Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	**Maaike Dijkstra**
Student number	5951461

Studio		
Name / Theme	Metropolitan Ecologies of Places	
Main mentor	Kristel Aalbers	Environmental Technology and Design
Second mentor	Remon Rooij	Spatial Planning and Strategy
Argumentation of choice of the studio	MEP fits my project because I am interested in water problems and ecology in the Netherlands. The Netherlands will become more wet because of rising sea levels and we already face other water problems as well. I am interested in the question of what we as urban designers could do to keep the Netherlands safe and healthy in the future. Furthermore, I like to look through the scales and see how interventions on different scales affect each other.	

Graduation project	
Title of the graduation project	A design towards a water resilient landscape: Integrating nature-based solutions for a sustainable water system in Flevoland
Goal	
Location:	Flevoland
The posed problem,	Flevoland, as part of the IJsselmeer region and with the IJsselmeer as its largest freshwater supply, faces increasing challenges due to climate change. Extreme weather events will result in excess water and prolonged droughts, threatening the balance of the province's water infrastructure. Despite maintenance and investments in technical solutions, the existing water management systems are reaching their capacity. The loss of ability to deal with these extreme weather events and other related water problems poses a risk to the

	liveability of the region (Ministerie van Infrastructuur en Waterstaat, 2025). These issues will be compounded due to soil subsidence in clay and peat areas, which is driven by prolonged drainage to maintain dry soil for better land use. This not only stimulates the sinking of land but also accelerates the impacts of climate change and could reach a tipping point where adaptation is not possible anymore. The rising sea levels put more pressure on the IJsselmeer and Markermeer. If these lakes have higher water levels, they will increase the water pressure, intensifying seepage and salinisation, impacting different areas in Flevoland and are predicted to reach further inland, threatening the agricultural lands and the freshwater supply (Verzilting door zeespiegelstijging – Klimaateffectatlas, n.d.). Without integrating interventions, Flevoland risks environmental and social consequences as these challenges intensify in combination with urban growth in the coming decades.
research questions and	How could nature-based solutions be utilised to enhance the water system in order to improve the resilience of Flevoland? Sub-questions: What are nature-based solutions? Water system: Water quantity: What is water shortage? What is water nuisance? What are the consequences of these problems for Flevoland? Soil health: What is salinisation? What is water nuisance?

	What are the consequences of these problems for Flevoland? Water safety: What is flooding? What are the consequences of this problem for Flevoland? Flevoland: What are the characteristics and historical background of Flevoland? How is the water managed in Flevoland? Stakeholders: What are the different stakeholders in Flevoland? Which nature-based solutions could be used for which specific water problem? What will Flevoland look like in 2050 if there are no new interventions? What will the future of Flevoland look like in 2050 after the implementation of nature-based solutions for water problems?
design assignment in which these result.	The desired outcome of this research will be a pattern language that shows the relations between the patterns and the IJsselmeer region. The patterns fit the IJsselmeer region and show an overall vision for the whole area. Then, there will also be more specific locations with a certain combination of patterns in the focus area, Flevoland. So, the patterns work on multiple scales and show a vision for 2035, 2050 and 2100.

Process

Method description

To answer the main research question: 'How could nature-based solutions be utilised to enhance the water system and improve the resilience of Flevoland?', the research focuses on three parts of the question. These are the nature-based solutions, Flevoland and its water system.

The research approach is based on a systemic design, with a constant switch from theory to design. The research consists of three stages, as visible in the diagram (fig. 7). The first

stage is the basis for the other two. To answer the last stage of the research question, the second stage needs to be answered as well.

The first stage: literature review and mapping

The first stage of the research is focused on understanding the main topics of the research question. These topics form the basis of the research and explain the definition of each element. The literature review consists of four topics, being:

1. The meaning of nature-based solutions
2. The definition of the water problems with an explanation related to the water system
3. The characteristics of Flevoland
4. The stakeholders

These four topics have specific sub-questions and are shown in the blue boxes in fig. 7:

The first being nature-based solutions:

- What are nature-based solutions?

The definition of nature-based solutions is based on research papers. This question is answered in the theoretical background and is a starting point for the development of the pattern language.

Water system:

The water system has three sub-categories: water quantity, soil health and safety. These problems need to be defined in the location of Flevoland to understand the context of these problems immediately. The water problems are explained through maps, policies, research papers, and knowledge from the waterboard Zuiderzeeland.

Water quantity focuses on the questions:

- What is water shortage?
- What is water nuisance?
- What are the consequences of these problems for Flevoland?

Soil health focuses on the following questions:

- What is salinisation?
- What is soil subsidence?
- What are the consequences of these problems for Flevoland?

Water safety focuses on the following question:

- What is flooding?
- What are the consequences of this problem for Flevoland?

Flevoland:

- What are the characteristics and historical background of Flevoland?
- How is the water managed in Flevoland?

Stakeholders:

- What are the different stakeholders in Flevoland?

These questions are answered with policy documents and with an analysis of the region. The questions are split up into two chapters, and combined at the end of the chapters into one map.

The second stage:

The second stage of the research consists of the conclusion of the problem analysis and the start of the design of patterns for NbS. There are two questions related to this part of the research, the first question being:

- Which nature-based solutions could be used for which specific water problem?

The patterns are shown in the pattern book. The pattern book visualises the relations between patterns and Flevoland.

The goal of the patterns is that they could solve multiple problems, even though it may be possible that some patterns could only solve one problem. The patterns will follow from the definition, policy documents and literature review. The patterns also indicate possible difficulties, such as problems with stakeholders, costs or other problems.

The other half of this stage is based on the conclusion from Flevoland:

- What will Flevoland look like in 2050 if there are no new interventions?

In this question, the focus will be on the scenario without interventions. It will show the synthesis of the analysis of the water problems and Flevoland, combined with the effects for stakeholders.

The third stage (the pink box):

The third stage is the combination of the patterns (solution), maximisation and the tasks for the province. The patterns explain the options for the nature-based solutions, while the maximisation combines the different patterns in a specific location. This is then combined with the different challenges, such as ecology and urban expansion. The design goes back and forth between study and design. It focuses on the following question:

- What will the future of Flevoland look like in 2050 after the implementation of nature-based solutions for water problems?

This question is answered in the design and strategy chapter, and shows the integration of the maximisation strategy. This is combined with a governance chapter to show the different phases of the project. It will also explain how different stakeholders have different needs or certain roles in the future to reach the goal of a resilient Flevoland.

Pattern language:

The pattern language is used to show the different options of nature-based solutions with an explanation of how they work, on what scale they are applicable and for which problem they

could be used. Each single pattern will have a hypothesis, a theoretical background and practical implications. These three components show how and where a pattern works. It will also indicate specific problems, such as stakeholders or other difficulties. Furthermore, each pattern shows the relation between other patterns and problems.

By structuring these in a pattern field, it becomes visible which solutions could work together and which do not. At the beginning of the pattern book, there will be an overview of all patterns, and it will show the relationship between patterns.

After categorising the patterns, they are used in the maximisation and the vision making of Flevoland for the scenarios of 2050.

Maximisation:

The maximisation method includes two stages: maximisation and integration.

In the first stage, the maximisation proposal is built on the most desirable result for the five different water problems. The integration combines nature-based solutions for the water problems and introduces ecology, agriculture and urban expansion as other external topics. The integration will be combined with a governance page to explain the different stakeholders related to the interventions. The governance part will also explain the phasing of the nature-based solutions in combination with the policies that are needed to achieve the implementation of NbS.

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Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

My graduation topic is part of the studio Metropolitan Ecologies of Places in the urbanism master track. My graduation topic fits MEP because it is a systemic design that fits the ecological parts of the graduation studio. My project is about the resilience of the IJsselmeer region focusing on the water problems in the area. Water is a flow and has a lot of connections with the areas surrounding it. Furthermore, my project will be a design in the end, working with three scenarios where the patterns come together and create a vision for 2035, 2050 and 2100. The project is more on the landscape scale and focuses more on landscape elements, but the focus is from an urbanism standpoint. I look at the spatial implications of nature based solutions in the spatial planning.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework?

My graduation work could be used as an inspiration and exploration of nature-based solutions in an area where there are not that many projects with NbS yet. By researching NbS, it could give a new vision where the IJsselmeer region can live with water and make the IJsselmeer region resilient, so that people could still live there in the future.
On a social perspective, my project will cause discussion because it is not a conventional solution. Farmers will probably have to adapt their way of agriculture and there needs to be a change from a political standpoint as well because the focus of my research is not on technical solutions. This could cause problems but also shows new possibilities for the future.
Furthermore, my research uses the pattern language/field as a research and design tool for nature-based solutions. The pattern language explains each pattern and their connections to others. In this way, you can see clearly what will and what will not work together. Furthermore, the scenarios of different periods in time will show that not everything is possible in a certain time period but can work in the longer run.