Adaptation Strategy for Zwolle – towards a liveable and attractive blue-green city

In July 2019, the city of Zwolle (Figure 1) presented its Adaptation Strategy. The process to develop this strategy was supported by the Zwolle climate team and divided in 4 constructive phases: (0) development approach plan, (1) assessment of climate vulnerabilities: climate stress test, (2) risk dialogues and strategy development, and (3) implementation agenda vision 2050. This brief report shares some of the Zwolle Adaptation Strategy (ZAS) key highlights.

Zwolle delta city
Zwolle is a real delta city with water on all sides (Figure 2). The KNMI’14 (national) climate scenario’s show that Zwolle must also be prepared for even more water and for longer dry and warm periods. Together with the two regional partners (water authority of Drents Overijsselse Delta “WDODelta” and the province of Overijssel), the municipality of Zwolle explores the possibilities for the future to make the regional and urban water systems more robust, in line with the primary water system. Possible solutions are found in a combination of: (a) dike reinforcement, in conjunction with the “new standards for regional defences”, (b) increase of discharge capacity, e.g. pump stations and weirs, (c) temporarily store water in overflow areas, and (d) water-robust and climate resilient urban design.

Assessment of climate vulnerabilities (stress test)
A climate vulnerability assessment or stress test has been performed. The different vulnerabilities to climate change, like pluvial floods, heat stress, droughts and fluvial floods were placed in mutual perspective, and in relation to water quality, vital infrastructure, mobility and building programme, which focusses on reconstruction.

Following a light-version of the stress test based on the climate atlas of the local water authority WDODelta [1], Zwolle conducted more in-depth stress tests. Different situations, including nine rainfall events (pluvial flooding), different regional fluvial flooding scenarios (regional water courses) and two heat scenarios (tropical day and warm nights) were investigated. Various analyses and filters were then applied to this. This has provided tailored insight into the level of specific urban land use, like buildings and infrastructure. 

More info can be found in the geo-portal climate atlas Zwolle for professionals as well as in the public version of the climate atlas [2].

Not all districts and neighbourhoods in the city face the same climate stress challenges. For this, Zwolle is divided into 55 subareas based on water sheds in the (storm) water system, elevation of the surface levels and urban typologies. The climate stress effects (pluvial floods, heat stress, droughts and fluvial floods) are translated into these subareas in climate hot-spot maps (Figure 3).

Follow-up research is needed, especially into the risks in the built-up area in Zwolle due to increasing drought and heat stress. For the time being, drought does not seem like a major issue in Zwolle. The groundwater
levels are almost the same as the water levels in the city canals. During the dry summer of 2018, the Directorate-General for Public Works and Water Management and the Dutch association of Water Authorities presented a drought monitor that outlined a national picture of water shortages. It’s considered to develop such a drought monitor for the Zwolle region and/or to make it specific to the built environment.

**Dialogues on climate risks and spatial adaptation measures**

The Zwolle Adaptation Strategy (ZAS) isn’t a generic campaign. Zwolle opts for a targeted strategy in which actors are actively involved, to solve specific challenges and co-create opportunities. And the municipality of Zwolle cannot implement climate adaptation alone. Measures must also be taken by owners on private property. The municipality is therefore seeking explicit cooperation with private parties and residents. For this various city talks, multiple actor meetings with joined interests, urban design ateliers and climate risk dialogue workshops have been organized (Figure 4).

To accelerate implementation of climate adaptation projects in Zwolle and in the IJssel-Vechtdelta region the Climate Campus [3] partnership for professionals has been established in 2018. And to help private parties and residents, the municipality of Zwolle has appointed a so-called “climate proof” acceleration team. This team provides (internal) road shows about the role of the municipality, facilitates, inspires and motivates action in climate adaptation. In addition, new regulations are needed to get the sponsorship done.

Parts of Zwolle are largely paved with little space for blue and green infrastructure, especially in the areas in and around the historical city centre. Moreover, the drainage capacity around the city centre (outside the dikes) is limited. Zwolle is actively working in the focus areas with little surface water and a lot of paving. Following the risk dialogues, Zwolle takes

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**Figure 3:** Hot-spot maps of climate change effects (from left to right and top to down): pluvial floods, heat stress, droughts and fluvial floods

**Figure 4:** Urban planners, landscape designers and water management engineers, both from the municipality of Zwolle and the water authority of WDODelta, working together on a livable and attractive blue-green city of the future.
the initiative to draw up so-called “blue-green solution maps” in collaboration with interested parties and residents.

**Design principles for a blue-green city**

Working towards a liveable and attractive green-blue city is at the forefront of the Zwolle Adaptation Strategy. By strengthening green infrastructure and giving water more space in both the public and private domain, Zwolle has the potential to grow into the blue-green city of the Netherlands. Zwolle is therefore focusing on a blue-green design based on the three principles included in Table 1 which are mapped spatially in Figure 5.

**Implementation agenda vision 2050**

The Adaptation Strategy for Zwolle encourages a new way of working, a “new normal” in which climate effects are structurally and naturally considered in all tasks of the municipality of Zwolle and the water authority of WDODelta. The adaptation strategy is flexibly constructed based on the following sub-documents (Figure 6): (a) spatial elaboration in a ‘blue-green’ city, (b) the ‘new normal’ for professionals, (c) private action perspective, (d) financing, (e) regulations and (f) monitoring & navigation. The ZAS provides a product environment for professionals, actors and residents of Zwolle. The public version consists of the city website [4], brochure [5], climate atlas [2] and video [6]. For professionals, the ZAS consists of the full strategy document [7], geo-portal climate atlas for professionals, the aforementioned sub-documents and an implementation agenda 2019-2023. This Zwolle implementation agenda captures the first steps in the transition towards a liveable and attractive blue-green Zwolle. The monitoring & navigation section of the adaptation strategy illustrates pathways for achieving the long-term goals. While the national Delta Plan on Spatial Adaption has set spatial adaptation goals for 2050, the Zwolle Adaptation Strategy also anticipates on a broader evolution of the city and its water system after 2050. This broader ambition is captured in the transition to a Water Sensitive Zwolle by ensuring resilience through higher-order services such as social amenity and environmental protection, provide reliable water services under constrained resources, and ensure inter-generational equity and resilience to climate change. For this Zwolle participates as one of 7 pilot cities in the EU-funded Interreg CATCH-project [8]: ‘water sensitive Cities: the Answer To CHallenges of extreme weather events’. Working on a blue-green city of Zwolle contributes to spatial quality, living environment, health, biodiversity, property value, etc. In the combination of three blue-green design principles, the city is robust and has sufficient resilience to cope with the effects of climate change (pluvial floods, heat stress, drought and fluvial floods).

**Table 1: Design principles for a blue-green city of Zwolle**

<table>
<thead>
<tr>
<th>Blue-Green design principle</th>
<th>Spatial scale</th>
<th>Who?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sufficient urban “sponges” for detaining (using), retaining or delaying rainwater.</td>
<td>Buildings, streets and neighbourhoods.</td>
<td>Municipality of Zwolle together with its residents and actors.</td>
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<tr>
<td>Blue-green city network on which “sponges” can drain excess water and in which discharge and storage takes place.</td>
<td>Neighbourhoods, districts and city.</td>
<td>Municipality of Zwolle together with water authority of WDODelta.</td>
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<tr>
<td>Emergency valves for the blue-green network and overflow areas where water can temporarily go in extreme situations.</td>
<td>City, region and delta.</td>
<td>City of Zwolle together with water authority of WDODelta, province of Overijssel and neighbouring municipalities.</td>
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</tbody>
</table>

**Figure 5:** Conceptual design of a blue-green city of Zwolle in 2050, projected on the existing water systems and green infrastructure.
Figure 6: The adaptation strategy for Zwolle is flexibly constructed based on the following sub-documents (from left to right and top to down):
(a) spatial elaboration in a ‘blue-green’ city,
(b) the ‘new normal’ for professionals,
(c) private action perspective,
(d) financing,
(e) regulations and
(f) monitoring & navigation

References

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