Regenerative Landscapes

Redefining the relationship between Wetlands, Agriculture, and Urban Development

Master's Thesis 2024
Ellen Ömmelspång

Chalmers school of Architecture   Department of Architecture & Civil Engineering   Examiner: Nils Björling   Supervisor: Joaquim Tarraso & Louise Didriksson

Thank you,

Joaquim, Louise, and Nils for your support and rich discussions; for challenging my ideas and making me believe in the process in times of doubt.

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CHALMERS

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ABSTRACT

We are in the middle of a triple crisis of climate change, biodiversity loss, and pollution, creating lasting and devastating impacts on the world. Nature and its biodiversity are the base for human existence and are degenerating more rapidly than ever in human history. The risk of extreme weather, globally in the world and locally in Sweden, has increased because of climate change, and will only continue to increase. Our landscape has, throughout history, been changed by natural forces and human activity. Humans have adapted, modified, and degenerated the landscape, disrupting and disturbing natural processes and systems. One of these degenerated systems is wetlands, and two of the reasons are urban and agricultural development.

The thesis aims to redefine the relationship between the three main themes: wetlands, urban development, and agriculture. The goal is to explore whether a harmonising dynamic between the three main themes can be achieved, and if so, how. The thesis focuses on rurban environments, departing from the site, Östra Ramlösa in Helsingborg, Sweden, where a new urban area is being planned. The site is an example of a place where the three themes collide; the urban is expanding into the rural agricultural landscape where it historically has existed wetlands.

Speculative design, as a method for exploring possible and preferable future scenarios, along with methods of regenerative design, has created the theoretical framework and shaped the methodology for the thesis. Literature studies and a deep mapping of the context have been carried out. The mapping has been framed from six perspectives: hydrology, topography, flora and fauna, geology, urban structure, and agriculture. A search for synergy effects and an understanding of how the main themes relate to one another have permeated the entire process.

The result of the thesis is a set of tests, that explores the relationships and typologies identified throughout the process and framed by the context of Östra Ramlösa, Helsingborg. The tests will explore different ways of intertwining and merging the three themes to create harmony between human and non-human entities.

Keywords: agriculture, wetland, urban development, regenerative design, speculative design

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STUDENT BACKGROUND

2023 - 2024	*Chalmers University of Technology* Masters Programme in Architecture: Architecture and Urban Design Studios: Housing inventions 2
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FRAMEWORK

This chapter will set the precondition of the thesis by presenting the problems and questions addressed within the project and the methodology.

Problem Description

We are in the middle of a triple crisis of climate change, biodiversity loss, and pollution, creating a lasting and devastating impact on the world (United Nations, 2023a). Nature and its biodiversity are the base for human existence and are degenerating more rapidly than ever in human history, where the changing land- and water use is among the most important factors (Naturvårdsverket, 2020). Our landscape has, throughout history, been changed by natural forces and human activity. Humans have adapted, modified, and degenerated the landscape, disrupting and disturbing natural processes and systems (Bruyninckx, 2019). One of these degenerated systems is wetlands, and two of the reasons are urban and agricultural development (Naturvårdsverket, 2009).

Wetlands have, since the 19th century, faced a high level of degradation. One-fourth of the wetland area in Sweden has disappeared since the 19th century and in the south of Sweden, Skåne, that number is estimated to be 90% (Naturvårdsverket, 2019). Sweden needs to restore great areas of wetland that have dried out and overgrown in order to meet several of the climate and environmental challenges we are facing (Naturvårdsverket, n.d.a).

Wetlands are important elements in our landscape as they provide us with several ecosystem services, such as creating a robust blue-green infrastructure and strengthening biodiversity (Naturvårdsverket, 2023). These are vital systems since the risk of extreme weather, globally in the world and locally in Sweden, will increase as a consequence of climate change. Observations show that the days of extreme rainfall have increased and will continually increase, despite this the risk of flooding is already high in large parts of the country (The Swedish Civil Contingencies Agency, 2016). Likewise, the Sustainable Development Goals report shows that in the protection of biodiversity, the world is moving in the wrong direction. (United Nations, 2023b)

The main reason for the degradation of wetlands (especially in the south of Sweden) is the development of modern agriculture and forestry. During the late 19th century, great areas of wetlands were drained to maximise the area of productive agricultural land (Naturvårdsverket, 2009). Wetlands competed with the income-generating agriculture and the wetlands lost. Now we see the same pattern repeating when the agricultural land is competing against the urban development.

The access to farmland globally decreases due to expanding cities, sea level rising and desertification while the demand only increases because of a rising population (Jordbruksverket, n.d.). The Swedish farmlands are, from a global perspective, highly productive and its value will only increase as the access of farmland decreases (City of Helsingborg, 2021). Farmlands is a non-renewable resource and claiming it for urban exploitation is an irreversible action. Conflicts regarding land use appears when urban exploitation is competing against the preservation of agricultural land, just as the agricultural land has competed against the preservation of wetlands during the last century. There is a consensus that humanity's relationship to nature must change but how can wetlands, agriculture and urban development co-exist and co-develop instead of competing in an environment of expanding cities and a growing population.

"A fundamental shift in humanity's relationship with nature is essential"

(United Nations, 2023 a, p. 72)

Aim + Purpose

The aim of the thesis is to explore a more holistic and sustainable approach to land use in cities that are expanding into the rural landscape. The three main themes of the thesis: wetland, agriculture, and urban development set the frame for the explorations along with the site, Östra Ramlösa, Helsingborg, Sweden. The explorations are based on a speculative design approach where possible future scenarios are constructed. The thesis emerges from an ecological worldview.

The purpose of the thesis is to redefine the relationship between wetlands, agriculture, and urban development by exploring synergy effects and challenging the limits between them (Figure 1.). It further aims to bring awareness to the current, and often unsustainable, management of our land as a resource. The ultimate goal is to explore whether a harmonising dynamic between the three main themes can be achieved.

Delimitations

Is about: Wetland restoration as the point of departure, finding synergies between urban development, wetlands, and agriculture, and finding tools for designing to enhance the synergy effects. It is about exploring what environments can come prioritising water and considering both human and non-human entities in design.

It is for: Architects, planners, and decision-makers.

It is not about: Proposing a precise urban plan for the area, nor is it about proposing a detailed housing or building design or technical solutions. It is not about restoring landscapes to their historical state or a solution to the climate crisis.

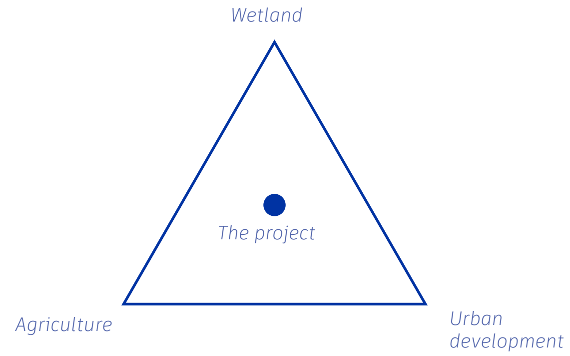


Figure 1. Above.
Positioning the thesis in relation to the main themes.

Thesis Question

How can agriculture, wetlands, and urban development co-exist and harmonise in the rurba context of Östra Ramlösa, Helsingborg, Sweden?

Sub-question:
How can the planning from an architect's perspective enhance the synergy effects and mitigate the conflicts?

Process guiding questions:
What synergy effects and conflicts exist between agriculture, wetlands, and urban development?

What are the core structuring patterns of the site?

Expected Outcome

The result of the thesis is a set of tests, that explores the relationships and typologies identified throughout the process and framed by the context of Östra Ramlösa, Helsingborg. The tests will explore different ways of intertwining and merging the three themes with the aim of creating harmony. The result also includes a discussion that reflects upon the tests and what this merging brings to the environments created and how architects can plan for harmony between human and non-human entities.

Methodology

The thesis is based upon research by design as the overall framework and the methodology consists of six main phases: Theory, Background mapping, Context, Design Explorations, Design proposal, and Discussion & Reflection. The thesis will not delve into the design proposal phase. It will end after concluding and discussing the explorations, but following the methodology, the development of the project would be to develop the explorations into a finalised proposal. The methodology proposes to iteratively back-loop and incorporate relevant findings from each phase into the project.

Theory

The theory contextualises the project within a broader field by establishing the discourse of how to design for desirable futures and harmony between human and non-human entities. This phase is based on literature studies regarding regenerative design and permaculture.

Methods: literature study.
Outcome: A theoretical framework and a set of design strategies.

Background Mapping

The background mapping brings an accuracy and deepened understanding of the main themes: wetlands, urban development, and agriculture. The background mapping also maps the relations between the main themes and identifies where conflicts and synergy effects appear.

Methods: Literature study, report study, mapping of the themes.
Outcome: Accuracy and understanding. Identified typologies conflicts and potential synergy effects between the main themes.

Context

The context brings a deepened understanding of the actual site. The context is investigated from the three main themes: agriculture, wetlands, and urban development from the six perspectives: hydrology, topography, flora and fauna, geology, urban structure, and agricultural structure.

Methods: Site visit, study of related documents and reports, study of maps, layering of maps.
Outcome: Core patterns structuring the site

Design Explorations

The design explorations investigate alternative futures and conceptual design solutions through different scenarios and what-if-questions. This phase is based on methods of speculative design and the findings from the previous phases.

Methods: What-if questions, scenario-based design, layering of maps, drawings, digital models, and physical models.
Outcome: Design explorations to further develop.

Design Proposal

Proposing an alternative plan for the development of the area based on the previous exploration

Methods: Digital model, drawings, perspectives
Outcome: A design proposal

Discussion & Reflection

The discussion & reflection occur continuously throughout the project. Findings and reflections are collected at the end of each of the previous phases. In the end, this phase reconnects the process, findings, and solutions to the research questions and aims. This phase also evaluates and discusses the design, the explorations and the decisions made throughout the process.

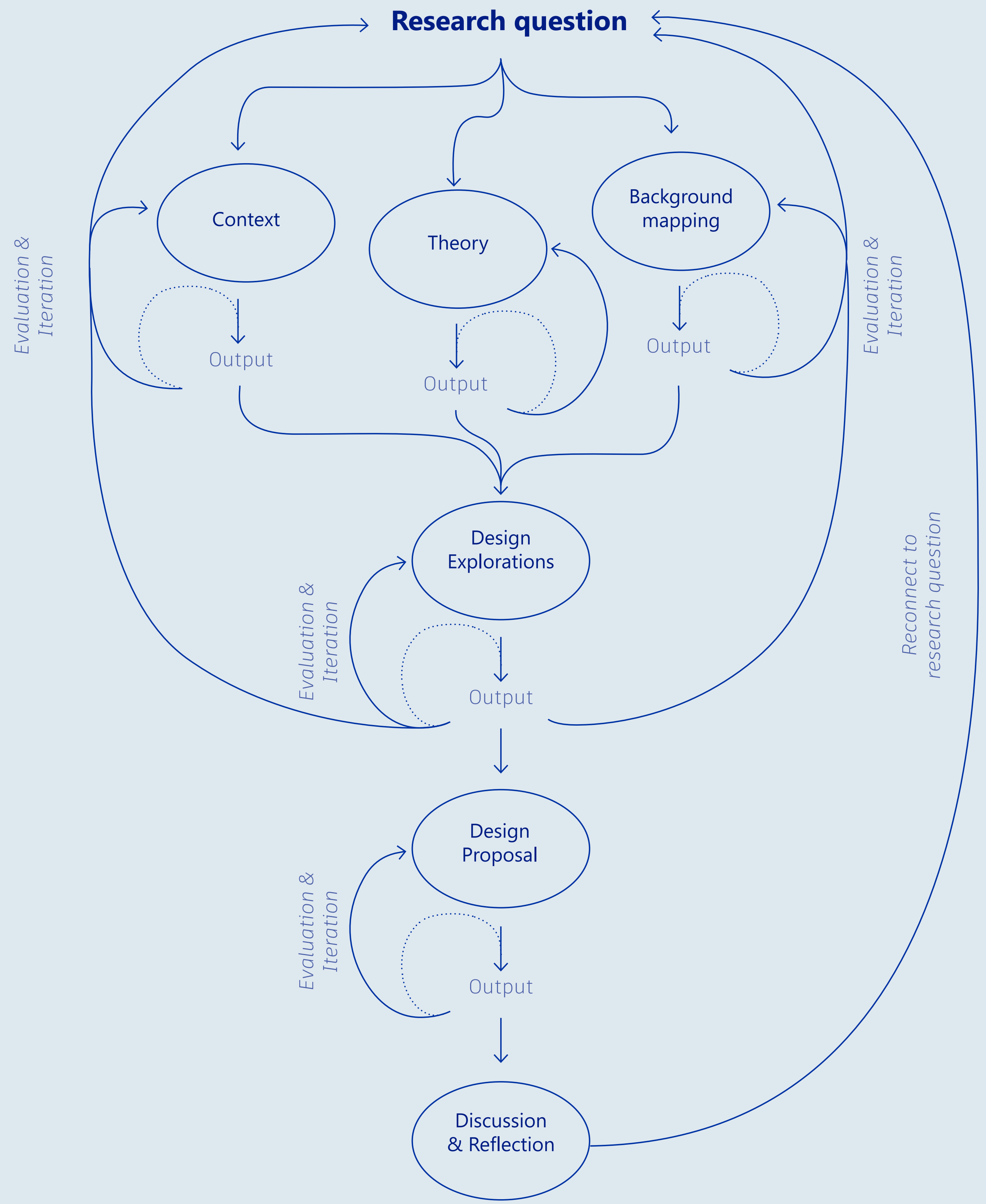
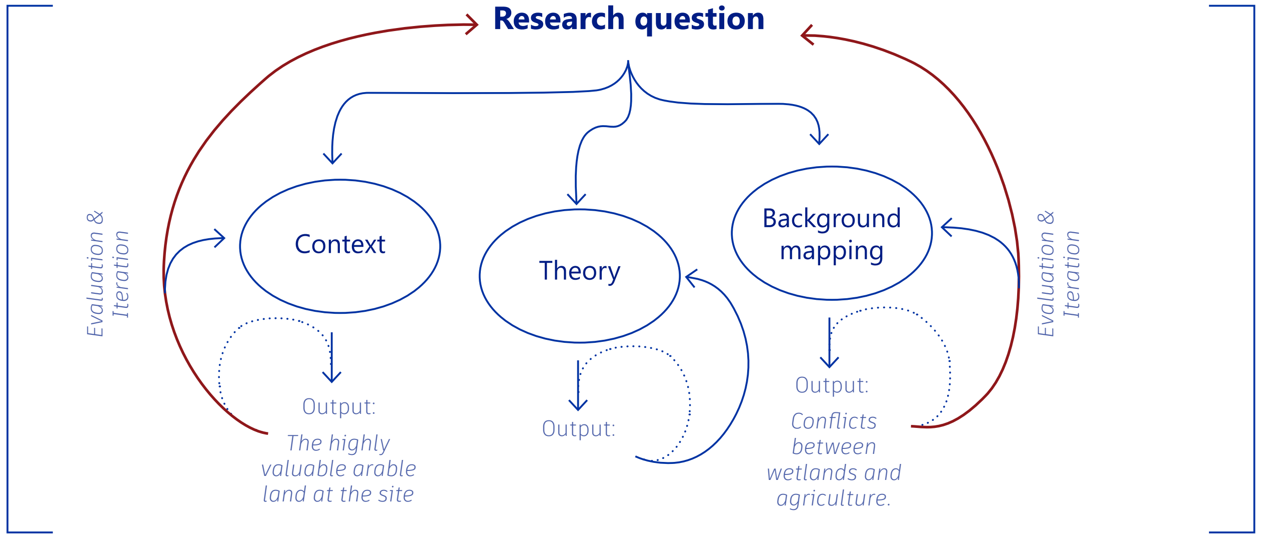


Diagram 1.
The relation between the phases in the methodology.



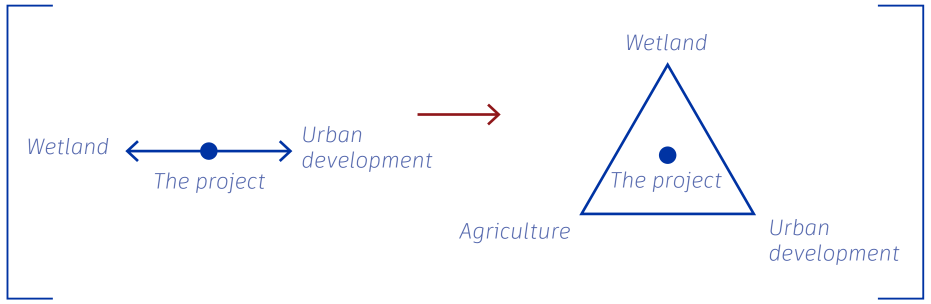


Diagram 2. Above.
Part of the methodology diagram. Red lines show the iteration loops that changed the project.

Diagram 3. Left.
The change of the research question and framework.

Point of Departure

The idea of the thesis emerged from the need to restore and preserve wetlands for their importance as a key element in our ecosystems. When delving further into the topic the near extinction of wetlands in Skåne became of interest. When about 25 % of the wetlands have been drained on a national level since the 19th century, 90 % of the wetlands in Skåne have been drained during the same time. This, along with my connection to Skåne as the region of my childhood home, evoked my interest even more.

One reason for the often-complicated processes and many oppositions for wetland restoration is that private landowners often own the land where wetlands historically have existed and where restoration is relevant. The benefits of restoring or constructing a wetland are seldom private or economical but rather societal. Because of this, wetlands have a hard time competing with other income-generating activities such as agriculture and the expansion of newly built housing. This conflict led me to search for a site where newly built housing was under planning and where wetlands historically have existed intending to find ways for restoring wetlands within the new urban development. This led me to the site explored within the thesis.

As the context phase emerged a finding was the highly valuable arable land at the site. Within the background mapping, one finding was the historical and continuing conflict between wetlands and agriculture. Knowing this, it became inevitable to continue without incorporating these findings, and as the iteration loops of the methodology (Diagram 2.) propose, the research question and the whole thesis moved from exploring the relations and conflicts between urban development and wetlands to exploring the relationships and conflicts between urban development, agriculture, and wetlands (Diagram 3.). However, since the starting point of the thesis was the need for wetland restoration this is positioned highest in a hierarchy between the themes.

Speculative Design

Since speculative design has created a base for the design explorations a segment is assigned to explain the core ideas of this method. Speculative design is a method used to explore alternative ways of conceptualising urban sustainability through possible futures (Wangel & Fauré, 2021).

Futures can be envisioned in three ways. They can be predicted, which is when you try to determine the most likely future and hope that nothing unexpected will occur. This implies that the future is a singular, fixed one, and tends to dominate the field of urban planning and design practices. The future can also be viewed as fundamentally open and uncertain, and you try to identify and manage the most important uncertainties. Lastly, the future can again be viewed as fundamentally open and uncertain, but this could be used to envision what a desirable future would look like and work towards getting there (Wangel & Fauré, 2021).

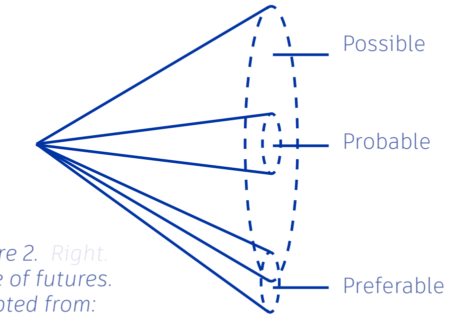


Figure 2. Right.
Cone of futures.
Adapted from:
(Wangel & Fauré, 2021).

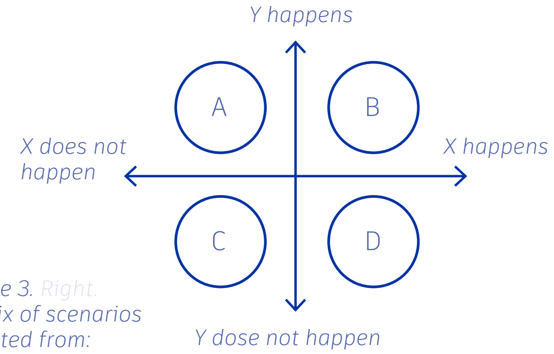


Figure 3. Right.
Matrix of scenarios
Adapted from:
(Wangel & Fauré, 2021).

Wangel and Fauré claim that envisioning the past, present, and future as singulars is problematic since they are always framed from a certain perspective, with specific agendas and aims in mind (2021). The timescapes must instead be understood as socially constructed and ambiguous and because of that, open for a diversity of interpretations. Referring to the past, present, and future as singulars make us forget the ambiguity and we start believing the dominating stories to be facts and truths and in relation to futures, inevitable (Wangel & Fauré, 2021).

Relating to futures through eventualities and visions instead, helps us explore alternative futures and reveal the possibilities and risks related to them. Futures can through visions be referred to as possible, what could happen, and preferable, what should happen, and probable, what is most likely to happen and through that positioned within the cone of futures (Figure 2.). The same future can be both possible, probable, and preferable at the same time or none.

Considering the future, to eventualities, implies actively looking for uncertainties and possible discontinuities. This creates the foundation for developing multiple scenarios representing different possible futures (Figure 3.), where the uncertainties are considered as the gradient across the axis (Wangel & Fauré, 2021).

According to Malpass (2017), speculative design is a type of critical design where future scenarios are created by asking what-if questions without the need to provide definitive answers. It has the ability to open up for critical reflection and discussion and can create a space for imagination. Speculative design can help people think about things differently and question our mindsets of beliefs and behaviors.

THEORY

This chapter will establish the discourse of how to design for desirable futures and harmony between human and non-human entities. The chapter is based on the theory of Regenerative design and Permaculture.

Design for Harmony

Harmony means that all elements in a system, at the same time as they contribute with their own uniqueness, cooperate in a way that creates a world in which all parts align seamlessly with the whole and with one another. It can be seen, metaphorically, as an orchestra where each element adds its own voice and melody in a way that avoids dissonance and creates a unison harmony (Hes & Plessis, 2015). Harmony is one of the ground values of an ecological worldview and a reoccurring word in the design methodology.

Regenerative Design

The regenerative methodology is based on the ecological worldview and aims to transform the way we interact with the built environment (Hes & Plessis, 2015). The following four premises create the core of the methodology.

First, the role of humans. Humans are a part of nature and therefore play an important role in the well-being and development of living systems within its context (Mang & Reed, 2012). Secondly, a new mind. A regenerative designer sees a project as "energy systems – webs of interconnected dynamic processes that are continually structuring and restructuring a site" (Haggard, cited in Mang & Reed, 2012, p. 26) and not as a collection of different factors or things. This demands an entirely new way of thinking and is often referred to as **living system thinking** (Mang & Reed, 2012).

Third, a new role. The designer designs ecosystems that continually change with the aim of creating a greater better for both the natural and human living systems (Mang & Reed, 2012). Lastly, working developmentally. A regenerative designer deepens the development potential of the systems which enables achieving higher goals and improves the value of the whole (Mang & Reed, 2012).

Furthermore, the regenerative design methodology consists of three phases. The first one is *Understanding and conceptualising the right relationship to place*. This phase aims to comprehend the dynamics and potential of a site and its community in relation to place. The site is understood from the dynamics, patterns, relationships, and inherent potential, specific to each site. It then conceptualises how the project can serve as a regenerative force (Mang & Reed, 2012). The first thing within this phase is to **define place** by asking the question "How big is here?", something that might not be obvious when working from a system perspective (Hes & Plessis, 2015).

The first phase includes an integral assessment which aims to discover the **core organising patterns** the systems are structured around. This is done through site visits, studying maps, reports, data, and interviews (Hes & Plessis, 2015). Based on the core patterns, a narrative is created to make the whole of the place understandable for the stakeholders involved, this is called the story of place. The final step in the first phase is to uncover the real potential. This is done by revisiting the initial aims and ideas of the project and envisioning the higher-order potential of the place. Finally, the project aims and aspirations are translated into a regenerative concept (Hes & Plessis, 2015).

The second phase of the regenerative design methodology is *Designing for harmony*. This phase is an iterative process of developing the regenerative design concept in relation to place until a greater potential for both is revealed. Such a design aims to harmonise with the patterns of the place to improve the whole (Hes & Plessis, 2015).

The third, and last phase of the regenerative design methodology is *Co-evolution*. A regenerative project aims to initiate a process of co-evolving mutualism – bringing together human and natural systems in a way that benefits both, allowing them to evolve together – harmonise. But harmony is not something static; it is an ongoing process of systems gradually coming together. While we cannot predict exactly how it will unfold, we can continuously plan and manage toward this harmonisation (Mang & Reed, 2012).

THEORY	STRATEGIES / PRINCIPALS	IMPLEMENTATION
REGENERATIVE DESIGN & PERMACULTURE	**Designing for harmony**	*Guiding principal throughout the project*
	Living system thinking	*Context*
	Place	*Context*
	Understanding patterns	*Context*
	Creating patterns	*Design Explorations*

Diagram 4. Above: Diagrammatic summary of the theory and its implementation in the thesis.

Permaculture

Permaculture is a concept and method adopted by the regenerative design methodology but was developed earlier. It comes from the word permanent and agriculture and is based on three ethical principles: care for earth, care for people, and limit consumption and reproduction. Care for Earth includes a **living system thinking**, which includes taking responsibility for growing and maintaining biodiversity in these systems. While care for people means developing a non-material well-being. The last principle, limit consumption and reproduction reflect the ethic of not taking more than needed (Hes & Plessis, 2015).

Permaculture acknowledges the significance of understanding the **patterns** that are structuring the human and natural systems at a site. It recognises that complex systems, such as ecosystems, cannot fully be understood by analysing its parts. Permaculture emphasises the importance of relationships and patterns in these systems, since within a living system the "whole is much more than the sum of its parts" (Amarala and Ottino, cited in Mang & Reed, 2012, p.29). By understanding the underlying patterns, such as nodes and attractors, one can gain insight into the dynamics of a system and its energy flows. Only then can new patterns that integrate human and natural elements into a dynamic whole be created (Mang & Reed, 2012).

Achieving harmony

Achieving harmony can be seen as the main aim of both regenerative design and permaculture. The first phase, in the regenerative design methodology, *Understanding and conceptualising the right relationship to place*, can be seen as understanding the preconditions of achieving harmony. The second phase, *Designing for harmony*, can be seen as designing the conditions for harmony, while the last phase, *Co-evolution*, can be seen as maintaining the design for harmony to appear and sustain. Within permaculture, it can be perceived that harmony between human and natural systems is the goal, and understanding and creating patterns is the means to get there; similar to the first two phases of the regenerative design methodology. Both theories emphasise the importance of understanding a place through patterns and by a living system thinking perspective.

The theory of regenerative design and permaculture have strongly shaped the way the context and background mapping have been conducted (Diagram 4.). Within these phases, the site is attempted to be understood from a living system perspective and the structural patterns, of the site and the main themes, aim to be identified. This is done in order to create the preconditions for developing a design proposal where wetlands, agriculture, and urban development harmonise.

BACKGROUND MAPPING

This chapter will give a deeper understanding of the three main themes of the thesis: wetlands, agriculture, and urban development in Skåne and Helsingborg. The chapter also presents a mapping of how the three main themes relate to one another, presenting conflicts and synergy effects, guided by the question: What synergy effects and conflicts exist between agriculture, wetlands, and urban development?

Wetlands in Skåne

According to the Swedish wetland mapping (VMI), by The Swedish Environmental Protection Agency (Naturvårdsverket), wetlands are such land where water exists close underneath or above the ground surface during large parts of the year. Furthermore, wetlands also include waterbodies covered with vegetation. At least 50 % of the vegetation should be hydrophilic but the term also includes occasionally dried lakes and streams even if they lack vegetation (Naturvårdsverket, 2009). This is the broadly accepted definition of wetlands within the Swedish context, but it varies from the International Wetlands Commission's (Ramsar) definition which also includes open lakes and rivers in its definition (Ramsar, 2014).

The term wetland includes a variety of environments thus classification and categorising of wetlands are complex. The categorising varies among human societies and scientific communities, and several countries have developed their own systems for classification (Keddy, 2010). The commonly used categories in Sweden are the ones stated in VMI, (Naturvårdsverket, 2023b), which proposes three main categories: mires, riparian wetlands, and other wetlands. Mires are wetlands with an active peat accumulation, also called peatland, for example, fens and bogs (Naturvårdsverket, 2009). Riparian wetlands are located along seas and lakes and are strongly affected by this. Peat accumulation can occur in riparian wetlands, but commonly there is no peat accumulation and no peat layer (Naturvårdsverket, 2009). Other wetlands are wetlands without peat accumulation and with a shallow to non-existing peat depth. These can be open wetlands or covered with forest, then called swamps (Naturvårdsverket, 2009).

Within Skåne, the dominating types of wetlands are different types of bogs and riparian wetlands. Bogs are mires that receive their water from precipitation and have a highly acidic environment (Naturvårdsverket, 2009). The human impact on wetlands has been high in southern Sweden which probably has negatively impacted the existence of mires (Naturvårdsverket, 2009).

Wetlands can provide several ecosystem services and are therefore important landscapes for several reasons. Wetlands delay water in the landscape, which balances the water flows and creates resilience against drought and flooding. A wetland can increase the base flow in a stream that otherwise would have drained during dry seasons, and works as a natural fire barrier (Naturvårdsverket, 2023a). During wet seasons, with a risk of flooding, the wetland can magazine water if it is allowed to flood (Naturvårdsverket, 2023a).

Wetlands can help purify the water from nitrogen (N) and phosphorus (P) by slowing down the water flow. The vegetation and microorganisms in the wetland absorb nitrogen, while the phosphorus binds to the sediment since the water flow is low (Naturvårdsverket, 2023a). If the water flow is too high, these processes do not have time to appear, and high levels of nitrogen and phosphorus are spread to seas and lakes (Naturvårdsverket, 2023a).

Several endangered species depend on the wetland environment, and it is the third most important biotope for red-listed species, after woodlands and agricultural land. Wetlands are therefore important for preserving a rich biodiversity and are one of the environments with the richest flora and fauna in Sweden (Naturvårdsverket, 2023a).

A wetland with an active peat accumulation (mires) binds coal to its vegetation (Naturvårdsverket, 2023a). Drained Mires, something that occurred when humans drained

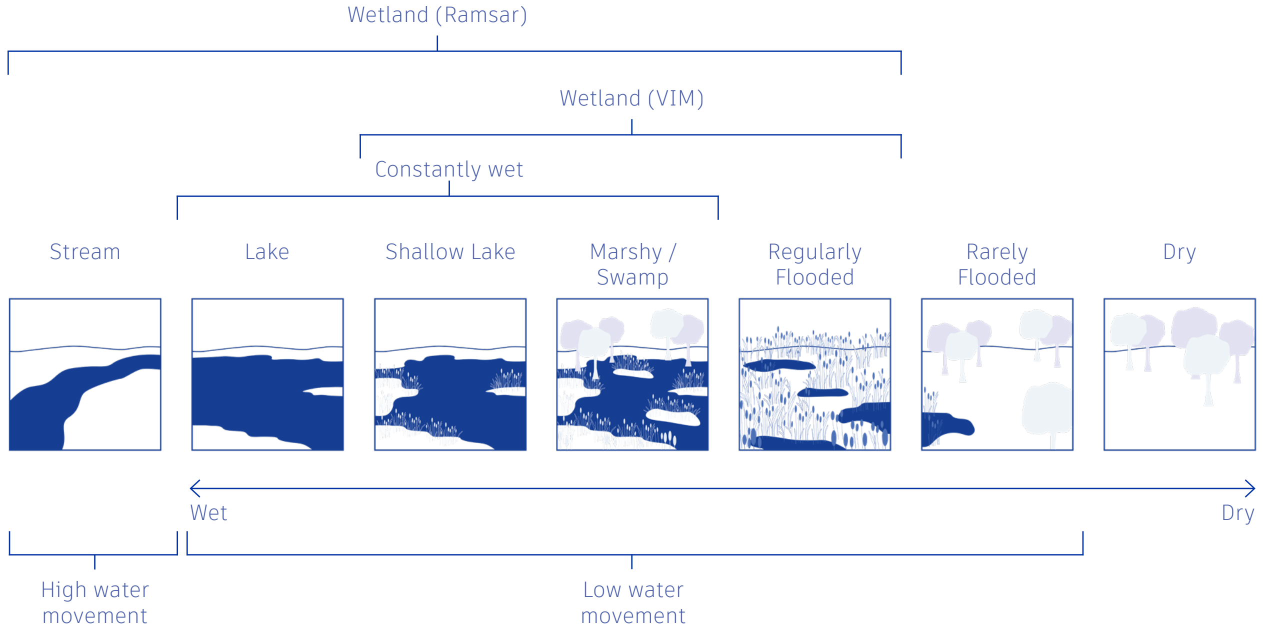


Diagram 5. Above Water typologies

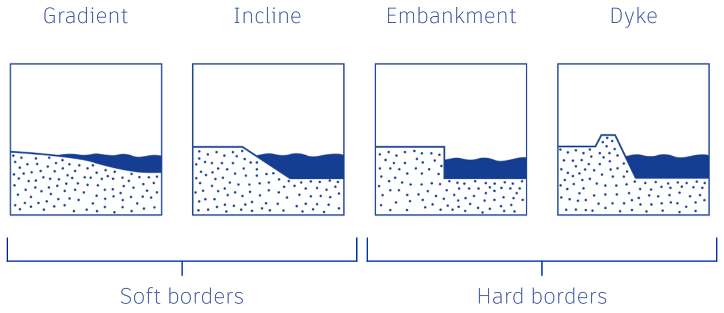


Diagram 6. Left Border typologies

land during the 19th and early 20th centuries, release considerable amounts of CO2 emissions. In Sweden, these emissions are greater than the CO2 emissions from private car traffic, and it is therefore important to re-wet drained mires to reduce carbon emissions (Naturvårdsverket, 2023a).

Water typologies

Since the building typology and agricultural typology suitable for a plot strongly depend on the type of water, different water typologies based on the water movement, frequency, and depth have been identified. This categorising rather explains the water environments from the experience of the environment than the biological environment as the one in VIM does. The typologies identified are based on relevant typologies for the site. Therefore, typologies such as the sea and the river are not part of the typologies presented. In this categorising the wetlands are divided into three categories, the shallow lake, the marshy wetland, or swamp, and the regularly flooded. Added to these typologies are then the stream and the lake and the contrasting rarely flooded and dry land (Diagram 5.).

Border typologies

The borders structuring the water can also be categorised into typologies. Two main types of borders have been identified soft and hard borders. Soft borders such as gradients or inclines allow for a freer fluctuation while hard borders such as an embankment or dyke can allow for fluctuation, but the water is more directed to a certain space (Diagram 6.).

Agriculture in Skåne

In the 18th century, the landscape of Skåne was characterised by three main types of landscapes: woodlands, plainland, and transitional or in-between land (Figure 4.), (Bergendorff et al., 2001). The ways of using the land in the different landscapes largely corresponded to nature's preconditions for cultivating the land (Länsstyrelsen Skåne, n.d.a), and traces of these are still visible.

The north and northeast of Skåne were defined by woodlands, where people subsisted on forestry by providing the rest of the region with timber and firewood (Bergendorff et al., 2001). There were few fields in the woodlands and the farms were often isolated or spread out in small villages. In contrast, the south and southwest parts of Skåne were defined by plainlands with arable land, where the people subsisted on agriculture and provided grains to the rest of the region (Bergendorff et al., 2001). The farms at the plains were collected into larger villages (Nationalencyklopedin, n.d.b).

The land in between the plains and woodlands, where Helsingborg is located, was characterised by fields and meadows but with more forest than in the plains (Bergendorff et al., 2001). In this area animal husbandry was the main occupation, as well as providing pasture for animals from the plains. During the 18th century, the human impact on the landscape increased and the limits between the types of landscapes were postponed north. The old transitional land became plainlands and the fields and meadows were cultivated into arable land (Bergendorff et al., 2001).

The area of agricultural land in Sweden had its peak in 1910. Since then, it has only decreased. Arable land previously depended on large areas of meadows and pasture for animals. Industrialisation of agriculture led to the possibility of producing more in less area but with the consequences of a dependency on fossil fuels and artificial fertilisers (Länsstyrelsen Skåne, 2015). Today, the farms in the plains are dominated by cereal farming where the farms often are of large scale and spread out in the farmland. The farmland is now shaped by straight plots and few of the previous hindrances are left. Roads and streams have been straightened, wetlands drained, and small islands of nature have been cultivated (Länsstyrelsen Skåne, n.d.a).

Cereal, sugar beets, and oil plants, such as sunflower and rape, are the most common crops in the west and south of Skåne, while potato is the dominating crop around Båstad (north-west) and Kristianstad (north-east) (Länsstyrelsen Skåne, n.d.b). In the old transitional land grains for animal feed and hay are most common to grow. The agricultural land in Skåne is the richest in Sweden and seen from a global perspective, among the richest in the world. Only 16 % of the agricultural land in Sweden is located in Skåne but 40 % of Sweden's total harvest of cereal, sugar beets, oil plants, and potatoes comes from Skåne. In addition, 70 % of Sweden's total harvest of garden plants, such as carrots, tomatoes, and lettuce come from Skåne (Länsstyrelsen Skåne, 2015).

A grading of agricultural land was conducted by Lantbruksstyrelsen in 1971 and was supposed to support decisions when conflicts between exploitation interests and preserving agricultural land occurred (Figure 5.). The grading evaluates the land from one, as the least productive, to ten, as the most productive and Skåne is the only region with arable land of class 8-10 (Länsstyrelsen Skåne, 2015). There are some weaknesses with the classification, one being that it does not consider garden plants, which probably would increase the value of several areas in Skåne. Another weakness is that the mapping shows a fairly rough picture.

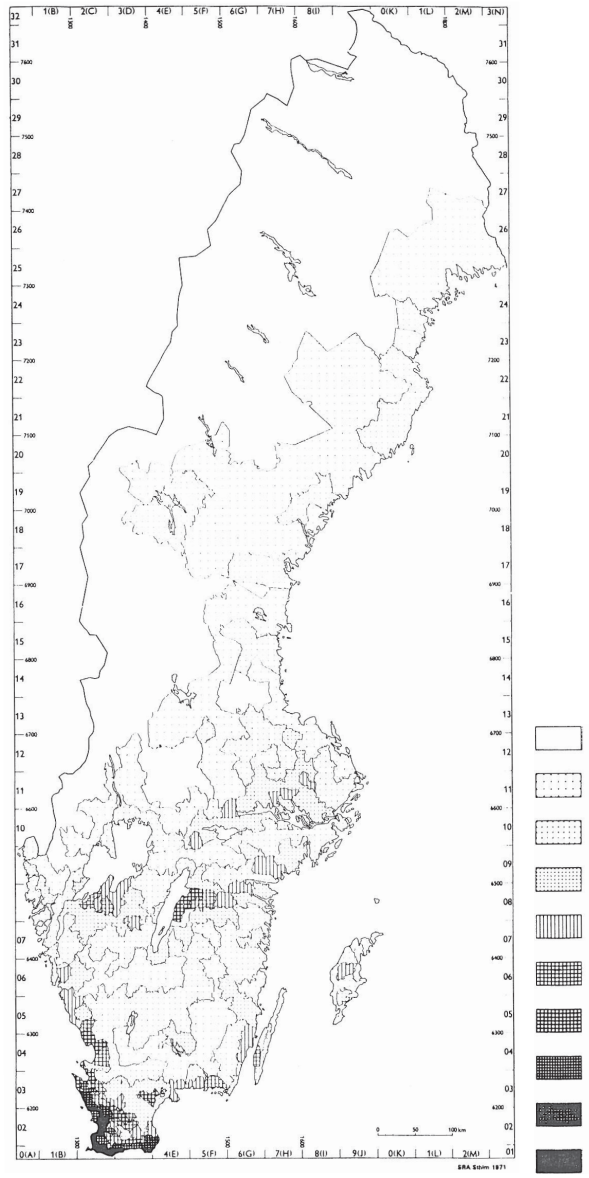


Figure 5. Left. The grading of agricultural land in Sweden. (Kungl. Lantbruksstyrelsen, 1971).

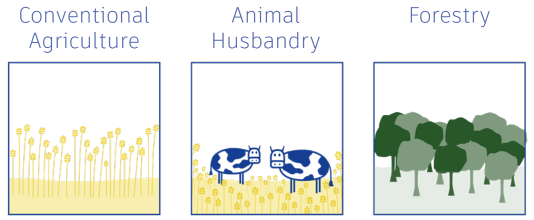


Diagram 7. Above. Agricultural typologies

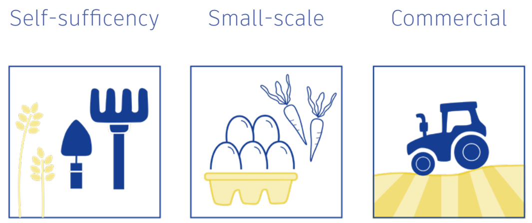


Diagram 8. Above. Agricultural scale typologies

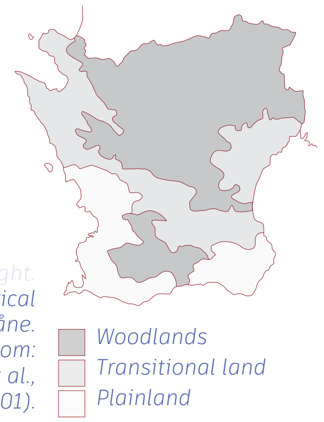


Figure 4. Right. Historical landscapes in Skåne. Adapted from: (Bergendorff et al., 2001).

The classification rather shows the productivity for a larger mapped area than the productivity of a specific plot (Länsstyrelsen Skåne, 2015).

Except for its importance for food security, the agricultural landscape is also one of our most important biotopes (Naturvårdsverket, n.d.b). Its biodiversity depends on human activity and the biodiversity that exists within our farmlands is a result of generations of cultivation of the land. For example, when stones were removed from the arable land they were often placed as small stonewalls creating important microhabitats for insects and animals. Another example is the grasslands where livestock feed which have provided great conditions for flora, fungi, and insects to thrive (Naturvårdsverket, n.d.b). None of these landscapes and elements would have existed without humans and their livestock.

Typologies of Agriculture

When discussing agriculture, it is important to distinguish between different types, with the first separation being forestry, crop farming, or animal husbandry (Diagram 7.). Thereafter, the scale of agriculture significantly impacts the landscape and is a key part of productivity (Mulholland et al., 2020). The scale can simplified be categorised into three typologies (Diagram 8.). Firstly, producing for self-sufficiency where enough to meet a single family's needs are produced (Ramsar, 2014). Secondly, it can be small-scale farming often specialised in specific crops or goods, in relatively small quantities. Lastly, it can be commercial agriculture often in a monoculture setting for a wide distribution (Ramsar, 2014), which is the dominant typology in Skåne today (Länsstyrelsen Skåne, n.d.a).

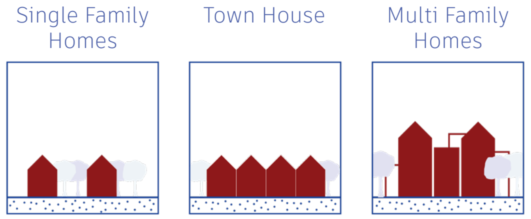


Diagram 9. Left.
Density typologies

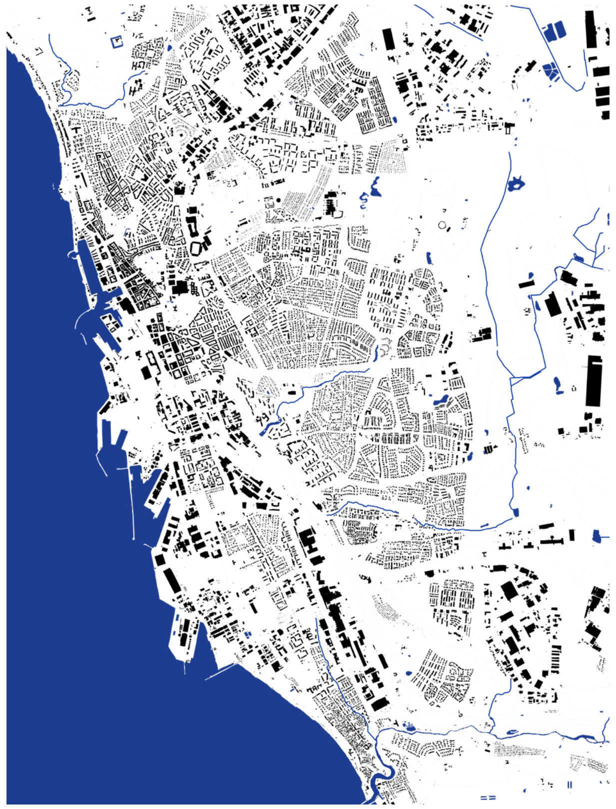


Figure 7. Above.
City structure of Helsingborg

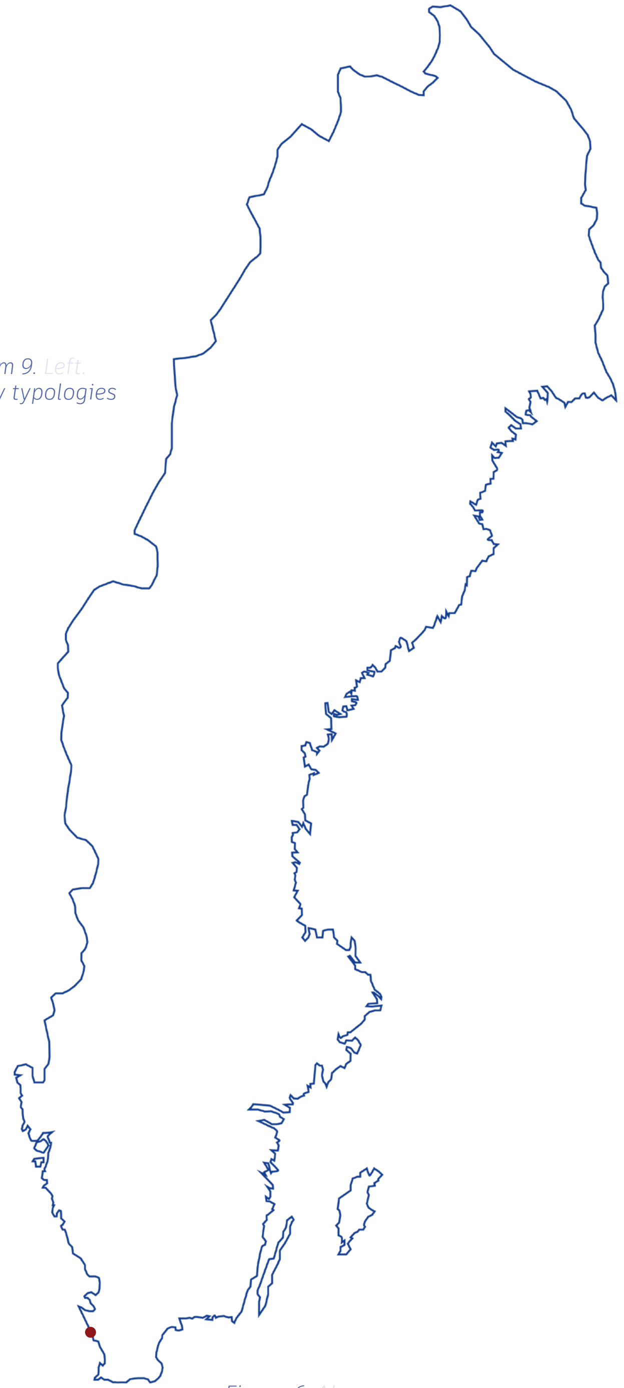


Figure 6. Above.
Location of Helsingborg in Sweden

City of Helsingborg

Helsingborg is a mid-sized city and a municipality in the south of Sweden, located in the north-west of Skåne (Figure 6.). The city is one of Sweden's oldest with traces of settlement from the early 11th century (Nationalencyklopedin, n.d.a). Its location at the shortest crossing between Sweden and Denmark has marked its history with war and conflict, but also as a main trading city. From Helsingborg, goods were sold and transported to Denmark and further out in Europe. The city is still an important trading and transport city with one of Sweden's largest harbors for goods and passengers (Nationalencyklopedin, n.d.a).

Helsingborg has had ongoing population growth since the 1970s, which has accelerated over the last 10 years (City of Helsingborg, 2019). The population today is about 150,000 inhabitants and is predicted to continue to grow to approximately 171,500 inhabitants in 2035 and to 190,000 inhabitants in 2050 (City of Helsingborg, 2021). The municipality of Helsingborg consists of the central city, Helsingborg, and several smaller villages in the rural landscape of open fields and meadows. The central city has a north-south spreading, following the shoreline of Öresund (Figure 7.). The site further investigated is located southeast of the city centre and is proposed to expand the city towards the east with a variety of housing typologies from single-family housing to townhouses and multifamily housing (Diagram 9.).

Wetland + Agriculture

Throughout history, wetlands and agriculture have mainly been standing in conflict with one another. With the motive of creating more agricultural land, several wetlands, and lakes around Skåne were drained during the 19th and early 20th century (Naturvårdsverket, 2017). Several streams that previously meandered through the landscape were straightened and deepened to control the water (Bergendorff et al., 2001). The drainage of wetlands and straightening of streams decreased the wetland area significantly and the consequences of this were devastating for the many species that depended on the wetland areas (Naturvårdsverket, 2009). Many bird species that depended on the wetland environment have decreased in quantity or completely disappeared from Skåne, along with several frog and toad species (Bergendorff et al., 2001).

However, human impact on the landscape has also benefited the wetlands. A type of irrigation and fertilisation of meadows, Ängavattning (direct translation: Watering the meadow) became common in Skåne during the 19th century (Bergendorff et al., 2001). The meadows, which were important for producing animal feed, needed to become more efficient and create larger harvests, since the arable land expanded at the expense of the meadows (Länsstyrelsen Skåne, n.d.c). The meadow irrigation was an answer to this problem.

The process of Ängavattning naturally occurs when lakes and streams flood, which brings nutritious water to the flooded areas. The meadow irrigation meant that humans reinforced this system by creating a small canal system in the meadows (Figure 8.). The water was redirected to the canal system at times to irrigate and fertilise the soil (Bergendorff et al., 2001). The system created a wetland-like meadow that varied in wetness with the season to generate an as effective harvest as possible. The environments created became important for several wetland birds in the landscape. Most of these systems were eradicated during the early 20th century, only one is preserved and restored, but traces of them can be found in the landscape (Bergendorff et al., 2001).

Today, several wetlands are being constructed in the agricultural landscape because of their purifying qualities. When land is cultivated, nitrogen (N) and phosphorus (P) in the soil wander up to the surface. Nitrogen and phosphorus are also often added to the soil in the form of fertilisers. Thereafter, along with rainwater, the nutrients are washed into the surrounding streams and further to rivers, lakes, and seas (Jordbruksverket, 2015). Wetlands in the agricultural landscape have the possibility of decreasing the amount of nutrition from agriculture that spreads to seas and lakes. This is done by absorbing and sedimenting the particles into the soil, at the site again (Figure 9.) (Jordbruksverket, 2015). Restoring wetlands in the agricultural landscape can, according to the Ramsar Convention (2014) be seen as an investment in the natural infrastructure. Besides providing resilience against flooding the wetlands can provide a local water storage for irrigation of the agricultural land during dry seasons.

However, wetlands can also be used as arable land. Some crops can be cultivated in wet conditions and this type of farming is called paludiculture. This is farming and agroforestry aimed at cultivating commercial crops in wetland conditions using species that typically tolerate such an environment (Mulholland et al., 2020). This practice is especially important in areas with peat soils and is a way of re-wetting drained peat soil while keeping a productive landscape. However, paludiculture can take place in various wetland environments (Mulholland et al., 2020). It does not seek to

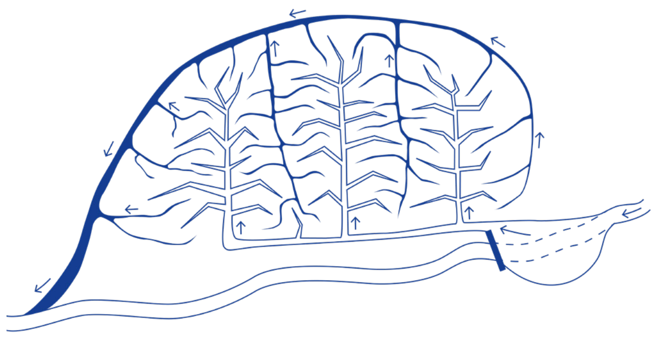


Figure 8. Above.
Irrigation of meadows.
Adapted from:(Bergendorff et al., 2001).

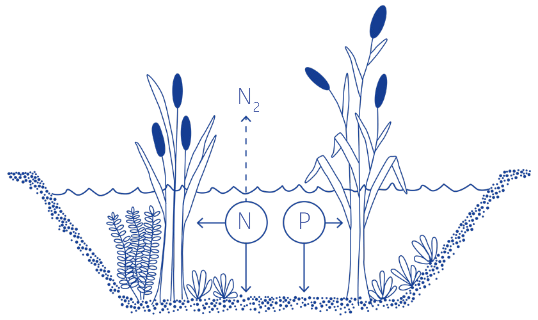


Figure 10. Above.
Purification process in wetlands.
Adapted from: (Jordbruksverket, 2015).

replace conventional agriculture but offers an alternative in areas where traditional farming is not suitable and can enhance productivity in unproductive areas (Mulholland et al., 2020). Even though paludiculture has the primary focus on crop production and not habitat conservation, several paludiculture projects show its potential to support habitat conservation and restoration efforts while generating various ecosystem benefits associated with wetland habitats (Mulholland et al., 2020). Even if the paludiculture is carried out as growing monoculture crops it can encourage the return of wetland species and provide opportunities for wetland species to colonise both the wet margin areas, the headlands, and small islands and at times, the waterbody itself (Mulholland et al., 2020).

Several crops can be grown with a high level of productivity in a wetland environment with different areas of use. For example, crops used for producing bioenergy such as several reed species, cattail species, and sedge species (Mulholland et al., 2020). Paludiculture can also be used for food production where the most common crop is rice, though growing rice is not feasible in a north European climate. Berry crops such as lingonberries and cloudberries or celery and watercress can be more suitable crops for a north European climate (Mulholland et al., 2020). In Finland, about 14 % of the harvest of edible berry crops comes from peatlands. A traditional wetland cop is the reed grasses that throughout history have been used as a building material, the most common use of reeds is for thatched roofing (Mulholland et al., 2020). Thatching reeds is the most profitable option for reed cultivating even compared with bioenergy production, but thatching demands a high quality of the reeds. This means that combustion for bioenergy can offer an alternative when sorting out the reeds of a lower quality (Mulholland et al., 2020).

Paludiculture

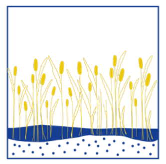


Diagram 10. Left.
The agricultural typology Paludiculture

Urban Farming

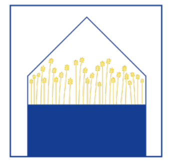


Diagram 11. Right.
The agricultural typology Urban Farming

Urban + Agriculture

The industrialisation of agriculture made it possible to farm the same amount of crops and more on the same area of land. This has made it possible for the urban structure to occupy more land, previously claimed by agriculture. (Länsstyrelsen Skåne, 2015).

The exploitation of agricultural land has been discussed for decades. Between 2016 and 2020, 3000 hectares of agricultural land in Sweden were lost due to urban exploitation, and the numbers are similar for the previous five-year period (Jordbruksverket, 2013). Agriculture is a non-renewable resource, the soil in our farmlands has been created for thousands of years. Agricultural land left to overgrow can be restored, but if the ground is exploited for buildings or roads, it is practically impossible to restore into arable land (Länsstyrelsen Skåne, 2015).

Skåne, together with Halland and Uppsala, are the regions in Sweden with the largest proportion of agricultural land that is being exploited (Länsstyrelsen Skåne, 2015). The most common reasons are housing development both single-family and multifamily houses. The exploitation in Skåne affects the whole country since Skåne stands for such a large part of the total food production in Sweden (Länsstyrelsen Skåne, 2015).

However, there are numerous advantages to incorporating agriculture into the urban landscape. Urban agriculture can create a higher level of self-sufficiency for cities, and create more employment opportunities, while at the same time strengthening the local ecosystems (Yücedağ et.al., 2023). Higher productivity of agriculture in the urban landscape can also lower the demand for creating or maintaining conventional agriculture where it conflicts with other environments such as wetland restoration (Ramsar, 2014). Furthermore, urban agriculture on the rooftops of buildings is one of the best ways to utilise unused space in cities (Yücedağ et.al., 2023).

Even though urban agriculture cannot compete with conventional agriculture in terms of scale and productivity it can help create a resilient urban food system. Moreover, can it build a better understanding and education about the origins and methods of food production (Yücedağ et.al., 2023).

Wetland + Urban

Urban development often implies the conversion of natural landscapes into impervious surfaces, like roads and rooftops that water cannot penetrate which disrupts the natural drainage system. This expansion intensifies stormwater runoff which leads to more frequent and severe flooding. This, in combination with a poorly planned development conflicting with natural drainage pathways and insufficient or outdated flood management, leaves cities and communities vulnerable to flooding. (Brody et.al., 2022)

A key component in reducing the impact of floods is to steer away the development from the most critical points and make room for water. The Dutch project Room for the River lets the river take up more space upstream to reduce the pressure downstream by removing human-built structures and obstacles that interfere with the river. (Brody et.al., 2022)

Several studies show the positive role wetlands can play in reducing and mitigating the risks of flooding and storing water from precipitation. Wetlands have a significant potential to reduce the damage from the flooding peaks and velocities (Highfield, 2022). Furthermore, collecting and storing the return flows from urban areas in wetlands can be valuable in providing water resources for agricultural landscapes. The wetland then helps purify the water before it is used for irrigating agriculture (Ramsar, 2014).

A wetland's effectiveness for flood risk management depends on several factors, such as the location, the surrounding landscape, and the type of wetland. However, it is important to incorporate wetlands into broader flood risk management strategies, rather than viewing them as a single fix solution (Highfield, 2022).

To mitigate the conflicts of flooding a wide variety of floodproof housing typologies exists. There are two main types of floodproof buildings, the dry proof and the wet proof. The dry proof intends to prevent the interior from flooding by a floodproof façade, and the wet proof intends to prevent or reduce the damage in case of flooding (Nillesen, 2022). The suitable type depends on the local flood characteristics, the depth, and the probable interval of flooding.

Typologies of floodproof houses

Mount buildings are placed on elevated constructed mounts. It can be an individual house or a smaller settlement placed on the mount. This demands that the mount is high enough to be effective since once the mount is constructed it is hard and costly to further elevate (Nillesen, 2022). Therefore, this typology is not adaptable to radical and unpredicted changes in water flows and levels.

Pole buildings follow the same principle as the mount houses; they are elevated to prevent flooding. An advantage of pole houses is that they can be placed where it regularly floods without reducing the water storage capacity. They can also be suitable where the flooding risks eroding a constructed mount. Similarly to mount houses, pole houses have a fixed height, which exposes them to the risk of flooding during unexpected events. Therefore, the typology suits best where water fluctuations can be predicted. Even though they are fixed, pole houses are often easier to further elevate since only the pole structure needs to be replaced (Nillesen, 2022).

Dyke buildings are houses that sit on the dyke itself or its incline. Dykes are structures built to protect the land from the water. Dyke houses can be built on either side of the dyke but the risk of flooding is evidently less on the landward side. New types of dyke housing where

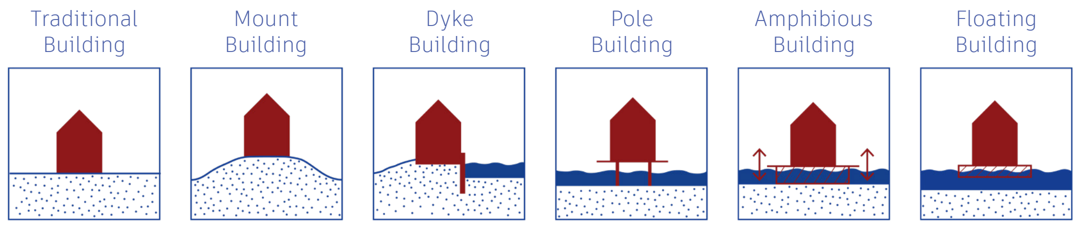


Diagram 12. Above. Building typologies

the border between the dyke and the building blurs becomes more common and the building itself is a part of the dyke. The dyke housing is seldom flexible in handling conditions where the dyke needs to be expanded, raised, or widened (Nillesen, 2011).

Floating buildings have their origin in the houseboat typology. This typology moves with the changing water levels which make them function in unexpected flood levels. The floating houses demand a sufficient depth to float and minimum water depth under the structure to prevent negatively impacting the seabed and water quality (Nillesen, 2022).

Amphibious buildings are a special type of floating houses that mainly still are applied experimentally. This typology is placed on land but can float if needed. Like a floating house, the amphibious house needs pipe connections and entrance walkways to be flexible to not break when the building is elevated (Nillesen, 2022). This type of housing is often built where high water levels are rare but extreme when they occur (Nillesen, 2011).

In areas with a low probability of floods, investments in floodproofing buildings become unreasonable, even though regardless of how low the probability of flooding is it can have severe consequences (Nillesen, 2022). Therefore, several alternative solutions can be valuable such as building on a floodproof plinth in areas with a shallow flood depth or providing shelters. In several flooding scenarios, the flooding depth is not more than 20 cm meaning a floodproof plinth can be enough to cope with the flooding. Another alternative solution is zoning, both on an urban scale and on a local building scale, meaning for example that floodable functions are placed in risk locations and non-floodable functions are placed in flood-safe locations. (Nillesen, 2022).

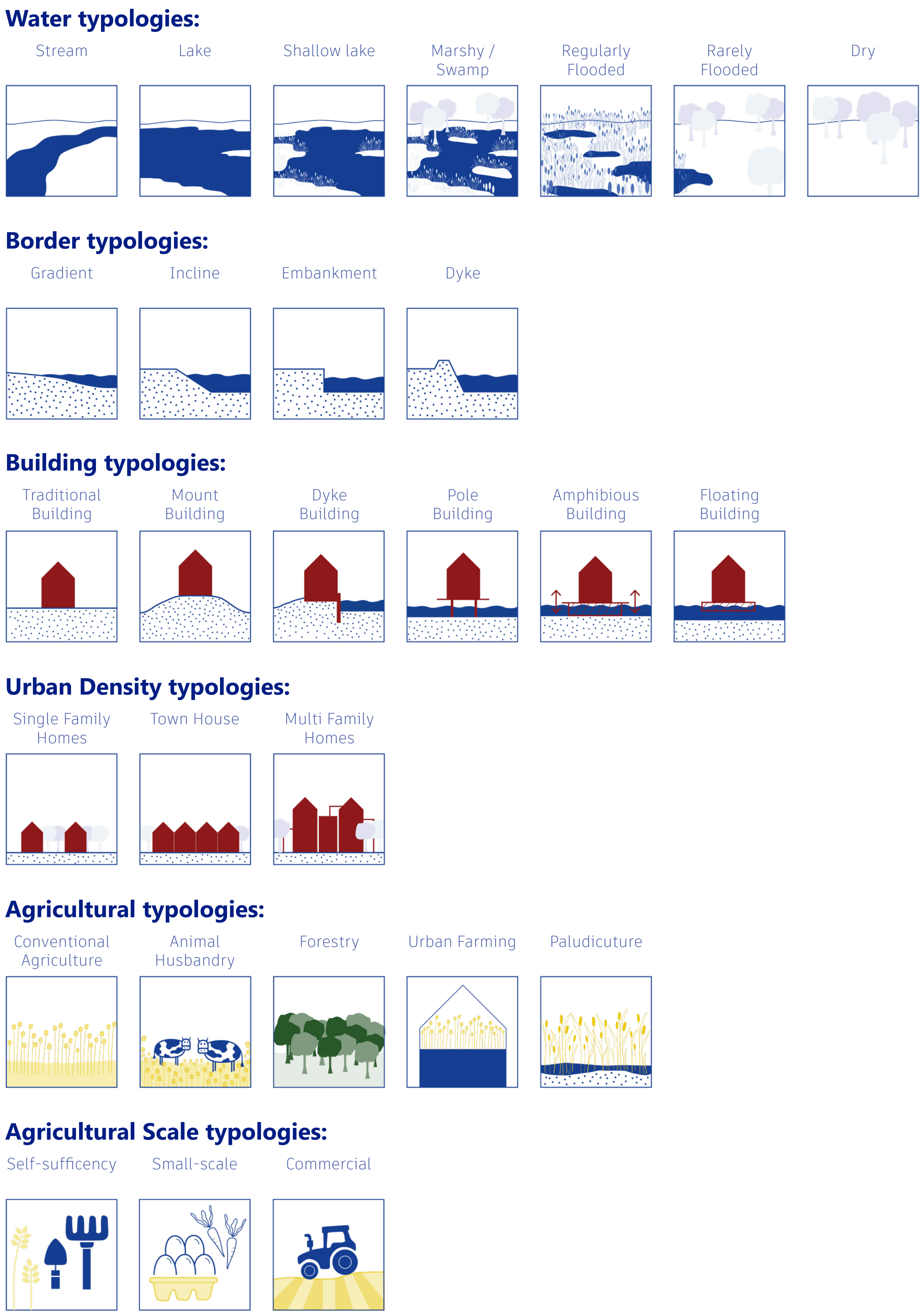


Diagram 13. Above
Summary of typologies.

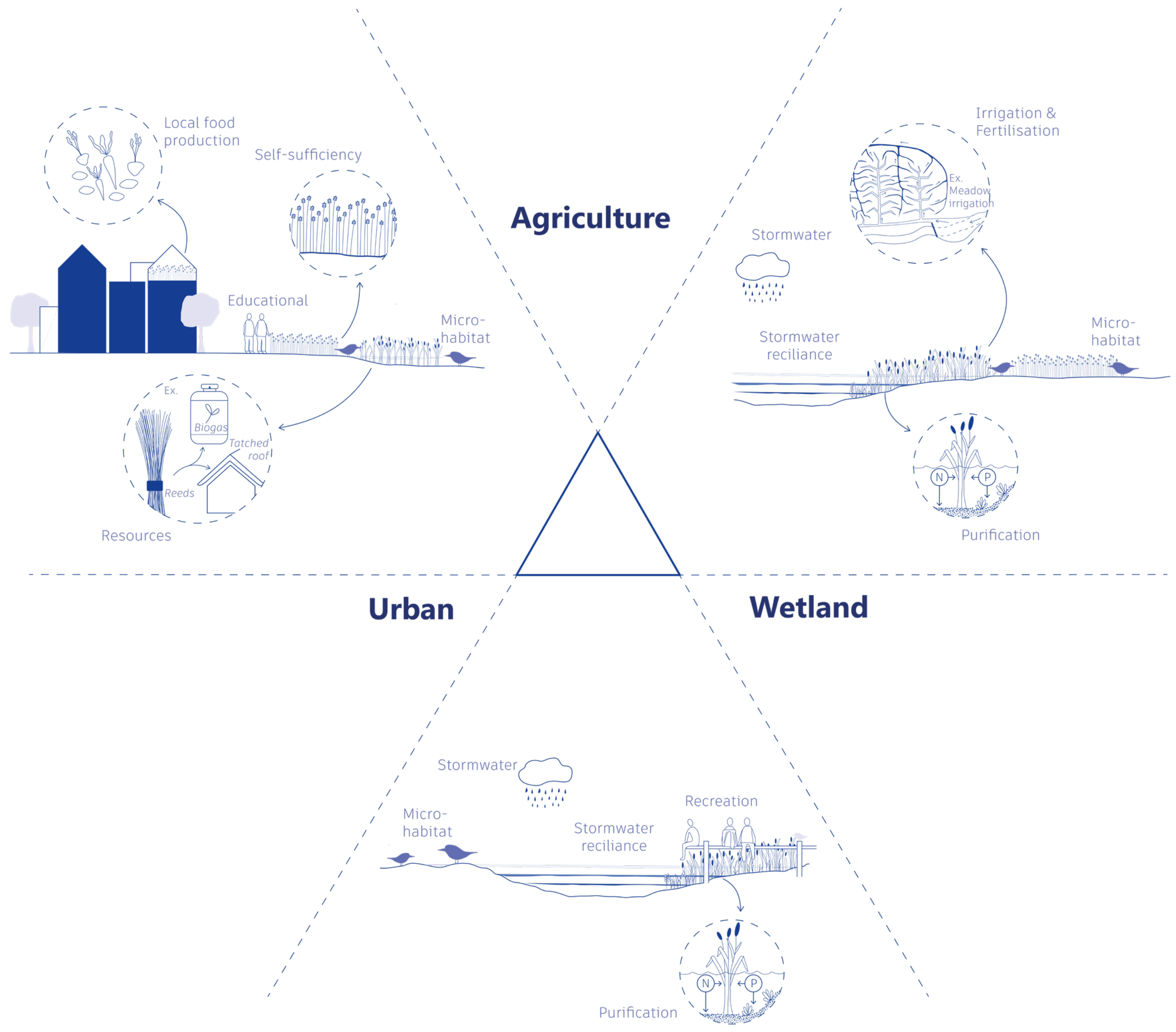


Diagram 14. Above.
The triangular diagram. Showing how the main themes relate to one and other, summarising the findings from this chapter.

Concluding Findings

The typologies identified through the background mapping have been summarised in a diagram (Diagram 13.) The different categories of typologies are color-coded, where the blue typologies are water-related, the red relates to urban, and the yellow to agriculture. The water typologies categorise the different environments of water and boards. The urban typologies categorise different building typologies in relation to water and urban typologies relating to urban density. The agricultural typologies differentiate between various ways of farming and the scale of the agriculture.

The relations between the different elements: wetlands, agriculture, and urban development have been summarised as a mind map around the initial triangle that frames the thesis (Diagram 14.). Sketches made during the readings that show different relations have then been placed in between the themes trying to showcase diagrammatically how the themes can work together and where synergy effects can be found.

CONTEXT

This chapter presents the site and surroundings. Further, it presents findings from site visits, studies of historical and contemporary maps and mapping of the site from the municipality. The site is understood from six perspectives: hydrology, geology, topography, flora and fauna, agriculture, and urbanity, guided by the question: What are the core structuring patterns of the site?

The Site
Östra Ramlösa

The site investigated in this thesis is located on the outskirts of Helsingborg, southeast of the city centre. Today the site is mainly covered by arable land, but the city aims to develop the northwest part of the site into a residential area and the southwest part of the site into a regional hospital. The stream, Lussebäcken, that runs through the area, characterises the site. The stream's catchment area has been the factor deciding "How big is here?".

The site is mapped from six perspectives, to understand the core patterns that are structuring and organising the systems at the site. The six perspectives are hydrology, geology, topography, flora and fauna, agriculture, and urbanity. A dashed red line marks the site on the following maps.

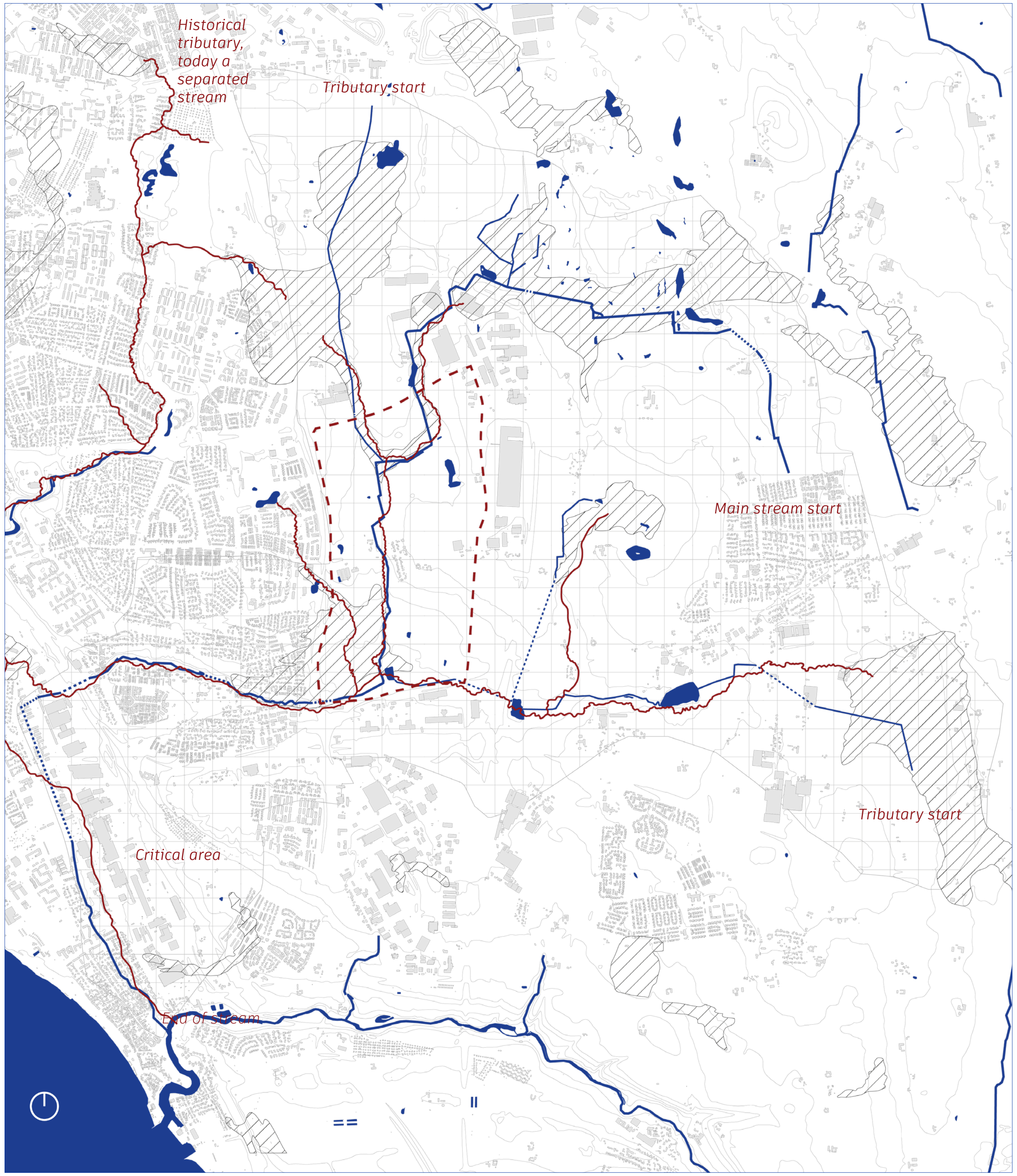
Hydrology

The flooding simulation is based on the report *Slutrapport – Klimatanpassning av Helsingborgs stad* (Sweco, 2016). The data from this report only shows a mapping for the central city thus flooding is not mapped for the whole catchment area.

The flooding scenario is based on a Copenhagen rain. Copenhagen rain is an extreme rain that occurred in July 2011, which meant 171 mm of rain for 3 hours, and can be used for simulating extreme rain events (Sweco, 2016). The historical structure is based on the Swedish recognition map (Rekogniceringskartan), developed 1812 – 1820 for military use. Its purpose was to map the accessibility in the landscape and therefore water, such as streams, lakes, and wetlands was of high importance to map.

From the historical maps, it can be seen that the sources for the stream historically were wetlands, almost none of them exists today. The stream historically had a meandering shape but is today straightened with sharp turns. The flooded areas do to some extent overlap with where wetlands historically were located and can imply lower and more exposed areas for precipitation.

The flooding scenario shows a high risk of flooding in the southwest part of the stream, where the stream is culverted. Increasing the capacity here, and delaying the water further upstream, could be ways of mitigating the risk of flooding. Within the site, there are two critical points for flooding, one in the north and one in the south. Both places are at the intersection of two parts of the stream.



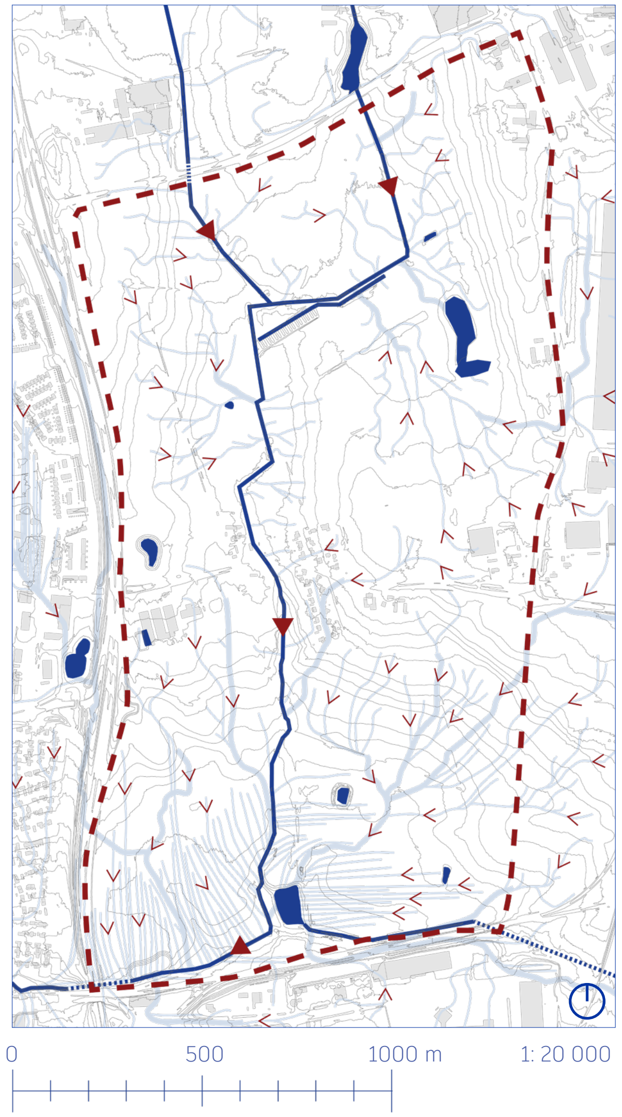
Flooding simulation:
- > 1,0 m
- 0,5 - 1,0 m
- 0,1 - 0,5 m
- Wetland, 1820
- Catchment area
- Site
- Stream, 2024, culvert
- Stream, 1820
- Stream, 2024

0 500 1000 2000
1. 40 000

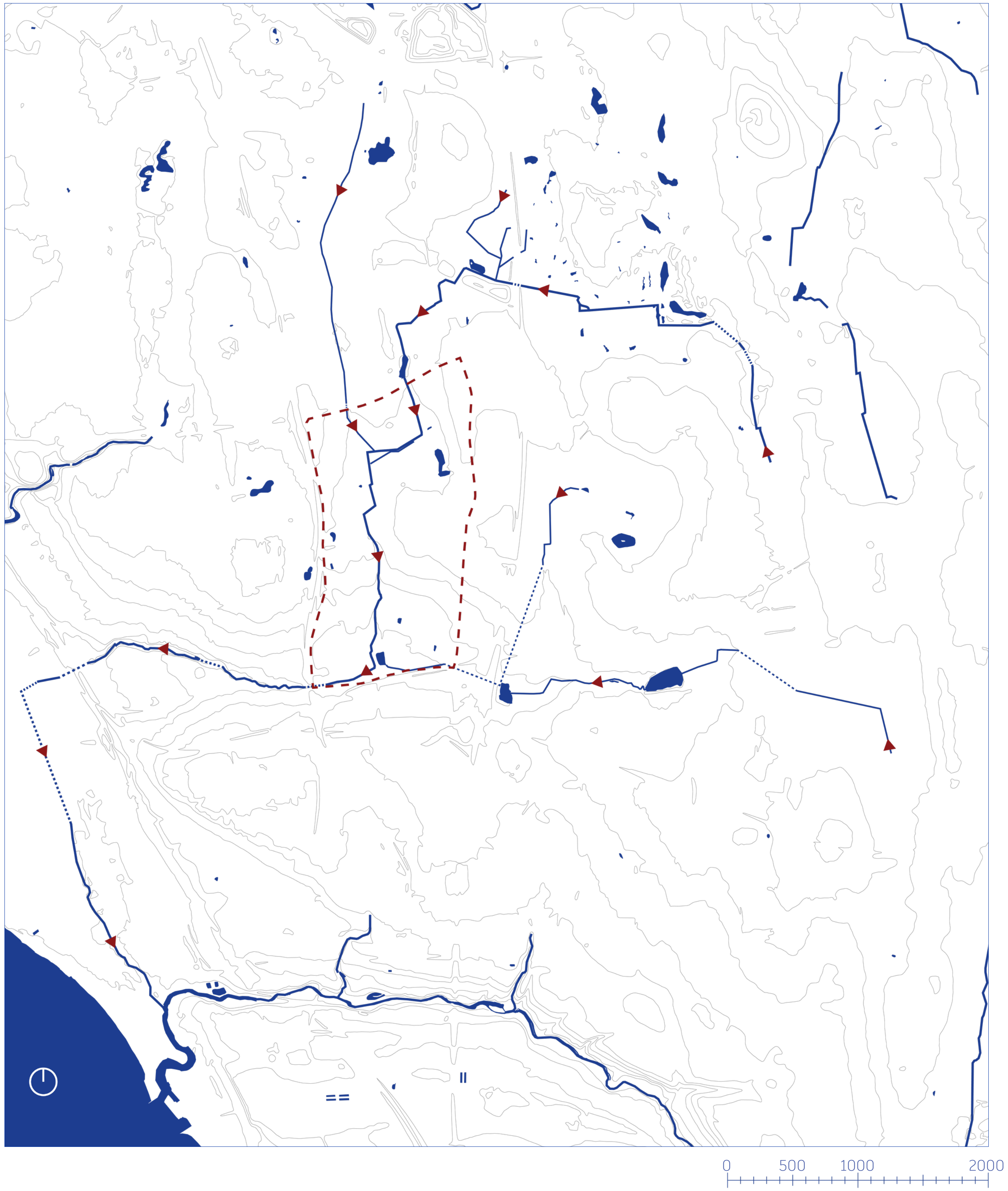
Map 1. Hydrology. Showing the existing stream and its catchment area. A flooding scenario simulating the Copenhagen rain, the historical stream, and wetlands is also shown on the map

Topography

The site is sloping towards the south. Within the site are two low areas identified, both of them where two segments of the stream intersect. Map 3 shows the overall direction of the water flow of the stream while Map 2 shows the waterways within the site to the stream. The site is fairly flat, sloping from the north to the south. The incline is a decrease of approximately 15 meters, from north to south, over a distance of around 2000 meters.



Map 2. Topography. Showing the waterways from the surrounding area to the stream. The contour lines show an interval of 1 meter.



Map 3. Topography. Showing the topography, low points, and direction of slope. The contour lines show an interval of 5 meters.

Flora and Fauna

The flora and fauna along the stream and at the site have been mapped based on site visits and studying of the four reports: Biotopkartering i Lussebäcken 2020 (Ekologigruppen, 2020), Lussebäcken åtgärdsplan (Ekologigruppen, 2021), Naturvärdesinventering Östra Ramlöds (Tyréns, 2020) and Dagvattenplan Helsingborgs stad (City of Helsingborg, 2015). The site visits were performed at the beginning of February 2024 after a time of snow and rain in the area, thus fairly high flows have been observed.

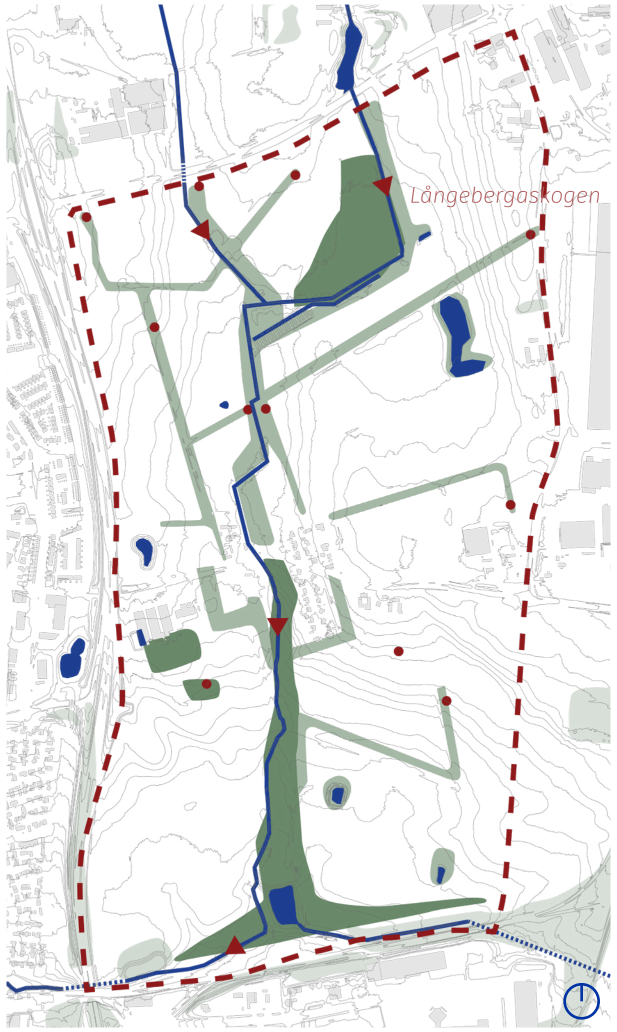
Connectivity

The connectivity describes the degree of connection between various natural environments and is mapped along the stream and sideways from the stream. The connectivity along the stream describes the ability of flora and fauna to move up and down the stream, while the connectivity sideways describes the ability to move from the stream to surrounding natural environments (Ekoogigruppen, 2020).

According to Ekologigruppen (2020), the connectivity along the stream is stated as good and trout has been documented along the whole stream. However, according to The City of Helsingborg (2015), dead fish have been documented in the stream several times which depends on the occasionally very low flows in the stream. The connectivity sideways is stated as bad since more than 75 % of the stream is surrounded by agricultural land or hardened surfaces (Ekologigruppen, 2020).

Important green areas

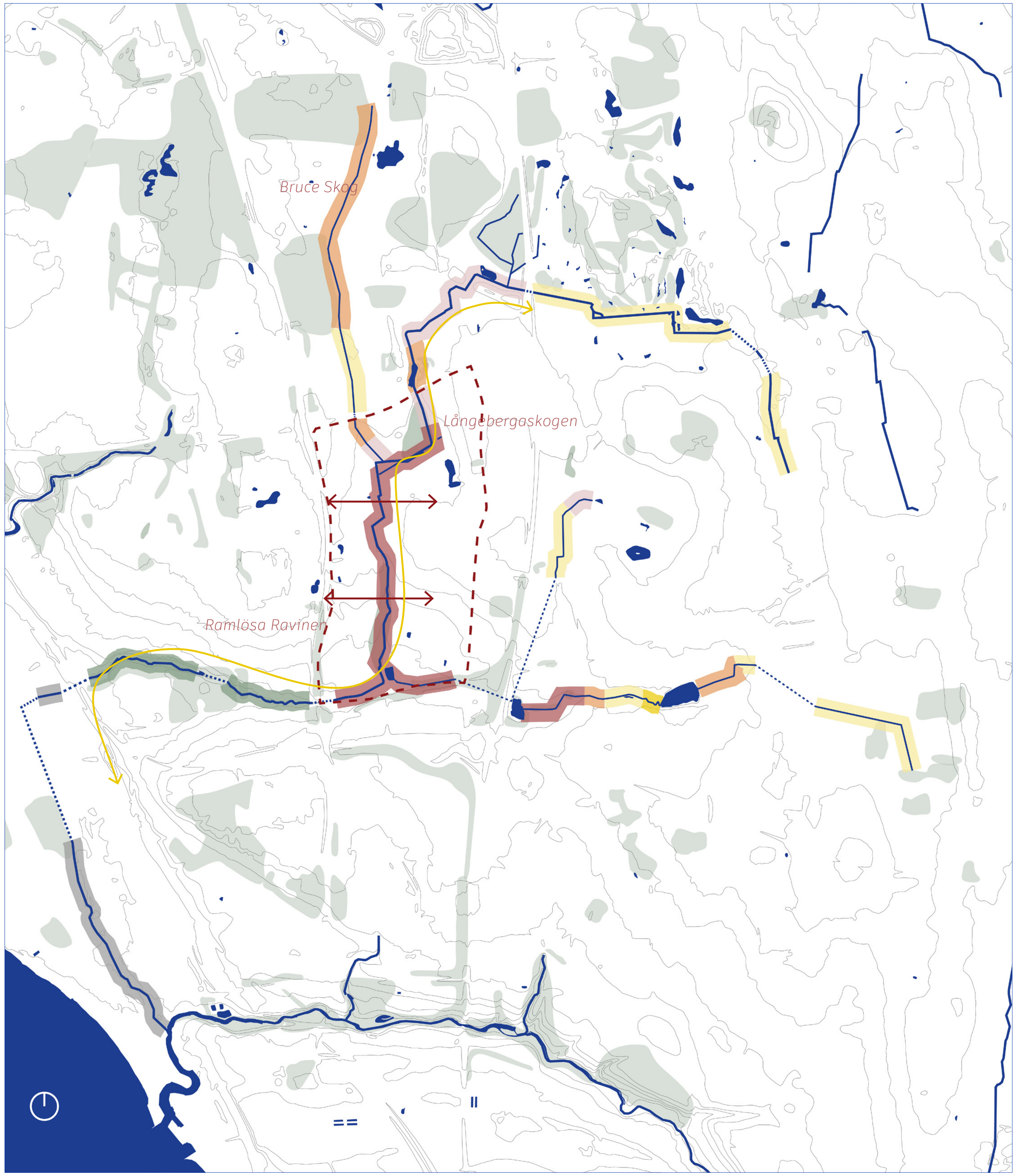
The stream is important in connecting the nature reserve, Bruce Skog, in the north and the green area Ramlösa Ravinen southwest of the site. Within the site, Långebergaskogen is described as a core for the biodiversity at the site (Ekologigruppen, 2020). There are traces of Långebergaskogen being a swamp, an



0 500 1000 m 1: 20 000

- Valuable trees
- High nature value
- Mid-high nature value
- Other green areas
- Stream
- Topography lines, 1m

Map 4. Flora and fauna. Showing a grading of nature values and valuable trees at the site.



0 500 1000 2000
1. 40 000

- Urban
- Ramlösa ravinen
- The middle of the stream
- Two-step ditch
- The meadow
- Ditch + vegetation
- Agricultural ditch
- Green areas
- Connectivity along the stream
- Connectivity sideways

Map 5. Flora and fauna. Showing connectivity, typologies of landscape along the stream, and valuable green areas.

unusual environment within the context, which contributes to a diverse landscape and positively to the biodiversity. However, Långebergaskogen is fairly drainage and would benefit from re-wetting (Ekologigruppen, 2021). Other important environments for the flora and fauna at the site are the several stonewalls and allées of old trees in between the agricultural plots. Along with, the old trees and vegetation along parts of the stream (Ekologigruppen, 2020).

The nature values at the site have been graded in a report from Tyrén (2020), presented in map 3. This shows the high preservation value of Långebergaskogen and the forest strip along the south part of the stream. It also shows mid-high nature values along the rest of the stream as well as along the stonewalls and allées.

Important birds species

The Nature value inventory by Tyréns (2020), showed 58 conservation species within the site, several of them connected to the stream, Långerbergaskogan, or the stonewalls and allées.

There have been found five red-listed bird species at the site, two of them are wetland birds; *Gravand (Tadorna tadorna)* and *Strandskata (Haematopus ostralegus)*, and three of them depend on the open agricultural landscape; *Kråka (Corvus corone), Tofsvipa (Vanellus vanellus)*, and *Stare (Sturnus vulgaris)*, (Diagram 15.). Furthermore, seven other wetland bird species have been found at the site that need consideration, and the bird *Kungsfiskare (Alcedo atthis)* that are nesting in the area (Ekologigruppen, 2021).

Typologies of landscape

Different typologies of landscapes have been mapped along the stream through site visits and report studies. From a large-scale perspective, seven typologies have been identified.

Urban

Here the stream runs through an urban to suburban environment where old trees surround the stream. Stone blocks have been placed as protection against erosion and in some parts, the stream is more like a canal with stone blocks as the ground surface. Some parts are affected by erosion.

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The only part of the stream that runs through a forest. Some areas allow for flooding and some parts of the stream meander. At times are the stream strongly affected by erosion and stone blocks have been placed as protection.

The middle of the stream

Often dense bushes and trees along the stream, mainly alder and ash. The ground surface varies a lot depending on the gradient, and the stream has a low flow during summer but does not drain completely. Some parts are more natural, and some are perceived as a ditch with vegetation, but this typology contains valuable environments for birds and trout.

Two-step ditch

Previously deep agricultural ditches but remade into two-stage ditches which contain a deep and narrow canal for low flows and a wider canal that can be flooded during high flows. The two-step ditch creates more of a natural environment and a more accessible environment for animals.

The Meadow

This typology is very different from the others and could be perceived as an exception. This is a newly constructed part of the stream. The stream runs through a meadow and is connected to a larger wetland. The stream meanders and stones are placed as protection against erosion. A pound which was very rich in birds was identified in the meadow.

Wetland species:


Gravand (Tadorna tadorna) Red-listed


Strandskata (Haematopus ostralegus) Red-listed


Gråhäger (Ardea cinerea)


Knipa (Bucephala clangula)

Wetland species:


Gråhakedopping (Podiceps grisegena)


Knölsvan (Cygnus olor)


Rörhöna (Gallinula chloropus)


Sothöna (Fulica atra)

Wetland species:


Mindre strandpipare (Charadrius dubius)

Agricultural Landscape


Tofsvipa (Vanellus vanellus) Red-listed


Kråka (Corvus corone) Red-listed


Stare (Sturnus vulgaris) Red-listed

Other:


Kungsfiskare (Alcedinidae) Nesting in the area

Diagram 15. Above. Mapping of important bird species found at the site. (Sveriges lantbruksuniversitet, n.d.).

Urban

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The Middle of the Stream

Ditch + Vegetation
An agricultural ditch with vegetation along one side at times mainly Alder and Ash. The gradient varies from non to low. This part of the stream has more of a natural appearance than the agricultural ditch but significantly is still straightened and deepened and is pursued as a ditch rather than a stream.

Agricultural ditch
This part of the stream is a steep and deep ditch that is completely dry during summer. Barley any vegetation that provides shade thus overgrown. This typology barely has any slope which makes the ground muddy.

Two-step Ditch

The Meadow

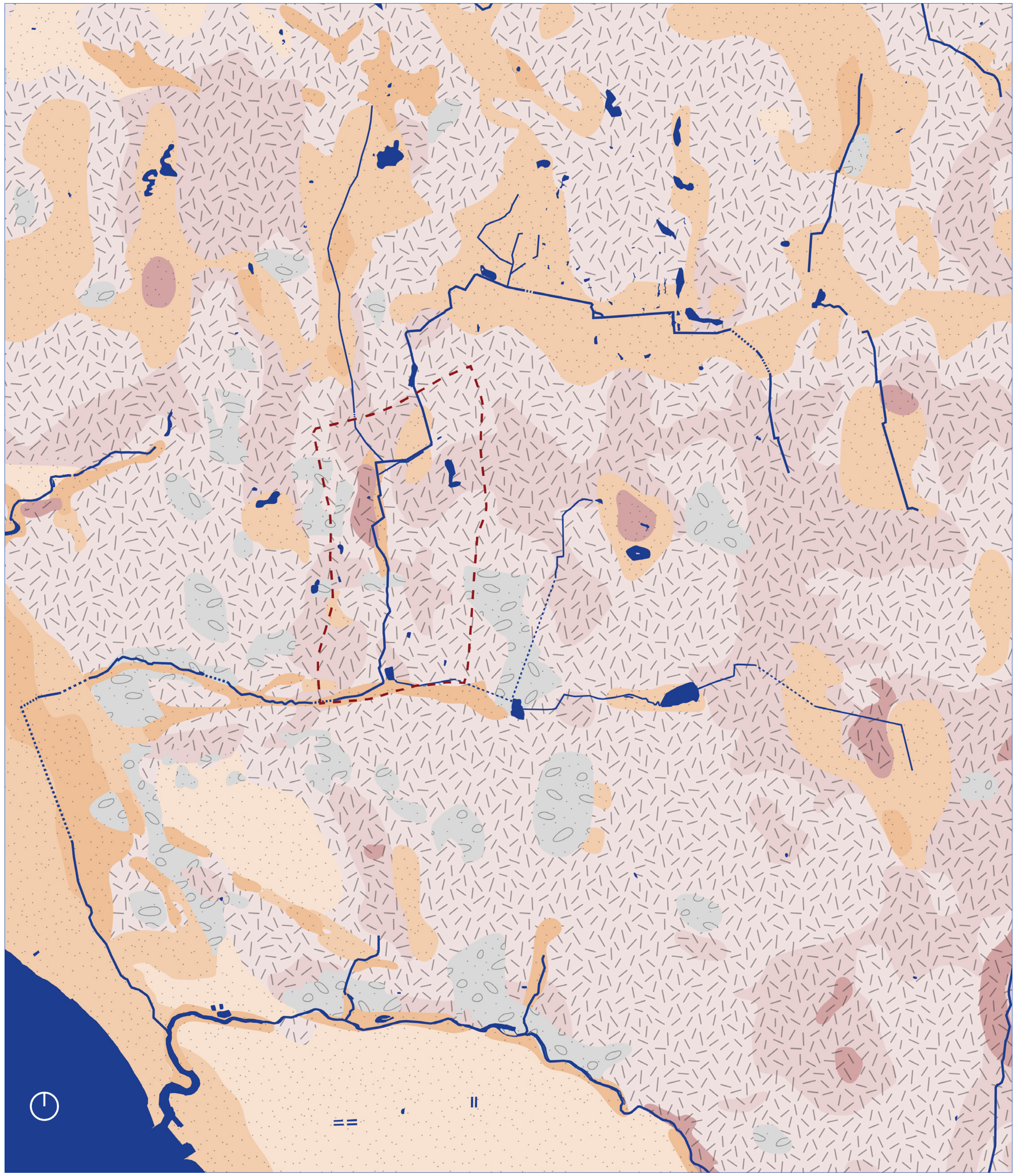
Ditch + Vegetation

Agricultural Ditch

Geology

The map shows the geological conditions at the site and the surrounding area. The grey areas show the area where the ground is rock. The nuances of red show soil with a variation of clay content and the nuances of orange show variations of sand. Dominating the whole area is till with a clay content of 5 – 15 % and within the site, the soil is mainly variations of clay, and some areas of sand as the ground.

The clay ground generally has a low permeability, meaning it can serve as a barrier protecting the groundwater from contamination. Sand, on the other hand, generally has a much higher permeability letting precipitation penetrate the soil to the groundwater, resulting in a higher risk for groundwater contamination. There have not been identified any layer of peat in the soil within the site.



0 500 1000 2000

1. 40 000

Sedimentary rocks

Young fluvial sediment, sand

Glaciofluvial sand

Postglacial coarse silt to fine sand

Glacial clay, clay content 15 - 25 %

Clay till, clay content 15 - 25 %

Till, clay content 5 - 15 %

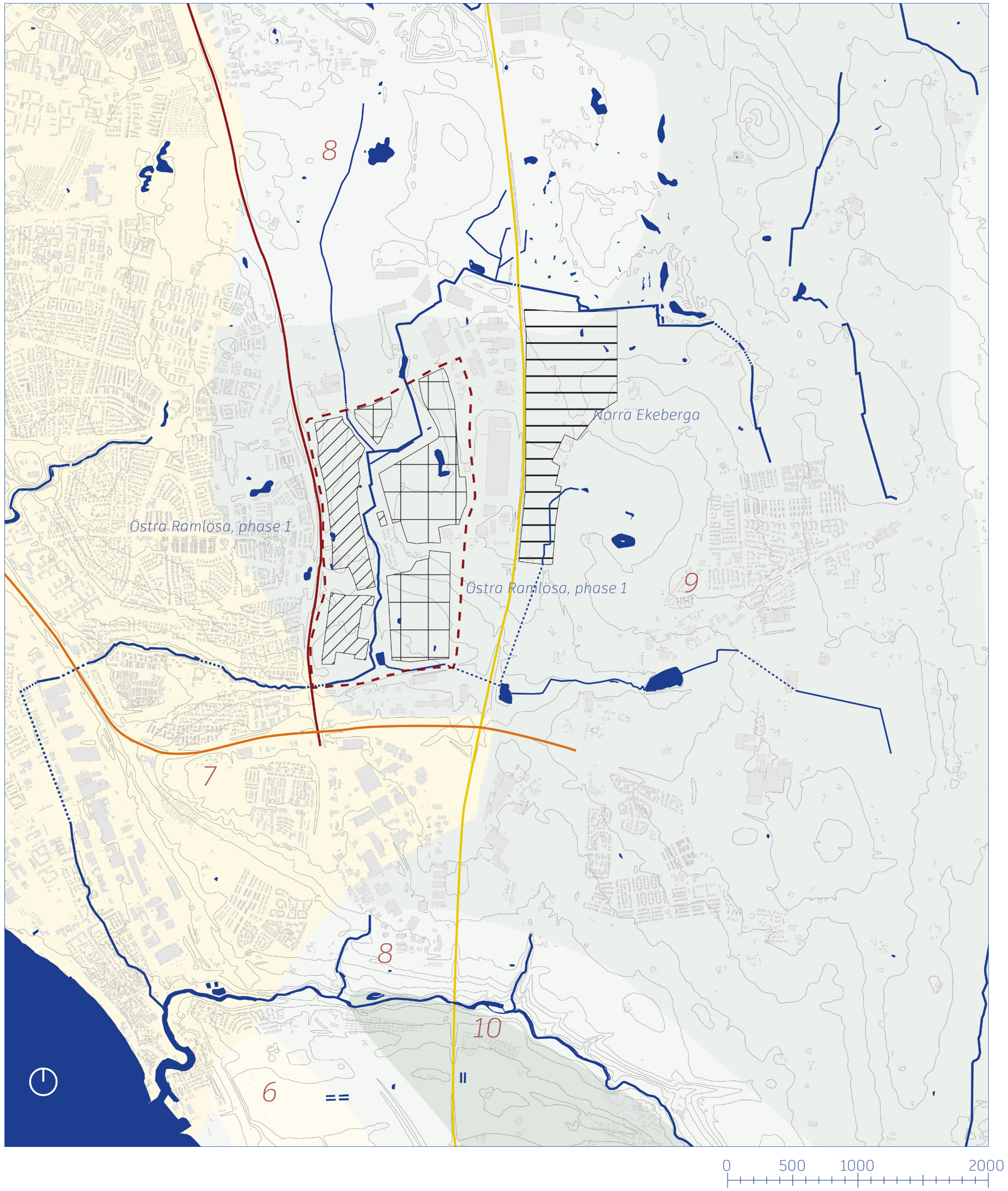
Map 6. Geology. Showing the different soil geological conditions at the site.

Urban Development & Agriculture

The mapping of the urban development in the area is based on documents from the municipality along with an interview at the city development office.

A new urban area is under planning for the site Östra Ramlösa. It is planned in two phases, the detailed development plan for phase 1 is predicted to be accepted during 2024 (City of Helsingborg, n.d.). Whether the second phase will be realised, and if so when, is not decided at this time. Within phase 1, a new residential area is planned in the north of the site and a new regional hospital in the south of the site. Within the catchment area the new logistic and industrial area, Norra Ekeberga, is being planned which risks increasing the base flow to the stream.

It has for a long time been discussed whether the city of Helsingborg should expand past the road Österleden. The aim has previously been to keep the city within Österleden. However, the political composition was changed after the election in 2018, and it was decided that the city should not be limited within Österleden due to the demands the population growth was putting on the city. There has also been a debate about whether the site Östra Ramlösa was suitable to develop because of the high grading of agricultural land. The site is within agricultural land of class 9, which is the second most productive type of arable land.



Map 7. The planned development at the area and grading of agricultural land. The numbers in the map refers to the grading of agricultural land.

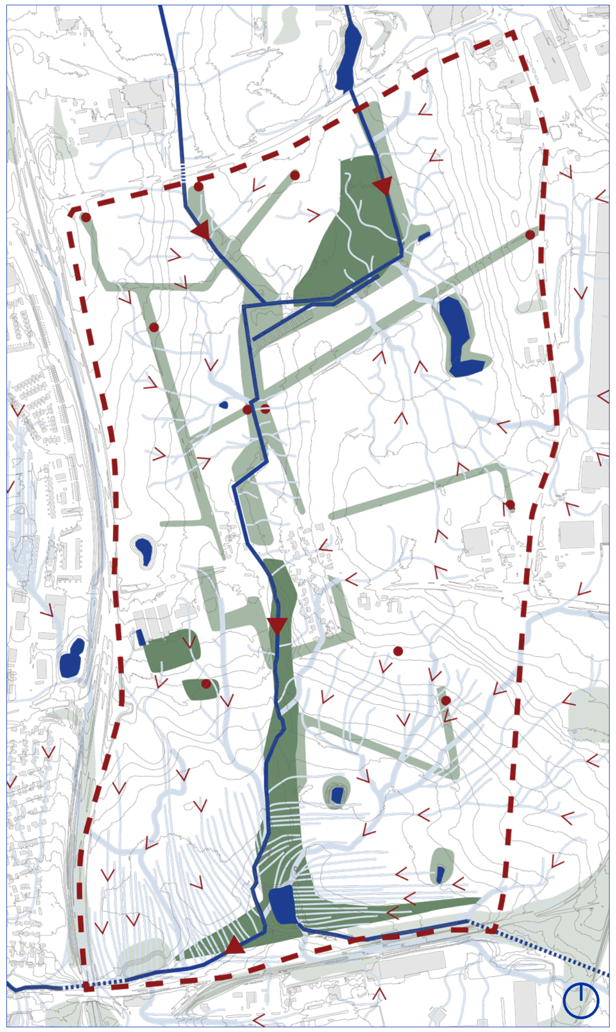
Concluding Findings

The stream has been strongly affected by humans and agricultural activities. It has been deepened and straightened. The site is located on agricultural valuable land, grade nine of ten on a national grading of the land's productivity.

The flooding scenario, historical mapping of wetlands, and the topography indicate low points in the terrain where it could be suitable for constructing a wetland. Delaying water within the site can be valuable in mitigating flooding further down the stream. This could also help prevent the stream from draining during summer. There is a risk that the stream will be exposed to higher flows because of the new development in Norra Ekeberga.

Långeberga Skogen is a core element for biodiversity at the site. This is a dried swamp that would benefit from re-wetting. Furthermore, the stonewalls and allées dividing the agricultural plots are elements of importance for biodiversity at the site. Several bird species that need consideration have been found at the site, five of them are red-listed. There have been found both species that depend on the wetland environment and the agricultural landscape.

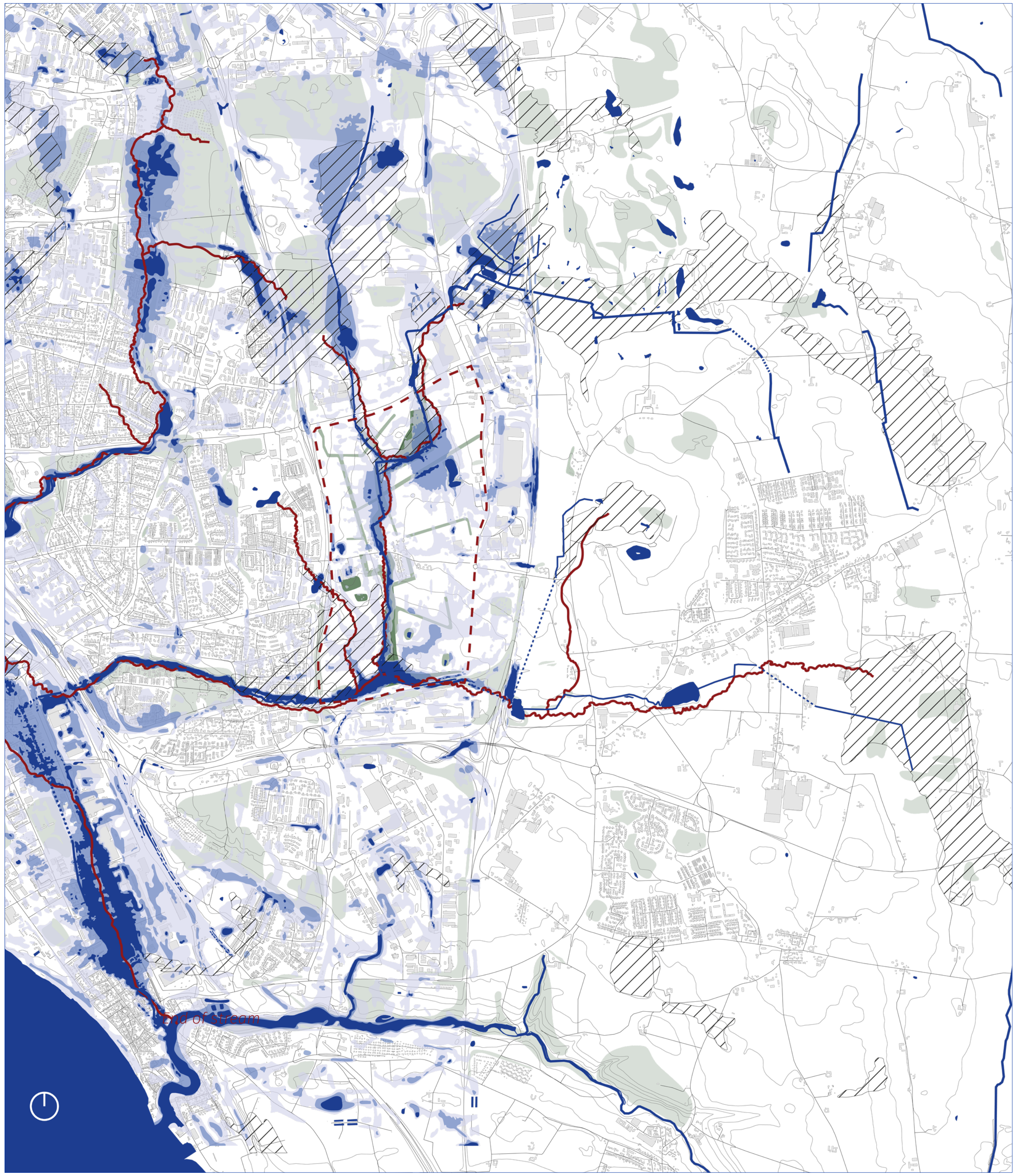
Flooded areas within the site mainly have clay or sand ground. The clay ground entails a low risk of contamination of the groundwater, while the sand ground entails a higher risk of contamination. Further mapping of the soils, together with an expert, would be of high interest.



0 500 1000 m 1: 20 000

- Slope direction, main stream
- Slope direction, waterways
- Valuable trees
- High nature value
- Mid-high nature value
- Other green areas
- Stream
- Waterways
- Topography lines, 1m

Map 8. Concluding the structural patterns of the site.



0 500 1000 2000
1. 40 000

Flooding simulation:
- 0,1 - 0,5 m
- 0,5 - 1,0 m
- 0,1 - 0,5 m
- Green areas
- Wetland, 1820
- Catchment area
- Site
- Stream, 2024, culvert
- Stream, 1820
- Stream, 2024

Map 9. Concluding the structural patterns of the site and the surrounding area.

DESIGN EXPLORATIONS

This chapter presents the design explorations done based on a speculative design approach and methodology. The base of the explorations is to envision alternative futures by scenario design and what-if questions.

Model Exploration 1

The first exploration conducted was an exploration of the relevance of a wetland at the site, in a physical model. The exploration was done roughly and iteratively with three tests to get a sense of the water structure at the site. The exploration was guided by the what-if question: *What if the inflow to the stream heavily increased?*

Logic of the model:
was poured along the existing stream, first a smaller amount and then a larger amount. The outcome was then observed and documented. After each water simulation, a new test could be conducted where subsidence and/or elevations were added, and water was again poured along the stream.

Result:
The result from each test is presented in the images to the right (Figure 11.). The tests are color-coded, each row represents a test, and they are read from left to right.

Reflection from test 1:
The water followed the stream as predicted, and when higher amounts of water were added it spread out at the lowest point in the south and the intersection of the two streams in the north.

Reflection from test 2:
When a subsidence was added in the north where the water was collected, for the smaller amount of water. The larger amount of water was again collected within the low point in the south and at the intersection of the two streams. .

Reflection from test 3:
When a second stream was added, the water was not as effectively collected within the subsidence. The new stream became the primary way for the water. A fourth iteration could be to place the second stream at a higher level. This would keep the original stream as the mainstream, and the new stream would only be used when a larger amount of water was added. This would also collect the water more effectively within the subsidence.

TOPOGRAPHY | SMALL AMOUNT OF WATER | LARGER AMOUNT OF WATER

TEST 1
The original topography

TEST 2
A subsidence is added in the north of the site

TEST 3
A second stream is added

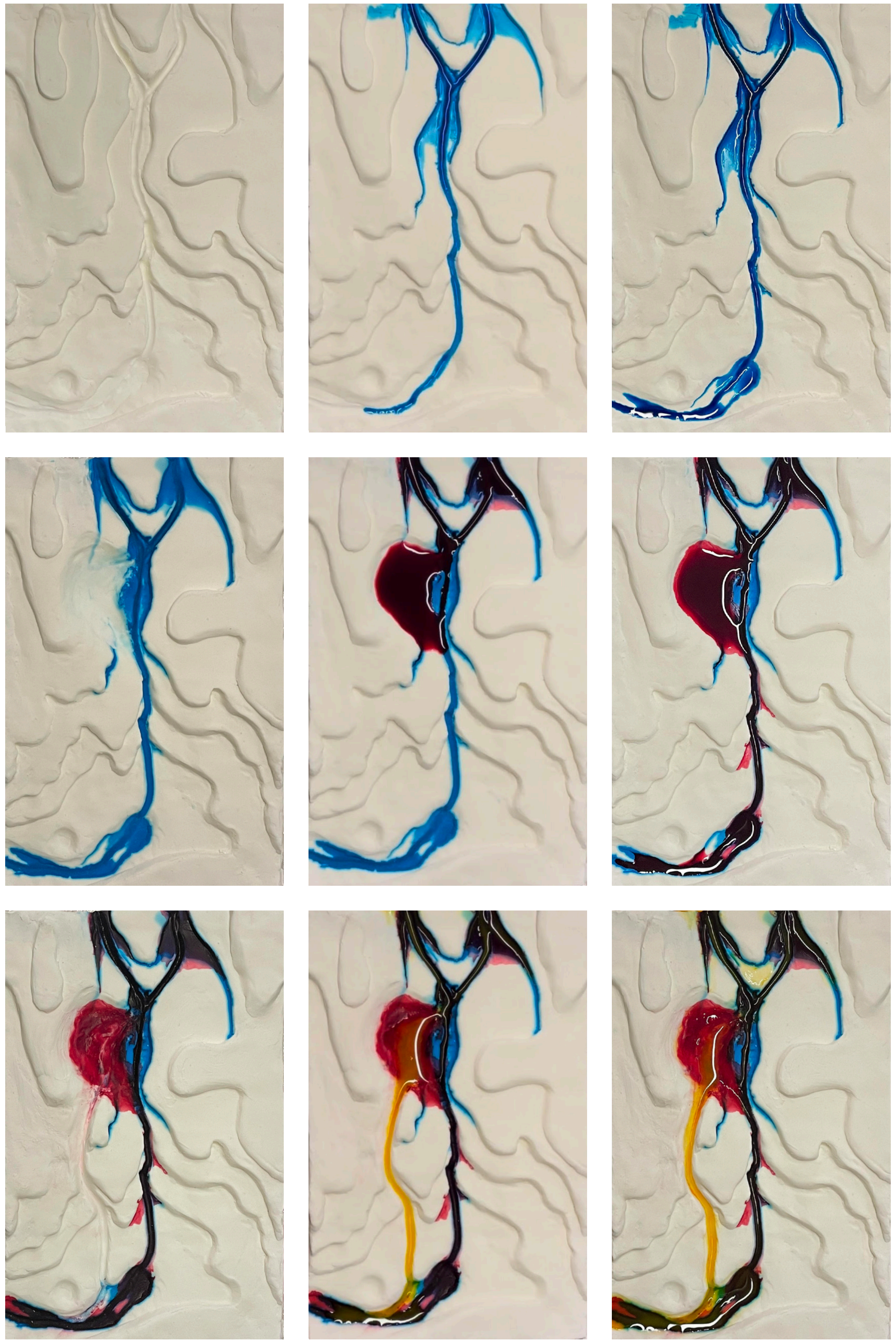
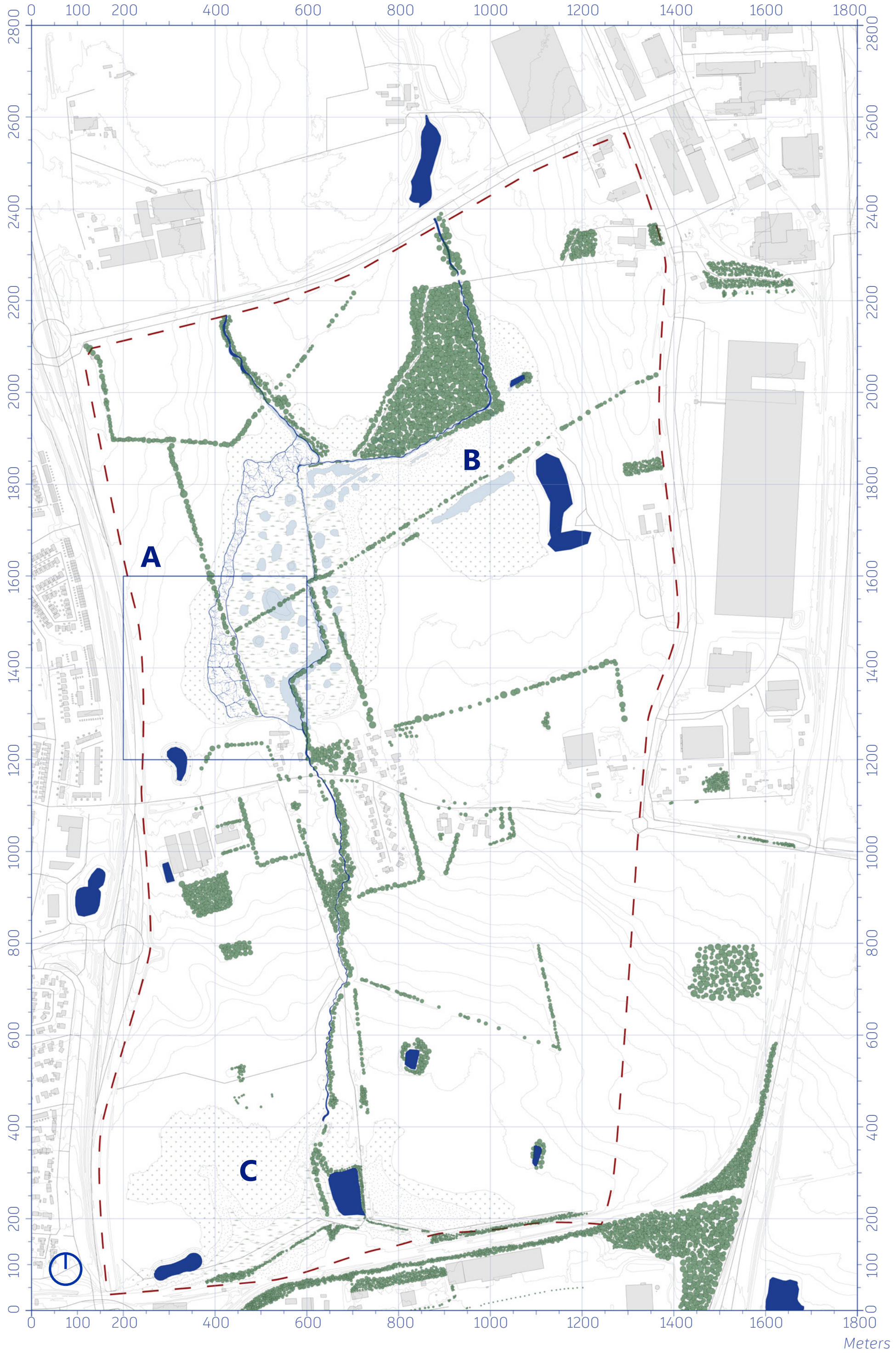


Figure 11. *Above*
Test of the relevance of a wetland at the site.



Map 10. The proposed water structure, 1. 15 000

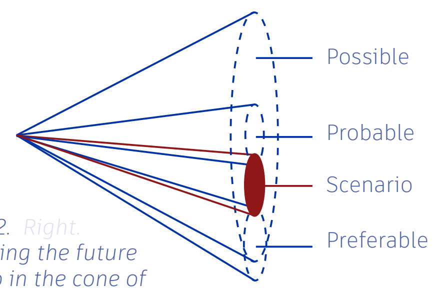
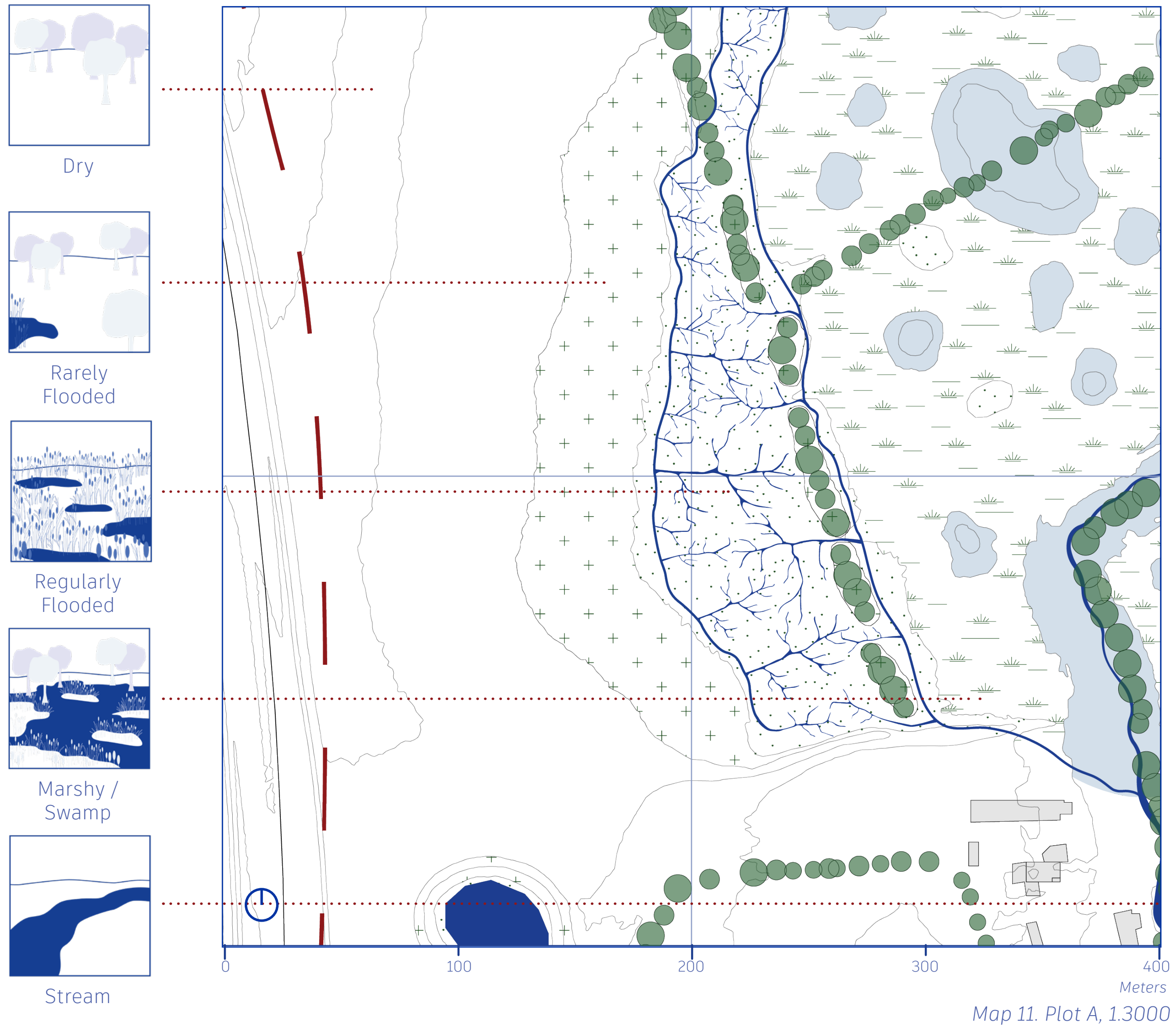


Figure 12. Right Positioning the future scenario in the cone of futures.



Map 11. Plot A, 1.3000

The Scenario

The explorations are based on the future scenario where extreme weather occurs more frequently with heavy rain and drought making it important for the landscape to have water storing abilities. This scenario can be placed in the cone of futures (Figure 12.). It can be seen as not the most probable future but a fairly probable one. Whether it is a desirable future or not is rather subjective. For a developer planning to develop an area with conventional urban typologies, it is probably not a desirable future. However, for one with the motive of restoring wetlands, it can be seen as a desirable future. In that way, radical changes in climate due to climate change can be used as the driving force for change.

Based on the context and background mapping a new water structure is proposed. The Flooded area and topography propose the location of the wetland and the re-meandered stream. Various water environments can be identified in the proposed water structure with the help of the water typologies. To ensure a floodable surface the concept of meadow irrigation is proposed in part of the regularly flooded zone.

Three plots within the site (A, B, C) have been evaluated for further tests and investigations. Plot A offers the largest variation of water typologies in a limited area and therefore has the most transitional zones where the water typology changes from one to another. This, together with the fact that it is in the limit between the existing urban and the site makes this plot the most interesting to explore further. Plot A is marked on map 10 to the right and enlarged on map 11.

The Tests

Within plot A two tests have been carried out. The plot has been divided in two horizontally, marked in the margin of the plan to the right, where one test has been implemented in the north of the one in the south. The test should not necessarily be seen as a connected plan but rather as two different explorations placed next to each other.

The first test, called W-A(U), has its focuses on exploring the relations between Wetlands and Agriculture where the Uban is subordinate. The test explores the What if question: what if wetlands and agriculture were prioritised when developing the area? Therefore, the test is placed to the left in the triangular diagram (Figure 13.). The border explored is a soft gradient from the stream to the marsh to the drier. Here the dry area is devoted to the commercial scale of conventional agriculture. The marshy wetland and the regularly flooded zones are devoted to small-scale paludiculture and wildlife. The rarely flooded zone is the only zone devoted to the urban creating a strip of urbanity between the open agricultural fields and the lush and green wetland. The building typology explored is the pole building with low poles since the buildings are placed in the rarely flooded zone.

The second test, called W-U(A), has its focuses on exploring the relations between Wetlands and Urban development where agriculture is subordinate. The test explores the What if question: what if wetlands and urban development were prioritised when developing the area? Therefore, the test is placed to the right in the triangular diagram (Figure 13.). The border explored is a soft gradient from the stream to the marsh to the drier from east to west but a hard border as a dyke in the south. In this test, the dry area is devoted to the traditional building with elements of urban farming and small-scale self-sufficiency farming. Within the different wet zones, the urban is spreading out

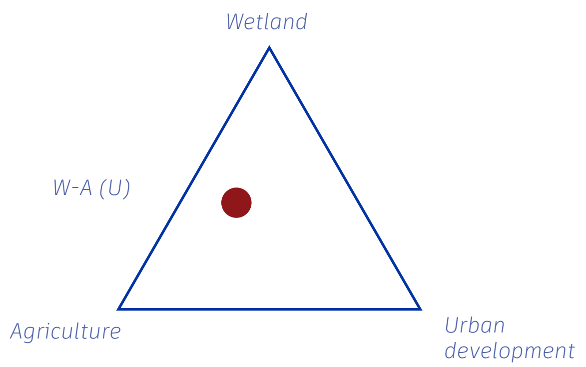


Figure 13. Above.
Positioning the test W-A(U) in the triangular diagram.

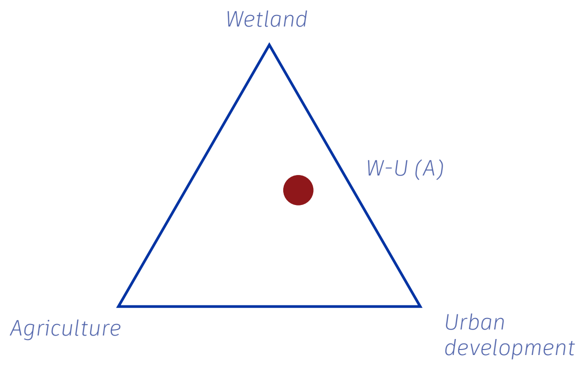
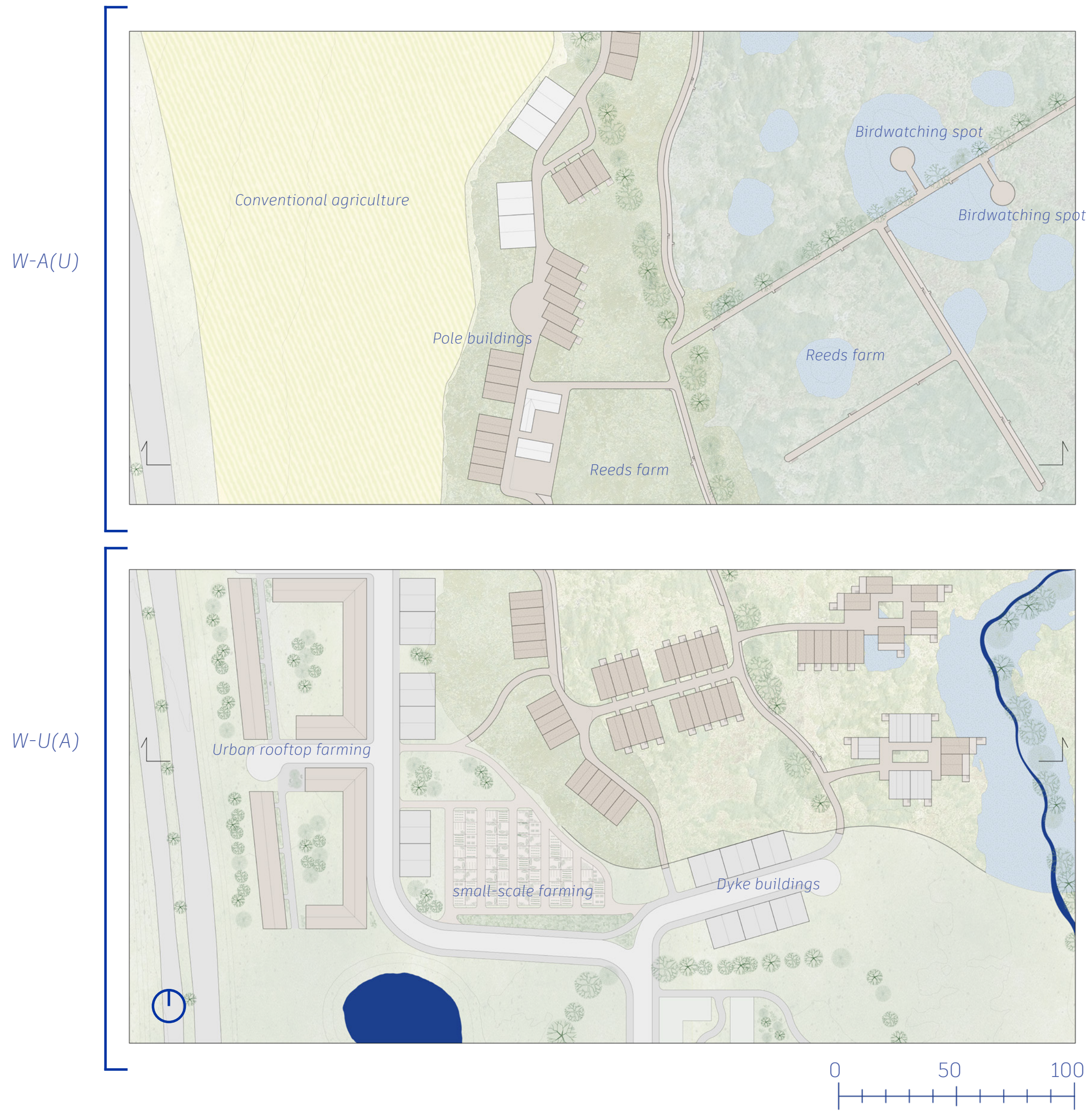
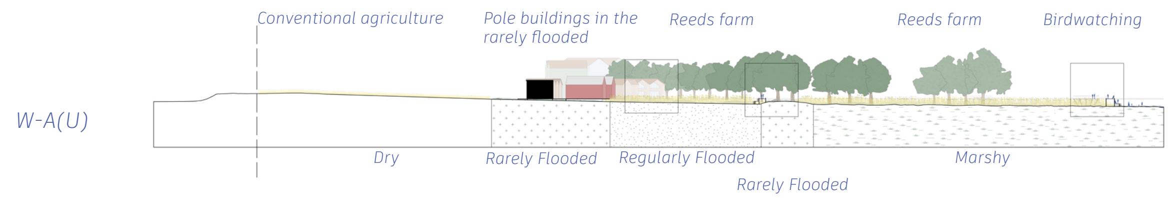


Figure 14. Above.
Positioning the test W-U(A) in the triangular diagram.

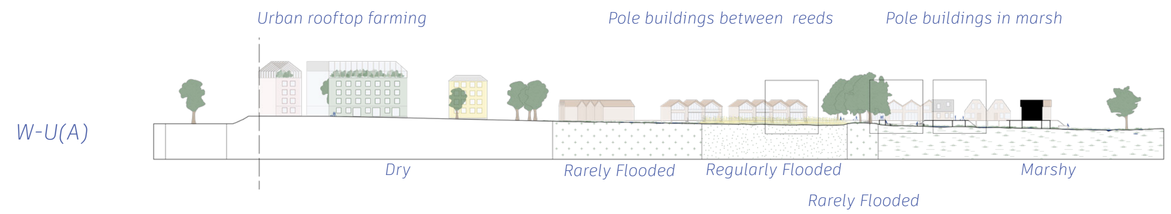
in different constellations, creating interesting meetings between the water and the buildings. Between the houses in the regularly flooded zone is space left for small-scale paludiculture.



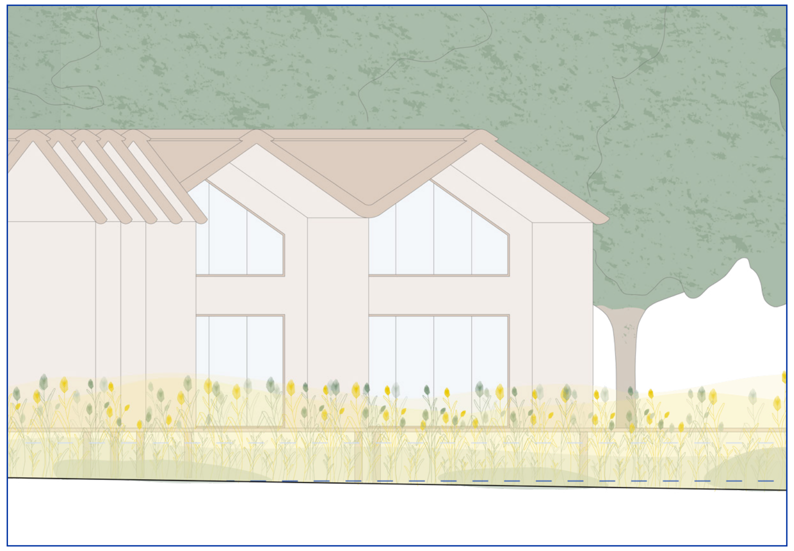
Plan, 1. 3000



Section, 1. 3000

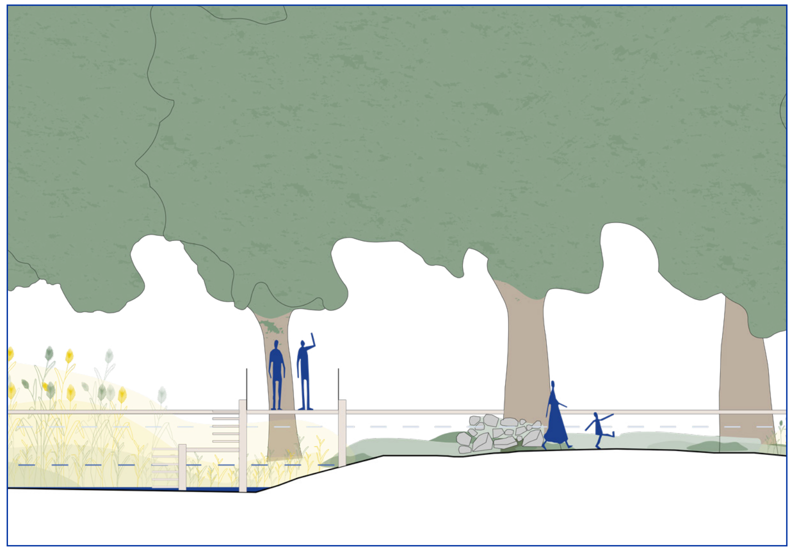


Section, 1. 3000



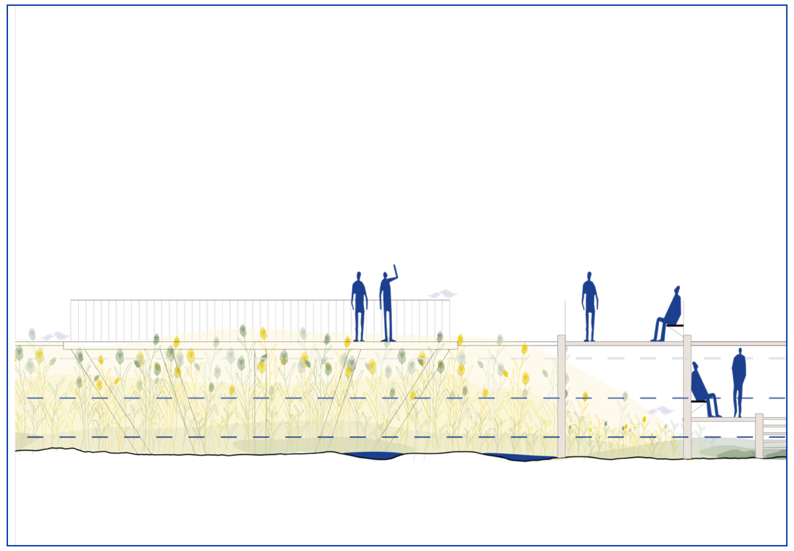
Section
1. 150

Living by the reeds



Section
1. 150

Walking between reeds and trees



Section
1. 150

The birdwatching tower

W-A(U)

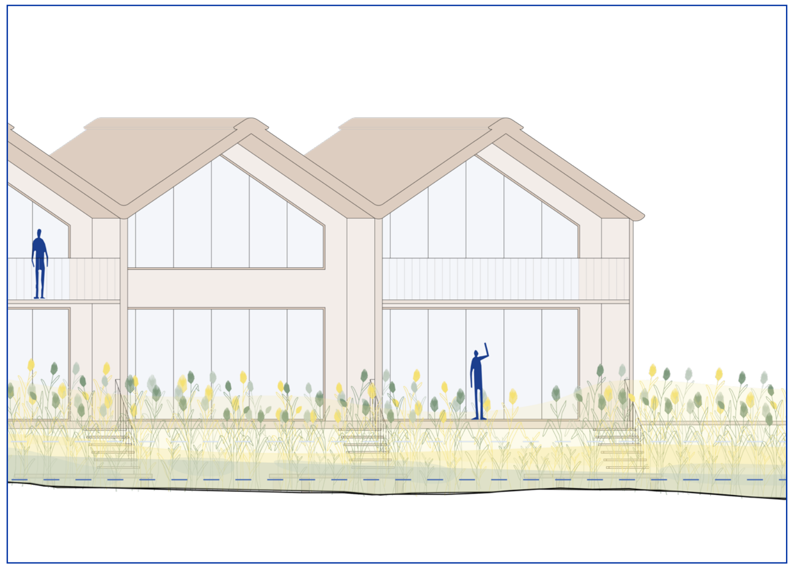
Perspective of the Reedsfarm

This page shows illustrations from the test Wetlands- Agriculture. Above is a perspective showing the reeds farm in the foreground and small-scale urban in the background. The section zoom-in shows glimpses of the transversal section from the dry to the wet. The dashed lines in the sections indicate the regularly flooded and the rarely flooded water levels. It is visible how the raised buildings and paths still function in an extremely flooded scenario while the lower parts of the paths and terraces allow for a close connection to the ground in a dryer scenario.

W-U(A)

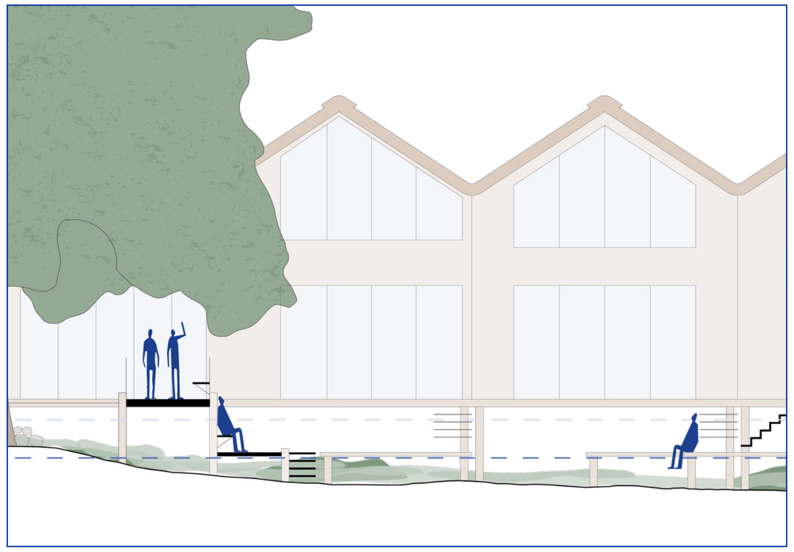
Perspective of the urban block in the marshy wetland

This page shows illustrations from the test Wetland - Urban. Above is a perspective showing the small-scale housing in the marsh. The steps down to the marsh allow for a connection to nature while the ground is fairly dry, but the raised buildings and paths allow for protection against extreme flooding. The dashed blue lines in the sections indicate the regularly flooded and the rarely flooded water levels. It is visible how the raised buildings and paths still function in an extremely flooded scenario while the lower parts of the paths and terraces allow for a close connection to the ground in a dryer scenario.



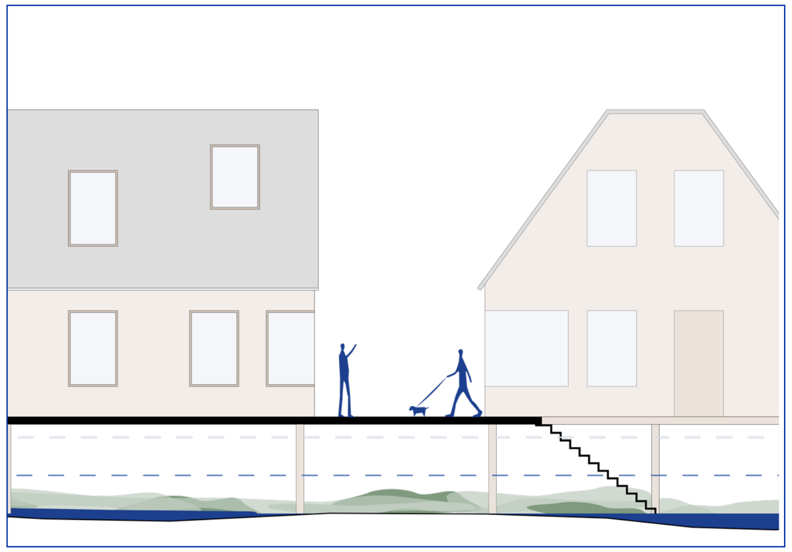
Section
1. 150

Living by the reeds



Section
1. 150

Walking between reeds and trees



Section
1. 150

The urban block

Connection to the Marsh

W-A(U)

Small scale farming at the edge of the wetland

W-U(A)

Model Exploration 2.

The last exploration conducted was to test the proposed water structure and topography changes in a physical model. The model was made as a concrete casting of the topography and can be seen as a refined version of the initial model exploration. The height differences in the model would become minimal (approx. 0,3mm) if casting the model in a manageable size and scale (scale 1. 3 000). To test whether it was possible to create a model for casting with height curves that small, three model tests were made. The first test (Figure 15.) shows a part of the topography on a scale of 1.3 000. The second test (Figure 16.) shows the same part of the site but with the z-axis of the model dubbed in height. This results in a scale of the z-axis of 1. 1 500 while the planar scale still is 1. 3 000. The last test (Figure 17.) shows the same cut-out but with a triple z-axis. Meaning the scale of the z-axis is 1. 1 000, still with the planar scale of 1. 3 000.

The height curves were visible in all three castings but since the goal is to be able to pour water along the stream the second test with the double z-axis was chosen to be the best for the final model. The final model and how the water is collected based on the topography are presented in Figures 18 and 19.

Figure 15. Left
Model test, accurate z-axis.

Figure 16. Left
Model test, double z-axis.

Figure 17. Left
Model test, triple z-axis.

Figure 18. Above.
Model Exploration 2.

Figure 19. Above.
Model Exploration 2.

Concluding Findings

As the design explorations progressed, the triangular diagram was expanded to further map out the relationships and dynamics uncovered during the process. This diagram served as a crucial tool, allowing us to define and articulate the interconnections among various elements. Each vertex of the triangle represents one of the elements, wetlands, agriculture, and urban development. The arrows between the elements, outside the triangle, show the relations that could be created and the potential for synergy effects. The direction shows which element contributes what to the other element. The test's position in the triangle shows what elements that are prioritised.

As a reflection of the tests the blue, red, and yellow arrows within the triangle were added as a representation of the urban density and the agricultural density, showing as you move further towards a higher urban density you are also moving further away from a higher density of wetland, and agriculture and the other way around.

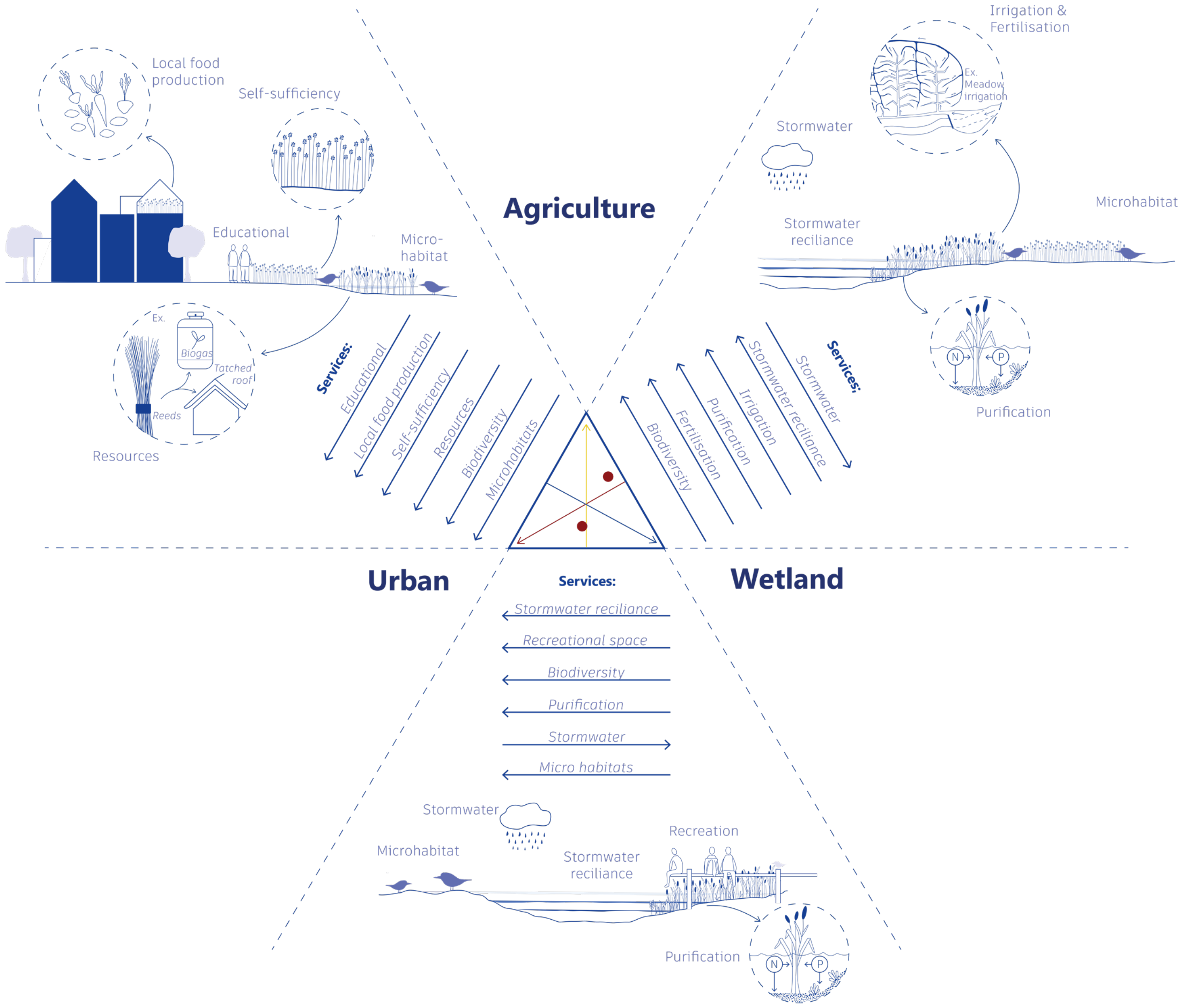


Diagram 16. Above.
The developed triangular diagram. Showing how the main themes relate to one and other, summarising the findings from this chapter. The tests from the explorations are positioned within the diagram as two red dots.

DISCUSSION & REFLECTION

This chapter will discuss and conclude the explorations and findings from the previous phases.

Discussion & Reflection

How can agriculture, wetlands, and urban development co-exist and harmonise in the rurba context of Östra Ramlösa, Helsingborg, Sweden?

To answer this question, one must first define what harmony means. In this case, it refers to creating a system where the three elements; wetlands, agriculture, and urban cooperate in a way that they align seamlessly with the whole and one another while still contributing with their own uniqueness.

The mapping

To be able to achieve harmony between the elements, they and their context must first be understood. The background mapping chapter and the context chapter have been devoted to this where the sub-question: *What synergy effects and conflicts exist between agriculture, wetlands, and urban development?* guided the process of the background mapping. Furthermore, the sub-question: *What are the core structuring patterns of the site?* guided the context phase.

The findings from the background mapping were a web of possible connections between the elements; some more intuitive than others, summarised in the triangular diagram (Diagram X, page 35.). The wetlands' purifying and water-storing abilities regarding agricultural- and urban runoff water were one of the findings. Another finding was the wetland's ability to mitigate flood risks and its fertilising abilities. The many ecosystem services and important habitats for a thriving flora and fauna the wetlands and agriculture provide is another finding from the background mapping. The possibility of incorporating crop cultivation within the wetland environment, paludiculture, was one of the less intuitive findings that can increase the incentives for wetland restoration since it makes the land productive. Within this phase, different typologies were also identified along the way. This was done to create a catalogue of suitable building blocks to facilitate the explorations.

From the context phase, the finding of the highly productive arable land at the site reshaped the project since it became inevitable to not incorporate it. What first was a search for harmony between wetlands and urban development became a search for harmony between wetlands, urban development, and agriculture. The stream, the structuring greenery, and the old stonewalls create important microclimates for flora and fauna. The historical water structure and the future possible flooding scenario showed the need for delaying water at the site to mitigate flooding further down the stream. These elements collectively create the structural patterns of the site (summarised in Maps 8 and 9, pages 52-53). The several red-listed species and the dried swamp also became elements of importance at the site.

The explorations

The explorations have aimed to implement the findings from the background mapping and context phases. First, the relevance of a wetland to delay the water at the site was explored. This was done through a physical model and showed that if a subsidence was added in the north of the site the water from the stream could quite effectively be collected within this.

The second explorations were the scenario. The scenario design was based on the future scenario where heavier rain will occur more frequently and the need for preserving water in the landscape will increase. This was used as the driving force for creating a wetland at the site. Then a test bed within the site was chosen to further explore what spaces could come from implementing and enhancing the relations from the background mapping.

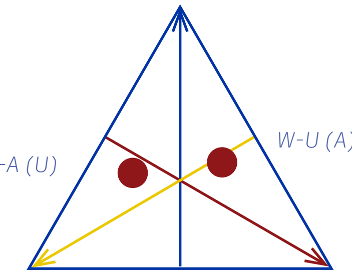


Figure 20. Above. Position of the tests in the triangular diagram.

The test's position in the triangular diagram (simplified version, Figure 20.) decided what to explore in each test. The first test explores the relationships between wetlands and agriculture where a low urban density was applied. The second test explores the relationships between wetlands and urban environments where small-scale agriculture is applied. The explorations in this thesis should be seen as a creative way of how architects can, through considering the systems and structures of water and agriculture in urban developing areas intertwine them into a coherent whole where they benefit from each other. I mean that these explorations show the versatile capacity and potential architects have and that the triangular diagram can be a tool for helping the designer and decision-makers to structure and prioritise what systems to incorporate into a final design proposal. Furthermore, the typologies can serve as building blocks, helping to comprehend the space and facilitate the first design decisions.

The tests only explore some of the relations in the triangular diagram and only a few of the typologies. I mean that the triangular diagram, together with the typologies, metaphorically can be seen as a card game, and that the tests are the first round of playing the cards. But the continuation would be to shuffle the cards and play another round, using the cards in different combinations.

The final exploration concludes the project by testing the proposed water structure in a model and proposes a refined version of the initial model exploration. The model is refined with hard and soft borders, gradients allowing the water to fluctuate, and dykes to redirect the water to the stream.

However, it can be questioned whether harmony is what is being achieved. As stated in the background mapping, it does not only exist positive relations between the three themes but also conflicts. There are reasons why the themes are standing in conflict with one another today, such as conflicts between different interests and economic incentives. Harmony can be viewed as a utopian goal, but the reality would probably entail a negotiation of what to prioritise the highest.

For example, claiming land from agriculture to wetlands and water will always negatively impact the productivity and area devoted to agriculture, and claiming land for water that could host a large-scale housing development will never end in a higher density of urban development. However, considering ways for the themes to coexist can mitigate the conflicts and initiate a negotiation process where other interests are considered. The triangular diagram can help expose and state these different interests and their importance. This means that where you are positioning yourself in the triangular diagram will both entail potentials and limitations.

Harmony is the word from theory – implying the existence of a perfect world - the point in the triangular diagram where the three arrows intersect. However, in the real world, a debate between interests would be the reality, and the arrows within the triangle all pull in different directions.

How can the planning from an architect's perspective enhance the synergy effects and mitigate the conflicts?

Based on the project, the main tool in enhancing the synergy effects is understanding the elements we aim to create synergy between. This has been done and framed as the triangular diagram which I see as a methodological exploration of how the elements and their relations can be understood. My strongest belief after conducting this thesis is that we as architects need to incorporate a broader perspective into our design practice and view a project and its site from a living system perspective. We need to reveal the underlying patterns structuring a site to be able to design something that either reinforces the desirable systems or intertwines new systems into the existing ones to lift the place to its higher potential. We need to step out of our field and co-operate cross-disciplinary to be able to create regenerative landscapes.

Possible continuations

To strengthen the reliability and simplify the evaluation of the project, CO2 calculations showing the capturing capacity of the wetland could be helpful. This could also be important in increasing wetland restoration and construction incentives.

As previously mentioned, cross-disciplinary cooperation is crucial for understanding and creating regenerative landscapes. Therefore, further developing the triangular diagram together with a variety of competencies could lift its accuracy regarding the relations and make it usable as a method that could be implemented in several similar situations and scenarios. Furthermore, the development of the project into a refined design proposal could help the audience grasp the regenerative force of the project and its tools.

The regenerative design raises the understanding and creation of patterns as a central aspect. The part of understanding the existing patterns at the site have been carried out through the context phase but to design from a pattern perspective were challenging. It was a difficult to keep the pattern and system perspective when going into the design-tests. A way to further develop the explorations could therefore be to push the pattern thinking further into the design explorations.

Conclusion

In order to enhance synergy effects between elements we need to understand the elements we aim to create synergy between. To achieve this, we as architects need to incorporate a broader perspective into our design practice and co-operate cross-disciplinary to be able to create regenerative landscapes. The tool for incorporating a broader perspective on urban development in this case has been the triangular diagram.

The triangular diagram can be viewed as one outcome of the project and the tests as another, which is an application of the triangular diagram in a specific context. The explorations show the versatile capacity and potential architects have and that the triangular diagram can be a tool for helping the designer and decision-makers to structure and prioritise what systems to incorporate into a final design proposal. The diagram can be used as a negotiating tool helping to advocating for interests often neglected. It is important to keep in mind that the triangular diagram is not a static product, but should rather work as a living diagram, summarising and collecting findings of dynamic processes and relations between elements to push the design explorations.

Figure 21. Above. Model exploration 2.

Closing words

When viewing a site as patterns of interconnected dynamic processes, that we as humans are a part of, unexpected radical changes in climate can be used as the driving force for change. Increasing events of extreme weather have throughout this project been used as the driving force for finding ways of transforming our landscapes into a whole where human and natural systems are intertwined. This is not the solution to the triple crisis of climate change, biodiversity loss, and pollution, but it is a call to action.

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