Delft

CREATING HISTORY

CONTENTS

1. SUMMARY > introduction

Delft Zuidoost is changing. The district, with densely populated residential areas, the University of Technology (TU Delft) campus, historic buildings and business parks, is facing various developments in coming years. The addition of houses, student accommodation and the development of the Technological Innovation Campus (TIC Delft) need to be accompanied by an increase in the quality of the living environment. The objectives of this urban renewal include a design that is rich in both green and water elements.

The Green-Blue project was initiated at the beginning of 2011 by the Municipality of Delft, Delfland Water Board, the Delft University of Technology (TU Delft) , the TU North Interest Group, student housing corporation DUWO, and project developer AM as a direct result of the Strategic Environmental Assessment (SEA) of the urban zoning plans for Delft Zuidoost (Southeast). The SEA concludes that the planned developments in the area are feasible, provided the municipal policy concerning water, ecology and sustainability is implemented. When the city council discussed the SEA, it requested that integrated solutions be developed to meet the entire district's green and water targets to inform the drafting of the urban zoning plans. The council wanted to avoid situations where sub-areas are examined in isolation, and only reactively in response to new developments.

The Green-Blue project has resulted in an opportunity map containing some 180 potential measures. These measures have been combined to form a project map with an accompanying list of projects. This report sets out the path that has led to these results.

SEA
In 2009, a number of building plans and separate zoning plans for Delft Zuidoost required an Strategic Environmental Assessment (SEA) report. SEA ensures that environmental considerations are integrated into the decision-making process for future zoning plans. The SEA was initiated on 29 January 2010. The first test-bed study, 'Climate in the city' (Klimaat in de stad), and the 'Delft Makes a Splash' (Delft Spettert) project, had already started by then. Both helped raise awareness on the importance of green and water elements in Delft Zuidoost.

First test-bed study 'Climate in the city'
The first test-bed study, 'Climate in the city', was organised in January 2010. It was part of the stimulation programme of the Ministry of Infrastructure and Environment / Delta programme, aimed at encouraging local councils to devote more attention to measures that address climate change in the city. The test-bed brought to light that water retention is possible in the present urban environment.

Delft Makes a Splash
The 'Delft Makes a Splash' project was carried out in the spring of 2010 by a consortium of parties that included the Municipality of Delft. The project concentrated on participation and generating ideas on the subject of climate adaptation in Delft Zuidoost. The outcome of the 'Delft Makes a Splash' project is a list of measures that have been included in the SEA report as projected solutions to meet the water targets set for the district. The project increased support among stakeholders for these solutions and raised awareness that green and water contribute to the quality of life.

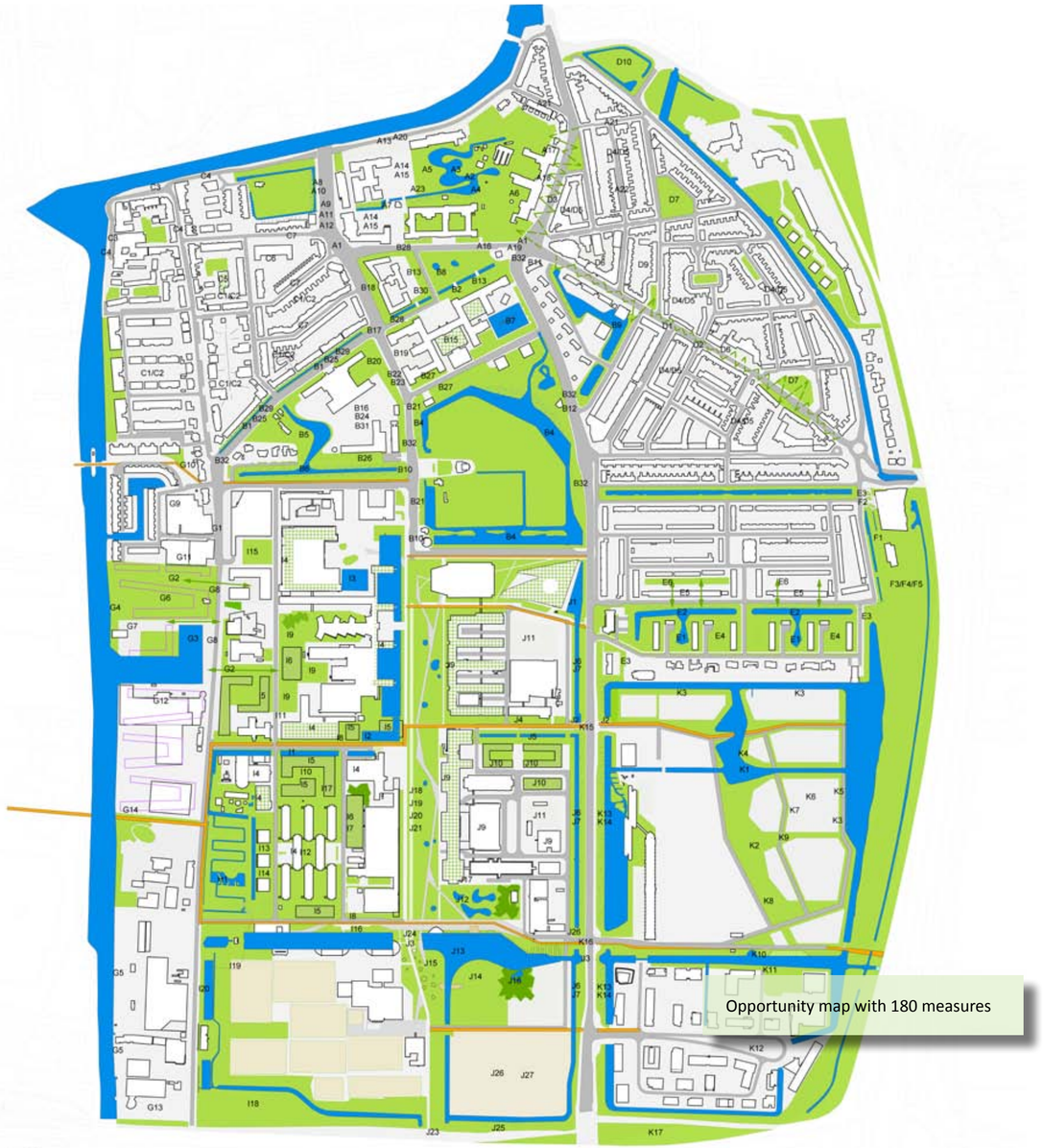
2010 2011

Green-Blue project
Following drafting of the preferred planning alternative in the SEA for the urban zoning plans at the beginning of 2011, integrated solutions to meet the green and water targets needed to be found. To this end, local stake-holders worked together in the Green-Blue project. This resulted in the Green-Blue opportunity map containing 180 measures. By looking at the district as a whole instead of the separate sub-areas, solutions have been devised that are much more (cost) efficient.

Second test-bed study 'Climate in the city' and 'TEEB in the city' project
The second 'Climate in the city' test-bed study was set up in the autumn of 2011 with financial aid from the Ministry of Infrastructure and Environment / Delta Programme. Delft also participated in the 'TEEB in the city' project of the Ministry of Economic Affairs, Agriculture and Innovation. The 'TEEB in the city' project brings into view what the social costs and benefits of the entire Green-Blue project are. During the test-bed study workshops, the spatial possibilities for three of the areas were further developed, and the costs and benefits of the proposals identified. This final phase led to the realisation that water and green elements can also be economically attractive.

TIC-Delft
TIC Delft 1.0 was presented in the spring of 2011. TIC Delft stands for 'Technological Innovation Campus Delft' and expresses the city's and the university's ambition to enhance the knowledge-based economy and the innovative strength of the region. TIC Delft also has a spatial context, to which the whole area of Delft Zuidoost belongs. TIC Delft's ambition is to design a sustainable innovation campus, i.e. one which is climate-resilient, energy-neutral and with a sound water balance. The Green-Blue project shows opportunities for a climate-resilient design and a robust water structure. The measures listed in the Green-Blue project will be further developed in sub-projects of the spatial programme of TIC Delft 2.0.

2011 2012



Opportunity map with 180 measures

1. SUMMARY > results

In the Green-Blue project, existing municipal policy has been translated into specific measures which have been clustered into projects. In this way, the measures can be integrated with the new and ongoing developments in the area or directly incorporated into an implementation programme.

The Green-Blue project has turned out to be a successful way of working that could be applied in other locations. The added value of the project lies in two aspects. Firstly, an area's potential to respond to climate change was studied in detail. Secondly, this was a joint undertaking by the parties involved, ensuring that it reflected as much as possible the needs and capabilities of the parties who involved in redevelopment of the area.

This has produced a method that, on the one hand, provides flexibility for developers and, on the other hand, ensures the ambitions of municipal policy can be realised.

2. BACKGROUND > history of Delft Zuidoost

There have long been plans for densification and urban renewal of Delft Zuidoost. In 2009, a lawsuit led to the nullification of the TU Noord zoning plan by the Council of State. In January 2010 the Council of State indicated that an Environmental Assessment report was needed for the plan.

Situation in January 2010

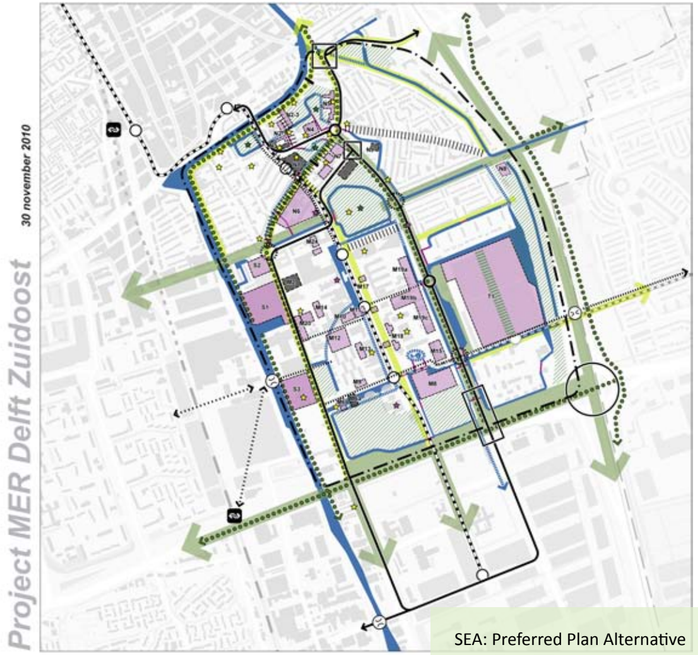
When all the sub-developments are added up, it appears that more than 4,000 new student homes and houses are planned in the area. There are three locations where these developments could take place. As part of the SEA procedure the effects that the various alternatives have on a number of environmental aspects, such as the quality of the living environment, water and green, will be assessed. At the same time, there are initiatives from the government, the municipality and water specialists to conduct studies into the possibilities of climate adaptation in the area. At that time the municipality had two important policy documents in the area of water and green: the Water Structure Vision and the Ecology Plan.

Water Structure Vision

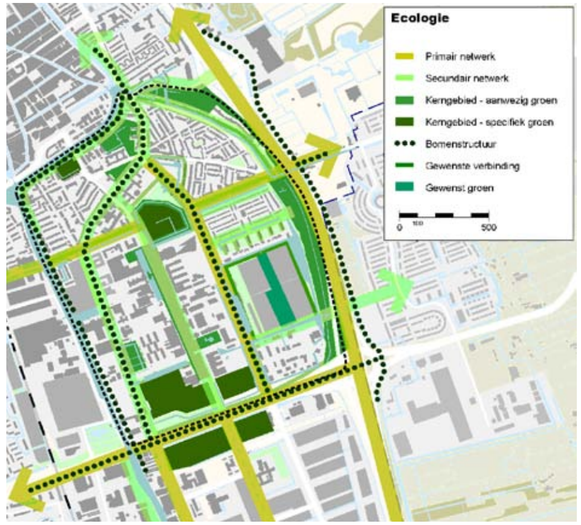
The Water Structure Vision for Delft sets out the municipality's water policy for its entire territory. A development programme specifies the implications of the policy for each sub-area. It includes a long-term plan with a self-sufficient water system for Delft Zuidoost.

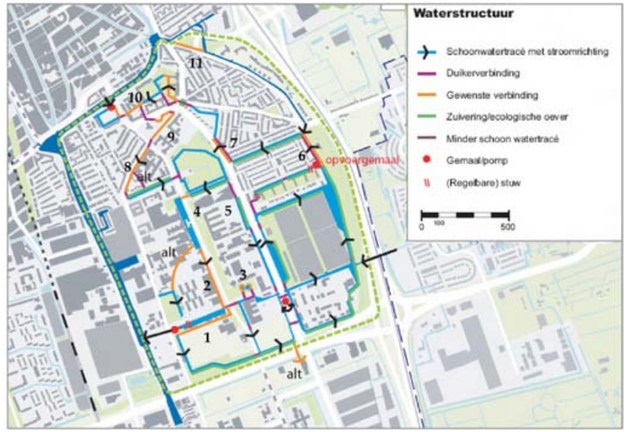
Ecology Plan 2004-2015

In the Ecology Plan, the Municipality of Delft describes how it intends to preserve and develop the diversity of nature in coming years to ensure quality of life for its citizens, in the context of ongoing social and economic developments.



SEA: Preferred Plan Alternative





2. BACKGROUND > SEA: building targets, green and water

Building targets

The SEA assesses the proposed building activities in relation to various environmental aspects in Delft Zuidoost. The building targets include:
> About 5,000 new homes, of which 3,000 student apartments.
> Projects in the area of tourism, business development and educational facilities.

The SEA compared various alternatives. Different building sites were considered in the SEA, and their effects on green, water and the quality of the living environment were studied and compared. The SEA also explores whether the developments fit within municipal policy, including the Water Plan (and Water Structure Vision), the Ecology Plan and the Delft Sustainability Plan.

Based on the results of the study, the Most Environmentally Friendly Plan Alternative and the Preferred Plan Alternative were determined, which differ only slightly from each other. The Preferred Plan Alternative, combines the traffic, water and ecological structures with the planned building targets, which had not been done before.

Green in the SEA

In the Delft Ecology Plan 2004-2015, the Municipality of Delft formulated two primary objectives for urban ecology:
> Realisation and development of a high quality ecological structure.
> Maintaining a balanced relationship between nature and the built environment, taking into account the accessibility and natural quality of areas.

The SEA tests the alternatives against both primary objectives:
> The SEA assumes that Delft's Main Ecological Structure will have been realised in the reference year (2023), but concludes: "At present, it can certainly not be ruled out that Delft Zuidoost's zoning-plan targets will have affect Delft's Main Ecological Structure adversely." (SEA, p.157).
> The SEA shows that relatively little green is added to the area, whereas 5,000 homes will be added. There are also projects planned in places where green elements are currently present. "The objective formulated in the Ecology Plan, of 'maintaining a balanced relationship between nature and buildings' will therefore be compromised." (SEA, p.159). The SEA states that compensation and mitigation will therefore be required.

Water in the SEA

The SEA describes four assessment criteria for water: retention capacity, water quality, water safety and the risk of groundwater flooding. The SEA assumes that the entire water structure of the Water Structure Vision is included in the plan alternatives. The report observes: "Based on the available retention at [a water level increase of] 30 cm and the included water targets, a shortage of approximately 35,000 m3 can be expected for the named areas. The shortage will only partly be resolved [by the improvement proposals of the Water System Analysis and Water Structure Vision]. Ultimately, additional measures are necessary." (SEA, p.131/132). The aforementioned improvement proposals only provide an additional water retention capacity of 7,000 m3. These improvement proposals have not yet been implemented.

Green-Blue project as follow-up of SEA

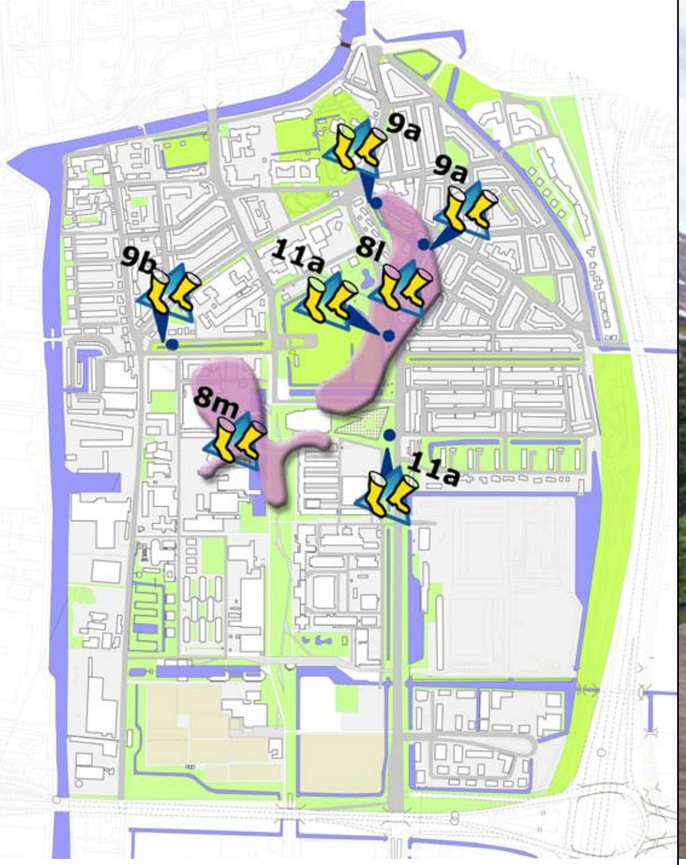
In sum, the SEA points out that the 'main structures' for green and water – Delft's Main Ecological Structure and the Water Structure Vision – still need to be realised. The SEA also concludes that even when these main structures are realised, the targets for green and water will not be fully met. The Green-Blue project addressed this gap.

3. GREEN-BLUE > introduction

The Green-Blue project was set up to devise integrated solutions for the water and green targets that were described in the SEA.

The project is a collaborative effort by the Municipality of Delft, TU Real-Estate, DUWO, TU Noord Interest Group, Delfland Water Board and AM Housing. Together they defined the targets, formulated projected solutions and mapped out possible measures for incorporating green and water. The project team also participated in the ‘TEEB in the city’ project, for which Witteveen & Bos carried out a Social Cost-Benefit Analysis in order to gain insight into the costs and benefits of the green and blue measures.

The targets, the projected solutions, the possibilities and the participation in the ‘TEEB in the city’ project are addressed below.



Flooding
There is a risk of flooding in the area due to a lack of capacity to retain water. Rainwater that falls on streets and roofs during a heavy downfall is collected by the sewer system and enters the waterways in the area via the sewer overflows. In particular, the water retention capacity in the northern part of the area is too small to absorb all that rainfall. As a result, the waterways flood. In addition, the underground connections between two waterways (called culverts) are often too small, so that the water is unable to discharge quickly enough to the lower lying area. The third problem is that the sewer system collects the majority of rainwater and then channels it into the waterways. The sewers are not designed to cope with extremely heavy downfalls, which can occasionally result in excess water remaining on the streets and even flowing into houses. The map shown above is an adaptation of the so-called 'Rubber Boot Map' (Laarsjeskaart) from the Delfland Water Board's Water Catchment Study. It shows the places where flooding could occur and where the culverts are too small.

3. GREEN-BLUE > water targets

The water targets combine the findings of the SEA, the results from the first test-bed study and 'Delft Makes a Splash', the municipality's policy from the Water Structure Vision and the information from Delfland Water Board's Water Catchment Study.

Water retention capacity
The water-retention target is set by the Water Structure Vision and the SEA at 35,000 m3 with an average water-level rise of 30 cm. This figure was calculated using the so-called ABC standard of the Delfland Water Board: 325 m3/ha. This standard indicates that if there is 325 m3 of water retention in an average urban area of 1 ha, the waterways will not flood more than once in 100 years on average. The Delfland Water Board's objective is that in 2050 the urban area does not flood more often than once in 100 years on average. The chance of flooding is now higher, the areas identified in the so-called 'Rubber Boot Map' (Laarsjeskaart) may flood once in 10 years.

Water quality
In dry periods, the water system in Delft Zuidoost is refreshed or replenished with water from the Schie waterways (the 'boezem'). The quality of this water is not optimal. To improve water quality in the area, it is important to retain clean rainwater for a longer time and to keep it clean. There are a variety of measures that could contribute to this. For example, the creation of more surface water bodies so that rainwater can be retained for longer, the disconnection of the sewer system so that soiled sewage water no longer enters the waterways, and the creation of nature-friendly margins and banks, which will improve water quality.

Spatial quality
The first 'Climate in the city' test-bed study and the 'Delft Makes a Splash' project led to the realisation that there is more to water than just the technical component. Water that can be seen and experienced by people actually contributes significantly to the quality of the living environment. Solving the water problem and simultaneously increasing the quality of the living environment has been explicitly defined as a target in the Green-Blue project.

Green and the quality of the living environment
Many parts Delft Zuidoost have been completely paved over and built on. The future building targets will result in even less room for green. Areas with 'hard' materials, such as buildings and paving, warm up much quicker than areas with 'soft' elements, such as plants. The map above is an adaptation of measurement data from TNO (an independent research institute). It shows that the surface temperature of built up areas (purple) can sometimes be 9 degrees higher than areas rich in trees and plants (green). In addition, a green environment increases living enjoyment: everyone wants to live in a street with trees. Green recreational spaces in the vicinity enhance social cohesion in the district and invite outdoor exercise and play. Residents can make their own environment greener, small measures that require little effort often have great effect.

3. GREEN-BLUE > green targets

The green targets combine the findings of the SEA, the results from the first test-bed study, 'Delft Makes a Splash', and the policy from the Municipality of Delft's Ecology Plan. The green targets address more than ecology alone and are approached from different perspectives:

Ecological green
The aim is to enhance Delft's Main Ecological Structure. Plant and animal habitats are under pressure. They depend for their survival on existing corridors and areas they can colonise.

Enjoyable green
More people, residents and users, will be living and working in the area. More people means more demand and necessity for recreational, enjoyable green.

Functional green
Green also has a number of 'functional qualities'. It contributes to the reduction of heat stress and to the improvement of air quality by capturing particulates.

Economic green
Green contributes to a pleasant living and working environment and to productivity. It increases living enjoyment, and with it property values. Moreover, a well-designed green structure promotes public safety.

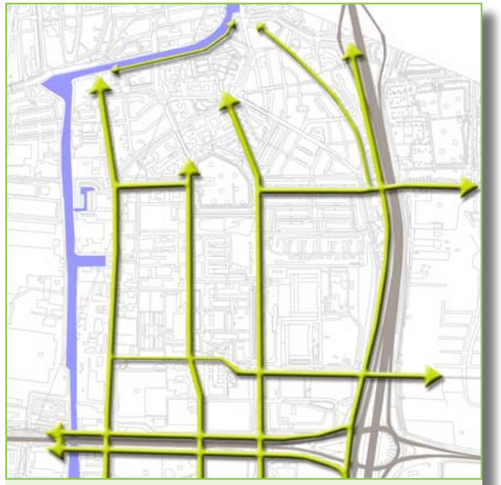
0. Present situation

1. Add new water
A lot of water elements have been added, especially to the northern area, such as a pond in the Kanaalhof, the Julianalaan and the extension of the water system around Jaffa cemetery.

2. Robust water structure
The northern area drains via two routes into the 'roundabout' around Jaffa, and from there via three routes to the drainage channel and pumping station on the Balthasar van der Polweg.

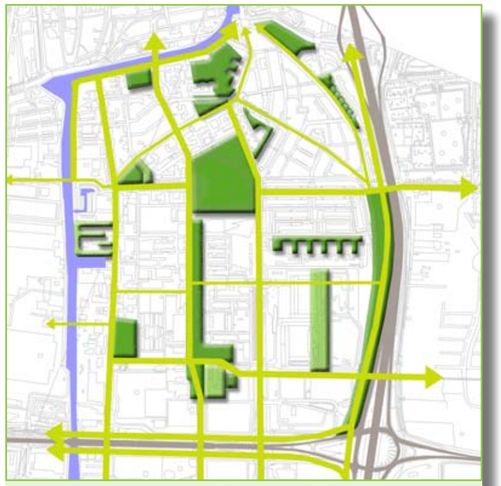
3. Effective use of the system
Find out what is necessary and what is possible for each area. Examples: making more effective use of the retention area around Watertuinen by placing weirs.

3. GREEN-BLUE > solution alternatives for water



0. Present situation

1. Green structures
The existing green structure is strengthened when the currently missing segments are completed and by making new connections, so that an intricate network is created.



2. Green spaces
New parks are laid out, for instance in Watertuinen, and the ecological quality and experience of existing green spaces, such as Kanaalhof and the Jaffa cemetery, is improved.

3. Greening of sectors
Strengthen and supplement green on a small scale, appropriate to the spatial structures of that sector. Examples are green roofs, residents' projects and nesting boxes.

3. GREEN-BLUE > solution alternatives for green

The map indicates the species for which new habitats can be created.

3. GREEN-BLUE > measures

Opportunity map and measures

The alternative solutions for water and green were jointly developed in an opportunity map and in a list of about 180 different measures.

Effectiveness, feasibility and costs

The measures were compared and scored in order to assess their effectiveness. Each measure was evaluated against the contribution it would make to ecology, habitat quality, water retention, water structure and climate adaptation. The technical feasibility was examined in order to assess the practicality of the measures: is it technically or spatially possible to add green elements or to make a waterway? And can measures be included in existing projects? (Creating work with work). Subsequently, an estimate was made of the cost of each measure. That estimate was initially made by the stakeholders themselves and verified later with existing indicative figures. The effectiveness of each measure, combined with its technical feasibility and costs, results in the efficiency of each measure. A number of measures appear to be very efficient:

Nature-friendly margins and banks

Nature-friendly margins and banks score high on ecology, green experience and water retention, and are relatively inexpensive to realise and manage. Nature-friendly margins and banks are actually much cheaper to create than timber-faced banks or paved quaysides. However, they do take up more space.

Green roofs

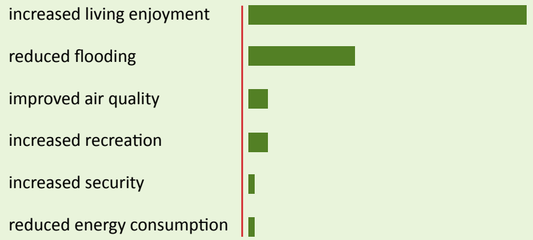
Green roofs or roof gardens score well on four of the five criteria: they offer a pleasant environment for people, plants and animals, capture particulates, reduce the heating of the roof, retain rainwater and provide cooling through rainwater evaporation. Green roofs can also be water-retaining. For this, they would need to be of a certain thickness, which would also make them a lot more expensive. Green roofs can be recommended in any situation, while water-retaining green roofs are only recommended when water retention is not possible by other means.

Biodiversity measures

Small measures for enhancing biodiversity have a great impact, while being inexpensive or even free of cost. The right choice of (native) plant species and the planting of fruit-bearing trees and shrubs will attract insects, birds and other small animals. A further example is the placing of nesting boxes and insect hotels.

nr.	kans	effect op groen-ecologie	effect op groen-beleefbaar	effect op klimaatadaptatie	effect op waterberging	effect op waterstructuur	combinatie met een ontwikkeling	technische haalbaarheid	score effectiviteit
A2	Aanleg nieuwe waterpartij in de Kanaalhof, doorlopend in Botanische Tuin en op gebied achter Science Centre.	2	3	3	3	1	ontwikkeling Kanaalhof	goed	12
A12	Michiel de Ruyterweg: trambaantijdelijk inzaaien met bloemenmengsel	1	3	0	0	0	nee	goed	4
B6	Aanleg natuurvriendelijke oevers Prins Bernhardlaan en helofytenfilters aanplanten op overstortplaat gemengd riool.	3	1	0	1	0	nee	redelijk tot goed	5
C1	Bewonersprojecten opzetten m.b.t. water vasthouden: groene daken, afkoppelen van daken en tuinen en water opvangen in binnentuinen van bouwblokken.	1	2	1	0	0	nee	goed	4
C2	Bewonersprojecten opzetten m.b.t. vergroenen leefomgeving: groene daken, ontharden tuinen, geveltuinen, boomspiegels, nestvoorzieningen voor vogels, herinrichting besloten groengebiedjes.	1	2	1	0	0	nee	goed	4
K2	Realiseren van extra waterberging door aanleg van een wadi in het park. Deze wadi kan functioneren als een "droge" berging met een stuw die het water gereguleerd afvoerd naar het watersysteem. Zo veel mogelijk daken en verhard oppervlak afkoppelen op deze wadi.	0	0	0	3	0	ontwikkeling Watertuinen	goed	3
I5	Groene daken/daktuinen/verblijfsruimten aanleggen op alle geplande nieuwbouw.	1	3	2	1	0	ontwikkeling Midden-West	goed	7
J14	Op het voormalig Bouwkunde-terrein tijdelijk natuur geschikt voor buitensport/recreatie of recreatief functioneel zoals kwekerij, fruittuin of boomgaard. Mogelijk ook expositieterrein voor studentenprojecten.	1	3	1	0	0	ontwikkeling voormalig Bouwkunde	goed	5

overview of Green-Blue project benefits



3. GREEN-BLUE > TEEB in the city

SCBA method for municipalities

The Municipality of Delft submitted the Green-Blue project for the nationwide programme 'TEEB in the city'. TEEB stands for 'The Economics of Ecosystems and Biodiversity', and is an international cooperation. The Netherlands participates in the initiative through the TEEB-NL programme. 'TEEB in the city' is part of TEEB-NL and is a project involving 12 municipalities and the Ministry of Economic Affairs, Agriculture and Innovation. In this project a method is being developed to present the social benefits of green-blue measures at the municipal level. This is to ensure that not only the costs but also the social benefits are included when deciding on projects.
The TEEB method is based on an SCBA (Social Cost-Benefit Analysis) and consists of different layers. It begins with an assessment of the benefits: what are the social benefits of a green-blue measure? The next layer quantifies and calculates those benefits and investments. A third layer then examines financing constructions, in which benefits and investments are divided.

A positive SCBA for Delft Zuidoost

The costs and benefits were calculated for all of the measures on the opportunity map. The stakeholders had already made an estimate of the costs, which were reviewed in this part of the process. In this phase the costs were estimated at 17 million euros. Witteveen & Bos (a consultancy) calculated the benefits as part of the 'TEEB in the city' project. These were divided into 6 main groups: living enjoyment, flooding, air quality, recreation, social safety and energy. There were also benefits that were not calculated due to a lack of available data. These include heat stress, productivity and biodiversity. The total benefits were calculated at 27 million euros. The benefits, therefore, work out to be much higher than the investments: calculated proof that Green-Blue will make a positive contribution to the developments in Delft Zuidoost.

Using TEEB in design sessions

In the test-bed study of autumn 2011, three sub-areas were analysed further and designed using the outcomes mentioned earlier and the TEEB working method. Looking at the potential benefits in this way proved to be an alternative way of thinking that adds a new dimension to the design process:
> Thinking about the benefits and advantages instead of the costs and limitations can generate new spatial solutions.
> The method also lists and quantifies qualities that are often difficult to grasp concretely, such as air quality and social safety.
The alternative way of thinking, however, does not directly solve the issue of investment. The ability to reason and calculate in terms of social and financial benefits does not actually mean that the responsibilities for investment costs are thereby settled. TEEB appears to have been a very useful step in the Green-Blue project. Financing constructions, however, will need to be examined further.

The calculated benefits of Green-Blue

> Increased living enjoyment: the increase in living enjoyment is reflected in the valuation of houses and other real estate. Research shows that the value of a house can rise by as much as 11% when the garden backs directly onto a stretch of water. Also, when a park is added in the neighbourhood the value rises by 6%.
> Reduced flooding: an improved water structure will reduce flooding and will save costs (of flood damage and clean-up). Water treatment costs will also be saved when clean rainwater is drained via surface water channels instead of through the sewer system.
> Improved air quality: particulates are collected by trees, green roofs and reeds in nature-friendly margins and banks. It is known how many kilograms of particulates that a tree or a square metre of reed can collect per year. Through a calculation, it is possible to translate the reduction in the amount of particulates into an increase in health.
> Increased recreation: people are willing to pay for recreational experiences, be it for petrol for the journey or for a walking guide. The 'value' is determined by how much people are willing to pay for a recreational visit. New recreational possibilities in a neighbourhood mean that 'recreational value' is being added.
> Increased social safety: this benefit is expressed through the savings made on removal expenses and delinquency costs, both of which are reduced when the district's green structure improves.
> Reduced energy consumption: this concerns the energy savings made through the insulation-value of green roofs.

4. FOLLOW-UP > project gains

The Green-Blue project simultaneously designed and assessed the measures that could offer an integrated solution to meet the green and water targets in Delft Zuidoost. What is striking in this project is its degree of depth and scope: 180 feasible measures have been listed. That is extraordinary, since a spatial planning process is often limited to ambitions and general directions for solutions. However, without further development of these, policy implementation often stagnates at the level of good intentions. The Green-Blue project illustrates the added value of describing measures concretely, and in relation to each other, in the spatial planning vision.

The added value is also visible in the process. The stakeholders closely collaborated from the onset of the project. Continually showing what the concrete solutions could be, helped the parties involved understand what the consequences for an specific area would be. That degree of clarity and stakeholder collaboration has resulted in a plan that is widely endorsed.

4. FOLLOW-UP > looking ahead

Now that the possibilities and opportunities are clear, the follow-up phase needs to focus on the actual realisation of measures. Which measures can be linked to existing infrastructure projects, which can be included in spatial and economic development projects, and which can be included in the stakeholders' implementation programmes? When considering the (financial) implications in selecting which measures to implement, it is important to always keep in mind the integral relationship between the measures.

To safeguard this integrated approach, the stakeholders will continue to collaborate in the follow-up phase. Not only to fulfil the quantitative green and water targets, but also because a good green and blue development of Delft Zuidoost contributes to an innovation campus with a good quality living environment.

CREDITS

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opMAAT	p6, p12 - p13
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