Sponge City, the Chinese interpretation about storm water management in Cities – examples of Wasser Hannover Association

Dr. Jens Knollmann
Chiyan Peng

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E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Wasser Hannover e.V.

- 12 Engineering Offices
  Hydraulics, sanitary engineering, urban development, architecture, ecology
- University of Hannover
- Offices: Hannover, Berlin Changde, Changsha
- In China since: 2006
- Projects: Urban river rehabilitation, nature related rainwater treatment, sponge city, urban developement

NETWORK

联合工作团队

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Situation in Cities

- Fast urban developement
- High degree of sealing of surfaces
- Subdimensional sewer systems
- Lack of stormwater retention

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Typical old residential area

- Large building density
- Little green areas
- Less room for leisure acitvities
- High population density
- Less infiltration

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Problems Urban Drainage System

- Subdimensional sewer systems
- Stormwater overflow discharge in suface waters
- Lack of Stormwater bassins
- Badly maintained septic tanks
- High amount of sewer infiltration water flow
- Badly maintained wastewater treatment plants, low cleaning performance

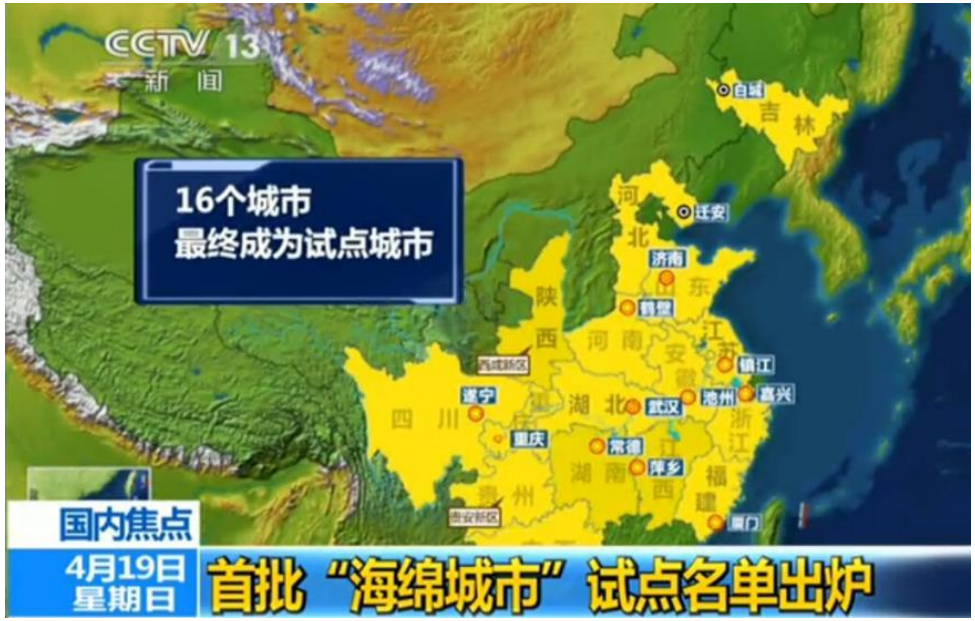
E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Governmental Support Programm for Sponge City Projects

- 2015 – Competition for sponge city projects – 16 Pilot cities
- Promotion with 1,5 billion Yuan per city for projects, completion time: 3 years
- 2016 – Competion for 14 further cities, at least one Pilot city in each province/climate zone

Goals:

- Examples for planning, construction and running of Sponge City facilities
- Developement of Sponge Cities industries



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Sponge City Concept

- Restore natural water circulation
- Reduce surface runoff
- Reduce investment in drainage systems
- Increase of groundwater recharge
- Purification of rainwater

By means of:

- Building of retention basins to limit peak discharge
- Reduction of surface sealing
- Decentralised or semi-decentralized rainwater treatment

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
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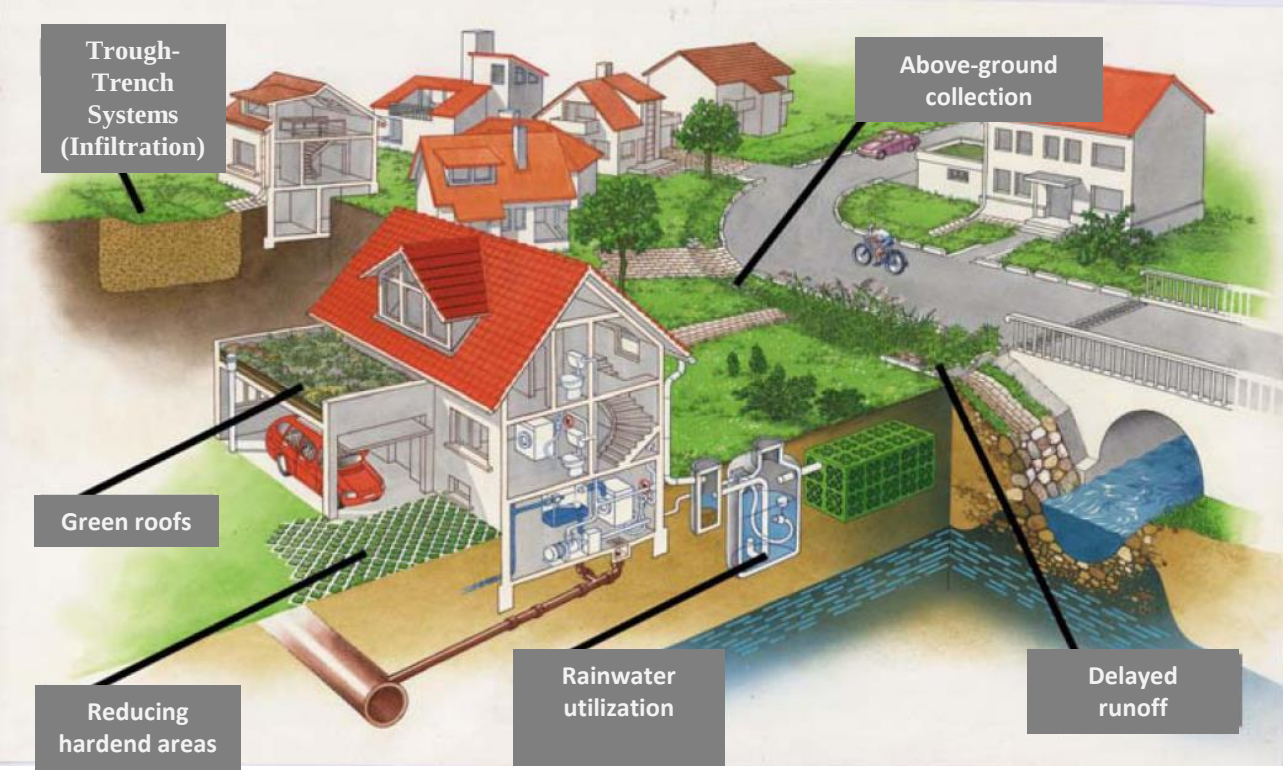
Typical Sponge City applications



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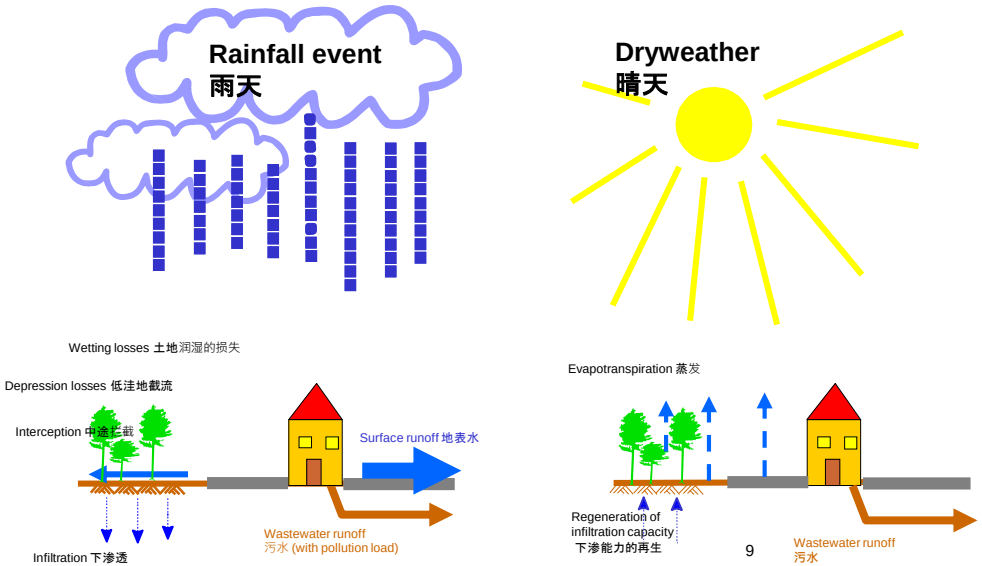
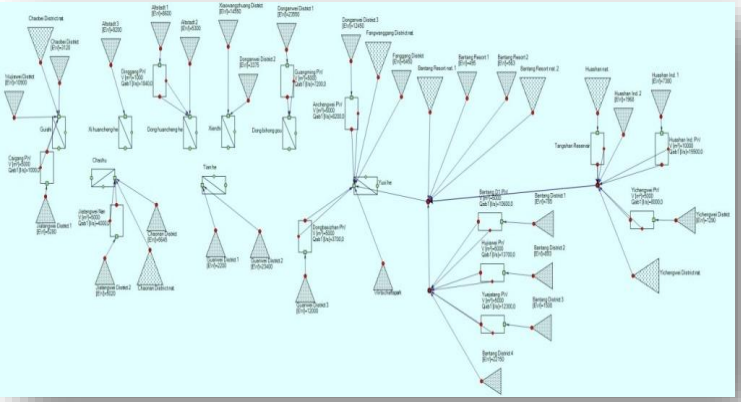
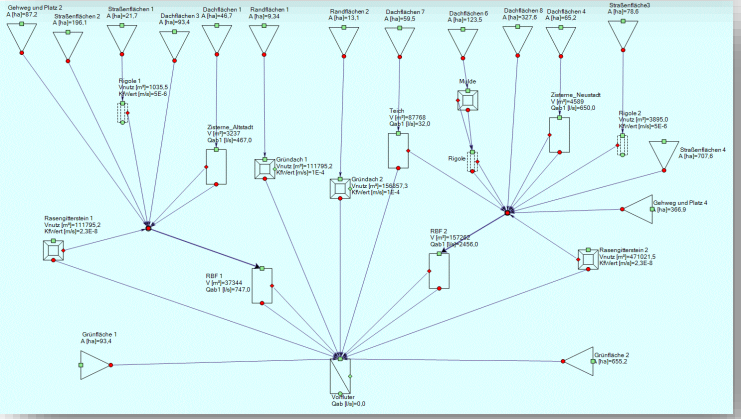
Hydraulic and pollution model: KOSIM

- Simulation: influence of Retention basins on pollution overflow discharge
- Proof of combined water overflow quantities
- Proof of purification success







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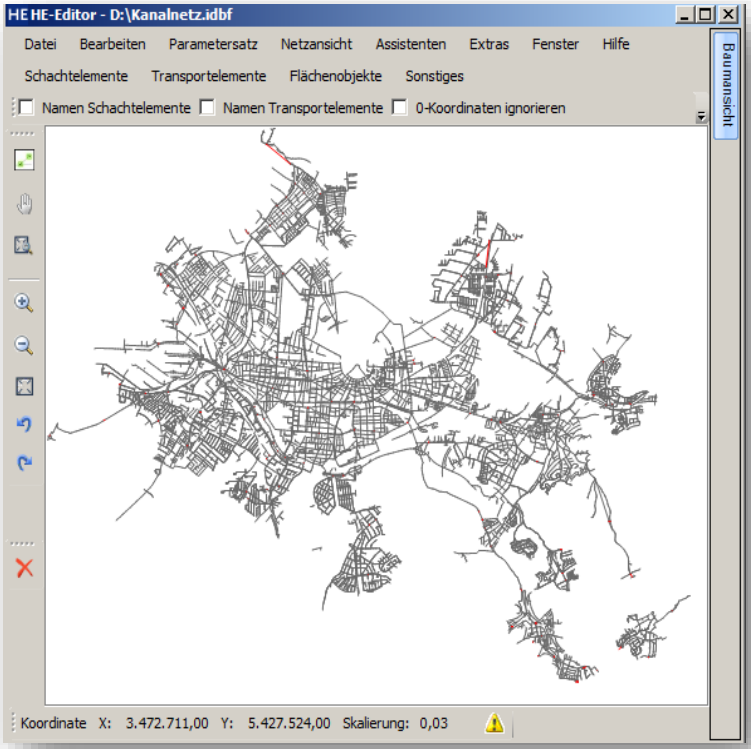
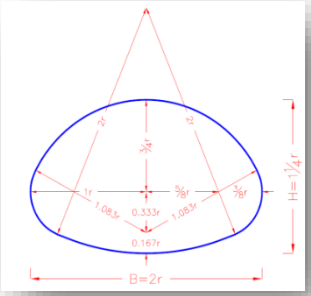
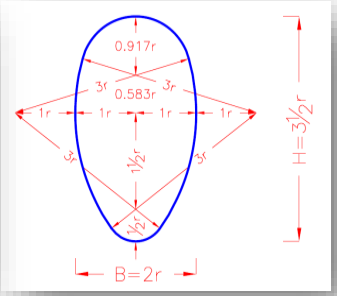
Mathematical sewer modell –HE

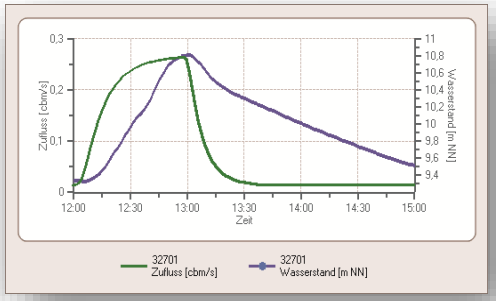
Software
HYSTEM-EXTRAN

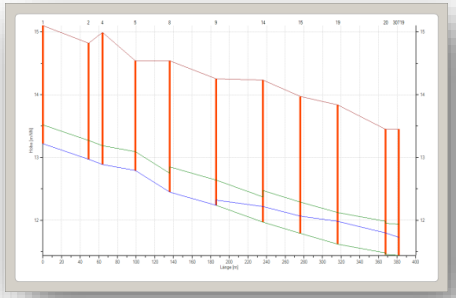
Hydrodynamic simulation of sewer network











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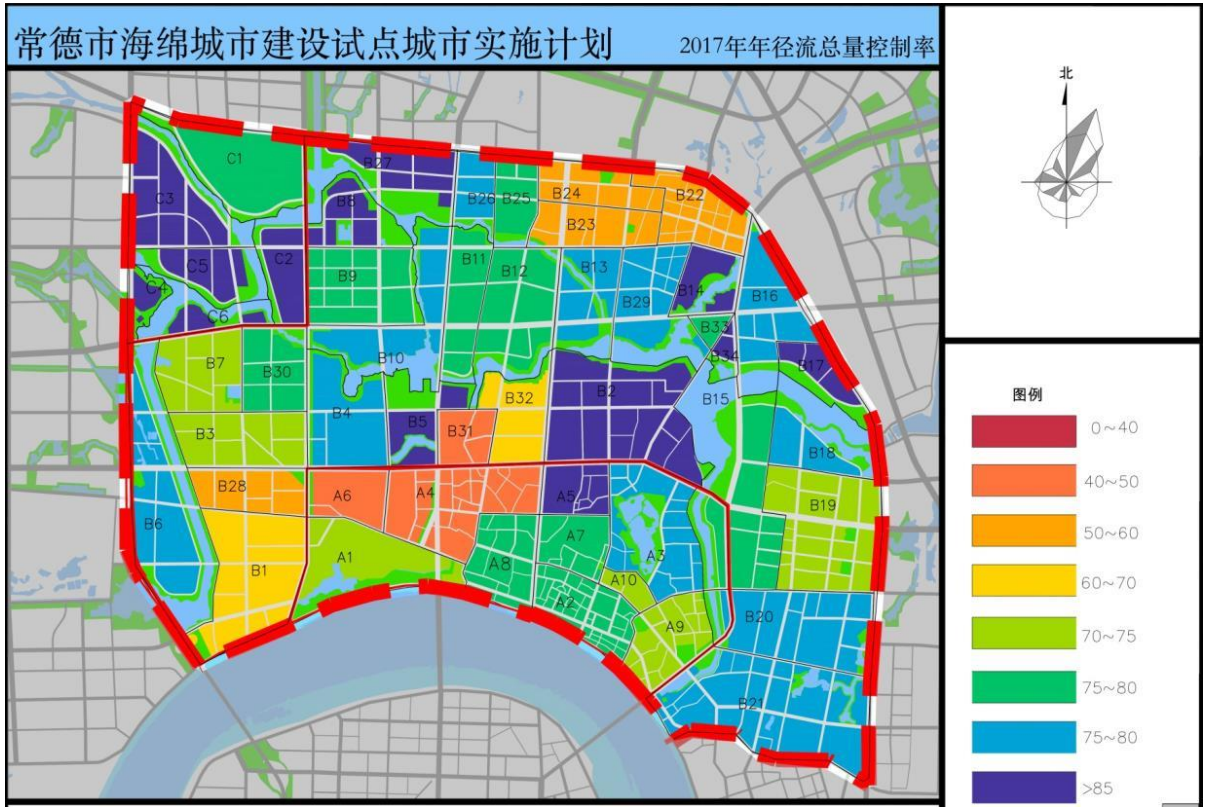
Sponge City Construction Objectives

- Reducing annual total runoff rate at least for 85%

  (corresponding precipitation 28 mm)



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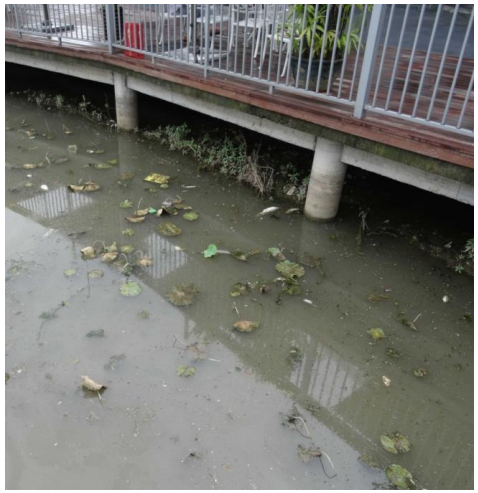
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reconstruction RW Pumping Station ChuanmaTou, Changde

RW Pumping Station:

- Catchment area 415 ha
- 37.000 Population
- Planning area 15 ha



设计范围

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Example: RW Pumping station Chuanmatou, Changde

Problems

- Water body, bassin are stinking, water quality was inferior
- The drainage system ist misconnected
- Pumping station facilies are old, no purification capacity
- Natural course of the water ist interrupted
- 14 km of river through the city with odor nuisance

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn

Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reconstruction Pumpingstation, river section

Measures:

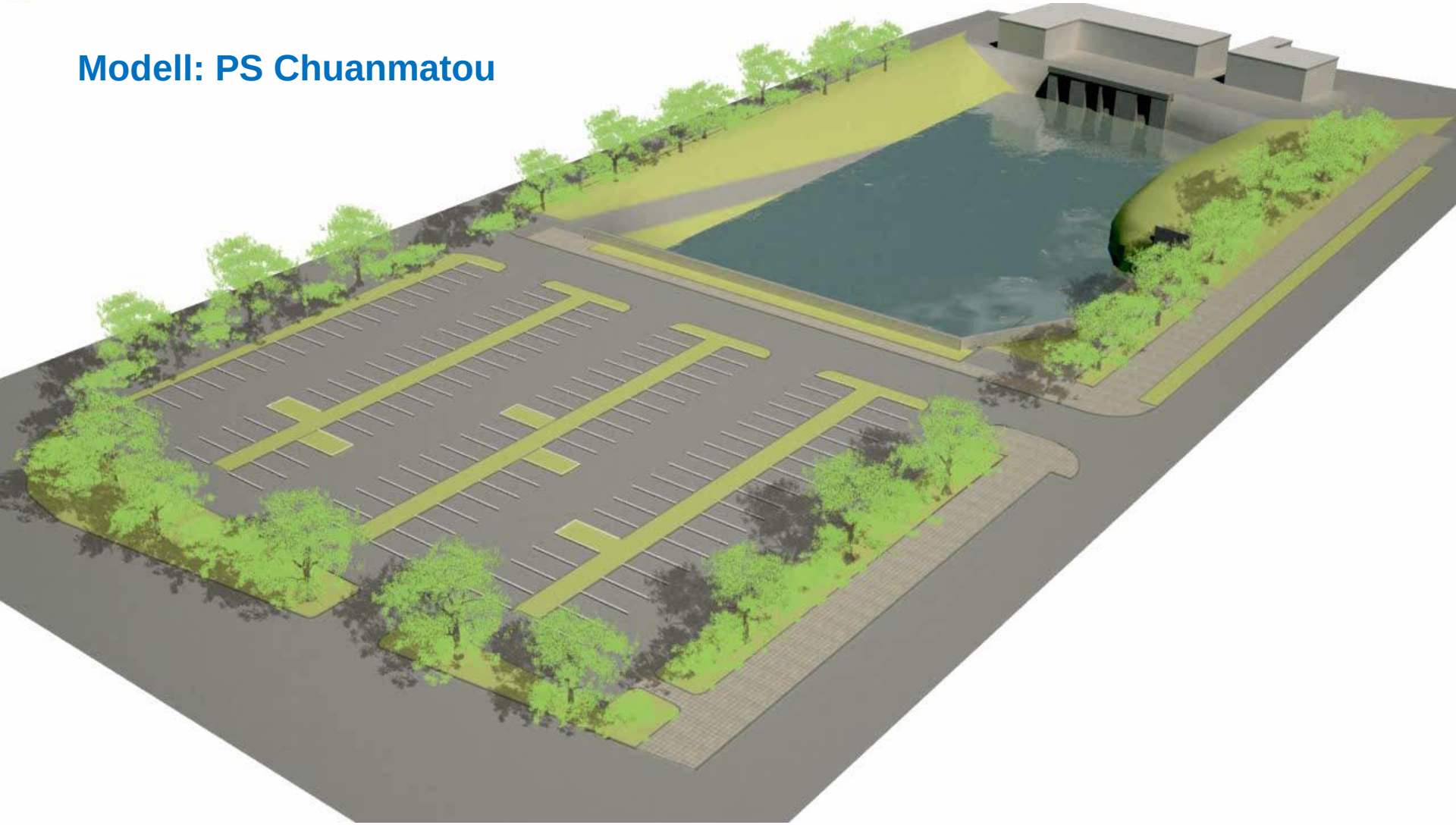
- Reconstruction of pumping station, stormwater basins, RBF
- Reconnection of River to natural course
- Construction of parkarea

Parameter:

- RW Pumping capacity: 12,6 m³/s
- WW Pumping capacity: 0,5 m³/s
- Settlement basin: 7.000 m³
- Storage basin: 13.000 m³
- RBF: 8.400 m²

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Modell: PS Chuanmatou



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Situation after renovation

排雨水草沟

泄洪通道

雨水排出口

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Situation after renovation (2016)

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Situation after renovation (2016)

- High quality living space

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reconstruction of Schutzgraben (protection trench), Changde

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
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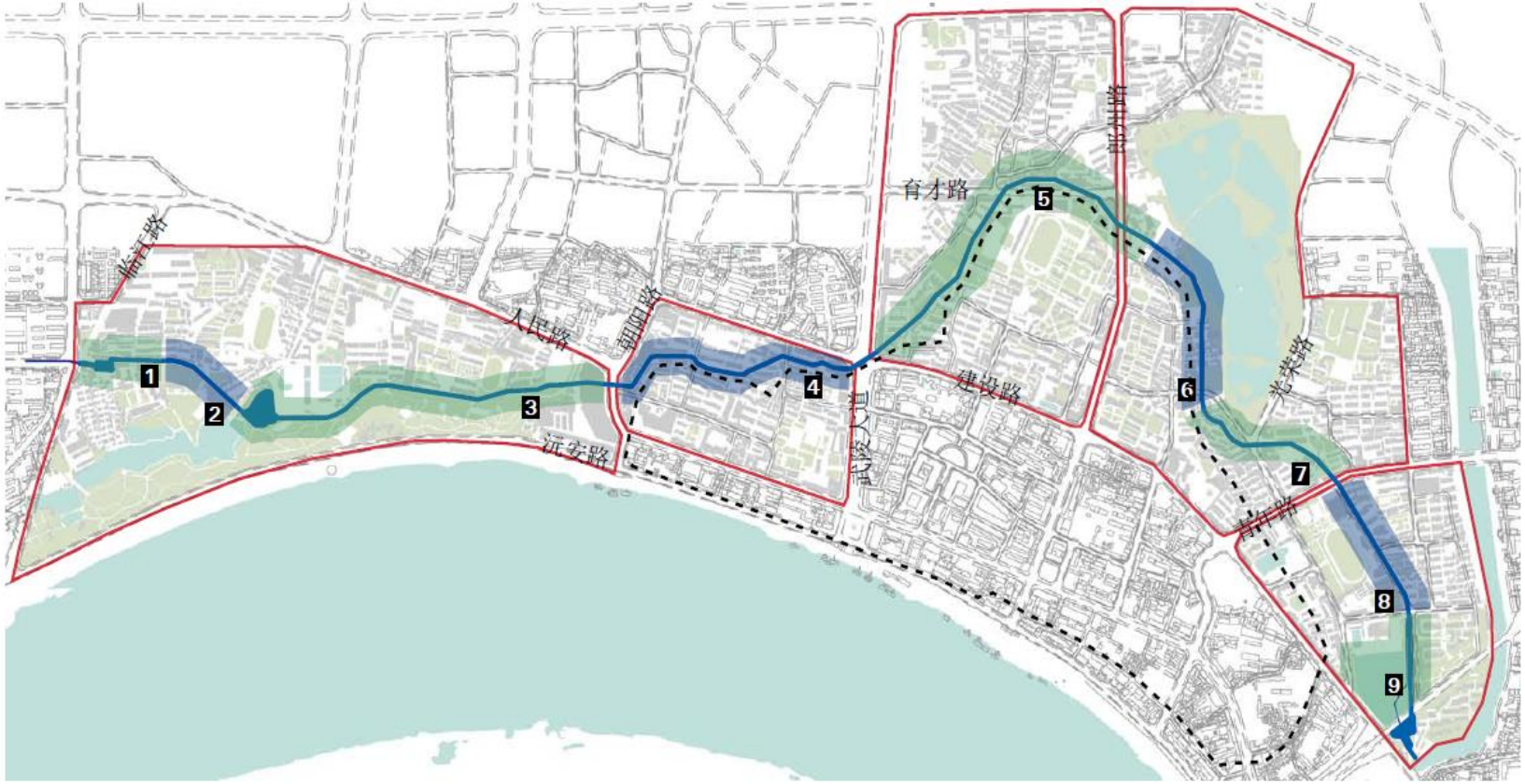
Reconstruction of Schutzgraben (protection trench), Changde



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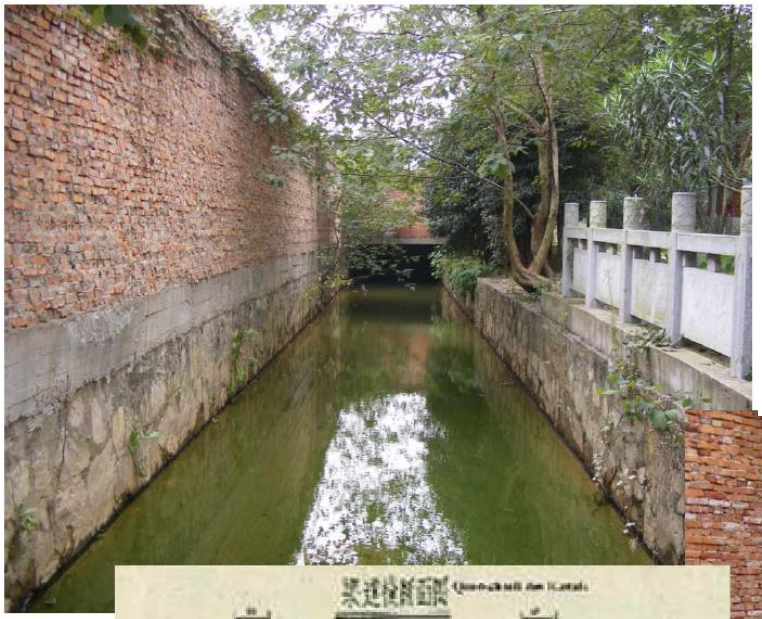
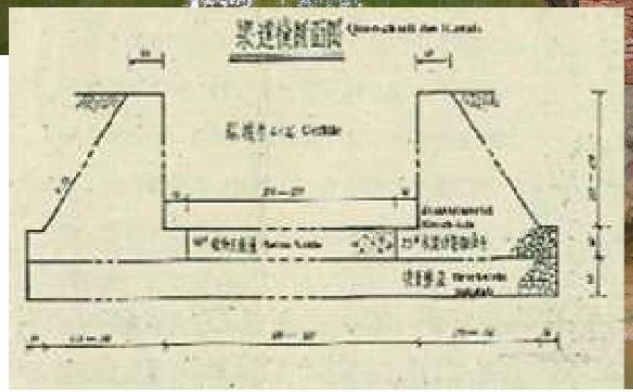
Current state



- Wastewater inflow
- Poor water quality
- Odor nuisance
- Disturbed water passage
- Poor state of construction



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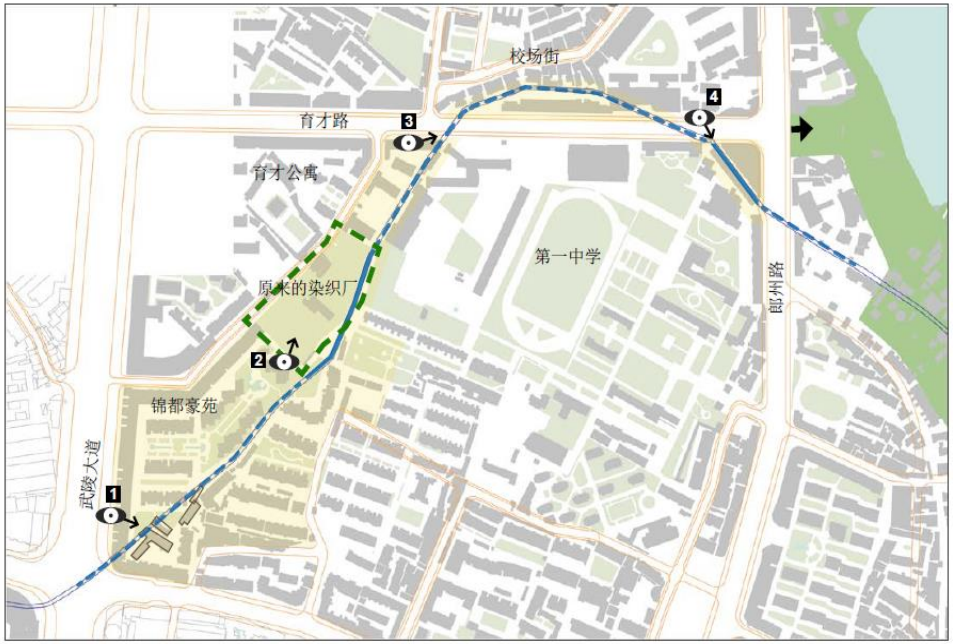
Current state – covered trench



计划敞开部分

多处修建，短期保持闭合

公园，公共绿地

问题/挑战

特征明显的周边区域

待建区域，可以作为公共空间使用

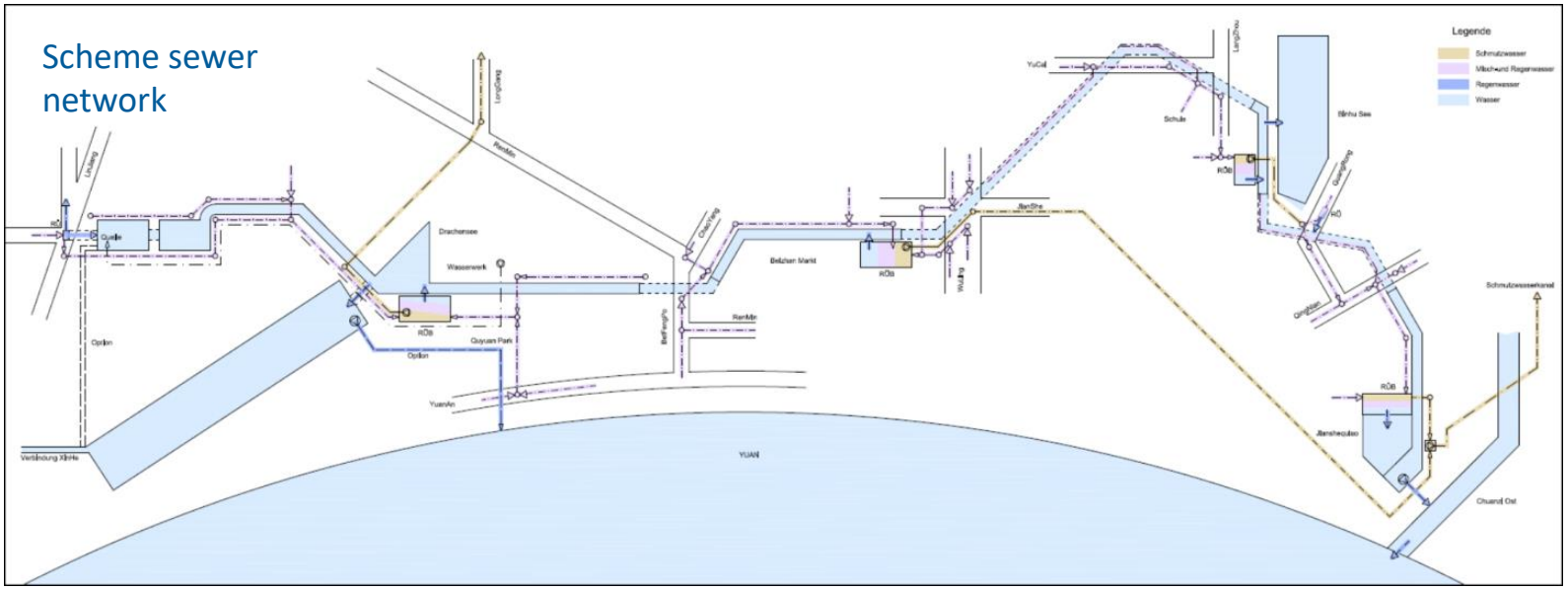
现状描述:

这个区域内的护城河从两个小区之间流过，被覆盖起来。其中有一段的上方是原来的染织厂厂房，已经废弃了，现在被当做菜园使用。另外一侧是第一中学校园。护城河两次横过育才路，之后有一小段敞开。朗州路东面的护城河上方的高层建筑，是近两年才修建起来的。

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Stormwater Basins, WW Pumping Station, RBF

- Treatment of combinded waste water in Stormwater Basins
- Reed Bed Filters
- Catchment sewer System
- Expansion of protective trench as a rainwater channel
- Pedestrian zone with commercial buildings (traditional architecture), restaurants etc.



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Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Planning phase: city planning, channel (reference pictures)

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Current state: Daximen (Section 2)

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
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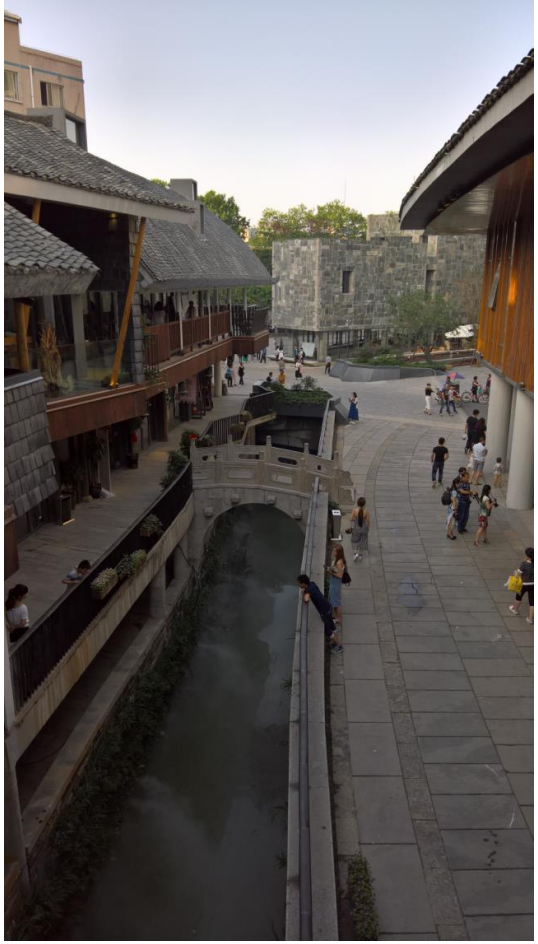
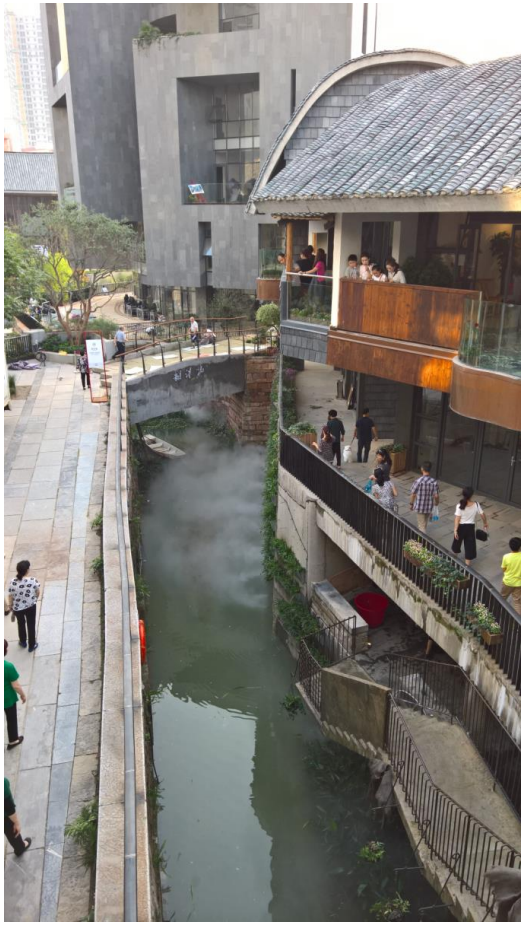
Current state: Daximen (Section 2)





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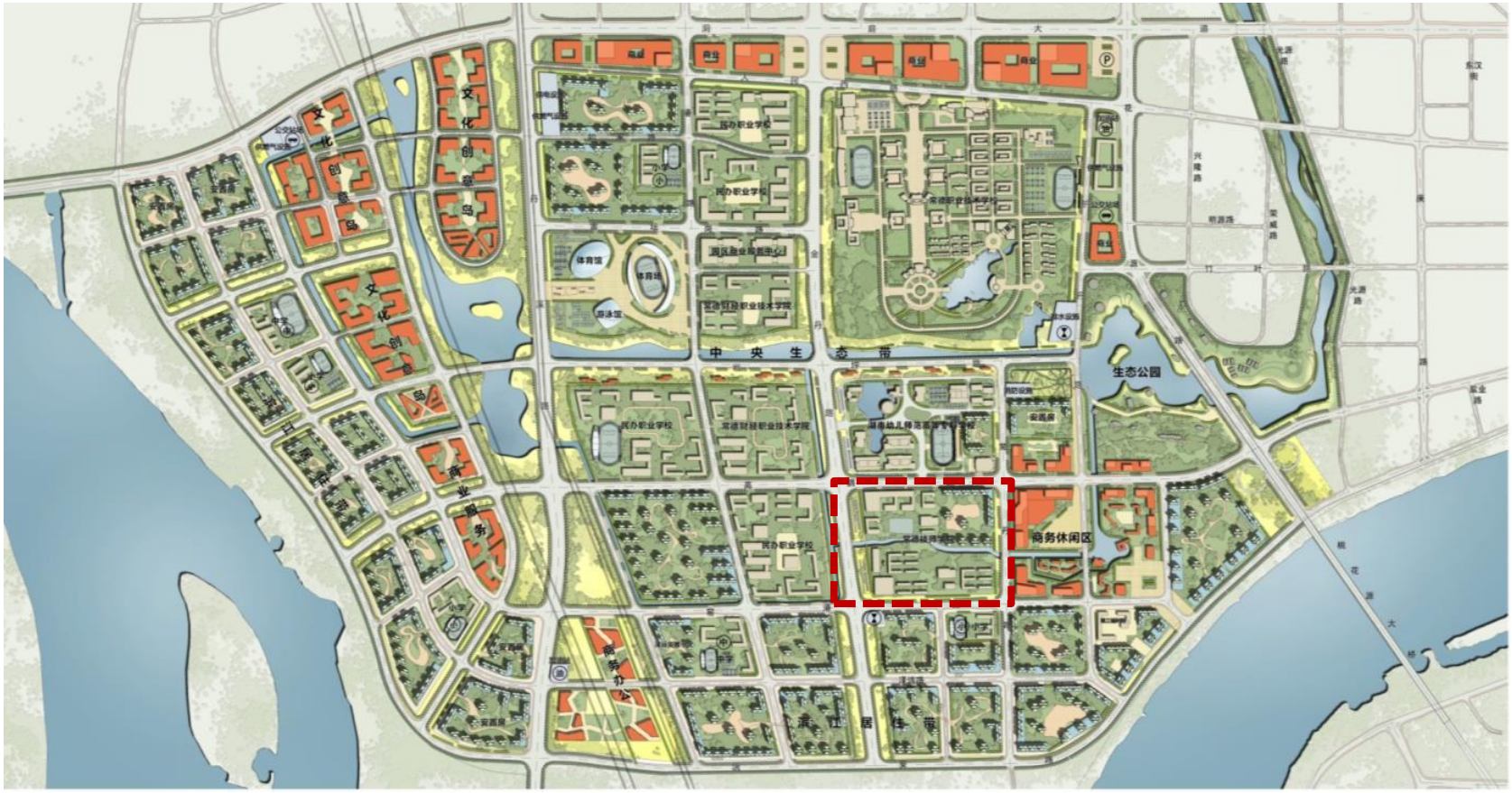
区位图

Sponge Campus – Technical College (26 ha)



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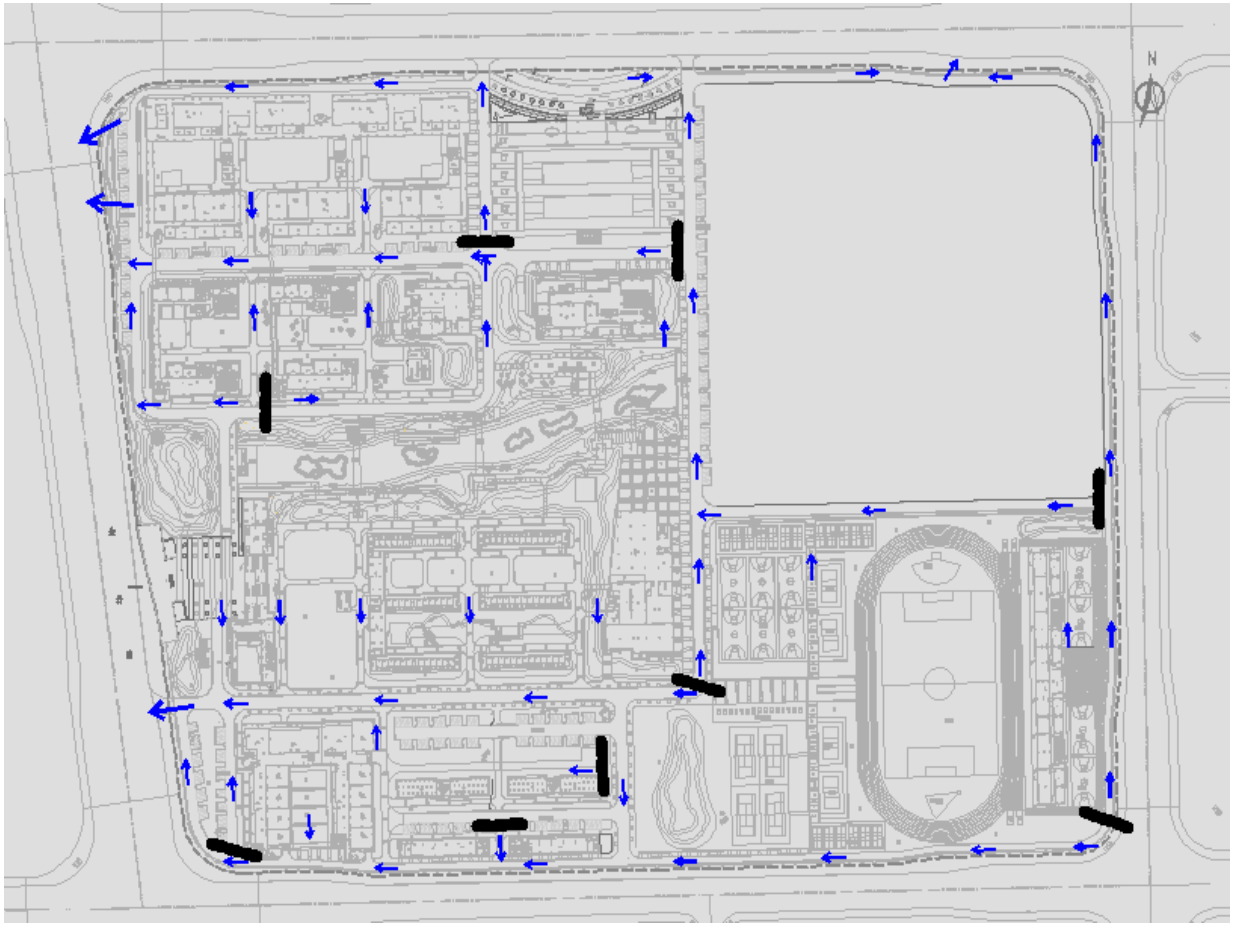
Original rainwater drainage plan



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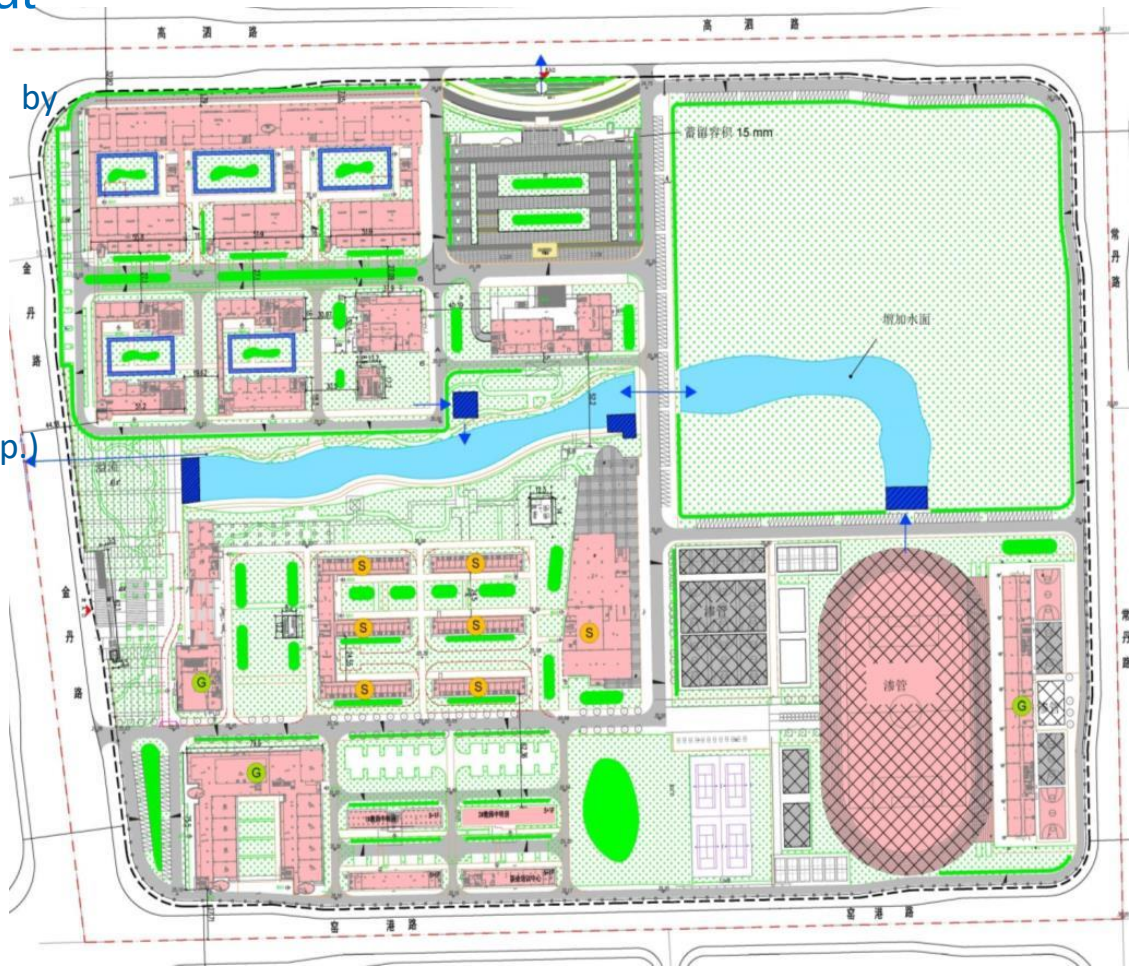
Sponge City - General Layout

- Trenche system in Atriums, inspired by traditional chinese architecture
- Trough-Trench Systems
- Underground infiltration devises (sporting area)
- Green roofs
- Retention river (6.000 m², 2.000 m³ Ret. cap.)



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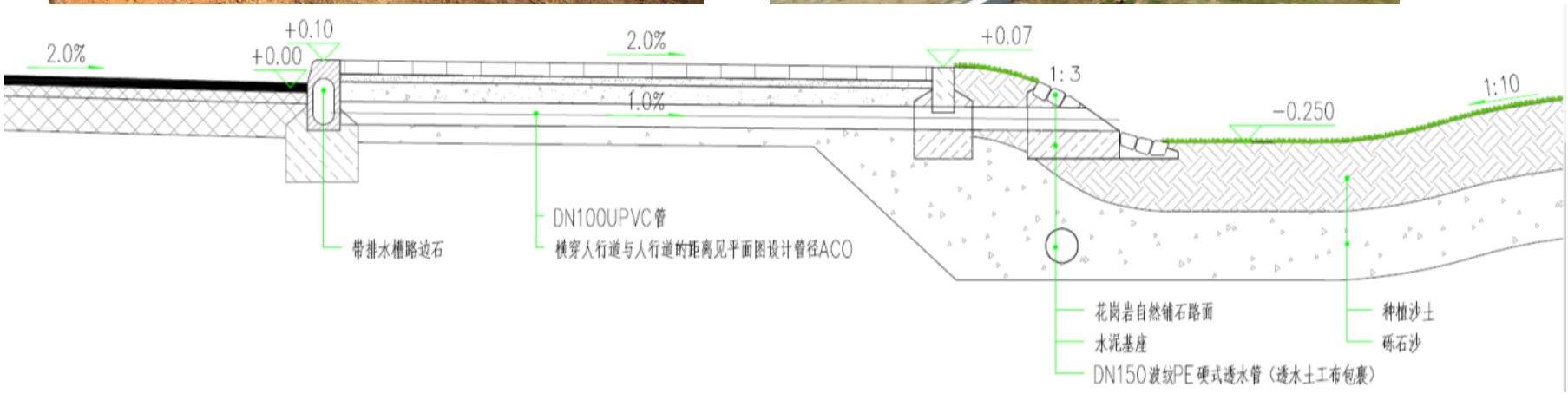
Current state (constuction process):



植草沟断面图

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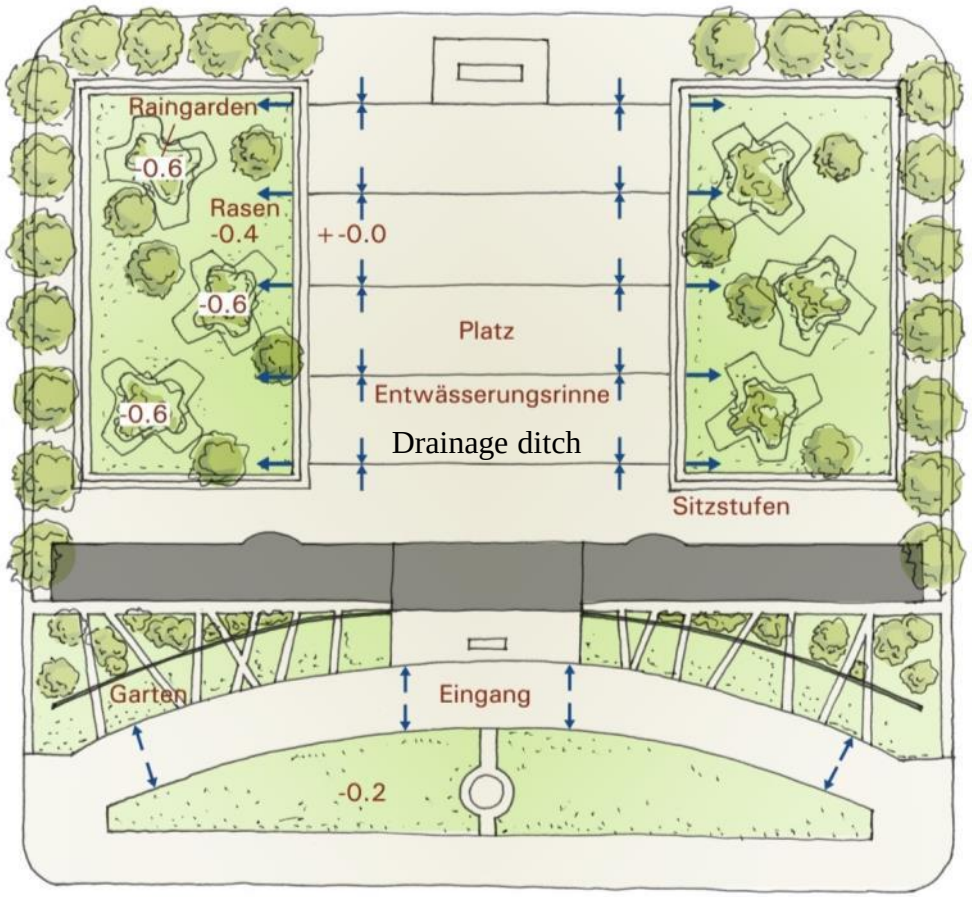
Raingarden – Drainage of Campus Plaza



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Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Current state: Raingarden, Campus plaza

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Current state: percolation ditch

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
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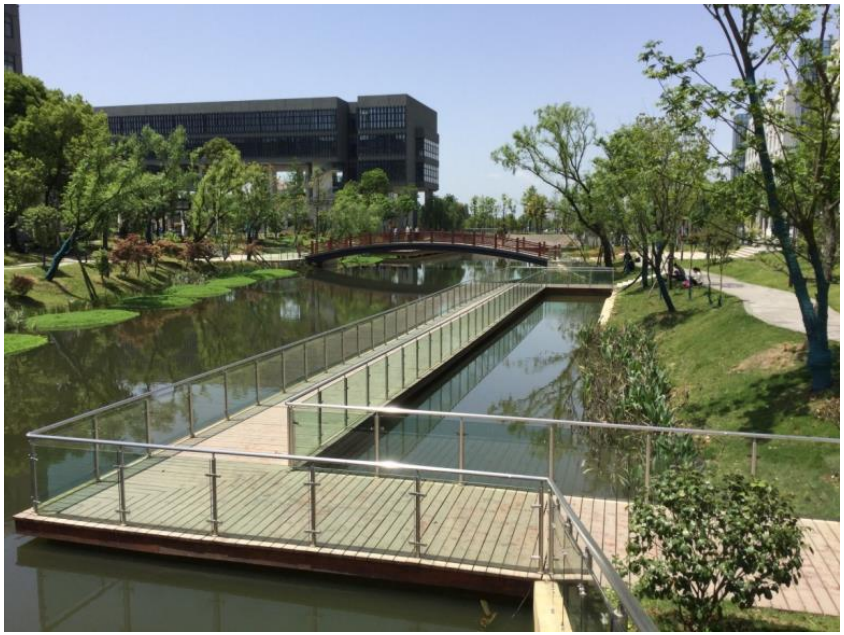
Current state: Retention river



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Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Current state: Trough-Trench Systems

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
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Project: Guitanghe river revitalization - Changsha

- Changsha – Capital of Hunan Province
- 7 Million Inhabitants
- Guitanghe River-
  28 km, 125 km²

→ Project river section: 2 km, 60 ha

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Guitanghe River – Projekt section

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Guitanghe – Current state (hard surfaced river profile)

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

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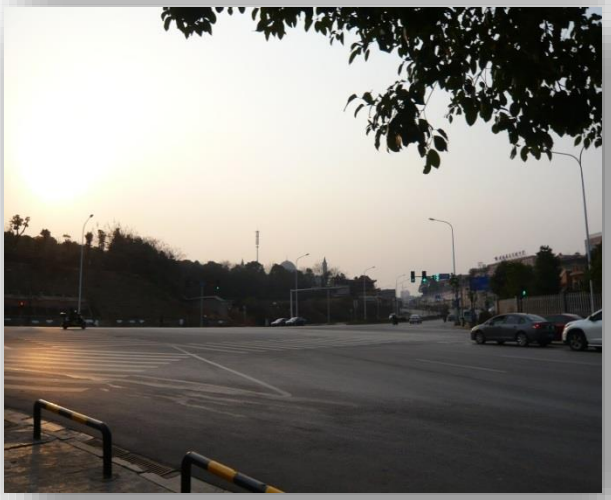
Surrounding Areas (Jingtang district)

- Densely build-up area, high-rise buildings
- High degree of surface sealing (80-90%)



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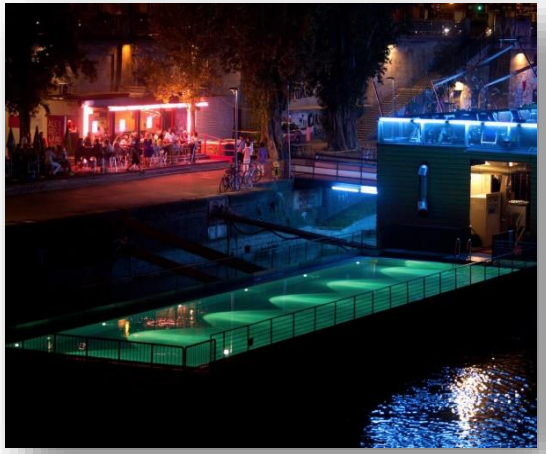
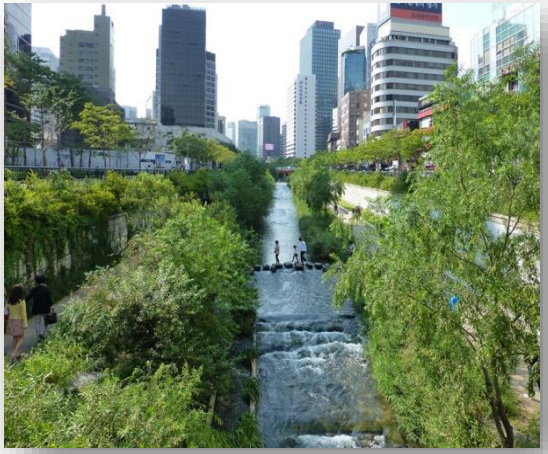
Project Goals:

- Ökological river rehabiltiation Guitanghe (2 km)
- Realisation of sponge city guidelines of Changsha
- Flood protection
- Developement of urban area

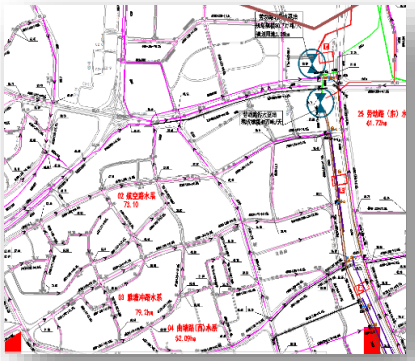




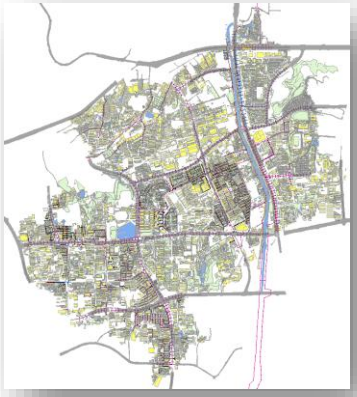
E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Collecting Data

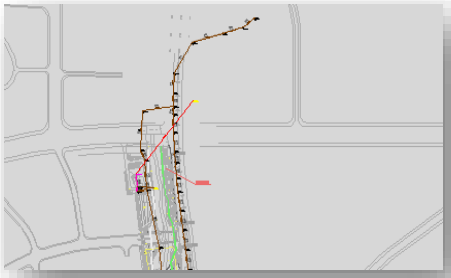
Sewer System (Masterplan 2017)



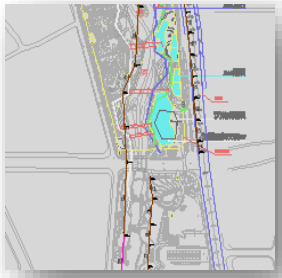
Digital Surface data (Catchment area) (Jingtang 08/2017)



Survey Sewer System (2017)

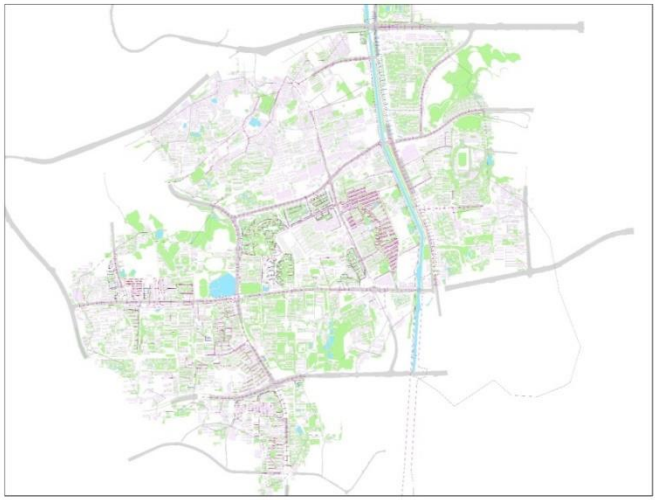


Survey Inflow (Area Jingtang 2017)



E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Modelling – Sewer Network (Hystem-Extran)



Modell Jingtang Sewer Network, Surfaces

Surface assignment (Thiesen-Polygon)

Part of sewer network

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

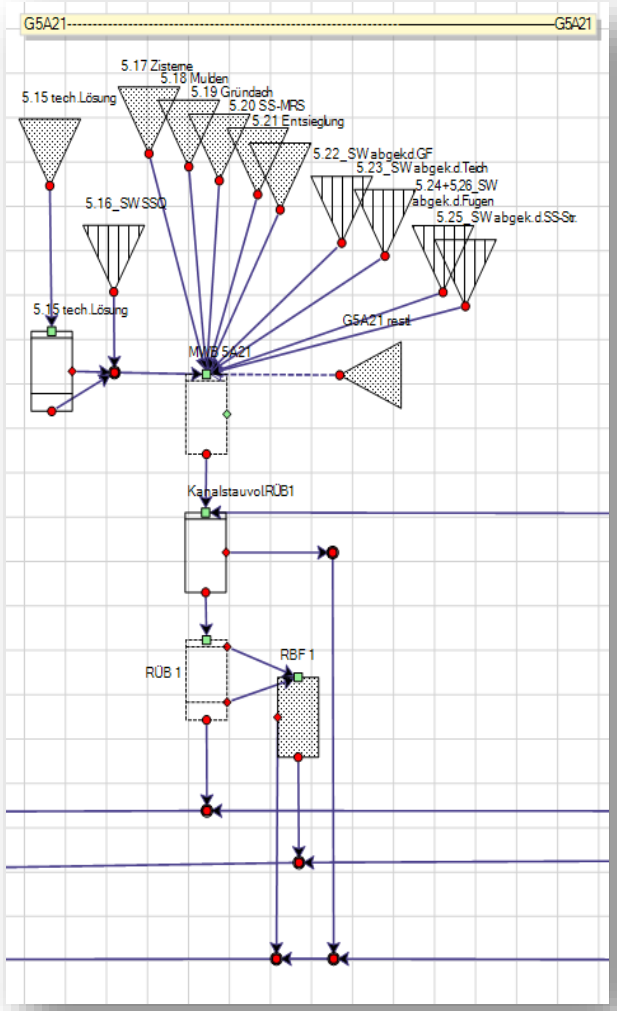
Polution load calculation (KOSIM)

Depending on sponge city measures:

- Minimum goal < 250 kg COD/ha/a
- Maximum goal: < 200 kg COD/ha/a

Bereich	Ages (ha)	Flächentyp	Flächenanteil	Maßnahmen
Dezentrale Maßnahmen	295,8	Dachflächen	20%	Zisterne
				Gründach
				Mulden Privatgelände
				ohne Maßnahmen
		Straßenflächen	20%	Schwammstadtstraßen MRS
				ohne Maßnahmen
		Gehwege, Platz	40%	Rasengitter., Entsiegelung
				ohne Maßnahmen
		Grünflächen	20%	Versickerung
		Summe	100%	
Schwammstadt quartiere	93,8			
		Summe	0%	
	389,6	Schwammstadtstraße		3110
Technische Lösungen im Gebiet				Bewirtschaftung Kanalstauraum
				Stauraumkanal/Becken
		Summe		
Naturnahe Lösungen im Gebiet				Grüne Fugen
				Nutzung Teiche
				Umwandlung von GF in Retentionsräume
		Summe		
Zentrale Maßnahmen (End of Pipe)				Becken
				RBF
		Summe		

Modelling



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Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Planned Sponge City Measures (Jingtang)

End-of-Pipe-Solution
Retention Basins, RBF

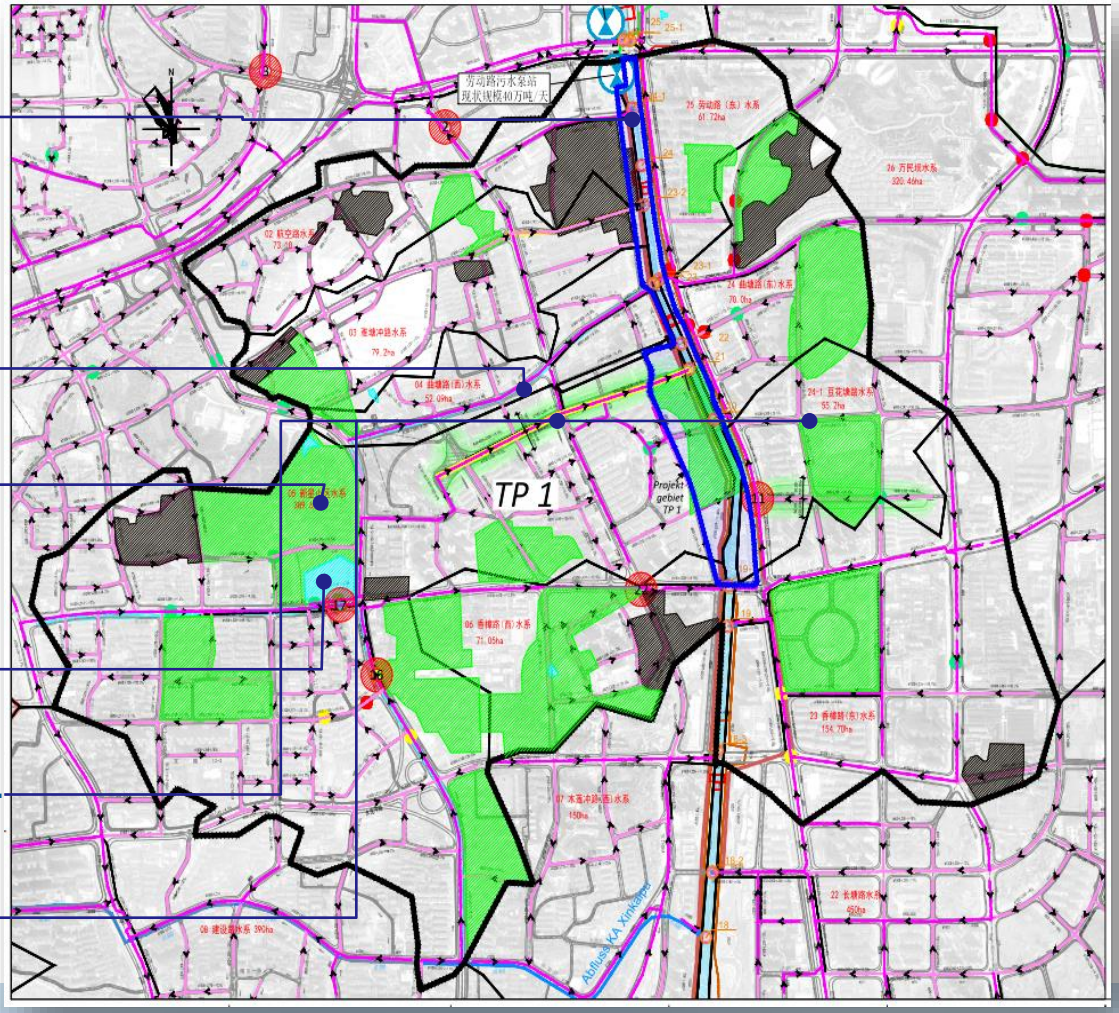
Sponge City Streets

Sponge City residential areas

Retention pond

Management of sewer storage cap.

Seperate sewer system



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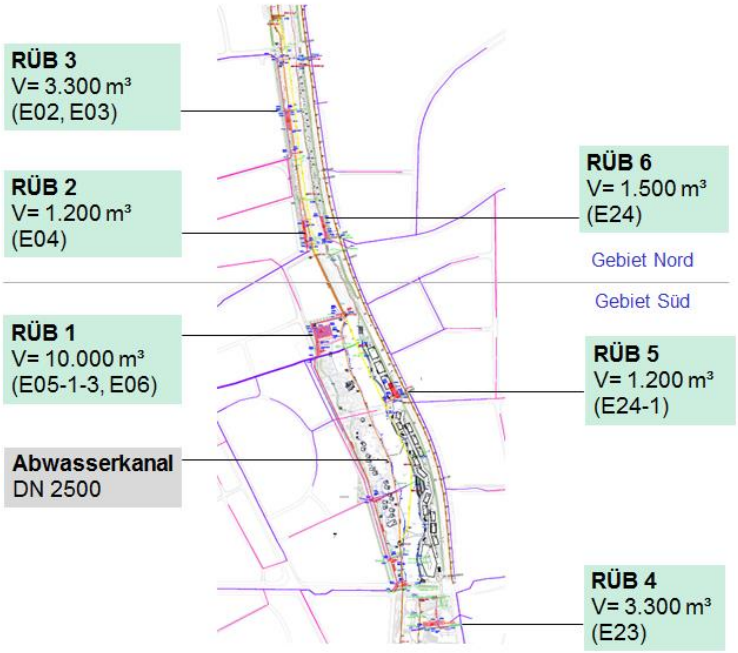
End of pipe Solutions – Stormwater Tanks, RBF (Jingtan Section)

- Construction 6 Stormwater Tanks (20.500 m³) (RÜB)
- Construction of collecting Sewer DN 2500



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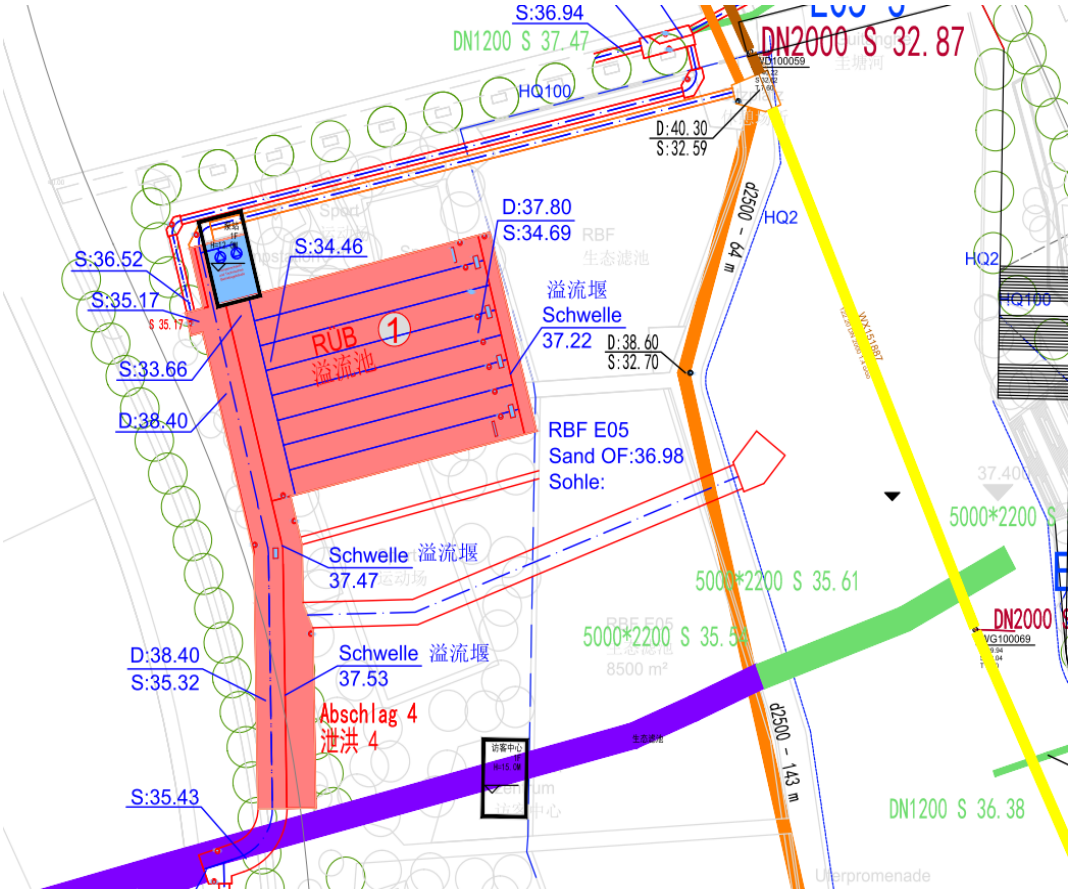
Example – Guitanghe river revitalisation, Changsha

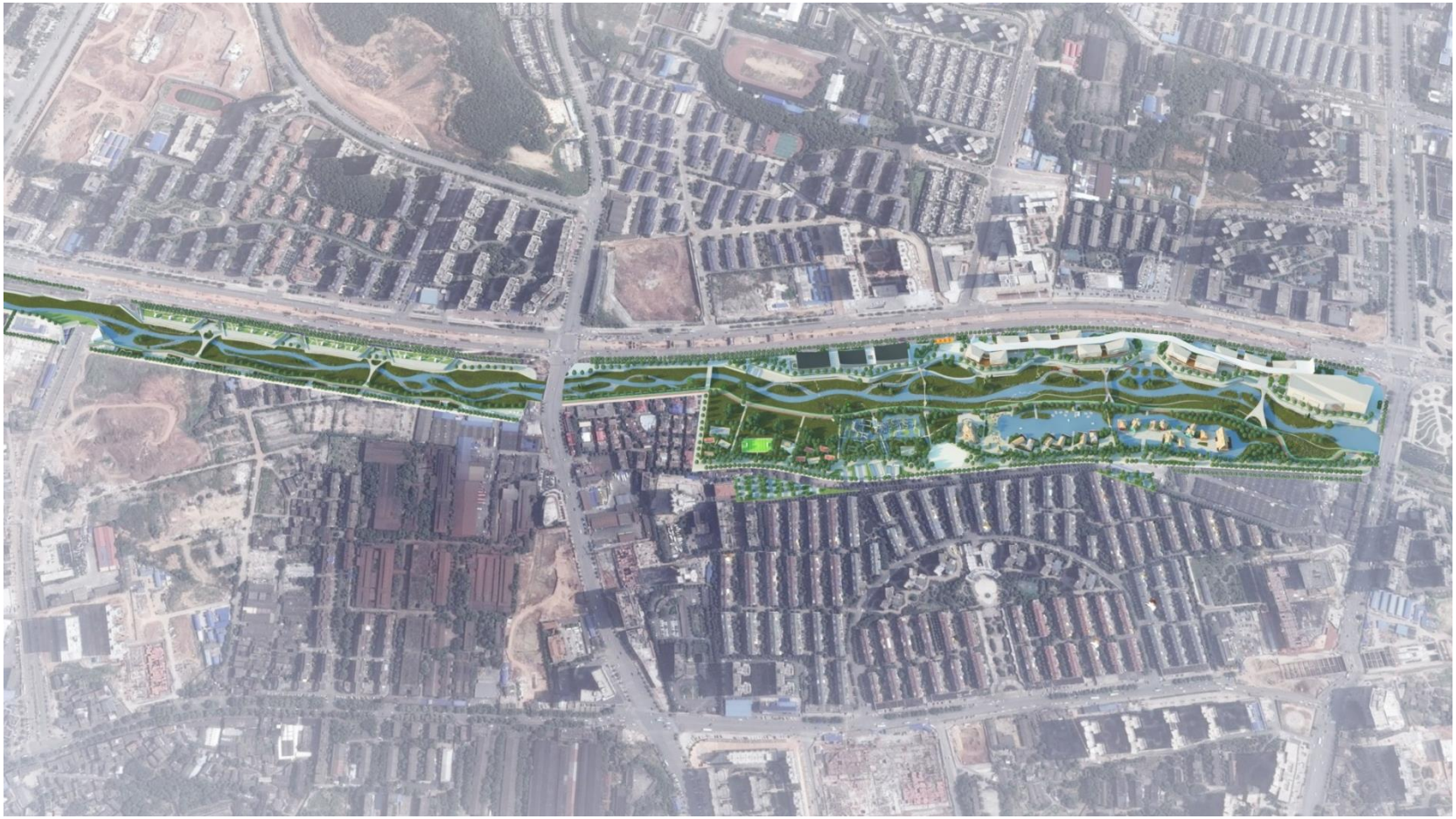
Stormwater Tank 1 (V= 10.000 m³)



Example – flushing flaps

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Model - Architecture and urban planning



E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
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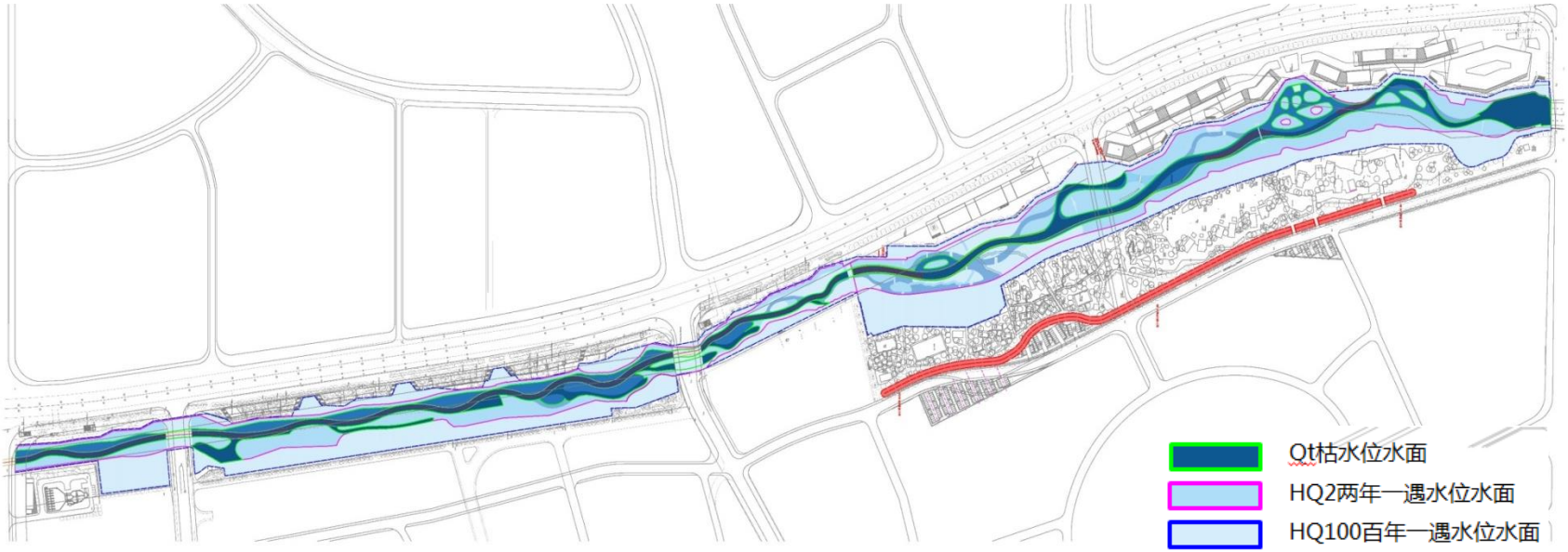
River Hydraulic
Water level – Different Return periods



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Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Developement – Bridges, Paths, Promenades

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures – paths, meandering river

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures – Clean water areas

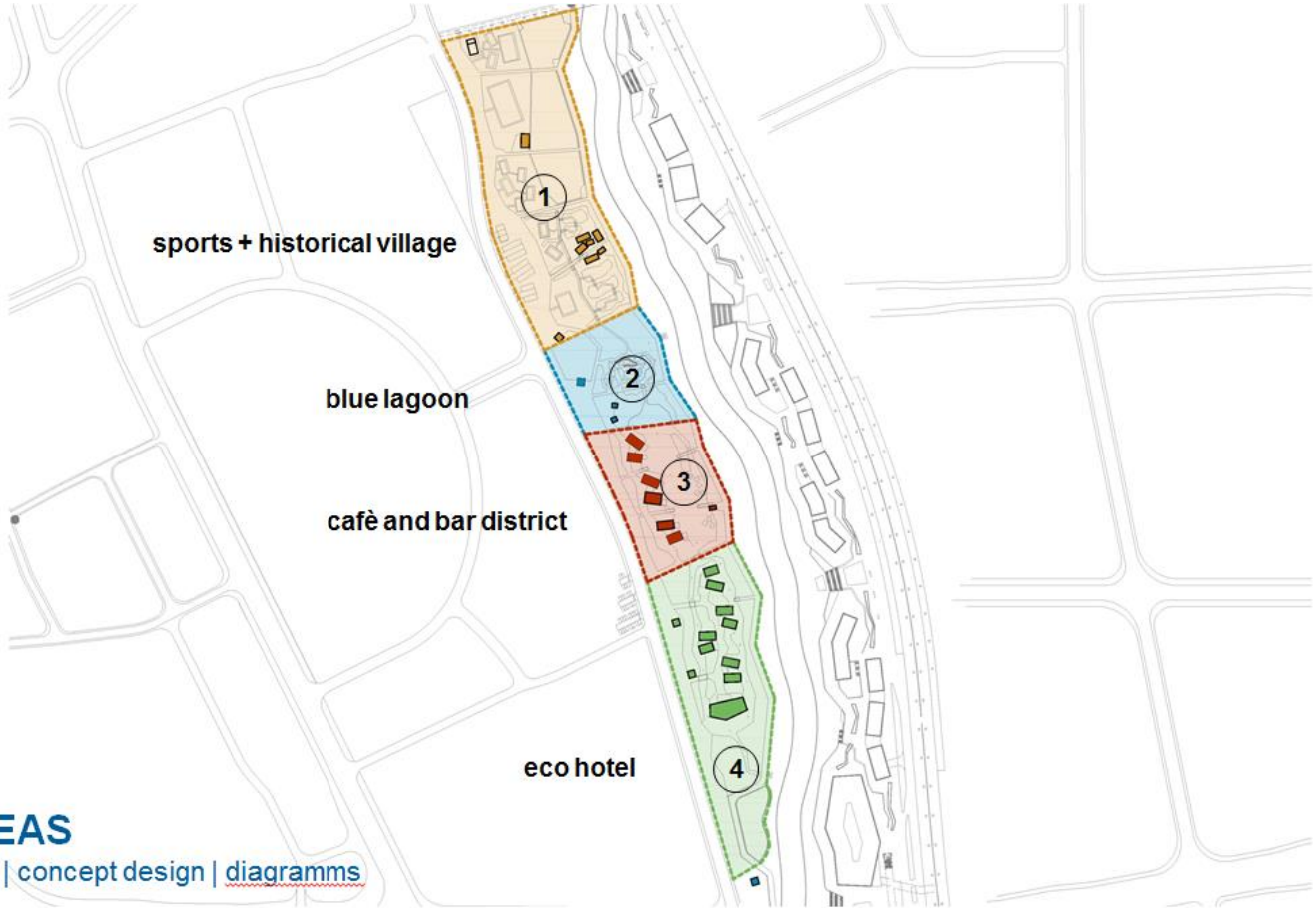
E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures - Sport

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures - Promenades

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany



FOUR AREAS

jingtang section | concept design | diagramms

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures – Water places

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures – Reed Bed Filters

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures – Park Promenade

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures – Paths for Pedestriants, Bicycles

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Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures – Bridges

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Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures – step stones

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
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Reference Pictures – Promenades, Stairways

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Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Reference Pictures – Historical village

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Example – Guitanghe river revitalisation, Changsha

AREA 2:CAFÈS

jingtang section | concept design | building references

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn

Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

UN World Water Day – Nature for Water

Example – Guitanghe river revitalisation, Changsha

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

Sponge City - Hannover Street

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn
Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany

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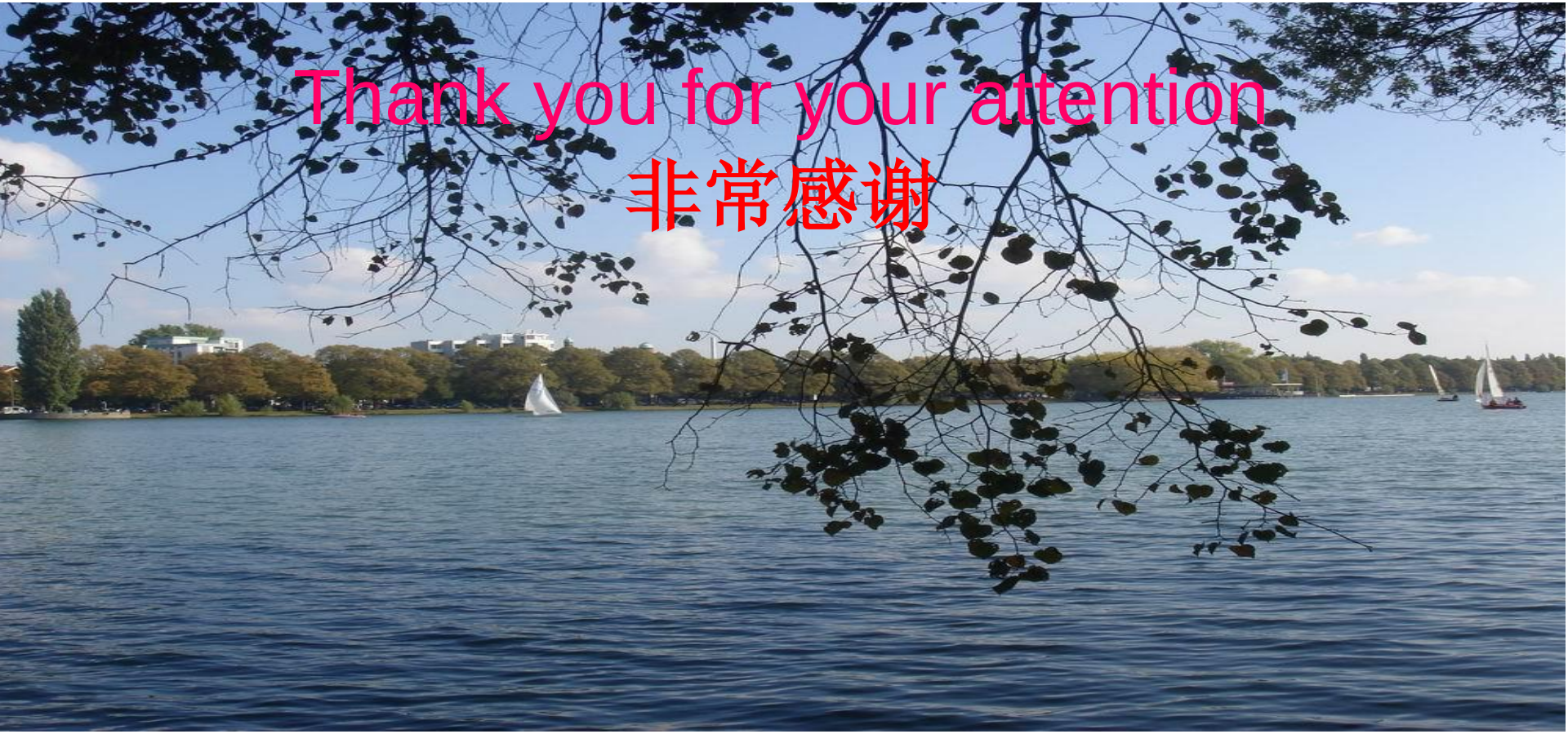

Thank you for your attention

非常感谢

E-Mail: j.knollmann@knollmann.de, c.peng@itwh.de www.wasser-hannover.cn

Wasser Hannover e.V. Engelbosteler Damm 22, 30167 Hannover, Germany