GREEN
CITIES
EUROPE

WORKSCAPES OF THE FUTURE

Design explorations and ideas for a flooded future by Dariia Alieieva, Meric Altintas Kaptan, Lady Choque Olivares, Lara-Sophie Dejon, Gili Hofland, Eline Holtes, Masja Rietveld, Pieter van der Wel

workshop week 06 – 10 November 2023
Tutored by Nico Tillie & Rosa de Wolf (TU Delft)
Rob Roggema (Tecnológico de Monterrey)

TU Delft

Figure: Photograph of group

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Figure: visualisation TU Delft Campus by authors

OBJECTIVE

In the Netherlands, most (industrial) business districts are fully grey and paved, making them unpleasant environments for people. However, these districts house 30% of all jobs in the country and have a significant impact on the Gross National Product. Over 3,500 districts cover more than 100,000 hectares of land, making their impact on the biosphere, society, and economy enormous. Therefore, it's essential to transform these districts and make them more inviting for people and investments.

The Dutch national Werklandschappen van de Toekomst (translated: Workscapes of the Future) programme aims to transition a thousand (industrial) business districts into more healthy, biodiverse, nature-inclusive, and energy-efficient areas. The programme envisions a multifunctional workscape, where businesses are combined with housing and recreational functions. Thus, the programme aims for a new generation of business districts.

The objective of the international Workscapes of the Future workshop week organised by TU Delft from November 6 - 10 was to contribute to the national programme while going beyond the current state-of-the-art business districts. It is essential to consider what happens after the programme duration, as the future does not stop then.

The national programme aims for Workscapes of the Future. It's important to consider what this future holds. Investments made now must last for a long time, and it's essential to consider the impact of climate change on the Netherlands.

For instance, what happens when The Netherlands must deal with 2.5 metres or more sea level rise, and the current dike system would not last or should be widened immensely? These are important questions that need to be addressed. For new investments, it's important to consider how it will adapt to future challenges like these.

Figure: Visualisation potential flooded scenario Delft business districts

METHOD

Via a one-week charette design workshop, students explored possible future scenarios for business districts. The workshop week began with a site visit to the design locations: TU Delft campus, Schieoevers-Noord, and Schieoevers-Zuid. These sites house different functions. The TU Delft campus is a university campus where housing, educational institutions and businesses are combined. Schieoevers-Noord is an urban mix with businesses, and Schieoevers-Zuid is more industrial.

On the TU Delft campus, a visit to The Green Village Living Lab showed multiple sustainable innovations regarding designing for climate adaptivity, the energy transition, and digitalisation. This test site aims to help entrepreneurs and researchers develop, test, and demonstrate their experimental projects.

Introduction sessions on health, biodiversity, climate adaptation, multifunctionality, and the energy transition ensured common knowledge despite the diverse educational backgrounds of the participants. The current state-of-the-art regarding designing for business districts was shown via inspirational sessions.

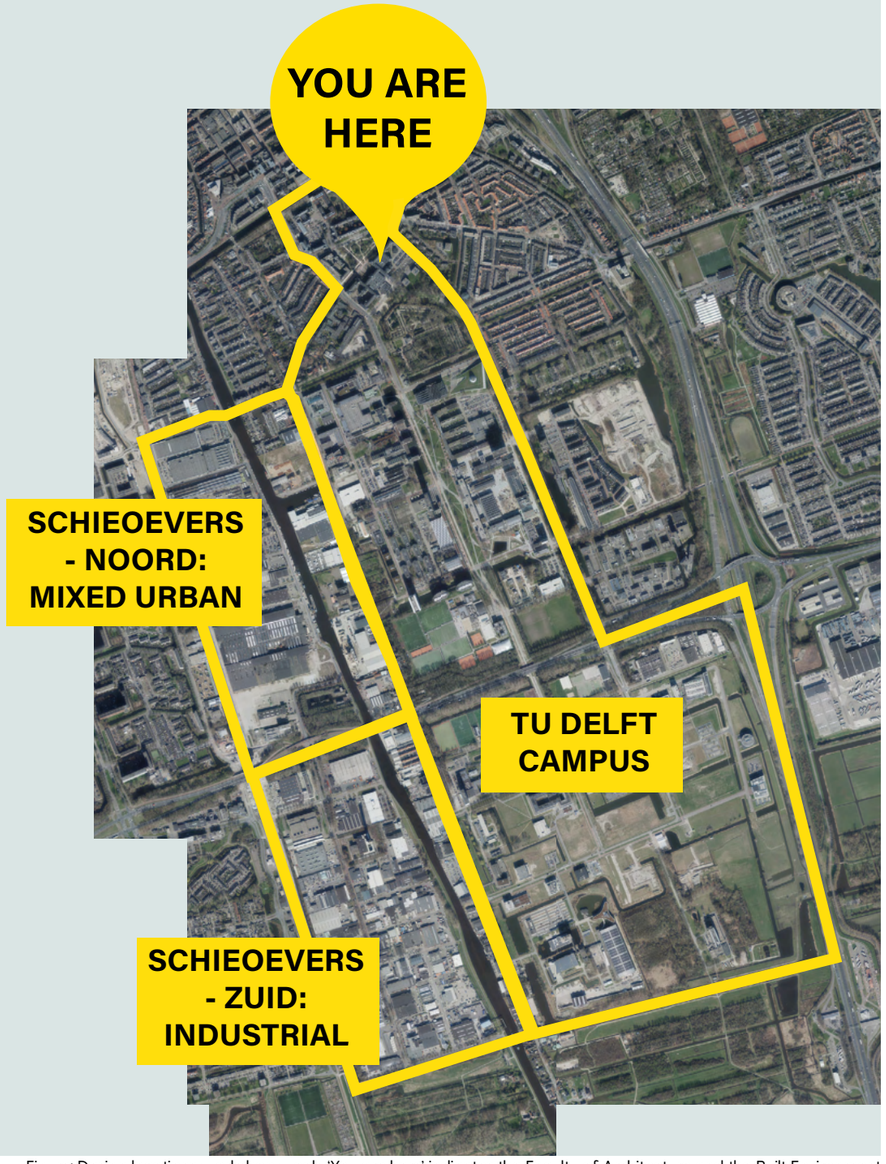


Figure: Design locations workshop week. 'You are here' indicates the Faculty of Architecture and the Built Environment

PROBLEMATISATION

What does the Netherlands in 2121 look like? Architectural firm KuiperCompagnons and Jan Rotmans, professor at EUR, formulated a vision for The Netherlands by 2121. This vision, shown on the image on the next page, presents the western part of The Netherlands as way more wet than it currently is.

A situation like this will not occur tomorrow, as the current landscape looks dry and is functioning. However, when thinking about future landscapes, the investments for a future landscape are made now. These must be considered.

The Faculty of Architecture and the Built Environment's building in Delft was built in 1923 and it is still functioning now. If this building was built today, investors would expect it to be functional in 2123. 2121, the year for which Rotmans and KuiperCompagnons formulated their vision, does not seem as far away as one might think.

More might change in the coming 100 years than already has in the past. Will this drastic sea level rise happen in 100, 80, or 120 years? Who knows? When (re-) designing a building or a landscape, designers should already incorporate some level of adaptability and not wait for this flooding to chaotically happen. By this, investors get some insurance that their investments are prepared for this. Sooner or later, investments will stop when no good alternative strategy is found.

The Volkskrant published an article midst of the workshop week, on November 7, headlined 'Toezichthouder: minder hypotheek bij meer risico op schade aan woning door overstroming of extreme droogte'. The article mentioned that the Autoriteit Financiële Markten (translated: Autority Financial Markets) pleads for a cut on the mortgage space for houses with a climate risk. This way, homeowners have some leftover financial space to cover any damage to their homes caused by extreme drought or heavy rainfall. The AFM also pleads for a

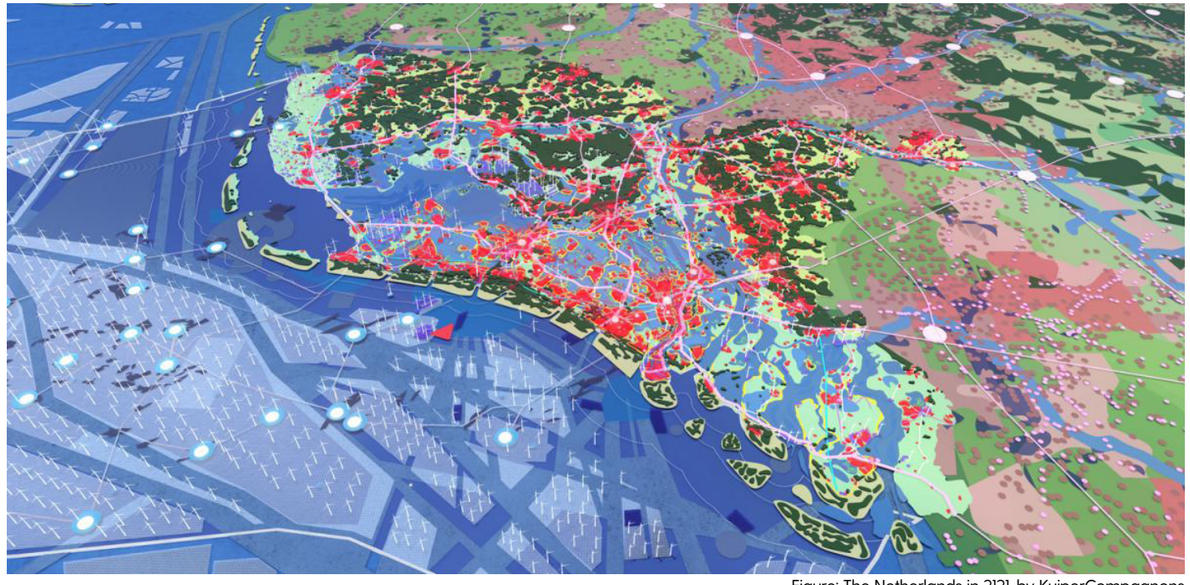


Figure: The Netherlands in 2121, by KuiperCompagnons

'climate label' for housing. This should provide both the buyer and the mortgage provider with insight into the risks that climate change poses to many Dutch homes. Tightening the lending standards should protect home buyers from buying a house they cannot afford to renovate. With this, the buyer can also afford an additional mortgage for, for example, repairing the foundation.

The maps on the next pages show the Province of Brabant in The Netherlands. The maps show the climate structure map of the province, highlighting the areas that are affected by the Urban Heat Island and areas that are posed with higher flood risk. As visualised, many people would be affected by such a label.

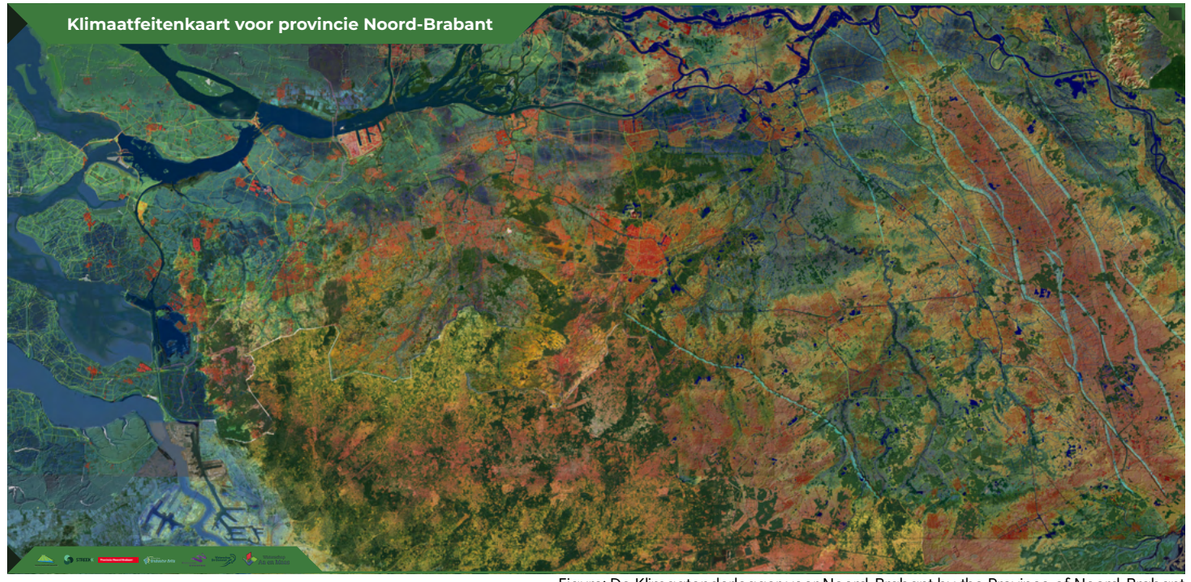


Figure: De Klimaatonderlegger voor Noord-Brabant by the Province of Noord-Brabant

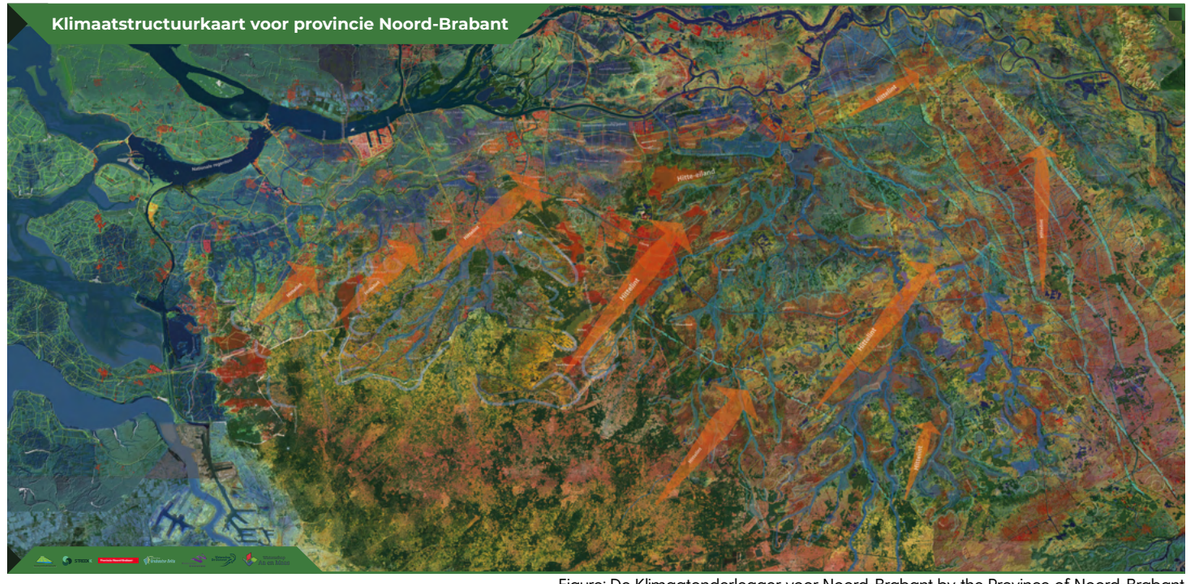


Figure: De Klimaatonderlegger voor Noord-Brabant by the Province of Noord-Brabant

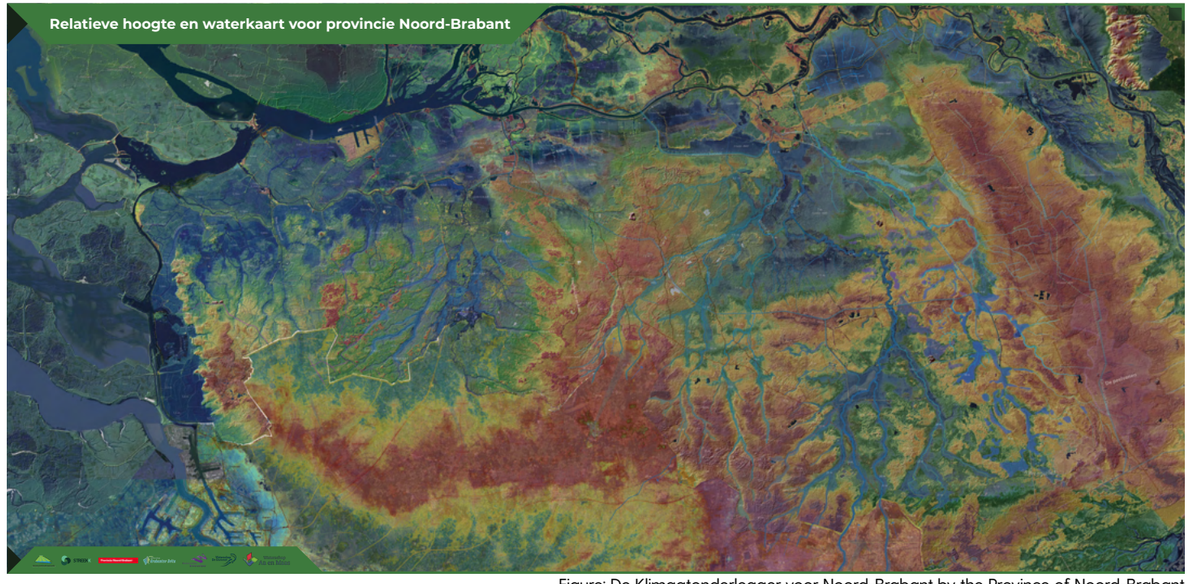


Figure: De Klimaatonderlegger voor Noord-Brabant by the Province of Noord-Brabant

The climate label might be applied to business districts in the near future as well. The climate risk is very location-dependent. In more elevated provinces a climate label probably will affect the financial situation of investors differently than in Western provinces such as Zuid-Holland, the province where the design locations are located.

Delft University of Technology's common mission is to impact for a better society. Therefore, participants of the workshop week were asked to look from a different perspective when designing for the Workscapes of the Future. **How can we learn to live with the water again? How do we deal with this? How can we start testing all of this?**

Together with students in the ECOCampus ON SITE elective, the TU Delft works towards a more sustainable, biodiverse, climate-adaptive campus. In recent years, students have redrawn the campus and rethought the Mekelpark as a canal for boats. Four years ago, this sounded extremely futuristic. Lately, intense rainfall has become more common already. The photograph on the right above was taken on the 3rd of November 2023. The newly constructed tramway, with high investments, is meant to last approximately 100 years. The photograph shows that the road is completely flooded due to this heavy rainfall. These investments might be lost in the future when this trend continues or accelerates.

The objective for the workshop week was not to draw a final plan for the Schieoevers and campus district in Delft. The design explorations of a landscape-based approach on business districts aim to show that the quality of space can still be improved when linking to scenarios like drastic sea level rise.

Figure: Photograph Mekelweg TU Delft Campus

Figure: Visualisation De Leperaar using the tramway on Mekelweg

SCENARIOS

When looking at the elevation of the current landscape, the old coastal system is still visible. This is depicted in the maps on the next page.

Different future scenarios can be envisioned, depending on the level of sea level rise.

The group envisioned three scenarios, wherein the historic landscape is used as a base for a future-proof workscape.

Figure: Left: current elevation Delft. Right: highlighting old coastal system in Delft

Design location

Currently, the strategy to raise the water levels and pump out less water is reasonable already.

Wadi city is the first scenario, which deals with a one-meter sea level rise. Wadi city can store a lot of water. The city's infrastructure and grasslands are completely redesigned into a wadi structure. In this phase, urban atolls are formed by using materials from demolished buildings and infrastructure as a structure. Organic and concrete waste are used to start growing the atoll. These atolls can be linked to the old landscape, the old riverbeds, where an elevation difference is still visible.

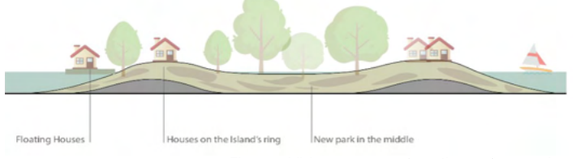
+1 meter: wadi city

The urban atoll is a new design principle for this scenario. The formation of this atoll starts with creating a ring with materials from demolished buildings. Via sedimentation and land formation, organic material forms dikes. The materials such as clay are stacking up. The clay, the ring, the island, and the atoll, can be used for new urban development, there can be built upon. The development of these atolls must start from the start to be able to build on top of them before the flooded scenario.

+3 meter: island city

The next scenario relates to more drastic predictions. In this phase, the urban landscape is partly flooded already. The built form is protected by dikes.

+5 meter: flooded city



Figures: Vision maps and sections of scenarios

So far, the effects of climate change have turned out worse than predicted. This last phase goes beyond the predicted level of sea level rise. Now, the city is flooded and a new urban environment arises, linked to the atoll.

DESIGN EXPLORATIONS

These three scenarios wadi, island, and flooded city are considered in the design exploration. As these principles show potential for future-proof redevelopment, they might interest investors.

This design exploration was done from the perspective of learning to live with the water on Schieoevers-Noord, Schieoevers-Zuid and the TU Delft campus.

For the wadi city scenario, the figure on the next page visualises the parts that are affected by this one-meter sea level rise. The Floopmap simulation tool was used to create this image.

As the map shows, the centre of Delft is still functioning with this one-meter sea level rise. However, the connectivity between different cities is lost. To ensure accessibility of and transportation between urban areas different proposals and solutions are explored.

Introducing submerged bridges for vehicles can secure this connectivity. Within the cities themselves, floating bridges for pedestrians and bikes are explored.

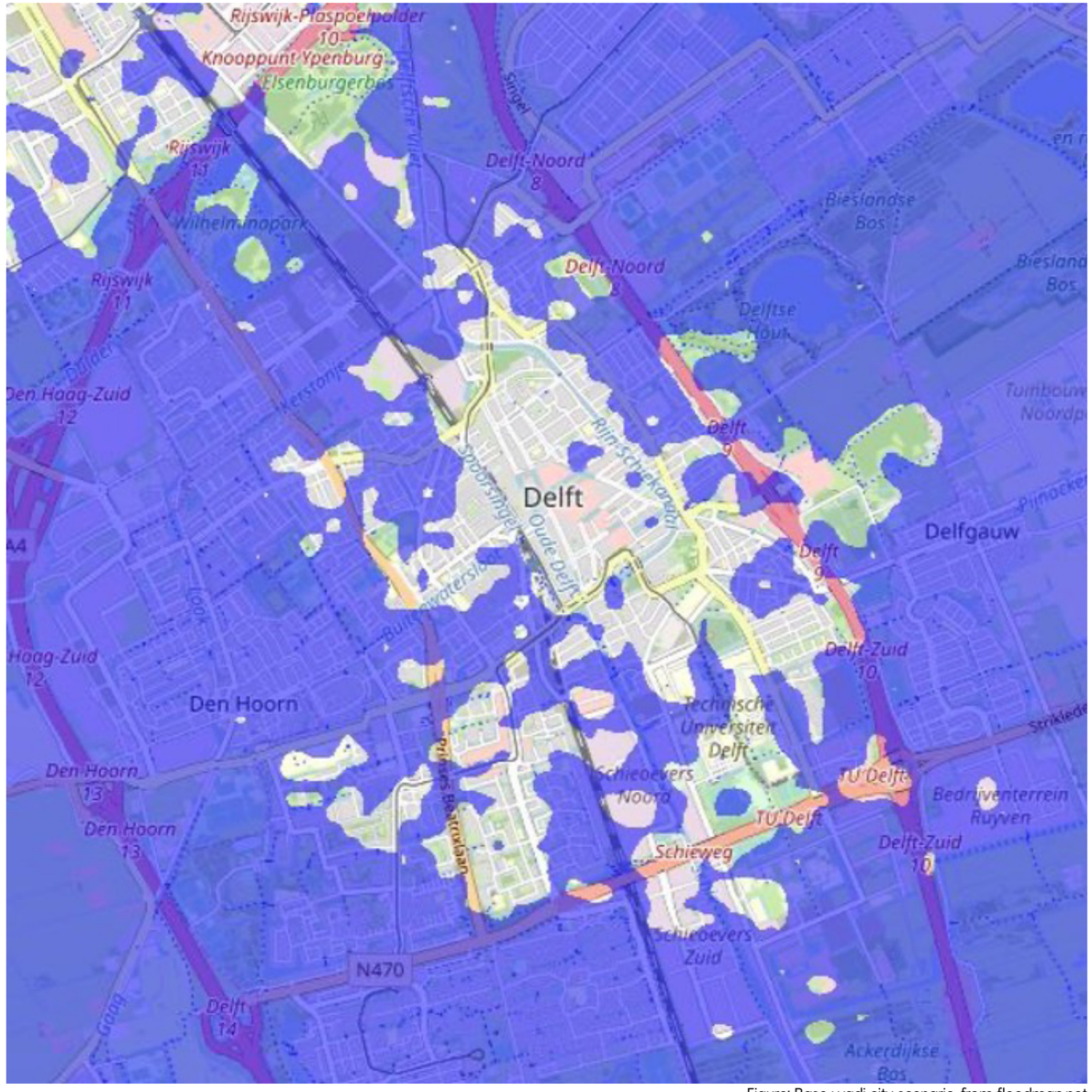
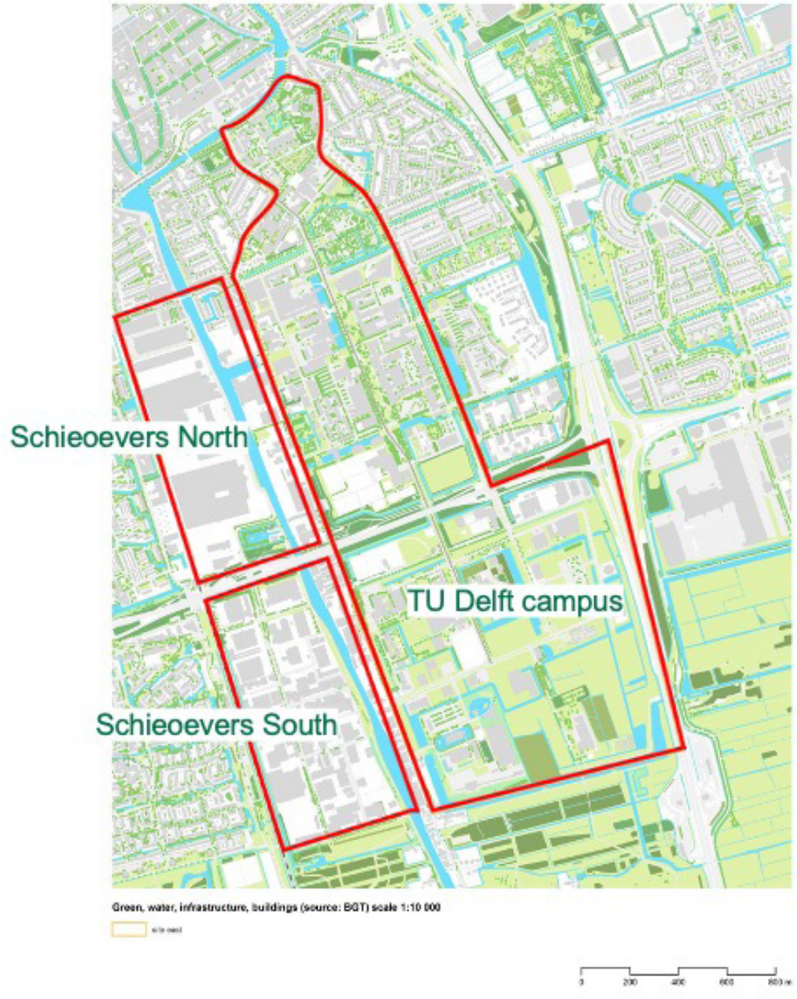


Figure: Base wadi city scenario, from floodmap.net

With a 3-meter sea level rise, an island city is formed. This is what it could look like if the sea level rise continues.



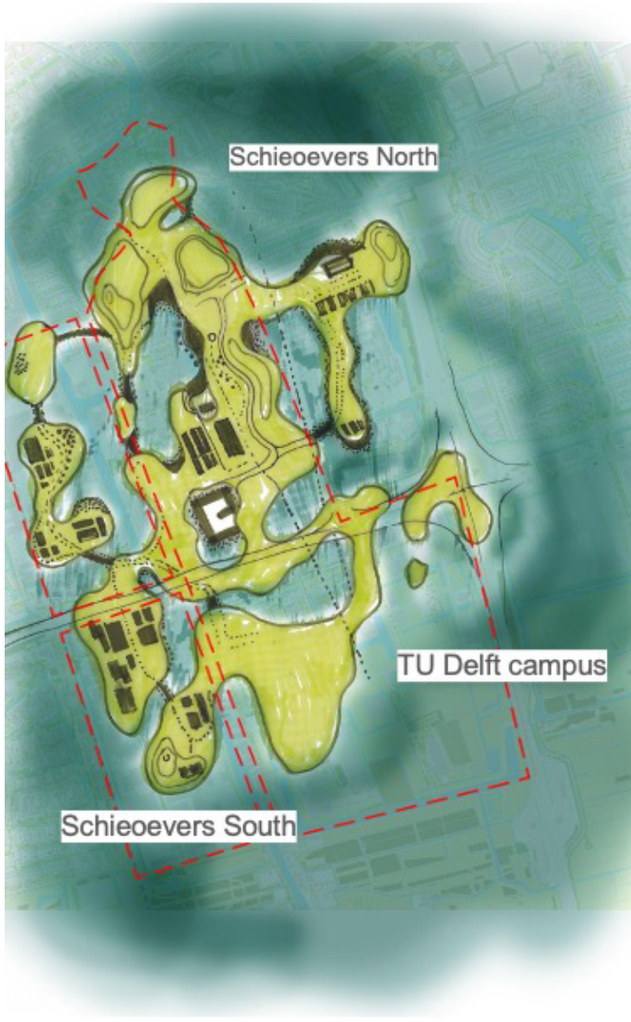


Figure: Potential island city

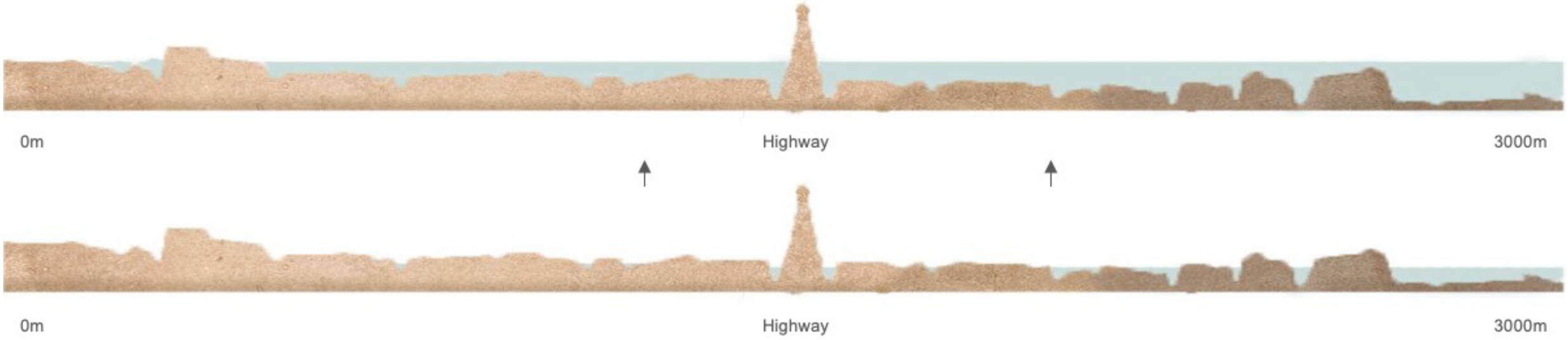


Figure: Section showing the effect of sea level rise

The sections above visualise the difference in elevation on the TU Delft campus from north to south. The peat landscape to the south is lower. With the sea level rise, it could flood. This is shown in the upper section.

This visualisation envisions a possible transition of the TU Delft campus. As we expect this area to flood more, animals and humans should coexist, together with the water. More layers in the landscape are needed, for all current and new species in the urban environment. A more saline habitat should be considered while still aiming for a nice mix of functions for students, residents, and the university.

Figure: Visualisation TU Delft Campus by authors

In a flooded 10-meter sea level rise scenario, the resilience of the landscape must be explored. This shows that the (re-)design of the campus must be adaptive.

Green infrastructure, elevated buildings, and floating bridges must be explored. In this adaptive design, public space for recreation must be included as well.

Apart from this, the current species must be considered, how can safety and shelter for the native species of birds be ensured? All these adaptive systems must be considered.

Figure: Visualisation TU Delft Campus by authors

This future scenario is quite apocalyptic and looks utopian. As an extreme sea level rise could happen, design principles must be explored now to make a less chaotic scenario in the possible future. One of those design principles is to keep (while enforcing) the existing buildings and transform them into a hub to link floating buildings around them. In this scenario, flooded infrastructure will be the norm. This shows that it is needed to start thinking about all these aspects related to sea level rise.

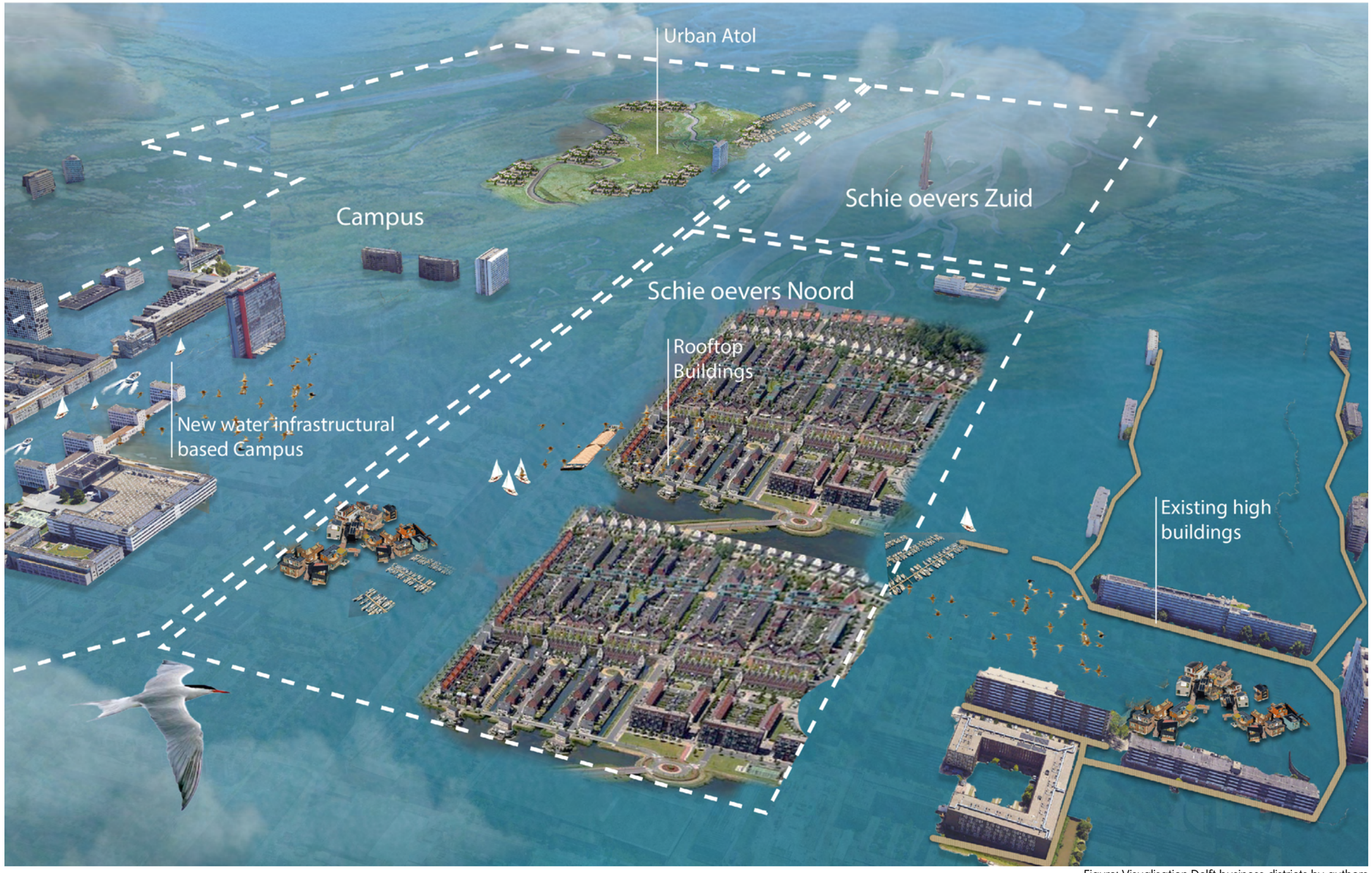


Figure: Visualisation Delft business districts by authors

Here, the Faculty of Architecture and the Built Environment, TU Delft, is shown with a one-meter sea level rise. Opposite the faculty, the former chemistry faculty is located. This building will partly be demolished for redevelopment of the site. Instead of rebuilding this location, it could be used for water collection, with floating buildings

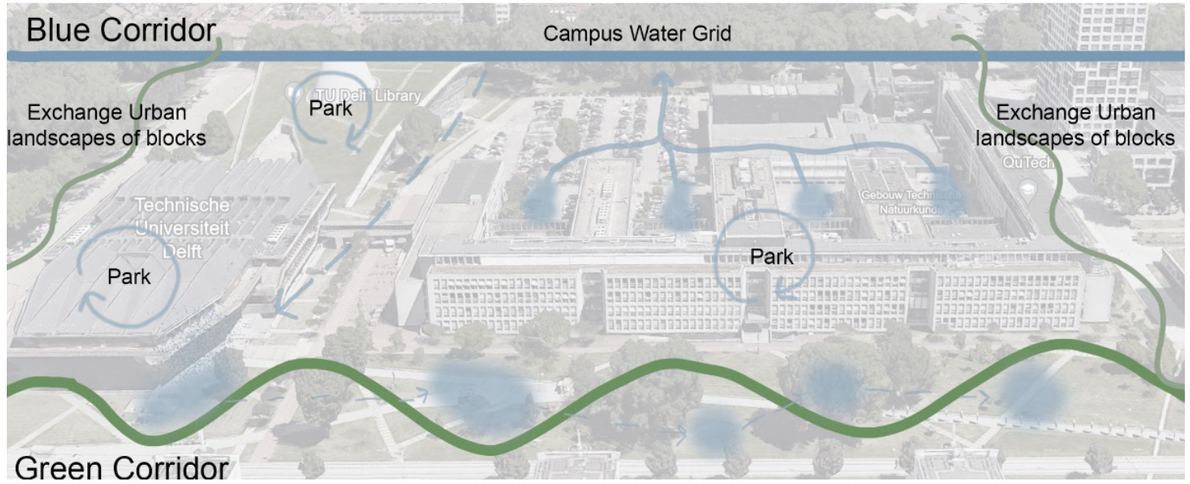
Figure: visualisation Faculty of Architecture and the Built Environment by authors

Waterbodies can also be integrated into the scenery near the TU Delft library. This design principle can be applied in other areas as well. Depending on the location, it can synergise with transportation methods or recreational functions.

Figure: Visualisation TU Delft Library by authors

With extreme sea level rise, integration of ecology and the landscape inside buildings might be needed. A potential integration of the landscape and architecture is about the connection of the landscapes and the buildings and the user's experience. The Figure on the next page above shows an example of the bigger scale, in the campus vision, these different blocks (islands) can be formed. By making use of the climate and the natural systems of the water in essence, filtered rainwater can be reused for flushing toilets. Users can experience a nice water wall, which later on can be stored in the Mekelpark which is elevated.

On the building scale, the open structures of buildings are important. By only using these open structures, the connection to bring the outside world in can be made. Insulation boxes can be made in the open grid. By this, the zone linked to the inner courtyard becomes a transition zone, the 'natural in-between place' from the inside to the outside. The rest of the building is the climatised zone. Water is an opportunity, for example for helophyte filters, making people aware of the processes happening. This is good for their mental health and relates to the climate problems. People see what is happening with water and this principle emphasises their connection with water.



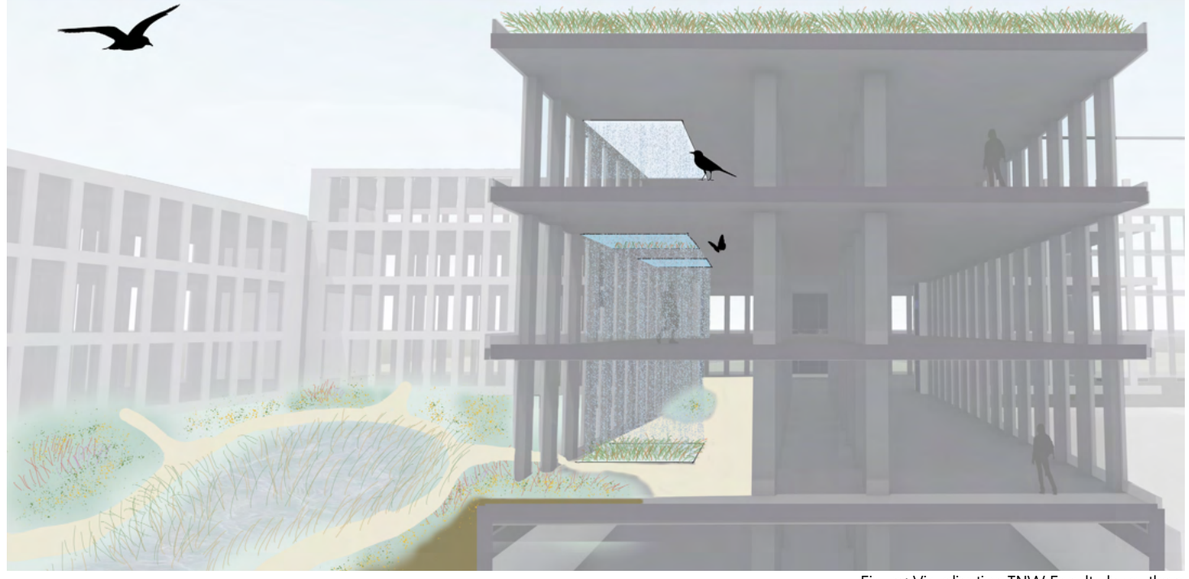
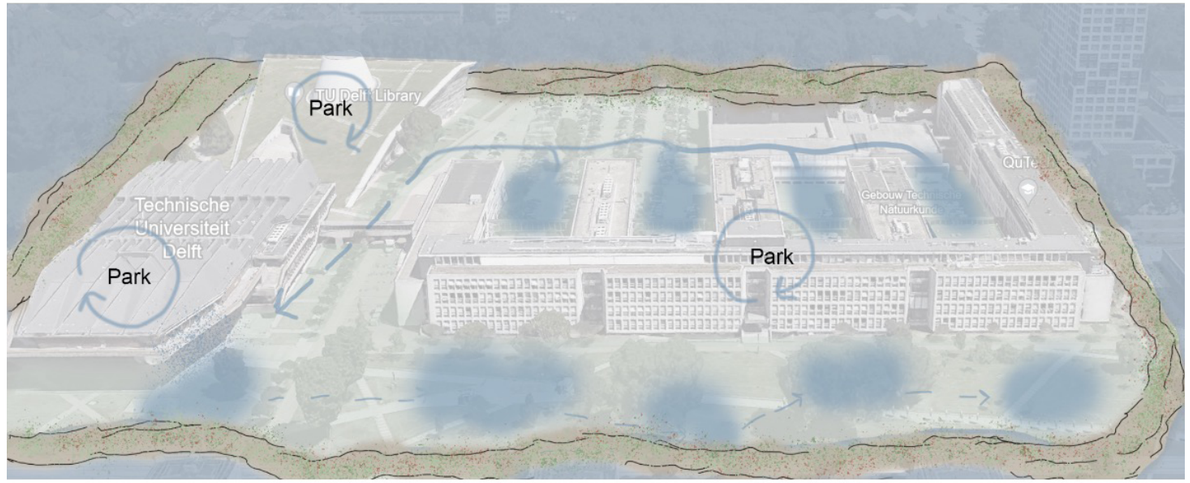


Figure: Visualisation TNW Faculty by authors

In the island city scenario, neighbourhoods are created by forming multiple buildings as a block while still thinking about the landscape and all the buildings as a whole. This phase is about awareness. Groundwater is levelling up. In the island city, floating paths and objects are introduced. In this principle, the whole building can still be used, but all the users are aware of what is happening, they think about the future.



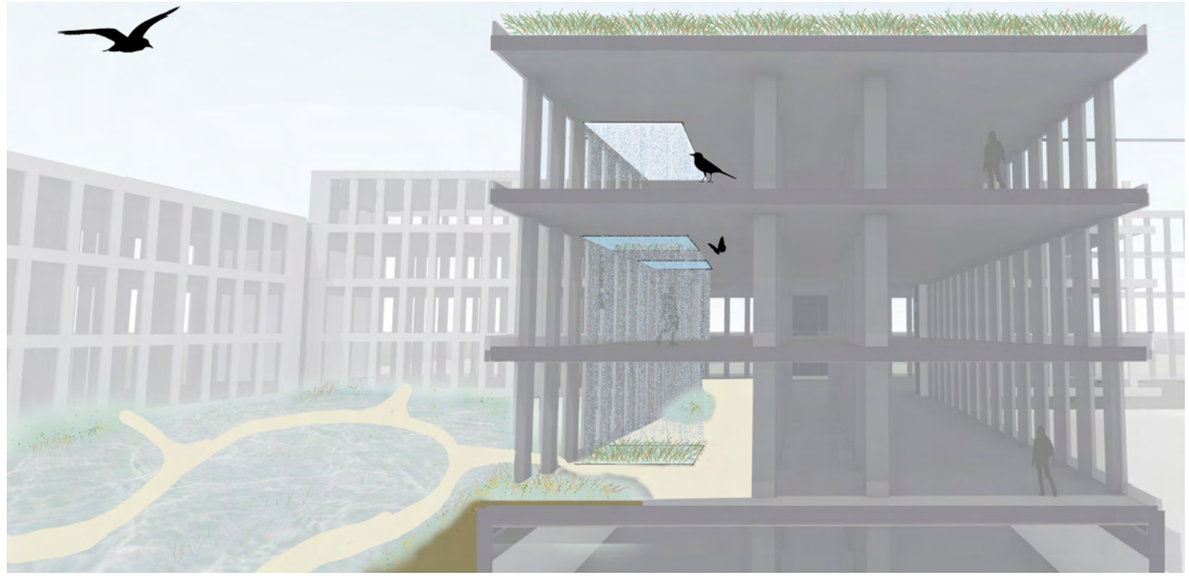
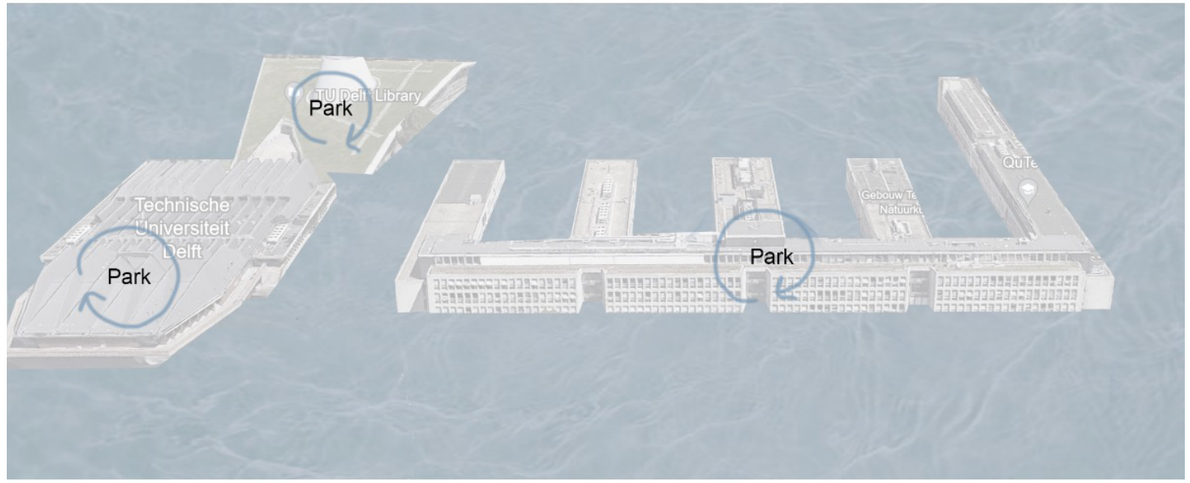


Figure: Visualisation TNW Faculty by authors

In the most extreme scenario, everything is flooded. The open structure and flexibility of the building are crucial in this phase. Until now, the natural in-between zone was between inside and outside, but now it is also horizontally oriented. For animals a different, new place is created with a different climate, a lot of safety and protection. Humans move up, together with the water. Modular boxes can be used to heighten the buildings. The natural in-between place is a new place to connect to the modular boxes on top or the side. Built volumes are enlarged.



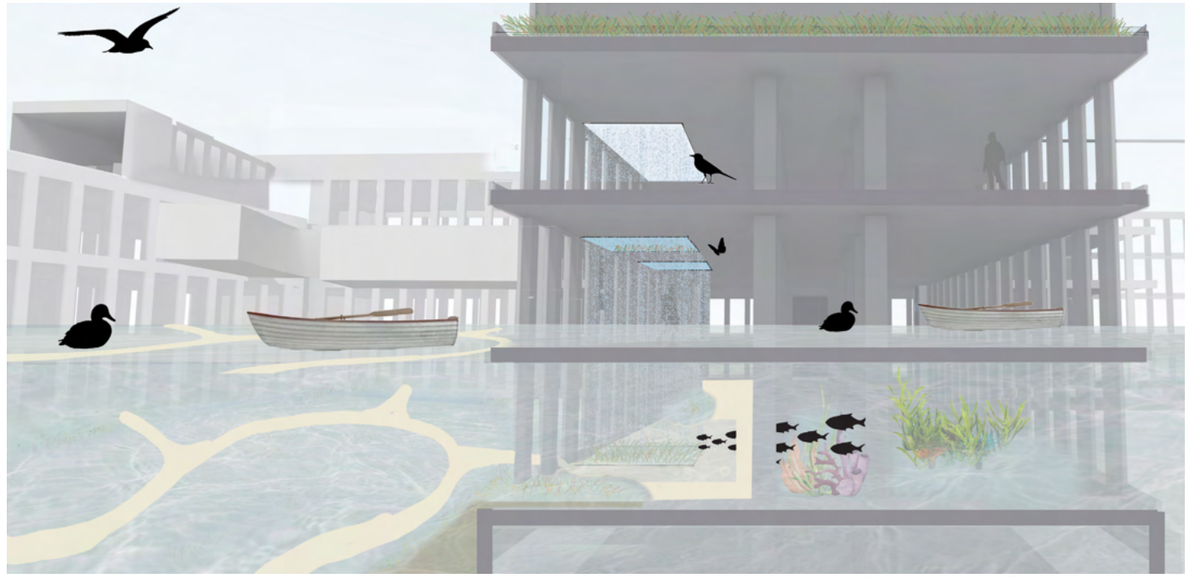


Figure: Visualisation TNW Faculty by authors

Figure: TU Delft South by authors

The Figure above shows the South part of the TU Delft campus. Plans are currently being made to redevelop this part of the campus. It is a very interesting area, as it is the lowest part of Delft. What if there will be a one-meter sea level rise? Water flows to the lower part, so there will be more water here. A bigger wadi will be formed here. For this design principle, the options for the reactor building are explored.

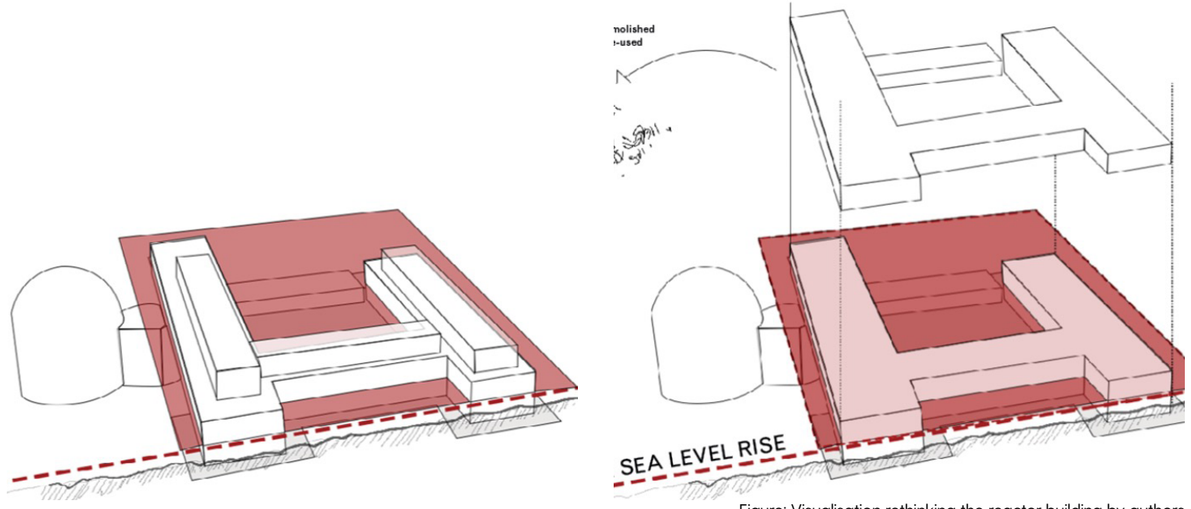


Figure: Visualisation rethinking the reactor building by authors

Imagine that there will be a one-meter sea-level rise. The ground floor is not accessible anymore on the South campus. The first floor will become the new ground floor. By strengthening the current structure, building on top of it is made possible. Floating bicycle lanes should already be functional.

Figure: Visualisation flooded TU Delft South by authors

This Figure on the next page shows a section overview of the proposed phasing, starting with the existing landscape. The middle image shows what happens with the one-meter sea level rise. Here, more activity, such as floating sports facilities, takes place on the water. This vision shows a drastically different plan than what is being planned to build here now.

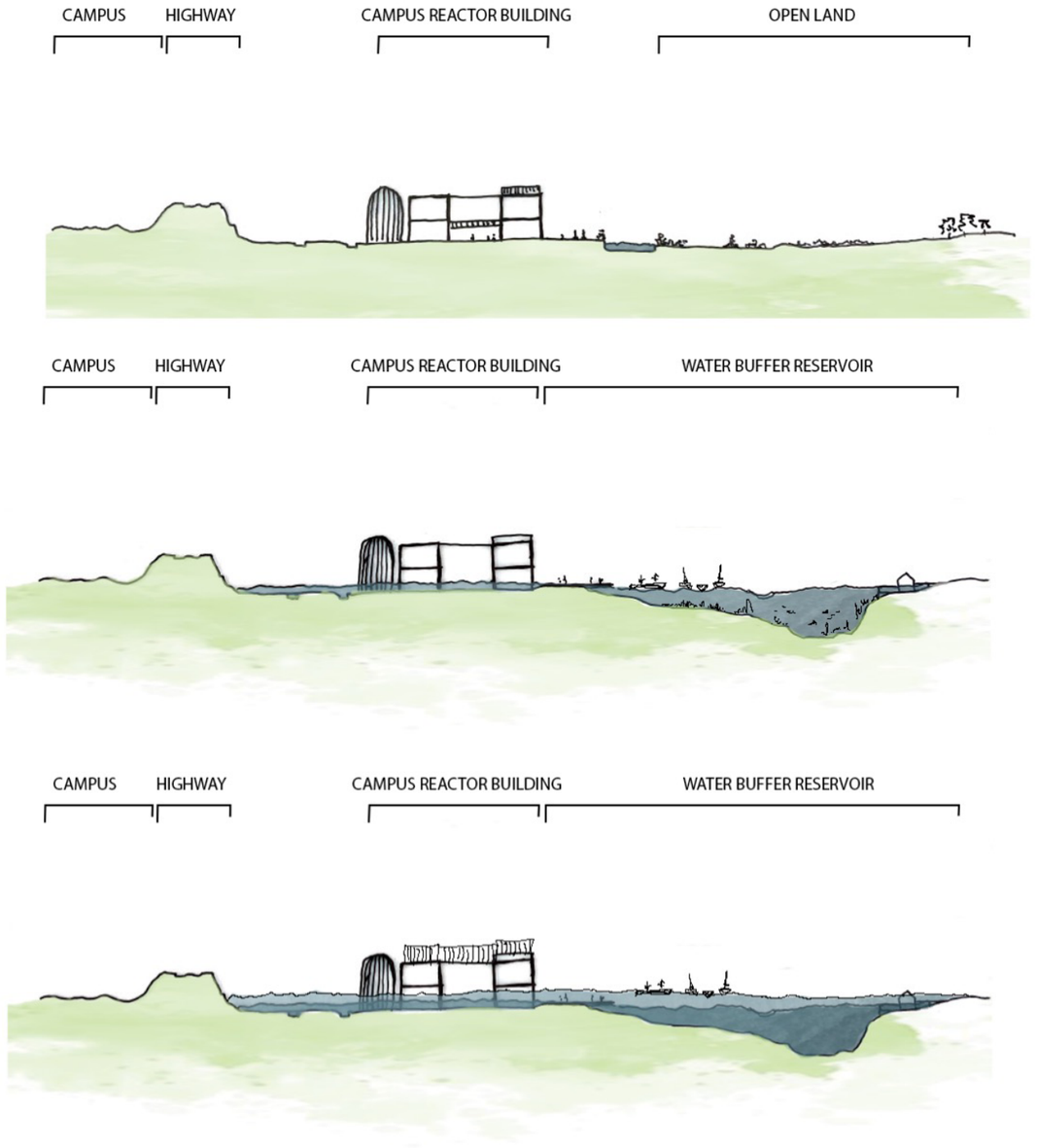
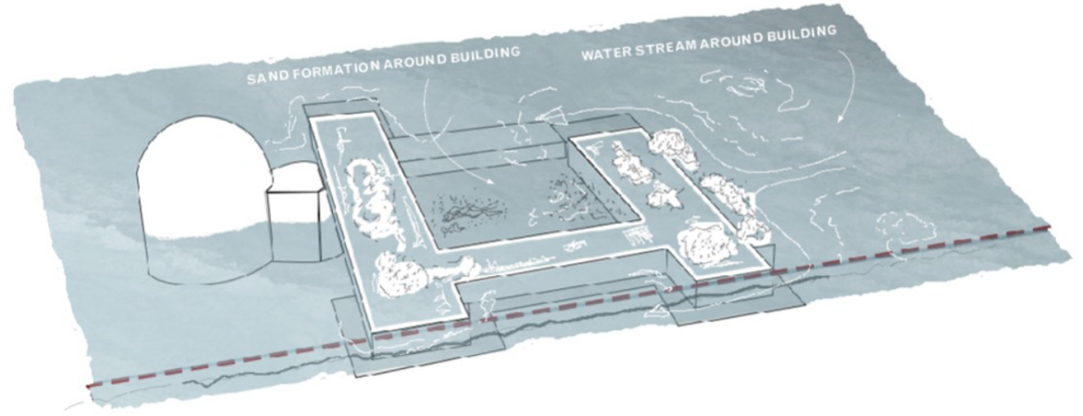


Figure: Section overveiw flooded TU Delft South by authors

With a three-meter level sea level rise, the original structure can be used to form a kind of island. The water is going to flow, sedimentation starts land formation in the courtyard and the building. By using the existing structure as a base, the process is sped up. One can build on top of this island. In this scenario, the building will still be accessible. The next Figures show an overview of how this could be realised. It becomes a flooded area, but still accessible and liveable.



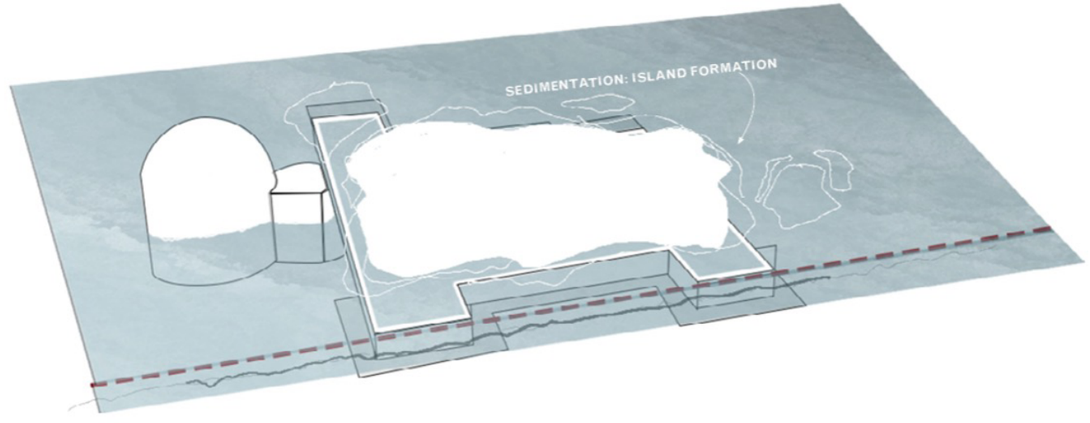


Figure: Visualisation rethinking the reactor building by authors

The Figures on the next page show how to live with a one-meter sea level rise in Schieoevers-Noord. Some of those design principles can be applied to the whole area. A swampy area will be integrated that can be flooded by heavy rainfall. Also, a planted island can store even more water. When streets should be demolished, the concrete can be used to construct islands in the river. Also, sponge islands can be planted. Floating pedestrian bridges are proposed to provide connectivity within the district. It's hard to predict what places will be flooded, but these kinds of design principles can help keep the continued connectivity.

Figure: Visualisation Schieoevers by authors

The canal is going to widen. Temporary buildings will be built next to the water. A new architectural typology is already needed at this point. A modular system is preferred, where buildings are stacked up onto each other. Both temporary and permanent solutions, depending on the proximity to the water are needed.

Figure: Visualisation Schieoevers by authors

Some impressions of what it could look like. The facilities and businesses can remain on the Schieoevers, but they might need to be raised. With every phase of sea level rise, some island formation and floating bridges must be applied. Together with adding functions on pillars.

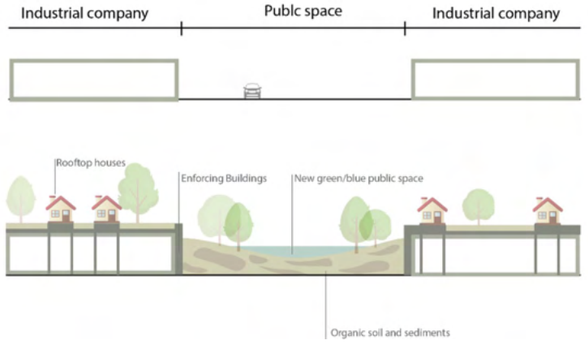


Figure: Visualisation Schieoevers by authors

The scenario with a ten-meter sea level rise shows a very futuristic impression. In this scenario, rooftop houses can be built when the existing structures are enforced. Three different systems must be synergised: the humans, animals, and vegetation. In this scenario, the main transportation will be by boat. Futuristic, as it might happen in the future.

Figure: Visualisation Schieoevers by authors

The Figure to the right shows an exemplary overview of buildings, however, it can be applied to the three areas. Modular systems can be used to create flexible buildings that can adapt to changing conditions. The idea is to choose specific buildings within the area and transform them into an open grid. When water comes in, certain buildings will flood, and these buildings can transform into flexible systems. For example, if a primary school would flood, then the primary school can be moved into this building. But another function can also be put here, using the flexibility of the system.

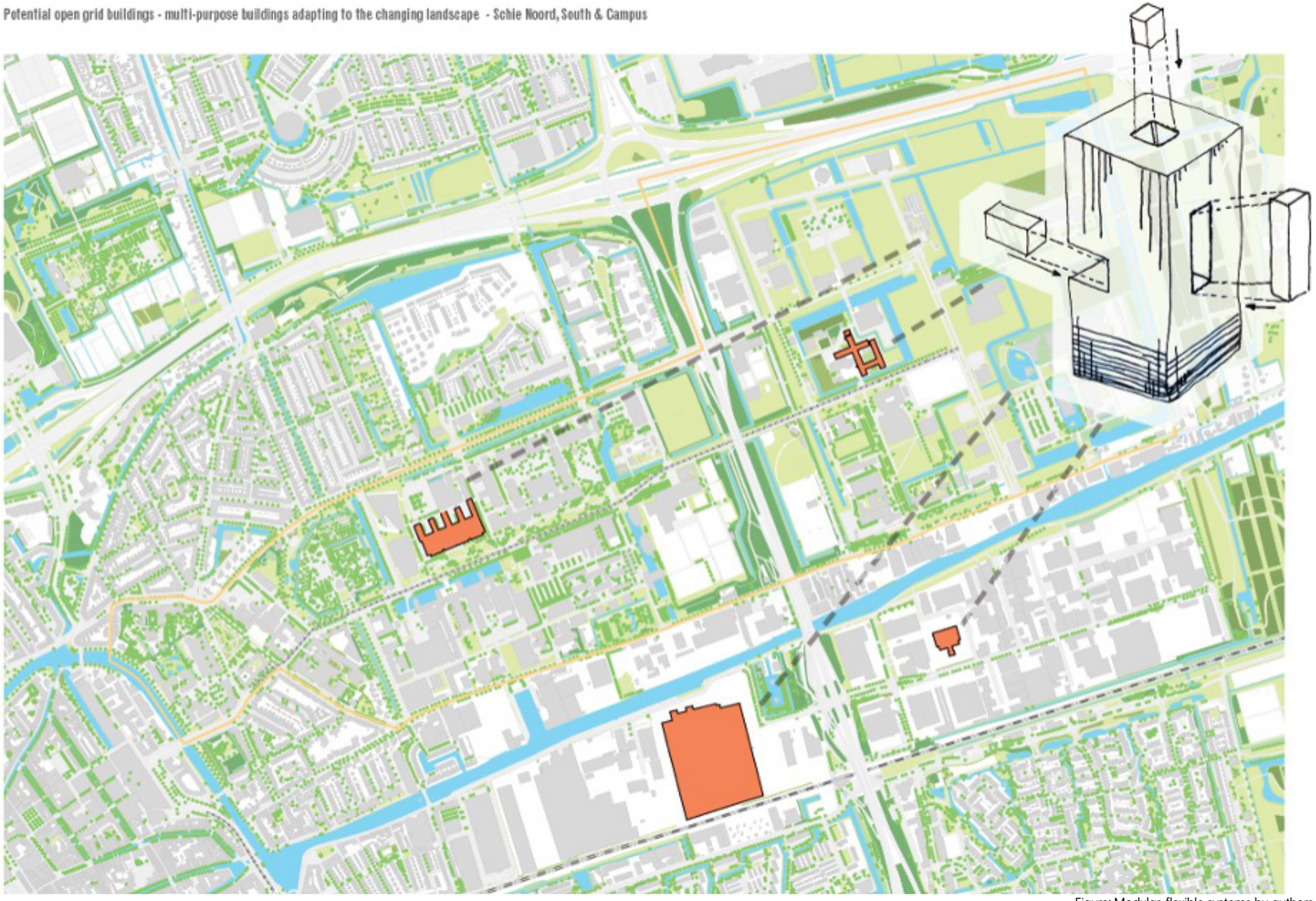
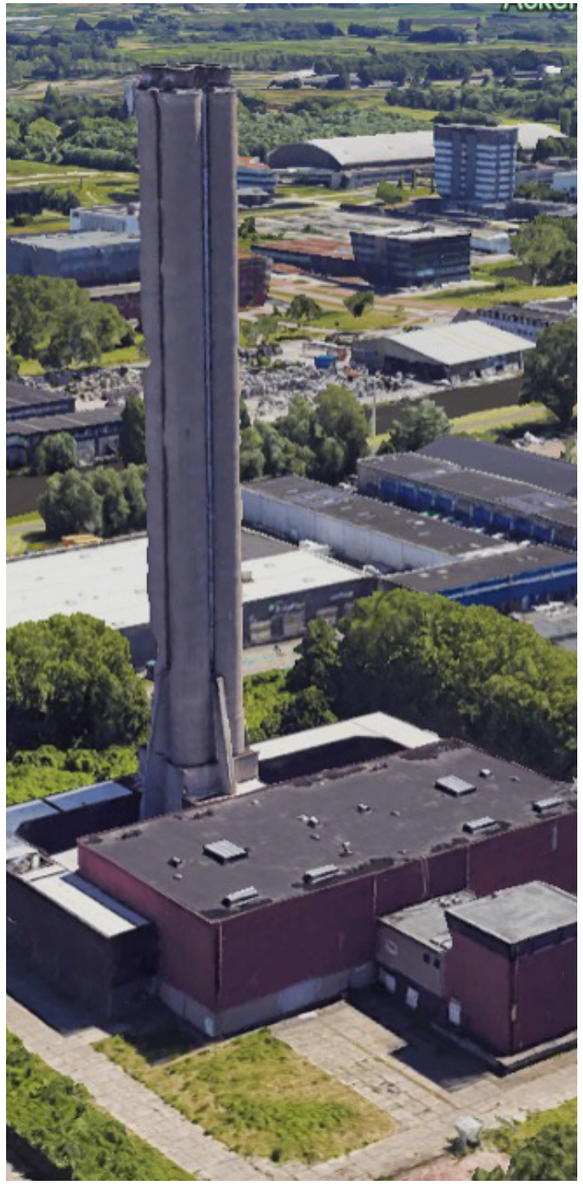
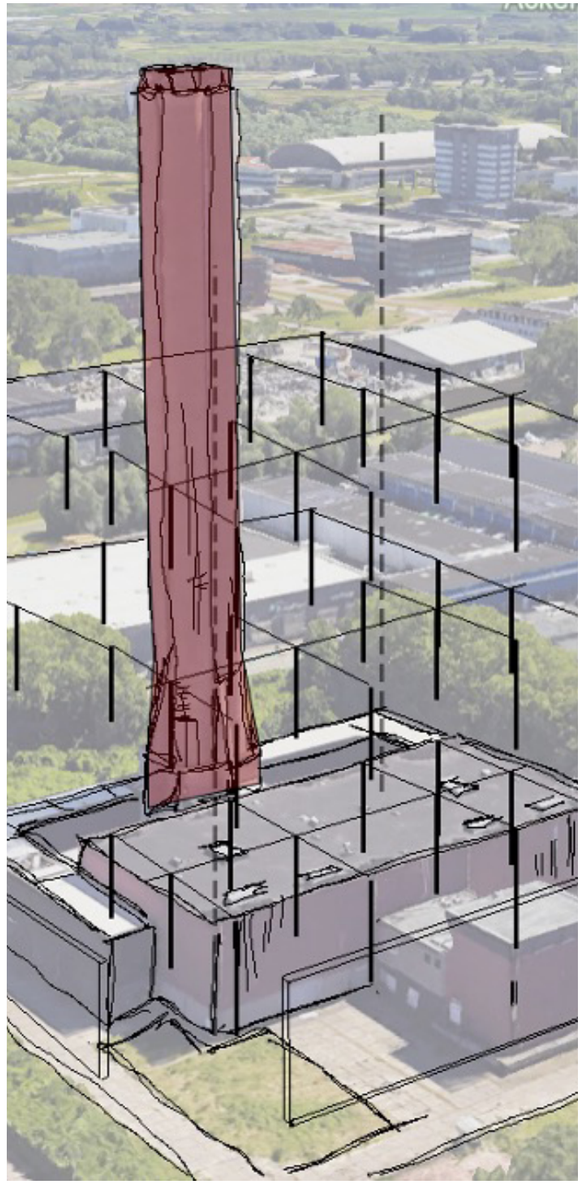


Figure: Modular, flexible systems by authors

For example, this chimney in Schieoevers South will be demolished, however, it has a lot of potential because of its height. This is what it could look like if you integrate this open grid. By adding this, there is more flexibility in functions to house here.





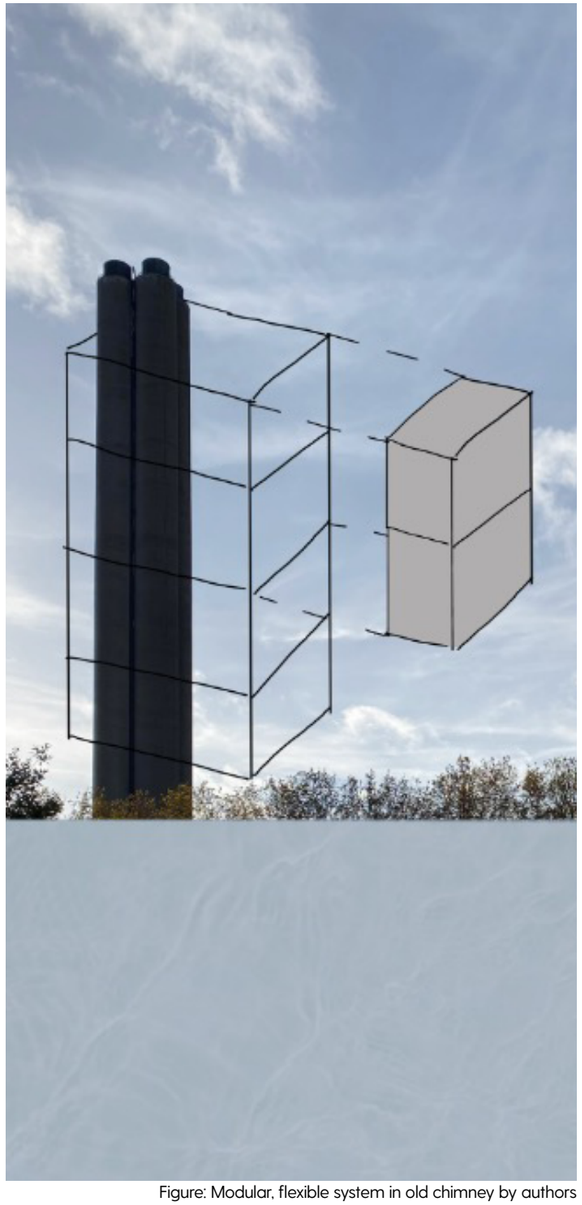


Figure: Modular, flexible system in old chimney by authors

In the proposed transition, the current (urban) landscape typology is transforming, new habitats are being formed. It's important to consider preserving existing habitats and the species that inhabit them. New peat formation is expected, and it's essential to think about what came before us and what species and plants were found in the area then. Biodiversity is currently declining, and it's crucial to take action to preserve local species.

Possible actions include planting plants that absorb heavy metals from the local environment. It's important to save wild plants and enhance the diversity of soil and nutrients. Biotechnologies such as bacteria mineralisation processes can be used to shape the landscape.

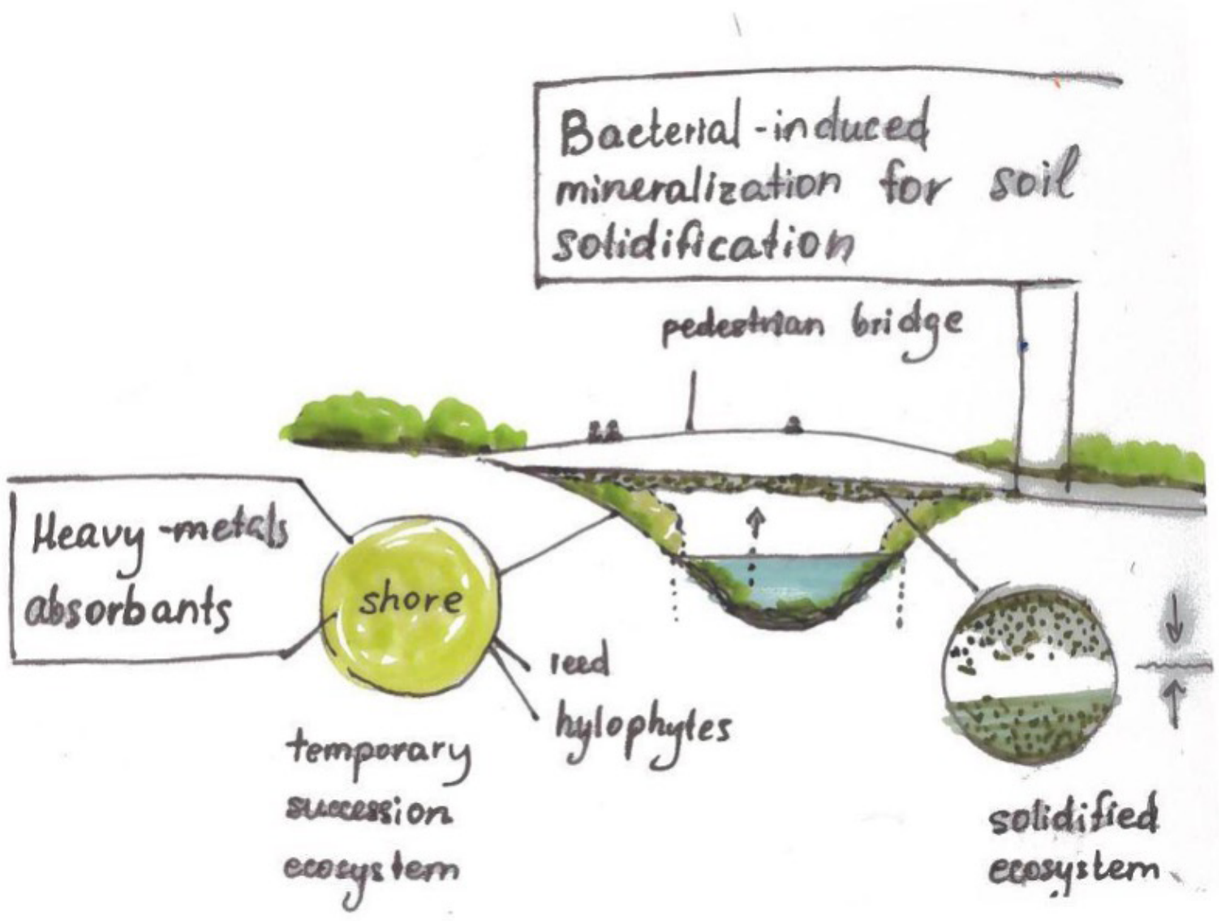


Figure: Ecosystem transformation by authors

CONCLUSION

The study and design explorations presented are meant as a reflection, to show some future ideas. This charette week was not meant to predict flooding or present scientific models about this. The outcomes aim to provoke a different way of thinking to deal with the current design and planning of our cities in three different 'what if' scenarios.

Six lessons learned from these design explorations:

1. The future doesn't stop in nine years when the Workscapes of the Future national programme is finalised. Dare to look further into the future. Investments made today will have an impact 50 years from now.
2. We must understand the environment on different scales, from systems and habitats to species.
3. We must include process planning that adapts to biodiversity, changing water levels, changing companies, and modular systems into our design task.
4. Let go of the boundaries. We are being pushed to let those go and think outside the box.
5. Regarding the water system level, we need to consider the potential and limitations of existing natural resources when designing urban ecology projects.
6. All new developments should either be: floating, able to elevate, able to adapt and rebuild (modular).

How can we live with the water, floating, flexible, demountable, modular? On poles or islands? For buildings, infrastructure, and spaces? Existing buildings and new buildings can both be designed with these principles in mind.

It's important to test new ideas and techniques, to see if they can be applied in the future. This should become our expertise, specialists in this field are needed. Because if not now, they will be needed in the future. These are multiple research lines that need to be picked up right now. Linking this theme of sea level rise to all TU Delft faculties, other universities and existing companies, can help create a collaborative effort to tackle these issues. There are a lot of business opportunities, and we need innovations for this as well.

Regarding salt and freshwater, now all the water from the rivers flows into the North Sea. It's possible to create a freshwater bubble by catching the water earlier on and pushing saltwater out. This can help with growing crops and other vegetation. Sewage, electricity, and mobility are all important considerations when designing future-proof projects. It's important to explore innovative solutions for these issues. We need to start research on how to do this in or on water. How can we use waste flows for island formation and create urban atolls? What about fresh water? If brackish water comes in, what about food production? How is that happening in Westland? There are floating bridges in Norway where they must cross fjords. Why isn't there a start-up company on the TU Delft campus that does floating walkways?

It's important to consider the potential and limitations of existing natural resources for future-proof development plans. Building areas higher could be a solution to prevent flooding and ensure water safety, but it's important to consider the impact on the environment and the community. Allowing water to come into the polders and forming peat in it can help with water management and sedimentation.

A Blue Village on the TU Delft campus is needed to facilitate this research.

Figure: Visualisation Workscapes of the Future by authors

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