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Document Version

Final published version

Citation (APA)

Hooimeijer, F. L., & de Boer, J. J. (2025). Spatial Design Starts with a Cross Section: The subsurface as a building block for the future-proof city. In M. Hertogh, & F. Hooimeijer (Eds.), *Building Futures : Integrated design strategies for infrastructures and urban environments* (pp. 194-203). Delft University of Technology.

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PROJECT

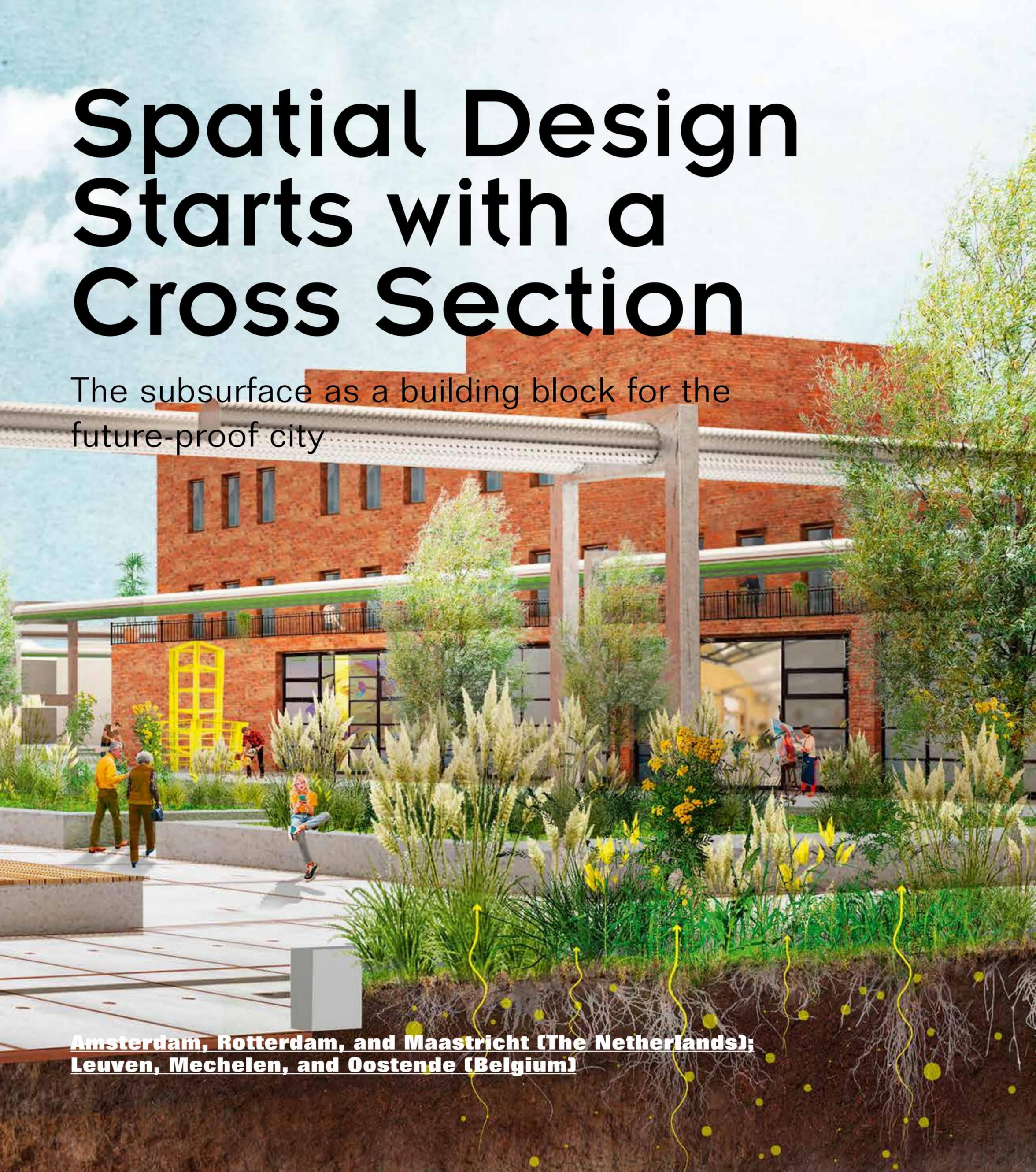
Maastricht Case – Impression of Industriehof Rijdam
(Team Obscura, -C-A-S-, Bureau Ufo, Oto Landscape Architecture, Studio Bereikbaar)



Spatial Design Starts with a Cross Section

The subsurface as a building block for the future-proof city

**Amsterdam, Rotterdam, and Maastricht (The Netherlands);
Leuven, Mechelen, and Oostende (Belgium)**

An architectural rendering of a modern urban courtyard. In the background, a multi-story brick building with large windows and balconies is visible. The courtyard is filled with lush greenery, including tall grasses, yellow flowers, and trees. Several people are walking and sitting on a paved area. In the foreground, a cross-section of the ground is shown, revealing a network of roots and yellow spheres, suggesting a focus on subsurface infrastructure or soil health.



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TYPE OF PROJECT Design study with practice

YEAR 2021

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LOCATIONS Amsterdam, Rotterdam, and Maastricht (The Netherlands); Leuven, Mechelen, and Oostende (Belgium)

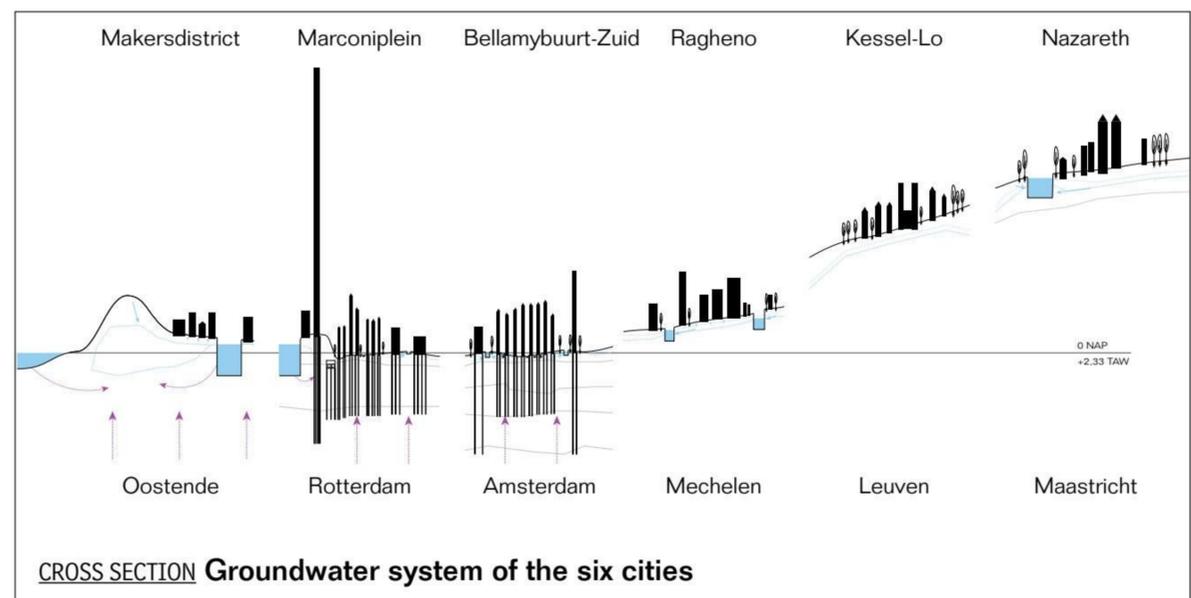
KEYWORDS Integrated and multifunctional use of space, Spatial advantage, Environmental quality, Modal-shift, Climate adaptation, Energy transition, Design strategies, Integrated business-model, Urban value

INTRODUCTION

Innovating from the subsurface perspective

This design study builds on research by TU Delft and the Environment Department of the Flemish Government and on the vision and design created by the multidisciplinary teams from the field and student teams from TU Delft. As in the Netherlands, there is a desire among Flanders' politicians and administrators to realise new functions and programmes as much as possible within the existing built environment, with a higher 'spatial efficiency' for public space and buildings. Due to a multitude of tasks and systemic transitions in densifying cities, and with it, the increase in spatial claims, the pressure on public space is increasing. How much densification is still possible for locations already overloaded with programmes and where public space – both above ground and below ground level – is already filled up? How can the spatial efficiency of the city be increased in an innovative and, above all, sustainable manner? The design study looked at the possibility of designing the arrangement of urban functions from a subsurface perspective, building on the Intelligent Subsurface project.

(Source: Thomas Dillon, Vereniging Deltametropool)



Enhancing urban resilience

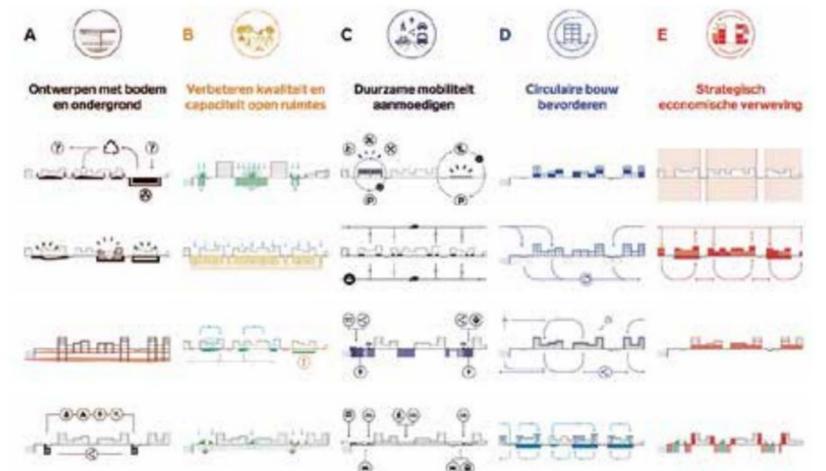
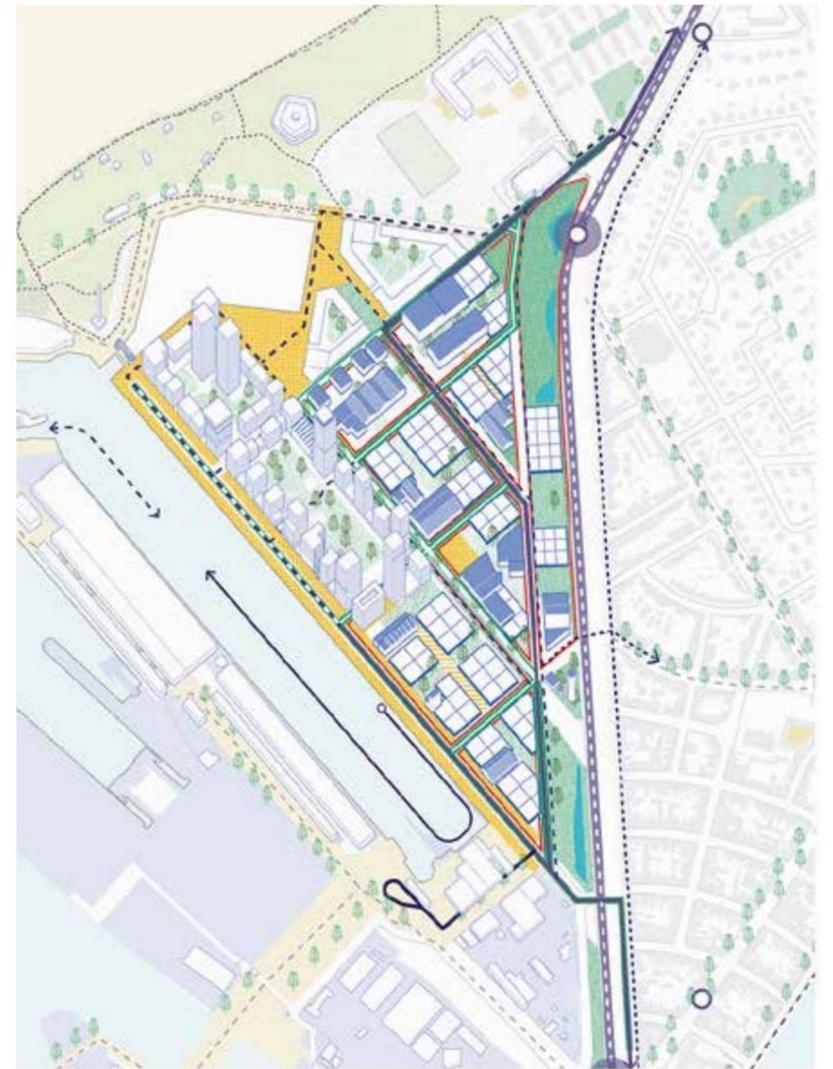
The main challenge of the project was: How can the integral and multifunctional use of space – public space, subsurface, and buildings – within a densified urban environment create space and value that contribute to an attractive and future-proof living environment? The working hypothesis was that the integral design of subsurface, public space, and buildings requires an adaptive and resilient design in which the ecosystem, the climate, and the urban system are designed together and in which the soil dynamics are taken as the basis.

The subsurface plays an important role in the urban climate challenge. Higher rainfall calls for urban adaptations. The soil plays a major role in water storage and drainage. In combating heat stress, open soil is an essential element that lays the foundation for cooling greenery and acts as a carrier for improving biodiversity. Soil also plays a vital role in the energy transition. Systems for heat and cold storage (ATES) and the potential of geothermal energy in the Netherlands and Flanders are important elements of the new energy system. Everything that happens underground in civil constructions adds value to the city, so it is necessary to be smart about it.

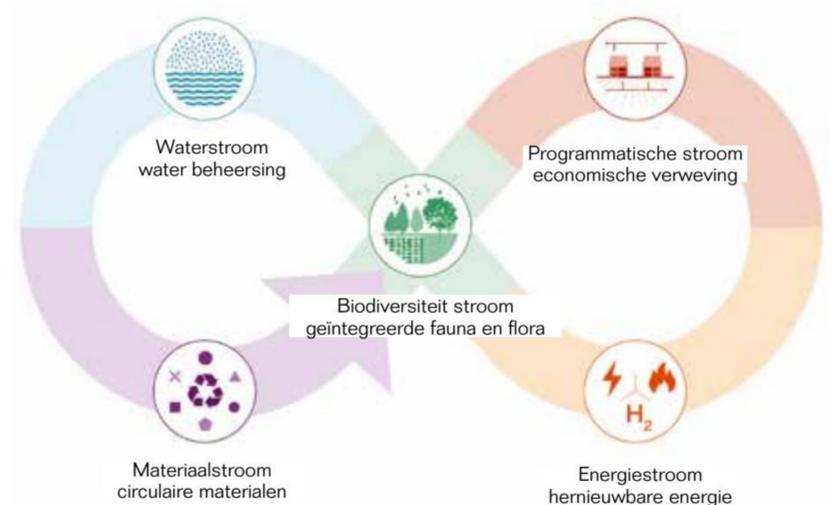
When the whole spatial section is taken into account, more benefits could be created in order to justify making high investments in the subsurface and connecting it with urban surface development. Moreover, the soil is literally the substrate for spatial quality and robustness; it is the subsurface that houses the natural system.

Integrating urban and subsurface design

COB and TU Delft, together with the Flemish Government, have carried out a design study into the possibilities of integral and multifunctional use of space within densified cities in the Netherlands and Flanders. This was based on long-term research carried out by these institutions. In this project, seven consortia of architects, urbanists, landscape architects, and engineers from different disciplines were invited to work on six neighbourhoods in three Dutch and three Flemish cities. These areas all faced particular issues with regard to their urban locations and specific positions in the soil-water system and, more generally, the challenge of providing an attractive and future-proof living environment. What is interesting about the results is that the definition of the problem is based on each neighbourhood's relative position in the design of the cross section of public space, subsurface, and buildings.



Ostende case – The application of different measures to the site (Team Sweco Belgium - Divisie Buur, Enprodes)



Ostende case – Circularity in five dimensions (Team Sweco Belgium - Divisie Buur, Enprodes)

replacing the natural system with urbanisation

PROJECT RESULTS

Addressing diverse subsurface challenges

The cities in the study are located in different positions in the delta with different conditions when it comes to the soil and water system. Their position determines the challenges they face, due to the conditions that can vary (from west to east) with regard to salinised groundwater, subsidence, flooding, and drought. These challenges are not only caused by changes in the hydrological system due to climate change but also by replacing the natural system with urbanisation. Two subsurface challenges that play a role in all cities are soil pollution and the underground infrastructure. All six cities aim to improve the quality and climate resilience (through adaptation or mitigation) of their public space and real estate in the neighbourhoods under scrutiny in order to support the socio-economic structure.

Ostende

In Ostende, the team has designed a matrix to link the subsurface challenges to circularity and high-quality and climate-proof spatial development derived from their circular approach. The challenges include dealing with the soil contamination of the former industrial area and the salinisation of the groundwater in the design process for the new maker district.

Rotterdam

Marconiplein in Rotterdam is a huge traffic and local public transport node intended to provide a high-quality connection between adjacent, developing neighbourhoods. CityFörster's team proposes to make

this connection by opening up the node and turning the intersection inside out, as it were, into a qualitative user space with its own green and open character, accessible from all neighbourhoods. The second team for this location, consisting of Delft engineers, elaborated on the idea of the multifunctional dike (water defence, park, and shopping facilities) of the adjacent Dakpark and designed a dike park that connects the surrounding neighbourhoods like a green heart. Both proposals make qualitative use of the height differences in the area: the dike and the inner and outer dike levels make the junction spatially interesting.

Amsterdam

The issues in the Amsterdam Bellamy district are typical of all polder cities in the Netherlands, where subsidence, an overload of subsurface infrastructure, and high groundwater levels make the redevelopment of the existing city virtually impossible. The Hus team developed a stakeholder and parametric design approach that should help navigate between the desirable and the possible. They designed a flexible green-blue network for the Bellamy neighbourhood that connects community energy hubs. They use the quay wall renewal to replace the wall with a multifunctional space housing a multi-utility tunnel. This tunnel will accommodate a heat network and underground bicycle park while the soil on top can be cleared and planted. Cars are banned from the streets and parked in a mobility hub located within a 15-minute walk. This improves the quality of the public space and stimulates the energy transition.

3.4.3 **PROJECT** Spatial Design Starts with a Cross Section



Rotterdam Case – Perspective cross section with housing along the dike park and subterranean water storage
(Team BVR, VenhoevenCS, Sweco, Maakdestad)



Maastricht Case – Impression of Industriehof Rijdam
(Team Obscura, -C-A-S-, Bureau Ufo, Oto Landscape Architecture, Studio Bereikbaar)



'Nature streets' in Nazareth, Maastricht (Team Obscura, -C-A-S-, Bureau Ufo, Oto Landscape Architecture, Studio Bereikbaar)

multifunctional use of available space

Mechelen and Leuven

In Mechelen and Leuven, the architectural assignments for both districts aim to include the underground space in the above-ground programme to add significant value without disturbing the groundwater system. In Mechelen, it was a central park building designed by team tek, using height differences, and anticipating future functions and their related values. In Leuven, the SUPTERRA design team designed a building as a sloping landscape with underground functions. Here, the design uses the stable subsoil, the deep groundwater table, and the high-quality sands that can be used as a raw material. There are three aquifers, two of which are highly suitable for thermal storage. The research question was as follows: How can we use the site to release the spatial pressure of urban densification by engaging the subsoil and, through phased restructuring, lay the foundations for an energy-neutral, socially inclusive, ecologically robust, and liveable neighbourhood?

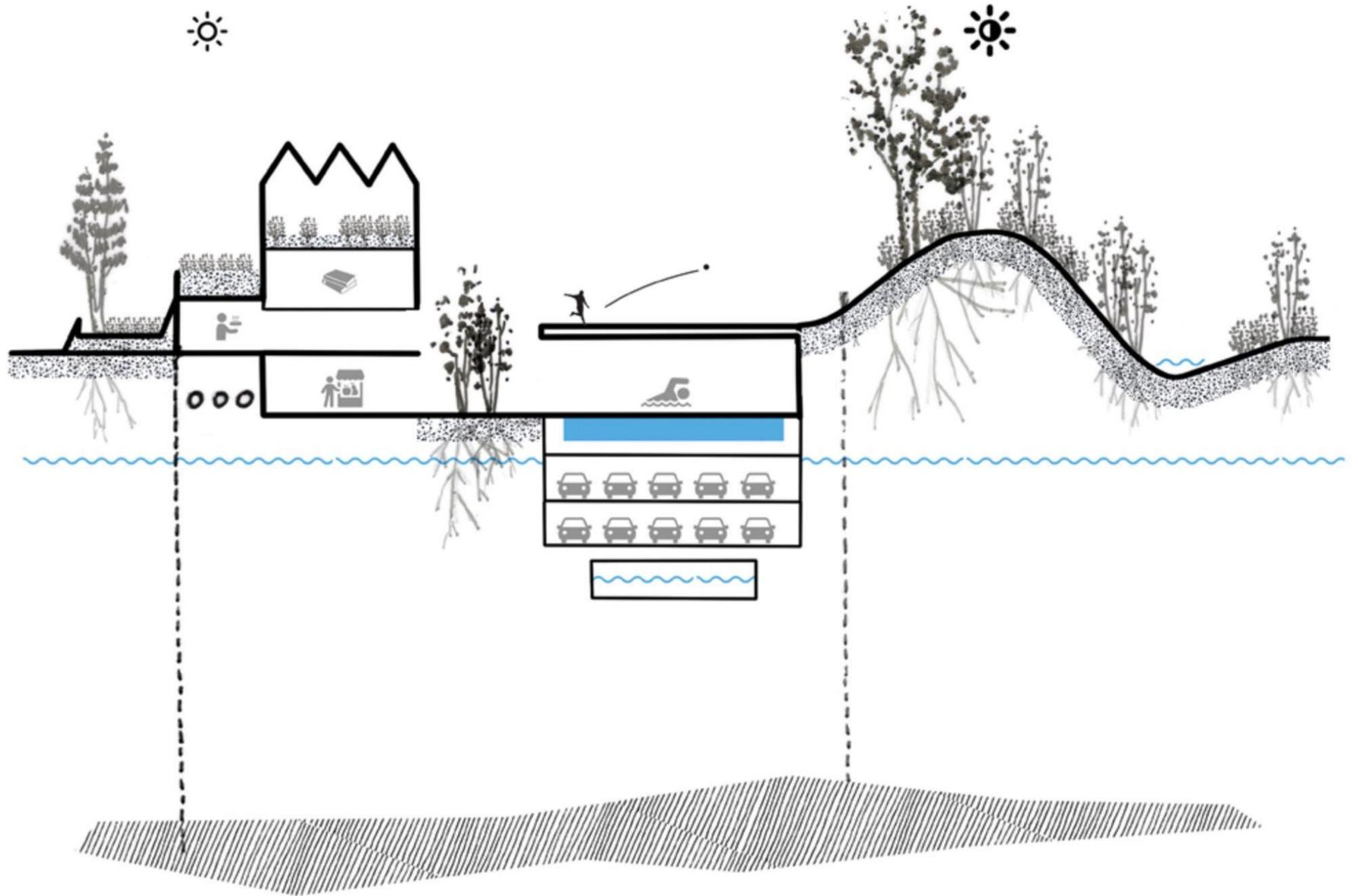
SUPERTERRA's design used three clear and integral concepts: a pleated ground level, a living site, and climate joints. 'Pleated ground' entails opening up the soil and having inside and outside, above and below, flow into each other, creating new spaces tailored to the user. Flora, fauna, and people live together in the 'living site'; the trees also grow 'inside'. This principle maximises the proportion of healthy soil, permeable surface, and naturally built-up vegetation layers. Climate joints are created by bundling several urban and ecosystem services into hyper-effective continuous corridors. These are part of a network in which public-space water storage, heat-stress reduction, increasing biodiversity, green mobility, and energy generation and distribution are systematically added to the city.

Maastricht

Finally, the Maastricht team deployed the Nazareth district heat network as a spatial strategy for clustering urbanisation in a shrinking region. Part of this strategy involved developing a 'nature-street' principle for the shrinking district. Instead of resorting to the demolition of houses and empty spaces in the neighbourhood, the Grondwerk team proposes replacing the demolished houses with greenhouses. These will be added to the remaining houses to increase the size of the houses and make them suitable for families and other target groups that would like to stay in the neighbourhood, which now lacks the desired type of housing. In addition, the greenhouse forms an intermediate climate where the air is heated and supplied to the rest of the house with a heat pump. These houses do not require connecting to the heat network. The greenhouse creates a new interaction between the inside and the outside, with the landscape as part of the living space. To us, this illustrates the potential living quality of the urban fringe of the future.

Lessons learned

The design results and the essays written for publication resulted in 14 lessons learnt. The main point was the innovative viewpoint that the subsurface could be used to tackle urban challenges and the use of space – another mindset and another way of dealing with actions. A paradigm shift is needed for the integrated and multifunctional use of the available space. The subsurface is part of the solution by setting new conditions for public space and existing or new buildings. This would include paying specific attention to the subsoil and the water system in order to restore natural processes. Finally, the need for other business cases is manifest; sustainability and its future benefits or avoidance of climate change-related damage would justify the necessary investments.



#VOID EARTH LEUVEN
(Team Overlant landscape architects,
BD+P architects and planners, and AGT)



The multifunctional embankment in the Amsterdam Bellamy district
(Team Hus tea)

EVALUATION

Multidisciplinary insights and long-term perspectives

This study contributes to insights into integrating the qualities and interests of the subsoil and topsoil in vision formation with regard to densifying cities. The project is characterised by interdisciplinary design by consortia of members from various relevant professions. The teams were free to choose their approach to the issues formulated by the municipalities, the location, and the design proposition. The teams opted for different approaches, such as the stakeholder perspective, parametric design, system engineering, urban metabolism, layers, or a specific sustainability approach. While differing in their approach, the designs all meet the criteria of the central question of the design study in similar ways. This proves that tailor-made solutions can contribute to more generic social themes and challenges. The trans-disciplinarity was achieved by collaborating with the municipalities. In this sense, these design studies are exemplary for research and practice coming together.

With the publication of the design studies, the teams' approaches and designs were subject to further investigation from five cross-cutting thematic perspectives in order to reveal more generic insights and practical knowledge at the study level. This concerned the integrated and multifunctional use of space, representation, planning and design of the sub-surface, architectural and urban concepts, the plan evaluation of the designs for their urban scale and system-level contributions, and business-case development.

The Longue Durée aspect of this topic has a twofold relevance. First, the fact that urban systems are left behind in the subsurface makes it possible to trace their history. This is the Longue Durée in the literal sense: legible archaeological findings. The accompanying risks and opportunities need to be taken into account when redeveloping areas. The second point is that the subsurface of water and geomorphological systems are

Longue Durée, structural, spatial elements with a long timespan. Man-made systems have their own – shorter – Longue Durée because these systems define the urban tissue, such as the networks of cables and pipes, which are like corsets for the urban layout and hard to change. On the other hand, new heat networks could restructure and renew the public space for the next decades. Both these relevancies were incorporated in the designs and brought into the future by the teams by explicitly adding a time dimension to their projects.

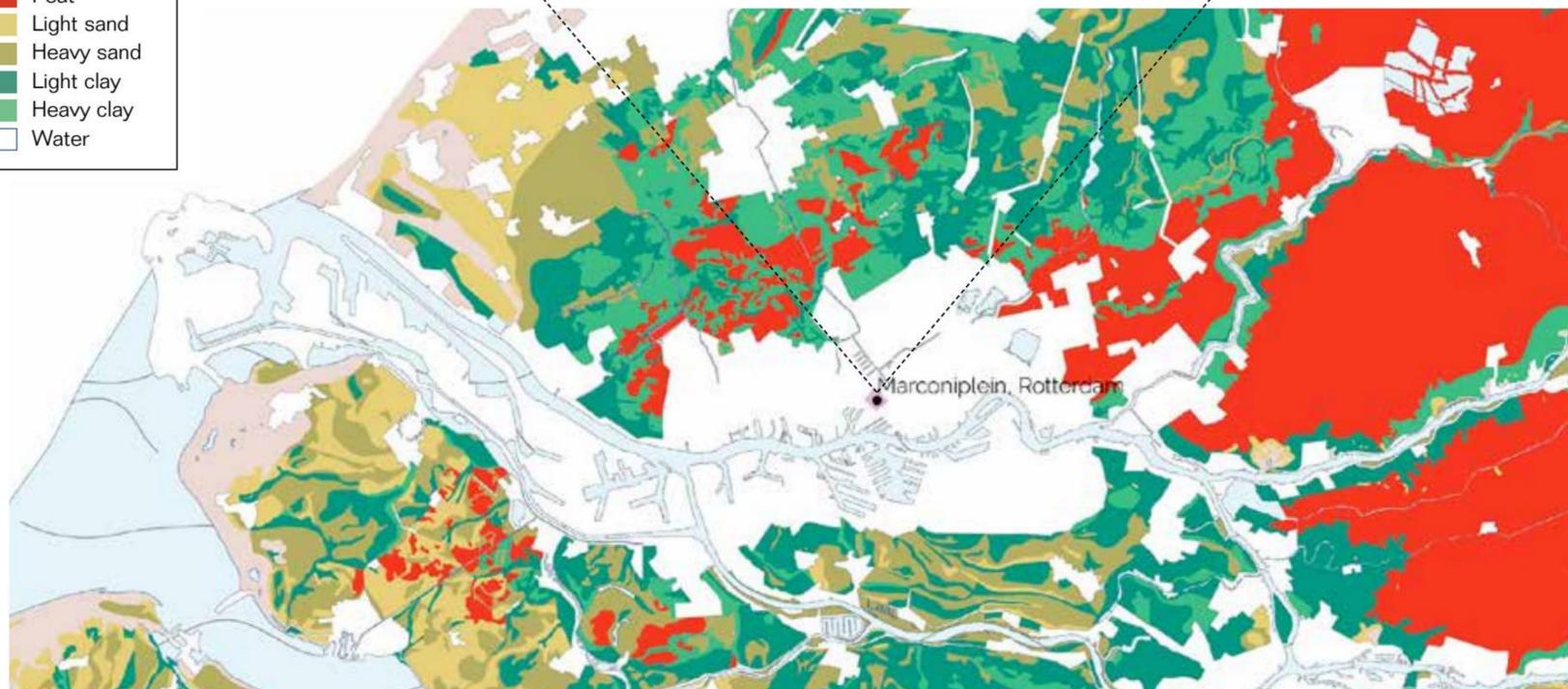
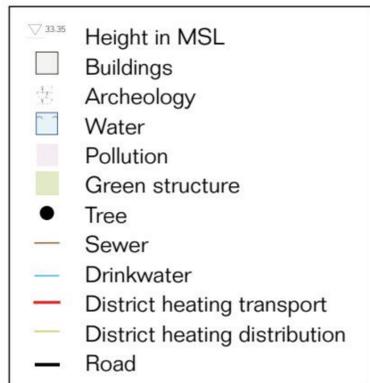
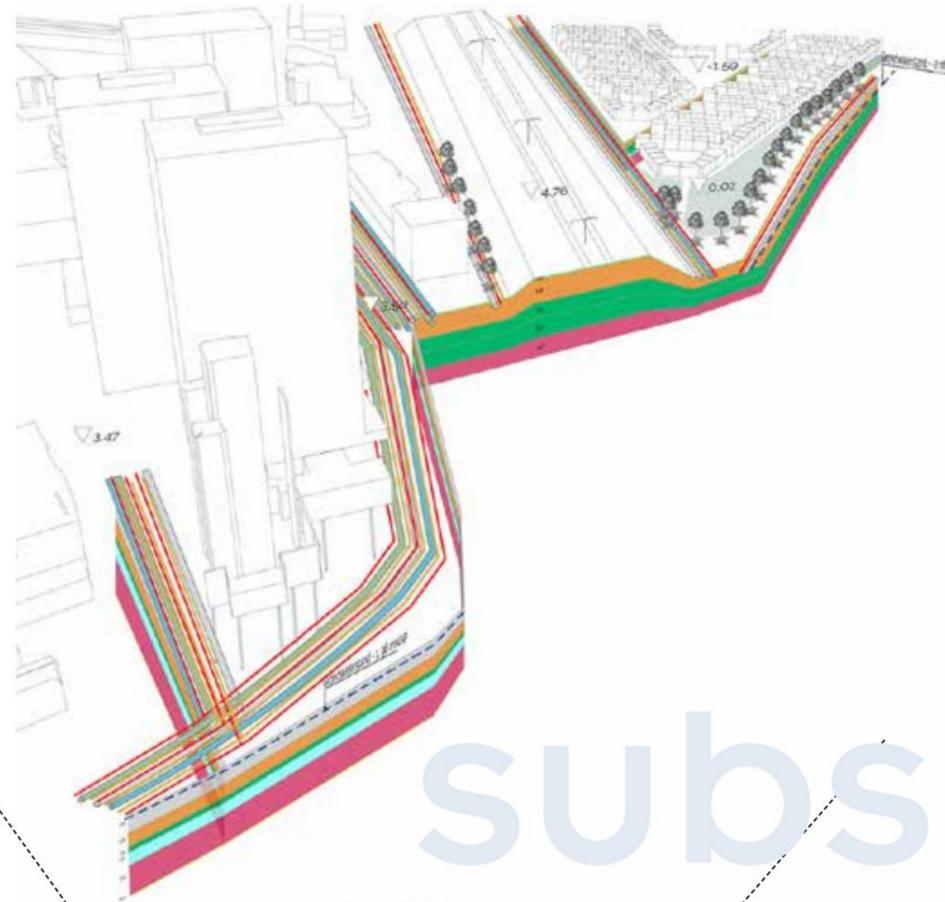
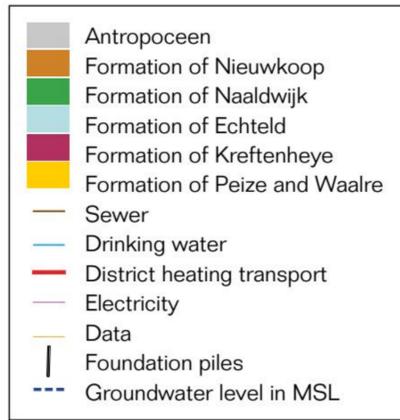
CONCLUSION

Unlocking the subsurface potential

The results of the study show that if a city's cross-section is taken as a starting point for the creation of space and value above ground, unforeseen opportunities arise, and logical connections can be made between measures that are future-proof and will prevent further overexploitation of the soil by the city. This will take the pressure off of competing claims for the public space.

Apart from the introductory masterclasses, the 'technical sessions' provided additional support for the City x Space study. At the start of the consortia's design processes, the technical data of the areas were discussed in the technical sessions. The differences between the six municipalities were extensive. While Amsterdam proactively involved specialists, Rotterdam had an urban planner who attempted to mediate. Maastricht hired an engineering firm that took part in the study.

The subsurface is different everywhere, as are other conditions, and because of these differences, it is important to involve specialists who can interpret the data. Increased insight and knowledge decrease the gap between the people with knowledge of the subsurface artefacts, the engineers, and the spatial designers, so that the interpretation of subsurface data can take a more prominent role in spatial planning and design processes for the built environment. Facilitating the integration of subsurface data into spatial designing and planning is an essential element of this process.



subsurface potential

Colophon

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PRINTING

G.B. 't Hooft bv, Rotterdam

BINDING

Binderij Van Wijk Utrecht BV

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This publication is funded by the TU Delft Delta Infrastructure
and Mobility Initiative (DIMI)