

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	Ganesh Umasankar
Student number	6002463

Studio		
Name / Theme	Metropolitan Ecologies of Places	
Main mentor	Claudiu Forgaci	Urban Design
Second mentor	Alexander Wandl	Environmental Technology and Design
Argumentation of choice of the studio	<p>The Studio Metropolitan Ecologies of places's approach to address climate resilience and sustainable transition focuses on a neighborhood scale and looks for spatial implications. My intention of this project is to choose this approach on a regional level. This focus towards regional scale and developing a strategy would analyze its elements broken down to materials, form, scales, density and networks and rethink the parameters which would create a positive impact on the place. The studio's approach on focusing on a block scale bring in experimentation, exploration withing the specific test site, this would give various iteration and room for evolution process. Rather focusing on un-tangible intervention, this studio would give room for design to evolve in a spatial setting.</p>	

Graduation project	
Title of the graduation project	When Disaster Flows: A systemic overview for climate resilient spatial framework on the Rijnmond delta region
Goal	
Location:	Rijnmond region, The Netherlands
The posed problem,	Water is the basis for any human settlement to thrive. The rise of global warming has increased the frequency of extreme natural calamities in recent years across the globe. Record-breaking heat waves on land and in the ocean, drenching rains, severe floods, years-

long droughts, extreme wildfires, and widespread flooding during hurricanes are all becoming more frequent and more intense.(NASA, 2021) Water is one element that plays a key role in all of these extremities, it includes Heat extremities, Wildfire, Drought, Tropical cyclones, Heavy precipitation, Floods, High-tide flooding and Marine Heatwaves. Natural hazards are deeply intertwined, and if managed separately, can feed off of each other to drive more extreme damage. That's because the climate crisis acts as a threat multiplier. A drought may parch vegetation, increasing the amount of tinder available to spark a wildfire, which incinerates a forested area, releasing CO2 and further increasing the climate crisis in a negative feedback loop. (Vernick D, 2024). The frequency of these extreme climate scenarios is increasing over the years, this brings the urgency to focus on climate resilience alongside disaster resilience. The disaster resilience would involve vulnerability framework and threshold capacity of a region to enhance its spatial conditions

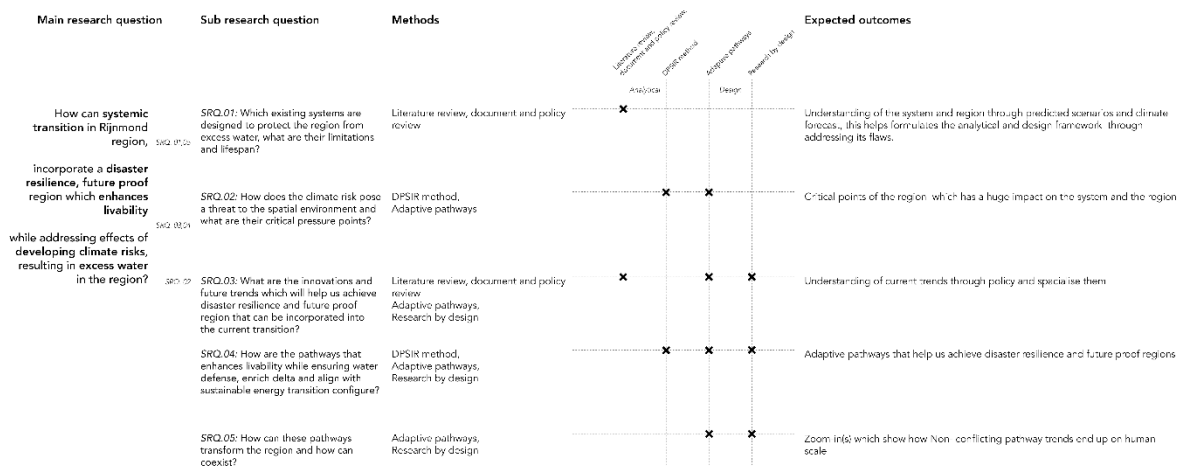
Contextualizing this problem in a geographical location such as The Netherlands were the Policies, strategies and vision plans were made under meticulous research, outliers and ground reality. By 2035, the goal was to enhance the urban quality of life and increase water resilience through green roofs, water retention squares, and even floating urbanization. (De Graaf, R. E., 2009). The Rijnmond region, along with the broader Netherlands, faces significant and complex water challenges that are expected to increase in the future, primarily due to climate change. Adapting to these changes is a crucial, cross-cutting task that affects many policy areas and sectors. The

	<p>ambition is for the Netherlands to be climate-proof and water-robust by 2050. Critical Aspects of Climate Change in the delta region include increasing water levels from the ocean, increasing water level from river (High River discharge), Waterlogging due to heavy rainfall, groundwater issues and freshwater shortages</p> <p>Water safety, water quantity and water quality are prime elements to focus on in these contexts. Additionally, climate change intensifies these effects which we are not prepared for. Ageing Infrastructure which are critical to the main water system and waterway network are over 50 years old and require replacement or they don't meet the operational requirement in the predicted future. A recent assessment (ILT 2023) shows that 62 percent of primary water barriers do not meet the legal standard that must be achieved by 2050, and improvement is urgent for 26 percent of these, particularly in the river area.</p> <p>In Rijnmond delta regions these factors meticulously affect how a resilient future is framed, an integrated, location-oriented approach is required to understand and overcome this situation.</p>
<p>research questions and</p>	<p>Main research question:</p> <p>How can systemic transition in Rijnmond region, incorporate a disaster resilience, future proof region which enhances livability while addressing effects of developing climate risks, resulting in excess water in the region?</p> <p>Sub research question:</p> <p><i>SRQ.01:</i> Which existing systems are designed to protect the region from</p>

	<p>excess water, what are their limitations and lifespan?</p> <p><i>SRQ.02:</i> How does the climate risk pose a threat to the spatial environment and what are their critical pressure points?</p> <p><i>SRQ.03:</i> What are the innovations and future trends which will help us achieve disaster resilience and future proof region that can be incorporated into the current transition?</p> <p><i>SRQ.04:</i> How are the pathways that enhances livability while ensuring water defense, enrich delta and align with sustainable energy transition configure?</p> <p><i>SRQ.05:</i> How can these pathways transform the region and how can coexist?</p>
<p>design assignment in which these result.</p>	<ul style="list-style-type: none"> - Understanding of the system and region through predicted scenarios and climate forecast, this understanding formulates the analytical and design framework through addressing its flaws. - An understanding of the spatial condition of the region set against the developing risks which forms an ideal base for design development. - A Regional strategy that has an integrated approach addressing climate scenarios.

- Strategic outcome on macro scale level which illustrates the regional strategies and shows the design being implemented in the context
- A set of patterns created to build a toolbox to achieve the strategic outcomes derived from both existing literature, policy and future scenarios which are contextual to the region

4.2 Research framework



Process

Method description

Literature review, document and Policy review/analysis

The literature review entails a critical examination of scholarly articles, books, official reports, and academic publications to build a theoretical and contextual foundation for the research. This process allows for a comprehensive understanding of existing knowledge, perspectives, and findings relevant to the topic. It plays a crucial role in shaping the research problem, identifying knowledge gaps, and guiding the direction of the study. Given the research's reliance on complex systems theories such as complex adaptive systems and assemblage theory to analyse cities and regions, the review is instrumental in establishing a robust conceptual framework.

Document and Policy Review

This method involves an in-depth analysis of key spatial planning documents and policy instruments at both regional and national levels. Various governmental bodies have produced strategic plans, climate risk assessments, environmental policies, and disaster management frameworks. These are evaluated critically to assess the trajectory of urban development, uncover institutional constraints, and identify potential inconsistencies, overlaps, or limitations within current policy approaches.

DPSIR method

This approach is valuable for interpreting and visualizing the physical characteristics of a geographical region. It conceptualizes space as either continuous or discrete, but acknowledges that spatial reality is multifaceted, requiring complex modelling to capture its full range of dimensions.

By understanding the Driver, Pressure, State, Impact and Response of a certain geographical location under the lens of developing climate risks helps un narrow down to key regions and bottlenecks that have a bigger impact in the region.

DPSIR method spatializes the problem statement and gives us a preliminary response to understand where the research could focus and multi-scalar mapping techniques help pin aspects of the project to be later intervened. This offers both vertical (sectoral or institutional) and horizontal (geographical or jurisdictional) perspectives of planning. Spatial mapping specifically aids in understanding how different phenomena interact across scales, revealing connections between Drivers, pressures, and Impacts.

Ultimately, this method supports a deeper understanding of spatial planning and urban development in relation to climate adaptation, offering a multidisciplinary lens through which to read the landscape.

Adaptive pathways

Adaptive pathway planning method is used in situations dealing with climate change, they come with deep uncertainty and this method is predominantly useful for decisions or plans that "have a long-term (multidecadal) lifespan or long societal impact," that "experience ongoing progression of impacts," and those that "are surrounded by uncertainties and can have a large impact" or "have the potential for path-dependencies to emerge" (Haasnoot et al., 2024). By using this method decision making under deep uncertainty (DMUD) is achieved through pathway planning. Combining the current trends as variables for the pathway configuration and aligning the timeline with predicted climate trends, a pathway configuration is achieved. This pathway configuration could be focused on favored pathways which achieve the project goals. Identifying limits to current and future adaptation strategies "can

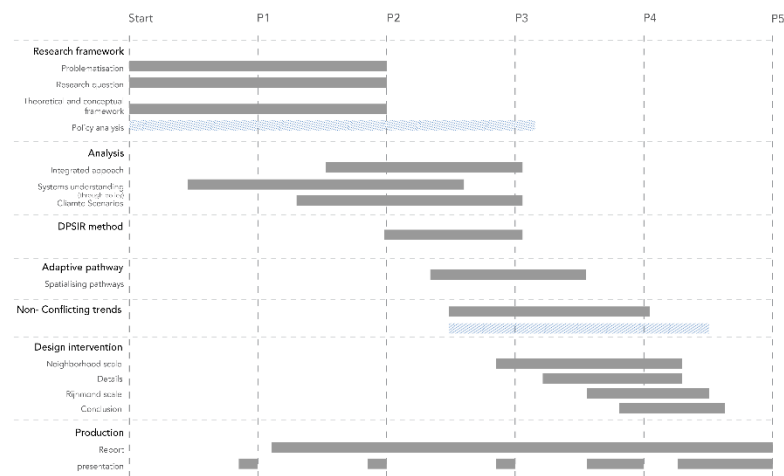
illuminate the need for transformative adaptation, if the system is sufficiently stressed against changing conditions (e.g. low-likelihood or longer time horizon)" (Haasnoot et al., 2020; van Alphen et al., 2022). The challenge then would be to either follow one preferred pathway and develop a spatial strategy for the region or to combine all the preferred pathways towards a non- conflicting pathway trend and develop the spatial strategy.

Research by/ through design

Research through design applies design thinking as a tool to investigate the potential of a given context by formulating and testing solutions to identify challenges. This structured approach aids in uncovering the root causes of complex issues. It is a pragmatic, goal-driven method that emphasizes the feasibility and applicability of strategies. In this research, the approach is used to experiment with spatial patterns drawn from both theoretical and historic backing while exploration on spatial planning helps to achieve the design outcome for the region.

Research timeline:

4.5 Research timeline



Literature and general practical references

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- Cross, K., & Imbert, F.-X. (n.d.). Basin-connected cities (ISBN 978-2-9563656-2-4). International Water Association (IWA) and International Network of Basin Organizations (INBO).
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- Witmer, M. C. H., Franken, R., van Gaalen, F., van Minnen, J., Beije, E., & Kirkels, F. (2023, March 23). National Climate Risk Analysis 2022 – 2026; Elaboration of analysis methodology. (PBL Publication No. 5044). PBL Netherlands Environmental Assessment Agency.

Policy references from:

(Nationaal Water Programma 2022–2027)

(Deltaprogramma)

(National Climate Adaptation Strategy)

Flood Risk Management Plan (Hoogwaterbeschermingsprogramma):

KNMI (Royal Netherlands Meteorological Institute), Landelijk Informatiesysteem Water en Overstromingen (LIWO) Predictions/ Scenarios

PBL Netherlands Environmental Assessment Agency's Scenarios

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)?

When Crisis Flows: A systemic design for climate resilient spatial framework on the Rijnmond delta region is a project that demands integrated approaches throughout the research stages, and role of different expertise through stages. The systems thinking approach of the studio helps in bringing the research techniques together. The role of an urbanist plays a major role in this process to translate the regional strategy on a delta scale and to be reflected on human perspective as well. The design not just caters human needs but plays a positive impact in various ecosystem services. The project is holistic in a way that it utilises the studio's approach to

effectively impact on the process. I chose to work on water systems as water plays a major role in delta region and with increasing urban ambitions parallel to climate change, there needs to be a strategic intervention in place to address them, and this project intend to experiment on creating this strategic framework.

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

This graduation project intends to look at various climate risks that take place in the same urban structure throughout the year. This precinct undergoes various risks, and each climate threat requires a different spatial intervention to overcome the risks. This project addresses this notion and creates a unifying spatial intervention that addresses various risks that a region faces over the time, the dynamism in this outcome would impact in saving various scattered investment, time and space. By addressing urban ambition alongside climate change, a better future is being envisioned, this creates a positive impact on human livelihood, the biodiversity thriving there and nature systems that exist. Addressing climate change and mitigating its impact has been the major role of administrative bodies and urbanists in the past years. Huge investments have been made to mitigate the human impact on nature. Positive impact on ecosystem services has been monitored over adapting climate mitigating strategy, this promotes more such innovative strategies to be tested and upscale in a larger region. This project aims at one such innovative way to address the widespread issue. The knowledge gap that this project addresses is a strategic framework to overcome issues that takes place in the same region across different timeframe.