

Metamorphosis of an Urban Lake: Reviving Xinglong Lake through Nature-based Solutions



Project Title

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Project Statement

Located in Tianfu New Area, Chengdu, Sichuan Province, China, Xinglong Lake is an artificial excavated lake serving as an important infrastructure for water conservation and hydrological regulation of the Luxi River, which was once experienced deteriorating water quality and rapid biodiversity declines subject to intensive human disturbances. To cope with the adverse environment and declined biodiversity, we restored the lake ecosystem and resolved prominent conflicts between urbanization and Xinglong Lake through nature-based solutions. Design strategies included:	(i) design of lake bottom topography and construction of underwater biotic community; (ii) design of multidimensional lakeshore space, and (iii) island design for wildlife. After restoration, Xinglong Lake becomes a living landscape that is characterized by its stunningly clear water and rich biodiversity, and also act as the most favorable green open space supporting citizens’ wellbeing, thriving communities and economic growth in the new town development.
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Project Narrative

Background

This site was originally a typical rural area of the Chengdu Plain, which was excavated to form the Xinglong Lake in 2014 to meet the needs for flood regulation and landscape recreation. This project covers an area of 3.95 km² and the total area of its water body is approximately 3 km² with a storage capacity of 6.7 million cubic meters. As urbanization continues to intensify and the decision on accelerating building a beautiful and livable Park City in Tianfu New Area by the Chinese Central Government, the Xinglong Lake is vital for water conservation and hydrological regulation of the Luxi River and perform as the most important public space that is critical for the delivery of ecosystem services in Tianfu New Area.

Challenges

- 1) Nonpoint source pollution from urban surface runoff around the lake and endogenous pollution derived from the bottom sediment in the Xinglong Lake continually cause damage to the water quality.
- 2) The lake bottom topography was flat and homogeneous before restoration, resulting in the lack of habitats and poor biodiversity.
- 3) The monotonous lake boundary led to unnatural and unpleasing landscape, and the lake was segregated from the city, thus citizens had limited access to nature.

Strategies

Strategy 1: Lake bottom topography design and construction of the underwater biotic communities

Topographic reshaping of the lake bottom was carried out, associated with planting of submerged plants. In this way, heterogeneous underwater ecological spaces were established from the deep-water area to the nearshore zone. The total planting area of submerged plants in the Xinglong Lake is approximately 1.98 million m², creating a great carbon sink with a carbon sequestration capacity of 12.8 tons. The heterogeneous underwater ecological spaces provide diverse underwater habitats serving as refuges for freshwater fishes and other aquatic organisms, therefore, the Xinglong Lake has become a germplasm bank for indigenous fishes in the Chengdu Plain. A complex food web consisting of aquatic invertebrates, fishes and waterfowls was established. Notably, the old stone bridge across Luxi River submerged in the Xinglong Lake also becomes an underwater ecological structure performing as shelter for fishes. The complex of diverse lake bottom topography and species-rich biotic communities increases the self-purification capacity of the lake water and thus maintains stunningly clear water, and the colors of the crystal lake vary according to seasons at different water depths, significantly enhances the lake recreational and aesthetic values.

Strategy2: Multidimensional lakeshore space design

The original monotonous and unnatural lakeshore rigidly separated the lake from the city. By meandering the existing straight shoreline of the Xinglong Lake, the length of the lakeshore is greatly extended. To further restore the landscape wildness and biodiversity of the lakeshore, through nature-based solutions, we created near-natural lakeshore topography and planting herbaceous and woody wetland plants to form a variety of wetland features such as wet forests, wet forest-marshes, sparse forest-island and forest-pond complex. The newly formed multidimensional lakeshore space from the near-shore shallow waters to the waterfront and upland presents a visually dramatic landscape and also acts as the buffer zones for water purification and migration corridors for urban wildlife.

Strategy 3: Island design for wildlife

Islands in urban lakes can be key sites for biodiversity conservation. Through topographic design and plant community construction, the island at the center of Xinglong Lake has expanded from 40,000 m² to 86,000 m², forming a multidimensional ecological structure. We introduced small and micro wetlands including forest ponds, depressions as well as dense and sparse forests in the lake island to provide habitats for birds. Also, diverse near-natural ecological structures such as lagoons, bays, marshes and wet forests are implemented along the edge of the island, providing overwintering refuges for fishes and therefore act as foraging habitats for waterfowls. The diverse island habitats have greatly benefited the bird species diversity in the Xinglong Lake and thus make the lake a hotspot for birds, especially wintering waterfowl in the Chengdu Plain. In 2021, 148 bird species were recorded in the Xinglong Lake, including 66 species of overwintering birds such as *Cygnus columbianus* and *Larus ridibundus*, and 18 species of family Anatidae (ducks). The maximum number of Anatidae recorded in the site is estimated nearly 3,500, while *Aythya baeri* (assessed as Critically Endangered in IUCN Red List) was also observed.

Impacts:

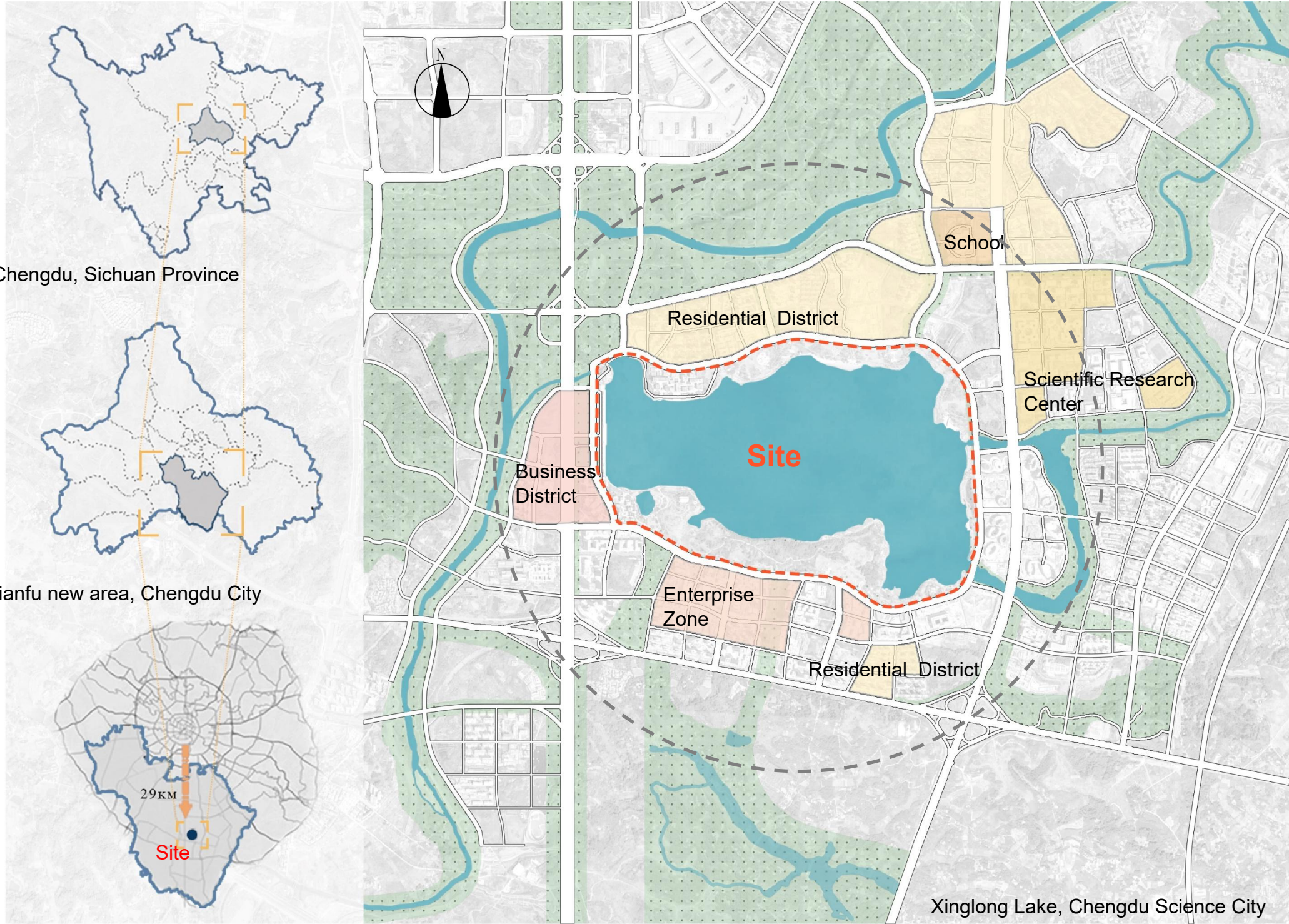
The ecological restoration of Xinglong Lake is the greatest highlight of the development of the Park City. After restoration, the Xinglong Lake becomes a living landscape for urban wildlife, representing the harmony between human and nature. A wide range of economic activities were taken place around the Xinglong Lake which significantly promote urban vitality of Tianfu New Area. As a large blue–green infrastructure, the restored Xinglong Lake plays an important role in optimizing urban ecological network in the context of rapid urbanization. This project is considered a best practice model for reviving urban lake and enhancing urban biodiversity, promoting the harmonious coexistence between human and nature and the co-prosperity of lake and city.

Background and Site Analysis

Development History of the city and lake



Site location



Original Site Conditions





0 100 300m

Master Plan

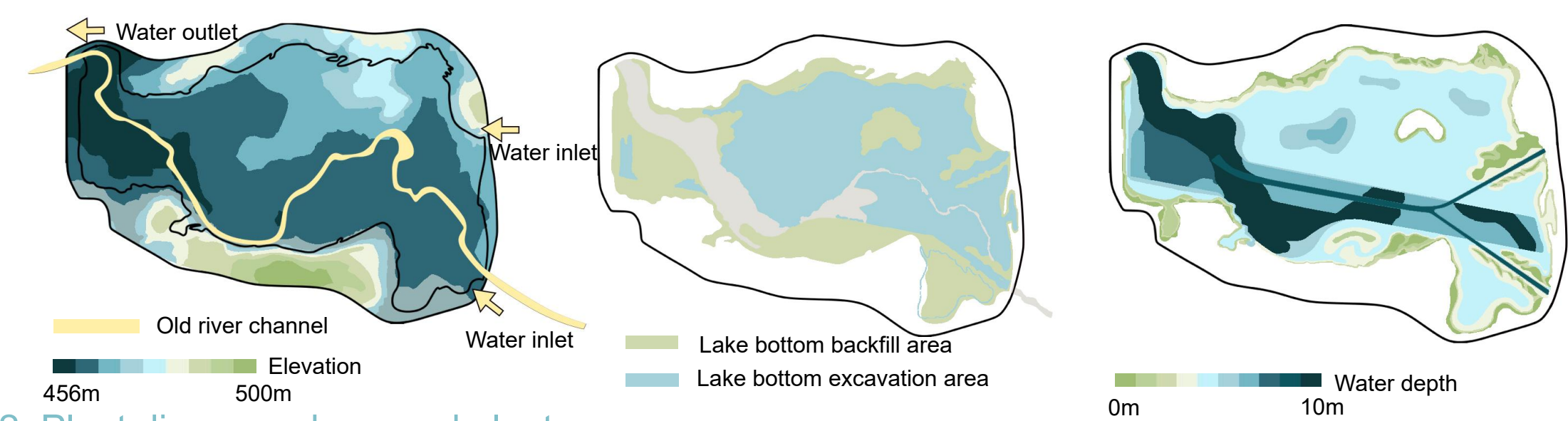
1. Marshes
2. Grass islands
3. Lakeshore walkway
4. Wet forest
5. Lake island
6. Lagoon
7. Eco-conservation area



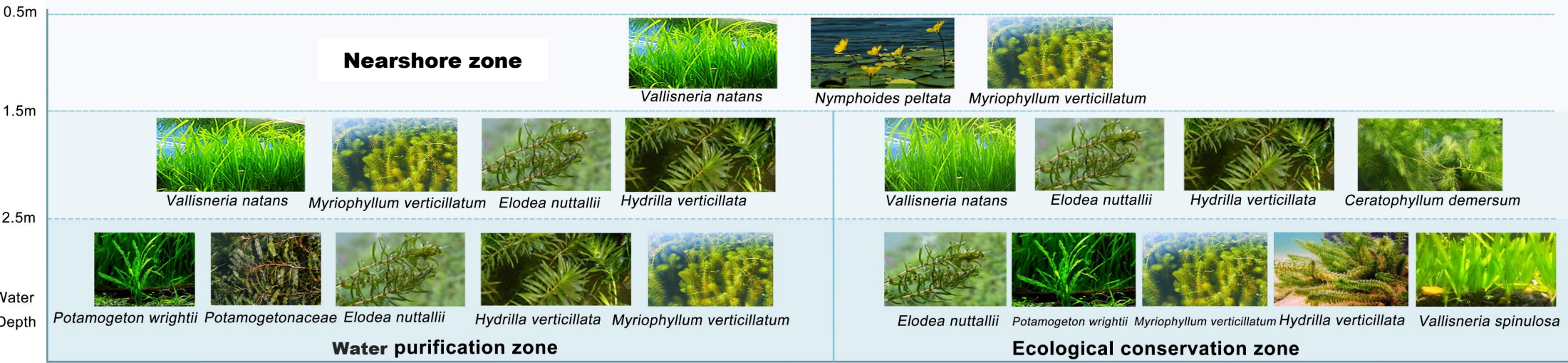
I . Design for lake bottom topography and construction of underwater biotic community

1. Reshape the underwater geomorphology

- Original geomorphology
- Topography design and implementation
- Water depth management
- Construction process

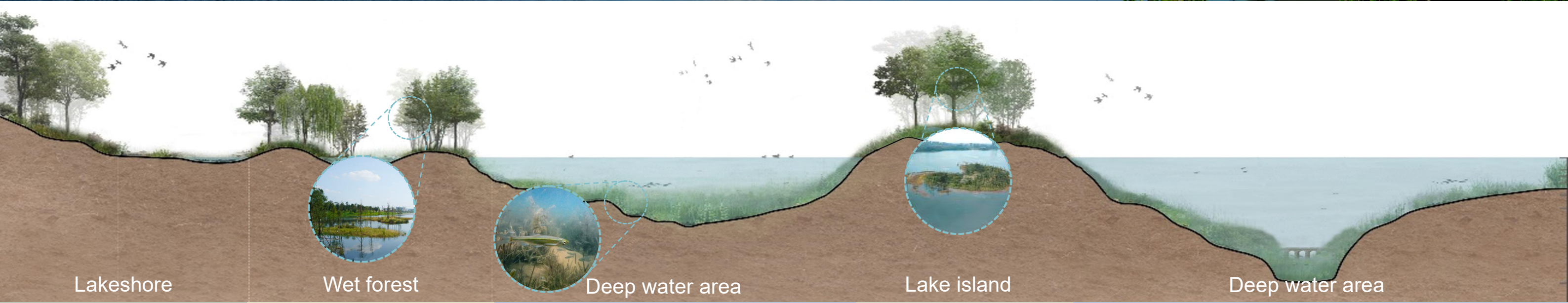


2. Plant diverse submerged plants



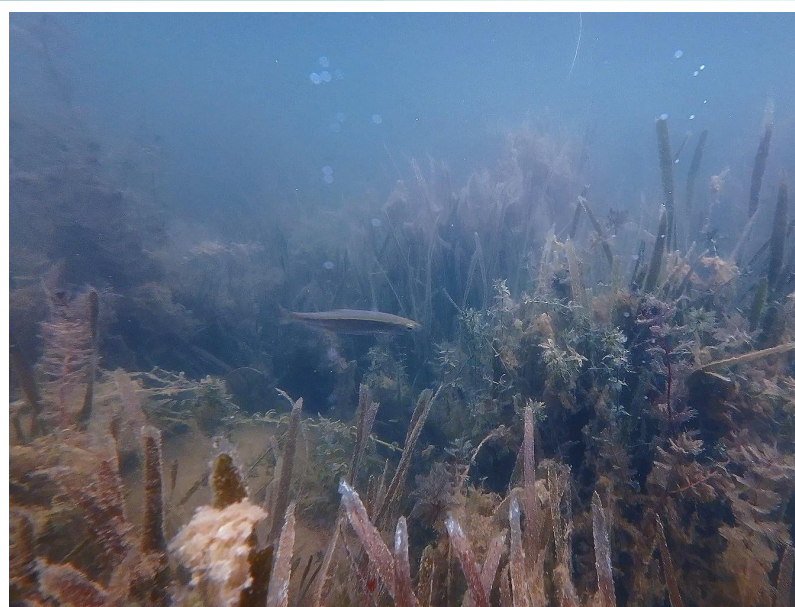
3. Create heterogeneous underwater ecological structure







Underwater landscape



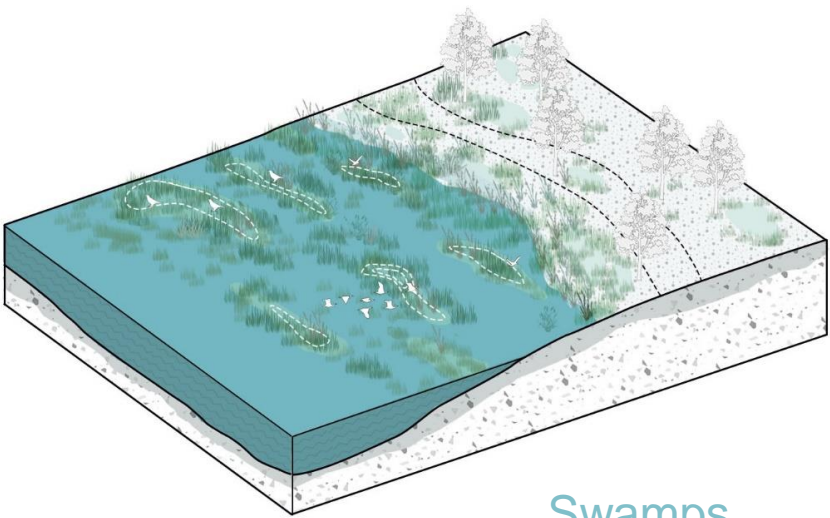


Winter, 2022

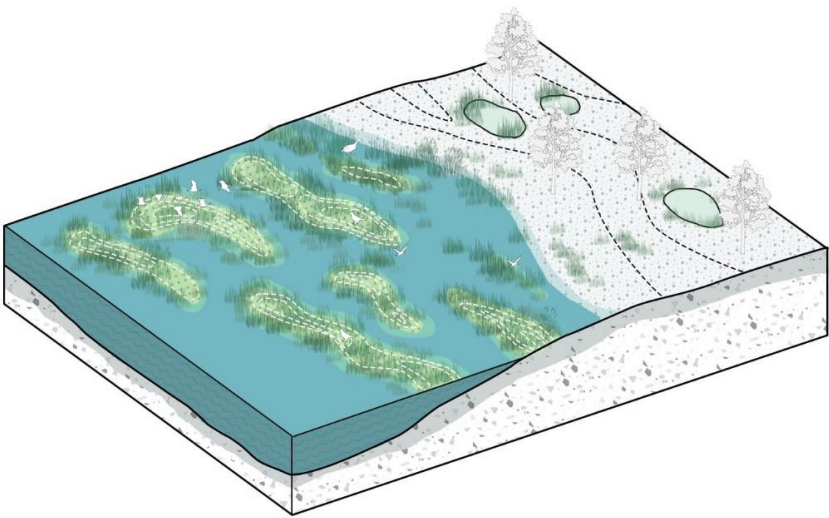


II. Multidimensional lakeshore space design

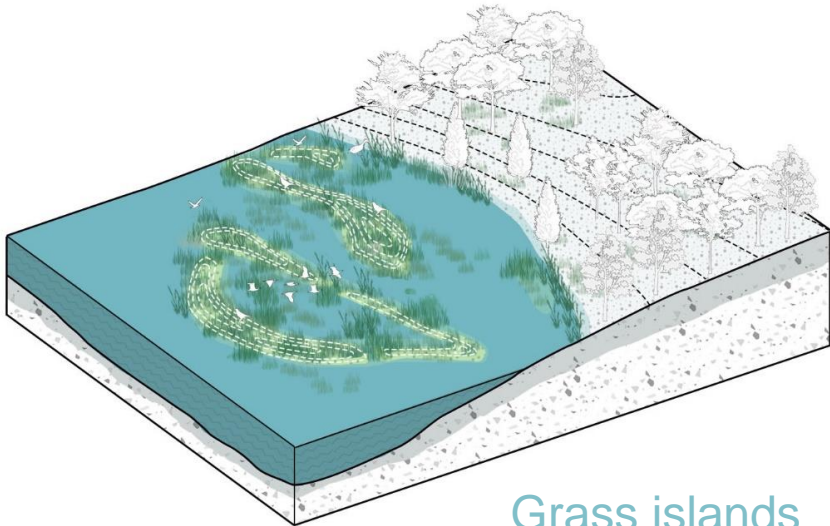
1. Meandering the lakeshore and expand the waterfront space



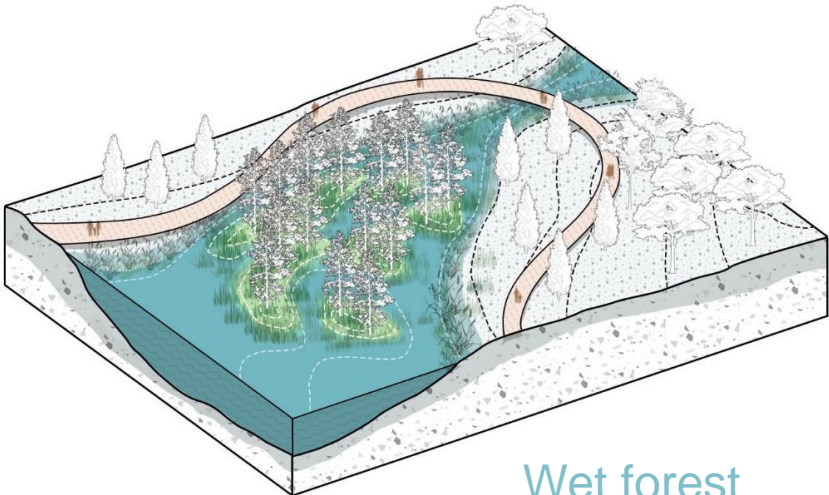
Swamps



Grass islands

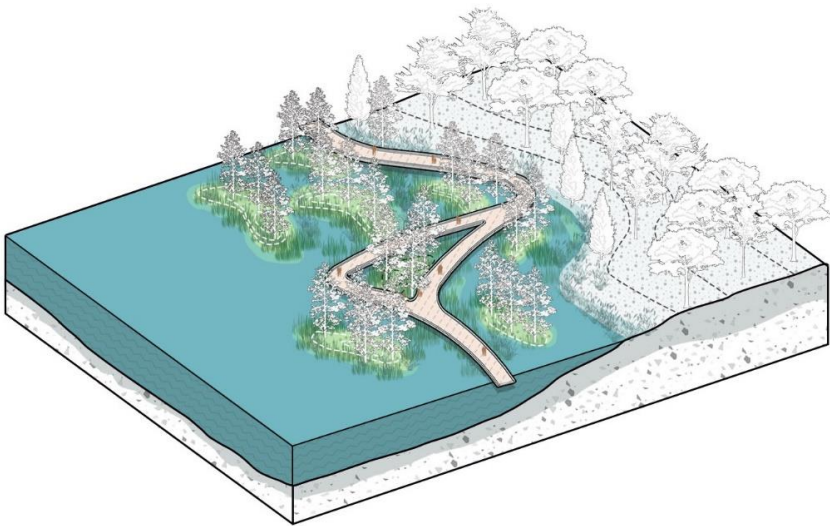


Grass islands



Wet forest

2. Diverse near-natural lakeshore space



Natural walkways



Natural walkways

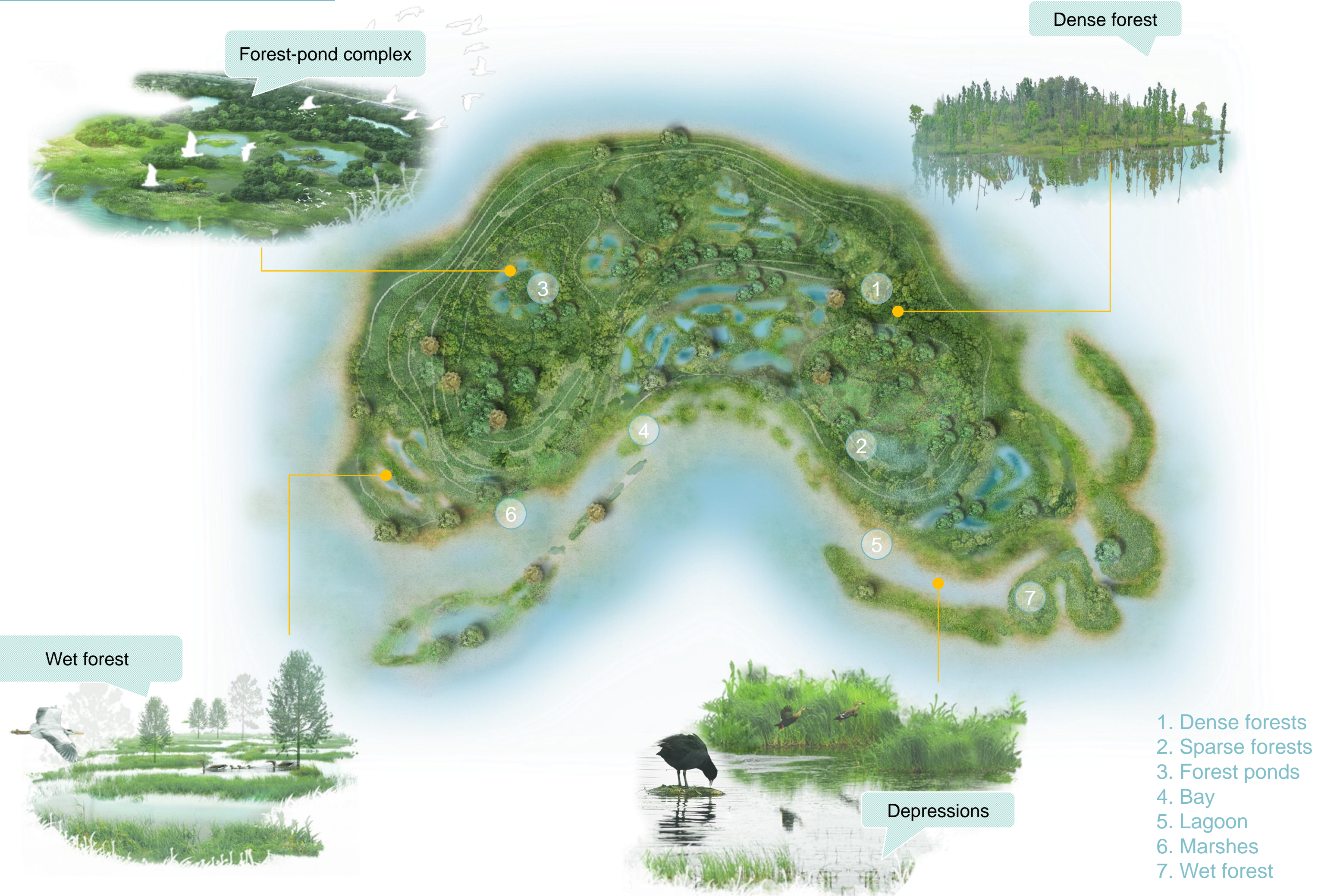








III. Island design for wildlife







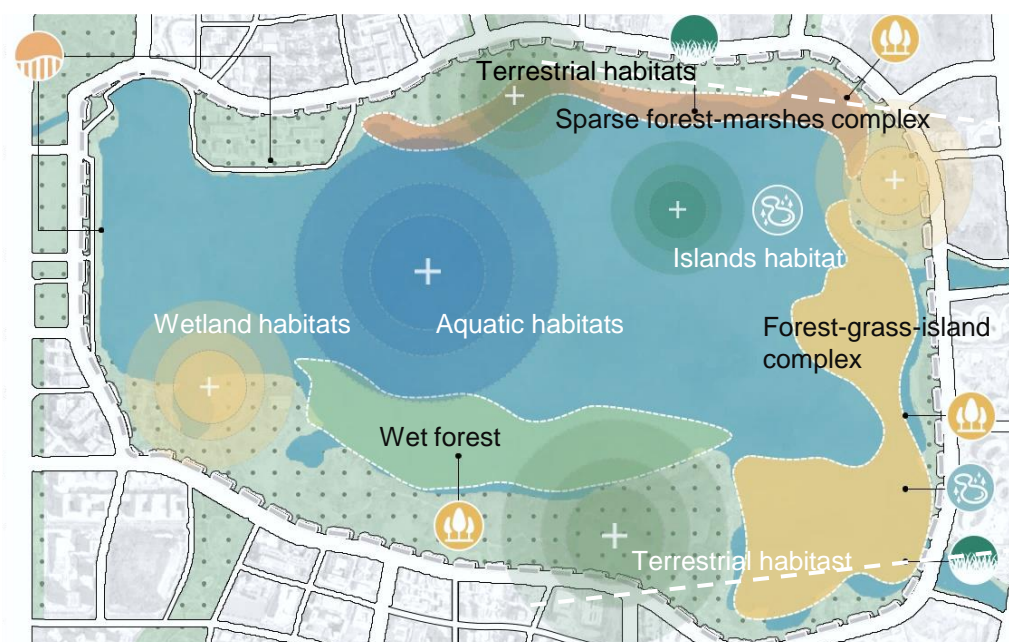
September, 2021



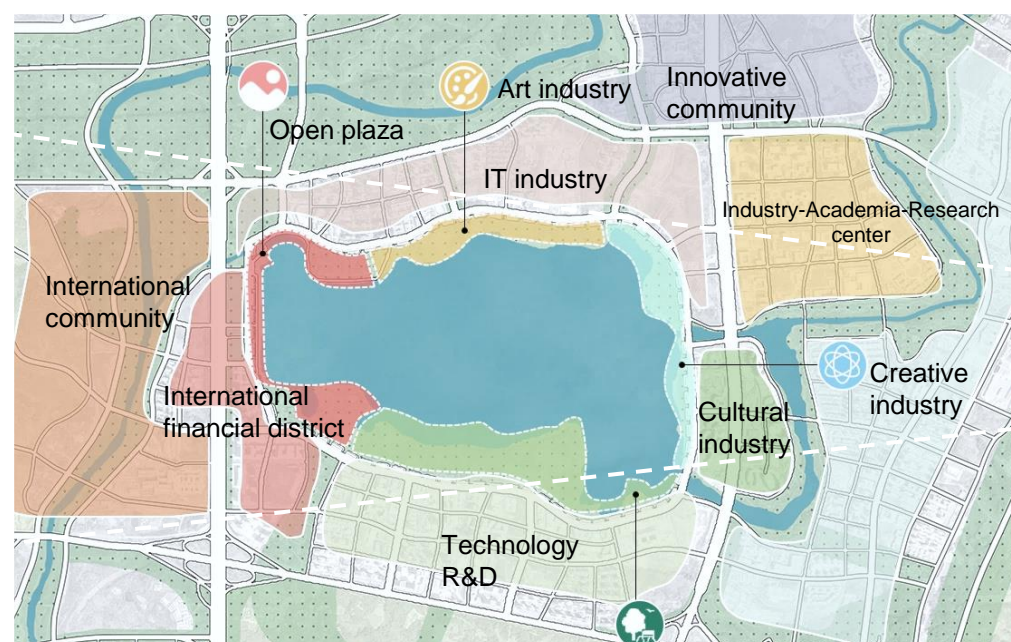


From a living lake to a livable Park City

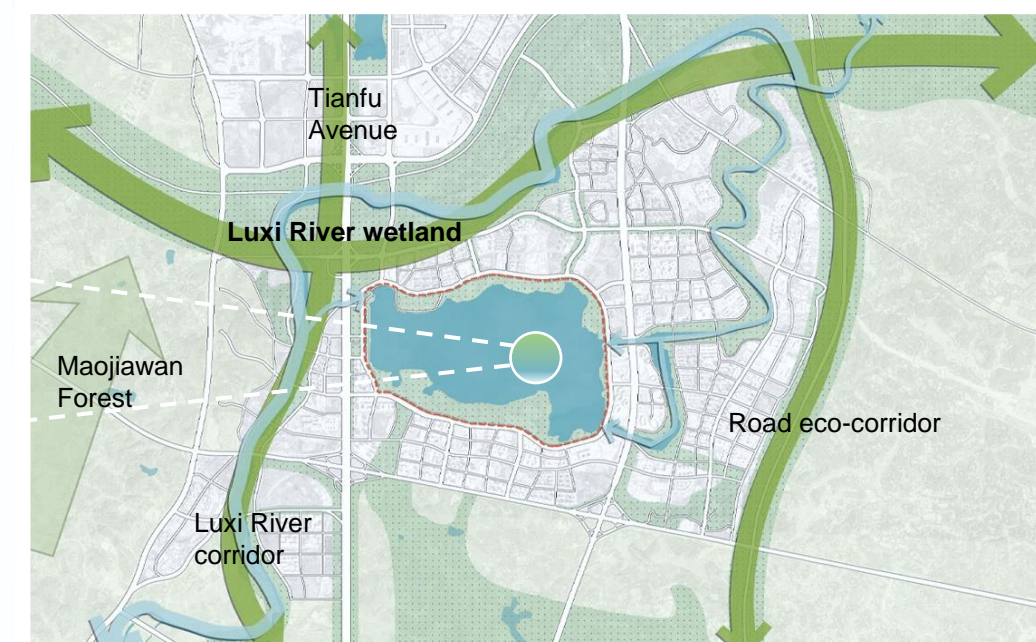
① A living lake acting as wildlife paradise



② A new developing town around the lake



③ A large blue-green infrastructure in Park City









Harmonious coexistence between human and nature.
Co-prosperity of the lake and city.