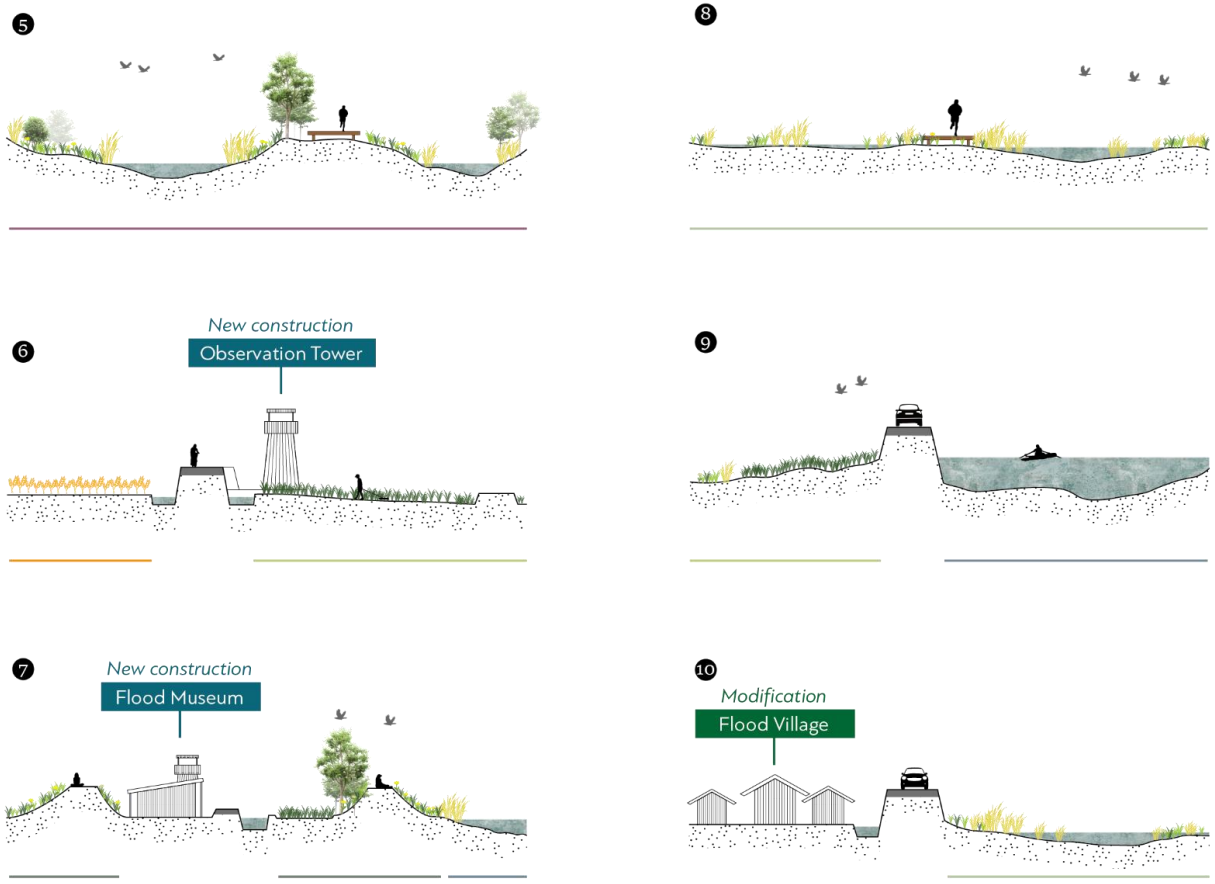




LANDSCAPE / TOURISM / AWARENESS

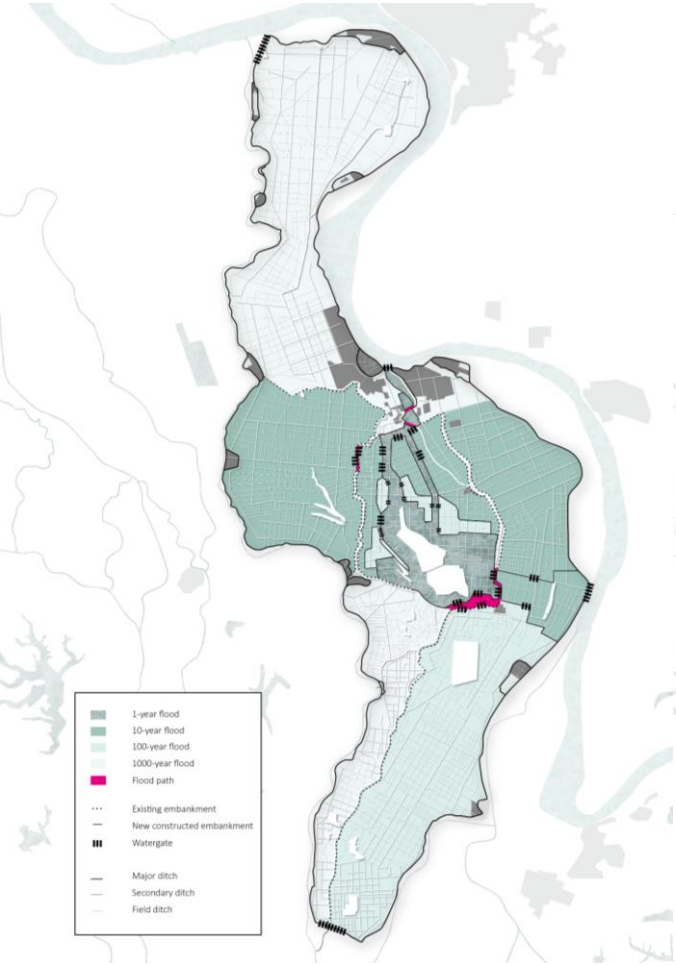
Landscape types

Flood adaption route

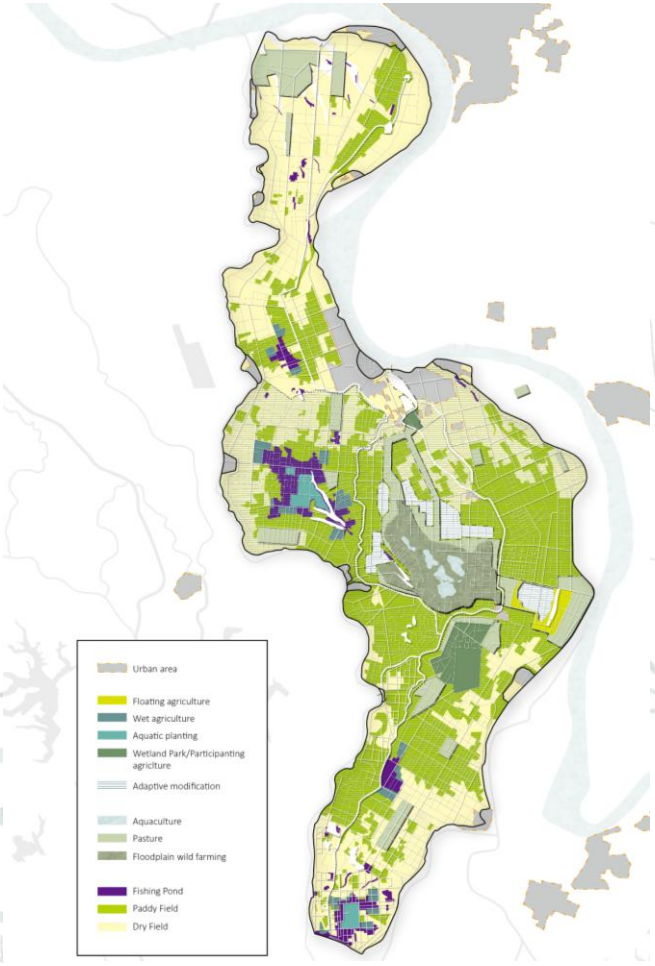


FOUR DESIGN PARTS PLAN

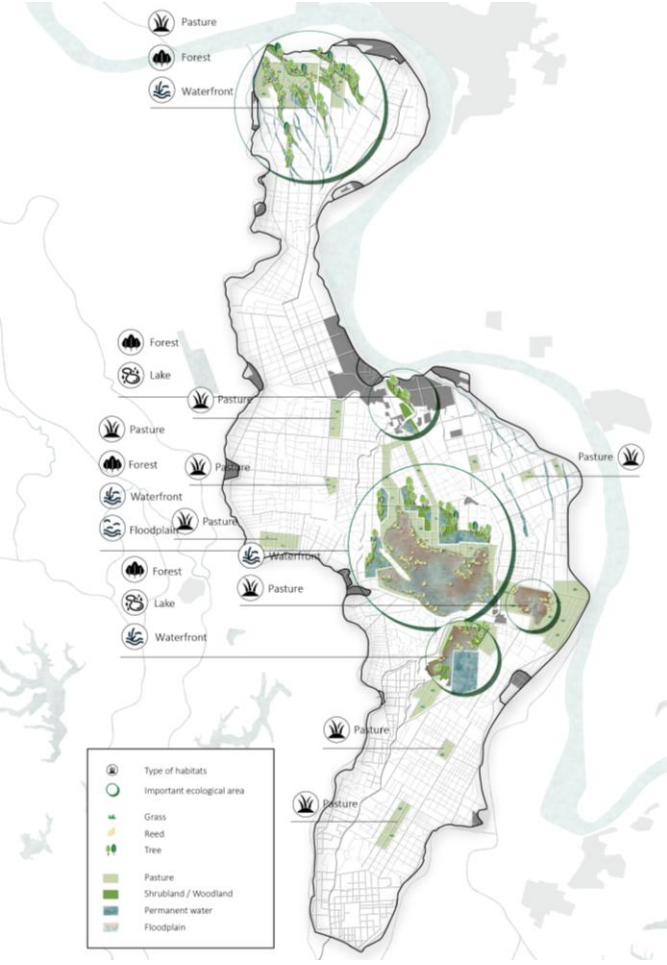
Flood prevention



Agriculture



Ecology / Pollution



Landscape Tourism Awareness

MASTERPLAN

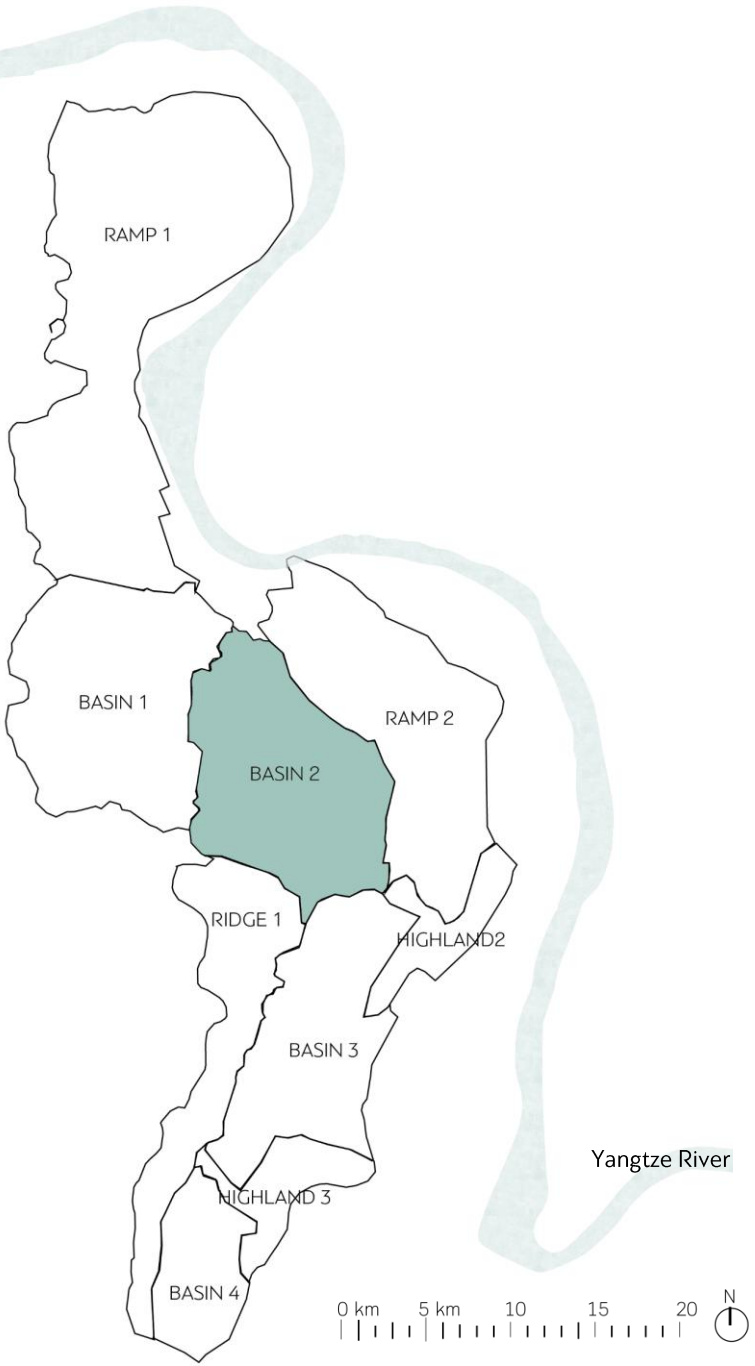

Agriculture flooded
Area flooded
New embankment
Point of interest
Tourism bike path
Tourism car path
Watergate
Reed
Tree
Modified agriculture
Waterfront wetland
Permanent water
Shrubland / Woodland
Floodplain
Pasture
Major ditch
Secondary ditch
Field ditch

MASTERPLAN


Agriculture flooded
Area flooded
New embankment
Point of interest
Tourism bike path
Tourism car path
Watergate
Reed
Tree
Modified agriculture
Waterfront wetland
Permanent water
Shrubland / Woodland
Floodplain
Pasture
Major ditch
Secondary ditch
Field ditch

ZOOM IN BASIN 2

Location



ZOOM IN BASIN 2

Area

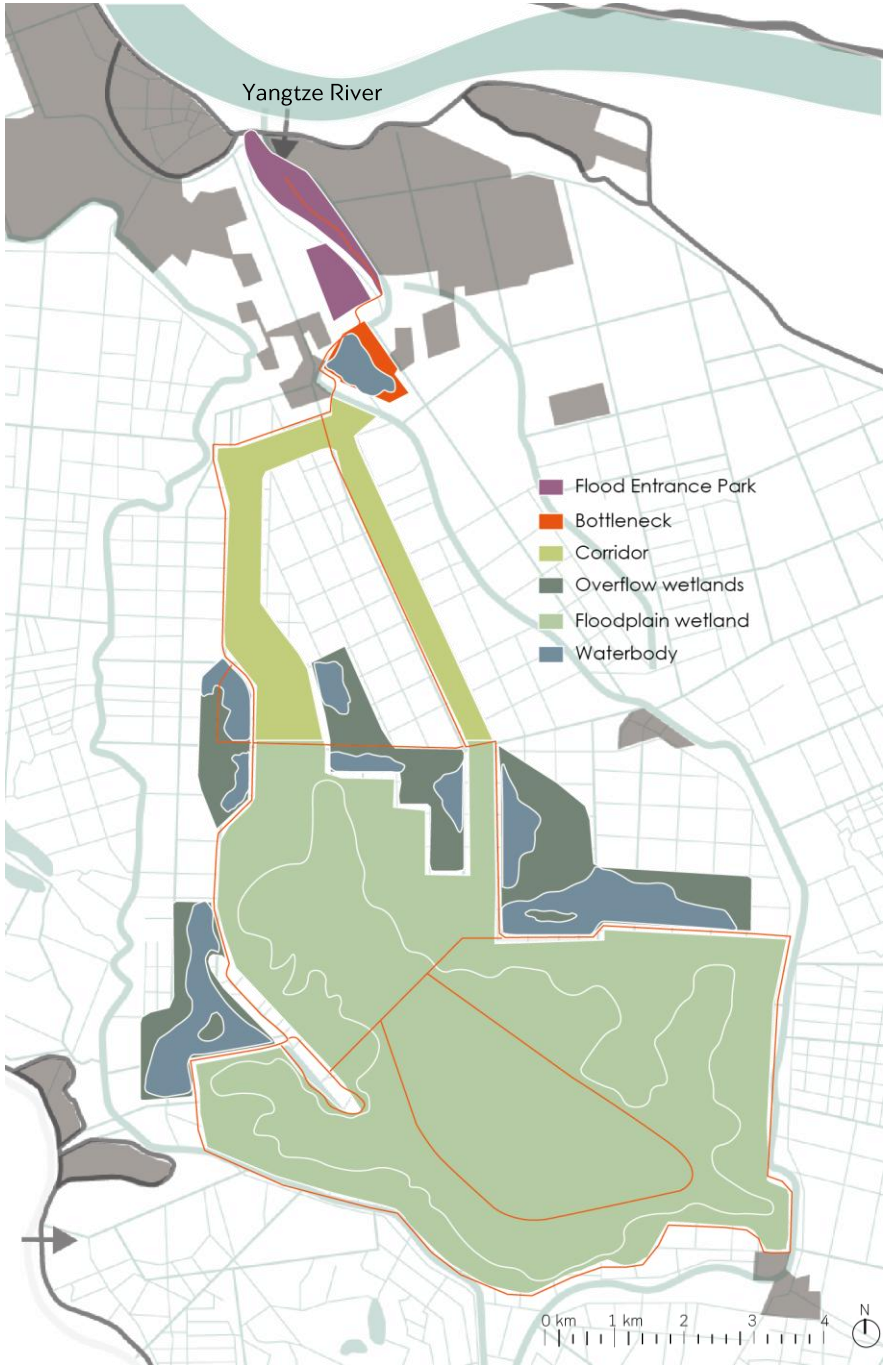
Flood Entrance Park
A small urban park at the northern edge of Gong'an County that doubles as a flood entry point and civic space, showcasing a miniaturized version of the basin's layered flood system.

The Bottleneck
A symbolic and spatial threshold between the city and floodplain, featuring overflow structures and a retention lake to mark the transition into flood-adaptive terrain.

The Corridor
Two linear grassland strips that direct floodwater through the site while integrating bike paths and viewing towers for public access and seasonal engagement.

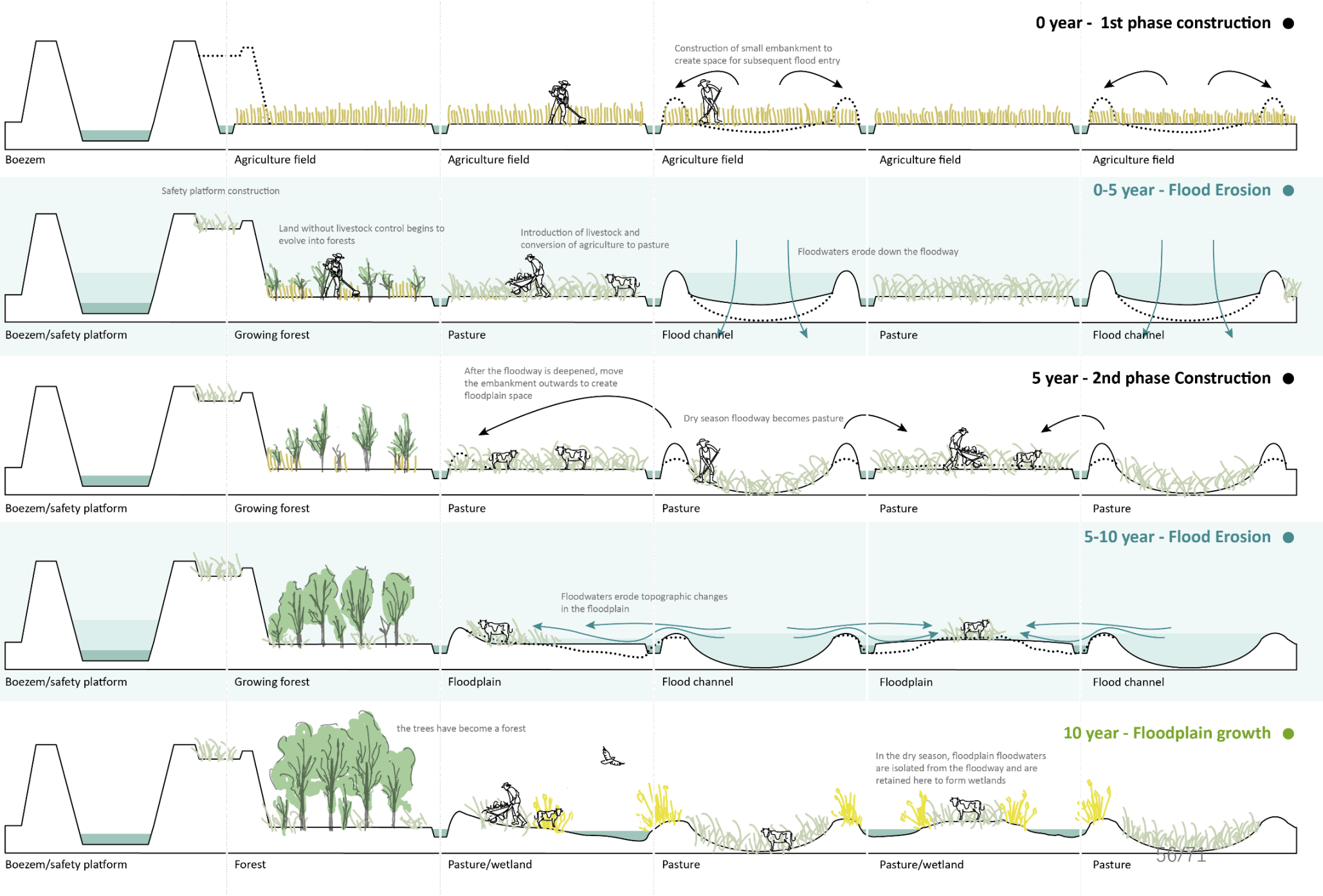
Overflow Wetlands
Wetlands along the corridor that retain water longer than floodplain zones, supporting stable ecologies and educational functions like the Flood Museum.

Floodplain Wetland
A wide, low-lying zone at the southern end that stores most floodwater during major events, fostering biodiversity and seasonal landscape transformation.



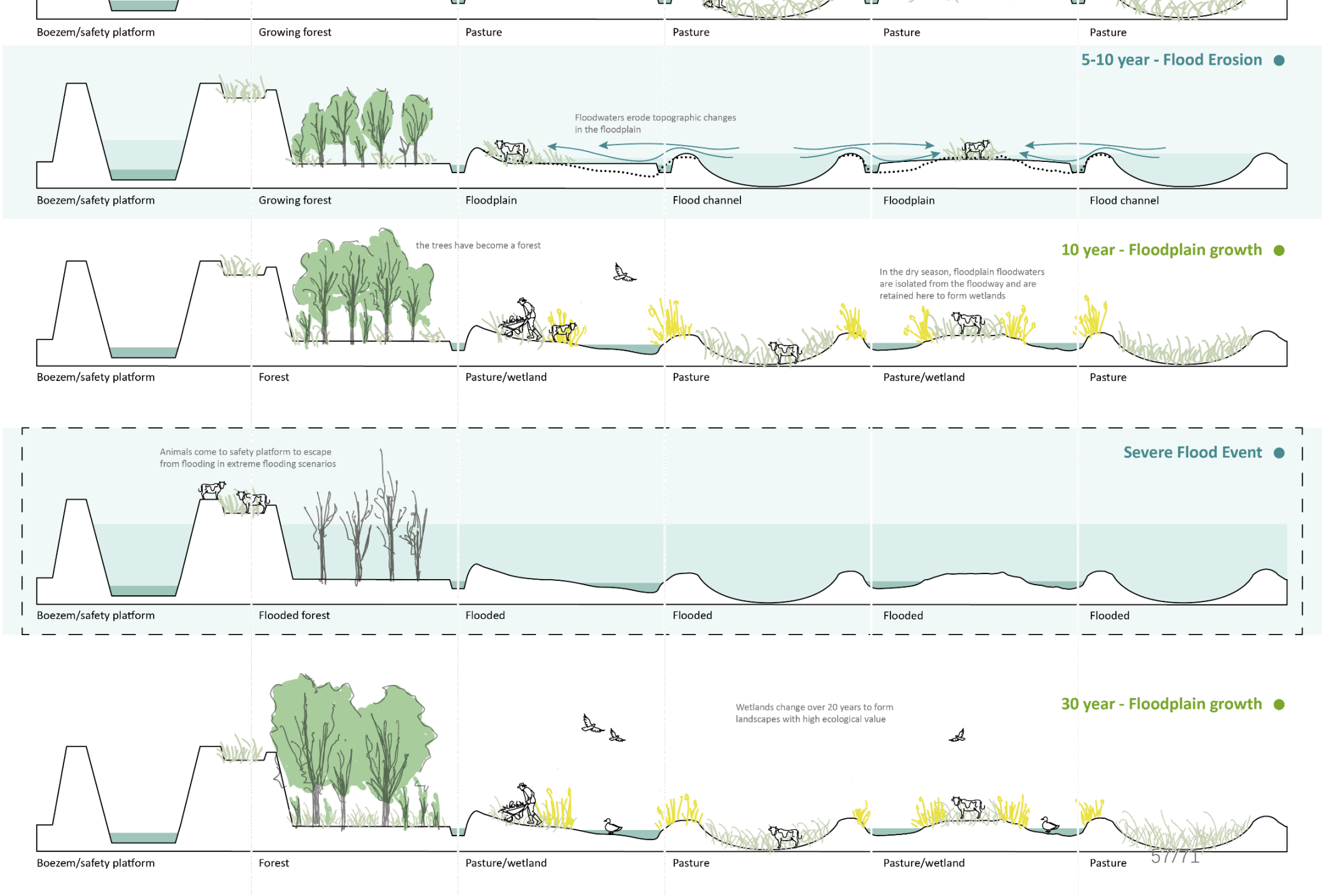
ZOOM IN BASIN 2

Phasing

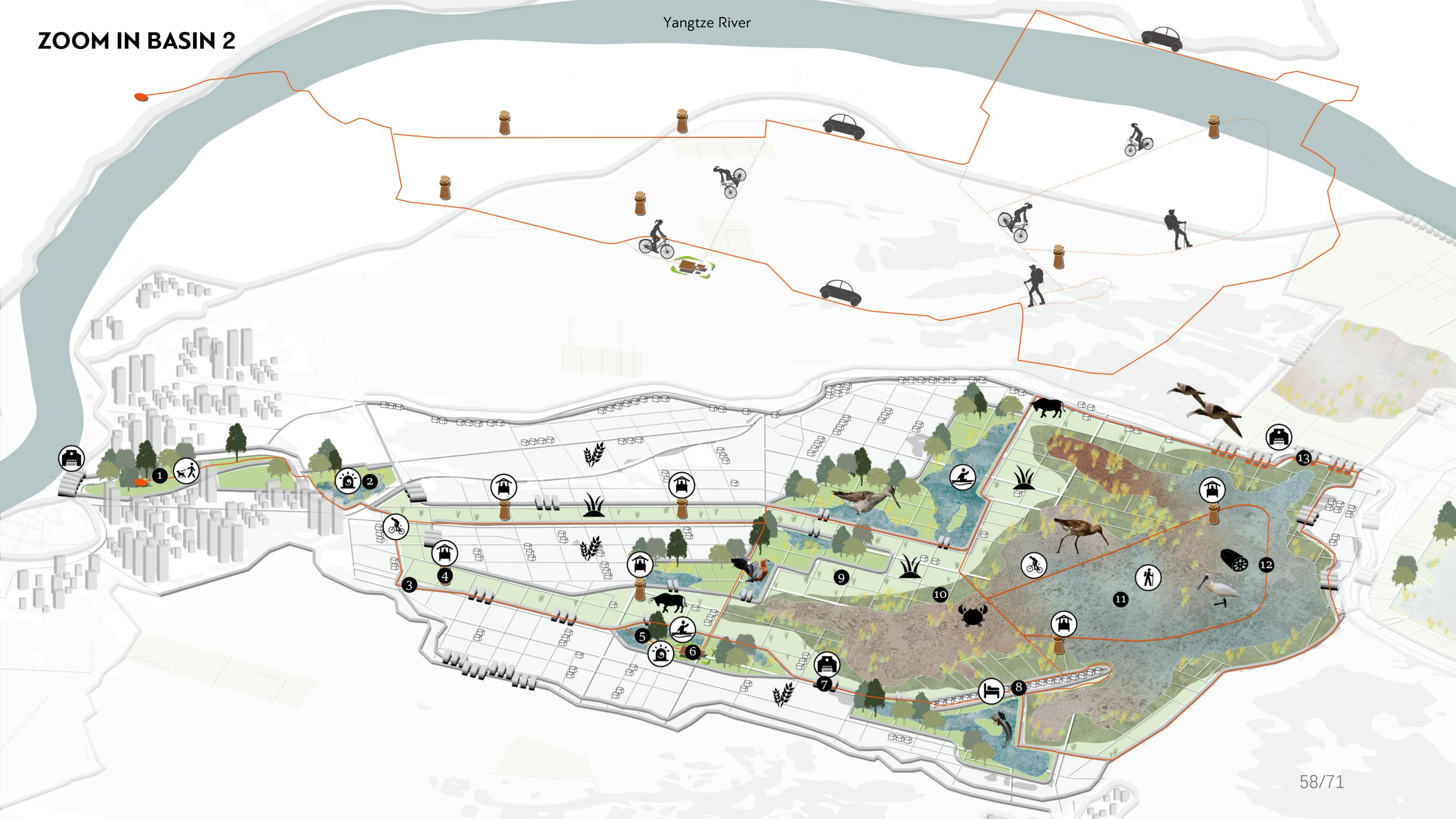


ZOOM IN BASIN 2

Phasing



ZOOM IN BASIN 2



ZOOM IN BASIN 2

Detailed design – green corridor and museum

Detailed Design - Museum & Corridor

Masterplan - Normal season

1 Green fertilizer generator
2 Flood house
3 Basin2 - corridor
4 Viewing tower
5 Overflown watergate
6 Overflown lake
7 Dock
8 Flood museum
9 Experimental eco-agriculture
10 Personal Garden
11 Settlement

ZOOM IN BASIN 2

Detailed design – green corridor and museum

Detailed Design - Museum & Corridor

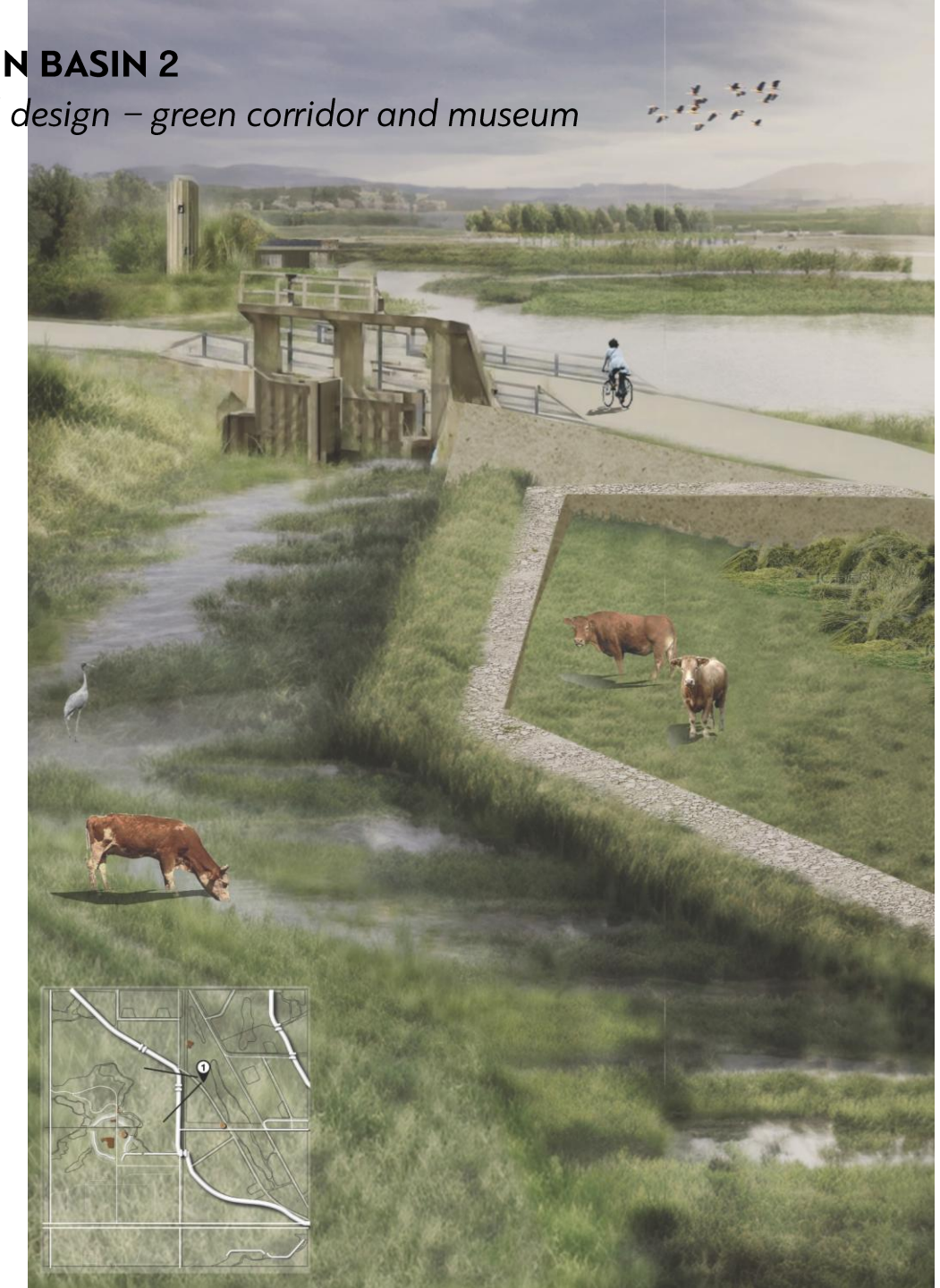
Masterplan - Flood season

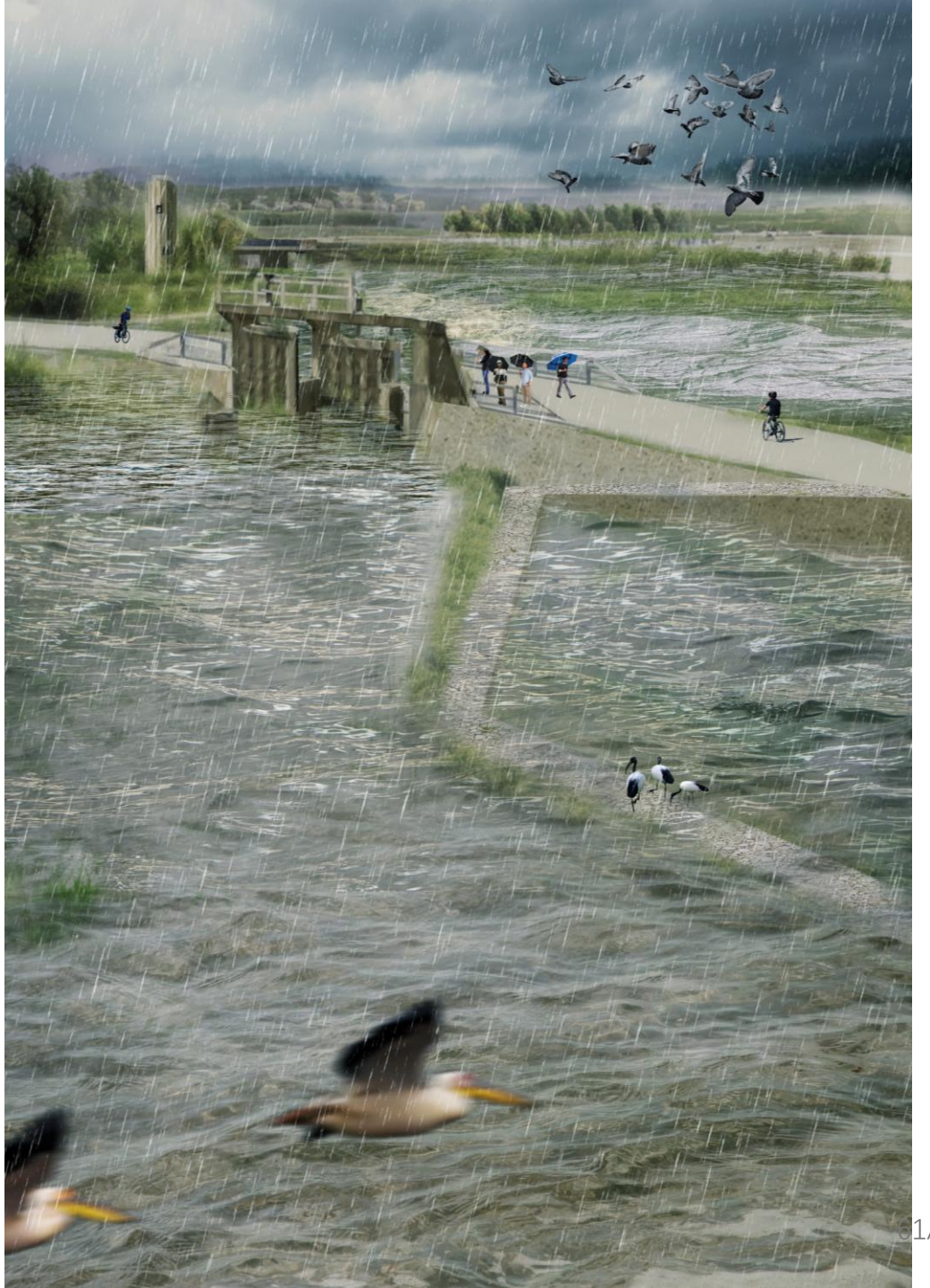
1 Green fertilizer generator
2 Flood house
3 Basin2 - corridor
4 Viewing tower
5 Overflown watergate
6 Overflown lake
7 Dock
8 Flood museum
9 Experimental eco-agriculture
10 Personal Garden
11 Settlement

0 km 100 m 200 300 400 N

ZOOM IN BASIN 2

Detailed design – green corridor and museum





ZOOM IN BASIN 2

Detailed design – Bottleneck

Detailed Design - **Bottleneck**

Masterplan - Normal season

1 Participating agriculture
2 Elevated Mark
3 Elevated Mark (Observation platform)
4 Natural Water Channel
5 Dock & Bench
6 Existing Water Channel (Pasture)
7 Remained Lake
8 Observation Tower
9 Sluice Gate
10 Flood Path
11 Elevated Path
12 Green Corridor

ZOOM IN BASIN 2

Detailed design – Bottleneck

Detailed Design - **Bottleneck**
Masterplan - Annual Flood

1 Participating agriculture
2 Elevated Mark
3 Elevated Mark (Observation platform)
4 Natural Water Channel
5 Dock & Bench
6 Existing Water Channel (Pasture)
7 Remained Lake
8 Observation Tower
9 Sluice Gate
10 Flood Path
11 Elevated Path
12 Green Corridor

0 km 100 m 200 300 400 N

ZOOM IN BASIN 2

Detailed design – Bottleneck

Detailed Design - Bottleneck

Masterplan - Severe Flood

1 Participating agriculture
2 Elevated Mark
3 Elevated Mark (Observation platform)
4 Natural Water Channel
5 Dock & Bench
6 Existing Water Channel (Pasture)
7 Remained Lake
8 Observation Tower
9 Sluice Gate
10 Flood Path
11 Elevated Path
12 Green Corridor

ZOOM IN BASIN 2

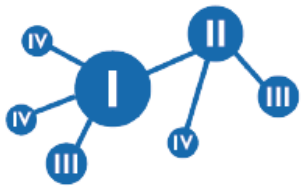
Detailed design – Bottleneck

ZOOM IN BASIN 2

Detailed design – Bottleneck

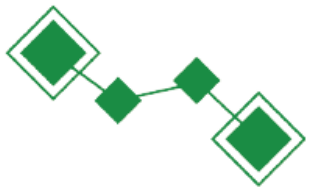
ZOOM OUT CATCHMENT

components



Flood storage network

Flood zones are categorized into four levels based on their capacity and internal layering, enabling synchronized yet differentiated flood absorption across the region.



Eco habitat network

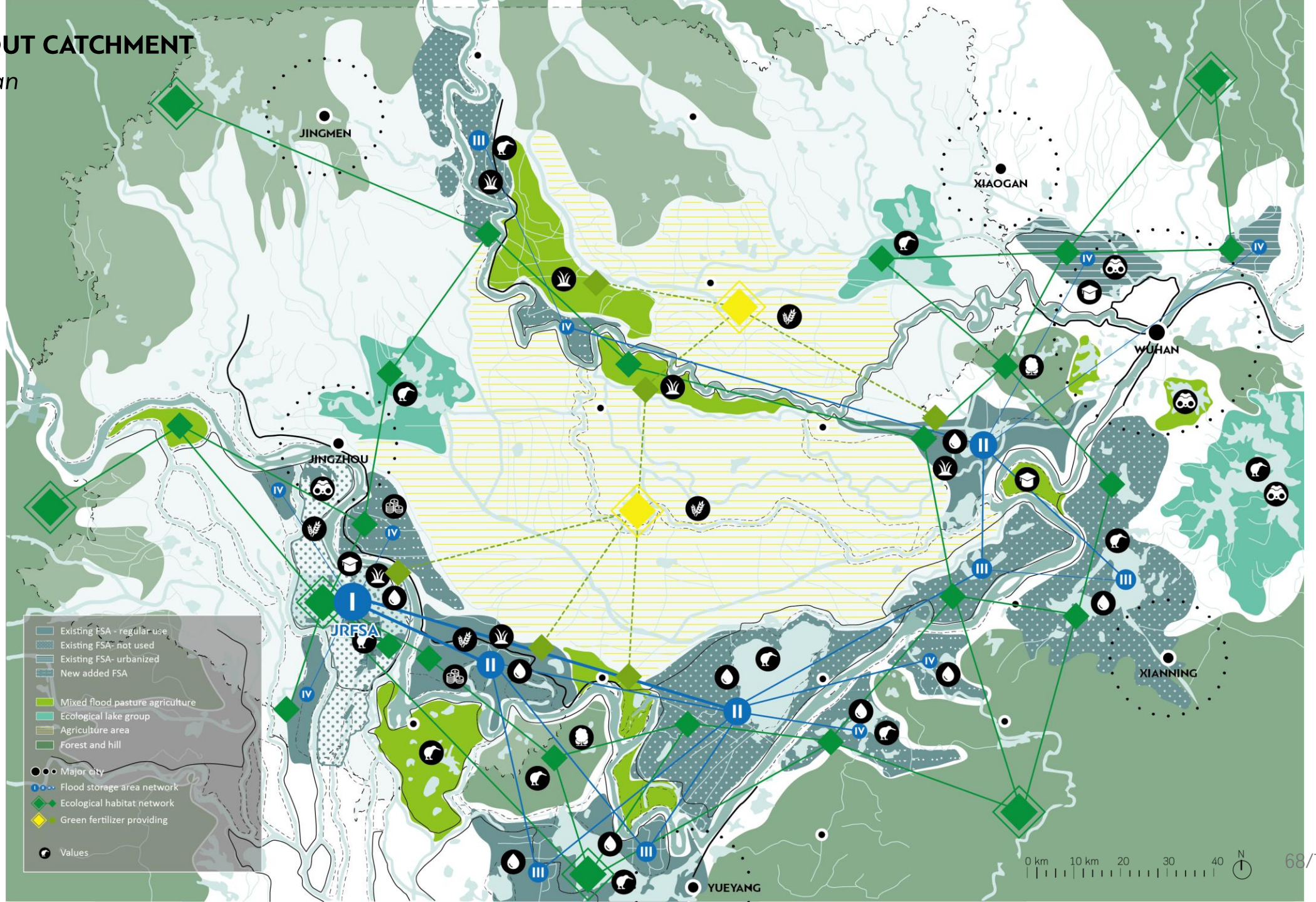
Ecologically significant flood areas are linked to surrounding lakes and mountain habitats, forming two continuous ecological corridors along the Yangtze and Han Rivers.

Green fertilizer network

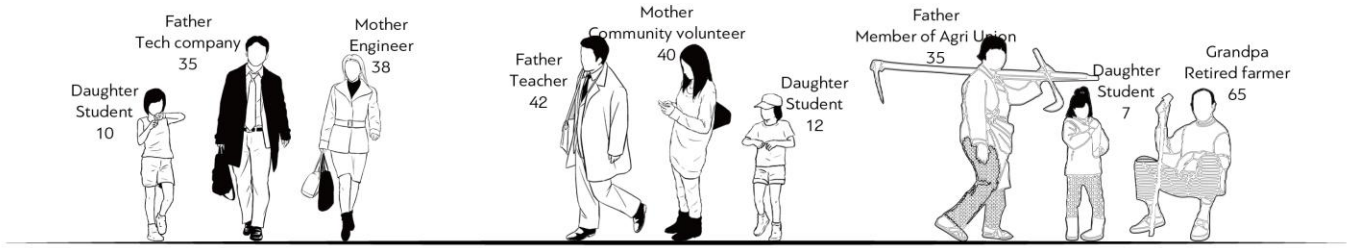
Floodplains with extensive grass production are connected to external pastures, supporting regional agriculture with a distributed source of organic green manure.

ZOOM OUT CATCHMENT

Masterplan



WHERE IS THE LINKAGE?



WUHAN

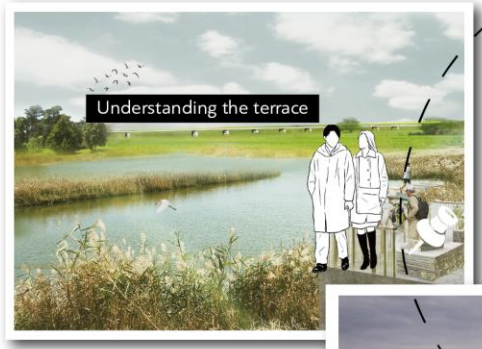
GONG'AN

RURAL AREA

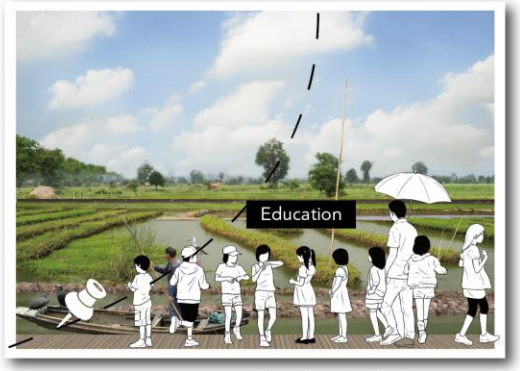
Family of Wang

Family of Liu

Family of Zhang



Bottleneck Park



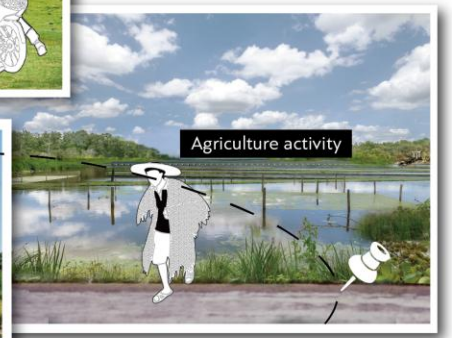
Floating Agriculture

Pasture Farming

Green Corridor

Overflown Lake

Marshland



Adaptive Fish Pond

thank you