

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	Annika Francesca Petra Lucia van der Nat
Student number	5219159

Studio		
Name / Theme	Transitional Territories	
Main mentor	Ir. Francesca Rizzetto	Environmental technology and design
Second mentor	Prof.dr Arjan Van Timmeren	Environmental technology and design
Argumentation of choice of the studio	<p>My thesis project will focus on the Isla Refinery area on Curacao, a highly polluted area in the Schottegat bay near Willemstad.</p> <p>In my thesis I would like to explore possible sustainable future scenario's for this area, focusing on three important pillars, namely; ecology (pollution clean-up), economy (the main reason for reopening the refinery for the local government) and society (creating a new narrative/identity).</p> <p>I believe Transitional Territories would be the best studio for this project, since it focusses on the relationship between natural processes, societal practices and (geo)political frameworks. This is a perfect fit with the three pillars I would like to focus on. Moreover, I believe TT could help me further in creating a sustainable future for this fragile area, because past projects within this studio also address high risk area's coping with transitions.</p>	

Graduation project	
Title of the graduation project	Sustainable brownfield redevelopment: A phased approach to nature based remediation methods in the reclamation of the Isla Refinery in Curacao
Goal	
Location:	Isla Refinery, Curacao
The posed problem,	Brownfield redevelopment projects typically consist of three phases; site assessment, site remediation and site redevelopment. Conventional remediation methods are used during these projects, which take a relatively short amount of

	<p>time to clean-up the soil and water in these areas. However, a growing demand for nature based solutions in the urban planning field is challenging this paradigm. Phyto technologies are remediation methods that use plants to extract or stabilize pollution particles in soil and water. These less invasive remediation methods need a longer amount of time to clean-up the pollution compared to conventional methods. This changes the typical timeline of brownfield redevelopment projects drastically, meaning the remediation phase will be significantly longer.</p> <p>This thesis will research how this longer remediation phase can be best approached to increase sustainability during brownfield redevelopment projects.</p>
research questions and	<p>How can brownfield redevelopment projects be best approached to benefit local citizens, ecosystems and economies?</p> <p>This question will be answered by researching the following sub research questions;</p> <ol style="list-style-type: none"> 1. What is the existing context of the case study and how will this research interact with that context? 2. How can the pollution on the case study site be sustainably remediated? 3. What are possible new sustainable activities for the case study and how are they contributing to the value of People, Planet and Prosperity? 4. What will a sustainable remediation phase look like for the case study?
design assignment in which these result.	<p>What will sustainable future scenario's look like for the Isla Refinery site, using nature based remediation methods and contributing to people, planet and prosperity</p>
<p>[This should be formulated in such a way that the graduation project can answer these questions. The definition of the problem has to be significant to a clearly defined area of research and design.]</p>	
<p>Process</p>	
<p>Method description</p>	
<p>[A description of the methods and techniques of research and design, which are going to be utilized.]</p>	

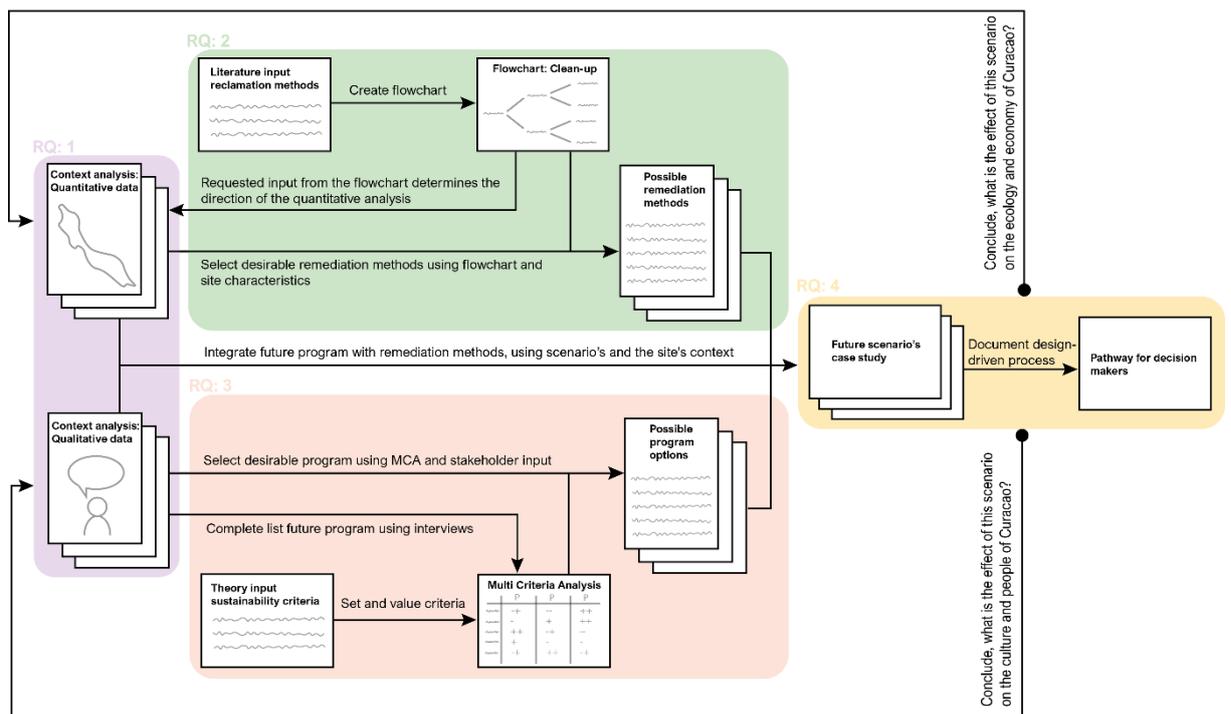


Image 1: Methodological Framework, Source: Author.

The image above shows the methods used in this research and its iterative process and the relations between different research questions and their outcomes and input. The first research question will take both a systematic and a participatory approach. The existing context of the case study is analysed, through GIS-mapping, semi-structured interviews, stakeholder analysis, historical analysis, analogue mapping and by comparing the case study area to reference projects. The information needed from these analysis is determined through the input needed for research questions two and three. Research question two requests input data about the case study to be able to go through the flowchart and determine which remediation methods are possible on the case study site. Research question three requires stakeholders' input to determine what future program needs to be analysed using the multi criteria analysis and which of those are desirable for local stakeholders.

The second research question is answered only using a systematic approach. Input from existing literature will be used to create the flowchart, which is completed, using data from the case study provided by the first research question. The main sources to create the flowchart are the book *Phyto* by Kennen & Kirkwood (2015), the publication *Phytotechnology Technical and Regulatory Guidance and Decision Trees*, Revised by ITRC (Interstate Technology & Regulatory Council) (2009) and the publication *Brownfields Redevelopment, A Guidebook for Local Governments and Communities* by ICMA (the International City/County Management Association) (1999).

The third research question takes an exploratory and participatory approach. First, theory about sustainable brownfield redevelopment is used to set and value criteria for the multi criteria analysis. These critique the future program considered for the case study, by local stakeholders. Furthermore, The desirable program is selected by using the results from the multi criteria analysis and stakeholders' input.

The final research question is answered using a design-driven approach. Multiple future scenario's are analysed for the case study, using the outcomes from the second and third research questions. The whole process of this thesis is then documented using a toolbox, which helps make this design and decision process applicable to other brownfields.

Literature and general practical references

This thesis will primarily focus on increasing the sustainability of brownfield redevelopment. Due to the ambiguity of the term sustainability, a further explanation on how this thesis defines this term is needed. The triple bottom line theory from Elkington (1994) will be used as a basis for this definition.

This theory stems from the idea that sustainable development consists of three components; people, planet and profit. Meaning, projects and businesses should aim to positively impact society and the environment, instead of using the business as usual approach of only focussing on creating monetary profit. In more recent years the word prosperity was adopted to replace profit, this emphasizes a broader scope of economic well-being and considers factors beyond just financial gains. In this theory people is described as societal impact, adding benefits for local communities and their cultures. Planet stands for the environment, meaning ecosystems and biodiversity are not harmed but instead rejuvenated (Elkington, 2004).

These three components are often used in sustainable development projects. To link this theory to urban planning, each component will be elaborated on using different concepts from the urban planning field. For people the spatial justice triangle by Rocco (2023) will be used, for planet the concept of ecosystem services (SOURCE) is explained and for prosperity the autotroph cities by Rizzetto & Hooimeijer (2022) is used. The table below shows the relationship between the theory and different concepts with their corresponding urban planning strategies.

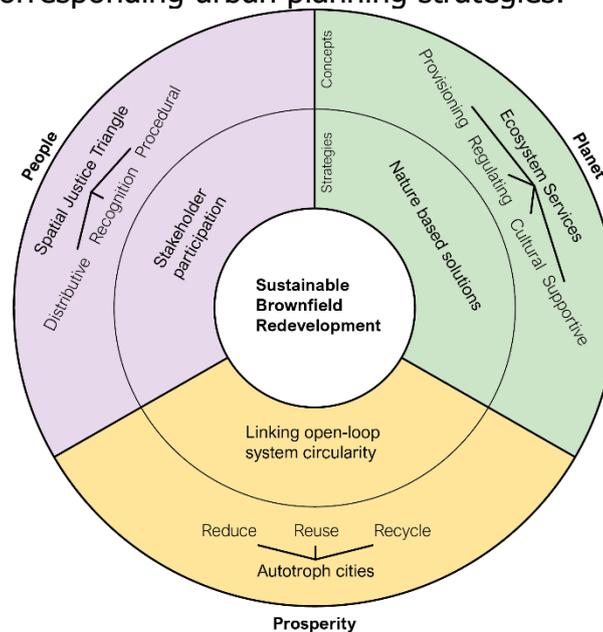


Image 2: Conceptual Framework, source: Author.

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)?

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

This thesis focusses on sustainable brownfield redevelopment. Within the Transitional Territories studio this research focusses on the effect of the global transitions and crisis on the site. Especially the energy transition, climate crisis and transition towards self-sufficiency, are important to this research. The site's specific history and context are analysed to create a future vision appropriate for the island of Curacao.

Within the master track Urbanism, this thesis combines spatial planning, urban design and engineering to achieve its main research aim. This aim is aimed at socio-cultural, economic and natural perspectives, which is in line with the learning goals of this master track. Moreover, the methods used to analyze the specific characteristics of the site, are common among research projects of this master track.

Within the master AUBS, this thesis will use design-oriented research. To make this method repeatable for other stakeholders, this thesis will make its design steps and decision making process explicit, using a pathway that decision makers can use themselves.

In this research sustainable pollution clean-up is key to achieve the research aims stated earlier. Phytoremediation could be a less invasive alternative to conventional methods for clean-up. Multiple researchers have looked into this method and have proven its effectiveness (Kafle, 2022; Kennen & Kirkwood, 2015). However, the implementation of this method in the context of the tropical climate of Curacao has not yet been researched.

This thesis project will close this knowledge gap by doing a site specific research and design, providing knowledge about the feasibility of this remediation method and highlighting the possibilities during this relatively long clean-up process. The research will take a phased approach to this clean-up process which typically takes around 20 years but may take up to 50 years, depending on the type of phytotechnology used and the level of contamination present in the area (Kennen & Kirkwood, 2015). During that time the project area will have different levels of pollution throughout time.

Meaning, the area will have different possible functions during the different clean-up phases. Researching when which functions are possible, will generate economic value to the area during the whole clean-up process, making the nature based remediation methods more feasible. This will make future brownfield regeneration projects more likely to use phytoremediation.

Democracy in decision making and participation of local residents are key success factors in brownfield regeneration projects (Glumac, 2020). This is also the case for the Isla Refinery site. However, decision makers in this case study are focusing on economic benefits by attracting new investors to the area. It lacks transparency towards the civil society. This neo-liberal approach to redevelopment lacks transparency towards local residents and makes it more difficult for them to get involved and accept the project.

My project aims to make a more holistic sustainable future vision for the area, where people, planet and prosperity are equally important. Moreover, the project will ensure transparency for all stakeholders involved. Making sure that local citizens, that have been negatively affected by the pollution from the refinery, will experience the positive effects of the project. This will reduce inequalities on the island and promote environmental justice.