DESIGNING THE FLOODPLAIN

Strategies for more-than-human resilience and nature-based solutions for public space transformation by the Göta Älv

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2026
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Architecture and Planning Beyond Sustainability
Building Design and Transformation for Sustainability

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Abstract

Climate change increases the risk of natural disasters, and rising sea levels expose an increasing amount of coastal cities to flooding. Gothenburg, situated in close proximity to a large body of water, is no exception. As traditional grey infrastructure can no longer alone manage future water levels, there is a growing need for sustainable and environmentally sensitive flood management strategies. Recent research highlights Nature-Based Solutions as a means to manage excess water while simultaneously enhancing ecological and social values.

This thesis explores how Nature-Based Solutions can be applied in a Swedish context through a design proposal located along Göta Älv in Gothenburg. The project focuses on flood risk management and more-than-human design, while creating a recreational public space along Göta Älv, where green spaces and water elements interact to support biodiversity and human activity. Non-human species are given opportunities to reclaim their habitats, while humans are provided access to the river.

Skeppsbron and Stenpiren Resecentrum is reimagined through implementation of Nature-Based Solutions, using intertidal zones and expanded green spaces to increase use of the area's spaces and qualities. Reviewing research, previous implementations of similar solutions and thorough analysis of the site informs the decisions necessary for a multifunctional and resilient environment. Throughout the process, research for design becomes research by design.

The final design proposal addresses three central agendas: flood management, more-than-human design and urban climate adaptation. Key principles and strategies such as implementing biodiverse intertidal zones and constructed wetlands as flood management systems, can be extracted and applied to other contexts.

This thesis contributes to discussions on climate-adaptive design in Gothenburg, highlighting the benefits of green spaces for flood management, and encourages exploration of such solutions in future practices through its extensive effect on the transformed space. The project demonstrates how more-than-human design can enhance urban experience, while managing other global issues such as flooding and habitat loss simultaneously. Thereby, the thesis presents how several issues can be managed through one design.

Key words: Nature-Based Solutions, Blue-Green Infrastructure, More-than-Human Design, Flood Resilience, Public Space Transformation.

CONTENT

Education

2021- 2024
BSc Architecture
Chalmers University of Technology

2024-2026
Msc Architecture and Planning Beyond Sustainability

Studios:
- Key projects for Sustainable Development in a Local Context
- Dare2Build
- Community Architecture

Profile:
Building Design and Transformation for Sustainability

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To friends and family.

INTRODUCTION

This first chapter sets the starting point of the thesis and explains the problem, purpose and aim of this thesis.

**Figures presented in this thesis are produced by the author unless otherwise indicated.*

Research Question
How can more-than-human design shape and transform urban spaces while mitigating flood risks?

Sub Questions
How can flood management be integrated in an environment that both regenerates ecological systems, provides accessible spaces as well as ensuring protection, restoration and resilience?

How can a public space be transformed through more-than-human architecture while increasing human use?

Background

Since the beginning of Gothenburg, the harbor has been constantly changing to fit the new needs to grow the city. Until the 1800 century, the water depth was so low that the inner part of the city could only be reached by smaller boats. As the shipping industry grew, the depth and size of the harbor had to change (Port of Gothenburg, n.d).

On the areas previously covered by reed, new harbors were built. One of these areas was Skeppsbron, where a bay was mainly made up of water and reeds. This was covered and a port was built over it. Over the years the function has changed, but what remains is the grey infrastructure and adaptation for human needs (Svensson, 2018).

In relation to climate change, the sea level rises continuously. According to The Intergovernmental Panel on Climate Change (IPCC), sea levels could rise to be as much as 1.1 meters higher than today by 2100. Current projections indicate that nearly one billion people will be much more exposed to the risks of flooding, and cities such as Amsterdam, Manila and Bangkok are at the top 10 list of high-risk areas (Igini, 2022). Although these are some of the cities at most risk, all areas with closeness to bodies of water face the same threat. It is therefore crucial to develop a system to prevent flooding, in a manner that does not harm the environment further.

An investigation from 2006 showed that Gothenburg's future heavily relies on adaptations to the unavoidable floodings to come. In case of a storm like Gudrun in 2005, combined with a sea level rise of 0,9 meters, research concluded that the coastal areas of Gothenburg would suffer major consequences, and that the current safety measures would not be enough. The actions to prevent this are often very expensive and usually result in adding more grey infrastructure (Göteborg Stad, 2006).

One approach called Nature-Based Solutions have become more frequently discussed as another way of managing climate related hazards. Incorporating wetlands, swales and water management systems in so called "Blue-Green Infrastructure" is an effective and sustainable way to capture excess rainwater, prevent flooding and protect urban resilience (Alaka et al, 2025). Currently, these systems are often used on a smaller scale and research needs to advance to make the method applicable in an urban context. Just as importantly, there is a lack of holistic methods to address more than just one problem, but several issues related to climate change (Everett et al, 2023).

Another multilayered solution is working with more-than-human design. This concept revolves around acknowledging the rights of other species than humans and creating conditions for these (Jaque, 2024), while understanding in what ways human activity is bound with other living systems (McGuirk, n.d). A new movement to secure legal rights and policies for non-humans are growing, and the implementation of these allows more-than-human design to possibly address more than one global challenge at a time (McGurik, n.d).

Purpose and Exploration

In Gothenburg, there is a need to explore alternative approaches to flood management design. The city is not immune to global climate threats, and needs to be adapted accordingly. Skeppsbron and Stenpiren Resecentrum are two spaces at big risk of flooding and exploring how this can be managed without grey infrastructure is the core of this project. In order to not further add to the climate crisis, the adaptations need to be done with climate consideration and avoid the solutions that could affect the climate negatively.

Therefore, the purpose of this thesis is to explore how more-than-human design and Nature-Based Solutions can be applied in an urban context in Gothenburg. The project explores how these two concepts can be combined into one project and how the collaboration between human and non-human species can approach several issues simultaneously, including both flood management and nature restoration.

Aim

The thesis aims to investigate and gain understanding of how to design and transform public spaces with nature as a tool, while simultaneously decentralizing humans and prioritising non-human stakeholders.

Through Nature-Based restoration, the design project will draw key elements for successful transformation along a harbour similar to the one along Göta Älv. The project seeks a more nature-focused approach to transformation, finding ways to integrate flood prevention, human recreation and nature restoration. This thesis will explore how a combination of several concepts of architecture, such as more-than-human design could look at a central location along the river.

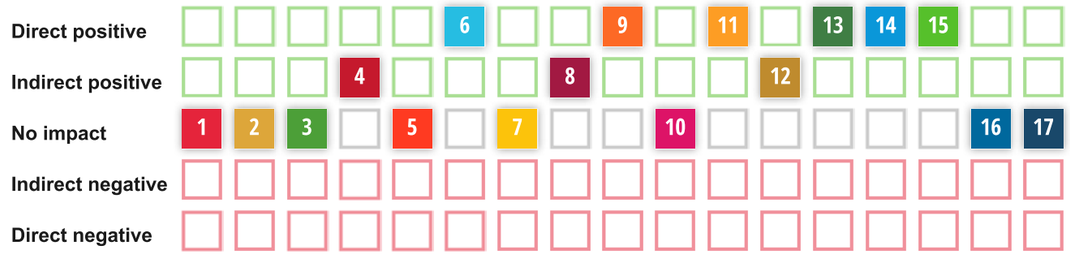


Figure 1. Project impact on Sustainable Development Goals.

Delimitations

The thesis explores Nature-Based Solutions in the context of Gothenburg. The work addresses how flood risk can be managed with environmental consideration and from there propose key principles for further work. Floodproofing is explored through a variety of Nature-Based Solution, in different configurations such as constructed wetlands and intertidal zones, depending on the conditions in different areas of the site. A more-than-human design approach guides the project, with the intent of exploring different adaptations for the proposal. The project presents a new recreational space in the urban context of Gothenburg, with both human and non-human stakeholders in focus.

This project does not try to translate all scientific research to comprehensible information, but merely touches upon subjects needed to explain and explore the theme itself. The more-than-human design approach is used as guidance, but cannot be defined through specific key elements that can be applicable at other locations. The thesis does not discuss applications in developing countries, but focuses on the very specific site along Göta Älv in Gothenburg. The ongoing plans regarding a new bridge located at the site, as well as the detailed plan of Skeppsbron from the municipality of Gothenburg is not taken into account, nor applications for a larger context than what fits within the chosen site.

Sustainable Development

By integrating greenery both on land and in the water, the design project creates habitats for diverse species, providing safe and supportive environments. Providing these new spaces have a direct positive impact on three Sustainable Development Goals - 13 (Climate Action), 14 (Life Below Water) as well as 15 (Life on Land). Protecting and restoring ecosystems is central to the project, particularly through restoration and the recreation of marine environments that resemble historical conditions. The greenery on land plays a similar role in protecting biodiversity. This approach encourages species to return and establish themselves in the area.

Simultaneously, the transformation of the current space creates opportunities for local engagement and a recreational hub that encourages people to enjoy nature and experience the benefits of blue-green infrastructures. The design proposal suggests an approach to sustainable urbanization and has a positive impact on goal 9 (Industry, Innovation and Infrastructure). As a result, the space reinforces the vision of building sustainable, resilient and inclusive urban environments.

By reimagining the harbour along Skeppsbron, the project contributes to a new identity for Gothenburg, offering a space that manages flooding. The design proposal supports sustainable urbanization by reducing environmental impacts through nature-based solutions, rather than addressing the same challenges through traditional grey infrastructure. The new blue-green infrastructure will enable the area to prepare for potential flooding, while maintaining some of its original functions. Through this approach, the project has a direct positive impact on both goal 6 (Clean Water and Sanitation) as well as 11 (Sustainable Cities and Communities.)

Combining the interventions on land and in water creates a dynamic, adaptive and environmentally responsible harbour that supports both people and nature.

Out of the 17 goals, Sweden has only achieved three (Sustainable Development Goals, n.d). This project focuses on, and tries to have a positive influence on six of the goals Sweden haven't reached yet.

Methods

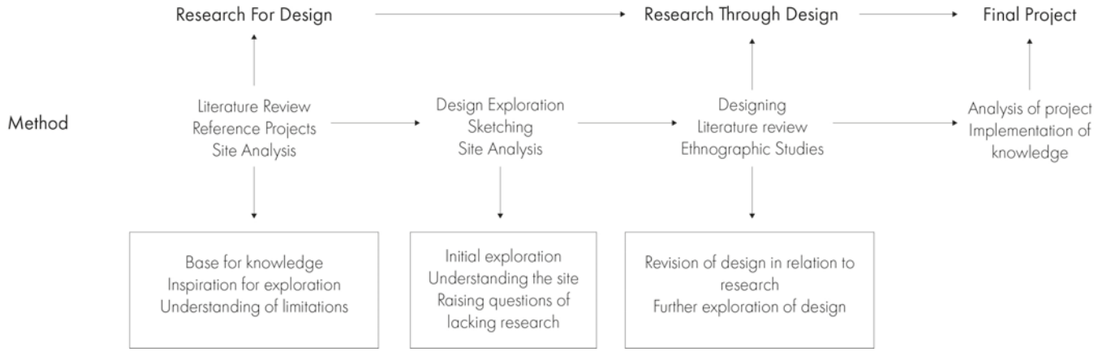


Figure 2. Use of methods during process.

Literature

The thesis is built on a foundation of recent scientific research and takeaways from these. Research is gathered from multiple sources, including articles, research papers and books. These are found through library visits, prompts using Scopus AI as well as following the sources other articles have used themselves. Prior to any design explorations, this information is collected and analysed to formulate the foundation of the project. Therefore, the thesis is initiated through "Research for Design".

Site Analysis

In order to understand the chosen site in a broader context, the area was analysed over a longer period of time. Weekly on site visits, of roughly one hour, during different days and time provide insight to the climate and physical restrictions of the space, but also intensity and movement of people. Understanding the activity of the site is performed solely by documented observations, while climate and physical restrictions are collected through a combination of observations as well as digital collection of data.

This method is a crucial part of the design proposal over time. Visiting the site gave the opportunity to compare design iterations to the context and from there develop them to further create design principles as well as following these during the design process. Additionally, the use of Stenpiren Resecentrum was further investigated and thereby informed decisions in terms of functions and movement.

Reference projects

Studying previous similar projects allows an evaluation of the solutions and challenges of each proposal, and therefore guides the project forward. These studies are analyzed by dissections of elements in these designs and understanding how the knowledge can be included in the design proposal, what made them successful or what needs to be avoided in order to create something that differs from the original idea and concept.

In order to limit the extent of references, the selection is based on a connection to environmental consideration, recreational spaces and traces of more-than-human design.

This investigation will further strengthen and formulate the design principles of the project.

Sketching

Through the concept of "Research Through Design" this process is intertwined with all other methods and informs iterations of the design proposal. Using a visual tool not only functions as a creative output, but inspires further research needed in order to follow the aim of the thesis.

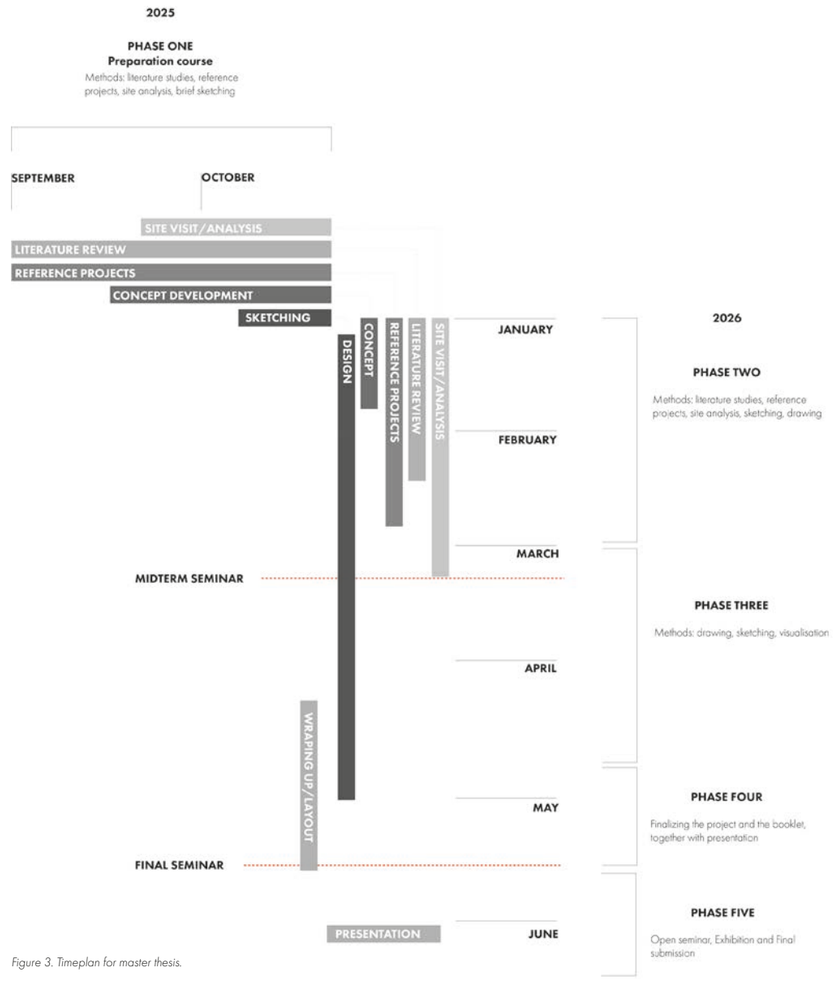


Figure 3. Timeplan for master thesis.

Design Exploration

The project emerges from an iterative process of generating, testing and evaluating several design ideas. Depending on the research found along this process, new iterations are trialed compared to the aim of the project, and from there further ideas will grow. This method allows the project to grow more organically, and allows curiosity in the process of designing.

AI

For this project, AI has been used in order to quickly gather research. Scopus AI has been given prompts related to the theme of the thesis, such as "more-than-human architecture" and "Nature-Based Solutions" in order to find the most relevant articles to this work.

Ethnographic Studies

In order to broaden the different perspectives on landscape and urban planning, ethnographic fieldnotes were done through a three day workshop with students from the master of science in conservation. Notes, observations, conversations and reflections summarised this time and influenced the thesis with the knowledge of other professions.

In this chapter, theories and reference projects that shaped the project are presented.

THEORY

Literature

Figure 4. Riparian Zone. (Caff55, n.d). Public Domain.

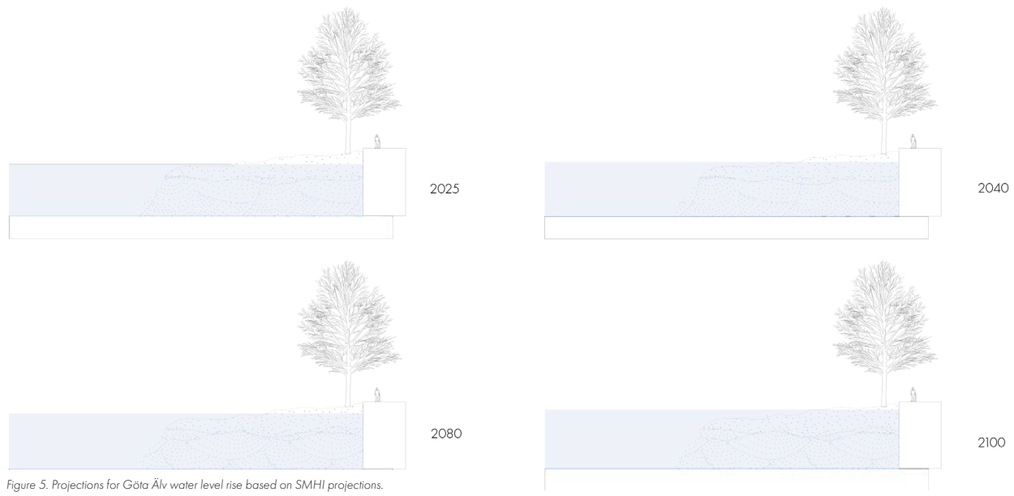


Figure 5. Projections for Göta Älv water level rise based on SMHI projections.

Nature-Based Solutions

Nature-Based Solutions (Nbs) is an approach that harnesses the power of nature to address the different challenges society faces today. This approach offers responses to climate change adaptation, public health improvement and disaster risk reduction (Ogwu et al, 2025).

In coastal cities, with many risks related to sea-level rise, Nature-Based Solutions have been proven to be strategies with greater potential for coastal protection when compared to grey infrastructure that today is widely implemented worldwide. Despite the growing evidence of nature's potential as a solution to buffer climate change risks, and national policies there is a knowledge gap on Nature-Based Solutions effectiveness (Manes et al, 2023). Sweden adopted their own climate policy framework in 2017 (Naturvårdsverket, 2025).

In an urban setting, green spaces offer recreational opportunities and can also contribute to air purification as well as stormwater management. Similarly wetlands play a critical role in managing stormwater and purifying water. In addition to ecological benefits, wetlands and other green spaces offer educational opportunities for city residents as well as the possibility to engage with local wildlife (Ogwu et al, 2025).

There are several measures that can be implemented as Nature-Based Solutions for adapting and preparing for flooding in urban settings. Besides managing higher flows of water, Nature-Based-Solution measures can also improve the life of both aquatic and terrestrial species (Ogwu et al, 2025).

Urban Riparian Restoration

Riparia, from the latin word "riparius", means "belonging to the river bank". In the most simple description, it is a zone immediately adjacent to the river. Riparian zones are vegetated areas bordering rivers, streams and lakes. These areas are not mainly in place to manage flooding, but play an important role in preserving habitats, stabilizing banks and filtering runoff (Nair et al, 2023). Human settlements have over time converted many natural areas for urbanisation and agricultural purposes. Urban development has domesticated ecosystems around the world, leading to habitat fragmentation. Besides the threat of the loss of biodiversity, the reduction of urban vegetation could further lead to reduction of pollinators, and local species habitats. Having urban rivers and corresponding riparian zones are of high importance for natural wildlife. Conserving, restoring and rehabilitating urban rivers will not only benefit the river ecosystem, but establish a network for biodiversity connections (Zhang et al, 2022).

According to Zingraff-Hamed et al (2021), there are several obstacles for riparian restoration. Following urbanisation, space is limited. Riparian zones require flood frequency, and succession cycles typical for this ecosystem need to be managed in a way that can be difficult with man-made interventions. Because of this, many urban riparian areas are reduced to minimalist green lines. However, these still play a crucial role in delivering ecosystem services, even though expanding the areas would be preferred.

Flood Resilience and Rising Sea Levels

The variation of sea levels depends on several different factors. Globally, the two most central ones are the water's thermal expansion, as the ocean expands when the water gets warmer, and contributions from melting glaciers and large ice sheets. Locally, there are significant differences depending on salinity conditions, changes in the local wind climate as well as changes in land uplift and land subsidence (SMHI, 2014).

Besides natural changes to the sea level, the risks of flooding in coastal areas are increasing, due to hazards related to both climate change and urbanization. In order to respond to these risks new technical knowledge has been developed, and the discussion regarding flood resilience is growing. Scientific literature introduces the concept of "resilience" as the best and desirable outcome of flood risk management. An often used definition of resilience is "the capacity of a system to absorb and reorganize undergoing change, so as to still retain essentially the same function, structure, identity and feedback"(Driessen et al, 2018 p. 2). Therefore, a resilient system has the capacity to resist and recover from floods, as well as adapt, transform and take advantage of the consequences of floods (Driessen et al, 2018).

In the early 1990s, satellites were launched with the purpose of measuring the Earth's surface. These measurements revealed that the global mean sea level rose by just over 3 mm per year during the period 1991-2003, something that was also visible in Swedish measurement records. Future water levels in Västra Götaland have been calculated based on an expected sea level rise of 0.98 meters by the year 2100. For flood risk projections, it is primarily short-term variations that are important, and these are driven by large-scale low-pressure and high-pressure systems (SMHI, 2014).

Measuring sea water level is stated either with RH 2000 or RW. In RH 2000, the sea level is related to a fixed land benchmark, which is preferred if one wants to determine whether it is the sea level or the land mass that is rising. The measurements that the system is based on, was carried out between 1979 and 2003 and consists of approximately 50 000 fixed benchmarks. The zero level is defined by a point in Amsterdam, called Normaal Amsterdams Peil (NAP), and is used in several other countries in Europe (SMHI, n.d).

RH 2000 has been Sweden's national height system since 2005. In order to ensure access to this zero level, a reference point was established in Varberg, where the land uplift is relatively small in comparison to other locations in Sweden. There, a marker has been placed in the bedrock at 4.234 meters above NAP (SMHI, n.d).

“If you choose the river as your neighbour, don’t be surprised if this neighbour visit you from time to time.”

- Unknown

Flood Mitigation Measures

Wet floodproofing

This method uses water-tolerant materials in order to reduce the flood damage of a building, while rearranging utilities and contents. The design or changes of a structure allows the water to enter with minimal damaging effects.The method is common for cases where the building has basements or crawlspaces that cannot be protected with other mitigation measures, or when another method is too expensive to use. One of the main issues with this method is that it limits the use of the flooded areas, and that the time before usable again is prolonged. Some of the more common practises for this type of method includes waterproofing the interior walls with paint, using tile or terrazzo flooring and elevating mechanical equipment (Paleo-Torres et al, 2021).

One example of a smaller scale solution was made in Shrewsbury, England. An independent coffee shop had several times been the victim of floodings, with water levels reaching 30 cm inside the shop. This often led to disruption in the business, and the owner had to make several adaptations to the property. Besides installing flood barriers and subversive pumps, they decided on using flood-recoverable materials and adapting the interior furniture to withstand big volumes of water. For example, all tables and chairs all had metal legs and the counters were made modular to easily be moved. With limited financial resources, the coffee shop managed to use low-cost methods to flood proof their business, shortening the recovery time after a flood (BeFloodReady, n.d).

Dry floodproofing

A method that instead of allowing water to enter, waterproofs the building to keep flooding water outside of the building. The method can be used directly on the building by sealing gaps or adding to the structure, which is more expensive and time consuming. Another option is to use free standing objects consisting of flood barriers outside of the building, which is cheaper and easier to manage (Rappazzo & Aronica, 2016).

There are several measures to use, both permanent or temporary in order to protect a building from being flooded. For permanent flooding resistant measures, one could use periphery fences with sealed gates, storm porches for external doors, or raising the building. Temporary solutions include external door guards and flood skirts. Dry floodproofing is often a more visible solution, changing the appearance of the building even if only for a short period of time. To use measures with less visibility, the interventions necessary are often more expensive, time consuming and require far more construction work (Beddoes & Booth, 2012).

Nature-Based

The following two pages will describe and entangle three measures for flood resilience, with its background in Nature-Based Solutions. Although Urban Blue-Green Infrastructure, intertidal zones and constructed wetlands are only a few examples, they can also be connected to enhance biodiversity and work with more-than-human design.

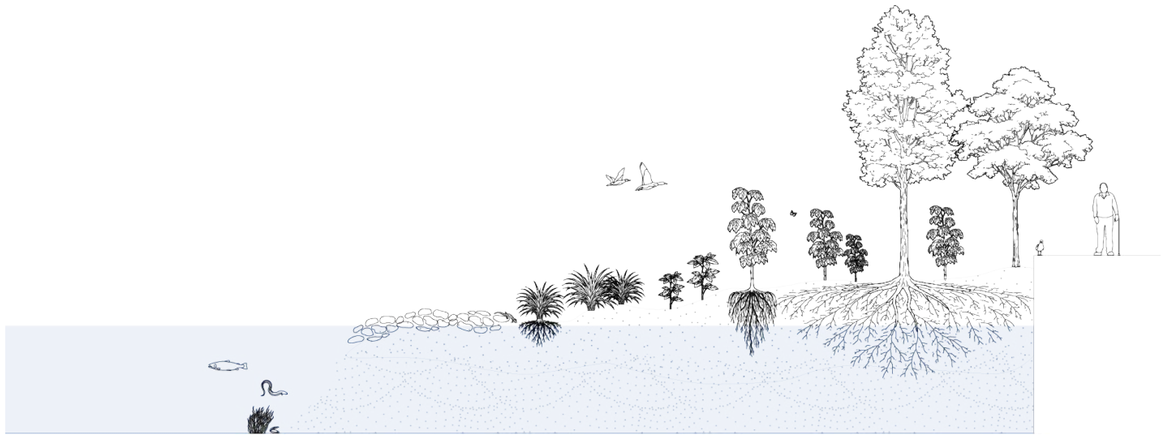


Figure 6. Illustration of an intertidal zone.

Urban Blue-Green Infrastructure

A type of infrastructure that balances environmental, social and economic development objectives and has over the years become a well used approach for fostering urban resilience as well as sustainable development. Not only does UBGI provide green spaces for the health of citizens and species, but has been evidenced to provide adaptive response for climate hazards, such as storm surges, heatwaves and flooding. Several studies have confirmed that blue-green spaces can provide numerous health benefits, by enhancing psychological resilience, alleviating social isolation and even lower blood pressure (Wang et al, 2025).

Over the years the trend of research on UBGI has increased greatly, with only 0.9% of total publications touching upon the subject between the years 2000-2013, while in the period of 2019-2023, 86.1% of all scientific publications within urban planning mention or discuss the subject. This growth seems to be the result of several factors, including environmental crises and interdisciplinary integration (Wang et al, 2025).

Yet, as Everett et al (2023) states, blue-green infrastructure projects often begin as small and local interventions. Thus, scalability needs to be a focus in order to achieve true potential benefits in an urban setting.

Intertidal Zones

The intertidal zones are extreme ecosystems because they are constantly affected by drastic changes. Located on marine coastlines, they may vary in shape with both rocky shores and sandy beaches. These zones are distinguished by the mere fact that they experience different states; exposed to air and submerged in seawater. These vegetation zones are highly biodiverse and productive due to the fact that they have a mixture of both terrestrial and aquatic ecosystems. They host many different species, such as snails, algae, mussels and crabs, all strong enough to survive vast changes in their habitats (Intertidal Zone, 2023).

Intertidal zones offer many environmental benefits. They manage water quality through trapping pollutants, are enormously valuable for wildlife habitats and trap and filter atmospheric pollutants. In terms of flood management, the zones will naturally absorb stormwater, reduce the volume and speed of water and therefore reduce the risk of flooding. The scale of a zone can vary greatly, spanning from 15 to 55 meters on each side of the waterbody (Intertidal Zone, 2023).

Figure 7 . Våtmarksparken. (Zaar, T., 2024). Reprinted with permission.

Constructed wetlands (CWs)

An engineered system that is constructed and designed to utilize the natural functions of wetland vegetation, as well as their associated microbial assemblages for wastewater treatment. Constructed wetlands have several benefits, including easy operation and maintenance, good potential of water and nutrient reuse as well as being a significant function as wildlife habitats (Wang et al, 2017).

It has been recognized as a sustainable wastewater management option, and its use is increasing as the field of research grows (Wang et al, 2017).

The pollutant removal efficiency varies depending on a combination of physical, chemical and biological processes, as well being heavily affected by temperatures. The absolute best prospects for successful wetland treatment will always be in tropical or subtropical regions, and using the constructed wetlands in colder climates present special challenges. Yet, recent studies in North America and Europe have shown that the approach can be feasible. Studies made in Denmark and Sweden have stated that the constructed wetland performance in winter was not as significantly reduced during the winter season, compared to what they were expecting (Wang et al, 2017).

In Sweden, a wetland park was constructed in Västerås, as the first Swedish project within the EU's environmental program Life IP. Designed by Topia Landskapsarkitetker, the goal with the project was to improve the aquatic environment as well as managing and purifying the flow of water going into lake Mälaren. Another part of the project was to make the water accessible for visitors, and the park has therefore been enhanced with bridges, platforms and walkways. By introducing new vegetation in the area, new conditions for biodiversity were created in a previously monocultural environment (Landezine, 2024).

Similarly, Svankälla våtmarkspark in Gerrebacka, Gothenburg, provides access to a wetland park with surrounding walking paths for bird watching and recreation (Göteborg Stad, n.d).

Responsibility species and habitats in Gothenburg

In order to help prioritize municipal nature conservation work, responsibility species and habitats have been identified. These are the species that the city has a particular responsibility to protect and preserve. This is due to the fact that they are threatened and their populations range within Gothenburg. All of them are red-listed species that Miljöförvaltningen (Environmental Administration) have identified in order to help other municipal departments to use the species and habitats as a tool for working with planning and maintaining natural areas. The responsibility habitats have been highlighted as an important part of monitoring the environmental objective "Göteborg har en hög biologisk mångfald", in english "Gothenburg has high biodiversity"(Miljöförvaltningen Göteborgs stad, 2022).

Some of the responsibility habitats include eelgrass meadows and wetlands. Eelgrass meadows are a threatened ecosystem that has declined greatly over the past 30-50 years. They are important habitats for many different species and have a unique ecological role in Sweden's marine environments, and provide environmental benefits such as counteracting erosion and improving water quality. Similarly wetlands contain high biodiversity and are among the most species-rich habitats in Sweden. Wetlands also absorb several environmental pollutants and can prevent flooding by storing large amounts of water (Miljöförvaltningen Göteborgs stad, 2022).

There are several responsibility species prioritised in Gothenburg, and many of them rely on the protection of the responsibility habitats. Both eel and pollack are red-listed and rely on eelgrass meadows, and red-listed plant Marsh Gentian hosts the responsibility species Alcon Blue Butterfly (Miljöförvaltningen Göteborgs stad, 2022).

“More-than-human is an energy, a political stance between the actors within a system, that express when collective actions start to change for good.”

- Arne Berger (2025, p.149)

More-than-human Design

According to McGuirk (n.d), the turn to more-than-human in anthropology seeks to understand in what ways human activity is bound with living systems. There has been an increase within designers to come to terms with the limits of human-centered design and its possibility of addressing the climate crisis. Rather than giving absolute privilege to a specific user, more-than-human design seeks to bring other species into consideration. This can take shape in projects specifically designed for other species, or by respecting a certain ecosystem more thoroughly. More-than-human design is more of a mindset rather than a methodology or a specific set of solutions. Designers are encouraged to change perspective, notice things that were previously unnoticed and understand the consequences of intervening with a living system.

This way of thinking is a challenge to the very idea of design as people within the field know it today, and challenges the anthropocentric way humans view the world. In Michel Serres book The Natural Contract, the author express the following; “We must add to the exclusively social contract in a natural contract of symbiosis and reciprocity in which our relationship to things would set aside mastery and possession in favour of admiring attention, reciprocity, contemplation, and respect; where knowledge would no longer imply property, nor action mastery” (Serres, 1990, p 38). A new movement of securing legal rights and policies for natural bodies are growing, and several countries have given nature legal rights. For example, the Ecuadorian Constitution has granted Mother Nature or Pachamama, legal standing, which includes the rights to rivers not being polluted. Through these new policies, more-than-human design can address global challenges like pollution and biodiversity loss and the design can support ecological resilience (McGuirk, n.d).

Jaque (2024), argues that acknowledging the rights of other than human species, and furthermore creating conditions for more-than-human agencies, is the crucial difference in cosmopolitical regimes that more-than-human architecture contributes to. He also expresses a worry that architects design for “post-occupancy”, or buildings that will later be occupied, a naive idea that separates bodies, buildings and environments that are actually inseparable.

Berger (2025), defines more-than-human design as embracing entangled, relational agencies, and that the mindset fosters a more sustainable way of existing, while acknowledging the complicity of design in the climate crisis that all species are currently in. He avoids using the word collaboration, as it implies that the entities have a subjective intent, when they in reality live in their different ways, taking advantage of their distinct traits. More-than-human design is multiple species living in symbiosis, and non-human entities are treated as active participants in the design process.

Neves and Duarte (2025) define one feature of more-than-human design to be the concept of “decentering the human”, embracing hybridity and multiple voices of users. The approach of decentering involves a shift from the focus on human needs in architecture and design, to a broader ecological perspective that fosters empathy and care for non-human species.

Reference Projects

Figure 8. Jubileumsparken sauna and added vegetation.

Jubileumsparken

Architect: Mareld Arkitekter
Year: 2014
Location: Göteborg, Sweden

Learnings:
Human and non-human stakeholders share space
The possibilities along Göta Älv
Combining urban environment and closeness to nature

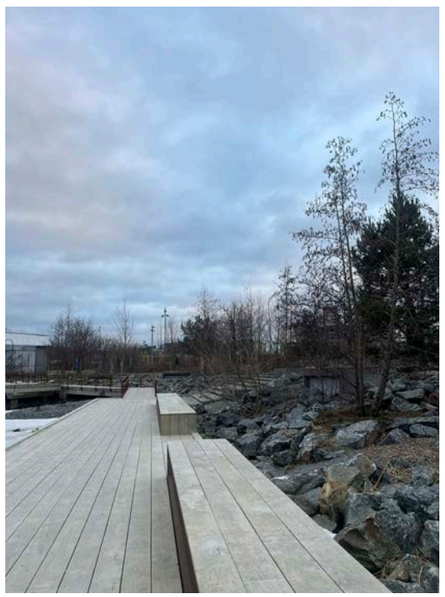


Figure 9 . Jubileumsparken waterfront divided into human and non-human zones.

This project was selected due to its location in Gothenburg, but also that the implementation presents one solution for giving citizens access to Göta älv.

Mareld Architects together with Atelier le Balto was commissioned to propose a social, economic and environmental growth strategy for Jubileumsparken at Frihamnen. Through research and investigations, the purpose was to envision an experimental landscape with the aim to enable visitors to enjoy a both urban and activity-focused landscape (Mareld Arkitektur, n.d).

It is a place where biodiversity, closeness to water and human presence meet, while emphasising the industrial heritage of the area. By using the existing character and vegetation, the transition to the proposed changes show appreciation to the specific site. The project has grown through prototypes experimenting with the site, making this a special type of project where the park grows over time depending on use, rather than being finished all at once (Mareld Arkitektur, n.d).

It is still under development, and has over the years expanded with a sauna, pools and a playground. Together with the citizens of Gothenburg, the architects gather wishes through workshops with all ages and explore what might fit on the site before permanent changes are made to the park (Mareld Arkitektur, n.d).

Figure 10. Wetland by Bergen Bystrand and a new Lungegårdsparken. (White Arkitekter, n.d). Reprinted with permission.

Bergen Bystrand

Architect: White Arkitekter
Year: Ongoing
Location: Bergen, Norway

Learnings:
More-than-human design
Promoting human health, while regenerating habitats for aquatic and terrestrial species
Zoning for different groups of stakeholders
Flexible spaces

Given the similarity with my aim, this project was selected due to its use of Nature-Based Solutions in an urban setting, as well as the inspiring actions of how to activate meeting between different species.

An international competition for Bergen's new city beach and city park was won by White Arkitekter in 2020. The proposal suggests an almost one kilometre long park, becoming the city's new landmark, giving the opportunity for residents to experience water and nature in all seasons for the next 100 years. Bergen Bystrand aims to be a place for people, nature, animals and water to intertwine in a sustainable urban environment. The concept of the project can be concretized in three steps; conveying a story about paths and forms of water, a terraced and robust landscape and a park with a variety of content (White Arkitekter, n.d).

In order for the park to withstand the changes over 100 years, the space must meet new needs, as well as engage future generations. Therefore, White Arkitekter suggests a combination of defined and flexible spaces, making sure that the park will be relevant for years to come (White Arkitekter, n.d).

The sustainable vegetation structure in the park is structured with a dedication to urban nature and nature restoration. Greenery can be divided into different zones, where the coastal part promotes regeneration of the marine ecology, while the 350 metres long and 3800 square metres large wetland connects water and land, as well as creating new habitats for both aquatic and terrestrial species. Furthermore, the park extends into hills of dense forest that will also provide habitats and nesting sites for terrestrial species (White Arkitekter, n.d).

Figure 11. Path Bergen Bystrand. (White Arkitekter, n.d). Reprinted with permission.

Figure 12. Tåsinge Plads. (LYTT Architecture, 2014). Reprinted with permission.

Tåsinge Plads

Architect: Lytt Architecture
Year: 2014
Location: Copenhagen, Denmark

Learnings:
Storm water management in an urban setting
Adaptation rather than prevention for flooding

This park presents ideas for how to use the current topography of the site to prepare for future floodings, while creating a Blue-Green Infrastructure for human use at a central location.

The park is described as the first climate-adapted urban space in Copenhagen. Through welcoming the water and reconnecting to nature, the park works with Nature Based Solutions to manage storm water as well as providing a green, recreational space for the neighbourhood. The 1000m2 of asphalt that previously covered the area has now been transformed into a green park (Klimakvarter, n.d).

The topography and greenery in the park has been adapted to fit the changing conditions through the area. Trees and bushes have been selected based on their tolerance to water levels and contaminants from the surrounding roads, and the height differences to the amount of water the area will be exposed to (Klimakvarter, n.d).

Besides just adapting to the increasing amounts of water, the park incorporates water into the experience through rain gardens, water flow and playground equipment. Large water tanks have been constructed below the park to collect the water, which is then later pumped back to the surface to allow playing, touching and experiencing. This project provides an example of how increasing amounts of water does not have to equal issues, but can be incorporated into the experience of the park and the wellbeing of the visitors (Klimakvarter, n.d).

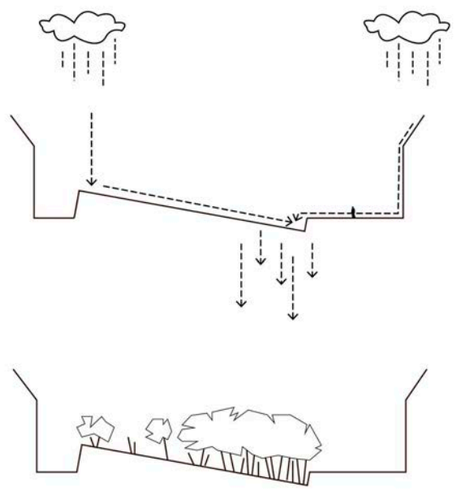


Figure 13. Diagram of water management through a changing topography. (LYTT Architecture, 2014). Reprinted with permission.

Development of Framework

Figure 14. Retention pond as a active space during a dry period. (SLA, 2024). Reprinted with permission.

Grønningen-Bispeparken

Architect: SLA
Year: 2024
Location: Copenhagen, Denmark

Learnings:
More-than-human design approach
Soft paths blending into nature
Zones focusing on non-human stakeholders

Although all previous projects can be interpreted and read as projects of more-than-human architecture, this is the one that inspired and influenced the project the most. Therefore, this project was chosen and dissected to heavily influence my own project.

SLA Architects (n.d) describes this project as the most radical nature-based climate adaptation project in Copenhagen. The concept revolves around letting form follow nature, and every turn of path has been dictated by the natural typologies in the area. The park is designed to contain up to 3000 m3 of rain in 18 specifically designed bioswales that during dryer periods are turned into "social swales" that create spaces for residents' social activities and recreation. Nature in the park is designed to strengthen local biodiversity, with a changing topology landscape creating habitats for a rich and varied wildlife.

Grønningen-Bispeparken features five different nature typologies designed to fit the local climate and the social function. This includes wet "bio-oases" where nature and wildlife have their right of way, being the main stakeholder of the space. On the other hand, there are smaller dry biotopes for play and relaxation, as well as common lawns free of function. The paths connecting the different areas are designed to draw people into nature for an up close experience. They radically follow nature, varying in width and surfaces, with some of the paths dissolving into pure nature (SLA Architects, n.d).

Figure 15. Use of topography and green infrastructure to create spaces. (Københavns Kommune, 2024). Reprinted with permission.

"...Bodies, buildings, environments and climates are intrinsically inseparable."
- Andrés Jaque (2024, p.81)

The research and reference projects presented in this chapter present a new strategy for urban planning that can address several issues simultaneously. Flood management can take many different shapes using Nature-Based Solutions, such as intertidal zones and constructed wetlands. The theory also states the depth and importance of more-than-human design and the benefits of transforming spaces according to this practice.

Using greenery as a strategy rather than just an addition, can transform environments that fit both human and other species needs. This new theme of urban architecture presents future resilience that does not have to be dependent on new technology, but rather takes inspiration from natural systems that are already in place and apply them in an urban setting. Adding more-than-human design elements to this strategy, allows possibilities to address more than one global challenge in one specific project.

The reference projects can all be interpreted to work with more-than-human design. They range from being more adapted to human needs, to solutions that involve addressing the needs of non-human stakeholders. Grønningen-Bispeparken is one of the projects where form follows nature, and by an extent deciding non-humans as a main stakeholder, introducing humans only when nature needs are met. Since more-than-human design lacks a concrete definition, it is important to stress that this motivation is strongly based on my own interpretation of the project.

Insights gathered from this chapter, informs the development of the design proposal in this thesis. The approach of more-than-human design is one of the components guiding this project forward, and is adapted into different configurations at the chosen site. For instance, the main stakeholders for this proposal are the non-humans, to challenge the idea of always designing for human use. Humans are the secondary user and have to adapt to the needs of non-human species.

The issue of flooding is addressed through Nature-Based Flood Resilience, taking inspiration from reference projects where constructed wetlands and other nature typologies work to manage storm water.

Using the principle of zoning areas to different users, and defining areas where the two groups of stakeholders meet, allows the project to grow organically in pace with the functions needed.

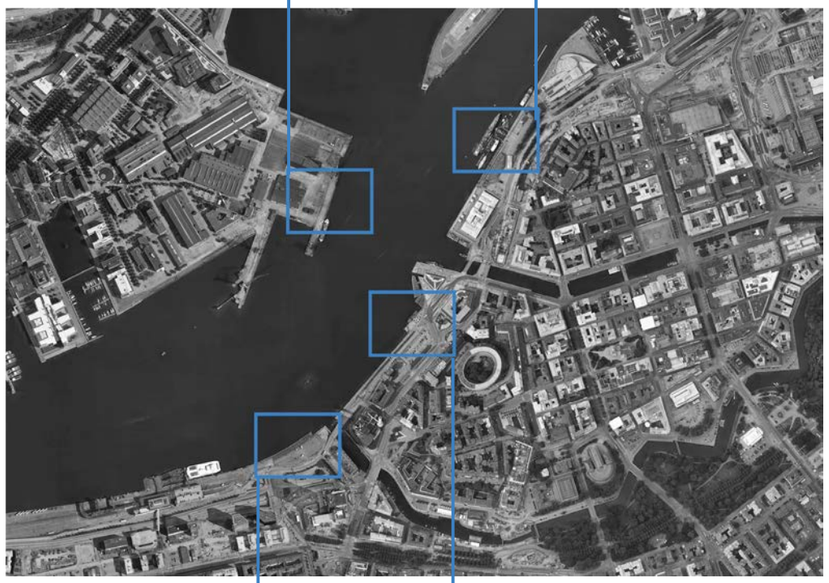
INVESTIGATION

This chapter investigates the site of the project, through analysis of climate, current activity and the limitations of the site. This part also presents the stakeholders for this project and their connection to each other.

Choosing the Site

Other side of the river, outside of "vallgraven" fewer easy connections by public transport. Plots of unbuilt area, by Göta Älv.

Outside of "vallgraven" with fewer connections by public transport, plenty of unbuilt areas, by Göta Älv.



Close to Järntorget. Currently being extended and built to be "Halvön", therefore lack of unbuilt space. Outside of "vallgraven". By Göta Älv.

Parking lot, close to public transport hub, built surroundings. Inside of "vallgraven" and by Göta Älv.

Figure 16. Gothenburg map. (Google Earth, 2025). Public Domain

When choosing the site, a few requirements needed to be fulfilled. Because of the idea of creating an accessible site for the public, the site had to be close to the city center, which is defined as within "vallgraven" and be easily accessible by public transport. Preferably, a site that is already lively and with many people present during different times during the day. Of course, the site also needed to be in close relation to the harbour and river, in order to collaborate with the existing blue infrastructure and add more in a more natural way.

It is also important that there is an existing plot of unbuilt land, in order to not have to demolish current structures more than necessary. Choosing a site heavily affected by grey infrastructure and human activity, makes for an interesting challenge, while also suggesting that the same project can be applied to other similar sites along Göta Älv.

At the same time, it is also crucial that there was some kind of built structure to be utilized within the project, as a conceptual model for flood resistant buildings.

Central location

Accessible by public transport

Closeness to water

Unbuilt plot of land

Surrounded by built structures

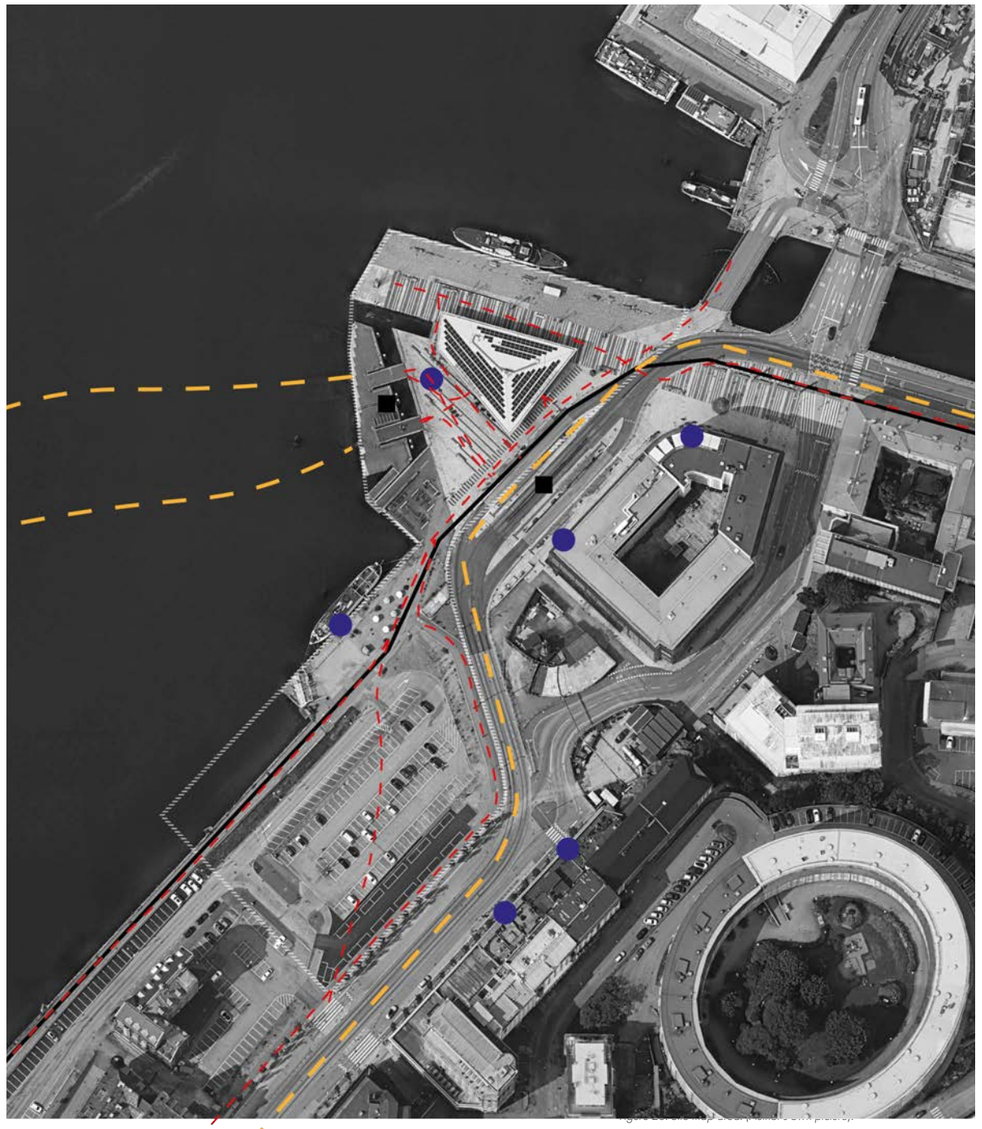


Figure 17. Skeppsbron Gothenburg. (Google Earth 2025.) Public Domain

The chosen site of Skeppsbron and Stenpiren resecentrum fit all requirements previously presented. Other than that, the area is currently well visited and many people pass through it. Defining the site limit came down to a few borders already in the area. First, the public transport movement. The tram tracks and roads surrounding the site will remain, due to the public transport's important function and qualitative addition to the site.

Second, the waterfront acts as another natural border and will not be intervened with, besides possible interventions along and in connection to the water. Third, the parking lot at Skeppsbron is already a defined area and suitable for a larger intervention that could contain most part of the imagined design proposal.

PlaCES

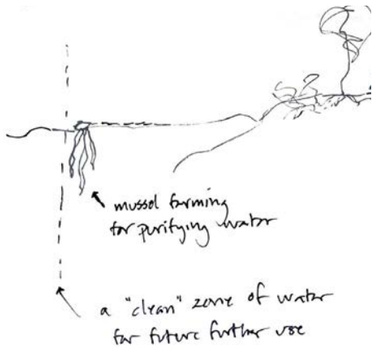


Figure 18. More-than-human design through mussel farming

The PlaCES workshop spanned over three days, located at Frihamnen in Gothenburg. A group of students from different fields gathered together to learn about Cultural Ecosystem Services (CES), more-than human design and what this would mean for this specific site. Through lectures, discussions and thorough analysis the aim was to present a design proposal that would further enhance the CES at a chosen location around Frihamnen. Students were supported by different stakeholders from other professions, including biologists, architects and staff from the municipality, who shared their knowledge and aided in the process of the proposal.

By being there as both a student and an observer, I took notes on the discussions that filled these days in the hope that it would provide new insights that could guide my own project forward.

A few goals for Gothenburg city that greatly relates to this thesis was a healthier living environment, promoted biodiversity and accessible and varied parks and natural areas. This was something that we discussed together and participants were shown examples of what has been applied and where, such as Jubileumsparken, as well as getting access to reports made in relation to this topic. This knowledge informed this thesis theory and further gives insights to the design proposal.

One of the in depth discussions we had was regarding the implications of CES, or rather ecosystem services as a whole. Some argued that the notion can have a negative tone, implying that non-human entities are servants rather than something that we live together with. In reality, nature has no interest in providing for us humans, but prioritises staying alive. On the other hand, some argued that the concept is necessary in a capitalist world, to protect and preserve non-human species. That the term can be used to "sell" a project that in reality might not have humans as its main stakeholder. Having this thesis focus on more-than-human design, it became clear to me that this proposal is not something that aims to "sell" an idea to capitalists, but rather shed light on a bigger issue and a possible solution, and the term "ecosystem services" is therefore excluded from this thesis.

In relation to CES, and the fact that many of the students study conservation, another common topic of discussion was heritage. Mainly what can be defined as heritage and the fact that it includes both built environments and nature, not just one or the other. Throughout the analysis we were tasked to identify remnants of heritage in the area, and how this could influence our design proposal. For example, old street race tracks or structures from industrial times. We were challenged to decide their value, and define how each object or space relates to the heritage of the harbour and the historical changes the area has been through. Even after the end of the workshop, it was still somewhat hard to exactly define heritage, especially for non-built environments. Even though the site of the thesis itself has changed over the years, with new functions to fit current needs, heritage will not be discussed in depth, even if a part of the project can be related to the harbours history of marshlands.

During the study visit to Jubileumsparken, experts and employees presented their thoughts on the process and what issues might remain in the area, as well as the advantages of the process during which the park has grown. One issue that was brought up was the lack of light, which sometimes created unsafe environments. Since the space is somewhat isolated from other more crowded parts of the city, human presence is quite low during the night and might therefore lead to unwanted activities to take place. In connection to the park's "isolation", both stakeholders and students raised the issue of accessibility. Even though the area has little changes in topography, the distances from public transport stops make it difficult for some age groups to reach it on their own. During our visit, one taxi had to pick up a group of seniors by driving all the way through the park. Thankfully, this won't be as big of an issue for this design proposal, due to its very close proximity to public transport, but accessibility for all age groups is still something to take into close consideration. Finally, more-than-human design was discussed and reflected upon. It was brought to our attention that one of the main issues with biodiversity projects is that the needs of the species are rarely presented, making the project lack credibility. Therefore, this has been presented and repeated in this thesis.

At the end of these three days, all groups presented a design proposal based on the knowledge gained and analysis made during the workshop. This included a wetland park especially designed for non-human species, as well as human centered space where nature decides its design. Many participants in the course felt that the new knowledge of CES provided them with a new set of arguments for presenting projects similar to the ones we presented. Students also enjoyed working in cross-disciplinary groups that extended their knowledge and provided more perspectives than what one individual might have.

Figure 19. Old wooden pier at Bananpiren providing cultural ecosyste services.

Figure 20. Change of material by the waterfront.

Figure 21. Small intervention creating a whole new function of the space.

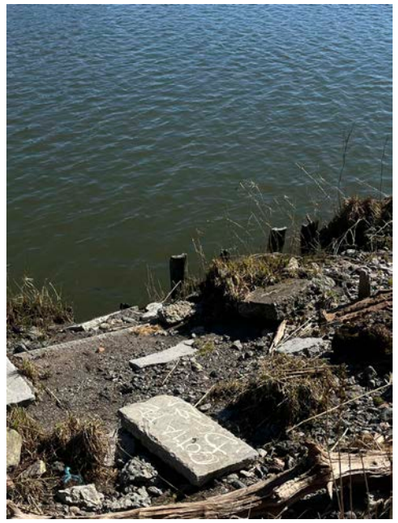


Figure 22. Piece of intertidal zone with remenants of historical structures.

Figure 23. Nature slowly reclaiming the space.

Figure 24. Memories of Bananpirens different uses over the years.

Site Analysis

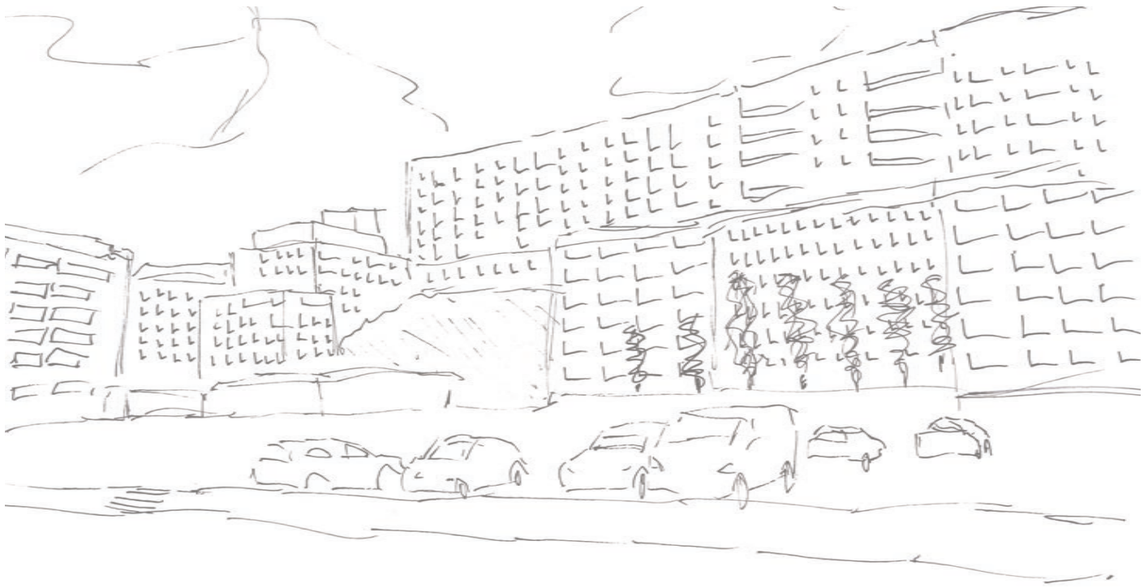


Figure 25. Sketch of parking lot at Skeppsbron.

Visiting the site gives the opportunity to compare design iterations to the context and from there develop them to further create design principles as well as following these during the design process. Additionally, the use of Stenpiren Resecentrum is further investigated and thereby informs decisions in terms of functions and movement.

The site holds many values, being a hub for the public transportation system. Here buses, trams and ferries meet and become a central spot of transportation. The site is to a large extent covered in grey infrastructure and hard surfaces, that although works for its current purpose, will not be able to manage floodings. Being a space with a lot of human activity, the public transport and humans create a soundscape that makes the site less attractive for longer stays.

It is possible to find traces of green infrastructure, especially the area going along the waterfront, but this alone would not be capable of managing large amounts of water for a longer period.

The space is human-centered in its identity and fills the needs of very few non-human stakeholders. In order to include other species than humans, the site will require a much more dense green infrastructure that provides not only recreational spaces for humans, but habitats and safe spaces.

Although the river is visible from the entire site, it is still not accessible to invite citizens to get closer, and is as the greenery surrounded by grey infrastructure. The movement of public transport, both on land and on water, creates a soundscape of high volumes with little natural sounds from more-than-human entities, further shaping the space as an area to move through and not stay around at.

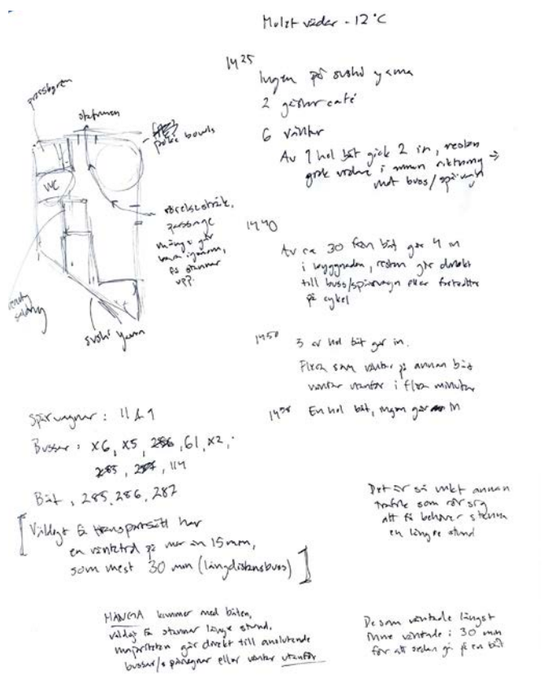


Figure 26. First notes after initial site visit.

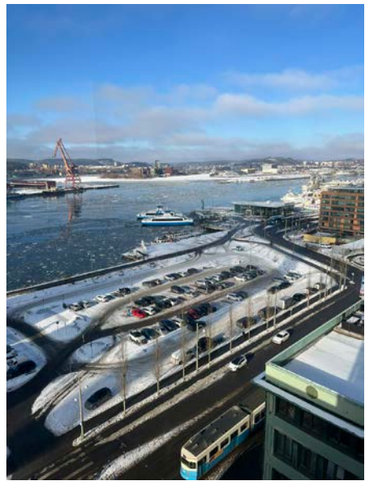


Figure 27. Official and unofficial paths in the snow.

Figure 28. Public Transport System as a key factor in the site's identity.

Figure 29. Grey infrastructure and human-centered spaces covers most of the area.

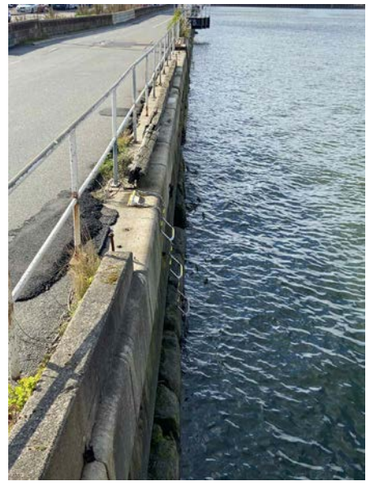


Figure 30. Grey and solid meeting between water and waterfront.

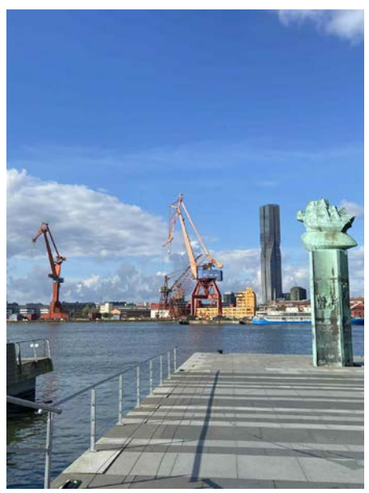


Figure 31. Views towards Gothenburgs identity of a harbour city.

Figure 32. Small traces of green infrastructure acting as a border between grey and blue.

Stenpiren Resecentrum

Figure 33. Stenpiren Resecentrum view from Skeppsbron.

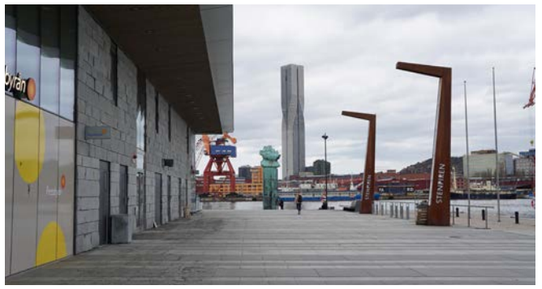


Figure 34. Back side of Stenpiren Resecentrum.

One part of the transformation of this site was to investigate and work with Stenpiren Resecentrum. Finalized in 2016, the building was meant to bring the public closer to the water, as well as creating a warm and comfortable space to wait for the bus, tram or ferry (Sweco, n.d). Considering the position, the building is at great risk of being flooded in the future. Its main function is crucial to the site, but considering the surroundings Stenpiren Resecentrum could benefit from a stronger function in connection with nature and the river.

The inside contains a few functions still necessary to preserve, such as bathrooms, a Pressbyrån and technical rooms, all gathered in one large "block". The outer walls surround this space and creates the limits of the waiting hall, a large space bigger than what might be needed based on the use. People mostly move around the building, or use it as a passage to get to the different public transport stations. Similarly to the greater area of the site, the building is surrounded by grey infrastructure and lacks any type of greenery both on the inside and the outside. One of the strengths of the building related to wet floodproofing, is that all of the technical spaces such as ventilation and electricity, are already located on the second floor. Therefore, the indoor space already contains one of the crucial parts for a flood resilient transformation. To further adapt to this flood management method, only smaller interventions need to be done, mainly in relation to the furniture.

It is clear that this volume is meant to serve humans, and needs a larger intervention to invite and serve non-humans as well.

Figure 35. Indoor space of Stenpiren Resecentrum.

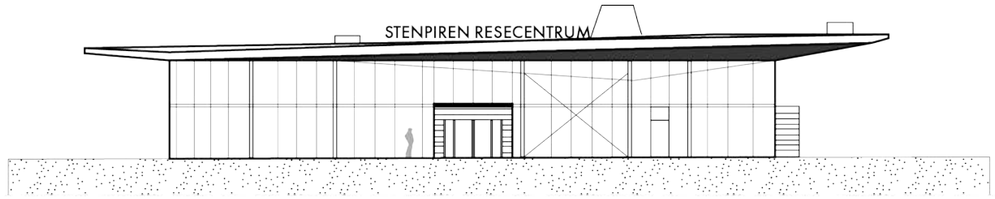


Figure 36. Elevation North.

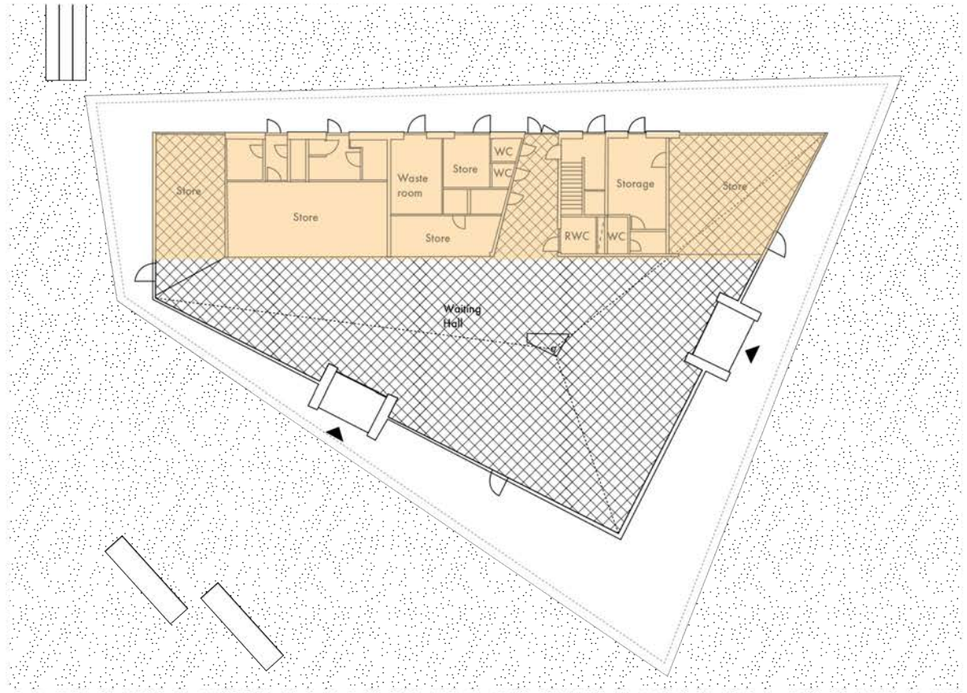


Figure 37. Floor plan.

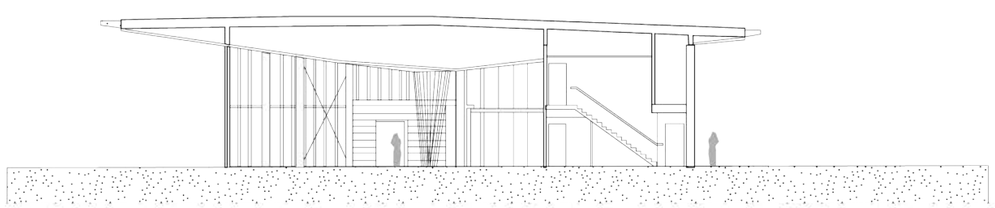


Figure 38. Section.

Material Inventory

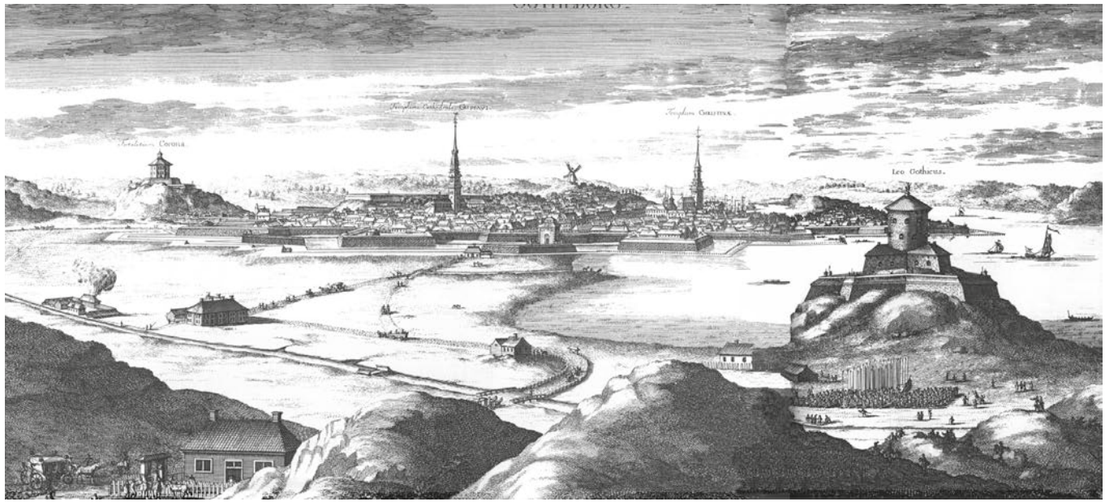


Figure 39. Svecia Antiqua et Hodierna - Gothenburg Harbour 1690-1710. (Dahlberg, 1983). Public Domain.

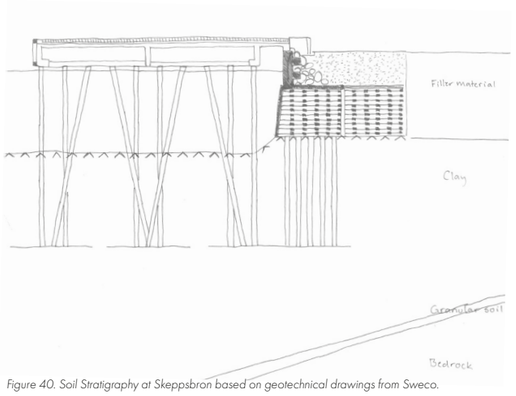


Figure 40. Soil Stratigraphy at Skeppsbron based on geotechnical drawings from Sweco.

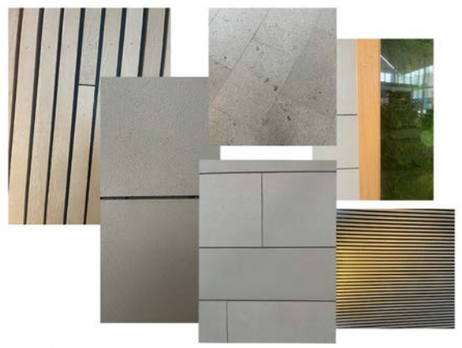


Figure 41. Collage of interior material in Stenpiren Resecentrum.

The area currently known as Skeppsbron has previously been beneath the river surface. When Gothenburg was developed during the 1600s, Skeppsbron was mainly made up of marshlands and the current pier was non-existent. Thereby, all of Skeppsbron has been constructed by human hands and has changed massively over time. Stenpiren pier was first constructed in 1844, and has since then been expanded to 30 meters in total. (Göteborgs Stad, 2011).

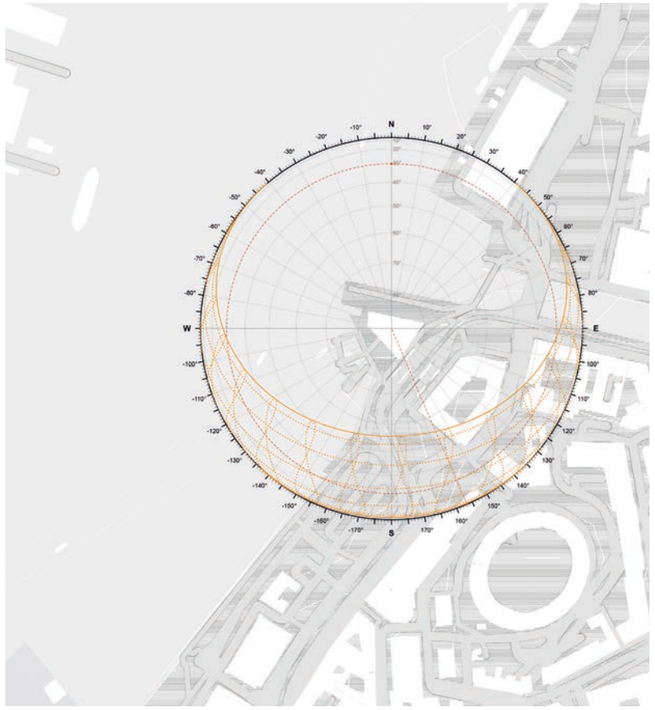
In preparation for the current detailed plan, Gothenburg City together with Sweco and Tyrens made several investigations of the site. Soil conditions were tested at several locations throughout the parking lot, with soil stratigraphy mainly consisting of clay, sand, concrete, crushed stone and construction debris. Considering its history of land reclamation, the soil is expected to contain different levels of contamination, as well as diverse soil stratigraphy in close proximity to each other (Göteborgs Stad, 2011).

Stenpiren resecentrum consists of three main materials, alternating somewhat in shape and size. The ceiling and some of the inner walls are covered in varieties of wood. The floor and the other inner walls consist of some variant of stone, with different patterns depending on wall or floor structure. The exterior facade is based on a curtain wall system in glass and steel, while the two main entrances have stone elements.

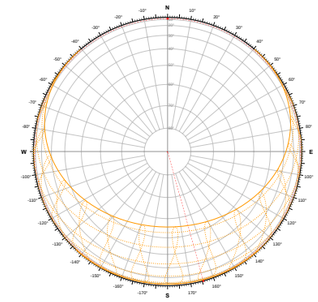
Deciding on the design is determined on the current amount of material, and be adapted to reuse. The glass facade is used in a similar way, yet be reduced based on the new size of the building. The interior floor remains the same, due to the idea of wet floodproofing, where the current floor is already a good choice for this kind of solution.

Climate

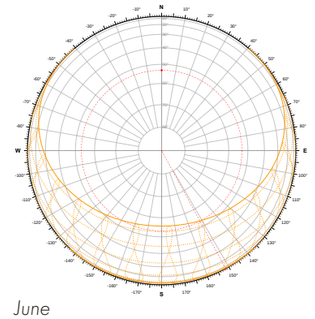
Sun path



March



December



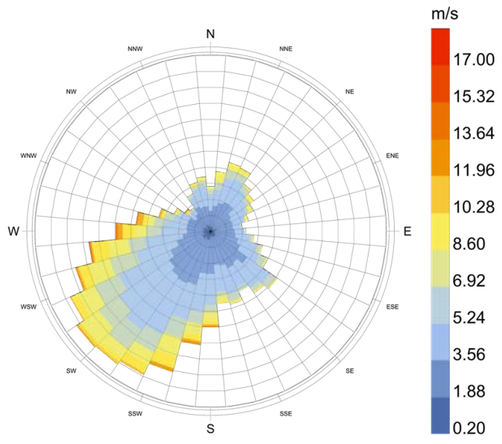
June

Figure 42. Sun paths of site.

The sun conditions throughout the year changes greatly and the site is during winter quite dark, with long shades and depraved from longer periods of sun. On the other hand, summer time allows all areas to get direct sunlight some time every day. These conditions create prominent micro climate zones where the southern areas are more attractive with greater qualities for recreation during summer. During winter time, the northern areas are highly shadow dominated and therefore lack qualities for longer stays and enjoyment.

Another challenge with the site is the high exposure to wind. Based on the wind rose analysis the area is only calm from wind during 0.78% percent of the time, which means that the area only has 68 hours per year without winds affecting the area. In order to create enjoyable spaces within the project site, several sheltered areas are necessary for low intensive activities, and decide placement of different functions accordingly.

Wind rose



Period: 1/1 to 31/12 from 00.00 to 23.00

Figure 43. Wind Rose.

Current Activity

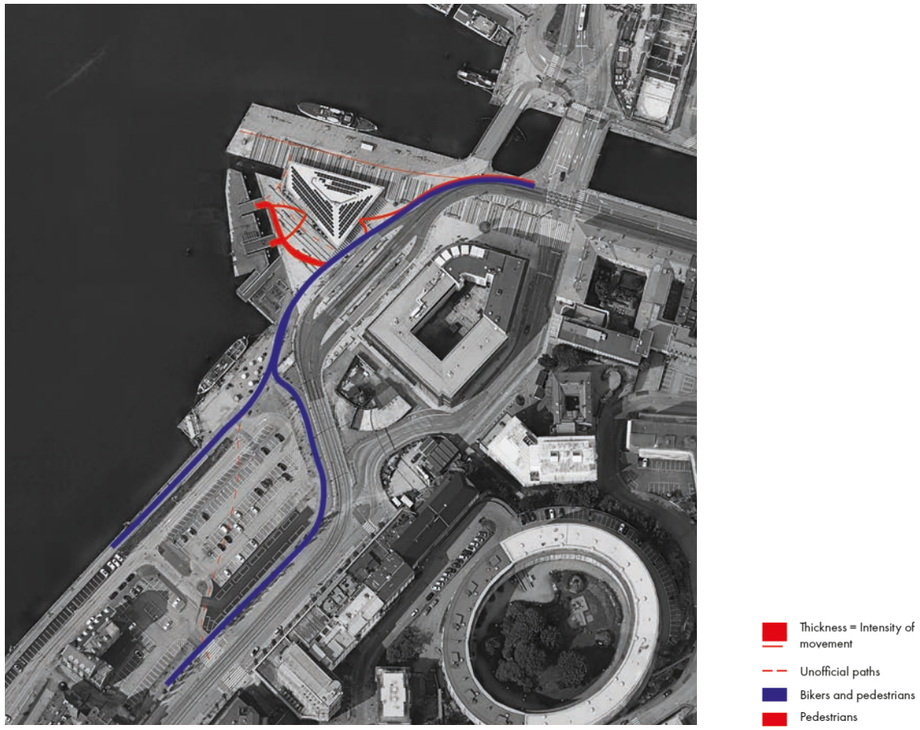
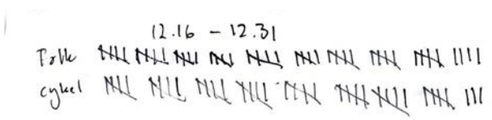


Figure 44. Flow of people's movement surrounding Stenpiren Resecentrum.



Date	Time of visit	Temp	People staying	Duration of visit
Tuesday 21 oct	14:40	10 C	5	30 min
Thursday 29 jan	15:10	-9 C	15	60 min
Friday 6 feb	10.30	-5 C	3	45 min
Wednesday 11 feb	11.45	-6 C	5	50 min
Monday 16 feb	16.00	-3 C	5	40 min
Thursday 19 feb	13.00	-4 C	10	30 min
Friday 27 feb	09.00	4 C	4	35 min
Thursday 25 mar	16.30	6 C	14	25 min
Saturday 11 april	13.30	9 C	21	20 min

Figure 45. Count of people using the building.

The building currently holds two restaurants, a beauty salon, a grab-and-go shop, bathrooms and a larger waiting area. Outside, there are several buses, trams and ferries running consistently. During visits it was made clear that the building itself is quite unused and most of the actual waiting is done outside. Even during a cold or cloudy day, most of the travelers tend to wait outside rather than take a seat in the warmth.If a traveler decides to go inside, it is either to walk through the building rather than going around it, or to wait for the buses driving a longer distance and therefore having a longer waiting time. Even during lunchtime, the two restaurants only had one or two guests each (M. Sommansson, Fieldnotes, January 26, 2026).

The building has quite a clear "back side", where activity is low and few people stay there for longer. It is also the space with the least amount of sun, and where the facade lacks insight into the building (M. Sommansson, Fieldnotes, March 25, 2026)

There are clear paths that most travelers choose to take, and the activity is mainly south of the building.This movement needs to be considered in the project in order to not stop the natural flow, but rather work with it. The majority of the pedestrians walk straight toward the bus and tram stop, or continue south of the site (M. Sommansson, Fieldnotes, February 19, 2026).

SWOT Analysis of Site

S	W
Proximity to Water	Loud Noise
Central Location	Grey Infrastructure
Public Transport Hub	Wind Exposed
Active Area	Traffic and Human Focused
Great Views	Shadowed Areas
Low Current Exploatation	Polluted Water

O	T
Large Area for Expanded Greenery	Exploatation for Residential Area
Connecting Water and Land	Future Flooding
Urban Ecology Hub	Loss of Habitats
Blue-Green Infrastructure	
Regeneration of Habitats	

Figure 46. SWOT Analysis of site.

Stakeholders

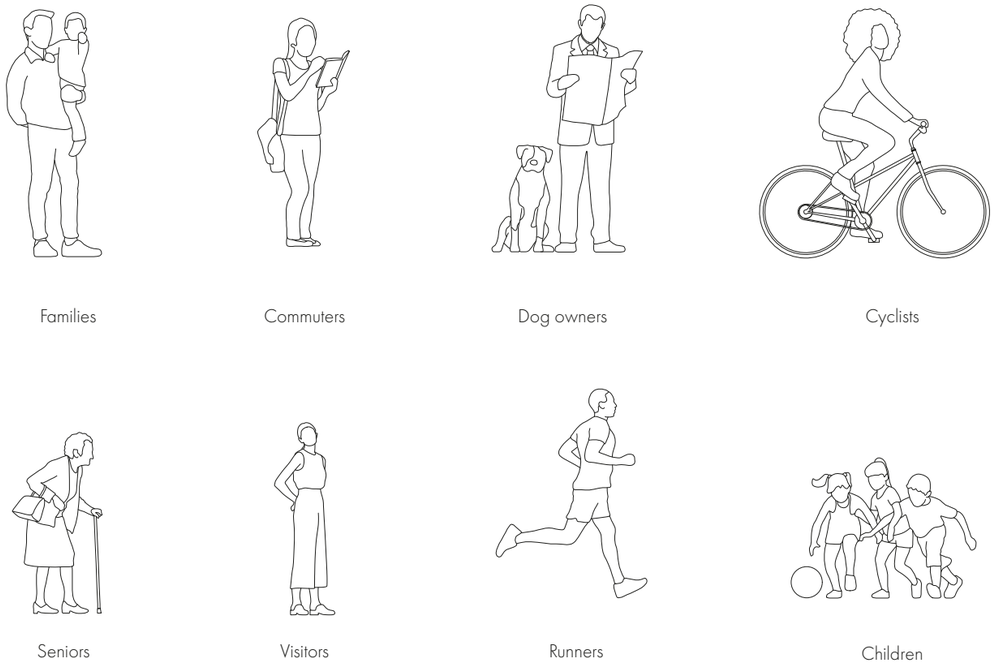


Figure 47. Selected human stakeholders.

Since the project in different ways serves both human and non-human species, planning the site and exploring the options with precision is crucial. Human stakeholders have been defined based both on current users, but also imagined future ones. One of the more prominent human stakeholders at the moment are the commuters and cyclists, but transforming the area into a space for longer stays and recreation will allow others to take ownership of the space. The current area serves primarily humans, but the design proposal aims to add biotopes and habitats for the non-human species.

The non-human species have been selected according to species already present in Västra Götaland as well as the need for them to gain new habitats. This was investigated through documentation already made by the city of Gothenburg as well as through SLU Artdatabanken (2026). They have also been selected depending on their reliance on each other and how their natural habitats fit the area now as well as what the space intends to become.

Furthermore, in the spirit of more-than-human design, Göta Älv and other types of water accumulating at the site will also be considered a stakeholder.

In order to integrate the non-stakeholders and use nature as a tool for the design of the park, mappings of their connections were made. On figure 49 on page 38, the non-humans connections and dependency has been mapped, as well as their relation to the chosen systems. Identifying if the stakeholders will connect to the intertidal zones or constructed wetlands enable an overview of how the connections need to be strengthened as well as what system might need the most space. On figure 50 on the same page, the main needs and wants of each specific stakeholder were made, in order to identify the main functions necessary and if there are overlaps between both groups.

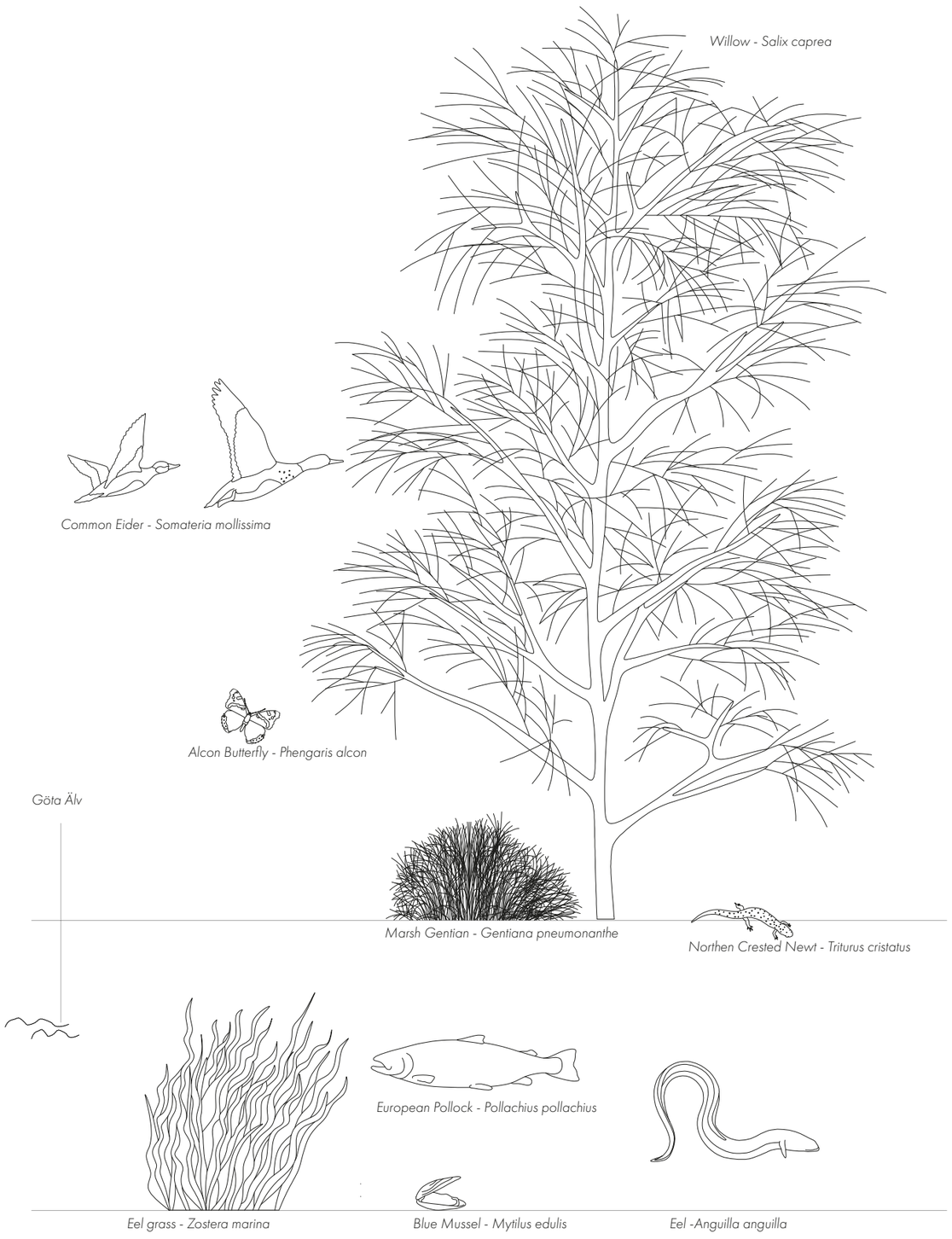


Figure 48. Selected non-human stakeholders.

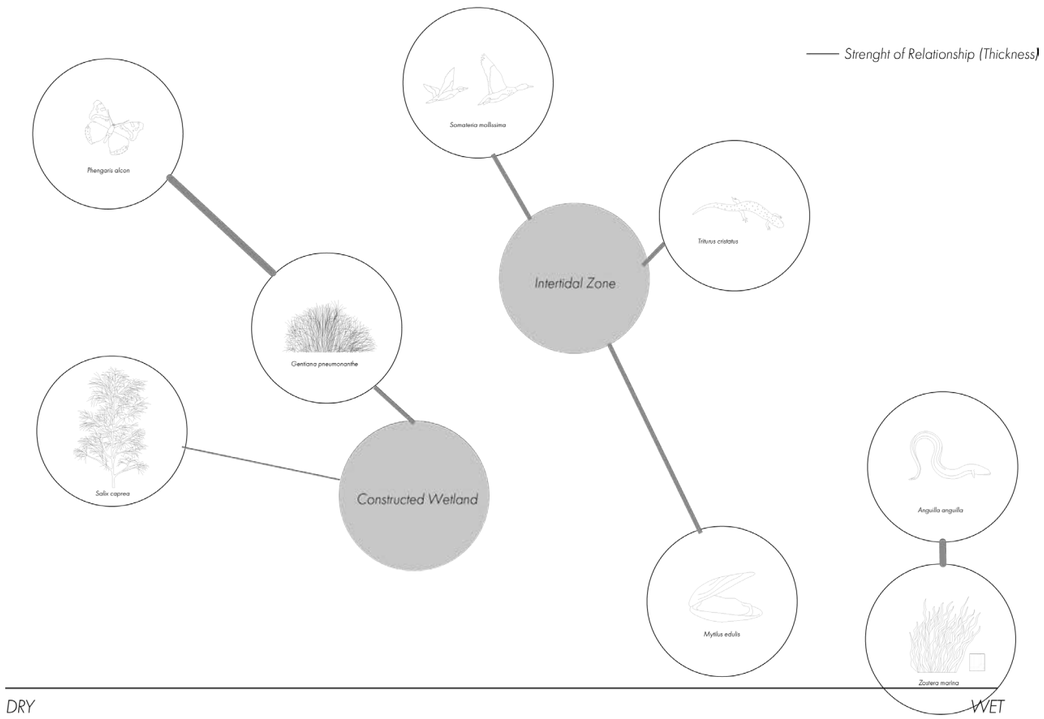


Figure 49. Non-human's relationship and dependence on each other, as well as connection to chosen systems.

Stakeholder	Paths	Seating	Acessible green area	Wind protection	Area for play	"Dry" spaces	"Wet" spaces	Acess to River
Human								
Families	●	●	●	●	●	●	●	●
Commuters	●	●	●	●		●		●
Dog owners	●		●	●	●	●		●
Cyclists	●		●			●		●
Seniors	●	●	●	●		●		●
Visitors	●	●	●	●	●	●	●	●
Runners	●		●			●		●
Children	●	●	●	●	●	●	●	●
Non-human								
Somateria mollissima			●				●	
Phengaris alcon			●				●	
Gentiana pneumonanthe			●				●	
Triturus cristatus			●				●	
Zostera marina			●				●	●
Mytilus edulis			●				●	●
Anguilla anguilla			●				●	●

Figure 50. Mapping of stakeholder needs.

Takeaways from Investigation

Summary of Learnings:
Protection from wind will be one of the biggest challenges
The site holds strong visual qualities
Spaces for non-humans are lacking
Main activity happens around the building, not within

The site occupies a strategic and central location in the city of Gothenburg, with easy access due to its proximity to major transportation hubs in the area. The area can be easily reached by foot from several important locations in the city, and is currently an area that can be heavily defined by movement. The ferry transports people over the river and is a necessary function. Although the movement of the ferry works as a divider of the waterfront, it is important that the ferry remains and therefore has to be worked around.

The area is characterized by extensive hard surfaces, a high flow of commuters and a changing topography. Simultaneously, the site offers several spatial qualities, including good views of the water and an existing waterfront path. On the other hand, the site's climate presents challenges in order to create a stay-oriented environment. The site is highly exposed to wind, generating a need for well planned sheltered areas to invite longer stays. The area is also at large risk of flooding in the future, which makes planning the space accordingly to those risks crucial. Using Nature-Based Solutions to manage storm water, enable flood resilience as a part of the new Blue-Green infrastructure.

The current detailed plan offers an insight to current requests from both the municipality and the residents in the city, inviting the idea of transformation of the area. Knowing the soil stratigraphy, the idea of transforming the parking lot into a green area becomes more reasonable than previous conceptions. Adding intertidal zones along the waterfront will enable a combination of flood management, as well as creating currently non-existing biotopes to the area.

Overall, the site presents strong potential for development into a more inclusive, ecologically responsive and flood resilient environment, while presenting a few bigger challenges to reach the aim.

DESIGN PROPOSAL

The content of this chapter presents the implementations of knowledge gathered from previous chapters and the result of the learnings throughout the thesis work.

Concept

1

Flood resilience

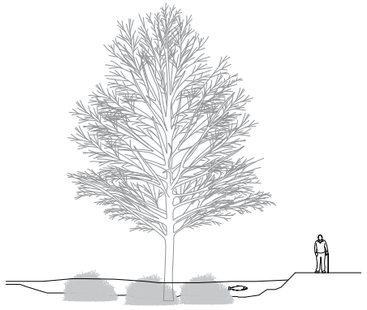


Figure 51. Flood resilience through constructed wetlands and wet floodproofing.

2

More-than-Human

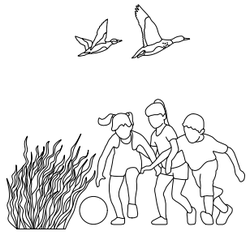


Figure 52. More-than-human design with blue-green infrastructure.

3

Transformation for use

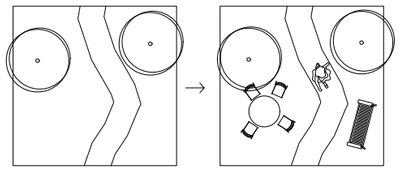


Figure 53. Transformation of spaces for human and non-human use.

Flood resilience

In order to give the area a proper chance against future conditions and potential floodings, the design proposal uses concepts such as intertidal zones and constructed wetlands for flood management, working together with more human centered infrastructure as means to manage extensive amounts of water. The current Stenpiren Resecentrum is adapted to the concept of wet floodproofing.

More-than-human

The site is transformed in such a way that the different stakeholders can share the space. Different habitats are created or recreated to invite common as well as endangered aquatic and terrestrial species to the area, allowing their return to a space that used to belong to them. Humans find a recreational area for a range of activities, utilizing the new blue-green infrastructure as a quality and a complement to the interventions for use and staying.

Transformation for use

Both Skeppsbron and Stenpiren Resecentrum are currently spaces with great qualities, while lacking proper use and transformation. Therefore, based on analysis of the area, both parts of the site are transformed to fit current needs, and functions change to enhance the spaces further. New possible uses are presented, transforming less used spaces to well visited and appreciated ones. The area is a place for longer visits, not just an area to pass through.

Why, What and for Whom?

As a transformational project, the site undergoes changes in order to fit new needs and preparation the city has to make in order to protect the existing in Gothenburg. As the majority of the site is currently covered in asphalt and other hard surfaces, the transformation of this project aims to use Nature-Based solutions to manage future floods and stormwater. The parking lot, although used by several, sits right next to a hub for public transport and a grey area such as this one works more as a barrier between the city and the river rather than an opening.

The green area will be available for the citizens and allow another type of access to the harbour that is not currently at the site, open for recreational use and without limitations to anyone.

Stenpiren Resecentrum is transformed in a way that invites new users, with complementary functions in the hopes of increasing the use of the building. The building will be transformed based on current conditions, while utilizing the location and space for more inviting space for staying.

Design Criteria

Long Stay and Recreation (3)

Transforming the space from a mostly unused space to an area filled with life and activity

Intertidal Zones (1,2)

For flood management and habitat recreation, while softening the edge to the waterfront

Humans Absorbed in Nature (2)

Space where humans becomes absorbed into nature, erasing the border between human and non-human zones

Zoning for Different Stakeholders (2,3)

Areas separate for each stakeholder group, as well as spaces where they meet. Where humans can stay for longer periods of time

Organism instead of Building (2)

Stenpiren Resecentrum becomes a system where nature takes part in the transformation

Different Levels of Wetness (1,2)

Addressing needs of different both human and non-human stakeholders

Flood Resilient Planning (1)

Planning paths and human-use spaces for the possibility of being flooded

Figure 54. Original Site Plan

Defining the Space

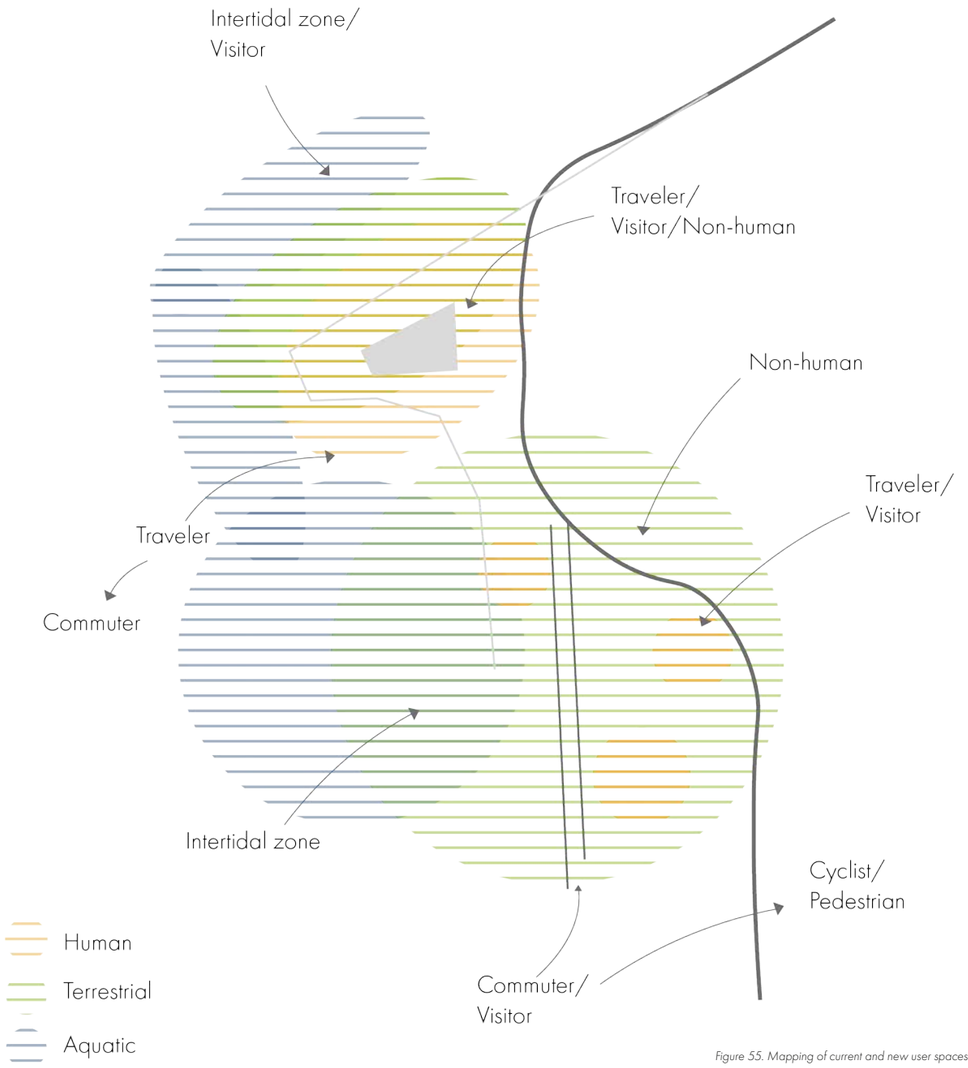


Figure 55. Mapping of current and new user spaces at the site

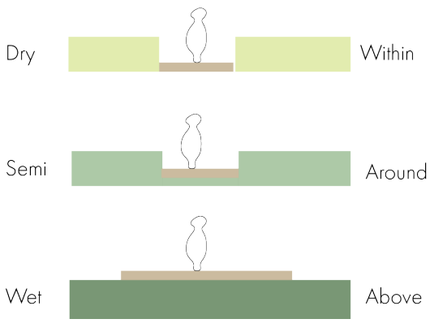
User spaces

In order to define the large area that the design proposal covers, zones serve as a foundation. There are several stakeholders involved and the aim is to create spaces where they meet, but also areas where they are safely separated from each other. Zones will be divided between human, non-human and spaces where the two meet. Defining points where these groups meet create a clear pattern of where they meet and intertwine, which furthermore creates a shape of which the proposal can grow from.

It is important to note that even though both groups of stakeholders are meant to gain from this project, more focus has been given to the non-human species. The idea is to first create a green space suited for their needs, and from there slowly include human centered spaces into this area.

Zoning for Different Stakeholders

Humans Absorbed in Nature



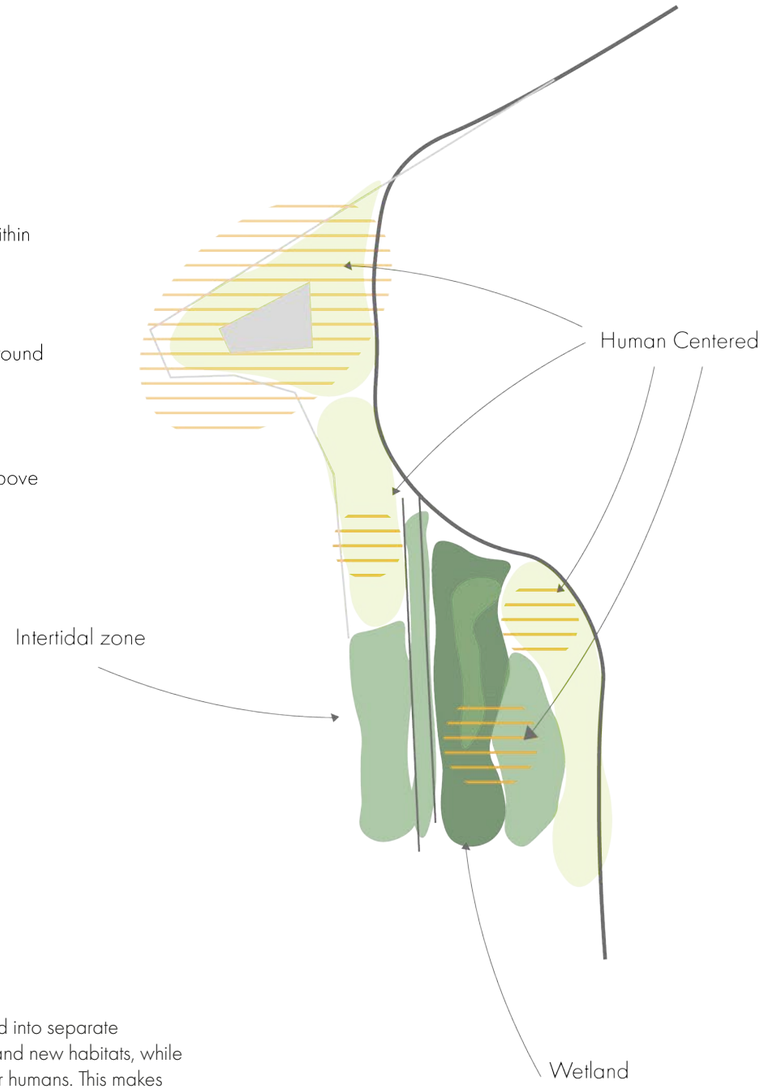


Figure 56. Zones with the different levels of wetness at the site.

Zoning

Different areas within the project site are divided into separate climates. Some more focus on water retention and new habitats, while others rather function as more usable spaces for humans. This makes some zones more or less accessible to humans, with the intention to keep these less disturbed habitats. The green areas are divided into three categories; wet, semi-wet and dry. This does not only entail the proposed climate during all 365 days of the year, but will also separate them into more or less flood resilient. Paths going through the park will also be adapted to the different levels of wetness, being within, around or above. This is a consequence of the different zones being more or less accessible to humans, with the intent of still inviting humans to enjoy the space, with more or less closeness to nature and habitats.

The so-called dry areas are mainly grass fields and meadows, allowing humans to claim the space and use the area as they wish. Here, paths allow humans to be directly absorbed into nature, and the borders between paths and green spaces will melt together into one big space. The semi-wet areas will be working as a transition zone between the wet and dry, and the wetness will be dependent on the surrounding conditions. Therefore, during dryer periods, they work as an extension of the dry areas, and as a buffer during rainy or flooded days. Wet areas, mainly being true constructed wetlands, is the area that serves humans the least, being wet all year with paths being raised to be "above" the green.

Different Levels of Wetness

Intertidal Zones

Humans Absorbed in Nature

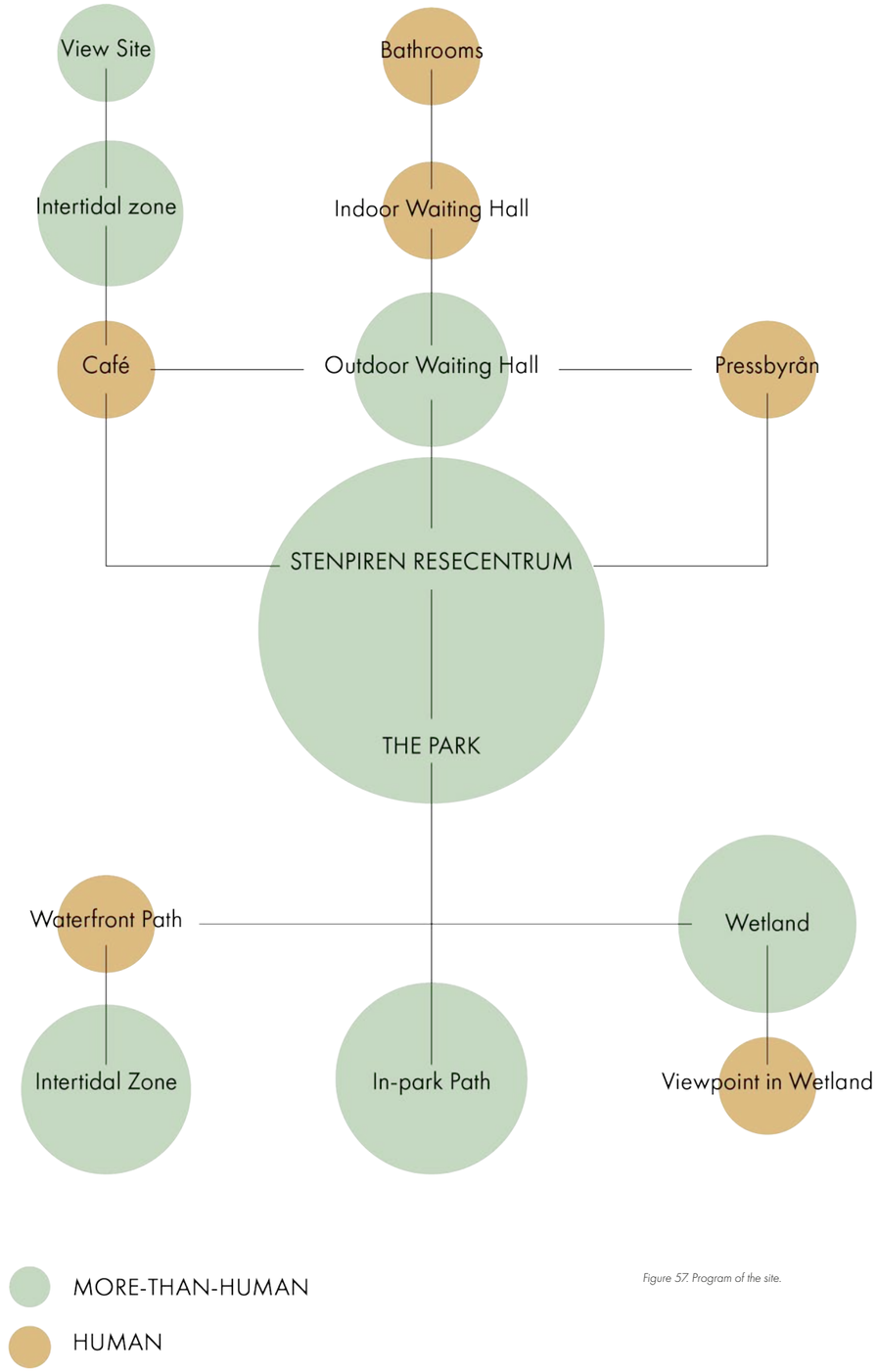


Figure 57. Program of the site.

Design Exploration

Stenpiren Resecentrum

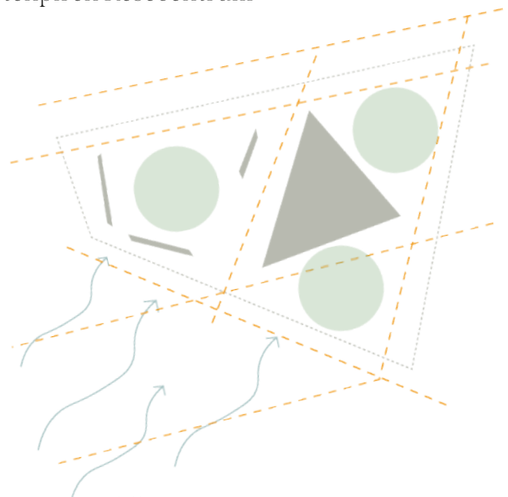


Figure 58. 1st iteration building.

Starting off the exploration, the building was "dismantled" and rearranged. With the goal of creating outdoor spaces, the indoor space turned into one volume with additional separate walls creating wind sheltered areas. The new paths were designed by the new volumes and could mimic the current movement through the building. However, the volume meant for inside use ended up being a difficult shape to host all of the necessary functions.

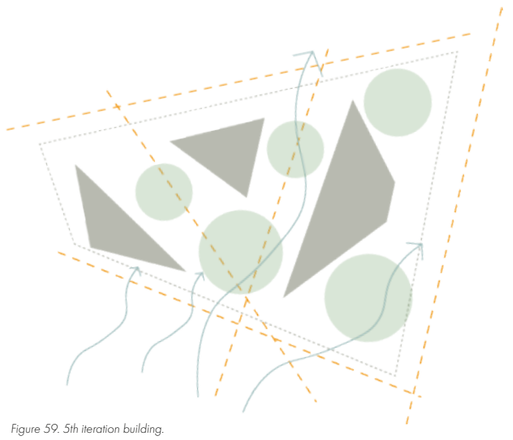


Figure 59. 5th iteration building.

To create more indoor space, the previous free standing walls inspired the shape of two new volumes. While this idea created more spaces, both indoor and outdoor, the shapes were still difficult to manage and highly randomized. Another issue occurred when adding wind to the analysis, since the arrangement of the volumes created a wind tunnel going through the entire structure. Since the wind is one of the bigger challenges with the site, this proposal idea was also discarded.

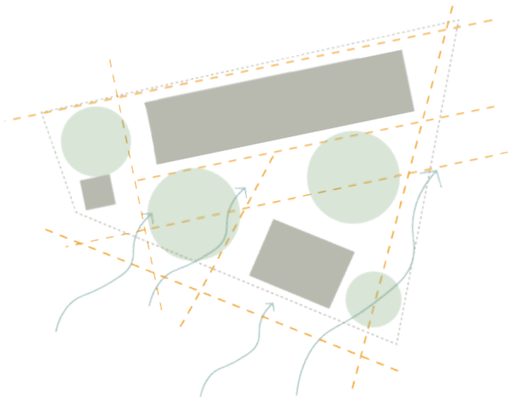


Figure 60. Last iteration before final proposal.

After a proper reflection of the iterations so far, and the current state of the building, it was decided that the inner volume of the current volume would remain more or less the same. The west, south and east facades were removed and reused in two smaller volumes, one for a small exhibition space and the other as the new waiting hall. This iteration preserved many of the functions already at the site that previously had been rearranged completely. It became apparent that if the functions were to remain, they might as well be left at the location they are already at. Simultaneously, a reflection of the non-human stakeholders and the lack of spaces for them, lead to further rearrangement for the final proposal.

The Park

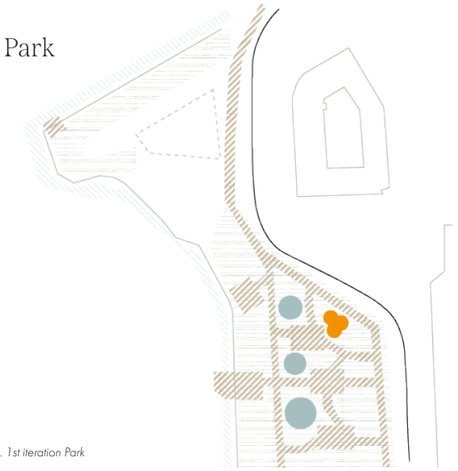


Figure 61. 1st iteration Park

For this first iteration, the park hosted several spaces with decided functions, including several new squares and a larger playground. Humans and non-humans became separated from one another and therefore lost connection to one of the design principles. Furthermore, green spaces and zones for different levels of wetness were decided based on where human recreation would take place, and not the other way around.

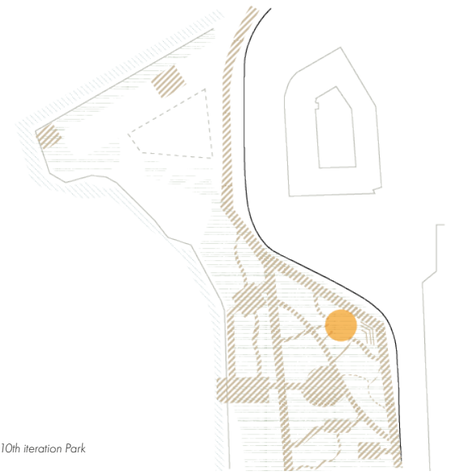


Figure 62. 10th iteration Park

In contradiction to the reflection of the first iteration, this proposal too had many defined spaces for humans. They were more integrated with nature, as a wetland observation deck took place, where humans could connect with nature. The playground became more undefined for children to create their own spaces, but still took a lot of space in the overall area. After further reflection, it also became apparent that the defined spaces had little to no connection to the topography, and once again the green and blue spaces were still lacking.

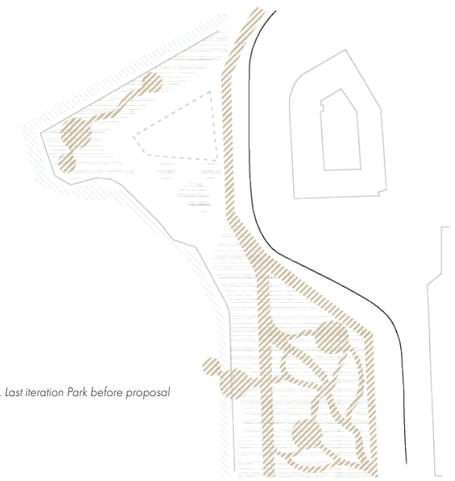


Figure 63. Last iteration Park before proposal

Before this iteration, a longer reflection of previous proposals and the design principles of this project was done. Both the previous ones had unintentionally still focused on humans as a stakeholder, and non-humans were forgotten. This time, the topography decided the different green zones in connection to the different levels of wetness and those limitations from there showed the spaces for non-human stakeholders. Only when those spaces were decided, human functions came into consideration and were limited to only two spaces within the park. For the final proposal, this approach continued. Topography decided the shape of the paths, and only when non-human needs were met, human functions could start to take place.

The Proposal

Figure 64. Site plan scale 1:1000

1 Stenpiren Resecentrum
2 Display of More-than-human Wall
3 View Deck
4 Ferry
5 Bicycle parking
6 Pond & "Meet the waterfront"
7 Waterfront seating
8 Square and Playground
9 Wetland Observation Deck

The design proposal suggests one answer to the thesis question: How can more-than-human design shape and transform urban spaces while mitigating flood risks?

From the iterations made during this time, the one prominent mistake being made was the subconscious creation of human spaces. Therefore, this final proposal grew from the true intent of the thesis; using more-than-human design to shape urban spaces.

The new space of Skeppsbron has been reinvented as a park for recreation, integration with nature and with precautions for potential future flooding. The application of Nature-Based Solutions in order to address the issues of both biodiversity loss and flooding risks creates a space more resilient to our future, in comparison to what is currently present. Intertidal zones and constructed wetlands are multifunctional solutions that additionally well represents the decentralisation of humans and adapting to a more-than-human design approach. This transformation project presents one potential solution applied to the threats of the specific site along the Göta Älv, while presenting an option to the current plans.

The proposal explores how nature can be used as a tool to create new public spaces in an urban setting, while keeping the tool itself a stakeholder. A key part of the design is the limited amount of spaces with decided functions, a means to keep the area adapted to changing needs and conditions of the future. Therefore, very few spaces are defined with a specific function in mind, where options of use are limited. It is up to the user to define the space, with the restrictions that it might hold. The main defined spaces are the wetland observation deck, the square as well as the playground connected to it, where children can interact with nature and play with natural elements.

Some of the previous functions are however untouched. The ferry is a crucial part of the site's function, and remains where it is. Similarly, the bicycle parking and the main path along the waterfront stay, with smaller adjustments in relation to the bigger plan.

New stakeholders have been introduced, both human and non-human. The priority have been the aquatic and terrestrial species that either already exist in the area, or those in need of new habitats that fit within the program.

To further express the idea of more-than-human design, a small space on the north side of the site has gained a "more-than-human" wall, displaying how we within the built environment can produce walls adapted to more than just humans. Here the walls have been built with different materials, some parts of rocks and others by a similar style as insect hotels, to express the diversity of a wall that can be inhabited by several species simultaneously.

Figure 65. Perspective from the square

Figure 66. Perspective towards the wetland observation deck

For the new park, the current parking lot, the transformation included a large intervention of removing the grey infrastructure and adding plenty of blue-green infrastructure instead. This differs a lot with the current plans for a new residential area. A majority of the space has been transformed into a constructed wetland, that both provides habitats, but also creates conditions to withhold large amounts of water, both from potential floodings but also storm water. Here water can be contained, filtered and absorbed by the vegetation. This zone is the area considered the most wet according to the concept of zoning, and therefore the most wet. Thereby, it is the area least accessible for humans, which was the intent of the system.

New paths have been created within the site, inspired both by the unofficial paths identified during the investigation, but also by topography and the new zones. The intention is for humans to be absorbed in nature in a few different ways, decided by nature itself. The paths have several spaces for seating, both "above" nature with benches, as well as "within" nature with lowered seating areas connecting directly with the surrounding green areas.

The two new spaces with the most defined functions, are the two presented in the figures above. First, a new square with nature-interactive play going into the wetland, as well as seating, barbeque and spaces going into the more nature-heavy areas. Second, the wetland observation deck, where humans can come in direct contact with the wetland through the lowered seating area. This spot is one of few places where humans can be part of the wetland as a whole, yet still "above" it creating distance and protection for the non-human species. Besides these two spaces, humans can for themselves decide the use of the space according to their own needs in the many undefined natural areas.

Figure 67. Site plan of Park scale 1:500

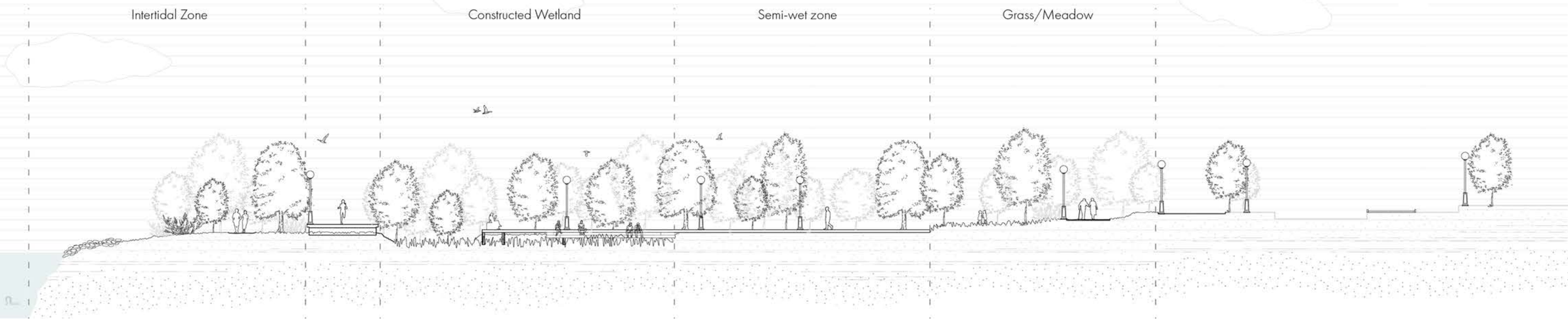


Figure 68. Section A-A scale 1:300

Figure 69. Wetland Flooding Scenario

Scale 1:300

0 1 5 10 20

The park is divided into several different zones, decided by topography and conditions necessary for the non-human stakeholders. A big part of the space is turned into a wetland, which wetness affects the surrounding zones. The wetland is the area most focused on non-human use, and therefore the space with the most biodiversity. The southern part of the wetland has an observation deck where humans can come in contact with the area through a lowered seating area.

Surrounding this area are the semi-wet zones, working as a transition to the dryer areas as well as a buffer zone during heavier rain. This also includes the intertidal zones, rich in biodiversity containing multiple habitats, while being an area of constant change in wetness level. Therefore, both these zones are areas where the current weather and climate decides whether humans would want to be in the space or just in close proximity to it.

Finally, there are the dry zones, with grass or somewhat harder surfaces. These are intended to serve the humans more than the other ones. This zone includes a smaller square where nature is still close and can be interacted with, while providing more space for strictly human activity.

The division of zones gives humans different amounts of access depending on the conditions of the areas. During a potential flooding, the wetland is able to contain large amounts of water, but in the event of extreme levels of water, the excess will and is allowed to flow further in the surrounding zones. The current bike and pedestrian path along the waterfront have been elevated and stormwater can also be transported away from the park beneath it, while still being usable by humans. From there, it ends up in the river being cleaner through the wetlands natural filtration system.

Figure 70. Perspective from the Waterfront Path

Figure 72. Perspective from the waterfront path towards Stenpiren Resecentrum

Figure 71. Section C-C scale 1:800

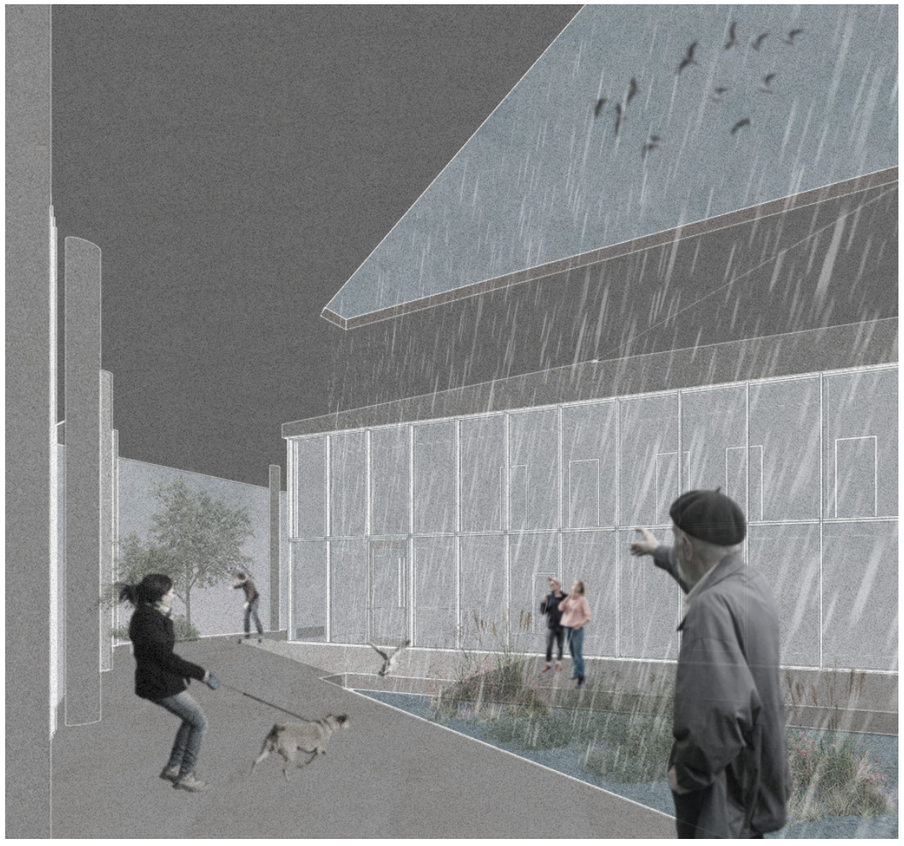


Figure 73. Perspective under the roof

The new Stenpiren Resecentrum is transformed in a way that the scale fits better with the current use. Most of the exterior walls have been removed and the waiting hall is now moved into a smaller space inside the remaining indoor space. The space still within closed walls is left with few changes, as the functions of a Pressbyrån and the bathrooms are what most visitors use currently. In order to recreate parts of Stenpiren Resecentrums expression, the removed glass facade has been reused in the transformation of the indoor spaces. Most of the previously closed walls have been pushed back slightly and enabled the glass facade to be present in this proposal as well.

As previously mentioned in the investigation, one benefit of the building is that it is already currently somewhat adapted to the concept of wet floodproofing, with the technical rooms being placed upstairs. Therefore, the interventions needed to allow water to enter could be minimized. A change of furniture made of more water resistant materials, together with the current stone flooring, created a perfect base for a building that can accept being flooded.

In order to transform the surrounding space to fit more-than-human needs, much of the grey infrastructure has been removed and replaced with greenery.

Similarly to the park, there are zones with different levels of wetness, yet here limited to two larger ones: an intertidal zone going around the entire waterfront, and a dry, grasscovered area allowing humans free access, while providing non-human entities to claim the space themselves. Paths registered during the investigation have been reimagined as harder surfaces with a smaller square in front of the building allowing a seating within nature, once again acknowledging the needs of humans, while limiting it to what is actually necessary rather than leaving the vast hardened surfaces that are unable to manage potential flooding.

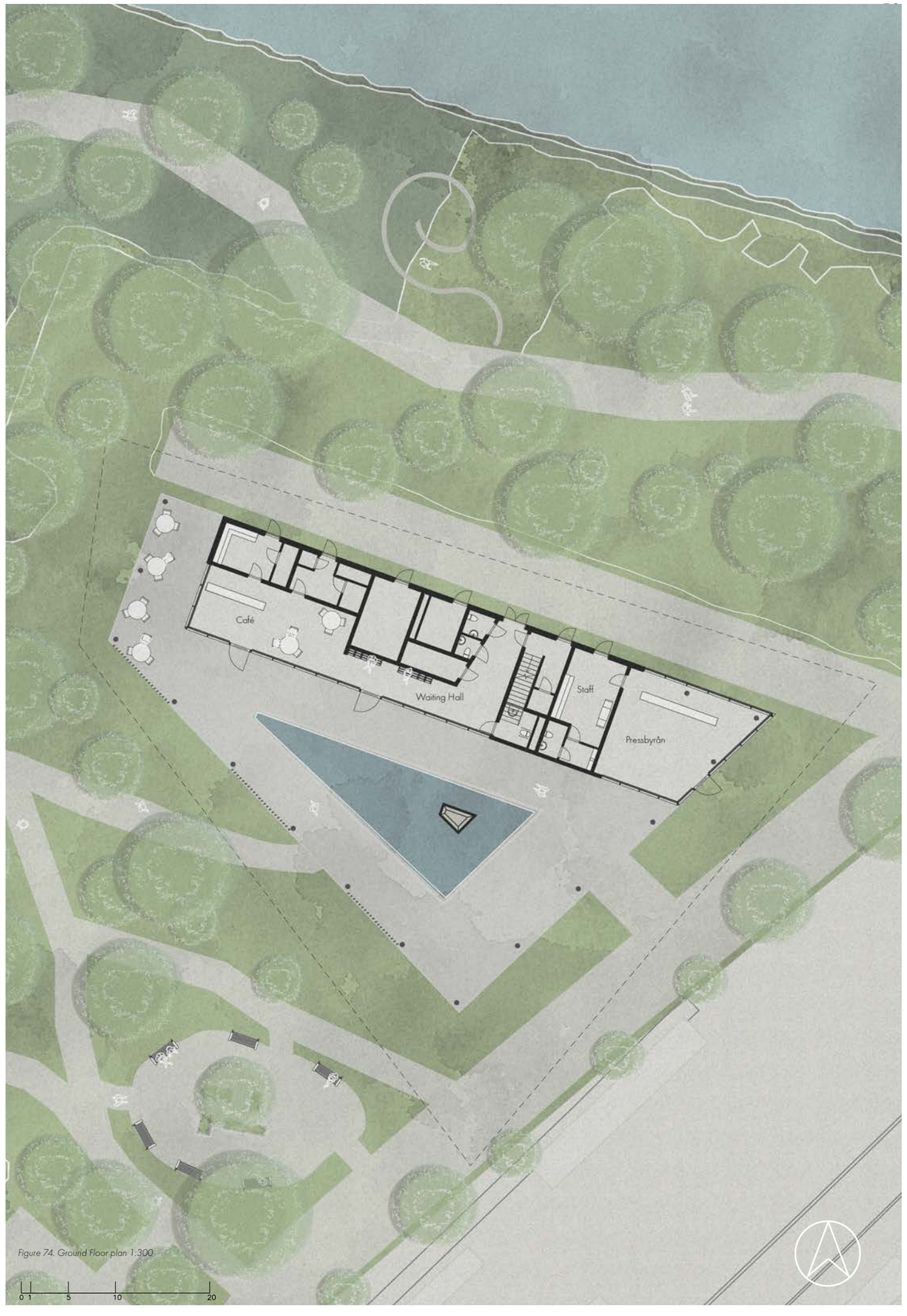


Figure 74. Ground Floor plan 1:300

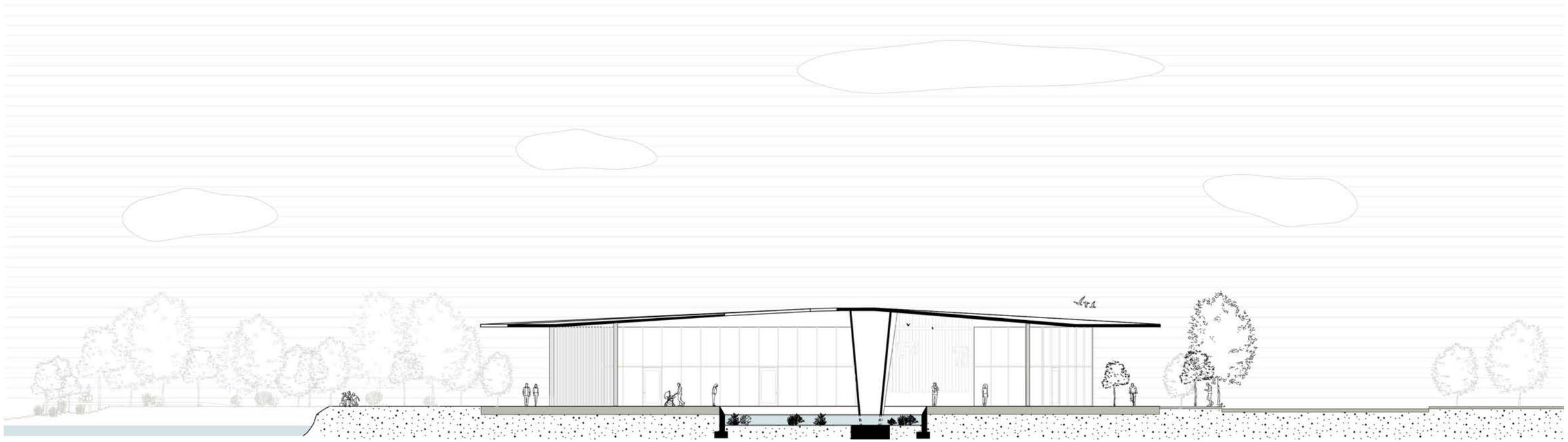


Figure 75. Section B-B scale 1:300

0 1 5 10 20

Figure 76. Elevation West scale 1:500

0 1 5 10 20

Two interventions have been made to further showcase the concept of more-than-human design. The area of the south facade of the building that needed to be closed, have been reimagined as an inhabited wall, varying in materials and creating cracks and cavities where non-humans can claim the wall as their space. North of the building, along the created pathway, another one of these walls have been created, more as an exhibition of its potential, while still providing wind shelter and an experience of what something made for someone other than humans can look like.

In addition to the more-than-human wall and wet floodproofing of the building, a pond has been created beneath the roof. An opening in the roof allows sun to enter and shed light into the building, while also simultaneously creating a water display where rain can fall into the pond. This pond works as a small constructed wetland, once again both displaying more-than-human design as well as serving the non-human needs.

The existing central pillar goes into the pond and preserves its function while becoming a more present part of the new structure of the building. The rest of the pillars previously within the building, becomes part of the exterior expression. Wooden screens are added and add wind shelter to the now more exposed interior space, as well as creating a shadow play during sunny days.

Figure 77. Flooding Scenario by the Waterfront Path

DISCUSSION & CONCLUSION

The final chapter summarises the thesis with a discussion and reflection of the theory, context and proposal that connects to the aim and thesis question defining this project.

This thesis was inspired by the need for preparation for natural hazards as an effect of our changing climate. As Gothenburg faces risks of major flooding, while having to adapt to new sustainable methods, a search for possible concepts began. More-than-human design, while an undefined concept, has been a cornerstone leading the project from start to finish. Similarly, Nature-Based Solutions entered early in the process and inspired a new way of managing crises, both in relation to flooding as well as biodiversity loss. Both of these topics ended up defining the research question as follows:

How can more-than-human design shape and transform urban spaces while mitigating flood risks?

The proposal aims to present key elements for such a transformation, adding to the topic of Nature-Based Solutions and inviting designers to adapt to similar approaches.

In order to let this project grow organically, the process has been done through a thorough reflection of several iterations, connecting back to the theory gathered in the beginning. Although the ethnographic studies were made quite late in the process, they were highly valuable for the final design process as well as the intent of the project. The discussion during this time added yet another layer of more-than-human design and perspectives from other professions. If the project were to continue further, discussing and analysing with professionals within fields such as biology would help further argue for the realisation of such a project.

The learnings gathered during the time of the thesis have influenced a new way of thinking of architecture, and provided me with many new perspectives to a previously unknown subject. Every source has been critically reflected upon, and the combination of topics have together been compared to find a common ground from where my own work stems from. Of course, there has still been a selection of the chosen references which affects the angle of this thesis, based on the common thoughts and the research that I could gather during this time.

The proposal suggests that by having the more-than-human design concept in mind, one can decentralize humans at the early stages of the process, and only later on apply functions that can suit both the needs of human and non-human stakeholders. For this project, that meant starting from zero, and imagining the site without human presence. From there, the knowledge of different systems and stakeholder needs created design criteria focused on natural ways of transforming spaces, using systems with several strengths including biodiversity and flood mitigation measures. Only when a basic design of the site, where the work only contained designing with nature, were the humans introduced. From there, spaces where the two stakeholder groups could meet and interact were identified. Still being careful with defining functions, these spaces grew with the intent of serving human activity, while still respecting the boundaries of the non-human species.

The decision of the Nature-Based Solutions systems was based on two factors: they should be able to provide flood management, while increasing habitats and therefore increase biodiversity in the area. Constructed wetlands and intertidal zones both seemed appropriate for the area as well as the climate, being two adaptable systems.

Although the project was intended as a site specific design presenting key elements for successful transformation, it is important to further stress that the systems used will be more or less applicable in other contexts. The intertidal zone would work well at several locations along the river, while the constructed wetland requires a more changing topography to be used.

The constructed wetland in this project is a suggestion of a system within the field of Nature-Based Solutions, yet true results could only be known through proper application of the method. Similarly, the true test of the proposed solution can at this point only be done during a flood or with extensive amounts of storm water. There are very few projects of similar wetlands at such urban and central locations, therefore making the proposal quite explorative.

As this project aims to create new habitats for local species, both common and endangered ones, the site undergoes a large transformation turning into something very different compared to today. Even though the intent is to bring back species and promote biodiversity, it is important to acknowledge that the changes done to the site might end up dislocating current species, as the habitat they require is changing.

It was also important that the new species introduced was not intentionally put there to provide ecosystem services, but to gain a new space of safety. Presented in the investigation part of this thesis, the term “ecosystem services” can in some perspective have negative connotations. When designing this space, it was always important to keep the non-human stakeholders as a priority, without the intent of them directly providing services for humans. By using more-than-human design as a key concept, and relying on Nature-Based Solutions, the project grew from the idea of designing for other users than humans.However, this method comes with two main consequences. Firstly, being a designer with a long background of designing for humans, might affect the project in subconscious ways and the concept of more-than-human design is still vague. There are no specific requirements or rules, making the project a suggestion and speculation of how this method can affect a project, rather than a handbook for designing in this way.

The second and most prominent consequence, is that a project with a foundation of decentralizing humans, might have limited appeal to investors and decision-makers. It is a radical response to the current detailed plan with fewer economical benefits and therefore lack of interest in a capitalist context. In order to make this project plausible and appealing, major changes of the design would probably have to be made, focusing on more functions specifically tailored towards humans. Yet, this would lead to the project losing many of its core values, and like many other projects go right back into fitting within the anthropocentric world we currently live in.

Bruno Latour’s Actor Network Theory (1996), only encountered at the very end of this thesis, can be connected to the relationship between this thesis and the anthropocene. Although Latour does not focus on more-than-human design, his idea of actors and the network those created could be interpreted to relate to this topic. He argues that anything that makes a difference, or affects something else, is an actor and that the world consists of networks of these actors. This contrasts to the current anthropocene, arguing there is no real difference between a human, an insect or an object. Keeping this theory in mind could be a next step towards designing with a more-than-human approach.

While limited in scope, this thesis contributes to ongoing discussions on climate adaptation within the architecture industry. The goal is to initiate critical thinking in an anthropocentric world and reflect on how we intend to solve the climate crisis with all inhabitants of the earth in mind. The proposal tries to show one option of a multilayered solution, where both biodiversity loss and flooding risks are managed while transforming an urban space.

Urbanisation is a global shift and while cities are growing, so are the risks of floods, biodiversity loss and other climate hazards. Constructed wetlands and intertidal zones are two of many systems valuable for future applications, not only in Sweden. These systems show the opportunities of Blue-Green infrastructure in urban transformation, as they can be adapted to site specific conditions. Additionally, they can be connected to more-than-human design as they provide benefits for non-human entities, often more than for humans. The lack of more-than-human design in this industry is prominent, and proposing a method that fits within urbanisation could provide key elements applicable in larger or smaller contexts. Yet, there are no defined systems and this might be one of the larger challenges with further research.

In this sense, the thesis should not be interpreted as a final proposal, but as arguments for how architecture might engage and design more respectfully with our non-human neighbours. It shows that through a lens of a more-than-human concept, beginning with non-human stakeholders, design grows through nature.

The project has had me continuously reflect on who I design for, and redefine what fits within the scope of an architect’s work. It provided me with a new standpoint that this thesis hopefully shares.

This section presents the references used and refered to in this thesis.

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