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International Water Resources Association (IWRA)

Water Connectivity and Hydro-ecological Progress in Huairou New Town

怀柔新城水系连通与水生态建设

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Water for All
Harmony between Humans and Nature

第18届 世界水资源大会
水与万物：人与自然和谐共生

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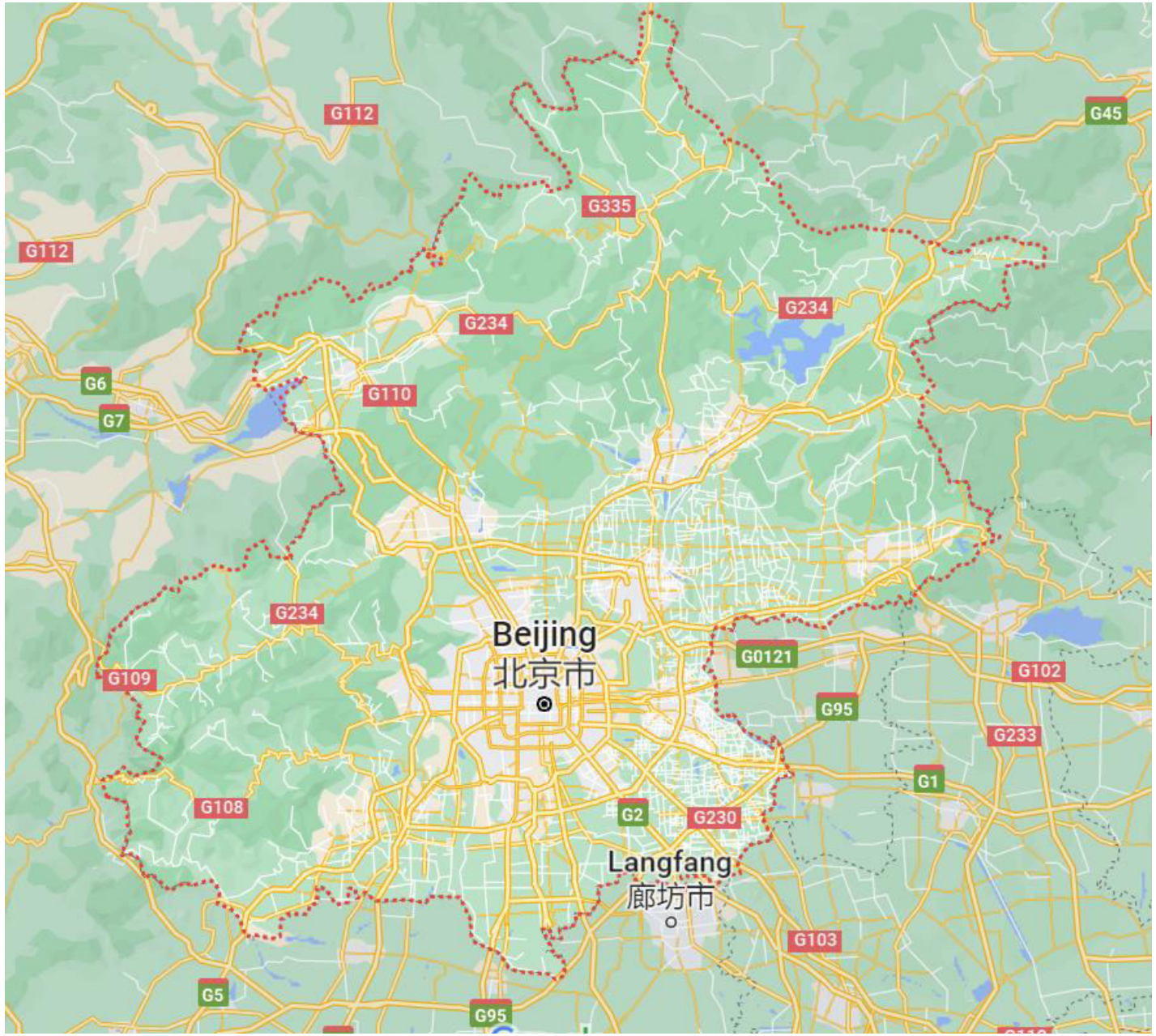
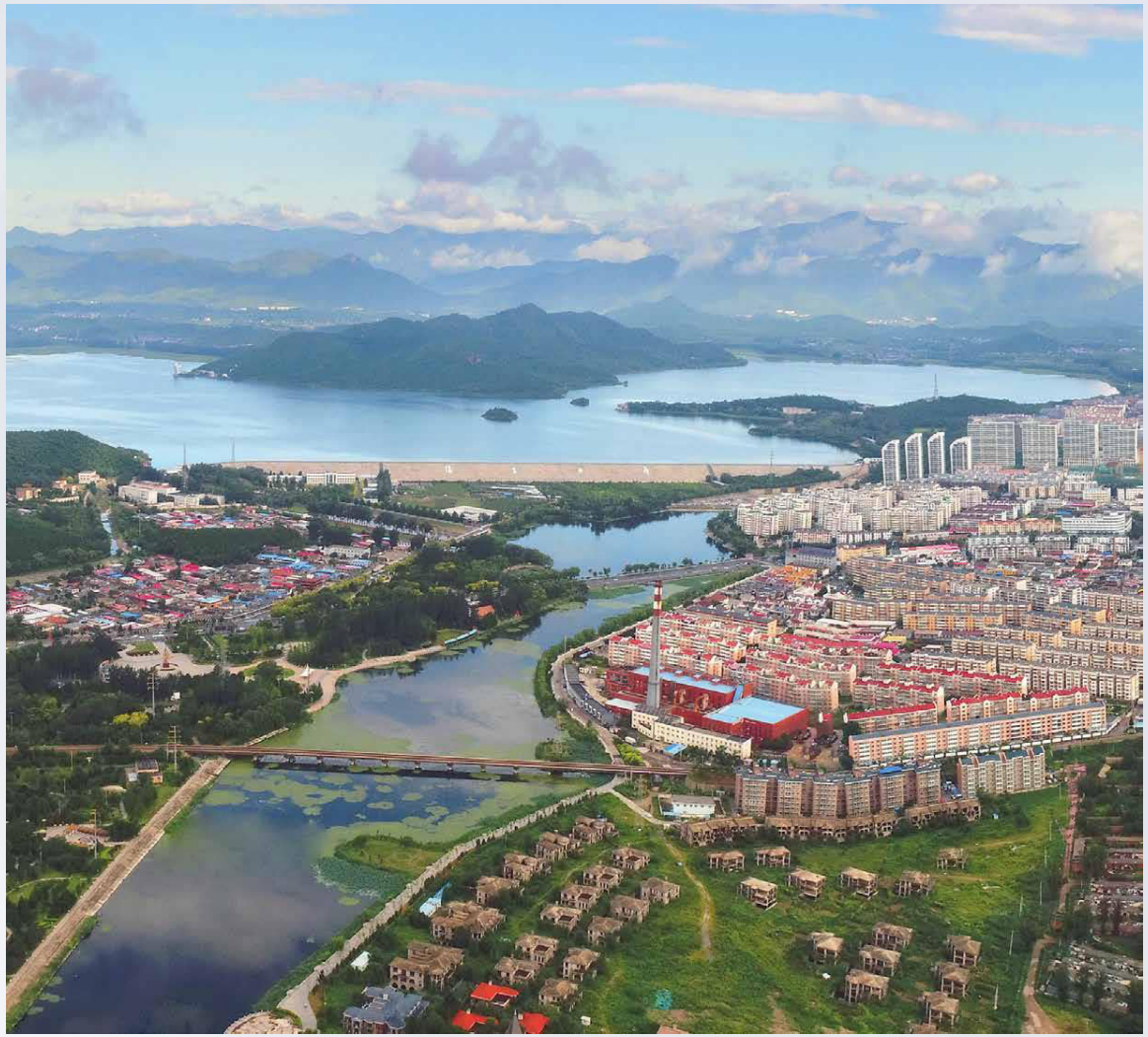
Content

- General situation
- Problems
- Countermeasures
- Prospects



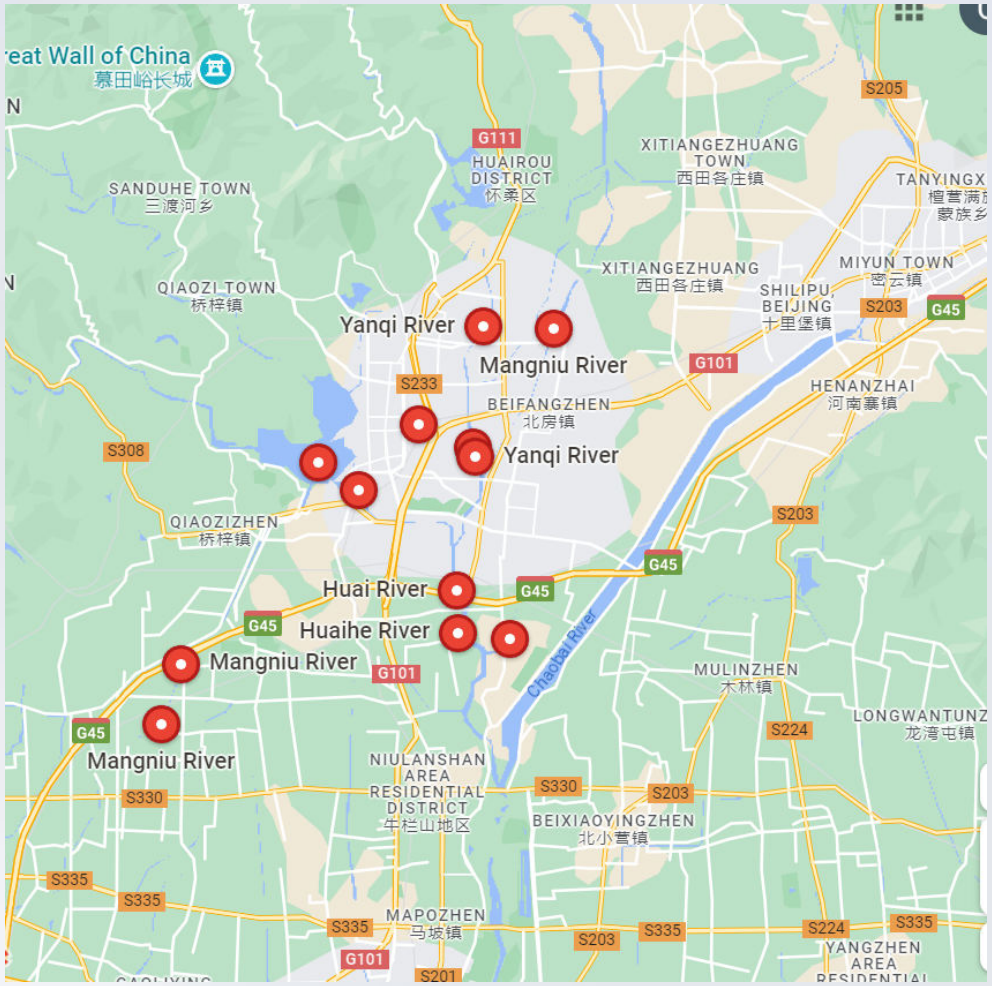
Huairou District:

- In northern Beijing about 50 kms from the city center
- covers 2,550 square kilometers
- 90% is mountainous area
- 69% forest cover, natural "oxygen bar"
- 12 towns
- Population of 296,000



In Huairou District

- 63 rivers, >10km²
- total length ≈ 911 km
- 16 large and medium + 46 small reservoirs



Water bodies in Huairou New Town (HNT)

- **Natural waters**: Huai, Yanqi, Xiaoquan, Sha, Mangniu, Huaibei streams 怀河、雁栖河、小泉河、沙河、牤牛河、怀北小河
- **Man-made channels**: 1~4 River Network, and 1~2 Branches of East Main Channel一二三四河网、东干渠及一二支渠
- **Reservoirs**: Huairou, Beitai, Hongluozhen and Dashuiyu 怀柔水库、北台上水库、红螺镇水库、大水峪水库

Renewed water

Yanqi sewage treatment center

Diverted water

Jingmi water-diversion canal

Problems

Security
- Embankment — 189km long, 16.1% (30.4km) unqualified
- Emergency roads — part unfinished — branches unconnected — flood prev. 
- Flow-passing sections — small or silted up
- Sponge City criteria — 22.92%
- Waterlogging — 20-odd chronic water logging spots.

Ecology
- Water availability — surf. water distributed unevenly in a year; groundwater depleted; some rivers cut off in dry season
- Ecological flow — birds habitats inadequate; coastal lines —— canals 三面光

Pollution
- Sewage pipelines — 400km, branches incomplete; carrying mixture of…..; No. is unknown —— diffi. to locate problems
- Treatment plants — capacity strained; standards unmet; quality of treated water = Category V ~III

Landscape
- Water ∞
- Planning

T: landscape + culture
S: lack of water ∞ ; planning

1 Water security —— Flood prevention

Storing water upstream

Reservoirs

improve reservoirs' peak shaving and valley filling

- reinforce dangerously weak reservoirs
- downgrade the incapable to small reservoirs

Dredging water midstream

Rivers

- treat 8.7 km-long river reaches mid- and down-stream with latent flood risks
- install a gate at the estuary of Xiaoquan-Yanqi-1st River network flowing into Huai River (an 80km-long river in Huairou) 在小泉河、雁栖河、一河网汇入怀河处设防洪闸控制
- comprehensively treat 31km-long reaches on 1st~4th River networks

Draining water downstream

Urban water-logging

- install pumping stations
- upgrade rainwater pipes in line with higher water-quality criteria
- regulate storage capacities of detention ponds
- correct misconnection of rainwater and sewage pipes

2 Ecology — replenish ecological flows

secure water supply + enlarge water surface + replenish groundwater

Step 1 Estimate how much water to be replenished

Calculate ecological base flow + groundwater recharge + evaporation loss

Considering

- water supply for ecology and landscape
- economic cost and effect
- capability to treat inflowing water

Methods — water displacement 换水法, flow rate流速法, Tennant method and Environmental Flow Envelopes (EFEs)

Accordingly, we **recommend** that **7615m^3** of water be replenished for ecological flow in non-flooding periods.

(1) Definition: Ecological flow replenishment = ecological water demand − rainfall induced runoff

(2) Ecological water demand = ecological base flow + groundwater recharge + evaporation loss

(3) Ecological base flow = MAX [water displacement method + flow rate method + Tennant]

Countermeasures

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Ecological water demand during non-flooding period

(unit: 10,000m³)

River	Eco. base flow			Reple. gdw.	Evap.	Eco. demand	Rainfal l-runoff	Eco-reple.
	换水法 Water displ.	流速法 Flow rate	Tennant					
沙河 Sha River	163	365	433	607	21	1060	28	1032
牤牛河 Mangniu River	95	365	143	352	12	729	26	703
小泉河Xiaoquan River	99	376	160	369	13	757	33	725
一道河网 1st River nwk.	23	133	0	84	3	219	27	193
二道河网 2nd River nwk.	18	133	0	68	2	203	21	181
三道河网 3rd River nwk.	22	133	0	81	3	217	26	191
四道河网 4th River nwk.	10	133	0	36	1	170	11	158
雁栖河 Yanqi River	234	608	889	868	30	1787	32	1755
怀河Huai River	275	664	1442	1022	35	2499	28	2472
怀北小河Huaibei Stream	15	166	95	54	2	222	16	205
合计 Total	**954**	**3074**	**3162**	**3540**	**121**	**7863**	**248**	**7615**

= 76,150,000m³

Step 2 Engineering measures

Guarantee multi-source water supply

Protect groundwater

- Install surface water plants
- Nurture water sources underground —

1) curb exploitation

2) displace groundwater artificially

Store water

overflow weirs, plunge pools and gas shield dams

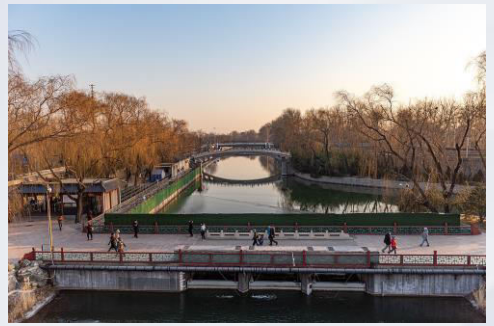
Rehabilitate habitats

- Transform some banks into **terraqueous** places (composed of land and water) inviting birds
- Recover some micro- and small water bodies and wetlands to increase water surface area.

Water replenishment in Beitai upper reservoir

Water intaking from sandpits at Chaobai River

Water storage in Yanming Bay



Water diversion from Jingmi Canal

Upgrade of water treatment plants

3 Pollution —— 清洁入流 purify Inflow

Source-tracing detection + pipelines overhaul + integrated management

“源头预防+过程控制+末端治理”

1 Source-tracing detection

Trace pollutants across the whole circulation process from 4 dimensions: factory, network, river and source.通过以溯源排查为核心，从“厂、网、河、源”四个维度确定排查内容和排查方法，查找水体污染根源。

2 Pipelines overhaul

Correct the misconnection of rainwater and sewage pipes and complete sewage branch network.对老城区的部分片区合流、错混接等问题，开展雨污分流和调蓄池建设；对老城区管网空白区推进污水支次管网完善工程，消除污水收集空白区。

3 Integrated management

Improve sewage gathering and treatment system

Upgrade and expand Huairou and Huaibei Sewage Plants ＋ O&M of main pipelines connected ＝ a holistic way.

通过怀柔新城建设配套和完善现状的污水收集与处理系统，将怀柔、怀北污水处理厂提标扩建工程连同外围主干污水管网运维一并整体打捆推进，实现厂网一体化、建管一体化，提升处理能力和运管水平。

Landscape —— 景文串联 Eco-culture integration

Restore riverside ecology + strengthen city-water intimacy + create more space for activities

重塑滨河生态+强化城水联系+打造活动空间”

Overall layout is “one axis, one center, two wings and multiple corridors” “一轴一心，两翼多廊”总体格局

- Distinctive ecological **corridors** on Huai River and Huaibei River and 1st~4th River networks结合各片区特点，打造特色鲜明的生态廊道,以怀河、怀北小河、一二三四道河网为“多廊”，打造时光绿廊
- dotted along the Yanqi River (**axis**) from south to north以雁栖河为“轴”贯穿南北
- with Mangniu, Sha and Xiaoquan Rivers running through the Huairou Scientific City and Old City (**two wings**)牤牛河、沙河及小泉河为“两翼”
- Yanming Bay (**center**) is built at the convergence of Sha River and Yanqi River. It links the whole ecological network by storing and regulating rainwater, flood water and released water from reservoirs. The water saved in the flood season can fill in 1st~4th River networks.雁鸣湾为“心”，作为生态纽带，调节存蓄雨洪水与水库弃水。结合调洪、生态蓄水和河道补水，在沙河和雁栖河交汇处构建城市湿地——汛期可调蓄洪水，非汛期可作为一~四河网的水源。

Together with the landmark building “Gateway of Science”, the ecological center Yanmin Bay serves for flood prevention, ecological health and landscape altogether. 结合科学之门地标性会客厅，兼顾安全、生态与景观，形成怀柔新城的生态之心。

智慧共享 Smart water management

The **digital water network** is the information infrastructure for water-connectivity projects and decision-making support.数字智能水网是保障水系连通工程正常运行的信息化基础，为生态水网的高效稳定运行提供了基础环境和决策支撑保障。

The **comprehensive service platform** has functions as:

1) centralized management and optimized allocation of water; 水资源集约管理与优化配置
2) monitoring, early warning and intelligent deployment; 水安全监测预警与智能调度
3) dynamic monitoring and control of water environment; 水环境动态监测与综合管控
4) periodical monitoring-feedback-adjustment loop for hydro-ecosystem. 水生态定期监测与反馈调度综合管理服务平台

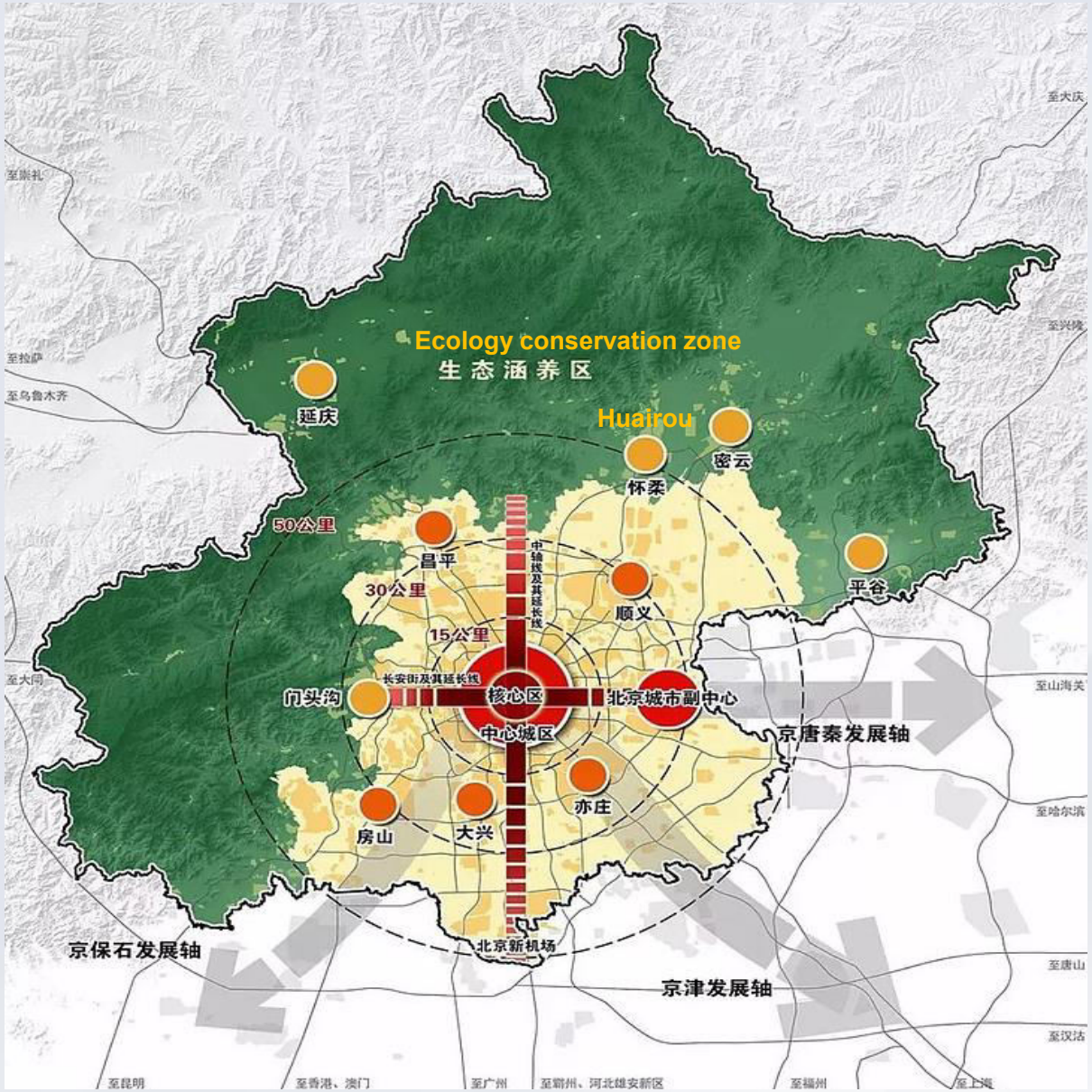
The platform is **featured** by 1) digital **scenarios**, smart **simulation** and targeted **decision-making**; 2) decision support system equipped with forecasting, early warning, exercising and contingency planning. 数字化场景、智慧化模拟、精准化决策为路径，构建具有预报、预警、预演、预案功能的智慧水网支持决策系统

→ smart management of the ecological water network in Huairou New Town and facilitates the formation of Smart Huairou. 实现生态水网管理的智慧化，有序推动智慧怀柔建设。

Corridors centring rivers, sceneries interwoven with buildings, as well as harmony between city and water **一心怀水、绿廊柔城，蓝绿交织、水城共融**

Huairou is playing

- a supporting role in Beijing’s governance of ecology **区域生态治理协作区**
- an exemplary role in showcasing China’s ecological progress to the world. **服务国家对外交往的生态发展示范区**



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