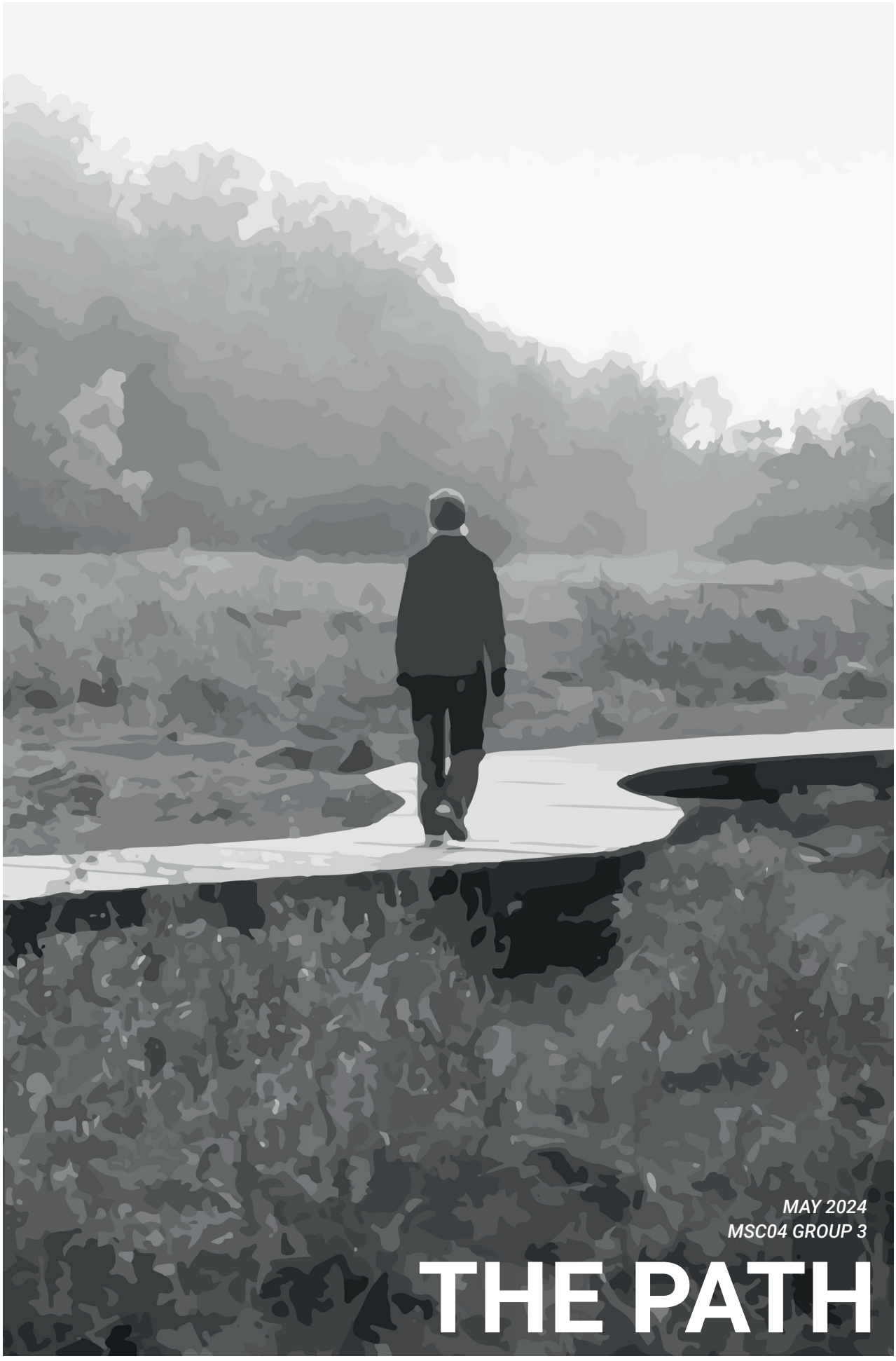

MAY 2024
MSC04 GROUP 3

THE PATH

PROCESS

TITLE PAGE

PROJECT TITLE: THE PATH

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Architecture and Design

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Jonas Nordestgaard Graversen

Lasse Skov Midtgaard

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PROLOGUE

ABSTRACT

This master's thesis features a design proposal for a 24-hour rehabilitation center for drug addicts located in Rold Skov, Denmark. Through the initial research for the thesis, it was found that current rehabilitation centers across Denmark mostly share the same architectural challenges. Their expression, spatial layout, and provided functions for the users are often substandard and there is often a lack of focus on the users' needs for self-fulfillment. Furthermore, current offers are typically old, renovated, two-story buildings, that are often inaccessible and poorly designed for the many moving impaired users.

The concept of this design proposal revolves around bringing structure to the daily routines of the clients through clear architectural programming, while also introducing functions that ensure the clients have their esteem needs and self-fulfillment needs met, in accordance with Maslow's theory on the hierarchy of needs. The users' needs for esteem and self-fulfillment will be addressed through the implementation of e.g., workshops, greenhouses, and other activities. To facilitate a structured setting for rehabilitation, the architecture provides legibility in the spatial layout, as a division of the functions creates an easily understandable environment for the clients to recover. Furthermore, designing a home for the residents to live in and giving them a homely atmosphere in the social spaces as well as private spaces is pivotal for this project. Including therapeutic rooms for therapy, mindfulness and yoga is also important, as these are some of the primary functions of a rehabilitation center.

This thesis displays the research, analysis, and design process, utilizing the integrated and iterative design process. This culminates in a design proposal that inspires a new take on rehabilitation centers, and how programming, functions and adaptive opportunities can provide a healing environment that helps to foster long term recovery for the users.

Ill. 1. The path towards Store Blåkilde.

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INTRODUCTION

This master thesis revolves around drug addiction and the residential treatment process. The project features a design proposal for a rehabilitation center located in the heart of Rold Skov, Denmark, where addicts can recover through various therapy methods and activities, and by utilizing the beauty of the surrounding nature.

The project is an integrated design solution of high architectural quality, where extensive analysis, research, and simulations have been done throughout the process to argue for and conclude on the best possible design solution based on various defined criteria.

The challenge of this project is to rethink the physical frame of what a rehabilitation center is. Whereas the current rehabilitation offers in the country are very similar and outdated in their architectural value, this master thesis seeks to offer a new and better alternative for drug addicts to recover. The thesis also seeks to map the existing offers throughout the country and research their individual functions and any unfulfilled needs the clients may have through case studies and interviews. Lastly, relevant literature has been reviewed on the subject of designing for rehabilitation and the incorporation of healing architecture, to ensure that the architecture can supplement the recovery process.

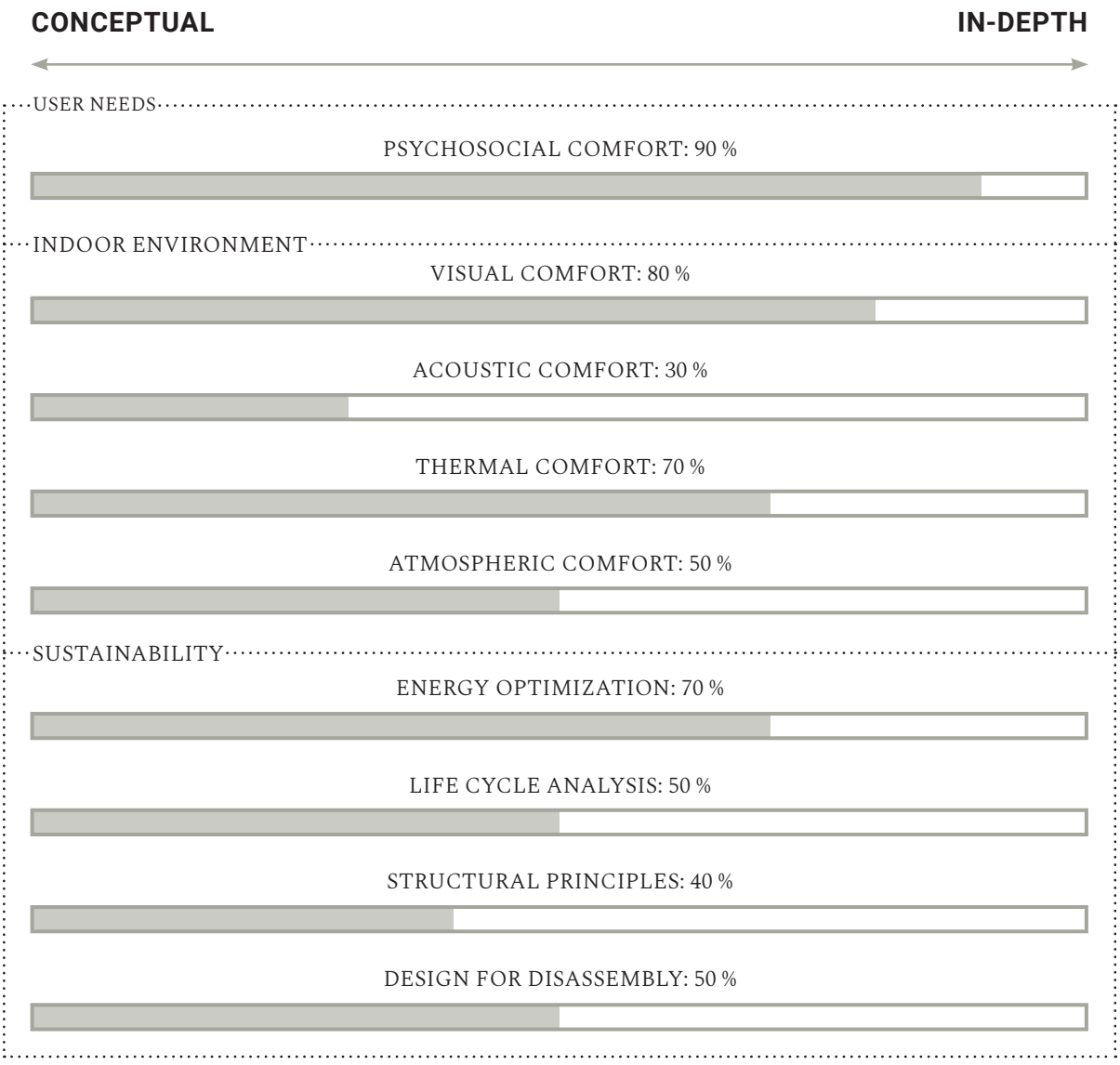
READING GUIDE

The following report covers all key aspects of the final design proposal. The report is divided and structured into sections containing analytical, theoretical, and methodological aspects as well as extensive user research, case studies, and contextual conditions. This initial part functions as the premise and basis for the project's problem definition and the initial work of the project's design. The initial part is completed with a program, leading into a summarized explanation of the extensive design process that took place throughout the project. The report culminates with a conclusion and answer to the problem definition. Throughout the report, relevant illustrations and imagery were made to accompany and support the textual phrases in each section.

Separately to this report, the final design proposal is presented in its own paper as well as the Appendix document supporting this report is given in a separate paper.

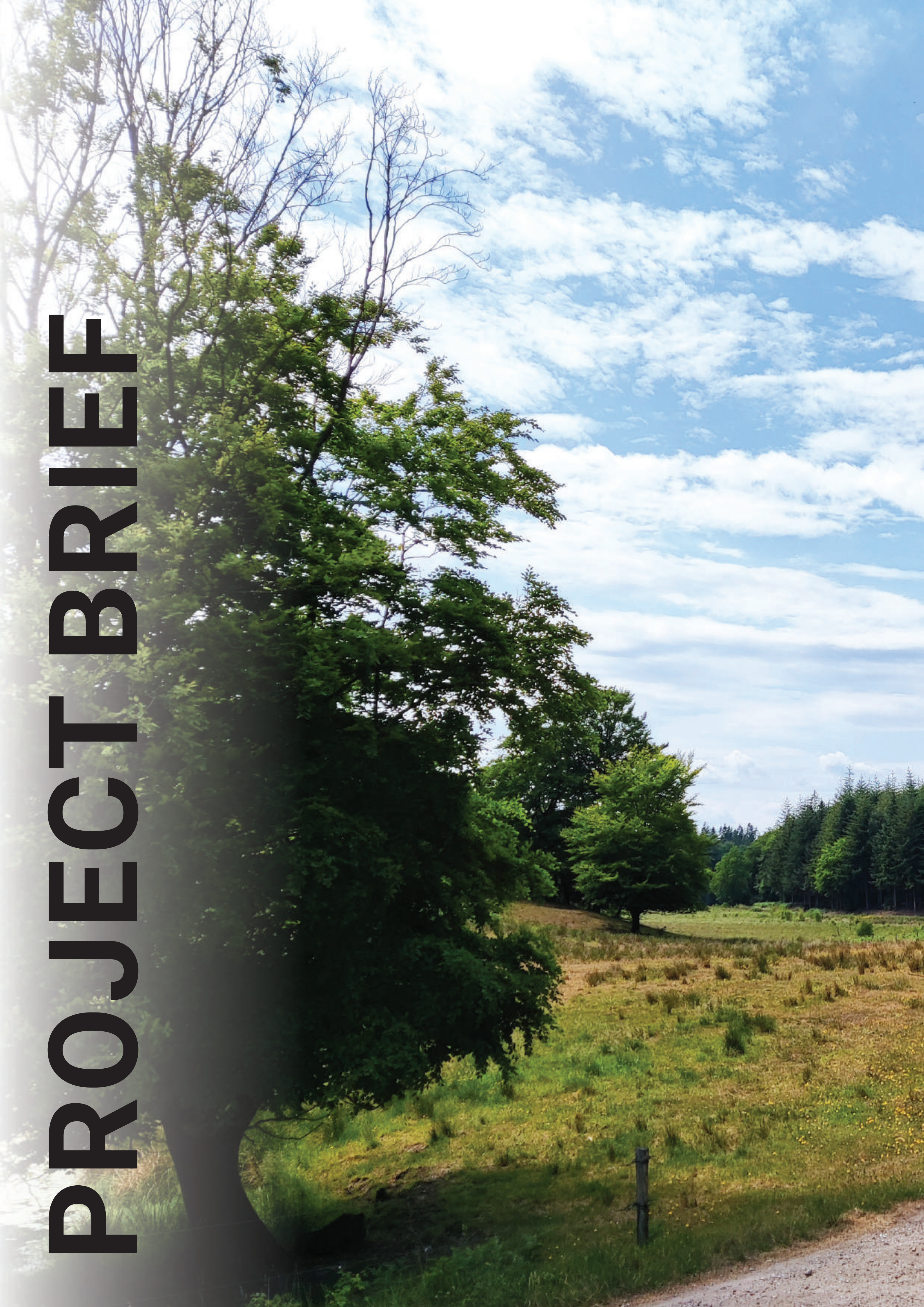
PROJECT FOCUS

The goal of the master thesis is to address the underlying subjects of architecture relevant to this project, seen in the illustration below. The importance of the different aspects has been carefully evaluated, both in relation to the user group and to support the sustainable agenda in the building industry. It is important to mention the interconnected nature of these topics and how changing one parameter would affect and change the result of the others. A holistic approach is necessary in architecture, but to not make the scope too broad, it can be beneficial to focus on a pre-determined selection of parameters. On an individual level, the personal learning goals of each group member have been discussed, which also influenced the general direction of the project.



Ill. 2. Project focus.

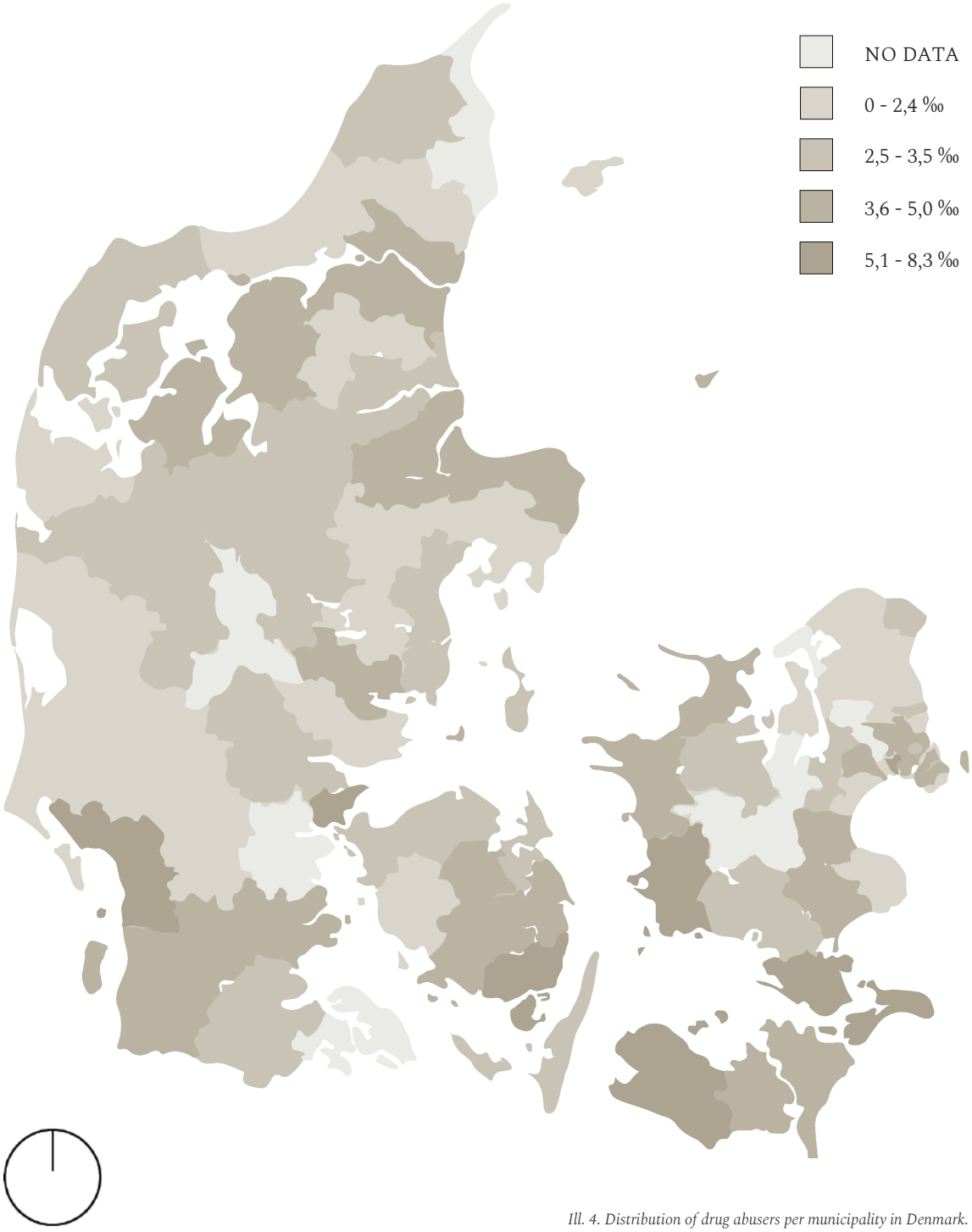
PROJECT BRIEF



Ill. 3. The arrival to the site.

MOTIVATION

In Denmark, there are about 33.000 substance abusers, and this number has been slowly rising over the past years. It is estimated that around half of the people with substance abuse are in some form of social or medical treatment and there has been a rise in substance abusers struggling with cannabis abuse while fewer seek help with opioid abuse. The distribution of people using varying substances is seen in the illustration to the right, and here it is shown that the substance abusers throughout the country are overrepresented in some locations compared to others (Grünberger & Lauridsen, 2013).



Ill. 4. Distribution of drug abusers per municipality in Denmark.

WHAT IS SUBSTANCE ABUSE?

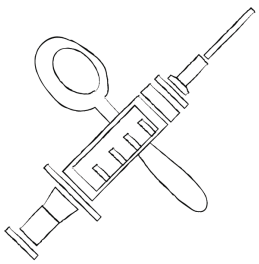
Substance abuse can be defined by the excessive or inappropriate use of substances such as illegal drugs, prescription medication, alcohol, etc. (Sundhedsstyrelsen, 2016). It can be said in general that substance use always involves risks, and the danger should never be ignored. A person under the influence of drugs can both experience psychological and physical discomfort, such as anxiety attacks or throwing up. Many of the drugs in circulation can also be deadly due to the risk of overdose. In addition, there can also be a heightened danger if the user is moving in traffic since both reaction time and judgments can be altered. This occurs because the drugs directly influence the brain which is in charge of administrating the inputs of our senses. The reward center of the brain is also particularly affected by drug use, which contributes to the addictive nature of the drug. One can become dependent on the feelings of happiness or satisfaction that the brain's reward center receives when using substances and seek to experience these feelings over and over leading to substance abuse (Sundhedsstyrelsen, 2016).

Drugs can influence people in many ways, but they are typically divided into three different groups depending on how they affect the user.

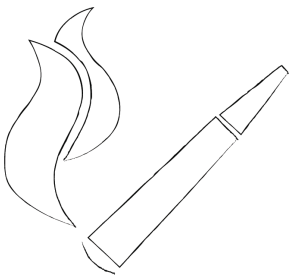
1. The first group of drugs is depressants which slow down the central nervous system, including cannabis, heroin, and morphine.

2. The second group is stimulants, which speed up the central nervous system, including drugs like amphetamines, cocaine, and ecstasy.

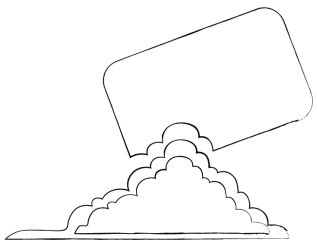
3. Finally, there are the hallucinogenic drugs which include LSD, ketamine, and some forms of hallucinogenic mushrooms (Sundhedsstyrelsen, 2016).



ABOUT 20.000 PEOPLE
USE OPIOIDS



ABOUT 32.600 PEOPLE
USE CANNABIS



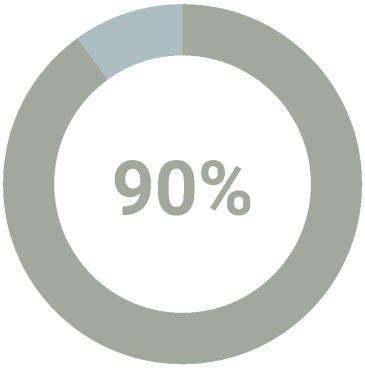
ABOUT 32.000 PEOPLE
USE OTHER SUBSTANCES

Ill. 5. Substances abuse statistics in Denmark.

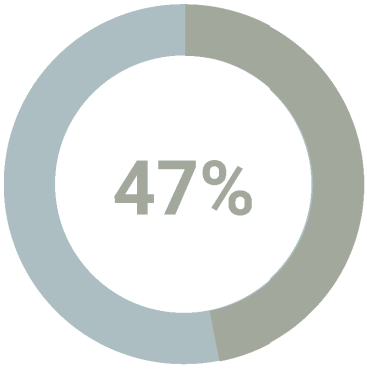
Ill. 6. A person using heroin.

CHALLENGES OF DRUG ABUSE

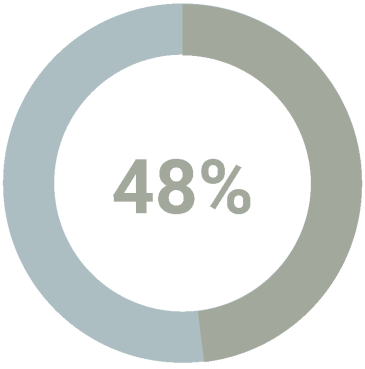
People with substance abuse often struggle with other individual challenges, which on a large scale also pose a societal challenge as seen in the illustration to the right. The treatment coordination should therefore be extended to a long list of professionals i.e., social workers, doctors, or psychiatrists for it to have a long-term effect and to boost the chances of recovery. This complete approach aims to not only focus on substance abuse but also to ensure a proper reintegration of the client into society, including assistance with finding a home, securing a job, or starting medical or psychological treatment (Grünberger & Lauridsen, 2013).



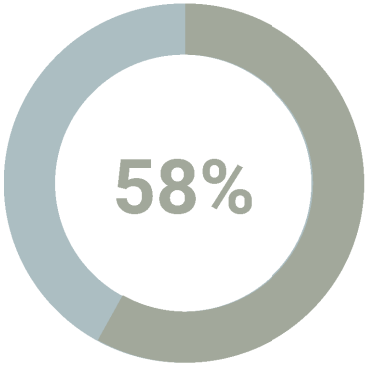
DO NOT HAVE EMPLOYMENT



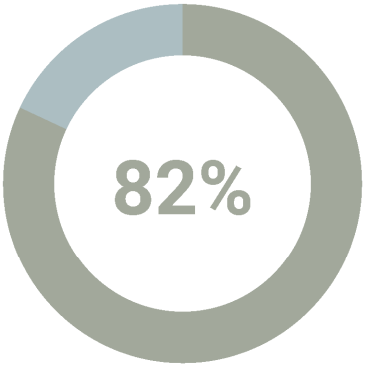
HAVE NO INDEPENDENT RESIDENCE



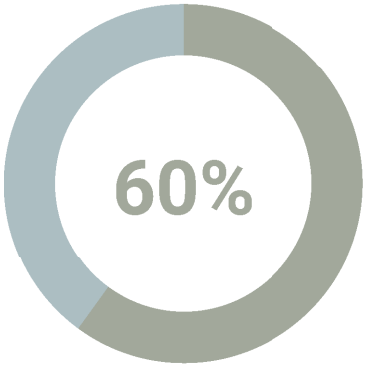
HAVE DONE CRIMINAL ACTIVITY



FEEL STRESSED IN THEIR DAILY LIFE



HAVE ONE OR MORE ILLNESSES



HAD MENTAL HEALTH CHALLENGES

Ill. 7. Challenge related to substance abuse.

TYPICAL TREATMENT PROCESS

TREATMENT PROCESS

The typical treatment course for a substance abuser who wants to seek help starts with a visitation at a local visitation center in the person's municipality. At this meeting, the best course of action is discussed, and the substance abuser is guided about the treatment offers that would be best for the individual person. Some substance abusers need or want ambulatory treatment, which is typically set up through the person's doctor, but is guided by the advice from the conversation during the visitation. The treatment could be day-treatment with individual or group therapy, for example. In other cases, the person might benefit more from a longer stay at a 24-hour rehabilitation center. Here, the therapy would be more engaging and there would be more supervision of the users (Sundhedstilbud Aalborg, n.d.). Since this master's thesis seeks to design a 24-hour rehabilitation center, the research will focus on this type of treatment.

Treatment for substance abusers is outlined under the Danish "Serviceloven", which gives substance abusers the option to choose freely where they go to get rehabilitated or what type of treatment they want. The client can be treated at any of the approved 24-hour rehabilitation centers in Denmark (Aalborg Kommune, n.d.).

There are differences in the treatment models used at the different centers. The treatment types offered span wide and are often tailored to fit into a certain stage of the recovery process. The visitation centers not only monitor and inspect rehabilitation centers, but also seek to guide clients and recommend various places depending on the addict's age, personality, and treatment type at the different rehabilitation centers (Appendix 1).

DESCRIPTION OF THE STAY

A stay at a 24-hour rehabilitation center typically lasts two to four months, and it is up to the center's staff and social workers to evaluate when the stay should end for a client. When the stay is over, the client returns home, but the treatment is often not finished as there will be follow-up meetings with visitation workers post-treatment, where they advise the client and aim to support the client's new life without substance abuse (Aalborg Kommune, n.d.).

The activities and treatment can vary greatly depending on the rehabilitation center, but there are certain things that are common. For example, most rehabilitation centers offer individual and group therapy sessions, various indoor and outdoor activities as well as daily tasks such as cooking and cleaning with the goal of helping the recovering substance abusers get back into a daily rhythm.

When the person gets back home, the 'real work' starts. Here, the person will quickly be faced with a lot of decisions, and enticing opportunities that could make the person veer off their new path. Therefore, an essential part of the homecoming is to continue therapy regularly at a local treatment center or join a volunteer organization such as Narcotics Anonymous (NA) to stay on track.

TYPES OF TREATMENT

Cases of substance abuse vary in what the substance is and which stage of abuse the substance user is in. Therefore, the type of treatment varies, offering a more specific treatment for the state the patient is in. The Danish Government has various free offers for drug addiction recovery, which fall under *'Serviceloven'*, and the offers are listed to the right (Socialstyrelsen, 2021).

PHASE 0

Community-Based Services:

Community organizations and services may offer outreach, harm reduction programs, and community resources to address substance abuse issues.

Prevention and Educational Programs:

Prevention initiatives and educational programs aim to raise awareness about substance abuse, promote healthy behaviors, and prevent the initiation of substance use.

PHASE 1

Municipal Visitation Centers

In the visitation centers, the clients are screened, and from there a treatment plan is developed that fits with the severity of the abuse problem and the client's profile. Here it will also be mapped out if the client has other challenges such as mental or physical illnesses.

PHASE 2

Detoxification Services:

Detoxification programs are designed to help individuals safely withdraw from substances under medical supervision. These services may be provided in specialized detox units or as part of inpatient treatment programs. This is done through a referral at a doctor's office where you are sent to a hospital, or the doctor can decide to give you medication for this process, also known as 'Medication-Assisted Treatment'.

PHASE 3

Outpatient Treatment:

Outpatient programs offer counseling, therapy, and support for individuals with substance use disorders, while allowing them to live at home. This may include individual counseling, group therapy, and educational sessions.

Inpatient Treatment:

Inpatient treatment involves a stay at a residential facility, where individuals receive intensive, round-the-clock care at a rehabilitation center. These programs often include counseling, therapy, and skill-building activities.

Dual Diagnosis Treatment:

For individuals with co-occurring mental health disorders and substance use disorders, dual diagnosis treatment addresses both issues simultaneously through integrated care.

PHASE 4

Support Groups:

Support groups, such as Alcoholics Anonymous (AA) or Narcotics Anonymous (NA), provide a supportive community for individuals in recovery. These groups often follow a 12-step program and offer peer support.

Aftercare and Support:

After completing formal treatment, individuals may receive ongoing support through aftercare programs, counseling, and support group participation to help prevent relapse.

Family and Social Support:

Involving families in the treatment process is crucial. Family therapy and support services can help address the impact of addiction on relationships and provide a supportive environment for recovery.

Ill. 8. Treatment offers and process.

CURRENT OFFERS

In Denmark, there are an array of 24-hour rehabilitation centers spread across the country, as seen in the illustration to the right. The rehabilitation centers are mostly situated outside of urban areas, either in the countryside or in natural settings. They are often located in older, but renovated mansions or farmhouses, making them less expensive given the remote location. As the rehabilitation centers are mostly private owned businesses, cost is important to be competitive and attractive for patient referrals. In other words, given that municipalities are responsible for paying for the treatment, they are more attracted by lower cost facilities and therefore more likely to refer patients to these facilities.

The size and capacity of the rehabilitation centers vary greatly, but in general they range between 15-40 recovering substance abusers, and often the company running the center has multiple locations (Appendix 1). There is not a direct link between the number of drug addicts in a certain municipality and the locations of the rehabilitation centers, as travelling to or from the center is of less importance. The rehabilitation center's surroundings and landscape are more important than the distance to certain cities or areas.

Ill. 9. Current offers for drug rehabilitation in Denmark.

METHODOLOGY

Ill. 10. The woodlands near Store Øksø.

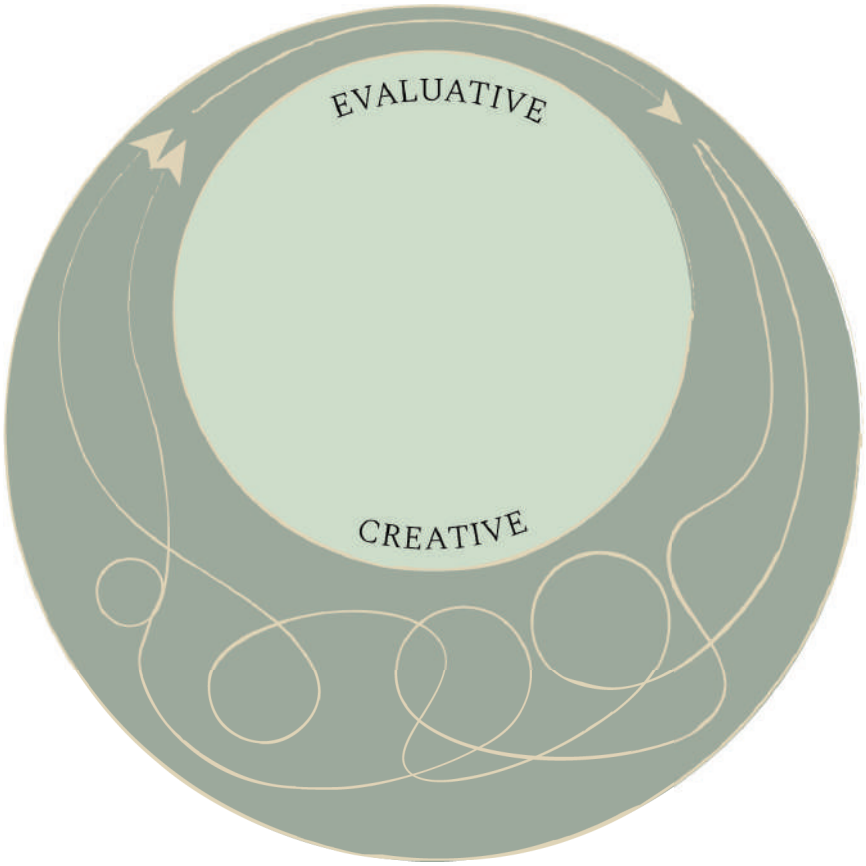
INTEGRATED DESIGN PROCESS

This master thesis utilizes the Integrated Design Process methodology from Marie-Ann Knudstrup, commonly known as IDP. The Integrated Design Process consists of five phases, 'Problem, Analysis, Sketching, Synthesis, and Presentation' (Hansen & Knudstrup, 2015).

The concept with this process is that each phase of the process is iterative. Thus, when information is acquired in a phase, the previous phases are revisited to reconsider earlier conclusions and knowledge. Each phase has specific tools and sub-methods to examine and evaluate the process, thus making the design process integrated as decision-making strives to be based on data and knowledge rather than subjective opinions.

ALTERNATING APPROACHES WITHIN THE DESIGN PROCESS

To put a twist on the standard IDP method, this master thesis utilized Lars Brorson's interpretation of the method and incorporated it into the design process. The method's fundamental structure requires alternating approaches to make the design evolve and confirm or deny various design solutions. The illustration to the right showcases the concept of how the process starts off with acquiring knowledge and data to construct design criteria and a program for the overall design. Then, shortly after the initial stages, ideas and thoughts should start generating freely, where concepts and ideas should not be weighed down by previous knowledge or criteria. This is to construct a more creative free space for the design process to evolve, where the creative approach can roam without disruptions. Finally, the contracting stage is an equally important part, where the ideas should be rounded back up at the starting point and evaluated based on the criteria and gained knowledge. The process then repeats itself, constantly shifting between the approaches of being creative or being evaluative (Fich, 2024).



Ill. 11. Alternating approaches within the design process.

STAGES, TOOLS & SUB-METHODS

The design proposal is achieved through a series of methods and tools used throughout the iterative design process. The following list is divided into the stages of IDP to give more specific insight into the project's process.

Problem & idea
The project is initiated by a subject of interest and user research that shapes the initial problem to be solved. The project specification gets narrowed down to the core throughout the other phases, and the finalization of the stage ends with a problem definition for the project overall.

Through the other phases, the specific user was chosen and researched, and in combination with the other stages, the final problem definition was concluded to be designing a rehabilitation center with architectural principles focusing on the users' needs defined in the research stages.

Analysis
To gain knowledge and data to inform the project, various analysis and research have been conducted. Specifically, extensive user research has been done in the form of interviews with professionals and recovered substance abusers. These interviews were conducted online and during site visits to existing rehabilitation centers to gain valuable information on what is already working at these centers and potential challenges the users face during their stay.

Further, the site, context, and micro-climatic conditions were analyzed during field studies and mappings. In-depth research in relevant theory has also been done to gain theoretic input on how architecture can help solve the challenges.

The phase is summarized in specific design criteria and a program to use during the design phase to evaluate various solutions. As the stages are in a continuous movement, the program and criteria are edited and adapted throughout the process when other stages are revisited, and new knowledge is obtained.

Sketching
During the sketching stage, ideas are generated through various creative sessions. Respectively, 3D modeling, hand drawings, and model building are utilized to visualize possible design solutions to later be evaluated and discussed in the synthesis stage.

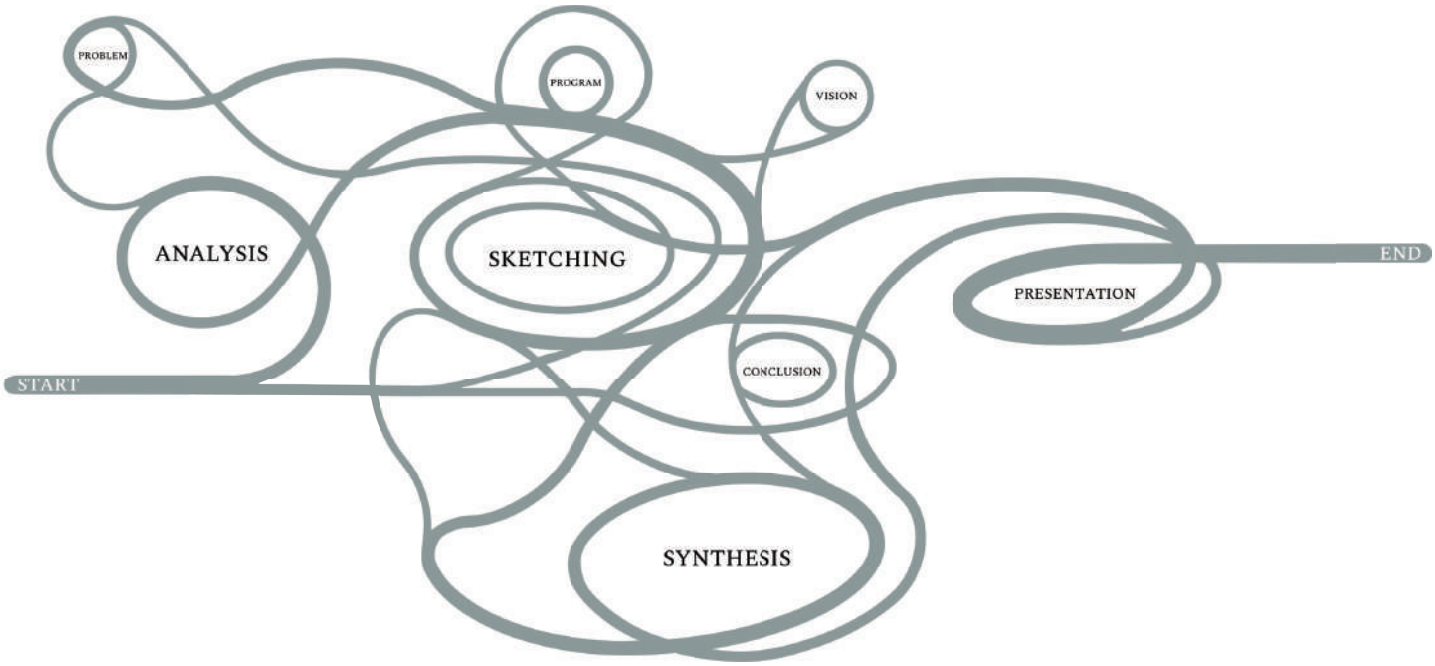
The illustrative and expressive nature of this stage can furthermore be an asset in gaining new realizations. When ideas are produced into form, sub-conclusions, and knowledge can be gained, after iterating and discussing various ideas and design iterations.

During the sketching stage, simulations are done within different design solutions to test the buildability of each idea and to gain insight into concepts that might work great in one design and could be improved by combining it with an idea from another design.

Synthesis
The synthesis stage is assigned to evaluate and assess various design solutions, often done with the program and design criteria in mind. The stage is on its own, as the sketching and designing stage is often done freely to spark a creative process without restrictions. When various solutions are sketched, the process of synthesis can begin to evaluate the strengths and weaknesses for both entire designs solutions and smaller conceptual ideas. The stage is crucial to ensure an architectural project with integrated design. In the sketching stage, the designer must ask why not, but in the synthesis stage the designer must ask why, and these are the two questions that together turn different ideas and solutions into new information and therefore better designs.

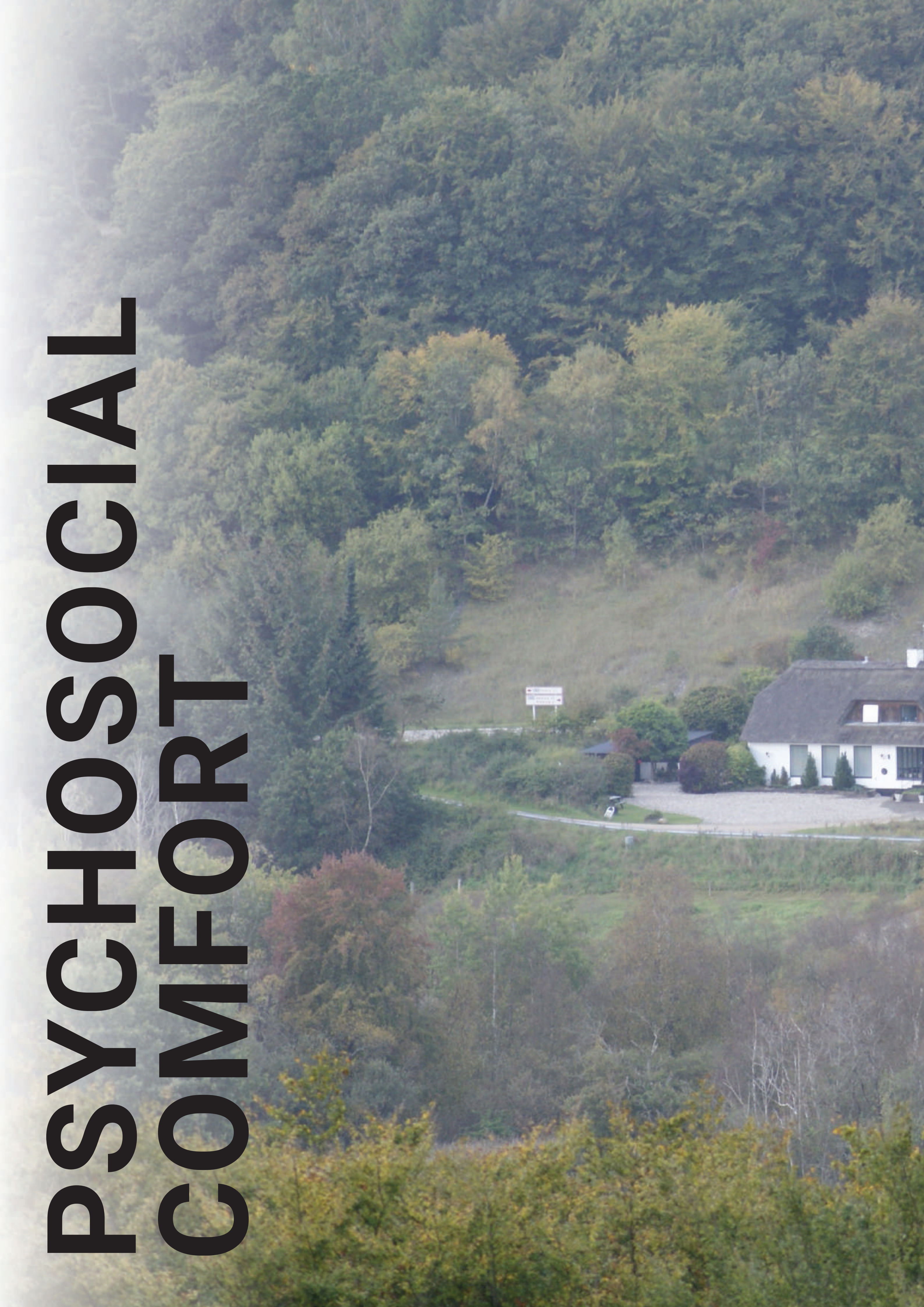
Presentation
The final stage of the process is the presentation of the project, where the final design is presented through diagrams, models, and sketches, and more specifically through plans, sections, elevations and renderings. The project is presented for architectural and technical qualities, emphasizing the importance of how they can work in symbiosis to improve a design.

The stage is also concluded with a project report, a design presentation report, final models, posters, and a presentation of the design that seeks to communicate the conclusions made throughout the project and the final design solutions.



Ill. 12. The Integrated Design Process.

PSYCHOSOCIAL COMFORT



Ill. 13. Viewpoint at Rebild Bakker.

HOMEOSTASIS & STRESS

Homeostatic balance is a vital function of our body, and it provides the ability to regulate itself and react to both external and internal influences (Bust, 2024). The different control systems of our body are constantly working together to ensure this balance, and these include both hormonal and neurological processes that work on a very precise level. Some of the parameters that the homeostatic balance regulates are for example the body's temperature, blood sugar level, and blood pressure to stabilize it when different influences occur. Longer periods of disturbances in the homeostatic balance can over time affect our health and well-being negatively which can result in physical and mental health problems (Bust, 2024).

Stress can affect the homeostatic balance which can then trigger the body's fight or flight response. Stress can be inflicted on a person from both internal and external factors and the nervous system then must react which then triggers one of these responses. Cortisol and adrenaline are released into the bloodstream and carbohydrates are mobilized, increasing blood glucose levels, and in addition to this the heartbeat is increased as well as respiratory activity. During sustained periods of stress, the body can be affected long-term, and the brain can encounter a structural remodeling that can alter a person's physiological and behavioral responses (Andrekovic, 2015).

Certain substances are used as self-medicating stress relievers, and therefore some of the clients in rehabilitation will experience heightened stress levels in addition to their withdrawal. This means that the environment in which the recovery takes place should not contribute to the stress factors that the clients may already be experiencing.

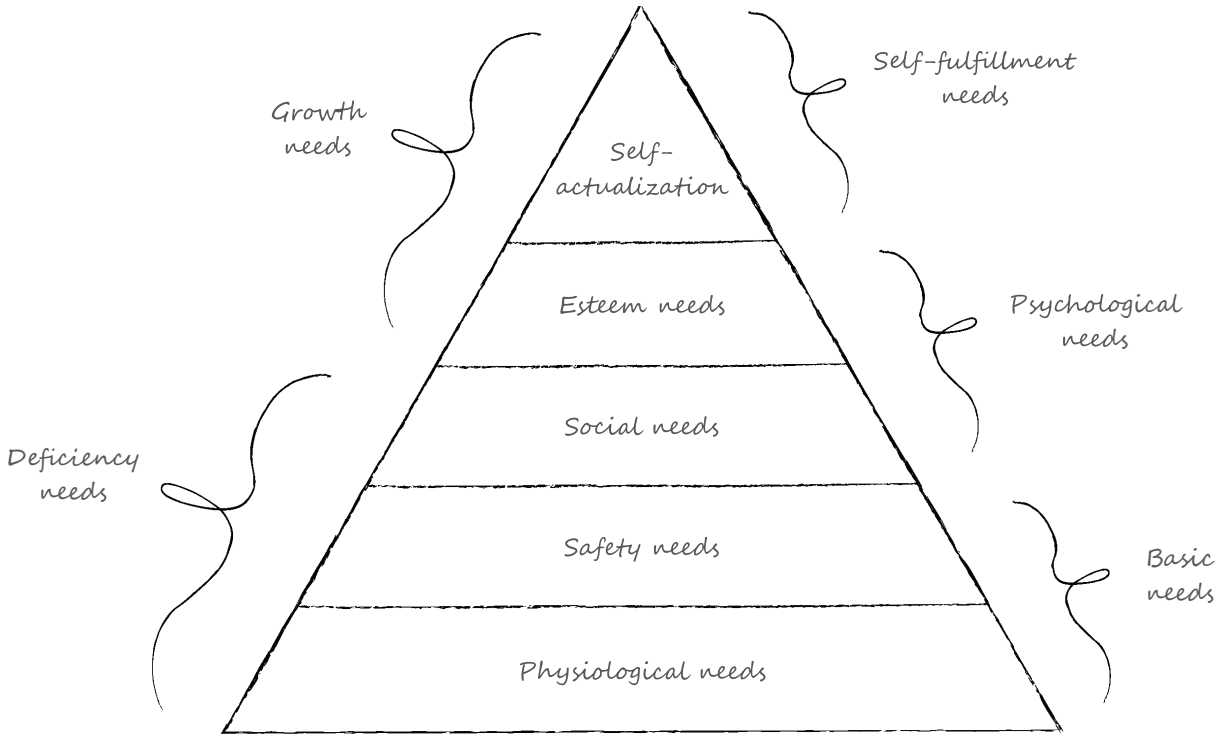
Ill. 14. The homeostatic balance.

MASLOW'S HIERARCHY OF NEEDS

Maslow's hierarchy of needs is illustrated as a triangle, and it is a theory that describes the individual needs that a person can have (Klitmose, 2023). The needs depicted in the triangle are divided into five stages based on their importance and the order in which the needs should be met. The fundamental needs are at the bottom of the triangle and these needs should be met first before the next stages of needs can be fulfilled. This means basic needs like food, water, sleep, and security must be met before psychological needs like social and esteem needs can be met. Lastly, both the basic needs and the psychological needs have to be met in order for people to start covering their self-fulfillment needs. For example, because of this hierarchy of needs a person that is hungry will set aside their need for security in order to venture out and gain food. Another example is that people need security first in order for them to be social. In this context, security does not only mean the societal functions that offer protection, such as police or health care, but it can also mean having safe conditions in their home environment and having spaces to relax in. Social needs are one of the broader stages in Maslow's triangle and it covers people's needs to gain acceptance from others and to feel a sense of belonging in a group (Klitmose, 2023).

Another way of looking at the triangle of needs is to divide it into two sections, namely the bottom section which can be described as the deficiency needs and the top part of the triangle which is the growth needs. The deficiency needs cover the first three needs that are all required to keep us alive and are therefore also necessary for us to thrive. If people do not have these needs met, it can result in both severe personal and societal problems (Klitmose, 2023). The growth needs are the two at the top of the triangle, including the need for recognition, where feelings of accomplishment and prestige enhance the person's self-esteem, and self-actualization, where people are able to unfold their full potential and accomplish themselves through creative expression (Klitmose, 2023).

These stages become the focal point of the master thesis, as the rehabilitation center needs to provide the physical space that allows patients in recovery to fulfill all the stages in the hierarchy of needs. The user often starts their journey at the very bottom of the pyramid because of their addiction, so designing spaces that allow them to fulfill both their basic and growth needs becomes the most important design criterion. It is necessary for them not only to recover, but also to develop and obtain a better view of life moving forward. Through user interviews done in this master thesis, the hierarchy of needs is later used to conclude on what needs current rehabilitation centers cover as well as what a new rehabilitation center could do better.



Ill. 15. Maslow's Hierarchy of Needs.

USER RESEARCH

Ill. 16. Forrest road in Rold Skov.

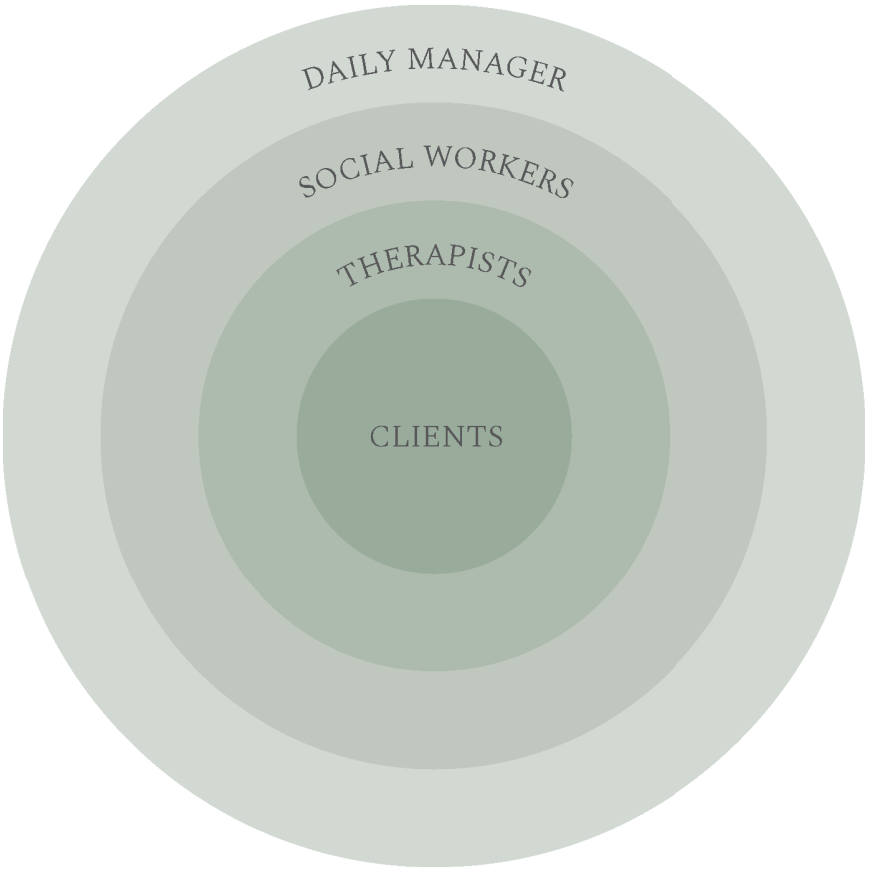
USER DEMARCATION

In this master thesis, there will be a heightened focus on the client as the primary user, meaning the design should first seek to support their recovery. This will be done by creating spaces for therapy where the clients can work on their personal goal of becoming addiction-free. In addition to this, there should be social and private spaces, both indoors and outdoors, where the clients can either socialize or be alone to reflect on their path to recovery.

To further specify, the primary users in this project are recovering drug addicts spanning from the ages 18-75. Generally speaking, this user often faces additional challenges, such as mental illness and decreased physical functionality. The design, therefore, needs to be adapted to be accessible for users of different ages and physical forms, which is not the case in most existing rehabilitation centers.

The recovery center will not be a specified facility for either alcohol treatment or criminals sent to rehabilitation through the correctional services, since these users require different treatments and functions than regular substance users.

The secondary focus will be on the staff of the rehabilitation center, including a daily manager, therapists, and specialized social workers. The rehabilitation center must include offices and administration space, but the focus is on staff being a part of the client's daily lives and their interactions throughout the day.



Ill. 17. User demarcation.

VISIT AT STIEN REHABILITATION

Ill. 18. Picture of Stien rehabilitation center.

Stien Rehabilitation Center is a 24-hour treatment center for addicts located in Vojens in southern Jutland. Stien helps their residents with all forms of abuse regardless of age, gender, background, and diagnoses. The thesis group visited Stien Rehabilitation Center on February 13th, 2024, to see the layout and have conversations with the staff present.

"We treat everyone, from the Supreme Court judge who lives on Kongens Nytorv in a penthouse with an alcohol problem, to the street addict who walks from pavement to pavement" (Appendix 2).

The building is an old, two-story country house that has been renovated over several rounds and thus has changed a lot over time, and now contains 28 rooms for clients (Appendix 2). The communal areas are decorated to make them feel as homely as possible. Stien emphasizes that the rooms must be bright and inviting, and the atmosphere in the landscape must be calm and stress-relieving. Stien is located in a scenic setting, surrounded by trees and open spaces and is relatively undisturbed by the public. There are several walking routes and footpaths in the area which are used extensively (Stien Behandlingscenter, n.d.). The center provides residents with security and safety, including several measures such as a secured and fully managed medicine cabinet, as well as surveillance of the building and surrounding grounds from the staff office.

The visit to Stien confirmed that there were many passionate and professional staff who worked hard to help each and every one of their clients. The architecture also partially lived up to the descriptions of the rooms as described on the website. However, the group registered some problems in the spaces that could be reflected critically on. Firstly, the interior spatial layout was clearly marked by the many renovations, which had created a messy floor plan, with some strange spatiality. As first-time visitors to the rehabilitation center, it was felt that the interior layout counteracted Stien's vision of a stress-relieving and harmonious layout as some rooms were large, crowded, and filled with furniture leaving little to non-empty floor space while other rooms were relatively small.

The bedroom shown was to some extent bright due to the many white surfaces; however, this simultaneously created a sterile, clinical-like environment with little furniture. In this room, little daylight entered through the window, as the context and orientation of the room were not optimal, facing directly into an opposite building a few meters away.

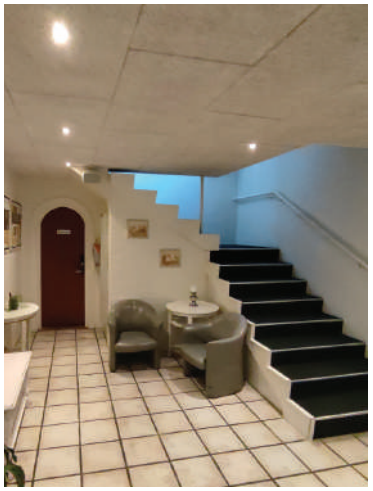
In the common areas, an emphasis has been placed on decoration, comfortable furniture, and activities. However, an interview with a former client informed the project group that when there are many residents, the common areas are very busy, which can be unpleasant if you want a more tranquil and relaxed atmosphere. Therefore, there appears to be a lack of opportunity to be social in smaller settings, so that it is not a choice of either being alone in the bedroom, or being social with all the residents present in the communal areas. The former client expressed that there was a lack of a space or rooms where you could talk more vulnerably and personally in a small group without feeling overheard by other clients or staff (Appendix 6).

Overall, the visit to Stien gained valuable insight into the functions and activities that work well, supported by the interview of a previous client at Stien. On the other side, it also showed some of the challenges and missing functions or limitations to the spaces that come with renovating and expanding an old building into a large rehabilitation center.







Ill. 19. Mood board of pictures from Stien rehabilitation center.

CASE STUDY, SLETTEN

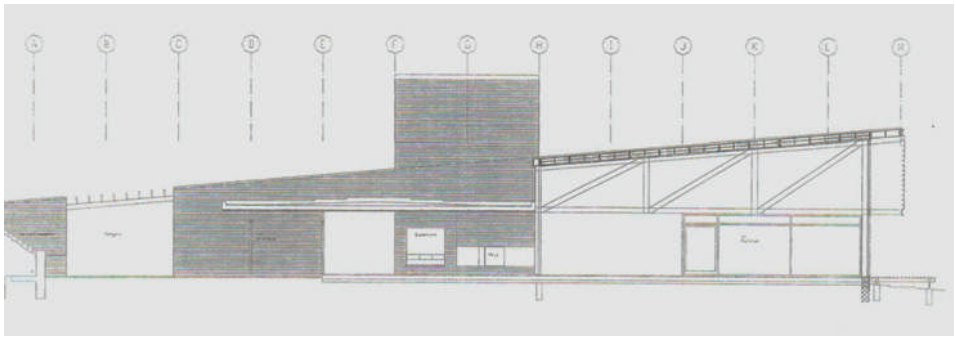
Sletten is an 800-square-meter outdoor center in Ry and the building was designed by AART architects to form the framework for an active, outdoor life. The group visited Sletten on February 13th, 2024, to see the layout and functions of the space.

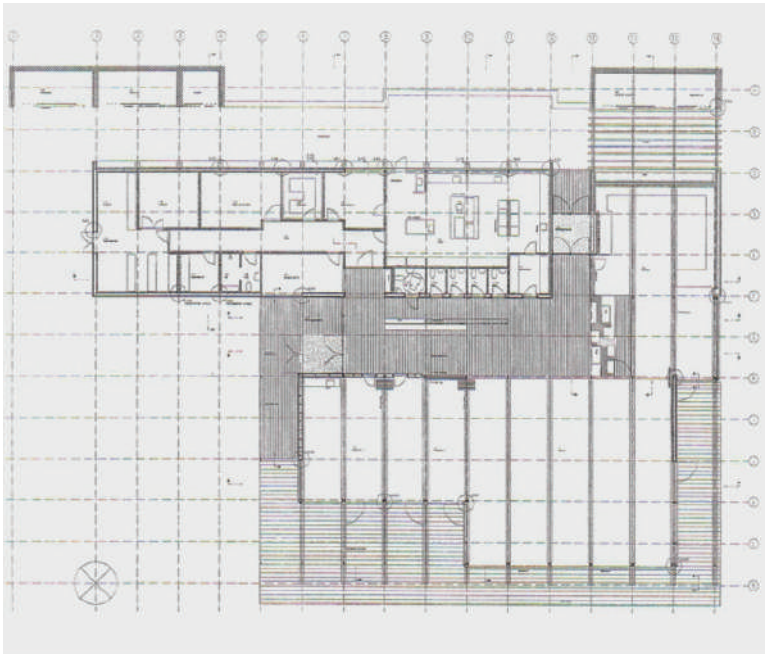
"Architecture and landscape merge in the outdoor center, where overhangs, window facades, and materials such as wood and stone draw nature deep into the outdoor center - all with a focus on providing space for life inside and out all year round." (AART, n.d.)

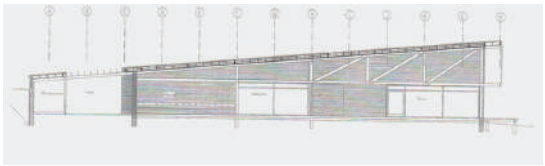
The building is clearly designed for the nature-loving user. The architects have focused on inviting nature into the building, and this can be seen, among other things, through the choice of materials, functions, room programming, and the large window facades that reach into the beautiful scenery. The core of the building is built in stone and almost hugs the forest hillside, from which the light and yet monumental wooden construction emerges. The large window area puts the scenic surroundings in focus and invites nature inside. As a centerpiece of the building, a large built-in fireplace is placed which also becomes a natural gathering point for the users of the building (AART, n.d.)

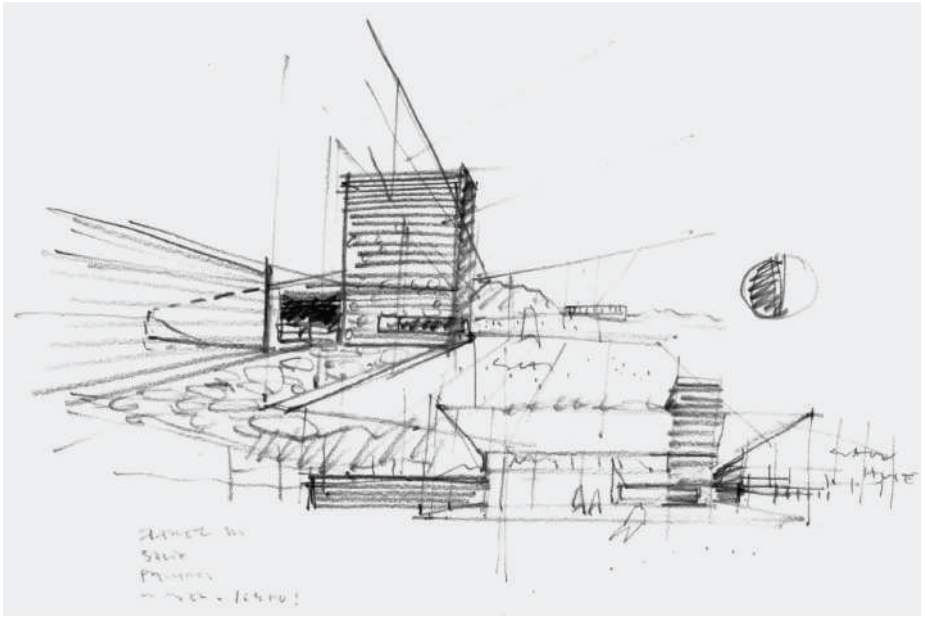
The building challenges the surrounding nature, as the sharp and geometric shapes in dark shades contrast with the organic and colorful forest. It also challenges the relationship between inside and outside and tries to dissolve the abrupt transition between inside and outside areas, by means of continuous construction, continuous materials, and sheltered outdoor spaces. The floor plan and room programming of the building create a broad target group for the place, as it consists of some very flexible rooms including a 200 square meter multi-room, a 100 square meter fireplace living room, and a 126 square meter covered outdoor area. The building is flexible as it can be changed and used to serve various needs (Lokale og anlægsfonden, n.d.). The building is of high architectural quality and was also honored with a nomination for the recognized Mies Van Der Rohe Architecture Prize in 2005.

The architecture displayed at Sletten is something to be considered in this project for the material choice and structural principles and the flexible and various communal areas. Furthermore, the design of outdoor spaces that are in direct connection to the surrounding nature as well as the functions and spaces inside is an example of how to create a connection between the building's interior and the surrounding nature.









Ill. 21. Mood board of pictures and drawings of Sletten outdoor center.

USER INTERVIEWS

In the initial stage of the thesis, conversations and interviews were done with three recovered substance abusers, to gain valuable information on who they were and their experiences with recovery both during their stay at a rehabilitation center, as well as the process and offers before and after. The interviews which form the basis for this section are attached in Appendix 4, 5, and 6 but the people's names have been changed, so they remain anonymous. The thesis group is aware of their real identity.

When researching existing rehabilitation centers throughout the country and interviewing users, it quickly became clear that the centers have many similarities in their architectural design and share many of the same challenges. For example, they are often renovated two-story houses, where bedrooms and bathrooms are on the upper floor. As Jan from Møllen Rehabilitation Center puts it:

"Getting a place in one story would be important, making it more handicap friendly and allowing elderly addicts or people that have poor walking abilities to use the place easier. All places I've visited are designed with this very challenge and it makes it really hard for all these people to recover and use the place." (Appendix 5)

The basic need to have an accessible and inclusive rehabilitation center is often missing, as the design and spaces do not allow everyone to use them. This is something that must be addressed, as it was also one of the main challenges put emphasis on by the visitation worker from Aalborg Municipality, Dina Mørk (Appendix 1).

During interviews, the users were asked to describe what activities the rehabilitation center must provide and their importance as this would assist in the definition of the program for this project. For example, Jan says:

"Especially table tennis and table football. It was a really important thing that was used a lot. In addition, cozy corners, games, TV or sports activities and things where you can use your body because you often have a restlessness and need to get rid of energy." (Appendix 5)

Various activities must be provided so that the user feels at home and has something to do, preferably something to do with the other clients as a means of socializing. This creates an environment where you can get rid of your restlessness and feel like you have the freedom to choose what you want to do, so as not to feel like you are imprisoned in an institution. Furthermore, sizes and the selection of spaces are important as they need to be flexible and often must provide multiple activities. As John from Stien puts it:

"We often had yoga and mindfulness sessions which worked really well, but we didn't have a space for it. We sat in the same therapy room but there wasn't space for everyone to lay out a mat for example." (Appendix 6)

Current offers often have limited space, and the group therapy room is therefore also the place for an array of other activities, but as it is not designed for these functions, it presents challenges. Another example mentioned by all users interviewed is sheltered outdoor spaces. As many substance abusers are smokers, it is something used multiple times a day. Current offers often have only one sheltered space, which is small and compact, which also means that providing a space for non-smokers is non-existent.

When discussing activities with the user, the conversation often shifts to the outdoors, nature, and the location of the rehabilitation center. Cecilia from Ringgården Rehabilitation Center puts it this way:

"It was placed in a forested area with beautiful surroundings, I was doing multiple small walks a day, I tried to be outdoor as much as possible even though it was winter, both alone and in groups." (Appendix 4)

The outdoor activities and location in nature seem to be a common subject for all interviewed users, as they see it as an important activity and a form of therapy in itself. Furthermore, a location in nature is also mentioned as a positive thing, as the setting provided stands out from the typically urban settings of their normal life, with more scenery and fewer temptations, which is viewed as a positive factor. Integrating nature in the indoor spaces is also seen as important,

both having views of the surrounding nature, integrating natural light in the spaces, and having plants and flowers inside. Cecilia explains it this way:

"The more natural it becomes, the less clinical it is, which also means a more cozy and homely atmosphere. Basically, the natural elements helped me a lot mentally." (Appendix 4)

The homely atmosphere was likewise something mentioned by all the interviewed users. To feel welcome and safe, there needed to be a non-clinical setting. As the stay is long and the user is there 24 hours a day, the setting and spaces must be designed as a safe and relaxed environment. Elements such as a fireplace, an open kitchen and dining area, and a living room with couches are mentioned as key elements in achieving this. John from Stien puts it like this:

"I think back on it now as a cozy and homely setting, there was not that institution's vibe about the place and that was really important for my development and my progress." (Appendix 6)

Including warm, natural materials and warm colors is something to not take lightly when designing a rehabilitation center, as these elements are key factors for the user to feel welcome, and in a setting that allows for growth and development.

When discussing rehabilitation centers, it becomes clear how the communal areas often are the centerpiece of the recovery process, as they provide a setting for a community to arise and for the user to create lasting bonds and have conversations with each other. John from Stien explains it like this:

"In the common areas, the whole effect of being in 24-hour treatment is where it happens. It is important that they work well out there (the common areas). Because the community is what makes people progress if they work well." (Appendix 6)

He emphasizes how important these spaces are, but also explains that sometimes they can have a negative effect on the atmosphere, which is an opinion also shared by the other interviewed. Often the communal areas are designed as one big space, but this can result in them quickly becoming overcrowded. In this scenario, there are no options to have more intimate chats or be divided into smaller groups. Communal spaces with elements that can be divided into differently sized areas would therefore be beneficial, also so that the user does not feel exposed, for example when waiting for a private consultation with the staff.

When researching the rehabilitation centers, it became clear through conversations with the users that there is a missing piece in the hierarchy of needs in the physical space and the activities provided. The users are tasked with doing daily tasks such as cooking and cleaning, but doing work to be proud of beyond the basic tasks is often not an option. Jan from Møllen gives an example like this:

"For example, that you are given the responsibility to go and look after something, i.e. being able to be proud of something and look after something. Few people in treatment are proud of themselves, so you can give people a task they can succeed in and be proud of." (Appendix 5)

To achieve a sense of fulfillment and self-actualization, the user needs to choose a path based on tasks and activities that they can succeed in and be proud of, something that might stick to them and progress even after leaving the rehabilitation center. Providing options such as workshops or flower gardens or similar activities is crucial for the user to achieve this and fulfill their growth needs.

Throughout the interviews, there are many similarities between the answers given, which gives the impression of a general trend of the challenges and the conclusions that can be gathered. The group is aware that these interviews are not definitive empirical evidence. However, the thesis has certain limitations in relation to its scope, so we must conclude from the collected data as is.

In the following pages, Maslow's theory of the hierarchy of needs has been utilized to index and interpret the quotes from the user interviews and the conversations with professionals. This was done to categorize the many valuable inputs that were gained and filter them into tangible functions to implement in the design.

USER NEEDS HIERARCHY

SELECTED QUOTES FROM THE USER INTERVIEWS

"For example, that you are given the responsibility to go and look after something, i.e. being able to be proud of something and look after something. Few people in treatment are proud of themselves, so you can give people a task they can succeed in and be proud of." (Appendix 5)

"Daily activities such as cleaning and cooking are something you do to learn how to interact with others and that you cannot always get your way. For example, it is a really good exercise where you gain recognition from others and feel you have a responsibility in a social setting." (Appendix 5)

"In regard to communal spaces, when new people arrive straight from their detoxification, there may well be a lot of noise and disturbance, where it could be better with more division in the space. I know I was not the only one who thought that was an issue, and the common areas are so important that they function well as this is where we all progress." (Appendix 5)

"In the shared spaces there were sofas, but because it was all one open space you sat exposed with your back to people. There were trees and plants, but it could be cool with a little more screening so that you did not feel like everyone could see you, if you were, for example, sitting and waiting to go in and talk in the office." (Appendix 4)

"Sleep is super important when you have to recover from your addiction, sound is therefore important. Where I lived, you could hear everything from the other rooms, and it works the same in our rehabilitation center as well, because the walls are very thin and not designed with this in mind." (Appendix 6)

FUNCTIONS DERIVED FROM MASLOW

Self-actualization

Functions and activities for the user to choose themselves must be integrated in the design

Giving the client the option to be creative and express themselves through creative activities

Projects they genuinely are interested in and something they can be proud of. Self-realization is affording a path a new view on life, by setting goals for oneself

Esteem needs

Daily routines and tasks, that both teach responsibility and make people acknowledge their achievements are important to include

Acknowledgment can also be given through creative activities or by giving the clients responsibility for plants or animals

Social needs

The clients develop themselves through stages in their recovery, and therefore the social spaces need to accommodate the changing needs as the client progresses.

Socializing should be offered and never forced, as it is something that builds throughout their journey. The spaces therefore must offer different degrees of social interaction

Safety needs

Sub divided communal areas, cozy corners, or smaller social spaces to provide a more tranquil and safer atmosphere to socialize in

The Rehabilitation center should be relatively sheltered from surrounding functions in the context and must have a well-defined entrance to monitor who comes and goes

Physiological needs

Private soundproof bedrooms, functional furniture to be well-rested and relaxed

Kitchen and dining areas accessible for everyone

Ill. 22. Needs derived from user interviews and turned into functions using Maslow.

PERSONA

MEET WILMA

NEEDS

- Personal space to relax
- Structure in the daily activities
- Feeling of self worth
- An outlet for emotions
- Tranquil environment

CHALLENGES

- Anxiety in large crowds
- Being social in new groups
- Withdrawal symptoms
- Adjustments to new routines
- Fear of Relapse

Ill. 23. Word cloud & diagram of needs and challenges.

TIMELINE

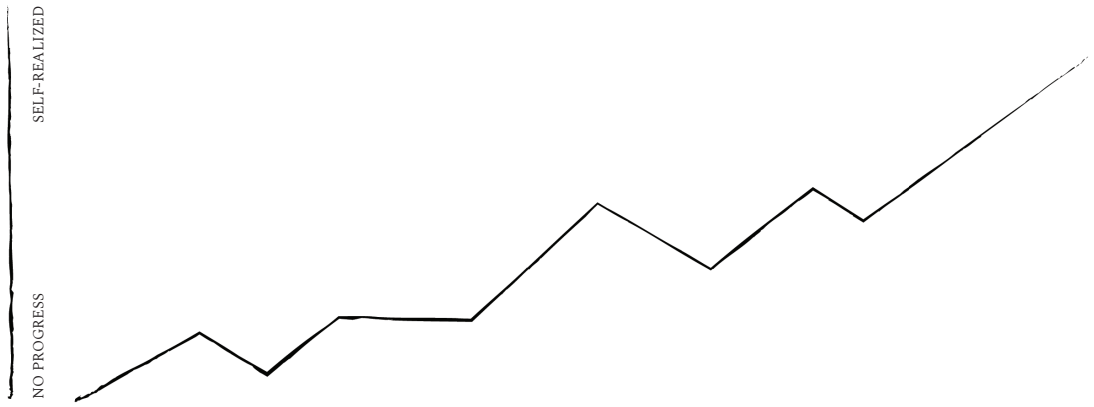
16 YEARS OLD	Struggled with anxiety as a teenager
Tried smoking cannabis at a party	17 YEARS OLD
18 YEARS OLD	Smoked cannabis on a weekly basis
Moved to Copenhagen and found friends that also smoked cannabis	19 YEARS OLD
20 YEARS OLD	Smoked cannabis daily and dropped out of high school
Got a job as a waitress to fund her drug addiction	21 YEARS OLD
22 YEARS OLD	Got into a bicycle accident and was prescribed morphine
Was still in pain and began to use morphine illegally	23 YEARS OLD
24 YEARS OLD	Uses morphine daily when she gets home from work
Got fired from her job as a waitress	25 YEARS OLD
26 YEARS OLD	On social benefits and struggles to find work
Has trouble paying rent and is threatened with eviction	27 YEARS OLD
27 YEARS OLD	She decides to seek help and is sent to 24-hour rehabilitation

Ill. 24. Persona timeline & artwork.

USER SCHEDULE

REHABILITATION PROGRESS

Throughout the user research, two schedules were made to illustrate the daily routines and activities done by the clients in rehabilitation centers. The illustration below shows the path and progress a client goes through during their entire stay at the rehabilitation center. They start off the journey in a vulnerable stage, affected both physically and mentally by their addiction. When progressing further into their stay, they become integrated into the daily routines and structure and the social groups formed by the residents. At the end of the stay, they have obtained knowledge of how to tackle their challenges and have gained new skills to bring home with them into a new and improved life.



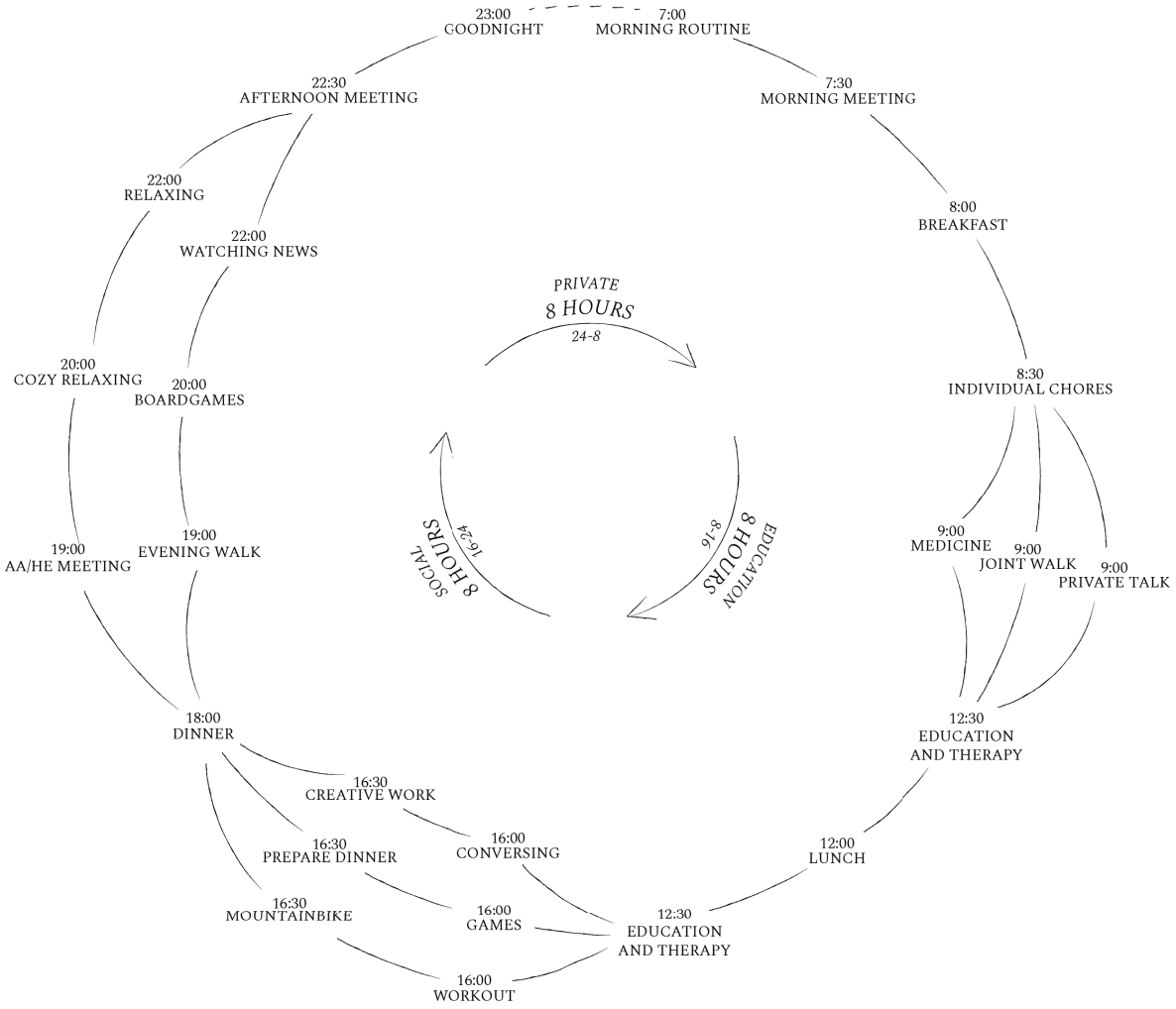
START OF TREATMENT — END OF TREATMENT

MISSING A PATH IN LIFE	FINDING YOUR PATH	COURAGE TO FOLLOW THE PATH
LAZY	GETTING A RESPONSIBILITY	BEING APPRECIATED
A MESS	LEARNING HOW TO LIVE	COURAGE AND FAITH IN THE FUTURE
NO STRUCTURE	STARTING TO APPRECIATE STRUCTURE	APPRECIATING STRUCTURE
MINIMAL SURPLUS FOR ACTIVITIES	INTEREST IN AND PRIDE ABOUT SOMETHING	NEW PASSIONATE HOBBY
HARD TIME OPENING UP	OPENING UP ABOUT PROBLEMS IN THERAPY	SURPLUS TO HELP OTHERS
CONFUSED	FACING YOUR PROBLEMS	FOCUSED AND IN CONTROL
SHORT-TEMPERED	MORE FOCUSED AND SURPLUS	CARES ABOUT TASKS
ISOLATED AND LONELY	STARTING TO SOCIALIZE	ABLE TO TALK TO FRIENS ABOUT PROBLEMS
POOR PHYSICAL SHAPE	BETTER SHAPE AND HEALTH	ACTIVE AND SOCIALLY ENGAGED
STRONG ABSTINENCES	LIGHTER ABSTINENCES	CONTROLLED ABSTINENCES
DEPRESSED	MORE OPTIMISTIC	ACHIEVING AND ENJOYING RECOGNATION
LOW SELF-ESTEEM	PROGRESSING	HAVE GAINED MORE SELF-ESTEEM

Ill. 25. User schedule for the entire stay.

DAILY SCHEDULE

The illustration below shows the daily schedule for the clients. The rehabilitation center offers a firm routine that residents must eventually learn to adapt to. However, during the day, the schedule includes certain variables, as the client can choose between different activities depending on their wishes and needs at their given stage. The schedule is roughly divided into three segments, which attempt to mirror what a daily schedule will hopefully come to look like when the user gets home. This division of three segments can be directly translated into the building's further composition and programming. The illustration highlights some examples of these variables, that seek to offer the clients a way to make their own choices and spark an interest they can take with them afterwards. This is to allow the clients to do something to be proud of and be recognized by the group, to finally gain self-realization.



Ill. 26. Daily user schedule.

SOCIAL SUSTAINABILITY

Ill. 27. Picture from Rold Skov.

DESIGNING FOR REHABILITATION

ARTICLE: ARCHITECTURE AND SOCIETAL PROBLEMS: DEVELOPMENT OF REHAB FACILITY FOR DRUG ADDICTS REINTEGRATION

In the article, the authors address how architecture can have a therapeutic effect on substance abusers in rehabilitation. They emphasize that architecture undoubtedly stimulates people and how it can shape the way we feel and act in any specific given context. They also highlight how architecture should be more than just a shelter, and how the architectural design could help notch or 'shape' the occupants into a better lifestyle, which is particularly relevant to people with substance abuse. The architecture of a rehabilitation center should exhibit a feeling of exclusiveness, where both the indoor and outdoor environment should be calming and therapeutic, so the clients can have the possibility to reflect on their lives without too many disturbances. This ensures that the clients have a better chance of building strength to overcome their physical and psychological challenges on their path to a substance-free life. In the article, the authors explore which therapeutic techniques to apply, e.g. holistic patient treatment, and different spatial optimizations to implement to treat the clients and integrate them back into society in the best way possible. One parameter they emphasize in this regard is to infuse both nature and landscaping into the architectural design because it promotes physical and psychological health. In order to create a tangible design model, the article addresses six different architectural design principles to consider when designing a rehabilitation center for substance abusers which is shown in the illustration to the right (Atamewan, 2022).

Of the six proposed design principles, two will be investigated further in the following pages, while the other principles will be implemented into the design process more conceptually. The two principles that will be investigated further are 'Healing architecture' and 'Biophilic design' since they have been assessed to have a significant impact on the project.

THERAPEUTIC COMMUNITY

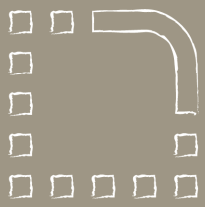
- Encourage change by socializing with likeminded
- Personal growth in a 'society away from society'
- There is less tabu or stigma regarding addiction
- Gain meaningfulness by contributing to the community
- Clients become a valued part of the solution

BIOPHILIC DESIGN

- Improve connections to the natural environment
- Promotes learning, wellbeing, and recovery
- Being close to nature can reduce stress
- Staff and clients will increase productivity
- Ensures a healthy environment beneficial to recovery

HEALING ARCHITECTURE

- Have environments that provide comfort and security
- Create spaces that affords calm and relaxing emotions
- The design should encourage healthy activities
- Promote recovery through accommodating architecture
- The spaces will also have a positive effect on the staff



BUILDING FORM

- Shape and forms can influence emotions
- Spaces can affect people's actions and behavior
- Scale contributes to people's affiliations to the building
- The shapes of a space can invite to specific activities
- Some shapes can increase the legibility of a space

COLOR THERAPY

- Implementation of colors to stimulate positive emotions
- Colors can create ambiance in a given space
- They can influence people's moods
- Energy levels can be affected by different colors
- It is predictable how people respond to colors

ART THERAPY

- Inviting paintings into the spaces can strengthen reflection
- Art can help and assist the process of recovery
- It has been proven to reduce hospitalization time
- Mellow paintings of e.g. landscapes can reduce stress
- The art could be expressed in the architecture

Ill. 28. Design principles for rehabilitation.

HEALING ARCHITECTURE

ARTICLE: HEALING ARCHITECTURE

In the article, the writers seek to enlighten the psychological and physical aspects of recovery through architecture and examine the parameters of which architecture can contribute to a healing process. The article addresses how the design of healing environments involves nuanced considerations that directly impact occupants' well-being. In this context, the text explores crucial elements such as 'Daylight,' emphasizing its significant influence on emotions and patient well-being. 'Circulation and spatial organization' delve into minimizing stress through strategic design, focusing on rest areas and clear navigation paths. 'Form and building systems' highlight the importance of passive strategies for efficient healing processes. 'Building envelope' underscores the optimization of natural light, ventilation, and materials, while 'Salutogenic outdoor spaces' advocate for active lifestyles through thoughtful design. Together, these elements contribute to a holistic approach to creating spaces that promote healing and well-being (Ghazaly et al., 2022). The following lists five pivotal design goals within healing architecture and clarifies its merit and impact on the user.

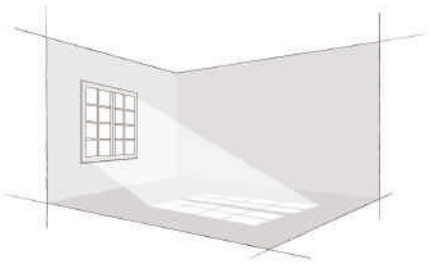
'Daylight' can have a great impact on people's emotions both positive and negative and therefore it should be a parameter to focus on. Especially the implementation of natural light has been proven to reduce the time in which a patient feels unwell, meaning that the extent of daylight being let into the building is something to notice. Another thing light can influence is the user's activity level and it can also decrease tiredness, which can act beneficial to the healing process (Ghazaly et al., 2022).

'Circulation and spatial organization' are important in order to minimize complex path networks in buildings to reduce confusion and stress. Implementing focal points for rest areas and streamlining navigation will enhance comfort while clearly defined path hierarchies can help improve privacy and efficiency in the design. Lastly, it is important to optimize a room's location based on their functions and ensure a smooth transition between indoor and outdoor spaces (Ghazaly et al., 2022).

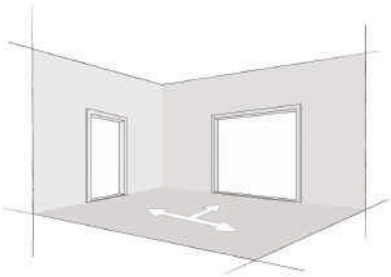
'Form and building systems' can significantly impact the buildings efficiency and the healing process for occupants, considering aspects like lighting, airflow, and temperature control. Passive building strategies, utilizing nature's strengths for well-being, prove cost-effective and should therefore be implemented in the design. Strategies for natural light admission vary with a building's form, and the buildings orientation can influence heat gain and ventilation strategy (Ghazaly et al., 2022).

'The building envelope' should also be a focus to ensure the optimization of natural light, ventilation, and thermal properties of the building and to create comfortable spaces. Strategic placement of openings ensures effective utilization of views, wind for ventilation, and sunlight, and can balance heat gain and prevent glare. Material choices can also greatly impact on psychological well-being where e.g. the presence of wood has been proven to reduce stress (Ghazaly et al., 2022).

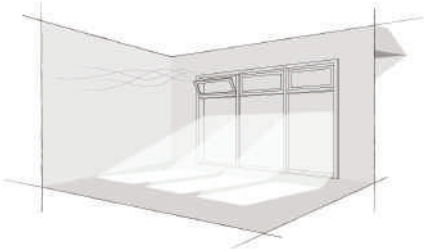
'Salutogenic outdoor spaces' should be implemented in the design to encourage the occupants to gain a more active lifestyle and prevent ill health, thereby taking a more integrated approach than just traditional therapy. Functions that can be implemented could be therapeutic gardens where the occupants can focus on the tasks at hand. Another possibility is to implement natural environments that are sensory stimulating and that can be explored (Ghazaly et al., 2022).



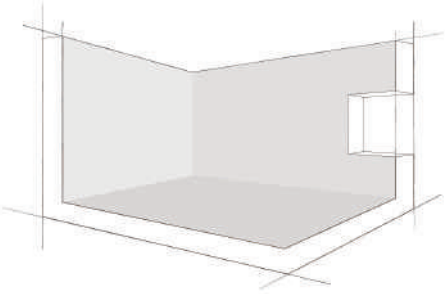
Daylight



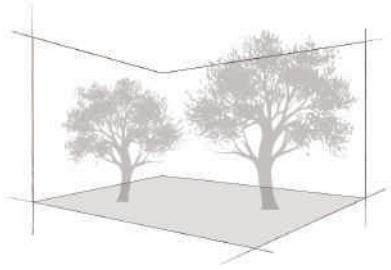
Circulation and spatial organization



Form and building systems



The building envelope



Salutogenic outdoor spaces

Ill. 29. Design principles of Healing Architecture.

BIOPHILIC DESIGN

ARTICLE: 14 PATTERNS OF BIOPHILIC DESIGN, IMPROVING HEALTH & WELL-BEING IN THE BUILT ENVIRONMENT

The theory of biophilic design is mapping elements from nature that could influence our psychological function in relation to the perception of the built environment. The different elements of the theory are listed as '14 patterns of biophilic design' and these are then categorized into three separate groups depending on their relation to the space, namely 'Nature in the space', 'Natural analogs' and 'Nature of the space' (Browning et al., 2014).

'Nature in the space' refers to the physical presence of nature in a given space being materials, such as water, plants and even animals or more sensory elements such as scents, sounds or airflows. When implementing "Nature in the space" there should be a heightened focus on both multi-sensory experiences and diversity (Browning et al., 2014).

'Natural analogs' addresses the more inanimate elements of nature, were especially material choices, such as stone or wood is desirable, but also natural elements in a more figurative sense, for example shapes, patterns and colors that could be translated into a design element. The focus when working with 'natural analogs' should be to offer informational connections to nature (Browning et al., 2014).

'Nature of the space' describes some of the spatial experiences that are encountered in nature. Some examples hereof could be the appeal of having unobstructed views for long distances or the desire for people to feel protected from being attacked from behind by having the back against a wall. Here the focus should be on creating spaces that engage the observer and preferably in combination with the patterns from 'Nature in the space' and 'Natural analogs' (Browning et al., 2014).

Furthermore, the 14 patterns can have drastically different influences on our mind and body, whether it is physiological, psychological or our cognitive functionality and performance and they have for example been shown to lower blood pressure and cortisol-levels (Browning et al., 2014).

In this master thesis, some of the patterns have been picked out for implementation and highlighted in the illustration to the right, based on their individual impact on the three parameters that Terrapin Bright Green evaluate them on. These parameters are stress relief, Cognitive Performance, and emotional impact and in addition to this it is also considered how much the impacts the individual patterns are backed by peer-reviewed evidence.

NATURE IN THE SPACE

Non-visual connection with nature, Auditory, haptic olfactory stimuli

Visual connection with nature, living systems and natural processes

Presence of water, enhance experience through many senses

Thermal and airflow variability, mimic natural environments

Non-rhythmic sensory stimuli, that adds a degree of unpredictability

Connection with natural systems, both seasonal and temporal

Dynamic and diffuse light, that changes over time like in nature

NATURAL ANALOGUES

Biomorphic forms and patterns, reference contours and textures in nature

Material connection with nature, creates relation to natural surroundings

Complexity and order, through the spatial hierarchies found in nature

NATURE OF THE SPACE

Prospect, ensures views over long distances for observation

Refuge, creates protected spaces for withdrawal from activity

Mystery, through incomplete or obscured views creates anticipation

Risk and peril, balances seemingly danger situations and safeguard

Ill. 30. Principles of Biophilic Design.

INDOOR ENVIRONMENT

PHYSICAL & PSYCHOLOGICAL IMPACT

Most of the daily routine unfolds in the indoor spaces, underscoring the importance of creating a great indoor environment. When discussing the indoor environment, four categories can be investigated: Thermal comfort, atmospheric comfort, visual comfort, and acoustic comfort.

These categories influence the quality of the indoor environment, intertwining both physical and psychological factors. Achieving an optimal environment from a physical standpoint can be generalized and categorized from certain standards given by research. The psychological impact, however, is a subjective experience based on the individual and the current state they find themselves in (Funch et al., 1997).

In this project the user goes through stages of physical and psychological states which makes it crucial for the indoor environment to both be optimal as well as adjustable depending on the user and the stage, they are in. Therefore, the main focus will be on visual- and thermal comfort as the importance of these categories has been underlined through user research.

Visual comfort is focusing on daylight and views within the building frame. These factors are important as the user's health, comfort, and sense of safety can be influenced by them. This category can be measured in various ways; one example is having a daylight factor of 2% in 50% of the space (Johnsen & Christoffersen, 2008). Furthermore, the Danish building regulations have instructions calculating the 10% rule as well as documentation on building depth to window size ratio (Social- og Boligstyrelsen, n.d.). Lastly, giving the user options for shading and window openings can be active strategies for the user to adjust their visual comfort, for example in their bedroom.

Acoustic comfort considers the acoustic factors and barriers within the building to ensure optimal sound quality and noise level depending on the function of the space. In this project, the acoustic comfort mainly concerns sound transmissions between rooms and reverberation time within the building, as the location of the site is remote. To achieve optimal acoustic comfort, DS 490, dictates airborne sound insulation under 55 dB is crucial for attaining class C (Fonden Dansk Standard, 2018). Furthermore, window design and openings can be an active strategy for the user to adjust how they experience activities or sounds from the outdoor environment.

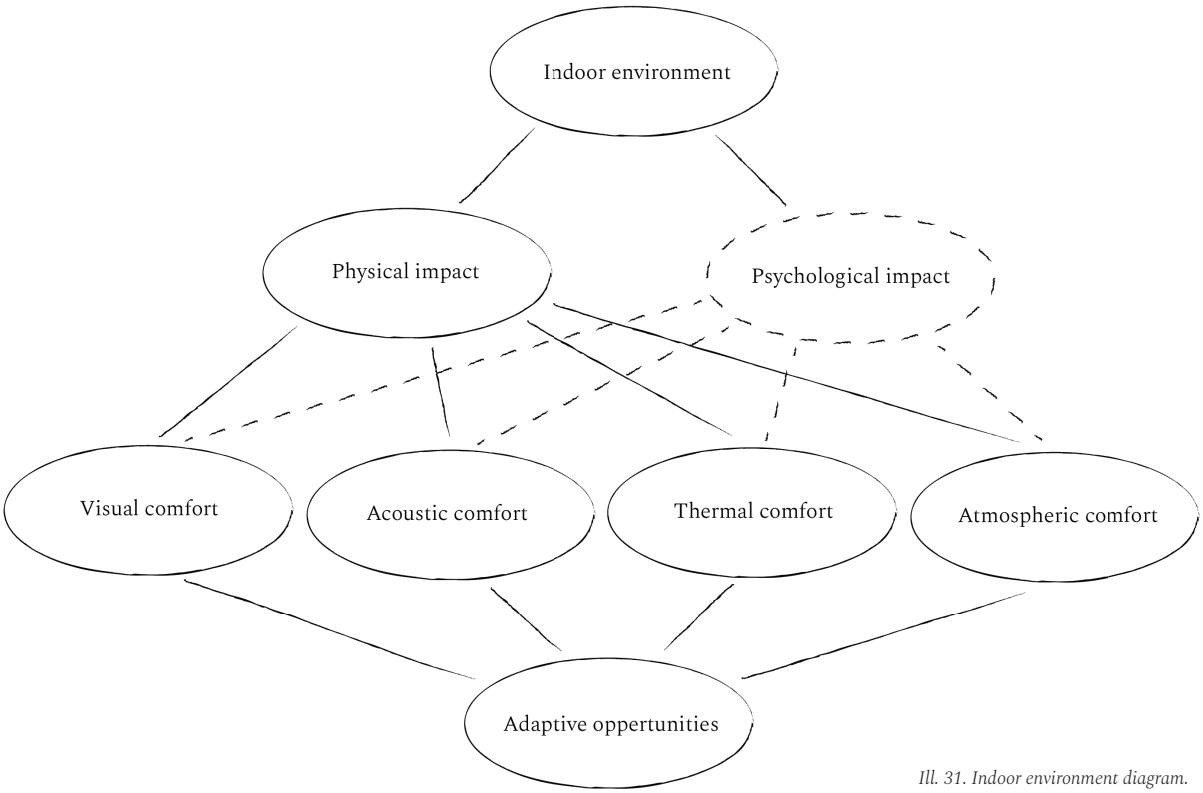
Thermal comfort focuses on indoor operative temperatures with upper and lower limits dependent on the season. The set parameters include a minimum of 18 degrees in winter and a maximum of 27 degrees in summer (Fonden Dansk Standard, 2019). The Danish Building Regulations indicate that there must not be more than 25 hours a year where temperature is beyond 27 degrees and 100 hours a year above 26 degrees (Social- og Boligstyrelsen, n.d.). Also, energy consumption can be improved by advocating for the user to adjust to temperature differences like changing clothes rather than using energy for heating or cooling. As the user in this project goes through stages of initially being in abstinence, it is important that the indoor environment can be thermally comfortable. Furthermore, the spaces should promote user made adjustment, so that the user themselves can adjust the temperature to fit their needs. To generalize for the user overall, this thesis aims to reach a minimum of 20 degrees in winter and a maximum of 25 degrees in summer for the private housing units, as these are the most crucial spaces for thermal comfort.

Atmospheric comfort is important to consider as achieving good indoor air quality will ensure the well-being of the users. To achieve this, it is necessary to consider an effective ventilation strategy that considers the building use, occupancy levels, and emissions (Social- og Boligstyrelsen, n.d.). Calculating the requisite air change rate for each housing unit is furthermore important and is therefore also included as a calculation in the final program for each room. The building must include a mechanical ventilation system to cover the basic air change rate requirements, especially during the winter season, as well as having window designs that give the user the opportunity to naturally ventilate.

ADAPTIVE OPPORTUNITIES

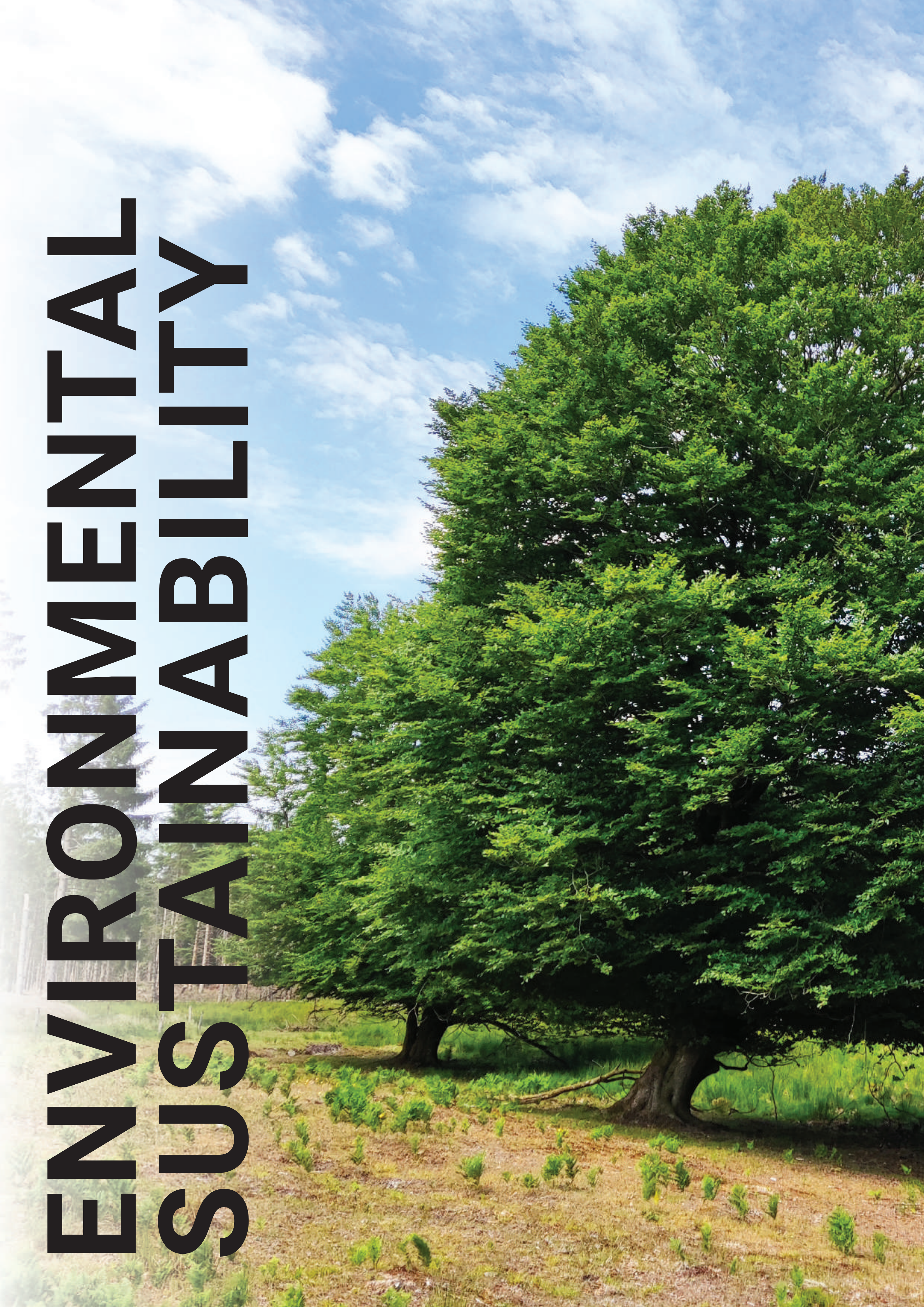
As the user in this master thesis is on a path of recovery, both their physical and psychological stages change throughout their stay at the rehabilitation center, highlighting that each user has different needs depending on multiple factors. Furthermore, the recovery functions as a learning experience for the user to obtain skills and knowledge on how to live a normal life, including adaptive principles for achieving a good indoor environment. These factors combined emphasize the importance of incorporating adaptive principles into the design. Translated, this is about the user learning and being able to take adaptive actions or to adjust the indoor environment, for example this can be achieved by changing of clothes, changing a thermostat, opening a window, shading devices etc. (Hellwig et al., 2022). In continuation of this, Hellwig & Boerstra (2017) argue that a centralized control can have drawbacks, as personal control changes the user's perception of the indoor environment, meaning that in the case of discomfort the user perceives their environment differently if they can adjust their environment themselves. Having this opportunity serves as confidence in their comfort, as they can adjust the temperature and fresh air supply to satisfy their needs (Hellwig & Boerstra, 2017).

When discussing thermal zones, designing outdoor sheltered or protected spaces as well as offering different thermal zones within a building can provide occupants with thermal neutrality and physiological adaptation as they are exposed to a different environment. Transitioning between various thermal exposures can affect the comfort perceptions in a positive way (Hellwig et al.,2020). Specifically, this can be used when designing a rehabilitation center by offering various thermal zones both in the outdoor areas and within the building. For example, having various thermal zones the user can choose between sitting next to a window with sun, a fireplace, an open window or similar. Not only does this give the user a sense of choice depending on their needs, but it can also contribute to energy conservation, as it allows for a larger span in thermal temperature differences (Hellwig et al., 2020).



Ill. 31. Indoor environment diagram.

ENVIRONMENTAL SUSTAINABILITY



Ill. 32. Picture from the site.

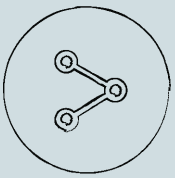
DESIGNING FOR DISASSEMBLY

BOOK: BUILDING A CIRCULAR FUTURE

There is an increasing global focus on sustainability and especially the building sector is targeted as one of the industries that is responsible for a large portion of the total CO_2 emissions. Out of the 17 goals put forth by the United Nations to create a more sustainable future, half of them either directly or indirectly demand a more circular building industry. There is an especially heightened focus on the European countries, since combined they use six times the resources in comparison to what they produce. While this overconsumption of resources is taking place, there are also vast amounts of waste produced. In Denmark, upwards of 40% of the total national waste is coming from the building industry and this is why a greater focus has been placed on circular economy (Jensen & Sommer, 2018).

In the book 'Building a circular future', the authors attempt to frame how the construction industry can go from a linear economy to a circular economy and how this transition will contribute to a vast array of potentials. One of the key design strategies the book mentions as a path to success with the implementation of a circular economy, is design for disassembly thereby reducing waste at the end of service. Design for disassembly is about keeping the value of materials when a building is decommissioned or when the individual materials need replacement by enabling a takedown process that is as gentle as possible. This does not only optimize the building operation, but making sure that the materials have the best possible chance of reuse also contributes to the establishment of a material bank to be utilized in the future. The approach also increases the flexibility of the building because introducing reversible joints in the construction makes it possible for the building to be partially taken apart and then reconfigured to fit a new function. Furthermore, the strategy ensures easy repairs on the building since the components can be simply removed and exchanged with other components (Jensen & Sommer, 2018).

The general approach when designing for disassembly is to make sure that the components are assembled with reversible joints, so they can be taken apart without inflicting damage on them. In addition to this, it is preferable to have the joints visible and to an extent easy to access so deconstruction becomes simpler, while the materials should be of a certain quality to ensure reusability many times over. A complete summary of the guidelines from the book is illustrated on the page to the right (Jensen & Sommer, 2018). In this master thesis, design for disassembly will be used on a conceptual level, utilizing simple methods to make the building more sustainable, for example utilizing wood that can be disassembled and reused is pivotal. Therefore, the focus points on design for disassembly in this thesis will mostly be om the implementation of natural materials and the utilization of reversable joints.



MATERIALS

Materials should be of high quality to ensure many lives cycles

Avoid toxic materials to ensure a healthy environment

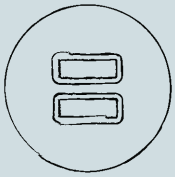
Use pure materials that can be recycled easily

LIFE CYCLE

Allow for easy replacements of short-lasting elements

Design with flexibility in mind to ensure future functions

Design with preservation of material value in mind



STANDARDS

Building system should be modular to ease replacements

Prefabricated elements ensure a quick assembly

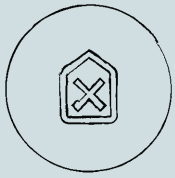
Use components when assembly of elements is complex

CONNECTIONS

Accessible joints make assembly and disassembly quick

Mechanical joints reduce material damage when disassembled

Non dissolvable binders should be avoided



DECONSTRUCTION

Design the building with a strategy for disassembly

Ensure static stability in the building during disassembly

Be thoughtful of the surroundings during the disassembly

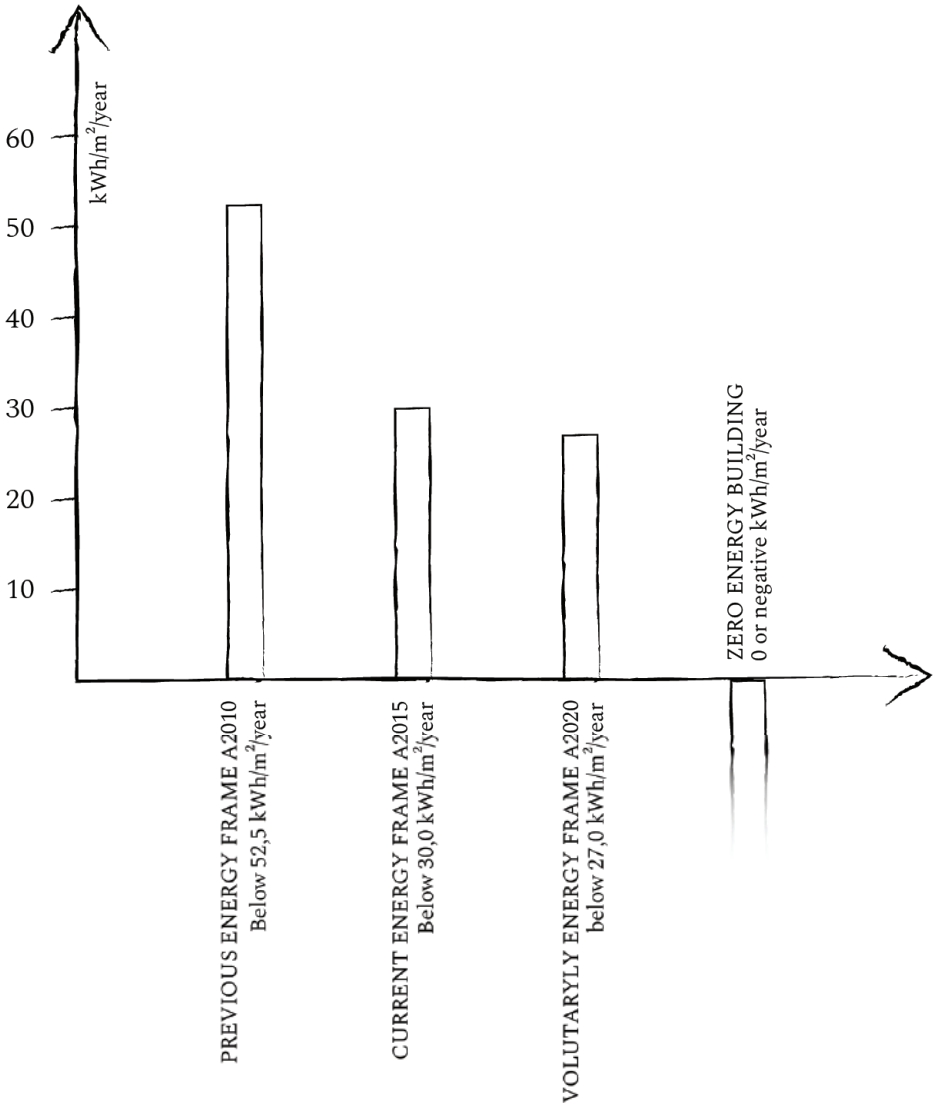
Ill. 33. Guidelines when Designing for Disassembly.

LOW ENERGY STRATEGIES

When aiming for a sustainable design, it is important to integrate sustainable practices to lower the yearly energy needed to operate the building. The Danish building regulation, BR18, has standards and energy frames to divide and certify buildings based on their energy use. These energy frames have multiple factors to consider, but the most important is the number of kWh used pr. m^2 pr. year. This can be calculated using a tool such as BE18, which factors in the building envelope, and both external and internal loads. The calculation considers the energy usage from hot water, heating and electricity with unique factors based on the energy source used, as well as considering possible renewable energy production (Social- og Boligstyrelsen, n.d.).

The energy frames vary depending on the year they were introduced, as the building strategy keeps improving. Today, it is even possible to make buildings in the category of 'zero energy buildings' also known as ZEB, where the building either needs no added energy or produces more energy from renewable sources than it uses (Bejder et al., 2014). As this project aims to achieve a sustainable design solution, it will focus on achieving the best energy frame and lowering the energy use as much as possible without restricting the design to a specific frame like ZEB.

To design sustainably, it is important to incorporate both active and passive low-energy building strategies and have these strategies in mind from an early stage in the design process. As an example of a passive strategy, it is important to consider the square footage needed per person, as smaller and more compact buildings naturally use less energy. Incorporating flexibility in the layout and floor plan and determining the space needed for each function can help optimize the building's layout. Furthermore, passive strategies can be utilized by contemplating passive solar heating through window placement and the building's overall positioning and direction, as well as incorporating natural ventilation strategies when deciding on the window- type, size, and placement. As an example of an active strategy, incorporating renewable energy, such as PV panels, can be valuable in decreasing the electricity needed to keep the building running. In this project, the location of the building is outside of the zones of district heating in Denmark, so incorporating heat pumps such as geothermal could be the optimal solution for heating the building, especially in combination with the PV panels that would provide the electricity needed to run the system.



Ill. 34. Energy Frame diagram.

LCA ON MATERIALS

As architects, it is important to evaluate the carbon footprint of the materials considered for the project, and by doing a Life Cycle Analysis (LCA), it is possible to compare the material's individual carbon footprints. The LCA, as the name suggests, considers the whole life cycle of the materials, for a period of 50 years, examined from the extraction of the raw materials to the end of use where the materials will be disposed of, but it does not consider recycling possibilities. The comparison of materials affords the possibility of lowering the carbon footprint of the building, which is of immense importance, as the building sector today accounts for 40 percent of the global greenhouse gas emissions (Mikku & Sons Roofing, 2023). The importance of LCA as a tool when designing buildings becomes evident when considering how much the carbon footprint can be lowered when discussing material choice early in the design process. For example, a report by Build from 2020 concluded that GWP from materials on new constructions vary by 260%, meaning we could build 2,6 times more of the same buildings with the same carbon footprint if designed accordingly (Zimmerman et al., 2021). This is also why the Danish government has implemented legislation that considers LCA on new constructions starting from 2023, which is set to include stricter rules and include more building types in the years to come.

In this section, the Global Warming Potentials (GWP) of an array of different insulation materials and façade claddings have been researched in order to gain an insight into which are more environmentally sustainable. In the research of the materials many distinct types of both insulation and claddings were found but, in this section, only the materials with the lowest GWP's are put forth and considered for the project. When comparing the insulation materials, it is important to ensure that their thickness is accounted for since varied materials have different insulation properties. To do this all the compared insulation materials were given an individually required thickness, in order for their u-value to all be 0.1.

From this preliminary study on the GWP's of the insulation and façade materials, it is now possible to make informed decisions during the design process on which materials to take into consideration. Previously made LCA projects show more in-depth materials and construction comparisons that also help make informed decisions throughout the project (Jakobsen et al., 2023). In general, it can be concluded from this study that the choice between the three presented façade claddings bare no noteworthy difference and, therefore, the final choice can be guided more by the desired aesthetic expression. On the other hand, there are some radical differences in the required thickness of the considered insulation materials, and this means that there will be some considerations in the design process where a compromise between whether a lower GWP or a slimmer wall profile is desired.

INSULATION LAYER

1. Hempcrete, Block	-5.67 kgCO2e per m^2	IsoHemp Hempcrete	(666mm - U = 0.1)
2. Straw, bales	-10.88 kgCO2e per m^2	BauStroh Straw Bales	(480mm - U = 0.1)
3. Wood fiber, Board	-7.13 kgCO2e per m^2	STEICOflex 036	(372mm - U = 0.1)

FAÇADE CLADDING

4. Painted Spruce	-11.70 kgCO2e per m^2	InnTre Kjeldstad	(19mm)
5. Pressure Treated Spruce	-11.50 kgCO2e per m^2	Bergene Holm AS	(19mm)
6. Treated Pine	-10.90 kgCO2e per m^2	Superwood	(21mm)

Ill. 35. Different insulation materials and claddings.

LCA ON CONSTRUCTION

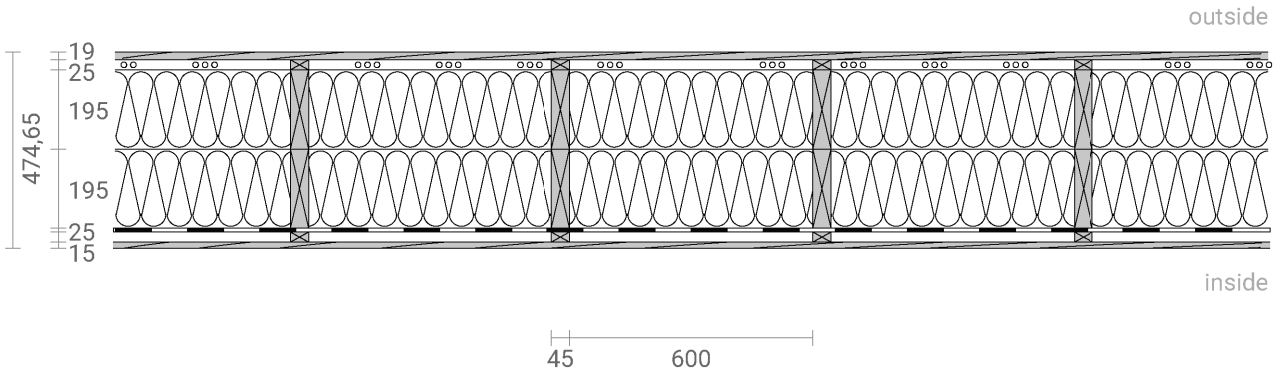
When keeping the learnings from design for disassembly in mind, while also designing with the intention of reducing the buildings overall GWP, the choice of structural system fell on timber. A timber construction is easy to erect, and the wood joints are simple to make either on site or in advance. Using nuts, bolts and screws for the construction's assembly ensures a speedy process and that the dismantling of the building can be done without damaging the components, ensuring their reusability. This ease of disassembly also heightens the possibilities of replacing components during the building's lifespan and another measure that ensures reusability on the component level is the use of standardized timber profiles.

When analyzing carbon emissions from buildings, it is best to simulate entire constructions or entire buildings. However, in this preliminary research only a few materials and constructions have been shown because of the project's restricted focus on LCA calculations. When evaluating the final buildings carbon emissions, GWP results can be compared with benchmark values concluded in publications, that states an upper, medium and lower quartile from investigating 60 buildings, where the lower quartile has a GWP of 13,68 CO_2 eq/m^2/year (Zimmermann et al., 2021).

For this preliminary investigation of construction principles, two types were found noteworthy to address and simulate LCA GWP values for, those being a wood frame construction and a timber construction. In both cases, the two construction types have wood fiber insulation and painted spruce wood cladding since those were found to be optimal in the section 'LCA on materials'. For the comparison of the two construction types, it was necessary to make sure that they both had the same u-value set as 0.1 since this would give the construction an optimized energy efficiency.

WOOD FRAME

- GWP: -66 kg CO_2 eq./m^2
- U-value: 0.10 W/m^{2*}K
- Simple construction
- More similar profiles
- Main wall is thicker
- More thermal bridging



1. Pine (15 mm)
2. Installation level (25 mm)
3. Vapor barrier sd=100m
4. STEICOflex 036 (195 mm)
5. STEICOflex 036 (195 mm)
6. Rear ventilated level (25 mm)
7. Spruce (19 mm)
8. StoColor Dryonic® 2x (0,15 mm)

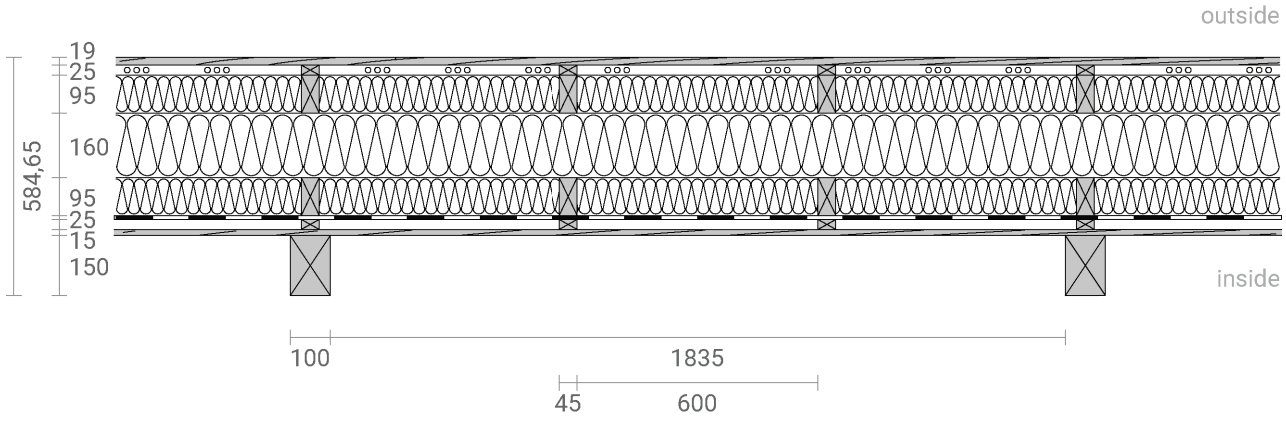
Ill. 36. Wood frame construction.

It was found that the difference in GWP on the two constructions was relatively small. It is noted that since most of the materials used have a negative GWP in their production, it would seem that the construction using the most materials is also the best, as the carbon is embedded. However, that is a misleading conclusion, as the LCA calculation does not consider reusability or end of life stage. In previous projects, end of life stage as well as transportation emissions have been calculated when comparing constructions, as these gives a more accurate conclusion to the total material emissions. The conclusions and principles made there will be used throughout the design process (Jakobsen et al., 2023).

Another substantial difference in the two constructions is the complexity of the two compared walls. The wood frame construction is more simply composed and uses the same timber profiles and insulation thicknesses throughout, which the timber construction does not. The timber construction has a smaller width when disregarding the timber columns and this can afford easier accessibility to daylight and more net square meters. The timber frame construction also has a middle layer of homogeneous insulation, which improves the thermal bridges in the construction. In the design process, the preference of the construction principle will be guided by the findings above and previous LCA projects in addition to the desired function, expression, and size of the space to be designed. This combined will affect the decision of whether a wood frame or timber construction will be used.

TIMBER CONSTRUCTION

- GWP: -60 kg CO_2 eq./m^2
- U-value: 0.10 W/m^{2}*K
- More complex construction
- More different profiles
- Main wall is thinner (not considering the Collums)
- Less thermal bridging



1. structural timber (150x100)
2. Pine (15 mm)
3. Installation level (25 mm)
4. Vapor barrier sd=100m
5. STEICOflex 036 (95 mm)
6. STEICOflex 036 (160 mm)
7. STEICOflex 036 (95 mm)
8. Rear ventilated level (25 mm)
9. Spruce (19 mm)
10. StoColor Dryonic® 2x (0,15 mm)

Ill. 37. Timber construction.

LOCATION

Ill. 38. Picture from the site.

INTRO TO ROLD SKOV

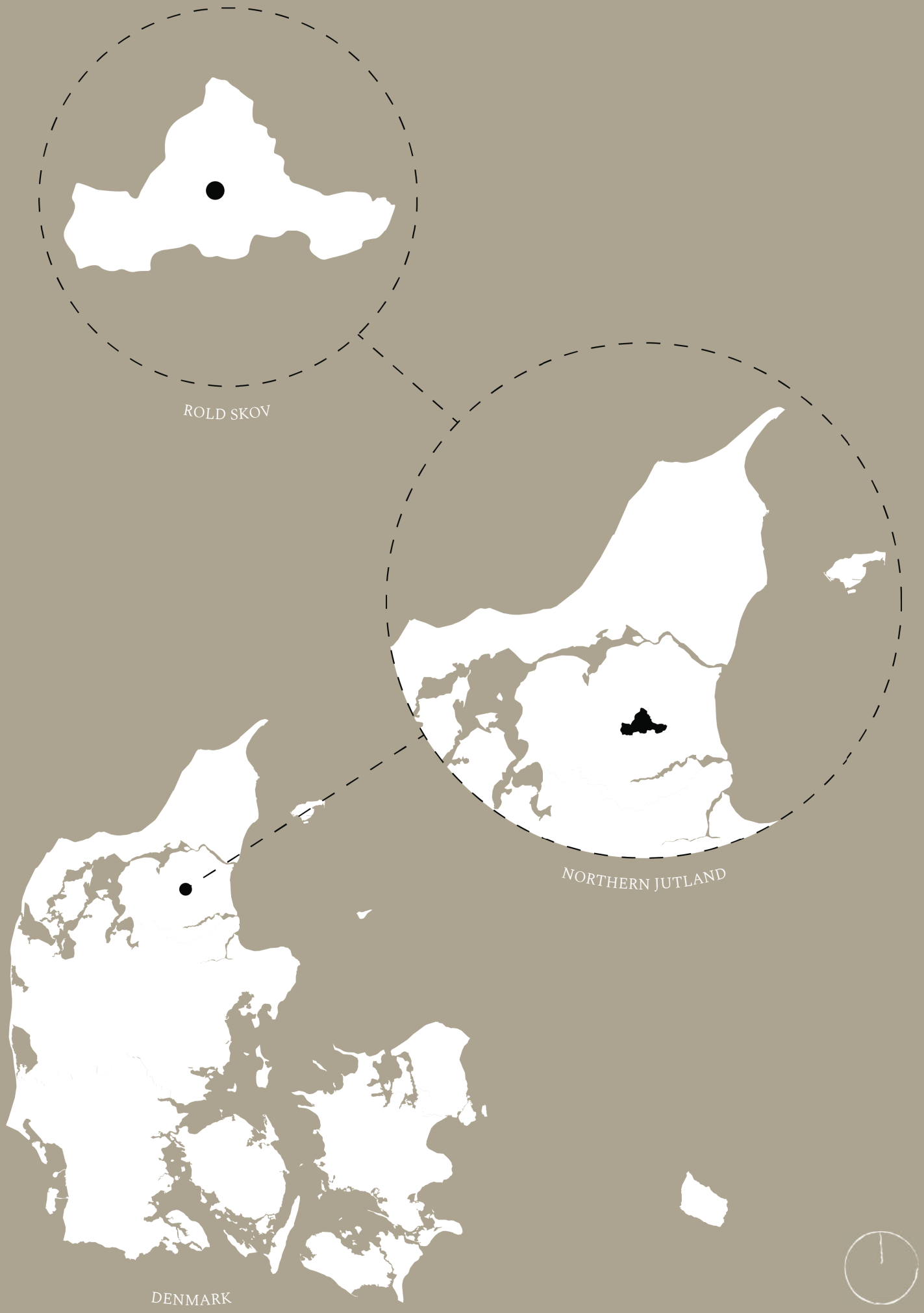
Rold Skov is located in the northern part of Jutland, with an annual visitor count of around 400,000 people, and an area of approximately 8,000 hectares, making it Denmark's most extensive forest area. Situated within this woodland area, is Rebild Bakker, which lends a unique character with its high peaks, breathtaking views, springs, and streams (Westerberg, 2011). The private sector owns 75% of the forest, primarily distributed among three estates: Lindenborg, Nørlund, and Willestrup, while the remaining 25% is state-owned and managed by the Himmerland Nature Agency (Rebild Portalen, n.d.).

Geographically, Rold Skov is located on a high moraine plateau, formed by ice over 18,000 years ago. The landscape is divided by the large valley of 'Lindenborg Å', where the terrain to the west is characterized by prominent hills, while the eastern area consists of ravines, small hills, and other natural formations (Rebild Portalen, n.d.).

Rold Skov is primarily a coniferous forest, due to its sandy and gravelly moraine soil, combined with high precipitation, creating optimal growth conditions for conifers. Since 1850, a variety of conifer species have been planted, including Norwegian Spruce, and Scots Pine, as well as North American species such as Douglas Fir, Sitka Spruce, Noble Fir, and Giant Sequoia (Rebild Portalen, n.d.).

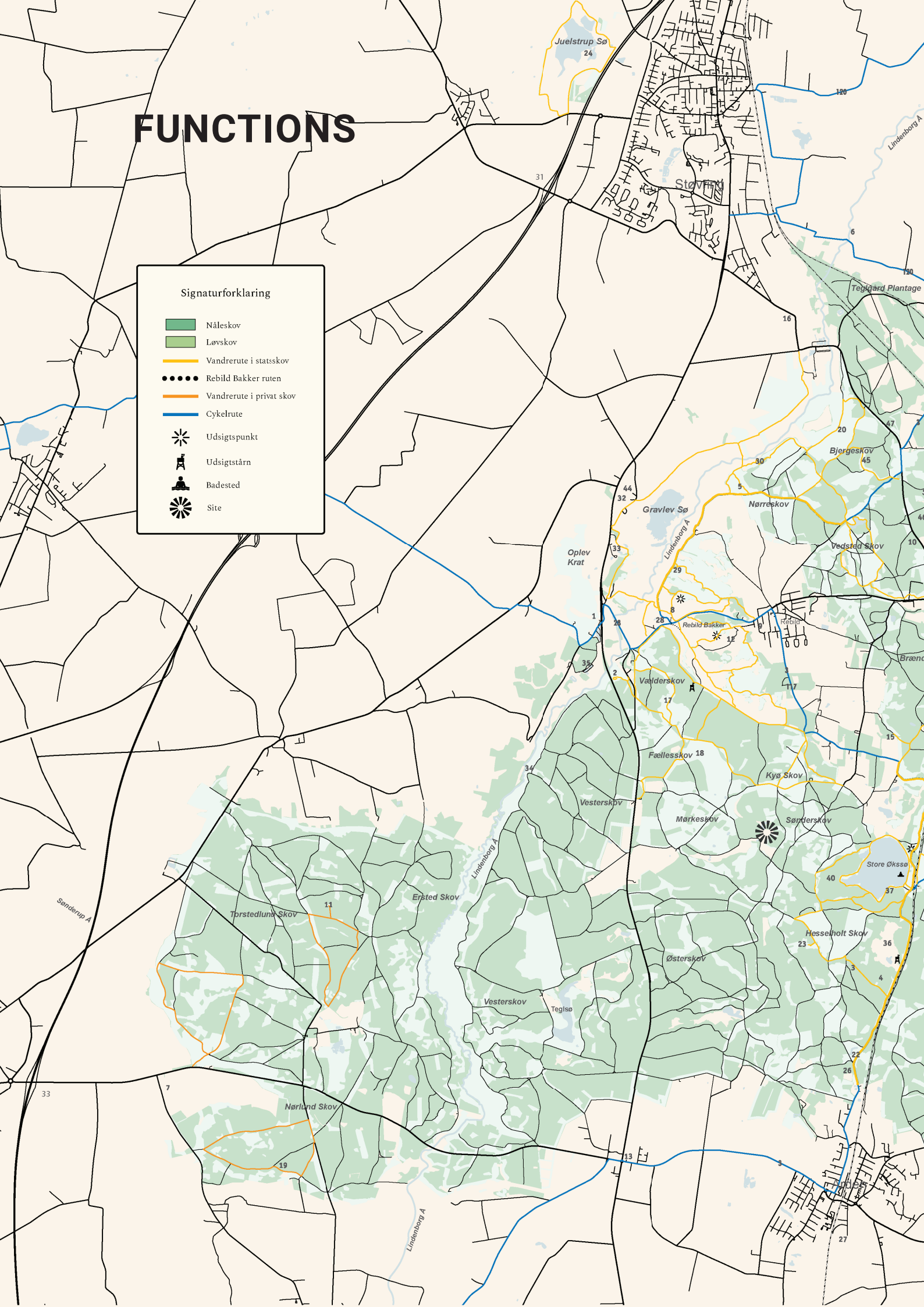
In addition to its impressive tree cover, Rold Skov is known for its unique flora and fauna, including rare plants such as lady's slipper orchids and red lilies, as well as a rich wildlife population including foxes, badgers, red deer, bats, and bird species such as ravens and black woodpeckers, which can be observed year-round (Rebild Portalen, n.d.).

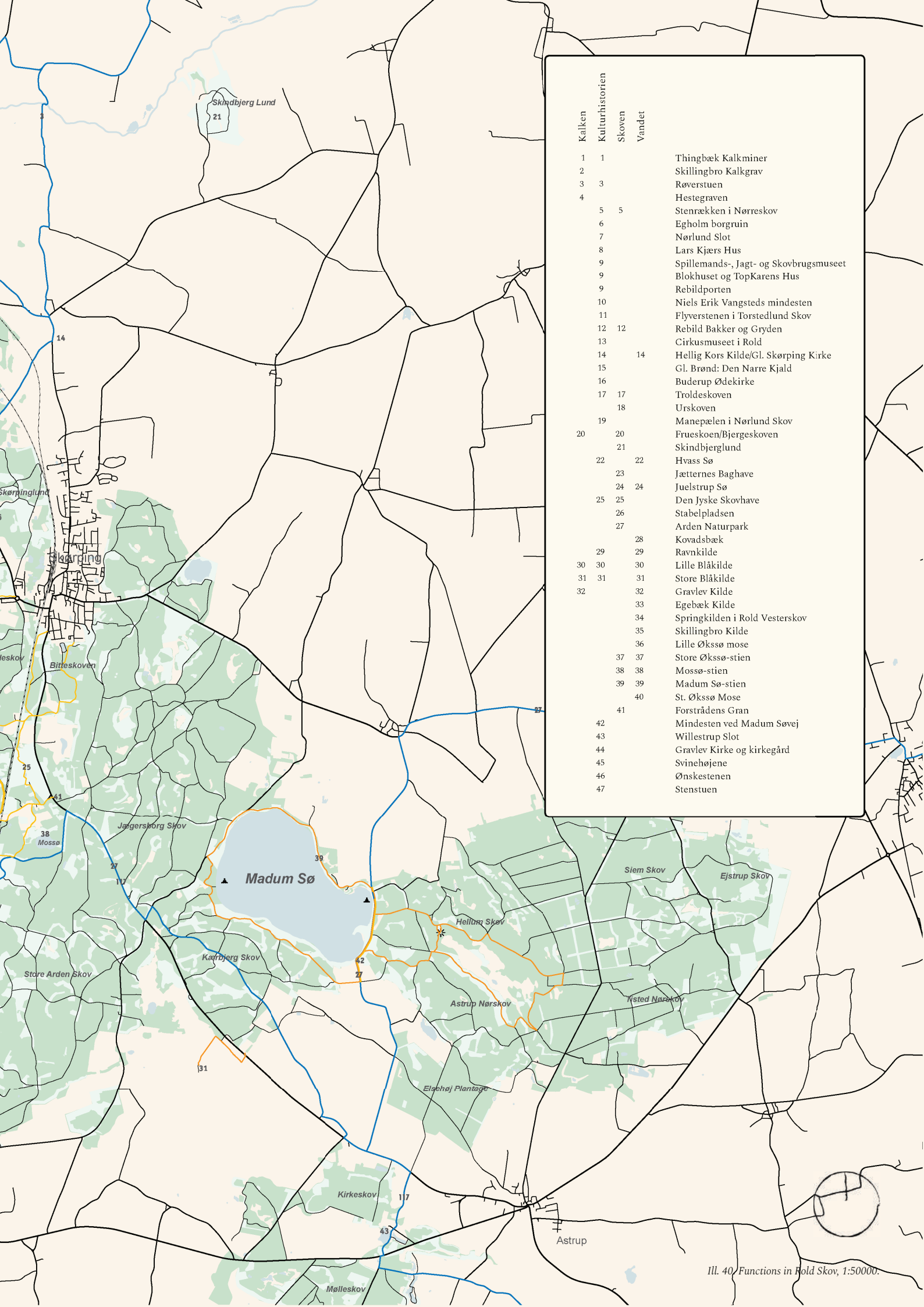
Rold Skov offers a wealth of attractions, including marked cycling and hiking trails, viewpoints, fishing lakes, playgrounds, and lakes, making it a popular destination for visitors throughout the entire year (Rebild Portalen, n.d.).



Ill. 39. Zoom in on the location.

FUNCTIONS


Signaturforklaring
Nåleskov
Løvskov
Vandrerute i statsskov
Rebild Bakker ruten
Vandrerute i privat skov
Cykelrute
Udsigtspunkt
Udsigtstårn
Badested
Site
Juelstrup Sø
Støvring
Tegldgard Plantage
Bjergeskov
Nørreskov
Gravlev Sø
Oplev Krat
Vedsted Skov
Rebild Bakker
Rebild
Vælderskov
Fællesskov
Kyø Skov
Vesterskov
Mørkeskov
Sønderskov
Store Økssø
Hesselholt Skov
Østerskov
Ersted Skov
Torstedlund Skov
Vesterskov
Teglsø
Nørlund Skov
Lindenborg Å
Sønderup Å
Aabes



Kalken	Kulturhistorien	Skoven	Vandet	
1	1			Thingbæk Kalkminer
2				Skillingbro Kalkgrav
3	3			Røverstuen
4				Hestegraven
	5	5		Stenrækken i Nørreskov
	6			Egholm borgruin
	7			Nørlund Slot
	8			Lars Kjærs Hus
	9			Spillemands-, Jagt- og Skovbrugsmuseet
	9			Blokhuset og TopKarens Hus
	9			Rebildporten
	10			Niels Erik Vangsteds mindesten
	11			Flyverstenen i Torstedlund Skov
	12	12		Rebild Bakker og Gryden
	13			Cirkusmuseet i Rold
	14		14	Hellig Kors Kilde/Gl. Skørping Kirke
	15			Gl. Brønd: Den Narre Kjald
	16			Buderup Ødekirke
	17	17		Troldeskoven
		18		Urskoven
	19			Manepælen i Nørlund Skov
20		20		Frueskoen/Bjergeskoven
		21		Skindbjerglund
	22		22	Hvass Sø
		23		Jætternes Baghave
		24	24	Juelstrup Sø
	25	25		Den Jyske Skovhave
		26		Stabelpladsen
		27		Arden Naturpark
			28	Kovadsbæk
	29		29	Ravnkilde
30	30		30	Lille Blåkilde
31	31		31	Store Blåkilde
32			32	Gravlev Kilde
			33	Egebæk Kilde
			34	Springkilden i Rold Vesterskov
			35	Skillingbro Kilde
			36	Lille Økssø mose
		37	37	Store Økssø-stien
		38	38	Mossø-stien
		39	39	Madum Sø-stien
			40	St. Økssø Mose
		41		Forstrådens Gran
	42			Mindesten ved Madum Søvej
	43			Willestrup Slot
	44			Gravlev Kirke og kirkegård
	45			Svinehøjene
	46			Ønskestenen
	47			Stenstuen

Ill. 40. Functions in Rold Skov, 1:50000.

WHY ROLD SKOV

The location chosen to establish the rehabilitation center for substance abusers is deep within Rold Skov for several compelling reasons. Despite the significant number of visitors to the forest, Rold Skov spans a large area, and the project location in the heart of the forest is one of the less visited and affected areas. The site is an untouched forest landscape, so the architectural design must consider the impact on the natural surroundings.

The location is far disconnected from the users' previous environments where substance abuse patterns and negative influences may have impacted individuals. By locating the rehabilitation center in this remote location, this thesis aims to provide the clients with a fresh start in a picturesque and tranquil setting, which can significantly contribute to their healing process. However, the most significant argument for selecting Rold Skov as the site for the rehabilitation center is the extraordinary natural surroundings that envelop the area. As the previous theories suggest, nature can be viewed as an active participant in the healing process and therefore it is intended to be integrated it into many aspects of the center's architecture and programming.

The nature of Rold Skov will be utilized to stage therapy sessions and outdoor activities that help residents connect with their surroundings and to gain inner peace. Furthermore, the architecture will be shaped by nature, and the design will strive to create harmonious and unobtrusive buildings that blend seamlessly with the surrounding landscape. By adapting the buildings to nature and providing clients with the opportunity to enjoy and engage in activities with the surroundings, the rehabilitation center will create the optimal conditions for the users healing and recovery. Nature will serve not only as a source of physical well-being but also as a source of mental health and tranquility, which are crucial for our users' journey to recovery.

"The subject about beauty from nature and living well, i.e. the physical environment, is extremely important. The fact that you are placed in a good setting surrounded by beautiful nature where you can go for walks and activities helps a lot with the treatment." (Appendix 3, interview with Tjele Behandlingscenter)

Ill. 41. Picture from the site.

CONTEXTUAL CONDITIONS

Ill. 42. Picture from Rold Skov.

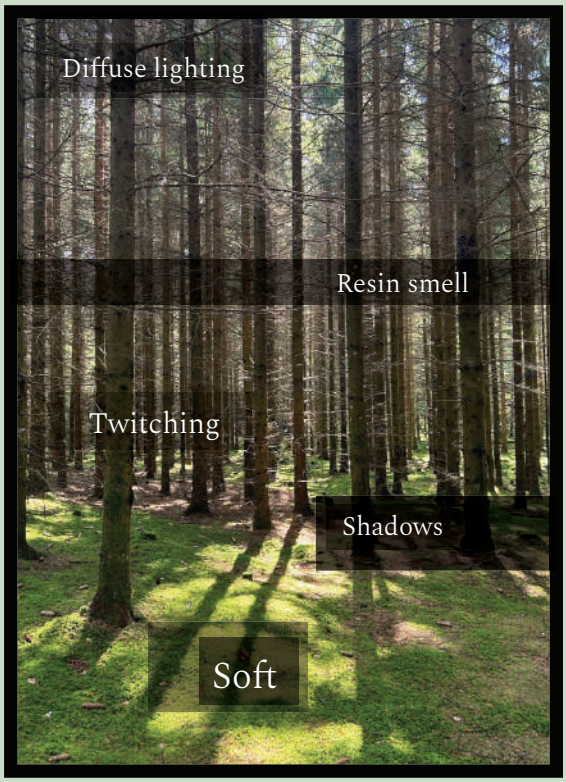
EXPERIENCES & IMPRESSIONS

In continuation of the site visit, notes were taken about the phenomenological impressions in the various places around and on the site. This has been made into a phenomenological storyboard analysis that seeks to understand the spatial processes from a human perspective. This analysis is a twist on the storyboarding method developed by architect, Anna Aslaug Lund, that strives to document experiences and impressions gained when walking through a location. The storyboarding method is made through a series of images with words attached describing the experience and impressions gained at that time (Lund, 2021).

This approach will also give the reader a better understanding of the site overall as it is unknown beforehand, storyboarding is therefore an effective way to capture and communicate the potentials of the site as well as the spatial qualities found in a series of images. Lund argues that when displaying and explaining a site for an architectural project, it is often done at a large scale such as mapping analysis where the knowledge of possibilities for the architectural and spatial principles are lost. Therefore, an analysis from the human perspective is necessary as it is a tool that considers the architectural potential carefully at the scale of the user (Lund, 2021).

The following graphic showcases four images taken during the site visit and the impressions gained from being both in motion and standing still at these locations. The perspectives chosen varies in their expressions and advantages, as they have different elements in the field of view. These different perspectives seek to understand the various possibilities of the site at the various locations to gain an understanding of how this could be incorporated and utilized in the design and layout of the architecture.

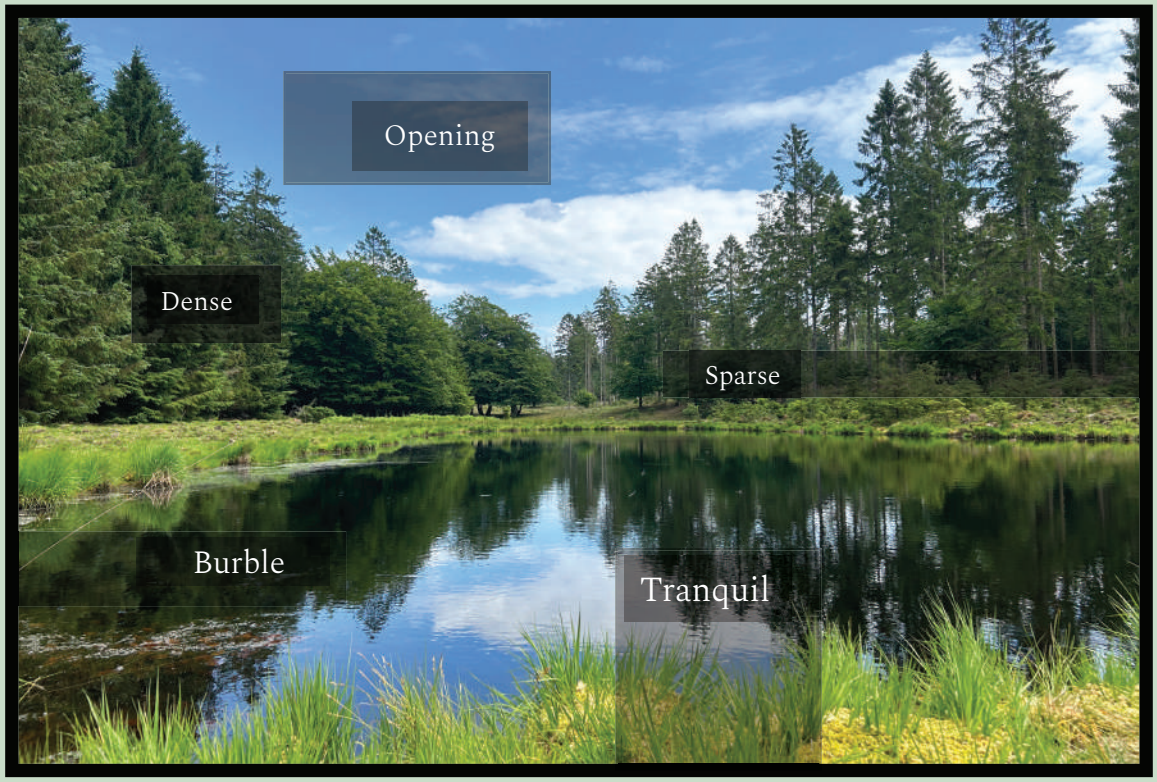
Ill. 43. Storyboard, viewpoint.



FOREST

TRAVERSING

Ill. 44. Storyboard, forest & traversing.



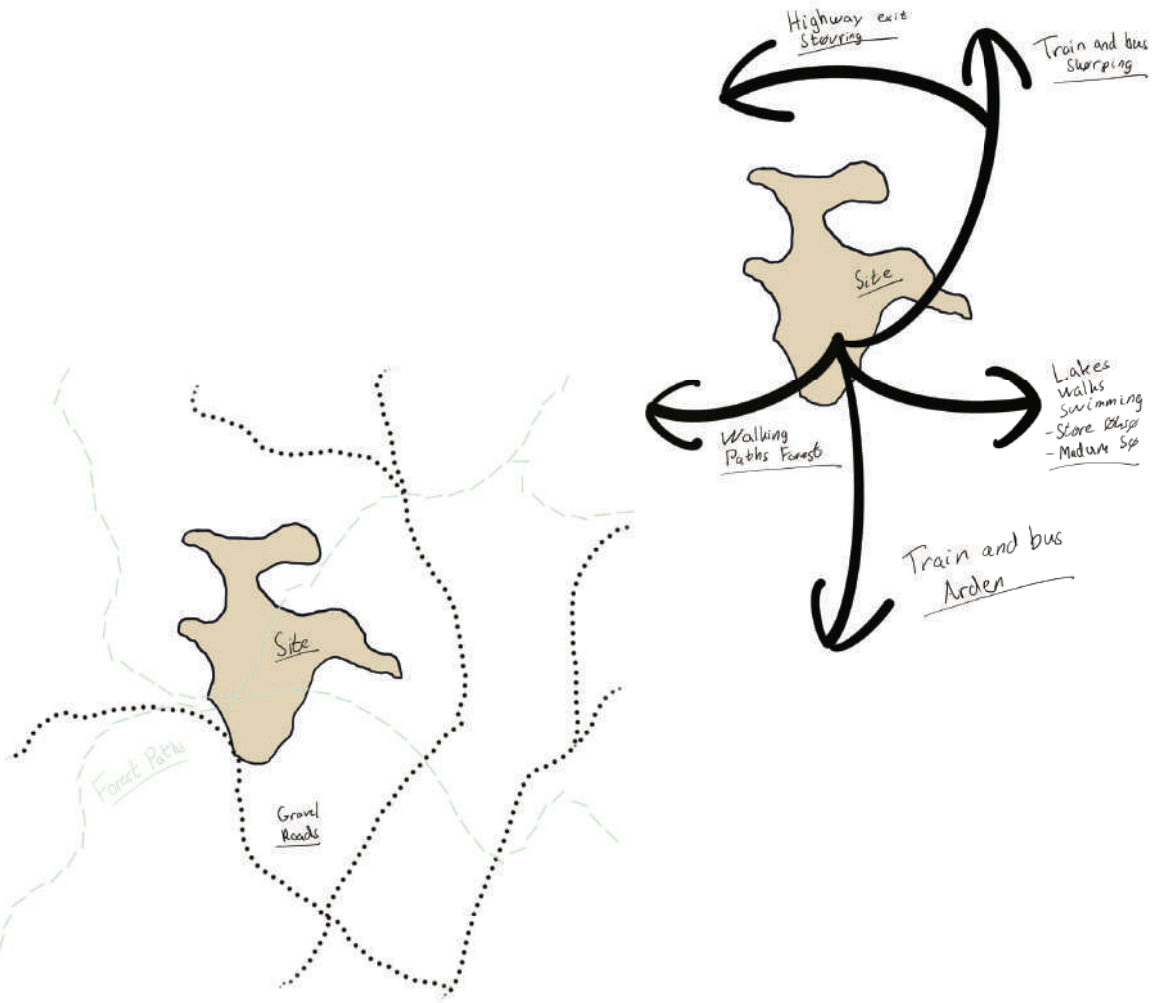
LAKESIDE

Ill. 45. Storyboard, lakeside.

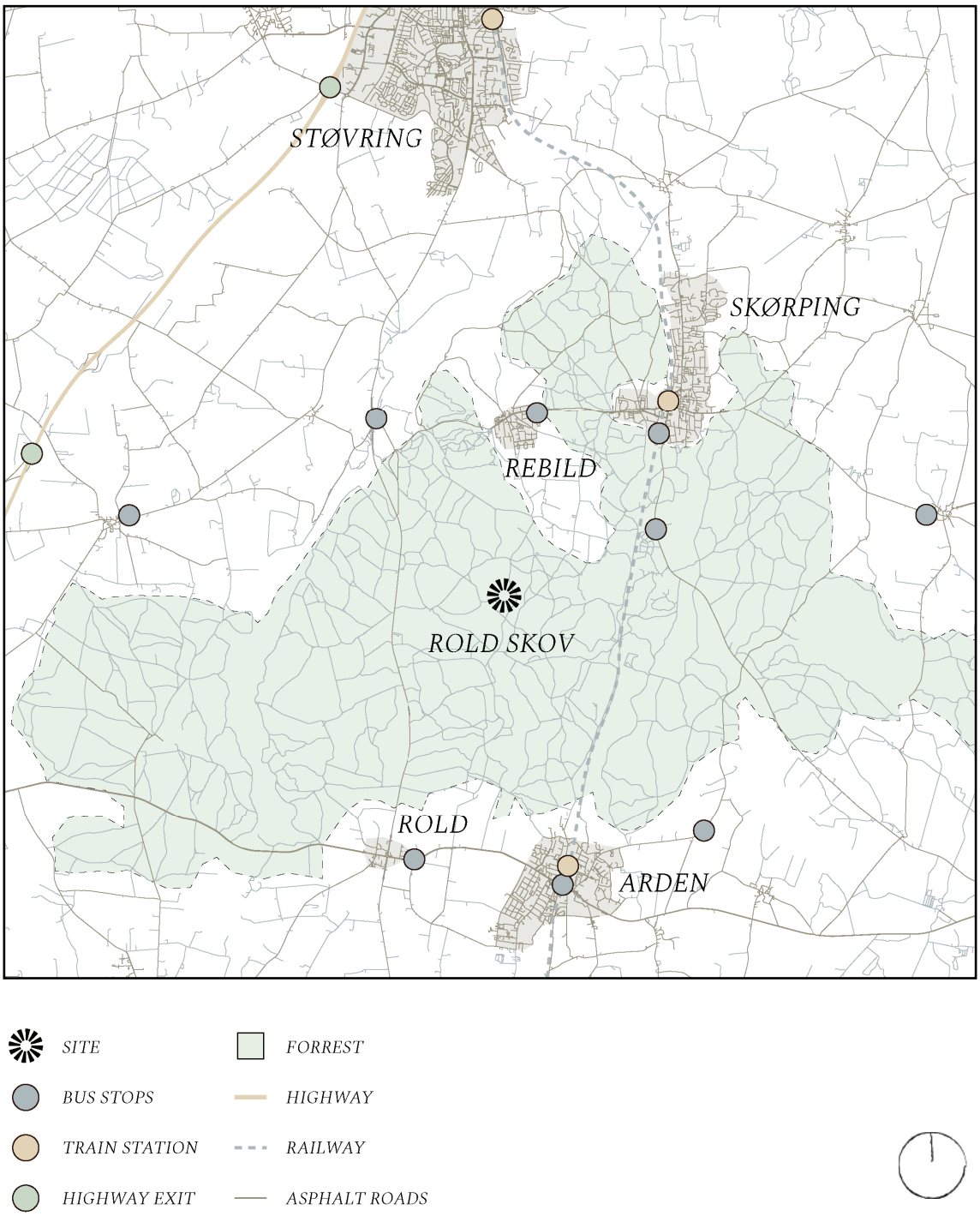
INFRASTRUCTURE

The site is located in the middle of Rold Skov, a 45-minute walk or 10-minute drive from the train station or bus stop in Skørping, as well as a 10-minute from a highway exit in Støvring. This means our site is located remotely in an unpopulated part of the forest. At the edge of the forest there are some smaller towns, with shopping opportunities, while the nearest big city, Aalborg, is approximately a 30-minute drive away.

Sub conclusion: The site allows for walks and activities in the nearby forest context and is close to public transport and highway exits without being too close to urban areas where users could be tempted to buy substances.



Ill. 46. Analytical drawings & conclusions.



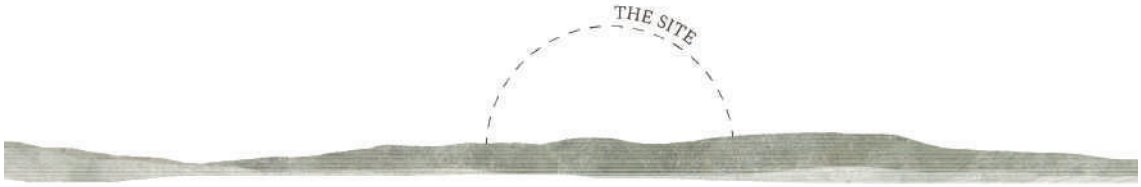
Ill. 47. Infrastructure analysis, 1:5000.

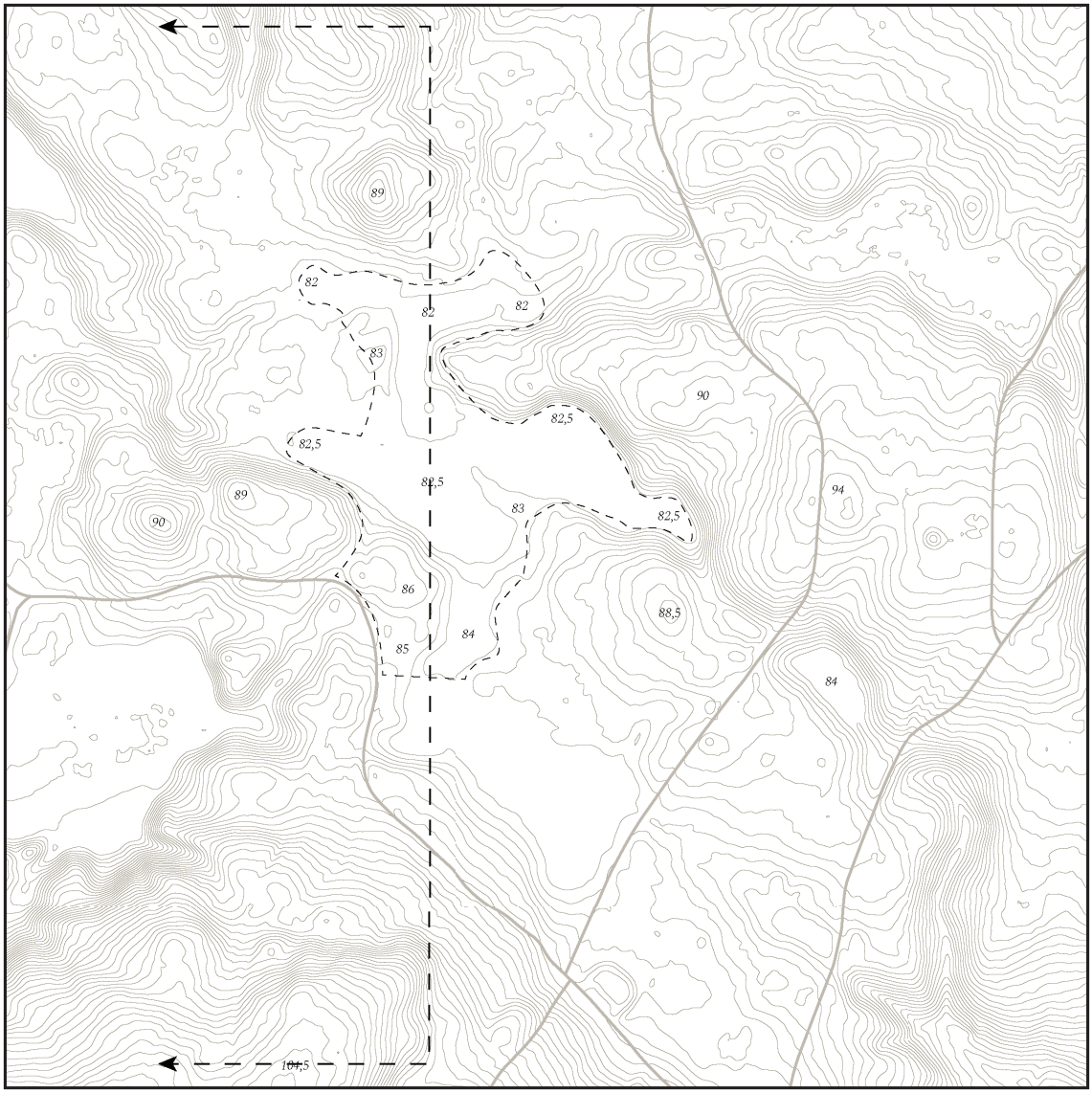
TOPOGRAPHY

The site is located in a hilly area, but the site itself is relatively flat. Most of the site lies in a depression, and it rises four meters from the northern to the southern part of the site. In the south-west part, there is a gravel road which borders the site. All roads in the nearby context are gravel and are rarely used by the public.

Sub conclusion: The site allows for various building placements both in flat terrain and on hilly terrain, as well as having various views of both the forest surrounding the site, the lake on the site, and overlooking the site itself.

Ill. 48. Analytical drawings & conclusions.





ROADS

SITE

0,5 METER ELEVATIONS

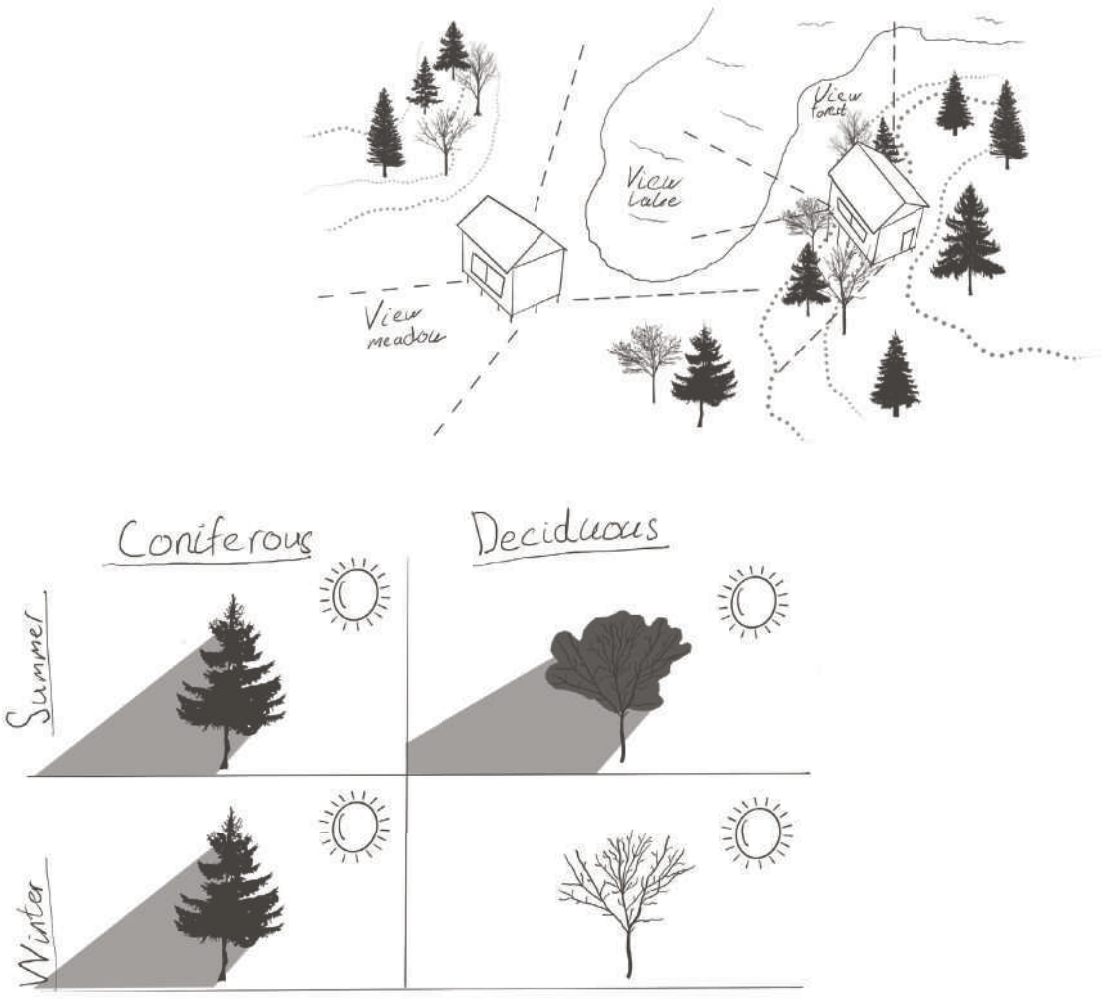
TOPOGRAPHY SECTION

Ill. 49. Topography plan & section, 1:5000.

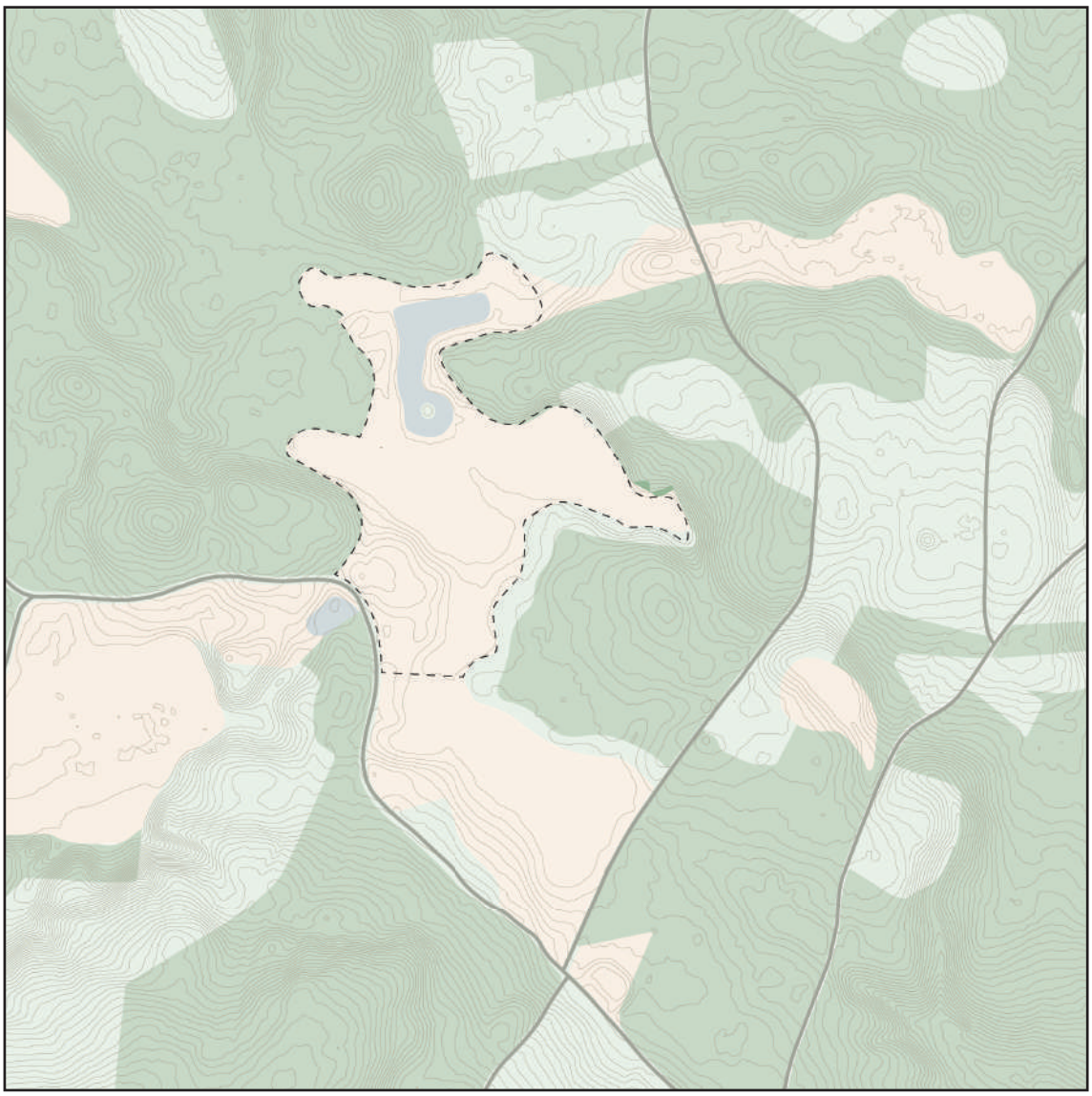
GREEN AND BLUE STRUCTURES

The site is located on a meadow surrounded by forest. The surrounding forest consists primarily of coniferous trees which are green all year round, but there are also deciduous trees which lose their leaves every autumn. Both in the northern and southern part of the site, two small ponds are positioned, and these water features can add an extra natural element that can be incorporated into the architecture.

Sub conclusion: The site allows for various natural elements to be utilized depending on the layout of the masterplan. As the site is in a depression, it is possible to get views overlooking the meadow, the lake, and the forest.

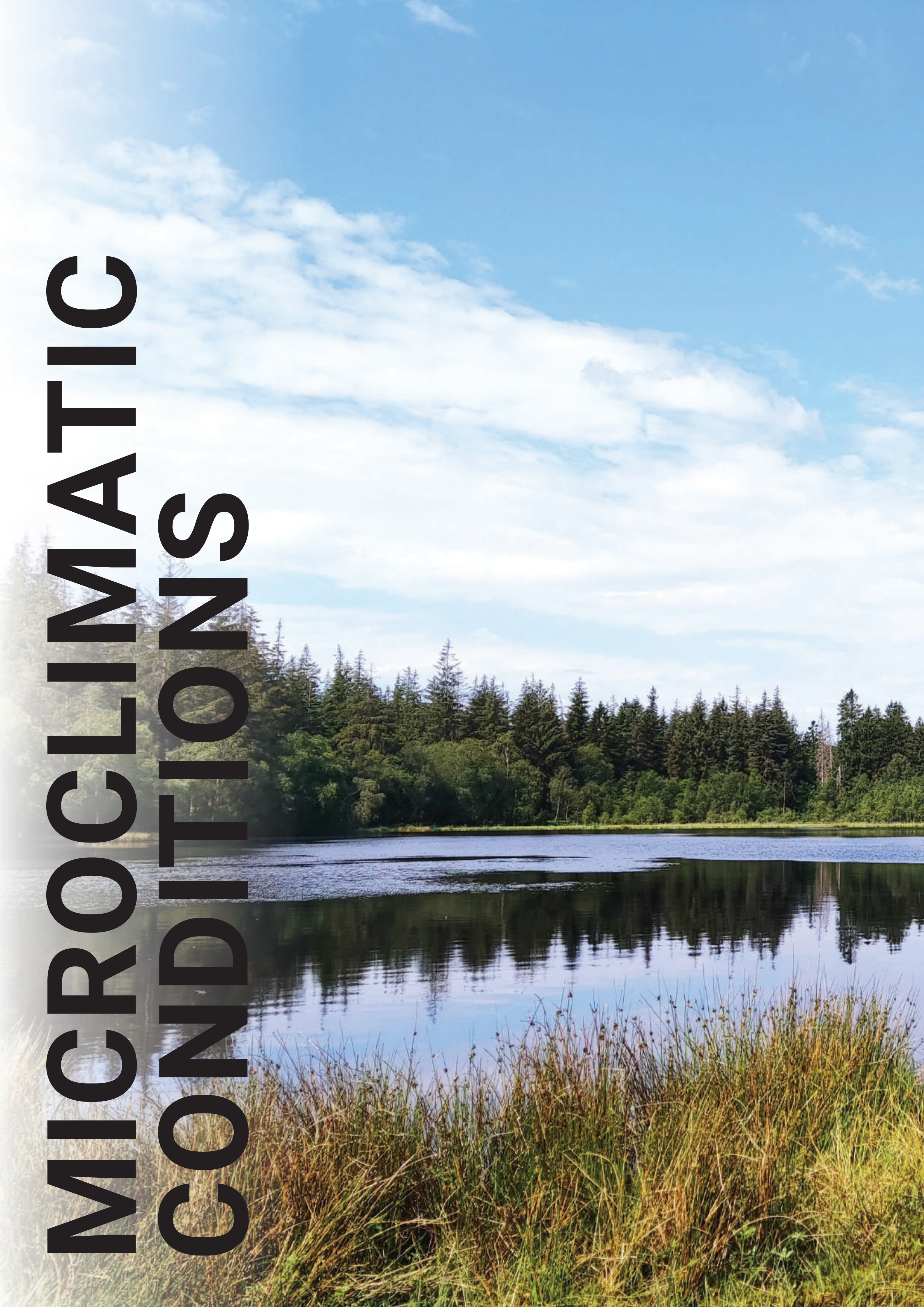


Ill. 50. Analytical drawings & conclusions.



Ill. 51. Green and Blue Structures, 1:5000.

MICROCLIMATIC CONDITIONS



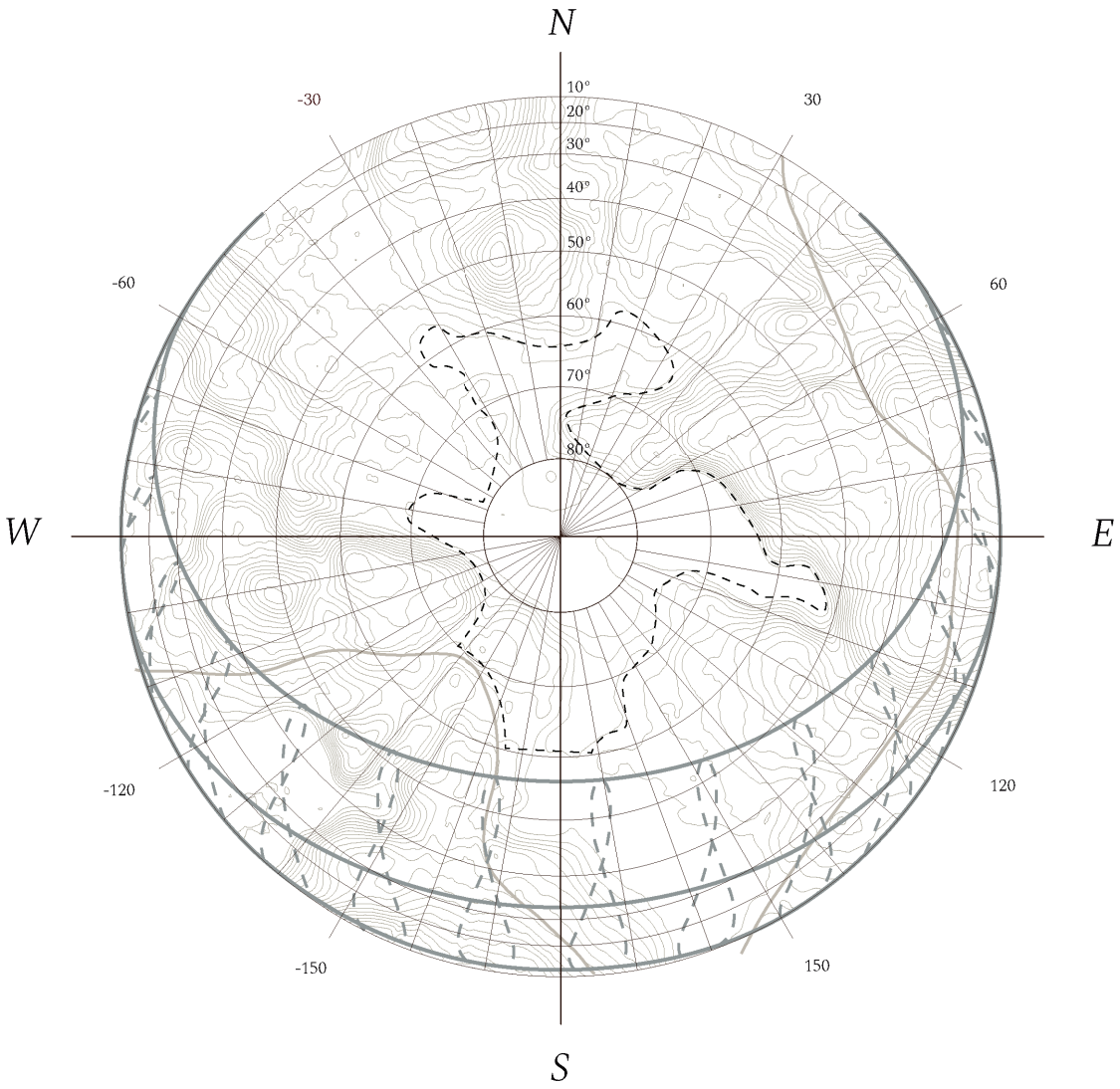
Ill. 52. Forest lake in Rold Skov.

SUN STUDY

The sun study shows the position of the sun at different times throughout the year. Orientation and elevations are shown in the diagram. The dashed lines show the sun's path per hour during the day, while the three thick lines show respectively the shortest and longest day of the year, as well as the equinox.

Sub conclusion: The positioning of the sun in relation to the site is a key factor to consider when deciding on building placement, as some parts of the site are blocked by coniferous trees as well as being shaded by the landscape itself. When considering window placement in the design process, it is important to consider the pathing of the sun as passive solar gains, shading devices etc. that could be utilized.

Ill. 53. Analytical drawings & conclusions.

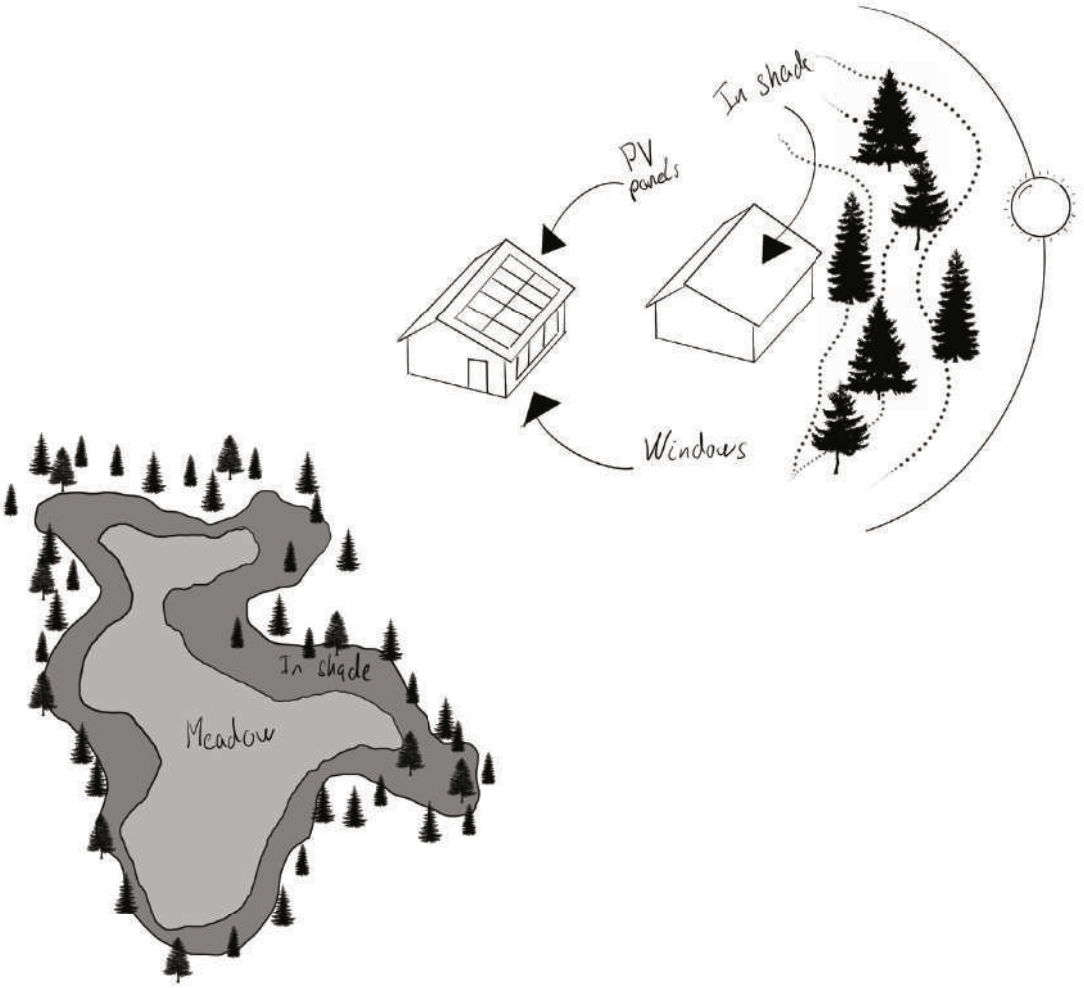


Ill. 54. Sun study illustration.

SHADOW STUDY

The shadow study shows where and when there is shadow on the site. The analysis was made based on the area's topography and the trees. The illustration displays the shadows cast on the site at four separate times of the day on the longest day of the year, the shortest day of the year, and at the equinoxes. The analysis shows that there are limited amounts of sun in winter. In the morning, there are shadows on the eastern part of the site, while in the evening there are shadows in the western part. In general, there is a lot of sun on the site, when taking into account that the site is located in the middle of a forest.

Sub conclusion: The site is with little shadow throughout the year. However, in the meadow in the center of the site, there is more sun throughout the day, as the boundary of the site is hilly and with trees casting shadows. The building's positioning should therefore consider where there is sun and shadow depending on its function.



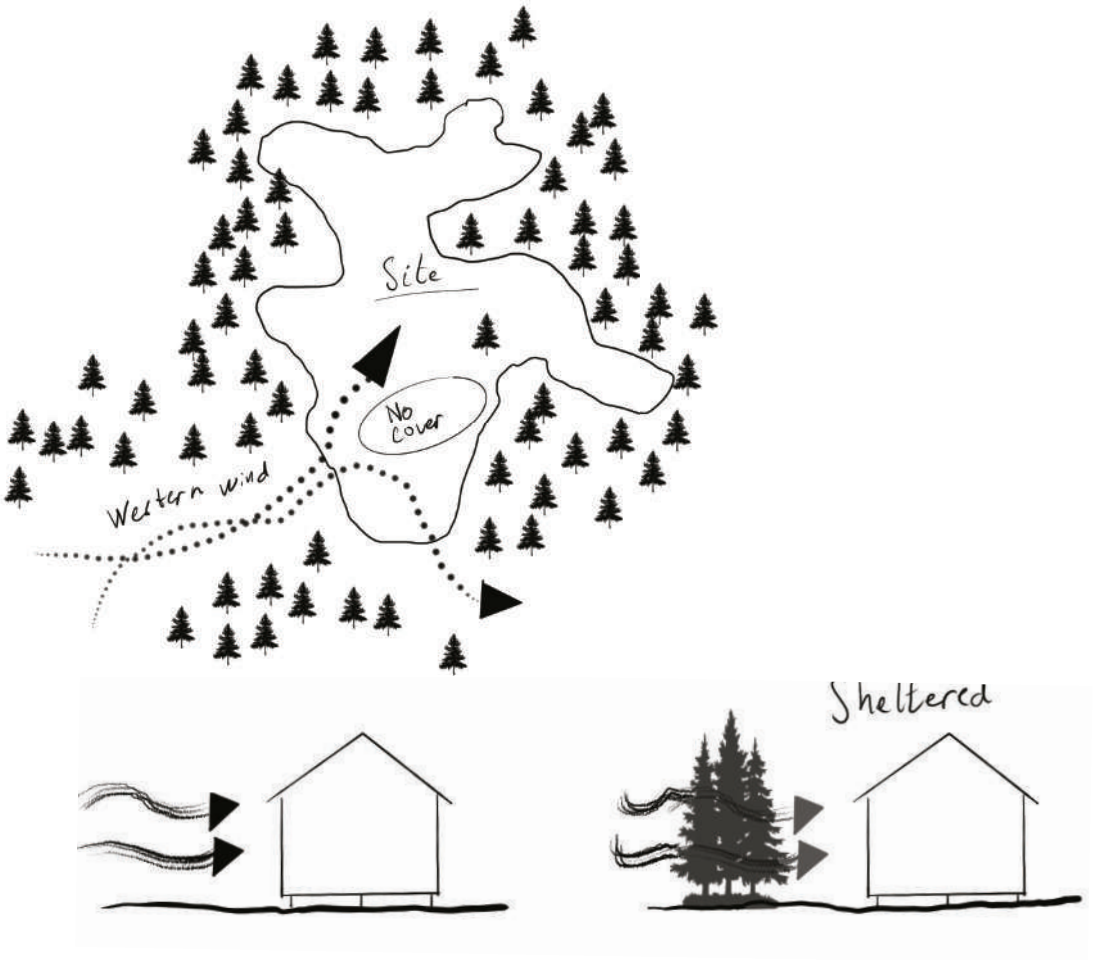
Ill. 55. Analytical drawings & conclusions.

Ill. 56. Shadow study illustration.

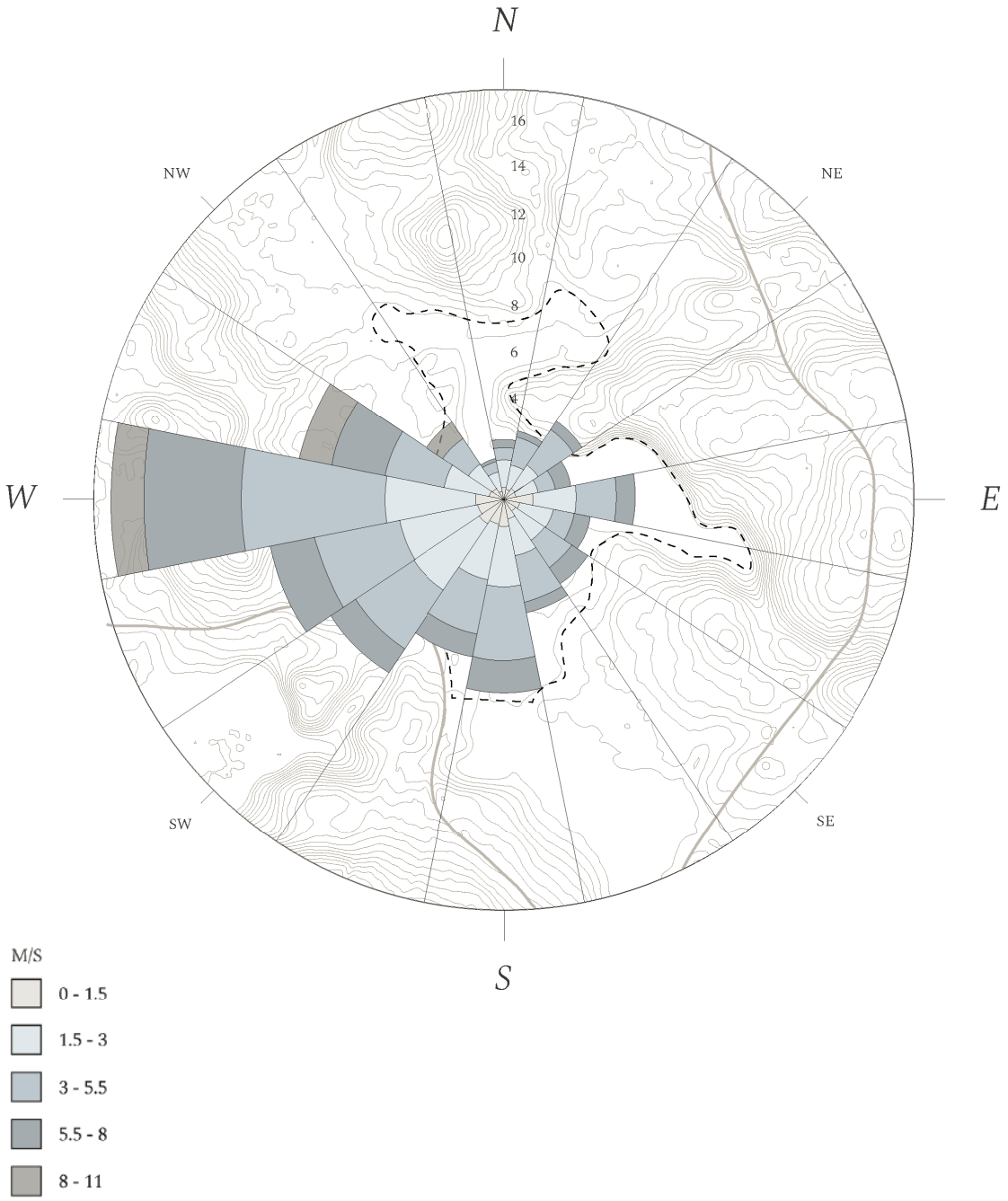
WIND STUDY

The wind study shows the direction of which the wind in the area strikes from. The graph shows that the wind primarily comes from the west, and having milder and less winds from the south, east and north direction. The hilly forest we are in, however, means that the wind is broken up by the trees and landscape, and will therefore most likely not be a nuisance for the project.

Sub conclusion: The site is sheltered in its natural surroundings because of the hills and forest surrounding the site. However, there is a smaller opening from the west and south direction where the landscape does not offer much protection. When planning the layout of the buildings and outdoor spaces, it is important to factor in where the wind arrives from and how to create sheltered spaces both from the landscape or the building itself. The wind direction and positioning on the site should also be utilized when incorporating natural ventilation principles.



Ill. 57. Analytical drawings & conclusions.

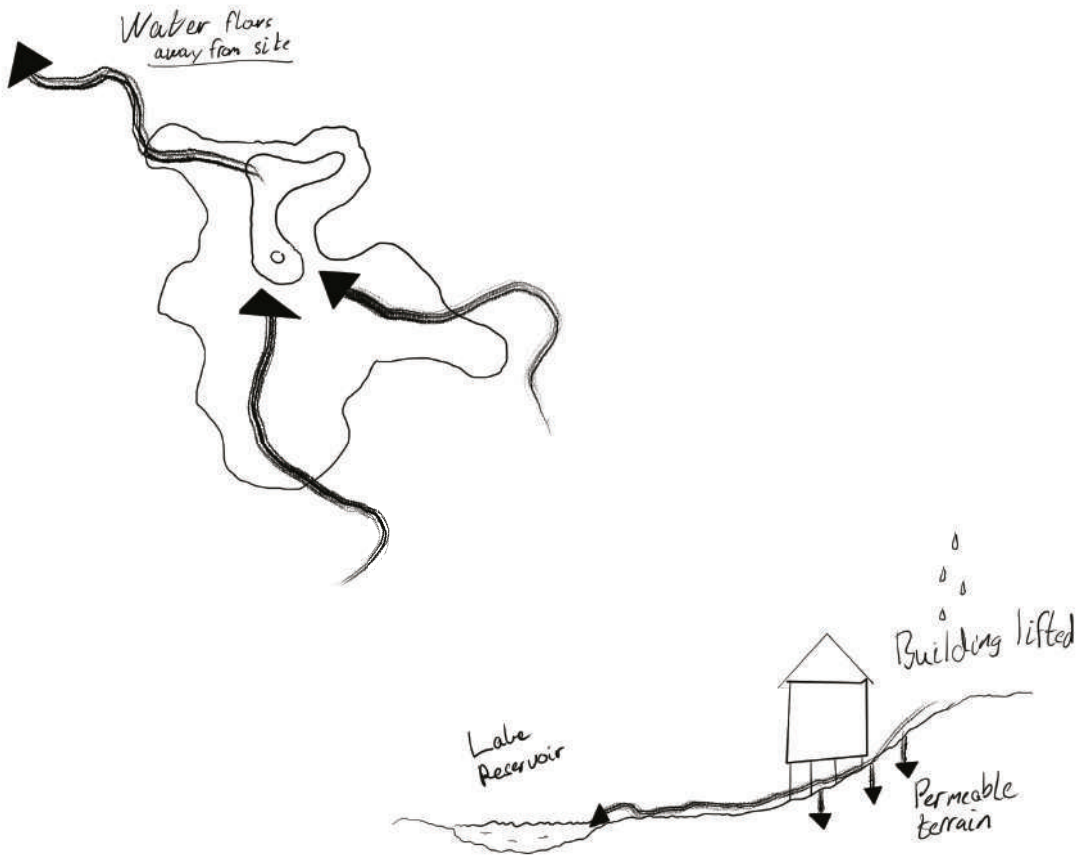


Ill. 58. EPW annual wind data from Aars, 2023.

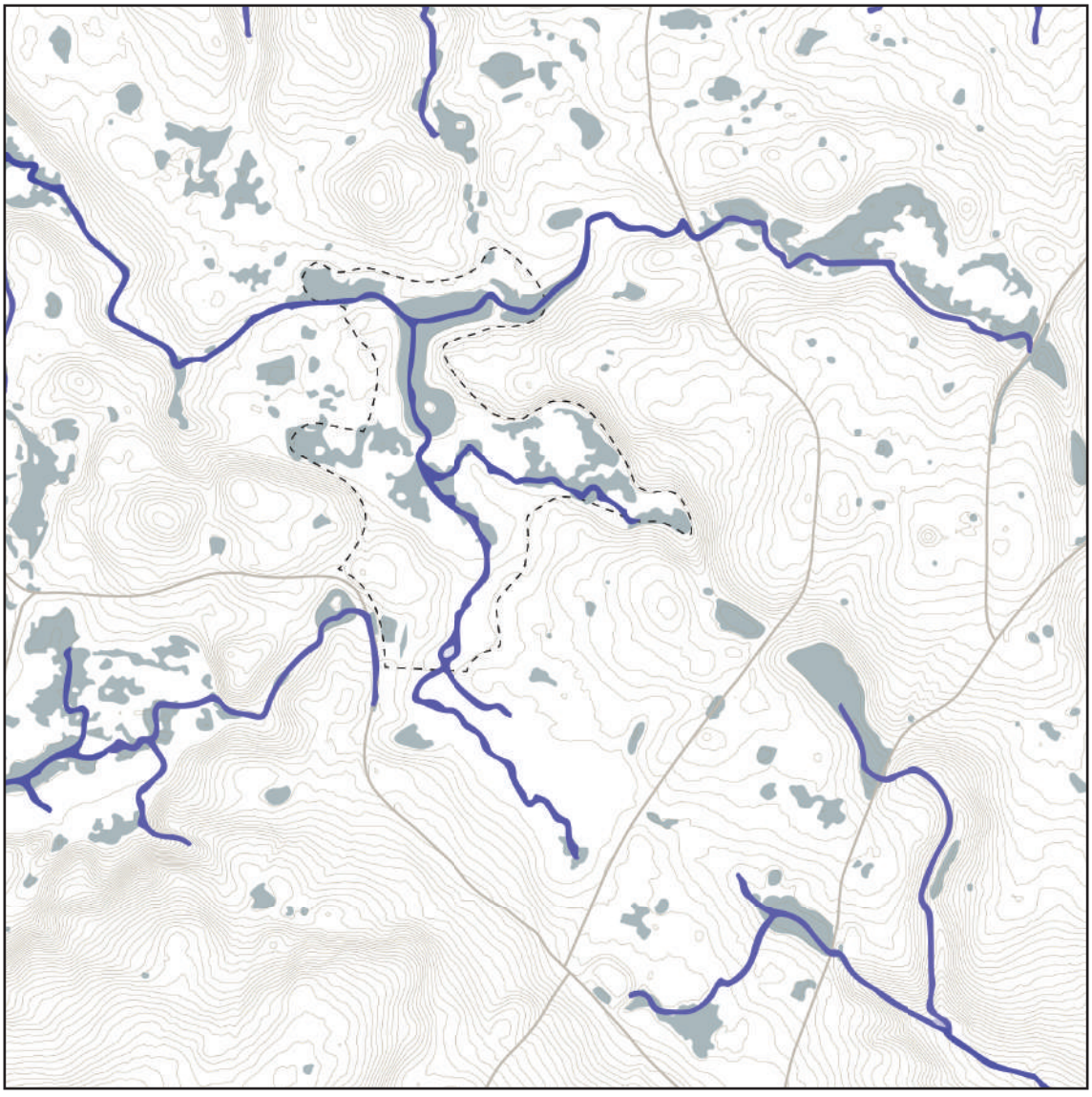
RAIN STUDY

The analysis shows where rainwater is collected on the site and how it is diverted away from it. The Bluespot analysis is based on a rain event where 150 mm of rain will occur, which would be described as a 100-year event. As seen from the hydrological flow paths, the water is directed away from the site to the north.

Sub conclusion: The groundwater table is relatively high on the site, but the hilly landscape is naturally leading the water away to the northeast corner of the site. Furthermore, the pond placed centrally on the site functions as a reservoir where rainwater can be gathered. As the site is on permeable land, it could be considered placing the buildings on a raised foundation letting the natural water flows stay intact.



Ill. 59. Analytical drawings & conclusions.

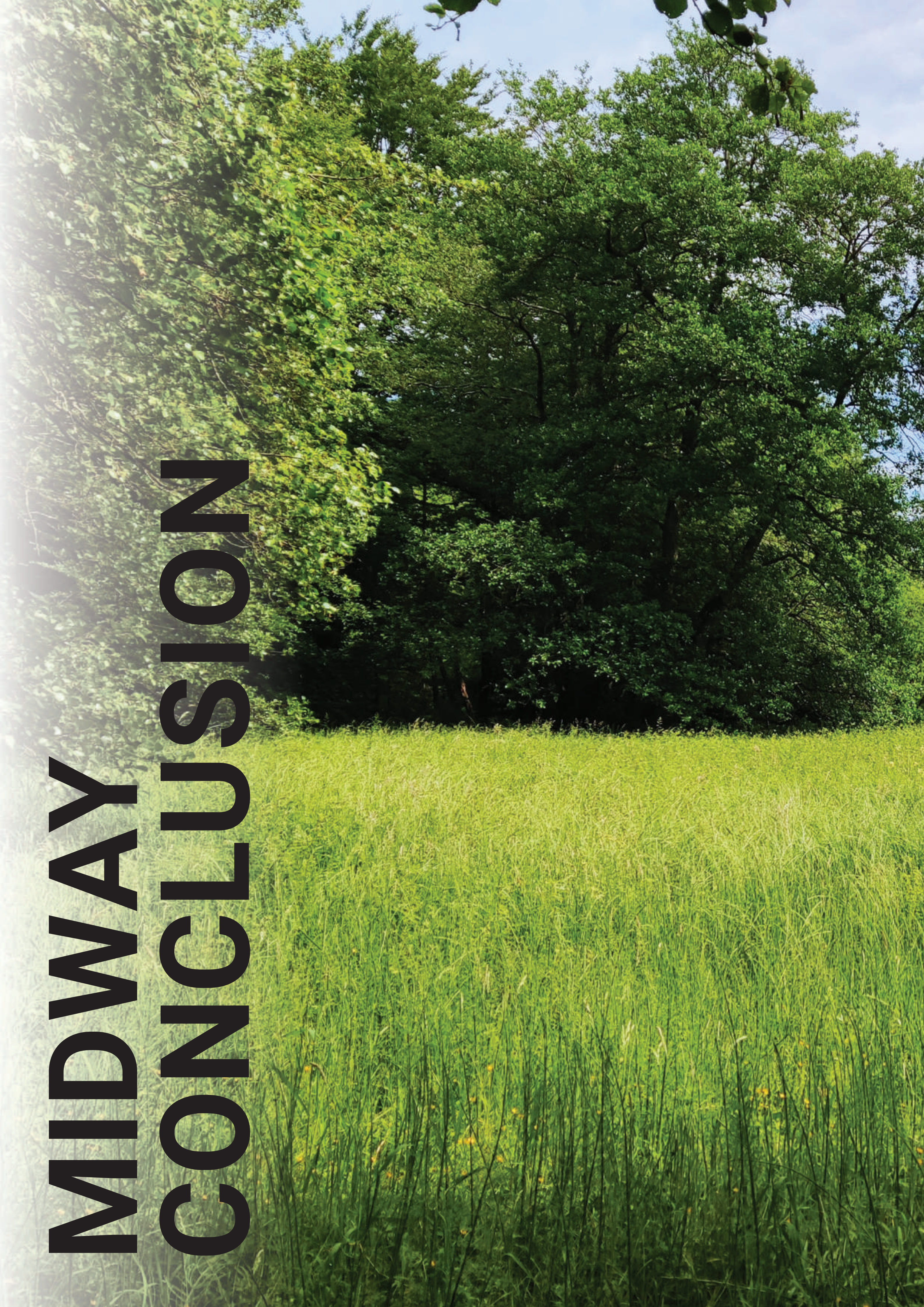


BLUESPOT 150 MM

HYDROLOGIC FLOW PATHS

Ill. 60. Rain study & blue spot analysis, 1:5000.

MIDWAY CONCLUSION



Ill. 61. Picture of a field in Rold Skov.

PROBLEM STATEMENT

How can architecture assist in the recovery process of drug addiction in the setting of a rehabilitation center, that promotes long term healing and recovery by integrating natural elements and considering the clients practical, social and self-fulfillment needs in the design of the spaces, while also incorporating sustainable practices and appraising an optimal indoor environment?












Ill. 62. Pictures from Rold Skov.

DESIGN VISION & CONCEPT

Current rehabilitation centers across Denmark mostly share the same architectural challenges, as their expression, spatial layout, and available functions are often substandard. The architecture is undeniably important for the healing and recovery process of the clients, but existing offers have been limited in overview and financials as rehabilitation centers do not have enough focus on architectural qualities and the user's needs.

Vision based on Maslow's Hierarchy of needs

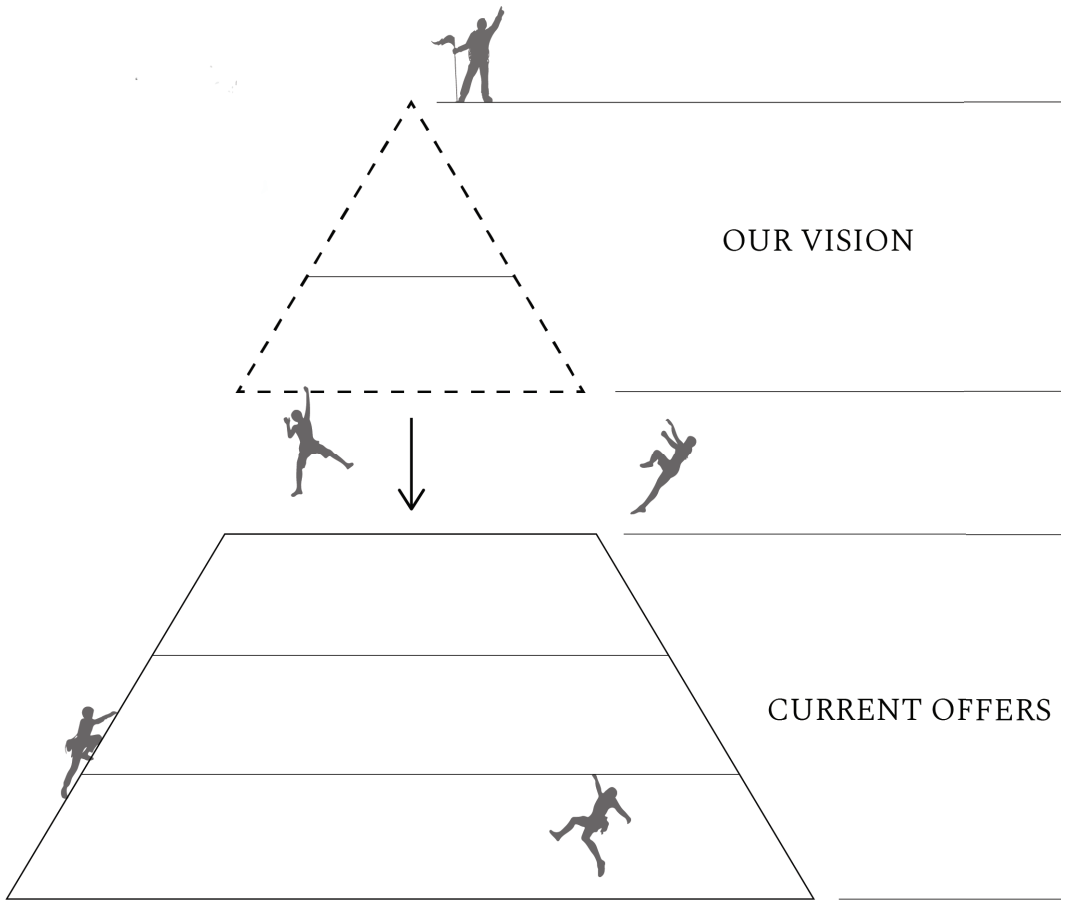
This master thesis seeks to challenge the perception of the typical rehabilitation center and investigate how the physical space can be designed to improve the recovery of substance abuse, both during the stay as well as leading to a better path for the users going forward. The vision is to design a home with a tranquil environment and space for functions and activities, so that the user can progress into a better lifestyle. Firstly, as the rehabilitation center is in desolate and scenic surroundings in the heart of Rold Skov, it is crucial to utilize nature and integrate it into both the outdoor spaces and create a connection to the indoor spaces. Furthermore, designing a home for the residents to live in and giving them a homely atmosphere in the social spaces as well as private spaces is pivotal for the project. Including therapeutic rooms for therapy, mindfulness and yoga is also important, as these are some of the primary functions of a rehabilitation center. Together with recreational functions such as workout rooms, creativity rooms, workshops, and outdoor activities such as kitchen gardens are key factors for the user to achieve self-realization and progress to a new path in life.

The architectural design must consider various zoning and sizing options for a variety of social settings, giving the spaces flexibility to adapt depending on the user's needs and therefore giving the user an option to choose their own path. The centerpiece of this master thesis and where this project stands out, is how the hierarchy of needs of the user becomes the main design driver. Current rehabilitation centers struggle with their layout, activities, and overall offers to the user making the users unable to progress through the stages in Maslow's hierarchy of needs. This thesis envisions a fundamental change opposing existing rehabilitation offers, where the architecture is designed specifically for the user to climb the hierarchy, giving them a recovery that prevails after treatment.

Concept

The aim of this master's thesis is to explore how the recovery of substance abusers can be improved through the architecture of the rehabilitation facility. In this report's program and research phase, it was found that the existing rehabilitation centers offer structure to the clients' daily routines and that this is a fundamental part of the process. It was also found that a crucial aspect of client needs was neglected in many of the treatment facilities researched, which was the self-fulfillment need. This need is described by Maslow, to be the most important need for people to experience self-actualization and thereby to make changes to their lives, such as recovering from substance abuse.

Therefore, the concept of the design revolves around bringing structure to the daily routines of the clients through clear architectural programming, but also introducing functions that ensure that the clients have their self-fulfillment needs met. To facilitate a structured setting, the architecture must provide legibility in the spatial layout, as a division of the functions in the structured rehabilitation process produces a tranquil environment for the clients to recover.



Ill. 63. Concept & Vision based on Maslows hierarchy of needs.

DESIGN PARAMETERS

THERAPEUTIC COMMUNITY

A therapeutic community thrives on a foundation of security, calmness, and a homely atmosphere. The simplicity of the building layout, coupled with intuitive wayfinding, fosters a sense of belonging and ease of navigation. The element of comfort and support are essential for individuals on their journey towards healing.

HEALING ENVIRONMENT

Through the collaboration of architecture and nature, the aim is to establish a healing environment. Drawing upon the principles of healing architecture, spaces should be designed to foster emotional well-being, facilitate overcoming challenges, and empower individuals to regain control and move forward in their lives.

OPPORTUNITIES IN CONTROLLED SETTINGS

Controlled settings are a parameter to ensure that it is possible to have freedom in some controlled framework. The residents are in different stages of their treatment and, thus, in different states of mind. Therefore, it is important that there are architectural options so that everyone can thrive, socially, physically, mentally, etc.

IMPLEMENTATION OF NATURE

The implementation of nature within the architectural framework serves multiple functions, from activating the senses to providing visual comfort and enhancing treatment outcomes.

ENVIRONMENTAL SUSTAINABILITY

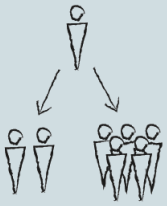
Environmental sustainability lies at the core of responsible architectural design. By prioritizing materials and strategies that are gentle on the environment, buildings can minimize their footprint while harmonizing with the surrounding landscape.

INDOOR ENVIRONMENT

Optimizing the indoor environment is paramount to supporting the healing process. From climate control to lighting and acoustics, every aspect should be carefully curated to enhance comfort and sensory stimulation. By harnessing natural elements, such as daylight and fresh air, the architecture becomes an active participant in promoting well-being.

THERAPEUTIC COMMUNITY

HEALING ENVIRONMENT



OPPORTUNITIES IN CONTROLLED SETTINGS

IMPLEMENTATION OF NATURE

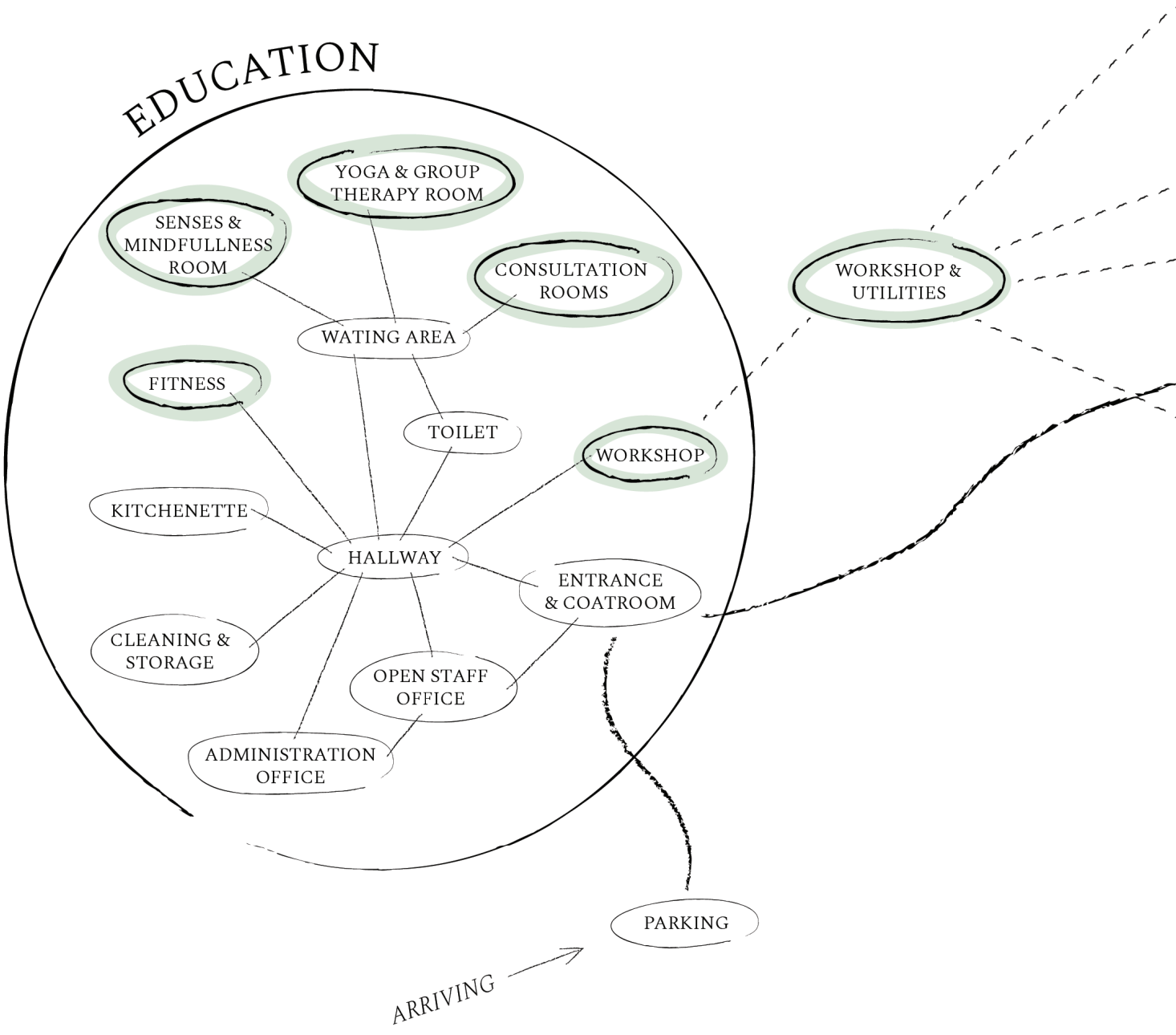
ENVIRONMENTAL SUSTAINABILITY

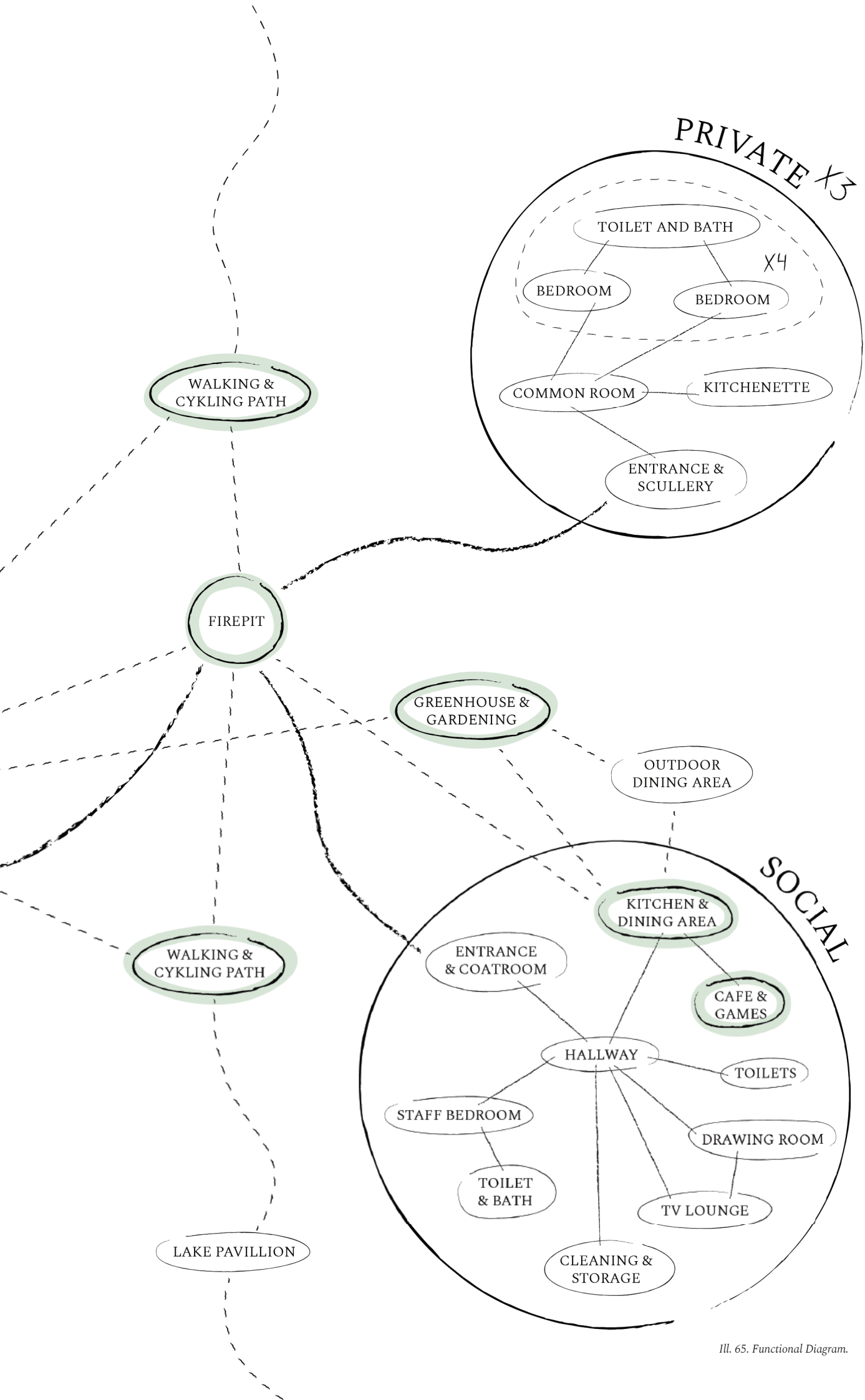
INDOOR ENVIRONMENT

Ill. 64. Design Parameters.

FUNCTIONAL DIAGRAM

The functional diagram was developed in unison with the room program on the following page and the user schedule put forth earlier in the master's thesis. The diagram is developed to show the project's concept of bringing structure to the daily routines of the clients through clear architectural programming by the divisions of the private, educational, and social buildings, to implement a realistic and simple structure in their everyday life. Furthermore, the diagram provides an overview of the necessary connections between functions, serving as a guiding framework for the development of the site- and floor plans. Here, the importance of implementing functions to strengthen self-actualization for the clients is also key and these functions have also been marked on the diagram.





Ill. 65. Functional Diagram.

PROGRAM

Room	Placement & Function	Quantity	Area netto	Total netto area
			[m^2]	[m^2]
Client housing				**267**
Bedrooms	Private with forest view	24	6	144
Bathrooms	Shared by two occupants	12	4	48
Common room, kitchennete & scullery	Shared, oriented to center	3	25	75
Social				**309**
Kitchen & dining area	Central in building	1	50	50
Cafe & games	Lake view	1	25	25
Drawing room	Lake view & fireplace	1	35	35
TV lounge	Lake view	1	10	150
Entrance & coatroom	Central & hallway	1	25	25
Restrooms	Acessible to everyone	3	3	9
Restroom acessible	Acessible to everyone	1	5	5
Bedrooms staff	Acessible, close to entrance	1	10	10
Therapy staff & admin				**252**
Restrooms	Acessible to everyone	2	3	6
Restroom acessible	Acessible to everyone	1	5	5
Reception, coatroom & public office	Acessible to everyone	1	20	20
Staff office	Connected to reception	1	20	20
Medicin room	Connected to reception	1	2	2
Consultation room & private office	Private, forest view	2	7	14
Group therapy	Semi private, forest view	2	25	50
Large therapy & flexible room	Semi private, forest view	1	40	40
Therapy breakroom & kitchenette	Acessible & central	1	40	40
Workshop	Encourage participation	1	40	40
Fitness	Acessible to everyone	1	15	15
Outdoor activities				**130**
Sheltered outdoor space	Connected to common areas	4	20	80
Greenhouse	Connected to kitchen	1	20	20
Workshop & Utility shed	Connected to workshop	1	15	15
Firepit area	Central on site	1	15	15
TOTAL				**1492**

Room height	Occupants	Visual comfort	Metabolism	Min. air flow	Air change rate	Temperature
[m]			[met]	[l/s]	[h-1]	
2,5	1	Light & private view	0,8	9,10	2,18	User controlled
2,5	1	Light	1	8,40	3,02	Temperate
2,5	6	Light & views to buildings	1	50,75	2,92	User controlled
3	20	Light & view	1,2	157,50	3,78	Warm
2,5	10	Diffuse light & view	1,2	78,75	4,54	Temperate
3	20	Diffuse light & view	1	152,25	5,22	Warm
2,5	10	Light & view	1	73,50	10,58	Warm
2,5	5	Light	1,2	43,75	2,52	Temperate
2,5	1	Light	1	8,05	3,86	Temperate
2,5	1	Light	1	8,75	2,52	Temperate
2,5	1	Light & view to buildings	0,8	10,50	1,51	User controlled
2,5	1	Light	1	8,05	3,86	Temperate
2,5	1	Light	1	8,75	2,52	Temperate
2,5	5	Light & view entrance	1	42,00	3,02	Temperate
2,5	6	Diffuse light & view	1	49,00	3,53	User controlled
2,5	1	Light & no view	1,2	7,70	5,54	Temperate
2,5	2	Diffuse light & minimal view	1	16,45	3,38	User controlled
2,5	10	Light & private view	1	78,75	4,54	Warm
2,5	15	Light & private view	1 or 2	119,00	4,28	Warm
2,5	20	Light & view	1	154,00	5,54	Temperate
2,5	8	Light & public view	2	70,00	2,52	Temperate
2,5	5	Light & public view	2,8	40,25	3,86	Temperate
2,5						
2,5						
2,5						
2,5						

Ill. 66. Program.

DESIGN PROCESS

Ill. 67. Image from Rold Skov.

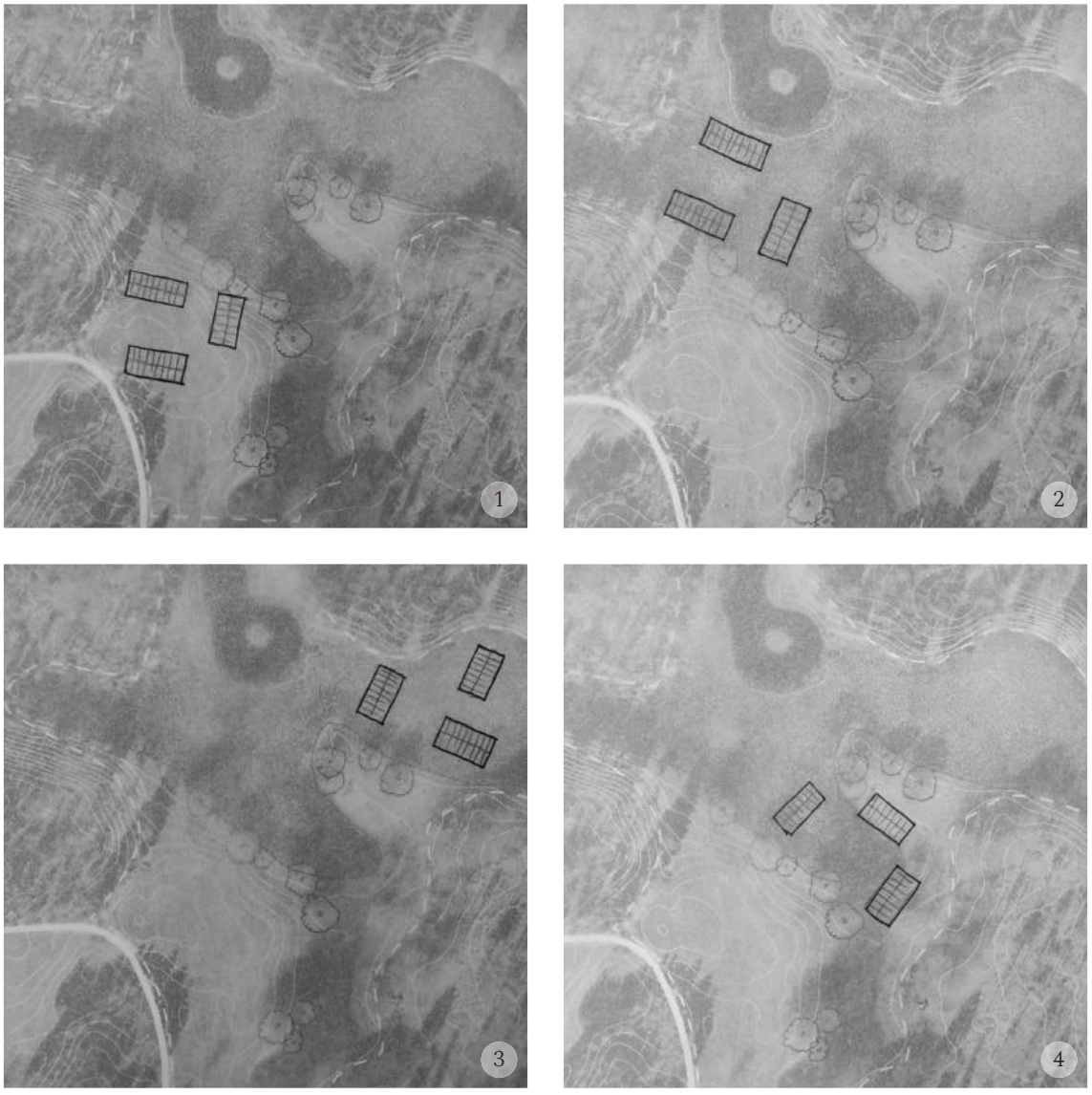
ZONING OF THE SITE

After site visits and various analyses, a map was prepared to give an understanding and an overview of the site. This zoning iteration was done by writing down thoughts, senses, and conclusions on the map to understand the different possibilities for building placement and orientation. The site was unique surrounded by forest and a hilly landscape, while the site itself was relatively flat, and the only trees were a few grand old trees that adorned the site together with the beautiful lake to the north. The analysis suggested that the user would arrive in the southwest corner of the site where the gravel road connects. This part of the site was raised, and moving north, one would meet the large, beautiful, old trees that laid in line with the terrain that dropped a few meters. This transition would work well as a separation between the natural zones of the site and could be utilized to obscure the rehabilitation center from possible bystanders, creating privacy and security for the residents, at the same time, it would not take too much focus from nature. On the other side of this tree line, there was a sunny and flat area surrounded by a sharp forested tree line and lake.

Ill. 68. Arial photo of the site with zoning & descriptions.

RELATION TO THE SITE

After getting an overview and understanding of the site, a rough estimate for the building placement was investigated. Four general placements were considered: The southwest corner of the site towards the access road (1), in the large flat and open area (2), the eastern flat and secluded part of the site (3), and around the small, elevated terrain patch that protrudes the site (4). It was found that iteration 4 had significant potential, which meant that this placement would be the point of further investigation. This location would be close to parking possibilities but still well hidden behind the tree line consisting of large old oak trees. It was on flat terrain with hilly terrain surrounding it, which made it possible to build onto the terrain or on a raised foundation. There were also a few large trees on the elevated terrain patch that protrude the site, which would allow the buildings to be placed between the trees to be screened and protected, but without losing view and orientation to the other parts of the site. Lastly, the location had good sun conditions and possibilities for amazing views to the rest of the site.



Ill. 70. Building placement iterations.

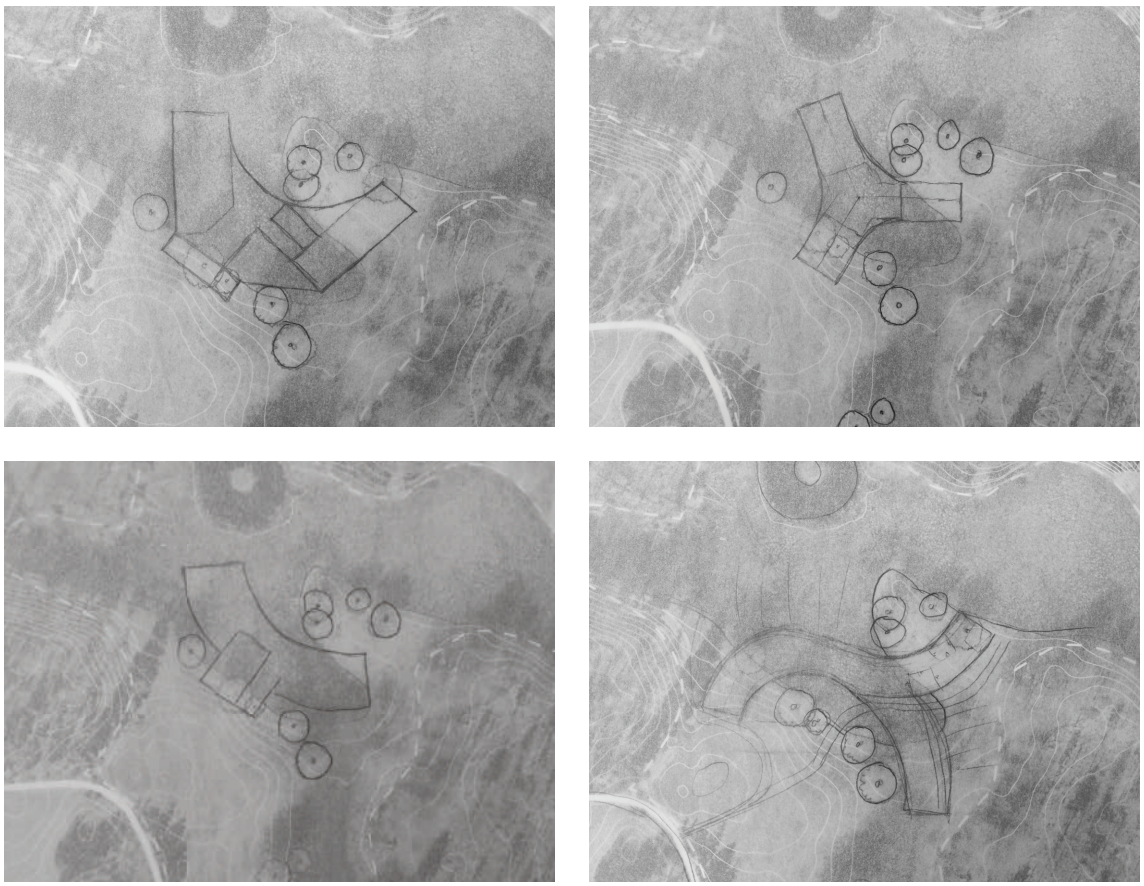
MAIN GRIP

Various design proposals for singular volume structures were initially iterated to test its pros and cons. However, there were a lack of clarity in the separation of the buildings, thus not achieving a clear 8-8-8 structure (8 hours in private, 8 hours in education and 8 hours in social), which aimed to prepare the user for life outside of rehabilitation. A large volume could also seem dominant in the setting and appear intimidating and institutional, rather than homely and rural. A positive aspect of a singular volume was that outdoor spaces or transitions could be sheltered under the same roof, making transitioning easier.

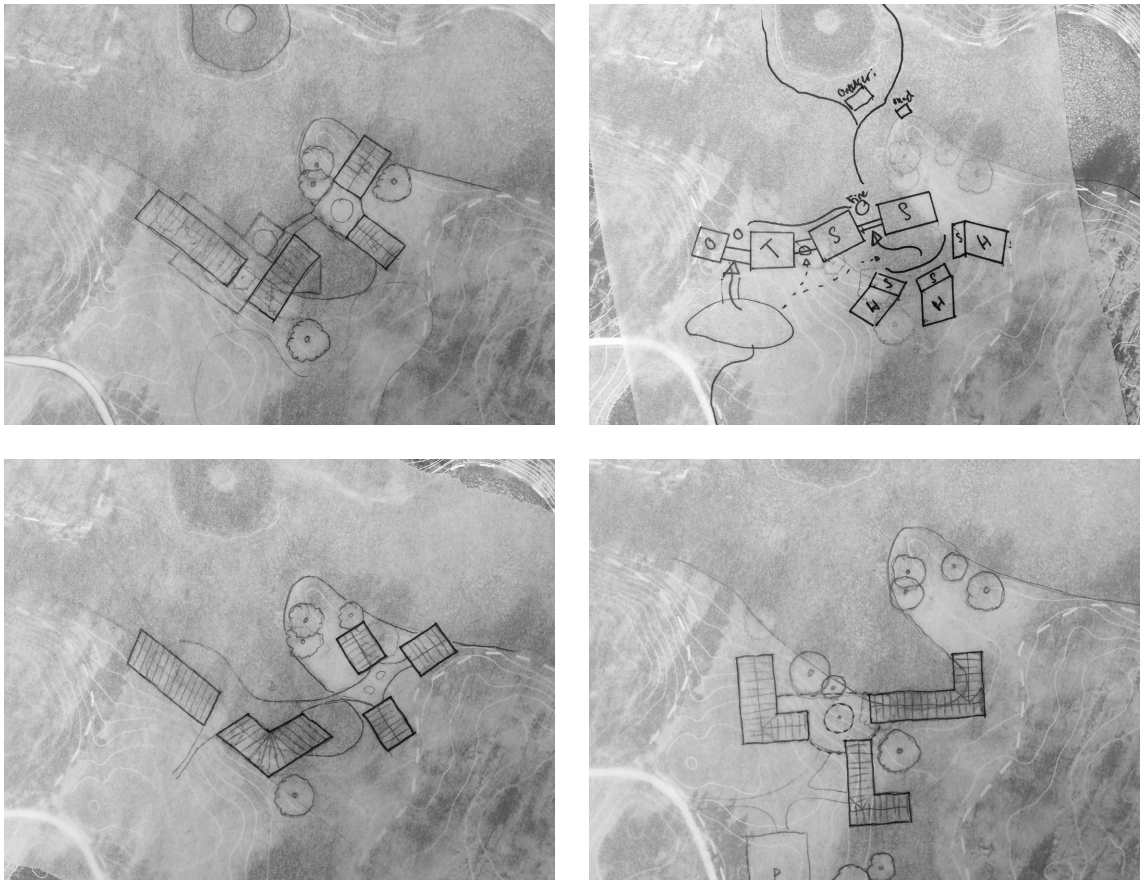
In the semi-fragmented iterations, volumes were both aggregated and dense. It was therefore a combination of the other typologies; it was cautious and stood out neither positively nor negatively. The general expressions of these were the strict forms that reached out into the landscape with a focus on view, orientation, and form.

The fragmented iterations were integrated in the natural setting through utilization of paths as they created a close connection between each function and the surrounding environment. After the user research, studies on thermal zones, etc., the fragmented volumes separating the functions were decided, as outdoor connections would open up the site and push the user into a structured day-to-day routine with opportunities to choose activities etc. Furthermore, it was found that separating the private bedroom buildings into smaller groups would give the option for the user to create a more intimate, cozy and neighbor like social settings. Therefore, the private buildings were separated into smaller identical buildings, hosting eight people in each.

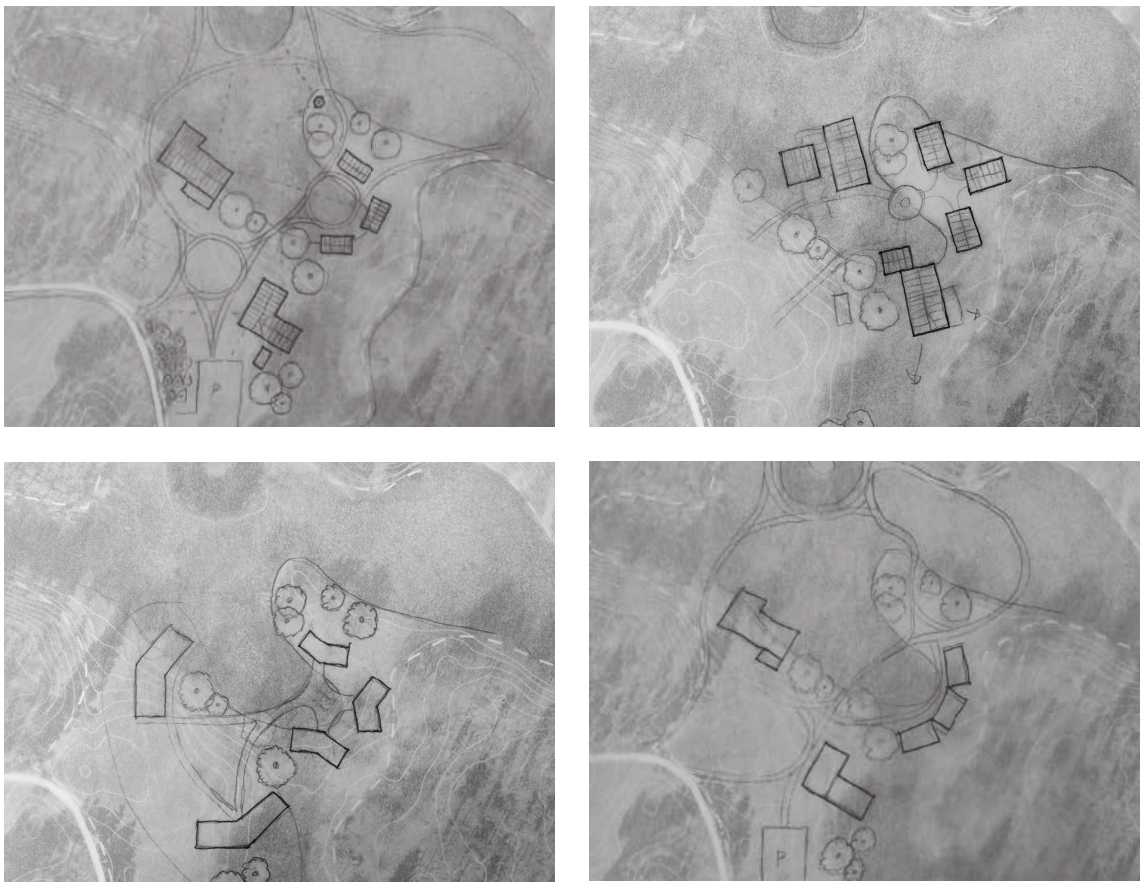
The way the volumes fitted in between the trees minimized viewing nuisance and became an integrated part of the site, while the gables reached out into the open area, creating a new community between the users. The point where this ideation stood out from the others was precisely in the space that was created between the buildings, which became protected and intimate, and where all the flows to the different activities, functions and volumes could take place.



Ill. 71. Singular volumes.



Ill. 72. Semi fragmented volumes.

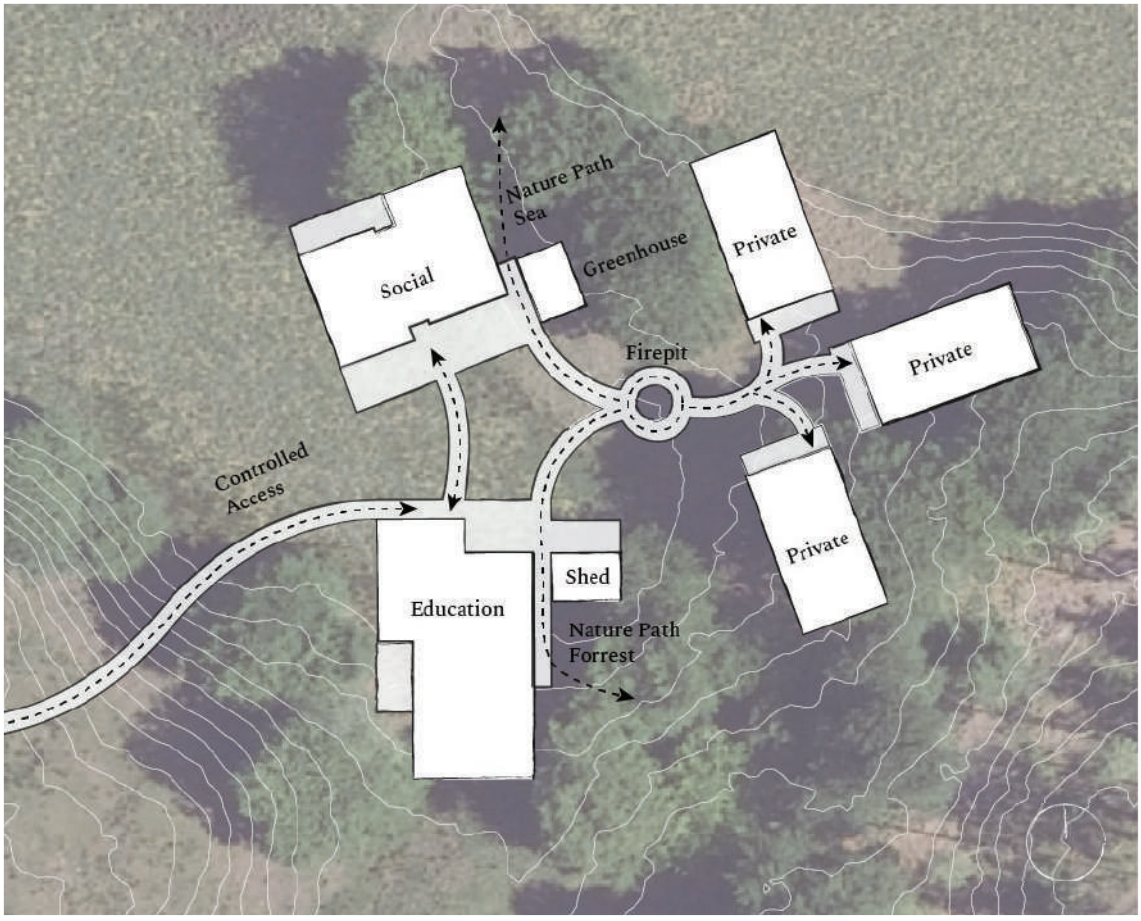


Ill. 73. Fragmented volumes.

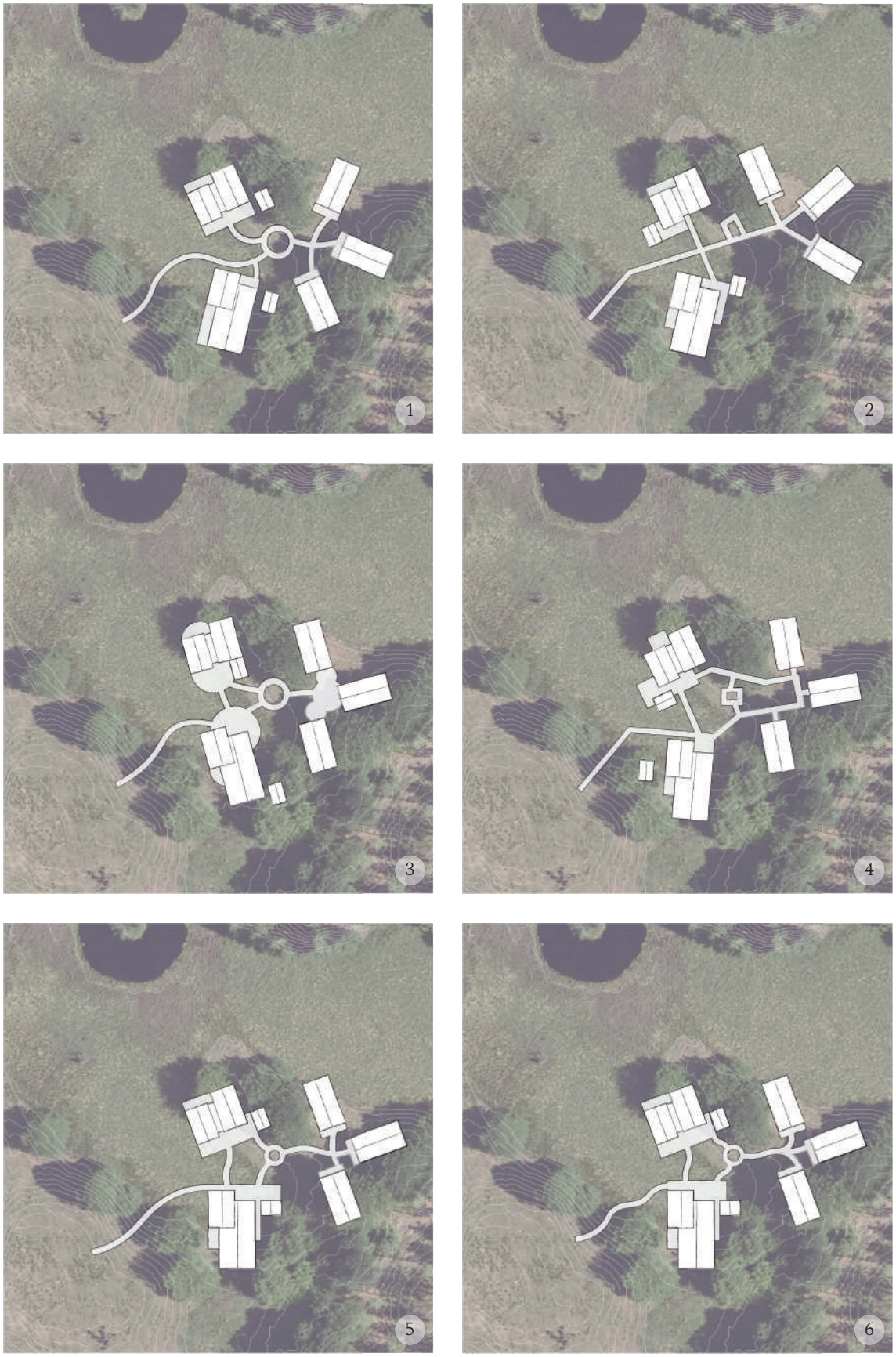
DEVELOPMENT OF MASTERPLAN

Various building placements, paths and outdoor functions have been considered on a masterplan level to iterate and conclude on the pros and cons of each variation. The orientation and placement of the buildings depend on several factors such as trees, solar conditions and views. The first iterations (1, 2, 3) were placed based on geometric shapes, square, pentagon and octagon, where the angles of the buildings align with the geometry. The other layouts were based on a pattern based on the aforementioned factors. The terraces are placed in connection to the building volumes to bridge the indoor and outdoor functions, as well as giving the opportunity to create sheltered outdoor spaces, whereas the path iterations are based on the natural flow and connecting the outdoor spaces. All flow iterations create a central junction that was to be developed into a firepit area as well as having primary paths, leading the users to the three primary building functions. Through all iterations, it was important to implement prospect and refuge into the masterplan, ensuring the users have views over long distances as well as having protected spaces when withdrawal was needed. To conclude, it was observed that there was a value in having organic-shaped paths in contrast to the geometrically shaped buildings as depicted in (1, 3, 5, 6).

Throughout the iterations, outdoor functions, bicycle shed and greenhouse, were placed centrally in the clusters, making them visible and accessible to tempt the user into participating in new activities as these functions appeal to the user achieving self-realization. The illustration beneath summarizes the conclusions made throughout this study.



Ill. 74. Chosen design for further development.

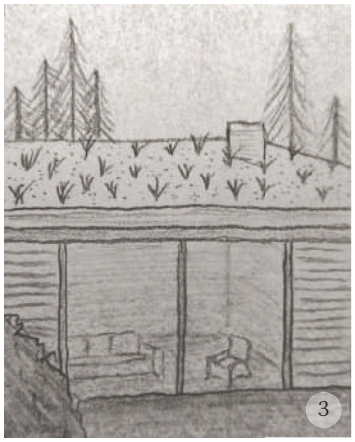


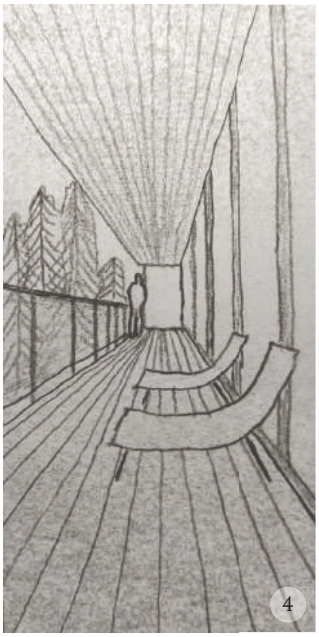
Ill. 75. Iterations of masterplans.

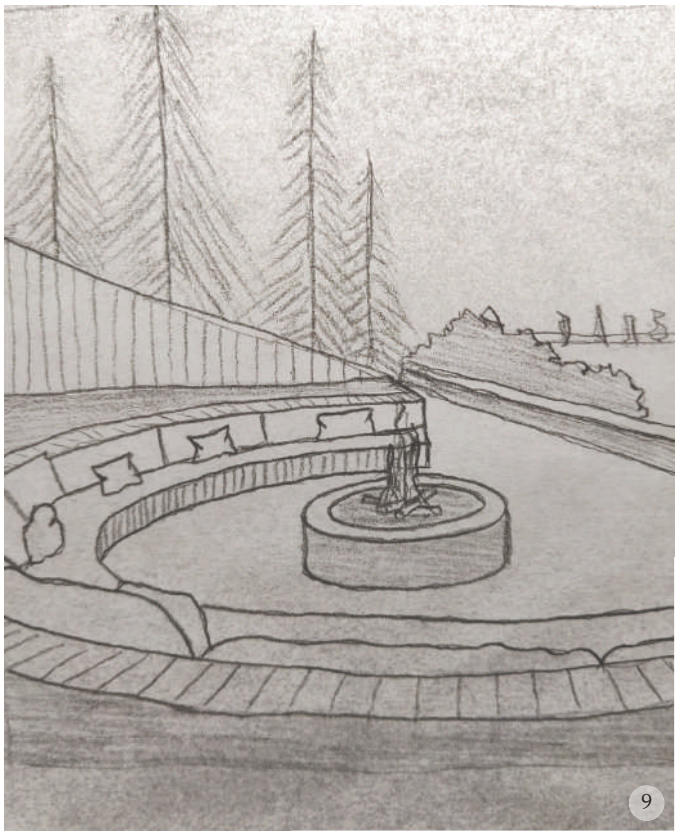
MOOD BOARD

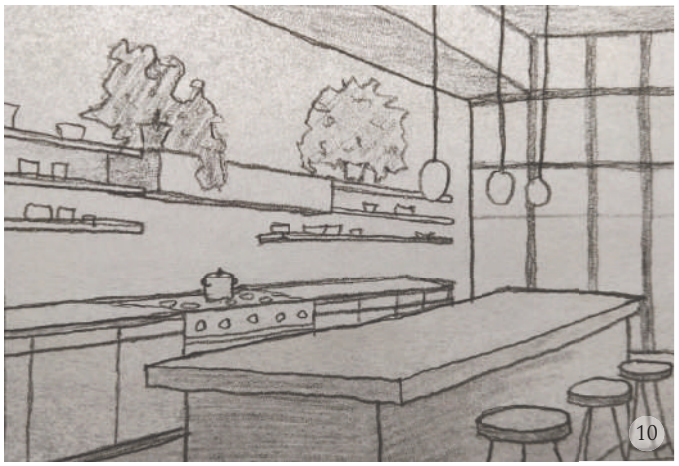
IMPLEMENTING BIOPHILIC AND HEALING ARCHITECTURE

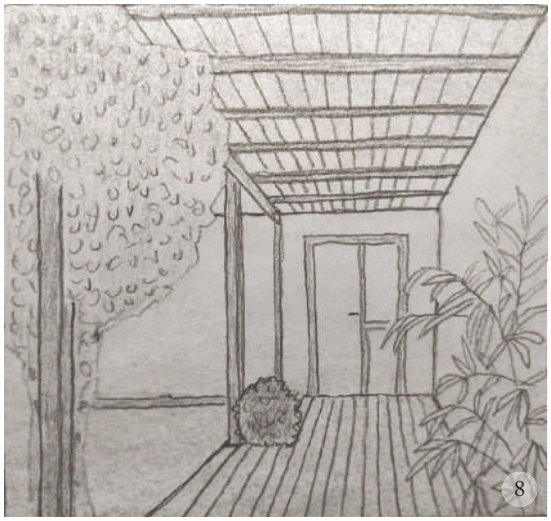
1. Organic shaped paths guide the occupants through the landscape
2. Sedum roofs blend the building into the surrounding forest
3. Large window openings invite nature and daylight indoor
4. Large patios create different temperate zones and casual meeting points
5. Greenhouses introduces a warmer environment and stretches the seasons
6. Separate bedrooms with natural materials and views to nature reduce stress
7. Natural materials activate the senses, and a fireplace creates a relaxed atmosphere
8. Pergolas and espaliers create green and sheltered outdoor spaces
9. A central outdoor fireplace can act as a gathering point for the occupants
10. An open kitchen concepts invites people to join the cooking and food preparation
11. Large windows let in vast amounts of direct and diffuse daylight
12. Visible constructions enforce the tectonic legibility in the workshop







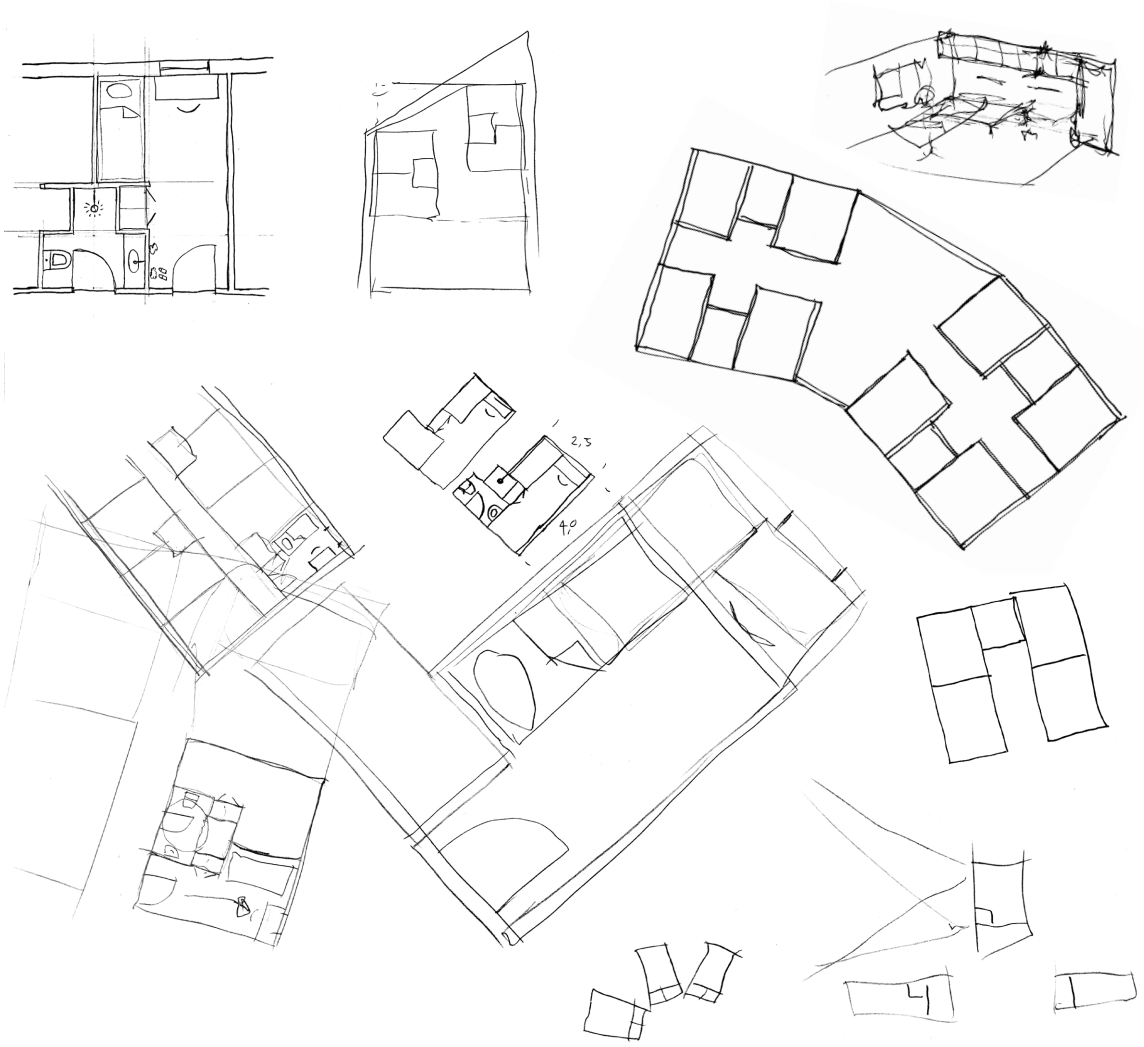




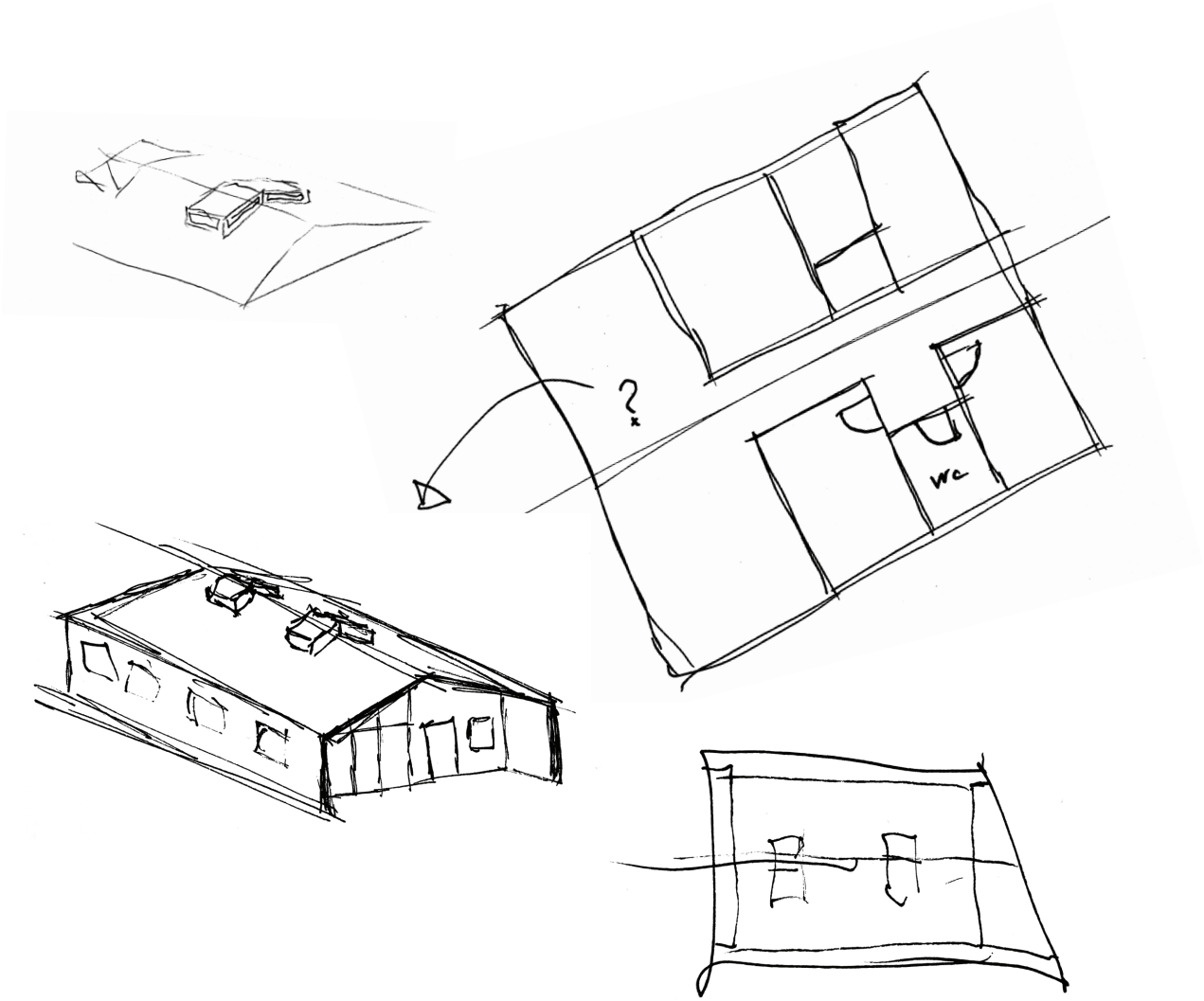
Ill. 76. Mood board showing key design grips & details to be implemented in the design.

DEVELOPMENT OF PRIVATE

Based on the user research, the residential buildings needed private rooms for the users to rest with a shared bathroom between two rooms. Each room had to include a window and a radiator or thermostat for the user to regulate the indoor environment depending on their needs. Furthermore, the layout needed to incorporate a shared entrance, scullery, and common room with a kitchenette. This was decided to foster a smaller social setting, where the user could engage with each other. In front of the common room, a small, sheltered terrace was placed for the users to step outside, smoke etc. but the terrace had to only invite for a short-term stay, as the users should seek activities and social settings within the other functions placed on the site. Throughout the corridor, connecting the rooms, skylights could be placed to include better lighting throughout the building that also seeks to lead the users into the social and outdoor spaces.



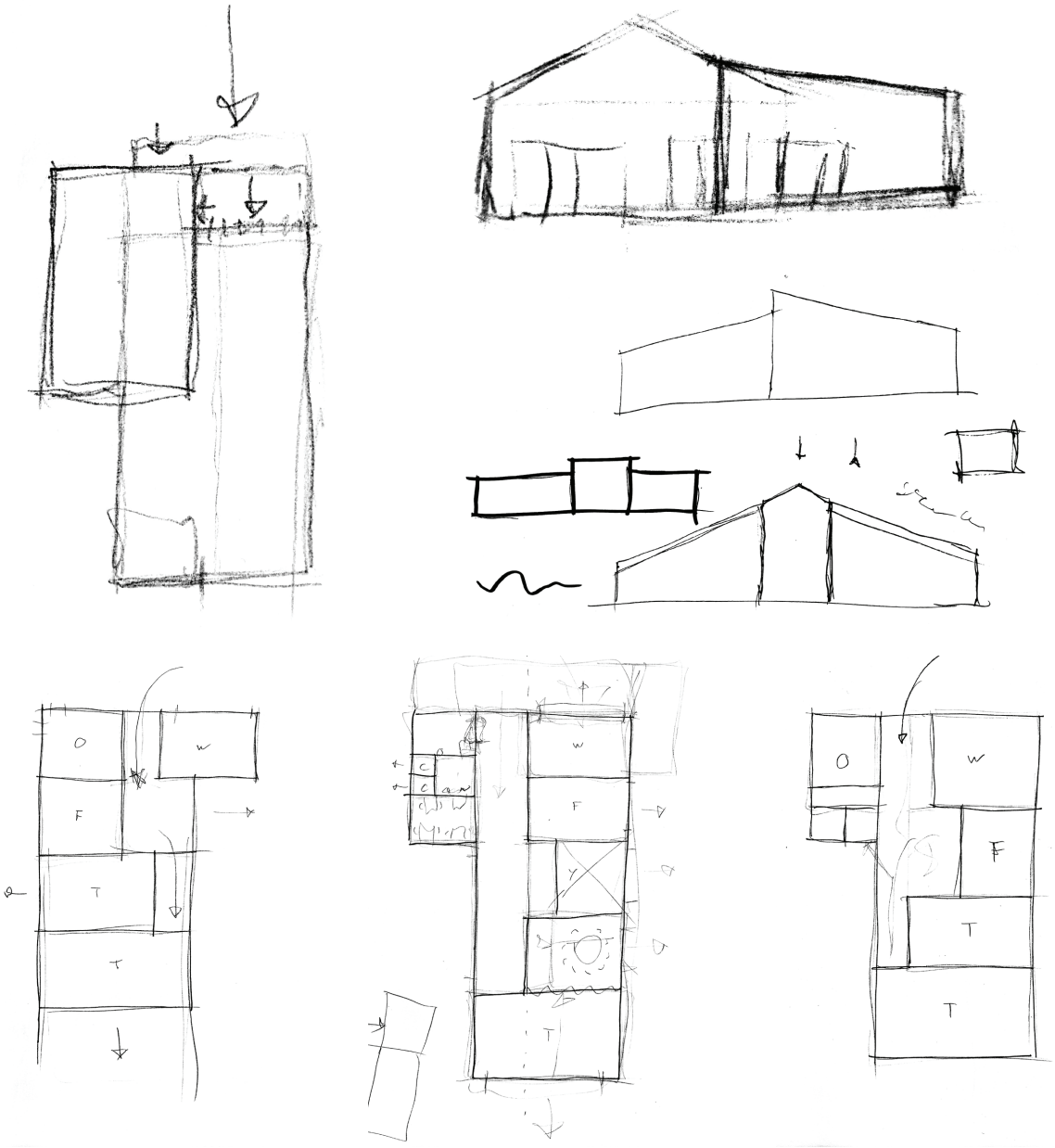
Ill. 77. Sketches of the private buildings.



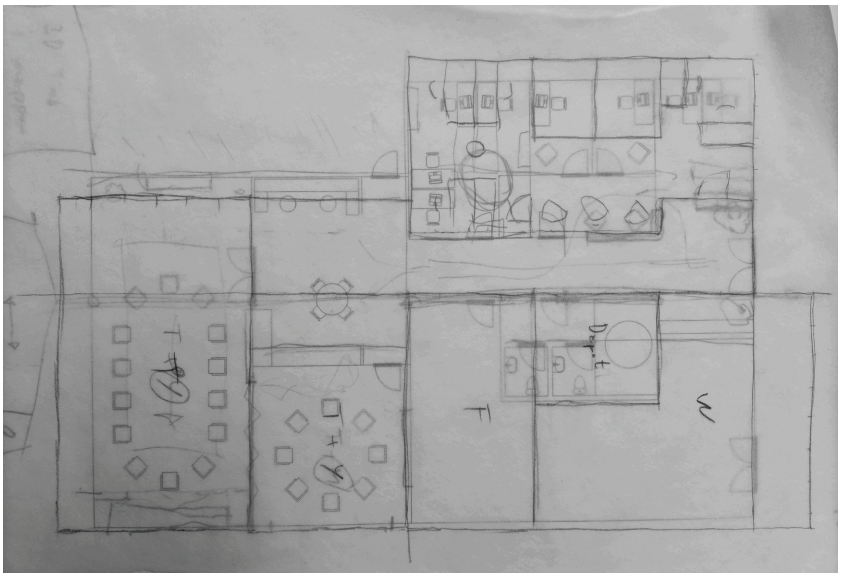
Ill. 78. Sketches and drawings on manifold of the private buildings.

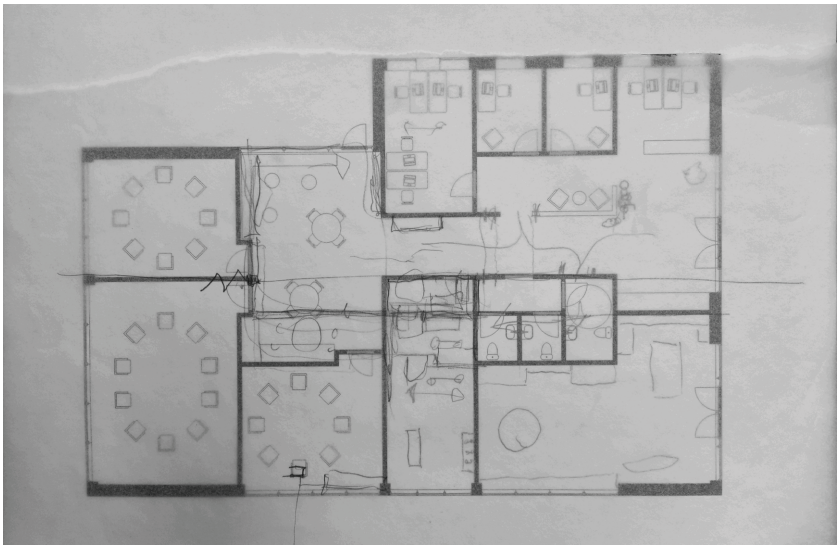
DEVELOPMENT OF EDUCATION

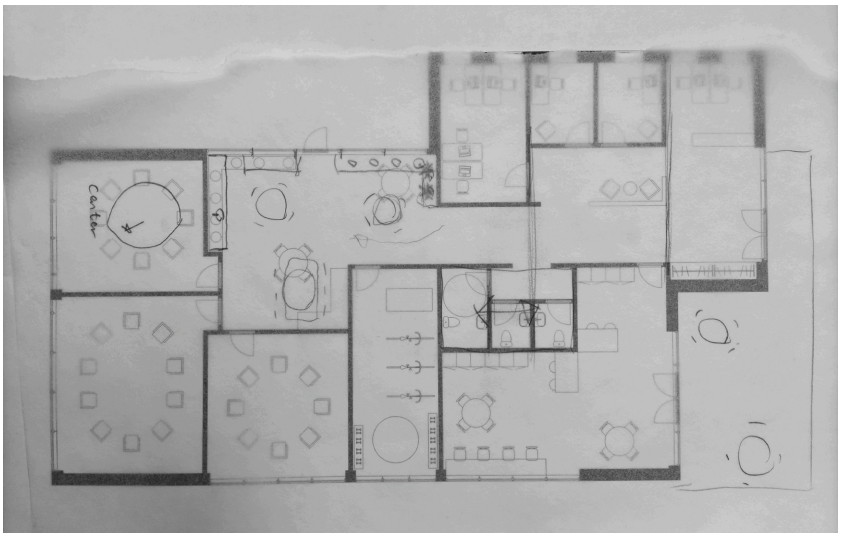
The programming of the building reflected the level of privacy and intimacy increasing the further into the building you would get, as the therapy rooms were decided to be situated south, where they also would have good lighting conditions. Throughout iterations, the main focus was on integrating a clear circulation and spatial organization, so the user would have a clear view of where to go and the various possibilities within the building. Towards the center of the site, the entrance is placed in connection with the staff office and the workshop, as they needed to be more accessible and visible. Through iterations, various layouts and volumes had been studied to consider the best architectural options for the building's functions and user. The general concept was to subdivide the building into zones where employees, activities and therapy could be placed in connection to each other, as this concept could also be shown as an exterior expression of the building volume, making the opportunities within the building visible from the outside.



Ill. 79. Sketches of education.





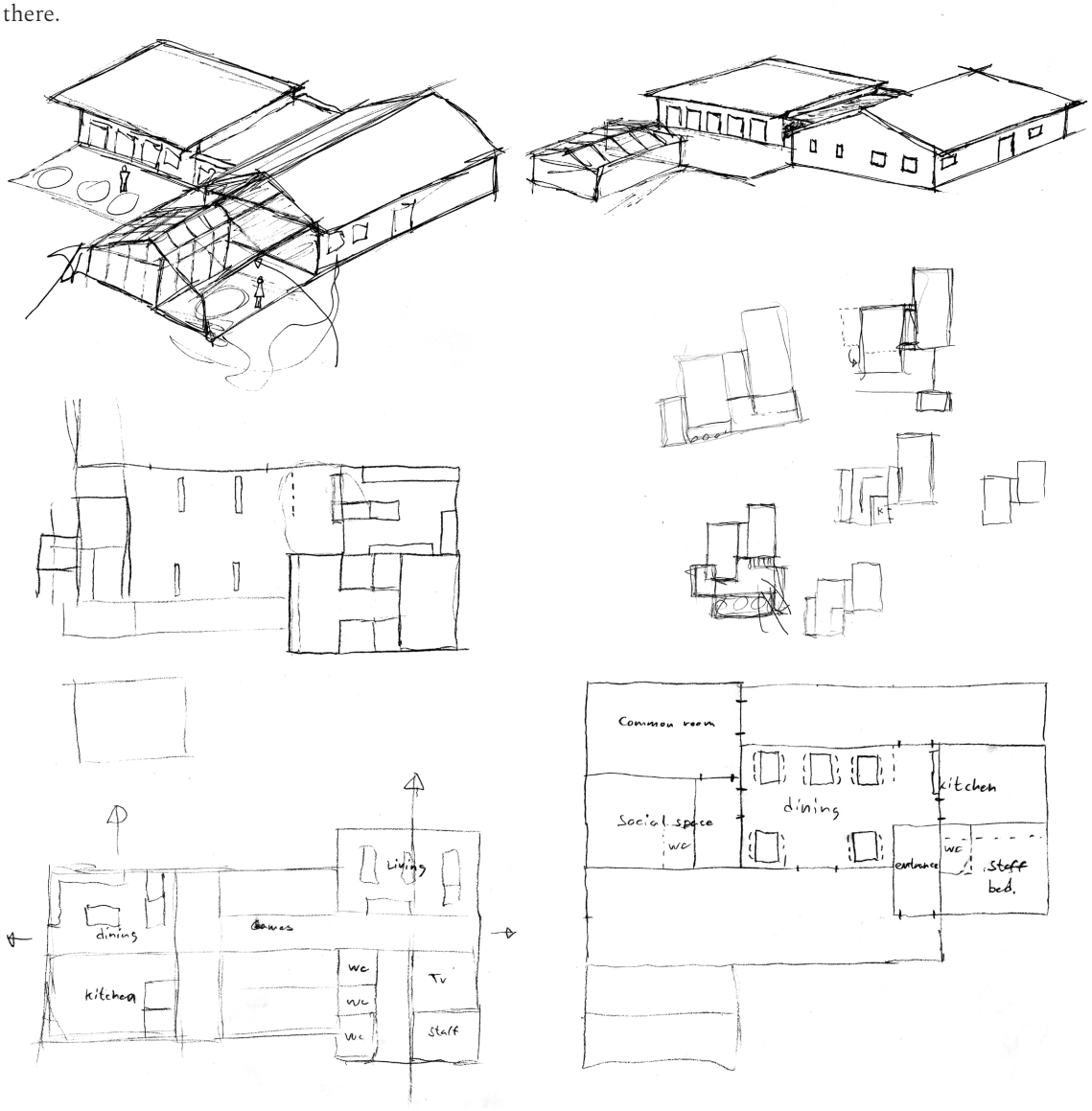


Ill. 80. Sketches and drawings on manifold of education.

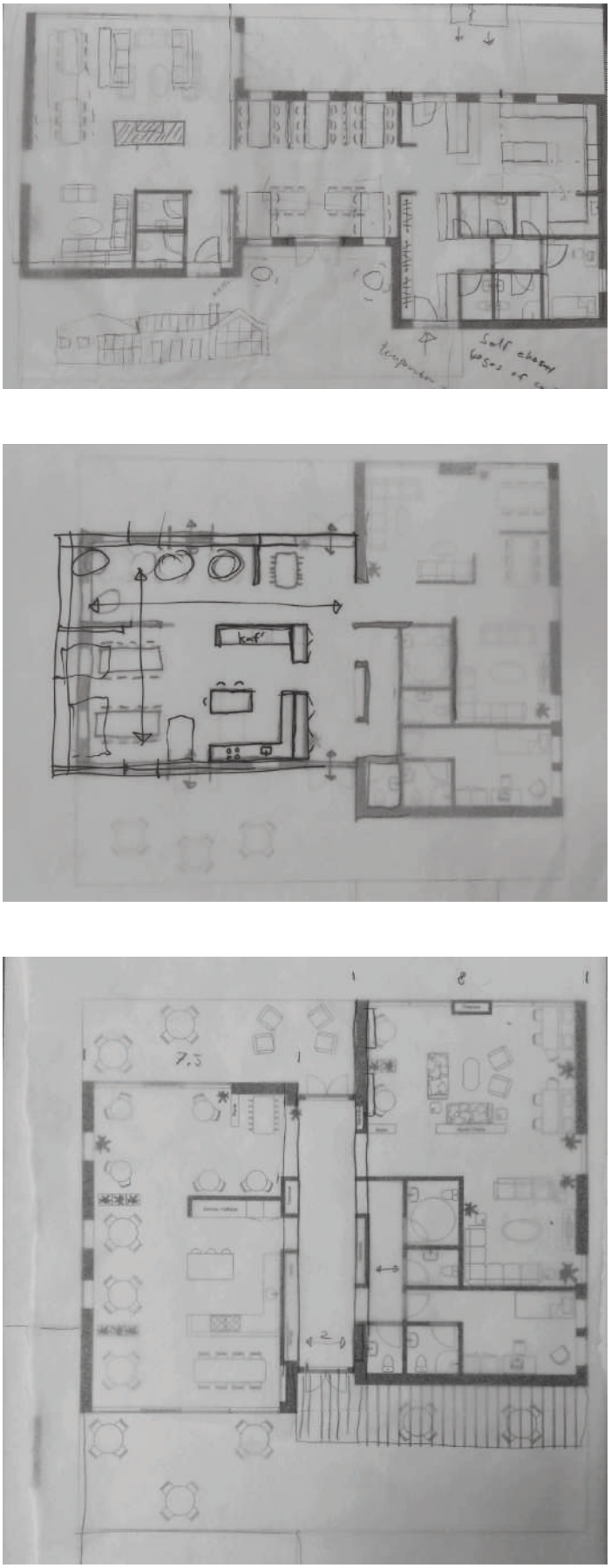
DEVELOPMENT OF SOCIAL

The social building should function as a common gathering point for social activities. The building should have views of the lake to the north, trees up close to the east, the grounds to the south and a long unobstructed view to the west. The building was designed to house two primary functions, kitchen & dining and living room & relaxing, which are separated by a hallway with a coatroom. The kitchen had to accommodate all residents and employees from the rehabilitation center, as it should be the primary meeting point in the rehabilitation center for daily gatherings, meals etc. The kitchen itself must accommodate approximately eight people, and it must have a close connection to the greenhouse, as locally grown herbs and vegetables could be broad in from there.

As the building should accommodate various social settings, the iterations focused on dividing areas into different zones to accommodate the varying needs of the users. The second primary function was the living room, which should also be divided into smaller zones, so the transition is less intimidating. The living room were early in the iterations divided into two primary zones, the TV room, and the fireplace room, where the TV room could be more intimate and with a lower light level, while the fireplace room could be open and bright. The idea in these iterations of the programming was to create a clear circulation and spatial organization, so the user could choose themselves based on their wishes and needs.



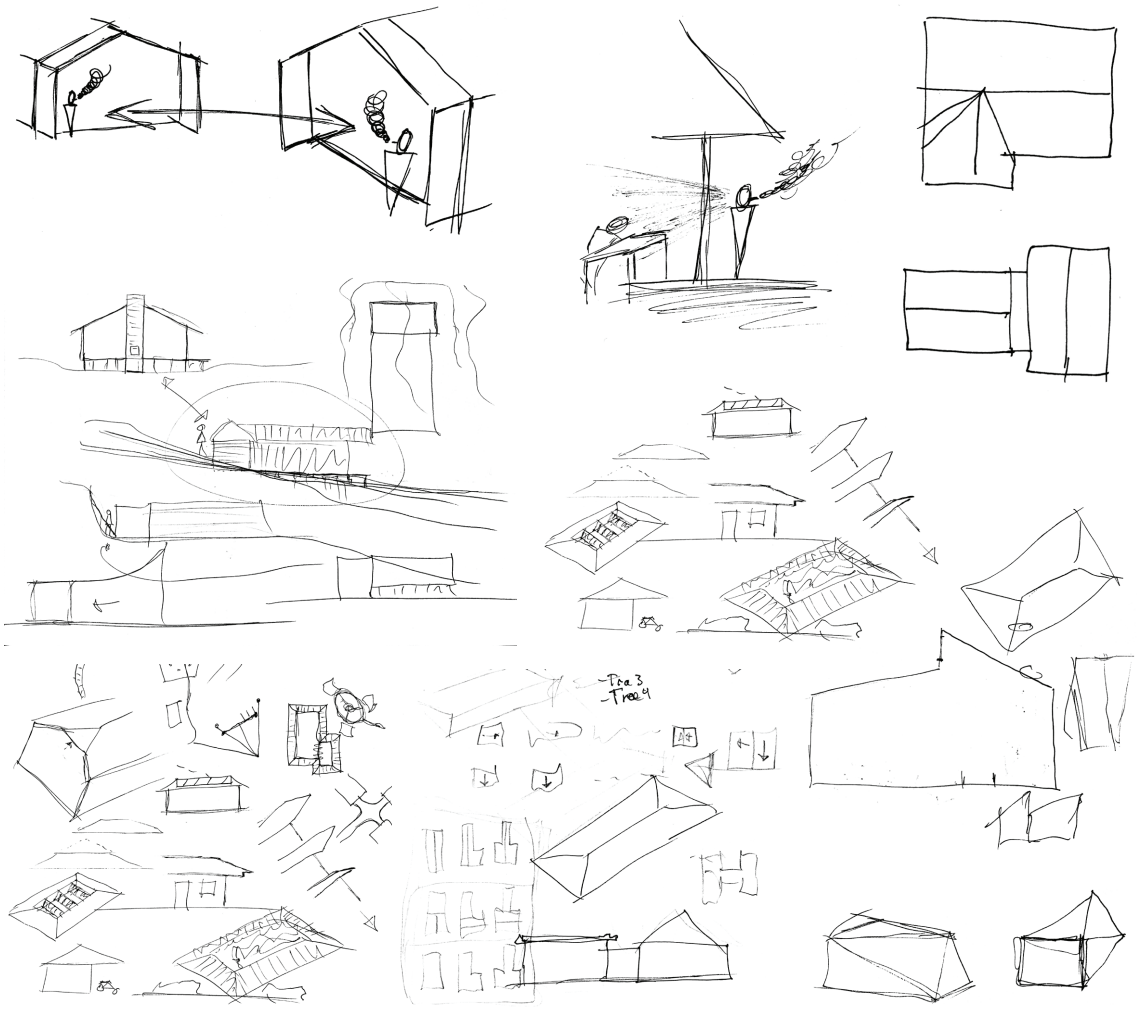
Ill. 81. Sketches of social.



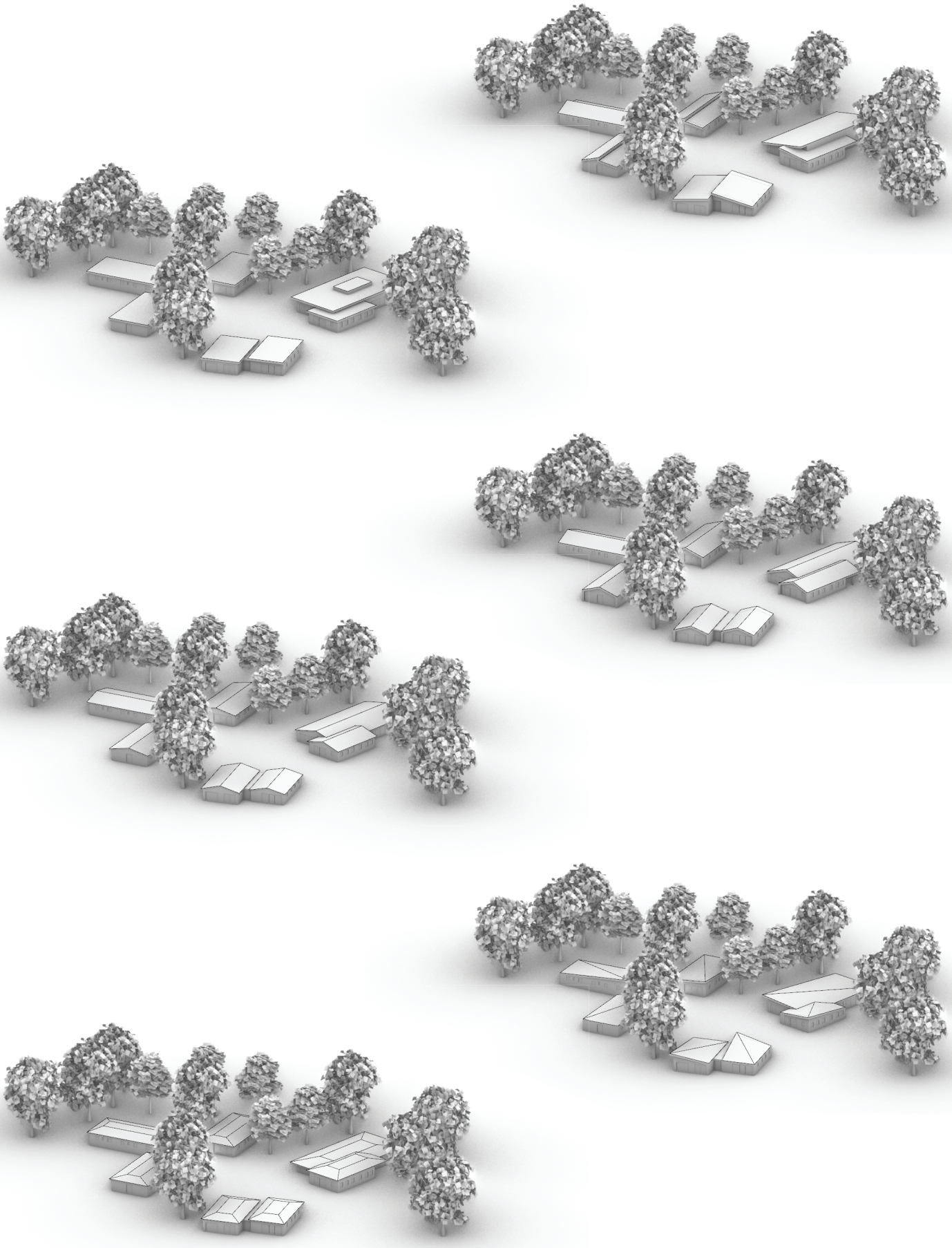
Ill. 82. Sketches and drawings on manifold of social.

ROOF ITERATIONS

During the master plan's design and the plans for the individual buildings, various roof designs were tested and evaluated. The criteria for the iterations were firstly that the roofs should have a unified expression to tie the buildings together, and secondly that they should afford sheltered outdoor spaces by the entrances as well as reflecting on the desired internal room heights. During the study, it was concluded that a humble architectural style fitted the project frame and setting better than a more extravagant design. Especially the gabled roof had great possibilities for overhangs to shelter the desired outdoor spaces in connection to functions and entrances of each building. Lastly, it was found that the integration of PV panels would be difficult on most of the iterated designs because of their low pitch in addition to the many shadow-casting trees in the near vicinity.



Ill. 83. Sketches of the roof construction.

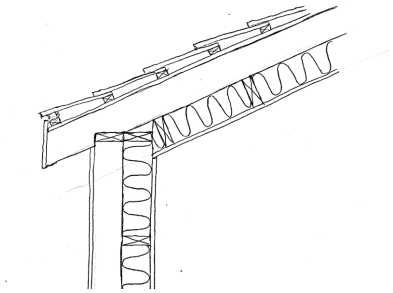


Ill. 84. Digital models of the roof iterations considered.

LCA & MATERIAL EXPRESSIONS

In continuation of the roof study, an LCA calculation and expression study was done to analyze their carbon footprint and detailing. Below are shown three details, all with a similar structural system, to analyze the differentiation in GWP on the roof material itself. When detailing and choosing the roof material, it was important that the materials were of high quality and could be installed correctly for them to be recyclable, even though this is not included in the LCA calculations. The numbers shown below are calculated using EPD files through LCAbyg. When deciding on roofing and the material choice, both the aesthetical expressions were important as well as considering the roof slopes, as some roof materials requires a steeper slope than others.

WOOD SHINGLES ROOF

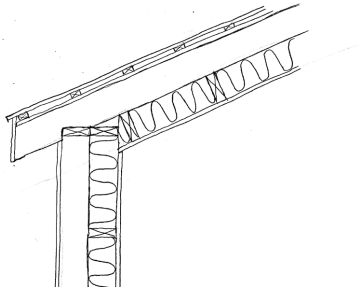


Untreated larch wood shingles with wood underlayment

GWP for 1 m^2: 0.8393 kg CO2 eq./m^2

- Requires a steeper roof pitch
- Organic materials, no adhesives
- Shorter lifespan

ROOFING FELT

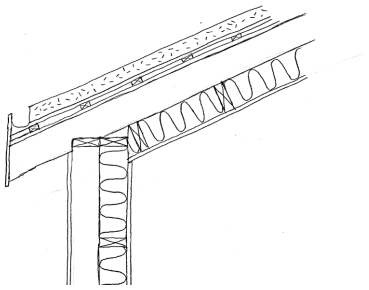


Bitumen felt base and top layer with wood underlayment

GWP: 0.8343 kg CO2 eq./m^2

- Lower angle roof pitch possible
- Bitumen is not organic
- Burnt on wood during installation, can't be reused

SEDUM ROOF

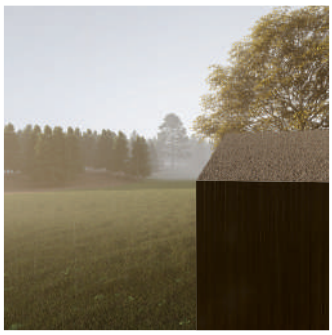


Bgreen-it sedum trays, bitumen felt base and top layer with wood underlayment

GWP: 0.9153 kg CO2 eq./m^2

- Carbon capture during lifetime
- Rainwater absorption & good for biodiversity
- Slightly higher GWP because of sub-structure
- Easy installation

Ill. 85. Construction detail sketches of walls & roofs.

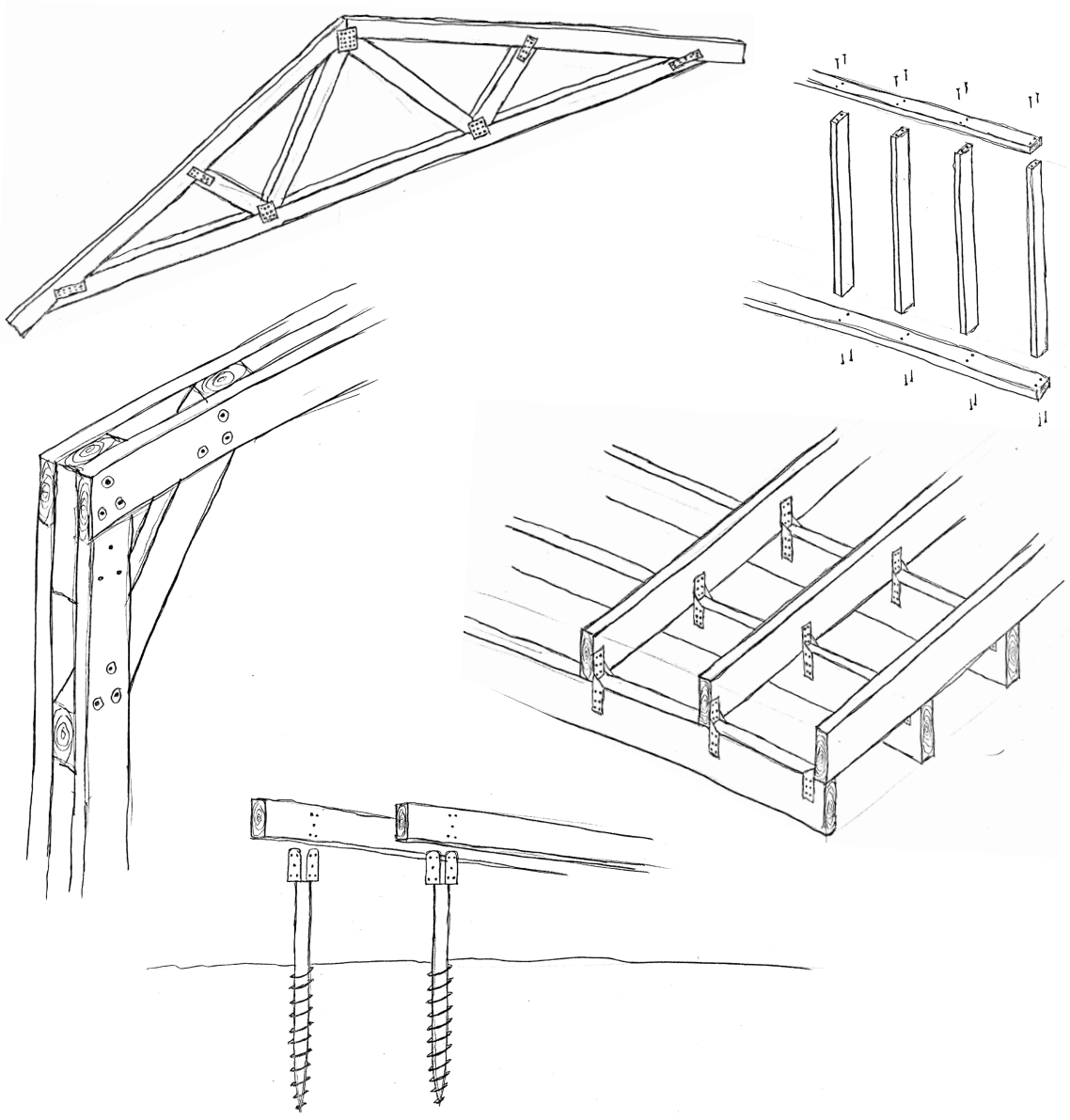
	TREATED PINE	TREATED SPRUCE	PAINTED SPRUCE
			
			
			

Ill. 85. Exterior renderings of roofs & walls.

CONSTRUCTION DETAILING

DESIGNING FOR DISASSEMBLY

During the design of the rehabilitation center, there was a heightened focus on two key components from the design for disassembly theory, namely material choice and connections. The materials that were explored on the previous pages live up to many of the requirements for disassembly and in this section, the different connection methods have been explored. Firstly, the roof structure was discussed, where one of the benefits of using roof trusses would be that they could easily be taken down and reused in another construction, which is already normal practice in many smaller buildings. On the other hand, designing from a more tectonic stand, with a loadbearing structure of construction timber assembled with nuts and bolts, could easily be dismantled by the end of life and elements could be changed if damaged. Another possibility would be to design the building with a wood frame construction which is light, easy to assemble, and would consist of mostly standardized material dimensions and lengths. Depending on the reversibility of the wood joints, using either nails or screws, the frames could be reused as whole wall elements or dismantled into separate components for reuse. Lastly, the foundation and deck could be constructed of standardized timber profiles, joint with screw fittings, and raised above the terrain by a screw foundation. This would, again, ease the disassembly of the construction and ensure the reusability of the timber, fittings, and screw foundation by the building's end of life.



Ill. 86. Sketches of different construction details.

ENERGY CALCULATIONS

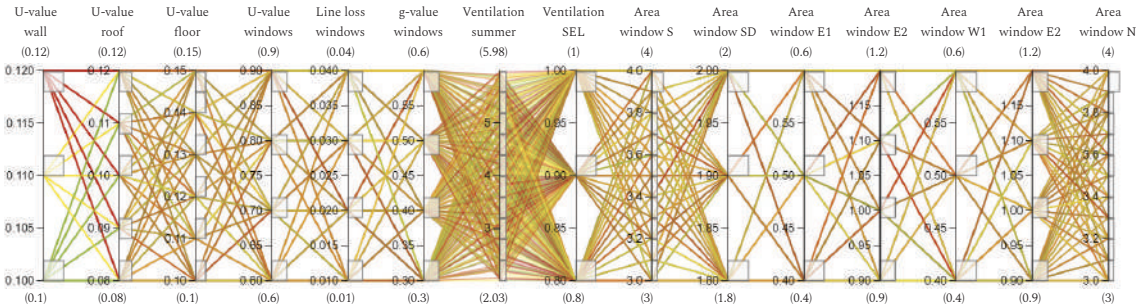
Energy calculations were made in Be18 on each building volume to test the energy frame and iterate on optimizing the buildings energy performance. The building is located remotely and therefore active strategies such as geothermal combi heat pump and PV panels were implemented. The initial design was simulated and optimized in Be18 and, afterwards, simulations were made in BeDesigner to achieve a better performance based on the important factors for the design. 500 simulations were made for this process that was then narrowed down to one chosen solution based on the set criteria. The Dataexplorer images showcase the various factors that were chosen as possible iterations, all other Be18 inputs were unchanged. The illustrations below show the simulation and calculation process for one of the three private buildings, similar processes have been made on the other buildings in the design.

BE18 BASE MODEL

Total energy frame: 10.7 kWh/m^2/year

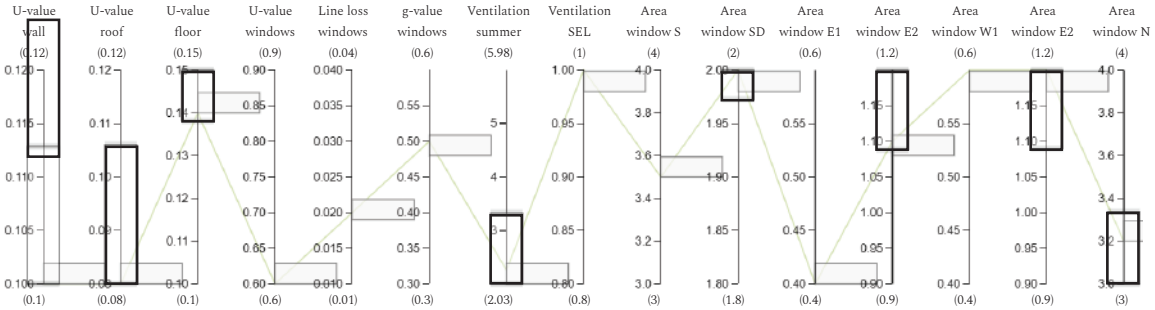
Contribution to energy heating:	7.6	Energy needs heating:	14.7
Contribution to energy electricity:	1.7	Energy needs hot water:	15.9
		Heat loss room heating:	7.5
		Heat loss hot water:	2.8

BEDESIGNER INTIAL



BEDESIGNER SELECTION

The marked boxes show the criteria chosen for the simulation to find a possible solution based on the design wishes and needs. For example, U-values were set based on the current construction possibilities and window sizes were changed based on the desired sizing and function in the various rooms.



BE18 FINAL MODEL

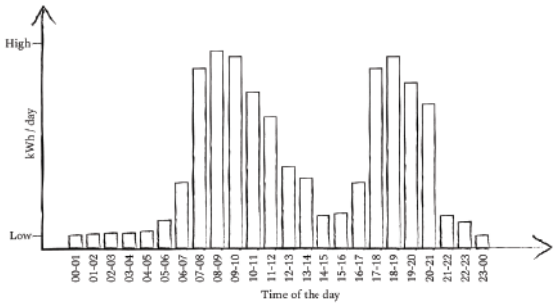
Total energy frame: 10.2 kWh/m^2/year

Contribution to energy heating:	7.6	Energy needs heating:	12.8
Contribution to energy electricity:	1.4	Energy needs hot water:	15.9
		Heat loss room heating:	7.5
		Heat loss hot water:	2.8

Ill. 87. Be18 key numbers & Dataexplorer results.

ELECTRICITY USAGE DURING THE DAY

The illustration shows electricity usage for all the buildings combined, and peak hours are between 8-12 and 17-21. Because of these intervals, PV panel orientation could be considered to both the south, east and west.

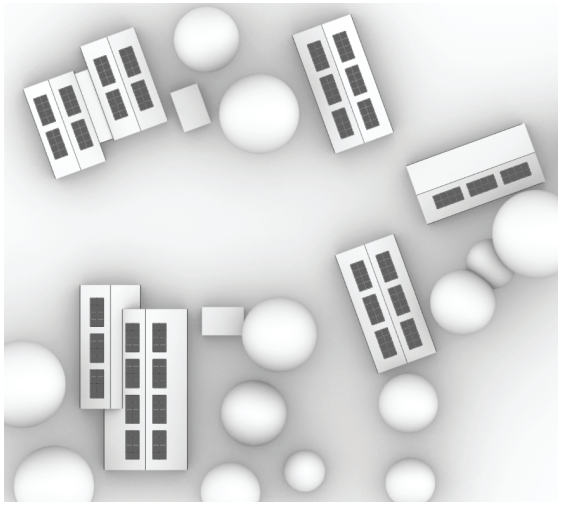


PV PANEL CALCULATION

The estimated electricity needed from all buildings combined, taken from Be18 results is 32900 kWh/year. The PV panels chosen are integrated mono-crystalline high efficiency panels. When designing PV panels, it is important to balance out the aesthetic expression and the desired supplement to improve the energy frame. Below, it is shown how two iterations for how the PV panels could be integrated and their annual yield.

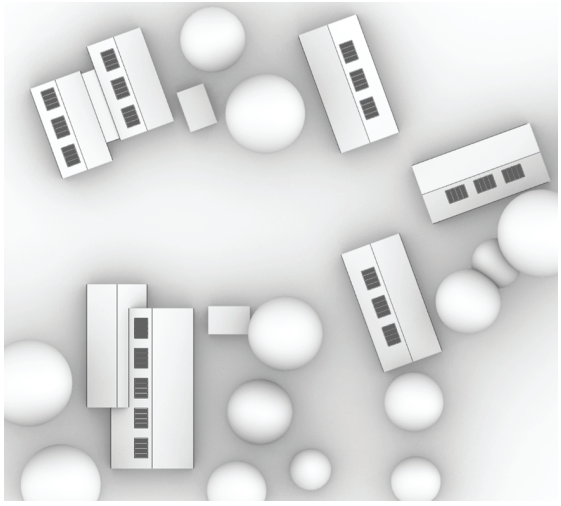
PV PANEL VERSION 1

Orientation	**South**	
PV panel area	24	m^2
Solar radiation intensity	1107	kWh
Annual yield	**2988**	**kWh/year**
Orientation	**East**	
PV panel area	112	m^2
Solar radiation intensity	976	kWh
Annual yield	**12297**	**kWh/year**
Orientation	**West**	
PV panel area	136	m^2
Solar radiation intensity	999	kWh
Annual yield	**15284**	**kWh/year**
Annual yield total	**30571**	**kWh/year**



PV PANEL VERSION 2

Orientation	**South**	
PV panel area	16,8	m^2
Solar radiation intensity	1107	kWh
Annual yield	**2092**	**kWh/year**
Orientation	**East**	
PV panel area	16,8	m^2
Solar radiation intensity	976	kWh
Annual yield	**1844**	**kWh/year**
Orientation	**West**	
PV panel area	78,4	m^2
Solar radiation intensity	999	kWh
Annual yield	**8811**	**kWh/year**
Annual yield total	**12748**	**kWh/year**



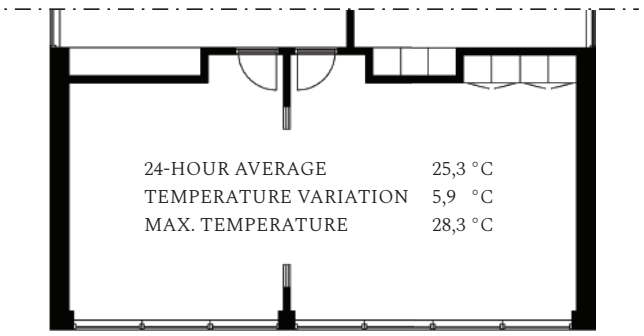
Ill. 88. Electricity usage & PV panel calculations and illustrations.

THERMAL PERFORMANCE

In this section, calculations on the thermal performance of two critical rooms in the construction have been performed. Calculations on the large therapy room were important, since it had the largest window-to-floor area ratio while the windows would also be oriented directly south. In addition to this, the room could be subject to high internal loads if fully occupied. It was also interesting to look at one of the southern-oriented private bedrooms where users would spend a lot of time and be able to regulate the temperature themselves.

To test the room's thermal performance, the calculation method to find the 24-hour Average was used, and the two parameters changed for the therapy room to get the temperatures down were reducing the window area and increasing the possible air change rate. It was found that changing the window size alone to reduce the solar heat gains was not enough to get the temperatures down on its own, and this was because of the high internal loads in combination with the well-insulated building envelope. Lastly, the calculations showed that there were no problems with the temperature in the bedroom and, therefore, no changes were needed.

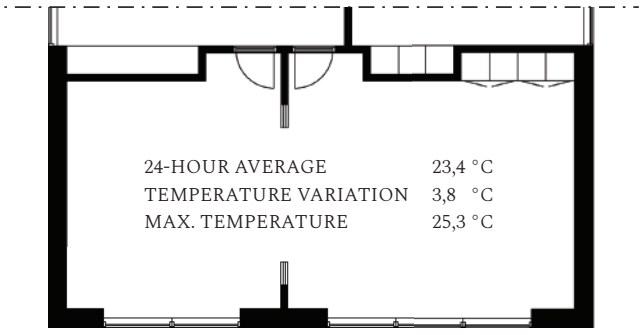
PRELIMINARY DESIGN, THERAPY



Parameters for the calculation:

- The two rooms are connected
- 18 people occupying the room
- In use from 8-16
- Average outdoor temperatures for July
- 7 windows, 2,8 m^2 each
- Air change rate $2h^{-1}$

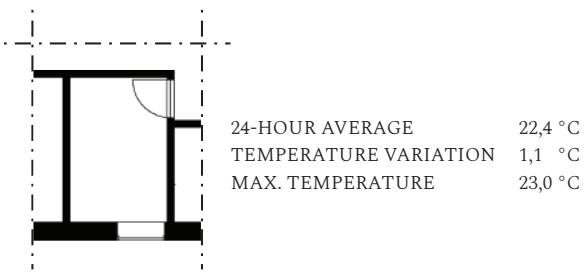
AFTER ITERATIONS, THERAPY



Iterations:

- 5 windows, 2,8 m^2 each
- Air change rate $3h^{-1}$

PRELIMINARY DESIGN, BEDROOM



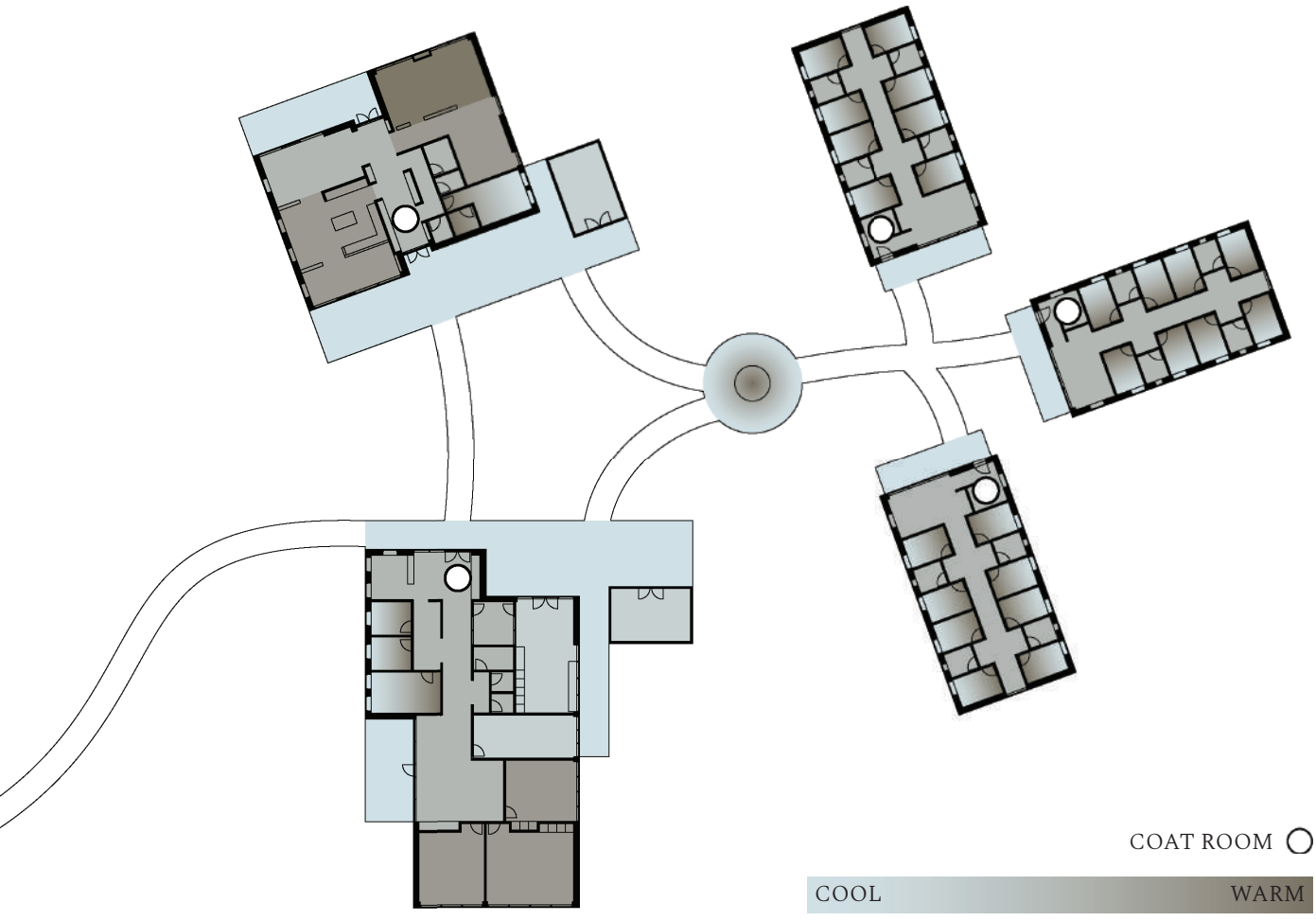
Parameters for the calculation:

- 1 person occupying the room
- In use from 19-8
- Average outdoor temperatures for July
- 1 window, 1,1 m^2
- Air change rate $2h^{-1}$

Ill. 89. Thermal performance illustration of therapy & private bedrooms.

THERMAL COMFORT ZONES

Working with an exposed user group, such as recovering addicts, close attention to thermal comfort was essential. Therefore, the designing and programming of the rehabilitation center also included a reflection on the different desired thermal zones within the buildings. This was done by assigning temperature zones to the layout in accordance with the function of each room and the expected activity level of the users. In the more private rooms, the temperature control would be managed directly by the user, shown by color gradients in the diagram, thereby enhancing user satisfaction. The social, shared, and outdoor spaces are thermally programmed to afford an array of different temperature zones for the users to choose from based on their experience and needs. Lastly, it was important to ensure the possibility for the users to adapt to their thermal environments by being able to easily change clothes, so implementing well-functioning coat rooms at all entrances was essential.

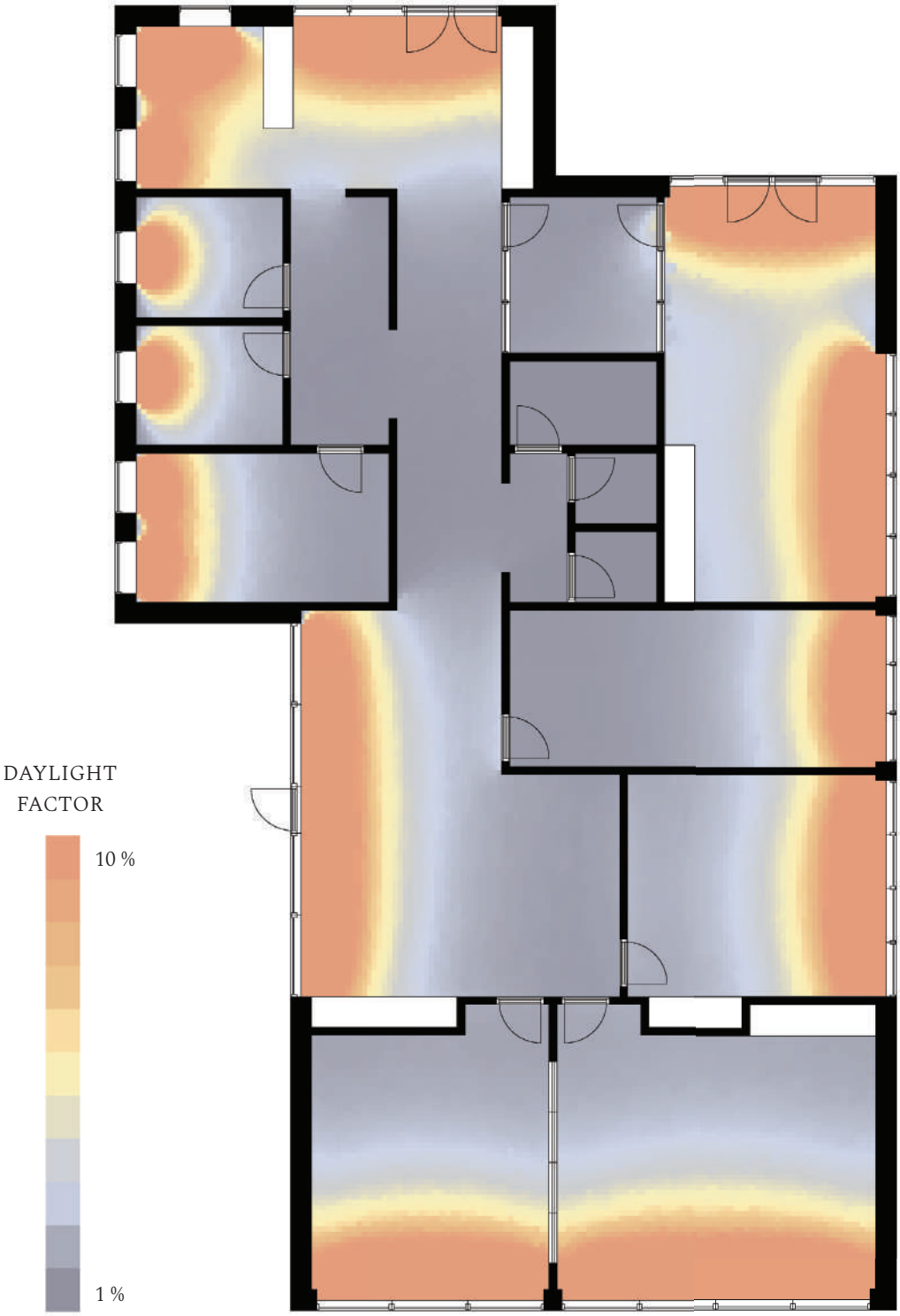


Ill. 90. Thermal comfort zones with the buildings.

DAYLIGHT SIMULATION

The preliminary daylight simulation was done to check the daylight factor of the individual rooms in the rehabilitation center. Here, it was found that the social and educational buildings were the most important to look at, since it would be here that the clients would spend most of their time during the day. It was found that most of the rooms in the two buildings have more than a 3% daylight factor in half of the rooms, and sometimes even more. Therefore, it would be possible to reduce the window areas in some of the rooms to optimize the energy performance of the buildings without sacrificing daylight. Especially the north-oriented rooms and windows would be subject to revision in the design process, since they would not contribute as much to solar gains. Thermal comfort also influenced the windows where especially the south-facing rooms would be subject to over temperatures and therefore might need to be regulated to address these problems. Lastly, natural ventilation in the form of cross-ventilation and single-sided ventilation was discussed in choosing the window forms and placements to ensure good airflow.

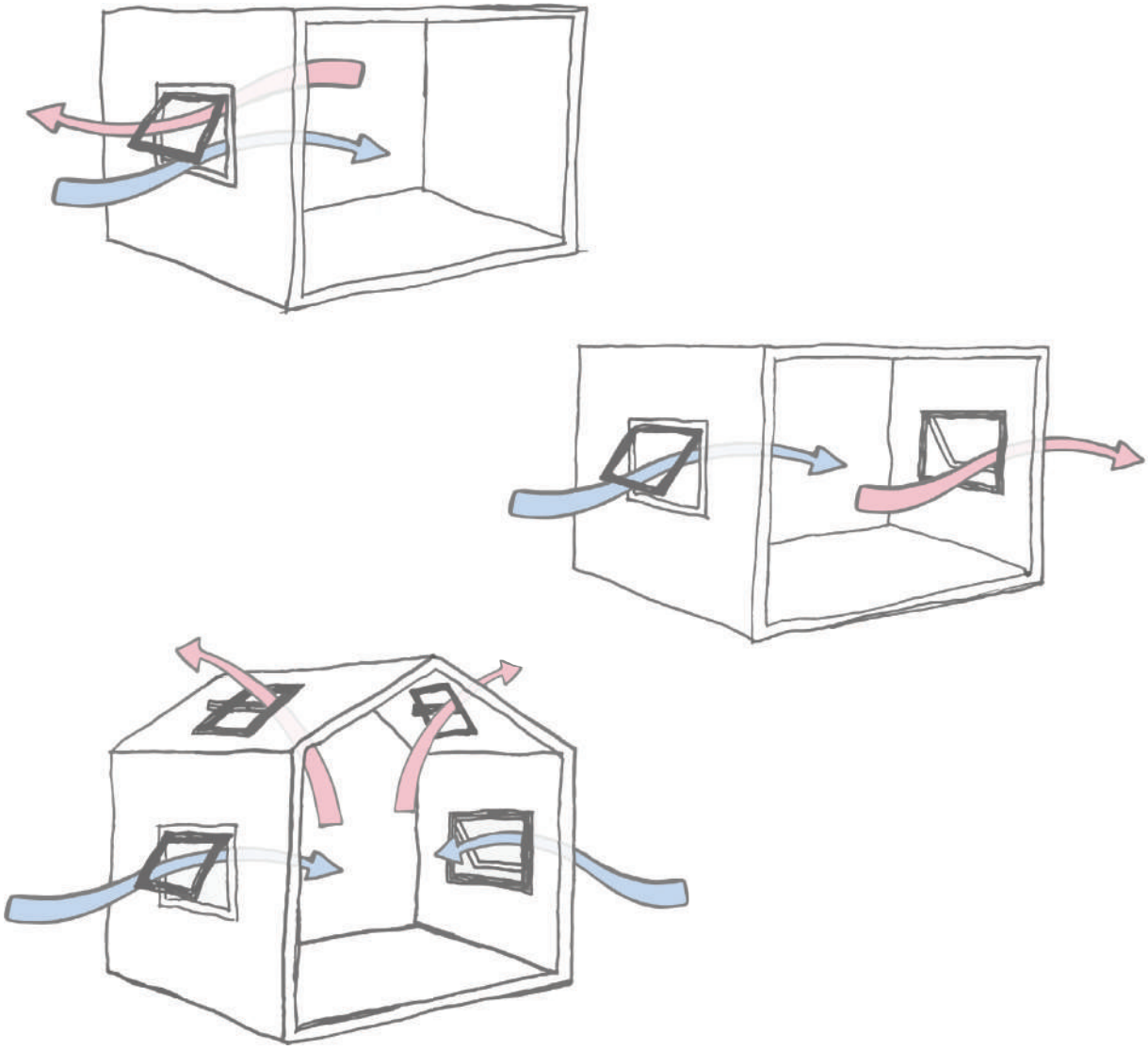
Ill. 91. Daylight simulations on the social building.



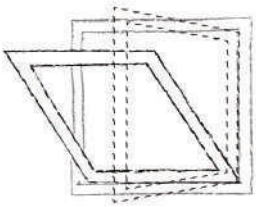
Ill. 92. Daylight simulations on the education building.

NATURAL VENTILATION

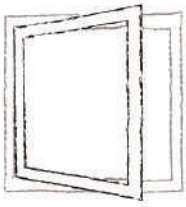
To prevent overheating and have good indoor air quality throughout the year, natural ventilation principles and window designs were iterated and researched to be implemented in the design. The variation in the programming and the size and purpose of the spaces could suggest using a mixed natural ventilation strategy, utilizing single-sided, cross, and thermal buoyancy ventilation principles. Furthermore, implementing mechanical ventilation with heat recovery to reduce energy needs during winter periods and secure air quality was concluded to be the best option. The total ventilation needed in each building was calculated based on the room program to find a fitting mechanical ventilation system to fit into each building's attic. The air change needed for the private buildings was 400 m^3/hour, for the education building it was 760 m^3/hour, and for the social building it was 530 m^3/hour. The chosen window designs are underlined in the illustrations to the right showing all of the investigated window types.



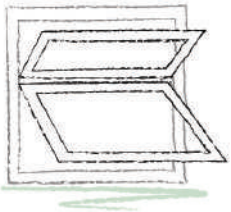
Ill. 93. Natural ventilation principles.



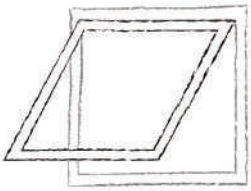
Tilt and turn window
- Multiple options for natural ventilation
- The turn function can obstruct with internal blinds
- Not the most effective ventilation



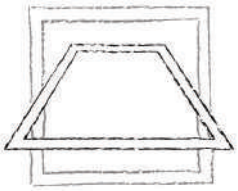
Side-hung window
- Poor security when open
- Rain can enter when open
- Bad ventilation effectivity



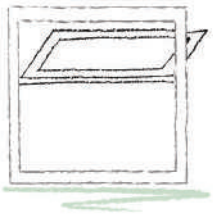
Top and bottom openings
- Great ventilation effectivity
- Well performing all round
- Rain and noise can enter when open



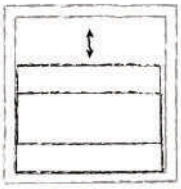
Awning window
- Common and cheap window
- Big opening area
- Can reflect noise from ground level into the room



Central turning window
- Great airflow
- Can create glare in the room
- Good for one-sided ventilation



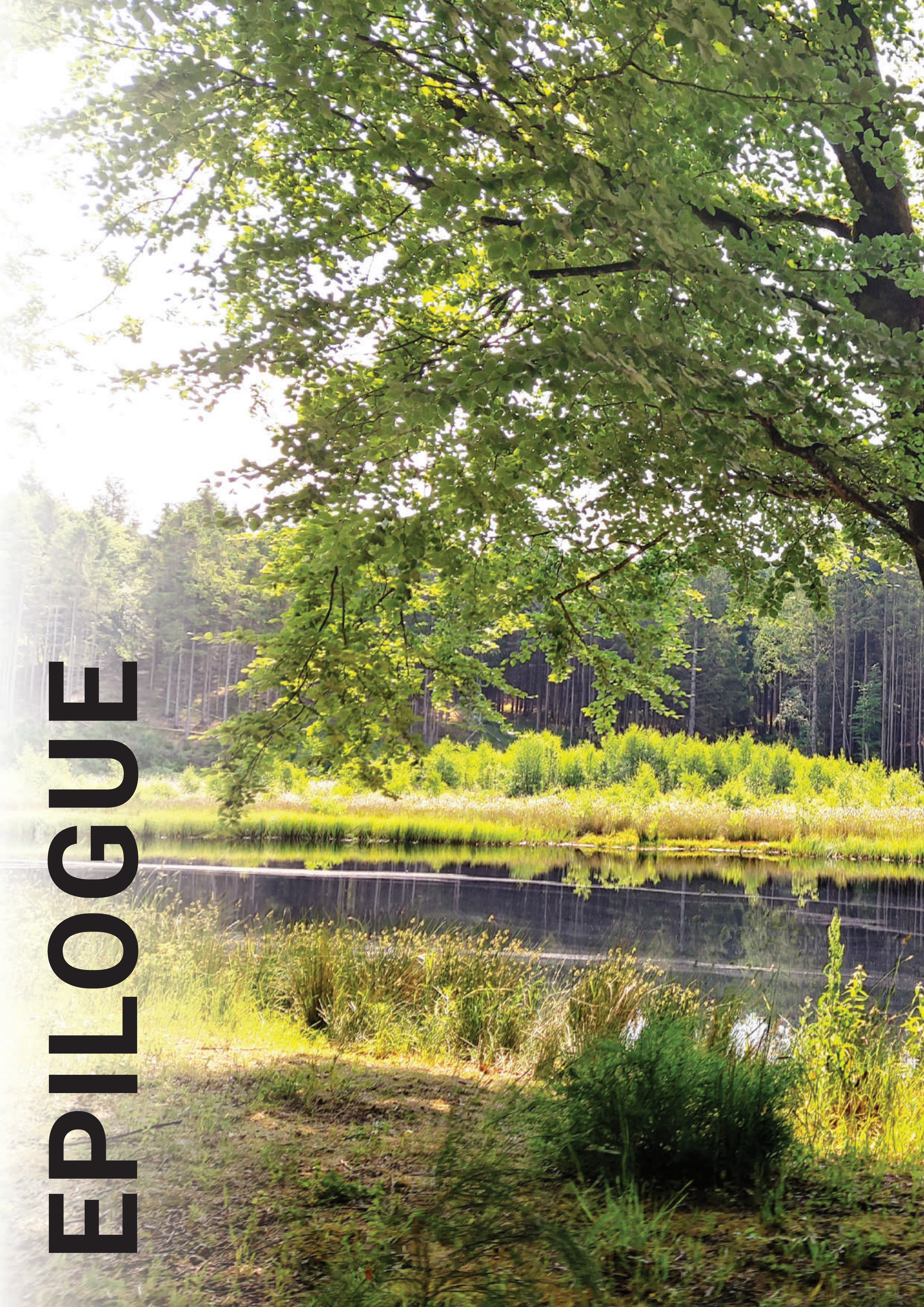
Bottom hung top opening
- Great ventilation effectiveness
- Can provide good control of external noise
- Can be hard to open due to opening height



Single slider
- Good airflow
- Atypical window type
- Not obstructing with internal blinds

Ill. 94. Window design for ventilation (Hellwig, 2022).

EPILOGUE



Ill. 95. Image from Rold Skov.

CONCLUSION

The Path is a 24-hour rehabilitation center for drug addicts located in Rold Skov, Denmark. The space can host up to 24 residents as well as approximately 10 staff working on site and the architectural layout fosters moving impaired residents.

The architectural programming encourages a structured daily routine and introduces activities and functions for the residents to choose and engage in to nudge them up the triangle in Maslow's theory on the hierarchy of needs and fulfill their growth needs. This is done by implementing activities such as a gym, indoor and outdoor workshops, a greenhouse and gardens, and social spaces where the users can engage in games and conversation. In addition to this, the location offers physical outdoor activities such as walking, running, mountain biking, swimming and kayaking.

The layout of the functions is split into three building categories based on the typical daily routine structure desired for the occupants to acquire. This includes a private building, where residents sleep and socialize in smaller groups with their closest neighbors. An educational building that functions as a place of work, where residents will engage in both group and single therapy, advance their skills with digital media, arts and crafts, or gain various building skills or similar. Lastly, a social building where residents will engage in social activities, cook and eat dinners, relax, watch television, or play games.

To facilitate a structured setting for rehabilitation, the architecture provides legibility in the spatial layout, as a division of the functions produces an easily understandable environment for the clients to recover. Furthermore, the layout and interior aspire to become a home for the residents to live in, giving them a homely atmosphere in the social and private spaces.

The structure is nestled in the tranquil environment the surrounding forest provides and is located on relatively flat ground in a lightly hilly landscape. The structures have gables angled towards views to the center of the site opening up to the residents, but also focus views to the surrounding landscape and the lake located to the north of the site. These views are utilized throughout the spaces as well as incorporating natural elements in the interior to foster a healing environment.

The Path is an integrated design that achieves both low energy usage during the building's lifespan and a low GWP during the building's construction and use phase. Furthermore, the design aspires to achieve a good indoor environment, and in general, have a low footprint on the surrounding nature. Lastly, the design inspires a new take on the typology of rehabilitation centers, showcasing how programming, functions, and adaptive opportunities can provide a healing environment that helps to foster a long-term recovery for the users.

REFLECTION

This segment reflects on the project overall, encompassing challenges and potentials not included in the final design proposal. It will discuss possible alternative strategies that could have been pursued, and possibilities for additional refinement if given more time and focus during the design process.

For instance, the project's main focus revolves around Maslow's Hierarchy of Needs, and the thesis discusses and considers only the classic interpretation of this theory and makes conclusions and design parameters based on these findings. However, in recent years multiple approaches to this theory have been developed and discussed, and delving into some of these ideas could perhaps give nuances to strengthen design decisions made throughout. The idea of focusing on user needs through the model put forth in Maslow's theory also came later in the process, and utilizing and implementing it earlier and more directly in the design process might have benefited the project greater and evolved the project further.

Another discussion topic throughout the design process's initial stages was whether to combine the different functions into one building volume or to separate the volumes. Research on current rehabilitation centers showed they were mostly similar in design and singular volumes. There are definitely pros when considering accessibility and direct links between the functions of the institutions. However, nudging the users into a direct meeting with nature multiple times during the day as well as dividing the functions into a structured setting was a feature that could enhance and simulate the users' journey after treatment.

The integrated design process can be complex and close to unmanageable as solutions must be discussed, calculated, and simulated on various parameters. Therefore, having focus points and design parameters is crucial to determine various solutions throughout the process. However, these focus points tended to change throughout, when new information was obtained during research, the importance of the different subcategories changed as well. This is something to reflect on, as some topics could have been considered further in the design process, and some could have been used less. The overall structure of how design solutions are assessed is always something that can be discussed further, as using integrated design can often bring contradicting arguments depending on the category of focus.

In hindsight of the design process, various topics had a lack of attention and could possibly be discussed and reflected upon further. For example, integrated PV panels were iterated and discussed, but as these decisions and calculations were done in the later stages of the design, perhaps better solutions could be found. Another topic for reflection could be the interior design, where both the materiality and the integration of natural elements in the interior design were concluded as an important subject during research. However, this was a topic that unfortunately was neglected to a degree during the design process and upon reflection could have been iterated further to improve the design proposal.

Overall, the current offers share many similarities in their spatial layout, architectural style, and type of treatment. Challenging this style and approach can seem radical and would naturally be a point of reflection. However, the research made on current offers as well as conversations with substance abusers gave clear insight into the existing challenges and needs that could be improved. Therefore, this master thesis suggests delving into why existing rehabilitation centers are designed the way they are, and perhaps reconsidering a new approach to rehabilitation. An approach where the users' needs for esteem, self-fulfillment, and long-term recovery becomes the main focus, and by establishing daily structure, spatial legibility and offer various activities other than the classic treatment can cultivate the healing process.

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Ill. 38. Own illustration.
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MAY 2024
MSC04 GROUP 3

THE PATH

PRESENTATION

TITLE PAGE

PROJECT TITLE: THE PATH

Aalborg University
Architecture and Design

4th. Semester
MSc04 A&D 2024

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Pages presentation:	40
Pages report:	146
Pages appendix:	31

This report is in three parts and has a separate process report and appendix.

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INTRODUCTION

The Path is a 24-hour rehabilitation center for drug addicts located in Rold Skov, Denmark. The center can host 24 residents as well as approximately 10 staff on site and fosters moving impaired residents.

The architectural programming encourages a structured daily routine and introduces activities and functions for the residents to choose from in order to nudge them up the triangle of Maslow's theory on the hierarchy of needs and eventually fulfill their growth needs. This is done by implementing activities such as a gym, indoor and outdoor workshops, a greenhouse and gardens, and social spaces where the users can engage in games and conversation. In addition to this, the location offers physical outdoor activities such as walking, running, mountain biking, and kayaking.

The layout of the functions is split into three building categories based on the typical daily routine structure desired for the occupants to gain. This includes a private building, where residents sleep and socialize in smaller groups with their closest neighbors. An educational building that functions as a place of work, where residents will engage in both group and single therapy, advance their skills with digital media, arts and crafts, or gain various building skills or similar. Lastly, a social building where residents will engage in social activities, cook and eat dinners, relax, watch television, or play games.

The architecture provides legibility in the spatial layout, as a division of the functions produces an easily understandable environment for the clients to recover. Furthermore, the layout and interior aspire to become a home for the residents to live in, giving them a homely atmosphere in the social spaces as well as the private.

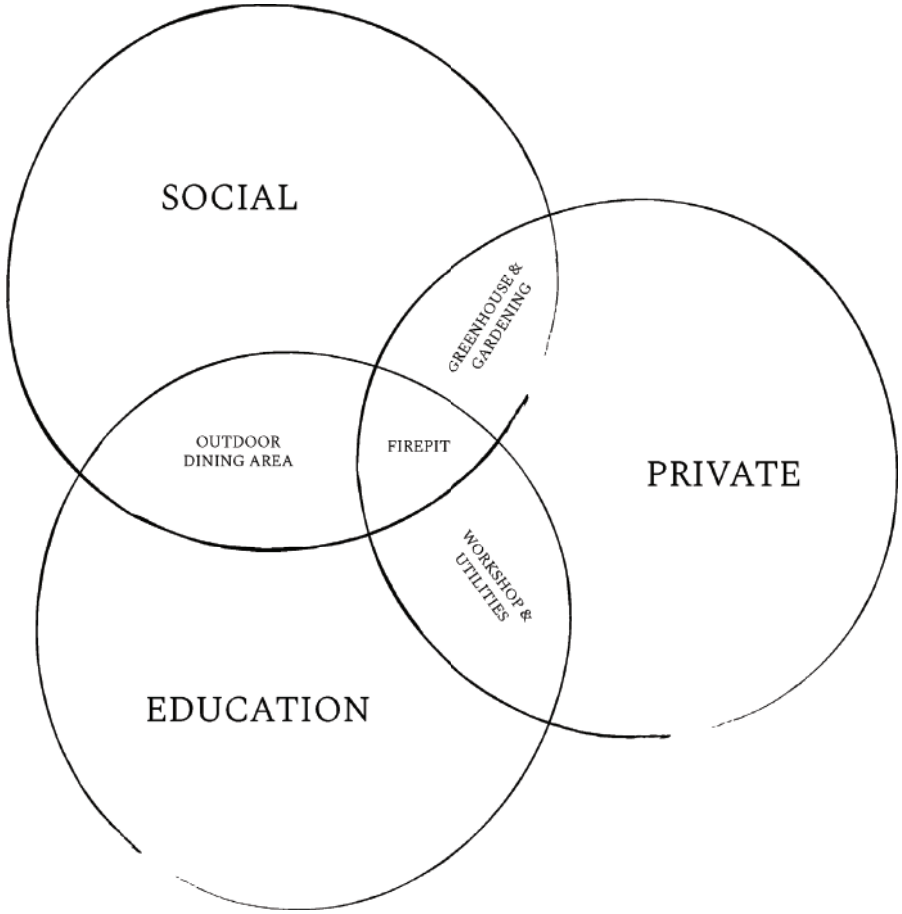
The structure is nestled in the tranquil environment the surrounding forest provides and is located on relatively flat ground in a lightly hilly landscape. The Path is an integrated design that achieves both low energy usage during the building's lifespan and a low GWP during the building's construction and use phase. Furthermore, the design aspires to achieve a good indoor environment that provides the users with adaptive opportunities. Lastly, the design inspires a new take on the typology of rehabilitation centers, showcasing how programming, functions, and adaptive opportunities can provide a healing environment that helps to foster a long-term recovery for the users.

BUILDING INFORMATION

Location:	Rold Skov, Denmark
Residents:	24
Staff:	10
Site are:	29500 m^2
Building area, Private buildings:	430 m^2
Building area, Educational building:	313 m^2
Building area, Social building:	216 m^2
Building area total:	956 m^2
Plot ratio:	3.24%
Terraces area total:	340 m^2

Axonometric view of the rehabilitation center seen from the southwest

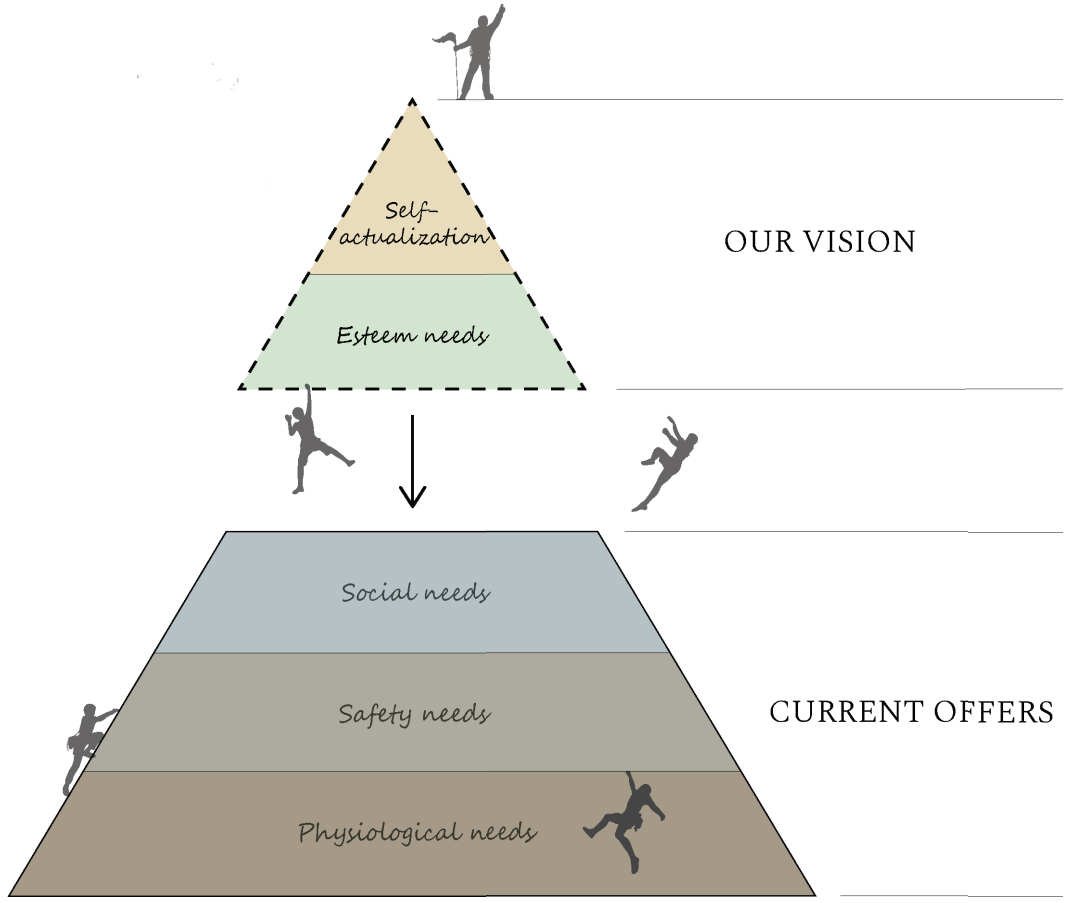
THE MASTER PLAN



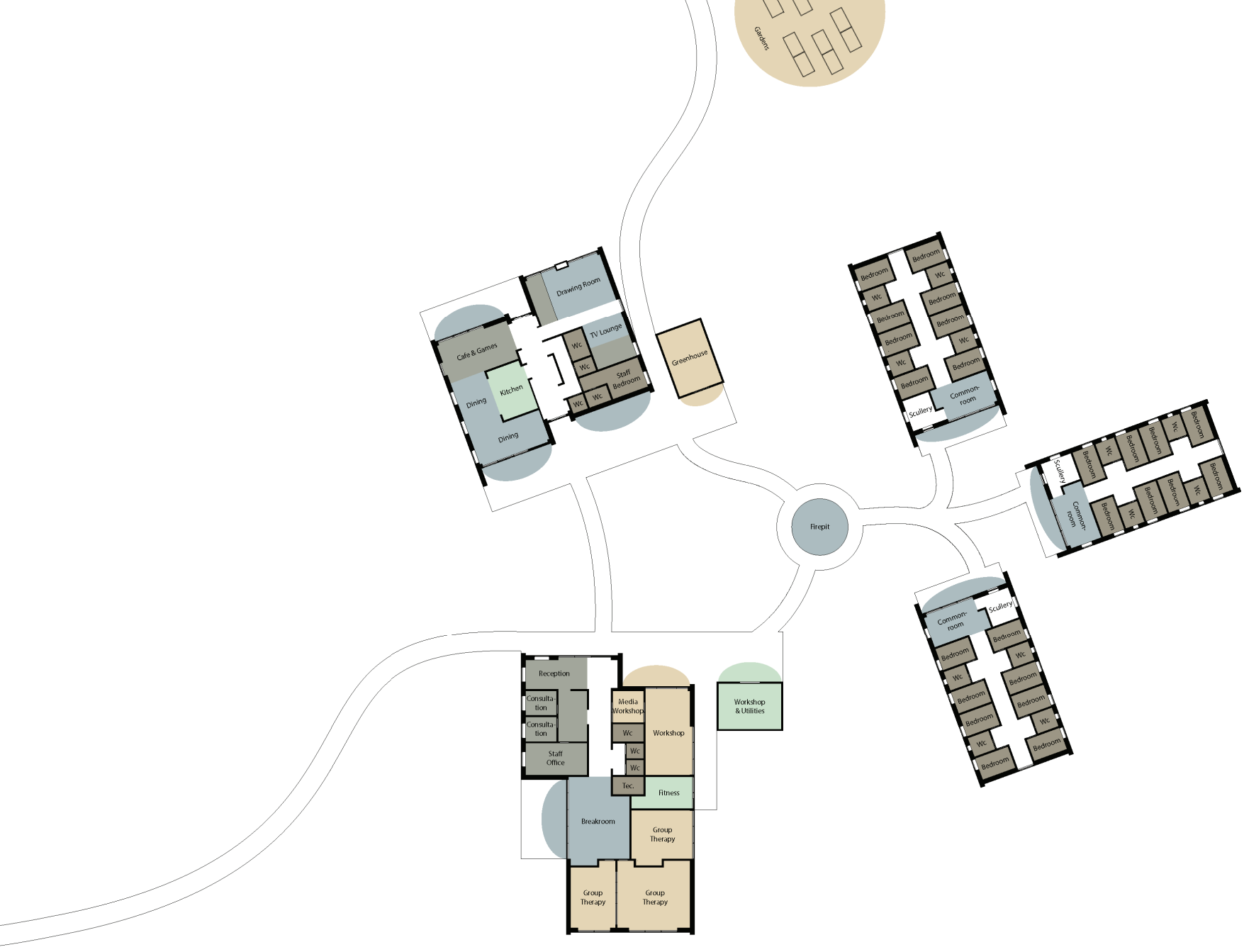
The architectural programming principle that ensures a structured daily routine


Masterplan, 1:1000

VISION & PROGRAMMING

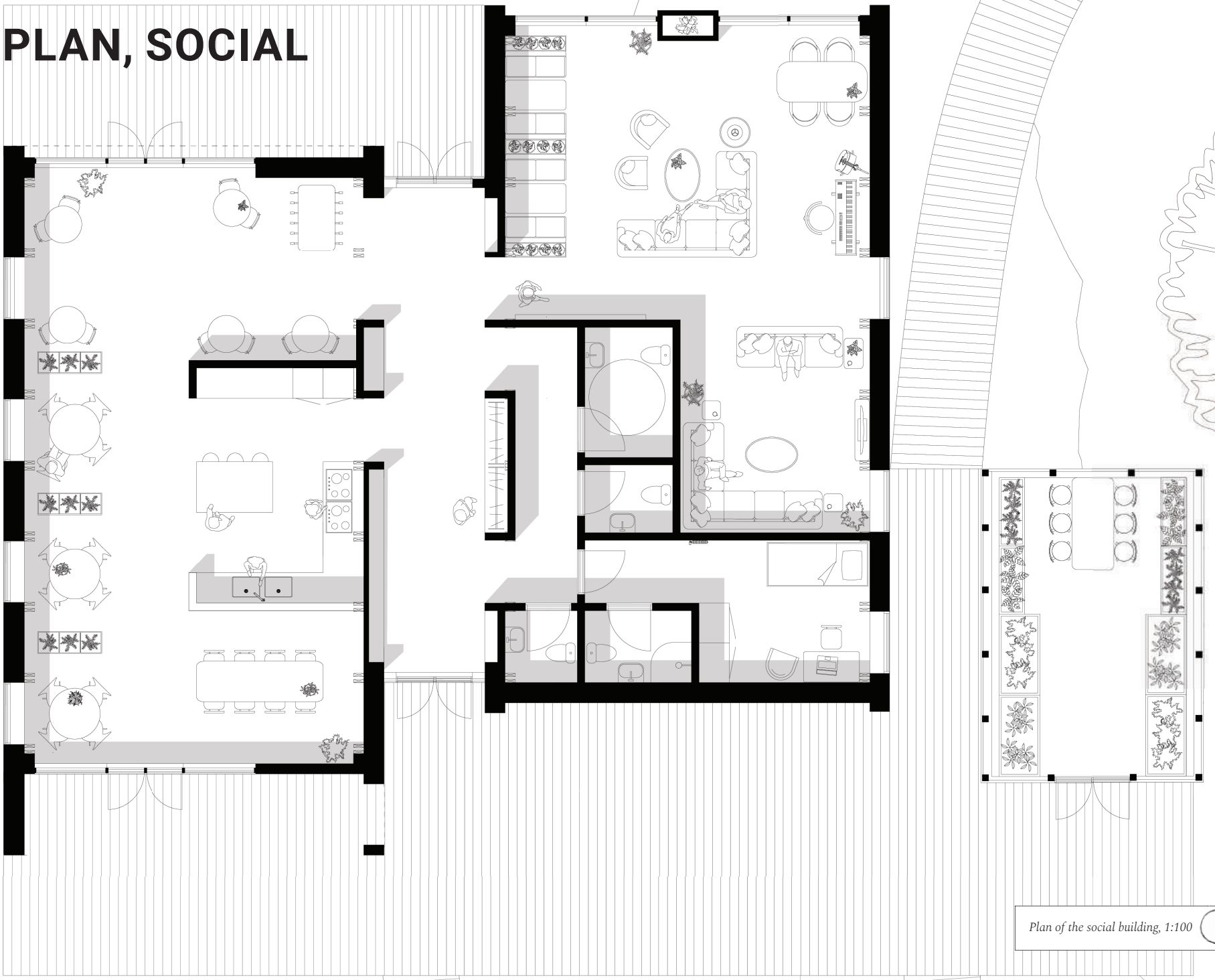


Maslow's hierarchy of needs



Programming of the buildings in relation to Maslow's theory, 1:500

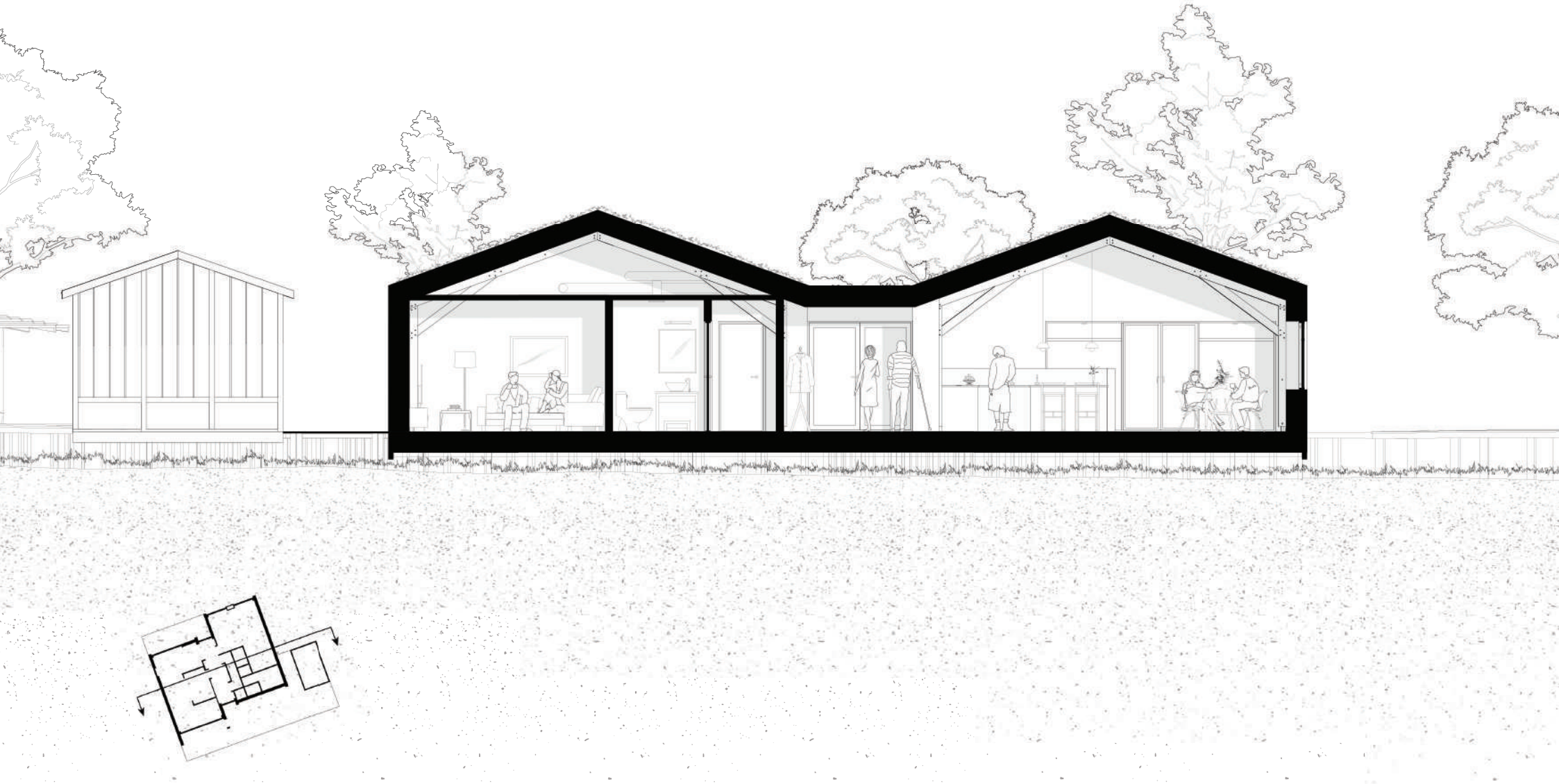
PLAN, SOCIAL



Plan of the social building, 1:100

Rendering of the kitchen and dining room

SECTION, SOCIAL



Section of the social building, 1:100

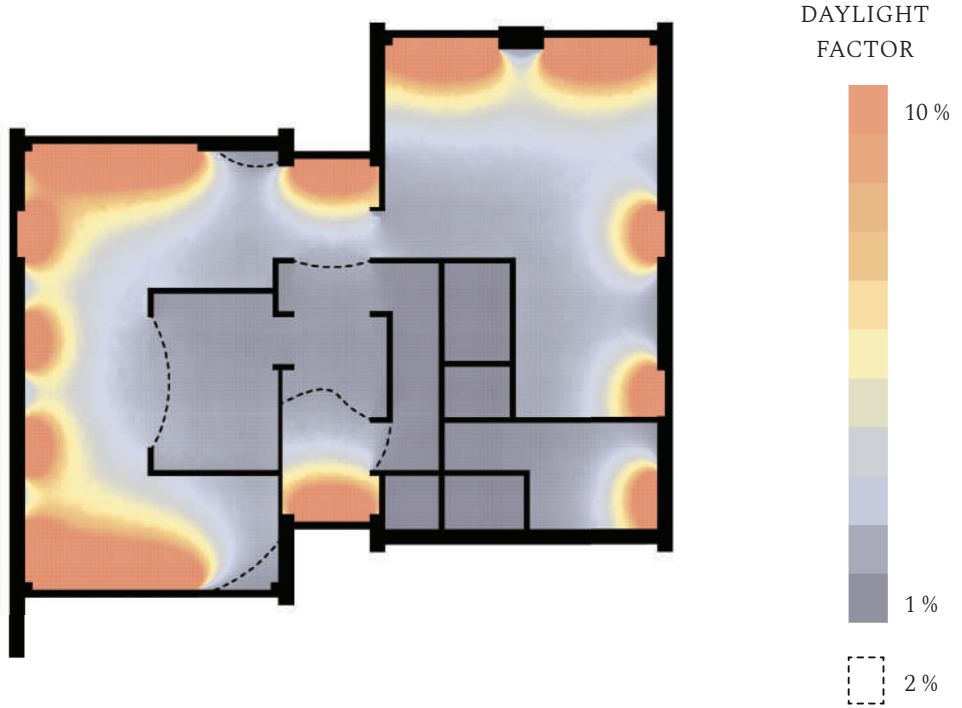
Rendering of the drawing room

ELEVATIONS, SOCIAL

West and south elevations of the social building, 1:200

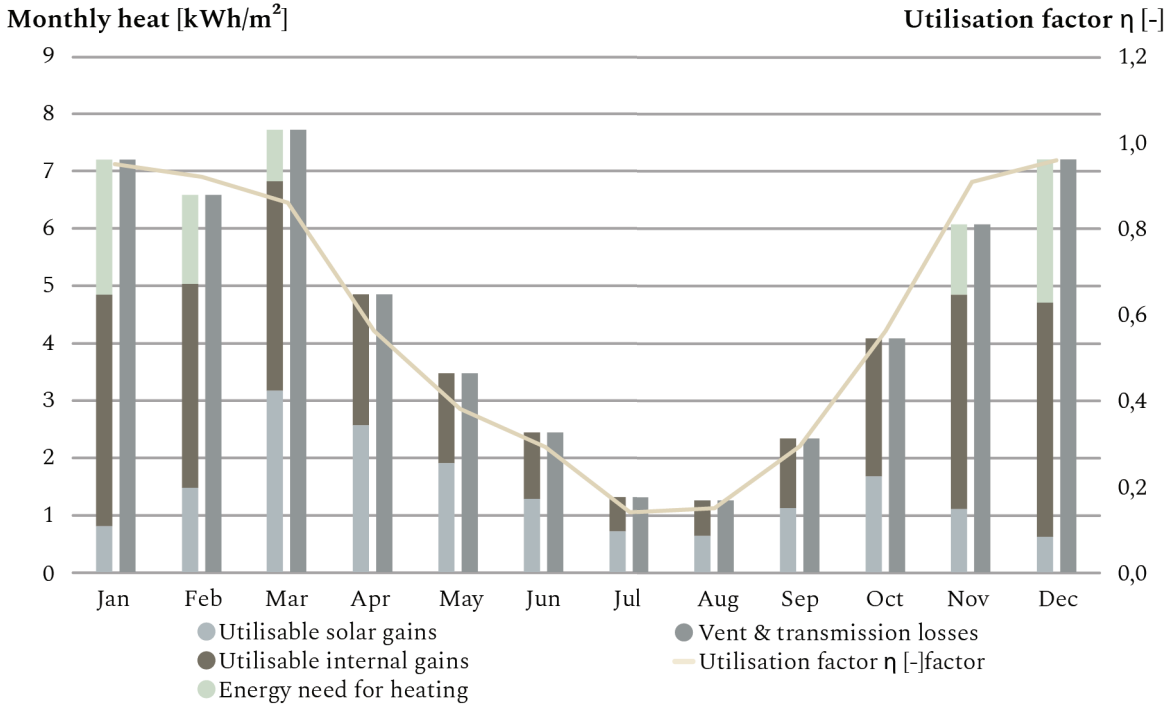
Rendering from outside the social building

DAYLIGHT, SOCIAL



Simulation of the daylight factor in the social building, 1:200

ENERGY, SOCIAL



Be18 key numbers	kWh/m²/year
Room heating needs	8,6
Hot water needs	15
Room heating loss	12,4
Hot water loss	1,8
Total electricity needs	44
Heat pump gains	28
PV panel gains	23,8
Total energy frame	**8,2**

PV panels		
Orientation	West	
PV panel angle	20	
PV panel area	36	m²
Module efficiency	15	%
Installed power	5,4	kWhpeak
Efficience of the system	0,75	%
Solar radiation intensity	994	kWh
Annual yield	**4026**	**kWh**

Air change rate: 1,91 h^{-1}

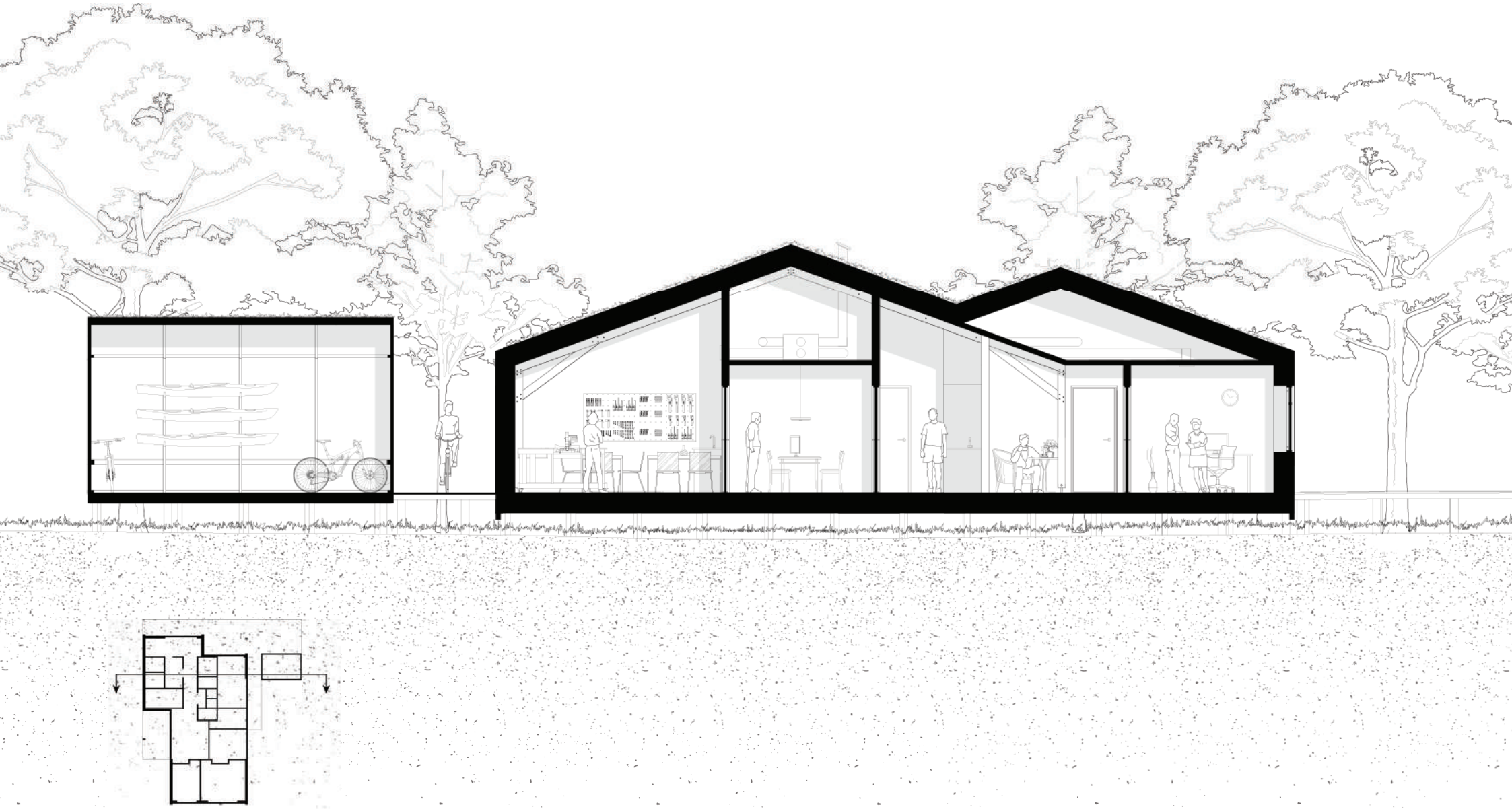
Energy performance of the social building's monthly heat gains and heat losses and Be18 key numbers

PLAN, EDUCATION

Plan of the educational building, 1:100

Rendering of the breakroom in the educational building

SECTION, EDUCATION



Section of the educational building, 1:100

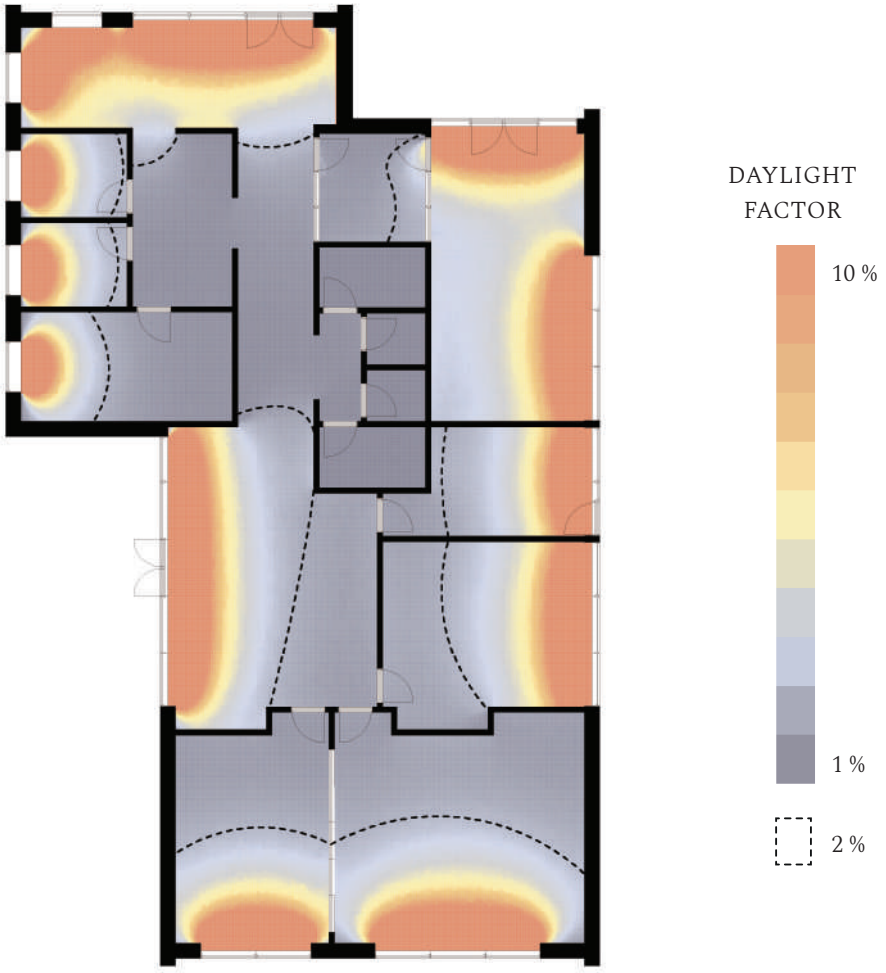
Rendering of the workshop in the educational building

ELEVATIONS, EDUCATION

West and north elevation of the educational building, 1:200

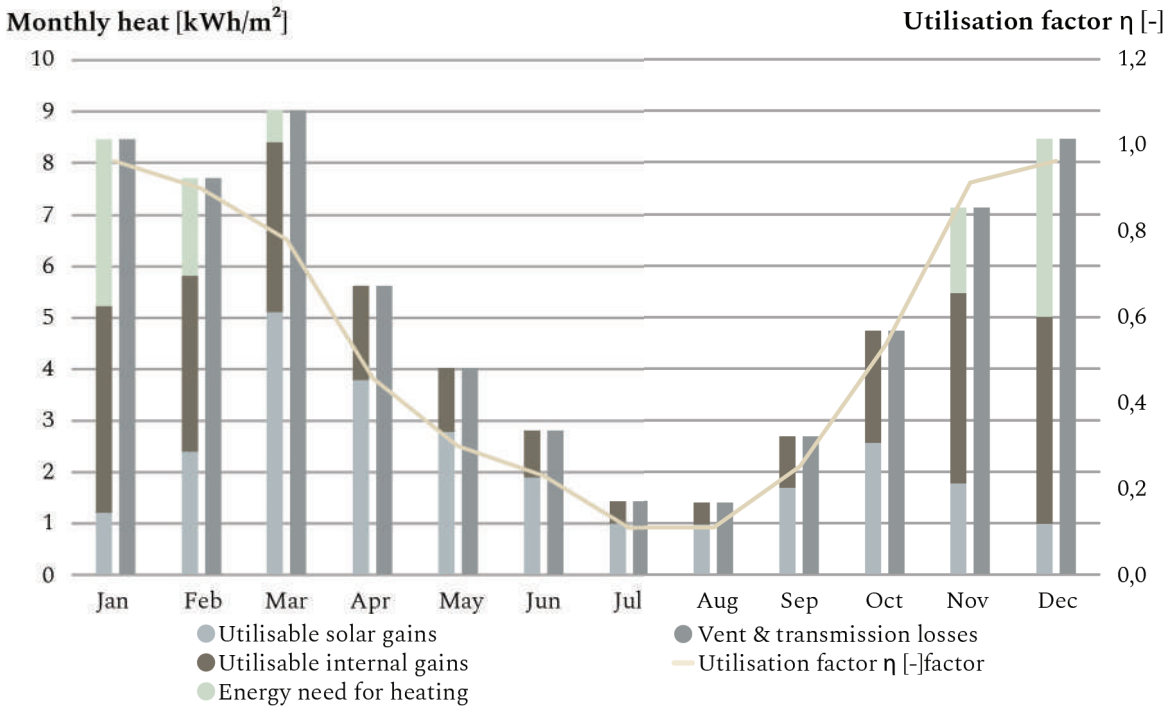
Rendering of the central firepit

DAYLIGHT, EDUCATION



Simulation of the daylight factor in the educational building, 1:200

ENERGY, EDUCATION



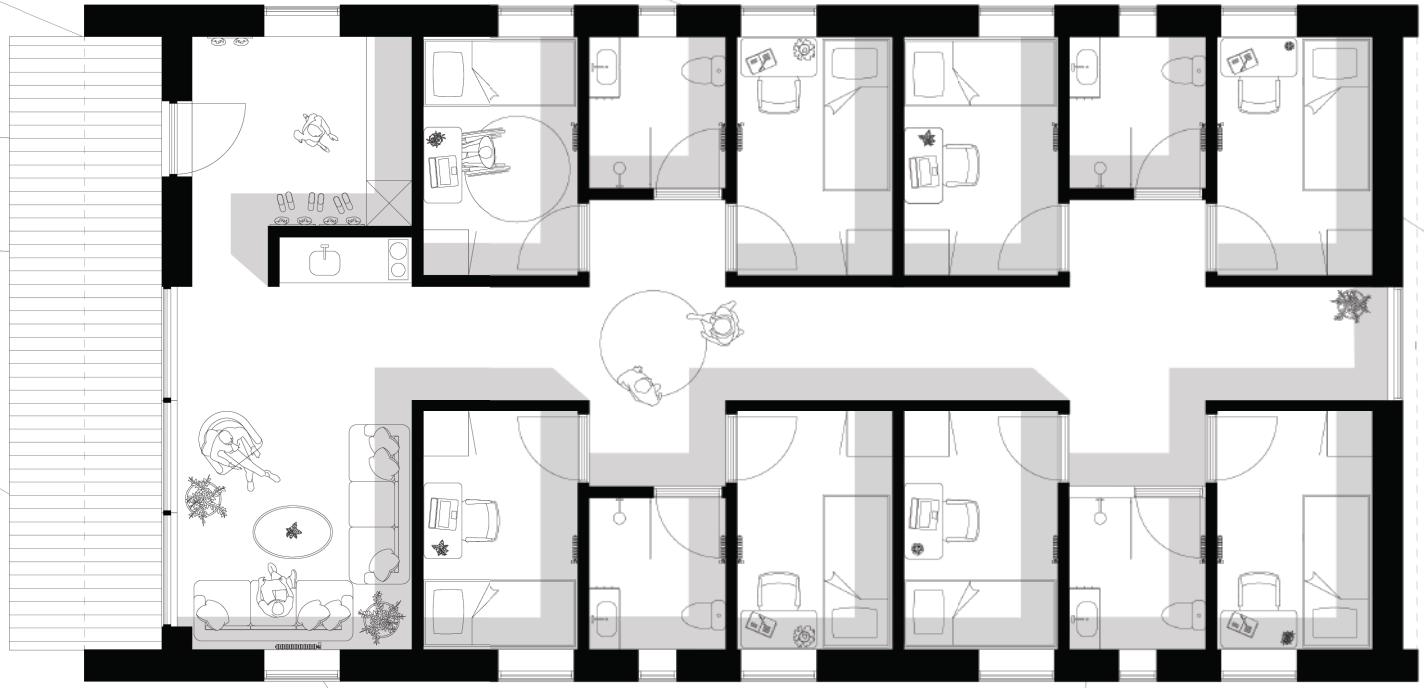
Be18 key numbers	kWh/m²/year
Room heating needs	10,9
Hot water needs	14,4
Room heating loss	12
Hot water loss	1,3
Total electricity needs	45,3
Heat pump gains	29,1
PV panel gains	23,3
Total energy frame	**10,2**

PV panels		
Orientation	West	
PV panel angle	20	
PV panel area	54	m²
Module efficiency	15	%
Installed power	8,1	kWhpeak
Efficience of the system	0,75	%
Solar radiation intensity	982	kWh
Annual yield	**5966**	**kWh**

Air change rate: 1,49 h^{-1}

Energy performance of the educational building's monthly heat gains and heat losses and Be18 key numbers

PLAN, PRIVATE



Plan of the private buildings, 1:100

Rendering of the building nestled in the landscape

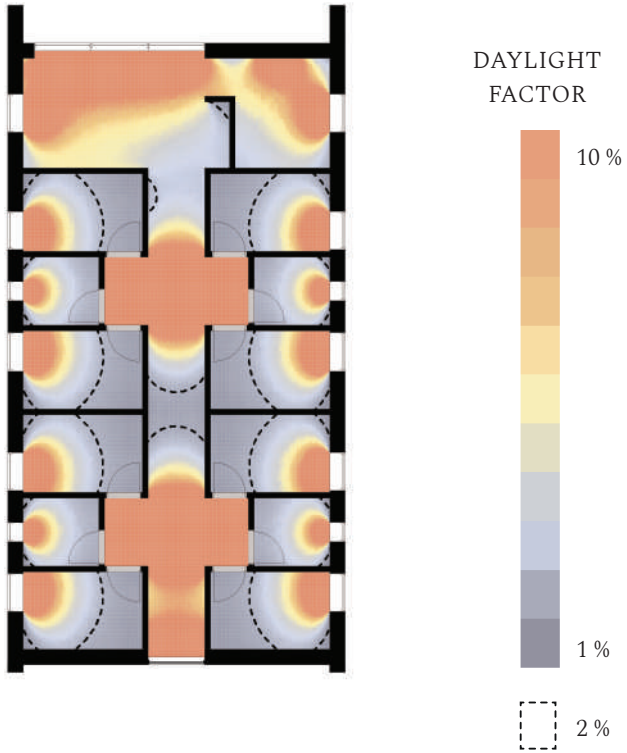
SECTION, PRIVATE

Section of the private buildings, 1:100

ELEVATIONS, PRIVATE

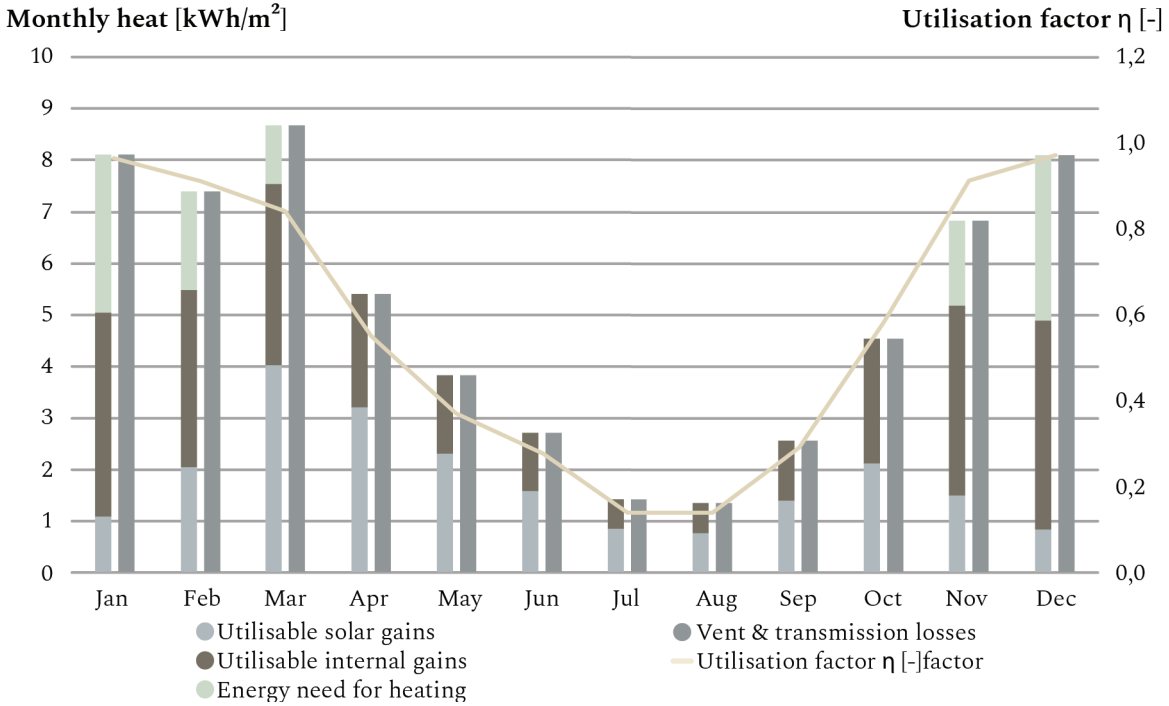
North and South elevations of the private building, 1:200

DAYLIGHT, PRIVATE



Simulation of the daylight factor in the private buildings, 1:200

ENERGY, PRIVATE



Be18 key numbers	*kWh/m²/year*
Room heating needs	11
Hot water needs	15,9
Room heating loss	7,5
Hot water loss	2,8
Total electricity needs	44,5
Heat pump gains	26,7
PV panel gains	12,5
Total energy frame	**10,2**

PV panels		
Orientation	East, South, West	
PV panel angle	20	
PV panel area	54	m^2
Module efficiency	15	%
Installed power	8,1	kWhpeak
Efficience of the system	0,75	%
Solar radiation intensity	1027	kWh
Annual yield 6241	**kWh**	

Air change rate: 1,01 h^{-1}

Energy performance of the private buildings' monthly heat gains and heat losses and Be18 key numbers

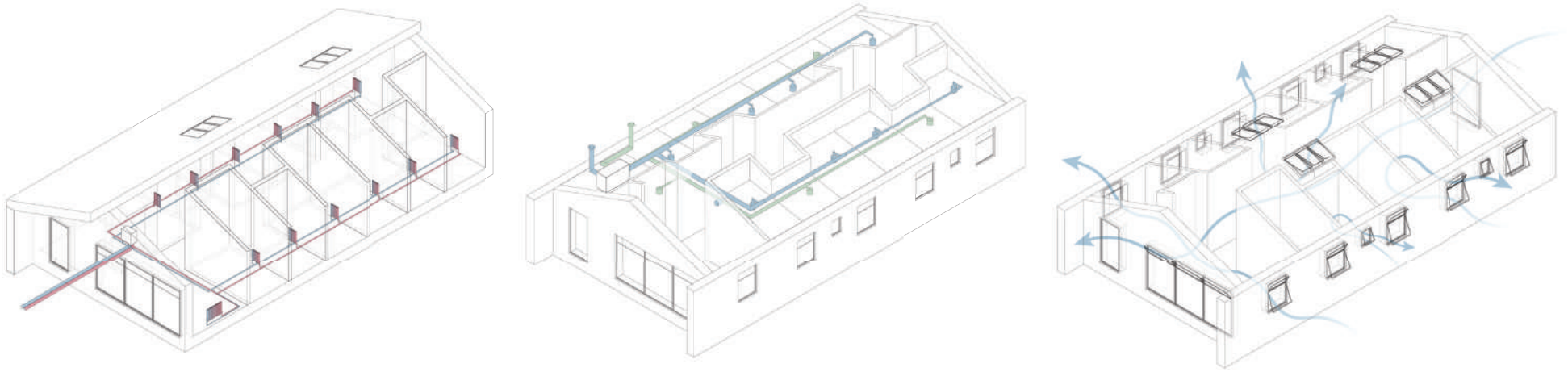
TECHNICAL INSTALLATIONS

The illustrations show how the technical installations are placed in the design of one of the private buildings. The heating chosen is a combi geothermal heat pump that can provide both room heating and hot water. As the private building houses the residents' individual rooms, it was important to provide them with adaptive opportunities, giving them a small radiator to adjust the temperature as well as a window in each room. The ventilation strategy chosen is hybrid ventilation, with mechanical ventilation with heat recovery installed to provide basic ventilation based on the air change needed and to reduce energy usage during winter periods. The mechanical ventilation is dimensioned smaller than the needed ventilation during the summer months, as natural ventilation is to be used as the primary ventilation throughout that period. Windows were designed to be easy to use and provide a variety of ventilation options for the user. Each building has a room with a motorized window, to solve possible complications for disabled residents, as well as having motorized skylights installed to integrate thermal buoyancy principles.

HEATING

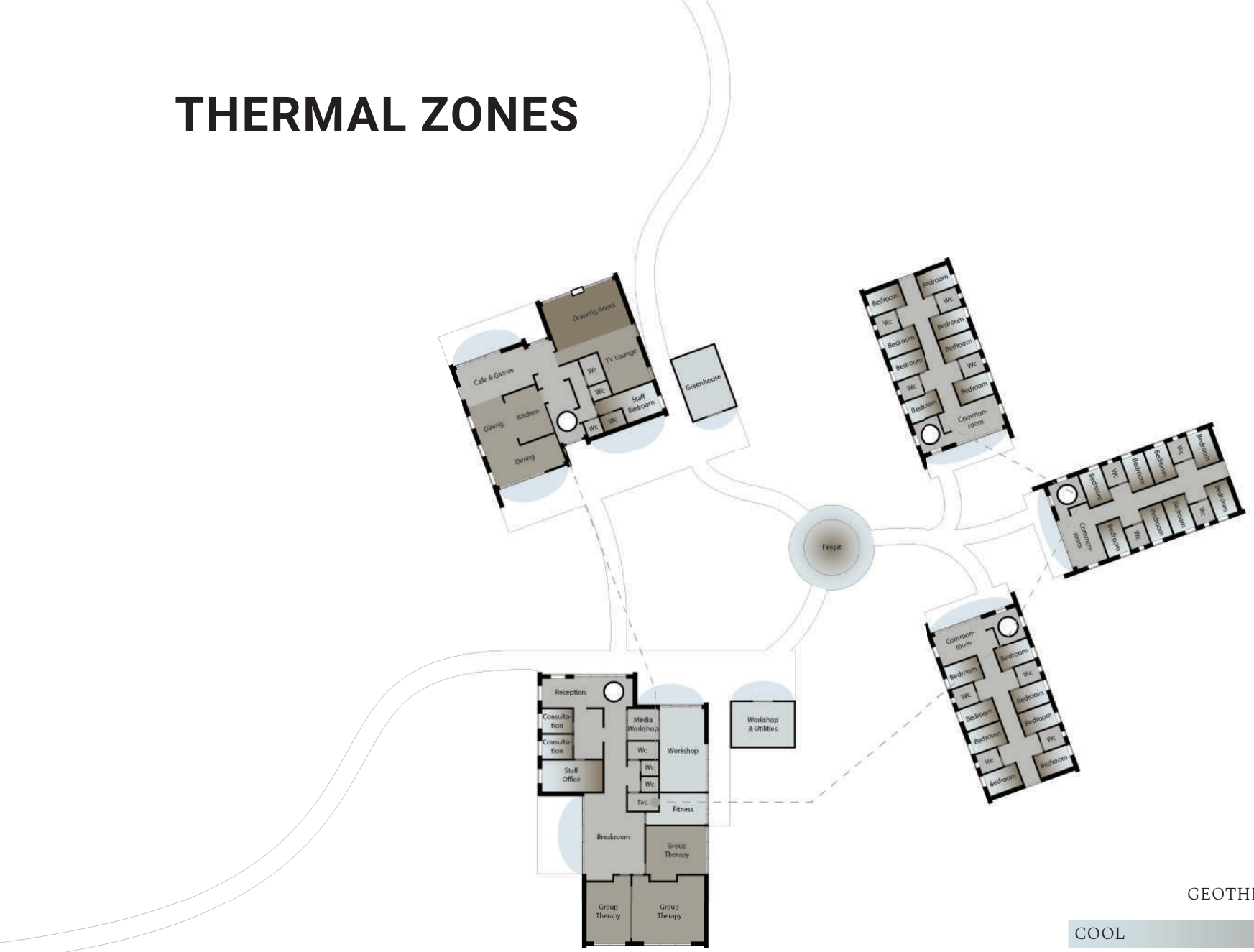
MECHANICAL VENTILATION

NATURAL VENTILATION



Principles of the technical installations and natural ventilation

THERMAL ZONES



COAT ROOM

GEOTHERMAL HEAT PUMP

COOL WARM

Thermal zones and opportunities for self-regulation in the design, 1:1000

LIFE CYCLE ASSESSMENT

The result, 8,9 CO_2 eq/m^2/year, from the LCAbyg calculation for all buildings excludes terraces and outdoor functions. Comparing this result with the benchmark value of a lower quartile building from the initial research, at 13,68 CO_2 eq/ m^2/year, the rehabilitation center performs 35% better.

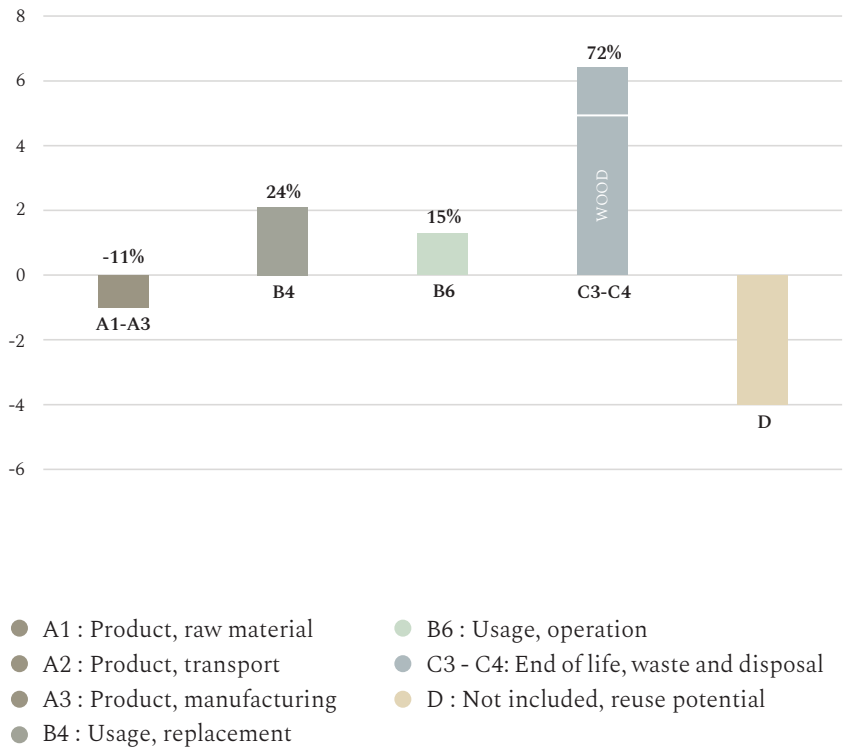
Stages C3 & C4 show that waste treatment and disposal of the materials is by far the biggest contributor to the total GWP and, as illustrated, 4,93 CO_2 eq/ m^2/year, or 78% of these stages is from the timber used throughout the construction. Therefore, throughout the design, a focus has been on designing for disassembly and using standard timber profiles to ensure material reusability after the building's end of life. In relation to this, stage D, potential for reuse, is also included in the graphs, as 50 years from now, the assumption is that there will be a greater potential for the reuse of materials.

LCA-BYG RESULTS ALL BUILDINGS

Current limit value requirements §291, subsection 1	12	kg CO_2-eq/m^2/year
Current low-emission class §297, subsection 9	8	kg CO_2-eq/m^2/year
Total climate impact (A1-3, B4, B6, C3-4)	**8,9**	**kg CO_2-eq/m^2/year**
Increased climate impact §298, subsection 3-4	2	kg CO_2-eq/m^2/year
Total climate impact §298, subsection 1, excluding increased climate impact	**6,9**	**kg CO_2-eq/m^2/year**

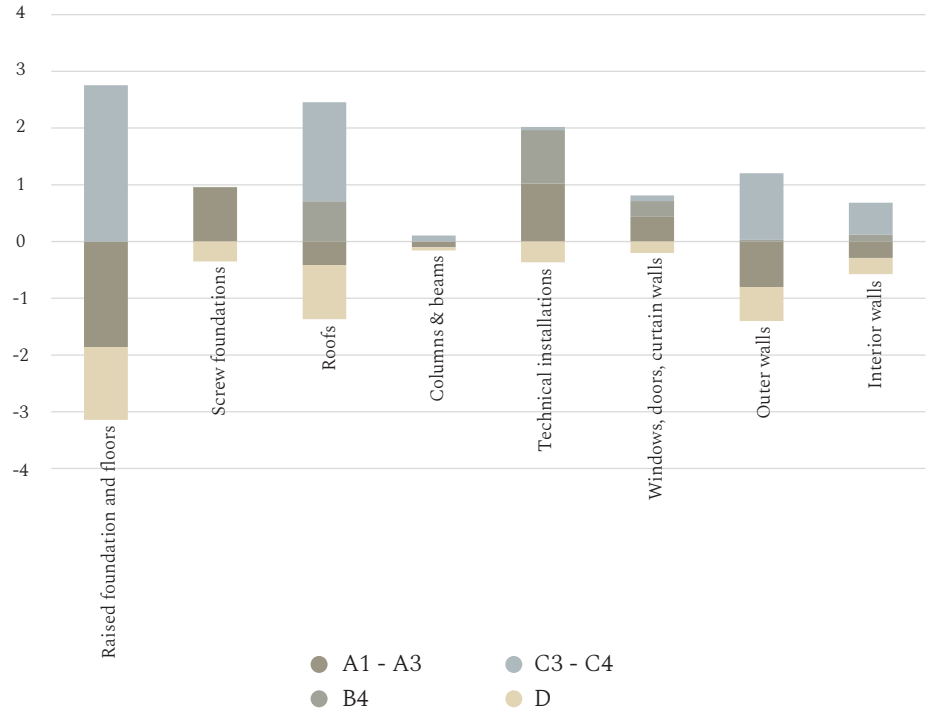
GWP DIVIDED BY LIFE CYCLE PHASES

kg CO_2-eq/m^2/year

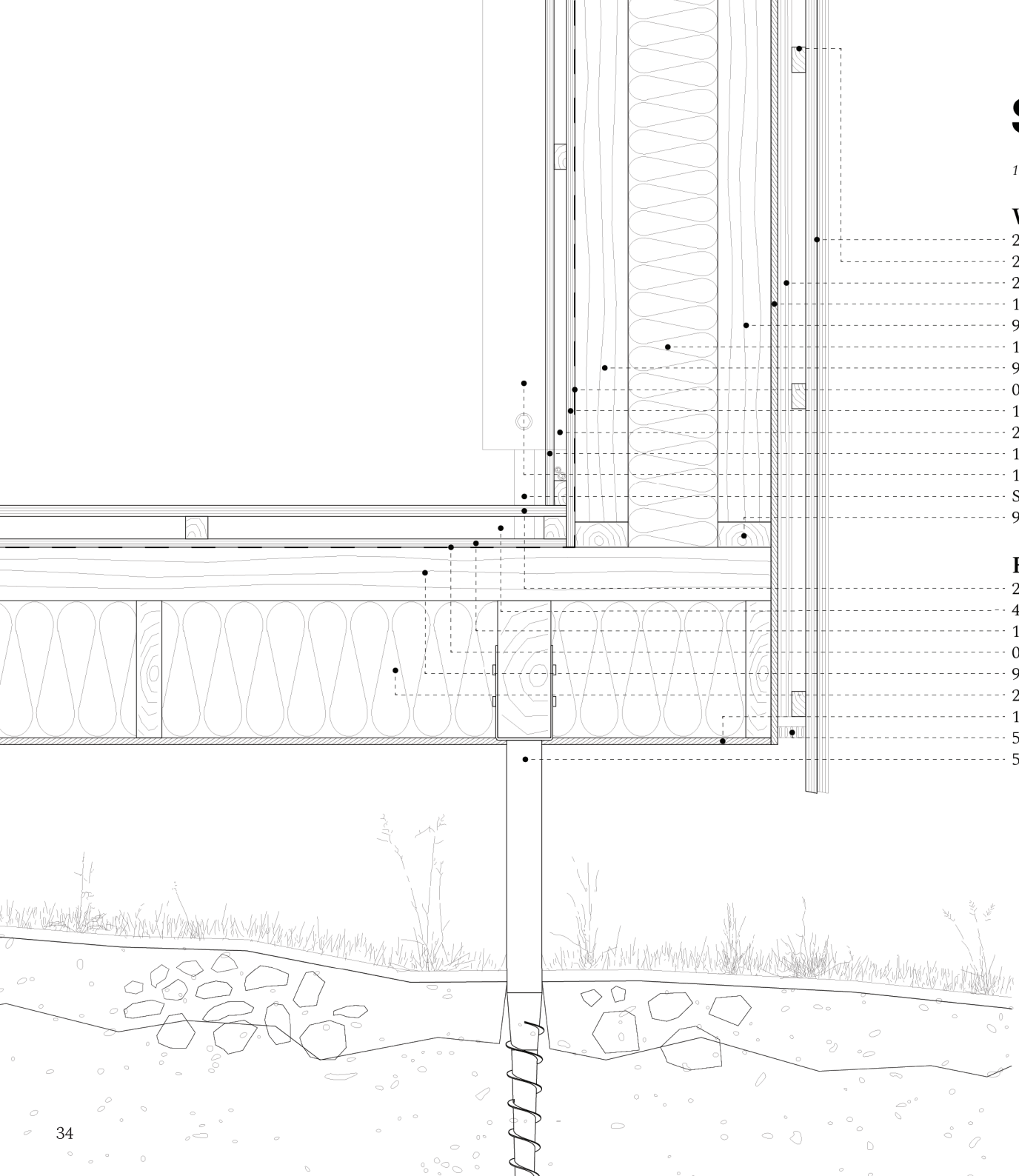


GWP DIVIDED BY BUILDING ELEMENTS AND LIFE CYCLE PHASES

kg CO_2-eq/m^2/year



Life Cycle Analysis for the whole construction and the individual building elements



SECTION DETAIL A

1:10 section detail, wall / floor

Wall U-Value: 0,114 W/m^{2}K

- 20 mm * 2 pressure treated timber, exterior cladding
- 25 mm vertical battens
- 25 mm horizontal battens
- 12 mm Hunton wind barrier
- 95x45 mm studs, spruced insulation layer, wood fiber insulation
- 160 homogeneous insulation layer, wood fiber insulation
- 95x45 mm studs, spruced insulation layer, wood fiber insulation
- 0,2 mm vapor barrier
- 15 mm plywood board
- 25 mm vertical battens, installation layer
- 15 mm gypsum fiber board / interior cladding
- 145x45 mm column, construction timber
- Steel bolted joint
- 95 x 45 mm bottom plate, construction timber

Floor U-Value: 0,121 W/m^{2}K

- 22 mm timber boards
- 40x39 mm battens
- 15 mm plywood board
- 0,2 mm vapour barrier
- 95x45 mm joist, spruced insulation layer, wood fiber insulation
- 245x45 mm joist, spruced insulation layer, wood fiber insulation
- 12 mm OSB board
- 50x20 mm ventilation strip
- 5000 mm x 350 mm OD, point foundation, steel screw

Detail of the foundation and wall, Social/Education, 1:10

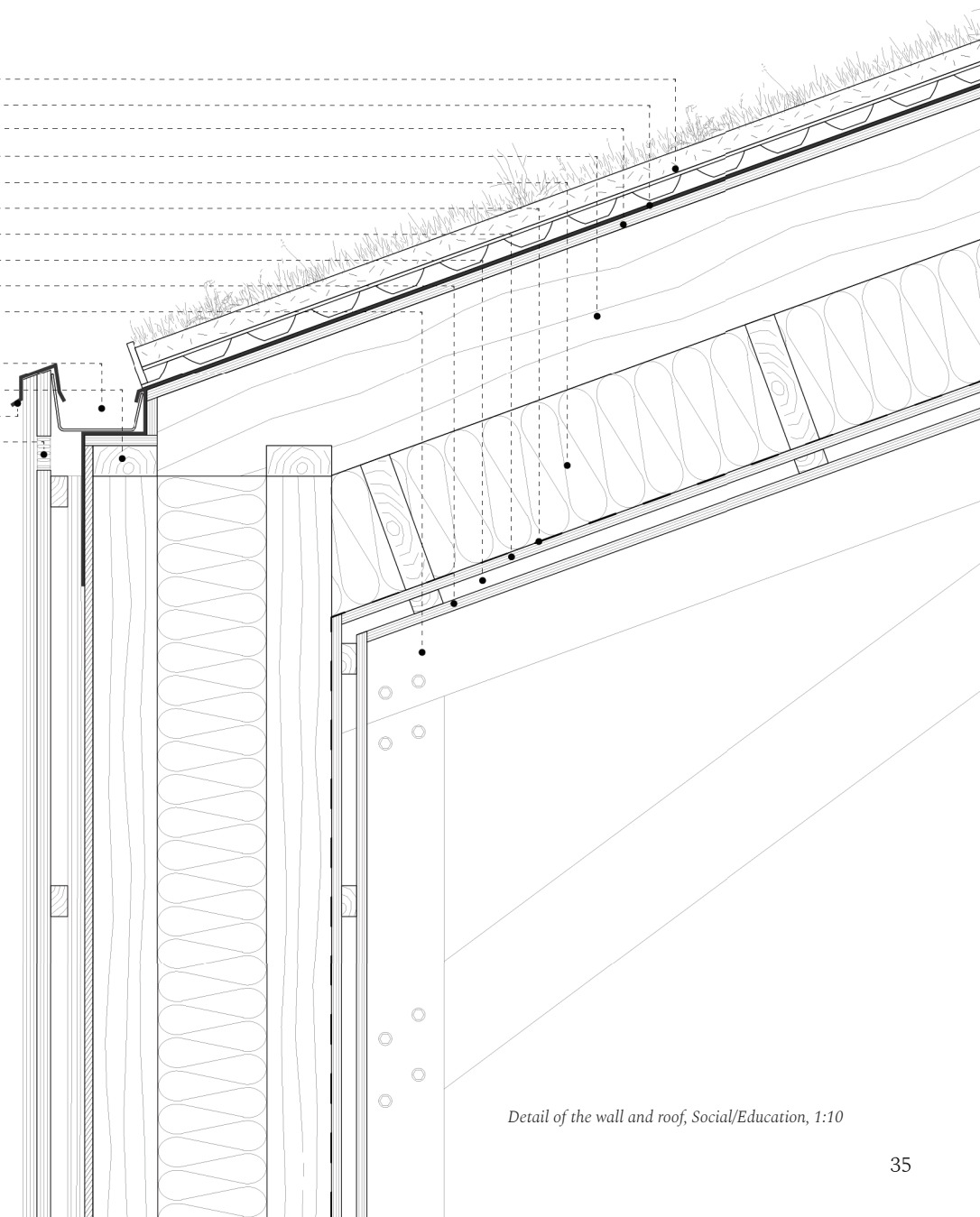
SECTION DETAIL B

1:10 section detail, wall / roof

Roof U-Value: 0,108 W/m²K

70 mm sedum roofing, growing medium, felt layer, drainage layer
2x2,5 mm bitumen roofing felt
15 mm OSB board
195x45 mm rafter, spruced insulation layer, wood fiber insulation
195x45 mm rafter, spruced insulation layer, wood fiber insulation
0,2 mm vapor barrier
15 mm plywood board
22 mm vertical battens, installation layer
15 mm gypsum fiber board / fiber cement boards / interior ceiling
145x45 mm beam, construction timber

Integrated zinc gutter
95x45 mm top plate, construction timber
5 mm aluminum flashing
20x50 mm ventilation button



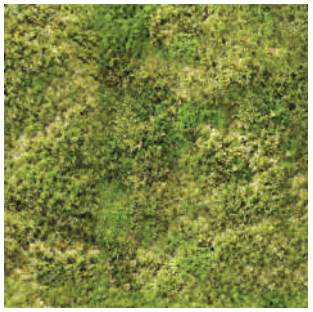
Detail of the wall and roof, Social/Education, 1:10

MATERIAL PALETTE

OUTDOOR

FACADE CLADDING
Black Painted Spruce

FACADE CLADDING
Pressure Treated Spruce



GREEN ROOFS
Sedum Plants

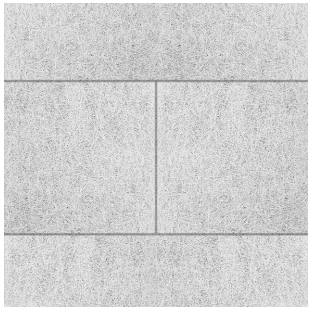
CHIMNEY
Staggered Grey Bricks

INDOOR

WOODEN FLOOR
Stained Pine Planks

WALL CLADDING
White Painted Plasterboards

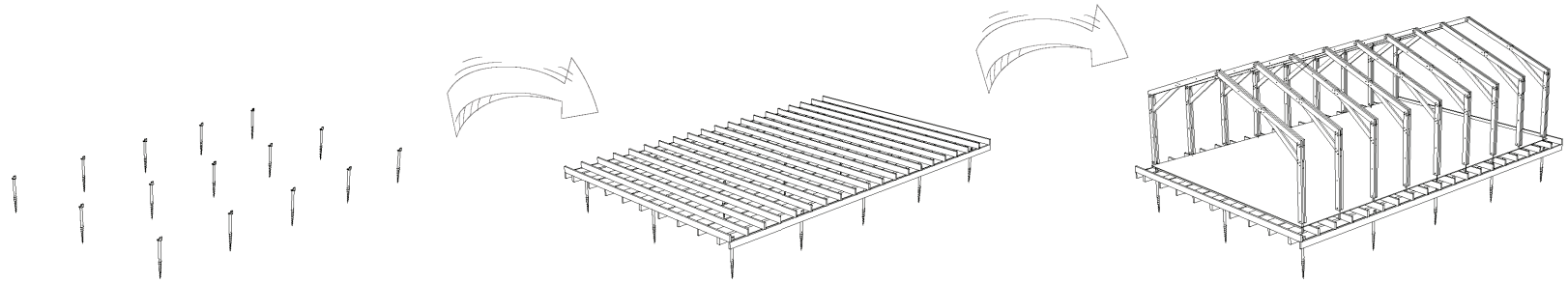
BATHROOM TILES
Grey Ceramic Tiles



ACOUSTIC CEILING
Fiber Cement Panels

Materials used in the design

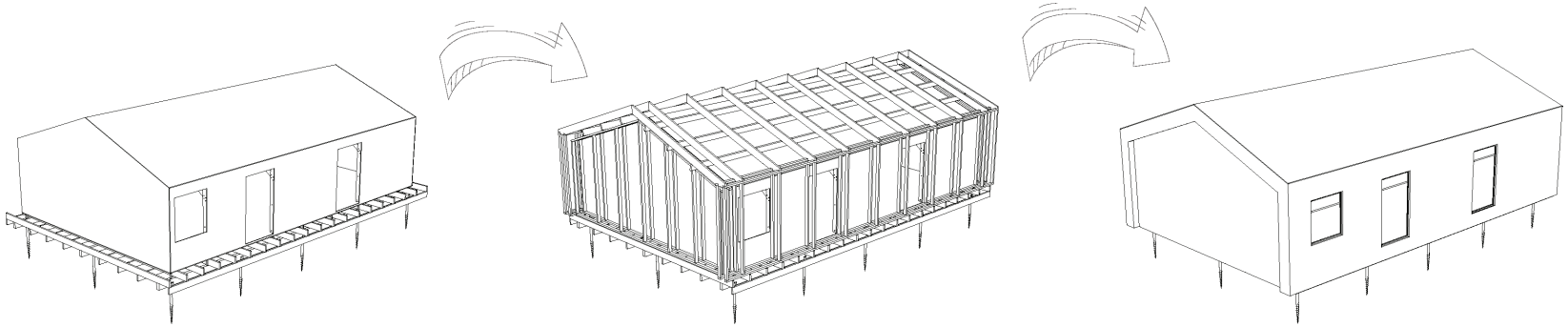
ASSEMBLY & DISASSEMBLY GUIDE



SCREW FOUNDATION

FOUNDATION JOISTS AND
INSULATION LAYER

LOAD BEARING
STRUCTURE



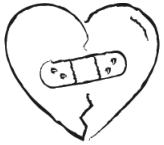
PLYWOOD SHEDDING
AND VAPOR BARRIER

FRAMING AND
INSULATION LAYERS

ROOFING AND
FACADE CLADDING

Steps in the construction phase and disassembly phase

DESIGN PARAMETERS & SOLUTIONS



HEALING ENVIRONMENT

The structure is designed to enforce the adaptation of daily routines by dividing key activities into different buildings

The recovery center is designed to nudge the users out into nature thereby presenting a more active lifestyle

The programming of the building supports therapy sessions, a gradient of social opportunities, and self-actualization

THERAPEUTIC COMMUNITY

The healing process is supported by the communal living the users experience where they can socialize and learn from each other

The rehabilitation center is designed with security and a homely atmosphere in mind offering tranquil settings for recovery

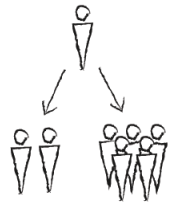
Implementing functions such as workshops, gardens, and a greenhouse support the users' needs for esteem

IMPLEMENTATION OF NATURE

Placing the building in the tranquil surroundings of Rold Skov the users are always close to the natural elements

Views of nature have been a key design driver in both social spaces, therapeutic spaces, and private spaces

Natural materialities have been implemented in the design in addition to securing vast amounts of natural daylight



OPPORTUNITIES IN CONTROLLED SETTINGS

The structured daily routine is accompanied by a freedom to choose between many recreational activities

Social interactions of varying sizes have been implemented so that the users can choose their own level of engagement

By placing activities strategically visible, the users can easily be inspired by each other to join and gain esteem and self-actualization

INDOOR ENVIRONMENT

Adaptive thermal opportunities have been implemented for the users to listen to body signals and practice self-regulating

Visual comfort has been achieved in regard to the Danish building regulations and beyond as this was a pivotal design criterium

Natural ventilation principles have been implemented throughout to ensure thermal and atmospheric comfort

ENVIRONMENTAL SUSTAINABILITY

Principles of design for disassembly have been implemented in the design, together with natural and reusable materials

LCA comparisons on materials have been done throughout the process to ensure sustainable choices and low GWP's for the buildings' life cycle

Passive and active design strategies such as building envelope, window placement, PV panels and heat pump implementation ensures optimal energy performance

The path towards Store Blåkilde.