Satisfying Urban Thirst

Towards a water sensitive and inclusive urban ecosystem through the metabolism of Cape Town

„A person can survive only about three to five days without access to water. What about a city? This is not a hypothetical question: The thirsty city threatens to be the most dire social crisis of the 21st century."

- Ashley Dawson

Context

In 2018 Cape Town faced the threat of becoming the first city in modern age to run out of drinking water and reach Day Zero, the day when due to a 3-year long drought the city's taps are switched off and residents are compelled to fetch their daily 25 liters of water from communal taps. This time the city successfully managed to avoid the critical date; however, the underlying problems are not solved permanently, the future is not secured. The city is pushed forward to take action and „be a beacon in Africa through the progressive realization of Cape Town as a water sensitive city (CoCT, 2018A)".
Although the apartheid era - the system of institutionalized racial segregation - has ended 25 years ago in South Africa, its legacy is still present in many townships of the city where communities remain marginalized and often lack access to basic infrastructure. Even though the country's new constitution approved in 1996 guaranteed water as a human right, there are still high inequalities in access to water services. Approximately 2 million people, roughly half of Cape Town's total population live in townships where informal settlements often rely solely on communal taps. At the same time, these communities are only accountable for 5% of the city's total water use (Dawson, 2018). The recent water crisis and the threat of Day Zero has highlighted and made these inequalities even more evident.

Problem statement

Climate-induced stress and population growth put a huge pressure on the urban water system and the city of Cape Town, culminating in severe water scarcity. In townships the situation is further complicated by poor water quality and high levels of inequality in access to water services (Smith & Hanson, 2003). The lack of cross-scale and intersectoral cooperation (Cameron & Katzschner, 2017) in governance, management and planning exacerbates the problem.

Research question

How to develop a regional spatial strategy to foster the transition towards a water sensitive and inclusive Cape Town?

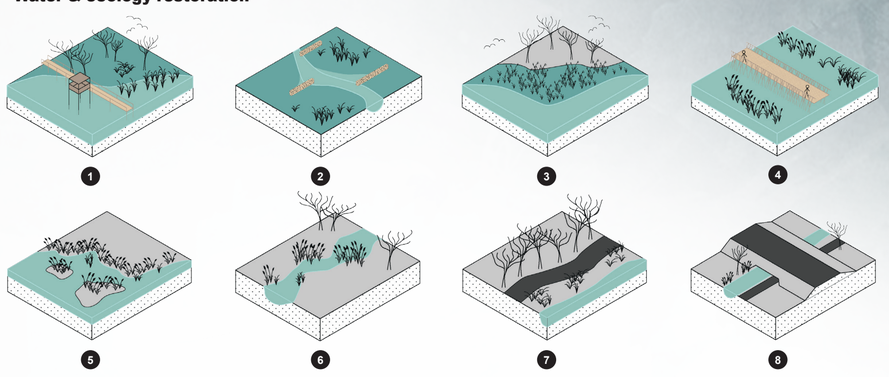
Metabolic analysis

Planning water sensitive cities is becoming a priority for sustainable development in more and more countries all over the globe. However, in order to identify opportunities and limitations of the system and develop the most suitable strategies for water resilient urban environments we must be able to quantify, therefore characterize the flows of urban water cycles. In my research I adopt the urban metabolism (UM) framework to understand the urban water system of Cape Town and evaluate its water flows. The Water Mass Balance method is applied to the Cape Town Metropolitan Area which enables the individual quantification of water resource flows and the comparison of both anthropogenic and natural hydrological flows.
The estimated data of input and output flows was used to calculate performance indicators which can show the replaceability potential of certain flows in relation to the whole system. This analysis was completed with a qualitative water sensitivity ranking to show which water flows have the biggest potential to support the transition to a more sustainable urban water cycle. The metabolic analysis is completed with spatial mapping of regional water flows, which reveals vulnerable territories and potential intervention zones.

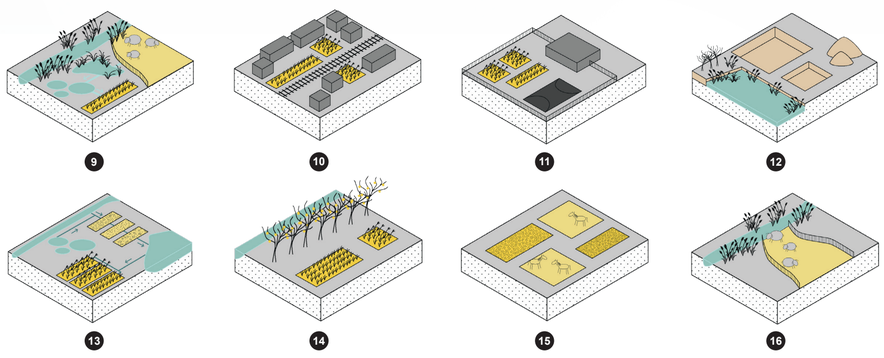
Design

Three peri-urban cluster areas along different watercourses have been selected to showcase water sensitive design interventions focusing on the water-food-energy nexus (A-B-C). A micro scale design for Imizamo Yethu township (D) exemplifies the details and technical aspects of implementing Water Sensitive Urban Design and Sustainable Drainage Systems. Spatial measures are translated into typologies to enhance their transferability as design principles to various locations. In the long run, they can form a network of water sensitive projects, improving both upstream and downstream ecosystems and urban environments within the catchments. Besides the spatial strategies, the project provides recommendations on improving public participation in water governance by bridging the communication gap between local communities and decision-makers through catchment forums.

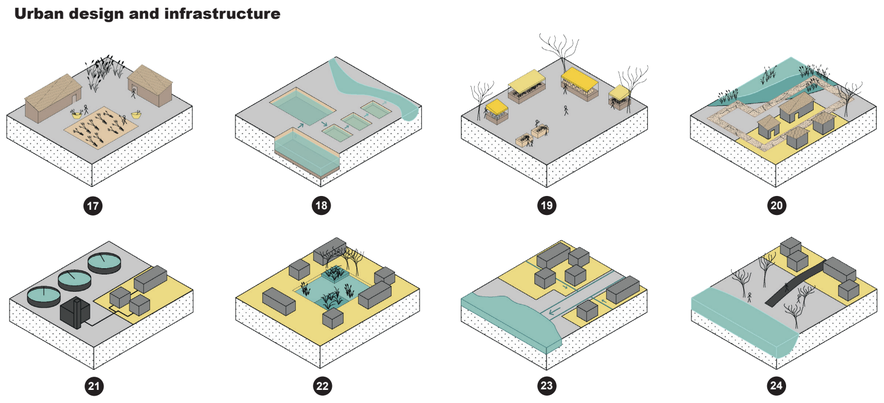
Water & ecology restoration



Agriculture



Urban design and infrastructure



A - Vygekraal
/energy flow, the heart of Cape Town/

VYGEKRAAL **A**

Langa is the oldest township of Cape Town and often referred to as the heart of the city. It has a strong community and many bottom up initiatives striving for the development of the township. Next to the Langa sport fields the abandoned plot of the former Athlone Power Station can be found. The Vygekraal project envisions this area as a new central location and mixed use neighbourhood. An important part of the design is to create a connection between this new neighbourhood and the Vygekraal river by means of a pedestrian tunnel under the N2 highway. The Athlone WWTP along the Vygekraal is used to produce heat and electricity for the new residential areas of the ‚Langa Power District'.

B - Big Lotus
/food flow, minerals/

BIG LOTUS **B**

The Big Lotus canal flows through the farms of the Philippi Horticultural Area, small scale silica sand mines and dense urban environments. All these conflicting sectors are competing for land in the area. The main element of the Big Lotus masterplan is the sand mine restoration which aims at minimizing the negative impacts of sand excavation already during the lifetime of the quarry. Underused plots between informal settlements and linear infrastructural elements are utilized for crop production. Purified water from the Big Lotus is used for crop irrigation. The backyards of the numerous primary schools in the area are also used for growing vegetables by students.

C - Kuils
/water flow, ecotourism/

KUILS **C**

The third location is focusing on the Khayelitsha wetlands and downstream areas of the Kuils river. The goal of the design is to combine township and ecotourism to boost local economy by providing job and business opportunities by means of a combined wetland-township trail. Along the trail a community market square and a small scale reed (Typha capensis) manufacture is built. Another key element of the Kuils masterplan is the development of the Zandvlei WWTP with a post-treatment pond system which would prevent pollution of surrounding waterbodies and soils.

D - Ikhaya project

IKHAYA PROJECT **D**

Ikhaya means ‚home' in Xhosa, which is one of the official languages in South Africa and is spoken by many in the townships of Cape Town. The main purpose of the Ikhaya projects is to test and showcase design principles for waterside residential development projects in townships which adopt WSUD and SUDS measures to create more resilient neigbourhoods. The first Ikhaya pilot project is located in the Disa river catchment in Imizamo Yethu township. The design focuses on sustainable drainage systems and stormwater harvesting design solutions.

How does the Imizamo Yethu stormwater design function?
Check out this short simulation testing and explaining the system!

Langa Power District water square (A)

Khayelitsha Wetlands Park development (C)

Silica sand mine restoration along the Big Lotus (B)

Dóra Hegyi
4715381
Urban Metabolism
Kristel Aalbers & Roberto Rocco

TU Delft MSc Urbanism 2019-2020