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.

Personal Information

Name	Jenna Zuidmeer
Student number	4865804

Studio

Name / Theme	Architectural Engineering	Flow & Stock
Main Mentor	Thomas Offermans	Architecture
Second Mentor	Luca Iuorio	Research
Third Mentor	Arie Bergsma	Building Technology

Argument of choice of the studio

The architectural engineering graduation studio thrives on the fusion of imagination and fascination, whilst guiding the quest for practical solutions. This dynamic interplay allows architecture to emerge as a response to significant societal challenges. By unveiling the intricate layers of the research and design process, the studio aims for a comprehensive outcome that encapsulates both creativity and functionality.

Graduation Project

Title of the graduation project

Rethinking by Design: Envisioning a Future Where Dikes Become Dams in Hoedekenskerke, Zeeland

Goal

Location

Zeeland, the Netherlands

The posed problem,

Sea-level rise, the ending life cycle of water defence systems, and the lack of tools provided by the adaptation strategy on an urban and human scale.

Research questions and,

The study's main research question is:
'Since the sea levels are rising and the life cycle of water infrastructure is ending, is there a new way in which we can adapt hydraulic infrastructure to live in harmony with water?'

To further explore the topic, the sub-questions are:
- Which parts of Zeeland are more at risk of flooding based on the probabilistic method?
- What are the consequences of flooding on an urban scale?
- What is the spatial relation between the hinterland and water infrastructure in Hoedekenskerke, Zeeland?

Design assignment in which these result.

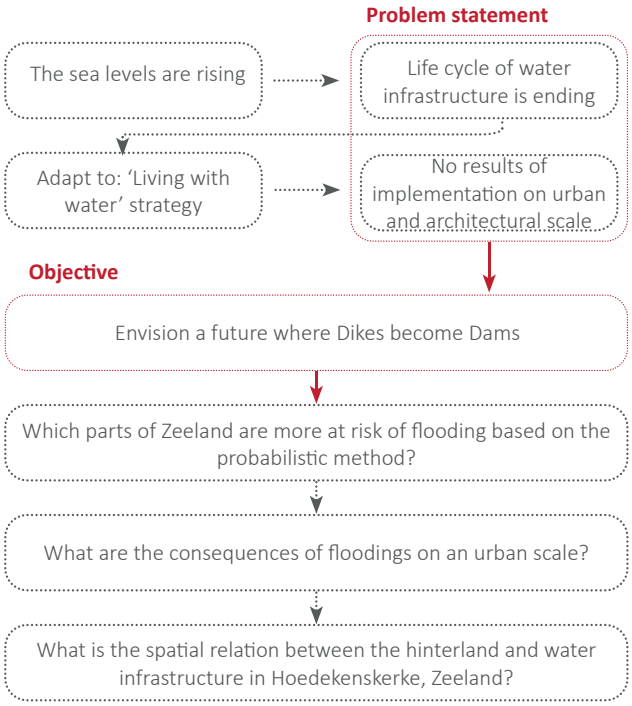
Overall design question:
'What is the future role of dikes concerning the hinterland of Hoedekenskerke, Zeeland?'

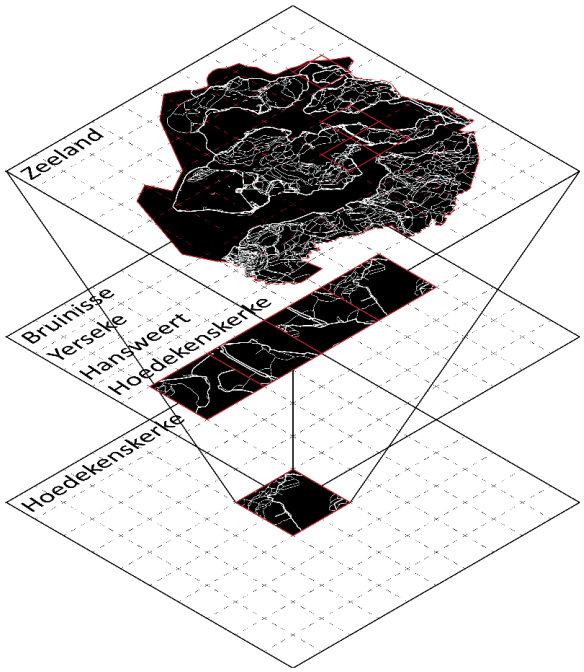
The overall objective of the graduation project is to envision the future in which the Living with Water adaptation strategy by Deltares is implemented, to rethink the primal function of water defense systems and cope with the inevitable circumstances, particularly sea level rise, through architectural design. Simultaneously the research aims to contribute valuable knowledge and recommendations for sustainable water management practices in the face of climate change. Additionally, it seeks to provide a deeper understanding of social realities by analyzing the spatial relationship between the hinterland and water infrastructure.

Method Description

The research methodology is both quantitative and qualitative and primarily based on a funneling approach. This method systematically narrows down information through levels of refinement, considering scales from regional to human. The input for the quantitative approach is derived from datasets of the Dutch government and water management institutions, focusing specifically on the province of Zeeland. The findings are presented in the form of diagrams and critical mapping. Additionally, the research takes a qualitative approach to defining the spatial relation between the hinterland and water infrastructure for the case study of Hoedekenskerke. This is done by descriptive research of fieldwork analysis.

Since the **sea levels are rising** and the **life cycle of water infrastructure is ending**,
is there a new way in which we can **adapt hydraulic infrastructure** to live in **harmony with water**?





Layer 1: Consequences of Dike Failure on a Regional Scale
Question: Which parts of Zeeland are more at risk of flooding, based on the probabilistic method?
Research methods (quantitative): data analysis, critical mapping, literature review, and risk analysis.

To evaluate the risk of a dike breach, it is crucial to first establish a knowledge base regarding the most common dike failures, as described by Pleijster et al. (2015). Subsequently, a diagram is generated using data on flood probabilities from the National Water and Flood Information System to pinpoint dike rings susceptible to failure (Rijkswaterstaat; Ministry of Infrastructure and Water Management, 2022). Thirdly, an assessment of dike rings at higher risk of flooding is conducted to identify potential breach locations using the dataset provided by the Legal Assessment Instrumentation for safety assessments of primary water defenses (2019). Subsequently, the same dataset is used to examine the area affected by a potential breach. Based on this evaluation, four urban areas are singled out as being particularly susceptible to flooding in the event of a breach. These areas are selected for a more detailed assessment of the consequences of potential dike failures in Chapter 3.2.

Layer 2: Risk Analysis of Dike Failure on an Urban Scale
Question: What are the consequences of flooding on an urban scale?
Research methods (quantitative): data analysis, literature review, and risk analysis.

This chapter's objective is to investigate the repercussions of dike failure in the urban areas of Bruinisse, Yerseke, Hansweert and Hoedekenskerke, commencing with the identification of the definitive probability of failure at potential breach locations. This determination relies on information sourced from the Legal Assessment Instrumentation for safety evaluations of primary water defenses (2019) and is complemented by flood scenarios provided by the province of Zeeland (2014). Once a clearer understanding of the flooded area is established, the consequences of dike failure can be evaluated.

Utilizing documents from Rijkswaterstaat detailing flood scenarios (Boon, 2012; Bart & Bossenbroek, 2011; Bossenbroek & Bardoel, 2014), the consequences of dike failure are assessed for each urban area based on the flood scenario with the highest probability of occurrence. These consequences are categorized into two aspects: economic damage and the number of casualties. The chapter concludes with a diagram illustrating the consequences of dike failure in the four selected urban areas, a visual representation of this diagram is available in Appendix 7.2. Based on this evaluation, one urban area is singled out with the most pressing need for an adaptation strategy. This area is selected for a qualitative assessment of spatial relations between the hinterland and water infrastructure in Chapter 3.3.

Layer 3: Spatial Relationship between the Hinterland and Water Infrastructure on an Urban Scale
Question: What is the spatial relation between the hinterland and water infrastructure?
Research methods (qualitative): fieldwork and literature review.

This chapter aims to get an in-depth understanding of the spatial relation between the Hinterland of Hoedekenskerke and water infrastructure. Exploring nuances, complexities, and the context surrounding the question. This chapter analyses the dike as a spatial object, a reflection of history, and the faith between water infrastructure and the inhabitants of the hinterland. The dike is a landscape element with a spatial significance based on one's perspective (Hudig et al., 1928). Additionally, the dike embodies Hoedekenskerke's history concerning water management, bearing the imprint of calloused hands that adapted the dike to ever-changing demands. Moreover, the dike resembles the blind trust that inhabitants have in its water-protecting services

Reflection

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)?
Architectural engineering, Stock, and Flow are related to the selected graduation topic. The project is about a future scenario where the primary water defense loses its primal function. 'Stock' relates to the potential of the existing water defense structure concerning the current and future needs. On the other hand, 'Flow' refers to the structure that is seamlessly integrated into its broader system, mirroring the layers of Dutch heritage and the implicit trust that society places in it, as the primary water defense becomes intricately woven into the fabric of societal values.

What is the relevance of your graduation work in the larger social, professional, and scientific framework?
The graduation project holds significant relevance within the broader social, professional, and scientific framework, considering the imminent threat of sea-level rise in the Netherlands. The urgency of climate change necessitates prompt action, as each day of indecision amplifies the risks and costs of mitigation. The research offers insights into the prevailing probabilistic water management approach, where the government mitigates flood risk by maintaining water infrastructure. However, the project takes a distinctive perspective, focusing on minimizing the consequences of a flood. This shift in approach not only raises awareness but also highlights the challenges stemming from the existing political framework.

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