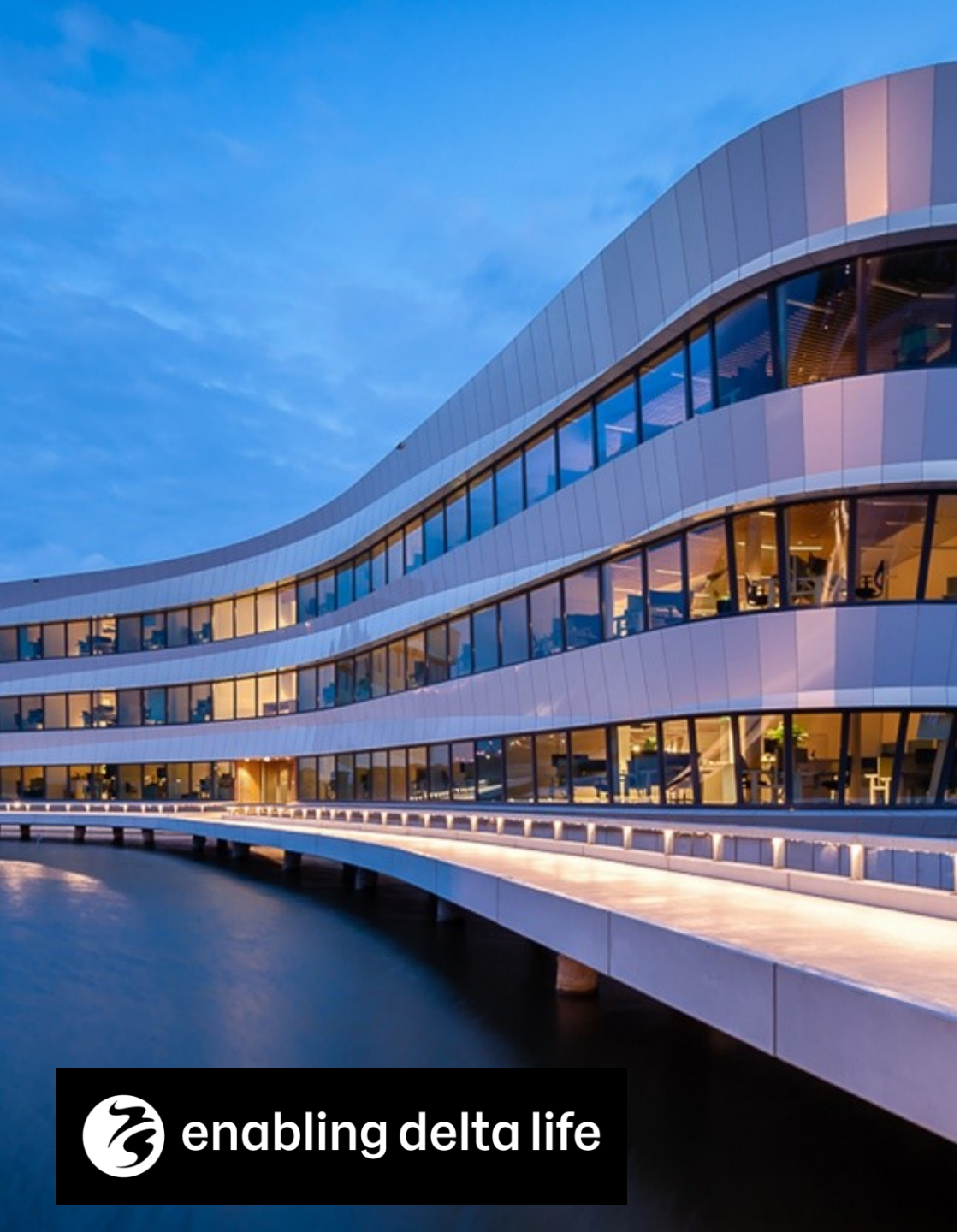




CHINA
EUROPE
Water Platform

Deltares

Supporting implementation of the Sponge City Approach

Dr ir Frans H.M. van de Ven

Dr Reinder Brolsma

Shiyang Chen MSc

January 26, 2021

Basis of this presentation

3 studies

Sponge Design

A Study on Comprehensive Sponge City Design Approach

Presentation for Deltares
Presented on 2020-09-30

Master student

Shiyang Chen

Graduation committee

Committee chair & daily supervisor:
Committee members:

Dr. ir. Frans van de Ven (TU Delft & Deltares)
Prof. Dr. ir. Chris Zevenbergen (IHE)
Dr. Lisa Scholten (TU Delft)
Dr. Qinghua Ye (TU Delft & Deltares)
Mr. Weijun Zhang (Ewaters)



Pre-feasibility study of confirmed ecosystem-based adaptation measures for Xiangtan

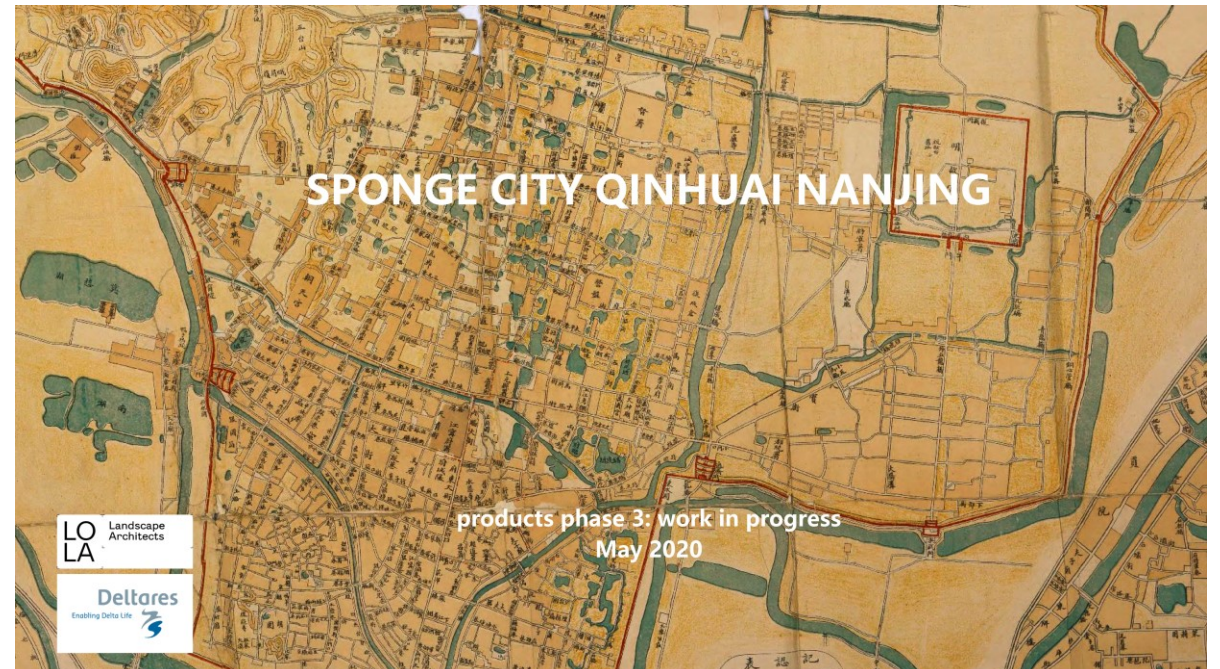
Deltares

Frans van de Ven
Reinder Brolsma
Helena Hulsman
Shiyang Chen

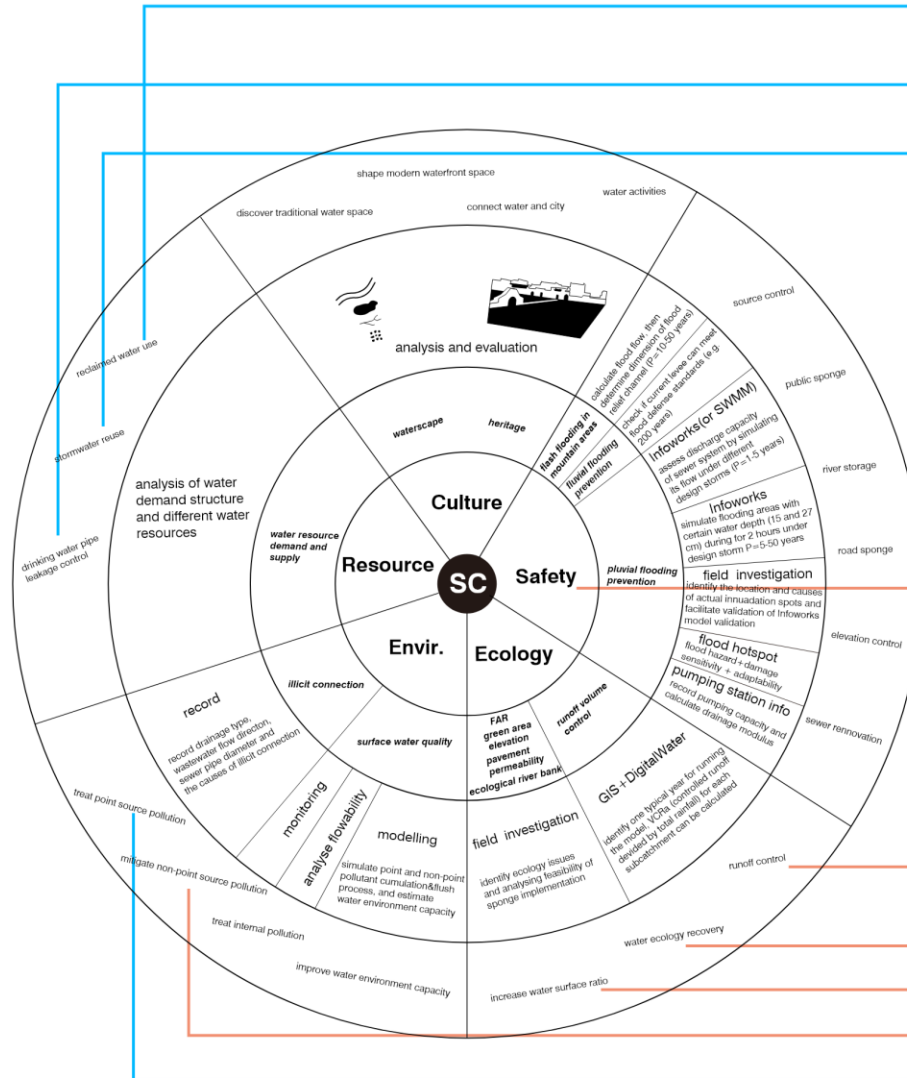
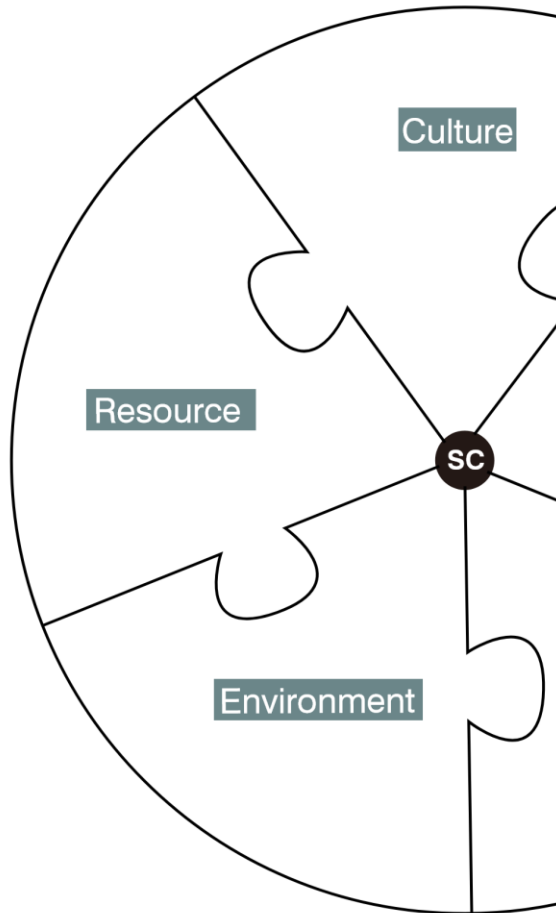
Ewaters

Weijun Zhang
Ran Zhu
Tingting Hao
Zhengmin Lei

18 January 2021



Sponge City approach



RWUR: Reclaimed Water Use Ratio

PLR: Pipe Leakage Ratio

SRR: Stormwater Reuse Ratio

FCS(R): Flooding Control Standards (Recurrency)

VCRa: Volume Capture Ratio of annual rainfall

ERBR: Ecological River Bank Ratio

WSR: Water Surface Ratio

SSRR: Suspended Solid Reduction Ratio

WQQR: Water Quality Qualified Ratio

recommended indicators

obligatory indicators

Enhance SC implementation

SC guidelines evaluated with

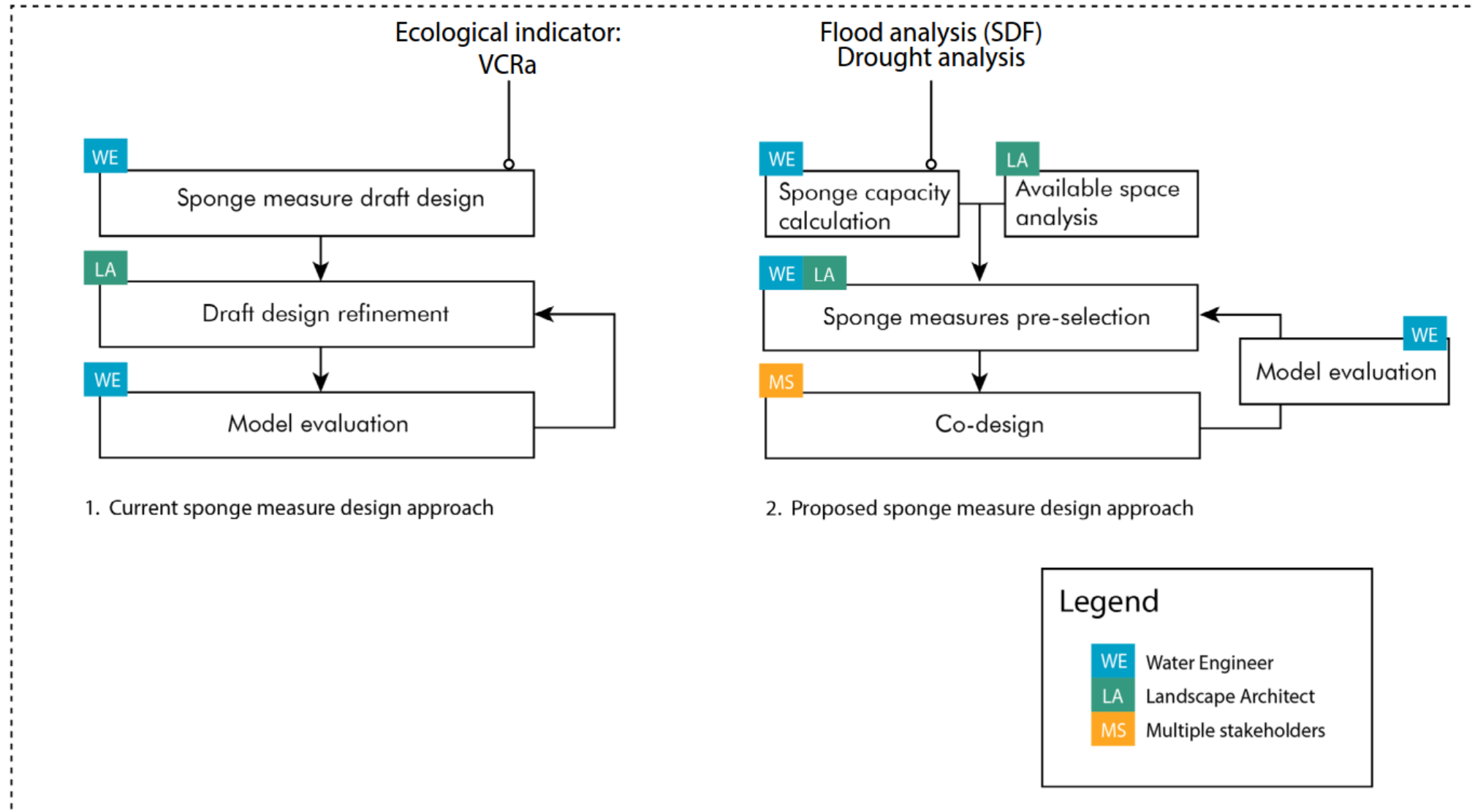
- Water Sensitive Urban Planning
- Climate Resilient City Planning



Sponge planning principle

1. **Never shift problems**
2. **Design for resilience**
3. **Respect local conditions**
4. **Arrange sponges systematically**
5. **Make sponges attractive**
6. **Bring relevant stakeholders around table**
7. **Good governance**

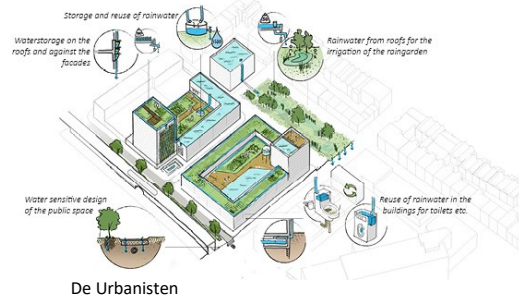
Sponge measure design approach



NEVER SHIFT PROBLEMS: Retain - Store - Drain strategy

Retain and Detain and Store **at the source**
to avoid overloading the drainage capacity

CLIMATE ADAPTATION IN THE NEW DEVELOPMENTS IN THE ZOHO-DISTRICT



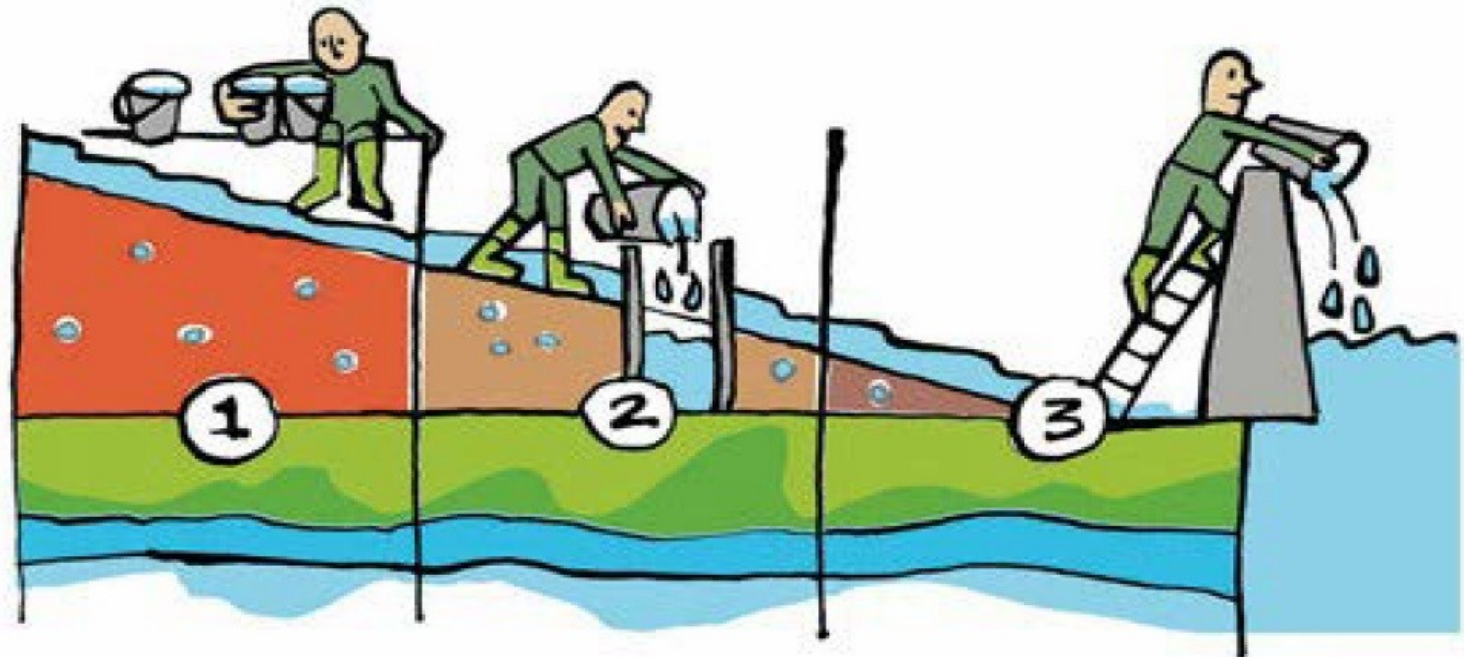
LOD (Lokalt omhändertagande av dagvatten)



Retain

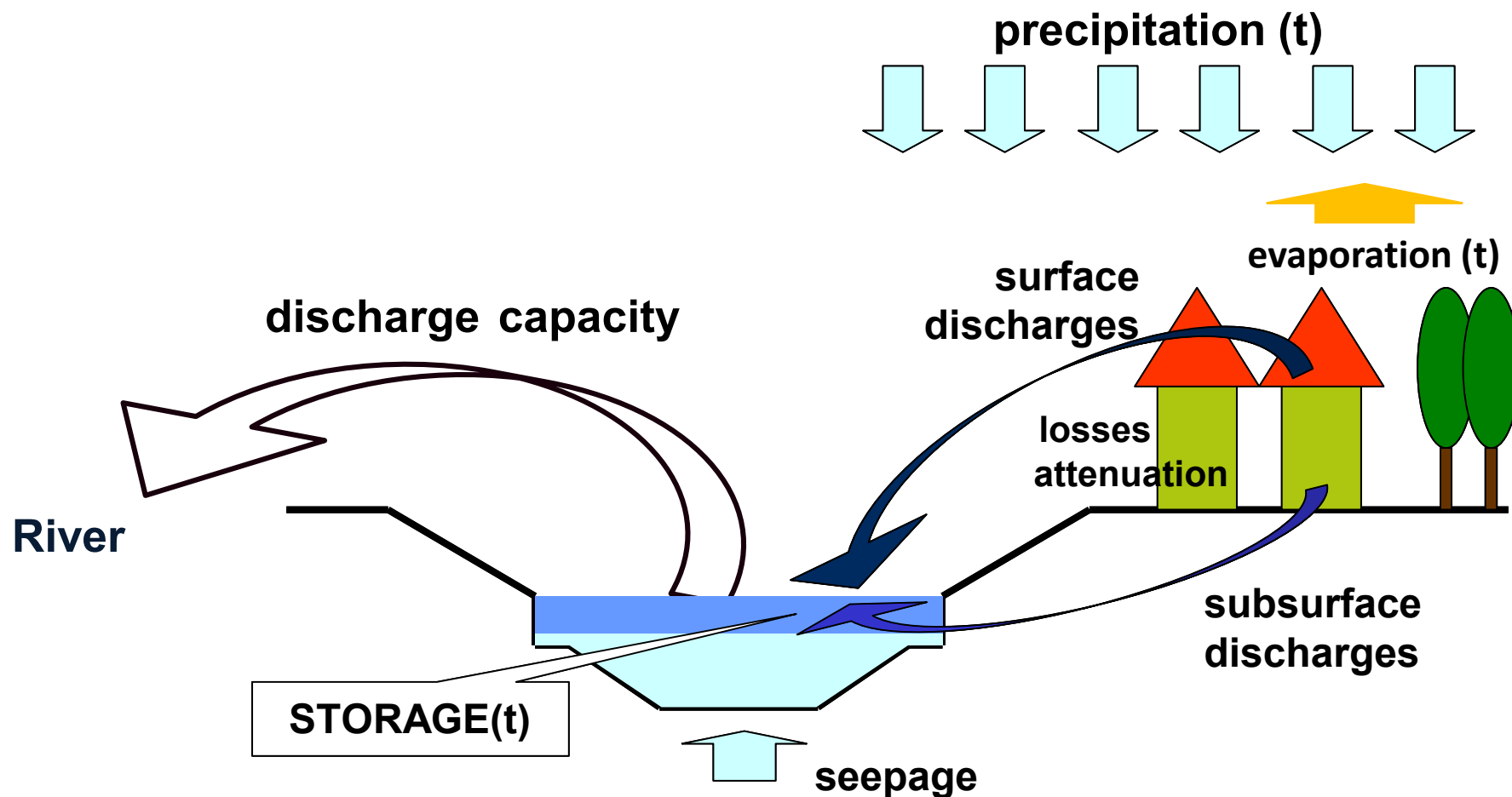
Store

Drain



Assessment of required stormwater detention capacity: Conceptual model of the SPONGE

评估所需的雨水滞留能力: 海绵的概念模型

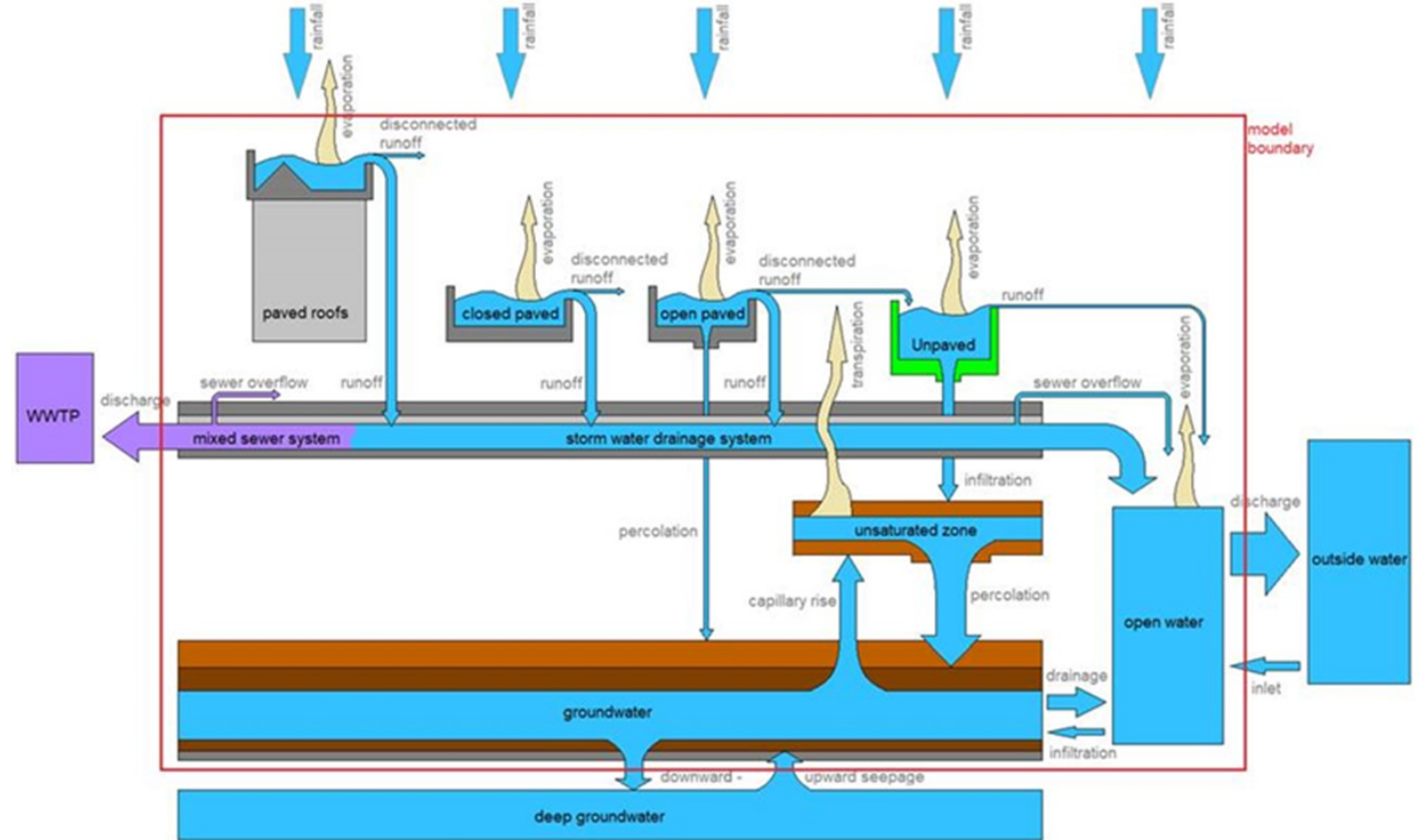


Water balance model 水平衡模型

The hydrological effects of the adaptation measures are determined by means of a **multi-reservoir water balance rainfall-runoff model**

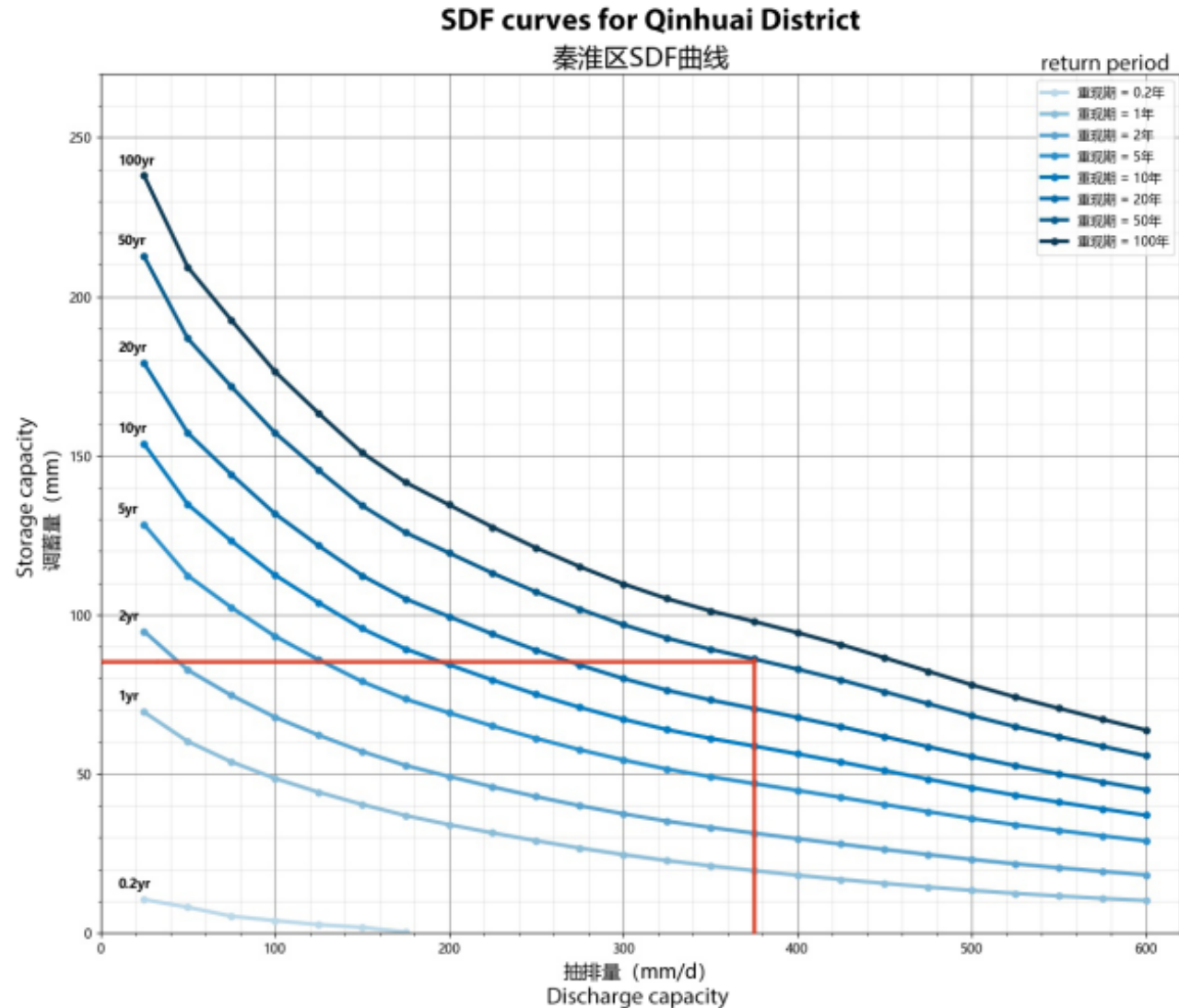
based on (ideally) long (30 years or more) time series of meteorological data, using hourly time steps.

- **Hydrological boundary conditions** of the water balance model are based on local conditions 水文边界条件
- **Runoff** is calculated for measures with varying storage depths and rainfall events with varying intensities with known return periods. 径流计算



Storage – Discharge – Frequency curves for Qinhuai District

to assess sponge capacity as function of discharge capacity



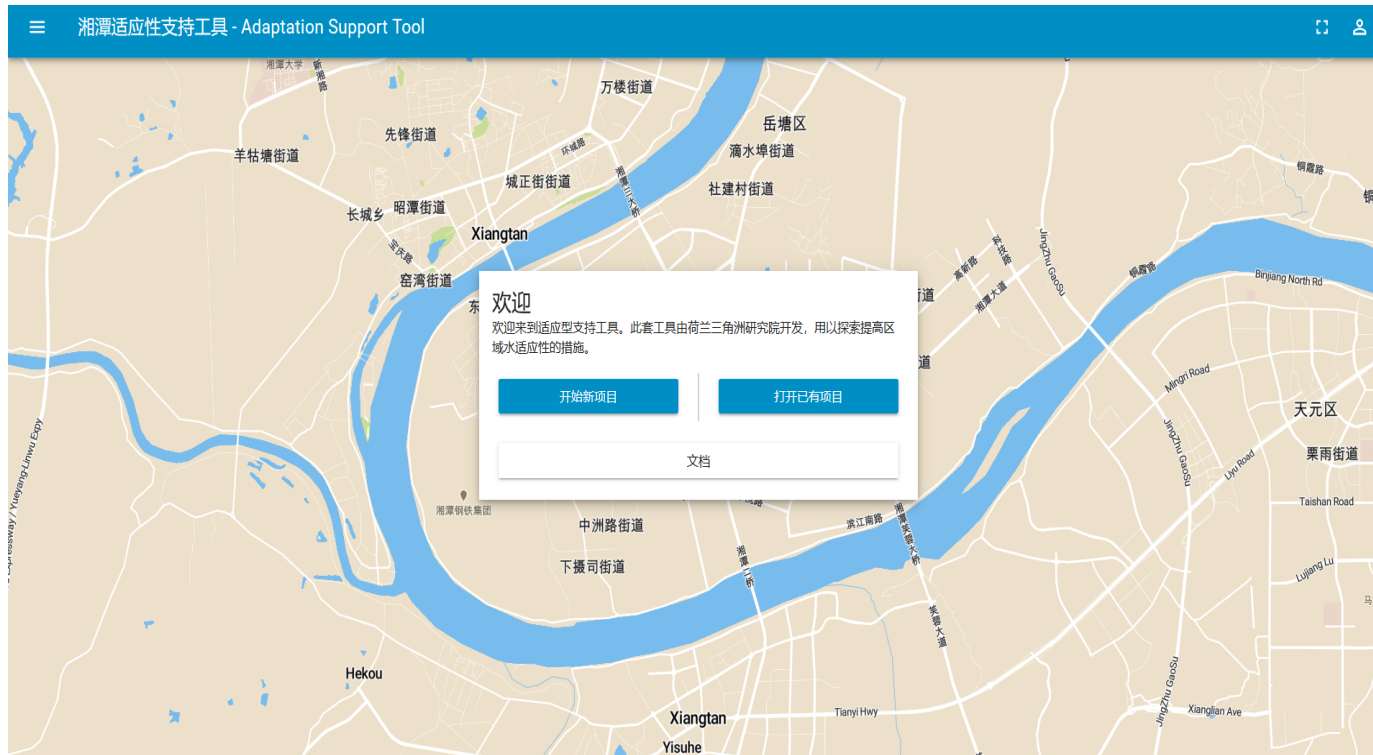
Design workshop



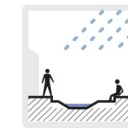
Xiangtan Climate Resilient City Tool (CRCT)

https://xiangtan.crctool.org/zh_cn/

- **Customized** for use in Xiantan and is **available to all** actors
- **Ecosystem-based adaptation**: mostly **nature-based**, **blue-green** solutions
- Co-create **conceptual** designs



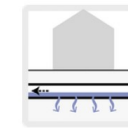
水广场



很多城镇已经设计了此种系统用以在公共区域滞留雨水。此类水广场系统可以结合其他城市功能，如娱乐场地、绿地和居住。水广场通常被用在空间较少，不利于缓存水且地下水位高亦无法下渗水的市中心区域。



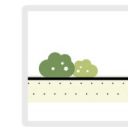
排水下渗运输 (DIT) 的排水系统



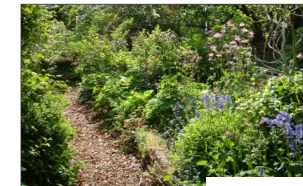
这是一种有排孔的水平放置的由土工布包裹管道的排水系统，排水到周围土壤，使水体下渗或蒸发。此类系统可被置于铺砌地表旁，也可放置在无法为下渗沟渠提供足够空间或渗透率不足的未铺砌地表。



去铺植绿



在城区和花园里减少铺砌路面有众多好处：雨水可被土壤吸收，从而补充地下水。在夏季，铺砌地表比绿色地表温度更高；移除铺砌路面可以给植物创造空间，植物也会在炎炎夏日提供凉爽。去除铺砌路面也会为动植物和土壤生物提供更多的空间。



1

Select a measure

2

Draw an area

search



为街景增添树木

51.6



了解更多

选择

生物滞留池（含排水系统）

35.5

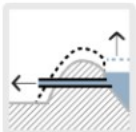


了解更多

选择

创造更多的地表水体

67.4



了解更多

选择

利用冗余超高创造容量

63.0



了解更多

选择

空心道路

61.6

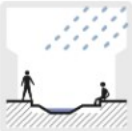


了解更多

选择

水广场

61.6



了解更多

选择

CANCEL



结果



气候

存储容量:

径流重现期提高系数:

补充地下水:

蒸发:

减少热量:

凉爽的地方:

造价

建设费用 (元):

维护费用 (元):

水质

减少病原体:

减少营养物:

吸收污染物:

查看图表

< 返回

选择



生物滞留池（含排水系统）

排涝

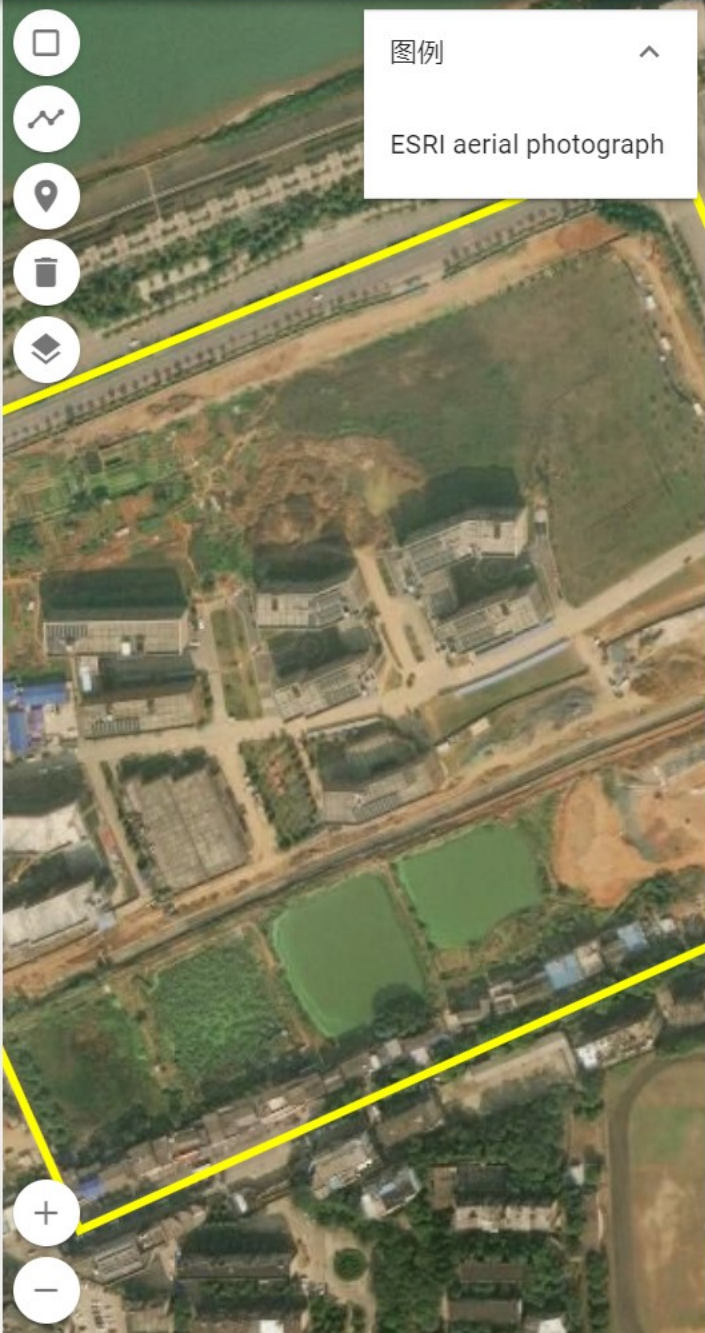
干旱

炎热

生物滞留池是由植被覆盖，有多孔底部并且其下有一层砾石和由土工布包裹的下渗管道或排水管道的沟。它可用于存储、下渗和运输雨水，同时也可增强生物多样性和提高生活质量。



Wadi Culemborg, Eva Lanxmeer, atelier GroenBlauw



结果

气候

存储容量:

径流重现期提高系数:

补充地下水:

蒸发:

减少热量:

凉爽的地方:

造价

建设费用 (元):

维护费用 (元):

水质

减少病原体:

减少营养物:

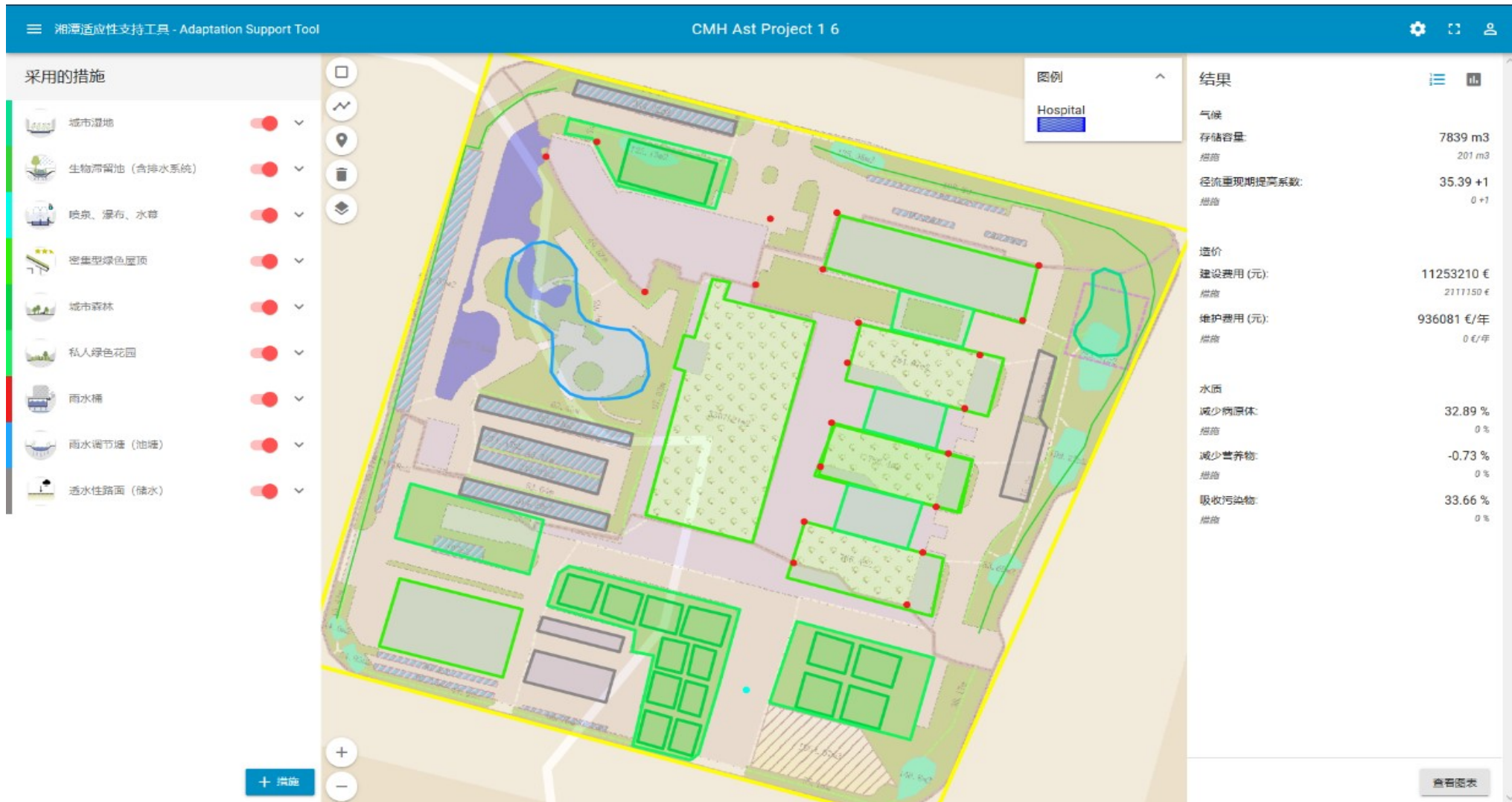
吸收污染物:

查看图表

CRCT: Effectiveness of measures 有效性

Adaptation goal	Key performance	Calculation method
Pluvial flooding 雨季洪水	Storage capacity [m3] Return time factor [-]	Map and user input
Drought reduction 减少干旱	Groundwater recharge (infiltration) [m/y]	Urban Water Balance Model
Heat stress reduction 降低热应激	Evapotranspiration [mm/y] Coolspots [-]	Urban Water Balance Model Literature and geometry
Water quality improvement 水质提高	Pathogen reduction Nutrient reduction SS and adsorbed pollutants	Conceptual model
Cost 成本	Construction cost Maintenance cost	Guidelines and practice

Climate Resilient City Tool for Xiangtan: Chinese Medicine Hospital conceptual plan



CRC Toolbox background information

- <https://publicwiki.deltares.nl/display/AST/AST2.0+Documentation>
- Voskamp IM, Van de Ven FHM (2015) Planning support system for climate adaptation: Composing effective sets of blue-green measures to reduce urban vulnerability to extreme weather events. Building and Environment 83, p 159-167. <http://dx.doi.org/10.1016/j.buildenv.2014.07.018>
- Van de Ven FHM , RPH Snep, S Koole, RJ Broksma, R van der Brugge, J Spijker, T Vergroesen (2016) Adaptation Planning Support Toolbox: Measurable performance information based tools for co-creation of resilient, ecosystem-based urban plans with urban designers, decision-makers and stakeholders, Environmental Science & Policy, Volume 66, 2016, Pages 427-436, <https://doi.org/10.1016/j.envsci.2016.06.010>
- McEvoy S, FHM van de Ven, MW Blind, JH Slinger (2018) Planning support tools and their effects in participatory urban adaptation workshops, Journal of Environmental Management, Volume 207, 1 February 2018, Pages 319-333, <https://doi.org/10.1016/j.jenvman.2017.10.041>
- Mc Evoy S (2019) Planning support tools in urban adaptation practice. PhD thesis, TU Delft, <https://doi.org/10.4233/uuid:48b7649c-5062-4c97-bba7-970fc92d7bbf> or <https://repository.tudelft.nl/islandora/object/uuid%3A48b7649c-5062-4c97-bba7-970fc92d7bbf>
- <https://development.asia/explainer/how-ecosystem-based-solutions-can-develop-climate-resilient-cities>

Thank you for your attention

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info@deltares.nl



Deltares



Ecosystem-based Adaptation: Adaptation Support Tool – Training

适应性支持工具

1. Planning for urban adaptation

城市适应性规划

2. Adaptation Support Toolbox in planning process

AST规划过程

3. Adaptation Support Tool

定义

4. Underlying parameters, conceptual model of AST

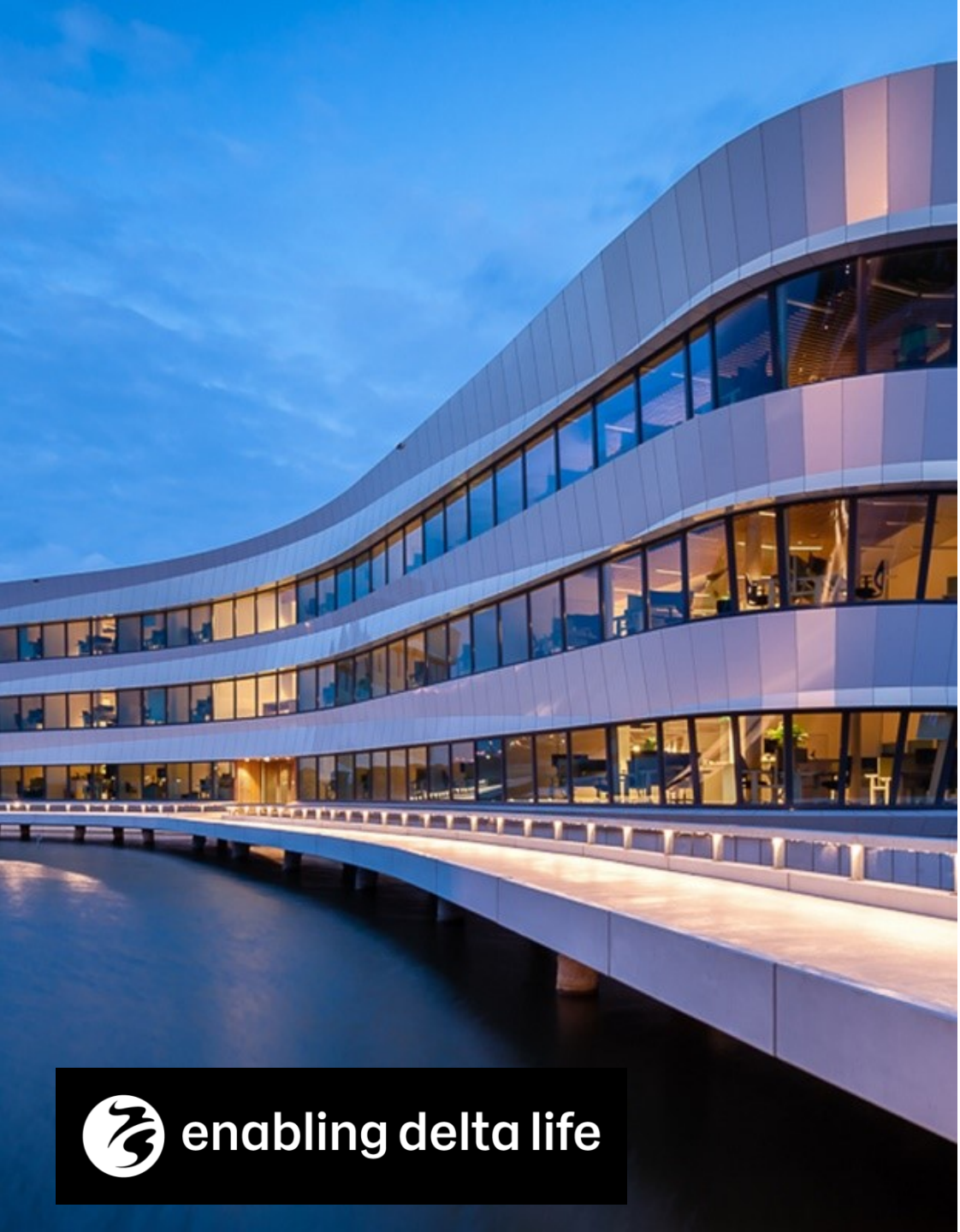
下垫面参数、概念模型

5. AST examples, best practices and case studies

AST案例、最佳实践和案例研究

6. AST process: steps to take to use the tool

AST使用步骤





- Deltas, coastal areas and river basins are vulnerable



Flood risk



Water and Subsoil Resources



Delta infrastructure



Ecosystems and Environmental Quality



Sustainable delta planning





- Legal form: Foundation under Dutch law
- Workforce: 840
- Number of nationalities: 28
- Annual turnover: 113 million euros
- Locations: Delft and Utrecht
- National and international activities
- Unique in-house facilities

Lab facilities, field scale experiments, open source software

