MASTRUP DELTA

A LEARNING CYCLE

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A LEARNING CYCLE

The title 'Mastrup Delta' refers to the site's physical location and the understanding of the concept for the design. The word "delta" is *"an area of low, flat land, sometimes shaped like a triangle, where a river divides into several smaller rivers before flowing into the sea"* (Cambridge Dictionary, 2017). The "rivers" in this project consists of many different forms of learning: learning about water, vegetation, animals, biodiversity, farming, health, climate adaption, geotechnics, et cetera.
The learning cycle is a concept of how people learn from experience. A learning cycle will have a number of stages or phases, the last of which can be followed by the first. These "learning-rivers" will all have their own cycle which will merge together and become the final proposed design.

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ABSTRACT

This Master's thesis aims to change the way rainwater in cities are seen and used. Rainwater is a resource, and like all other resources it needs to be used in the best possible way and not be misused. The site of intervention is Mastrup Delta in Støvring, Denmark. The project encompasses the implementation of rainwater management for a larger area in the city. Using rainwater in cites has several advantages for the city, it increases the physical and mental health of the inhabitants and is a one of several tools to make a city more liveable. By crossing between the theories of 'liveability' and 'learning', the project aims to design a recreational space in Støvring which creates a cycle where water management both solves water problems and provides the local community with a new identity. Learning is a good tool for raising awareness of a subject, which is why this thesis is using learning as a tool for raising awareness of rainwater and the nature we live in.

The project is strategy-based and contains three scenarios of water management on site. The three different scenarios are analysed and compared in order to find a water strategy that the project will be based on. The chosen scenario also needs to consider the visions of both Rebild Municipality and Rebild Forsyning.

The result is a strategy plan for Mastrup Delta in Støvring. The strategy plan includes an open-air learning centre which functions as a path system around the site that connects different programmes such as learning programmes, recreational programmes and sport programmes.

PREFACE

This Master's thesis is made as the final project of the Master's programme Urban Design, Department of Architecture and Design, Aalborg University in the period February 1st 2017 to May 18th 2017.

The project has been carried out in cooperation with Rambøll, Department of Urban Water Management and Rebild Forsyning. This cooperation has included continual meetings with collaborators and a midway presentation for Rebild Municipality. We thank all involved persons in Rambøll, Rebild Forsyning and Rebild Municipality for inputs and feedbacks during the project.

Reading guide

The booklet consists of nine chapters; introduction, analysis, theory, case study, design intro, scenarios, presentation, reflection and epilogue - and an appendix.

Chapter one introduces the motivation for this project and the methodology. Chapter two contains the analyses consisting of the groundwork of mappings and observations made on site. The third and fourth chapter present selected theories and definitions followed by two case studies of sØnæs and Østerådalen. Both chapter two, three and four constitute the fundamental support and background for this project and is sustaining most of the decisions made during the design process.

The chapters five to seven present the main design process and the final design proposal. As the project is strategy-based, the design process is fundamental for understanding the final design. Therefore, important processes including an investigation of three scenarios for the water management on the site is presented prior to the design result. The part of the design process that is not fundamental to understand the project can be found in appendix 18. The chapters five to seven include an explanation of the concept, plans, drawings and visualizations of the design and technical details regarding water management.

The two last chapters are reflection and epilogue, which sum up the project through a reflection on the process and project and through a final discussion. In the appendix some extra analyses, supporting texts and parts of the design process can be found. Accompanying the booklet is a drawing folder containing a site plan in 1:1000, four detail plans in 1:200 and four detail sections in 1:200.

The report is using the Harvard Referencing System.

Ill. 1: Mastrup lake

Ill. 2: Frozen lake

TABLE OF CONTENT

MOTIVATION

We see an increased amount of rainfall events. Over the last 150 years these events have become more and more normal (Olesen, 2014). Traditionally, rainwater has been managed in sewer systems, but climate changes have resulted in heavier rain events which have caused pressure on the sewer system. The sewer system cannot handle the extra amount of rainwater, and the result is flooding. The rainwater needs to be managed to prevent water damage to buildings and urban spaces, but also to people's health. Due to these climate changes, urban planning needs to have an increased focus on rainwater management in the future.

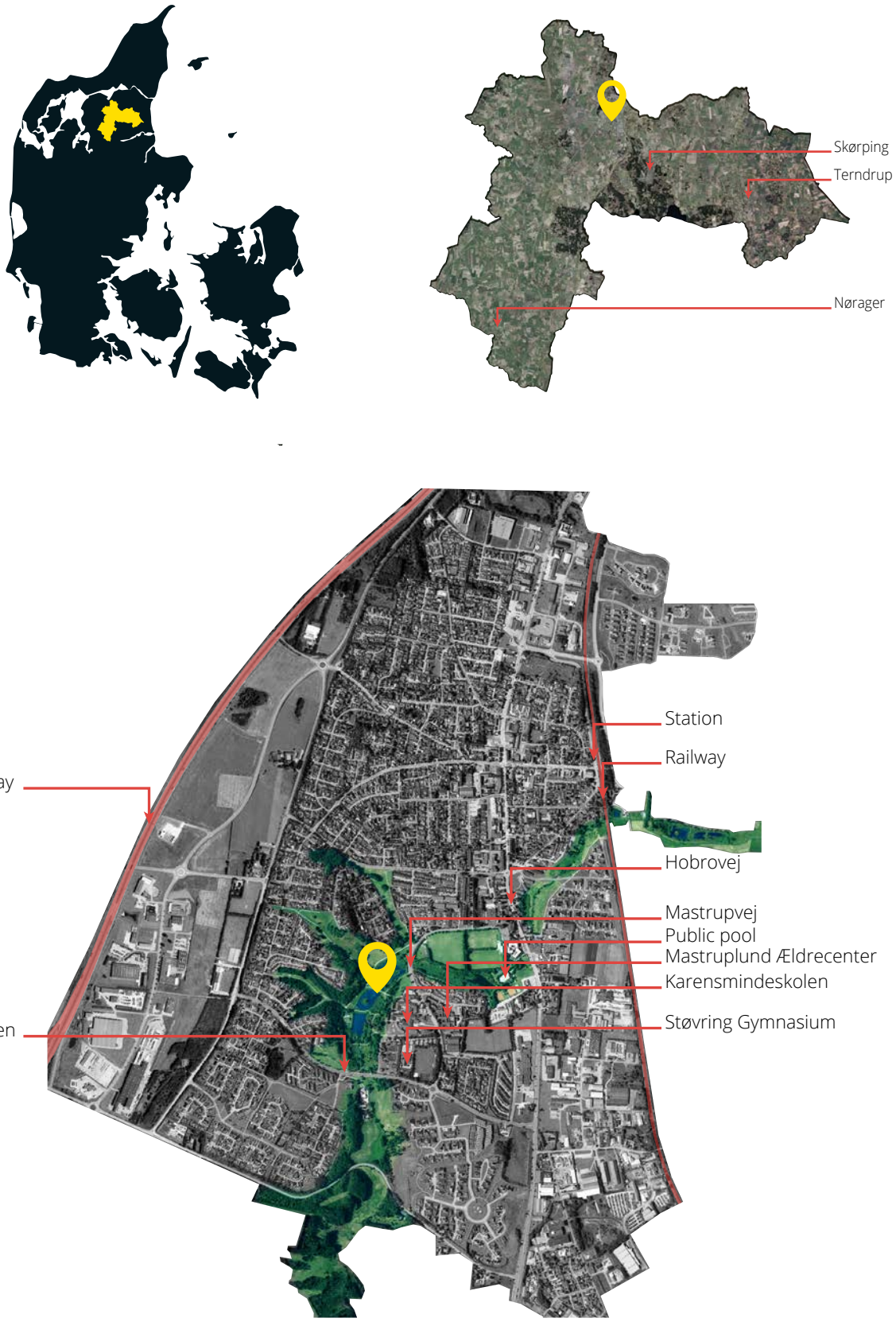
We need to change the way we see stormwater in urban spaces. Can stormwater be something useful in the urban space, and can it make the city more liveable?
With this Master's thesis we will have a focus on the way people see rainwater to show that it can be more than just waste water, maybe it can be something useful in the city.

The site of the Master's thesis is a green area in Støvring, with lakes and a brook close to schools, residential areas and within working distance to the city centre. The area functions as a city park for Støvring – where programmes meet and where the break in the everyday life can sprout.

The municipality of Rebild wants to use the area for recreational purposes and has just started to work on a district plan for the area, as the existing district plan for the area is from 1991 and therefore outdated. In the municipality plan, the area is to be kept as a park, and the area will also have a function of managing rainwater. At the same time, it is described that the municipality of Rebild wants to split the brook and the lakes into two separate flows. By splitting the brook and the lakes, the water quality in the brook will be somewhat better, and it will increase the conditions for sea trout in the brook. However, this will result in stagnant water in the lakes creating an increment in the growth of plants in the lakes, and it may also result in obnoxious smell.

Therefore, we want to challenge the municipality's strategy to see if it is the right thing to do for the area, or if there is another strategy that will work better for the area.

Ill. 3: The farm



Ill. 4: Site location

WHERE ARE WE?

This Master's thesis takes its point of departure in the belief that a liveable city is a parameter for a good life. A good life requires quality in the surrounding environment. More and more people are moving to smaller cities and communities – to find nature, more space and less stress. This is addressed in a study from Syddansk Universitet; Johansen, P. H., & Thuesen, A. A. (2011) "Det, der betyder noget for livet på landet":

"The study showed that the majority of respondents considered 'country-life' and everyday life in 'the country' as significantly different than in cities. Nature and the weather had an impact on everyday life, confidence and tolerance was considered greater and life was considered less stressful."

Johansen & Thuesen 2011, p 6

Statistics from Danmarks Statistik (see appendix 3) shows that people are moving from the bigger cities to the countryside or smaller cities. A questionnaire done by Danish Centre for Rural Research (Johansen & Thuesen 2011) have found out that the reasons for people moving to the countryside are:

- Nature
- More inexpensive, attractive houses
- Communities
- The number of schools, day care, associational life

(Johansen & Thuesen 2011)

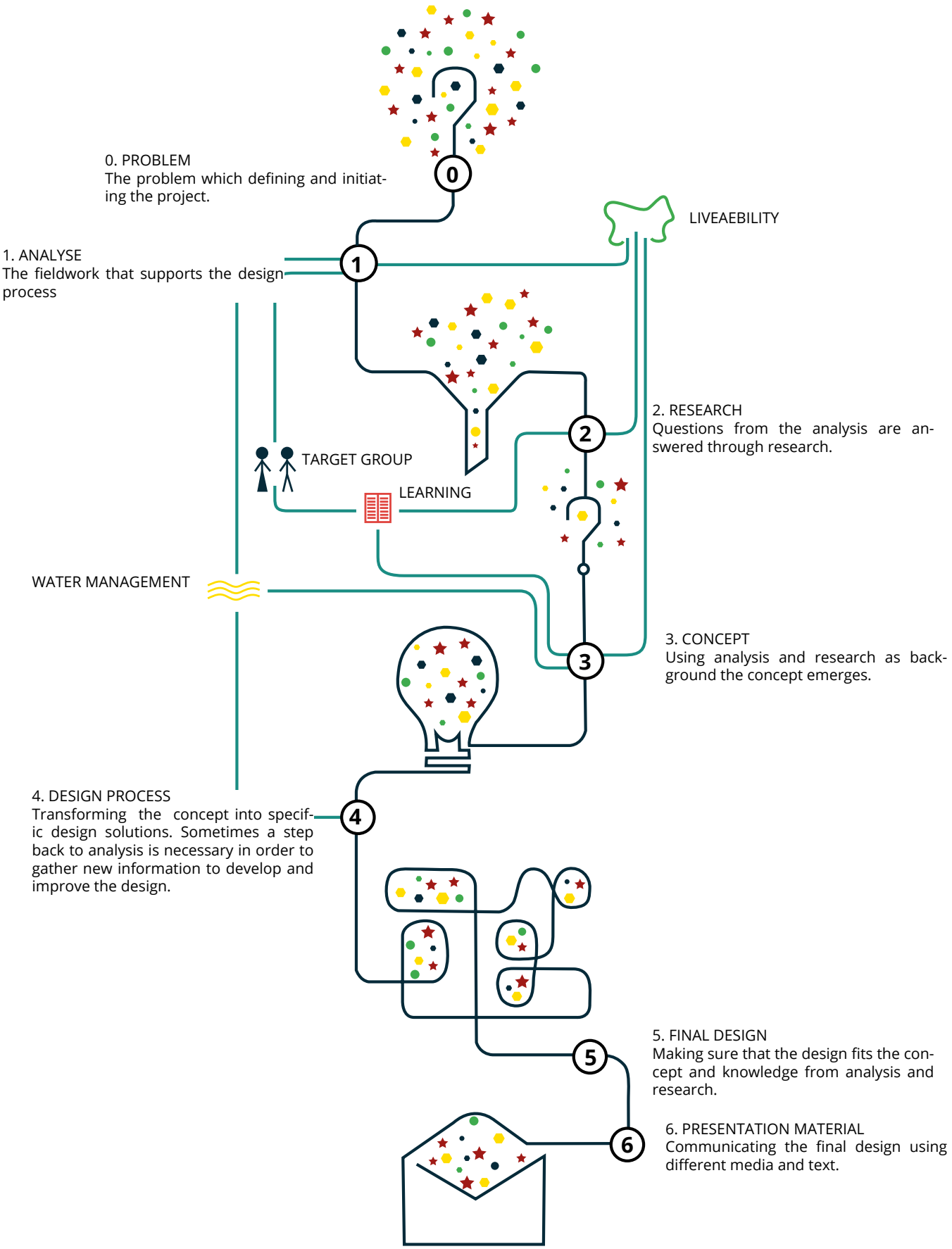
These factors are what people are looking for when moving to another place, if you look at the report from Danish Centre for Rural Research (Johansen & Thuesen, 2011). There are off course other reasons for people to move, these four reasons are just what the report found to be the most dominant. These four elements are something Støvring can provide. This can be seen in the increasing number of residents in Støvring. Støvring is the largest city in the municipality of Rebild with 7.050 inhabitants out of a total number of 30.000 inhabitants in the whole municipality. The number of newcomers are increasing, and Støvring is growing.

New areas with single-family houses are emerging as Høje Støvring (south) and Støvring Ådale (east). Most of the newcomers are coming from inside the municipality, but also the municipality of Aalborg is contributing with many newcomers to Støvring. (Rebild Kommune, 2014)

Støvring is only 20 km away from Aalborg and has good infrastructural connections: highways and railways connect Støvring with the rest of Denmark. A house in Støvring is cheaper than a house in Aalborg*, and with the small distance to the station you can be in Aalborg city centre faster from Støvring than from outer Aalborg. Støvring has all the functions you demand of the main city of a municipality, with primary school, high school, culture, library, et cetera.

The site of intervention is placed in the centre of Støvring and consists of a recreational green area where the brook, Mastrup Bæk, is running through the four lakes, Mastrup Søerne.

* The average price per square meter house in Rebild municipality is 11.251 kr./ m2 and in Aalborg Municipality it is 16.626 kr./m2 (Boliga.dk, 2017).



Ill. 5: Method diagram

METHOD

The project is based on the Integrated Design Process (IDP) (Knudsen, 2005) where the goal is to integrate design, form, functions and technical parameters in a holistic design. A constant search for new knowledge during the design process ensures that the project evolves through theories, case studies, technical parameters, et cetera.

The IDP is characterized by five steps, or phases. The five phases are as follows: the problem phase, the analysis phase, the sketching phase, the synthesis phase, and the presentation phase, but it is important to state that during this project the IDP was used dynamically, going back and forth, as new concepts and ideas emerged for the design and stages of the process were hereby revisited continuously. (Hansen, 2005)

The larger problem was identified as the need to address climate change in increasingly urbanized areas for the benefit of humans. The project's analyses took its inspiration from phenomenological analysis methods and quantitative methods, but started out with a more "shotgun" approach, where a lot of different things were tested to see what worked best on this site using a combination of phenomenological and quantitative methods.
Phenomenological analyses focus primarily on how the site affects human beings sensibly and emotionally. The phenomenological analysis methods are based on the person's own experience of the city and architecture. The purpose is to create new knowledge about the connection between diverse phenomena, the physical environment and visual and emotional reactions and only to a lesser extent to quantify. Analyses of the site reveal the potentials and obstacles currently existing on the site. (Hansen, 2005)

Quantitive analyses focus primarily on informational fact about the site, such as municipality plans and local plans, the architecture of the neighbourhood, topography, vegetation, access to and size of the area.
Therefore, the analysis chapter is a combination of these two analysis methods to find the potential of the site.

In the sketching phase the professional knowledge of architects and engineers is combined and provides mutual inspiration in the IDP so that the demands and wishes for the site are met. During the sketching phase all defined criteria are being considered in the development of design solutions. In this phase, new and creative ideas and solutions are produced. In this phase a lot of sketches are made to solve the various problems in order to optimise the final and best solution that will appear in the next closely connected phase: the synthesis phase. (Hansen, 2005) This project is strategy-based and therefore the sketching phase includes an investigation of three scenarios for the water management on the site before the final sketching phase begins. The design process can be seen in appendix 18.

In the synthesis stage, ideas from the sketches were combined in a way that considered the entire site and its functionality. Ideas fell into place, and smaller details were the focus of attention. The presentation phase involved revising arguments for the designs, creating concise descriptions and diagramming.

ANALYSIS

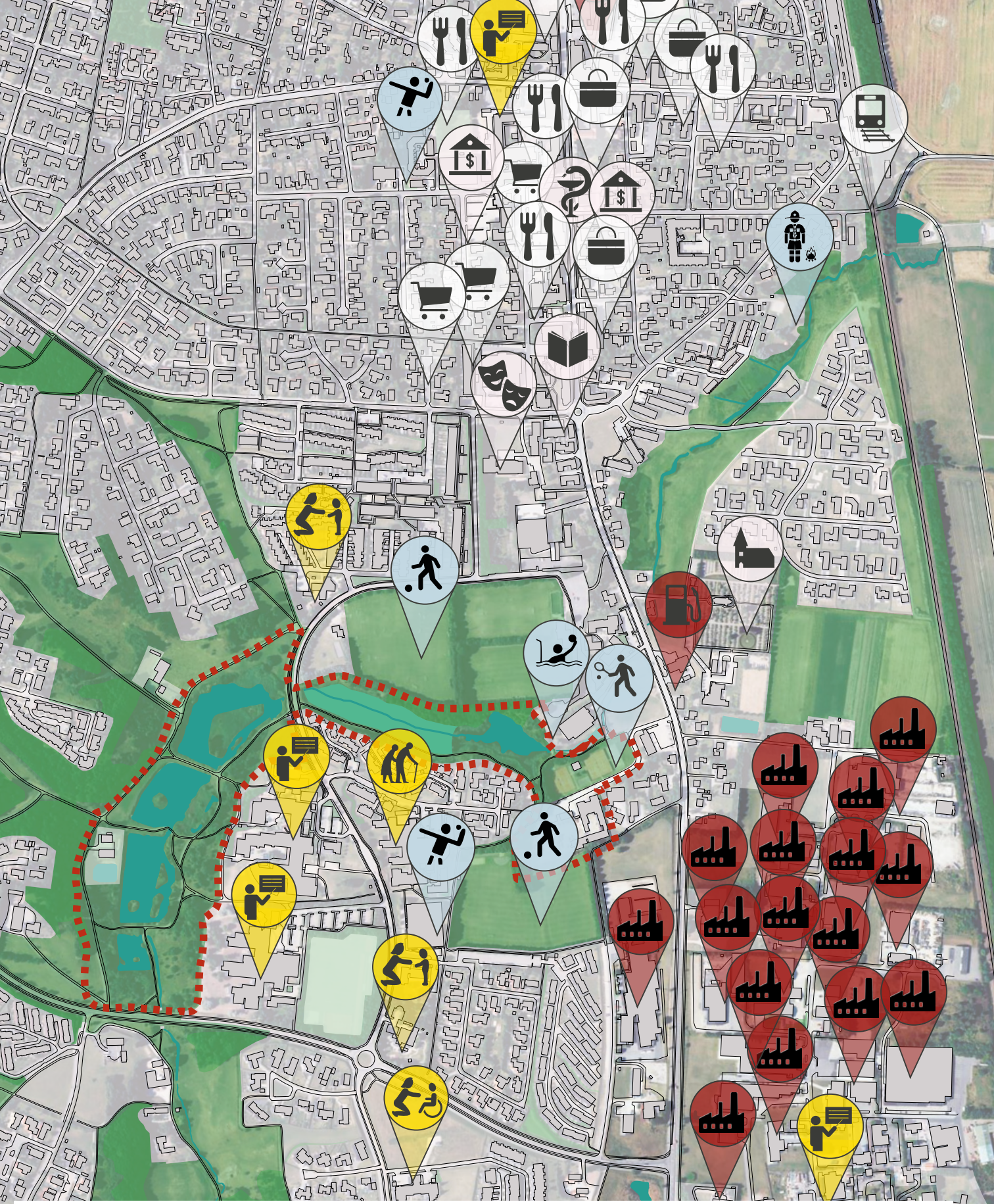
"If you think of Brick, you say to Brick, 'What do you want, Brick?' And Brick says to you, 'I like an Arch..."

Louis Kahn. (Kahn, 2003)

The tool that makes it possible to ask the site what it wants to be, is analyses, but is it important to find out what the site wants to be or is it important to make the site what Støvring needs?

In this section, the site and its context is examined and analysed to establish an understanding of the site's problems and potentials. The analyses consist of registrations, mapping and gathered information to provide a knowledge-based concept for the design. The analyses operate in different scales which become essential to the design proposal.

Ill. 6: Walking in nature


Function
Sports hall
Football field
Swimming pool
Tennis court
School
Kindergarten
Special child home
Care centre
Scout
Shopping
Eatery
Food shop
Bank
Pharmacy
Culture house
Library
Church
0
50
100
150
m

STØVRING

Location

Støvring is located in the northern part of Rebild Municipality and the city is the main city, as it is the largest urban area in the municipality. Støvring is located close to the highway, 20 km to Aalborg, 28 km to Hobro and about 60 km to Randers. Additionally, both the local railway and the IC3 train stop in the city. In addition to the highway and railway, there are good regional transport connections to Nibe in the west and to Skørping to the east (Rebild Kommune (a), 2017).

Ill. 7: Picture of Støvring station from around the 1890.

History

Støvring is a railway town. The city itself is a new city, but it has a history. The town was mentioned in written sources from 1268 as 'Styfhring', and in 1453 as 'Støffring' (Gjøde, 2007). Settlements had been in the area since the Middle Ages, but not enough to be the main city back then or the parish city for the area. For centuries, the mane to the parish was reserved to Buderup (Gjøde, 2007).

The railway came to Støvring in 1869, which in railway historical context is quite early. In Støvring the developments were furthermore supported by the construction of the road between Viborg and Aalborg in 1870. Thus, the development in Støvring was supported by both railway and road, however, it was first after 1880 that the railway town houses began to appear. Sørup had so far been the largest city in the rural district, but was overtaken by Støvring when the development started in the west side of the station. Around the turn of the century about 87% of residents in Støvring were newcomers (Harder, 1983). However, it was not until the late 1950s the big building boom started in Støvring, where the detached house started to appear in the city. From 1960-70 Støvring´s population increased by 75%, and the city appeared in the late 1960s as a city with about 2400 inhabitants (Harder, 1983).

Functions

Most of the institutions in Støvring are located near Mastrup Ådal. The city's industrial area is scattered in three areas; Hobrovej, Juelstrupparken and Porsborgparken (Rebild Kommune (a), 2017) (see appendix 4). The city offers several different housing types: detached, terraced or semi-detached houses and apartment buildings, and this creates the potential for citizens to move around within the city, depending on their life situation, and thus they can stay in Støvring for life. This mix of housing types is enhanced with ongoing and planned projects in the city, which include new detached houses, apartment buildings and close low settlements (Rebild Kommune (a), 2017). However, the largest demand on housing type is detached houses (Rebild Kommune (a), 2017).

Close to the site a primary school, a high school, a care centre and many sport activities including football fields, a public swimming pool, tennis lanes and a sports hall are located. Because of their nearness to the site, it could be beneficial to plan programmes for these users on the site.

Development

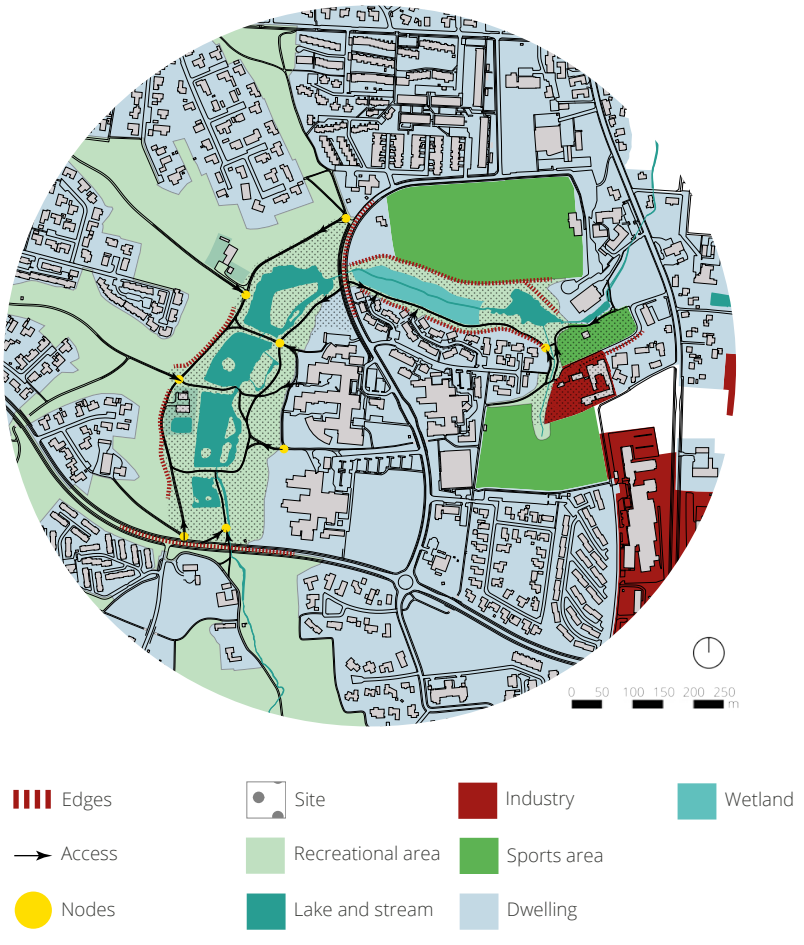
The first time Støvring population achieves the statistical definitions of a railway town is in 1906, when the town has 446 inhabitants. In 1911 this number has risen to 495, in 1950 to 1134, and in 2006 there were 6,322 inhabitants (Gjøde, 2007). The population in Støvring is still increasing, which creates a potential for future urban development.

Støvring is within the last decade almost completely developed within the four barriers: highway, municipal boundary, railway and Nibevej, see appindix 4, which until now have been the physical limitations of Støvring´s development. However, two continual and future development of Støvring are planned east of the railway towards Støvring Ådal and in the south of Støvring.

The new urban development of Støvring Ådal is a development with family homes, day care and nursing home for people with dementia. The development in the southern part of Støvring is called Høje Støvring. Høje Støvring is a new residential area, which is located between Mastrup Ådal, Nibevej, Hobrovej and the next planned Nibevej in the south (Rebild Kommune (a), 2017). These new and future developed areas have resulted in today's lack of kindergartens in Støvring (Christensen, A., 2017). The urban planning of the site could therefore beneficially include a new kindergarten.

Ill. 8: Map showing different functions in Støvring

Ill. 9: Infrastructure



Ill. 10: Approaching the site

APPROACHING THE SITE

The aerial photograph of the site (illustration 11-13) shows how the area has developed over the years. Here it is seen that the brook and the terrain play a crucial role in how the site has developed. Appendix 8 includes a map that was produced in the period 1842-1899. This map indicates among other things the terrain in the area. Illustration 10 shows that the area today mainly consists of a recreational area with lakes, the brook and a smaller wetland. It is also seen that the site is surround by dwelling, sport area and industry.

Edges and access

The edges of the area consist of the natural terrain, which encircles the area, see illustration 9. The terrain slopes significantly several places, creating a wall around the site. Illustration 10 also shows that the site is split in two because of the road, Mastrupvej while the road, Over Bækken, forms an edge in the south. Brooks and lakes act as natural edges, but are not drawn on the map. There are several opportunities to enter the site.

Two major green wedges give access to the site from the west, while in the south it is accessed from a tunnel under the road, and from the road itself there is also made access. In the east between Støvring Gymnasium and Karensmindeskolen there are paths down to the site as well as from the north of Karensmindeskolen. From Mastrupvej there are paths to both sides. There is no access from the football fields in the northern side of the site, in the south there are accesses from the football fields and the residential area, and in the east beside the tennis courts.

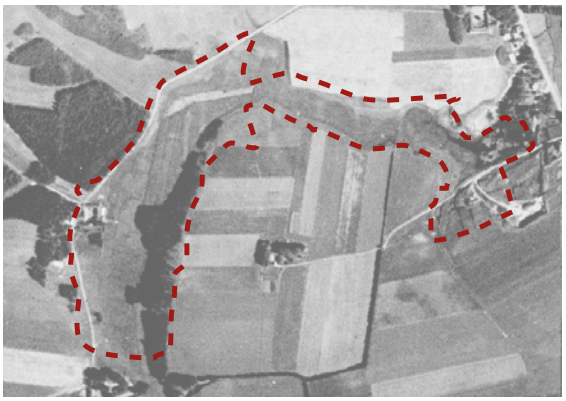
Pedestrians and cyclists can easily pass through the site as it is today, but the accessibility over Mastrupvej could be enhanced to create a better flow through the area.

Meeting points

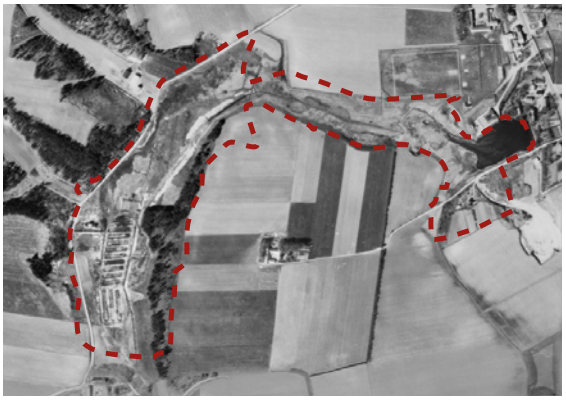
In this interpretation meeting points are where the flow of people is meeting or paths that are crossing. Existing meeting points on the site are mostly seen along the edge, where the path in the site meets with the surrounding areas.

Landmarks

The site does not contain specific landmarks. The paths encircle the lakes, which mean that the pedestrian can choose to go one way or the other way around. The paths are made so there is a good sense of which way you go around, but the site does not contain marks that stand out from the surroundings or can be seen all over the area. The site does not contain any significant mark other than the four lakes and the brook that are traversing the site.

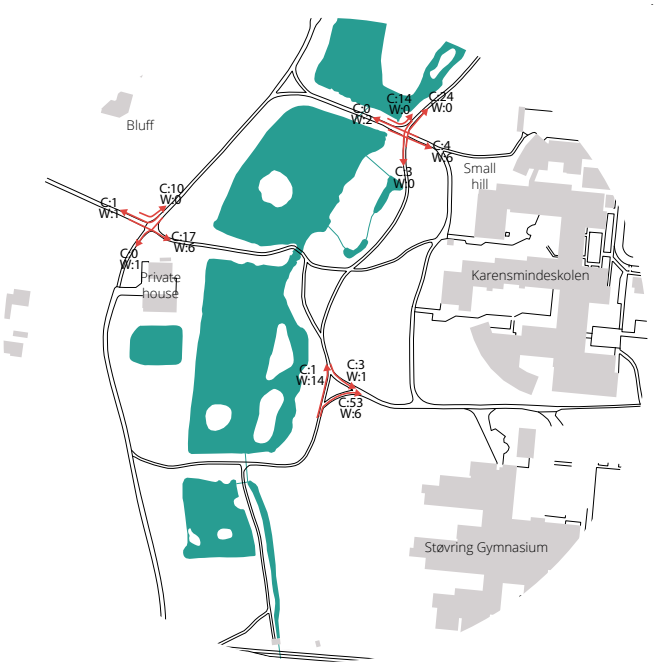


Ill. 11: Aerial photograph of the the site (1945) before the fish farm. The picture shows fields, planting of trees and Mastrup Bæk.



Ill. 12: Aerial photograph of the the site (1954). The picture shows a fish farm in the south, Mastrup Bæk river valley and a lake in the northeast.

Ill. 13: Aerial photograph of the the site (1995). The picture shows the four current lakes, with the new settlement.



Ill. 14: Registration of flow. 4th April 2017 between 7.30 and 8.00.
C: cycling and W: walking.

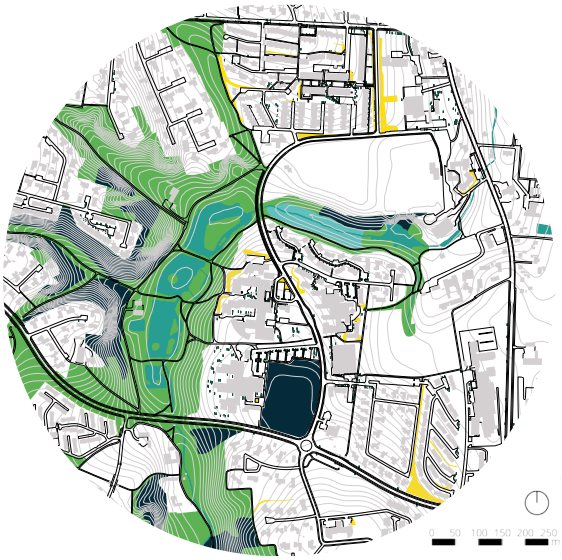
THE FLOW ON THE SITE

The registration of the use of the area, divided into pedestrians and bikers, was carried out the 4th April 2017 between 7.30 and 8.30 in order to track the flow in the morning rush hour. Three spots were chosen for the registration: Close to Karensmindeskolen, Støvring Gymnasium and the water crossing in the middle of the site.

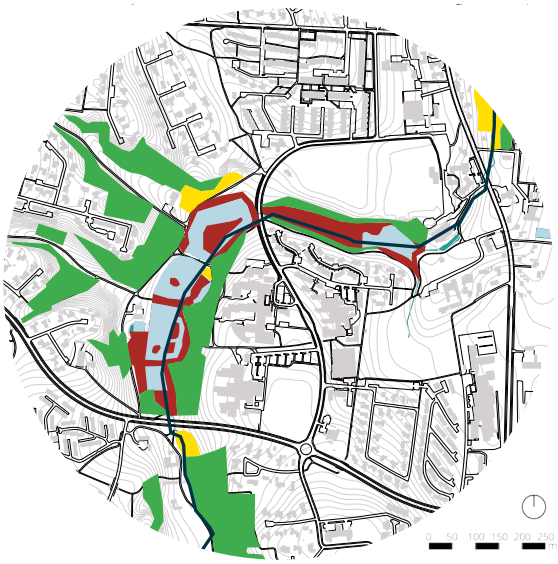
The number of people passing on the whole site after 8.00 was only six. Therefore, the time interval 7.30-8.00 is considered as the morning rush hour and is chosen as focus and presented on the illustration. The registered number of passing people was not high. However, it should be taken into account that the day was cold; only 2 degrees. Therefore, many summer-bikers have not taken the bike on the registration day. The registration shows, however, that many bikers and pedestrians use the water crossing in the middle of the site, the water crossing to the north of the site and the path along Støvring Gymnasium and Karensmindeskolen. It could therefore be beneficial to maintain at least one connection over the lakes and the path along Støvring Gymnasium and Karenmindeskolen. On the other hand, the path running behind the private house on the site was only registered to be used by one person in the whole registration period.

Most of the people crossing were children with or without parents and students on their way to school. There were several registrations of a walking child and a biking child walking/biking together on their way to school. Few dogwalkers were also counted.

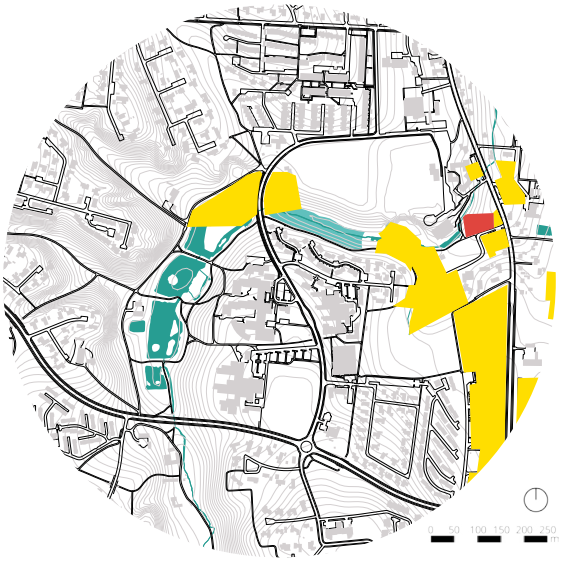
The registration also shows that some children are walking down the bluff on the west side of the site instead of using the path system on their way to school. Most bikers are crossing the site with high speed on their way to school, and close to Karensmindeskolen most children are biking around the hill in front of the school even though the hill is the most direct connection to the school.



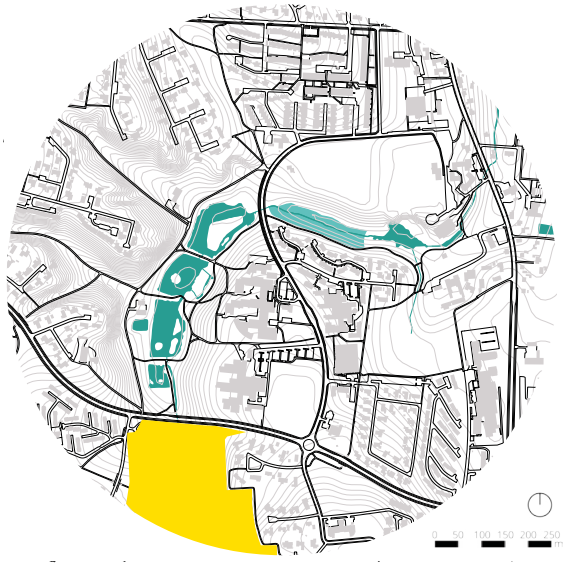
Ill. 15: Blue-green areas



Ill. 16: Nature protection, §3, including nature2000



Ill. 17: Soil pollution



Ill. 18: Preservation

NATURE AND LANDSCAPE

The landscape around, and especially in, Støvring city is characterized by a large hilly terrain and large coherent fields with shallow areas and wetlands. The most significant is Juelstrup Sø, Hæsum Mose and Lindenborg Ådal, see appendixes 8. Mastrup Ådal cuts across the entire southern and eastern part of Støvring and creates significant terrain jumps, which clarifies nature's impact on the city design.
Mastrup Bæk is set to be from the younger iron age (Germanic or the Viking Age) and is an old wet area, which probably contains findings from the early iron age (Rebild Kommune (b), 2017). From its origin a few kilometres south of Støvring in central Himmerland Mastrup Bæk slides through Støvring and continues to the outlet of Lindenborg Å.

On the site there was an old fish farm which previously characterized the valley. The fish farm may have affected the soil. The fish farm is today replaced by manmade lakes and fish ladders (Danmarks Naturfredningsforening, 2017). The lakes and fish ladders in Mastrup Bæk have a negative impact on the fish passage and might affect water quality negatively (Rebild Kommune, 2007). It is allowed to fish in Mastrup Søerne with the possibility of catching sea trout, roach and eels, and it is free to go fishing on foot with a valid state fishing license from the municipal areas (RebildPorten, 2017).

In the southern part of the site, Mastrup Bæk leads through a deep erosion valley with slopes characterized by meadows, grasslands and forest pieces with both foliage trees and conifers. Here the spawning grounds for sea trout are placed. North of the road Over Bækken, the landscape has a park-like character. Here, the valley is surrounded by public buildings and private residences. (Danmarks Naturfredningsforening, 2017)

The preservation case of Mastrup Bæk at Støvring was raised by the Danish Nature Conservation Association, and in 1985 a total of 42 hectares listed by order of Overfredningsnævnet in order to preserve and care for the landscape and natural heritage values around the undisturbed Mastrup Bæk. The area must be maintained in its current condition and must not be built on.

The soil conditions in the area are not very varied. In the top layer peat or mould is found, sand and peat is found in the underground. Additionally, some soil pollution exists in the area. The pollution in and near the site is defined in the categories "Soil pollution V1" (Geodatastyrelsen, 2017). "V1" refers to a suspicion about pollution in the area as there has been activity in the area that might have induced soil pollution. "V2" refers to the area being polluted and this has been documented. (Region Nordjylland, 2014)

Most of the site is categorized as protected, id est, the lakes, the brook, the pasture, the meadow and the wetland. A development of the site therefore demands a dispensation (Geodatastyrelsen, 2017). Mastrup Søerne are protected by § 3. Illustration 16 shows the § 3 protected area.

Lakes are protected when they are 100 m2 or more. The open water surface and the adjacent wetland with aquatic and marsh plants are included in the protected area. The protection applies to both the naturally occurring lakes, but also man-made lakes which have developed a distinctive flora and fauna (Miljøstyrelsen, 2001). Because of the nature protection act § 3 it is not allowed without a dispensation from this provision to adjust or create a grit chamber or something similar. Likewise, concerning § 3-protected lakes and marshes, it also requires a dispensation from this provision to adjust the water level or profile of the lake. (By- og Landskabsstyrelsen, 2009)

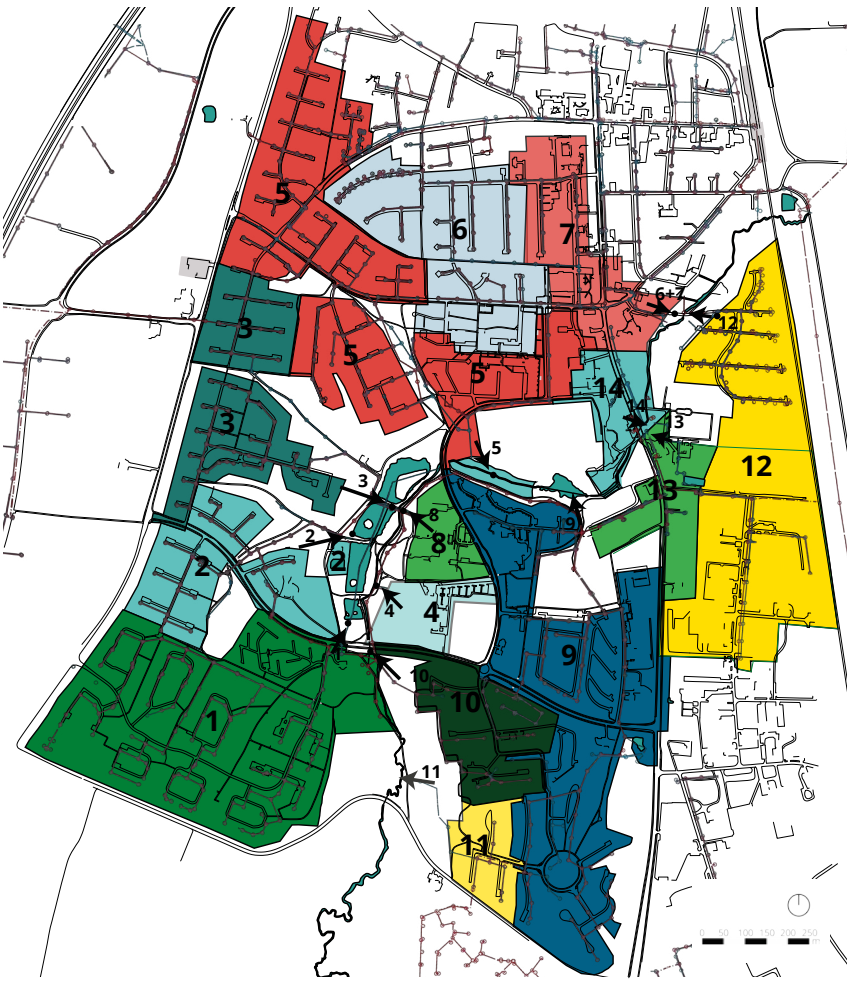
Ill. 19: Snow landscape

WATER

Rainwater management is a problem in Støvring (Niras, 2015). In appendix 6 a map over back watering shows which areas are influenced after heavy rainfalls, and appendix 7 shows the flooded areas after a 5-year rainfall event and a 100-year rainfall event. The existing pipes do not have the capacity to manage the large amount of rainwater after heavy rainfalls. New solutions are therefore required.

Støvring mainly has separate sewerage systems (Rebild Forsyning, 2017), which means that rainwater and waste water is separated in two pipe systems.

Today, rainwater from the surrounding area near the site is led to Mastrup Søerne and Mastrup Bæk. Illustration 20 shows rainwater that today is led to Mastrup Søerne or Mastrup Bæk and the approximate outlet point. Four catchment areas lead rainwater to the site today, but because of the problems with rainwater in Støvring, it is suggested to link more catchment areas to the site in the future to take the pressure off the sewer system (Niras, 2015). Illustration 21 shows all possible catchment areas that can be linked to the site in the future. Furthermore, the illustration shows catchment areas that are planned to manage the rainwater locally in the future (Niras, 2015). This Master's thesis will follow this suggestion of linking more catchment areas to the site as it is a proposal that will improve the condition for Støvring city and create a challenge for the Master's thesis that is interesting to accept.



Ill. 20: Existing catchment areas to Mastrup Bæk and their outlet points

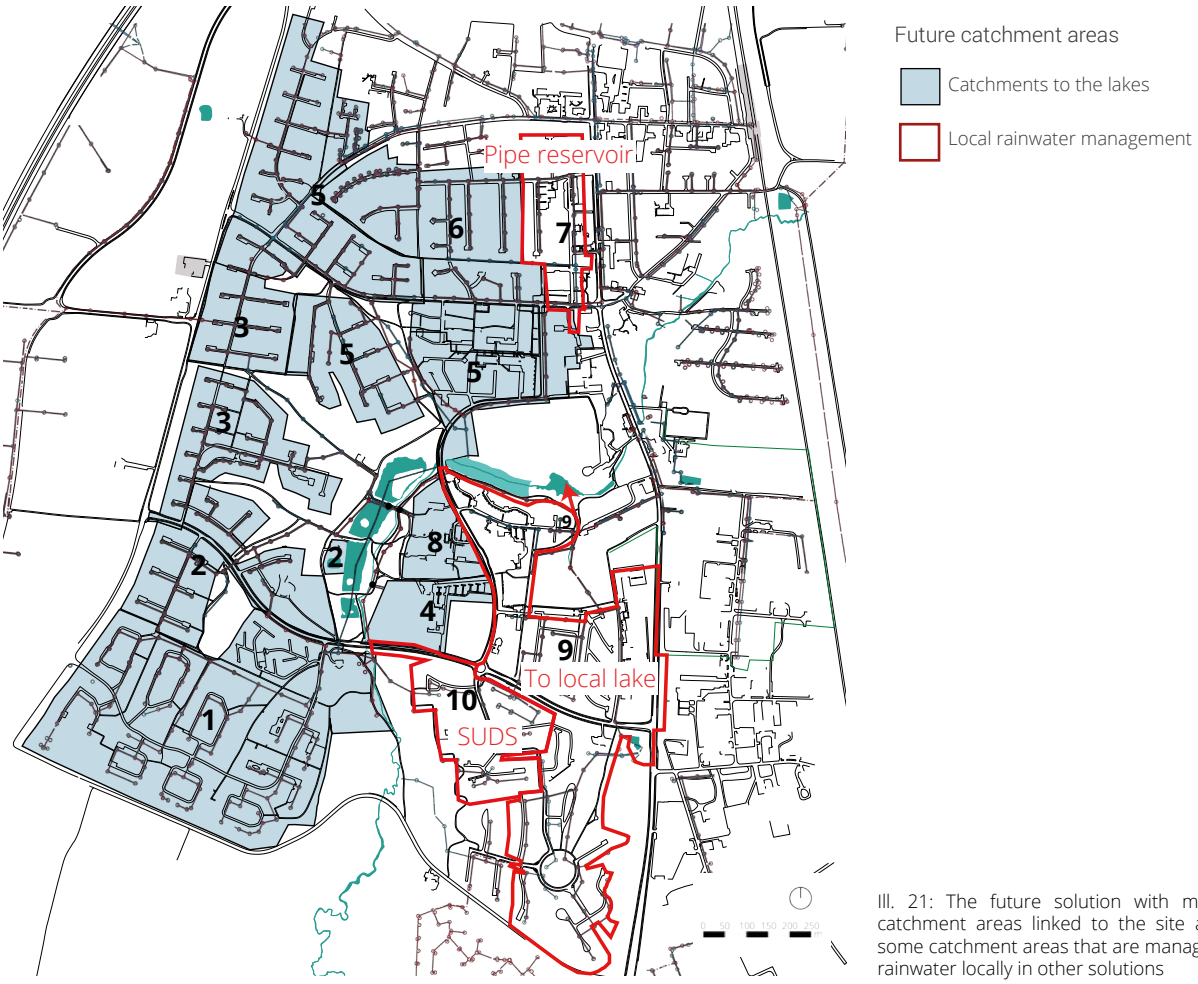
Basis information about the water on the site

The groundwater table on the site is high. Drillings show a groundwater level between 0.5 meter and 2.2 meter under the ground surface. (Andreasen & Hvidberg, 2013)

The depth of the lakes from the bottom to the water surface is approximately 0.75 meter and the basis flow in Mastrup Bæk is 12 l/s. (Niras, 2015) A private building is located close to the lakes, which has a small private lake established within the private plot. The water of the small lake is coming from the groundwater. Today, Mastrup Bæk manages the water from the private lake, and it must also do so in the future. It is estimated that the water discharge from the private lake to Mastrup Bæk is approximately 5 l/s. (Rebild Vand, 2017)

Obstructions in the brook

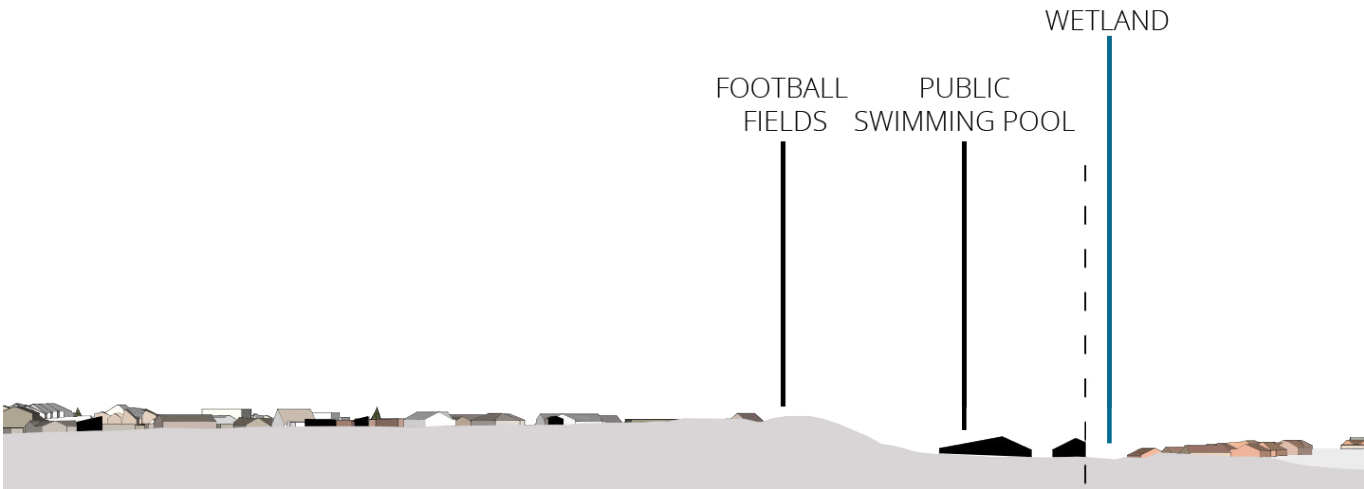
The brook passes through some obstructions in the site and near the site. Obstructions in the site are: two fish ladders close to the public swimming pool, water flowing in pipes under Mastrupvej and water running in a channel under the road Over Bækken. (Brandt Landskab, 2008)
It is the municipality´s plan to remove all obstructions in the future in order to create a better environment for fish, small animals and flora in the brook (Niras, 2015). The Master's thesis must therefore be aware of obstructions within the site.



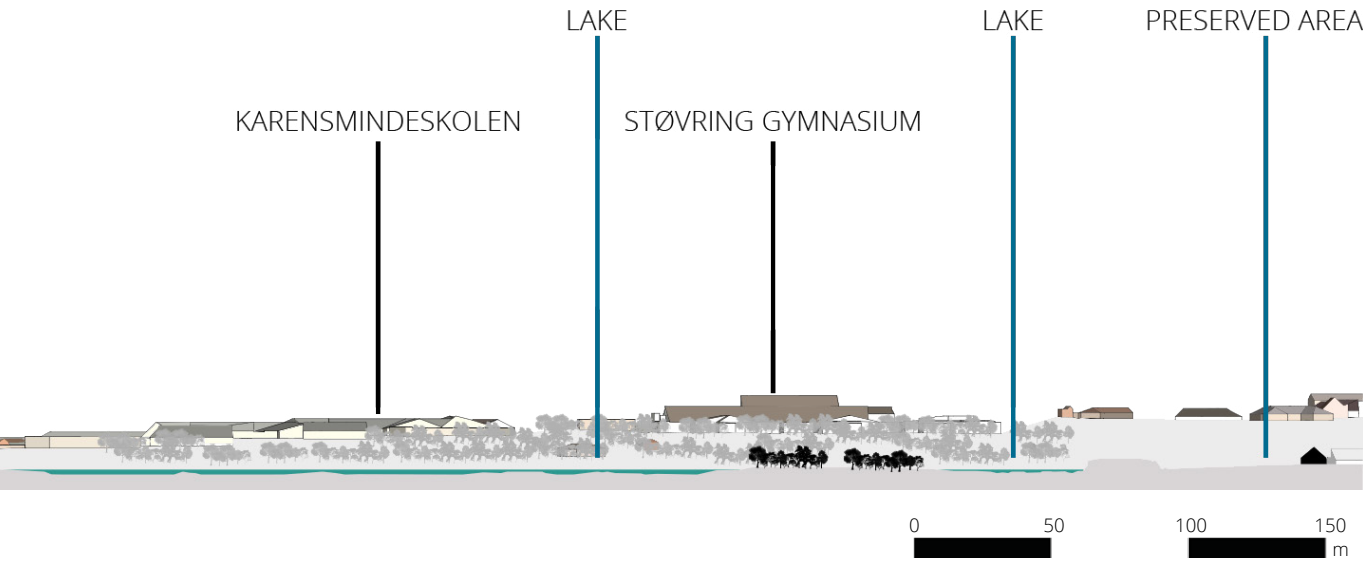
Ill. 21: The future solution with more catchment areas linked to the site and some catchment areas that are managing rainwater locally in other solutions

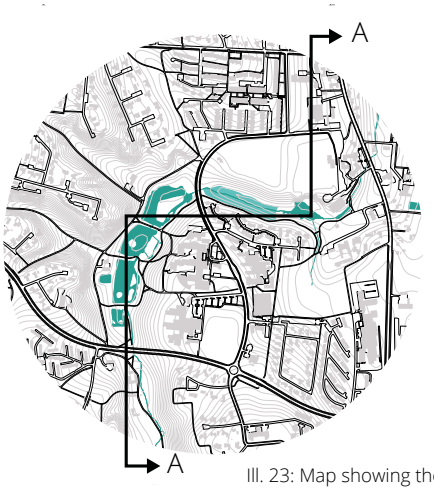
SECTION

The section shows how the area of Mastrup Søerne is placed in a valley. This shows that it is a good place to handle rainwater from the surroundings, as the area is a low-level part of Støvring city. The section also shows that the connections to the surrounding programmes are not that good, as there are a lot of natural boundaries here consisting of hills and trees.

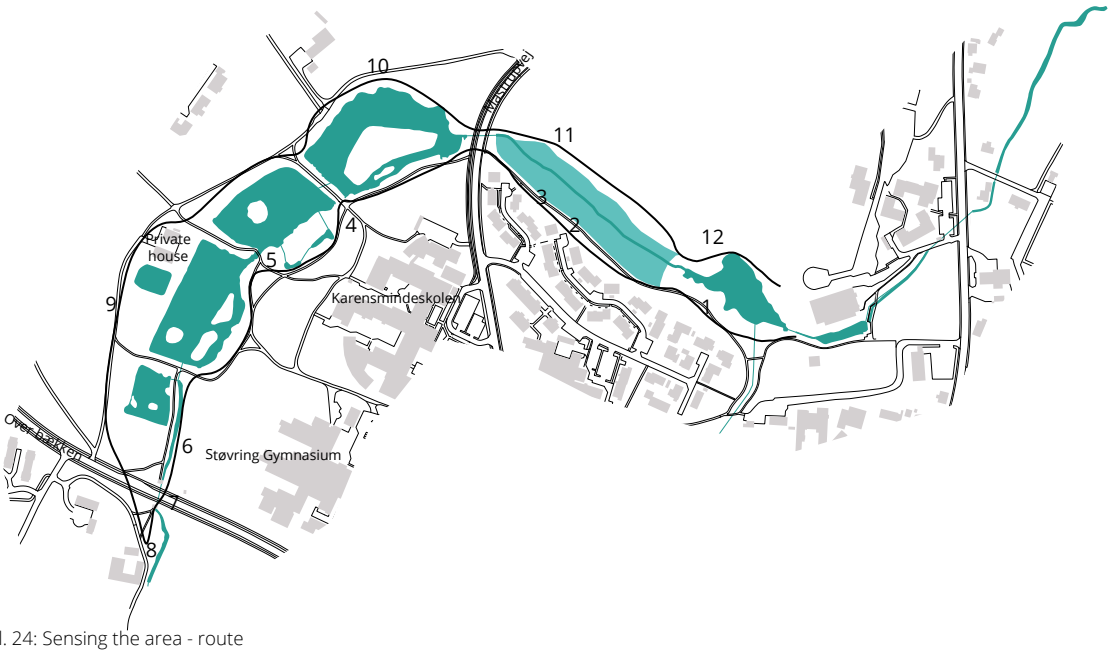


Ill. 22: Section





Ill. 23: Map showing the section



Ill. 24: Sensing the area - route

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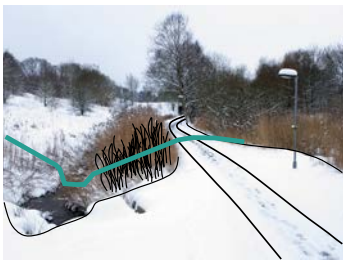

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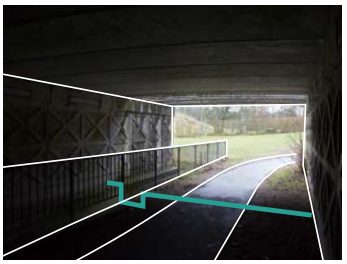

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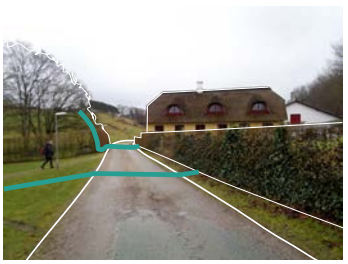

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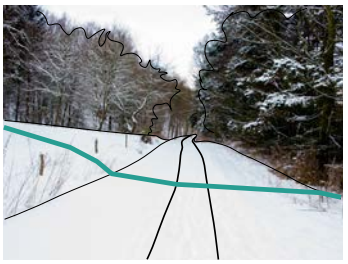

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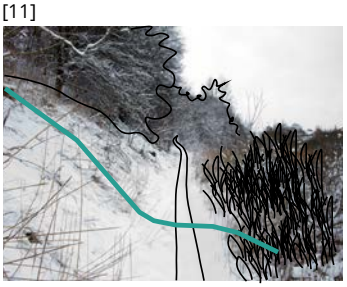

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Ill. 25: Sensing the area - photographs

SENSING THE AREA

Walking around Mastrup Søerne gives an understanding of the different natural environments that exist at the site. Illustration 24 and 25 show the lake´s connection by a series of photos and illustration 26 shows a sound experience.

In the following a description of the first walk for this thesis is presented, explained from illustration 24, 25 and 26.

The area near spot 1 is catalogued by clear blue water, bird songs and houses are close to the path system, and the terrain is relatively flat. The area near the spots 2 and 3 is categorized as a wetland with reeds and bushes. As there exists a large variation in terrain, you feel part of the nature although houses are located on the top of the hill. It is only possible to access the houses by two different stairs on the hill. The path system is covered with gravel.

Walking from spot 3 to spot 4 you have to cross a road called Mastrupvej. The road is a barrier that divides Mastrup Søerne into two areas. Close to the road you can hear the water in the brook purling, which gives a mixed feeling of being in a visual natural environment and close to traffic at the same time. As the purling water stinks and you are close to traffic, the area does not invite to stay.

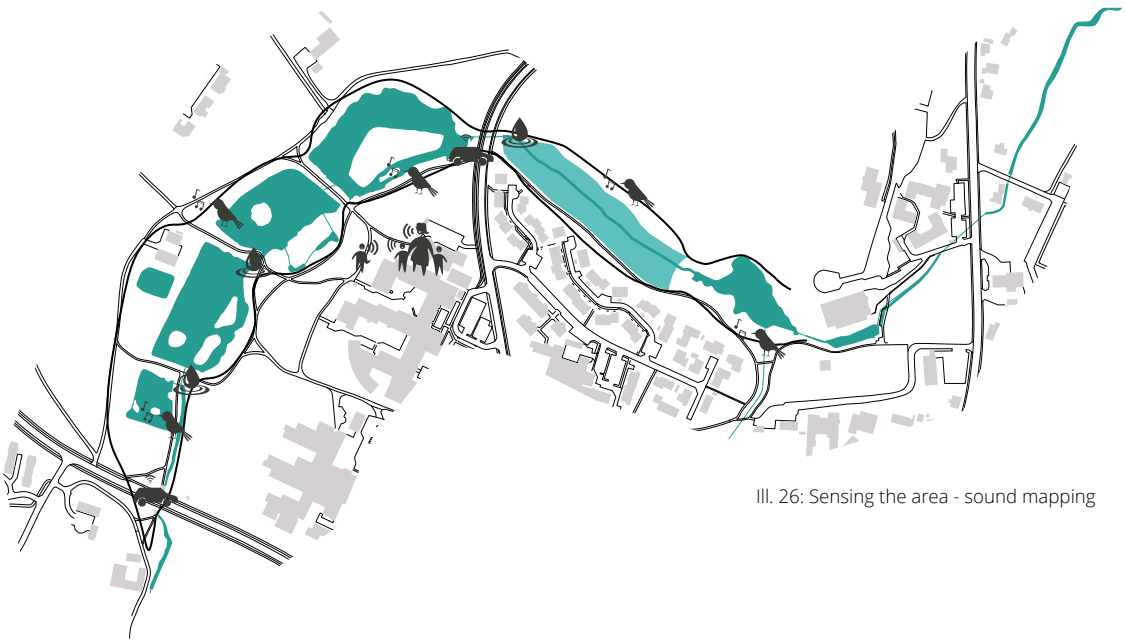
Walking over the road towards spot 4, it is again possible to hear bird song, and at spot 4 you hear children playing in the school yard. The terrain is hilly, and in wintertime you can see and hear school children tobogganing. The water in the lakes is clear and blue, and the area appeals to stay. The main path system is covered by asphalt and other paths by gravel.

The distance from Mastrupvej towards spot 7 has variation in landscape; at some spots, it is possible to see the water in the lake, and at other spots dense vegetation covers the view to the lake from the path system. There exist many small islands in these lakes. At this distance between spot 4 and 7 you can in some places hear purling water and bird song. It is possible to cross the connected lakes in three places.

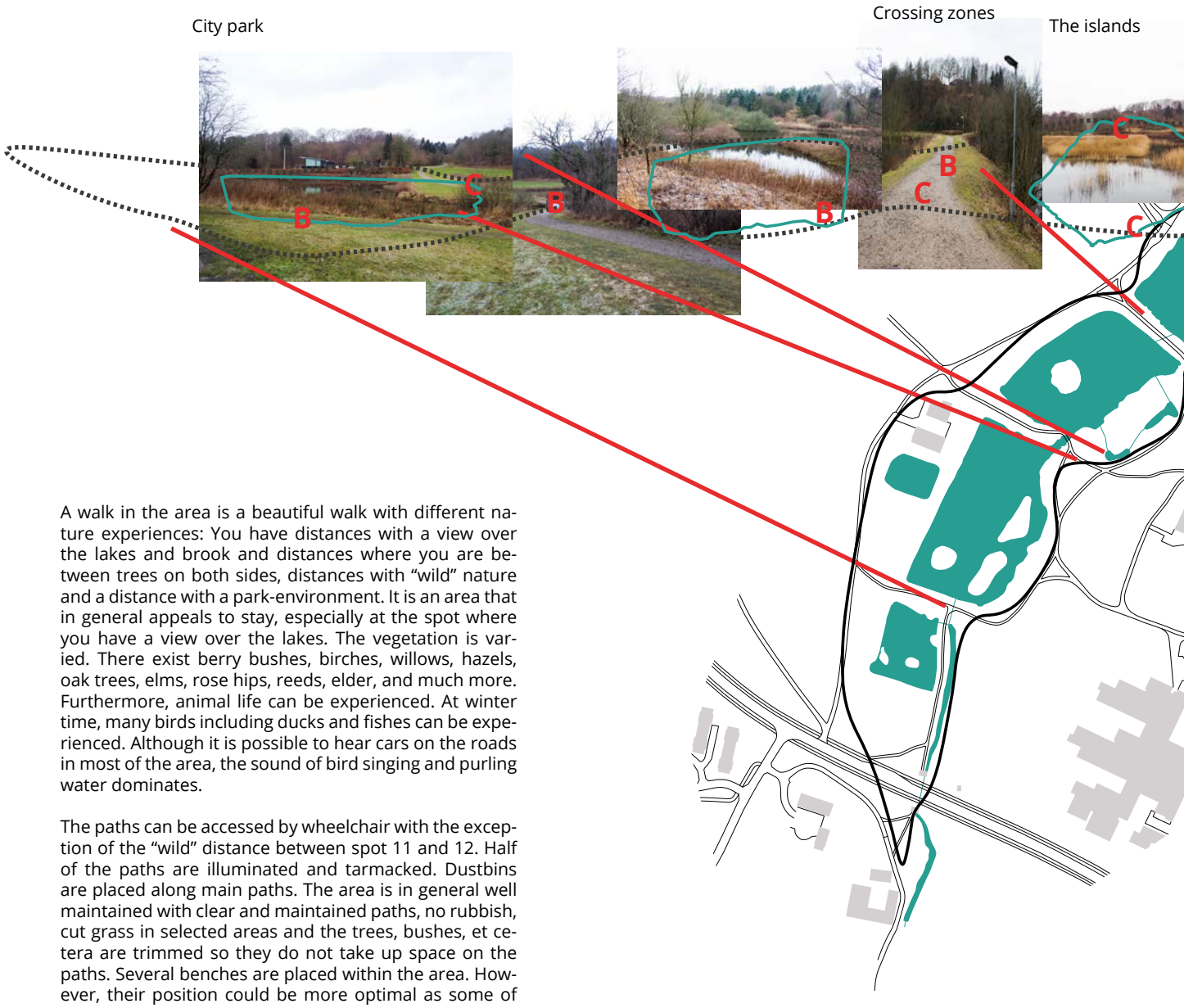
At spot 7 you can either walk over the road or under the road in a dark tunnel. The tunnel has graffiti on the walls, but is better-looking than most Danish tunnels, as it has a pattern in the walls. As the brook takes up some space, the tunnel is wider, and you feel safer than in more traditional tunnels. The brook runs along the path system in the tunnel. After the tunnel, you are outside the chosen site. You step into a more private zone with houses close to the path system and keeping of animals. Turning around and walking towards spot 9 over the road you are met with an asphalt covering which is both used as a public path and private access to a house. The road is wider than the other distances, and you do not have a view to the lakes.

Walking between spot 9 and 10, the surrounding changes: the grass is cut, and it seems that trees are placed systematically and are well-kept. You have a good overview of the area as there is more space. However, the larger open space also gives a more windy area. The feeling of being in a park stops when you have to cross the road Mastrupvej.

Walking over Mastrupvej, you step into a new type of environment. The path is very narrow and muddy, and you are very close to the surrounding trees and bushes. The terrain on both sides on the path system is very steeped. The terrain on the path itself is varied. The surrounding trees create a beautiful crown over the path – you are surrounded by nature in a tunnel created by trees.

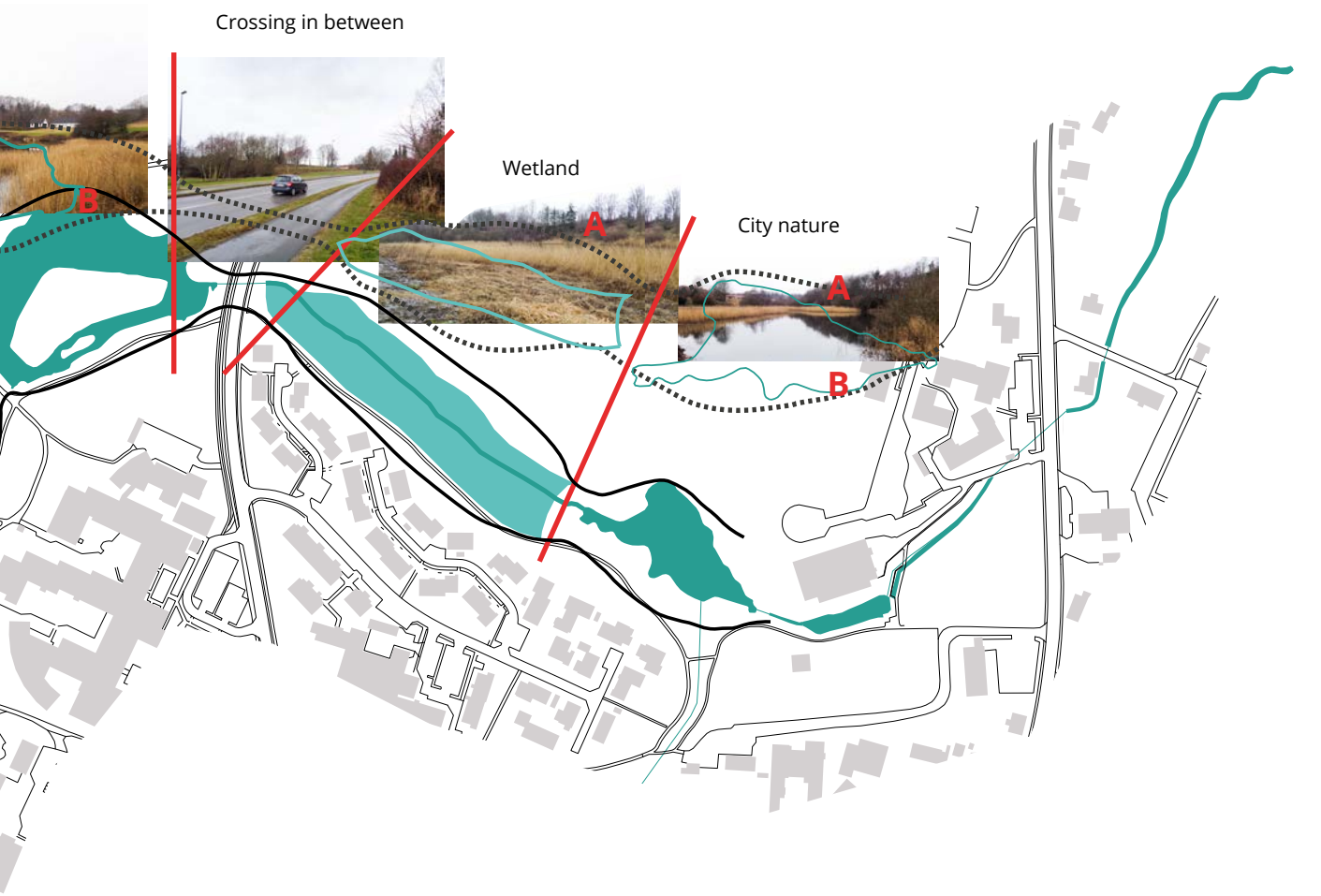


Ill. 26: Sensing the area - sound mapping



A walk in the area is a beautiful walk with different nature experiences: You have distances with a view over the lakes and brook and distances where you are between trees on both sides, distances with “wild” nature and a distance with a park-environment. It is an area that in general appeals to stay, especially at the spot where you have a view over the lakes. The vegetation is varied. There exist berry bushes, birches, willows, hazels, oak trees, elms, rose hips, reeds, elder, and much more. Furthermore, animal life can be experienced. At winter time, many birds including ducks and fishes can be experienced. Although it is possible to hear cars on the roads in most of the area, the sound of bird singing and purling water dominates.

The paths can be accessed by wheelchair with the exception of the “wild” distance between spot 11 and 12. Half of the paths are illuminated and tarmacked. Dustbins are placed along main paths. The area is in general well maintained with clear and maintained paths, no rubbish, cut grass in selected areas and the trees, bushes, et cetera are trimmed so they do not take up space on the paths. Several benches are placed within the area. However, their position could be more optimal as some of them are rotated so that people have a view to the road, bushes and scrubs, instead of a view of the beautiful lakes, brook, large trees, et cetera.



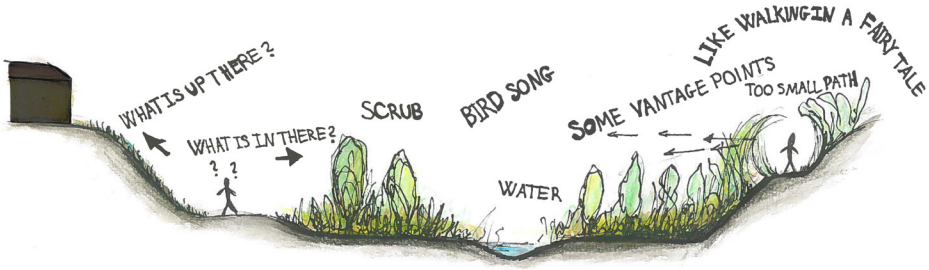
Contact with water:

A: Vantage point to water from hill
B: Large view over the lakes
C: Close encounter to water

Ill. 27: Sensing the area - section

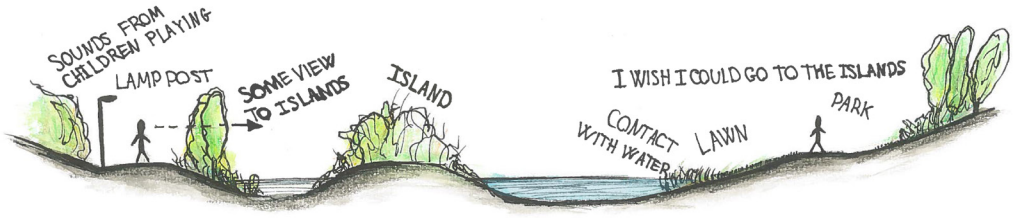
Ill. 28: Map showing the sections

The rising terrain around the whole site gives a strong feeling of walking in a river valley; you are surrounded by a beautiful landscape that defines the site. The sections are not in scale but are drawn to support the feeling of walking in the site, which means that vegetation heights, terrain differences, et cetera are made out from feelings. The humans in the sections illustrate the paths.



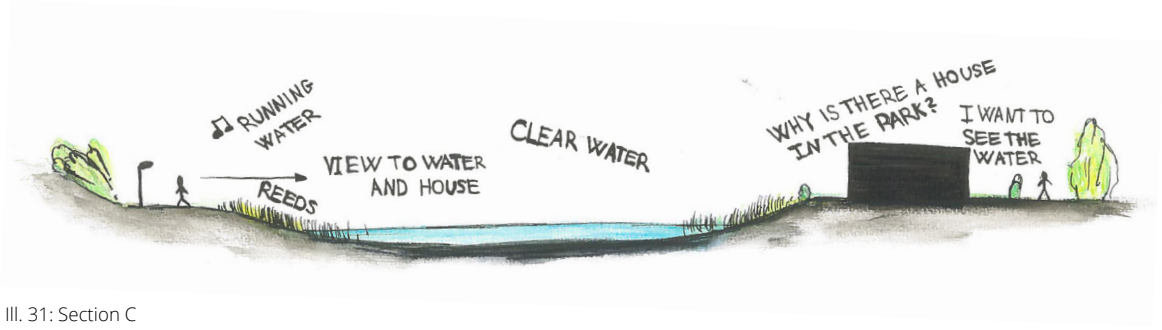
Ill. 29: Section A

Section A: You cannot see the houses on top of the hill when you are walking on the path just down the hill; you can only see nature. The vegetation around the brook feels much higher as you do not have a view over the water. Walking on the small path on the right side of the section feels like walking in a fairy tale – you are surrounded by nature.



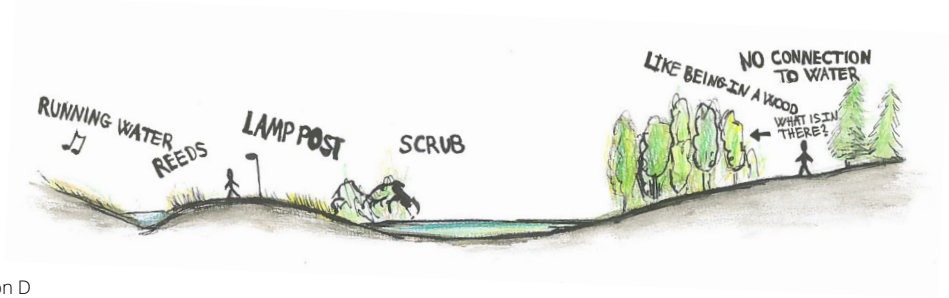
Ill. 30: Section B

Section B: On the left side of the section a vegetation belt partly conceals the view over the lake. As there is higher vegetation on both sides of the path, you feel the path is running through “wild nature”. You have some viewpoints to large hills/rising terrain, which gives a feeling of walking in a beautiful river valley. On the path on the other side of the section you have the opposite feeling: because on a cut lawn you feel like walking in a park. Because of the low vegetation, you have a large overview over the site on this path.



Ill. 31: Section C

Section C: Walking on the path on the left side of the section you have a beautiful view over the lake with a private house in the background. The private house feels like an unfamiliar element in the area standing out from the surrounding context. Walking on the path on the right side of the section, you feel cut off from the area as the private house blocks the view to the lakes and the vegetation. You feel that you are walking in a semi private zone. In the analysis “Flow on the site”, it was discovered that the path on the right side of the section path is only used by few people in the morning rush hour. Therefore, the alignment of the path could profitably be changed.



Ill. 32: Section D

Section D: On the left side of the section you have water on both sides; you feel as a part of nature. On the other side of the section you are surrounded by trees on both sides of the path. The high vegetation feels larger and higher than it is. You do not feel close to water, but within a forest. The wide asphalt path gives you a feeling that the path is also for cars.

ANALYSIS CONCLUSION

The site...

AS PART OF THE CITY

The city park is situated in the middle of the city and splits the city in two, and because it is significantly lower than the surrounding, the city park does not work as a "natural" part of the city, but it operates as a green oasis. The area has always been more or less completely settlement free, except for a few buildings. The city park is surrounded by a residential area, however, closer to the park the dominant functions are educational institutions, sport activities and care centre.

AS AN PARK

Once, the city park, which today is characterised by its four lakes, was only a river valley. The area was once characterised by the Mastrup Bæk running through the area, but after the fish farm was established, the four man-made lakes were created. Today the citizens use the city park for walks, and in the winter the school children use the slopes for tobogganing. The park slides through settlements in the West in three green wedges. The city parks' changing nature provides a great variability in the area. The park's aesthetic beautiful peaceful nature is split in two by Mastrupvej, which cuts through the area. There is today a raised surface to ensure a safer crossing, but the road still functions as a barrier in the area.

AS AN OPPORTUNITY

Because of Støvring's development this low-level city park is an optimal opportunity to resolve the existing, but also future problems associated with rainwater. Today, the city park does not include many functions, but dominant functions just outside the park are educational institutions, sport activities and care centre, which provide a lot of opportunities where these functions can become more involved in the area than they are today. By adding more functions to the site, the site will perhaps be able to offer something more to the user than being an ordinary city park. The idea of exploring this opportunity combined with what the place might offer to the users and what characteristics can be enhanced are the basis of this project.

Ill. 33: Winter photograph

THEORY

This chapter aims to give a better understanding of the theory that lies behind the project. After each presented theory, there will be a small introduction to how the theory will be applied within the project work.

The chapter starts with an introduction to what nature is in order to define how this project understands nature on the site. Then there will be a small introduction to Landscape Urbanism, Ecological Urbanism and Process Urbanism. Afterwards, liveability as a term is described and linked to this project. The chapter will end with a presentation of learning theories and our own definition of learnability – a mix of liveability and learning.

Ill. 34: The preserved area

WHAT IS NATURE

It is necessary to define nature before we can understand it. Hans Fink, professor of Philosophy at Aarhus University, defines seven different conceptions of nature. (Fink, 2003)

Nature as the untouched

The first concept of nature is that nature is that which has not been brought out of its original state for human purpose or due to human influence. Nature is that which is completely unaffected by human intervention. The areas of the world which remain unaffected by human hand and spirit is nature; the areas people have mastered or just have left their mark on, is thus acculturated and therefore no longer nature. This also means that the glacier wear marks in the rocks are nature, but the rock carvings are culture. The boundary between culture and untouched nature has been pushed far ahead during human evolution. In a country like Denmark, there is no part of the land surface, which is not under the supervision, being controlled or being influenced by human activity. (Fink, 2003)

Nature as the wild

The second concept of nature is that nature can be understood as the place people did/do not live in. Nature is therefore linked to the difference between the cultivated and uncultivated land. Nature's border goes where regular and systematic use stops. Nature is wasteland, jungle, mountains, deserts, swamps, tundra and wilderness where people never or only very rarely go, but also forests, heaths and beaches that people actually visit, and where there is a degree of exploitation in the form of hunting, fishing and gathering wood, fruits and mushrooms. Nature's contrast is culture areas with cities, villages, fields of crops, tamed animals and cultivated crops. (Fink, 2003)

Nature as the rural area

The third concept of nature is a more modern idea where nature is mostly linked to the difference between the rural and the urban area. Seen in this perspective, the countryside with its waving fields and grazing cattle is also nature. When thinking of Danish nature, most people also think about the varied agricultural landscape with areas of forest and water. The borders of nature are at the city wall or at the border of urban settlements. Nature unfolds under the open air and is depending on the seasons changing and weather vagaries. Nature is forests and beaches, fields and meadows, cottage areas and golf courses. Nature's contrast is still man's everyday world, but now understood as the city with its particular form of civilization and indoor culture. When people of the city are optimists on their civilization's behalf, farm life appears as primitive and nature bound. When civilization pessimism spreads, the country life is seen as genuine and in harmony with the wild. (Fink, 2003)

Nature as the green

The fourth concept of nature is when nature is a contradiction between the living organic and low-tech on the one hand and the mechanical, synthetic and high-tech on the other. The border of nature also goes all the way into the city and houses. Gardens, parks, plantings on roads and squares, even houseplants, cats and aquarium fish can be seen as nature in contrast to cement, asphalt and plastic gadgets. (Fink, 2003)

Nature as the physical

The fifth concept of nature is when nature is determined by natural laws, stretched in time and space, particles and fields, mass and energy. Nature is existing objectively. The opposite of nature is the subjective, psychological, symbolic, conventional, social and cultural. While the other concepts of nature relate especially to certain areas of the ground surface with their flora and fauna, nature here is understood as the basic, material and energy in everything that exists. Here there is no question whether there is nature in Denmark, or about what is particularly characteristic of Danish nature. All things follow the laws of physics, like the human body, and even the intervention of things is nature. (Fink, 2003)

Nature as the earthly

The sixth concept of nature is nature as a part of creation which we are a part of with our bodily existence and which we can perceive through our five natural senses and with our natural ability to reason. Nature is the earthly as opposed to heavenly things, the worldly as opposed to the hereafter, the temporal as opposed to eternal, and the general in contrast to the miraculous. The contrasting between the natural and supernatural comes in many different forms. In religious contexts, the relationship to the devilish and underground also acts as opposed to the natural, and nature can even act as a personified almost divine 'Mother Nature'. Also in non-religious contexts, it is not uncommon to talk about that math and logic represent a particular supernatural and extrasensory world of ideas separate from the physical nature. (Fink, 2003)

Nature as all

The seventh concept of nature is when nature is the World, Universe, and Cosmos. Nature is the original and the existing, but in a certain sense everything is initial and existing. Nature is both what the humans have affected and what they have not influenced, both cultivated and uncultivated, both the urban and the rural, in both the grey and the green, both the subjective and the objective, both the eternal and the temporal. Nature is what is on both sides of every conceivable limit. Nature is the link that connects even the most diverse, which also includes the entire human and the ideal and divine. (Fink, 2003)

Nature in relation to the site

In relation to Hans Fink's conceptions of nature, this Master's thesis takes as its base the concept of nature as the green. However, the project sees nature as the blue as well as the green. This is because of the site's location and environment. The understanding of nature will vary contingently on the circumstances, and as the water on the site plays just as big role as the green, nature is seen as both the blue and the green on site.

PERSPECTIVES ON LANDSCAPE, ECOLOGY AND DESIGN

There exist several urbanism directions. In the following three large directions relevant for this Master's thesis are presented. They describe a view of seeing and understanding the city.

Landscape Urbanism

Landscape urbanism is a theory of urban planning. It argues that the best way to organize cities is through the design of the city's landscape, rather than the design of its buildings (Connolly, 2004). The term itself appeared the first time in 1994 in a Master's thesis by Peter Connolly at RMIT Melbourne (Hagen, 2015).

Landscape Urbanism includes the urban as well as the non-urban and should drive the design on all scales (Hagen, 2015: 29). James Corner expresses *"The promise of landscape urbanism is the development of a space-time ecology that treats all forces and agents working in the urban field and considers them as continuous networks of interrelationships"* (Corner, 2006).

Ecological Urbanism

Ecological Urbanism is much discussed these days, examples of publications are "Ecological Urbanism" edited by Mohsen Mostafavi (2010), "Ecological Urbanism: The nature of the city" (2015) by Susannah Hagen and "Landscape as Urbanism – a general theory" (2016) by Charles Waldheim.

Ecological Urbanism picks up the threads of landscape urbanism and ecological design (Landscape + Urbanism, 2010). *"There would be no Ecological Urbanism without Landscape Urbanism, as it helped bring ecology into urbanism"* (Hagen, 2015: 29).

"Ecological Urbanism foregrounds a view of the city as a literal and metaphorical ecosystem. On a material level, the environment goal is to create some version of ´artificial ecosystem´: cities that achieve the same interdependent efficiencies and life-preserving redundancies as natural ecosystems"

(Hagen, 2015: 4).

Anne Whiston Spirn expresses in an article about Ecological Urbanism that it works as a framework for designing resilient cities: It *"is not just a matter of imitating or echoing the shape of natural features or of using indigenous materials, but of adapting urban form to natural processes"* (Spirn, 2012: 8). Ecological Urbanism has focus on natural processes rather than only the natural features (for instance rivers and trees). This makes it an important framework according to Spirn.

Process Urbanism

Nature is a system of processes. Nature consists of heterogeneous components: evolving, adapting to each other and seeking balance. It is in constant transformation. Nature's system is self-regulating, dynamic, flexible and adapting to change (ProcessUrbanism, 2017).

Process Urbanism is a landscape inspired planning method developed by SLA (World Landscape Architect, 2017). *"Process urbanism is a method that uses the same logic as nature's principles of organization"* (Process Urbanism, 2017). It can be understood as an urban model that is self-regulating and procedural like a circulation of an ecosystem (ProcessUrbanism, 2017). Process Urbanism does not regard nature and city as opposites, but sees the city as a part of nature´s ecosystem and vice versa.

Therefore, to create a design there must be knowledge about subjects as wind, water, light, energy, circulation, politics, health, urban life, density, sustainability, et cetera in order to create one urban ecosystem. (World Landscape Architect, 2017)

Process Urbanism and Ecological Urbanism have many similarities the essence of which is that both focus on ecological values and that areas affect the environment around them and vice versa.

Reflections to the site

The site is a city park placed between built environments. It is a part of the city landscape.

Ecological Urbanism and Process Urbanism are mostly used in situations within the built environment: a more city-like environment than the site for this Master's thesis. However, in this Master's thesis many understandings similar to these theoretical stances will be used to understand the site, for example we will in this project look at the city park as a part of a larger ecosystem which will evolve, adapt and seek balance. Natural processes will be in focus in the design process rather than only natural features. However, natural features could also be used with the purpose to enhance the design expression on the site.

The site can be understood as one large ecosystem. Different nature types including permanent lakes, wetlands, grasslands and high plants, result in increased biodiversity in the area. Birds are attracted by shrubbery which provides good hiding places, and the shrubbery is growing well among other things because of nutrients in the soil and the sun conditions. Bees are attracted to plants with nectar and pollen and other plants are dependent on the bees' pollination and the soil conditions. Furthermore, ducks and other animals are given better living conditions because humans feed them, and some plants are only surviving because humans affect the natural ecosystem by removing weeds. Many sorts of plants and animals in the area can only survive because of the existence of other plants, animals or humans. It is a cycle of life, an ecosystem, which we should be aware of in the design.

Solutions suggested this Master's thesis will take inspiration in natural ecosystems, natural hydraulic systems and natural landscapes in order to create a new artificial landscape in the centre of Støvring with good conditions for flora and fauna that can also manage rainwater from a large catchment area.

LIVEABILITY

Liveability is about creating the good life. Liveability is a response to specific characteristics of contemporary societies. The concept has become an important part of some cities' "brand" and has become a marketable trait in policy making to attract tourism, investments and labour (Veenhoven, 2014). Støvring should aim at being a city known for the good life within the city. We therefore want to make Støvring liveable.

Liveability in theory

Liveability is a wide term that has many definitions. One definition is the sum of the factors that add up to a community's quality of life - including the built and natural environments, economic prosperity, social stability and equity, educational opportunities, and cultural, entertainment and recreation possibilities (Partners for Livable Communities, 2017). Therefore, to understand liveability we need to understand what is the content of quality of life for individual humans.

The theory "quality of life" contains, among other things, that like all animals, humans have innate needs, such as for food, safety, and companionship. The gratification of needs manifests in hedonic experience and hedonic experience determines how much we like the life we live (Happiness). (Veenhoven, 2014) This, however, relates to several elements of society and life in general: Wealth and employment, the built environment, physical and mental health, education, recreation and leisure, and social affiliations (Mohit, 2013).

Quality of life refers to people´s quality of life. Therefore you cannot talk about design without talking about people (Jerome Frost – Designing the liveable city, 2014; Gehl, 2010).

The essence for liveability is people; therefore designs must be a human oriented approach (Gehl 2010). To make human oriented design, knowledge about primary theorists such as Jan Gehl, Jane Jacobs and William H. Whyte´s work can be beneficial. See appendix 11.

Liveability on the site

As mentioned above one thing that helps making liveable cities is the recreational areas – as is our site. The site therefore contributes to liveability in Støvring.

How is it possible to design the site in the centre of Støvring in a way that contributes to even deeper liveability? The site can provide urban settings with services that contribute to overall wellbeing which increases human quality of life. This means that the site can provide programmes that contribute to a healthy and educational life. Furthermore, the site can be a cultural, social and recreational gathering point that increases human quality of life.

Blue and green infrastructures in theory

In literature liveability is mostly discussed in urban context, and here parks as well as blue and green infrastructures are often considered as something that can increase the liveability of the city and humans' quality of life. Researchers argue that being in a natural setting

increases the citizens´ health and wellbeing (Newton, 2017). It has been confirmed by public health researchers Stamatakis and Mitchell that *"being in nature, or even viewing scenes of nature, reduces anger, fear, and stress and increases pleasant feelings"* (University of Minnesota, 2016) hence this can be argued to increase human quality of life and human wellbeing.

The Liveable City Lab in Rambøll has investigated how to strengthen Blue and Green Infrastructures (BGI) in cities to make liveable, sustainable and resilient cities. Here the term "green infrastructure" refers to projects involving vegetation design elements such as parks, green roofs, greenbelts, alleys, vertical and horizontal gardens and plants. However, "green" infrastructure is a slightly misleading adjective, since this type of infrastructure is often closely related to "blue" processes. Blue infrastructure technically refers to the hydrological functions including rainwater and urban stormwater systems and surface and groundwater aquifers. (Rambøll, 2016)

The Liveable City Lab uses BGI as a tool to reduce floods. Cities often have a reduced surface perviousness. This reduces infiltration and increases the runoff, which lead to an increase of rainwater to manage in the cities and can result in floods. (Rambøll, 2016) By integrating the water solutions within the city, *"blue-green infrastructure projects support the transition of the urban water management paradigm from large, centralized, technical solutions towards a more integrated approach, exemplified by multi-purpose BGI systems that enhance urban liveability, sustainability and quality of life."* (Rambøll, 2016) In other words, BGI combine the demands of sustainable water and stormwater management with the demands of urban planning and urban life (Rambøll, 2016). Furthermore, BGI help to create liveable cities by creating enhanced space for mental and physical recreation and social activities, thus reducing public health costs, and improving human well-being and ultimately attracting residents, businesses and tourism (Rambøll (b) 2017).

Blue-Green infrastructures are therefore a framework that can increase quality of life which again increases the liveability in the city and at the same time prevents floods and makes cities resilient.

Blue and green liveability on the site

The existing site can be argued to contain blue and green infrastructures. To achieve a liveable city, these infrastructures can profitably be maintained, as it is proved that natural settings increase citizens' health and well-being. But to increase citizen health the citizens need to be attracted to the site as you cannot talk about liveable design without talking about people.

The site can invite to mental, physical and social activities in order to attract residents. As the site is a low-lying area which is planned to become a future water management spot, the design can profitably be performed with the Liveable City Lab´s ideas about implementation of blue and green infrastructures to prevent floods. Furthermore, water management can also be used for learning purposes in schools and for the locals to get a higher level of liveability.

LEARNING ENVIRONMENT

Before you can start learning, you need to understand how you learn. Many have the conviction that one learns more or less the same way, but according to the philosophy of learning styles all people learn in different ways. There are many theories about learning styles and many of them are hardly distinguishable from one another, as many have also been inspired by each other. The best-known theories of learning are those of Howard Gardner, Lev Semyonovich Vygotsky, Bruner scaffolding, David Kolb, Dreyfus and Dreyfus, Benjamin Bloom, Biggs SOLO (the structure of observed learning outcome) taxonomy and Knud Illeris. However, Howard Gardner's ideas have laid the foundation for further research in the field and were originally introduced as a learning theory. Consequently, there are many ways to understand "learning". The American professor Howard Gardner has developed models for the multiple intelligences. The different intelligences have implications for which interests different people have and how they solve problems. Gardner started with five basic forms, but later added two. The five abilities of intelligence are *linguistic intelligence*, *musical intelligence*, *logical-mathematical intelligence*, *spatial intelligence* and *bodily-kinaesthetic intelligence* (Gardner, 1983). The two which were added later were *intrapersonal intelligence* and *interpersonal intelligence*. He describes the various forms of intelligence and argues that there are separate intelligences that are largely independent of each other. He describes the linguistic intelligence as a person's ability to use the spoken and written language as a tool for communication. This intelligence is based on vocabulary and the ability to construct sentences. The intelligence also includes the ability to organize and prepare both oral and written presentations. He describes the musical intelligence as a person's ability to key, melody and rhythm. The logical-mathematical intelligence is a person's abilities for systematic analysis using abstract mathematical concepts and methods. Gardner is also including the ability for numerical processing. The spatial intelligence is the ability to work with plane and spatial geometries. The bodily-kinaesthetic intelligence is the ability to master the physical motor skills. The intrapersonal intelligence is the persons' ability to analyse and understand themselves. And the interpersonal intelligence is the ability to analyse and understand other people, both individually and in social settings. We are talking here about a person's social empathy. (Flagga, 2007)

"It's been 30 years since I developed the notion of "multiple intelligences." I have been gratified by the interest shown in this idea and the ways it's been used in schools, museums, and businesses around the world. But one unanticipated consequence has driven me to distraction—and that's the tendency of many people, including persons whom I cherish, to credit me with the notion of 'learning styles' or to collapse 'multiple intelligences' with 'learning styles.' It's high time to relieve my pain and to set the record straight."

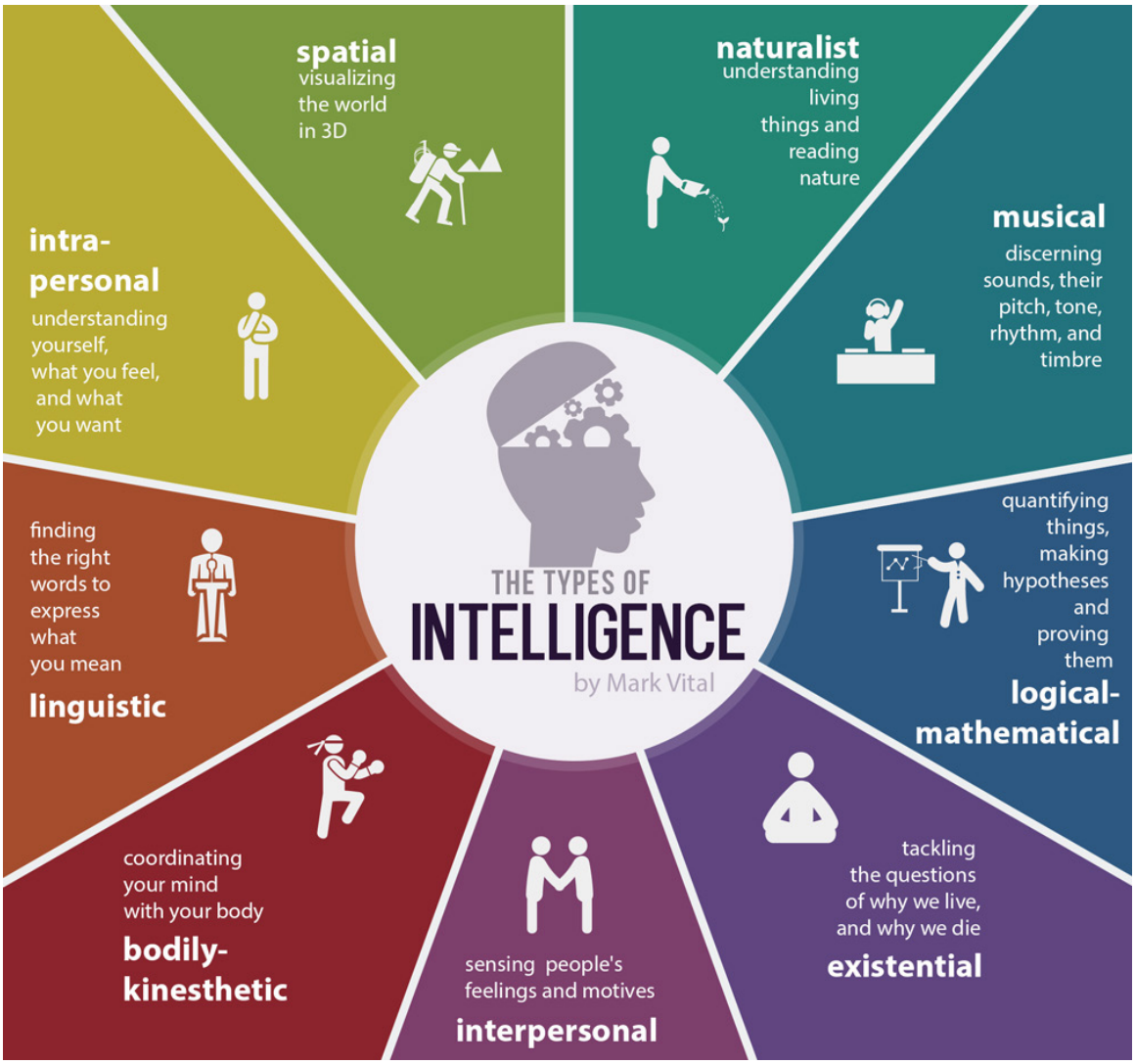
Howard Gardner (Strauss, 2013)

While Gardner does not describe learning styles, David Kolb's learning cycle model describes four typical learning styles; *concrete experimentation*, *reflective observation*, *abstract conceptualising* and *active experimentation*. The concrete experimentation is if you prefer to combine an experienced and experimental approach to problem solving. A person in this category prefers to work with practical work, are good at taking risks, good at acting in emergent situations and would rather solve problems using intuition than logic. The reflective observation is if you prefer to combine an experienced and thoughtful approach to problem solving. A person in this category prefers to ponder and turn the arguments into a game, the person is good at getting ideas and seeing things from different perspectives and to gather information and use imagination. The abstract conceptualising is if you prefer to combine a thoughtful and concept formation approach to problem solving. A person in this category prefers to understand the underlying arguments, concepts and connections, you here have a great ability to create theoretical models and will add greater value to a good explanation than the practical understanding and are often preoccupied with ideas and abstract concepts. The active experimentation is if you prefer to combine a thoughtful and concept formation approach to problem solving. A person in this category prefer to see what happens and to work with a more technical approach. She/he has a more solution-oriented approach and likes to make hypotheses.

However, understanding how to learn is not the only important issue, the learning environment is also essential. When talking about learning environments it is important to distinguish between the informal and formal. In informal learning environments, teaching is going on elsewhere than in the classroom - in museums, forests and so on. Many of these informal learning environments evolved and developed in relation to the perception of free-choice learning (Dier King and Falk, 2003). With free-choice learning students in a given context are believed to have free rein to delve into whatever catches their interest. Hence, there is no final goal, only a hope for increased learning. An often used model to describe learning in informal learning environments is found in Falk and Dier King (2000) as the basis of "free-choice" learning three overlapping domains are described that should be brought into play in relation to learning: The personal context, the socio-cultural context, and the natural context. Within each of these domains eight factors which the writer has identified as key factors are combined as seen below.

Personal context
- Motivation and expectations
- Prior Knowledge, interests and convincing
- Selection and control

Socio-cultural context
- Socio-cultural mediation within the group



Ill. 35: 9 types of intelligence by Gardner

- Facilitated mediation of others

Physical context
- Progressive orientation and organization
- Design
- Underpinning issues outside the museum

In relation to the preparation of teaching based on an exhibition, there are several challenges in this model. An informal learning environment has evidently neither knowledge nor ability to cater to the individual student's expectations, interests and prior knowledge. However, it is possible to exert greater influence, for example by organizing activities in groups rather than individually. (Petersen et. al., 2014)

The differentiation of teaching is also a principle of organization and implementation of education, whereby education as far as possible must be adapted to student differences in a class or group. There is thus a principle that can be realized in many ways, and not through one particular teaching method. This principle was formulated in the Primary Education Act of 1993 and is a requirement in schools today. Differentiated teaching has gained ground in the Danish education system since the 1960s and has gradually replaced student differentiation in primary schools, id est, the kind of differentiation that seeks to accommodate differences between students by dividing them into classes or teams at different levels according to their academic qualifications. Student differentiation appears in the special needs education of pupils whose development requires special support, and for educationally motivated divisions into smaller teams of shorter duration. Differentiated teaching involves the social situation in the organization and implementation of class teaching. Thus, it differs from individualized teaching, where students work individually, for instance, with self-paced and self-controlling materials, including computer programmes. Individualized teaching may well be one element associated with differentiation of teaching. (Den Store Danske. 2017)

Learning on the site

LEARNABILITY -THE MIX OF LEARNING AND LIVEABILITY

An urban project and learning may not make sense the first glance, but when two of the dominant features close to the site are a primary school and a high school, it may in this case be the perfect match. As the site is a city park that in the future should be able to manage an extra amount of rainwater, it is an obvious choice to make it function as a place where people learn about water management and climate changes.

Teaching these things is important for future generations as it is a way to understand the world. The increasing amount of rain that needs to be managed is not very different from place to place. However, the solutions and the problems that may occur in connection with the water management can vary from place to place. Therefore, it is important to show and tell about these innovative solutions.

As mentioned in the previous section, liveability is based on the community´s quality of life which covers many aspects. However, by providing good learning programmes on the site, the site can help to increase people´s mental health - which is one thing that can contribute to larger liveability. We call this combination of enhanced liveability and learning “learnability”.

To obtain learnability on the site, visitors need to have their mental health increased through learning. This can be a challenge as it was discovered in learning theory that people learn in different ways. Therefore, to obtain learnability, different learning styles than the common blackboard teaching should be offered. The learning programme on the site should include hand-on experience and other learning methods presented in the learning theory section.

THEORY CONCLUSION

The nature on the site can be defined as “the green”. For understanding the processes on the present site and the future design, we can take inspiration in Ecological Urbanism and Process Urbanism´s ideas/foundation. On the site different processes exist. Understanding these processes can help create an ecological future-proof design.

By improving the quality of life, we can help making Støvring liveable. From theory we know that the site should be planned to provide urban settings that will contribute to an overall well-being and increase human quality of life. This can be done by planning programmes that contribute to physical and mental health. Physical health might include sport activities, and mental health might include learning programmes.

Learning and liveability grow together and become learnability. Having learnability on the site includes people learning about the processes, environment, flora, fauna, water management, et cetera, which can help to achieve a mental health and help making Støvring liveable.

Ill. 36: Spring flowers

CASE STUDY

The case study focuses on areas which have been transformed in respect to either biodiversity or rainwater management and works as recreational areas. In the case study two different cases are presented. The first case is sØnæs and the second one is Østerådalen. The second case study can be found in appendix 10, as it only has little influence on this Master's thesis regarding programmes in nature.

Ill. 37: Stepping stones on top of grit chamber

SØNÆS

sØnæs is a new 10 hectare recreational area in Viborg. It is a project where climate adaption and technical solutions go hand in hand with design and places for people. (Vandplus, 2015) sØnæs is a large attraction in Viborg, where people meet for a picnic, yoga class, walk, run, et cetera. Furthermore, the site has become a new brand for Viborg city.

To different kinds of routes guide you around in the area. A urban red route of 725 meter containing red elements (pavilion, benches, dustbins, lampposts, et cetera) guides you on a handicap friendly route in sØnæs. A green route containing green elements guides you through a piece of more wild nature with hilly terrain and obstacles. This makes sØnæs a place that anyone can access. (Vandplus, 2015) Look at the map on illustration 40 to view the different placed facilities in detail.
The main concept in sØnæs is the large lake that divides the area and creates an island – hereby the caps lock Ø in sØnæs. Bridges are crossing the lake, which creates many opportunities to change your route and have a small stay while you are watching the blue and green landscape with red elements growing up in the landscape.

Rainwater management

The lake defines an aesthetic beautiful landscape, however, besides providing a good area for the citizens, the lake also functions as a cleansing basin that cleans and delays water from a 50 hectare residential area in Viborg (Viborg Kommune, 2016). The lake can contain rainwater from a 100-year rainfall event. Promotion of the climate adaption function has been important in this project, which has given the idea to write technical rainwater information all over the site – This is both done to teach students about water management, but also to teach the citizens in Viborg about the future climate changes (Viborg Kommune, 2016).

Ill. 39: Rainwater management solutions are highlighted in sØnæs

Ill. 38: Airphoto of sØnæs

BEACH

The beach contains a beach volley lane and free space for sunbathing, take a picnic, et cetera. In the buildings close to the beach are toilet facilities.

STEPPING STONES

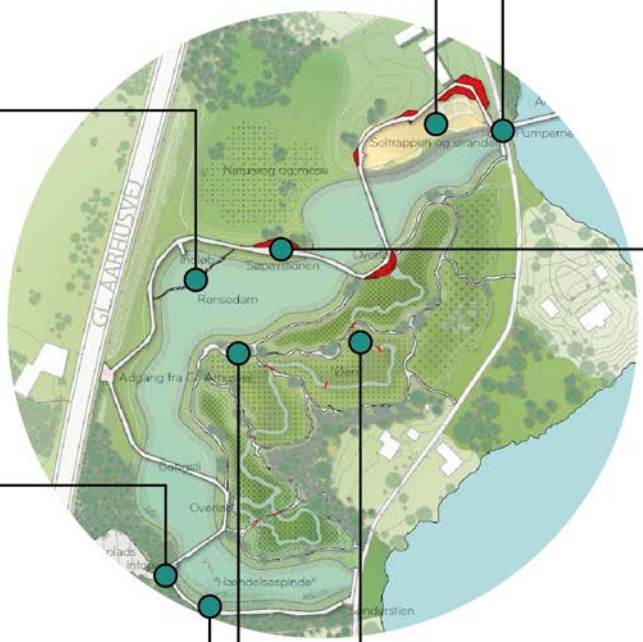
You can cross the lake by using the stepping stones. The stepping stones are placed in 3 different heights – you are therefore more challenged when the water table is high after rainfall events. The stepping stones are placed on top of the grit chamber.

INFOPORTAL

An info portal welcomes you to the area and gives information about the site's history, activities, the technique behind water management, and upcoming events.

LOOP

The path around sØnæs creates a 1081 meter loop that can be used for running. The distance is marked on the small lampposts that also illuminate the path system (Viborg Kommune, 2016).



BRIDGE

A bridge extends from the path out in the local sea. Under the bridge water from sØnæs is pumped out in the other local sea. The local tour boat "Margrethe 1" is moored at this bridge in periods of the year. Close by the bridge you also find drinking water facilities and bicycle facilities including a bicycle pump (Viborg Kommune, 2016).

LAKE PAVILION

Under the red pavilion benches are placed. Here you can enjoy watching the rain or can get some shadow on a sunny day. You can use the pavilion for outdoor yoga or work out in the TRX facilities. Small theater performance is also suggested to be performed here. (Viborg Kommune, 2016)

NATURE AREA

One side of the site contains a more wild nature expression. The grass is higher and it is expected that the future will bring a high diversity. A brook winds through the landscape. This area changes depending on the weather; In dry summers only the brook is wet and in wet seasons and after cloudbursts the area will be flooded in periods (Vandplus, 2015). In dry periods a small football lane occurs in the landscape. An obstacle course (forhindringsbane) is placed in this area and invites people to be active and have fun.

BARBECUE SPOT

In the barbecue spot you can barbecue you own food and have fun with friends, family and maybe meet new people.

Ill. 40. Planned activities and functions

DESIGN INTRO

In this section, the concept, design parameters and target groups are presented.

Ill. 41: Path near lake

RESEARCH QUESTION:

How can Mastrup Delta, as a recreational space in Støvring, create a cycle where water management is both the solution for water problems in Støvring and the new identity for the local community?

CONCEPT

In the context of the site are primary school and high school. These are all programmes of learning but also programmes that can benefit from a close connection to nature.

On a national level, we have a problem with heavy rain events in Denmark, and we need to do something about it. The concept for this site is to show children, students and citizens of Denmark that water matters and is a resource. Like all other resources we need to think about how we use or abuse this resource.

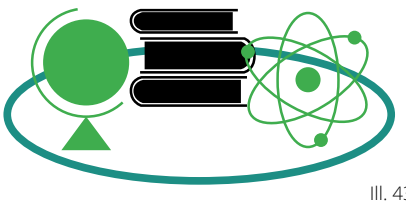
This project wants to combine the two aspects above. Teach children and students about water and that rainwater can be a resource just like clean groundwater. The concept diagram shows how learning and liveability together can be something more: how it can be leanability. Leanability is learning about water in everyday life, how water is an important resource and that we need to take care of the water that we have. In Denmark, we have easy access to clean water, but we may not have it in the future if we do not treat our water correctly. And that is learnability.

Ill. 42: Concept diagram

DESIGN PARAMETERS

Most inhabitants in Støvring have their own gardens. The site must therefore offer something that people do not have at home; the area must be an area for recreational purposes. The analyses show that a high school, primary school, care centre, public swimming pool and football fields are located close to the site. It would therefore make sense to attract people from these close-by places. This will be done by having learning and sport attractions integrated in the site.

Walking around the site today gives the feeling of being in a beautiful, blue and green area. This is a great potential for the area and is something that could be enhanced in order to create a stronger identity for the area. Another parameter that could contribute to a stronger identity for the area is having changeability and flexibility on the site.



Ill. 43.a

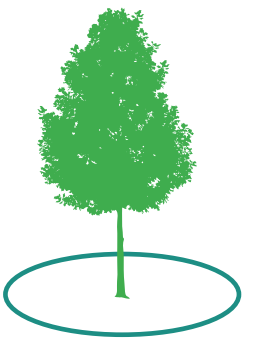
Ill. 43.b

Learning

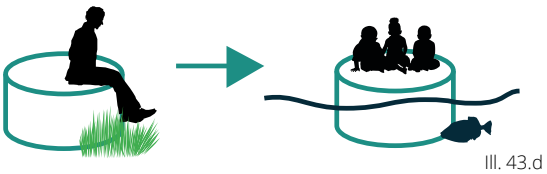
Programmes having focus on learning will enter school classes, but also in the citizens' private visits. Primarily school students and high school students will make group work on sitting places close to the school, and activities on the site will be part of their every day school day. Both students in the primary school and high school will have biology classes on the site, making test of the soil, water, plants, et cetera. The site will invite to learning.

Activity

As Rebild Municipality has the slogan "a healthy life in a healthy municipality" and due to other sport activities being located close by, sport activities are planned on the site. These activities should invite primary school students, high school students and elderly to exercise and be healthy.



Ill. 43.c



Ill. 43.d

Enhance nature

The existing site is aesthetically beautiful with blue and green infrastructures. The wish is to enhance these blue and green elements and make it a powerful identity for the site.

Changeability

The site will be planned to manage a lot of rainwater from the surrounding area in the future. Therefore, water management will make up a large part of the site. However, water will not be managed in technical facilities, but will be integrated in the area and make the area changeable. On a dry summer day water is controlled to be in specific areas, and after a cloudburst water will characterize the site. Functions will also change; in dry periods stones will be used for sitting, and in wet periods they will be used as stepping stones.

TARGET GROUPS

There is a great diversity of users in the area around the site, from small school children to seniors from the care centre. This gives a huge span in what the programme on the site needs to be able to provide in the form of facilities for everyone in the target groups.

It is important that the site creates cloning zones: programmes where people from different backgrounds can meet and see new cultures and perspectives. This is something the sociologist Zygmunt Bauman argues for in "The City of Fears, the City of Hopes". Cloning zones can be programmes as workshops, culture house and production communities. (Asaa and Amundsen, 2008)

The site strives to create a cycle of learning, a cycle where people from the surrounding programmes can come and learn about water as well as nature. Here, interaction between people will occur.

The target groups have been set up as it is important to design an area for the city. To give the people of Støvring ownership of the area, it is important to involve them in the development process. However, to create a focus group and have public meetings would be a lengthy process and would take up a lot of time, hence these target groups have been made instead.

The characters are therefore fictional people based on meetings and short interviews with people from the area. The narratives provide useful insight in the area and what the people of Støvring need in this area. The interviews reveal that people like the area and use it during the day. Many people take walks in the area and enjoy that there is a lot of water on the site.

School children and students mainly use the area for biking and walking to and from school. They do use the water in the area for learning purposes, but this has only taken place one time and is therefore not taking place on a regular basis. Rebild Municipality has educated people to be mediators of nature and nature guides, but they do not have a place to meet and to start their tours. The voice of the city is mentioned by most of the interviewed people and is therefore in the following considered as in one person.

Ill. 44.a

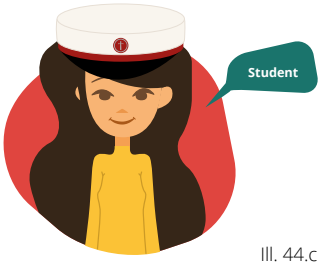
Voice of the city

The voice of the city wants the area to be an open space with a view over the water. The glassy water is an important element for the city park and is something the people of Støvring are enjoying about the area. They also like that the lake and the plants around it seem so "wild" and not cultivated, and that the area does not have a lot of buildings which makes it seem as a piece of nature within the city. The voice of the city likes to take a walk or go for a run in the park, which is something that is important for the voice of the city to keep.

Ill. 44.b

School child

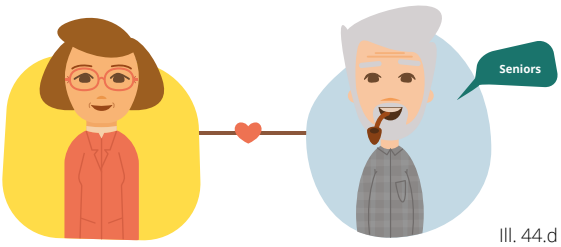
Kirsten is a school child form the nearby primary school. She just loves to be out in free air, and breaks are her favourite “class” during the day. They are not out in the city park as much as she would like; it would be better if all their education took place out there in the free air.



Ill. 44.c

Student

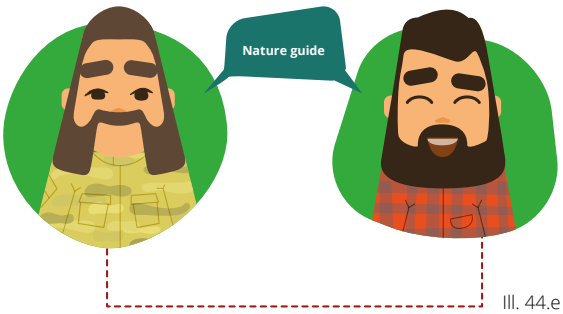
Aya is a student at the local high school just outside the city park. She can sit in her class and look at the landscape and dream about being out there to really see how it all works and not just read about water filtration and plant nutrition. She would love to have real hands on learning outside and not just sit in her classroom.
She loves nature and would like to get to know more about it so she can take better care of it. She can read about all the climate problems, but knows nothing about what she can do to help.



Ill. 44.d

Seniors

Bente & Ole are seniors and live at the nearby care centre. They love to walk in city park among lakes and trees. It is a silent place where the only disturbers are noisy happy children in the school and birds in the trees. They like the amount of water in the area and that there is no programme to interrupt the walks in the area. Before coming to the care centre, they had a single-family house in the area, thus they have seen the transformation of the area from a field to a city park. They like that it is open to the public, but do enjoy that there is not that many people in the area.



Ill. 44.e

Nature guides

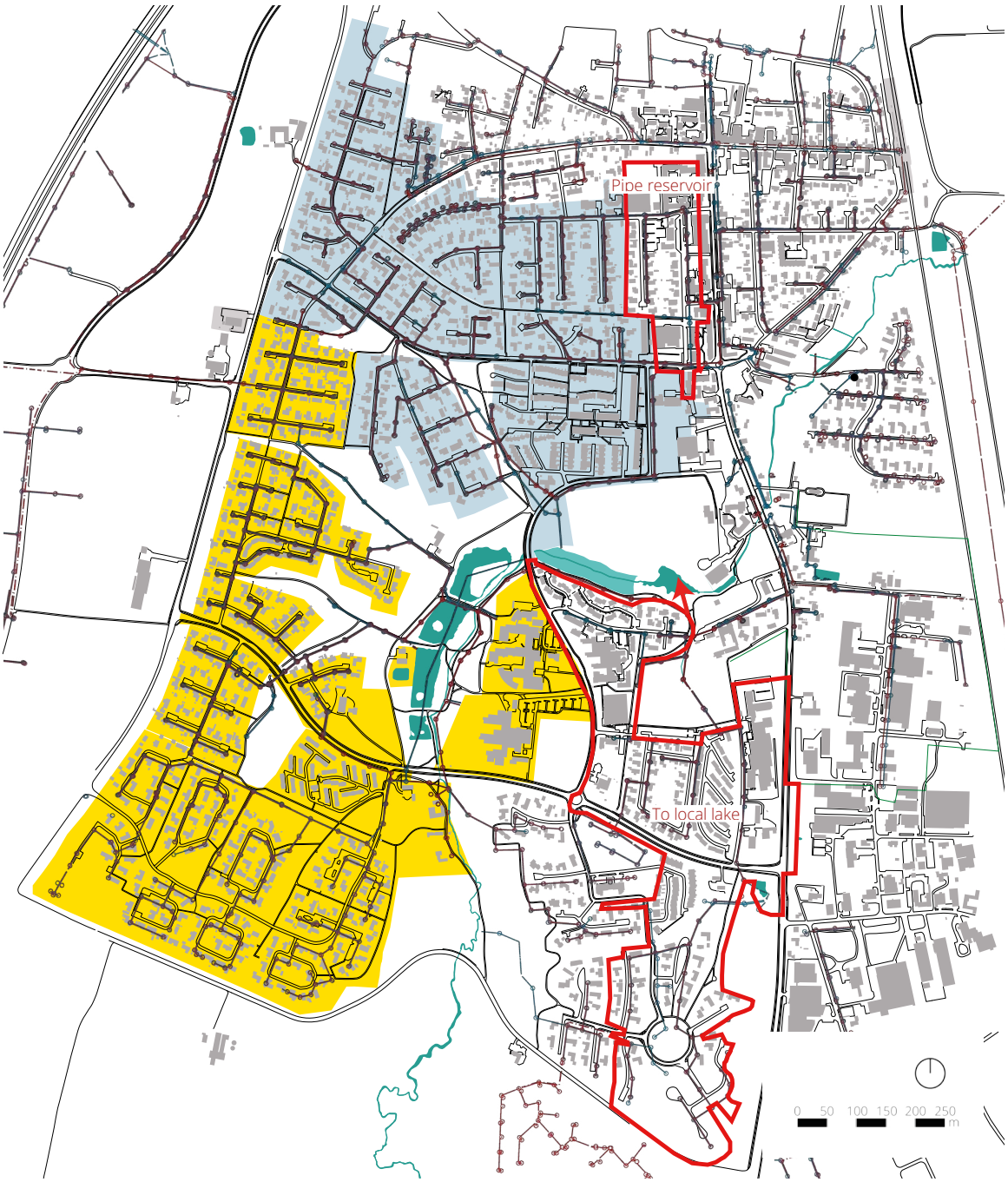
Knold & Tot are nature guides in Rebild Municipality. They like nature and the element of ever-changing views it gives an area. They are keen on telling stories about animals and plants and want to teach the next generation about nature and how to take care of it so that it can take care of us.
They are in the need of space to call their own; a place they can meet people and have guided tours in the surroundings.

SCENARIO

It is found that there are three ways in which the area can deal with water. In this chapter the three different scenarios are analysed and compared in order to find the scenario on which the project will be based.

The three scenarios are important to explore as they are the base for the design and the layout of the programmes. The chosen scenario needs to take care of the visions from both Rebild Municipality and Rebild Forsyning.

Ill. 45: Island in the lake



Future catchment areas

New catchments to the lakes (19,6 reduced ha)

Existing catchments to the lakes (27,6 reduced ha)

Local rainwater management

Ill. 46: The existing and new catchment areas

CHOOSING THE THREE SCENARIOS

As presented in the water analysis, rainwater management is a problem in Støvring city. New solutions are therefore required. The site for this Master's thesis is located in a low-lying area on the Mastrup Bæk alignment. 69 hectares (27,6 reduced hectares) are today draining to Mastrup Søerne on the site. The rainwater in the lakes is directly led further into the brook with only 20 cm high for delay, which is not enough. As there are flood problems in Støvring, it is beneficial to create some delay solutions within the site, but it is even more beneficial to both link more catchment areas to the site and to delay rainwater from all of them as this will help to reduce/ prevent future flooding in Støvring City.

Illustration 46 shows the existing catchment areas and the catchment areas that are possible to link to the site in the future (Niras, 2015; Rebild Vand, 2017). Furthermore, the illustration shows that one catchment area is planned to be managed locally in the lake closest to the public swimming pool. This increase in the catchment area that is draining to the site results in a larger volume of rainwater to manage on the site.

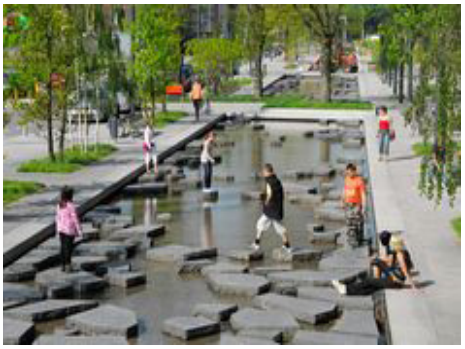
New solutions are therefore required. Rebild Municipality suggests a reshaping of the brook around of the lakes in the future in order to use the lakes as delay basins for rainwater (Niras, 2015). This solution will provide a better environment for the fishes, however, it is doubtful whether this is the best solution for the area, as it will demand many dikes, which will hinder an easy contact with the water, which is one of the potentials for the area today. Furthermore, by dividing the lakes and the brook, the water in the lakes will become stagnant, which will make the lakes become overgrown.

Aiming to find a good method for water management in the area that will also give a good recreational area for its users, we investigate three water management scenarios:

1. The existing solution where the brook is running through the lakes.
2. Rebild Municipality´s proposal of reshaping the brook around the lakes so that the lakes function as delay basins.
3. Our own proposal: The lakes are removed, and only a brook runs through the site. This scenario demands periodic flooding of recreational areas along the brook in order to manage the rainwater.

In the following these three scenarios will be estimated for the faculty of managing water after heavy rainfalls, the aesthetical expression and the activities that are possible to plan near the brook and lakes. This analysis will form the basis for choosing one scenario that will function as point of departure in the further work.

As background to the three scenarios, programmes fitting to the design parameters have been worked out. These can be found in appendix 16.

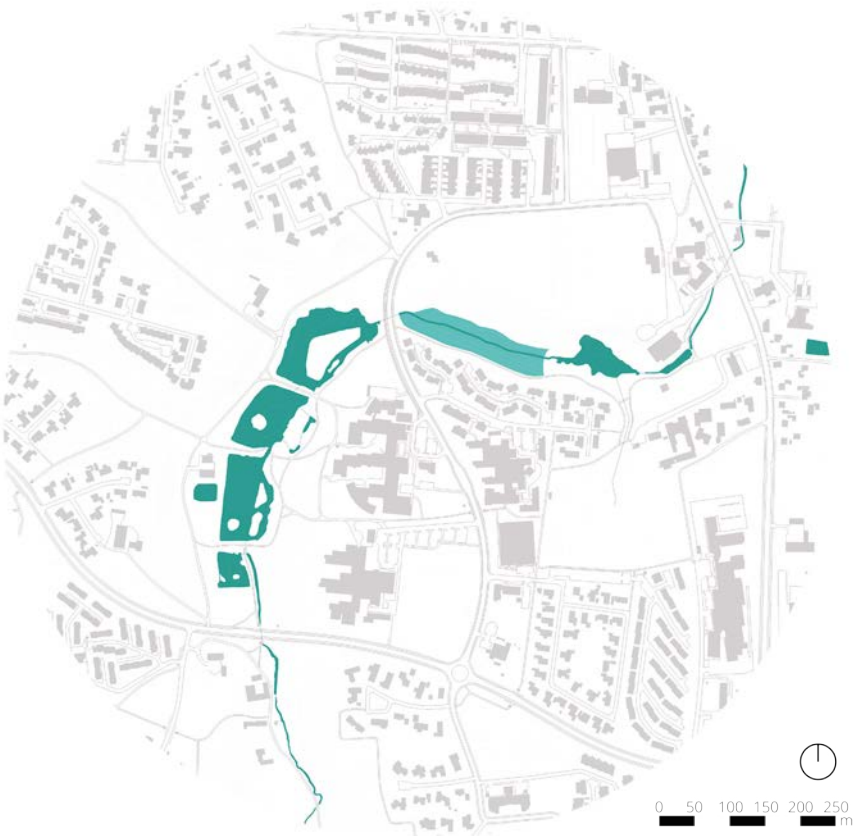


Ill. 47: Scenario 1 - Ideas for the existing solution

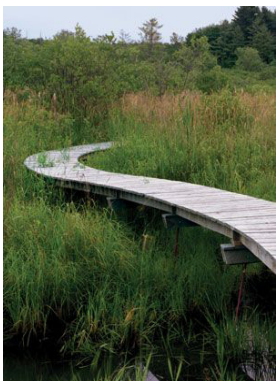
SCENARIO 1
The existing solution

The existing site is defined by blue and green infrastructures that create an aesthetically beautiful area. As the brook is running through the lakes, the water in the lake is clear and there are not many plants. This gives the opportunity to make activities on the lakes: jumping from stone to stone on the lake, rope drive from the land to the islands, or walking in “waterballs” on the lake. The opportunities are legion.

As today, it will be possible to fish in the lakes. Fishing bridges and bridges between land and existing islands both have space for fisherman, but also constitute the basis of picnic spots, stays for elderly on their daily walks and for biology students that try to define the fish life in the lakes. The large water surface in this scenario opens up to many possibilities.



Ill. 48: Scenario 1



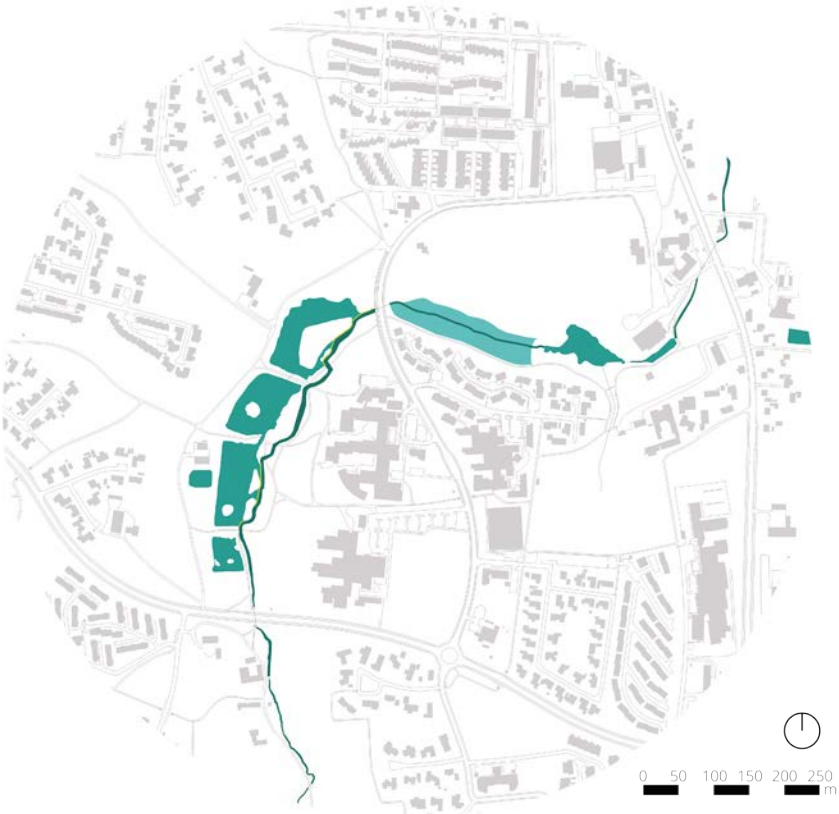
Ill. 49: Scenario 2 - Ideas for the municipality´s solution

SCENARIO 2
The municipality´s solution

The brook is running on one side of the lakes, and the lakes are used as delay basins for rainwater (Niras, 2015). This scenario will give a better environment for the fishes and therefore more fish will come to the brook. The scenario demands that dikes are established if rainwater is to be managed. These dikes will function as a barrier that hinders the existing easy contact with water. However, the dikes can also become good vantage points overlooking the area and will create variety of the terrain.

The water in the lakes will become stagnant as there is no flow through them, which will result in overgrown lakes on a long-term basis unless the maintenance level is high. The overgrown lakes will give a bad contact with water. It is possible to make access to water by establishing small path bridges over the lakes, which will give a new look to the area. The overgrown lakes form the basis for good hiding places for birds and other type of natural life, which can be watched from the dikes or an observation tower.

The access to water is still possible on some distances of the brook if stepping stones and obstacle courses over the brook are established.



Ill. 50: Scenario 2







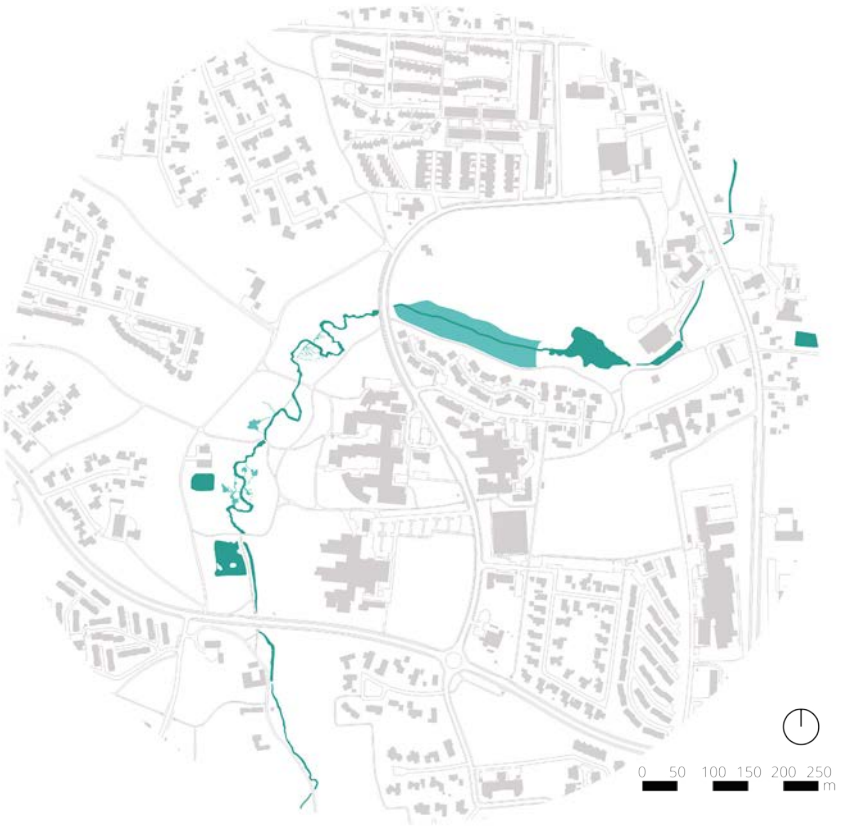



Ill. 51: Scenario 3 - Ideas for the brook with periodic wetlands

SCENARIO 3
Brook with periodic wetlands

The access to water will be good in this scenario. As in scenario 2 activities as stepping stones and obstacle courses over the brook can be planned. There is a lot of space so the brook can be reshaped in the best possible way for the fishes and vegetation. This scenario will probably create the best possible solution for the fishes and the biodiversity of the area.

This scenario is the only one of the investigated scenarios that will have a high visible changeability regarding the water. Rainfalls will change the area. Large rainfalls will cause some controlled wetlands to occur, and extreme rainfall will give larger wetlands. You will achieve different nature experiences dependent on the weather; on a dry summer day you can play ball in spots with cut grass, and you can walk all over the site, and after heavy rainfalls you have to walk on path bridges and stepping stones to cross the wetlands. In this scenario water provides many different experiences.

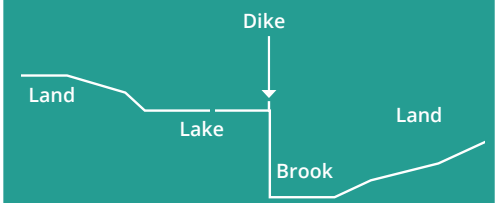


Ill. 52: Scenario 3

COMPARATIVE ANALYSIS

Normal Situation	Flooded Situation	Extra water	Normal Recreational space
		0%*	23.500 m^2
		73% (16.500 m^3)	20.900 m^2
		(19.000 m^3)	41.800 m^2

* Please note that the scenario can hold an additional 20 cm water, but it is not a part of the design.
Therefore this scenario is not able to have water management.
For calculation please look at appendix 14.

Flooded Recreational space	Education	Access to water
23.500 m²	• Nature workshop • Animal life • Plant life	
18.800 m²	• Nature workshop • Animal life • Plant life • Water cleansing	
28.100 m²	• Nature workshop • water cleansing • Animal life • Plant life	

Ill. 53

PROS AND CONS

Scenario 1 - The existing solution

PROS

- Large amount of water for recreational purpose
- Easy access to water
- Large space for activities on water
- Possibility of sedimentation

CONS

- No detention of rainwater
- Bad/no connection to the surroundings
- Small space for new functions
- Bad conditions for sea trouts

Scenario 2 - The municipality´s solution

PROS

- Detention of rainwater
- Possibility of sedimentation
- Large amount of water for recreational purpose
- Good conditions for sea trouts
- Vantage point on top of dikes

CONS

- Bad/no connection to the surroundings
- Small space for new functions
- Large distance to water due to dike
- Overgrown lakes or a high maintenance level
- No space for reshaping the brook in a natural alignment

Scenario 3 - Brook with periodic flooding

PROS

- Large space for new functions
- Detention of rainwater
- Easy access to water
- Good conditions for biodiversity
- Ever-changing landscape
- Good conditions for sea trouts
- Space for reshaping the brook in a natural alignment

CONS

- Small amount of water for recreational purpose
- Bad/no connection to the surroundings
- The locals like the lakes, which are removed

CHOICE OF SCENARIO FOR FURTHER WORK

An investigation of the three scenarios shows that the existing solution is not appropriate in relation to rainwater management, the municipality´s solutions is better, and the brook with periodic flooded surroundings is the best solution regarding rainwater management. The environment for fishes is also worst in the existing scenario and best in the solution with the brook with periodic flooded areas, as it in the last scenario is possible to create a natural flow and curves for the brook. The last scenario will also provide the best conditions for vegetation as periodic flooding will result in an increased diversity of flora (Miljøstyrelsen, 2015). This is elaborated further in the following pages.

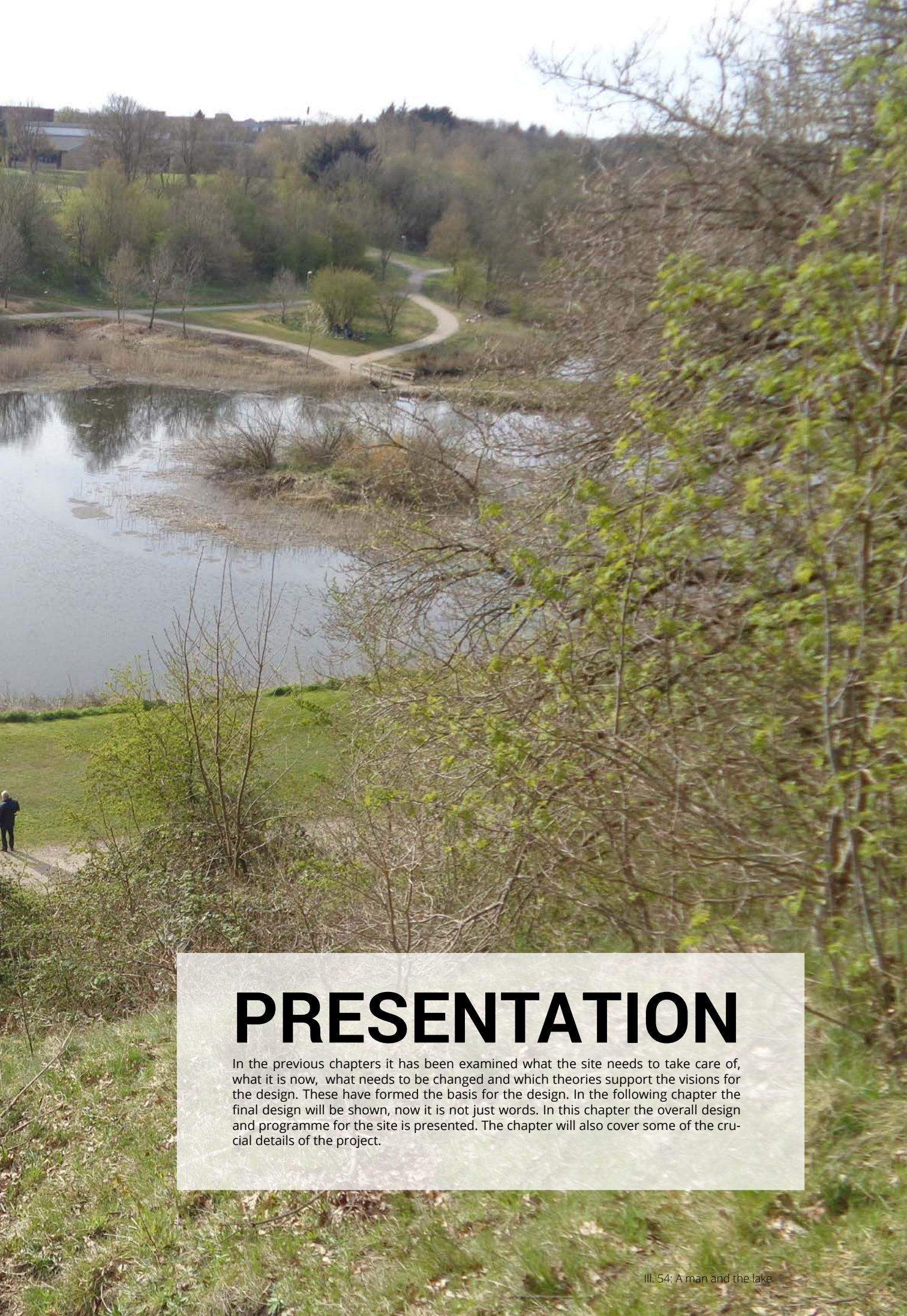
However, not only technical aspects must determine the choice of scenario to further work. Therefore, an investigation of the activities and aesthetic appearance of the site is taken into consideration. The existing solution prepares the ground for many new activities on the water surfaces as the lakes are open. This is a potential that should not be forgotten. Some of these activities are possible to reuse on the brook for the municipality´s solution and for the brook with periodic flooded surrounding. However, the large, glassy, permanent water table will not be maintained in the last two scenarios, which is something that the voice of the city wants to keep.

Another large potential in the existing solution is the easy access to water. The municipality´s solution will hinder this because the lakes will become overgrown, and the solution will demand many dikes. These dikes will also make the connection between the two sides of the lakes and the brook poor. Because of the above, it is chosen not to take the municipality´s solution further in this Master's thesis.

This leaves two alternatives: the existing solution and the brook with periodic flooded areas. Both scenarios have their potentials and problems. The brook with periodic flooded areas is the best regarding rainwater management, and the existing scenario is the solution that the voice of the city finds best and the solution with the best potential for activities and recreational purposes on the water. For further work, it is therefore decided to create a mix of these two scenarios. This is suggested done by removing the existing, artificial lakes and reshaping a new natural alignment of the brook. This reshaping will take as its inspiration the original brook alignment from the 1800s (see appendix 8), but it will not be the completely same alignment as soil has been moved about since the 1800s. Furthermore, by not being locked on a fixed alignment for the brook, the alignment can be designed in a way that both considers planned programmes and the environment, see appendix 13.

It is suggested to establish some new lakes with a glassy permanent water table. These lakes will maintain some potential for the existing recreational area, but will also have the capacity to manage rainwater from the surrounding catchment areas for normal rainfalls. For extreme rainfalls other lowered areas are used for rainwater delay. This will provide the area with changeability and give the site different expressions depending on the weather.

None of the scenarios investigate the access to the site and how to benefit from the surrounding terrain as the settings are the same for all scenarios. However, a small idea collage is worked out in relation to the production of the programmes on the site. The collage can be found in appendix 17.



PRESENTATION

In the previous chapters it has been examined what the site needs to take care of, what it is now, what needs to be changed and which theories support the visions for the design. These have formed the basis for the design. In the following chapter the final design will be shown, now it is not just words. In this chapter the overall design and programme for the site is presented. The chapter will also cover some of the crucial details of the project.

Ill. 54: A man and the lake

Ill. 55: Masterplan

All of the site is an open-air learning centre. It functions as a path system around the site that connects the different programmes, both the learning programmes but also the recreational programmes and sport programmes. The path system on the site is divided into different types of paths: Learning, Sport and Experience.

Learning path: a red path takes the users around the site teaching them about nature on the site and how important water is as a resource and that we need to think about how we use it. Around the path learning stops are placed wherever there is something important to learn. The learning stops are placed all over the site to be close to the "problems/elements/solutions" they are teaching. This gives room for more groups on the site at once and makes direct learning in situation possible which activates the whole site and not just one place. It creates a learning cycle. Learning stops are created in a way that they accommodate people in all ages.

Sport path: the site is just next to football fields and a tennis courts, hence sport is a part of the site's context. The site is also heavily used as a running path; this programme is represented on the site with a sport path around the site of 2 km. Throughout the sport path the user can choose some obstacle courses, or it can be a plain run for warm-up as a part of football, tennis or school sport. From the sport path, there is a new connection to the football fields in the form of a set of stairs.

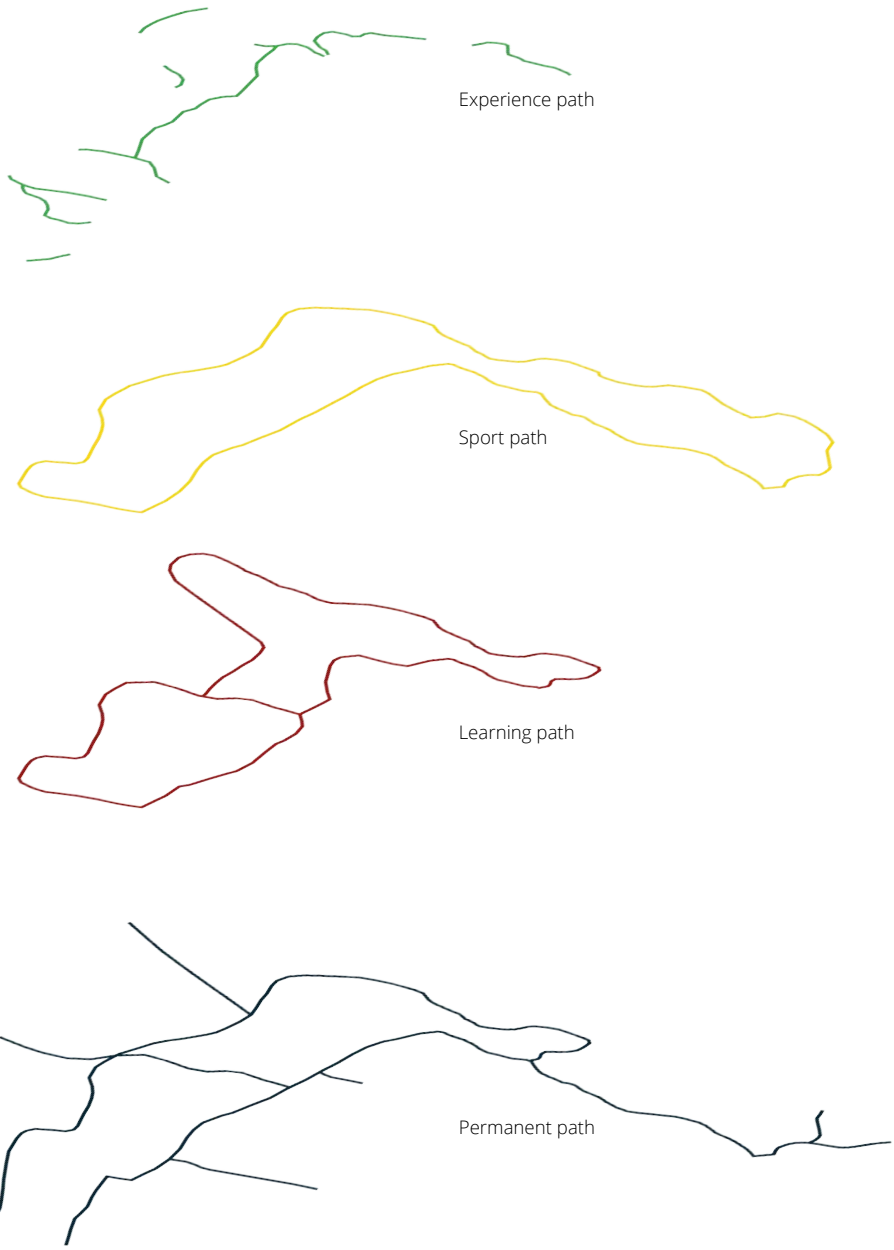
Experience path: to get more in touch with nature an experience path is added to the path systems. This path invites to play and takes the user close to the water and on the water with different activities along it. To get the full water experience you need to take the experience path. Permanent path: some parts of the path system are raised in order to connect the programmes of the schools with the surrounding housing, and it makes it possible to get round on the site in case of a heavy rain event. The permanent path is also handicap friendly.

No new connection has been made to the surroundings, except a set of stairs up to the football fields, as the area is designed to be "well-balanced". This is due to the fact that the area is an undisturbed "oasis" which does not have a character of city, but a landscape and this is desired to be preserved in the design.

Because of the size of the site, the site itself contains quiet places for stay. This is advantageous as the older target groups want more quiet places to walk or stay, but at the same time they can see and experience life in the area.

New programmes are added to the site: rainwater lakes, clean-water lakes, kindergarten, nature guides, camp site and a learning centre. As written, the programmes are placed all around the site to activate all of the site and to make it possible to have more groups in the site at the same time.

See the drawing folder for the masterplan in larger scale.



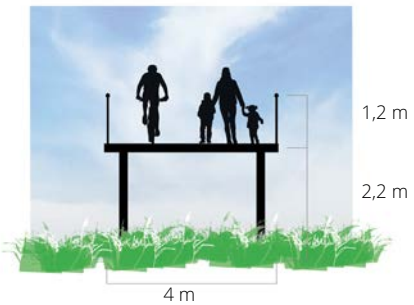
Ill. 56: Path system

THE PATH SYSTEM

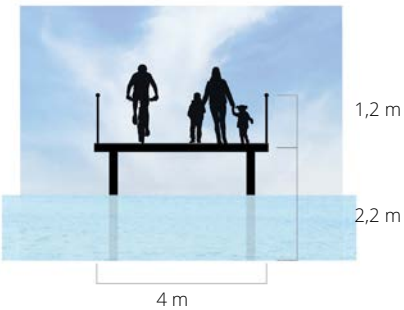
The permanent path is made of wood with nets to ensure that the pedestrians and cyclists do not fall when the wood gets wet. The permanent path is raised 2,2 m from the surface water on the rainwater lakes to ensure that the path does not get flooded, even during 5-year rain events. The permanent path is also the only part of the path system that is disability friendly and respects the rules regarding this. The permanent path is a combined walking and cycling path, there is a requirement for a minimum width of 1.5 m and 2.5 m, respectively, which gives a total path width for a shared path of 4 m (Celis Consult, 2014:52) (SBI, 2008). The learning path and sport path are made of gravel and are acting as secondary paths and do not run in the same course as the permanent path. All secondary paths are made with a minimum width of 2 m. The experience path is a footpath and therefore not made with any particular material or width.

All raised paths have a railing of 1.2 m. The railing is designed with a height of at least 1.2 m to prevent users from falling over it. At the same time, there should be no structural parts that make it easy or inviting for children to climb the railing as it can lead to serious falls. (Celis Consult, 2014:57)

Illumination at the site is important so that the users feel safe on the site at night. The lighting can also create awareness to certain details and create atmosphere. On the path system two types of lights are used: atmospheric and accent, see appendix 15.



Ill. 57.a: Section: Permanent path: Raised



Ill. 57.b: Section: Permanent path: Raised with water

Ill. 57.c: Section: Permanent path: On ground

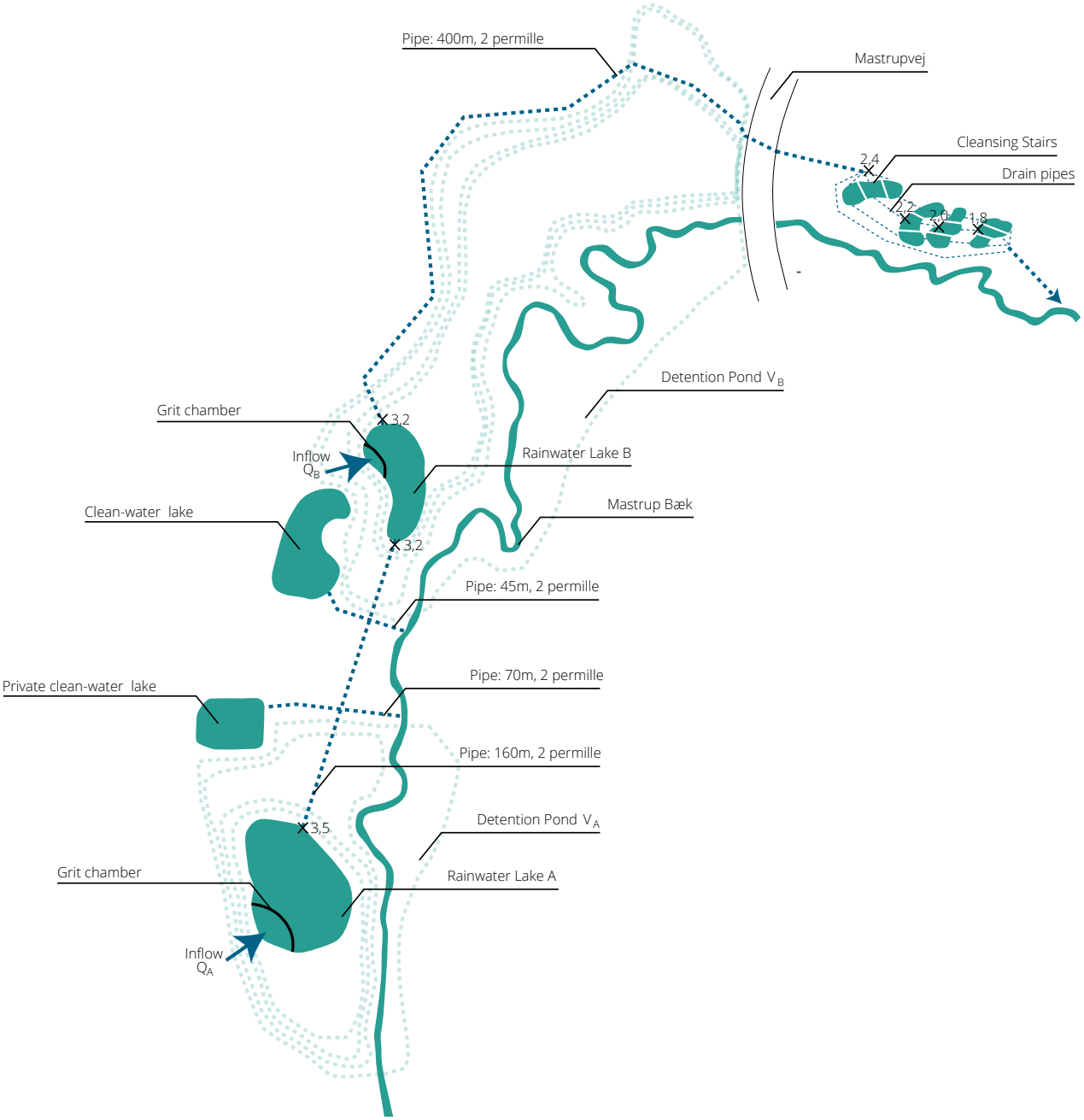


Illustration 58: Masterplan for managing rainwater on the site

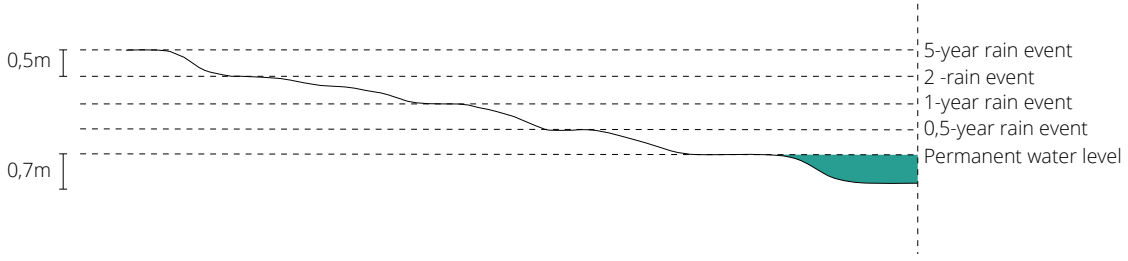


Illustration 59: Principle section showing the permanent water level and the gradual water rising in the landscape

WATER MANAGEMENT

The site will manage rainwater from a 118 hectares residential area (47.3 hectares reduced area), which is a very large area. Detention pond A will manage water from 14.2 reduced hectares (catchment area 1 on illustration 20 page 24), and detention pond B will manage water from 33.1 reduced hectares (catchment area 2, 3, 4, 5, 6, and 8 on illustration 20, page 24).

On a dry day, there will only be water in three small planned lakes on the site, but after a larger rain event the lakes will become larger, which will provide changeability for the site. Every 5 years the site will totally change character and be fully flooded by water for a period. However, you can always access the site via the permanent paths.

The site is dimensioned to a 5-year event. However, the site will be able to manage larger events before damage will happen, however, the permanent path will be flooded, and there is only a half a meter to the closest building.

Rainwater that is led to the lakes will have some larger particles that should be filtered out. Therefore, to gather the largest particles in the rainwater, a grit chamber close to the water inflow to the rainwater lakes is established that will divide the lakes into two. This solution will also slow down the incoming water, to prevent the sedimentation to stir up. Grit chambers are normally not a nice-looking solution, however, the grit chambers on the site will have stepping stones on the top so you will not see the grit chamber itself. This is a multifunctional solution that is inspired by a solution on sØnæs, see case study page 49.

Under the permanent water a bentonite clay membrane will be placed to ensure that the water stays in place and that the water does not infiltrate the groundwater.

The rainwater from the detentions ponds will be led into a trench to the cleansing stairs. Here, each step on the cleansing stairs are split into three smaller basins, in which it is possible to test different infiltration solutions. Close to the inflow of the basins there is a vent which makes it possible to regulate the inflow to the three different basin connections, so that the scientists can obtain the best possible outcome to make comparable results. Furthermore to obtain comparative results all small basins have the same volume, and the inflow and outflow from the basin is placed on each side of the basin with the longest possible distance.

In the basins, the water will infiltrate though different materials and then be collected in drain pipes covered by fibertext. The drain pipes will lead the water into another pipe and towards the next basin. After being led through four basins, the water will be led to the brook.

Appendix 14, shows the dimension of the detention ponds A and B, as well as the calculation of the dimension of the pipes.

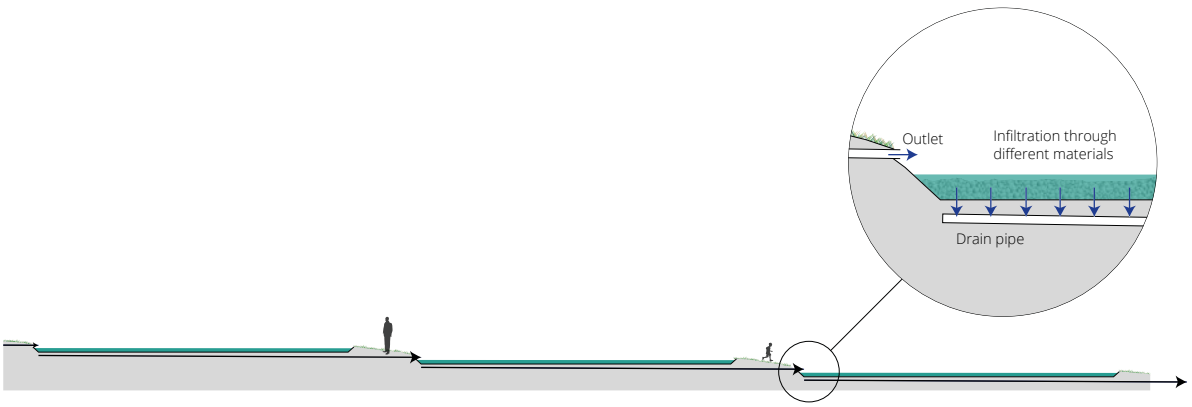


Illustration 60: Principle of the cleansing stairs with different materials for cleansing the rainwater

Ill. 61.a: Masterplan with a half-year rain event

Ill. 61.b: Masterplan with yearly rain event

Ill. 61.c: Masterplan with two-year rain event

Ill. 61.d: Masterplan with five-year rain event

BIODIVERSITY

As presented on the previous page, the area contains two detention ponds. Both detention ponds have a permanent water level. One of the reasons for this is to maintain the wildlife, that also needs water. Thus, the animals have the opportunity to always search for a water area so they can survive. (Stephansen, 2017) Additionally, the periodic floods can help increase biodiversity in the area, see appendix 13.

The selected vegetation was chosen based on what is commonly found in Danish forests, pastures, wet meadows and marshes and on the banks along lakes and brooks, see more in appendix 12 as this was a key inspiration for the landscape. The site's vegetation is designed to increase biodiversity and improve the ecological value of the project site. Biodiversity is defined in multiple ways. Biodiversity can be a measure of the variety of species in an area. However, the objective of enhancing biodiversity can also be reached by creating an environment suitable for one specific (perhaps endangered) species. This would allow for reintroduction of a species, and likely the arrival of several other species that live in a similar habitat. As shown in appendix 12, several of the selected plants can handle different environments, which means that the plants may move to another environment than the one they have been planted in. For example, a plant capable of coping with both the environment in the forest and the grassland, which has been planted in the forest, may slowly begin to move to the grassland if it can survive better there. It may also be that a plant disappears in an area, for example, as the area often contains too much water for the plant to survive. (Stephansen, 2017)

The vegetation is divided into different types of areas: Forest, pasture, wet meadow and marsh and banks. Trees, shrubs and flowers are chosen based on their natural habitat so that the area does not require much maintenance. Vegetation in different heights is selected to create a variation on the site. In order to choose the right type of planting that can stand in periodically flooded areas, another category has been added: Trees in wet meadow and marsh.

Ill. 62: Biodiversity plan

Forest

The forest is exciting because the trees are different and they create different growing conditions for the plants on the forest floor. The forest floor is an essential habitat for small biota. Moss protects the soil and along with flowers they constitute a colourful terrain. On the forest floor a large diversity of spring flowers including wood anemone exists. In May, when the beech blooms, not as much light is leaking out through the dense green leaves, and flowers wither in the middle of summer and are storing nutrients in the root for next year's blooming. (Danmarks flora (c), 2017)

Ill. 63.a: Forest

Pasture

Grass pastures or grasslands are terms for light and open, dry areas. Grass pastures or grasslands can quickly become dull and grey in some seasons and therefore not very attractive to look at, they can also often look uncared-for, but are an important element for flying insects. It is a habitat which is dependent on grazing animals or harvesting to keep the vegetation open. The pasture species resembles wet meadow and marsh, but they can not necessarily afford the same changes in water level. The vegetation can be a more multi-colored aesthetic than wet meadow and marsh if the right plants are chosen. (Danmarks flora (b), 2017)

Ill. 63.b: Pasture

Wet meadow and marsh

Vegetation in the wet meadows and marsh is specially selected for its ability to face changes of water levels. The tall grasses and reeds are great habitats for a wide range of biota. Meadows are aesthetically characterised by vegetations that are predominantly shades of green and yellow. (Danmarks flora (d), 2017)

Ill. 63.c: Wet meadow and marsh

TREES IN WET MEADOW AND MARSH

One of the desired qualities in the area is changeability. Therefore, different trees have been selected that can help with this effect. The selected trees in this category are also selected because they can withstand the moist soil that will occur in the area.

Ill. 63.c: Trees in wet meadow and

Banks

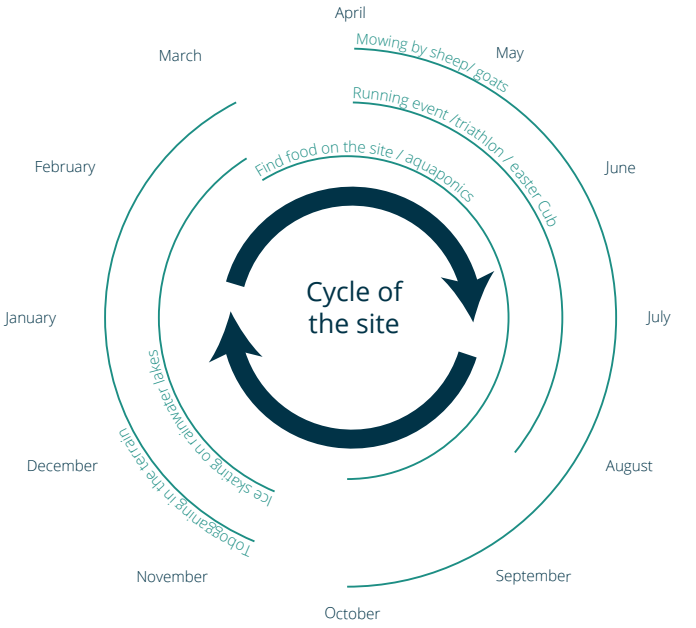
The reed swamp or bed is planted to help inhibit soil erosion, as well as to provide a habitat for wildlife and removing a variety of pollutants in the water, including oil, bacteria, nutrients and ecology. Often reed swamp creates a fringe all the way around the lakes. (Danmarks flora (a), 2017)

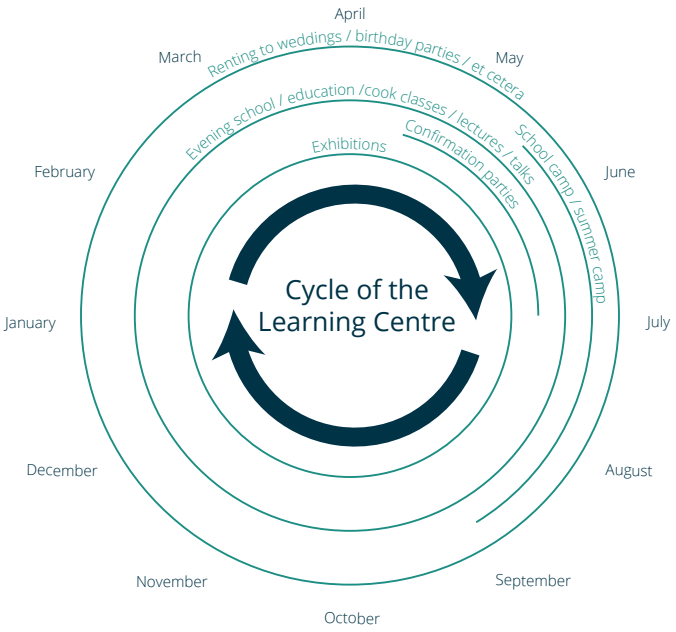
Ill. 63.e: Banks

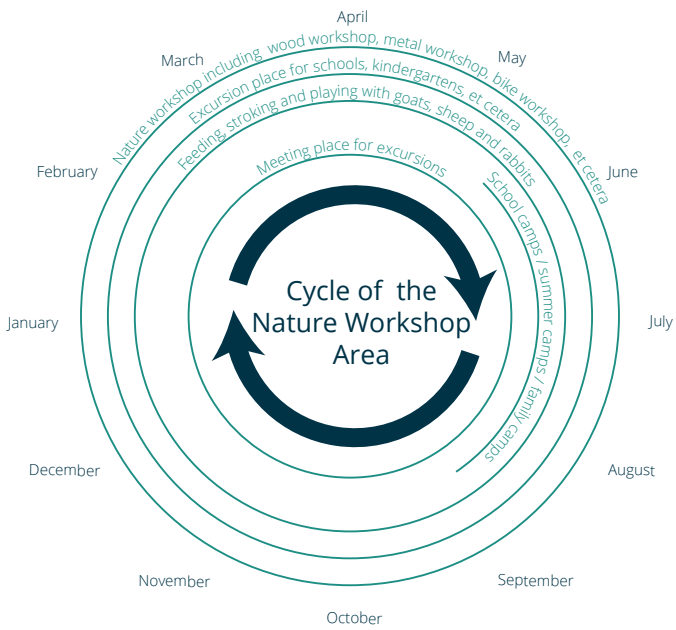
Detention ponds

There are three “lakes” in the area, two of which are rainwater lakes/detention ponds, and one is a clean-water lake. More species will generally do better in the clean-water lakes, as conditions are more stable. The rainwater lakes will have random additions of metals and general contamination from the stormwater. However, a big difference in biodiversity in rainwater lakes contra the clean-water lake will not be seen, which contradicts previous beliefs that detention ponds were big poison holes (Stephansen et al., 2016). However, salt and that the temperature fluctuates affects the biodiversity in the basins. A lake born from a spring will have a much steadier temperature, while the detention ponds are affected by how much water comes in and what time of year it comes in. Therefore, there is nothing in the detentions ponds to keep the temperature steady, which results in a faster rising of the temperature. Another big problem is that in the winter the detention ponds can become very salty due to road salt. The oxygen level and the PH balance can also fluctuate considerably in the detention ponds. Therefore, there will be a difference between the animals and plants that will live in these different “lakes”. (Stephansen, 2017)

marsh







Ill. 64: Season activity diagram

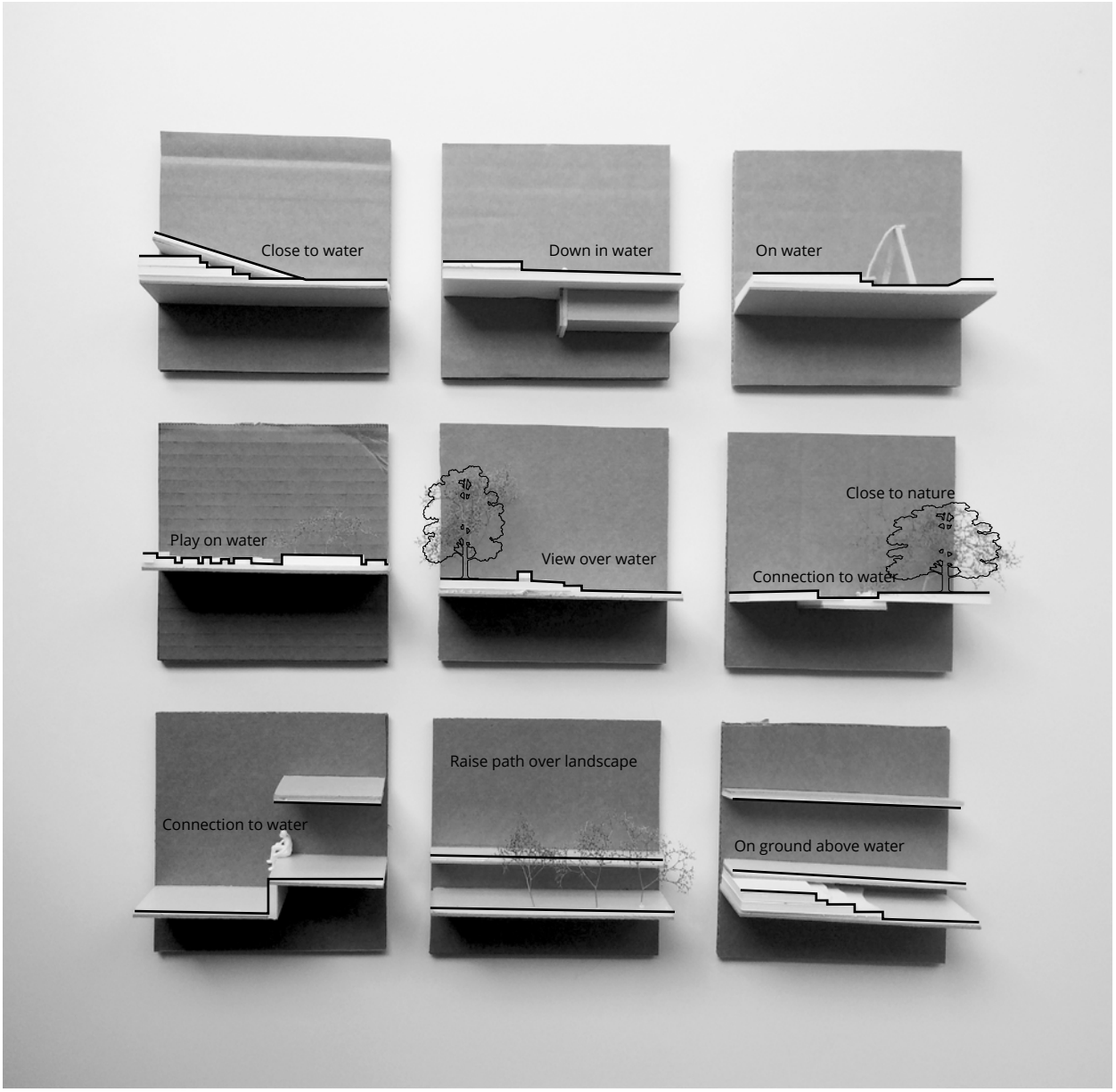
SEASON ACTIVITY CYCLE

Different activities on the site are happening in different seasons. We are dealing with a season cycle that provides changeability to the site. On the illustration potential activities for the site in general are presented, the Learning Centre and the Nature Workshop Area.

During the season, different events will take place on the site. A couple of times a year, the site is visited by sheep and goats that are grazing the vegetation and make the site change character. Different seasons also form the basis of different vegetation and eatable plants. Therefore, nature guides will throughout the season take citizens on different trips in the area. On cold winter days, the site will be a place for children tobogganing in the terrain and ice skating on rainwater lakes. In the summer half year running events will take place on the site. This may include the national running day for schools in week 41, Easter Club and triathlon which also can make use of the nearby public swimming pool.

The Learning Centre is a platform for learning which can be the basis for one-day events such as lectures and talks, and weekly events such as evening school for education and cook classes. The primary school and high school will also make use of the new facilities in their everyday life and use the building for school exhibitions. School camps and summer camps will in periods use the rooms for overnight stays. It is also possible to rent the facilities for weddings, confirmation parties, birthday parties and other private and public events.

The Nature Workshop may cooperate with the nearby afterschool care at Karensmindeskolen so that children and young people can visit the Nature Workshop to work with wood, metal, et cetera. The facilities can also be used for evening school workshops, and weekend/summer events for children. Just outside the building in the covered firecamp with surrounded shelters, there will be a meeting place for school and kindergarten excursions and school camps on weekdays in the summer half year. Here, children can feed, stroke and play with goats, sheep and rabbits around the camp. The facilities can also be used by families during holidays and weekends.



Ill. 65: Spatial studies diagram

SPATIAL STUDIES

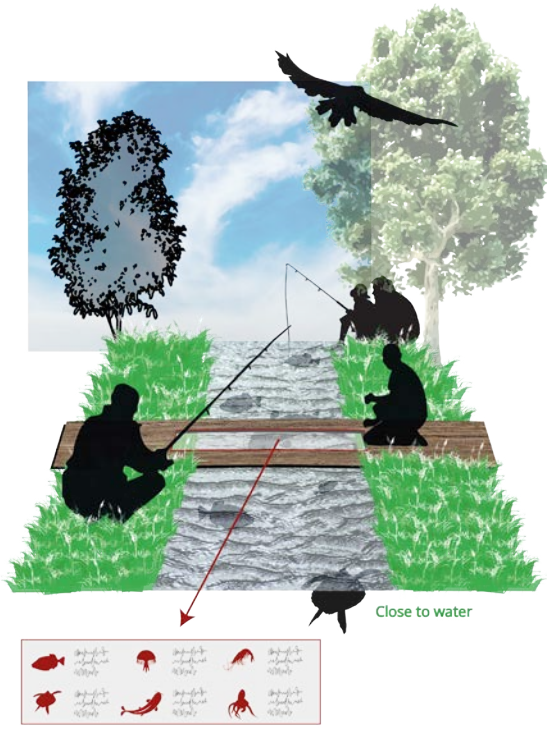
We have made some spatial studies to understand the connection to water, the connection to nature and how to keep the human connection on a large scale.

This was done through a section model workshop. The workshop took as its point of departure the path on the site, how this needs to be in order to connect with the site and the people on it and to explore how the design concept could create comfortable space for people. The workshop was made with cardboards and scale figures as the tools, the dimensions were investigated in a scale of 1:100. Afterwards the models were analysed according to how they connect with and enhance nature and the water around it, do they provide the desired feeling and atmosphere of the place?

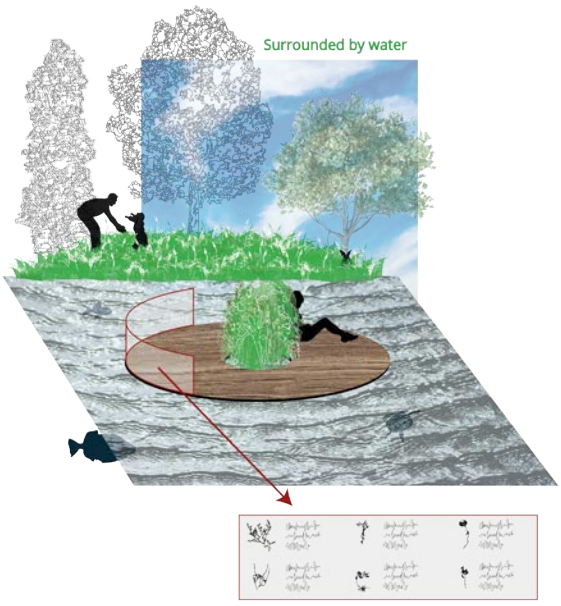
The workshop provided a good opportunity to come down in a human scale and shift from a top-down view, giving constructive insight into how paths, levels and distances frame nature and make a connection to it. In particular, the study contributed to an understanding of the design of a raised path in a natural environment.

Ill. 66.a: Learning stop: Soil conditions

Ill. 66.b: Learning stop: Forest and birds



Ill. 66.c: Learning stop: Fish



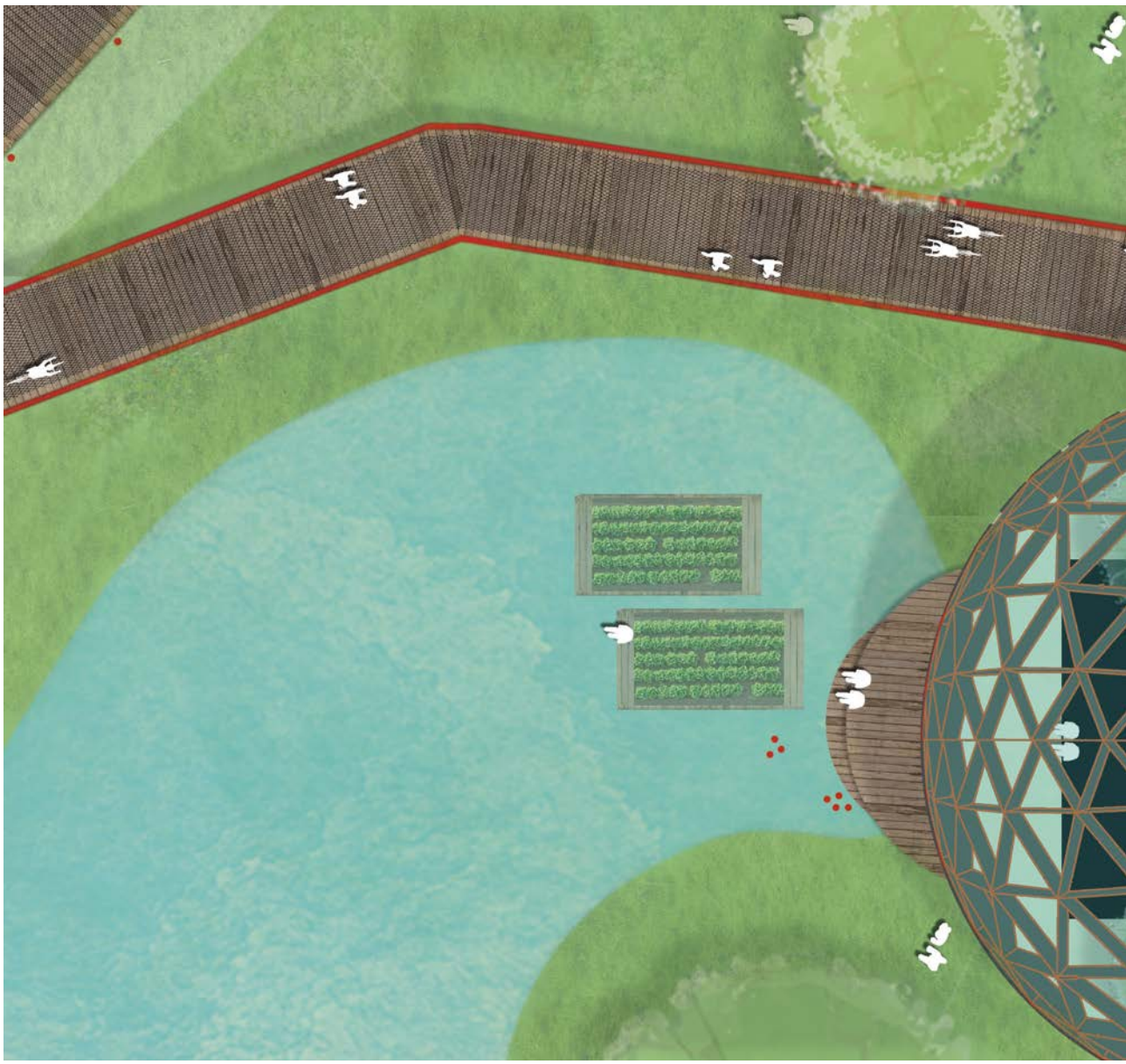
Ill. 66.d: Learning stop: Plants in water

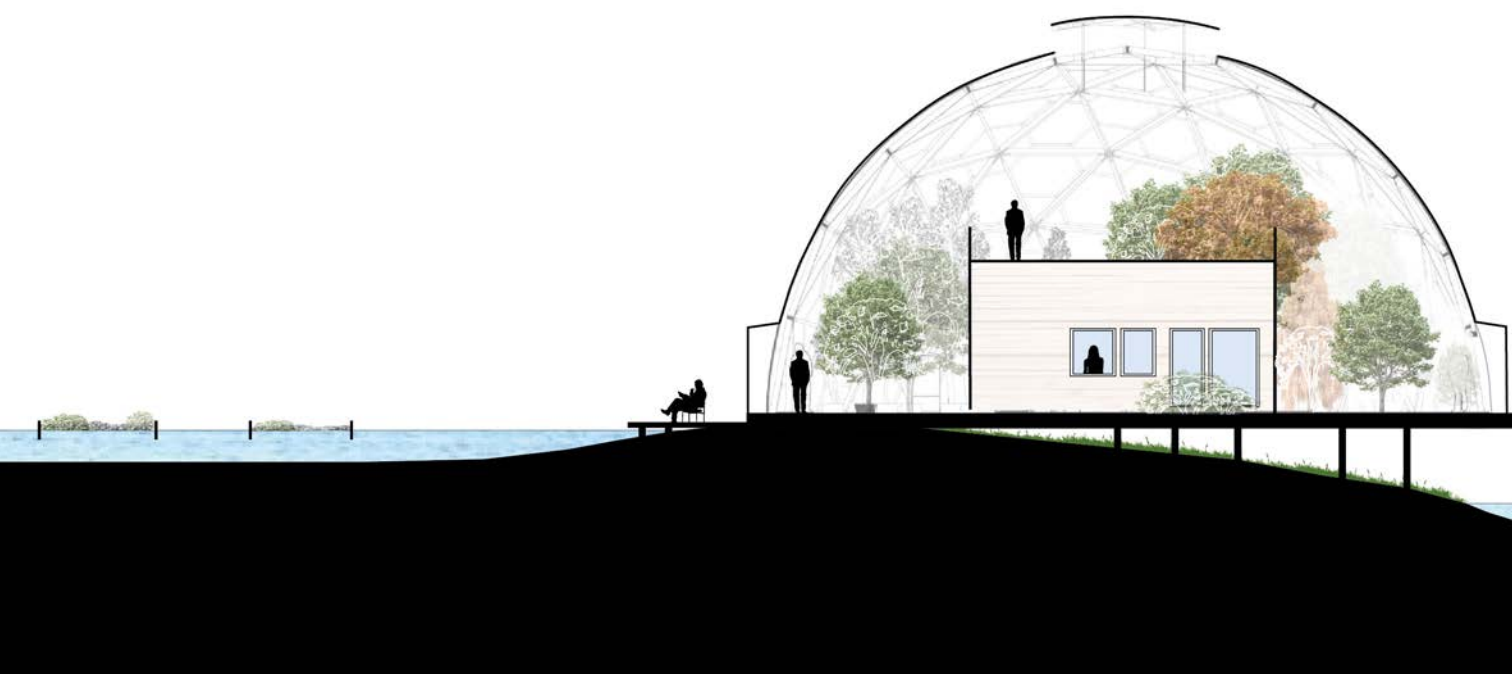
NARRATIVE OF THE LEARNING STOP

The learning path runs through the area, and along the path there are several learning stops. The stops are located in the environment, about which they are providing information. The four illustrations tell a story about the area. They show how the learning can be communicated to the citizens and set an atmosphere for how feeling and spirit can vary through the area. The illustrations are therefore not made to show the real conditions, but to give a sense of how the stops meet the landscape and how contact is created to the surroundings.

LEARNING CENTRE

Ill. 67: Visualization of the Learning Centre

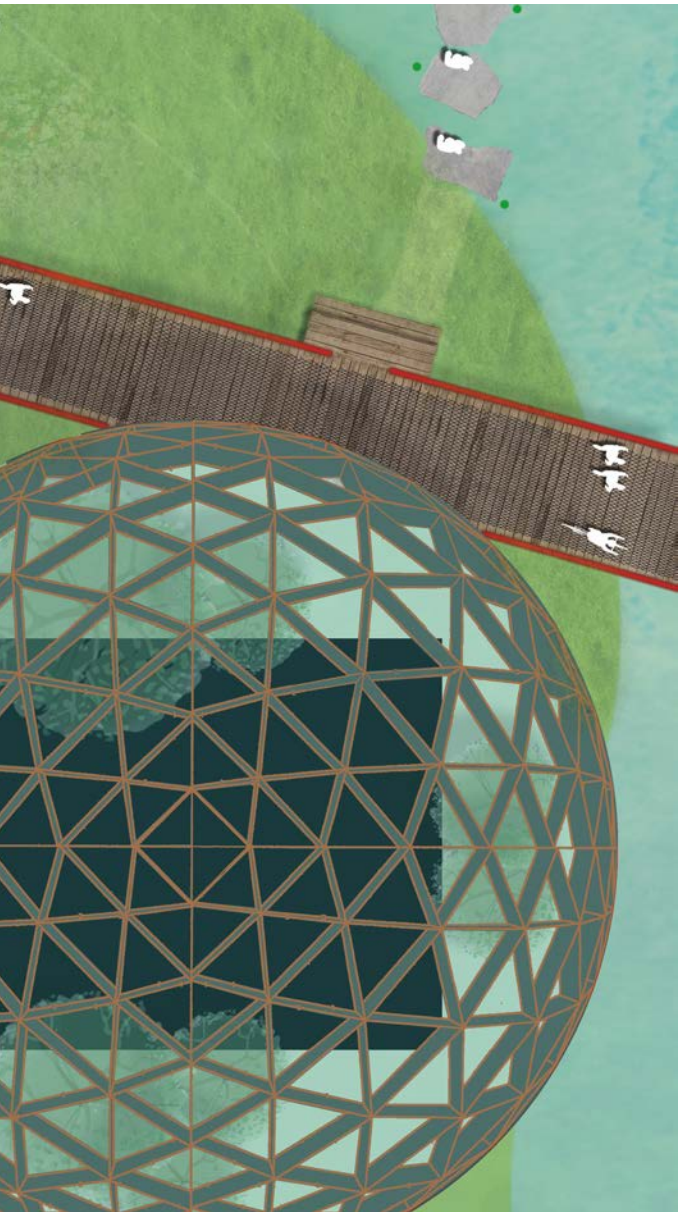




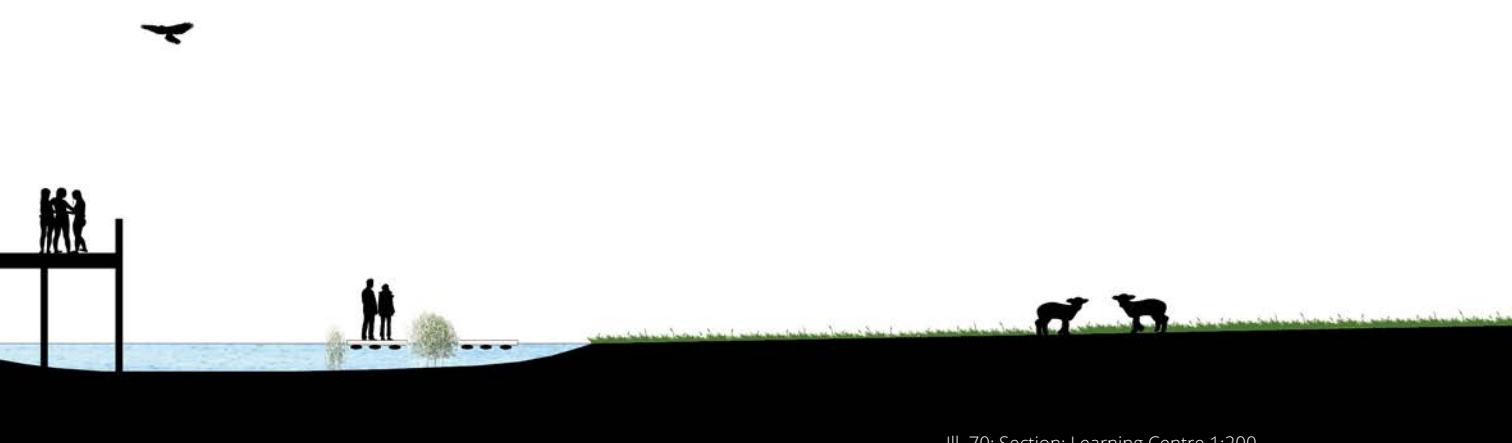
All over the site a learning path is teaching about the cycle of water and nature, but the Learning Centre has its own cycle. The Learning Centre is created as a dome, this will manipulate the natural cycles of water, plants and temperatures. This makes it possible to learn about the cycles at all times during the year.

Programmes in the Learning Centre will be classrooms, kitchen and a multi-room. The Learning Centre can be used for both learning and as an assembly house for weddings et cetera.

Ill. 68: Map indicating section and detail plan



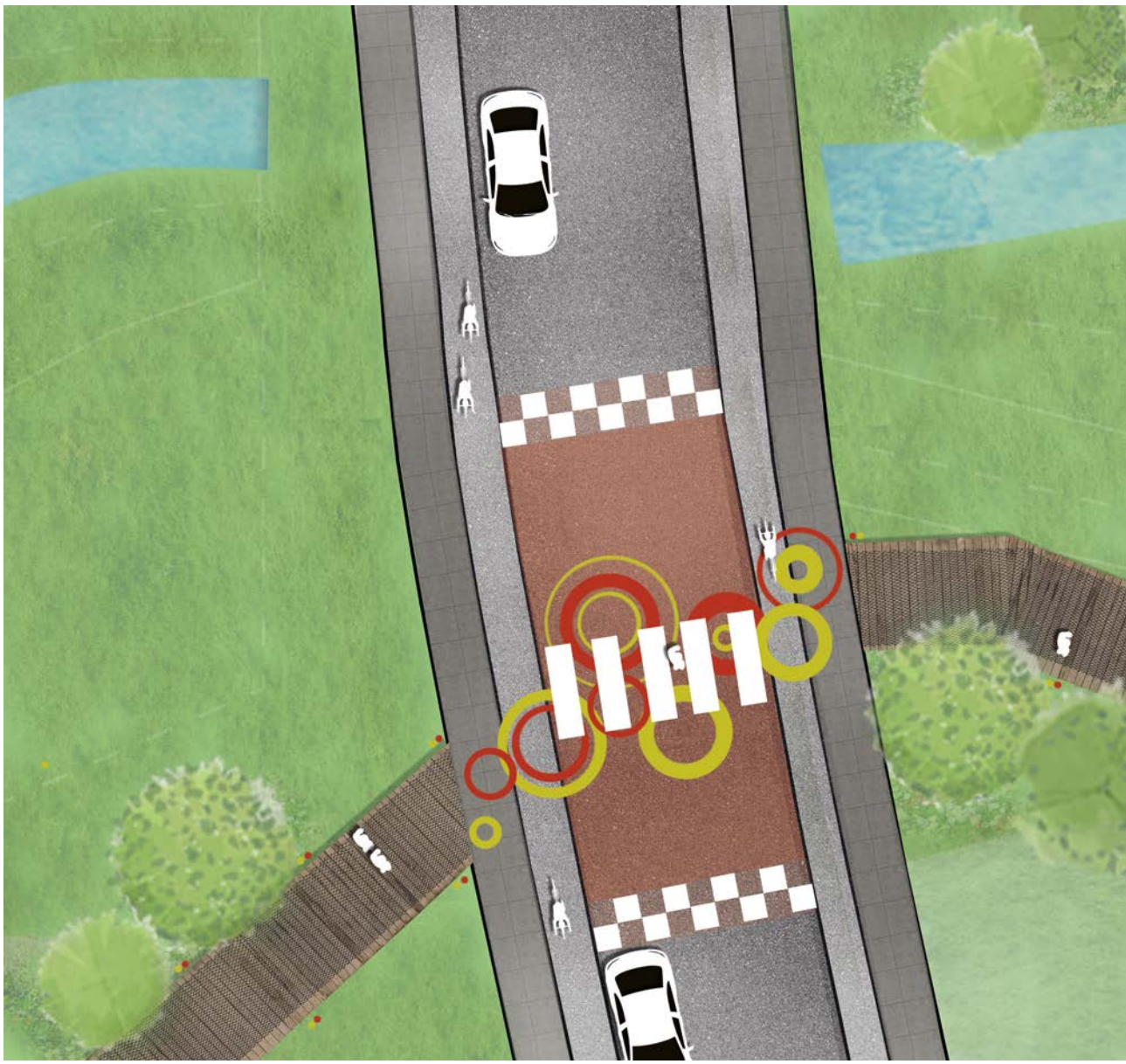
Ill. 69: Detail plan: Learning Centre 1:200

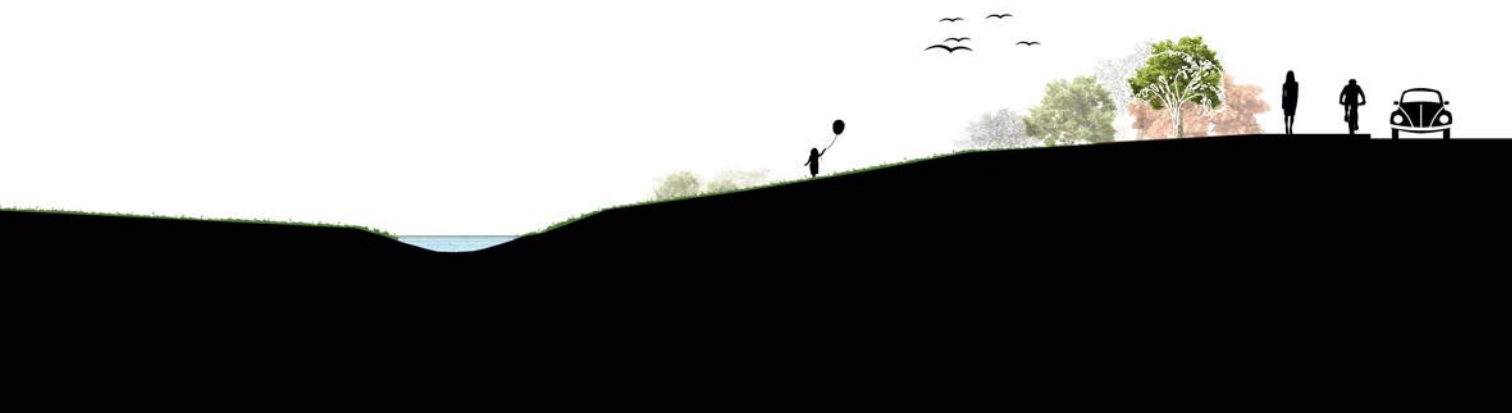


Ill. 70: Section: Learning Centre 1:200

MASTRUPVEJ

Ill. 71: Visualization of Mastrupvej


JUJI



Mastrupvej runs through the site, dividing it into two pieces, here a crossing is made to sew the two areas back together getting an easy flow from one side to the other. To link the areas together some graphical elements are painted on the road in the same colours as the paths throughout the site.

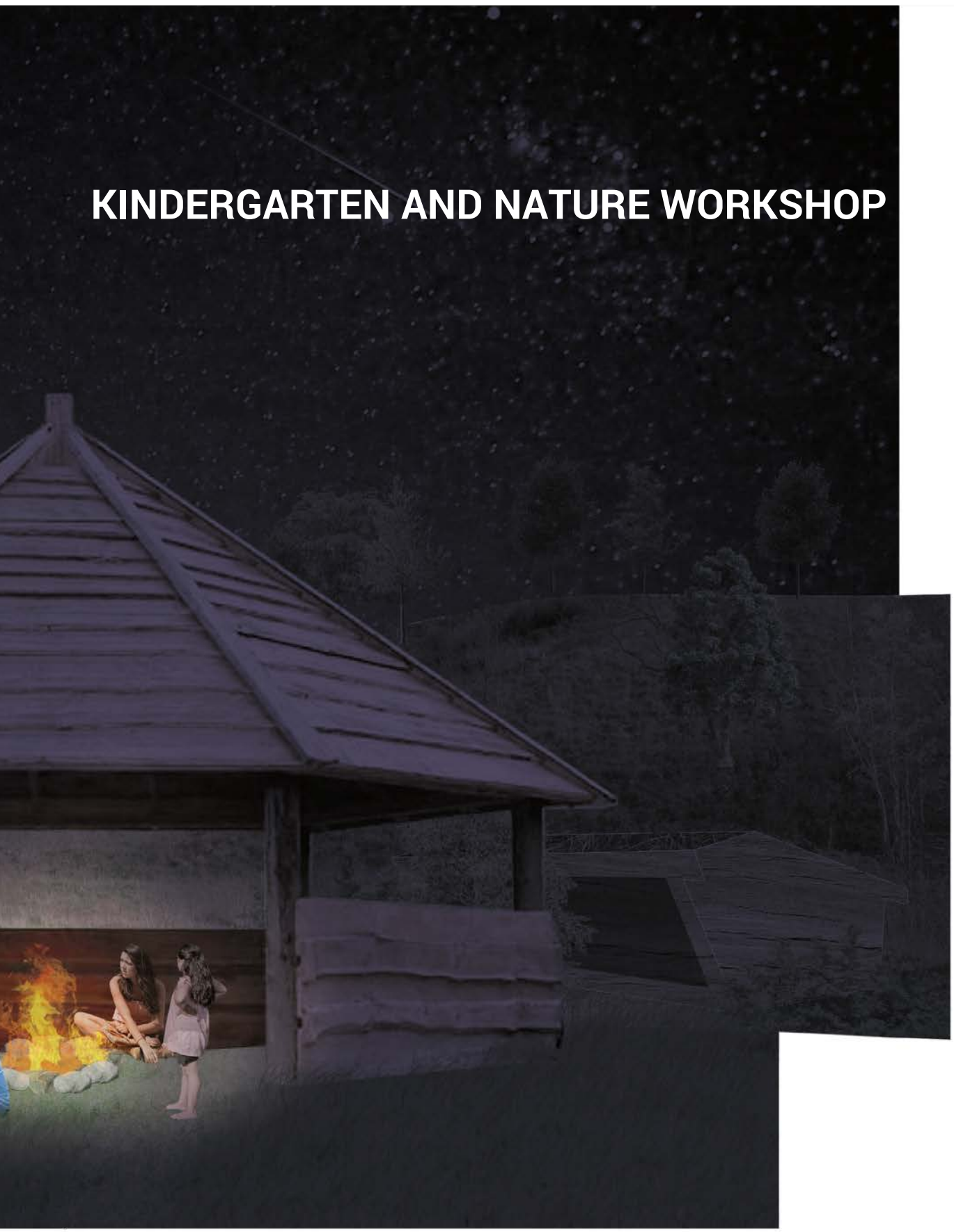
It is a space for transit, where high speed and low speed meet. Therefore, the time spent in this area is low, but nevertheless it is an important space as it is the only physical connection between the two areas.

Ill. 72: Map indicating section and detail plan

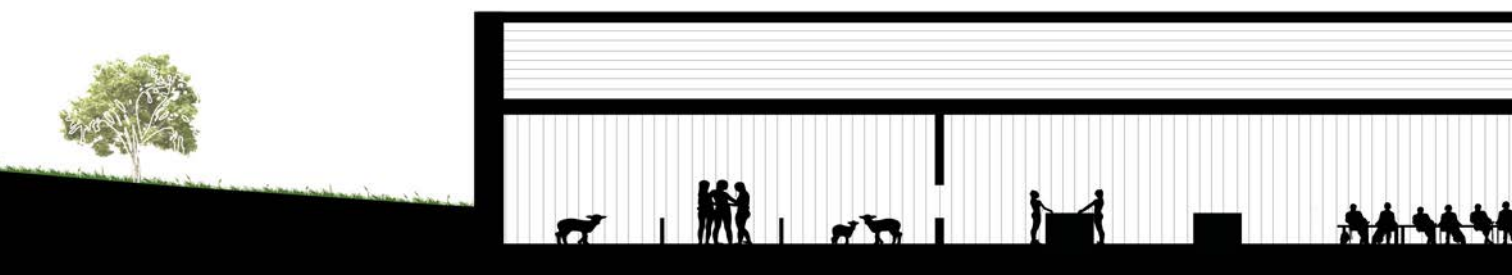
Ill. 73: Detail plan: Mastrupvej 1:200

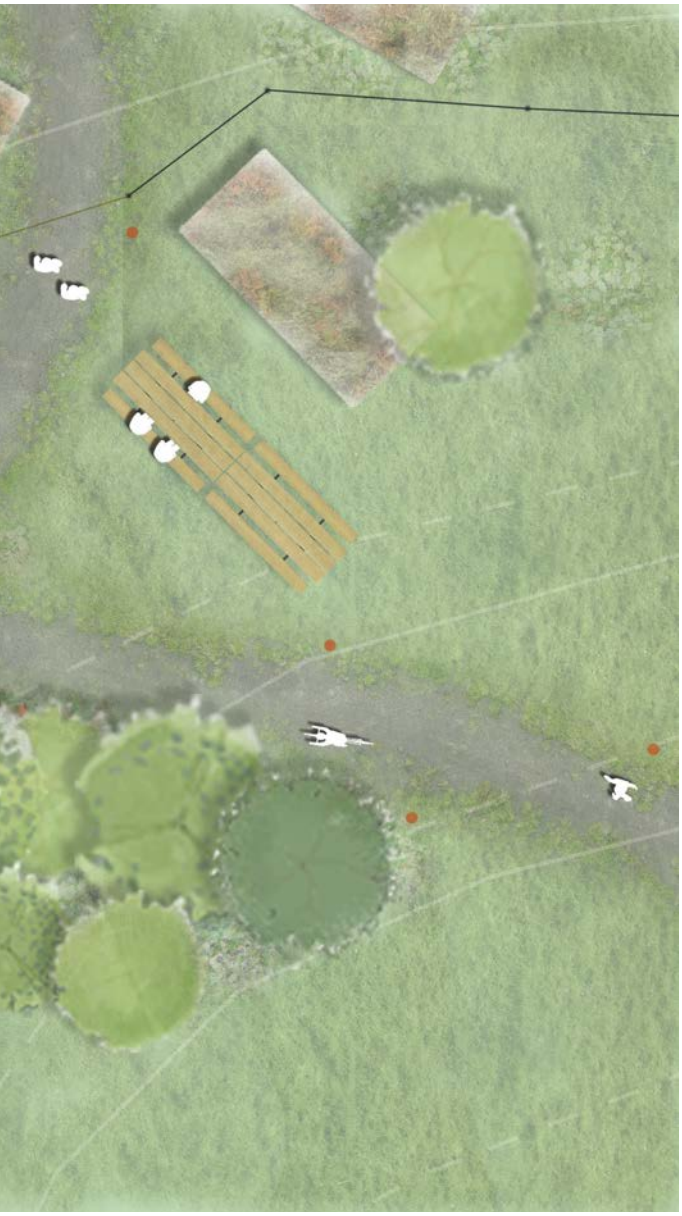
Ill. 74: Section: Mastrupvej 1:200

KINDERGARTEN AND NATURE WORKSHOP



Ill. 75: Visualization of the campfire



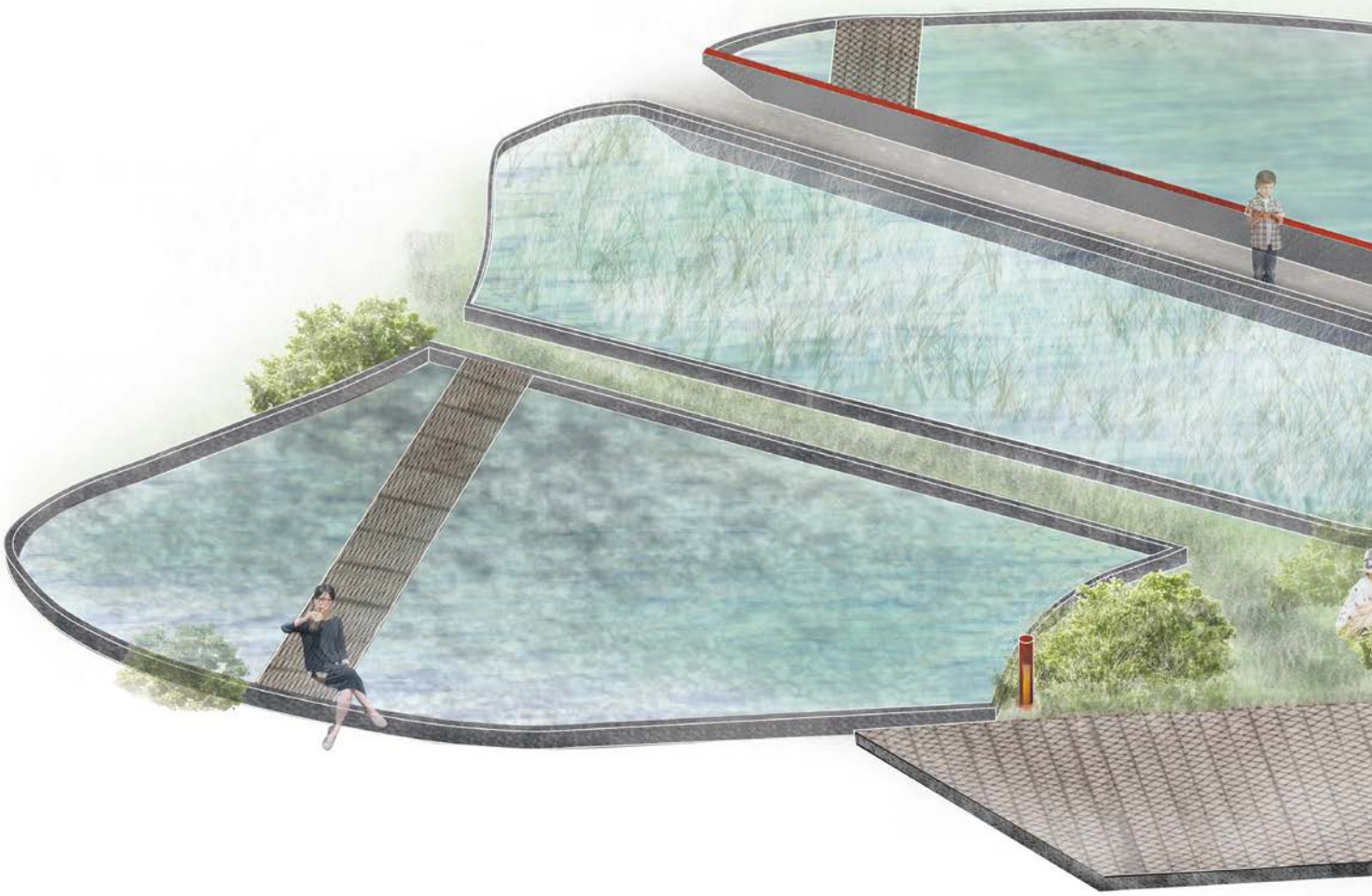


The grass is still wet from the dew. The sun has just started to come up; a new day has arrived. The sheep are starting to get up, as the day starts early in this part of the site. Children are beginning to enter the area; their happy voices fill the site with joy. Now the day can begin. The kindergarten gives the site life every day, even when other programmes are not open. The Nature Workshop is also located in this part of the site and offers workshops, nature guides, and a camp area. The area affords longer stay as the programmes are slow and allow the user to work meticulously with something. A learning stop gives information about the animals in the area and why they are good to have in a natural environment. If you wish for a longer stay in the area, this is the right place as there is a shelter and a grill area making overnight stays possible.

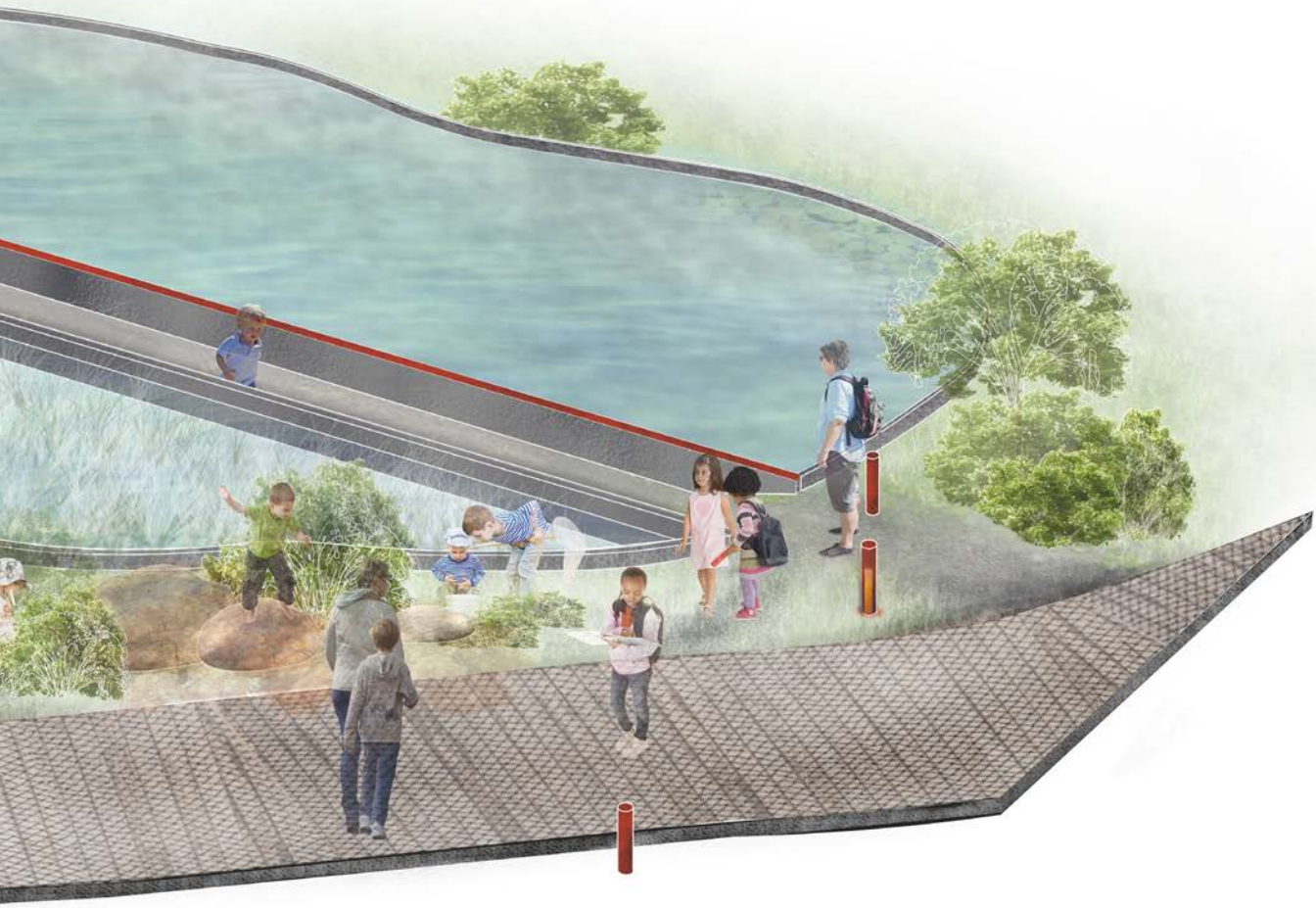
Ill. 75: Map indicating section and detail plan

Ill. 77: Detail plan: Kindergarten and the Nature Workshop 1:200

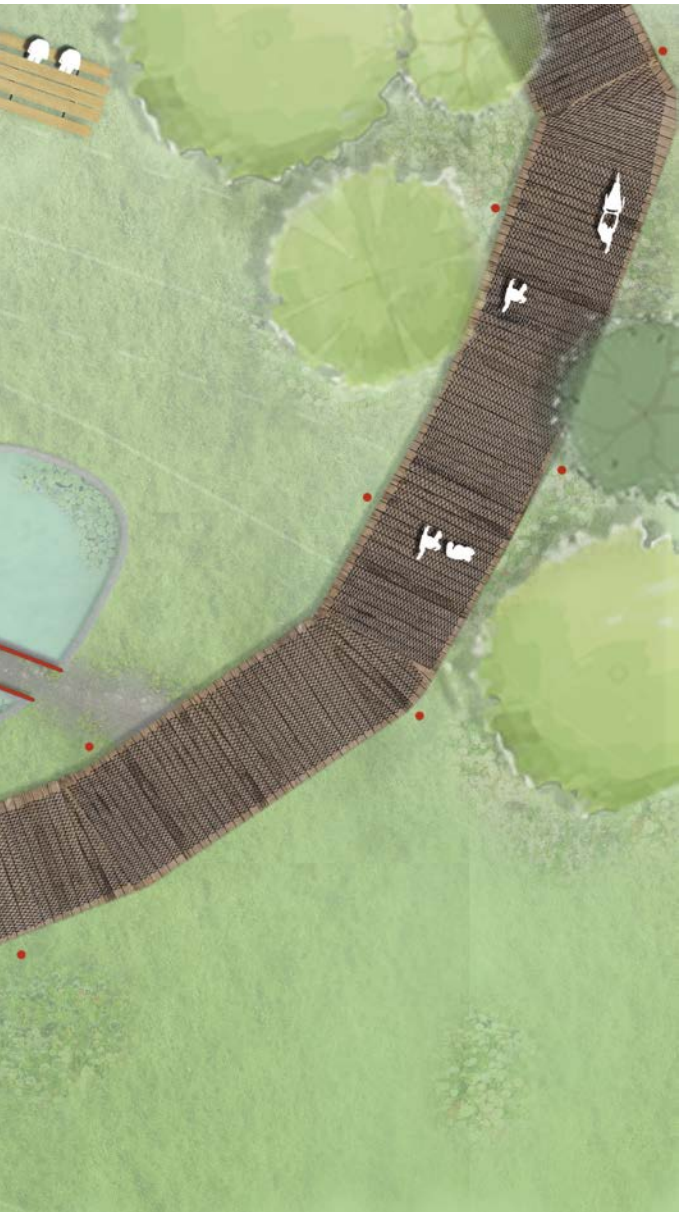
Ill. 78: Section: Nature Workshop 1:200



CLEANSING STAIRS



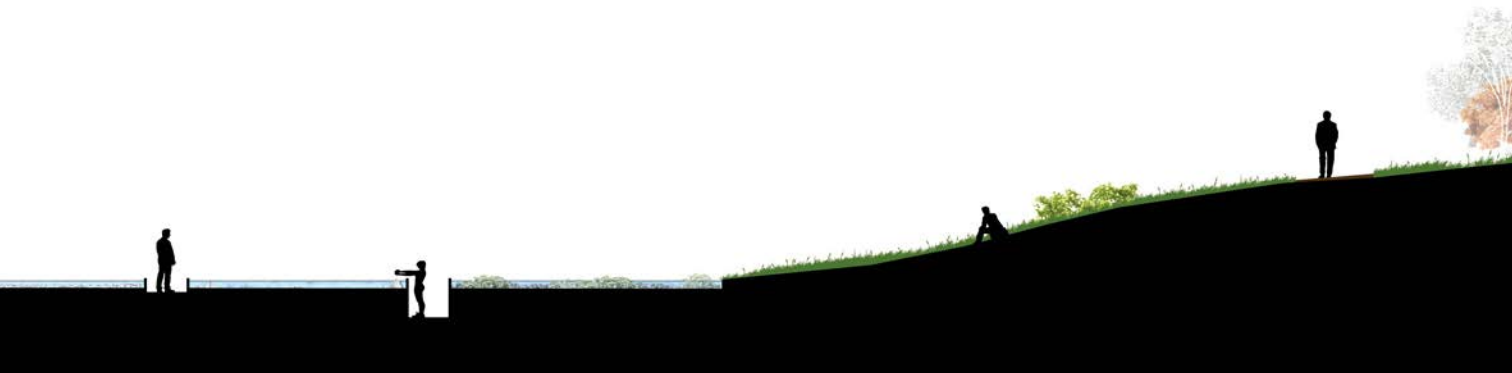
Ill. 79: Visualization of the cleansing stairs



The sound of the trickling water fills the air as you come closer to the cleansing stairs. In this area a research centre can be found, where students from the high school and Aalborg University can run tests on the water quality and test new infiltration solutions. The cleansing stairs are made in a system so that it is possible to perform analyses on a new formula on infiltration soil. Paths runs through the water so it is possible to come close to the water and take samples.

Ill. 79: Map indicating section and detail plan

Ill. 81: Detail plan: Cleansing stairs 1:200



Ill. 82: Section: Claensing stairs 1:200

REFLECTION

In this chapter the reflections on interventions and thoughts regarding the design, theories and the technical solutions of the project are described.

Ill. 83: Vegetation on site

REFLECTIONS

The project has been formed through a concept, design parameters, different theories and analyses. However, as the project is defined to be strategy-based, it therefore only contains detailing to a limited extent. The reflections are split up into reflections regarding concept and design parameters, technical considerations, and theory.

Design reflections regarding the concept and design parameters

The concept for the project binds learning and nature together and creates learnability. We have developed this concept into a design by creating a recreational area filled with nature (green and blue elements) and learning possibilities.

Four design parameters were defined in the project: learning, activities, enhancing nature and changeability. The first design parameter, learning, is the most dominant design parameter in the project as the final design is a learning cycle where a path with different learning stops covers the whole site. The site can be seen as one large open-air centre which is designed for free-choice learning. The involvement of stakeholders has been outside the scope of this Master's thesis, however, if the project was to be taken further, it should be investigated if the primary school and high school have a need for specific programmes that could be integrated on the site. It could also be investigated whether non-fit organisations would like to have a frequent use of the site, for example, some organisations might use the site for learning camps or other activities that demand specific needs that could be integrated within the design.

The second design parameter is activities. Activities in the design proposal appear as both learning and sport activities. Learning activities include catching fish in the brook, growing one's own vegetables in the aquaponic, touching different types of soil, taking tests of water in different areas, hearing different bird songs and connecting them to the right bird, et cetera. Sport activities include a 2 km running route with different additional choice obstacle courses and activities on terrain. The running path can be used for training and warm-up by teams from the nearby football fields and tennis courts as well as school classes. In a further work, it could be investigated if there is lack of some outdoor sport programmes in Støvring, and maybe incorporate them on the site. The running path could in that way bind different existing sport programmes close to the site together with new outdoor sport programmes. The site could become a catalyst for a new cooperation/community between different branches of sport. As the locals are also the future users, these could also be involved in the process of detailing the site.

The third design parameter is enhancing nature. The final design the pavilions enhance nature, for example the "soil learning stop" is surrounded by soil so that you get a feeling of being underground. All information is often given by drawing on plexiglas in order to enhance the things that should be explained. Furthermore, we are enhancing the sounds of nature, for example, you can hear bird sounds in the "bird learning stop" and hear water dripping from one basin to another on the cleansing stairs. These are only design guidelines to emphasize the expression of different pavilions. In a further work the design of the pavilions must be more detailed so that the combination of materials helps enhancing nature in in each pavilion (the feeling). Furthermore, on the strategy plan we have chosen two specific vantage points where you will have a beautiful view over the site. The design of these could in a further work be more elaborated in order to frame some particular views. Designs could for example include frames in the landscape which indicate specific views, as shown on illustration A.23.

The last design parameter is changeability. Changeability will be a part of the whole site as the site will switch between being blue and green depending on the latest rainwater events. As different plants grow best in different areas, there will be a variation in plants near the lakes, in the periodically flooded areas and in not flooded areas. This also contributes to changeability in the area. However, in a further work the blooming season could be studied more so that the vegetation on site would have different blooming seasons that define the exact season of the year and give changeability on site. Another idea from the beginning of the project was also to make multifunctional elements on the site, for example, stones that are used for seating in dry periods will now become stepping stones for children playing or secondary paths. In a further more detailed study, these could be designed and placed strategically on the site so that they also create natural places for stay in dry days.

Technical reflections regarding...

WATER MANAGEMENT

After a 5-year rainfall event, rainwater is calculated to take up most of the site. However, it should be noted

that this is the worst-case scenario as Mastrup Bæk will lead some of the rainwater away from the area. Furthermore, the 2 and 5-year situations are calculated with a safety factor on 1.58 for a 2-year rainfall event and 1.65 for a 5-year rainfall event, which is very high and the ultimate worst-case scenario. Therefore, the 5-year rainfall marked on the masterplan in most situations will probably be smaller. However, this will not affect the design ideas as there will still be a large changeability in the water zones on the site, but will only be positive for the project as the project site then can manage a larger rain event than calculated.
Furthermore, the detention basins to placed close to the bridge at Mastrupvej should be noted. This is a solution made for the bridge to be able to resist the water pressure on the side of its construction. It should be investigated if this is the case, and if the bridge is not able to resist the water pressure, the detention basins must be reshaped in the area close to Mastrupvej.

In the project, we have been also aware of the pollution on the site near Mastupvej. However, it has not been possible to get information about the cause of the pollution and the influence on the future development of the site. It should be investigated whether the rainwater is allowed to infiltrate the groundwater. If infiltration is not possible, it is suggested to place a membrane under the periodically flooded areas in the polluted area so that infiltration is hindered or to replace the soil in order to remove the pollution. However, more data is necessary before it is possible to come up with a final solution.

Another challenge in the project is the high level of groundwater. Drillings on the eastern side of the lake has shown a variation in the groundwater level from 0.5 meter to 2.2 meter under terrain. (Andreasen & Hvidberg, 2013) Because of the large amount of rainwater that should be managed on the site, reshaping of the terrain and digging will been necessary. In the lowest area on the site we have removed 0.5 meter soil, and there might therefore be a risk for being very close to the groundwater, which in the worst-case scenario means that the groundwater will make this area more or less permanently wet. If this project is taken further, the exact level of the groundwater in this area should therefore be investigated.

NATURE

The site is mostly protected by § 3 and because of this it is not allowed to make adjustments to the site or create grit chambers or similar without a dispensation from this provision. In the case of the § 3-protected lakes and marshes, it also requires a dispensation from this provision to adjust the water level and profile of the lake. Therefore, it is important for the project's realization that these permissions are retrieved. (By- og Landskabsstyrelsen, 2009)

Another subject we have been aware of is biodiversity. With reference to the section of the thesis on the biodiversity of the site (page 84), the plants for the detention ponds in the area were never chosen. This is mainly due to two things. Firstly, a major difference in biodiversity in rainwater lakes contra the clean-water lake has not been detected, this contradicts with previous beliefs that detention ponds were big poison holes. Secondly, there is no big difference between which animals and plants live in the detention ponds contra the clean-water lake. However, the plants and animals that survive in detention ponds are often the tougher ones, hence it will never be recommended to plant delicate plants. We will recommend that the plants and animals that are expected to live in the ponds should be selected from the article "Invertebrates in stormwater wet detention ponds — Sediment accumulation and bioaccumulation of heavy metals have no effect on biodiversity and community structure" (Stephansen et al., 2016), which, inter alia, holds plants and animals that live in detention ponds (in industrial, residential and highway areas) up against plants and animals that live in lakes (id est agricultural lakes, plantation lakes and forest lakes). To obtain the best result it will probably be most beneficial to cooperate with a specialist within the field of biodiversity as it is a complex system to understand in detail – A system that also has been outside the scope of this thesis.

Theoretical reflections regarding...

NATURE

When preparing to describe nature on the site we have found inspiration in Hans Fink´s conceptions of nature. The boundary between the conceptions is found to be a bit loose. We have as our point of departure used the concept of all green as being nature as this definition was closest to our understanding of the site. However, we have to adjust the definition a bit. In the definition of nature as all green stuff, Hans Fink also defines nature as plants on the roads, houseplants and even cats and aquarium fish. The reason is that these things are in contrast to non-natural elements such as cement, asphalt

and plastic gadgets. In the definition, he is not describing if blue elements (lakes, brooks, et cetera) are within the category of nature or not. We, however, understand these blue elements as nature. We also see the detention ponds on the site as nature because these are just lowered areas like the ones existing in nature. The whole hydraulic system on the site is a mimic of nature that can be found in untouched nature; we therefore understand the site as nature in this specific case. If we did not define nature as all green, but maybe chose one of Hans Fink´s other definitions such as nature is all untouched, wild or rural, then our site will be seen as artificial. In that case teaching on the site about nature including natural processes, biodiversity, et cetera, as planned in the strategy will not make sense.

If the site should not be understood as nature, the water solution could just have consisted of some technical concrete detention basins. Here, you will still be able to learn about cleansing processes, but you will not feel that you learn about natural processes, and you will not make a correlation to the environment and that water is a natural resource.

Furthermore, if the site should not mimic nature, the site will maybe not provide the citizens the same degree of well-being which, as researchers argue, can be found in nature and natural settings (Newton, 2017; University of Minnesota, 2016). This will lead to the site not increasing human quality of life in the same degree and thereby not increasing liveability in Støvring on the same level as in our thesis.

ECOLOGICAL URBANISM AND PROCESS URBANISM THINKING

The site is seen as one large ecosystem that will evolve, adapt and seek balance. We have in the design process focused on planning natural processes rather than natural features. For example, we have chosen new plants for the area on the basis of where they grow best in different areas of the site. Here, a further work could be to go into depth with how plants affect each other and which of the plants will have the best conditions for surviving as some arts outmatch others. This is something that is beyond the scope of this project and will demand cooperation with specialists. In case plants survival conditions are a subject that should be more researched in the future, it is an obvious chance for researchers to test it on the site.

We have tried to achieve solutions that will create an ecological balance. Furthermore, we have been aware of the existing ecosystem and have therefore, as an example, chosen to keep permanent water on the site to retain the existing animal life that needs water. Many sorts of plants and animals in the area can only survive because of the existence of other plants, water, animals or humans. It is a cycle of life, an ecosystem, which we have been aware of throughout the design. However, this is a very complex system that was beyond the scope of what the thesis was to treat in depth to seek deeply into. This is a design method with can be similar to the ideas of Ecological Urbanism and Process Urbanism. The architect firm SLA use Process Urbanism in their projects in order to incorporate nature from the beginning (SLA, 2017; ProcessUrbanism, 2017) However, the method itself is not that common yet. It might be because it needs a close cooperation between specialists to achieve the best result, and this may be an extra layer in the projects that will give more expensive projects. However, it might become a more common trend in the future, as more companies try to incorporate an evolution of nature in some projects, for example Rambøll makes evaluations of ecosystem services in some projects by pricing the services (including natural processes) and is aware of which services will be affected negatively and positively in their projects. (Rambøll, 2017)

LEARNING

The area is today dominated by educational institutions; therefore, it has been an important part of the project to be able to involve these in the development of the design even though it is outside the scope of the thesis to involve specific partners.

In the project we wanted to get an understanding of how to communicate learning at the site, we therefore looked at different learning theories. From the American professor Howard Gardner we got that people have different interests and intelligence forms which is the basis of people's different ways of learning. This is something that we have been aware of during the design process. In relation to David Kolb, our final design prepares the ground for two learning styles "active experimentation" and "concrete experimentation" as the planned activities on the site prepare the ground for people to make tests in real life to find out how things works.

Being able to take the teaching outside has been an important factor for this project. The site is therefore considered to be an informal learning environment, which is developed with reference to the perception of "free-

choice learning" (Dier King and Falk, 2003). According to "free- choice learning", school children and students in a given context have free rein to delve into just what interests them. Therefore, there is not a final goal to what they should learn, but a hope for increased learning.

Free-choice learning is a learning environment that can be difficult to involve in the school classes as it is a more experienced and experimental approach. In free choice learning the teachers can have difficulties with controlling what kind of learning school children/students are achieving. The site should therefore contain different learning elements for everyday- teaching in the primary school and high school. For example, the schools could introduce an app that can follow the school plan. If the theme in biology class is vegetation, the school children can, as an example, take pictures of the plants they find and upload them in the correct categories on the app. In that way the teacher can check if the school children have fulfilled the lesson or see if there have been some misunderstandings of vegetation type that should be followed up in the next lesson. Next step for this project will therefore be to involve the primary school and high school to find out what their specific needs are to be able to take the class teaching outside on the site.

LIVEABILITY

As mentioned in the theory chapter, one thing that helps making liveable cities is recreational areas. Our site will as a well-functioning recreational area therefore contribute to liveability in Støvring. However, we have aimed to create a site that contributes to even deeper liveability in Støvring. This is done by planning programmes that will increase the quality of life and the good life. Focus has primarily been on planning programmes that contribute to a healthy life and educational life and on making a local gathering point for these activities.

As the essence of liveability is people, we have been looking at some theorists that have studied humans and their behaviour in order to get an overall understanding of designing for people. Jan Gehl, Jane Jacobs and William H. Whyte have been in focus, see appendix 11.

Even though all the theorists´ studies are mainly performed in a city life context and are not necessarily connected to the term liveability, we could find some guidelines for designing the city park. From Jan Gehl´s 12 Quality Criteria we got the need for a protection against vehicular traffic. Therefore, we chose the pedestrian crossing at Mastrupvej as one needlepoint for detailing. Scale in the landscape context and scale in relation to planned buildings have also been reflected upon. Varying seasonal activities, invitations for visual contract, and aesthetic expressions of buildings, path systems, et cetera, have been considered. From Whyte's studies of the social life of small urban spaces we, for example, got an understanding of the quality, water can give an urban space (or in our project: a city park). People enjoy water by looking and feeling the water, but they also enjoy the sound and pleasure view. Water gives quiet and restful places. (Agrawal, 2017; Whyte, 1980) Therefore, in the project, focus has been on different ways to get into contact with water and the effect of sounds and pleasure views.

Jacobs works in a larger scale than Gehl and Whyte, which for example appears in her four principles that address the whole city. In her four principles, she argues for the need for mixed primary uses, varied building types, the concentration of people and frequent streets within cities. The principles are mostly city related, however, we have interpreted some of the principles in relation to the site: Variation in buildings can be interpreted as variation within the context of the city. Here, the city park is something that gives variation in the city picture. The mixed use is considered in relation to different learning groups: The site should be a place that assembles people of different ages from the kindergarten child to the high school student that receives education on the site, but it should also gather other people interested in learning, for example the adult that wants to learn to cook better and the man that wants to learn how to fish. The site will appeal to different people who learn in different ways; Therefore, both outdoor activities that help learning through physical activities to indoor activities such as lectures in the Learning Centre are planned. Moreover, the different programmes on the site have different activation times during the day as well as during the week. This creates a mix-use programme over time.

As this is a strategy project, there has not been much focus on detailing. If this project is taken further, the theorists´ work will be even more useful. For example, it would be beneficial go deeper into invitations for walking, sitting, standing, et cetera, final designing of buildings in relation to sun and shade, and designing of main areas/plaza based on previous studies of people´s behaviour.

EPILOQUE

The epilogue represents the final section of the project and includes the main conclusion and a discusion of the Master's thesis.

Ill. 84: Walking between lakes

CONCLUSION

This Master's thesis proposes a design for a rainwater management strategy in a city park and how a strategy for rainwater can be a learning centre to teach the importance of water. The strategy is not only a design for water management, the aim has also been to create a design that can tell the story of rainwater and how rainwater is a crucial resource in an urban context. The story has been told through a web of cycles for water and nature. This has created a new cycle: a cycle for the site and the users in it. Furthermore, one of the objects has been to link the site to the rest of Støvring; the site has in the project been seen as an important piece of the life of Støvring and the people in it. With focus on water and nature the site will contribute to the liveability of Støvring.

Liveability is one of the terms that had been explored through a theoretical discussion where we have been looking at how water management can make a city more liveable and how it can afford a healthier lifestyle and simultaneously follow the visions from the municipality? Liveability is always in relation to the local circumstances; how the conditions for a good life can be improved for the inhabitants. This includes physical health, but the mental health is just as crucial.

Learning is a way to keep a good mental health and through learning the story of the site's cycles can be told. To create a learning environment, the aspects of learning have been researched in the theoretical discussion. This research has provided knowledge that is useful in a design process and has led to a new way of seeing a site as an open-air learning centre. Here, childen can learn about about nature and sustainability, and it is done through a learning cycle where the children come around the site and see plants and animals in their habitat.

The theoretical basic has together with the analysis been the key for understanding the site and what the new identity of the site could be. Three scenarios were made to investigate the performance of the site in relation to the visions for the site from the Rebild Municipality and Rebild Forsyning. The chosen water strategy was a brook with periodic wetlands. The final design drew its inspiration from this strategy, but ended up adding two rainwater lakes with periodic wetlands to accommodate "the voice of the city".

The result is a diverse programme that accommodates multiple users and multifarious user groups with programmes for children in kindergarten, for students at the universities to the citizens in Støvring. The site facilitates space for cloning zones as people of different beliefs can meet in the area.

DISCUSSION

In this Master's thesis liveability is a term that has been used to describe the aim of the project. The word liveability is an open term, which often is used to describe the circumstances for people within the city. Liveability is a lot of things, ranging from safety to mobility and sustainable rainwater management (Nørgaard, 2015) Making the project liveable has been one of the goals, and to do that we have had a focus on water in cities and how this creates a better biodiversity, and, furthermore, how we can form a learning cycle out of the water management. It is important to note that this is just one way to make a city more liveable as there are many aspects in liveability. Another focus could have been to make a more including urban space where social gatherings and a diverse programme had been the tool chosen to make Støvring more liveable, but for this site and with the visions of Rebild Municipality and Rebild Forsyning, sustainable rainwater management was the way to go.

When making a project, the context of the design is important. If the context cannot handle the design, feed it with people or keep it operating, then it is not a useful design for the context. A design's influence on the context also varies according to the context. Støvring is a small city in a small municipality as regards number of citizens, hence a design proposal like the one present in this Master's thesis will have a huge influence on the image of the city, if not on the entire municipality as there is nothing like it for miles. If the same design was placed in Copenhagen, the influence of the design on the context may not be as big as in Støvring, as Copenhagen already has a lot of other well-known programmes. If the site becomes a brand or an image for the municipality, it can help put Rebild Municipality on the map, and if Støvring is made more liveable, it can play a role in attracting more residents to Støvring and the municipality (Veenhoven, 2014). When looking at the context around the site, there is a primary school and a high school. These programmes have been a substantial part of developing the concept for the design, as it is here many of the users are to be found. With this project, we have tried to make a realistic design strategy with some bits of dreaming to open up for how a site for water management can be shaped. Some parts of the design, such as the learning centre dome, may not be realistic in the term of the cost of construction contra the number of users in the area, but it could also be one of the things that would make people come to the site all year. The design of the learning dome and the individual learning stops are something that could be elaborated in more detail to take this project from a strategy project to a detail project.

We have had focus on water and the handling of this on the site, as well as on how to include water management in the development of a learning cycle that teaches about rainwater and biodiversity. The design of this has been on a strategical level and with the goal to make an area that looks "natural", but could it have been done more urbanely? Another focus could have been to make a design installation in Støvring, using the design to teach about water. It could be an installation that shows how rainwater can be managed through infiltration, evaporation and the sewerage system and what impact the different methods have on the city and the environment or how rain clouds are formed in the sky. This would take "nature" out of its environment and make it more like an art installation, showcasing the art of nature, manmade. However, is the design we have made any different? The site wants to tell the story of nature and that we need to take care of it by making an artificial wetland that makes better habitats for animal life, a process that would take nature 100+ years to do. Our Master's thesis proposes a water management strategy that teaches the next generation about water, the environment and the importance of it, so they know how to take better care of it in the future.

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ILLUSTRATIONS

Ill. 1-3: Own photos

Ill. 4: Own illustration based on maps from Krak.dk

Ill. 5: Own illustration made on basis of Slow Down, 2016, Student report, Aalborg University

Ill. 6: Own Photo

Ill: 7: www.stoevringlokalarkiv.dk/imagedisplay.asp?lan=da&gal=4&id=172&title=3

Ill. 8: Own illustration

Ill. 9-10: Own illustration

Ill. 11-13: drift.kortinfo.net/Map.aspx?Site=Rebild&Page=Kortopslag

Ill. 14: Own illustration

Ill. 15-18: Own illustration based on dato from arealinformation. miljoeportal.dk/distribution/

Ill. 19: Own Photo

Ill. 20-21: Own illustration based on material from Rebild Vand

Ill. 22-24: Own illustration

Ill. 25: Own photos

Ill. 26: Own illustration

Ill. 27: Own illustration and own photos

Ill. 28: Own illustration

Ill. 29-32: Own sketches

Ill. 33-34: Own photos

Ill. 35: fundersandfounders.com/9-types-of-intelligence

Ill. 36-37: Own Photos

Ill. 38: www.klimatilpasning.dk/media/1069182/soenaes_1.jpg

Ill. 39: Own photo

Ill. 40: www.xn--8ser-hra.dk/uploads/1/2/3/1/12310014/5476312_orig.jpg mgarkitekter.dk/media/articles/src/article62_image15.jpg mgarkitekter.dk/media/articles/src/article62_image3.jpg www.visitviborg.dk/soenaes-gdk1074133
And own pictures

Ill. 41: Own Photo

Ill. 42-44: Own illustration

Ill. 45: Own photo

Ill. 46: Own illustration made on basis of material from Rebild Vand and Niras, 2015. Grundlag for udarbejdelse af Masterplan for regnvandshåntering. Støvring By [PDF]. Project no. 215311. Document no. 129488839. Material delivered by Rebild Vand.

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Ill. 48: Own illustration made out from maps from kortforsyningen.dk

Ill. 49: upload.wikimedia.org/wikipedia/commons/thumb/5/5c/Stepping_stones.jpg/1200px-Stepping_stones.jpg
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Ill. 50: Own illustration

Ill. 51: brynshoej.dk/wp-content/uploads/2015/11/HJ9.jpg
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Ill. 52: Own illustration

Ill. 53: Own illustration

Ill. 54: Own photo

Ill. 55-62:Own illustration

Ill. 63: gobotany.newenglandwild.org/species/sambucus/nigra/
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Ill. 64-82: Own illustration

Ill. 83-84: Own photo

APPENDIX CONTENT

APPENDIX

The appendix comprises information that must be interpreted as supportive.
The booklet can still be read and understood without it, however, it helps to have a notion of how the project has been crafted, as well as the reflections that have been undertaken in the process.
It also includes analyses and the design process for a better understanding of the entire development of the project.

Ill. A.1: Children in the snow

1. SCHEDULE

Week	Monday	Tuesday	Wednesday	Thursday	Friday	Weekend	Phase
5			Semester intro Supervision				Analysis
6	Site visit			Meeting with Rebild Forsyning and Rambøll. Site visit with supervisor			
7			Supervision				Theory
8	Review of the analysis						
9	Discussion of introduction and theory						Strategy
10	Meeting with Rebild Forsyning	Pin-Up I Supervision Techical supervision	Study trip, sØnæs Østerådalen	Design scenario	Design scenario		
11		Status meeting with Rebild Forsyning and Rambøll		Discussion of report			
12				Meeting with Rebild Municipality			
13			Supervision	Meeting with Assistant Professor Diana Stephansen			Design
14		Site visit	Supervision				
15							
16		Technical supervision		Pin-Up II	Supervision		
17	Technical supervision				Discussion of report		
18	Supervision				Technical supervision		Presentation
19		Supervision					
20		Print of Report		Submission			

Please note that the indicated phases are not as divided as seen on the schedule. The division on the schedule indicates where the main work load of the phases have been. If the project found it necessary, there has been added to a completed phase.

2. DECLAMATION

The focus of this project is to find the optimal solution for a statically water management design for the area around Mastrup Søerne and to make a learning centre the focus of which is to teach about rainwater and the possibilities in rainwater. Rebild Municipality has made a water strategy plan for Mastrup Søerne. The plan argues that the lakes and brook should be divided into two separated flows. This should be done to give a better environment for sea trout in the brook as the lakes and fish stairs in Mastrup Bæk have a negative impact on fish passage.

Rebild Forsyning is not convinced that this will be the best solution. They wish to use the lakes for detention ponds in case of heavy rain fall events in the future. With the brook and lakes separated, Rebild Forsyning is afraid that the lakes will become stagnant which will turn the lakes into overgrown wetlands.

Rebild Forsyning proposes an alternative plan for the area. They propose that the lakes are dried out, and the brook will be taken back to a more natural flow, but the area around the brook is to be constructed so that it occasionally can be overflooded by rainwater in case of a heavy rain fall event.

This project will highlight opportunities and consequences when choosing one of the flowing solutions. With the project, we want to give Rebild Municipality a better basis for decisionmaking, and we want to make a design proposal for the strategy that we find to be the best strategy for this Master's thesis. We have found three proposals for the water strategy plan:

1. Keep it as it is now, with some changes in the water management.
2. Divide the brook and lakes in to two separated flows.
3. Drain the lakes and bring the brook back to a more natural flow.

To find out what opportunities and consequences each strategy gives, they will be evaluated on the flowing parameters:

- Water management
- Recreational functions for the users
- The design parameters defined on page 56

When the right strategy is found, we will make some needle points showing how a concept for the area could be designed. This Master's thesis will give a water management strategy for Mastrup Søerne together with an overall design strategy for the site.

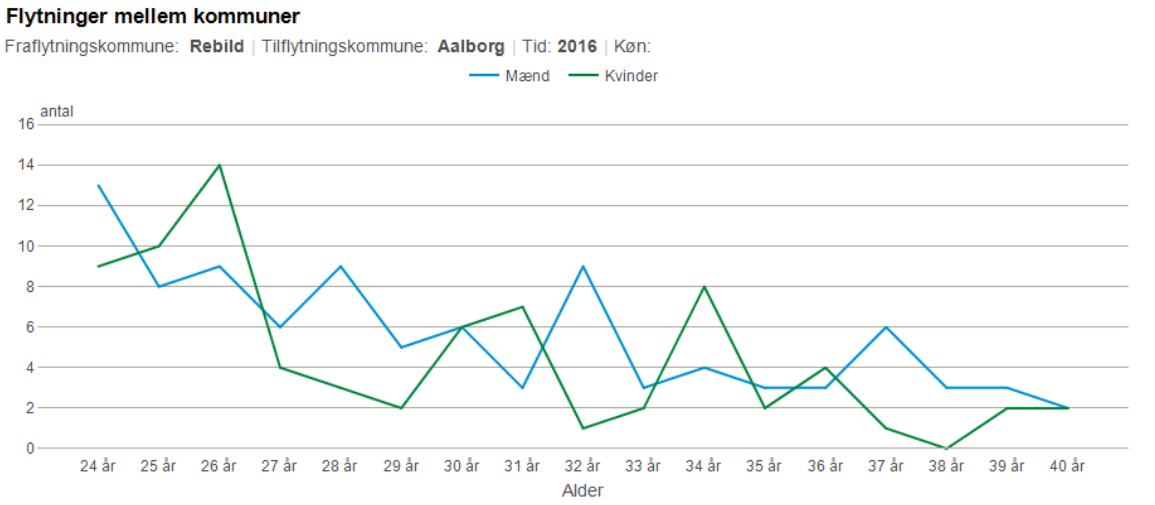
The thesis will not be a full design proposal with a solution for the entire area. It will have a high scope at strategy level, here to find how a concept can be integrated in an area with one of the three water strategy plans. The project will be concentrated around the lakes, and it is for this area the design proposal will be made. The project is to be seen as a visual district plan for the area around Mastrup Søerne.

When making a project, it is important to have public involvement in the process. This can be a part of selling the project to the inhabitants in the area, but also to hear how the area is used and what they need. However, this process takes a long time, so to have some interaction with the public we work together with Rebild Forsyning and Rebild Municipality, and make two small interviews with locals on the site. The direct public involvement with focus groups and public meetings is not a part of the Master's theses as it takes too long time if done right.

Plants and nature are a big part of the project's design as we want to make a learning centre in which BIG (Blue green infrastructure) plays a significant role. To make sure that the plants in the new design do not outmatch each other, we need to study which plants work together. This, however, can easily become a study in itself, so in order to make a project about water management in Støvring and not the biology of plants, we will not go deeper into this.

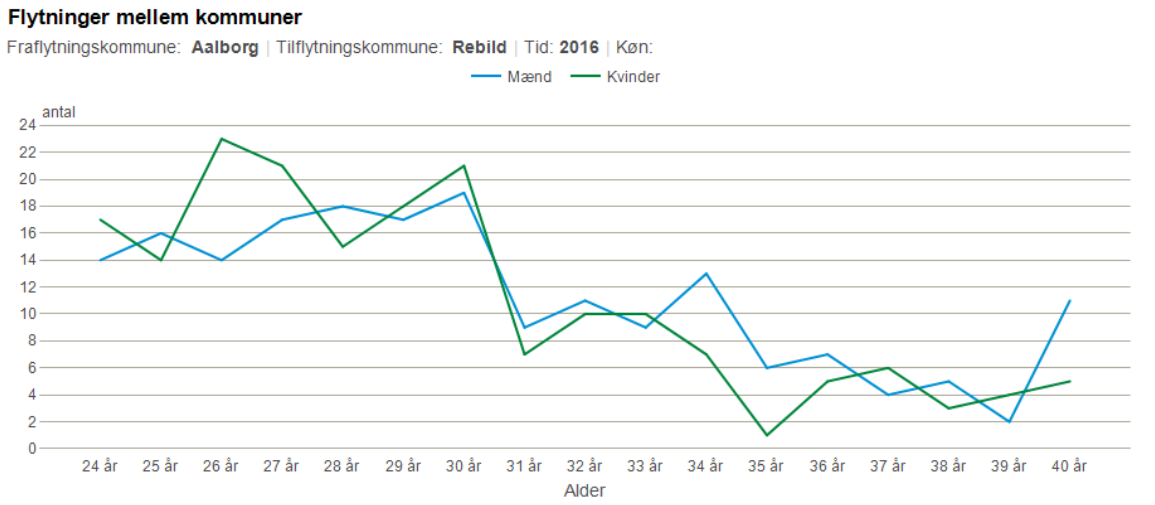
Project economy is equally important to the project. As this project is a cooperation between Rebild Municipality and Rebild Forsyning, the final project cost will be split between the two partners. However, we do not want to be limited by a budget in this project, and as Rebild Forsyning also has expressed a wish for us to dream and think big, economy and budget calculation is not a part of the project.

3. MOVING BETWEEN MUNICIPALITIES



Kilde: Danmarks Statistik

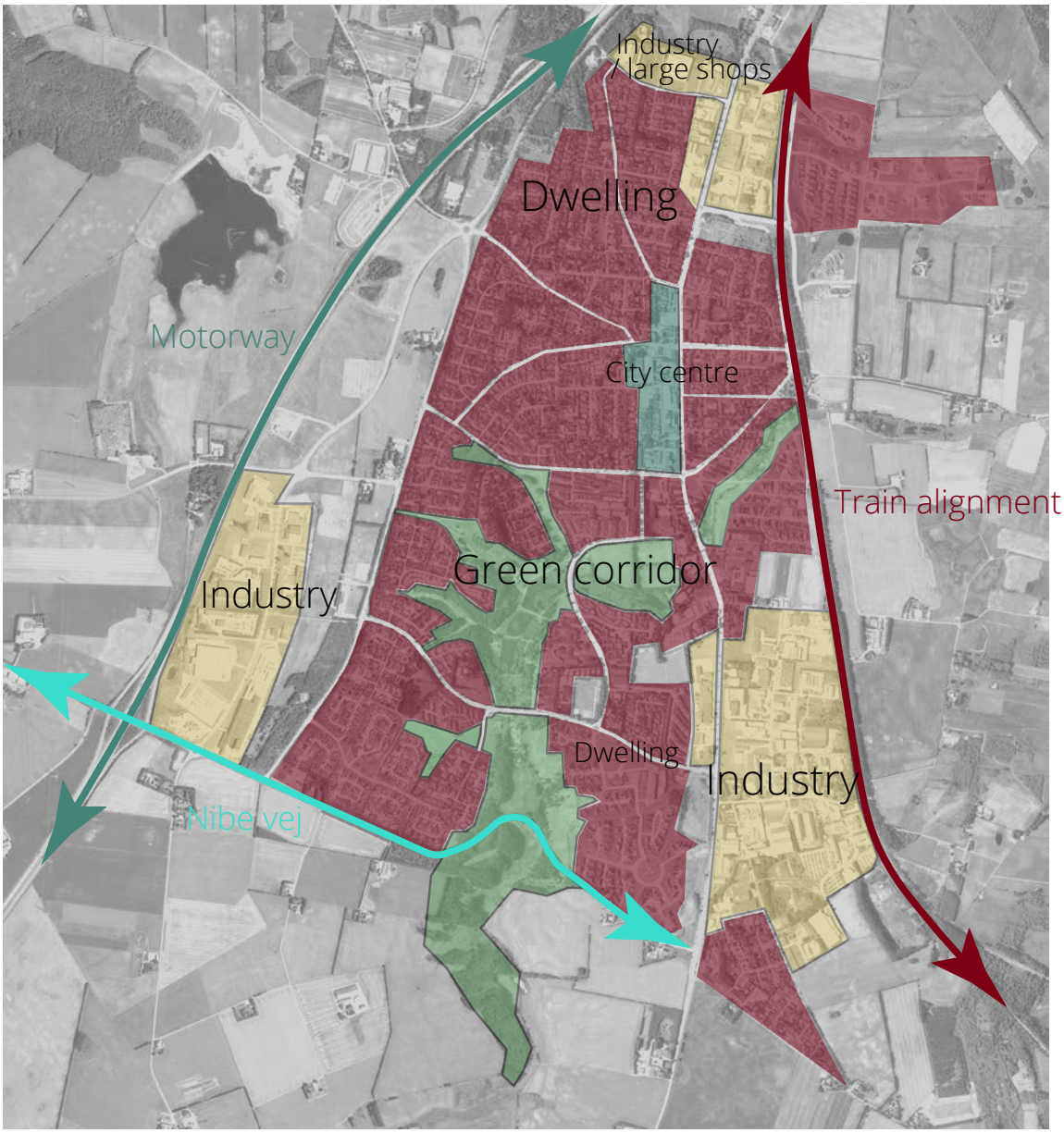
Ill. A.2.a



Kilde: Danmarks Statistik

Ill. A.2.b

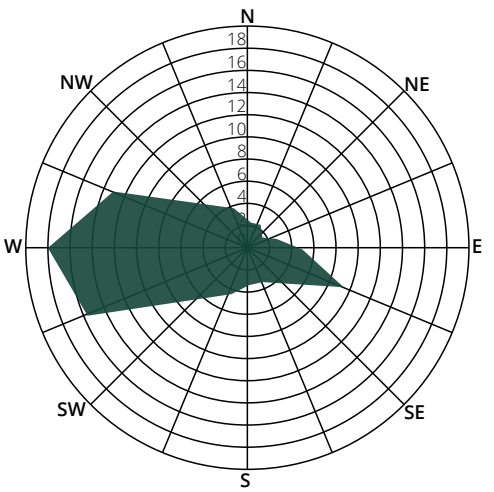
4. DISTRICT MAP



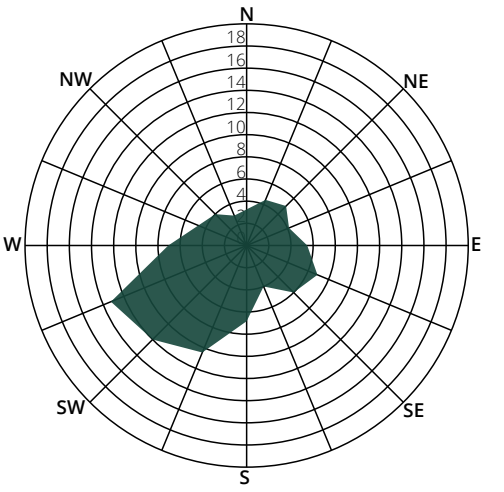
Ill. A.3: District map

5. WIND ROSES

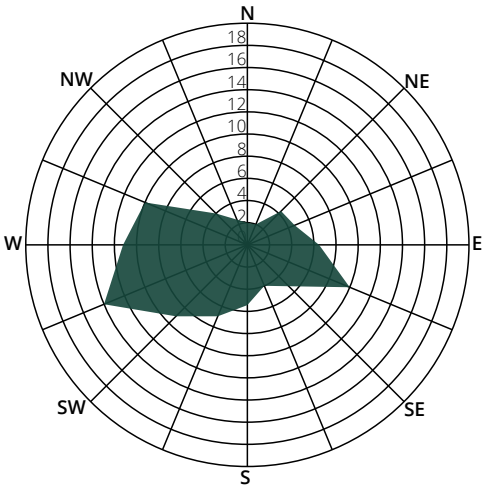
Summer [June]



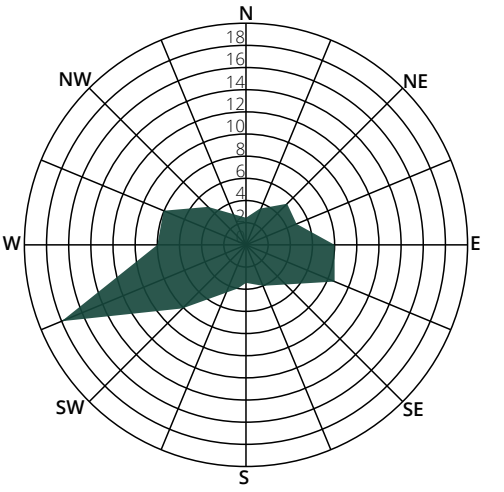
Winter [December]



Fall [September]



Spring [March]



Ill. A.4: Wind rose

6. BACK WATERING

Ill. A.5

7. FLOODED AREAS

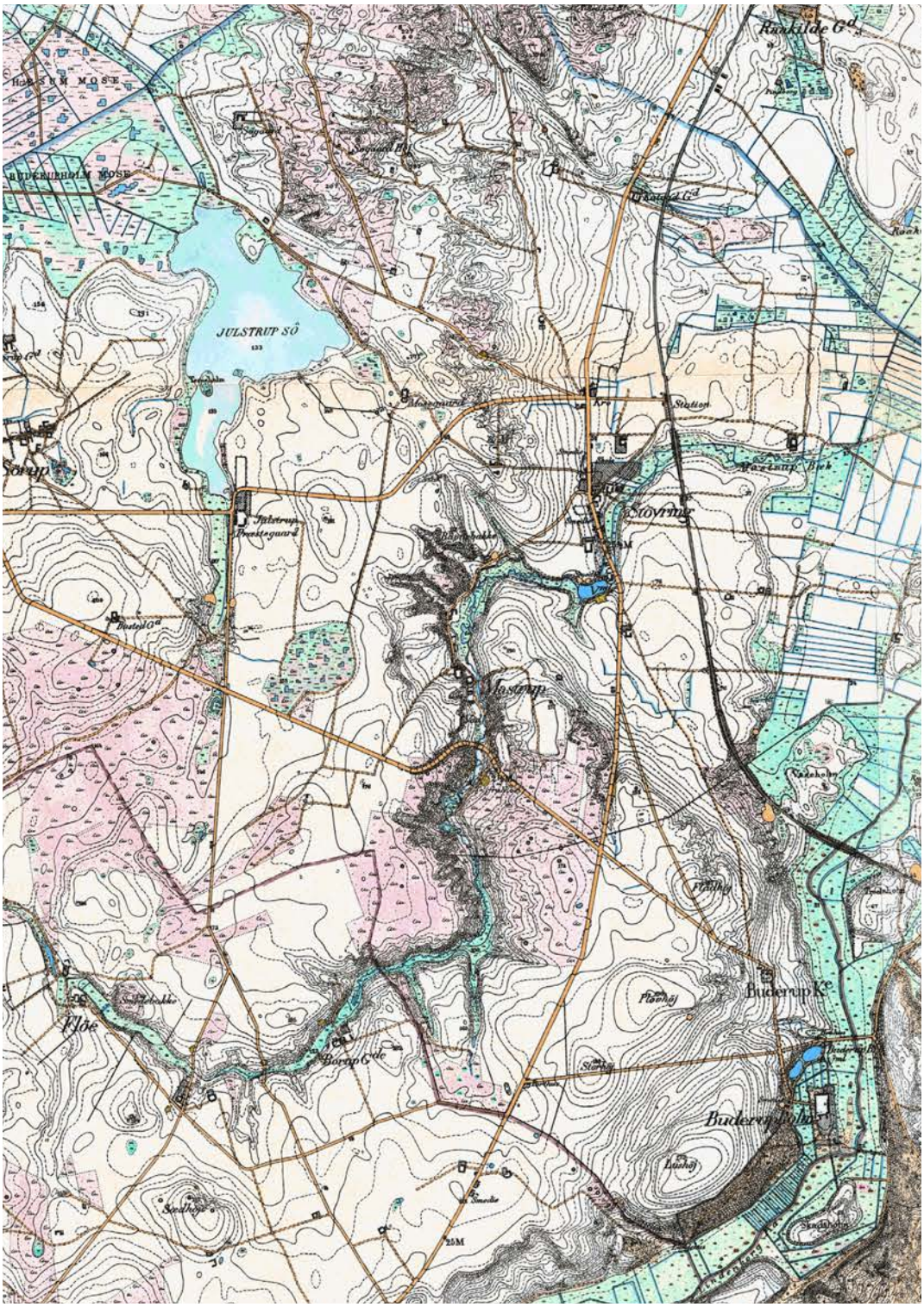
Flooded areas after a 5-year rainfall

Ill. A.6.a

Flooded areas after a 100-year rainfall

Ill. A.6.b

8. HISTORICAL MAP



Ill. A.7

9. CASE STUDIES: LEARNING

The school reform

The School reform will affect students' school days in three different ways (dr.dk, 2014):

Longer school days
- 0. -3. Class gets 30 hours a week including the offer of two hours of homework.
- 4. -6. Class gets 33 hours per week including offering three hours of homework.
- 7. -9. Class gets 35 hours per week including offering two hours of homework.

One hour corresponds here to 60 minutes and the number of periods per school week should be seen as an average. In practice, there may be fewer hours in some weeks and more in others.

All students get
- English from the first class.
- On average, 45-minutes daily exercise and movement.
- More hours of Danish and mathematics.
- German or French from the fifth grade.

The goal is for students in the 8th grade to have the same knowledge as students today have in the 9th grade.

New subjects
- Crafts (håndværk) and design replaces wood-work (sløjd) and arts and crafts/handicrafts (håndarbejde).
- Home economics (madkundskab), a course focusing on food and health, replaces home economics (hjemkundskab).

There will be more new elective courses from the 7th grade, for example a third language.

The longer school day provides both advantages and disadvantages. According to an interview from TV2 by Rikke Watson Madsen, vice president of the student council at Vibeskolen in Ullerslev, Funen, the good thing about the longer school days is that they get more out of the school day compared to before. School days with lots of variation were one of the intentions of the new school reform, and Rikke Watson Madsen can feel the positive effects of it. (Thiis, E., 2015)

"There is much more diversity during the day compared to before. Now we have small amounts of different subjects during the day instead of much of the same [...] it is many hours for us. There are many who cannot handle it. Compared to before, when we had fewer hours, it becomes very stressful now. [...] Many quickly become unfocused and stressed. Some cannot keep up. "

Rikke Watson Madsen (own translation, Thiis, E., 2015)

World Class School in 100 Days

TV2 series " – World Class School in 100 Days" is a project about making schools better and help students. The experimental object was Gauerslund Skole at Vejle. The documentary is divided into eight parts and started Thursday, 4 September 2008. The documentary is based on changing the problem that every fifth student leaving school has not learned what he/she should. In the series, you followed the public primary school's struggle to become among the world's best. The school must, for example, try out different learning styles. Learning styles are based on whether the individual student learns best by seeing, hearing, touching or doing. The experiment ended successfully, evaluates Hans Henrik Knoop (Research Director, Universe Research Lab and Associate Professor at the School of Education, University of Aarhus) who examined the school both before and after the experiment began. In 100 days, Gauerslund Skole moved over 1000 seats and came in the top 100 Danish academically best-performing schools. The school added 20% to the students' grades and is now clearly in the top 100 on a global basis. (TV2, 2008) (TV2 PLAY, 2008)

HEAR, DO OR TOUCH
In the TV2 series World Class School in 100 Days, one of the most essential tools has been testing the children to find out through which sense each student learns best. All people learn in different ways, the most learn best by seeing. They thrive on the traditional blackboard teaching as practiced in many places in schools. Others understand and remember better what they are told or hear. Therefore, it was important to find out how students learn best. Do-touch-kids are often left behind in Danish schools, because their specific learning style is not taken into account. In Gauerslund Skole 53% of the students are do-children or touch-children. Touch-children need to have the material in their hands. They need to touch it to learn. Do-children should preferably move and use the body while they acquire new knowledge. (TV2, 2008) (TV2 PLAY, 2008)

"Learning Styles is no miracle cure. It's a great tool that can help to increase teachers' understanding of students' best way to learn. Do-touch- children are typically a bit of trouble in the traditional teaching. They can easily become restless and unfocused. Learning styles can give especially do -touch-children small breakthroughs that makes them want to learn more."

Svend Erik Schmidt (own translation, TV2, 2008)

10. CASE STUDIES: ØSTERÅDALEN

Østerådalen is located 3 km from the centre of Aalborg and is divided into a northern and southern path. The northern path is about 100 hectares and consists of preserved nature, which is owned by the municipality of Aalborg. The river valley is an example of a restoration, even if the starting point is a species-poor farmland. (Aalborg Kommune, 2016)

Østerådalstien, which is a combined biking and pedestrian path from Aalborg Centrum to Dall Møllevej in Svenstrup. Østerådalstien coinsides with Hærvejen - a national and international biking route. Østerådalstien in the North is about 2 km, in addition, there are three marked hiking routes. Under normal weather conditions, most of the area's roads and trails can be used by wheelchair users. (Aalborg Kommune, 2016)

- Yellow route: "Østerådalen rundt": The journey is 4.1 km.
- Blue route: "Indkilderuten": The journey is at 1 km.
- Red route: "Fugleruten": The journey is almost 2 km.

In the middle of the area there is an info house. It is possible to book the info house as a base for larger events such as running events. Schools, kindergartens, institutions and bigger groups that wish to visit the site can book an appointment. Also, nature wagons can be borrowed with equipment for field investigations on their own, primarily for schools and kindergartens.

At the info house, a poster exhibition is placed to provide inspiration for trips in Østerådalen. The area also contains a health track. The trail starts and ends at the info house poster exhibition. Here posters with maps, directions and tables about fitness are placed. The trail is 2.3 km and marked with red arrows on black poles. (Aalborg Kommune, 2016)
In the area, there are several lookout towers where there is the possibility of looking/observing bird life in the area. Additionally, the red route leads to a bird hide and bird tower.

Ill. A.8: View from the observation tower: Lake

Ill. A.9: View from the observation tower: Running route

Ill. A.10: Aerial photograph

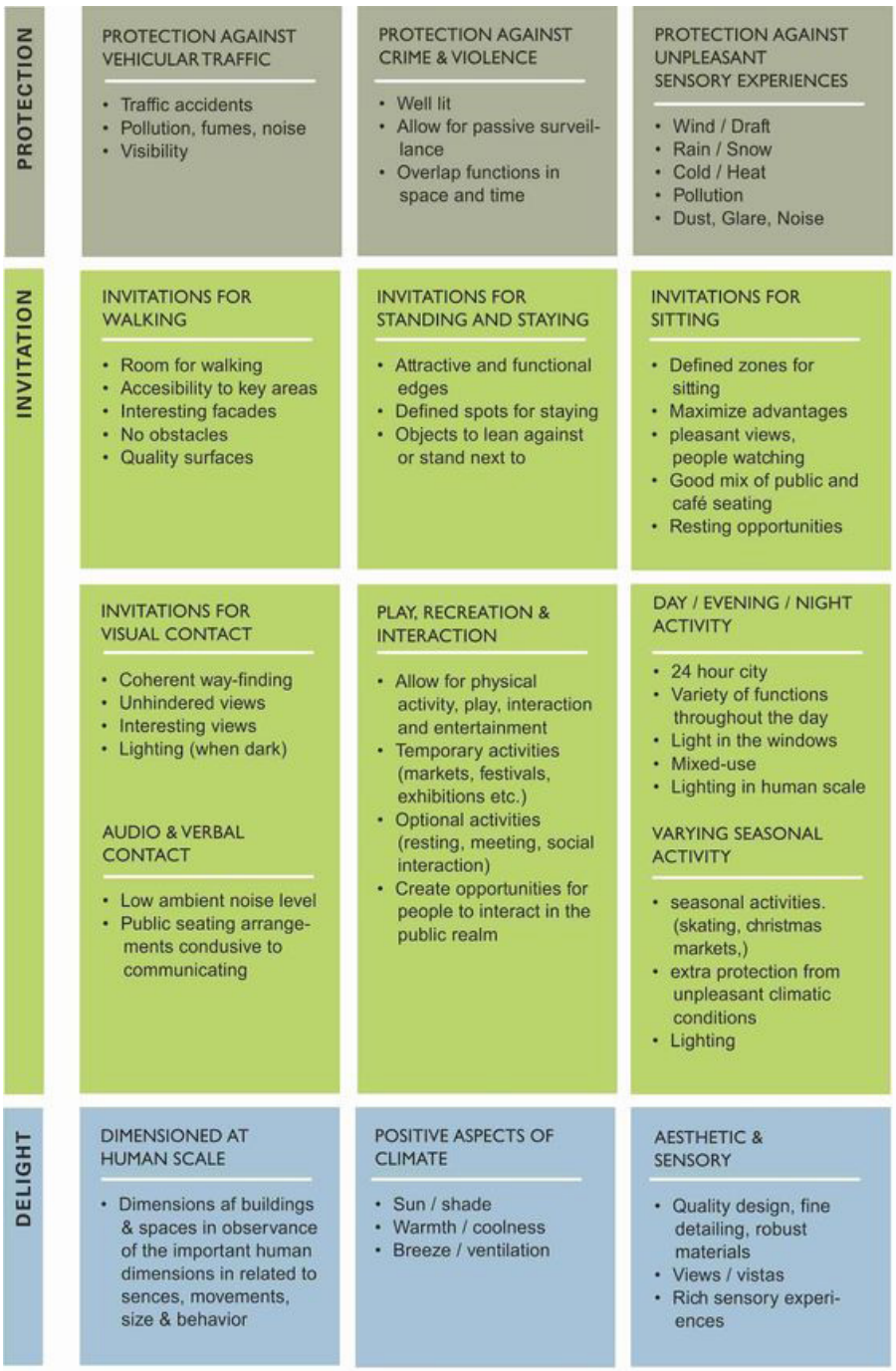
Ill. A.11: Info house

Ill. A.12: Observation tower

11. MAIN IDEAS OF GEHL, JACOBS AND WHYTE

Jan Gehl

Jan Gehl gives 12 quality criteria that together will create good public spaces:



Ill. A.13: 12 quality criteria by Jan Gehl

Jane Jacobs

Jane Jacobs studies why some places work and how to improve the places that do not work. She came up with four principles for healthy cities in her book "The Death and Life of Great American Cities" (1961) by making observations of neighbourhoods in use:

1. Varied building: "The district must mingle buildings that vary in age and condition, including a good proportion of old ones".
2. Concentration: "The district must have a sufficiently dense concentration of people, for whatever purpose they may be there".
3. Mixed Uses: "On successful city streets, people must appear at different times".
4. Frequent Streets: "Most blocks must be short; that is, streets and opportunities to turn corners must be frequent" (Allen, 2011)

William H. Whyte

William H. Whyte studies human behaviour in urban settings. In his book "The Social Life of Small Urban Spaces", he formulated specific needs to the design of urban spaces within cities. These formulations are important in a city context, but a bit difficult to implement directly in a city park landscape. Nevertheless, he made some important basic questions in his studies such as why people visit certain places and how people act and act among each other in urban spaces. As the project is a strategy project, these findings will first be relevant in the next phase and are therefore not developed further in this appendix.

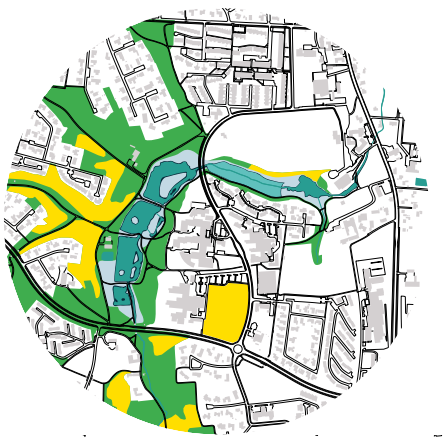
The three theorists´s parallels

The three theorists can be collected in a diagram showing their gathered themes

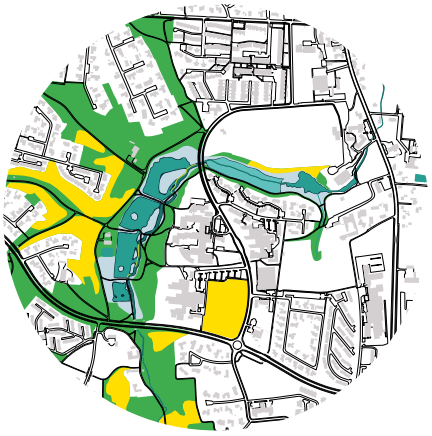
Ill. A.14: Gathered themes for Jacobs, White and Gehl

12. FLORA

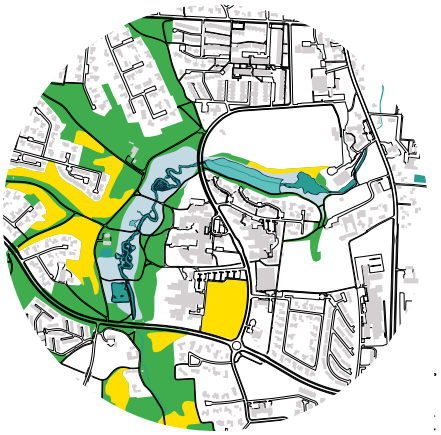
Plant diagram for the three scenarios



Ill. A.15.a: The existing solution



Ill. A.15.b: The municipality´s solution



Ill. A.15.c: Brook with periodic wetlands

Plant index

LEGEND

Forest

Pasture

Wet meadow ,marsh

Water, shore

FLORA

Ill. A.16.a

Name: Common alder, Alnus glutinosa
Heigh: 25 m

Ill. A.16.b

Name: Common spindle, Euonymus europaeus
Heigh: 5-6 m

Ill. A.16.c

Name: Katsura, Cercidiphyllum japonicum
Heigh: 8-10 m

Ill. A.16.d

Name: Amur maple, Acer japonicum
Heigh: 5–10 m

Ill. A.16.e

Name: Elder,
Sambucus nigra
Heigh: 2-8 m
Blooming: June - July

Ill. A.16.f

Name: Birches,
Betula pendula
Heigh: 25-30 m

Ill. A.16.g

Name: Osier,
Salix viminalis
Heigh: -10 m
Blooming: April - May

Ill. A.16.h

Name: Grey willow,
Salix cinerea
Heigh: 1-6 m
Blooming: April - May

Ill. A.16.i

Name: Goat willow,
Salix caprea
Heigh: -10 m

Ill. A.16.j

Name: Hazel,
Corylus avelanna
Heigh: 2-6 m
Blooming: February-April

Ill. A.16.k

Name: Oak,
Quercus rober
Heigh: 20-25 m

Ill. A.16.l

Name: Elm,
Ulmus glabra
Heigh: -35 m

Ill. A.16.m

Name: Hawthorn,
Rosa rugosa
Heigh: 150-200 cm
Blooming: June-September

Ill. A.16.n

Name: Blackberry,
Rubus plicatus
Heigh: 80-150 cm
Blooming: July

Ill. A.16.o

Name: Cowberry,
Vaccinium vitis-idea
Heigh: 5-25 cm
Blooming: May-July

Ill. A.16.p

Name: Myrica gale,
Myrica gale
Heigh: 50-150 cm
Blooming: March to May

Ill. A.16.q

Name: Cattail,
Typha latifolia
Heigh: 100-300 cm
Blooming: July

Ill. A.16.r

Name: Snowdrop,
Galanthus nivalis
Heigh: 10-20 cm
Blooming: February-April

Ill. A.16.s

Name: Clover,
Trifolium
Heigh: 10-20 cm
Blooming: May-September

Name: moss,
...
Heigh: 1-5 cm

Please note that there are often more than 50 species of mosses in even the smallest of forests in Denmark, hence when moss is discussed, it is in a broad sense.

Ill. A.16.t

Name: Meadowsweet,
Filipendula ulmaria
Heigh: 50-100 cm
Blooming: June-September

Ill. A.16.u

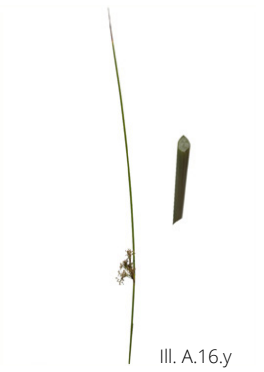
Name: Great willowherb,
Epilobium hirsutum
Heigh: 70-150 cm
Blooming: July-September

Ill. A.16.v

Name: Greater Spearwort,
Ranunculus lingua
Heigh: 3-5 cm
Blooming: June-September

Ill. A.16.x

Name: Branched bur-reed,
Sparganium erectum
Heigh: 30-150 cm
Blooming: July-August



Ill. A.16.y

Name: Soft rush,
Juncus effusus
Heigh: 30-100 cm
Blooming: June-August

Ill. A.16.z

Name: Blueweed,
Echium vulgare
Heigh: 30-80 cm
Blooming: June-July

Ill. A.16.aa

Name: Blueweed,
Pulsatilla
Heigh: 8-30 cm
Blooming: April-May

Ill. A.16.ab

Name: Wood anemone,
Anemone nemorosa
Heigh: 7-25 cm
Blooming: April-May

Ill. A.16.ac

Name: Reed canarygrass, Phalaris arundinacea
Heigh: 70-200 cm
Blooming: June-July

Ill. A.16.ad

Name: Reed mannagrass, Glyceria maxima
Heigh: 100-250 cm
Blooming: July- August

Ill. A.16.ae

Name: Common reed, Phragmites australis
Heigh: 100-300 cm
Blooming: August-September

Ill. A.16.af

Name: Commen/black bent, Agrostis capillaris
Heigh: 100 cm

Ill. A.16.ag

Name: Cocksfoo, Dactylis glomerata
Heigh: 100 cm

Ill. A.16.ah

Name: Barley/ brome grass, Bromus hordeaceus
Heigh: 10-20 cm

Ill. A.16.ai

Name: Vernal grass, Anthoxanthum odoratum
Heigh: 25-50 cm

Ill. A.16.aj

Name: Yorkshire fog, Holcus lanatus
Heigh: 20-60 cm

Ill. A.16.ak

Name: Purple moor-grass, Molinia caerulea
Heigh: 100 cm

Ill. A.16.al

Name: Foxtail/ marsh foxtai, Alopecurus geniculatus
Heigh: 15-45 cm

Ill. A.16.am

Name: Timothy grass, Phleum pratense
Heigh: 20-120 cm

Ill. A.16.an

Name: Rye-grass, Lolium perenne
Heigh: 20-70 cm

13. RESHAPING OF MASTRUP BÆK

Ecological advantages

Reshaping and restoration of Mastrup Bæk is chosen for this Master's thesis as it is the scenario that we have evaluated to have most potential – both for recreational purposes and for the fishes as "water starved" and other blockages limit upstream fish dispersal.

As described above it has been chosen to reshape the brook on the site. Restoration of brooks, streams and rivers are an increasing common approach (Bernhardt and Palmer, 2011). Many rivers, streams and brook alignments have through the years been changed for human purposes (Bernhardt and Palmer, 2011). Mostly to become more linear. This is also the case for Mastrup bæk. Originally. Mastrup Bæk was a natural brook with many bends and curves but to actively better the potential for agriculture and establishment of a fish farm, regulations of the brook alignment has been done (Støvring Kommune, 2000).

A literature review has shown that a reshaping of Mastrup Bæk will have other advantages, including that it is possible to restore biodiversity and its ecological function (Bernhardt and Palmer, 2011)* and that it is possible to restore ecosystem services provided by near-natural rivers/stream/brook and floodplains (Jähnig et. al., 2011)*.

By diving into other studies, it has been found that different types of fauna and flora affect each other in different ways. An initiative in the area can therefore result in an increase of some types and a decrease of others. This is a complex system, and an understanding on a detailed level is outside the scope of this thesis. However, some general guidelines can be created for obtaining an increased ecological value when reshaping Mastrup Bæk:

- Making a natural curved brook will have the advantage that it can have varying physical shapes (including varying depths and flow velocity), which results in a better habitat for different animals and plants (Rebild Kommune, 2013)
- Variance in terrain within the stream, and the existence of coarse inorganic substrate and and mud will result in different kinds of small animals living in the stream (Kristensen, 2014).
- Periodic controlled flooding entails large profits for the nature and the environment (Miljøstyrelsen, 2015). Periodic flooding of low-lying areas along the stream will help retention of nutrients and transform nitrogen and will result in an increased diversity of flora and fauna. Moreover, periodic flooding will result in sedimentation of nutrients in form of both organic and inorganic materials coming from the stream. (Miljøstyrelsen, 2015)

Design criteria for reshaping Mastrup Bæk:
- Removal of obstructions in Mastrup Bæk
- Varied brook alignment with varied physical shapes and depths
- Varied fall in terrain
- Areas that are flooded in some periods

How to create a varied brook alignment?

In nature, water will always find the easiest way to the sea. This means that the water flow will naturally adapt to the landscape. If water runs over a large terrain difference, the current will be strong and alignments often more linear. If the terrain is more flat, the current will be small, and the alignment will be more curved (Geoborderne, 2015). Designing of the new varied brook alignment of Mastrup Bæk should therefore include different terrain differences.

(* only little evidence about whether restoration of rivers, streams and brooks improve ecological functions in the area (Bernhardt and Palmer, 2011))

14. CALCULATION OF WATER

Calculation of existing catchment area

F[total_existing] = (354334 m2+118686 m2+3858 m2+88637 m2+56521 m2+29563 m2+38125 m2)*0,0001 = 69 ha
F[red_existing] = F[total] * β * δ * Θ
F[red_existing] =69 ha *0,4 * 1 * 1 = 27,6 ha

Calculation of water in lakes - A comparative analysis of the lakes

All the calculations are made by the assumption that lakes have vertical sides so the surface area is the same as the bed area. We have done it this way to make it an easier calculation, yet, as the conditions are the same for all the calculations, the outcome is still comparative.

The areas are found by measuring the plans in 1:1000 drawings

CALCULATION FOR EXISTING SITUATION

Area of lakes 22.000 m2. No extra water.

CALCULATION FOR MUNICIPALITY VISION SITUATION

Area of lakes 22.000 m2 Level of extra water 0,75 m
Amount of extra water = 22000m2 * 0,75m = 16.500m3

CALCULATION FOR BROOK ONLY SITUATION

For the situation with only a brook, the water level can increase the depth of the lakes and the level of the extra water. Here 1,5 meters
Area of flooded area 12.666 m2 Level of extra water 1,5 m
Amount of extra water = 12666m2 * 1,5m = 19000m3

Dimension of the detention ponds A and B

F [total] to basin A	354334,67	m2
	35,43	ha
F [total] to basin B	865023,14	m2
	86,50	ha

Catchment area 1 -> basin 1
Catchment area 2, 3, 4, 8, 6, 5 -> basin B
Antagelse at opland 6 kan kobles på bassin 2

Other information

Degree of imperviousness, β	0,40	-
Outlet, a	1,00	l/s/ha

Safety factor

Increased catchment area, γ[a]	1,10
Statistial/model uncertainty, γ[c]	1,20
Climate change (2 year), γ[c]	1,20
Climate change (5 year), γ[c]	1,25
Safety factor in total (2 year), γ	1,58
Safety factor in total /5 year), γ	1,65
Given from Rebild Vand, γ	1,25

Constant	**General**
Hydrological red. factor, Θ	1,00
Connection, δ	1,00

year rain event	**0,50**	**1,00**	**2,00**	**5,00**
c	11200,00	10980,00	16290,00	28070,00
α	0,73	0,71	0,73	0,76

BASIN A

F[red,a]	14,17	ha
Q[out,a->b]	14,17	l/s

	0,5 year rainfall without safety factor	**1 year rainfall** without safety factor	**2 year rainfall** with safety factor	**5 year rainfall** with safety factor	
T[r], max	58603,05	85862,45	97904,16	109003,14	s
i	3,70	3,45	3,70	4,17	l/s/ha
Q[in,opland]	52,49	48,87	52,49	59,06	l/s
Va	2245706,48	2979458,11	5942772,09	8072330,84	l
	2245,71	2979,46	5942,77	8072,33	m3
Basin depth	0,50	0,50	0,50	0,50	m
Basin area	4491,41	5958,92	11885,54	16144,66	m2
Basin width	50,00	50,00	70,00	90,00	m
Basin length	89,83	119,18	169,79	179,39	m

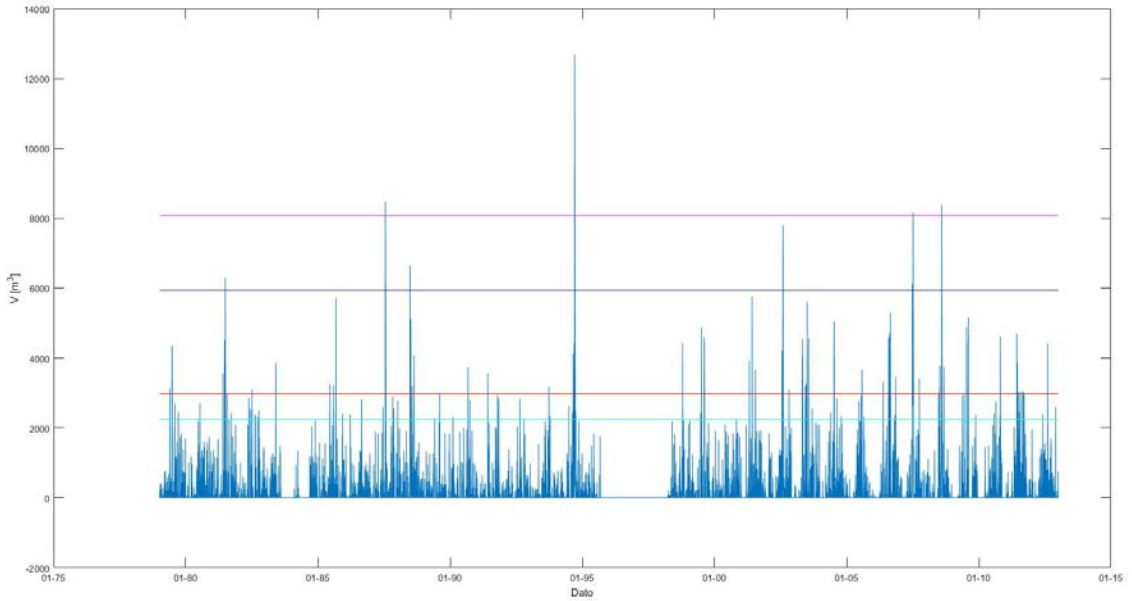
BASIN B

F[red,b]	34,60	ha
Q[out,b->bæk]	48,77	l/s

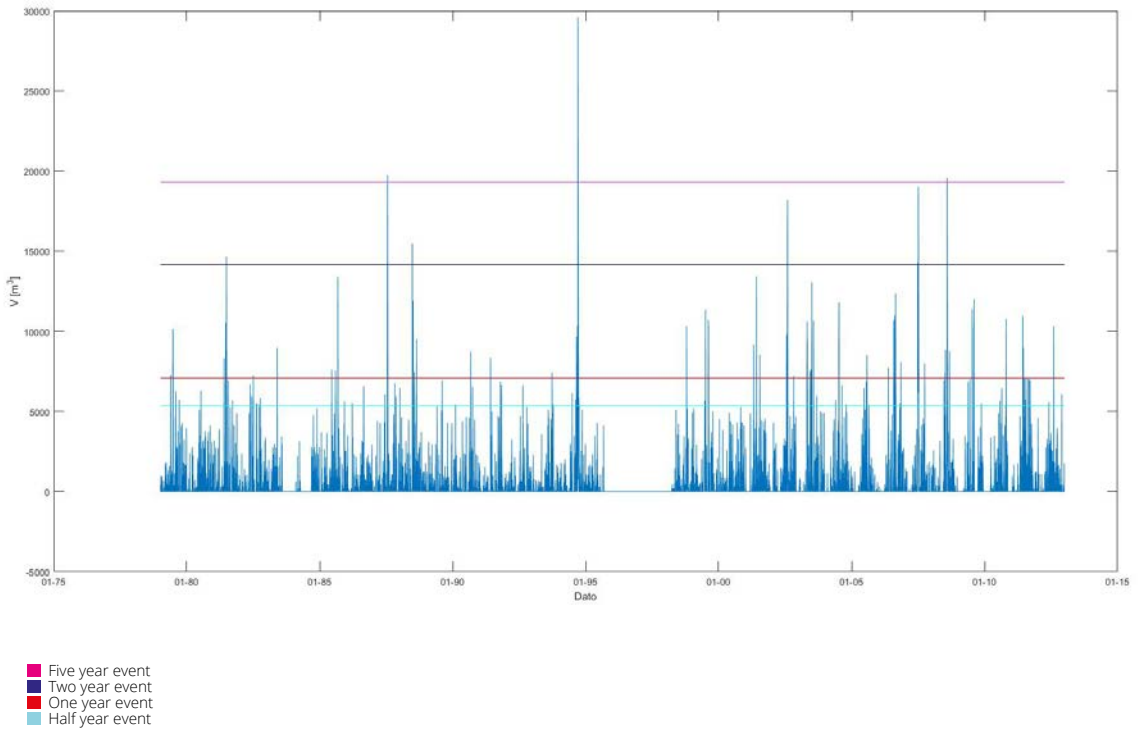
	0,5 year rainfall without safety factor	**1 year rainfall** without safety factor	**2 year rainfall** with safety factor	**5 year rainfall** with safety factor	
T[r], max	36615,84	52941,77	61171,61	69382,55	s
i	5,22	4,86	5,22	5,87	l/s/ha
Q[in,opland]	180,65	168,19	180,65	203,23	l/s
Q[in,tot]	194,82	182,36	194,82	217,40	l/s
Vb	5347548,09	7072298,15	14151118,98	19304437,83	l
	5347,55	7072,30	14151,12	19304,44	m3
Basin depth	0,50	0,50	0,50	0,50	m
Basin area	10695,10	14144,60	28302,24	38608,88	m2
Basin width	40,00	50,00	85,00	110,00	m
Basin length	267,38	282,89	332,97	350,99	m

MATLAB

Matlab has been used to see how often the two detention ponds actually would be flooded. The illustrations A.17.a-b are based on 30 years of data and therefore show more precisely how often the two basins are filled. The magenta-line shows the volume of the basin in relation to the dimension of a 5-year rain event; the blue-line shows the volume in relation to a 2-year rain event; the red-line shows the volume in relation to a 1-year rain event and the cyan-line shows the volume in relation to a half-year rain event.

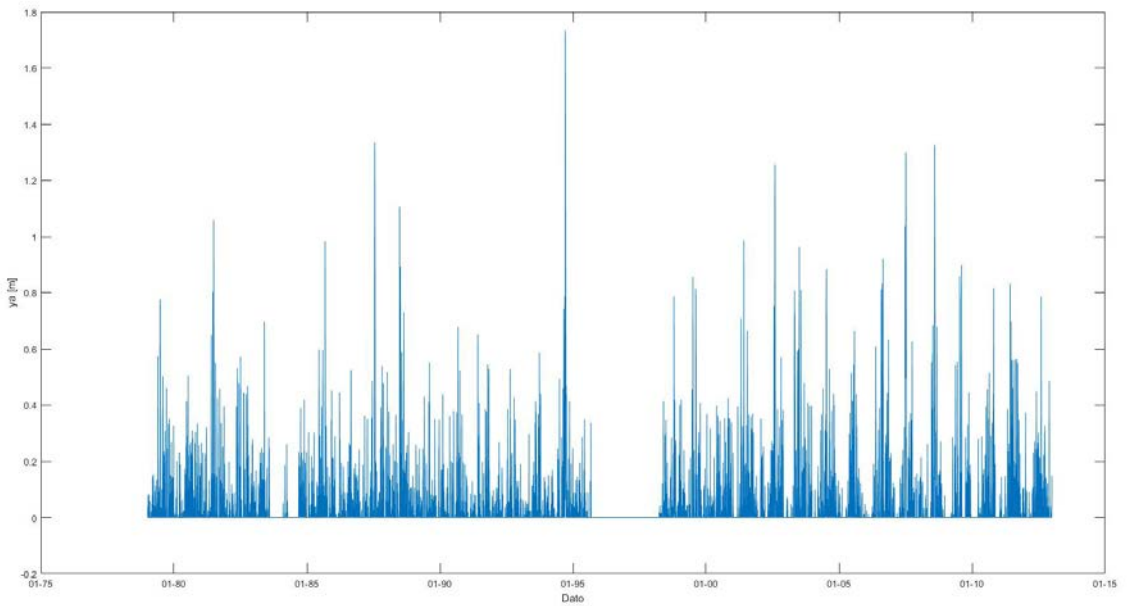


Ill. A.17.a: Volume of basin A

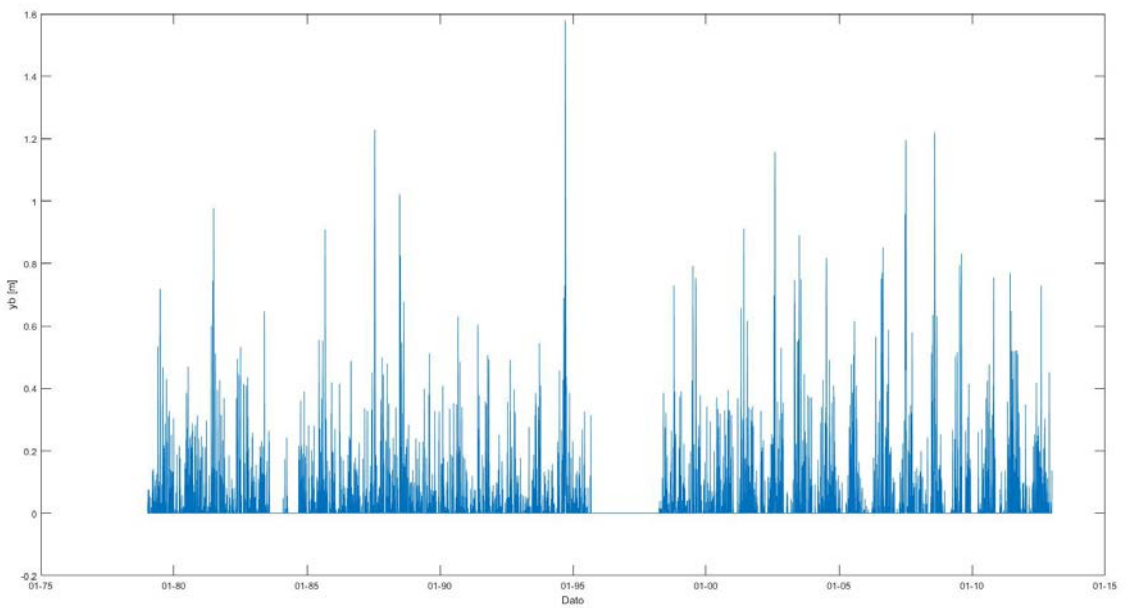


Ill. A.17.b: Volume of basin B

The illustrations 18a-b show the water level in the two detention ponds. However the diagrams do not show the whole picture, as the calculation is based on a very rough assumption of the shape of the two basins. The diagrams only show the idea of how often the detentions ponds will be filled with water or be empty.



Ill. A.18.a: Height of basin A



Ill. A.18.b: Height of basin B

Matlab code:

```
clc;
load('GaugeData.mat') %Indlæsning af data
%Serie (Qa) med indløb til basin A i m^3/s.
%14,2 Ha er det reducerede opland til basin A.
%1 er sikkerhedsfaktoren.
Qa=((INTtimeSERIE(:,2))/60)*14.2*10;
t=INTtimeSERIE(:,1);                    %Tidsserie (skridt i min)

%Serie (Qb) med indløb til basin B i m^3/s.
%33,1 Ha er det reducerede opland til basin B.
%1 er sikkerhedsfaktoren.
Qb=((INTtimeSERIE(:,2))/60)*33.1*10;
t=INTtimeSERIE(:,1);                    %Tidsserie (skridt i min)

% Konstanter
qud1=14.2/1000; %Udløbsvandføring mellem basin A og B i m3/s
qud2=47.3/1000; % Udøbsvandføring mellem basin B og bæk i m3/s
g=9.82; %Tyngdeacceleration i m/s2
dn=60; %Tidsskridt i s

%Variable
Va=zeros(size(INTtimeSERIE,1),1); %Volumen for basin A
Vb=zeros(size(INTtimeSERIE,1),1); %Volumen for basin B
Qu1=zeros(size(INTtimeSERIE,1),1); %Udløb mellem basin A og B i m3/s
Qu2=zeros(size(INTtimeSERIE,1),1); %Udløb mellem basin B og bæk i m3/s
Vu=zeros(size(INTtimeSERIE,1),1); %Fjernet volumen hver dag

%Begyndelsesbetingelser
Va(1)=0;
Vb(1)=0;
Qu1(1)=0;
Qu2(1)=0;
Vu(1)=0.1;

%Løkke til beregning af volumen til hvert n basin A
for n=2:size(INTtimeSERIE,1);
    if Va(n-1)>0 %Hvis der ikke er vand i bassinet er udløbet = 0
     Qu1(n)=qud1;
    else Qu1(n)=0;
    end
    Va(n)=Va(n-1)+(Qa(n)-Qu1(n))*dn;
end

%Løkke til beregning af volumen til hvert n basing B
for n=2:size(INTtimeSERIE,1);
    if Vb(n-1)>0 %Hvis der ikke er vand i bassinet er udløbet = 0
     Qu2(n)=qud2;
    else Qu2(n)=0;
    end
    Vb(n)=Vb(n-1)+(Qu1(n)+Qb(n)-Qu2(n))*dn;
end



%plot
%Volume dimensionerne for basin A
a0=2245;
a1=2979;
a2=5942;
a5=8072;
%Volume dimensionerne for basin B
b0=5347;
b1=7072;
b2=14151;
b5=19304;
```

```
figure
plot(t,Va) %Plot af volumen af basin A ift. tiden
datetick('x','mm-yy') %Dato på x-akse
xlabel('Dato')
ylabel('V [m^3]')
set(gca,'YTickLabel',num2str(get(gca,'YTick').'))
hold on;
plot(t,ones(size(t)) * a0,'color','c') %plot af a0
hold on;
plot(t,ones(size(t)) * a1,'color','r') %plot af a1
hold on;
plot(t,ones(size(t)) * a2,'color','b') %plot af a2
hold on;
plot(t,ones(size(t)) * a5,'color','m') %plot af a5
hold off

figure
plot(t,Vb) %Plot af volumen af basin B ift. tiden
datetick('x','mm-yy') %Dato på x-akse
xlabel('Dato')
ylabel('V [m^3]')
set(gca,'YTickLabel',num2str(get(gca,'YTick').'))
hold on;
plot(t,ones(size(t)) * b0,'color','c') %plot af bo
hold on;
plot(t,ones(size(t)) * b1,'color','r') %plot af b1
hold on;
plot(t,ones(size(t)) * b2,'color','b') %plot af b2
hold on;
plot(t,ones(size(t)) * b5,'color','m') %plot af b5
hold off

ya=zeros(size(INTtimeSERIE,1),1); %Højden for basin A
yb=zeros(size(INTtimeSERIE,1),1); %Højden for basin B
%Begyndelsesbetingelser
ya(1)=0;
yb(1)=0;

%Løkke til beregning af højde til hvert n basin A
for n=2:size(INTtimeSERIE,1);
    if Va(n-1)>0 %Hvis der ikke er vand i bassinet er udløbet = 0
     Qu1(n)=qud1;
    else Qu1(n)=0;
    end


end

%Løkke til beregning af højde til hvert n basin B
for n=2:size(INTtimeSERIE,1);
    if Vb(n-1)>0 %Hvis der ikke er vand i bassinet er udløbet = 0
     Qu2(n)=qud2;
    else Qu2(n)=0;
    end
    yb(n)=-9E-10*(Vb(n-1)+(Qu1(n)+Qb(n)-Qu2(n))*dn)^2 + 8E-05*(Vb(n-1)+(Qu1(n)+Qb(n)-↙
Qu2(n))*dn);
end

figure
plot(t,ya) %Plot af volumen af basin A ift. tiden
datetick('x','mm-yy') %Dato på x-akse
xlabel('Dato')
ylabel('ya [m]')


figure
plot(t,yb) %Plot af volumen af basin b ift. tiden
datetick('x','mm-yy') %Dato på x-akse
xlabel('Dato')
ylabel('yb [m]')
```

Dimension of pipes

Given values

Qa-b	14,17	l/s
	0,014	m3/s
Qb-bæk	48,77	l/s
	0,049	m3/s
M	68	m^(1/3)/s
I0	0,0002	mm

Pipes

D [m]	A [m2]	Q[m3/s]
0,10	0,008	0,001
0,15	0,018	0,002
0,20	0,031	0,004
0,25	0,049	0,007
0,30	0,071	0,012
0,35	**0,096**	**0,018**
0,40	0,126	0,026
0,45	0,159	0,036
0,50	0,196	0,047
0,55	**0,237**	**0,061**
0,6	0,283	0,077
0,65	0,332	0,095
0,7	0,385	0,116
0,75	0,442	0,139

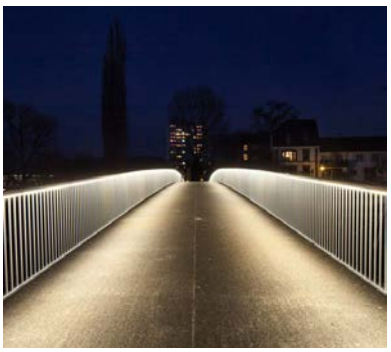
15. LIGHTING

Illumination at the site is important so that the users feel safe on the site at night. The lighting can also create awareness to certain details and create atmosphere. On the path system two types of lights are used: atmospheric and accent. See illustration A.19.

On the path system accent light will illuminate the path so the user can see where they are walking, but the light polls cannot be to high so that they create a light wall so the user are not able to look out on the area around the path. On the sport path there will be a light showing the distance from the starting point, so the user can see how long they have run when it is dark.

When the path system has a railing. The railing will be illuminated with a light stripe of atmospheric light.

At the Learning Centre, functional light can be placed so the centre can be used when it is dark, functional light are high light polls that create a wide area of light.



Atmospheric
Height: On the railing
Material: LED

Accent
Height: 1 metre
Material: Corten steel

Functional
Height: 5-8 metre
Material: Corten steel

Ill. A.19: Lighting

16. PROGRAMMES

The concept joins nature and learning in one solution by enhancing nature, having changeability and placing programmes that encourage learning and sport activities.
The following pages present suggestions for activities and elements that can be implemented within the area that fit the concept and the design parameters.

Changeability

Sittings stones become stepping stones, and grasslands become wetlands after a cloudburst. The site is changing regarding the weather; however, it is always possible to access the area by the permenent path. The season also makes the area change: different plants are blooming during the year, and fruit trees and beery bushes periodically give colour to the areas. Different weather conditions and seasons make the site changeable.

Enhance nature

BRINGING NATURE TO PEOPLE

According to the locals, one large potential in the area today is the beautiful nature that is defined as green and blue infrastructures. In order to strengthen the identity of the area, this potential can be boosted. A frame can frame the spots that citizens find most beautiful or mirror natural elements. An observation tower can give people an overview of the site. Here, people can both enjoy the view while having a picnic and study birds and other natural life.

INTERVENTION

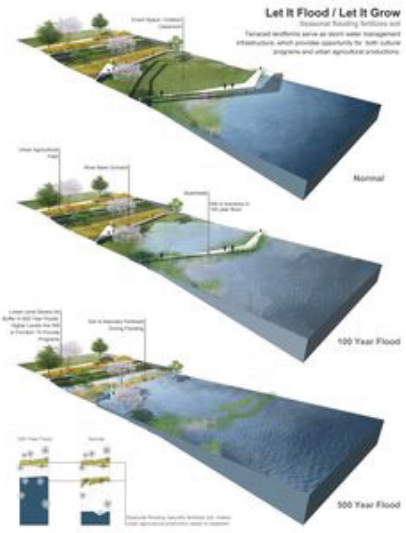
Enhancing nature can also be performed in an conceptual way. Here, atmosphere light can enhance trees, bushes and high grass, or trees can be decorated by colourful umbrellas and other elements in winter time in order to illustrate the blooming colours that will come in spring. Enhancing can also be done by colouring trees or walking routes or by placing installations that enhance the landscape and the surrounding terrain.

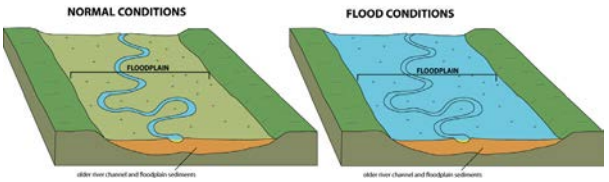
Learning

Biology classes can take tests of the water and soil and analyse it when they return to school. Furthermore, students can find plants in the area and learn about plant types, where they live, blooming season, et cetera, and music can be made by hitting on natural materials. Learning the alphabet as well as German and English conjugations can be done in nature by jumping from stone to stone or reading on small boards in a baton all over the area. Only the imagination sets the limits.
A learning hub can be established on the site. Here, all citizens can take trips in the area with a guide to find mushrooms, berries, eatable plants, et cetera. The learning hub can contain a building where kindergartens and schools from Støvring and other cities can visit and have a base on the trip to the area.

Activities

Activities is a wide term that covers anything from walking the dog and taking a run to sports activities in the area such as outdoor fitness, yoga classes, dancing performances, and beach volley battles, and more playful activities such as obstacle courses, relay race and jumping from stone to stone in the water. The primary school and high school can use the activities during sport classes, but the young people can also take a battle in breaks and after school, and locals can meet other locals in these activities.





III. A.20: Changeability

Ill. A.21: Activities

Ill. A.22: Learning



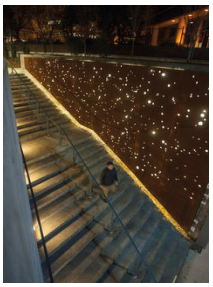





Ill. A.23: Enhance nature - bring nature to people

Ill. A.24: Enhance nature - intervention

17. USING THE TERRAIN



Ill. A.25: Using the terrain

18. DESIGN PROCESS

Design Parameters

The design process started with a theoretical and an analytical approach to the site. These analyses were used to better interpret the physical and social settings of site, such as flows, functions, atmospheres, problems and potentials. From the analyses, several parameters were found, ensuring what the site should contain and aim. This resulted in a concept brainstorm based on the analyses performed on site, and the problems and potentials were identified. From this the following parameters were determined:

LEARNING

Ill. A.26.a

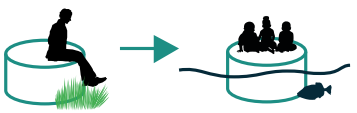
ACTIVITY

Ill. A.26.b

ENHANCE NATURE

Ill. A.26.c

CHANGEABILITY



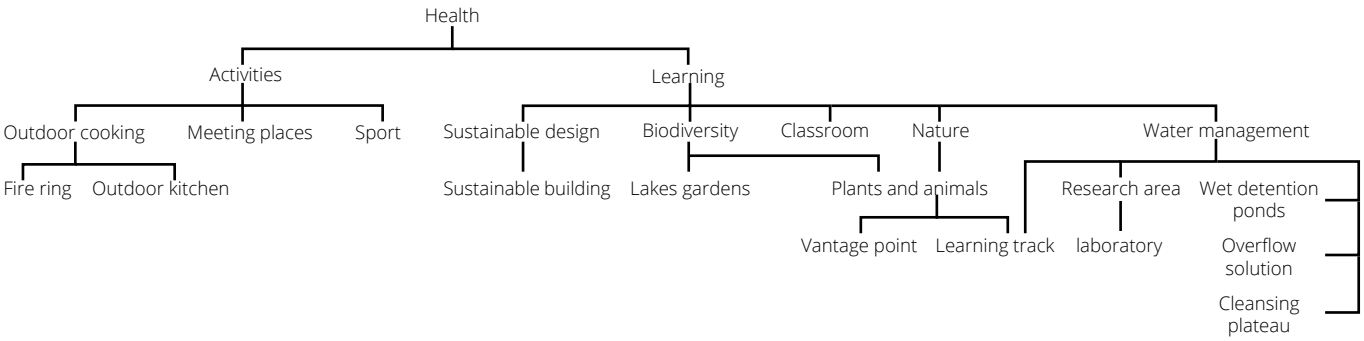
Ill. A.26.d

Approach

Ill. A.27

How can Mastrup Delta, as a recreational space in Støvring, create a cycle where water management is both the solution for water problems in Støvring and the new identity for the local community?

HIERARCHY OF PROGRAMMES



Sketching

The first design attempts emerged in drawings. Global ideas, shaping the area, scale of water management and placing and playing with the idea of the cycle of learning and its physical design.

Throughout the first part of the design process, there have been two principles: Introvert design and extrovert design. The introvert design is based on the fact that it forms itself and exists in the power of its inner world, while extrovert design forms itself and exists in exchange with the surroundings.

Ill. A.28.a

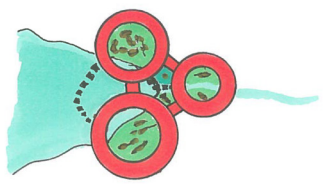
Ill. A.28.b

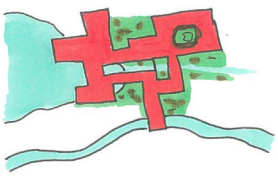
PROGRAMNING

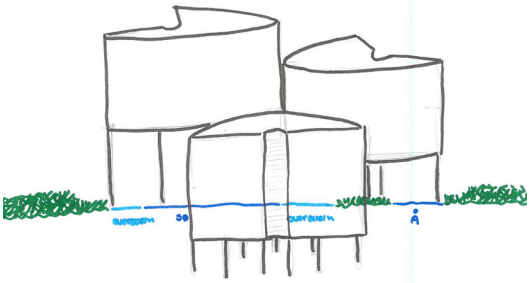
Early in the project the different programmes on the site were defined. From the analysis, it became clear that the project has three main programmes: sports, learning and experience. A new programme was also required in the site, such as a day care. Furthermore, it would be tempting to place a nature center and several different elements of learning, as well as sports items on the site.

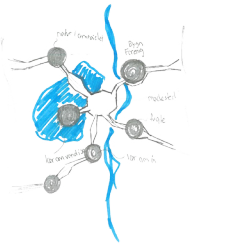
Introvert Design

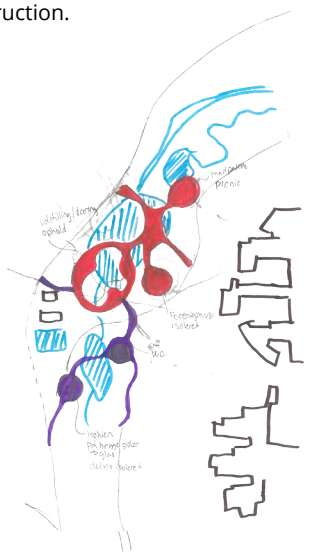
The first design principle that was tested was the introvert design that is expressed by an overall centre with all the programmes in construction.

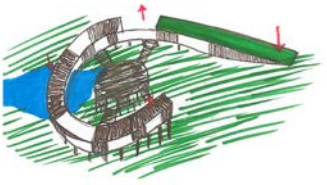


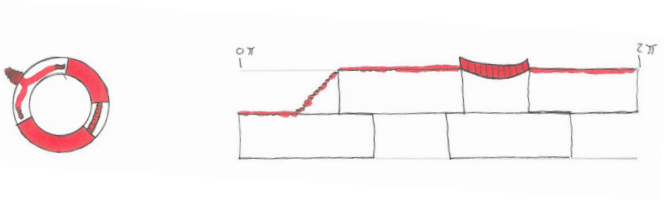


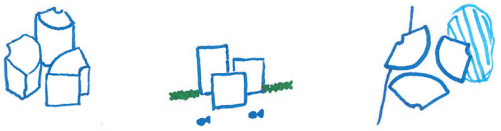


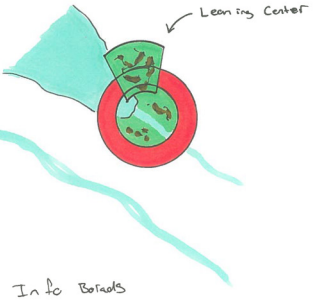


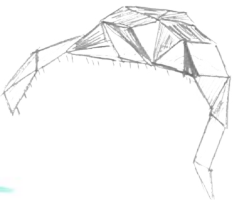


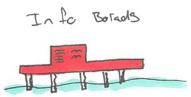


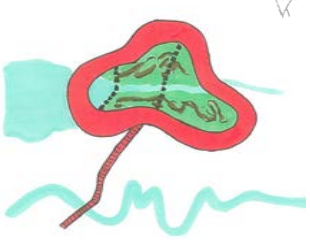


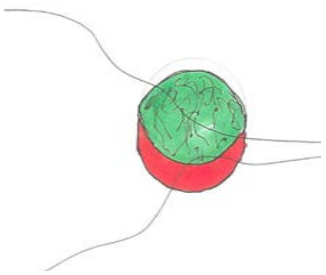


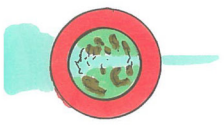


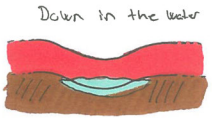


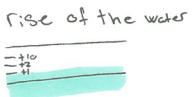


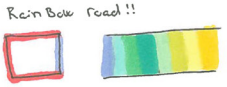




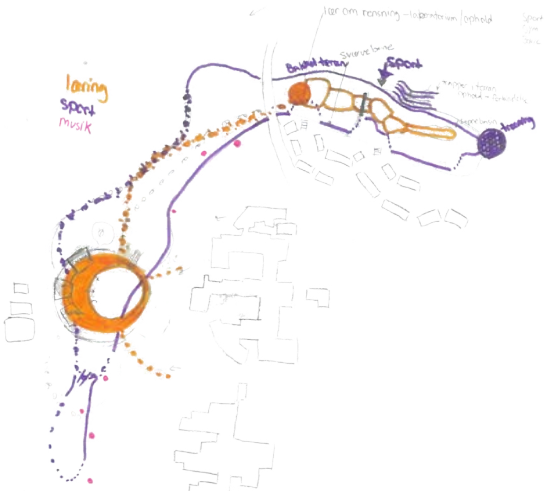






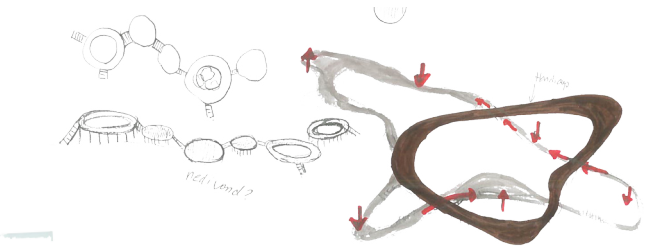


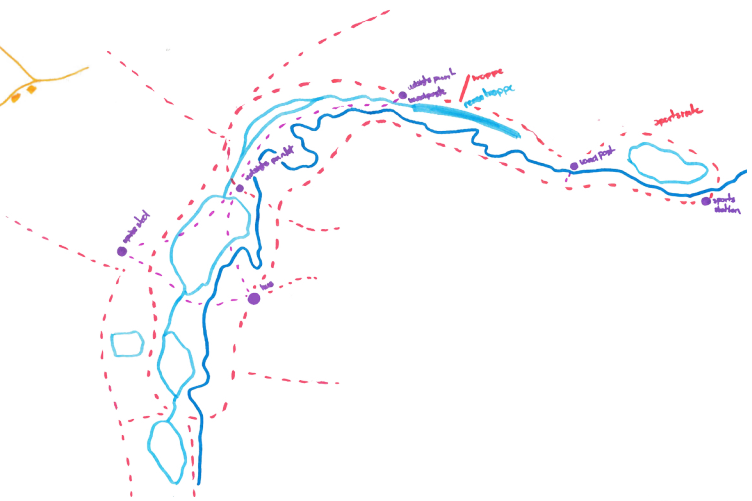
III. A.29

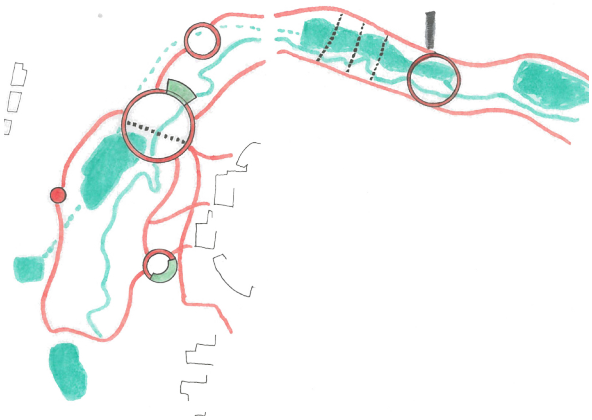


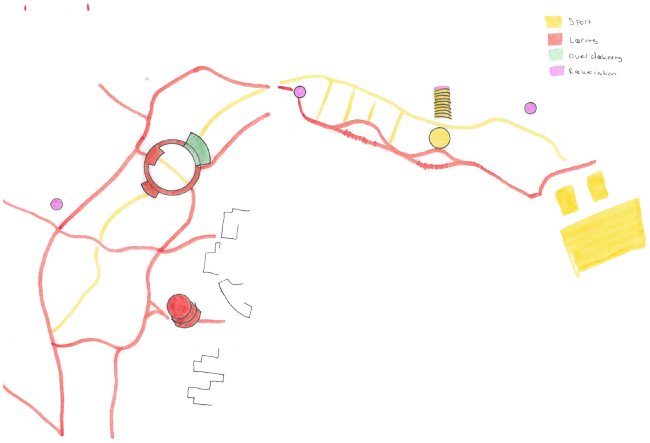
The transition

This is the sketching phase between introvert design and extrovert design. Throughout the sketching phase it became clear that there is a more natural approach to moving the elements into nature and closer to the programmes found in the area.





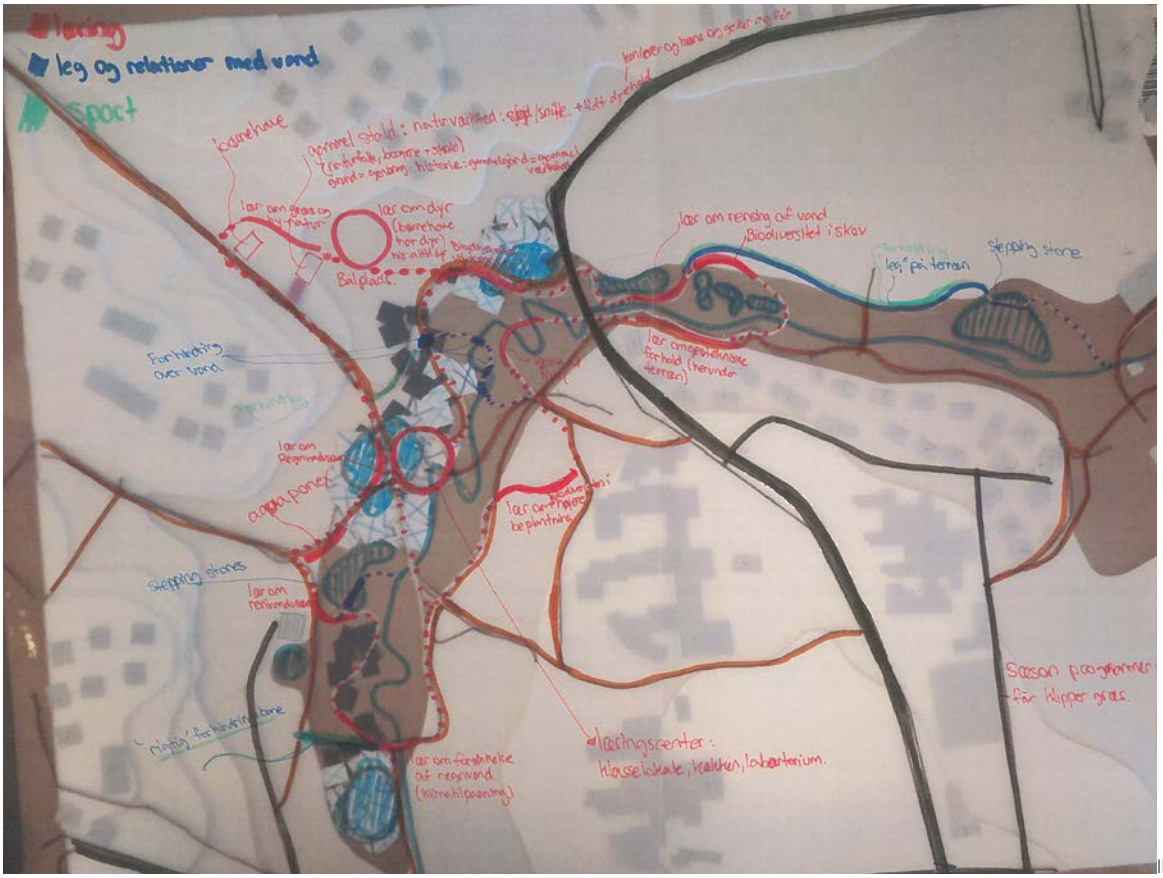




Ill. A.30

Extrovert Design

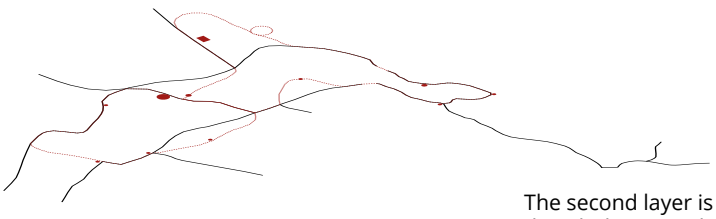
The last design principle that was tested was extrovert design, which helps to activate the entire area and allow multiple items to be used by several people at the same time.



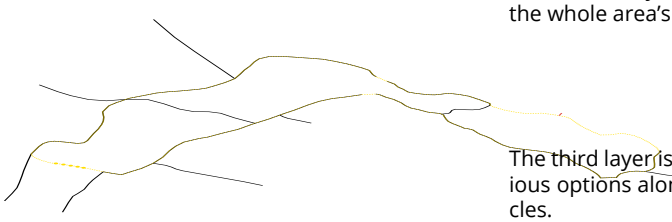
Ill. A.31

Layers

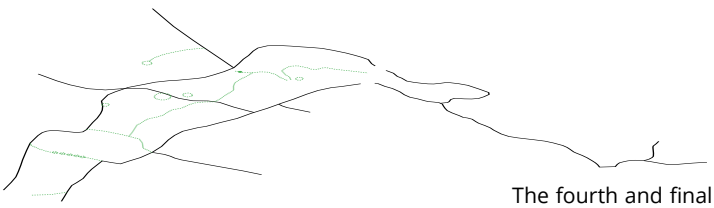
The first part of the design process has resulted in four different layers of paths.
The first layer is the permanent. This layer can be used at any time of day, by bicycles as well as by pedestrians. Since this path is permanent, it is also the only layer that cannot be flooded.



The second layer is the learning path, which is related to the whole area's diversity.



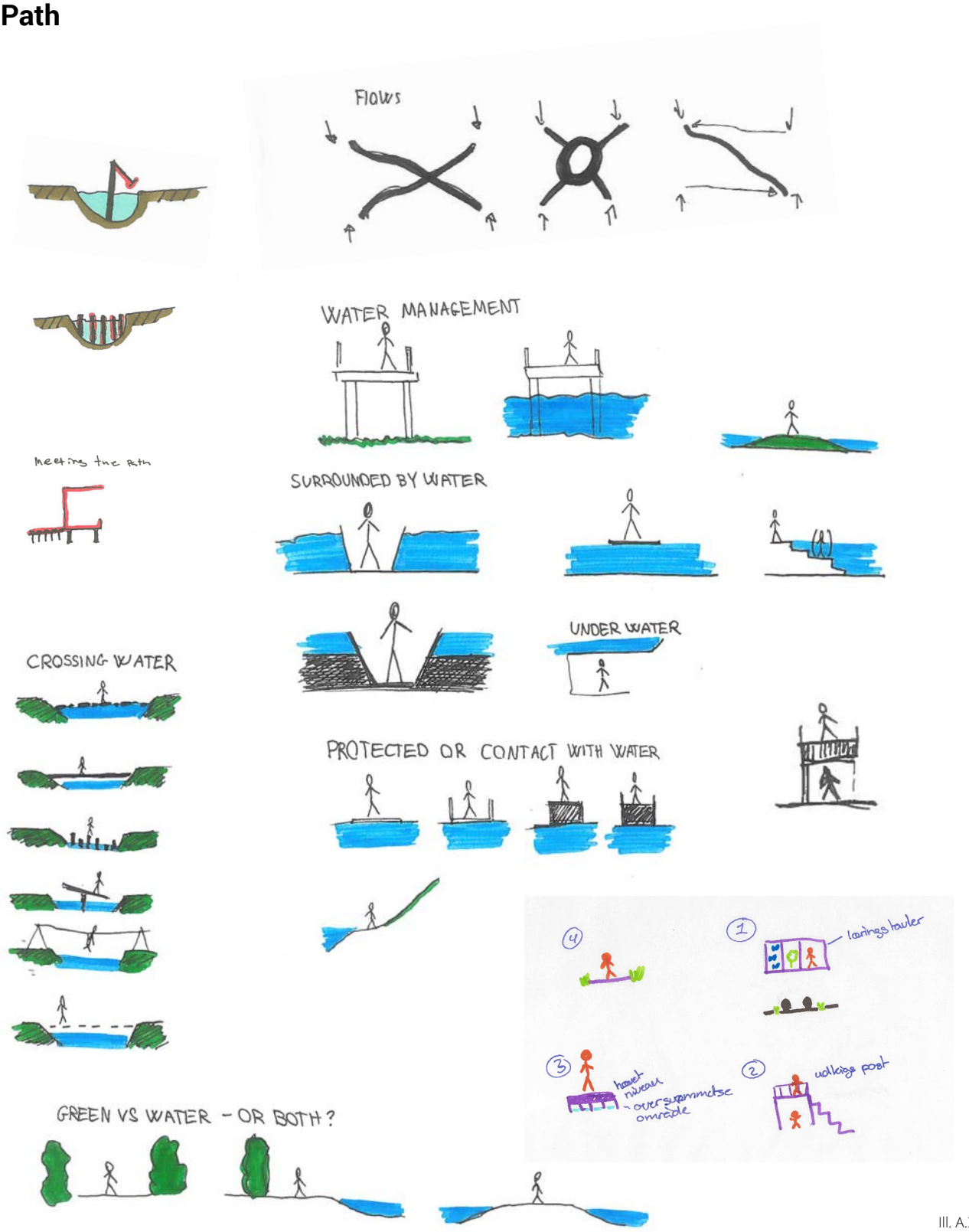
The third layer is sport, which is a running path, with various options along the way in the form of various obstacles.



The fourth and final layer is experience, which is a path which leads out onto the water and allows for play and establishes contact with the different types of water in the area.

Ill. A.32

Path


Flows
WATER MANAGEMENT
meeting the path
SURROUNDED BY WATER
UNDER WATER
CROSSING WATER
PROTECTED OR CONTACT WITH WATER
GREEN VS WATER - OR BOTH?

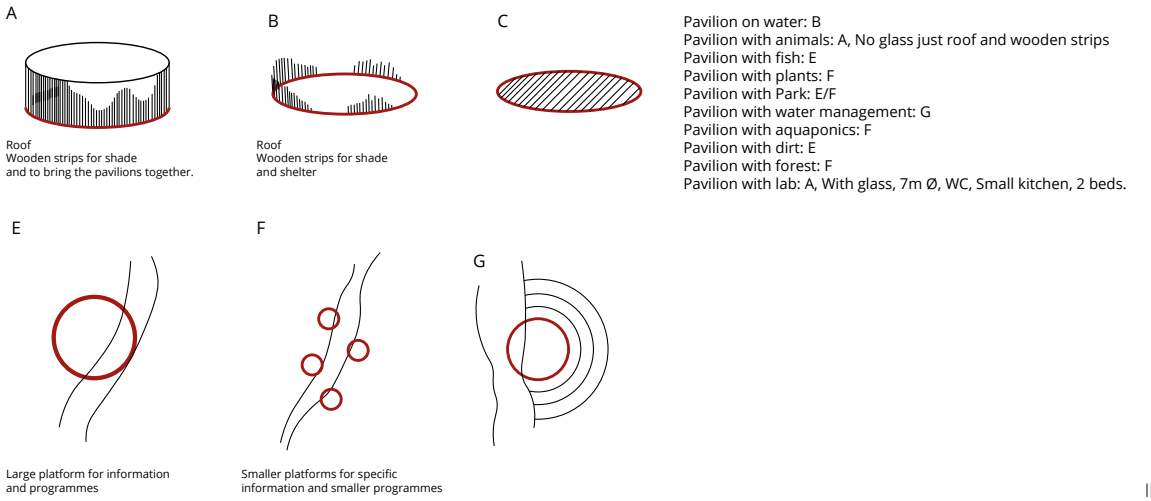
Ill. A.33

Learning stops

We started out with the wish that each stop should have the same type of pavilion. However, this changed during the sketching phase, and the new wish became that the pavilions should fit each stop and the information / learning for the stop.

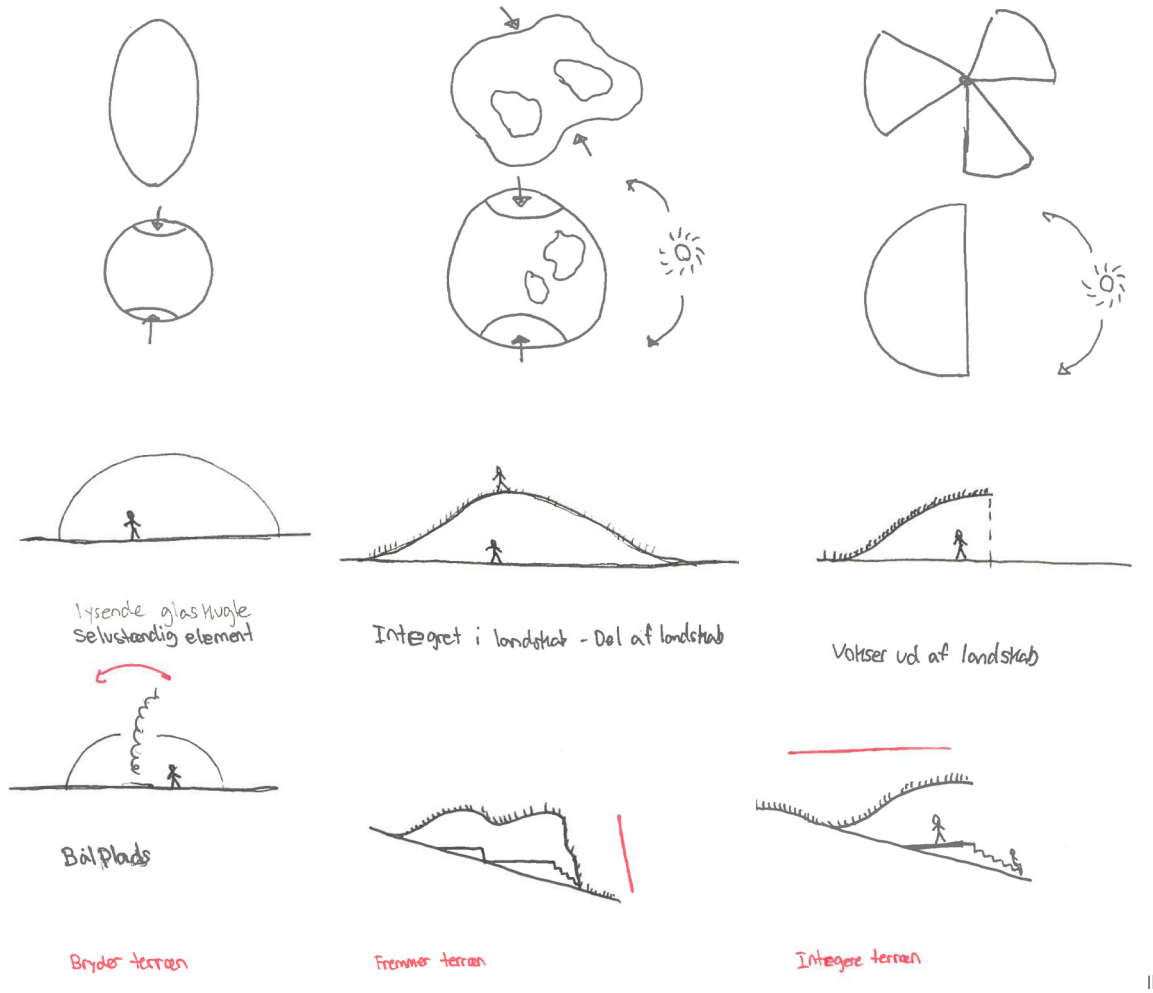
Certain elements are, however, required to go through the area to create a common thread, as well as a recognizable and holistic sense that the elements are part of the same cycle, for example:

- The information boards are made of plexiglas which allows to highlight specific items in the area.
- The red marking of the path must somehow recur at the stops.



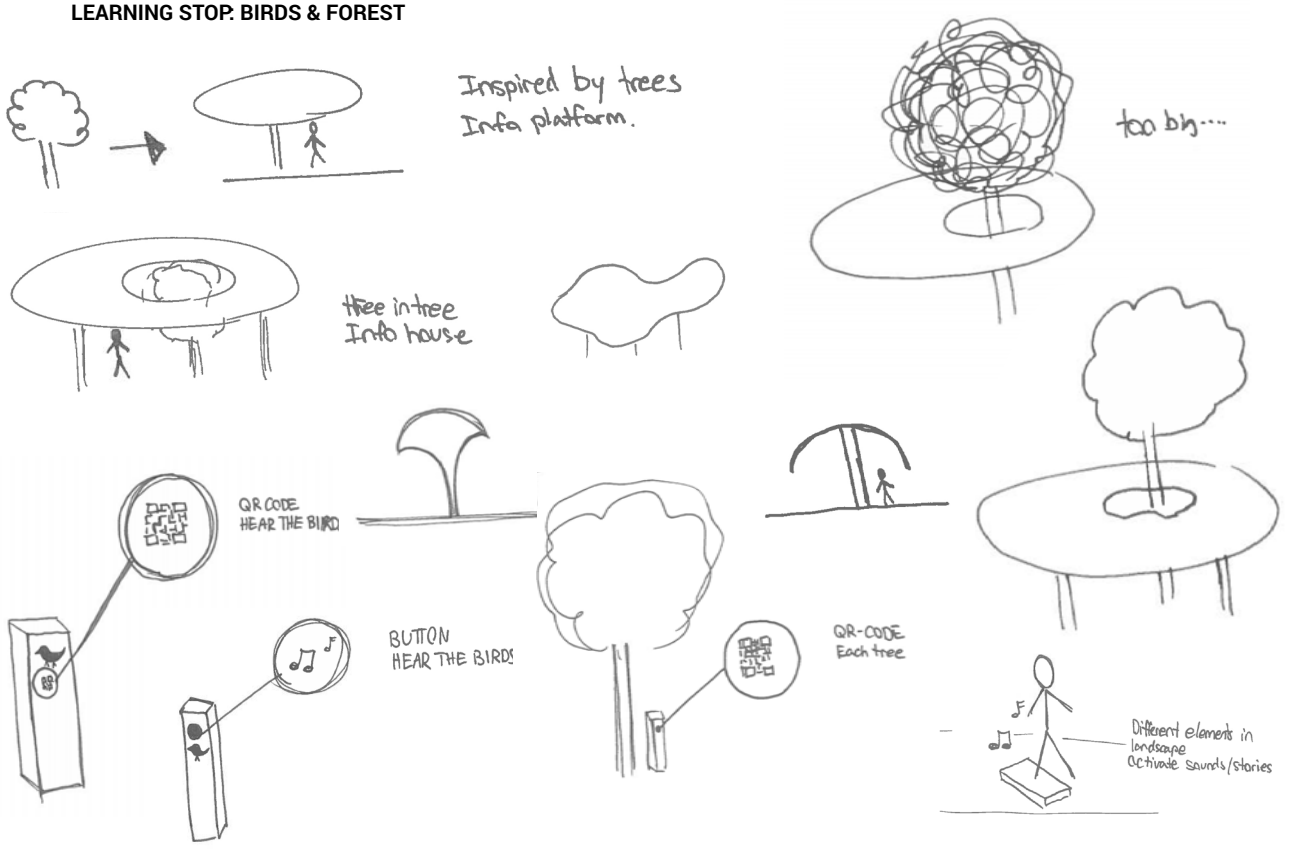
Ill. A.34

We started looking at different ways the pavilions can be placed in the landscape for breaking the terrain, enhancing the terrain or being integrated into the terrain, respectively. By doing this exercise we found that we wanted the learning stops to stand out, we wanted them to be foreigners so they could better emphasize what is nature and what is not nature. As they stand out, one can give the user a desire to stop and explore the item.



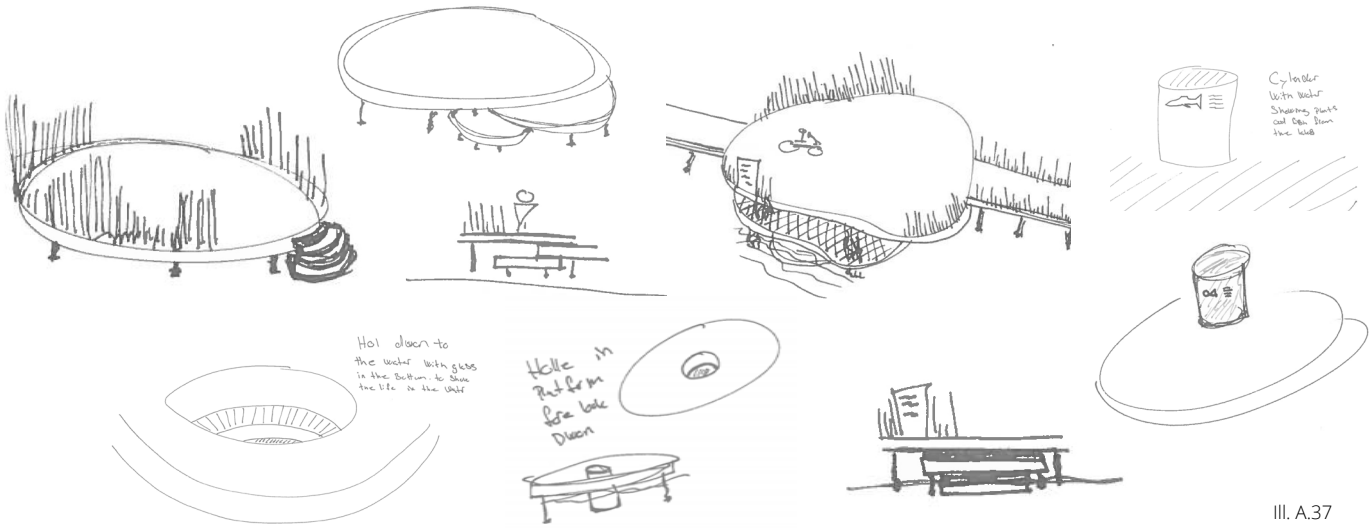
Ill. A.35

LEARNING STOP: BIRDS & FOREST



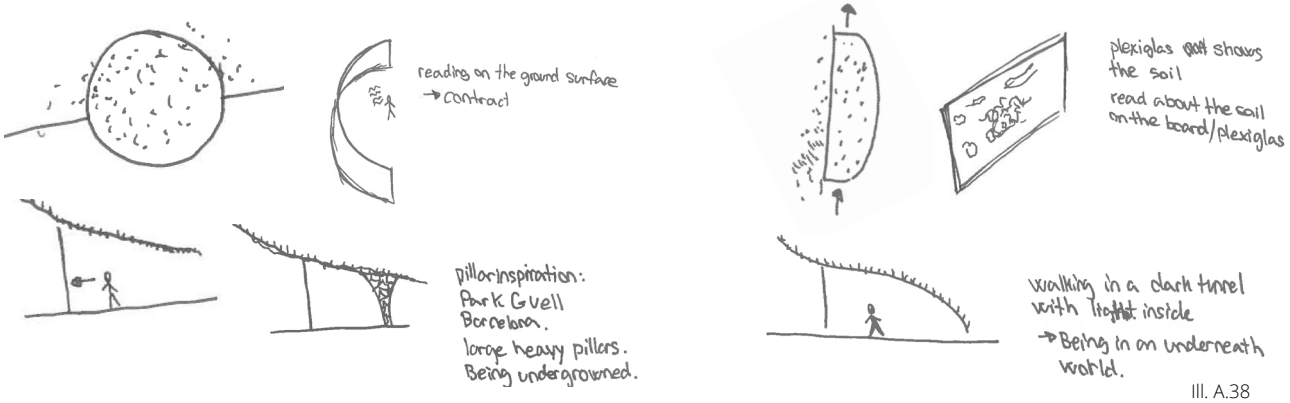
Ill. A.36

LEARNING STOP: FISH



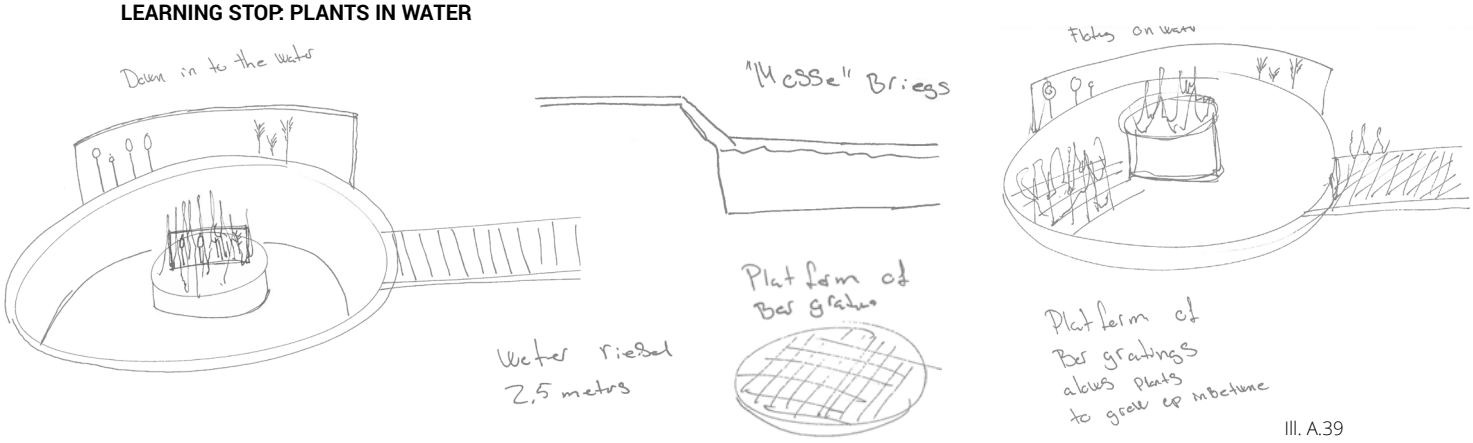
Ill. A.37

LEARNING STOP: SOIL CONDITIONS



Ill. A.38

LEARNING STOP: PLANTS IN WATER



Ill. A.39

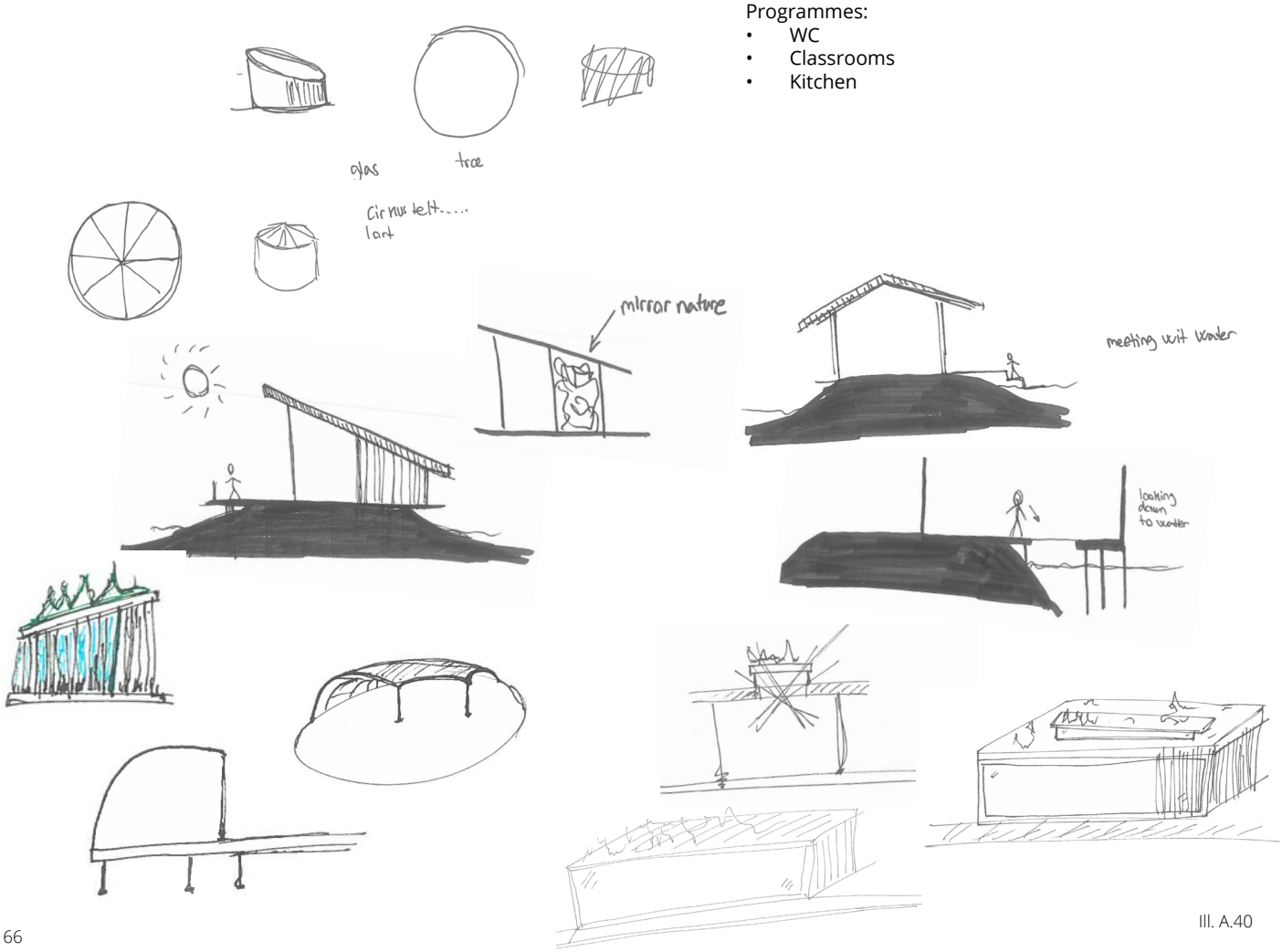
Needlepoints

Four needlepoints have been chosen for the design process to go into depth with. These points show places with complex issues and deal with elements that have a greater complexity than being a “pavilion”. The four needlepoints that are chosen are the Learning Centre, Nature Workshop, cleansing stairs and Mastrupvej.
The Learning Centre and the cleansing stairs are important stops in relation to learning and the water cycle, while the Nature Workshop is a different programme that helps to strengthen the area’s cycle. Mastrupvej is chosen because of the importance of the area being properly connected.
The four needlepoints also show what the area can offer and how the various issues are solved on the site. Therefore, the impact points contribute to give a picture of the single design for the area.

LEARNING CENTRE

The cycle for the whole area will be scaled down and become the Learning Centre. There, teaching can happen all year, and the area is displayed throughout the different seasons.

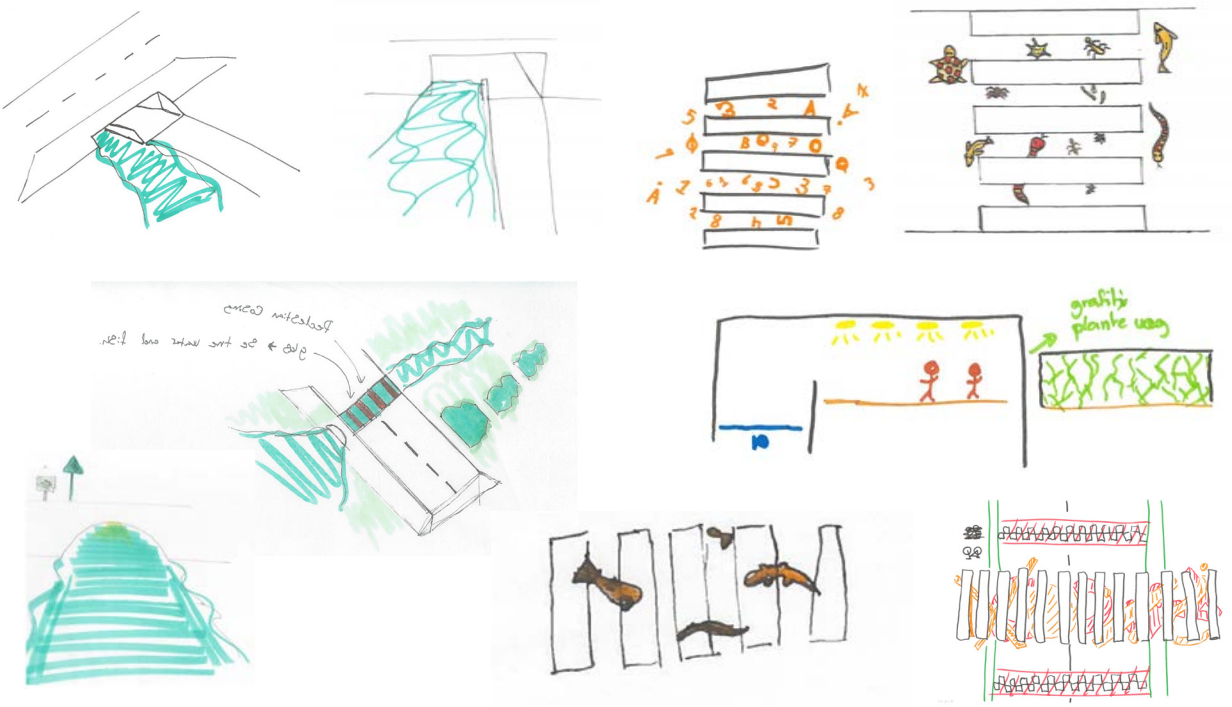
Programmes:
- WC
- Classrooms
- Kitchen



Ill. A.40

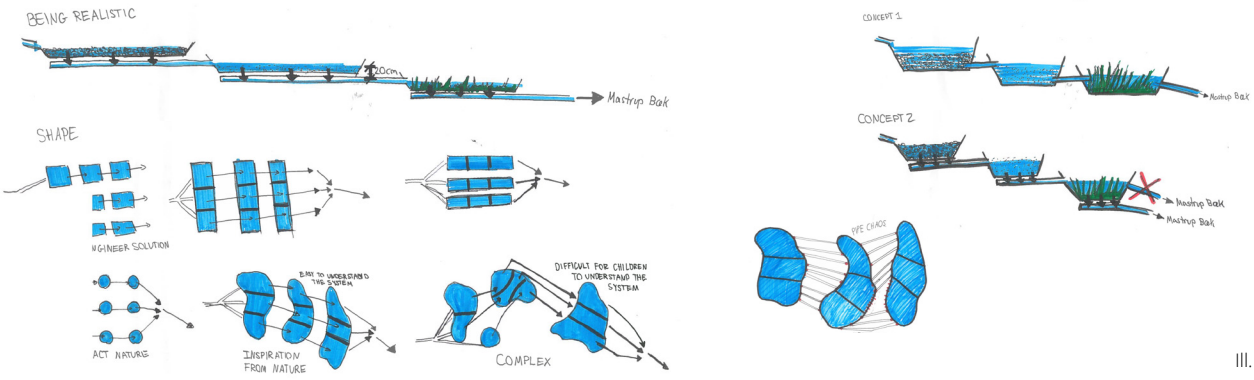
MASTRUPVEJ

Two different options for improving the transition have been discussed. The first was a tunnel solution, but this one quickly gets dark and thus insecure, but this can be solved with light and graphics on the walls. However, this solution will be below water level, which will cause water problems and will be an expensive solution. The other solution was a pedestrian crossing that can be made on the existing raised surface. The pedestrian crossing can be supplemented with graphics, but this should not be too vivid or too detailed, as it should not distract. It could be possible to use the same colour as the paths crossing so that it becomes a natural part of the cycle. Children should not be caught by the graphics as they must be aware of the traffic. Placement can appropriately be the same as now because of its visibility.



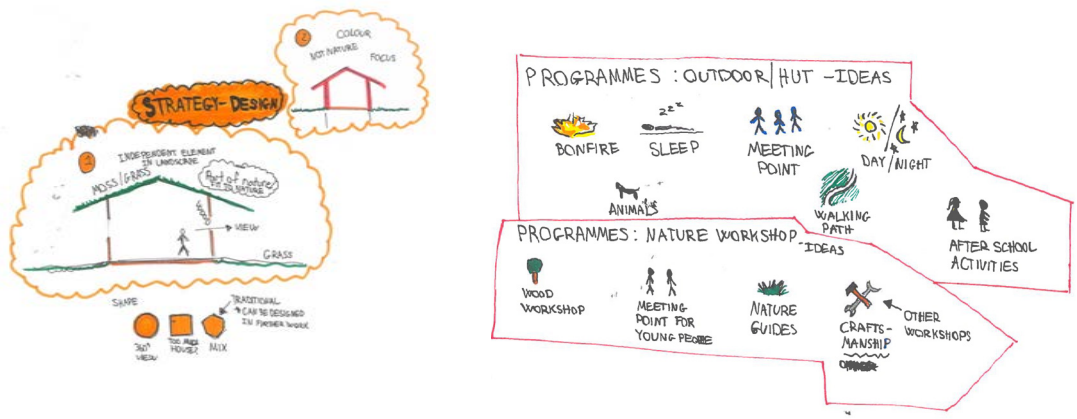
III. A.41

CLEANSING STAIRS



III. A.42

NATURE WORKSHOP



III. A.43

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ILLUSTRATIONS

Ill. 1: Own Photo

Ill. 2: www.statistikbanken.dk/statbank5a/selectvarval/define.asp?PLanguage=0&subword=tabsel&MainTable=FLY66&PXSId=146290&tablestyle=&ST=SD&buttons=0

Ill. 3: Own illustration

Ill. 4: Made out from www.windfinder.com/windstatistics/aalborg

Ill. 5-6: Appendix to Niras, 2015. Grundlag for udarbejdelse af Masterplan for regnvandshåntering. Støvring By [PDF]. Project no. 215311. Document no. 129488839. Material delivered by Rebild Vand.

Ill. 7: download.kortforsyningen.dk/content/dtkh%C3%B-8je-m%C3%A5lebordsblade

Ill. 8-9: Own photos

Ill. 10: www.aalborgkommuneplan.dk/media/890065/oesteraadal500px.png

Ill. 11-12: Own photos

Ill. 15: Own illustration

Ill. 16: Betula pendula: www.danmarksflora.dk/0302.php?planteid=45
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Ill. 17-18: Output from MatLab

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Ill. 22: domain.me/wp-content/uploads/2014/09/book-reading-nature.jpg
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Ill. 26-43: Own illustration