ILAGISAKKA

A CHILDREN'S AND FAMILIES' HOME
IN NUUK

Ilagisakka - A Children's and Families' Home in Nuuk - MSc04 ARCH - Group 31 - May 2017
Lene Nielsen, Mette Norden Simonsen, Sara Stounberg Østergaard

Project title	Ilagisakka - A Children's and Families' Home in Nuuk
Project period	01.02.2017 - 01.06.2017
Supervisor	Mary-Ann Knudstrup
Technical supervisor	Rasmus Lund Jensen
Editions	7
Pages	153
Appendix pages	22

Master Thesis MSc04 Arch
Project Group 31
Department of Architecture, Design and Media Technology
Aalborg University

Lene Nielsen

Mette Norden Simonsen

Sara Stounberg Østergaard

Thanks to

Mary-Ann Knudstrup, supervisor and architect
Rasmus Lund, technical supervisor and civil engineer

Annette Dunker, deputy at the Childrens' Home, Villaen
Per Hjelm Hansen from Det Grønlandske Hus in Aalborg
Jørn Holbech from Det Grønlandske Hus in Århus
Helena Lennart, architect at TNT Nuuk
Inunnguaq Fleischer, pedagogue and deputy at Mælkebøtten
Tina Dam, head of children and young department in Sermersooq municipalty
Else T. Lund and Jakobine Mathæussen, leaders at Røde Kors Børnehjem
Maritha Eugenius, urban consultant at Sermersooq municipality
Signe Kramer Mikkelsen, architect at TNT Nuuk
Daniel Andersen, architectural technologist at CUBO architects

ABSTRACT / ABSTRAKTI

This thesis describes the development of the children's and families' home, Ilagisakka. The building is placed in the suburb Qernertunnguit in Nuuk in Greenland, and arose from the need of the municipality to house neglected infants and vulnerable families. The program is developed to house two families with one child and one parent, two families with two parents and two children as well as 12 children from 0-18 years.

The name of the house means 'My Family', and summarizes the intention of the house; it focuses on the individual, the family and the big-family and the synergic effect several generations living together can create. The division of the different communities gives every individual the option to choose which community to join at any time. In that way, the house can accommodate a wide range of neglected children and vulnerable families.

The house is developed through an integrated design process with focus on sustainable architecture. Every design decision has been evaluated from architectural and technical perspectives mainly in terms of form, placement on site, construction, sunlight and indoor climate.

READING GUIDE / ILITSERSUUT

This thesis presents the different stages of the genesis of the children and family's home, Ilagisakka. The report is built up in seven chapters; a prologue, which introduces the different issues of the project as well as the motivation for the project; an analysis of physical, historical and cultural context of Nuuk; a vision and a problem definition based on the analysis; the headlines of the design process and origin of the design; the presentation of the design; an epilogue, which concludes and reflects upon the design and the process; and lastly an appendix, which will provide additional information to certain diagrams, these are referred to. Additionally, the report has an associated drawing folder with drawings in appropriate scales.
References generally, are referred to via the Harvard Style, and since many references are from interviews, these will be referred to in the same way.

In the analysis phase five fictive personas are introduced and they will be addressed again in design process and presentation.

Fig. 1: Ilagisakka

PROLOGUE

/ aallaqqaasiut

Fig. 2: Map of Greenland

INTRODUCTION / SIULEQUTSIUSSAQ

Greenland is a nation, which has challenges of many different characters. Many Greenlanders have an alcohol abuse, which causes problems in caretaking and upbringing of their children. Often it results in violent behavior, and Nuuk needs a home for these children. Moreover, the municipality also has a vision about creating facilities, where families can live temporarily to get help to structure an everyday and take care of their children. A program and a design is developed to facilitate these two user groups. The concept of the building is based on Greenlandic culture and traditions, where living together in several generations is a focal point.

The design arose from a holistic approach with focus on architectural qualities, indoor climate and building sustainably in terms of social and environmental responsibility. The building is intended as being a frontrunner in terms of sustainability, but adjusted to the Greenlandic climate.

Fig. 3: Nuuk city

METHODOLOGY / PERIAASEQ

Architecture has always been an expression of the community development. By being in the tension of art, knowledge, business and craftsmanship it has the possibility of being far-reaching and political energetic (ed. Eriksson 2010). This project seeks to explore this tension by basing the project on a community problem – both in terms of social and environmental challenges. The overall approach to investigate this was to use the integrated design process, IDP (fig. 4).

The IDP takes its starting point in a problem, as also known from the method of problem based learning used at Aalborg University. The problem becomes the focal point throughout the project's next phases, being analysis, sketching, synthesis and presentation (Knudstrup 2005). By using integrated design, both the architectural and engineering aspects are attempted to be united. These aspects should be united in a solution oriented process working with functional, technical and aesthetic characteristics (Knudstrup 2005). In the actual process the different phases are unfolded in an iterative manner, which blurs the transitions between the different phases. The fundamental idea of including multiple aspects in the early phases of the design process, is to use them in a combination to help both the process and the project. In this way, the aspects of the process are not seen as obstacles, but as contributors to making better architecture. This enables the designer to integrate the elements in the buildings to have multiple purposes.

The content of the phases in the design process are presented in the following:

Problem
In the problem phase, an initial framework for the given project is determined. The problem is being refined

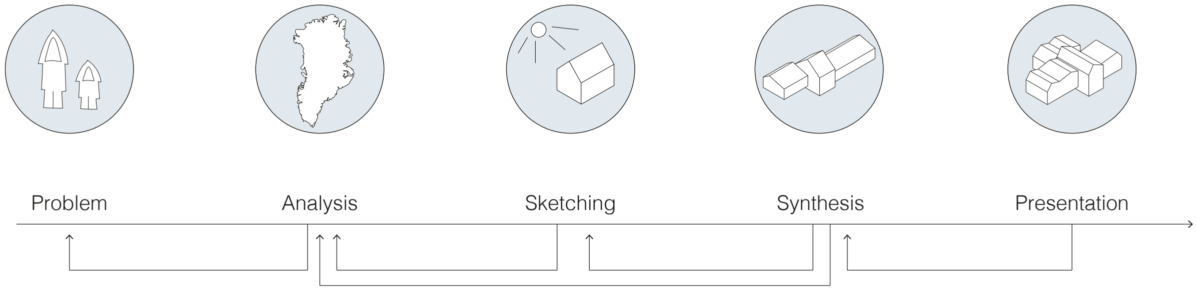


Fig. 4: Method based on this project's phases (Knudstrup 2005)

throughout the analysis phase as the knowledge on the problem is increased throughout the process.

Analysis

In the analysis phase, the knowledge that forms the basis of the project is collected. The gained information results in a phase that consists of different theme analyses, contextual and climate analyses and case studies. Analyses are made within the field of both aesthetical-, technical- and cultural parameters. This leads to the determination of demands for functionality, room program and a vision, which contribute with parameters that work both as catalysts, but also regulations in the following phases.

Sketching

The sketching phase is a creative and explorative phase rising from the knowledge of the architectural and engineering field gained in the analysis phase. Different conceptual ideas, forms and structures are shared through sketching, physical models and digital modelling. The design concepts are developed and discussed in terms of potentials, qualities and challenges.

Synthesis

The synthesis phase is the stage at which the project is evaluated and reassessed. Thus, ideas and solutions are constantly adjusted and optimized, in order to achieve synergy between the design and the technical solutions, still with the design criteria in mind. This is also the phase where details are being refined and optimized and more qualities are added.

Presentation

The last phase, presentation, presents the final design through descriptions, visualisations, illustrations and calculations. It expresses the visions and ambitions of the project and how they are reached (Knudstrup 2005).

WHY GREENLAND? / SOOQ KALAALLIT NUNAAT?

Greenland is one of the world's most magnificent, harsh and untouched countries. The tough climate and the lowest population density in the world make the people and the country unique. However, there are some major challenges in the society as it is today.

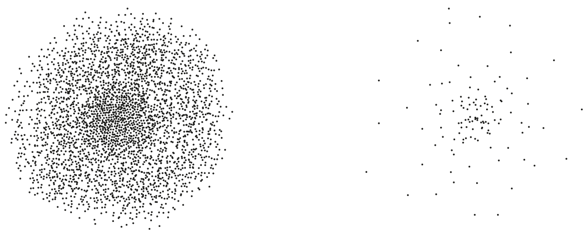
The rocky underground, the ice sheet and the rough and ever changing climate make Greenland a challenging place on Earth to settle. Moreover, there are only 56.000 inhabitants in the size of 50 times Denmark. It requires a special physical and mental ability from people to survive in such an environment, which makes the natives exceptional. Although this is what makes Greenland beautiful and unique, it is also what causes problems. It is an extremely expensive country to run, which results lack of infrastructure, health care and education. This is reflected socially (Hansen 2017).

The society of Greenland has changed dramatically; centuries of suppression of the indigenous people was complemented by a forced industrialization 65 years ago. It has left the natives with no influence.

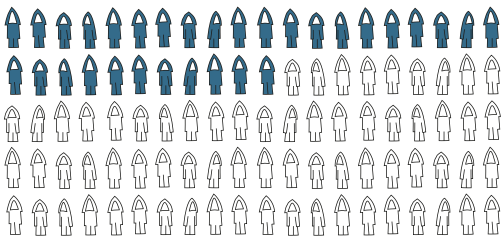
Dark statistics about suicide rates, neglect of children and sexual abuse, and reputation as alcoholics (fig. 5) pursue the country and its people. The social worker and Greenland expert Per Hjelm Hansen describe s it as a 'grotesquely depressed society' (Hansen 2017). These social challenges make Greenland an interesting case.

Greenland has many challenges socially, economically and environmentally and they are all linked. The main motivation for this thesis is to understand, reverse and help some of these challenges from a sustainable standpoint.

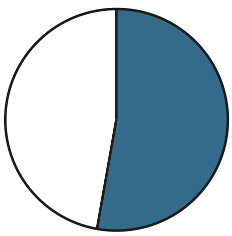
The density in Denmark is 434 times higher than in Greenland
(Larsen 2017 and Grønlands statistik 2017)



31% of Greenlanders have been subjected to sexual assault (Sá Lima et al, 2012)



54% of all Greenlanders come from a home with alcohol abuse (Sá Lima et al, 2012)



1 in 5 Greenlander under the age of 24 has tried to commit suicide
or had serious thoughts about it (Bjerggegaard 2007)

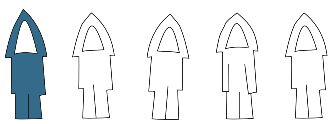


Fig. 5: Statistics

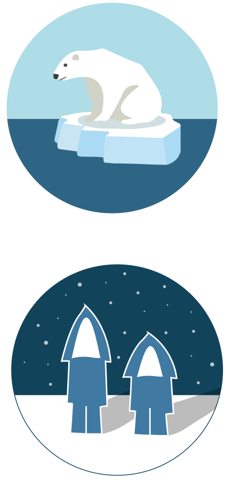


Fig. 6: Social and environmental sustainability

WHY SUSTAINABILITY? / SOOQ BÆREDYGTIGHED?

Greenland has one of the clearest examples of the consequences of global warming; the ice sheet is melting and it is one of the main reasons for rising water levels in the oceans globally. It is predicted to rise 59 cm within this century (Christensen et al 2012).
The current version of the building regulations in Greenland is BR06, which testify their lack of focus on environmental sustainability. However, there is a desperate demand of change from the global society, and this thesis will embrace that responsibility.

Economically, Greenland is dependent on Denmark via the multi-billion block grant the society receive every year. It equals to more than 60.000 DKK every year per Greenlander (Hyltoft et al 2013). Economy will not be the greatest focus in this thesis, but helping Greenland to be more independent and innovative through other initiatives, will result in economic benefits.

Likely, Greenland has massive social challenges as explained previously. The thesis will aim to make frames of a safe childhood and invite and educate individuals to an independent existence.

Although Greenland is socially, environmentally and economically challenged, it is not a place where sustainability matters (Mikkelsen 2017). Through a holistic approach this thesis will investigate how sustainability can be form and function determinate, and inspire to beneficial development of social and economic perspectives as well as protective to the environment, and to greater independency in Greenland.

Fig. 7: Child walking in the night

WHY A CHILDRENS' AND FAMILIES' HOME? / SOOQ HJEMMI?

Children observe the world in an exploratory manner differently than adults, and they correspond to their surroundings constantly. There are numerous psychological and pedagogical theories about children's evolution, and most adult behaviour means to be based on experiences from the childhood.

Children explore and interpret spaces in their own way. They have a lively imagination and watch the world from a different height, and when designing for children it is important to stimulate their curiosity to allow them to evolve. Through design you can regulate and invite to certain behaviour (Jensen 2012).
Children at children homes are extremely neglected and therefore they require special needs, which must be met. A children's home needs to create safe and protected frames for vulnerable kids, but most importantly it needs to be a home (Dunker 2017). A children's home is also a workplace for pedagogues and caring assistants though, which needs to be met in an optimal way. Therefore, these two user groups' architectural and organizational requirements must be taken into consideration when designing. Additionally, the home must also make frames for the chrilren's relatives, because that often is their strongest link to the society.
Vulnerable children often have mistrust to the surroundings. Therefore, it is important to design safe spaces for routines and predictability so the child can re-establish trust to their surroundings. The architectural and functional challenge is how an institution can be designed to be a home. There are three user groups and thus different uses the house needs to accommodate.

Children are often left to themselves in Greenland because the parents are not able to take care of them. There are multiple examples of children walking around at night because they are too afraid to go home due to a parent either drinking or being violent (Hansen 2017 and Fleischer 2017). Throughout the process of this thesis the program expanded to help both vulnerable children and vulnerable families that wishes a proper and independent family life.

This thesis will investigate how a children's and familie's home can affect evolvement positively and decrease their challenges.
Combining the social and environmental challenges of Greenland in a children's and families' home is the aim of this master thesis.

Fig. 8: Picture of Nuuk

PROGRAM

/ oqaaseqatigiilerineq

NUUK STUDY TRIP / NUUK PAASINIAALLUNI ANGALANEQ

The group had a motivation and desire to provide a solid basis of empiric material for developing this project. In February, we went to Nuuk to collect data. There were several purposes for the trip; to investigate matters on existing children's homes and define our target group, to understand the Greenlandic culture and their vision for development of the city and lastly to visit the project site.

Before project start we visited the children's home in Kerteminde, Villaen, designed by CEBRA architecture in 2014. Seeing the house and talking with the deputy superintendent Annette Dunker witnessed severely damaged kids and teenagers. They were difficult to control and would often have internal conflicts, because their ability to build relations is injured, explained Annette Dunker (Dunker 2017). However, the experience in Nuuk was significantly different. Our impression of the two children's homes, Red Cross Children's Home and Mælkebøtten, was that the kids was not expressive and outward reacting to the same extend as in the Danish Villaen. The pedagogues only seldom have conflicts with the kids as well as the kids only seldom have conflicts mutually. This results in greater sense of community and belonging among the kids and employees. This is partly due to a cultural way of being where feelings are not expressed widely. Partly due to less damaged children. The way through the social administration is shorter because there are fewer options before coming to a children's home, whereas in Denmark the offer of foster families is bigger. These observations will affect the architectural design strongly.

Although Nuuk has 10 children's homes they still need facilities. There are not enough places generally, but especially infants and families need

Fig. 9: View of iconic colourful buildings in Nuuk

accommodation. The visit to Mælkebøtten gave an understanding of the general lack of facilities for infants at children's homes (for pictures from the two children's homes, see fig. 10). There is today no children's home with these services, and therefore we defined our target group on that basis (Dam, pers. comm., 2017). Furthermore, the existing children's homes are not built as children's homes, why there are some organizational challenges.

Nuuk municipality had cooperation with the architecture firm Fantastic Norway in 2013 (Eugenius 2017), for a project called House of Families. The idea of the project was with the child in focus to offer professional help to struggling women and families. The project was later closed due to economic reasons. Today Nuuk municipality offers the same help in three existing bungalows as a temporary solution.

Visiting the children homes as well as using the city and talking to Greenlanders gave an impression of Greenlanders as being an open-minded, informal and social based nation. They value their history, traditions and nature, and try to implement and respect it in their society. This affects the way Nuuk develops now and in the future. The urban consultant Maritha Eugenius designated a vacant building site in the development plan, which is used as the building site in this project.

The study trip to Nuuk was essential for understanding the building site. Likely, seeing the existing facilities for children defined our target group, and furthermore it gave us a cultural understanding of the Greenlanders. The following analyses will elaborate on the relevant aspects.

Fig. 10: Collage of pictures from Red Cross Children's home and Mælkebøtten

GREENLANDERS / KALAALEQ

There are extensive social challenges in the Greenlandic society, and it is important to see Greenland in a historical context to understand – and remedy – the problems they face today.

Originally, Greenland was settled by artic hunting people and later by Inuits. In 1721 the Danish Priest Hans Egede travelled to Greenland to settle and to make the inuits Cristian and increase trade relations. Greenland became a colony dependent on Denmark and he founded the city of Nuuk (Danmarkshistorien.dk 2017). The relatively limited exchange of people between Denmark and Greenland allowed Greenlanders to live primitively and in big families and clans as before. Greenlanders were gregarious people, where the community was more important than the individuals. Everybody must contribute to survival and the limited food and resources were shared, and if elderly or sick could not contribute anymore, they would leave and never come back. It bears witness to a very collectivistic lifestyle and thus a different relation to life and death, where the individual's life is not perceived as being as valuable if it cannot contribute to the community, explained the social worker Per Hjelm Hansen (Hansen 2017).

After Second World War the pressure from the United Nations resulted in Greenland being assimilated to Denmark as a county. Then things change quickly, says former school principal in Greenland and head of The Greenland House in Aarhus, Jørn Holbech (Holbech 2017). The county needed to develop and adapt to the Danish industrial standard and European values. Thus, Greenlanders became wage earners instead of primitive people. People lost their valuable roles in the clans and felt redundant and unimportant. Furthermore, the invasion of Danes as master teachers resulted in the Greenlanders being minions, and their own culture and history was disregarded, which resulted in 'the population being depressed', as Per Hjelm Hansen formulates it, and it lead to massive abuse of alcohol and cannabis (Hansen 2017).

Although Greenland gained Home Rule in 1979 and autonomy in 2009 the society still fight to find foothold as a modern, western society. The turbulent industrialisation and modernisation of a primitive Greenland within only 65 years still results in identity crises and cultural schisms for many people today.

Fig. 11: Greenlandic children (Berlingske Tidende 2010)

Family and genealogy has great importance for Greenlanders. Kids used to be raised freely and to take care of themselves and each other already from the age of 3-5 years, because there were always many family members in the area to keep an eye on them. Upbringing is about being obedient and responsible for the community, and it is still predominant. The individuals in Greenland are not formed to be independent from an early stage in the same way as they are in Denmark (Jensen 2004). Today, the big-family is replaced by the nuclear family, but kids are raised in the same unrestricted way, which is a result of their unconcerned and relaxed attitude.

Traditionally, kids and young people would learn from their masters how to hunt, built, cook and sew – the community would transfer knowledge and experiences through generations. Today, it is imposed to be a knowledge-based society though, and what they are good at is disregarded. The low population density and small societies make it even more difficult to gain and share knowledge on an academic level, and therefore Greenland has a low level of education (Holbech 2017).

Additionally, Jørn Holbech experienced that Greenlanders are by nature very warm, polite and humble people. The collective is more important than the individual and therefore they do not brag, stage themselves and drag unnecessary attention. They gather at any occasion. They do not talk about feelings, but find peace in nature instead and turn personal issues inward. This is the beauty of the people, but this and their way of seeing life and death are also reasons for the high suicide rate in Greenland – being part of something bigger makes the individual less important (Holbech 2017).

The history of Greenland, the development of the society and cultural norms for behaviour result in many Greenlanders struggling with the western-inspired and individualised society. It often results in abuse of different kind, which inherits through generations. The society is improving socially although there are still massive abuse and neglect of child care in many families.

NUUK / NUUK

Nuuk has 16.000 inhabitants and constitute as a modern city and capital of Greenland, and 31% of the Greenlandic population lives in Greenland (Pedersen 2016).

Young people emigrate because there are limited educational possibilities in Greenland, and many settle in Denmark after graduation. Therefore, the total number of inhabitants in Nuuk has decreased slightly through the last years (Pedersen 2016).

Most urban and cultural services are located in the centre such as offices, educational institutions, museums and restaurants (fig. 12). There are only few high-rises, otherwise the centre is mainly dominated by low dense buildings. There are no green parks in Nuuk, which make the city seem bare and monotonous. All urban spaces are open and manmade in solid materials, and there are no trees to report about the age of the city.

The municipality of Nuuk has a 'Nuuk City Development' plan where both new residential areas are in motion and the existing city is getting an upgrade within the next 10 years. This is part of an urban development aiming for 30.000 inhabitants in 2030, explained Maritha Eugenius (Maritha Eugenius 2017).

One of the key factors is creating better environment for the children. They state, if our children should have a safe childhood and a good education, framework must be properly functioning. The municipality wants to renovate existing schools and develop new institutions and schools (Nuuk City Development 2017).
However, another strategy for Nuuk is to state themselves in the world. They use ambitious architectural projects to create landmarks and thus attract potential inhabitants and tourists. Amongst the projects are two buildings designed by BIG Architects (Maritha Eugenius 2017).

Lastly, Nuuk is surrounded by nature, which is meaningful to its people. Especially the mountains 'Lille Malene', 'Store Malene' and 'Sermitsiaq' are natures beloved landmarks.

Nuuk is under development and they have taken inspiration in the western urbanization. They use architectural landmarks to promote themselves as a modern Western society and have ambitious goals for the future.

Fig. 12: Map of Nuuk


N
Kote height 10 m
0 100 200 500 1000 m
Site
Nuuk Art Museum
Hans Egede Church
Queen Ingrid's Hospital
Katuaq - Cultural Center
Hans Egede Statue
Greenland National Museum
Qernertunnguit
Kangillinnguit
Industrial area
Nuuk Airport
Qarsaalik
Eqalugalinnguit
Vandsoomradet
Nuussuaq
Citycenter
Radiofjeldet
Tuujuk
Industrial area
Qinngorput
Industrial area
Qinngorput
Children's Home
School / daycare
Public institution
Education

THE SITE / INISSIINEQ

The site is located in the subarea Qernertunnguit 2 kilometres from the centre in the north-western part of Nuuk, facing the Godthaab Fjord and the well-known mountain, Sermitsiaq (fig. 13).

The site was assigned at a meeting with Maritha Eugenius, an urban consultant in Mayors Office, Sermersooq Municipality. The municipality has 2 empty building plots at the site intended for public institution (Eugenius 2017). The buildings around the site should accordingly to the district plan, Center Area for Qernertunnguit West, maintain as much view towards nature as possible and the foundation of the buildings should not exceed the necessary, in relation to both the structure and the architectural expression (The Municipal Council 1998). The footprint of the site is 2400 m2.

Today, Nuuk has 10 children's homes that inhabit 128 children. In 2015, 370 children were assigned to children's homes in Greenland and almost two-thirds of them was placed in Nuuk (Department of Family, Equality and Social Affairs 2015). Red Cross Children's Home, is the only institution build to function a children's home. Being build 60 years ago, it is today outmoded in functionality and building technique. The majority of the children's homes are instead placed in older single family houses. A new building project will give the opportunity of better facilities for the children and families.

The location in a residential area with an easy access to day care and a bus stop are essential aspects in creating a practical everyday pattern for both staff and children. The site is surrounded by colourful residential blocks with pitched roofs. There is one existing children's home and a kindergarten in the area. With a view towards nature and sea and a mountain shielding the area from the city centre, the site has interesting possibilities of creating a calm and secure area for the children. Qualities that both Inunnguaq Fleischer, deputy at Mælkebøtten, and Else T. Lund, Head of Red Cross Children's Home, found essential for the location of a future children's home (Lund 2017 and Fleischer 2017).

The site is located on a rocky underground of cliffs in a hilly terrain. Pictures from the study trip are shown in fig. 14-19. On the landscape sections (fig. 21 and 22) and the axonometry (fig. 20) the site is shown in its context.

Fig. 13: Mapping the site


N
0 10 20 50 100 m
Kote height 1 m
Sight over the Godhaabs fjord
Sight towards the mountain Sermitsiaq
b1
1a
Residentail
Site
a
Residentail
Kindergarden
Children's home
Bus stop
b

Fig. 14: View of the suburb Qernertunnguit and the site surroundings

Fig. 15: View from access road towards North with the site on left hand

Fig. 16: View from North towards South and the access road with the site on right hand.

Fig. 17: View from the site towards North and the mountain Sermitsiaq

Fig. 18: View from northern end of the site towards a mountain range in West

Fig. 19: View from north-east towards the site with the neighboring dwellings

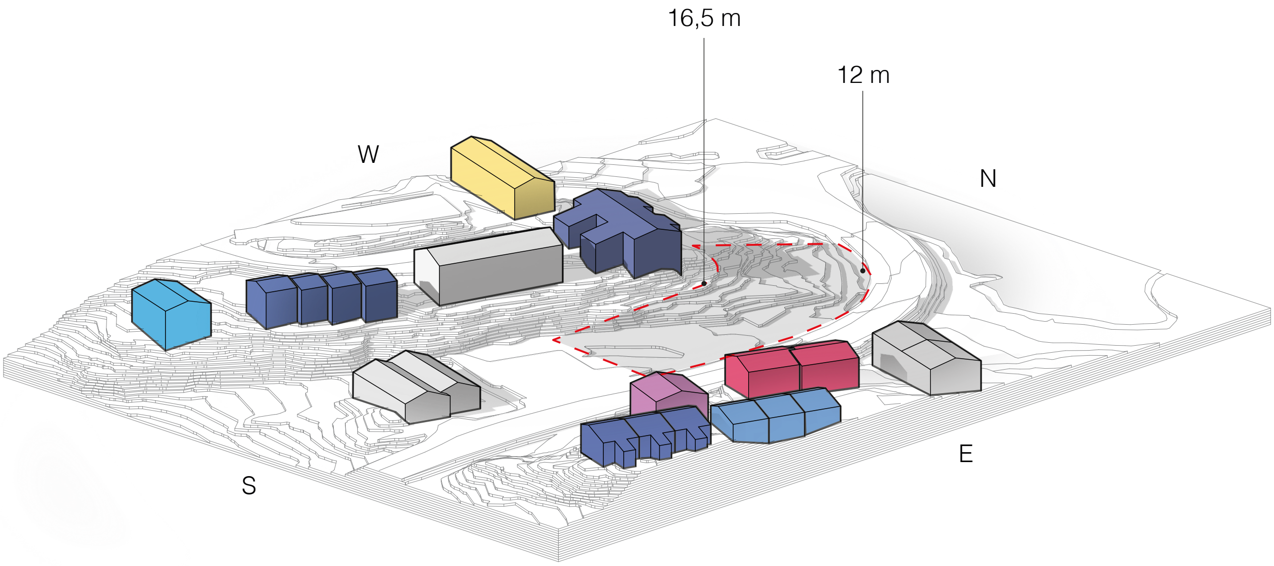


Fig. 20: Axonometry of the site and close context

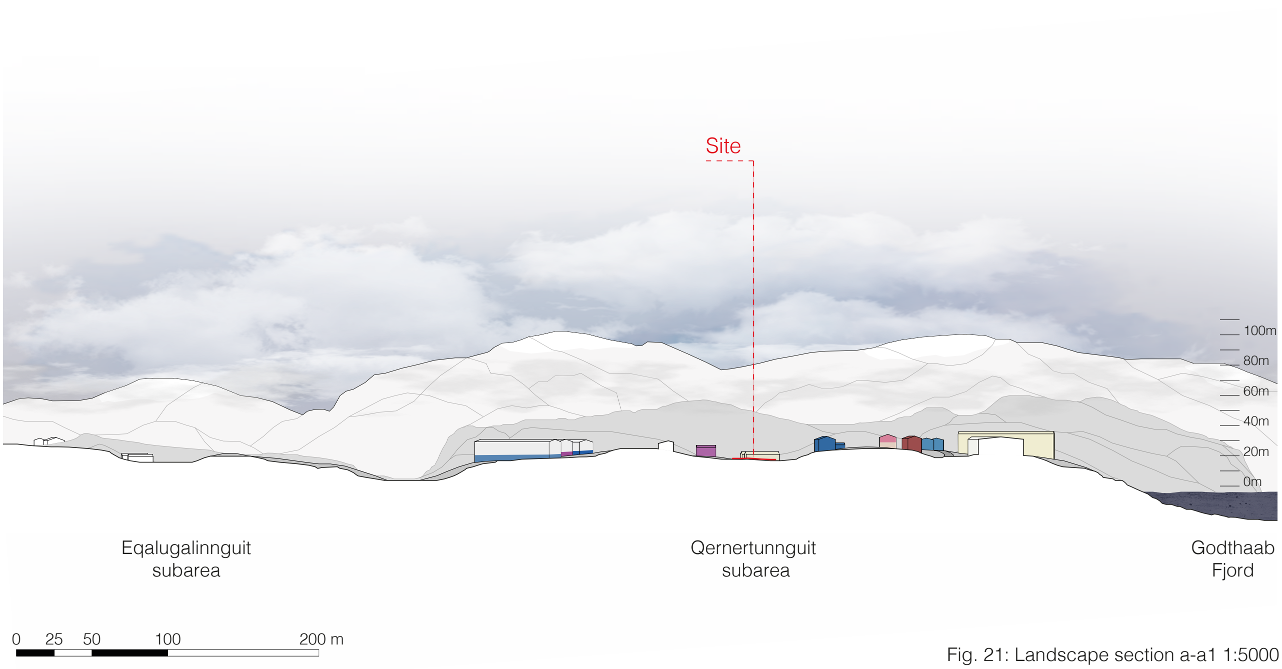


Fig. 21: Landscape section a-a1 1:5000

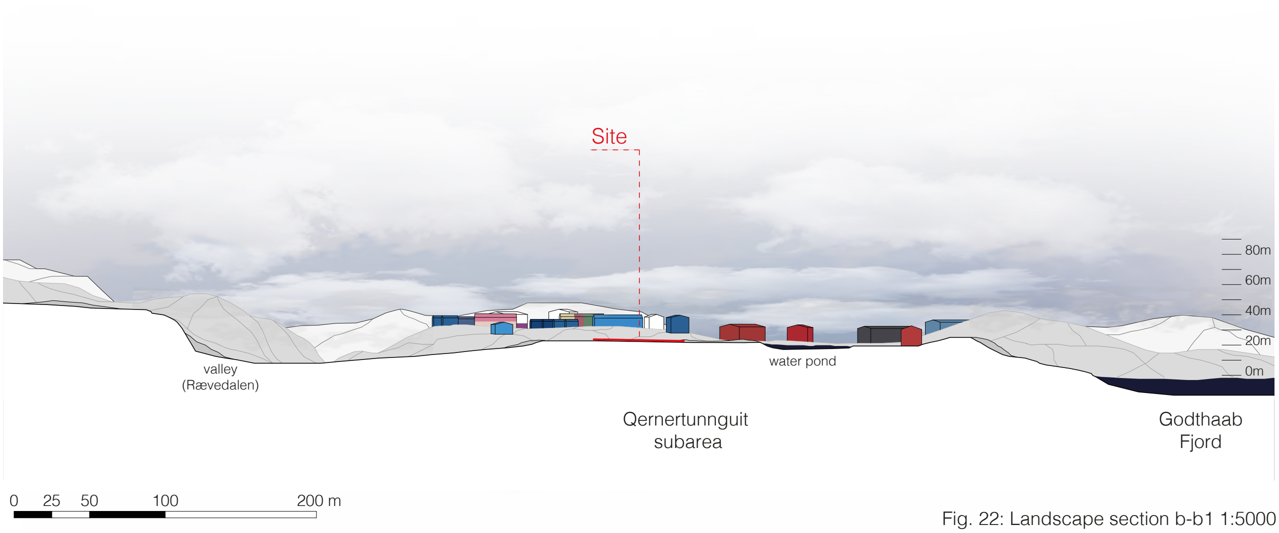


Fig. 22: Landscape section b-b1 1:5000

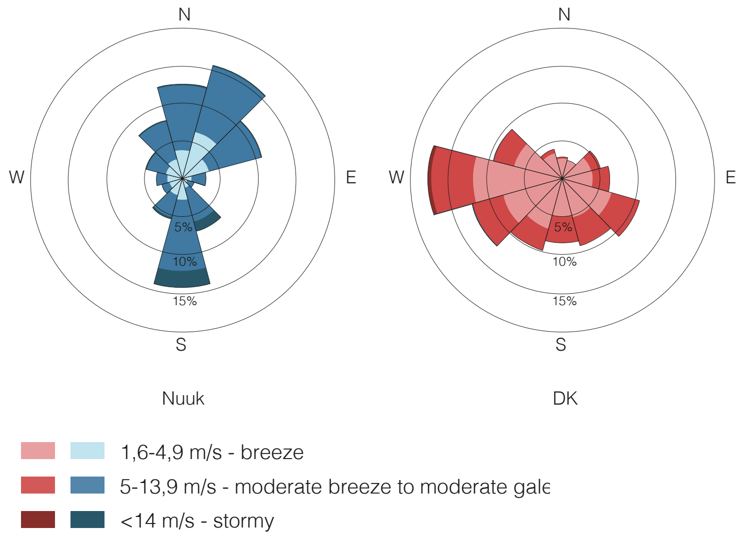


Fig. 23: Wind comparison between Denmark and Nuuk (Rambøll 2013 and DMI 2017)

SITE CONDITIONS / INISSIINEQ PISSUTSIT

The ocean currents and ice cap is determining for the climate in Greenland. Nuuk is placed in a costal climate, where the ocean keeps the temperature relatiely constant. The ice cap keeps the temperature low over the year. Wind, temperature, precipitation and relative humidity is compared with Danish data to give an impression of the extremes.

The wind in Nuuk is very determining for the temperature (fig. 23 and 24). The dominating wind direction in Nuuk is from South and north-northeast. Summer is dominated by warm southern wind, which is strongest during the light hours. It makes variation over the day larger than it is in Denmark as can be seen on the graph. Winter is dominated by wind coming from the cold icecap, which is more constant over 24 hours and keeps the mean temperature below 0°C from October through May. The maximum wind speed from North can reach 26 m/s, although the mean wind speed is 6,5 m/s (Rambøll 2013). Generally, the comparison shows that Nuuk is more windy than Denmark. Therefore, there is a risk of drifting snow from North during winter. Entrances and outdoor areas should therefore be designed with attention to the wind conditions.

Although temperatures can easily reach -20°C in Nuuk, it does not seem as cold as it would in Denmark, because of a low relative humidity (fig. 25). The graph shows how the relative humidity varies over the year and the day. Relative humidity is an expression for the amount of mousture the air contains in relation to how much it can contain. This is dependent on temperature and air pressure. The low relative humidity must be considered when designing for indoor comfort.

The amount of precipitation varies over the year from 41 mm in January to 90 in September (fig. 26). Because of the cold temperatures, a large amount of precipitation will descent as snow, making the landscape change to a white scenery during the winter months. New, dry snow has a water equivalent on 14-20, which means that 41 mm precipitation in January falls as more than 600 mm snow. The large amount of snow, creates logistic challenges which must also be taken into consideration on the site (Hansen 2010).

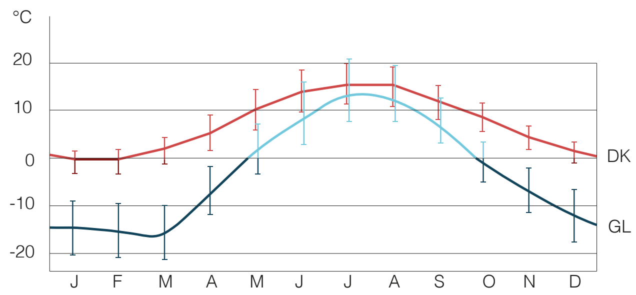


Fig. 24: Comparison of mean temperature, average day temperature and average night temperature in °C between Denmark and Greenland (Cappelen et al 2001 and DMI 2017)

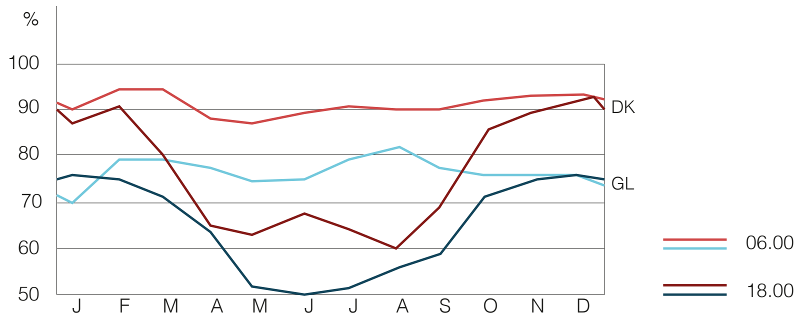


Fig. 25: Comparison between mean relative humidity at 06.00 and 18.00 in % between Denmark and Greenland (Cappelen et al 2001)

Fig. 26: Comparison of precipitation in Denmark and Greenland in mm (DMI 2017)

SUN ANALYSIS / SEQINEQ OQAASEQATIGIILERINEQ

At summer solstice in Nuuk the sun rises at 02.44 and sets at 00.04, and at winter solstice it rises at 10.22 and sets almost 4 hours later at 14.28 (fig. 27). It is a huge variation in amount of daylight and therefore challenging to design after.

As can be seen on the fig. 28, the sun does not hit the site at winter solstice, whereas there is plenty of light in summer. How and where the sun hits the site throughout the year is visualized in fig. 29 on next page. The results show a large variation from summer- to winter periods. As a consequence of the low angle of winter sun, there is no direct sunlight on the site at the darkest periods of the year. Contradictory, the sky will be lighted all hours of the day in the lightest periods of the year.

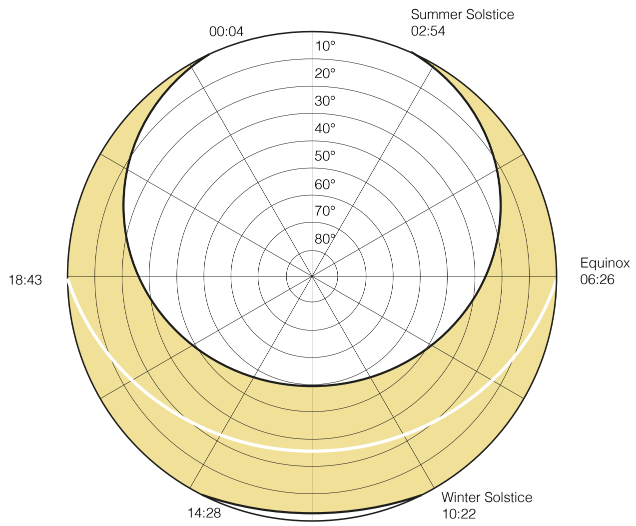


Fig. 27: Sun path (Gaisma 2017)

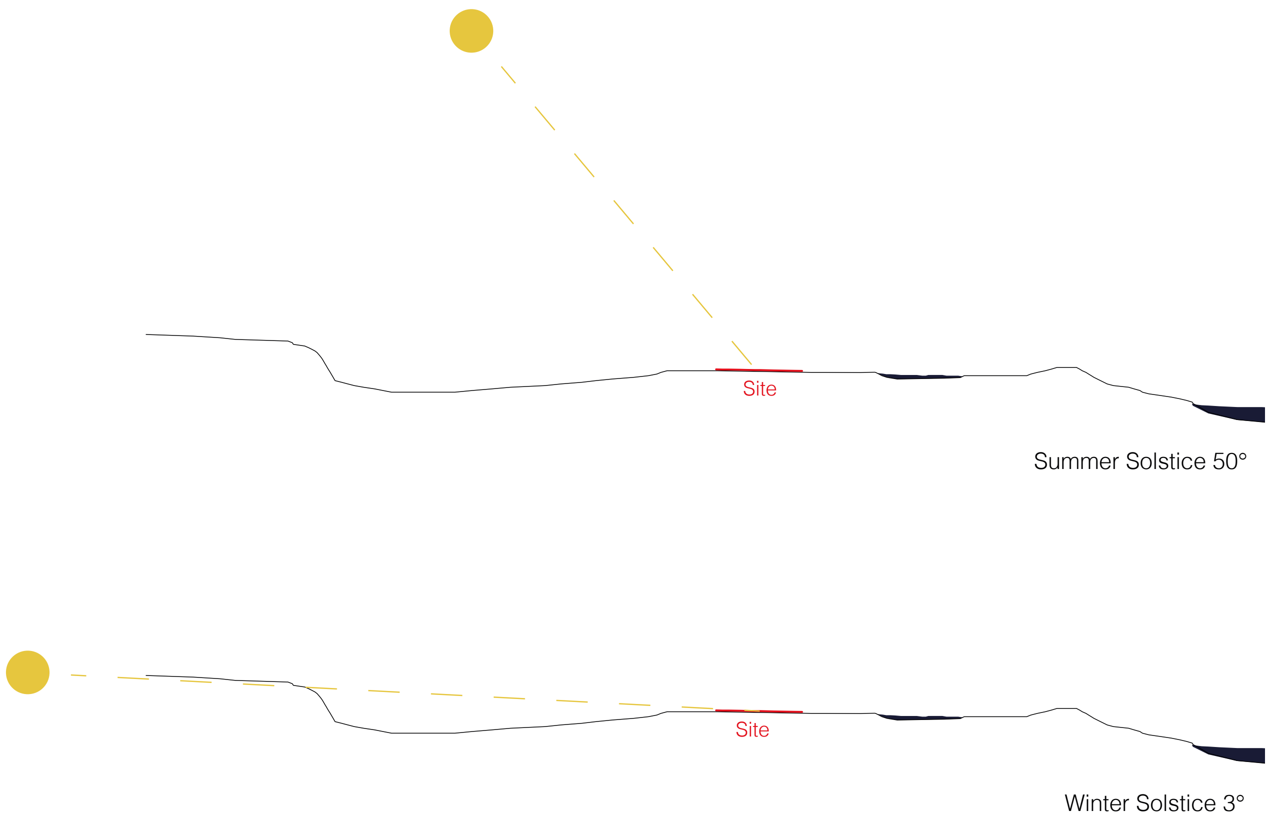
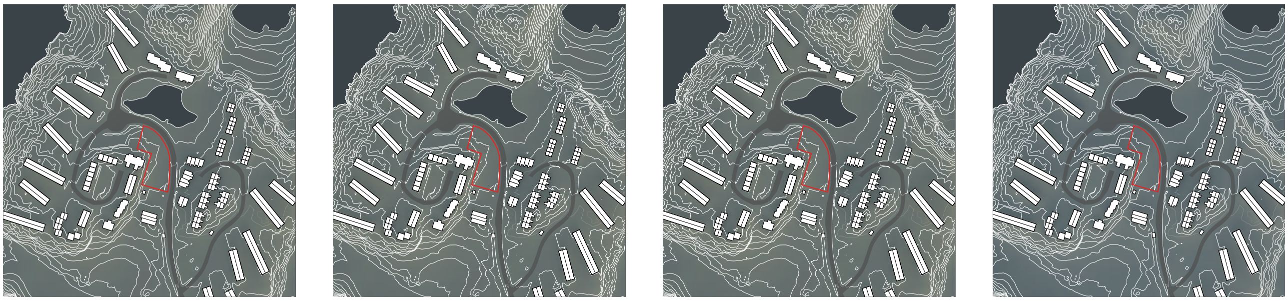


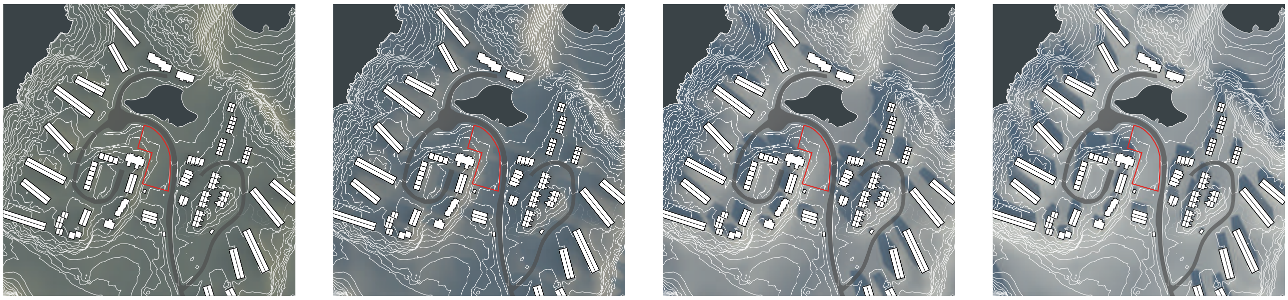
Fig. 28: Summer solstice and winter solstice

06.00 | 08.00 | 10.00 | 12.00

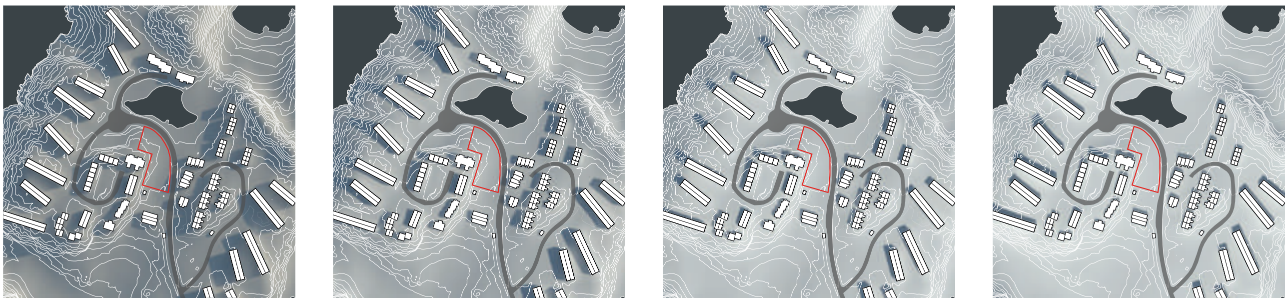
21st of December - Winter solstice



20th of March - Equinox



21st of July- Summer solstice



14.00 16.00 18.00 20.00

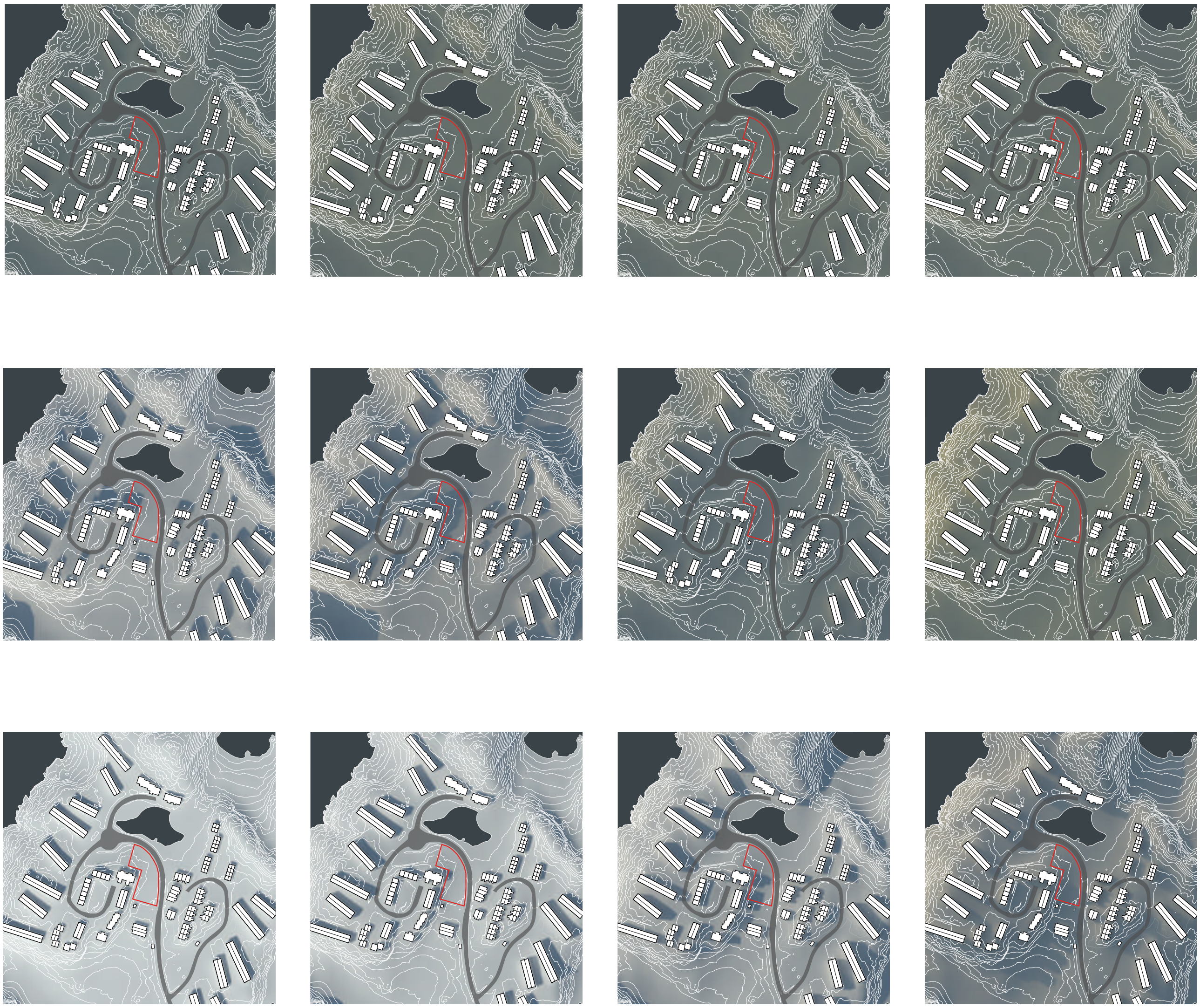


Fig. 29: Sun and shadow on site at solstice and equinox

Fig. 30: Turfhut in Greenland (Visit Greenland 2017)

BUILDING TRADITIONS / ILLU ILITSOQQUSSAQ

The traditional Inuit culture was dependent on nature and they lived both in and from their natural surroundings. This required dwellings that were simple and easy to construct – and located close to the places where hunting was good. In wintertime, they lived in turf huts and occasionally in igloos, whereas in summertime they lived in tents made from animal hide.
The typical winter residence, the turf hut, was low, square and its walls were made of large stones and turf. The roof was supported by wooden beams made of driftwood (fig. 30) (Visit Greenland 2017a).

Hans Egede's arrival marked the new colonial style. During the colonisation, wooden houses were sent from Scandinavia as timber kits, and the tradition of the characteristic, brightly coloured houses began. The colours were practical and indicated the function of the building: Commercial houses were red; hospitals were yellow; police stations were black; the telephone company was green and fish factories were blue (Visit Greenland 2017b).

During the decades after Second World War, standard houses and large concrete blocks of flats dominated the urban landscape, due to the need of housing a lot of citizens in limited space. An example of this is Block P (fig. 31), which stands as a failed icon in Greenland's architecture and history. At the time of construction in 1965-66 it was the largest residential building in Denmark. It was only five storeys high, but more than 200 meters long and hosted 320 apartments, making it resident 1% of the total Greenlandic population. With its concrete exterior and a floorplan different from Greenlandic way of living, it rapidly became a symbol of failed post-colonial urbanization, imposed by an un-empathic Danish administration. It contrasted the traditional weatherboard houses painted in bright, optimistic colours (Rosing 2012).

Fig. 31: Block P (Kucera 2009)

Fig. 32: Nuuk westcoast

The establishment of Home Rule in 1979 signalled a shift towards architecture, which linked old and new expressions. The larger cities saw a return to the colourful wooden houses. Spacious, light dwellings were built in a wide range of colours, where also purple, pink and orange buildings appeared in the urban landscape (Visit Greenland 2017b).

In recent years, the municipality of Sermersooq has formulated an architecture policy, with the purpose of creating a greater focus on architecture and how it influences the identity and environment in the cities. The policy concludes that good architecture is 'when the physical environment forms framework of the good life'. Meaning, the senses should be stimulated by the physical environment and the surroundings should be understandable in human scale and provide inspiring settings for community life (Narup 2016). It is difficult to recognize a certain building style in present Greenland. A block with pitched roof is significant for residential buildings, but form language today is exploratory as in many other western countries. Facade materials are mostly non-organic, as a consequence of a requirement of long lasting materials, which can manage in the harsh climate without maintenance and decay (Mikkelsen 2017). Furthermore, all building materials in Greenland are transported from Denmark. Due to the transportation, the building planning is comprehensive and it has a large influence on both the economy and the environmental impact (Mikkelsen 2017). Consequently, the use of local materials plays a significant role, when building in the Greenlandic context.

The new architecture policy and the absence of a modern building style, allow more exploration in architecture.

SUSTAINABILITY / BÆREDYGTIGHED

Sustainability as a concept is comprehensive, and depending on the approach, you will find various definitions of the term. To use sustainability as a design parameter, it is necessary to establish a definition of what sustainability is.

The term, sustainable development, was first popularized in the Brundtland report in 1987. The aim of the report was to create awareness of global sustainability, thus introducing an understanding of sustainability, including both social, economic, political and environmental issues (World Commission on Environment Development 1987).

The last decades, sustainability has been a profoundly debated topic, where the term has been used and misused in an extent to which the understanding is now more diffuse. A response to this progress, is the various sustainability certification schemes, which attempt to collect the original idea behind the concept of sustainability, and systemize it into tangible criteria and evaluation methods.

The certification system used in Denmark is DGNB, where several criteria within the 6 themes - sociocultural- and functional qualities, environmental qualities, economic qualities, technical qualities, process qualities and site qualities - are evaluated. The different themes of DGNB are visualized in the diagram (fig. 33). Compared to other certification schemes, DGNB has a holistic approach toward sustainability, where the different themes are equally important (DGNB 2017).

In Greenland, the awareness of sustainability is present, however it is mostly used as a buzzword. The term

Fig. 33: DGNB

is an undefined stranger with many facets, which they are not capable of integrating in their buildings as they cannot find the profit of doing it.

Greenland is not ambitious environmentally. The newest building regulation in Greenland is from 2006, therefore the requirements for the energy framework are low compared to the Danish requirements (Direktoratet for Boliger og Infrastruktur 2006). Sustainability is not a general concern and interest when building in Greenland, explained the architect Signe Mikkelsen (Mikkelsen 2017). It is a paradox that the ice sheet in Greenland is melting quicker than ever before, which causes dramatic changes locally and globally, and the building industry is still not taken sustainable strategies into consideration when designing.

Another important aspect of environmental sustainability is the life cycle analysis (LCA), a comprehensive calculation of the total environmental impact of a building throughout its lifecycle. The calculation takes factors from material production, construction, operation, maintenance and the demolition into consideration. Furthermore, all materials are transported from Denmark, which cause an extra transport expense.

The ambition for this master thesis is to be a frontrunner of building sustainably. Economic and social sustainability will also be demanding factors, and different design decisions will be taken with all three and possibly more aspects in mind.

MENTAL SPACES / SIANISSUTSINUT INI

A large part of Greenlandic kids suffer from mental well-being. Experiments have proved that architecture has influence on human's mental health. Likewise, Greenlanders tend to find peace and energy in nature.

In 1984 the first evidence-based experiments were made by the psychologist Roger Ulrich. He proved bedridden in a hospital with nature views from the bed recover faster, have less pain relievers and have fewer complications than bedridden who do not have nature views. Thus, the physical environment directly affect the patient's healing (Petersen 2012). Although the setup for this experiment is different than for this project, one can assume that nature still has a positive influence on mental well-being.

Research on stress and architecture supports this assumption. Recent research experiments have shown that open spaces affect the stress and immunity hormone cortisol less than closed spaces (Fich 2013 p. 148-149). This test is made on adults only, but it is assumed to have the same positive effect on kids. Therefore, designing open spaces with views to the outside is assumed to give the best opportunities for neutral cortisol level and thus less stress for the children.

The openings also contribute to daylight. An optimal lighting environment does not only create good viewing conditions, it also has a positive influence on the human's well-being both in terms of health and sleep quality.

Colours and furnishing will influence the light conditions, since lighter materials reflects more light (Christoffersen 2005).

From a phenomenological and qualitative based perspective nature has an important role for Greenlanders. 'Nature is our heritage' (trans.) states the former Greenland Minister of Culture Mimi Karlsen. It is an important part of Greenland's culture to be able to manage in the wild nature as many generations have done before them (Øhrstrøm 2010). Today, nature is used for diverse social activities in all ages as well as a place for mental restitution, where the deafening silence can overwhelm you completely, pictures Jørn Holbech from The Greenland House in Aarhus.

Nature's effect on the human being seems to be positive both from qualitative and quantitative perspectives. Therefore, respecting and including nature in designing the children's home is important and indeed obvious in the scenic settings of Nuuk.

HOME / ANGERLARSIMAFFIK

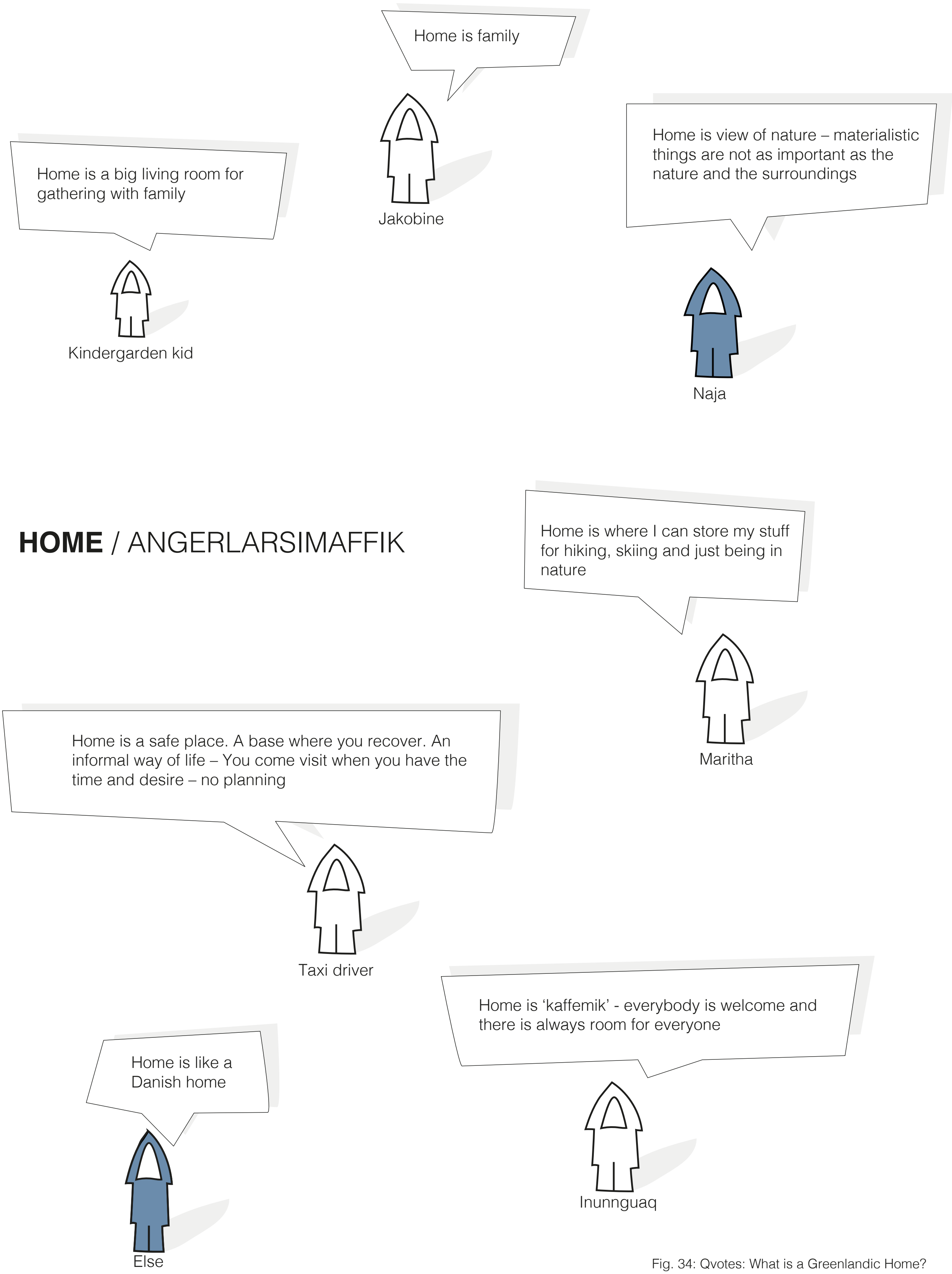


Fig. 34: Qvotes: What is a Greenlandic Home?

FORMATION THROUGH CHILDHOOD / INERIARTORSIMAVOQ

There is a special need for a children's home with facilities to resident infants in Nuuk. Studies have shown that moving during the childhood can have fatal consequences for the child, and therefore the target group at this children's home is to receive children from 0-2 years and house facilities for them until the age of 18. The municipality have also communicated a critical need for family propositions, and thus this residential institution house both groups with the intention of creating a synergic effect.

Although the need for housing vulnerable infants is crucial, the target group has been extended to create the best childhood for vulnerable children. Investigations by the PhD in Psychiatry Roger T. Webb proved that residential mobility during the childhood is associated with multiple long-term adverse outcomes such as violent behaviour to others and itself, mental illness and substance abuse and early death. The studies were made on 1,4 billion children born in Denmark from 1971-1997 until the age of 15. However, it is assumed that vulnerable children are more exposed for these negative tendencies (Webb et al 2016), which is why the project will embrace the full childhood. If children must find new relations several times through childhood they may experience it as neglect and it may damage their ability to create new relationships (Killén 2005).

The psychologist Erik Erikson's theory on psychosocial development further elaborates on this standpoint. The theory states that personal behaviour is influenced by the individual's social interactions. The social environment, combined with the biological maturation process presents each subject for a series of life-stage virtues to be acquired within a certain time before the next virtue arises. Virtues, which are not acquired, will act as problems or crises that will keep returning throughout the individual's lifetime (Harløv 2016). If there are too many disturbances such as moving during these virtues, they may not be handled successfully.

The first psychosocial crisis is trust vs. mistrust appears at the age of 0-1,5 years. If they receive reliable care, it will lead to the virtue of hope. Then it can explore the virtue of autonomy vs. shame, which occurs from 1,5-3 years. The child develops physically and becomes more mobile, and it asserts independence by walking away from its caregiver and making choic-

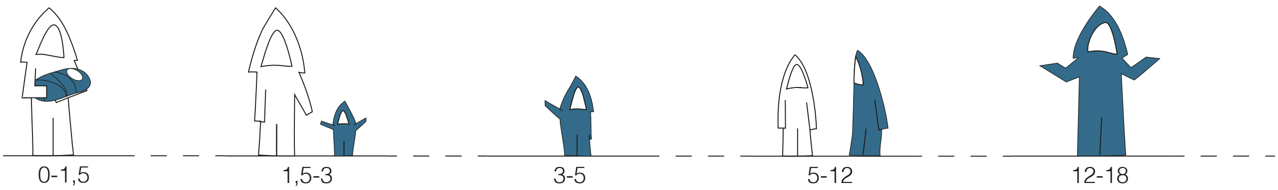


Fig. 35: Erik Eriksons virtues

es. The aim of this phase is for the child to have self-control without the loss of self-esteem. If they succeed they will experience the feeling of will. From 3-5 years, the kids get more independent and are in a particularly lively and rapid-developing period of its life. During this stage the psychosocial crisis is initiative vs. guilt. The child develops a sense of initiative through playing and feel secure in their ability to lead others. If the child is criticized or over controlled, it will develop a sense of guilt and a lack in self-initiative. Success in this phase will lead to the virtue of purpose. In the next phase, 5-12 years, the crisis is competence vs. inferiority. The child is now in school age and peer groups gain great significance. The child will feel the need to win approval by demonstrating competencies, and hereby begins to develop pride in its accomplishments. If the child cannot develop a specific skill, and therefore feel society as demanding, they may develop inferiority. However, some failure is necessary for the child to develop modesty. Success in this stage lead to the virtue of competence. In the areas for the children at the age of 3-10, the themes should therefore be purpose and competence to support the children in their natural psychosocial development. From 13-18 years, they face the virtue of identity vs. disunity, and it is a crucial period for defining identity (McLeod 2008).

The phases are closely linked and it can have broad consequences for the kids to have too many life-changing interruptions through these periods (Webb et al 2016).

Today, the municipality house family facilities in temporary bungalows in Nuuk. The function of families, will facilitate parents in different ages with an unstable family life. Accordingly, to Erikson, the parents can both be in the psychosocial crisis of identity vs. role confusion and intimacy vs. isolation. Both important factors, when being a parent and have responsibility for a child. The areas for families must therefore both support the parent in its own development, towards being a responsible caregiver. But it should also be an environment where the kids can be supported and developed in relation to its own psychosocial progress (McLeod 2008). Having proper facilities for this is crucial.

VULNERABLE CHILDREN / QITORNAQ

Children's development has always been a subject of great interest by psychological theorists. Common for most theories, is the importance of a positive childhood in relation to further development of the individual.

The psychologist John Bowlby's theory about a child's development relies on the attachment theory; A child is genetically determined to develop a set of behaviours, which in a suitable environment will result in the child seeking a closer or a more distanced proximity of those who take care of it. This behaviour serves as a protective pattern in adolescence, and it is the main factor in the formation of emotional bonds between people. The development of the quality of attachments depends on social factors, therefore, the child's environment has significant importance for the formation of the attachment patterns. The attachment pattern depends on the interaction between child and caregiver and it will influence the development of the child, both cognitively, emotionally and socially (Munkholm 2017).

The absence of social relations even from the very beginning of a child's life can have fatal consequences, which is also what Erik Erikson's theory's first phases are concerned about (see 'formation through childhood' p. 48-49). The psychologist Kari Killén describes neglect as a betrayal, which may both include inadequate physical or psychological care, in both passive or active manners. Physical neglect involves failure to provide sufficient needs such as food, clothing, daily hygiene and protection against physical damage, while physiological neglect includes unsuitable emotional conditions and inadequate intellectual stimulation. In passive neglect the provision of basic needs are absent while active neglect is a direct damage imposed by the caregiver, such as physical or mental abuse. The consequences of a neglect affect the child's cognitive thinking, the ability to interact with other humans and the emotional underdevelopments. Nevertheless, new research in developmental psychology shows that children can develop resilience and become well-functioning adults despite a past with failures and difficult family conditions. Protective influences that can make a child develop resilience is partly the individual factors being personal skills and characteristics. Partly the external factors being the socio-economic resources and the surrounding environment. Lastly, meaningful relationships, which throughout the childhood has given the child positive attention, empathy and respect, are vital to the development of resilience (Killén 2005).

Traditionally, Greenlanders lived in big-families including several generations. The children would bond with everyone in the big-family. Therefore, the one-to-one relation between child and parent was not as important, the child was a part of a larger community and indispensable. With the quick transition to the modern society (described in 'Greenlanders'), the previous responsibility of the family and local communities steadily progressed to the responsibility of the state. This shift in responsibilities resulted in a fragmentation of the previously close big-family relationships and an attitude and expectation towards the public instances to take care of the children (Olsen 2001). The deputy head of Red Cross Children's Home in Nuuk Jakobine Mathæussen, further explains that the Greenlanders are adapting the Danish family structures and now live more as nuclear families. This means that as there previously would have been another adult in the big-family structure to look after their children, when the parents were unable to do so, the children are now left to themselves. The generation which are giving birth today, has not been a part of the traditional Greenlandic society. Instead this generation has been raised by an identity seeking generation, in lack of role models. Thus, the psychological damages in Greenland has shifted from previously being later psychological damages, where today the Greenlandic children are victims of neglects even from birth.

To design a children's home, it is important to understand the background of the residents, and how deeply traumatized the children can be. It is not just a home for children, it is a home for children with special needs. It must facilitate this, by giving them a safe and trustworthy base from where they can develop a resilience despite of their difficult past. It should be a home where the possibility to break the negative social heritage can take place.

ARCHITECTURE FOR CHILDREN / QITORNAQ ILLULIORTAASEQ

Architecture is used and interpreted differently by children and adults, and indeed different from age to age. Thus, it is important to understand how infants and children perceive and interact with their surroundings.

Children are more sensual and immediate in their way of using spaces than adults. Spaces for imagination is important, and spaces should not always signal too strongly how they are indented to be used. The abstraction of the spaces must be open in order not to weaken the children's imagination and thus their ability to evolve (Jensen 2012).
Likely, privacy and intimacy is crucial for every child. To be able to retreat and have control of the near surroundings is important for the kid in order not to be overstimulated. Small niches and corners are areas, where they can be part of the situation socially without interacting. This needs to be laid out very carefully when designing for mentally damaged and possibly outward reacting kids though (Dunker 2017). The children should have a feeling of not being seen and watched, but the pedagogues benefit from having an indication of the children's activity.

Room scale, proportion and physical layout of furniture and equipment have significant effect on the behaviour and development of young children. They stay much on the floor when learning to walk and for playing. Thus, it is important to consider warmth and tactility on this surface. Additionally, scale of interior is important for the kids to interact and learn optimally with each other. Placement of windows is determining for views and interaction with the exteriors, which also help their evolvement and curiosity positively. This applies to older children too (Siegel 2016).

Colours can have a significant impact on children's behaviour and attention skills too. Bright colours can initially exude a sense of joy and fun, however they can often be over-stimulating for the children and adults who are spending many hours in such environment. Early childhood colours are warm and natural (Siegel 2016).

When designing for socially challenged kids the common spaces are extremely important for their ability to develop social skills. They are vulnerable and thus have a sensitive limit for

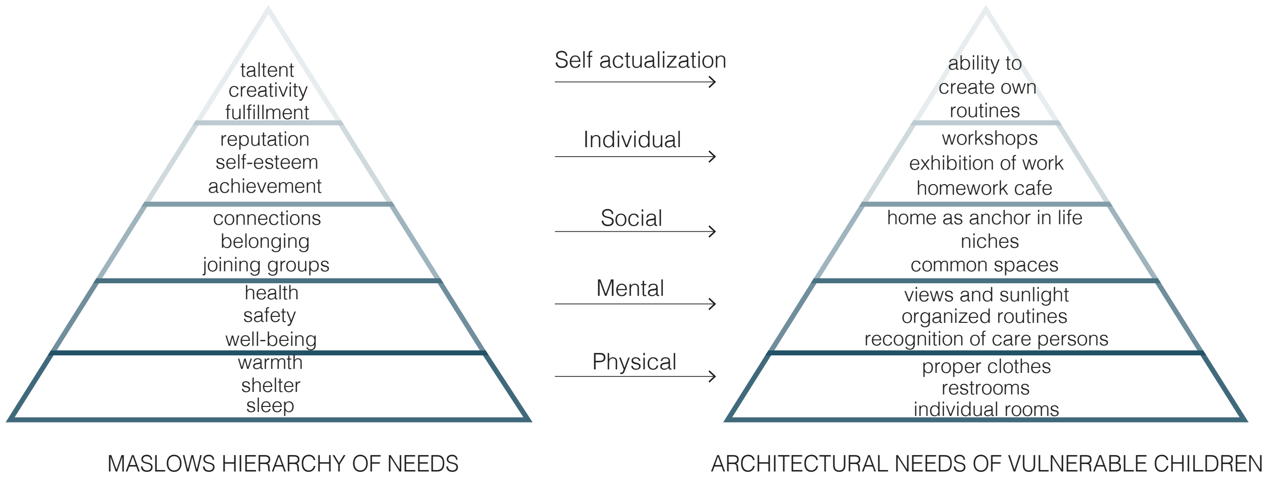


Fig. 36: Interpretation of Maslows Hierachy of Needs (Gyldendal Den Store Danske 2017)

stimulation that architecture provides, which is different from other kids. Further, they often have mistrust to their surroundings and thus view of the room is important.

Accordingly, to Maslow and his Hierarchy of Needs, there are five stages at which you can be (fig. 36). Maslow stated that people are motivated to achieve certain needs and that some needs are preferred over others. Our most basic need is for physical survival, and this will be the first thing that motivates our behaviour. Once that stage is fulfilled the next stage motivates us (Gyldendal Den Store Dansk 2017).
Vulnerable children do not always have their basic needs covered, and therefore it is relevant to interpret how the physical frames can affect their motivation for the next stage positively.
Based on the above-mentioned aspects that are different from kids and adults the Hierarchy of Needs is interpreted to the Architectural Needs of Vulnerable Kids to accommodate their special circumstances;
The physical need is relatively easy to cover by providing a room, restroom, proper clothes and food. Likely, can the mental needs be fulfilled by creating safe frames and routines around the child. In the 'Mental Spaces (p. 46) it was concluded that views to nature is positively affecting mental well-being. When these needs are covered, the child can focus on social relations, which is often a damaged skill. It can be created by making a home for the child, where it feels belonging. The connection and interaction with the other children is crucial, which must be accommodated in the architectural design. Likely, in the context of Greenland common spaces are valuable for informal gatherings or observations of social interactions between others. When the social needs are met, the child will be motivated to look inward and put itself in a larger context. Reputation and self-esteem become important, which can be reached by making workshops where kids can help each other and feel important, and they can show in exhibitions what they are good at. This will motivate the child to take initiative, be independent and lastly to be able to create own routines and live by themselves.

PARTIAL CONCLUSION / AGGUUT INERNILIINEQ

Greenland and Nuuk is an interesting context for this thesis. In many ways, it is likely to Denmark, but still worlds apart. How populations in centuries have survived primitively in the tough climate to now where they have many opportunities, but are struggling to find foothold as a modern society. Their social challenges based the foundation for this thesis.

Although Greenland is dependent on Denmark there are remarkable differences in culture and climate, which branch out in the whole society. The study trip to Greenland has given an insight in the Greenlandic way of thinking and living. Visiting two children homes provided unsaid and undefined information, but gave a true picture of the usage and life in such an institution.

The investigations and actual needs in Nuuk formed the basis for final decisions of target group and site of the building; 4 infants at the age of 0-2 years old, 8 children at the age of 2-18 years old and 4 families all facilitated in the area Qernertunnguit in Nuuk.

The interest for the social circumstances lead the way through several specific analyses, which provided a wide range of different information to be used during the design process.

VISION

/ takorluugaq

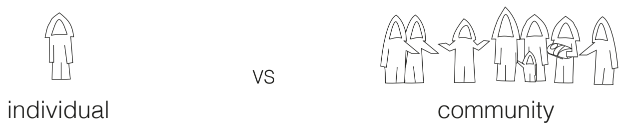


Fig. 37: Basis for concept

How can the design of a new institution create a safe and trustworthy environment to support the vulnerable families and children in their further development? Additionally, how can a building explore the possibilities and challenges of the arctic building context to create a sustainable design?

VISION / TAKORLUUGAQ

The vision is to create a safe home for socially vulnerable children and families in Nuuk. It will focus on infants both as individuals, who are removed from their parents as well as unstable families with infants. The house should accommodate the infants until the age of 18. The spaces and functions should be organized to accommodate individual needs as well as to make a synergic effect by utilizing each other. The children and family home should be organized rationally and with respect for the infants, children, families and for employees. It must not feel like an institution, but like a home from where the children and parents can mature and develop both socially and as an individual.

The project must respect the urban surroundings and the undomesticated nature. Additionally, it should challenge the current building technique to hereby create a healthy indoor environment and take a step towards a more sustainable way of thinking. The location must be utilized optimally in terms of views, terrain, sun and wind to create a sustainable building.

- Functions must be organized rationally in order to accommodate all users, represented in the personas
- The users, employees and relatives’ facilities must benefit from each other
- The architecture must be reassuring
- Materiality, tactility and interior design must create a feeling of home
- Building materials must be considered in the context of Greenland
- Climatic hazards such as wind, snow, and humiditymust be met in the design
- The building design must respect the urban context, natural surroundings and Greenlandic culture
- The building’s travel of sound must be limited
- Thermal comfort and indoor airquality must be optimized to building class 2 DS474
- The building must take advantage of its location near nature with visual and physical interaction
- All spaces must meet the demand of 2% daylight in 50% of the room
- The site must facilitate 6 parking spots
- The building should have a low environmental impact
- The form of the building must be playful at the same time as it respects its context

Fig. 38: Design parameters

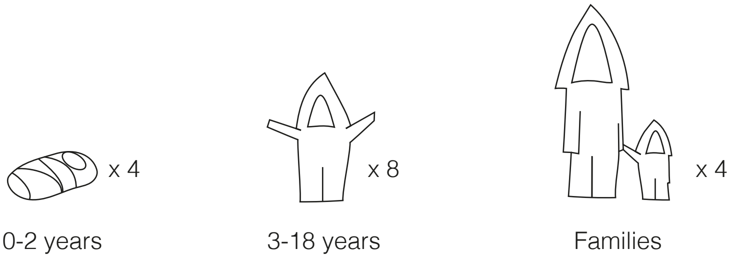


Fig. 39: Users

ROOM PROGRAM / INI NALUNAARSUUTIT

The program of the children's and families home must facilitate 12 children and 4 families (fig. 39).

The concept is to receive early damaged infants and house them until they can live by themselves around the age of 18, and to house whole families with infants and help them with structure and stability in the daily life.

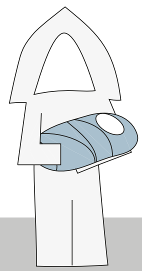
The building should not only have facilities for the different units of families and children. It should also have common spaces, where the residents can gather across age similar to the traditional Greenlandic big-family structure.

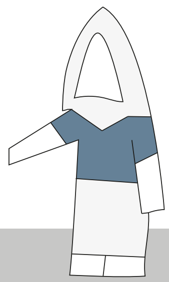
The room program is developed from the analysis, with inspiration from the different visited children homes. The functions count 847 m2 net.

Space	Number of rooms	Size per room (m2)	Total (m2)
Children's spaces:			
Bedroom	12	10	120
Living room	2	20	40
Kitchen	2	30	60
Bathroom	6	4	24
Apartments:	4	40-60	160-200
Bedroom per apartment	1-2	12	72
Living room per apartment	1	20	80
Kitchen per apartment	1	10	40
Bathroom per apartment	1	4	16
Common:			
Multi-purpose room	1	60	60
Kitchen	1	60	60
Living room	1	50	50
Playroom	1	30	30
Laundry	1	15	15
Entrance	1	10	10
Storage	1	15	15
Administrative:			
Offices	4	10	40
Storage	1-2	5	5-10
Printing room	1	5	5
Kitchen	1	5	5
Staff bedroom	2	10	20
Staff bathroom	2	5	10
Room for relatives	1	35	35
Meeting room	2	15	30
Total Net Area			**847 m2**

Fig. 40: Room Program

PERSONAS / INUUP PISSUSIA

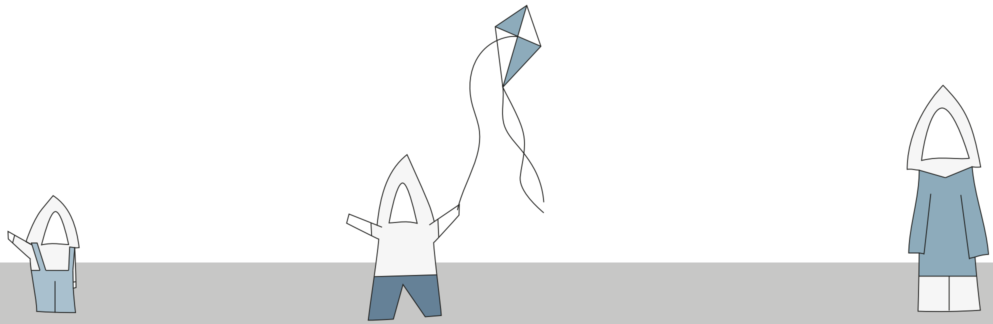




Every person is different thus they have different needs and challenges, which is indeed relevant to design accordingly to. In the following, five personas are presented as potential users of this children's and families' home. They all have different stories, are at different ages and have different needs. The personas give an understanding of how the building can be used by different personalities and how diverse the users are. In appendix 1 a weekly schedule of the personas is presented to further understand the flow and activities in the building. The five characters have been used throughout the design process to improve and qualify the design.

Aviaq and Pipaluk
22 years old mother and her daughter at 4 months
Aviaq became pregnant by accident. She has an alcohol abuse, but is keen on a stable everyday life as a family. Both of her parents were also alcoholic, and therefore they were never a real family. She has not learnt how to structure her life and take care of economy, laundry, cleaning and cooking.

Mille
38 years old pedagogue at the children's and families' home
Mille grew up in a nuclear family with two siblings, however her best friend had trouble with her parents. Therefore, she decided to be pedagogue and change something for the many challenged fates in Greenland.



Aqqaluk
2 years old boy
He is a happy boy who likes to socialize and play, however he constantly seeks stability and consistency of care. Therefore the employees are very aware of giving him the right attention and try to make him more independent.
The social authorities assessed that his mother would not be able to take care of her baby because of massive drug and alcohol abuse through many years and through pregnancy. Therefore Aqqaluk is also cognitively challenged and behind peers mentally.

Inu
10 years old boy
Inu's mother died a few months after he was born because of illness, and he lived alone with his father and his two years older brother, Hans. It was difficult for his father to handle the death of his wife, and his sadness lead to deep depression and suicide, when Inu was 2 years old.
Inu likes to be active and especially swimming is one of his big interests. He is well integrated socially because he has found trust and support in the close bond to his brother through his whole life. Hans also lives at Ilagisakka.

Naja
15 years old girl
Naja has led of sexual abuse from her parents and other relatives. The first 4 years of her life she lived in a small settlement in East Greenland called Isortoq, but when the social authorities became aware of the issue she was removed quickly.
She is a shy, introvert girl, who has difficulties finding herself. She is very aware of herself and is afraid to do something wrong due to lack of self-esteem. She is challenged in school, and prefer to spend time on her own and to be creative either by painting or drawing.

Fig. 41: Presentation of personas

DESIGN PROCESS

/ TAKORLUUGAQ

Fig. 42: Design parameters

DESIGN VISION / ILUSILERSUINEQ TAKORLUUGAQ

The analysis phase formed the basis for problem definition and vision. This chapter will present the journey of the design process. It was a very iterative process, and the focus constantly changed in scale in order to secure a holistic design.

The final design arose through a dynamic process in the field of different scales from site layout to interior design. Likely, the process was characterized and determined by constant involvement of functional, aesthetic and technical considerations. In the above diagram are the most important factors throught he design process shown within three catagories; envorinmental sustainability, social sustainability and design.

The design process is presented chronologically through three phases; brainstorm, building envelope and detailing. The actual process has been complex and thus simplified here and only the most important aspects are discussed.

The themes that had the most influence on the final design is shown in the diagram above. All parameters in a process are affected by each other to give the optimal design in both the short term and long run.

During the first phases sketching and physical- and digital modeling were the primary tools, whereas solar analysis, BSim and BE15 became important decision makers in the later phases.

PHASE 1: BRAINSTORM / ISUMMERSOQARTIGIINNEQ

The first phase of the design process will present some of the initial form and design concepts. The design is approached from different scales from the beginning of the process, to create a holistic design. Floor plan layout, 3D-modeling, interior design and placement on site are some of the topics that will be presented.

FORM CONCEPT

The first phase of the design process was kick-started by identifying the sites' potentials and hazards. The site is 2400 m2, and the building about the half - 1200 m2.

The site has an irregular shape wrapping around a hilltop. Towards North there is a view and a little lake as well as a cold wind coming in the winter. It lies between nature and the fjord and the city (fig. 43). The sketch (fig. 44) illustrates how the sun catches the inside of a building envelope, while it creates a large facade with views on the other side.

The building typology was an issue for discussion from start. In the close context, most buildings are blocks and town houses with slightly pitched roofs. This building must find its own identity and decide whether to blend in or stand out. Fig. 45 shows how an initial idea would combine the nearby typologies and reinterpret to something new.

Another idea (fig. 46 and 47) found inspiration in the range of mountains around Nuuk. The users are spilt in different living units and each represent a mountain top, which are connected by a shared space.
The common rooms are essential for the vision of the children's home and status between the individual, the family and the big-family. That is indeed the substance and thought about sketches fig. 48 and 49, where the family and individual spaces are placed around the common room.
The same is the case for fig. 51, where the living units are connected by 'the adults' and a covered outdoor space. Furthermore, the building is lifted on pillars in order not to disturb the nature.

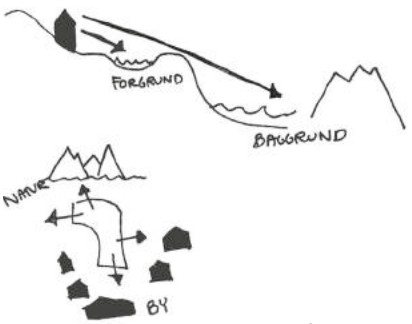


Fig. 43: Site qualities

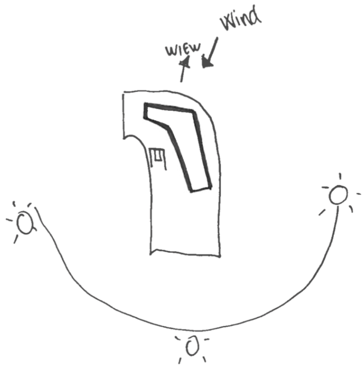


Fig. 44: Site conditions

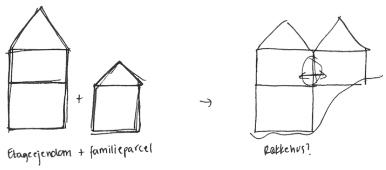


Fig. 45: Interpretation of existing typologies

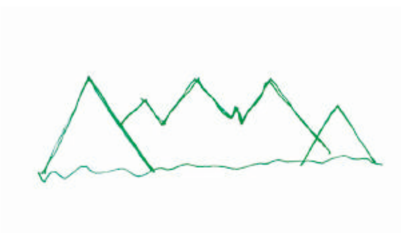


Fig. 46: Inspiration in mountain range

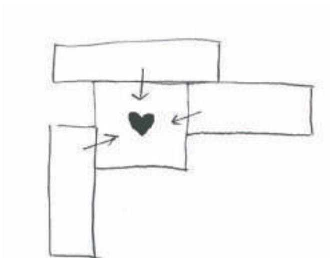


Fig. 48: Central core connecting the functions

Fig. 50: Raised envelope on pillars

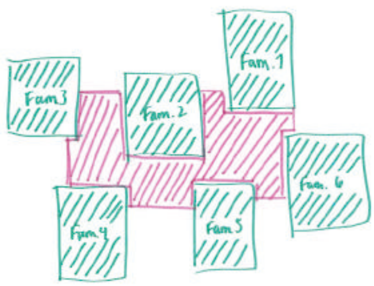


Fig. 47: Individual vs. common areas

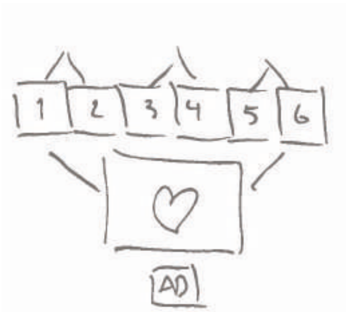


Fig. 49: Hierarchy in organisation

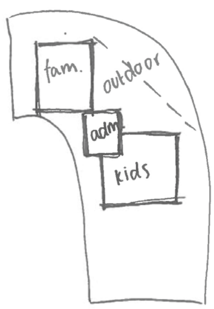


Fig. 51: Organisation on site

VOLUME ON SITE

In the meanwhile, as the sketching phase went on the site was modelled physically to understand the site fully and understand the scale of the building on site.

Firstly, simple forms were tested and placed on site (fig. 52, 53 and 54). Having only one volume on site fit fine to the context, which is large scale buildings, but on the other hand it - as presented here - seems massive and strange, which is not intentional for a this building. However, if working enough with the volume a very refined and elegant volume could make the home. Fig. 55, 56 and 57 are broken in smaller volumes, which give the possibility to work more with the terrain and optimize in terms of daylight. Furthermore, it gives the building a scale, which the children can relate to.

The physical models gave an understanding of how tricky and challenging the site is. The terrain can be modified, but the major challenge is the hilltop and building on the hilltop towards south-west, which shades different parts of the site over the day (as shown in the sun analysis on p. 40-41). At the same time the road creates a barrier towards north-east although it is a quite road with limited traffic.

This exercise again lead to the discussion about blending in or standing out. One aspect is how the building sits in its context and on site from an urban perspective. Another aspect is what the children would like to live in. The two deputies of the children's homes in Nuuk both agreed that the house should be neutral and not stand out as not to embarrass the children living there. Annette Dunker from the children's home in Kerteminde was of another belief; the children need something to be proud of and happy for. That could as well be their home, which would also help their feeling of belonging.
A different aspect of the dilemma is how independent Greenland wants to be of Denmark. By making a local landmark designed in Denmark, the locals might feel that Denmark is still determining their country.

From a sustainability energy consuming perspective, it is more effective to build compact and to minimize the floor-to-facade ratio.

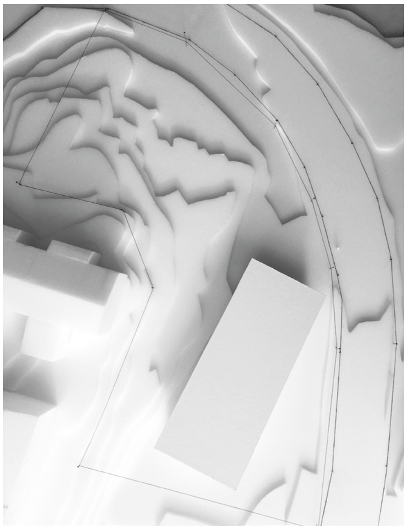


Fig. 52: Rectangular volume

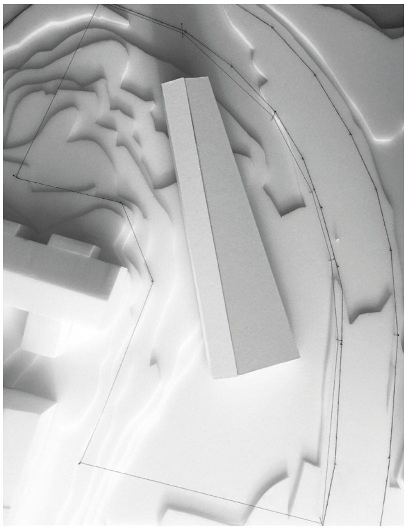


Fig. 53: Cone shape

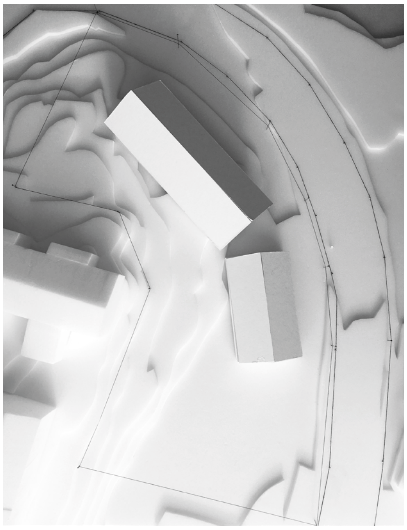


Fig. 54: One volume broken in two

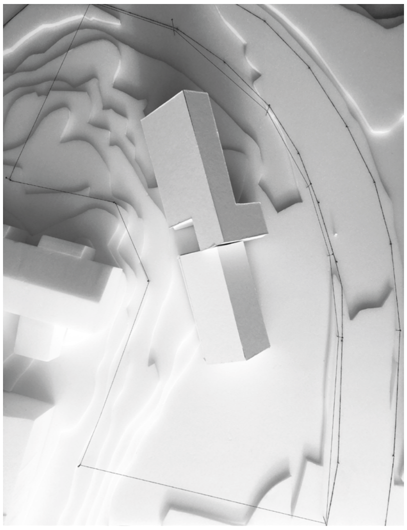


Fig. 55: One volume with displacement

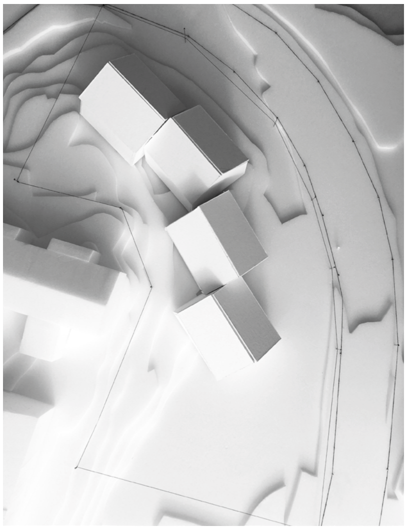


Fig. 56: Smaller volumes connected

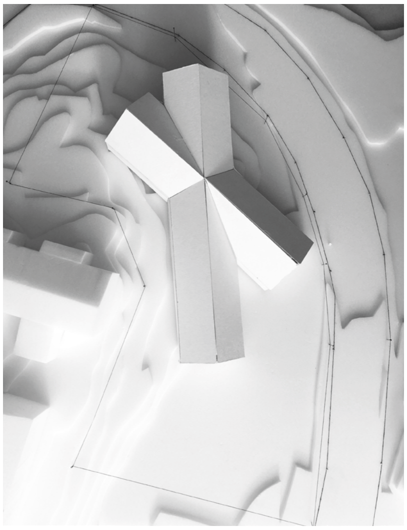


Fig. 57: Crossing wings

FLOOR PLAN LAYOUT

The group of users for the house consist of 12 children and four families. They need to be organized and spilt in smaller units. From Red Cross Children's home in Nuuk they experienced that having more than seven children together make things very chaotic for everyone (Lund, 2017). Therefore, these 12 children are divided in two 'families', who will have their own living units as well as all four families will have their own apartment. For building technical reasons it is most efficient and rational to place shafts over shafts, and therefore the units are duplicates placed above each other (fig. 58).

The figures on the opposite site, show the first initial proposals for functional layout. One based on a regular block envelope (fig. 59), which was held tight in its form. The discussion was, whether it would work with a simple, refined form standing clear and made special in its details. It is developed concurrently with the model in fig X and 52 and 53.
The other one is an irregular block with displacements (fig. 60), based on the philosophy of 'form follows function', and more inspired of the models in fig. 54, 55 and 56.
Soon after having started the floor plan different organizational dilemmas arose. Therefore, a list of priorities was made for what needs this house must accommodate.

1. Be a home - create a sense of belonging
2. Offer different stages of communities and secure possibility for privacy at any time. Create six units - six 'family homes'
3. Secure practical flow for users and employees
4. Optimize income of sunlight
5. Collect technical installations in few cores

These main criteria are the essential topics in the design of the floor plans.

At the same time as the floor plans developed the individual spaces were processed. From the analysis of architecture for children the importance of interior design in children's height was emphasized. In fig. 61 and 62 are some initial sketches of how niches can be created and create a retracted space for privacy in a common room. In the private rooms the creation of flexible furniture for different users is considered to personalize rooms. An example is how Naja, the persona presented on page 63 can use the desk in the window to express creativity with drawing (fig. 63). The integrated furniture can also act as storage, which will be necessary.

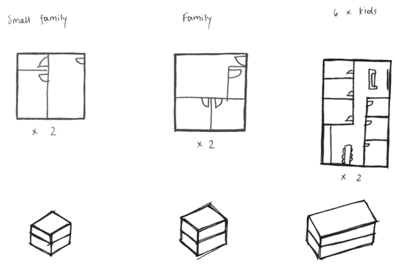


Fig. 58: Three units for different users

Fig. 59: Plan layout rectangular building

Fig. 60: Plan layout of displaced volumes

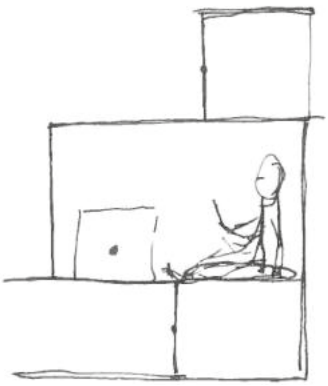


Fig. 61: Niche

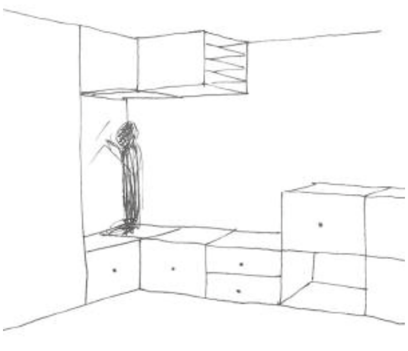


Fig. 62: Niche and storage

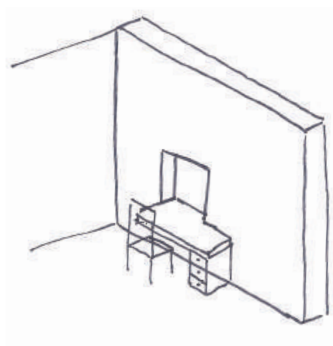


Fig. 63: Utility of window

BUILDING ENVELOPE

After developing shapes in physical models and sketching, 3D modeling in digital software was introduced. The digital 3D modeling is a quick way to test different ideas and idioms. The models investigated different degrees of displacement in the building. The envelope still seems massive in fig. 65 and 67. They have foundation in the idea of creating an energy efficient compact building that relates to the context. Since the buildings in the nearby context is smaller and closer to a human scale, more displaced shapes are also explored. The model in fig. 69 still has its starting point in the large volumes. The different displacements create niches inside and outside with interesting potentials. The displaced volume gives the volume a diverse expression. The different units have a feeling of individual homes, which does not harmonize with the vision of creating a big-family unit.

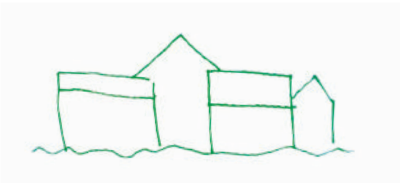


Fig. 64: Building silhouette of fig. 65

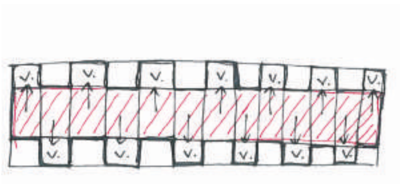


Fig. 66: Floor plan concept of fig. 67

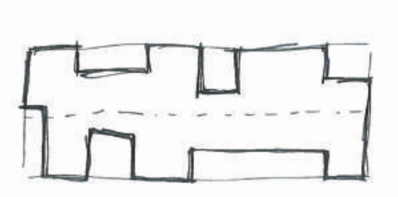


Fig. 68: Floor plan concept of fig. 69

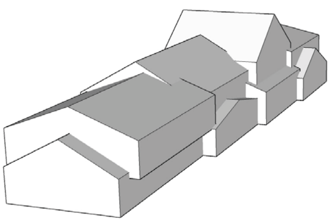


Fig. 65: Mixed building typologies

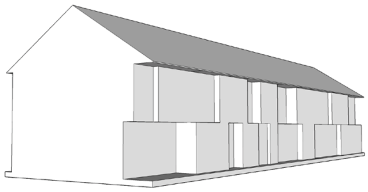


Fig. 67: Block with displacements in facade

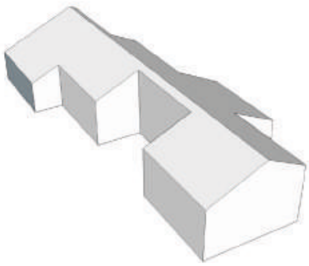


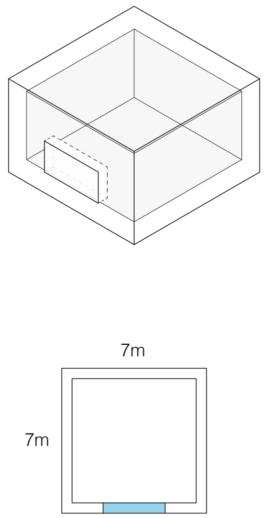
Fig. 69: Block with displacements in volumes

BUILDING SUSTAINABLE IN GREENLAND

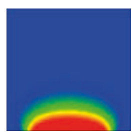
To take the comparison between a compact and a broken-down building in both aesthetics and technical aspects further, an analysis of three building shapes was made in terms of transmission loss, annual sun radiation and daylight factor.

The factor where the shapes obviously differs is on the transmission loss, because the facade-to-floor ratio is much higher in case 3 than in 1 and 2. The more facade the more transmission loss.
On the annual sun radiation case 2 is better, because the daylight reaches the opposite wall of the window and benefit from thermal mass and reflection.
When comparing daylight factors there is no pattern, but every space must be optimized individually depending on its own geometry and orientation. The analysis excluded overheating.
There are also some architectural qualities related to this issue. An equal distribution of daylight is preferred in most spaces as well as views to outdoors and nature are a high quality for mentality. Adding windows towards South will decrease energy consumption for heating, but will also in cold climates cause cold down draft.

There is a balance between making the most energy efficient building shape, while also getting an acceptable daylight factor to have a visual comfortable living space. The building should not only function as a shape with a low transmission loss - it should also be a space with a high level of indoor comfort and aesthetical qualities in order to create the best possible environment for the development of the children and families.

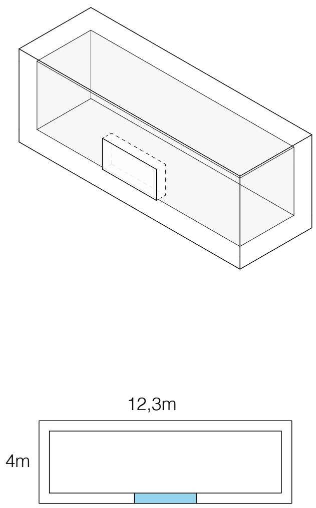


Window dimension: 3,5m x 1m
Height: 4,5m
Area: 49m²
Facade area: 126 m²
Annual transmission loss: -3850 kW
Annual sun radiation: 515 kW

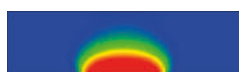


Mean daylight factor: 1,36 %
Area of room above 2 %: 15 %

Fig. 70: Case 1: Analysis of square space

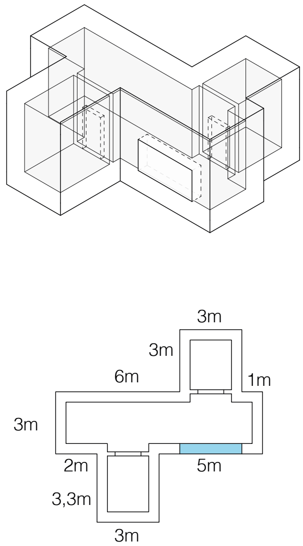


Window dimension: 3,5m x 1m
Height: 4,5m
Area: 49m²
Facade area: 147 m²
Annual transmission loss: -4192 kW
Annual sun radiation: 552 kW

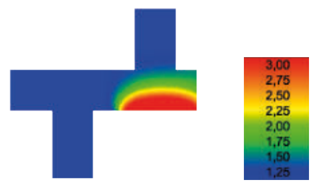


Mean daylight factor: 1,42 %
Area of room above 2 %: 18 %

Fig. 71: Case 2: Analysis of rectangular space



Window dimension: 3,5m x 1m
Height: 4,5m
Area: 49m²
Facade area: 160 m²
Annual transmission loss: -4644 kW
Annual sun radiation: 515 kW



Mean daylight factor: 1,29 %
Area of room above 2 %: 20 %

Fig. 72: Case 3: Analysis of irregular space

SITE AND SHAPE

When working with the buildings placed on site it becomes clear that having only one rectangular volume on site, alienates the building in its close context (fig. 73 and 74). The shape of the site is organic and the terrain is rocky and hilly. The building should further develop how it sits and shapes on site.

The best 'corner' of the site is north-east, because there is most sun over the day and the terrain is relatively flat. However, it is also placed close to the road. Other footprints of the building were placed on site as can be seen on fig. 75, 76 and 77.
The situation seems more integrated and smooth when the building works with the shape of the site. It gives more flexibility for the building to adjust to site, functions and terrain, which can be seen on fig. 78 and 79.
When the building is broken down to smaller units, it fits better into the surroundings than the tight block. Despite the results in BSim, the idea of a long and collected unit is completely dismissed at this moment, since it does not fit well on the rocky site.
However, it still works well and looks elegant with only a little displacement as the model in fig. 80 shows.

The relation between number of volumes, different roof designs and sizes of volumes must be balanced and partly be a result of floor plans to refine the design.

The model in fig. 80 is a compromise between the block and the fragmented and it has a simple appearance. This was developed further with plan and facades.

At the same time the issue about how the building meets the terrain arose. Either one can excavate the terrain, but that blocks facades for letting in day light. In fig. 81, 82 and 83 three design proposals are shown on the terrain with a solid foundation or on pillars. In the context all buildings are built on solid foundations. The block building in north-west and south-east has the highest foundation, which vary from 1,5-3 meters at the highest point. The smaller buildings closer to the site vary from 0-2 meters. This building is considered small in this context, and therefore it should not exceed 2 meters either. However, there are some issues about privacy and placements of windows, which needs to be in focus when detailing facades.
Another issue to be aware of if lifting the building on pillars is the additional facade it creates.

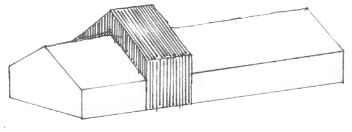


Fig. 73: Block with displacement and material

Fig. 75: Organisation on site of several volumes

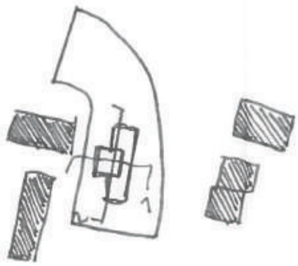


Fig. 77: Organisation on site of several volumes

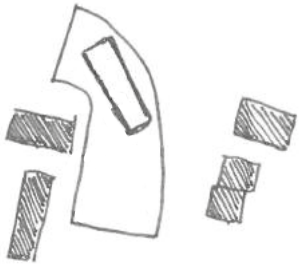


Fig. 74: Block on site

Fig. 76: Organisation on site of several volumes

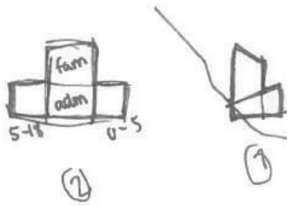


Fig. 78: Section of fig. 77 on site

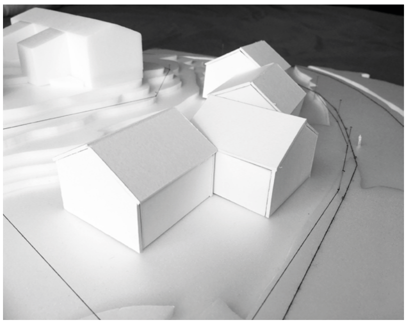


Fig. 78: Several volumes on site

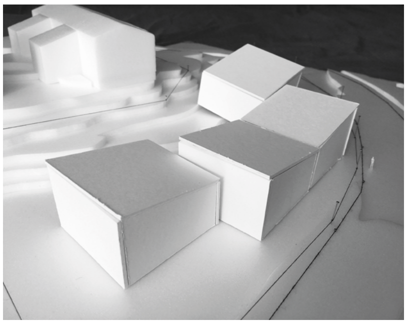


Fig. 79: Several volumes on site

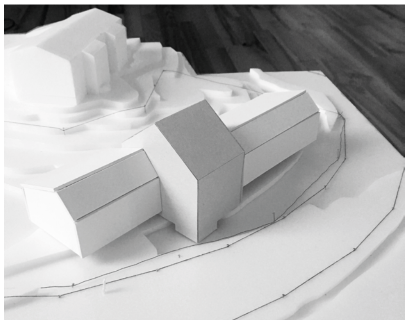


Fig. 80: One displaced volume on site

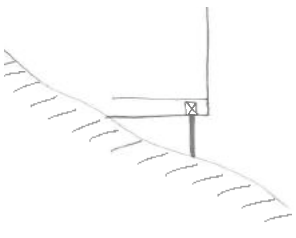


Fig. 81: Building on pillar with hidden beam

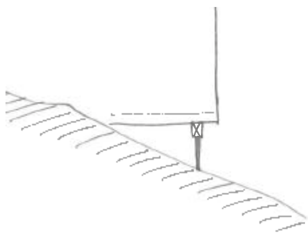


Fig. 82: Building on pillar with visible beam

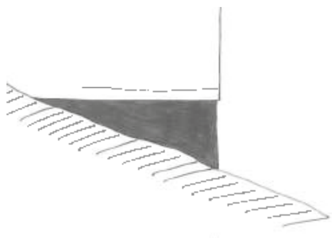


Fig. 83: Building on solid foundation

FLOOR PLAN AND FACADES

While making volume studies, organisation of different functions were made.

In this proposal, the two children unit functions are placed in the northern volume, while the families are placed in the small wing towards South (fig. 91).
The size of the different rooms become more precise and the flow in the building can be designed as intentional. With inspiration from the personas on page 63, the floor plan layout with the common functions creating a centerpoint in the building, gives the opportunity for the different persons in the house to have a natural connection, and create the sense of being part of the big-family.

As can be seen on the facades in fig. 87, 88, 89 and 90, the common building is taller and stand out from the rest of the building both in shape and material. The concept of creating different levels of privacy also formed the sizes of the windows, which differs in the different building units.

Fig. 84: Vertical facade band

Fig. 85: Facade with small vs. big windows

Fig. 86: Facade with small vs. big windows

Fig. 87: Facade with large windows

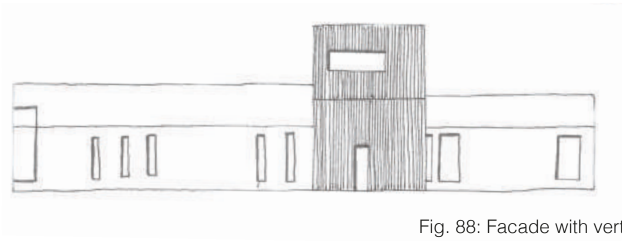


Fig. 88: Facade with vertical windows

Fig. 89: Facade with large windows

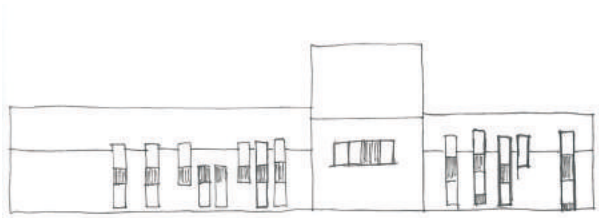


Fig. 90: Facade with vertical windows

Fig. 91: Initial floor plans

PARTIAL CONCLUSION / AGGUUT INERNILIINEQ

During the initial phase the design developed in different scales with different focus to integrate all perspectives from the beginning.

The building site is more challenging than firstly expected because of a hilly terrain towards south-west and thus a lack of direct day light on the site. Therefore, the most optimal place for the building is on the north-west side of the site.

Furthermore, the building needs to be broken down in smaller volumes to create a scale, which the children can relate to. It is also beneficial for the building's interaction and relation to the terrain.

But is the current building envelope appropriate for this site in this context?

Fig. 92: Current design

PHASE 2: BUILDING ENVELOPE / ILUSEQ

The previous phase's investigations and experiences formed the basis of this phase.
The building organization is reconsidered to optimize flows, rooms and daylight income. Since the building design has been very integrated in the context, it now stands as a characterless shape. This issue is further developed in the following phase, where facades and roof design are improved to give the building identity.

SHAPE AND SITE

After having worked much from outside to inside, this phase started from the inside in a more 'form follows function'-spirit. Firstly, the functions and flows were discussed and divided in clusters of functions; children units, families, common facilities, administration and lastly entrance. They are placed differently on fig. 94, 95 and 96 and are right in scale if the whole building is two storeys.

When comparing with the sun analysis one can see that fig. 93 and 94 is the most optimized shape in terms of daylight light and facade-to-floor ratio, which is beneficial in a transmission loss perspective. However, it is also the most deconstructed model, where the functions will be placed furthest apart. This model was chosen for further development, since it has the best opportunities in terms of daylight, which is the biggest challenge on the site.

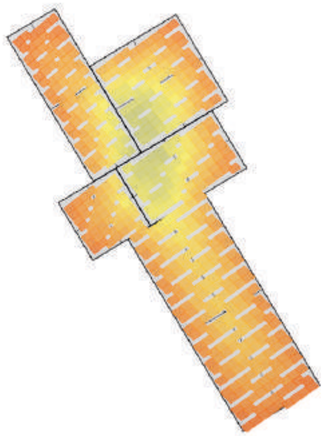
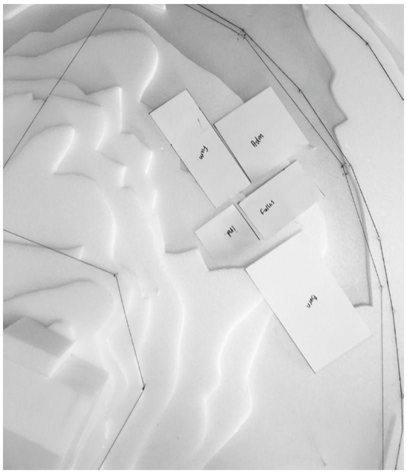


Fig. 93: Daylight factor analysis



Facade-to-floor ratio: 1,09

Fig. 94: Open layout

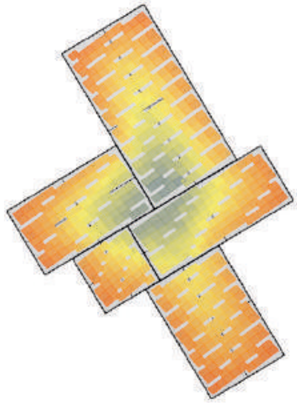
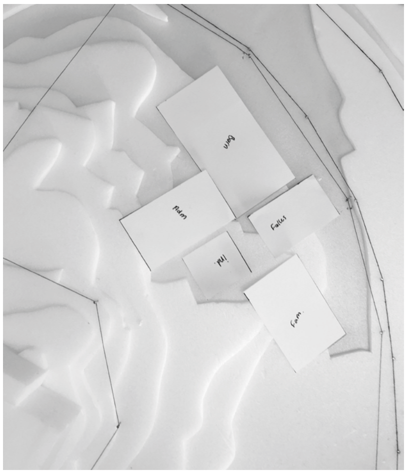


Fig. 95: Daylight factor analysis



Facade-to-floor ratio: 1,73

Fig. 96: Semi compact layout

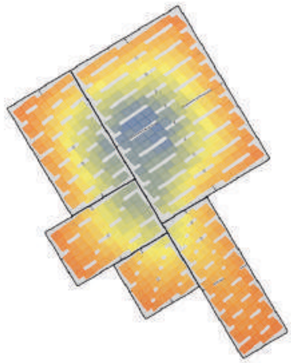
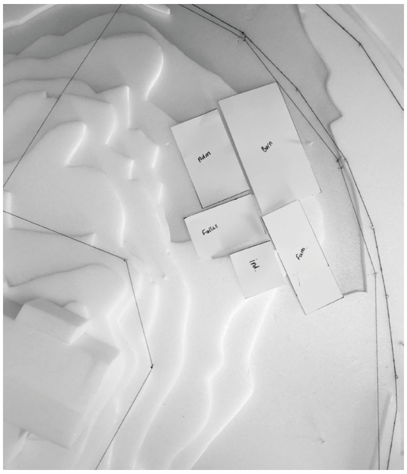


Fig. 97: Daylight factor analysis



Facade-to-floor ratio: 1,38

Fig. 98: Conpact layout

SHAPE AND SPACES

Based on the previous model the floor plans and the spaces became more specific.

During the layout of the floor plans many options were discussed and a list of priorities was made.

1. Equal access to common facilities
2. Privacy - possibility to come home without confrontation with the common rooms
3. Administration close to entrance
4. Optimize views in private spaces

Somehow, there needs to be a core in the building, from where the different functions can grow, when the criteria 1 must be met as sketched in fig. 99. This also gives the employees an overview of all the functions in the building. With the administration close to the entrance, the employees are close enough to hear the people that are coming to the house, without having a visual connection to the entrance. An example is the fictive persona Mille, who is a pedagogue (presented on p. 63). She is mainly spending time in the children units, where she is contact person, but periodically she writes reports or contacts parents and teachers. With the audible contact to the entrance she can always keep track of who is coming in or going out, without making the children and families feel monitored .

It is important with no hierarchy between the family units and the common functions. When building the family units in two storeys, the most equal would be to offset the functions in the common volume as sketched in fig. 102.
Having offset floors adds some issues related to staircases, accessibility and noise, which needs to be taken into consideration, but on the other hand it creates a transparency and overview of what happens in the building, which accordingly to the list of priorities is more important.

The individual volumes are laid out roughly in fig. 100, and are given atmospheres in fig. 101. This is done in order to have a common understanding in the group about the desired feelings and atmospheres in the specific rooms.

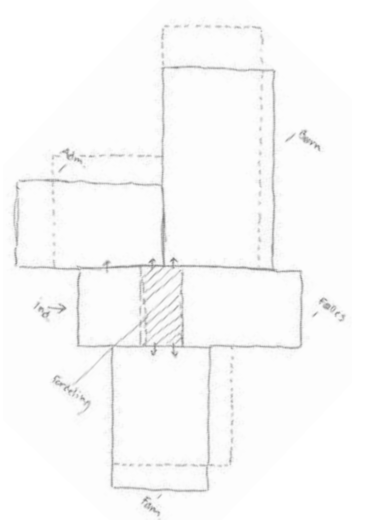


Fig. 99: Organisation of functions

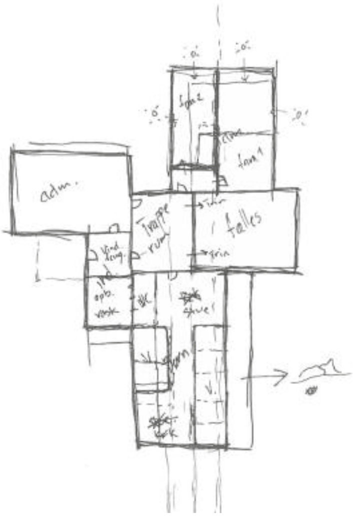


Fig. 100: Organisation of functions

Fig. 101: Indented feelings and atmospheres

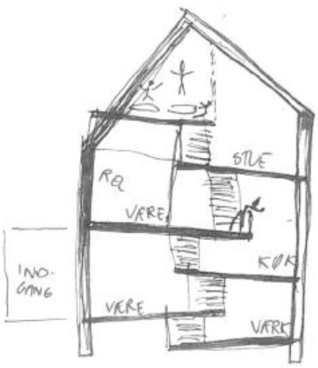


Fig. 102: Section of displaced floors

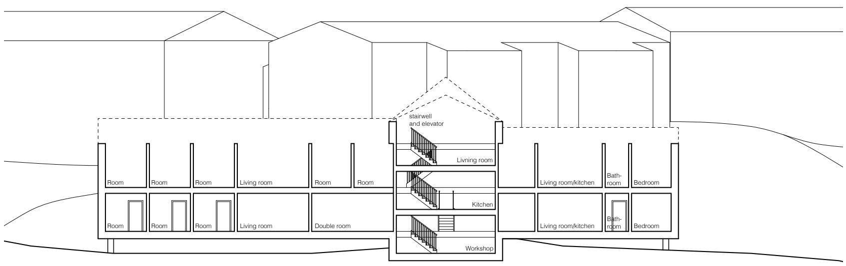


Fig. 103: Section of displaced floors

DETAILING OF SPACES

When digging deeper into the different functions, the many options again lead to a list of priorities in the family units.

1. Flows - privacy and discretion around bedrooms and bathrooms
2. Connection between kitchen and living room
3. Sun from more than one facade in common rooms
4. View from rooms to nature
5. Minimum of shafts

On fig. 104, there are some of the floor plans developed for the children units. In all three layouts kitchen and living room are in close connection, but in A and C they are still separate rooms, which is preferable in terms of noise and furniture. In B and C the individual bedrooms are placed in two clusters in the ends of the wing, but it makes the common space a passage space. It is more beneficial to locate all rooms in one end and leave the common spaces as an option to join. By placing all rooms together, the bathrooms can share shafts and two bedrooms can share one bathroom, which creates an intented discretion and privacy. A is definitely the best layout in terms of these priorities.

For the family units in fig. 105 the apartments are placed on the long side to give them equal facade area, daylight and views. The shafts and water supplies are placed around one central core. The small apartment is much a like except the bedroom. B is the best option though in terms of flow, because one enters the bathroom from the bedroom, which leaves the living room with no passages. When designing this space, the persona, Aviaq and her child, were used as inspiration. The apartment should have room for a child bed and storage to facilitate a small family.
For the large apartment option A creates the best rooms, since the kitchen and living room is a more defined space, whereas it is 'the negative space' in option B.

Likely, a list for the administration was made

1. Privacy to work with sensitive information
2. Auditory connection to hall
3. North-facing facades

The two layouts in fig. 106 are different in their connection to the rest of the building, which is placed to the right. All administrative functions are closed off from the rest of the building, whereas B is partly open, which complies with the priorities.

While detailing spaces, the sizes and placements of windows were also designed for the spaces. In terms of transmission loss and thermal bridges large windows with much glass and less frame are beneficial. It makes large square windows the best. In fig. 107 the first window designs can be seen.

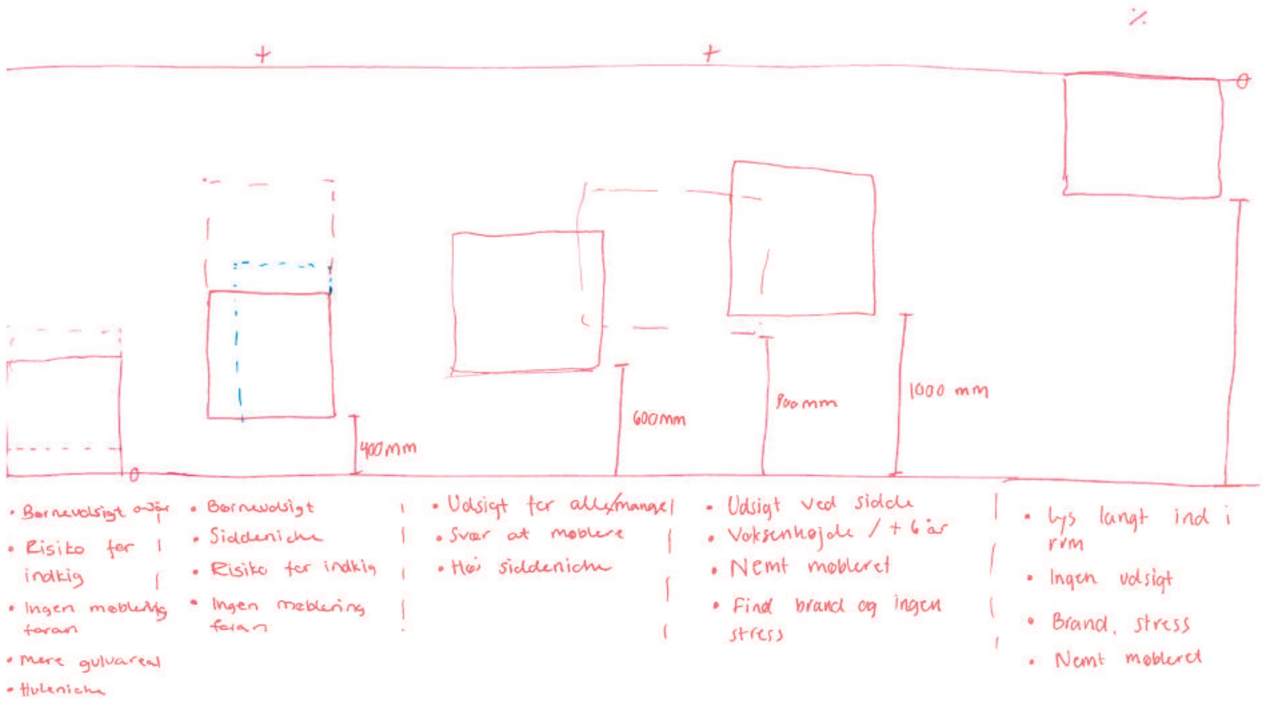


Fig. 107: Placement of site windows

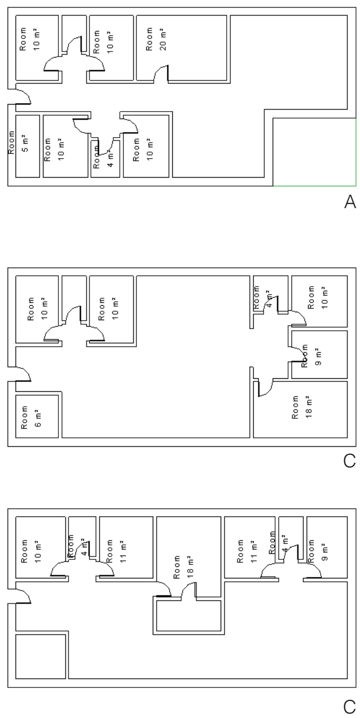


Fig. 104: Different plan layouts, children's unit

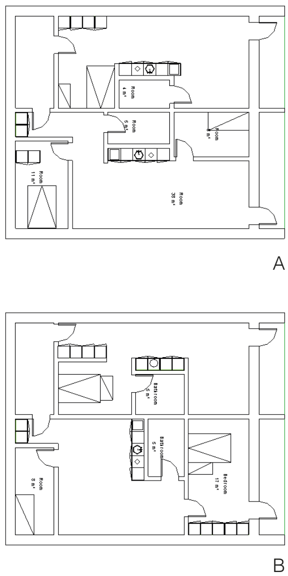


Fig. 105: Different plan layouts, familie's unit

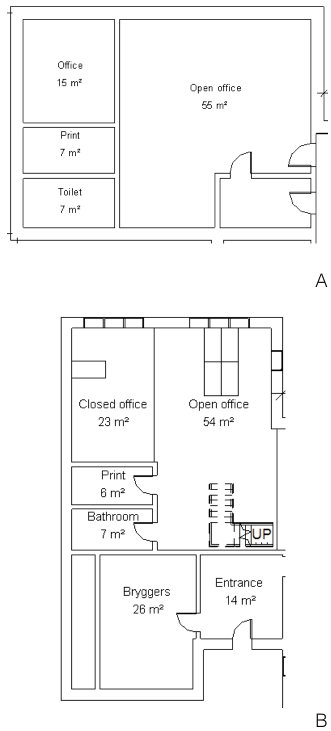


Fig. 106: Different plan layouts, administration

ROOF

At the same time as working with the internal flows, the outer expression and especially the roof was designed.

In fig. 111, 112 and 113 are a few of the models and while brainstorming on roof designs many dilemmas arose, which lead to another list of priorities.

1. Playful expression
2. Ceilings following the roof and placement of 'tops' and 'bottoms' depending of function of space (and where to have suspended ceilings)
3. Rational construction
4. Contrast between functions and volumes.

What was unsatisfying with previous designs was the predictability and 'a safe design' - lack of playfulness. Therefore, the design of the roof was tested in various models to find a balance between elegance and playfulness.

At the same time a constructive system was developed. There were some demands from the architecture to the construction.

1. Flexible in plan without columns and beams
2. Flexible facade
3. Effective and rational system leading the forces.

There are several ways to reach all criteria. One simple system is frames, which can be designed either with a beam, a scissors truss or a howe as illustrated in fig. 108. To reach complete freedom in the spaces the beam is most beneficial. In fig. 109 is a principle for the construction sketched as well as how it can be placed in the roof depending on whether it should be visible or not (fig. 110).

The only issue about using a frame system, is that windows cannot be placed in the supportive columns. otherwise the facade is open for placing windows.

Fig. 108: Frame profiles

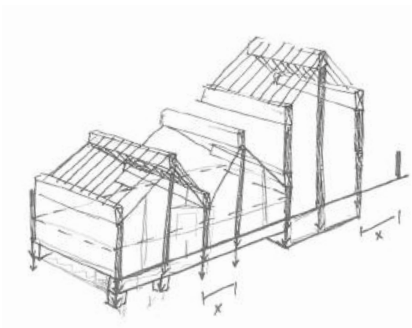


Fig. 109: Construction principle

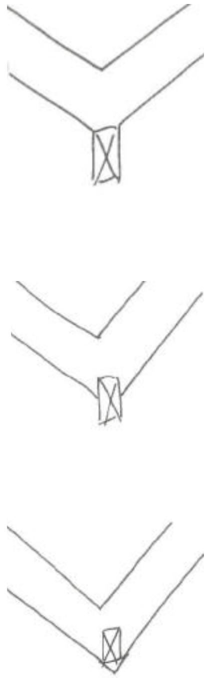


Fig. 110: Placement of beam

Fig. 111: Large cross-oriented roof facades

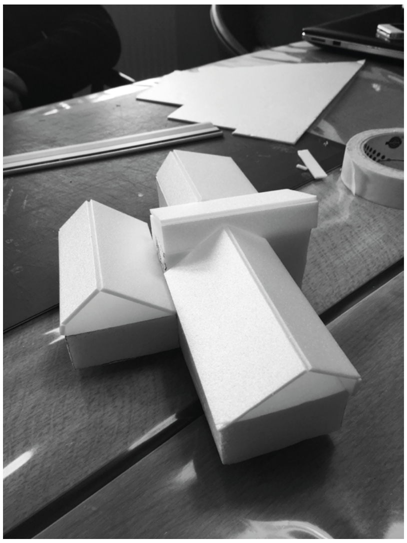


Fig. 112: Longitudinal roof facades

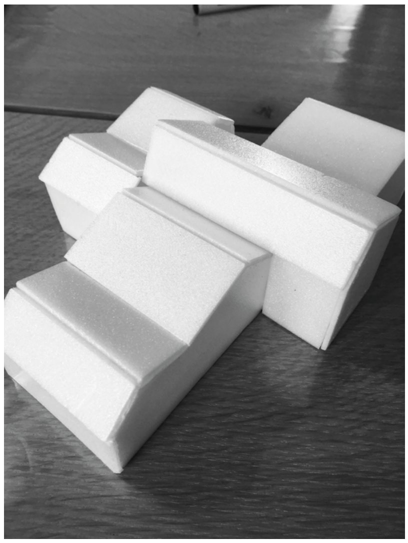


Fig. 113: Multiple roof tops

DETAILING OF ROOF

Based on the construction principle a grid was laid out on the floor plan to place the supports and lead the forces rationally. The gridlines were placed with a distance of 1 meter, because there will be a structural system for the facade to be placed at about this distance. Then some of the elements can be replaced by a supportive column.

The floor plan was used initially to figure out where to place tops and bottoms of the roof. Fig. 114 shows in plan in which gridlines roof tops and bottoms would be placed.
Afterwards it was drawn in section, where the outer expression became more important. There were extremely many design options and it easily became messy to look at (fig. 115).

Tidying up the facade could be done by either making the same roof angle (fig. 116), or by defining different heights, which the tops and bottoms should go through (fig. 117). The last option left most freedom for the inner spaces, and therefore 'top', 'bottom' and 'end' was defined by the space inside (fig. 118, 119 and 120)

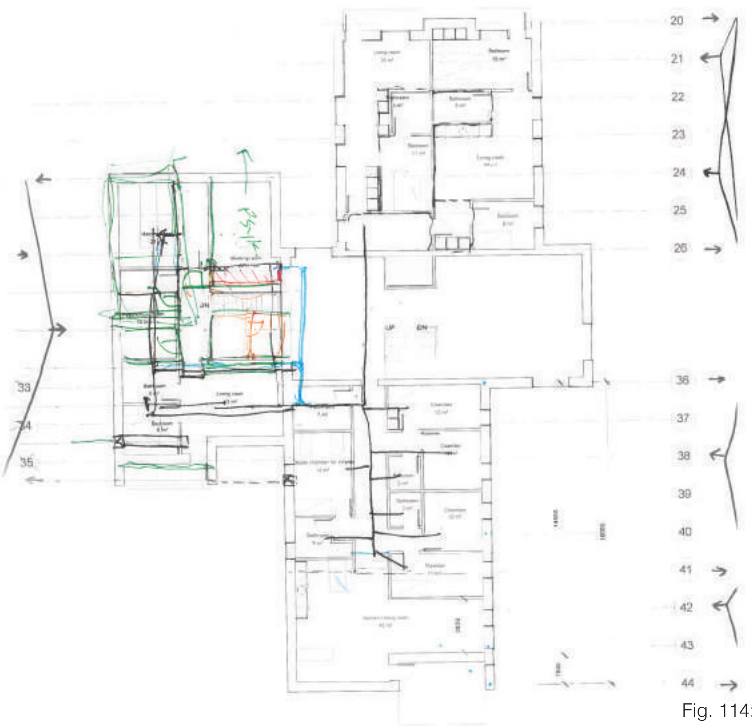


Fig. 114: Roof design on basis of floor plan

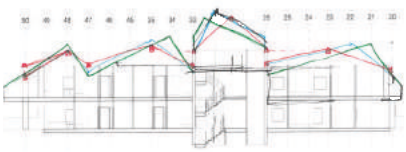


Fig. 115: Roof design proposals

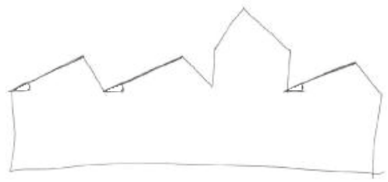


Fig. 116: Roof with same angle

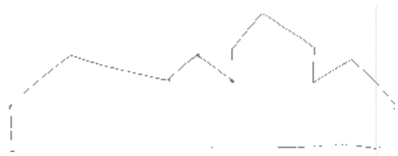


Fig. 117: Roof based on three heights

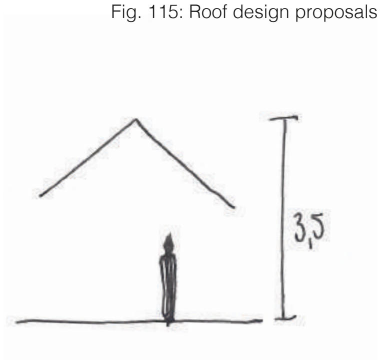


Fig. 118: Maximum indoor height

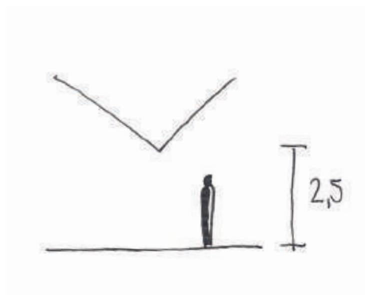


Fig. 119: Minimum indoor height

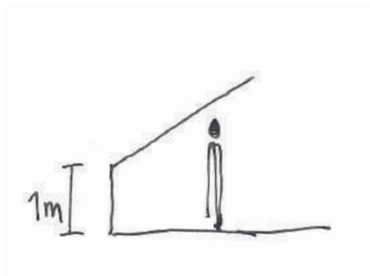


Fig. 120: Minimum height for functional space

SHAPE ON SITE

While working with the outside of the facade and with a more defined building envelope, the placement on the site was treated.

The common functions frame the core of the building, and therefore placing it as a solid on the site can symbolize it as an anchor in life.
However, in order not to make the building seem too massive and to let in most daylight the rest of the building should be lifted somehow. It will also limit insight from the road remarkably. It can either be elevated on solid foundation or on pillars. Pillars seem more appealing because one can leave the nature more untouched as well as it gives a lighter appearance of the building. On the other hand, it gives an extra facade and possibly some turbulence on the other side of the building. Furthermore, the space below the building must be considered - it must have a certain dimension or else it will seem meaningless.
In fig. 121, 122, and 123 the building is lifted in three different heights - 1 m, 2 m and 3 m. It is a balance to find the best height weighted between insight, road sequence and daylight income.

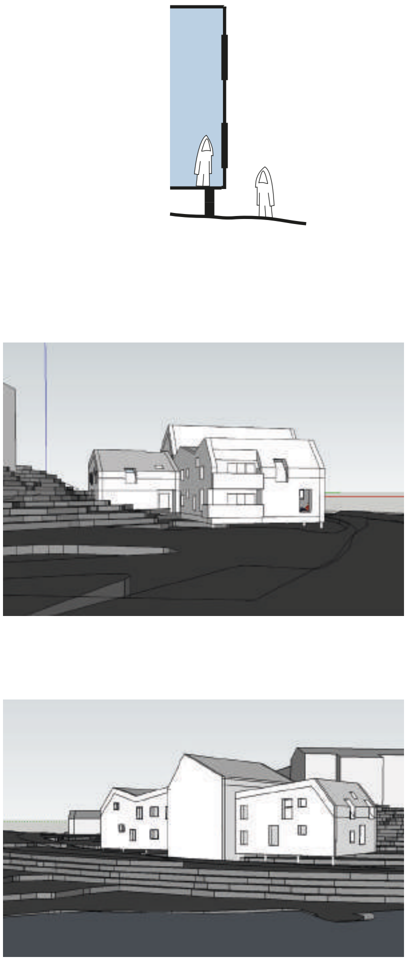


Fig. 121: Building elevated 1 meter above site

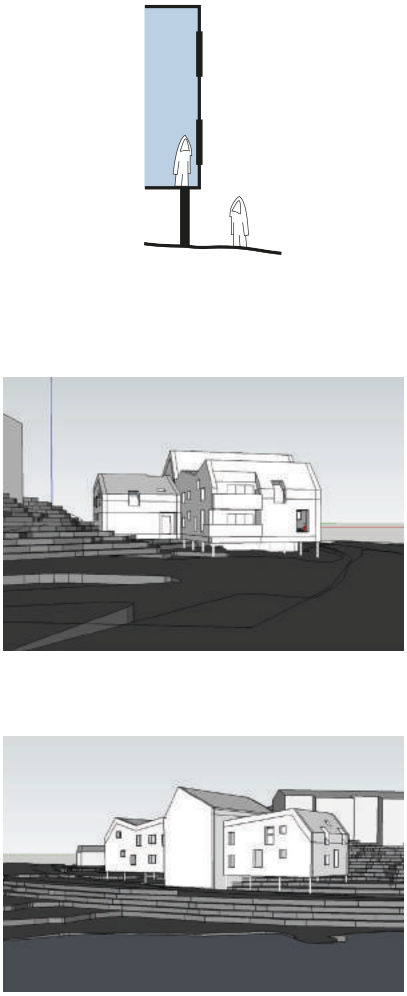


Fig. 122: Building elevated 2 meter above site

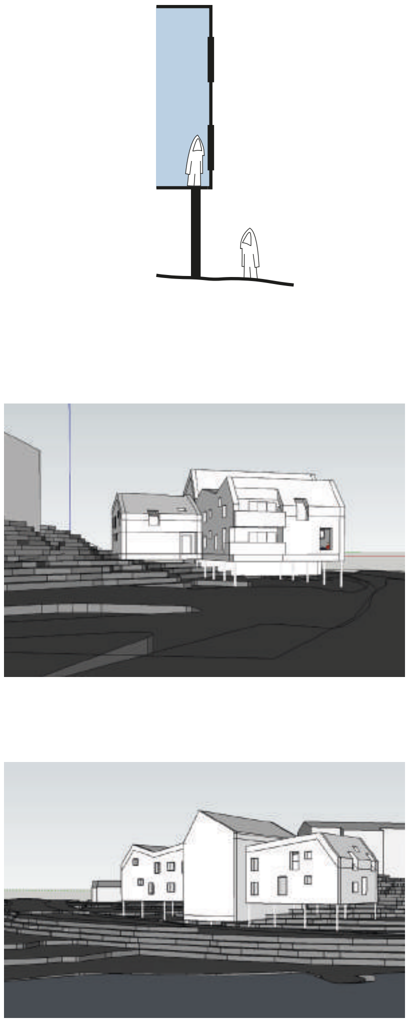


Fig. 123: Building elevated 3 meter above site

PARTIAL CONCLUSION / AGGUUT INERNILIINEQ

In the previous phase the concept and the building envelope design was refined. Floor plans and principle for facades, construction and roof was united in a holistic design. The building was placed on site as well, which was determined by terrain, sun on site as well as insight.

Fig. 124: Current building design

PHASE 3: DETAILING / ILAQ

Having the overall shape of the building decided, the level of detailing increased from phase 2 to phase 3.
Detailing the roof design and facades formes the exterior expression of the building, while also affecting the interior rooms. On this basis daylight in critical rooms, is further investigated in order to have a high level of visual comfort in all living areas. Choosing materials and detailing the central staircase are elements, which will further develop the appearance and experience of the building, both inside and outside.

FACADES

The first proposal of facades can be seen in fig. 125 and 126. The windows are placed with the intention to give the indoor space the right light settings and atmosphere, as mentioned under 'detailing of space', p. 89. Likely, as concluded in the 'mental spaces' views to nature as well as optimal inlet of daylight is crucial for well-being, and therefore many of the windows are designed to be an active part of the space as a seating window or in the height of a table.
At the same time the facade expression was intended playful with an off-grid system with multiple heights the window can be placed in.

To verify the income of daylight a daylight factor simulation was made. The requirement for living spaces is a minimum daylight factor of 2% in 50% of the room. The scale in this simulation is from 1-3 (fig. 127, 128, 129 and 130). All red zones are well-lit, while yellow zones are acceptable and blue is low. The common building performs with a mean daylight factor of 2,5% although almost 40% of the area is below 1%, which is low. For further details, please see appendix 2. Likely, for the children's and families' wings is the area below 1% more than 45%. The most critical spaces are the bedrooms for the children and the bedroom in the small apartment.

Generally, there is not enough light in the building, and when comparing with the window percentage of the facade, which is 14,4%, it justifies why it is low. Opening the facade is a balance between income of daylight and loss of heat through transmission. A rule of thumb in the industry is 20%. In this case, insight is also an issue to bear in mind.

How can the daylight income be optimized? Either by adding windows, making existing windows larger or by changing the floor plans and place living zones near windows. Firstly, all windows were scaled to see what difference it would make in the simulation. On the next pages the wings are analysed individually.

Fig. 125: Initial North-East facade

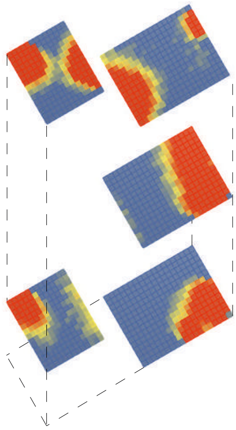


Fig. 127: Daylight common building

Fig. 126: Initial South-West facade

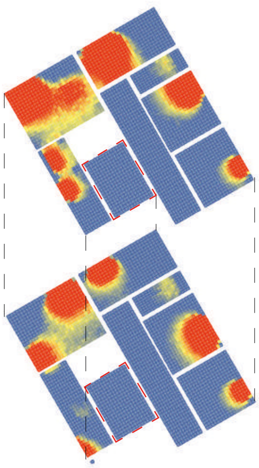


Fig. 128: Daylight family unit

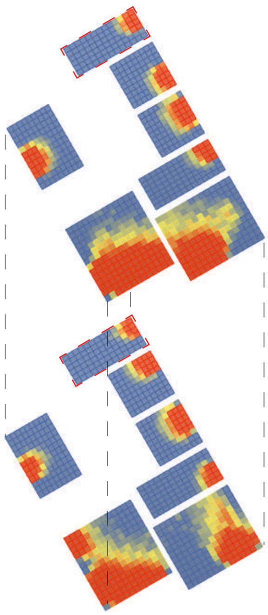


Fig. 129: Daylight children unit

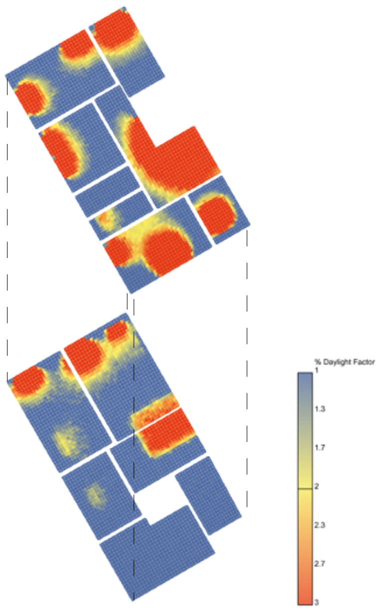


Fig. 130: Daylight administration

DAYLIGHT FAMILIES

After having redesigned and scaled the windows more, another simulation was made (fig. 131 and 132). The critical zones in the family wing is still the bedroom on 1st floor in the small apartment, and the living room in the large apartment, as marked on the illustration (fig. 132). The windows are placed slightly different on the two floors, but here the worst case is examined.

The bedroom only has a mean daylight factor of 0,88%, which is extremely low. Because of the floor plan layout in the apartment and the administration building 4 meters away from the window, it is difficult to reach an acceptable level. Therefore, the floor plan was reorganized and the entrance was placed in the dark zone away from the facade, and the bedroom near the facade (fig. 133) The windows were also replaced to limit insight. On the next simulation (fig. 134) the mean daylight factor has increased to 0,98%, which is still too low. Again, the floor plan changed and the bedroom moved further away from the rest of the building, which is shading (fig. 135). Furthermore, the bedroom was given another high placed window. In the last simulation, the mean daylight factor reaches 1,73% with only 14,2% area below 1%, which is acceptable for a bedroom.

Likely, the living room in the large apartment was examined to optimize light income. In fig. 131 the working area in the kitchen is placed furthest away from the facade, which gives a daylight factor below 1% in that area. Generally, the space is not lit enough. Therefore, a larger window was placed as well as the kitchen moved closer to the facade (fig. 133) Then the mean daylight factor reaches 1,84%, but 61,1% area is below 1% (fig. 134). Therefore, a small window was placed high to let the light deep into the room. The last simulation reaches a 2,63% with only 24% area below 1% (fig. 136).

During the process of optimizing daylight both floor plans, facades and indoor spaces have been vital factors for the final design. With the principle of having 4-5 different windows, every change has consequences for the whole facade. Additionally, some priorities from the early design process were revised. Optimal income of daylight became more important than having collected shafts in one core.

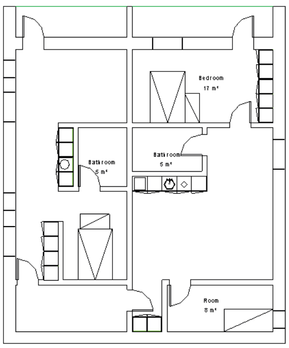


Fig. 131: First plan layout with larger windows

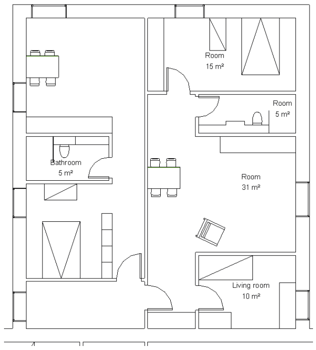


Fig. 133: Second plan layout

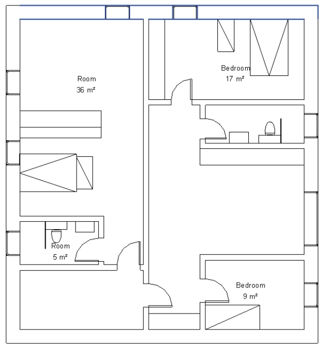


Fig. 135: Third plan layout

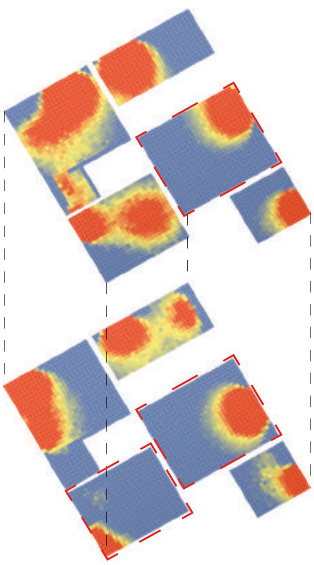


Fig. 132: First daylight analysis with larger windows

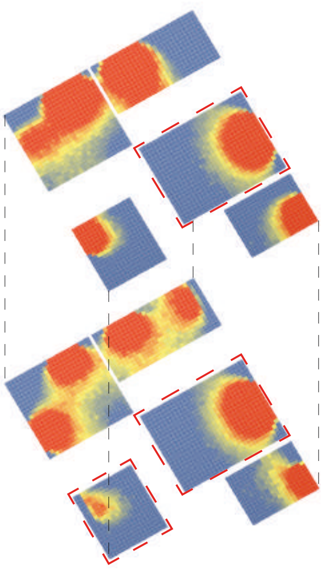


Fig. 134: Second daylight analysis

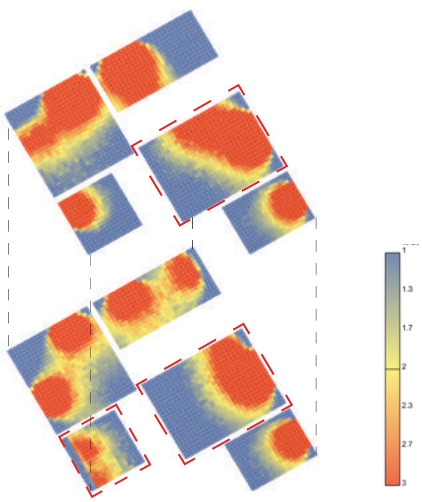


Fig. 136: Third plan layout

DAYLIGHT CHILDREN'S FAMILIES

With the scaling of windows, the children's family apartments reach the goal of 50% area above 2% daylight, except for the bedrooms marked in fig. 137.

To create a more precise simulation with materials on the surfaces, the single room was modelled and analyzed in velux visualizer. It was important to make windows that does more than just giving daylight. Some of the priorities were to have the window height work with the height of a child. The persona, Inu, a 10-year-old boy was used to define a window for sitting and looking out of while playing on the floor. In the simulation, the window is 900 x 1500 mm vertical and in a height of 400 mm as seen in first column in fig. 139.

The room was examined in daylight factor, transmission loss, temperature and sun radiation to identify the differences. The simulations are all very close, which was also expected. Transmission loss and sun radiation are factors dependent on the area of the window, and temperature is not sensitive with 3 layered glass and stays the same in the four new window proposals. The daylight factors are also equal, although window 2 performs slightly better.

From an architectural and spatial standpoint, the windows have different qualities. Mostly, the still height of the windows allows different functions as either a seating window or an extension of a table.
Window 3 is not intentional, because it mere and intimidate from passers. From a facade perspective, the building envelope is mainly oriented horizontally, and window 4 would emphasize this, whereas window 2 would create a more vertical striving expression. Window 4 and 5 does not seem elegant. Based on those considerations window 2 was chosen.

The other building volumes were examined in the same way to secure optimal daylight conditions. The constant alteration between indoor space, daylight factor and facade expression a new set of windows arose:

1: 1100x1800mm still height 400 mm
2: 1100 x 1100mm still height 700mm
3: 1500 x 2100mm still height 400mm
4: 850 x 850 mm, which can be placed in any height.

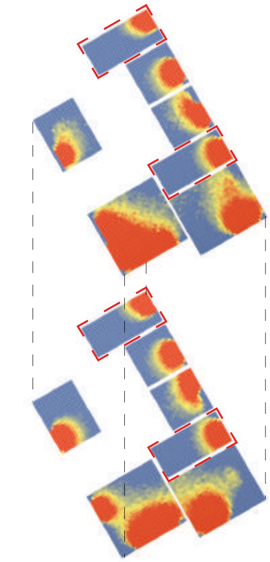


Fig. 137: First daylight analysis with larger windows

Chamber for one child on ground level
Inner dimensions: 4,9 x 2,3 m

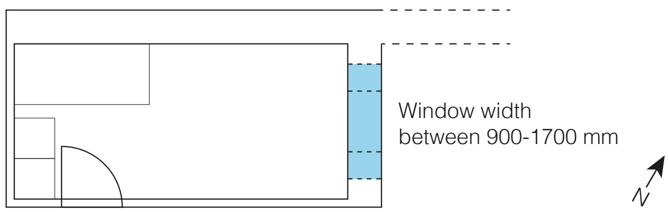


Fig. 138: Space modelled in BSim

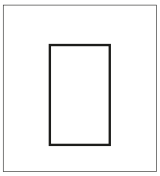
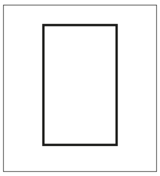
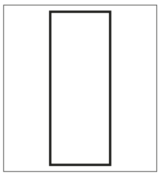
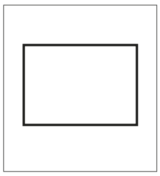
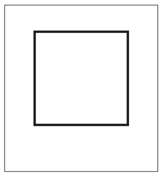
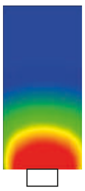
	Window 1 900x1500 mm	Window 2 1100x1800 mm	Window 3 900x2300 mm	Window 4 1700x1200 mm	Window 5 1400x1400 mm
Expression of the room Ceiling 2500 mm 700 mm 400 mm Floor					
Window area	1,35 m2	1,98 m2	2,07 m2	2,04 m2	1,96 m2
Mean daylight factor	1,6 %	2,8 %	2,5 %	2,8 %	3 %
Above 2 %	24 %	56 %	54 %	54 %	57 %
 1,25 1,50 1,75 2,00 2,25 2,50 2,75 3,00					
Annual transmission loss	-440 kW	-502 kW	-512kW	-509 kW	-500 kW
Operative Temp.					
Max	24 °C	25 °C	25 °C	25 °C	25 °C
Min	22 °C	22 °C	22 °C	22 °C	22 °C
Sun radiation					
Mean	0,014 kW	0,021 kW	0,022 kW	0,022 kW	0,021 kW
Max	0,137 kW	0,2 kW	0,201 kW	0,207 kW	0,199 kW

Fig. 139: Analysis of room with different windows

MATERIALS

In fig. 140 there is a brainstorm of different materials for the facade. The discussion about whether to blend in or not became essential again and concluded as last time to stand out, but respect the existing buildings and the building traditions. It should be an interpretation with a new touch, but not a stranger either in idiom or choice of materials.

As mentioned in the context analysis of Nuuk its buildings are characterized by coloured wooden facades, which is the most used and Greenlandic material one gets. Therefore, the three options with a coloured common building suits nicely into the context. On the other hand, it is a material, which needs much maintenance, and Signe Mikkelsen directly advised against using it, because it quickly looks defaulted (Mikkelsen 2017).
Greenland produce no materials by themselves. They can cast concrete in place, but all prefabricated materials come from Denmark; bricks, concrete elements, wood, glass, iron etc. Therefore, there is no benefit in choosing a local material in terms of sustainability and life cycle. The conditions are the same as in Denmark except for extra expenses and emissions related to transport.
There are two options with concrete and slate, but as they are both very hard materials, which are not used elsewhere with success in Nuuk, and therefore they were quickly skipped. Lastly, there are bricks in a soft red tone, which is also a hard material although more tactile, and wooden planks either oriented vertically or horizontally.

To help the decision a quick Life Cycle Analysis comparison was made between the two materials as facade cladding on 700 m2 facade (fig. 141). The analysis show the lowest global warming potential (GWP), but highest ozone depletion potential (ODP) and primary energy usage (PE) of wood cladding (marked with blue bar), and the opposite of for bricks (marked with red bar) on walls that have the same u-value. This is supported by the diagram fig. 142 and 143.
When comparing the two walls in fig. 142, they are built up with different constructions, where wood performs best.
When reflecting upon this information the most LCA-friendly choice must be a timber skeleton with wooden facades. The wish about mixing materials and giving character to the common building can be met in an LCA-friendly way by using hanging bricks, where the mortar is saved.

Fig. 140: Different facade materials and expressions

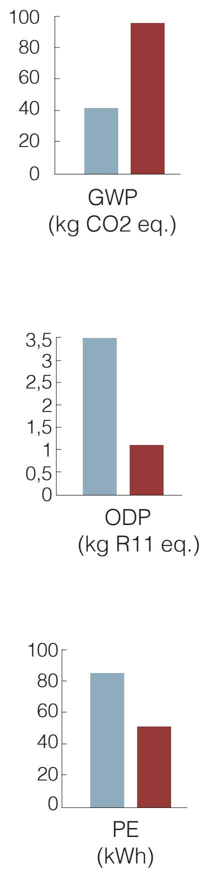


fig. 141: LCA-analysis of wood vs. bricks (LCAbyg 2017)

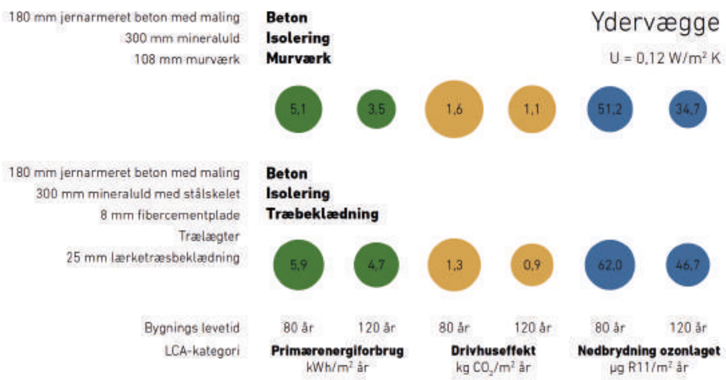


Fig. 142: LCA comparison of facade cladding (Aggerholm 2014)

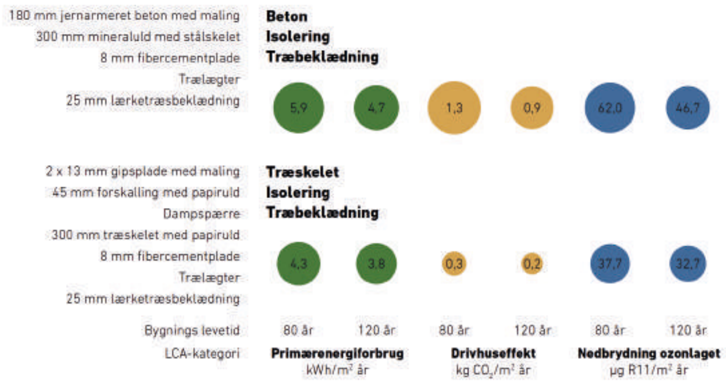


Fig. 143: LCA comparison of construction material (Aggerholm 2014)

STAIRCASE

One important thing for the building and the indented flow is the staircase connecting all the floors and functions.

The runway could either turn two ways as illustrated in fig. 114 and 145. In fig. 144 the flow is part of the floors and spaces with other activities, whereas in fig. 144 the staircase is an independent vertical flowline, where one can enter the common spaces if wanted. Then no one is forced to take part in a community against will.
There were many design proposals for the staircase, and factors like flow, dragging down daylight, transparency and elegancy were important.

There must be maximum 8,9 cm between each baluster in the railing accordingly to the building regulation. Otherwise solids or glass were possibilities for a railing, but none of them was chosen because of the lack of transparency when choosing a solid and the high level of cleaning required if a glass railing was chosen.

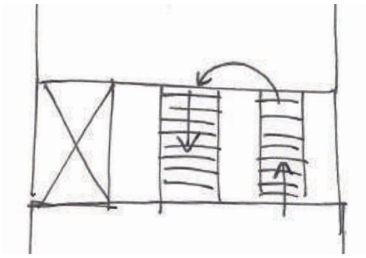


Fig. 144: Staircase flow with possibility for daylight

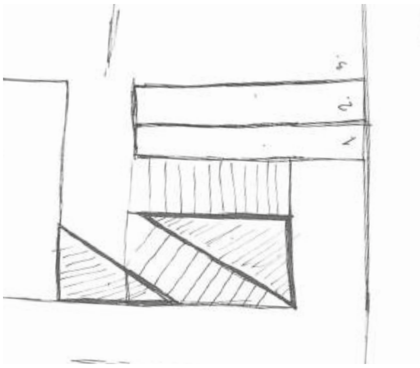


Fig. 146: Displaced runways

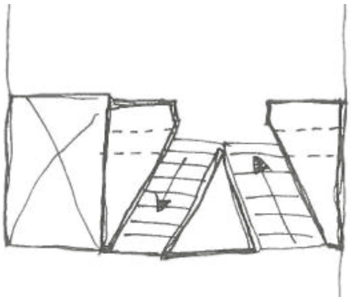


Fig. 148: Displaced runways

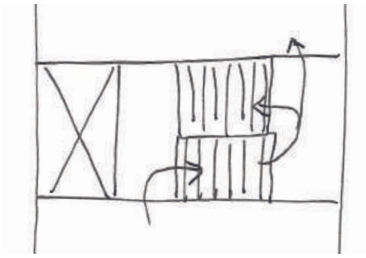


Fig. 145: Staircase flows

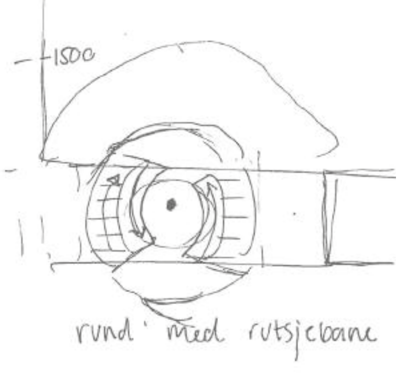


Fig. 147: Circular staircase

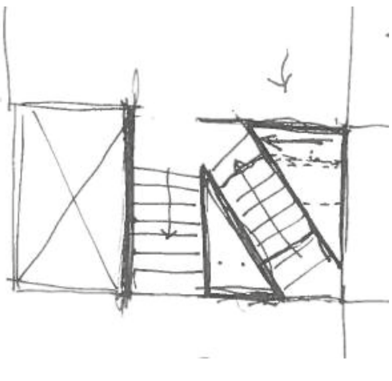


Fig. 149: Displaced runways

Fig. 150: Final building design

PARTIAL CONCLUSION / AGGUUT INERNILIINEQ

Through the last phase of the design process the house was designed into detail to create the most optimal indoor rooms in terms of spatial experience, indoor climate and daily flow. Furthermore, the architectural expression of the house in the context was refined with focus on the balance between blending in or standing out in the context as well as considered from an LCA-perspective in terms of materials.

Through this chapter the most important aspects of the design process was presented. Along the process there has been many other considerations, which had influence on the final design. In the next chapter, the design will be presented through floor plans, sections, facades and visualizations.

PRESENTATION

/ saqqummiussineq

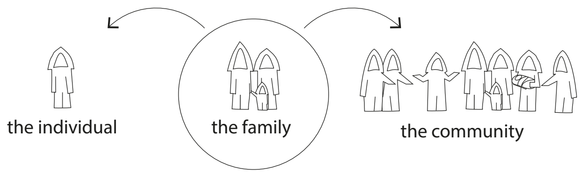


Fig. 151: Vision

ILAGISAKKA / A CHILDREN'S AND FAMILIES' HOME

Ilagisakka is a home for neglected children and a temporary home for vulnerable families. Ilagiskka means 'My Family' in Greenlandic; the vision for this project is to create homes for six families within the same building and reach a synergy effect between ages, gender and families based on Greenlandic traditions about learning from the masters. The building houses two children units, two small family units and two larger family units. They are all arranged around the central, common spaces.

Greenlanders are by nature a social people and they traditionally lived in big-families and small societies, where everyone would look after each other. This sympathetic thought and strong historic reference formed the concept for this project. However, today, the society and people are adapting the western nuclear family and more is expected from the individual. Therefore, this house is built up around the nuclear family, from where the individual can choose which community to join – itself, the family or the big-family, the last represented by the other families in the building. It embraces a wide target group of neglected children. Furthermore, it develops children to interact in these different communities.

The spaces are designed to vulnerable children with Maslow's Hierarchy of Needs in focus (presented on p. 53 in 'Architecture for Children'). There are private spaces, where the individual can retreat, and there are views and good daylight conditions from all these rooms to optimize mental well-being.
The daily life in the house is built up around daily routines and duties in the different units, making the children feel comfortable and safe. There are specific key persons among the employees for every unit, which help the children in developing their ability to create trustworthy relations. Furthermore, the spaces in the family units are designed to be intimate and focus on close social relations. In the common spaces of the building, the children can take part in activities and reflect themselves in people across ages, sex and interest. The workshop and the kitchen are spaces, where people can learn from each other as well as teach others, and it creates a synergy effect and feeling of self-esteem and achievement for the individual. At the same time, it creates social bonds. It is the traditional Greenlandic way of learning from the masters. Over time, the children will develop the ability to be independent and to create their own routines. These spaces are also used for social gatherings, which creates a feeling of belonging for the children.

Fig. 152: Arrival to the building

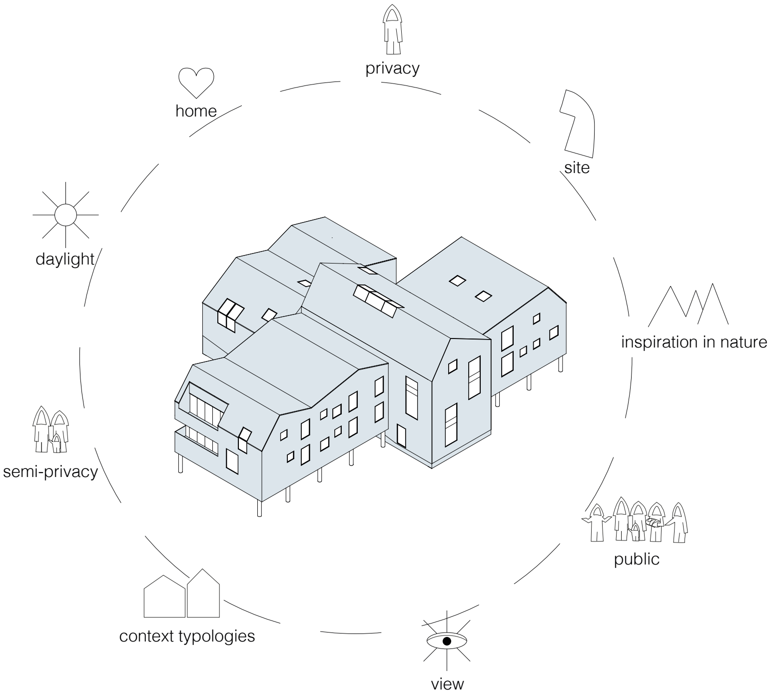


Fig. 153: Aspects determining for final design

ARCHITECTURAL APPROACH / PULLAVIK

Sustainability is an un-practiced discipline in Greenland in most aspects. There are other conditions in Greenland both socially, economically and environmentally, which makes it difficult to find motivation to introduce sustainability in the building industry. The aim of this project was to design a sustainable building, which should be of inspiration for future building projects, without alienating it.

The building is designed to attract attention and put focus on sustainability. It respects the surroundings and blends in in terms of scale, materials and roof slopes in an innovative way. The architectural expression is designed with a strong reference to the mountain ranges surrounding Nuuk to be playful, relatable and inspirational.

The building consists of four volumes with different functions. They are placed compactly to minimize facade area. The centre of the building is the common volume, which stands out as a heavy cliff and symbolizes it as being an anchor in life you can always return to. It is the core of the building and represents social sustainability in terms of common, diverse activities. The other volumes appear lighter, because they are elevated on pillars. It leaves the nature below the building and respects it to be the first and strongest element at that place, and at the same time it elevated the windows and blocks insight from the road.

The interior spaces are designed to optimize thermal and atmospheric comfort. This will affect the development of the children positively. The existing conditions in most Greenlandic homes are critical (Rode et al 2005), and when being a front runner on this aspect, it would help the general Greenlandic health, learning abilities and life quality if implemented in other buildings as well. Indoor environment will be elaborated on later.
Daylight and views are other aspects, which was determining for the architectural expression of the building. To invite as much view and daylight in as possible has a positive effect mentally. The building is placed on the northern part of the site, where the best sun conditions and best views are. It is rotated 30° from the north-south axis to optimize income of daylight over the day and views from most spaces.

Fig. 154: Site plan 1:2000

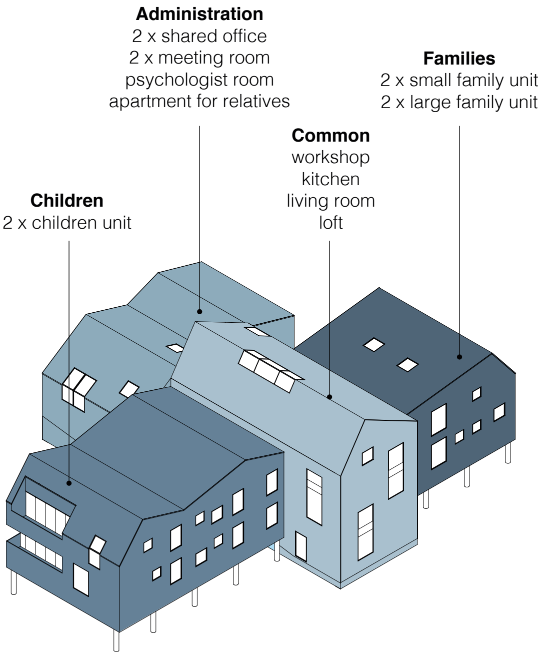


Fig. 155: Arrangement of functions

FLOOR PLAN LAYOUT / INITAQARPOQ

The building is composed by four volumes; one for the two children units, one for the four families, one for common functions and one for administrative functions (fig. 155), is 1183 m2 gross.

The exploded axonometry (fig. 156) shows how the building is composed. The children, family and administration volumes are two levels, while the common volume consist of four levels, which are displaced from the others. The common building has a double-high hall from where one distributes to the other volumes. The hall and the staircase is a central place for the flow in the building. On the displaced levels, all the common areas and activities are placed. Displacing the floors are intended to give transparency, equality and invitations to join for all the residents in the house. It is organised so it becomes a choice and not a part of the flow.

There are designed common spaces with different purposes; the workshop is level -0,5 and designed for diverse activities such as painting, repair and prepare of sleds, making beads or sewing and decorating national costumes. It is a place where master education can be practiced; the fictive persona Naja can draw with Aqqaluk, and Aviaq can make tupilacks with Inu.

The common kitchen, level 0,5, is designed to accommodate everybody in the house for festive events such as kaffemik, birthdays and Christmas. In the everyday, the common kitchen is used by the families, where they cook. However, it is welcoming everyone at any time for a cup of tea, help for homework or a chat.

The common living room, level 1,5, is for gatherings and play. There is a large TV, which collects the residents of the house when there are football matches, Disney Show and royal family documentaries.

The loft, level 2, is a quiet corner of the house where puzzles are made, books read and drawings drawn.

Both children units consist of five bedrooms and can house six children each. The children will come to the this place as infants and stay in the shared bedroom until the age of two years. There is room for two infants and one pedagogue in that room. The children are intended to stay here until the age of 18, and therefore they will get their own room at the age of 2 years. They will still be close to the overnight pedagogue if they need help in the night. The children units have two pedagogues each to help and structure the daily routines.

The family wing consists of four family units with two different apartment types. There are two small apartments designed for a single mother with an infant. The two large apartments are designed for a small family with mother, father, one child and one infant.

The period for staying at the home for families is six months, and after this period it will be revised every 3rd month whether they are ready to live on their own again.
There are also facilities to house parents to the kids for a shorter period and give them time together. It can be for birthdays, over Christmas or a weekend.
In continuation of the entrance hall, an outdoor area with wooden terraces are placed. The plateaus follow the terrain in both inclination and height. The placement in the north-western part of the site, gives the optimal conditions for enjoying the sun in summer afternoons.

On the next pages the floor plans are presented. They can be found in scale 1:100 in the accompanied drawing folder, no. 1-6. Furthermore, there is a final room program in appendix 3 and an emergency exit plan in appendix 4 .

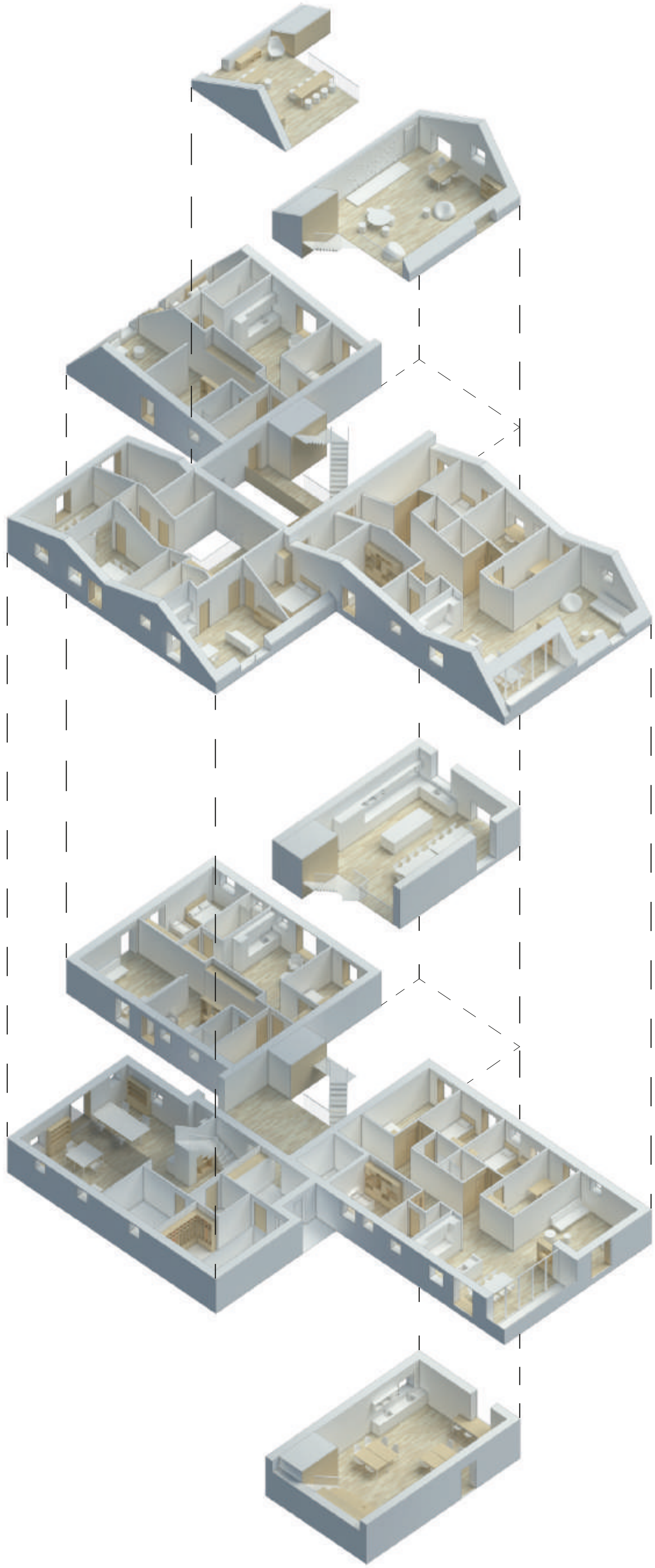


Fig. 156: Exploded axonometry of the building

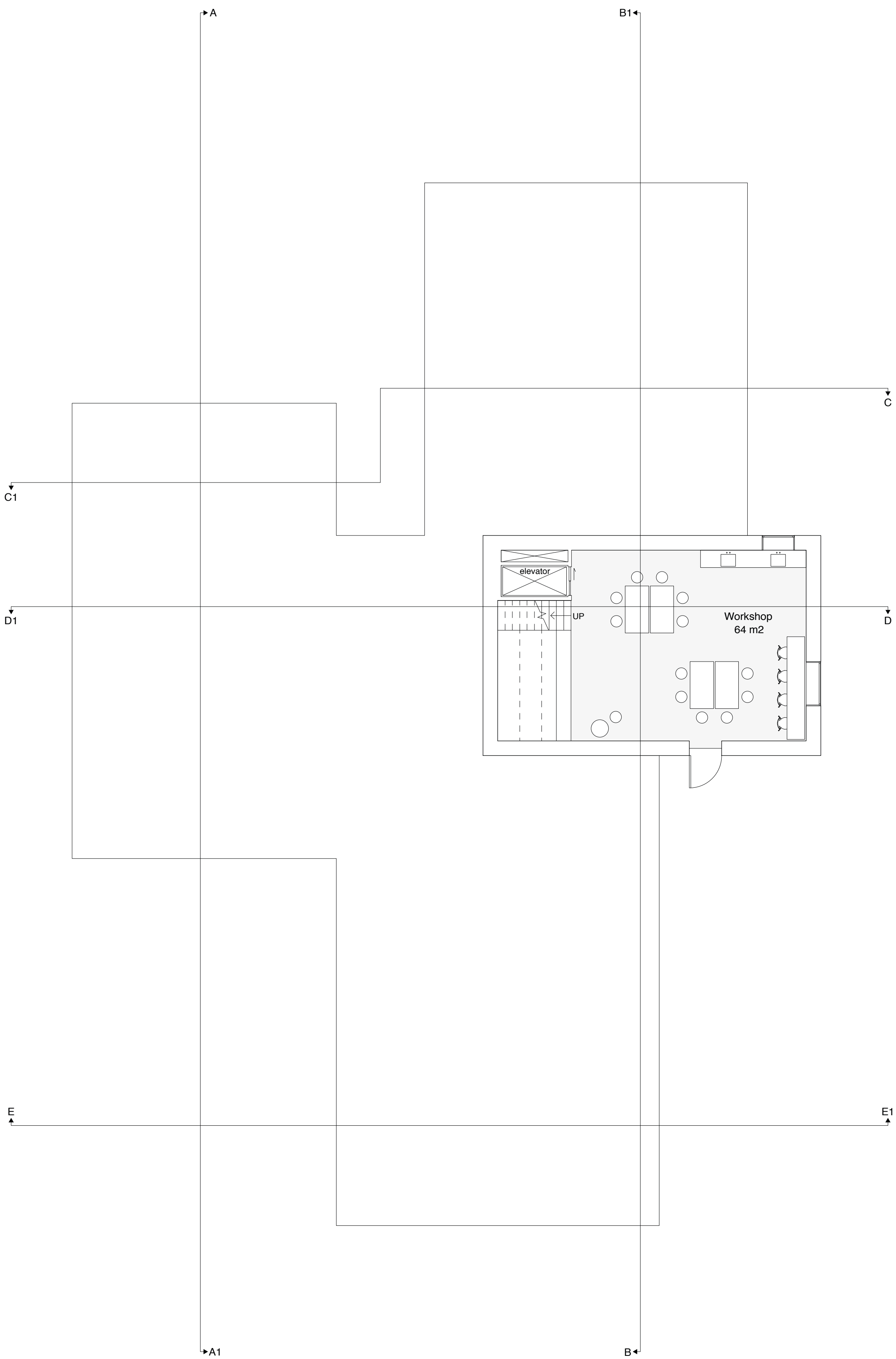


Fig. 157: Floor plan level -0,5

Fig. 158: Floor plan level 0

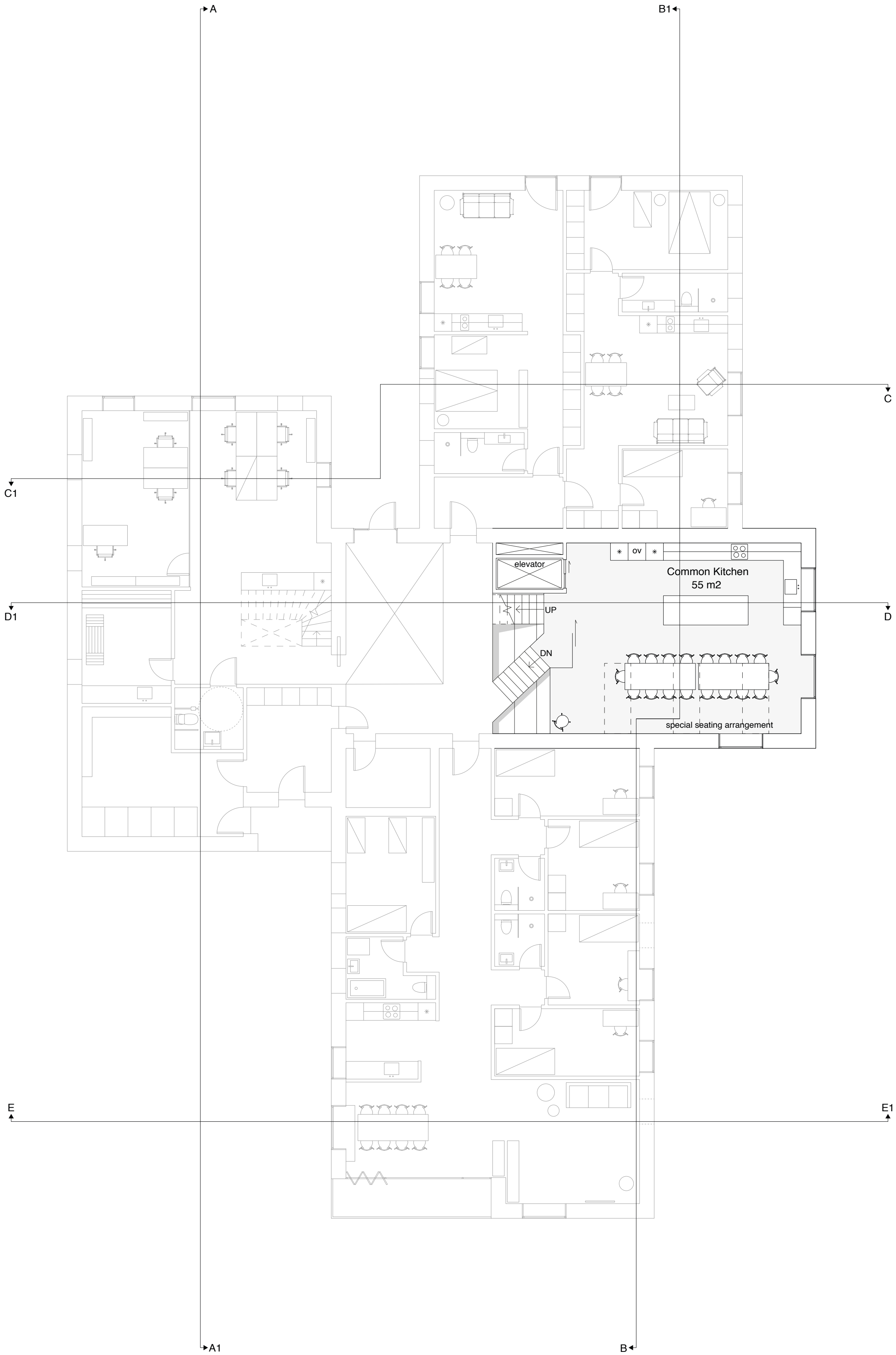


Fig.159: Floor plan level 0,5

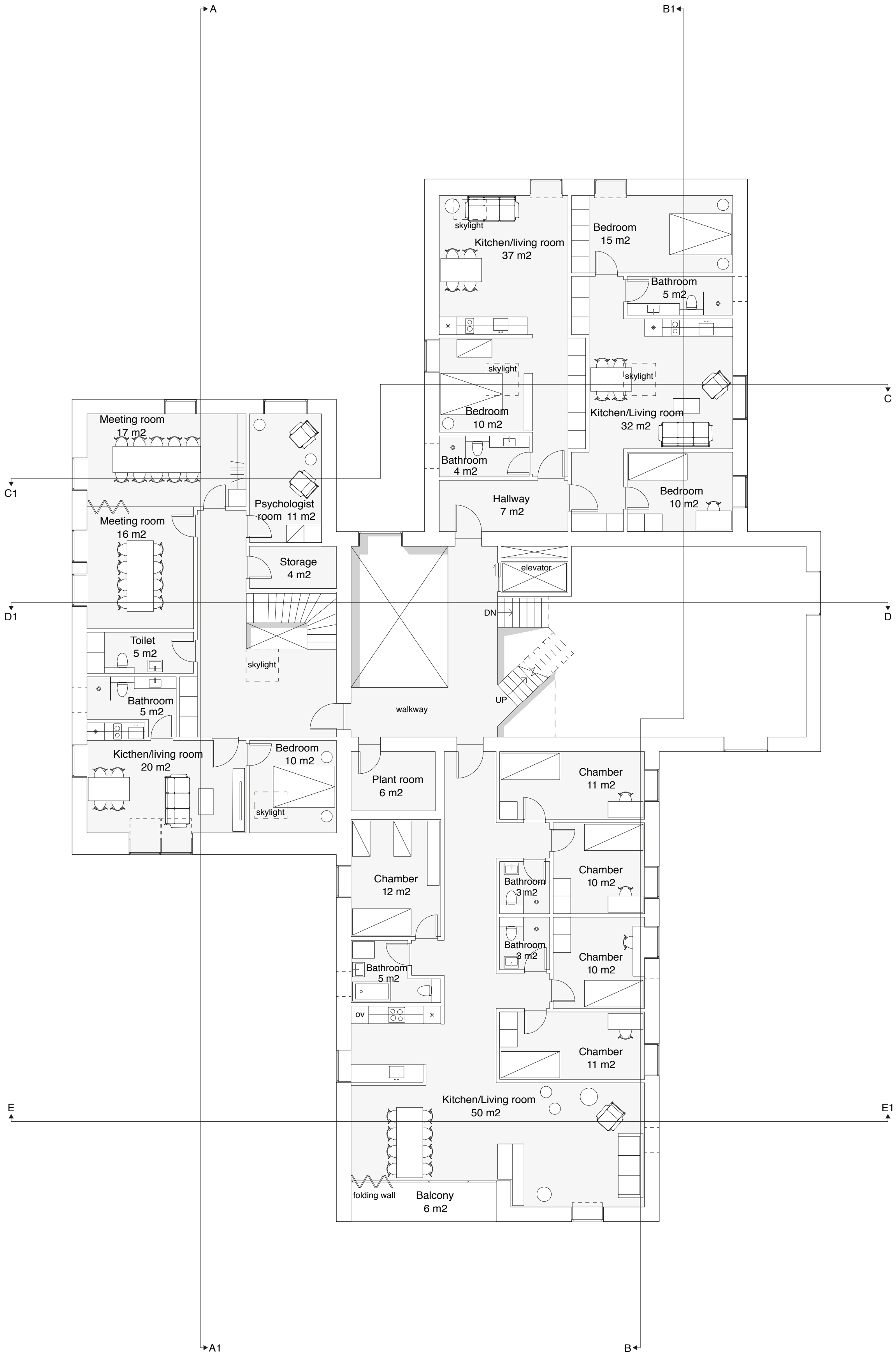


Fig. 160: Floor plan level 1

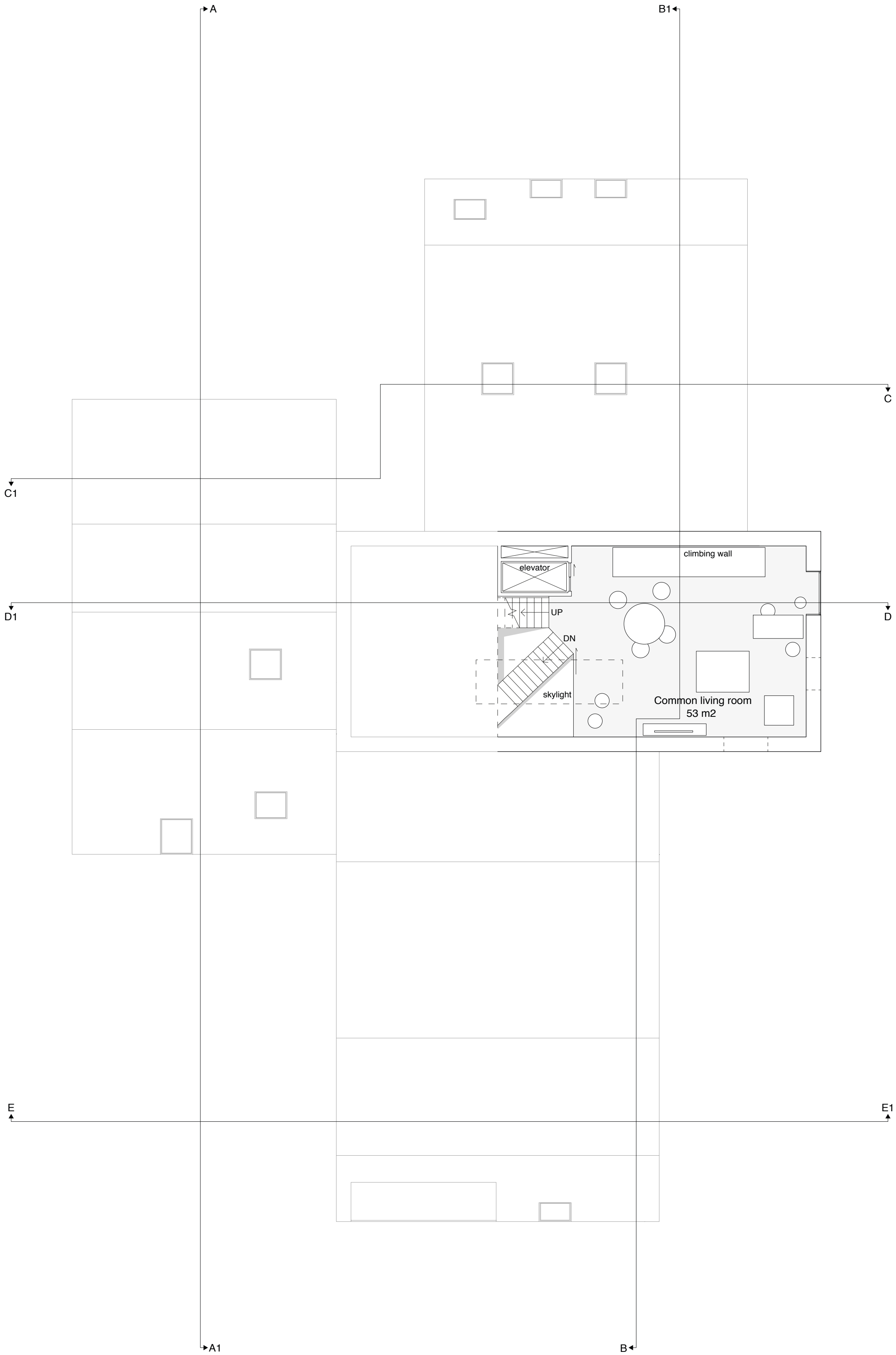


Fig. 161: Floor plan level 1,5

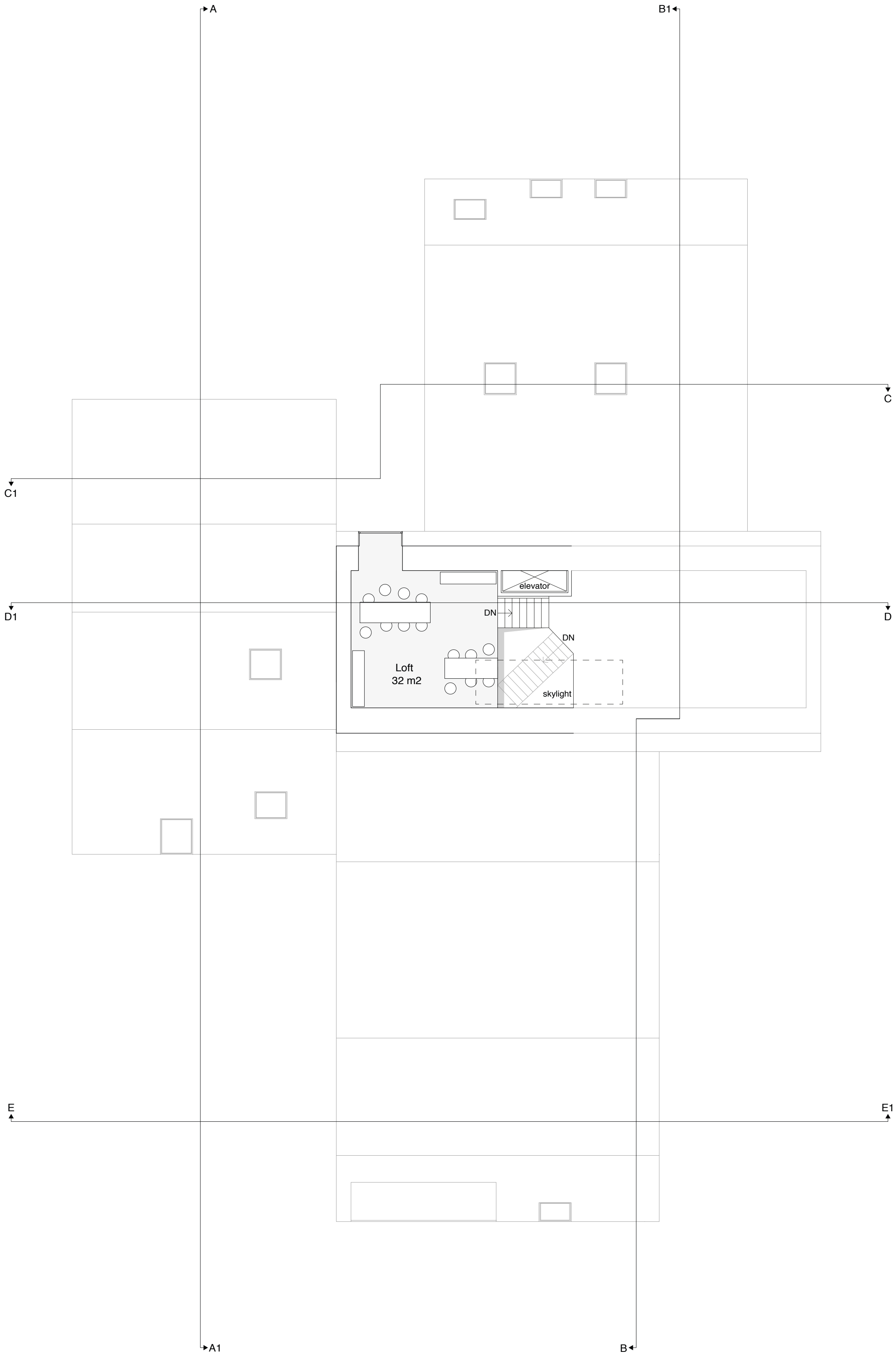


Fig. 162: Floor plan level 2

DAYLIGHT / QAAMANEQ

Because the site is difficult in terms of daylight the layout of the facades and the individual rooms have been designed with daylight as the main determining criteria.

In fig. 163 are the final daylight factors for some specific rooms shown. The daylight factor varies from 1,41% in the infant bedroom to 8,84% in the relative's kitchen. Accordingly, to this analysis there are some rooms, which are not meeting the demands of 2% daylight in half of the room. Since materials are not applied to this analysis, the results of this analysis are lower than how it will perform. In the design process (p. 103) the child bedroom was analyzed and optimized, and reached a mean daylight factor of 2,8% (for all rooms, see appendix 5).

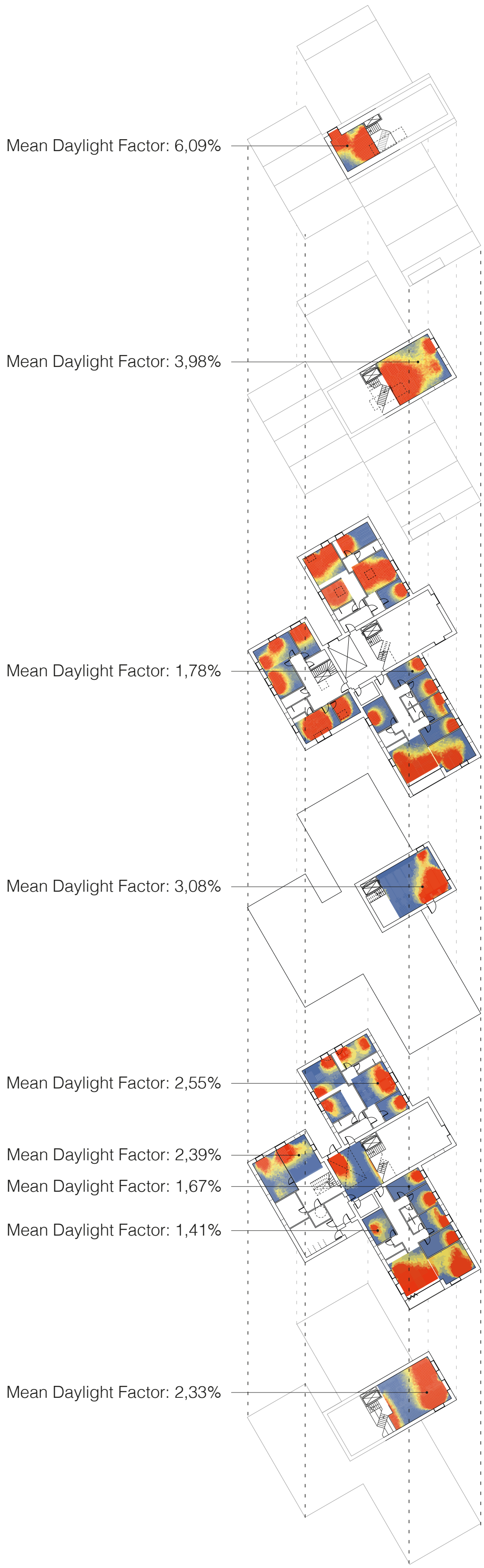
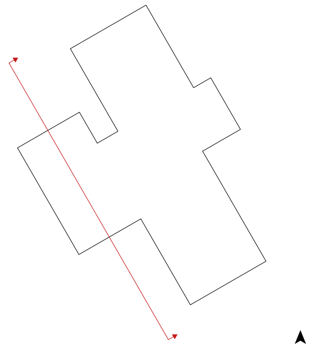


Fig. 163: Exploded axonometry analysis of daylight in the building

Fig. 164: View from entrance hall towards common areas



SECTIONS / SIKKIK

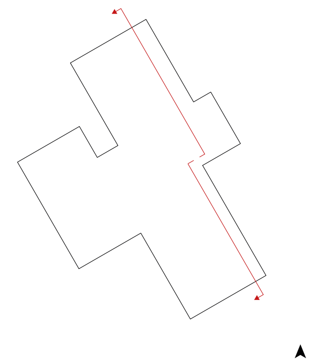
On the following pages are the sections presented.

The silhouette of the building is inspired by the ranges of mountains around Nuuk. The heights of the roof tops and bottoms are defined by what minimum and maximum heights of spaces are. The minimum height in a space is 2,5 meters, while the highest is 3,8 meters. In the ends of the volumes the roof is lower and helps defining and finish the volume. The slopes of the roof are intended low to fit into the built context.

The envelope is built up with low u-values for all construction components. They are:

Wall: 0,09 W/m2
Roof: 0,063 W/m2
Deck: 0,07 W/m2
Windows including frame: 0,54 W/m2

In some spaces suspended ceilings hide ventilation pipes. A principle for piping is illustrated in appendix 6. The pipes are not dimensioned, and therefore the ceilings are placed in a default height of 2,3 meters. Sections in scale 1:100 can be found in the accompanied drawing folder, no. 8-12.



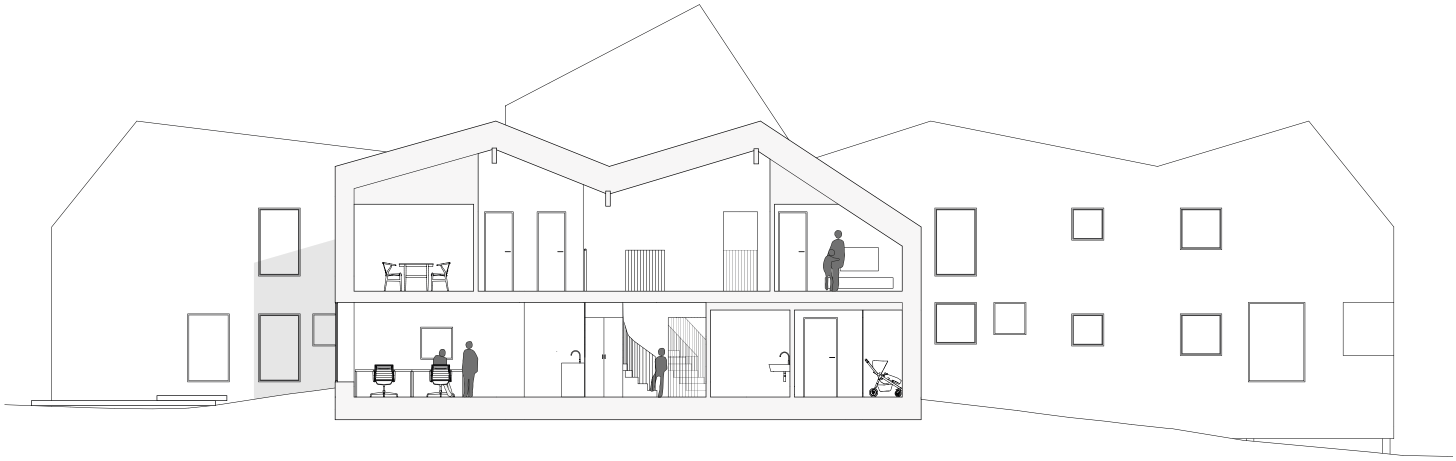
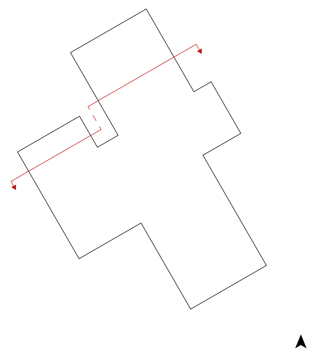
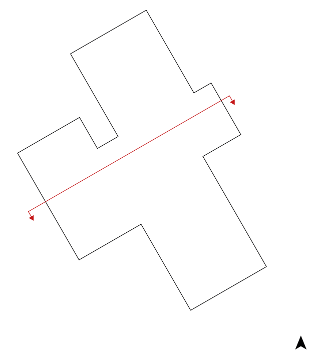
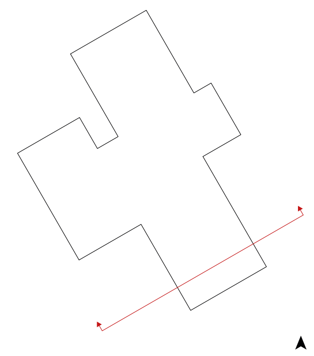


Fig. 165: Section A-A1

Fig. 166: Section B-B1







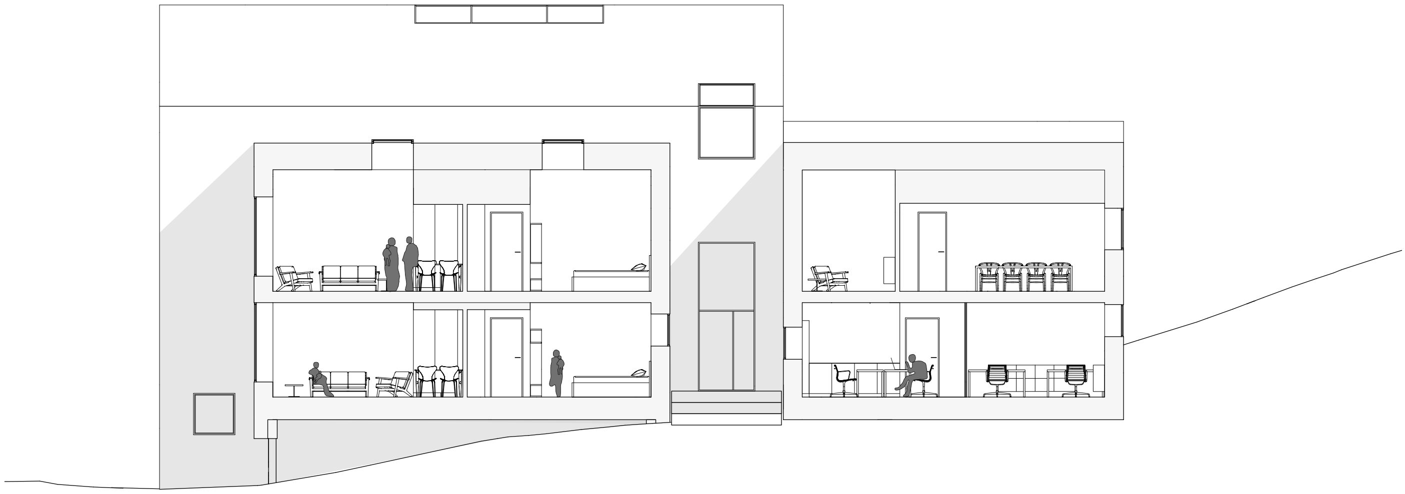


Fig. 167: Section C-C1

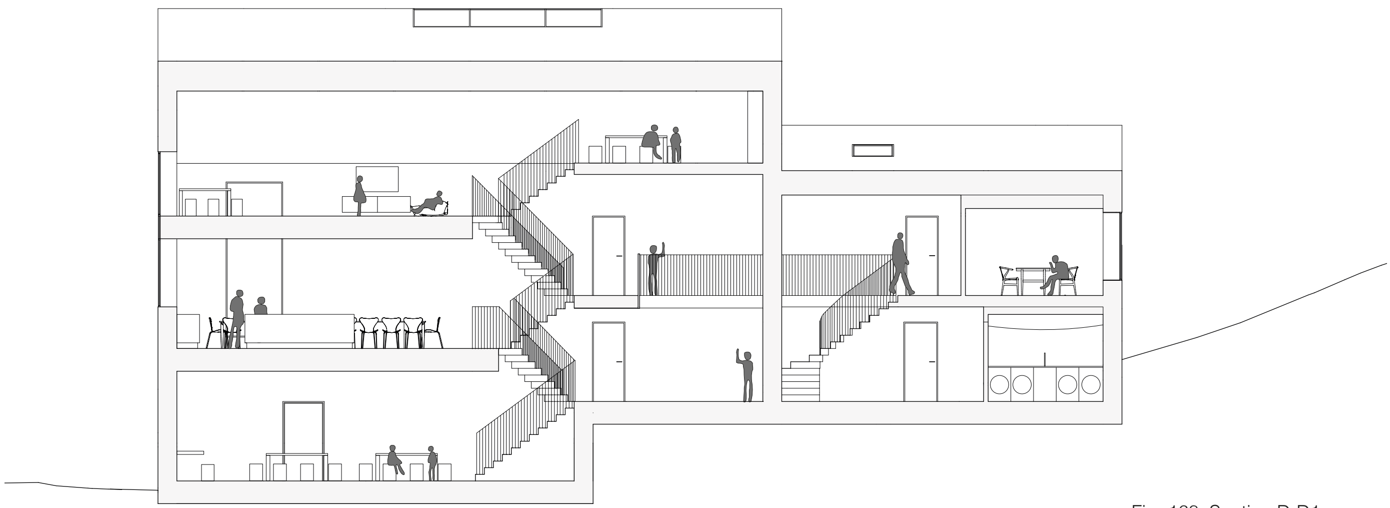


Fig. 168: Section D-D1

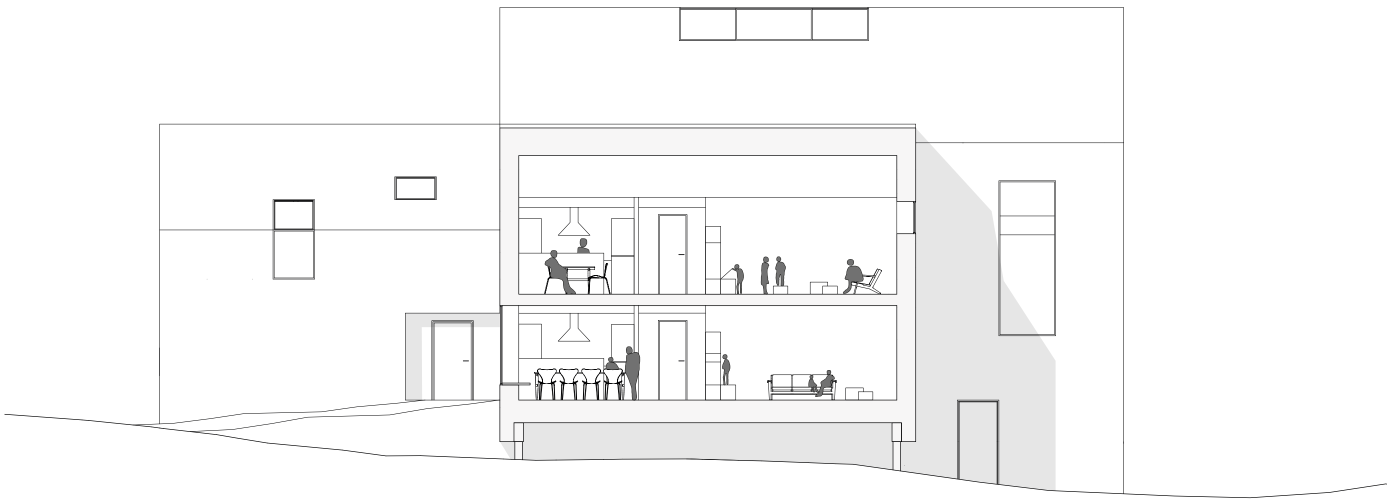


Fig. 169: Section E-E1

CONSTRUCTION / SANAAQ

In this diagram the different layers of the building are shown. The supporting construction consists of glu-laminated timber frames (fig. 170), which are placed in every roof top and roof bottom as well as a few other places to avoid too large span. On this, a simple wooden facade system is added (fig. 171) and on the facade system the floors are added with simple bracket (fig. 172). The two living wings are lifted on pilars (fig. 173) to give a lighter appearance. The windows are cut out in the facade system (fig. 174) and lastly the facade material is added (fig. 175).

The building envelope is constructed with a minimum of thermal bridges and low U-values for the building components. For further details about critical places in the construction and sections of facade envelopes can be found in the accompanied drawing folder, no. 17-21. On the next two pages the final facades with materials can be seen as well as in the accompanied drawing folder, no. 13-16.

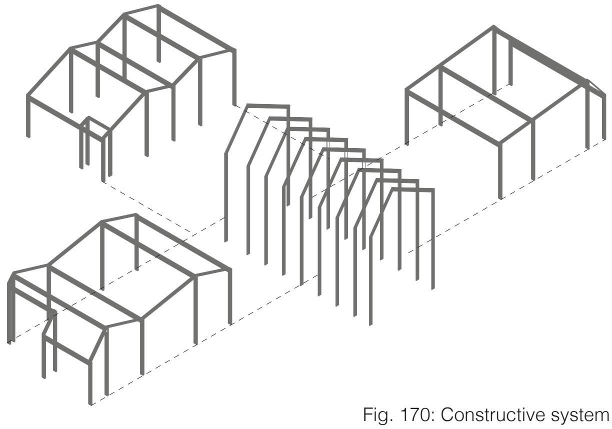


Fig. 170: Constructive system

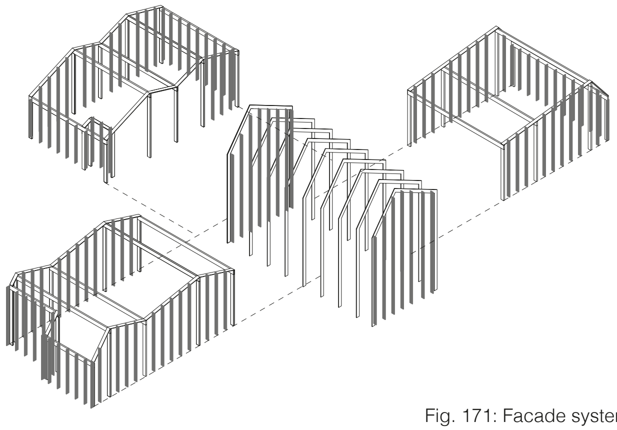


Fig. 171: Facade system

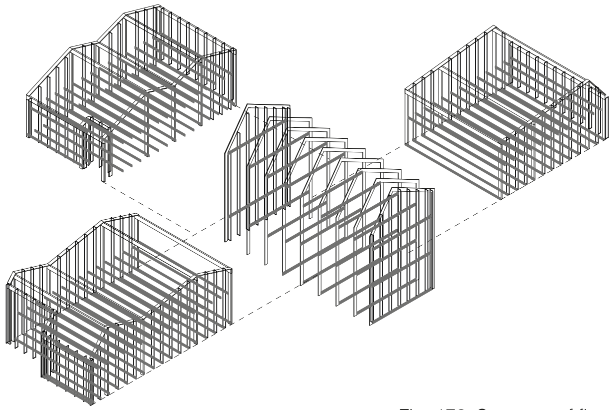


Fig. 172: Structure of floors

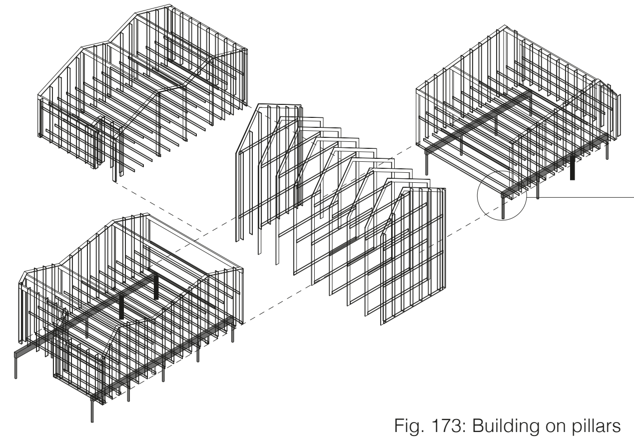


Fig. 173: Building on pillars

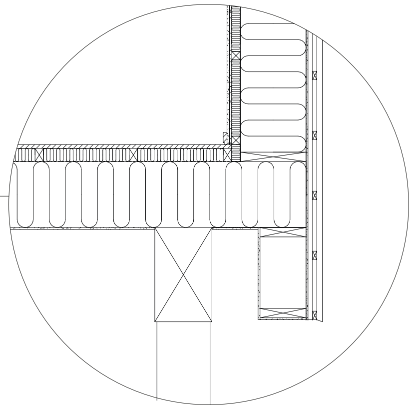


Fig. 176: Detail of building on pillars

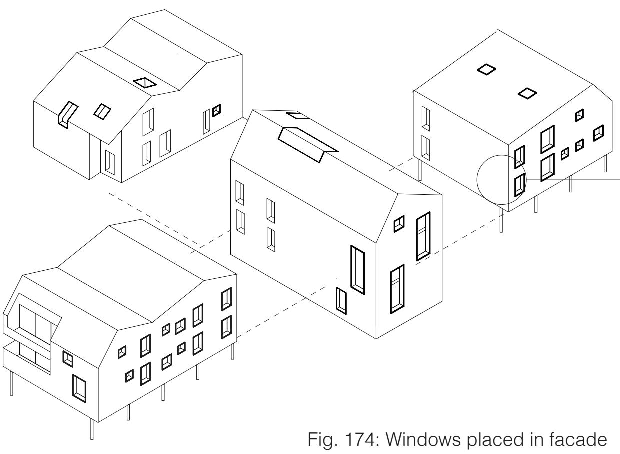


Fig. 174: Windows placed in facade

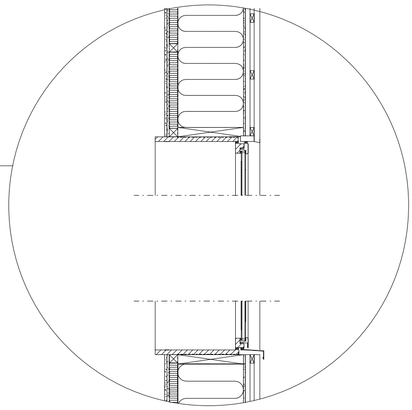


Fig. 177: Detail of windows placed in facade

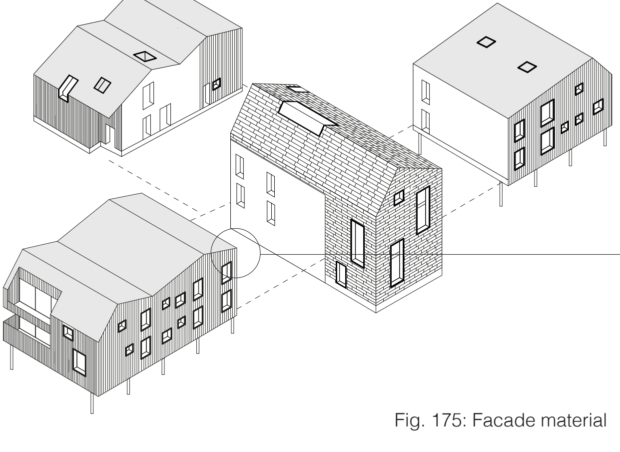


Fig. 175: Facade material

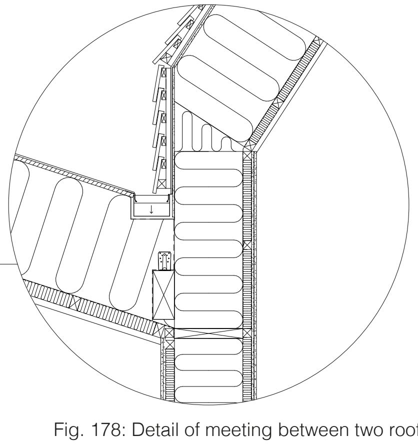


Fig. 178: Detail of meeting between two roofs

MATERIALS / ATORTUSSAQ

The facade materials are based on local traditions and goods. The common building is grounded and stands out from the rest of the building with its heavy hanging brick cladding. The other volumes are cladded with light wood.

The facade cladding consists of vertical kebony pine wood lamellas. The wood is treated with a bio-based waste from farming, which make the cell structure in the wood more resistant. It is a sustainable way of reaching a hardness in the wood, which can stand harsh climates (Kebony 2017). There are no examples of this materials used in Greenland, but several in northern Norway and Finland. Norway and Finland are not in the artic region, but has a higher relative humidity than Greenland (Climatemps 2017), and because moisture is the danger for wood, it is assumed that the material can stand the demands from the cold and tough climate. Over time it will patinate to a light grey color (Kebony 2017). The vertical orientation gives the building a light and elegant appearance, and it blends nicely into the area and the other buildings. Behind the lamellas are two layers of asphalt, which make the facade complete waterproof. The roofs are also made of asphalt. For further details about the facade layers a detail can be found in scale 1:10 in the accompanied drawing folder, no. 17.

The common building is cladded with hanging bricks, which is a heavy, solid material. It has a red-brown tone made from Greenlandic clay burnt by Petersen Tegl in Denmark (Villumsen 2015). It stands in contrast to the wood facade, but makes a clear reference to the other colored facades in the area. By mounting the bricks on rafters instead of making traditional masonry the mortar is saved, which counts positively in the LCA-calculation (Rode et al 2005). How the bricks are mounted on the facade can be found in scale 1:10 in the accompanied drawing folder, no. 19.

The pillars, the building is lifted on, is cast in place by Betoncentralen in Nuuk. The concrete material must be cast during the summer when temperature is above 5°C to prevent cracks. When the concrete is hardened, it is resistant to all climates for many years yet than other materials.

Inside, the floors are made of light wood and dark grey tiles. Tiles are in bathrooms, kitchens, the entrance and the utility room, whereas all other areas have wooden floors. Walls are white gypsum and the ceilings are nano perforated acoustic gypsum ceilings. In the hall, the elevator is covered vertical wooden lamellas with sound insulation behind. It will limit noise in the common areas.

Fig. 179: north-east facade

Fig. 180: south-east facade

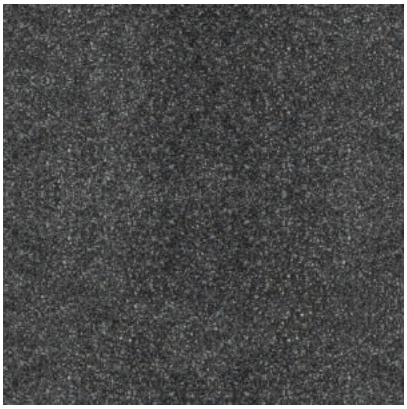


Fig. 181: Asphalt

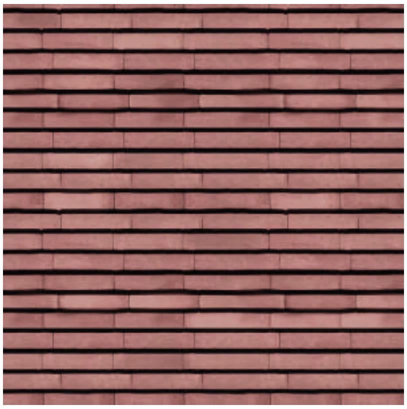


Fig. 182: Hanging bricks

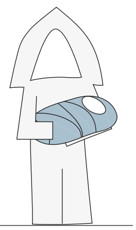

Fig. 183: Concrete


Fig. 184: Vertical wood lamellas

Fig. 185: north-west facade

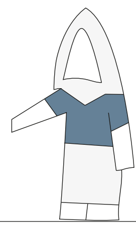
Fig. 186: south-west facade

PERSONAS' SPACES
/ INUTTUT INI



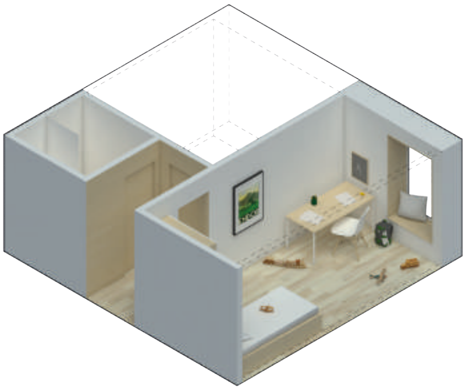
Aviaq and Pipaluk

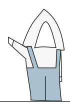
Aviaq and Pipaluk lives in one of the small family apartments. They sleep in a room separated from the hallway with a multi-functional furniture. It lets daylight into the hall and gives the opportunity to personalize the apartment. On the facing wall, they have a cabinet wall, with space for diapers, cloth, vacuum cleaner etc.

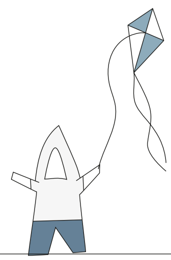


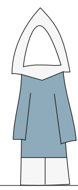
Mille

In the office, Mille does not have a private desktop, since she uses most of her working time with the children. If she needs to write reports or emails, she can use one of the flexible desktops in the open office. Storage for the staff is integrated underneath the staircase, which also creates a visible, but not audible boundary between the office and the hall.









Aqqaluk

Aqqaluk lives in a room with another infant. The room also has an adult bed for the staff having the night shift. Aqqaluk rarely uses his room for playing, since he spends most of the time near an adult or one of the other children.

Inu

The active boy, Inu, enjoys using the whole house. He is an active part of the common activities in the house (appendix 1). His room creates a place where he can play with his favorite toy, model airplanes. The thick window frame function as a bench, where he can relax after a day packed with activities.

Naja

Naja’s room gives her a place where she can retreat and find peace. She appreciates to sit at her desk and draw, while enjoying the scenery view. Storage for personal belongings are integrated under each bed, hereby creating functional solutions, to make use of all square meters in the room.

Fig. 187: Interior design

Fig. 188: Design of kitchen/living room

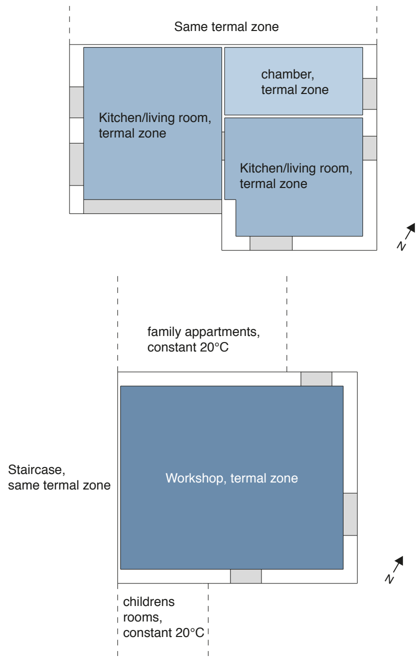


Fig. 189: Geometry used in BSim

THERMAL AND ATMOSPHERIC COMFORT / ATORUMINARTOQ

To optimize and verify the indoor comfort in the building, the thermal and atmospheric comfort has been investigated in BSim (appendix 7) in chosen rooms. The studies are based on a kitchen/living room in the children units, a children's room and the workshop (fig. 189). These rooms are chosen because of their diversity in size and use, to hereby optimize the indoor climate in different parts of the building.

Since the outdoor temperature does not exceed 22°C, overheating is not a problem neither a factor of which the ventilation system should be designed to cooperate with. Figure 192 shows that the operative temperature in winter is 22°C most of the time. In the workshop, the temperature rises 0,3°C in the weekend, due to a rise in the number of people using the room in these time intervals. In summertime, the temperature changes more over the day, but the rise in temperature still changes according to the people load (fig. 193).

Due to the low outdoor temperature, natural ventilation would not be beneficial even in summertime. Appendix 8 figure 221 -223 shows a comparison of airflow and heating in a week in February and a week in July using either natural ventilation or mechanical ventilation. The low outdoor temperature, results in a rise in heating when using natural ventilation, making it unbeneficial to make use of the natural ventilation.

Greenland has a low humidity, which also influence the indoor comfort. A low humidity can cause irritated nasal passages, eczema and dry skin, whereas a high humidity can cause dust miles and would. Consequently, the relative humidity should stay within the range of 20 and 60%. In appendix 8 fig. 220 the humidity in the rooms is investigated both with a humidifier in wintertime and without. With a humidifier, the relative humidity is more constant, and stays above 20% throughout the year, but using a humidifier will result in a higher energy use for the ventilation system.

The ventilation system and airflow is designed to accommodate the level of CO2 in the building. The ventilation system is designed to ensure an atmospheric comfort in category II, with the level decreasing to less than 700ppm when there is no people load (fig. 191). If the level of CO2 should instead be in the comfort category I, the higher air change would have a negative effect on both energy use and the relative humidity. In Fig. 190 the relative humidity in the kitchen and children's room is investigated in relation to an airchange resulting in either a CO2 level within the category I or II. The figure shows a perceptible ratio between humidity and airchange. When ventilating the rooms according to the category I the relative humidity will be less than 20% in 1000 hours more than when ventilating according to category II.

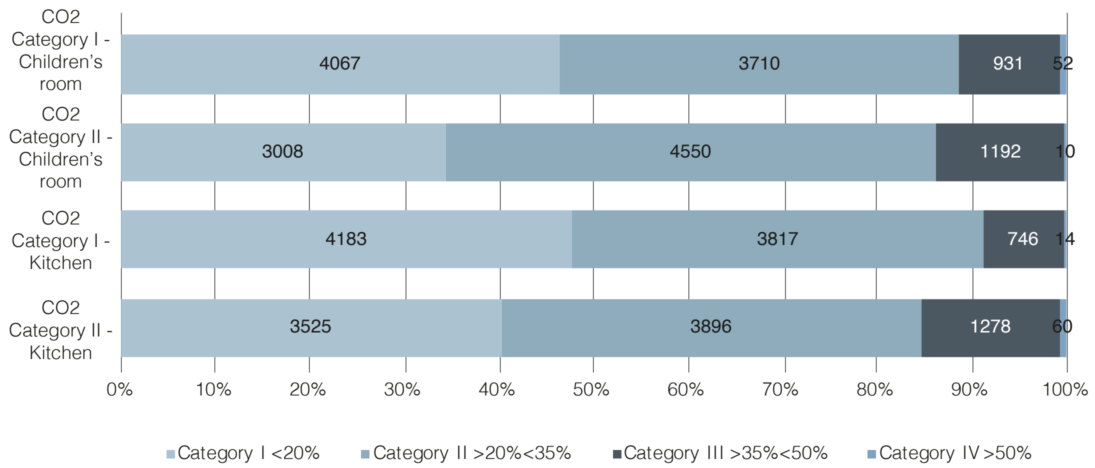


Fig. 190: Relative humidity in relation to the level of ventilation

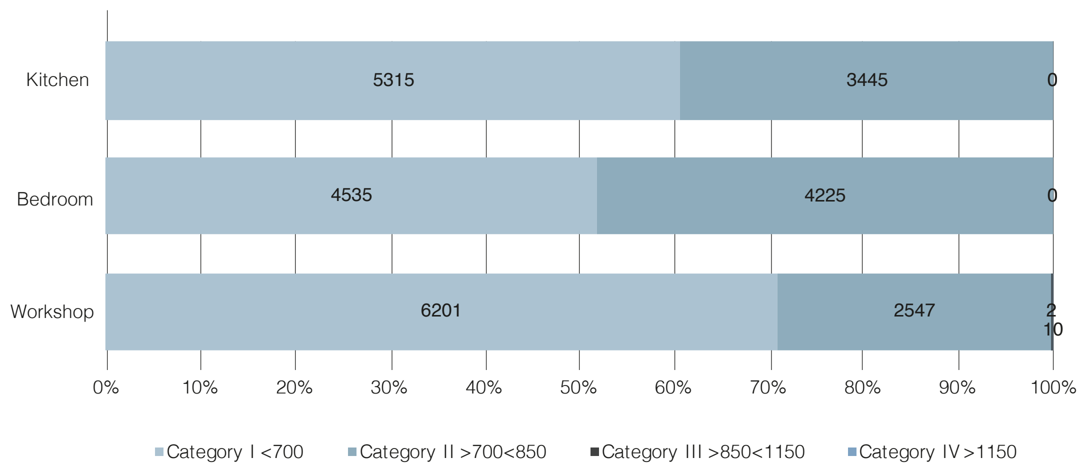


Fig. 191: CO2 concentration

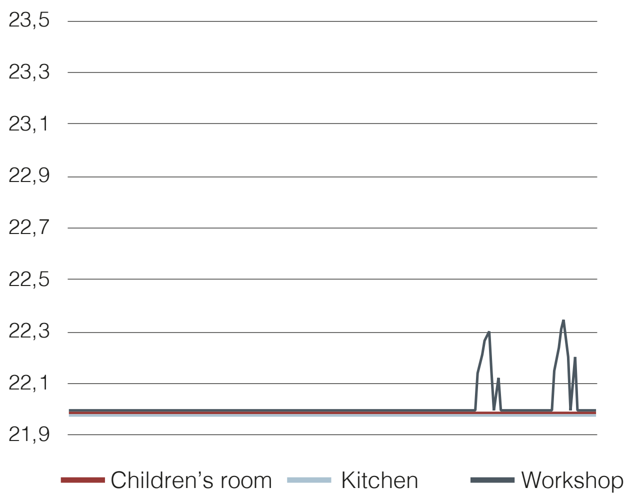


Fig. 192: Operative temperature (week 6)

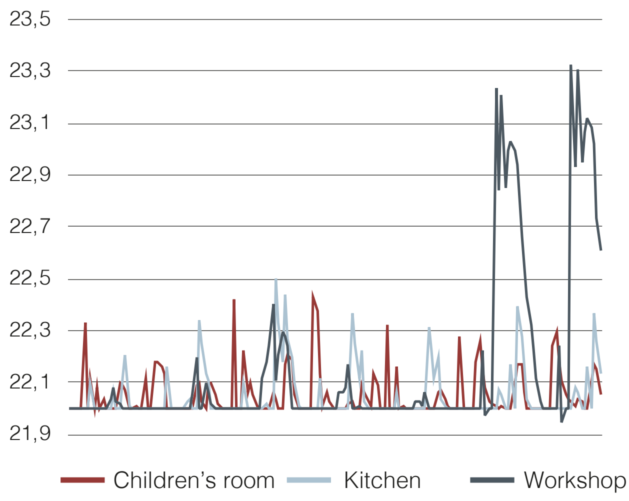


Fig. 193: Operative temperature (week 28)

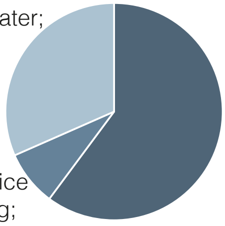


Fig. 194: Energy consumption for Nuuk

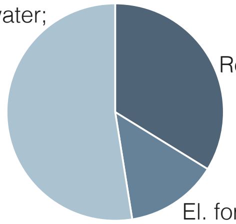


Fig. 196: Energy consumption for Denmark

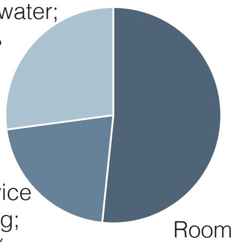


Fig. 195: Energy consumption 2020 for Nuuk

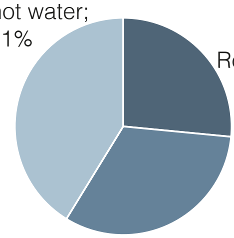


Fig. 197: Energy consumption 2020 for Denmark

ENERGY COMPARISON / NUKIMMIK ATUINEQ

The energy use for heating, domestic hot water and electricity for operation of the building is investigated using the certification software Be15. The results show a comparison of the energy frame when placing the building in a Danish climate and in a Greenlandic climate. The results show a higher demand of room heating in Greenland due to both lower outdoor temperatures and the different sun path, resulting in lower solar radiation in wintertime where the utilization factor is high, while the solar radiation in summertime is higher in Greenland (fig. 199) than it is in Denmark (fig. 201). In the Greenlandic climate, room heating accounts for 60% of the energy use (without primary energy factors) whereas it in the Danish climate accounts for only 34% (fig. 196). Consequently, the transmission loss through both the building envelope and ventilation system is of great importance. The transmission loss is kept down by having a well-insulated building envelope, a low number of windows and a small surface area. Heat recovery is implemented in the ventilation system, to further reduce the heat loss. To further minimize the energy consumption for room heating, larger area of windows towards South and a smaller area of windows towards North could have been implemented, to increase the solar radiation. But the shape of the site and the near context prevented this initiative to be fully integrated in the building. The low angle of the sun and short amount of sunhours in wintertime further sets a limit of the incident of solar radiation in the coldest months, making the use of solar radiation through windows less effective in Greenland than in Denmark.

The results in Be15 shows that if the building would have been placed in a Danish climate, the building would meet the energy frame of building class 2020. Without the use of primary energy factors, the annual energy would be 21,8 kWh/m2. Due to the colder climate in Greenland, the annual energy use in a Greenlandic climate is 36,4 kWh/m2 making the annual energy use 14,6 kWh/m2 higher in the Greenlandic climate than in the Danish (appendix 9). These results support the argument that the Greenlandic buildings should not copy Danish building standards and regulations, since the climate makes the building perform differently. The building industry in Greenland should have its own regulation to hereby create a high level of comfort and a low energy use in the Greenlandic climate.

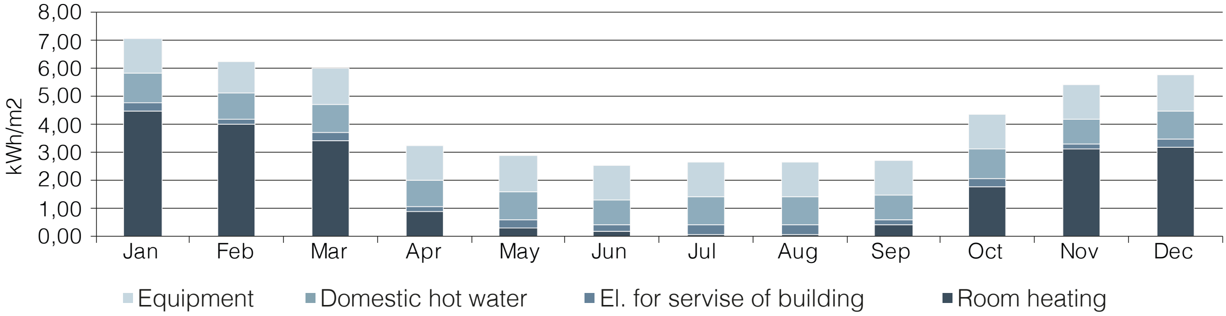


Fig. 198: Energy consumption for Nuuk

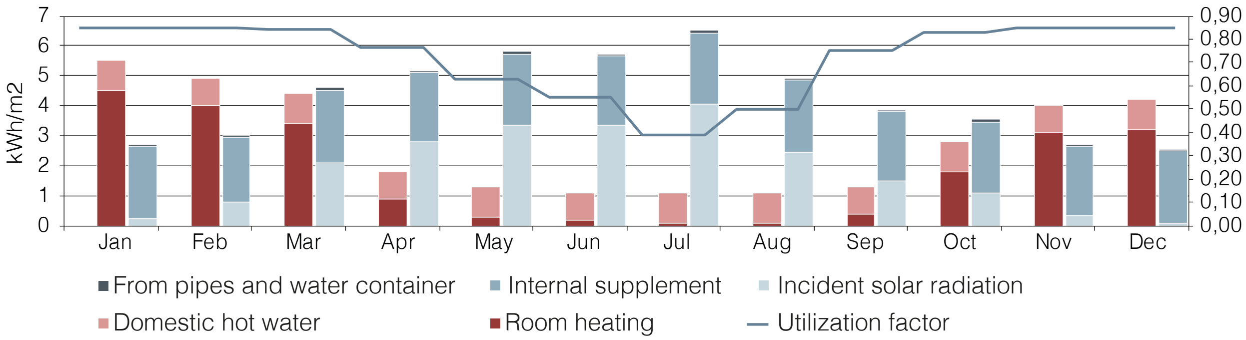


Fig. 199: Heating demand and heating supply for Nuuk

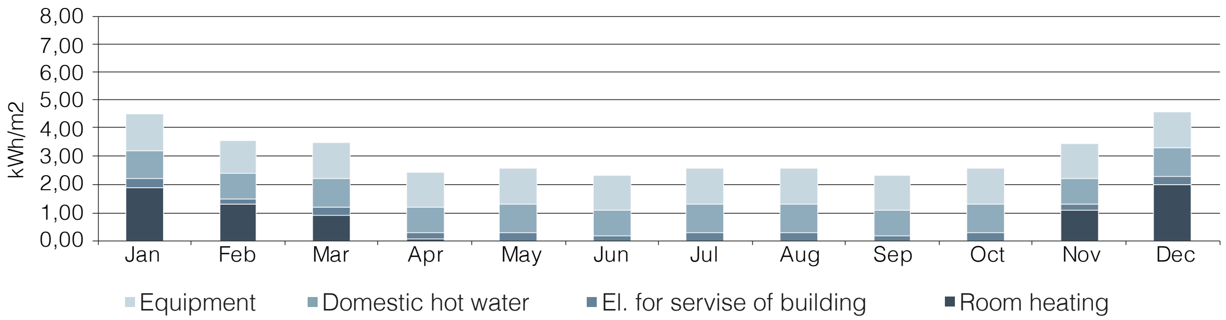


Fig. 200: Energy consumption for Denmark

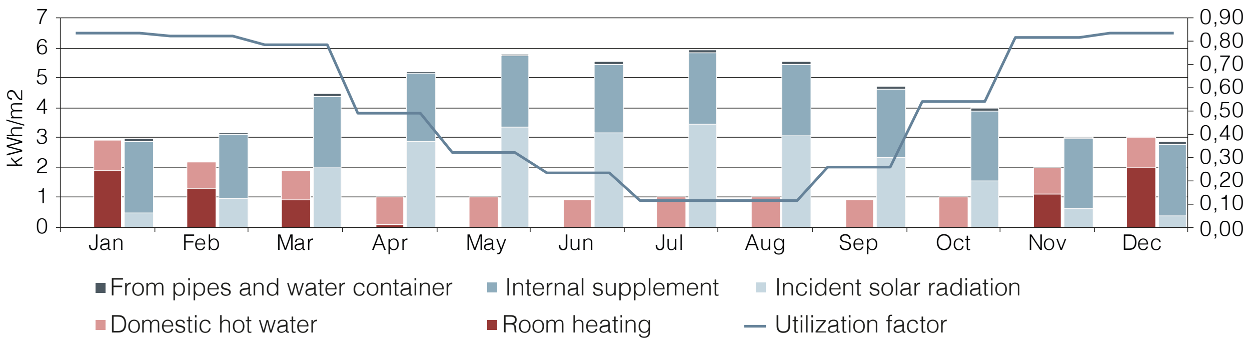


Fig. 201: Heating demand and heating supply for Denmark

Fig. 202: Ilagisakka seen from the road

EPILOGUE

/ naggasiut

CONCLUSION / INERNILIINEQ

The result of this master thesis is a children's and families' home in Nuuk. The design concentrates on creating a home with focus on different degrees of privacies, for the children and families to evolve as individuals. According to Maslow's hierarchy of needs, one must feel a belonging and connection to other people, before the personal development is possible. Neglected children are often socially underdeveloped and the neglect from early childhood can have fatal consequences for the child's ability to develop both socially and mentally. Thus, this children's and families' home focuses on creating a sense of community and belonging. The regular organization of a children's home is challenged. Instead of dividing the children in groups by age, they are divided in units with a mix of different ages, hereby creating a family-like structure, where the children can interact and learn from each other across ages.

Additionally, the children's and families' home is organized as a big-family, where workshop, kitchen and living room creates common facilities for the different families and children to gather in the larger community.

The idiom of the building is at the same time safe and playful. It is kept strict and refined in materials with a clear reference in materiality and tactility to the Greenlandic building tradition, but challenges the traditional block in form. It exudes playfulness and optimism, and pictures the users of the house in its expression.
The interior spaces are designed with focus on the individual. There are spaces for privacy, for small gatherings in the unit and for larger gatherings in the common spaces. It is designed to be children-friendly with soft wood on the floors, low windows, niches and playful elements such as the staircase and the climbing wall. Whereas the common areas concentrate on the social relations, the individual areas centers around nature and view as a healing aspect, to create areas for personal development and self-actualization.

The design arose through a holistic design process starting with loose sketching and physical modelling. It gave an understanding of the site qualities and – not least – challenges. The process ended in concrete detailing. The project is developed with the integrated design process as guideline and has constantly been evaluated in the field between form, function and technological performance. Site, sun, spaces and flows have indeed formed the project. All interior rooms are designed to have a high level of indoor comfort, both thermally, atmospherically, spatially and visually. The high level of indoor comfort and attention to a low environmental impact, makes a building, which sets an example towards a more sustainable Greenlandic building technique.

REFLECTION AND DISCUSSION / EQQARSAPOQ

When zooming out and looking at the project in a larger perspective there are issue, which can be reflected upon.

Firstly, is this site appropriate for housing a children's and families' home? Yes and No.
Yes, because the area is quiet, but close to Nuuk center. It is also close to nature, which is of high value.
No, because the sun conditions on site are extremely difficult and the site has an odd shape with the road on one site and a hill with residential buildings on the other side.
Throughout the process there has been predominantly focus on placing a building envelope, which would suit the site. It was indeed tricky to make it fit into context and the context, and integrate enough daylight to meet the regulations. Hence, the integration of other aspects started later. Likewise, the form that would allow daylight to come in would not be challenged, because it finally succeeded. In that way, the creative process was confined. It has given the daylight aspect much power through the design process, and other aspects have been secondary.

Since the visual comfort has had much focus, the passive strategies have not been explored extensively. One strategy, which could have been introduced was thermal mass and heat gain through south-facing windows. However, it has not been integrated because of the extreme differences between summer and winter. Moreover, the shape of the site prevents a long façade towards South, which could otherwise have given a larger incident of solar radiation. The building industry in Greenland has over the last 50 years been based on Danish standards and techniques. When investigating sustainability and indoor comfort in the climatic context of Greenland, it is clear though that buildings will perform very differently. Overheating, which is a focal point when designing in Denmark, is not an issue in Greenland. However, energy demand for heating and the low humidity are issues that challenge the energy frame and indoor climate in Greenland. The investigation of both energy consumption and indoor comfort, gave a broad but superficial understanding of the challenges and possibilities when building in an artic climate.

One aspect, which could have been explored more in detail are the outdoor areas. The terraces, the playground, the shed and the whole disposition of the site have only been designed superficially. A potential detailing of the outdoor areas would support the intentions and the concept for the building, and result in a more holistic design.

REFERENCES / NALEQQIUSSAQ

Aggerholm, Søren, 2014, 'LCA-profiler for bygningsdele – et katalog til brug tidligt i designprocessen', Statens byggeforskningsinstitut, Aalborg Universitet, accessed on 24th of April 2017 <http://www.hfb.dk/fileadmin/templates/hfb/visitkort/pdf/artikler/LCAP-katalog.pdf>

Bjerregaard, Peter, 2007, 'Godt 20 procent af unge grønlændere har forsøgt selvmord', Statens institut for folkesundhed, accessed on 26th of february 2017 < http://www.si-folkesundhed.dk/Ugens%20tal%20for%20folkesundhed/Ugens%20tal/12_2007.aspx>

Cappelen, John and others, 2001, 'Technical report 00-18. The observed Climate of Greenland, 1958-99 – with Climatological Standard Normals, 1961-99', Danish Meterological Institute, accessed on 5th of May 2017 <http://www.dmi.dk/fileadmin/user_upload/Rapporter/TR/2000/tr00-18.pdf>

Christensen, Peter Bondo and Egebo, Lone Als, 'Indlandsisen smelter', Videnskab.dk, 15th of April 2012. Accessed on 6th of March 2017 http://videnskab.dk/gronland-en-tikkende-klimabombe/indlandsisen-smelter

Christoffersen, Jens, 2005, 'Lys, sundhed og velvære', LYSnET accessed on 13th of May 2017 <http://lysnet.com/pages/lysnet.dk/viden-om-lys/artikler/artikler-om-kunstlys/lys-sundhed-og-velvaere.php>

Climatemps.com, 2017 'Relative humidity in Narvik, Nordland, Norway' Accessen on 11th of May 2017 <http://www.narvik.climatemps.com/humidity.php>

Dam, Tina, 2017, e-mail from 20th of February <tida@sermersooq.gl>

Danmarks Meterologiske Institut, 2017, 'Klimanormaler for Grønland', accessed on 5th of May 2017 < https://www.dmi.dk/groenland/arkiver/klimanormaler/>

Danmarkshistorien.dk, 2017, Aarhus Universitet, Aarhus, accessed on 15th of February 2017 <http://danmarkshistorien.dk/leksikon-og-kilder/vis/materiale/groenland/>

DAC and cities, 2017 '1987 Brundtland rapporten – vores fælles fremtid' Dansk Arkitektur Center, Bæredygtige byer, historik, from 31st of October 2016. Accessed on 8th of March 2017 < http://www.dac.dk/da/dac-cities/baeredygtige-byer/historik/1987--brundtland-rapporten-vores-faelles-fremtid/>

Department of Family, Equality and Social Affairs, 2015, Døgninstitutionernes Årsberetning 2015, Nuuk, accessed on 19th of February 2017, <http://naalakkersuisut.gl/~/media/Nanoq/Files/Attached%20Files/Familie/DK/2015/D%C3%B8gninstitutionernes%20%C3%A5rsberetning%202015/D%C3%B8gninstitutionernes%20%C3%A5rsberetning%202015.pdf>

DGNB, 2012, An Introduction to DGNB, Green Building Council (DK-GBC), Copenhagen, accessed on 20th of February 2017 <http://www.dk-gbc.dk/media/2292/dgnb_dk-gbc_oct_2012.pdf>

DGNB, 2017, Green Building Council (DK-GBC), Copenhagen, accessed on 20th of February 2017, <http://www.dk-gbc.dk/dgnb/introduktion-til-dgnb/baeredygtighed-paa-formel/>

Direktoratet for Boliger og Infrastruktur, 2006, Bygningsreglement 2006, Grønlands Hjemmestyre, Nuuk, accessed on 20th of February 2017 <http://www.byginfo.gl/Portals/0/pdf/love/BR2006DK.pdf>

Dunker, Annette, 2017, pedagogue and deputy at Villaen Children's home in Kerteminde, Denmark. Interview by Sara Stounberg Østergaard, Mette Norden Simonsen and Lene Nielsen, Aalborg, 27th of January 2017.

Eriksson, Hege Maria (ed.), 2010, 'Gode Prosesser – God Arkitektur', Norske arkitekters landsforbund, Oslo

Eugenius, Maritha, 2017, urban designer and consultant, interview at the Mayor Secretariat in Nuuk. Interview by Sara Stounberg Østergaard, Mette Norden Simonsen and Lene Nielsen, Nuuk, 17th of February 2017.

Fich, Lars Brorson, 2013, 'Towards a Neuroaffective Approach to Healing Architecture', PhD thesis, Aalborg University, accessed on 16th of February from Aalborg University's research portal vbn.aau.dk

Fleischer, Inunnguaq, 2017, deputy at the children's home Mælkebøtten in Nuuk. Interview by Sara Stounberg Øster-gaard, Mette Norden Simonsen and Lene Nielsen, Nuuk, 16th of February 2017

Gaisma, 2017, Matti Tukiainen, Vuorentausta, accessed on 14th of may 2017 <http://www.gaisma.com/en/location/nuuk.html>

Grønlands statistik Befolkning, 2017, Grønlands statistik, Nuuk, accessed on 26th of February 2017 < http://www.stat.gl/dialog/topmain.asp?lang=da&subject=Befolkning&sc=BE>

Haarløv, Winnie, 2006, Individets psykosociale udvikling, Terapeut.net, Copenhagen, accessed on 19th February 2017 <http://terapeut.net/individets-psykosociale-udvikling/>

Hansen, Niels, 2010, 'Hvad betyder 'sne' og 'en milimeter nedbør'?' Danmarks meterologiske institute. Accessed on 9th of March 2017 <https://www.dmi.dk/nyheder/arkiv/nyheder-2010/hvad-betyder-sne-og-en-millimeter-nedboer/>

Hansen, Per Hjelm, 2017, social worker, interview at the Greenlandic House in Aalborg. Interview by Sara Stounberg Østergaard, Mette Norden Simonsen and Lene Nielsen, Aalborg, 1st of February 2017

Holbech, Jørn, 2017, former school principal in Greenland, interview with the head of the Greenlandic House in Aarhus. Interview by Sara Stounberg Østergaard, Mette Norden Simonsen and Lene Nielsen, Aarhus, 3rd of February 2017

Hyltoft, Vibe and Sørensen, Bent Højgaard, 2013 'DF kræver kontrol ad milliardtilskud til Grønland' Berlingske.dk, on 6th of October 2013. Accessed on 8th of March 2017 < http://www.b.dk/nationalt/df-kraever-dansk-kontrol-af-milliardtil-skud-til-groenland>

Jensen, Irene Munk, 2004, 'Grønlandsk Kultur og Identitet' for Socialt udsatte grønlændere, oplæg ved temadag d. 4/10/2004 i Det Grønlandske Hus Aalborg, accessed on 16th of February 2017 <https://www.udsattegroenlaendere.dk/wp-content/uploads/irene-munk.pdf>

Jensen, Vibeke Bye, 2012 'Vi tegner rum til børn', Børn & Unge, Issue 5 March 2012, accessed on 17th of February 2017 http://www.bupl.dk/fagbladet_boern_og_unge/laes_boern_og_unge_som_epaper?opendocument

Kebony, 2017, Kebony A/S Norway, Oslo, accessed on 11th of May 2017 <http://kebony.com/en/content/wood-types/>

Killén, Kari, 2005, 'Omsorgssvigt er alles ansvar', Gyldendal, Copenhagen

Knudstrup, Mary-Ann, 2005, 'Arkitektur som integreret design', Ed: Botin, L. and Pihl, O. eds, 2005, Pandoras boks: metode.

Kommuneqarfik Sermersooq, 2014, 'Planstrategi 2014, accessed on 19th of February 2017, <https://sermersooq.gl/uploads/2014/08/Planstrategi-2014_dk.pdf>

Larsen, Dorthe, 2017, 'Folketal', Danmarks statistik, accessed on 26th of February 2017 < http://www.dst.dk/da/Statis-tik/emner/befolkning-og-valg/befolkning-og-befolkningsfremskrivning/folketal>

Lund, Else T., 2017, head of the Red Cross Children's Home in Nuuk. Interview by Sara Stounberg Østergaard, Mette Norden Simonsen and Lene Nielsen, Nuuk, 15th of February 2017

McLeod, Saul, 2008, Erik Erikson, SimplyPsychology, Manchester, accessed on 27th of February 2017 <http://www.simplypsychology.org/Erik-Erikson.html>

Mikkelsen, Signe, 2017, Architect MAA, interview at TNT Nuuk. Interview by Sara Stounberg Østergaard, Mette Norden Simonsen and Lene Nielsen, Nuuk, 17th of February 2017

Munkholm, 2017, John Bowlby – tilknytningsforstyrrelser, Munkholm Kursus- og Projektcenter, Jelling <http://www.munkholm.cc/artikler/tilknytningsforstyrrelser.html>

Narup, Asii Chemnitz, 2016, ‘Arkitekturpolitik’ - et redskab til at sikre og styrke de arkitektoniske kvaliteter og værdier i kommunens byer og bygder, accessed on 19th of February 2017, <https://sermersooq.gl/uploads/2016/09/Arkitekturpolitik_DK_nyeste-2.pdf>

Nuuk City Development, 2017, Kommuneqarfik Sermersooq, Nuuk, accessed on 19th of February 2017, <https://siorarsiorfik.sermersooq.gl/da/>

Olsen, Ivalo Rosing 2001, Børns opvækstvilkår i Grønland i et etnografisk – sociohistorisk perspektiv, Institut for kultur- og samfundshistorie Ilisimatusarfik, Nuuk, <http://mipi.nanoq.gl/Emner/Viden%20om%20boern%20og%20unge/Kategorier/~/media/mipi/MIPI_Viden_om_boern_og_unge/Projekter_og_rapportsamling/Opgaver_og_specialer/børns%20opvækstvilkår%20i%20gl.ashx>

Petersen, Trine Brun, 2012, ’Evidensbaseret design i sundhedsbyggeri’, in M. Dan-Weibel, S. M. Svarrer and B. Wistoft (eds.), Mentale Rum, pp. 28-35, Aarhus, Denmark

Pedersen, Lars, 2016, Folketallet falder fortsat, Grønlands statistic, accessed on February 20th 2017 <http://www.stat.gl/publ/da/BE/201601/pdf/Grønlands%20befolkning%202016.pdf>

Rambøll, 2013 ‘Udvidelse af havnen i Nuuk – Hydraulistisk modellering’ Made by JAN and supervised by JEES. Ref. 1100005443. Accessed on 9th of March 2017 < http://naalakkersuisut.gl/~/media/Nanoq/Files/Attached%20Files/Infrastruktur/DK/Havne/1271001-6712-001-1%20Hydraulisk%20modellering.pdf>

Rode, Carsten; Iversen, Anne.; Pedersen, Anne; Villumsen, Arne, 2005 ’Energy-efficient building’ Center for arktisk teknologi, 2. edition

Sá Lima, Joana da Rocha; Hjemdal, Tor Inge; Melsom, Anders and Jensen Boris Brorman, 2012 ’Possible Greenland’ Conditions, Oslo, Norway

Siegel, Tara J., 2016, ’Quality environments for children’, a design and development guide for childcare and early education facilities, accessed on 18th of February 2017 <https://www.gsa.gov/graphics/pbs/designguidesmall.pdf>

The Municipal Council, 1998, Lokalplan 3A7-2 Qernertunnguit Vest, Nuuk, accessed on 19th February 2017, <https://sermersooq.gl/uploads/2014/08/3A7-2_dk.pdf>

Villumsen, A., 2013 ’Rabarberfarvede mursten højt mod nord’ Petersen: 28, p22–23, Petersen Tegl A/S accessed on 11th of May 2017 <http://www.petersen-tegl.dk/media/444617/pt_28_dk_web_small.pdf>

Visit Greenland, 2017a, Dwellings of the Inuit Culture, Government of Greenland, Nuuk, accessed on 20th of February 2017 <http://www.greenland.com/en/about-greenland/culture-spirit/hunting-culture/dwellings-of-the-inuit-culture/>

Visit Greenland, 2017b, Architecture, Government of Greenland, Nuuk, accessed 20th of February 2017 < http://www.greenland.com/en/about-greenland/culture-spirit/architecture/

Webb, Roger T., Pedersen, Carsten B. and Mok, Pearl L.H, 2016 ’Adverse Outcomes to Early Middle Age Linked With Childhood Residential Mobility’ American Journal of Preventive Medicine, Elsevier Inc. p. 292-299. Accessed on 27th of February 2017 <http://www.ajpmonline.org/article/S0749-3797(16)30118-0/fulltext>

World Commission on Environment Development, 1987, Our common future, Oxford University Press, Oxford.

yr.no Weather statistics for Nuuk, Sermersooq, 2017, digital diagram, yr.no metrological institute Norway, accessed on 27th February 2017 < https://www.yr.no/place/Greenland/Sermersooq/Nuuk/statistics.html>

Øhrstrøm, Daniel, 2010, ’Naturen er vores kulturarv’, Kristeligt Dagblad, published online on 30th of August 2010, accessed on 16th of February 2017 <https://www.kristeligt-dagblad.dk/kultur/naturen-er-vores-kulturarv>

ILLUSTRATIONS / ASSILIARTAQ

Figure 1-3: Own illustrations

Figure 4: Method. Knudstrup, Mary-Ann, 2005, ’Arkitektur som integreret design’, Ed: Botin, L. and Pihl, O. eds, 2005, Pandoras boks: metode

Figure 5-10: Own illustrations

Figure 11: Greenlandic kids 2010, digital photograph, Berlingske Tidende, accessed on 27th February 2017, <http://www.b.dk/viden/groenlaender-magnet-fra-rummet>

Figure 12-22: Own illustrations

Figure 23: Wind 2013, digital diagram, Rambøll, accessed on 27th February 2017, <http://naalakkersuisut.gl/~/media/Nanoq/Files/Attached%20Files/Infrastruktur/DK/Havne/1271001-6712-001-1%20Hydraulisk%20modellering.pdf> and Danmarks Meterologiske Institut, 2017, ‘Klimanormaler for Grønland’, accessed on 5th of May 2017 < https://www.dmi.dk/groenland/arkiver/klimanormaler/>

Figure 24: Temperature 2017, digital diagram, YR, accessed on 27th February 2017, <https://www.yr.no/place/Greenland/Sermersooq/Nuuk/statistics.html> and
Cappelen, John and others, 2001, ’Technical report 00-18. The observed Climate of Greenland, 1958-99 – with Climatological Standard Normals, 1961-99’, Danish Meterological Institute, accessed on 5th of May 2017 <http://www.dmi.dk/fileadmin/user_upload/Rapporter/TR/2000/tr00-18.pdf>

Figure 25: Relative humidity: Cappelen, John and others, 2001, ’Technical report 00-18. The observed Climate of Greenland, 1958-99 – with Climatological Standard Normals, 1961-99’, Danish Meterological Institute, accessed on 5th of May 2017 <http://www.dmi.dk/fileadmin/user_upload/Rapporter/TR/2000/tr00-18.pdf>

Figure 26: Precipitation: Danmarks Meterologiske Institut, 2017, ‘Klimanormaler for Grønland’, accessed on 5th of May 2017 < https://www.dmi.dk/groenland/arkiver/klimanormaler/>

Figure 27: Sunpath: Gaisma, 2017, Matti Tukiainen, Vuorentausta, accessed on 14th of may 2017 <http://www.gaisma.com/en/location/nuuk.html>

Figure 28-29: Own illustrations

Figure 30: Turfhut in Greenland 2017, digital photograph, Visit Greenland, accessed on 27th February 2017, <http://www.greenland.com/en/about-greenland/culture-spirit/architecture/>

Figure 31: Block P 2009, digital photograph, Joshua Kucera, accessed on 27th February 2017, <http://flickriver.com/photos/joshua_kucera/3662660708/>

Figure 36: Interpretation of Marlows Hierachy of Needs 2017, digital diagram, Gyldendal Den Store Danske, accessed on 27th February 2017, <http://denstoredanske.dk/Krop,_psyke_og_sundhed/Psykologi/Psykologer/Abraham_Maslow>

Figure 37-141: Own illustrations

Figure 142-143: LCA comparison. Aggerholm, Søren, 2014, ’LCA-profiler for bygningsdele – et katalog til brug tidligt i designprocessen’, Statens byggeforskningsinstitut, Aalborg Universitet, accessed on 24th of April 2017 <http://www.hfb.dk/fileadmin/templates/hfb/visitkort/pdf/artikler/LCAP-katalog.pdf>

Figure 144-202: Own illustrations

Appendix:
Figure 203-225: Own illustrations

APPENDIX

/ bilagi

1: WEEKLY SCHEDULES FOR PERSONAS

Out of house
Family
Private room
Big-family

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
7-8 Morning routine	7-8 Morning routine	7-8 Morning routine	7-8 Morning routine	7-8 Morning routine	8-9 Morning routine	8-9 Morning routine
8-15 Day nursery	8-15 Day nursery	8-15 Day nursery	8-15 Day nursery	8-13 Day nursery	9-12 Playing	9-12 Playing
15-16 Playing	15-17 Music session	15-16 Playing	15-17 Playing	13-14 Nap	12-13 Lunch	12-13 Lunch
16-17 Bath	17-18 Playing	16-17 Bath	17-18 Help cooking	14.30-17 Table tennis battle	13-14 Nap	13-14 Nap
17-18 Help cooking	18-19 Dinner	17-18 Playing	18-19 Dinner	18-19 Dinner	14-17 Playing	14-17 Kaffemik
18-19 Dinner	19 Bedtime	18-19 Dinner	19 Bedtime	19 Bedtime	16-17 Bath	17-18 Playing
19 Bedtime		19 Bedtime			17-18 Playing	18-19 Dinner
					18-19 Dinner	19 Bedtime
					19 Bedtime	

Fig. 203: Weekly schedule: Aqqaluk, 2 years old boy

MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
7-8 Morning routine	7-8 Morning routine	7-8 Morning routine	7-8 Morning routine	7-8 Morning routine	8-10 Morning routine	8-10 Morning routine
8-14 School	8-13 School	8-12 School	8-14 School	8-13 School	10-15 Skiing daytrip	10-12 Playing outside
14-15.30 Homework	13.00-14.30 Homework	12-16 Playdate at friend's	14-15.30 Homework	13-14.30 Sparetime	15-16 Shower	12-13 Lunch buffet
15.30-17 Swimming	14.30-16.30 Playstation	16-17 Shower	15.30-17 Swimming	14.30-17 Table tennis battle	16-17 Ipad	13-14 Homework
17-18 Play in workshop	16.30-18 Reading book	17-18 Help cooking	17-18 Sparetime	17-18 TV	17-20 Pizza and soccer	14-17 Kaffemik
18-19 Dinner	18-19 Dinner	18-19 Dinner	18-19 Dinner	18-19 Dinner	20.30 Bedtime	17-18 Help cooking
19-20 Cleaning	19-20 Sparetime	19-20 Sparetime	19-20 Sparetime	19-20.30 Sparetime		18-19 Dinner
20 Bedtime	20 Bedtime	20 Bedtime	20 Bedtime	20.30 Bedtime		19-20.30 Sparetime
						20.00 Bedtime

Fig. 204: Weekly schedule: Inu, 10 years old boy

MONDAY	7-8 Morning routine 8-15 School 15-16.30 Homework 16.30-18 Painting 18-19 Dinner 20-21.30 Painting 21.30 Bedtime
TUESDAY	7-8 Morning routine 8-15 School 15-16.30 Homework 16.30-18 Sparetime 18-19 Dinner 19-20 Cleaning 20-21.30 Sparetime 21.30 Bedtime
WEDNESDAY	7-8 Morning routine 8-15 School 15-17 Drawing class 17-18 Homework 18-19 Dinner 19-21.30 Sparetime 21.30 Bedtime
THURSDAY	7-8 Morning routine 8-15 School 15-16 Homework 16-18 Psychologist 18-19 Dinner 19-21.30 Drawing 21.30 Bedtime
FRIDAY	7-8 Morning routine 8-13 School 13-18 Sparetime 18-22 Cinema 22 Bedtime
SATURDAY	8-10 Morning routine 10-17 Visit parents 17-18 Pizza 18-22 Movie night 22 Bedtime
SUNDAY	8-10 Morning routine 12-13 Lunch buffet 13-14 Homework 14-17 Kaffemik 17-18 Help cooking 18-19 Dinner 19-20.30 Sparetime 21.30 Bedtime

(Noon; 6pm)

Fig. 205: Weekly schedule: Naja, 15 years old girl

MONDAY	7-8.30 Morning routine 10-12 Baby swimming 12-13 Lunch 13-14 Nap 15-17 Stimulation training 17-18 Dinner 19 Bedtime
TUESDAY	7-8.30 Morning routine 8.30-10 Music for infants 12-13 Lunch 13-14 Nap 15-17 Grocery shopping 17-18 Dinner 19 Bedtime
WEDNESDAY	7-8.30 Morning routine 8.30-10 Walk with Pipaluk 12-13 Lunch 13-14 Nap 14-16 Stimulation training 17-18 Dinner 19 Bedtime
THURSDAY	7-8.30 Morning routine 10-12 Gymnastics 12-13 Lunch 13-14 Nap 15-17 Cleaning 17-18 Dinner 19 Bedtime
FRIDAY	7-8.30 Morning routine 10-11 Laundry 11-12 Walk with Pipaluk 12-13 Lunch 13-14 Nap 14-16 Stimulation training 16-17 Help cooking 17-18 Dinner 19 Bedtime
SATURDAY	7-8.30 Morning routine 10-12 Stimulation training 12-13 Lunch 13-14 Nap 17-18 Dinner 19 Bedtime
SUNDAY	7-8.30 Morning routine 10-12 Walk with Pipaluk 12-13 Lunch buffet 13-14 Nap 14-17 Kaffemik 17-18 Dinner 19 Bedtime

(Noon; 6pm)

Fig. 206: Weekly schedule: Aviaq and Pipaluk, 22 years and 4 months old

Fig. 207: Weekly schedule: Mille, 38 years old pedagogue

2: DAYLIGHT FACTOR SIMULATION 1

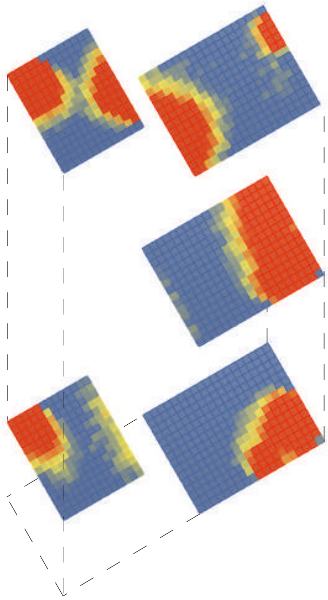


Fig. 208: Daylight analysis of the common areas

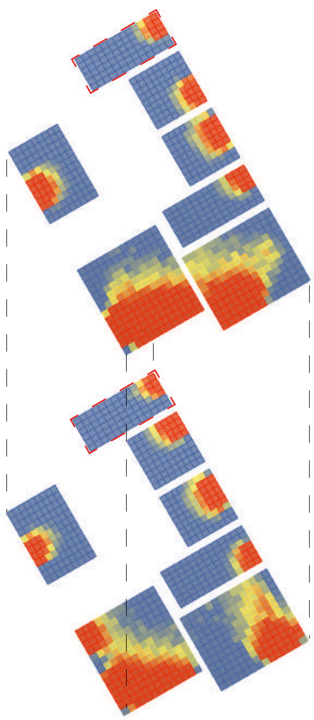
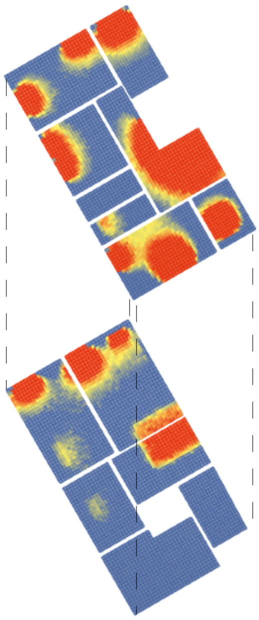
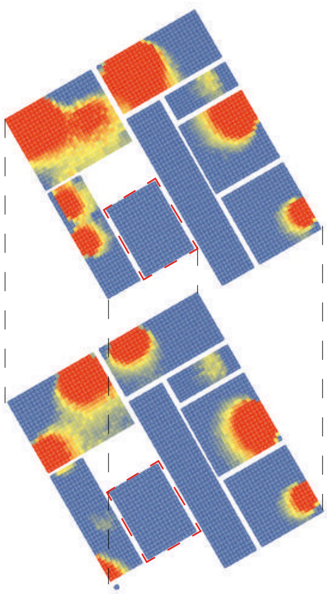


Fig. 209: Daylight analysis of the children’s units



DIVA-for-Rhino Daylight Factor Nodes Analysis
nodegroup00: Mean Daylight Factor =0 %
nodegroup00: 0% of Area between 1 & 3
nodegroup00: 0% of Area > 3 %; 100% of Area < 1 %
nodegroup01: Mean Daylight Factor =1.71 %
nodegroup01: 47.7% of Area between 1 & 3
nodegroup01: 9.4% of Area > 3 %; 42.9% of Area < 1 %
nodegroup02: Mean Daylight Factor =2.05 %
nodegroup02: 43.5% of Area between 1 & 3
nodegroup02: 13.9% of Area > 3 %; 42.6% of Area < 1 %
nodegroup03: Mean Daylight Factor =1.41 %
nodegroup03: 20% of Area between 1 & 3
nodegroup03: 24.8% of Area > 3 %; 55.2% of Area < 1 %
nodegroup04: Mean Daylight Factor =2.25 %
nodegroup04: 35.9% of Area between 1 & 3
nodegroup04: 19.4% of Area > 3 %; 44.7% of Area < 1 %
nodegroup05: Mean Daylight Factor =2.14 %
nodegroup05: 28% of Area between 1 & 3
nodegroup05: 20.6% of Area > 3 %; 51.4% of Area < 1 %
nodegroup06: Mean Daylight Factor =0.05 %
nodegroup06: 0% of Area between 1 & 3
nodegroup06: 0% of Area > 3 %; 100% of Area < 1 %
nodegroup07: Mean Daylight Factor =1.03 %
nodegroup07: 40.8% of Area between 1 & 3
nodegroup07: 0% of Area > 3 %; 59.2% of Area < 1 %
nodegroup08: Mean Daylight Factor =4.33 %
nodegroup08: 38.3% of Area between 1 & 3
nodegroup08: 33.3% of Area > 3 %; 28.4% of Area < 1 %
nodegroup09: Mean Daylight Factor =3.23 %
nodegroup09: 26.1% of Area between 1 & 3
nodegroup09: 39.3% of Area > 3 %; 34.6% of Area < 1 %
nodegroup10: Mean Daylight Factor =2.98 %
nodegroup10: 33.7% of Area between 1 & 3
nodegroup10: 30% of Area > 3 %; 36.3% of Area < 1 %
nodegroup11: Mean Daylight Factor =4.25 %
nodegroup11: 30.1% of Area between 1 & 3
nodegroup11: 56.5% of Area > 3 %; 13.4% of Area < 1 %
nodegroup12: Mean Daylight Factor =0.57 %
nodegroup12: 15.9% of Area between 1 & 3
nodegroup12: 0% of Area > 3 %; 84.1% of Area < 1 %
nodegroup13: Mean Daylight Factor =0 %
nodegroup13: 0% of Area between 1 & 3
nodegroup13: 0% of Area > 3 %; 100% of Area < 1 %

Fig. 210: Daylight analysis of the administration and room for relatives



DIVA-for-Rhino Daylight Factor Nodes Analysis
nodegroup00: Mean Daylight Factor =0.22 %
nodegroup00: 0% of Area between 1 & 3
nodegroup00: 0% of Area > 3 %; 100% of Area < 1 %
nodegroup01: Mean Daylight Factor =2.85 %
nodegroup01: 37.4% of Area between 1 & 3
nodegroup01: 27.2% of Area > 3 %; 35.4% of Area < 1 %
nodegroup02: Mean Daylight Factor =0.91 %
nodegroup02: 23.1% of Area between 1 & 3
nodegroup02: 4.1% of Area > 3 %; 72.8% of Area < 1 %
nodegroup03: Mean Daylight Factor =1.64 %
nodegroup03: 31.8% of Area between 1 & 3
nodegroup03: 13.2% of Area > 3 %; 55% of Area < 1 %
nodegroup04: Mean Daylight Factor =1 %
nodegroup04: 47.1% of Area between 1 & 3
nodegroup04: 0% of Area > 3 %; 52.9% of Area < 1 %
nodegroup05: Mean Daylight Factor =1 %
nodegroup05: 44.9% of Area between 1 & 3
nodegroup05: 0% of Area > 3 %; 55.1% of Area < 1 %
nodegroup06: Mean Daylight Factor =4.17 %
nodegroup06: 16.4% of Area between 1 & 3
nodegroup06: 44.2% of Area > 3 %; 39.4% of Area < 1 %
nodegroup07: Mean Daylight Factor =1.91 %
nodegroup07: 37.6% of Area between 1 & 3
nodegroup07: 20.3% of Area > 3 %; 42.1% of Area < 1 %
nodegroup08: Mean Daylight Factor =2.69 %
nodegroup08: 29.5% of Area between 1 & 3
nodegroup08: 24% of Area > 3 %; 46.5% of Area < 1 %
nodegroup09: Mean Daylight Factor =0.22 %
nodegroup09: 0% of Area between 1 & 3
nodegroup09: 0% of Area > 3 %; 100% of Area < 1 %
nodegroup10: Mean Daylight Factor =1.08 %
nodegroup10: 16.3% of Area between 1 & 3
nodegroup10: 9.1% of Area > 3 %; 74.6% of Area < 1 %
nodegroup11: Mean Daylight Factor =1.1 %
nodegroup11: 16.9% of Area between 1 & 3
nodegroup11: 9.4% of Area > 3 %; 73.7% of Area < 1 %
nodegroup12: Mean Daylight Factor =4.05 %
nodegroup12: 54.2% of Area between 1 & 3
nodegroup12: 35% of Area > 3 %; 10.8% of Area < 1 %
nodegroup13: Mean Daylight Factor =0.22 %
nodegroup13: 0% of Area between 1 & 3
nodegroup13: 0% of Area > 3 %; 100% of Area < 1 %
nodegroup14: Mean Daylight Factor =3.11 %
nodegroup14: 51% of Area between 1 & 3
nodegroup14: 29.2% of Area > 3 %; 19.8% of Area < 1 %
nodegroup15: Mean Daylight Factor =0.29 %
nodegroup15: 0% of Area between 1 & 3
nodegroup15: 0% of Area > 3 %; 100% of Area < 1 %
nodegroup16: Mean Daylight Factor =0.09 %
nodegroup16: 0% of Area between 1 & 3
nodegroup16: 0% of Area > 3 %; 100% of Area < 1 %
nodegroup17: Mean Daylight Factor =0.13 %
nodegroup17: 0% of Area between 1 & 3
nodegroup17: 0% of Area > 3 %; 100% of Area < 1 %

Fig. 211: Daylight analysis of the families units

3: ROOM PROGRAM

Space	Number of rooms	Size per room (m2)	Total per unit (m2)	Total (m2)
2 x children's units				
Bedroom type 1	2	10	20	40
Bedroom type 2	2	11	22	44
Shared bedroom for infants	1	12	12	24
Bathroom	2	3	6	12
Bathroom infants	1	5	5	10
Living room	1	21	21	42
Kitchen	1	29	29	58
Entrance	1	21	21	42
			136	**272**
2 x small family unit:				
Bedroom	1	10	10	20
Kitchen / living	1	21	21	42
Bathroom	1	4	4	8
Entrance	1	9	9	18
			44	**88**
2 x large family unit:				
Bedroom type 1	1	15	15	30
Bedroom type 2	1	10	10	20
Kitchen / living	1	22	22	44
Bathroom	1	5	5	10
Entrance	1	10	10	20
			62	**124**
Common:				
Workshop	1	64		64
Kitchen	1	55		55
Living room	1	53		53
Loft	1	32		32
Laundry	1	12		12
Entrance	1	10		10
Utility room	1	20		20
Hall	1	32		32
Walkway	1	16		16
				294
Administrative:				
Open office	1	27		27
Closed office	2	22		44
Meeting room type 1	1	16		16
Meetinroom type 2	1	17		17
Storage	1	10		10
Kitchen	1	6		6
Staff bathroom	2	5		10
Room for relatives	1	35		35
Walkway	1	37		37
				202
Total Net Area				**980 m2**
Total Gross Area				**1183 m2**

Fig. 212: Final room program

4: EMERGENCY EXIT PLAN

The building's four units each is a fire sections. All rooms have two rescue openings through a hall into another fire section or through a window. Each fire section has a building envelope of 50 cm and a fire doors between them. These doors will close automatically if a fire occurs.

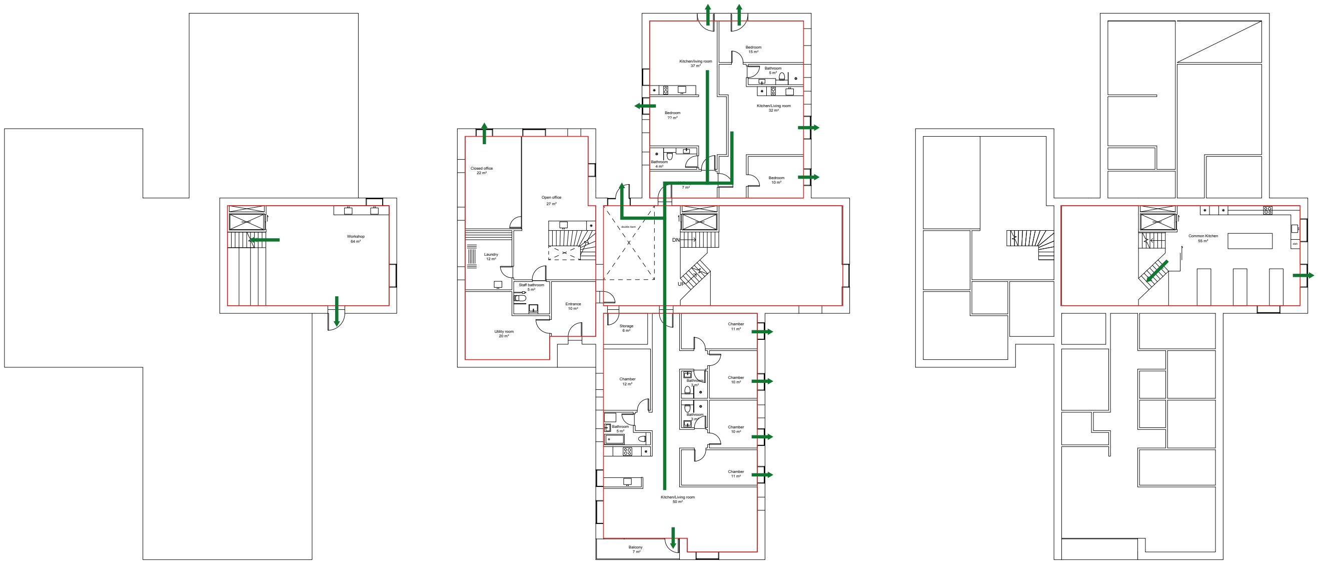
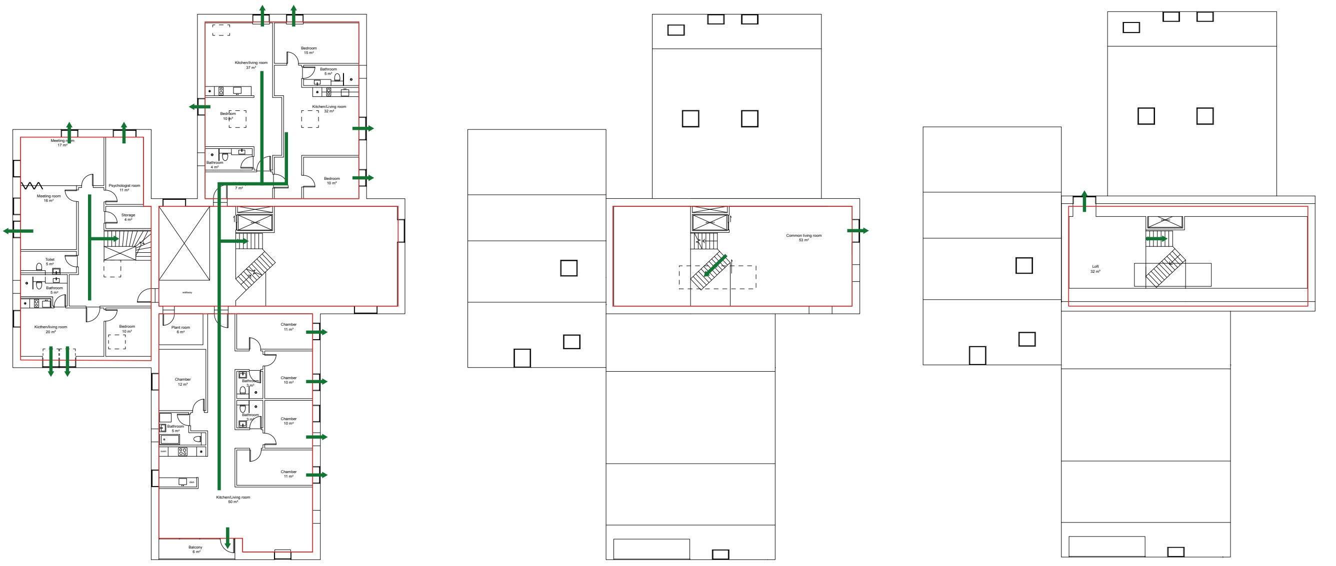


Fig. 213: Emergency exit plan



5: FINAL DAYLIGHT ANALYSIS

Workshop:
Mean Daylight Factor: 2,33 %
26,4% of area between 1% and 3%
23,6% of area >3%; 50% of area <1%

Level 0, Children:
Livingroom
Mean Daylight Factor: 3,27 %
61,1 % of area between 1% and 3%
28,8% of area >3%; 9,6% of area <1%

Kitchen
Mean Daylight Factor: 5,64 %
35,4 % of area between 1% and 3%
63,8% of area >3%; 0,8% of area <1%

Infants
Mean Daylight Factor: 1,41 %
64,1 % of area between 1% and 3%
4,7% of area >3%; 31,2% of area <1%

Children's room1
Mean Daylight Factor: 2,13 %
26,7 % of area between 1% and 3%
18,3 of area >3%; 55% of area <1%

Children's room2
Mean Daylight Factor: 2,27 %
56,7 % of area between 1% and 3%
15,6 of area >3%; 27,7% of area <1%

Children's room3
Mean Daylight Factor: 2,57 %
49,3 % of area between 1% and 3%
21,7 of area >3%; 29% of area <1%

Children's room4
Mean Daylight Factor: 1,67 %
23,1 % of area between 1% and 3%
15,7 of area >3%; 61,5% of area <1%

Offices
Common office
Mean Daylight Factor: 2,39 %
39,8 % of area between 1% and 3%
17,2 of area >3%; 43% of area <1%

Private office
Mean Daylight Factor: 1,89 %
39,8 % of area between 1% and 3%
11,5 of area >3%; 23,4% of area <1%

Level 0, large family
Childrens room
Mean Daylight Factor: 2,35 %
38,9 % of area between 1% and 3%
21,1 of area >3%; 40% of area <1%

Kitchen
Mean Daylight Factor: 2,55 %
35 % of area between 1% and 3%
23,11 of area >3%; 41,9% of area <1%

Bedroom
Mean Daylight Factor: 2,84 %
67,9 % of area between 1% and 3%
25,8 of area >3%; 6,6% of area <1%

Level 0, Small family
Kitchen
Mean Daylight Factor: 2,55 %
35% of area between 1% and 3%
23,11 of area >3%; 38,1% of area <1%

Bedroom
Mean Daylight Factor: 2,18 %
48,8% of area between 1% and 3%
17,6% of area >3%; 33,6% of area <1%

Level 0, entrance hall:
Mean Daylight Factor: 1,8 %
30,1 % of area between 1% and 3%
15,4% of area >3%; 54,5% of area <1%

Common Kitchen:
Kitchen area
Mean Daylight Factor: 3,08%
37,8% of area between 1% and 3%
34,3% of area >3%; 27,9% of area <1%

Dining area
Mean Daylight Factor: 4,16%
23,5% of area between 1% and 3%
47,4% of area >3%; 29,1% of area <1%

Level 1, Children:
Livingroom
Mean Daylight Factor: 3,3 %
50% of area between 1% and 3%
27,8% of area >3%; 22,2% of area <1%

Kitchen
Mean Daylight Factor: 5,1 %
38,7% of area between 1% and 3%
55,1% of area >3%; 6,2% of area <1%

Infants
Mean Daylight Factor: 2,1 %
37,8% of area between 1% and 3%
17,8% of area >3%; 44,4% of area <1%

Children's room1
Mean Daylight Factor: 2,1 %
27,8% of area between 1% and 3%
17,5 of area >3%; 54,7% of area <1%

Children's room2
Mean Daylight Factor: 2,24 %
54% of area between 1% and 3%
16,6 of area >3%; 29,4% of area <1%

Children's room3
Mean Daylight Factor: 2,52 %
45,9% of area between 1% and 3%
22,1 of area >3%; 32% of area <1%

Children's room4
Mean Daylight Factor: 1,78%
23,3% of area between 1% and 3%
16% of area >3%; 60,7% of area <1%

Level 1, administration:
Phycologist room
Mean Daylight Factor: 4,13 %
42,1 % of area between 1% and 3%
40,8% of area >3%; 17,1% of area <1%

Meeting room1
Mean Daylight Factor: 2,62 %
51,4 % of area between 1% and 3%
24,4% of area >3%; 24,2% of area <1%

meeting room2
Mean Daylight Factor: 2,81%
58,2% of area between 1% and 3%
28,8% of area >3%; 13% of area <1%

relative's bedroom
Mean Daylight Factor: 4,41 %
22,6 % of area between 1% and 3%
56,9of area >3%; 20,5% of area <1%

relative's Kitchen
Mean Daylight Factor: 8,84 %
26,2% of area between 1% and 3%
61,1% of area >3%; 12,7% of area <1%

Level 1, large family
Childrens room
Mean Daylight Factor: 2,32 %
37,2 % of area between 1% and 3%
21,4 of area >3%; 41,4% of area <1%

Kitchen
Mean Daylight Factor: 4,03%
34,9% of area between 1% and 3%
20,6 of area >3%; 44,5% of area <1%

Bedroom
Mean Daylight Factor: 3,43 %
19,6 % of area between 1% and 3%
29,9 of area >3%; 50,5% of area <1%

Level 1, Small family
Kitchen
Mean Daylight Factor: 4,92 %
38,7% of area between 1% and 3%
59,7 of area >3%; 1,6% of area <1%

Bedroom
Mean Daylight Factor: 5,28 %
26,3% of area between 1% and 3%
73,7% of area >3%; 0% of area <1%

Common Livingroom:
Mean Daylight Factor: 3,98%
53,6 % of area between 1% and 3%
42,3% of area >3%; 4,1% of area <1%

Common Loft:
Mean Daylight Factor: 6,09%
33,9 % of area between 1% and 3%
48,8% of area >3%; 17,3% of area <1%

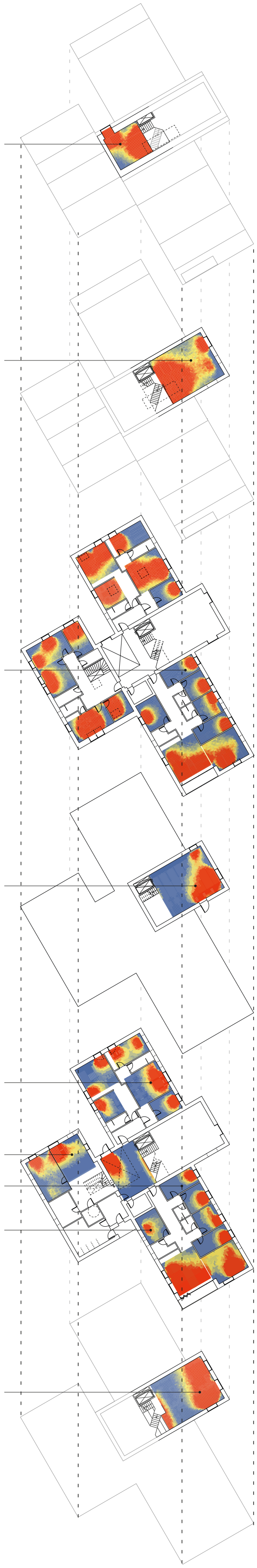


Fig. 214: Final daylight analysis of the building

6: PRINCIPLE OF PIPING FOR VENTILATION SYSTEM

The ventilation system for the building has one central in the plant room in the center of the building. The pipes run through suspended ceilings in hallways and toilets. The elevator core has a shaft used for pipes to the common areas. The pipes are not dimensioned and neither is the pressure loss. Therefore, this should be seen as a principle for, where to supply air and where to exhaust air.

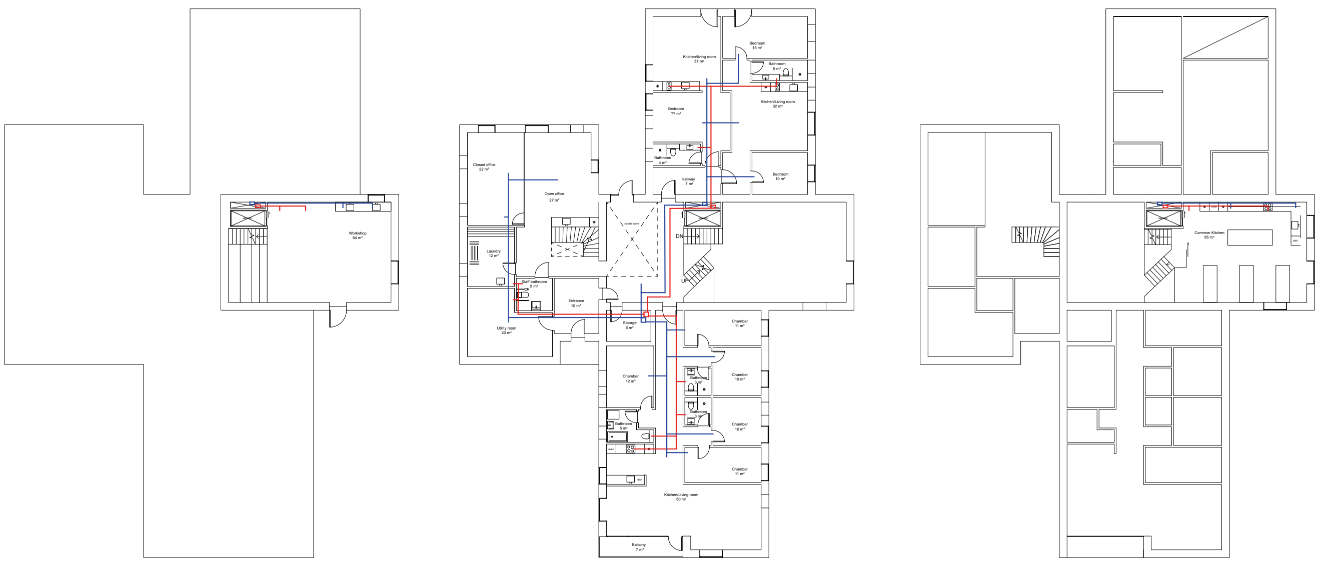
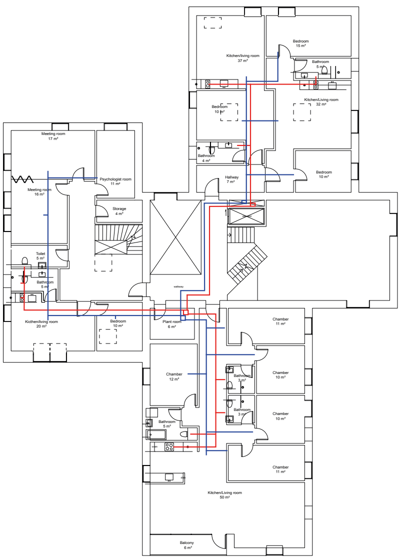
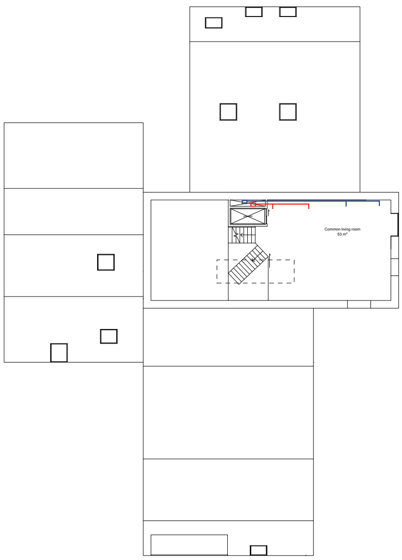
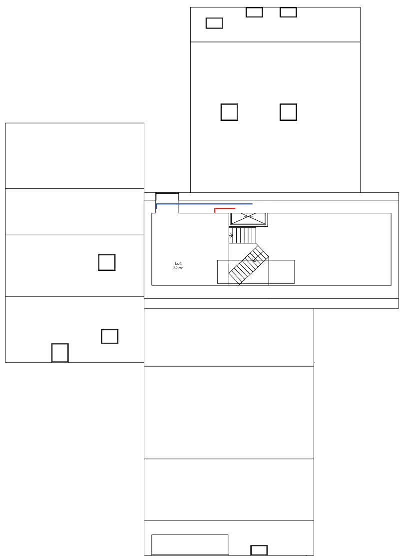
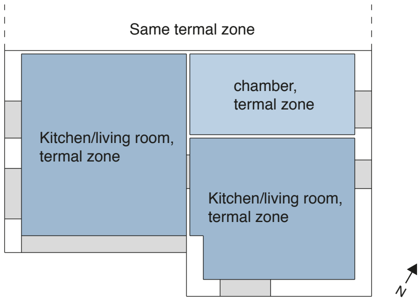


Fig. 215: Ventilation systems


Kitchen/living room
37 m²
Bedroom
15 m²
Bathroom
5 m²
Bedroom
10 m²
Kitchen/Living room
32 m²
Bathroom
4 m²
Hallway
7 m²
Bedroom
10 m²
Meeting room
17 m²
Psychologist room
11 m²
Meeting room
16 m²
Storage
4 m²
Toilet
5 m²
Bathroom
5 m²
walkway
Kicthen/living room
20 m²
Bedroom
10 m²
Plant room
6 m²
Chamber
11 m²
Chamber
12 m²
Bathroom
3 m²
Chamber
10 m²
Bathroom
3 m²
Chamber
10 m²
Bathroom
5 m²
Chamber
11 m²
Kitchen/Living room
50 m²
Balcony
6 m²

Common living room
53 m²

Loft
32 m²

7: BSIM SYSTEMS



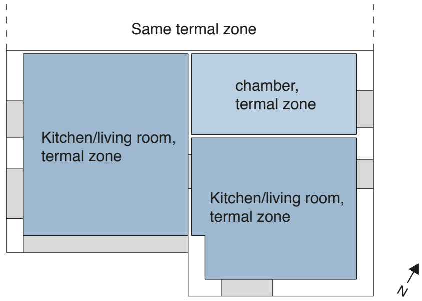
Chamber 10m2

System	**Description**	*Schedule* **Control**	**Indication of time**
Human Load (1 pers)	1 person, child 100 % present	See figure 2	Weedays Weekend
Equipment	Appliances and lighting in an energy neutral building corresponding maximum hourly use of 0,04 kWh (1,71 W/m2)	See figure 1	Winter Cold spring/fall Warm spring/fall Summer
Infiltration	Basic Air Change Rate 0,1 l/s per m2 TmpFactor. 0 TmpPover. 0 WindFactor 0	Full-load	Always
Lighting	Under equipment		
Venting	Single-sided natural ventilation	SetPoint 25,0°C SetP CO2 850 ppm Factor 1 ——— SetPoint 25,0°C SetP CO2 0 ppm Factor 1	Summer ——— Winter, fall, spring
Heating	MaxPow 2 kW Fixed Part 0 Part to Air 0,5	Factor 1 Set Point 22°C Design Temp –20°C MinPow 2 kW Te Min: 15°C	Always
Ventilation	Input Supply 0.0073 m3/s Pressure Rise 900 Pa Total Eff. 0,7 Part to Air 1 Output Return 0.0073 m3/s Pressure Rise 900 Pa Total Eff. 0,7 Part to Air 0 Recovery Unit Max Heat Rec 0,9 Min Heat Rec 0 Max Cool Rec 0,75 Max Moist Rec 0 Heating Coil Max Power 2 kW Humidifier Max output 0,01 kg/h	Part of nom. flow 1 Point 1 Te1: -30 Tinl1: 19 Point 2 te2 25 Tinl2: 19 Air Hum. 1 ——— Part of nom. flow 1 Point 1 Te1: -30 Tinl1: 19 Point 2 te2 25 Tinl2: 19 Air Hum. 0 ——— Part of nom. flow 0,01 Point 1 Te1: -30 Tinl1: 19 Point 2 te2 25 Tinl2: 19 Air Hum. 0	Winter weekday: jan-may + nov-dec - Hour: 01-07 + 20-24 Winter weekend: jan-may + nov-dec - Hour: 01-09 + 16 + 20-24 ——— Summer weekday: jun-oct - Hour: 01-07 + 20-24 Summer weekend: jun-oct - Hour: 01-09 + 16 + 20-24 ——— Always

Figure 2

Hour/day	Weekdays	Weekends
1	100	100
2	100	100
3	100	100
4	100	100
5	100	100
6	100	100
7	100	100
8	20	100
9	0	20
10	0	20
11	0	0
12	0	0
13	0	0
14	10	10
15	10	15
16	10	70
17	10	10
18	10	10
19	0	0
20	50	50
21	100	90
22	100	100
23	100	100
24	100	100

Fig. 216: Bsim system for chamber



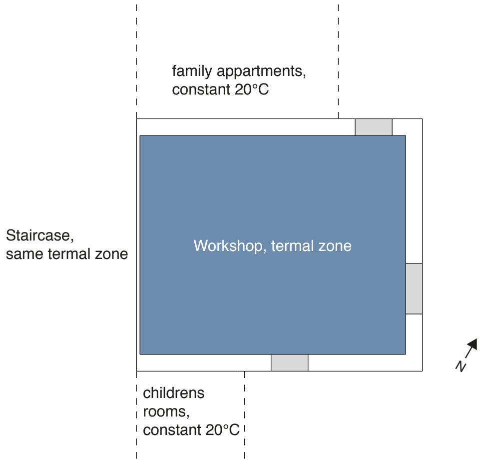
Kitchen/living room 48m2

System	**Description**	*Schedule* **Control**	**Indication of time**
Human Load (8 pers)	8 persons 100 % present	See figure 3	Weedays Weekend
Equipment	Appliances and lighting in an energy neutral building corresponding maximum hourly use of 0,2 kWh (1,71 W/m2)	See figure 1	Winter Cold spring/fall Warm spring/fall Summer
Infiltration	Basic Air Change Rate 0,1 l/s per m2 TmpFactor. 0 TmpPover. 0 WindFactor 0	Full-load	Always
Lighting	Under equipment		
Venting	Natural combined ventilation	SetPoint 25,0°C SetP CO2 850 ppm Factor 1 ——— SetPoint 25,0°C SetP CO2 0 ppm Factor 1	Summer ——— Winter, fall, spring
Heating	MaxPow 2 kW Fixed Part 0 Part to Air 0,5	Factor 1 Set Point 22°C Design Temp –20°C MinPow 2 kW Te Min: 15°C	Always
Ventilation	Input Supply 0.065 m3/s Pressure Rise 700 Pa Total Eff. 0,8 Part to Air 1 Output Return 0.065 m3/s Pressure Rise 700 Pa Total Eff. 0,8 Part to Air 0 Recovery Unit Max Heat Rec 0,9 Min Heat Rec 0 Max Cool Rec 0,75 Max Moist Rec 0 Heating Coil Max Power 2 kW Humidifier Max output 0,1 kg/h	Part of nom. flow 1 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 1 ——— Part of nom. flow 1 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 0 ——— Part of nom. flow 0,7 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 1 ——— Part of nom. flow 0,7 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 0 ——— Part of nom. flow 0,4 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 0 ——— Part of nom. flow 0,01 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 0	Winter weekday full load: jan-may + oct-dec - Hour: 18-19 Winter weekend full load: jan-may + oct-dec - Hour: 09-10 + 19 ——— Summer weekday full load: jun-sep - Hour: 18-19 Summer weekend full load: jun-sep - Hour: 09-10 + 19 ——— Winter weekday medium load: jan-may + oct-dec - Hour: 08 + 14-17 + 20 Winter weekend medium load: jan-may + oct-dec - Hour: 14-18 + 20-21 ——— Summer weekday medium load: jun-sep - Hour: 08 + 14-17 + 20 Summer weekend medium load: jun-sep - Hour: 14-18 + 20-21 ——— Weekday low load: jan-dec - Hour: 07 + 09 + 21-22 Weekend low load: jan-dec - Hour: 11-13 + 22 ——— Always

Figure 3

Hour/day	Weekdays	Weekends
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	10	0
8	80	0
9	10	80
10	5	80
11	5	40
12	5	40
13	5	40
14	70	50
15	70	50
16	70	70
17	70	70
18	80	70
19	100	100
20	70	70
21	10	70
22	10	10
23	0	0
24	0	0

Fig. 217: Bsim system for kitchen/living



Workshop 64m2			
System	**Description**	*Schedule* **Control**	**Indication of time**
Human Load (15 pers)	15 persons 100 % present	See figure 4	Weedays Weekend
Equipment	Appliances and lighting in an energy neutral building corresponding maximum hourly use of 0,2 kWh (1,71 W/m2)	See figure 1	Winter Cold spring/fall Warm spring/fall Summer
Infiltration	Basic Air Change Rate 0,1 l/s per m2 TmpFactor. 0 TmpPover. 0 WindFactor 0	Full-load	Always
Lighting	Under equipment		
Venting	Natural combined ventilation	SetPoint 25,0°C SetP CO2 850 ppm Factor 1 ______ SetPoint 25,0°C SetP CO2 0 Factor 1	Summer ______ Winter, fall, spring
Heating	MaxPow 2 kW Fixed Part 0 Part to Air 0,5	Factor 1 Set Point 22°C Design Temp –20°C MinPow 2 kW Te Min: 15°C	Always
Ventilation	Input Supply 0.12 m3/s Pressure Rise 700 Pa Total Eff. 0,8 Part to Air 1 Output Return 0.12 m3/s Pressure Rise 700 Pa Total Eff. 0,8 Part to Air 0 Recovery Unit Max Heat Rec 0,9 Min Heat Rec 0 Max Cool Rec 0,75 Max Moist Rec 0 Heating Coil Max Power 2 kW Humidifier Max output 0,1 kg/h	Part of nom. flow 0,85 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 1 ______ Part of nom. flow 0,85 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 0 ______ Part of nom. flow 0,35 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 0 ______ Part of nom. flow 1 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 0 ______ Part of nom. flow 0,01 Point 1 Te1: -30 TinI: 19 Point 2 te2: 25 TinI2: 19 Air Hum. 0	Winter weekend: jan-may + oct-dec - Hour: 10-16 ______ Summer weekend: jun-sep - Hour: 10-16 ______ Weekday: jan-dec - Hour: 07-18 ______ Holiday full load: saturday in week 13,23,50 - Hour: 10-15 ______ Always

Figure 4		
Hour/day	Weekdays	Weekends
1	0	0
2	0	0
3	0	0
4	0	0
5	0	0
6	0	0
7	10	0
8	10	10
9	10	10
10	10	30
11	10	50
12	10	50
13	10	50
14	20	100
15	20	40
16	20	20
17	20	20
18	5	5
19	0	0
20	5	5
21	5	5
22	5	5
23	0	0
24	0	0

Fig. 218: Bsim system for the workshop

Figure 1

	Data for hourly profiles in BSim (Relativ values)							
	Winter Jan-dec		Cold spring/fall feb-mar-okt-nov		Warm spring/fall apr-maj-aug-sep		Summer jun-jul	
Hour nr.	Weekend	Weekend/Holidays	Weekend	Weekend/Holidays	Weekend	Weekend/Holidays	Weekend	Weekend/Holidays
1	29	33	26	31	24	27	20	27
2	27	33	26	22	21	23	20	22
3	21	25	21	21	21	21	20	22
4	21	22	22	20	21	21	18	19
5	25	20	23	23	22	20	19	22
6	30	24	33	25	29	22	24	23
7	45	37	45	37	38	36	32	32
8	47	47	43	43	43	43	39	44
9	41	49	41	50	38	46	34	47
10	44	60	40	53	38	48	34	42
11	37	64	42	59	38	48	36	51
12	45	63	42	57	36	53	36	48
13	44	54	42	52	37	49	37	47
14	48	49	44	49	35	44	37	45
15	48	59	45	54	37	44	35	43
16	68	68	53	52	42	46	38	52
17	100	78	85	77	72	63	61	61
18	92	88	87	85	75	70	60	55
19	90	85	81	75	64	59	51	58
20	83	87	74	69	60	51	46	50
21	74	69	69	59	54	50	46	53
22	61	63	62	54	51	46	46	49
23	50	55	48	46	42	39	36	48
24	37	39	37	38	31	29	28	32

Fig. 219: Indication of time - Equipment

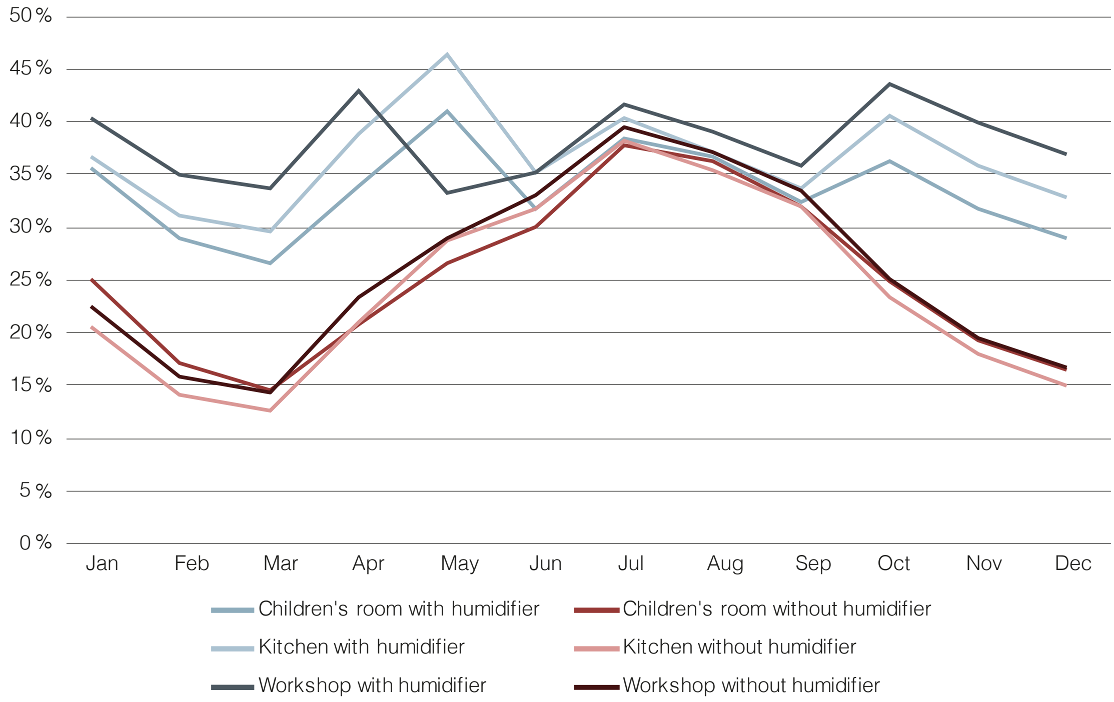


Fig. 220: Relative humidity with and without humidifer

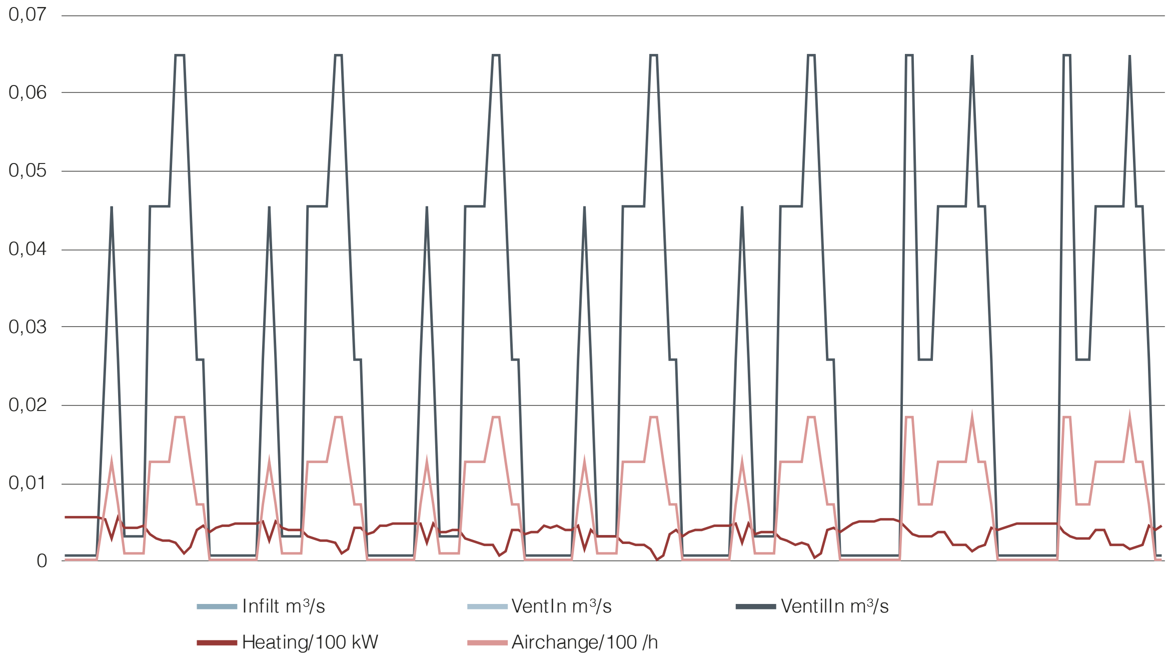


Fig. 221: Ventilation and heating (week 6)

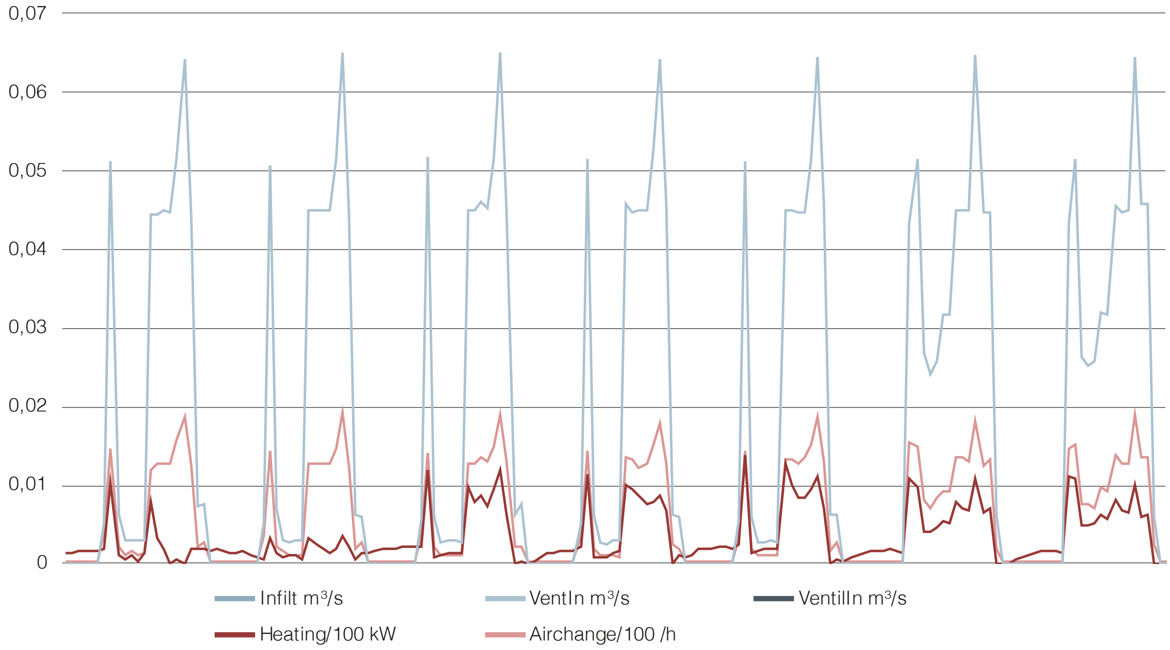


Fig. 222: Natural ventilation (week 28)

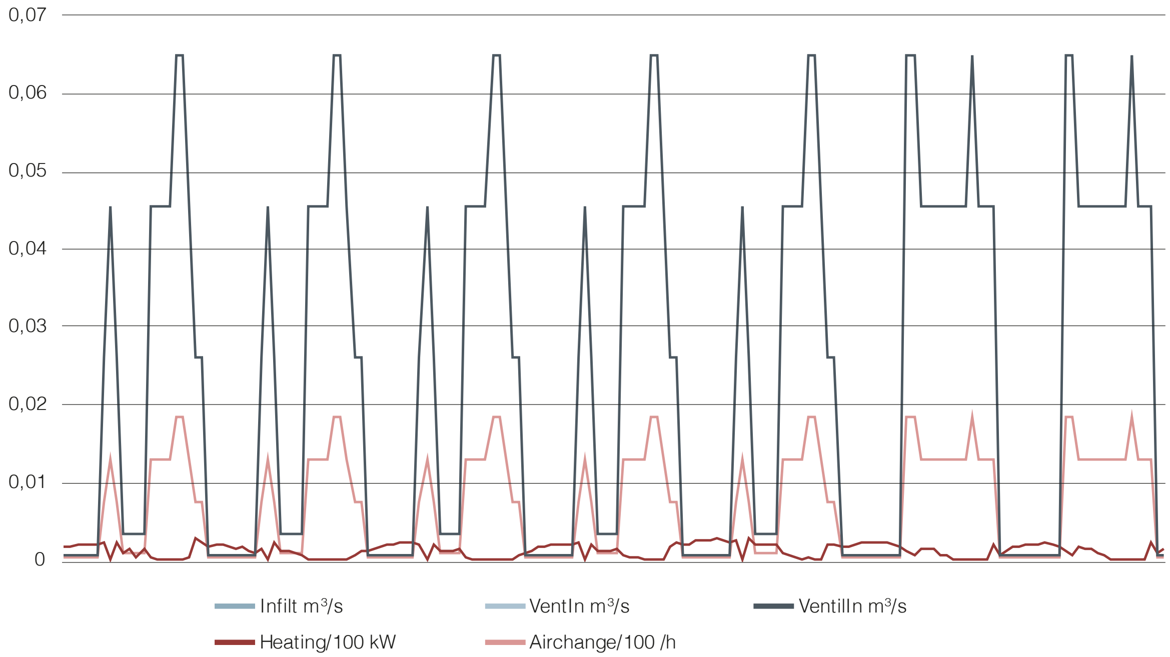


Fig. 223: Mechanical ventilation (week 28)

9: BE15 RESULTS

Nøgletal, kWh/m² år

Renoveringsklasse 2

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
112,7	0,0	112,7
Samlet energibehov		40,9

Renoveringsklasse 1

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
53,9	0,0	53,9
Samlet energibehov		40,9

Energiramme BR 2015

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
30,8	0,0	30,8
Samlet energibehov		34,3

Energiramme Byggeri 2020

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
20,0	0,0	20,0
Samlet energibehov		25,5

Bidrag til energibehovet

Varme	33,4
El til bygningsdrift	3,0
Overtemp. i rum	0,0

Netto behov

Rumopvarmning	21,9
Varmt brugsvand	11,5
Køling	0,0

Udvalgte elbehov

Belysning	0,0
Opvarmning af rum	0,0
Opvarmning af vbv	0,0
Varmepumpe	0,0
Ventilatorer	2,5
Pumper	0,5
Køling	0,0
Totalt elforbrug	18,0

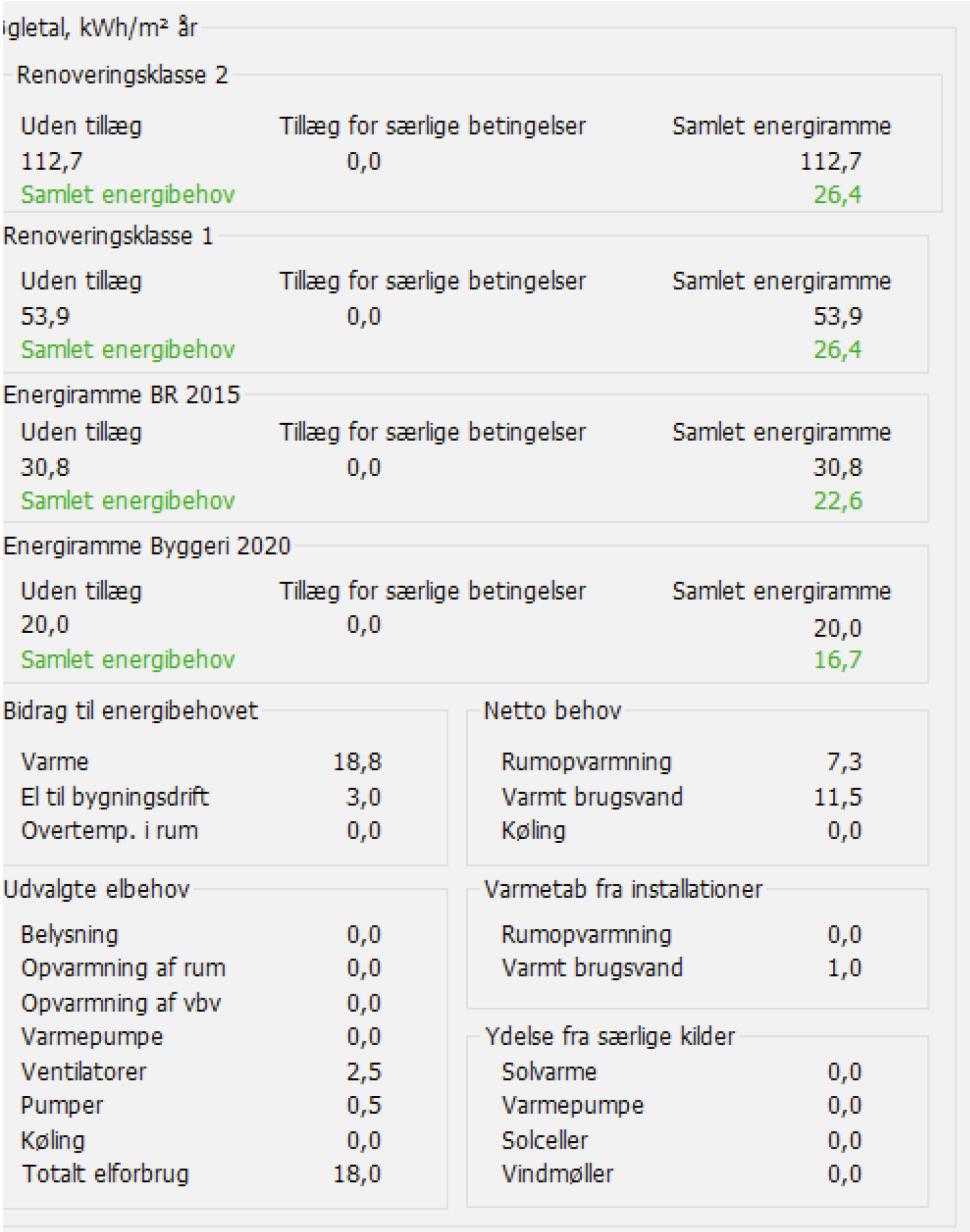
Varmetab fra installationer

Rumopvarmning	0,0
Varmt brugsvand	1,0

Ydelse fra særlige kilder

Solvarme	0,0
Varmepumpe	0,0
Solceller	0,0
Vindmøller	0,0

Fig. 224: BE15 results for Nuuk



igletal, kWh/m² år

Renoveringsklasse 2

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
112,7	0,0	112,7
Samlet energibehov		26,4

Renoveringsklasse 1

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
53,9	0,0	53,9
Samlet energibehov		26,4

Energiramme BR 2015

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
30,8	0,0	30,8
Samlet energibehov		22,6

Energiramme Byggeri 2020

Uden tillæg	Tillæg for særlige betingelser	Samlet energiramme
20,0	0,0	20,0
Samlet energibehov		16,7

Bidrag til energibehovet

Varme	18,8
El til bygningsdrift	3,0
Overtemp. i rum	0,0

Netto behov

Rumopvarmning	7,3
Varmt brugsvand	11,5
Køling	0,0

Udvalgte elbehov

Belysning	0,0
Opvarmning af rum	0,0
Opvarmning af vbv	0,0
Varmepumpe	0,0
Ventilatorer	2,5
Pumper	0,5
Køling	0,0
Totalt elforbrug	18,0

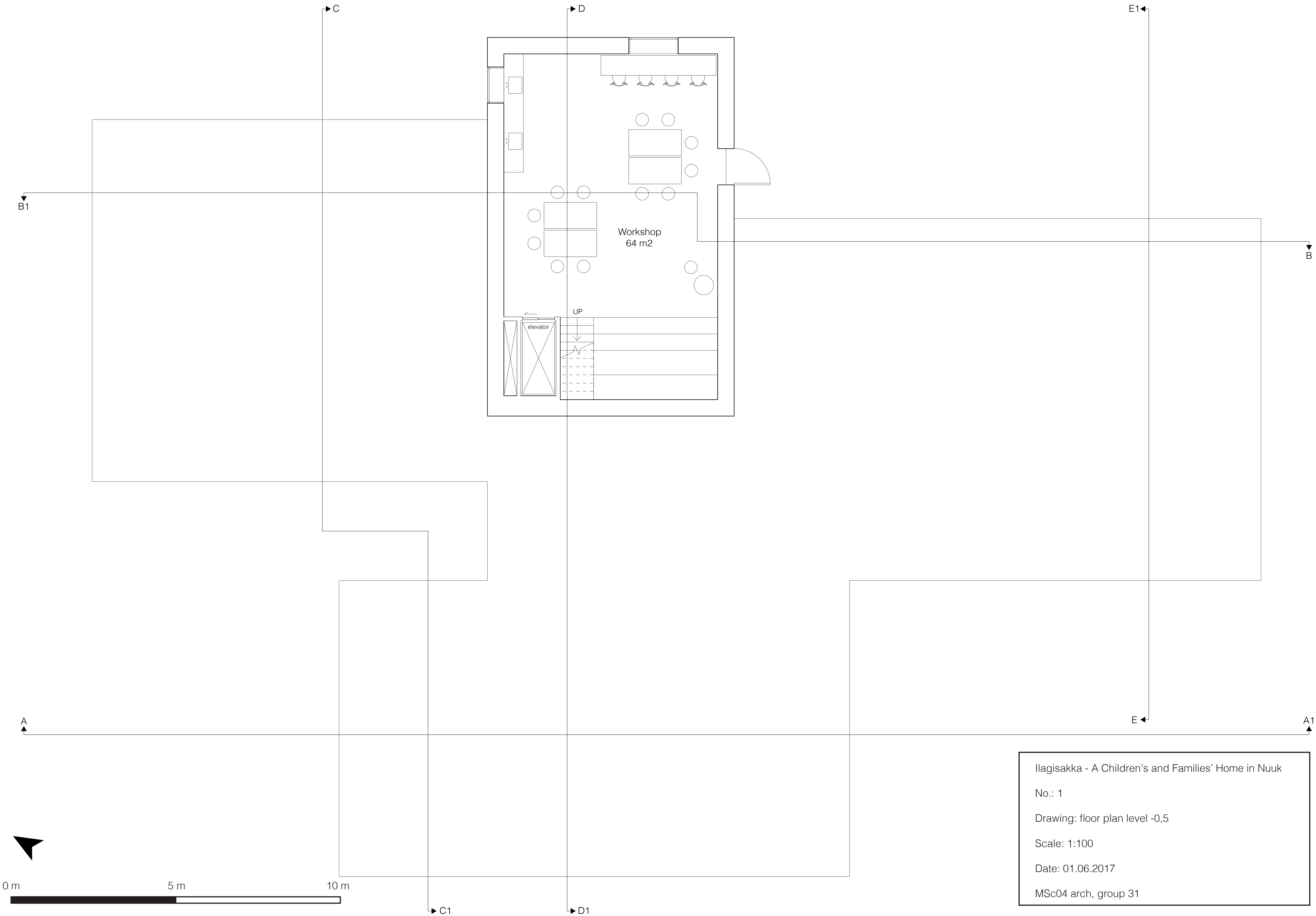
Varmetab fra installationer

Rumopvarmning	0,0
Varmt brugsvand	1,0

Ydelse fra særlige kilder

Solvarme	0,0
Varmepumpe	0,0
Solceller	0,0
Vindmøller	0,0

Fig. 225: BE15 results for Denmark



Ilagisakka - A Children's and Families' Home in Nuuk

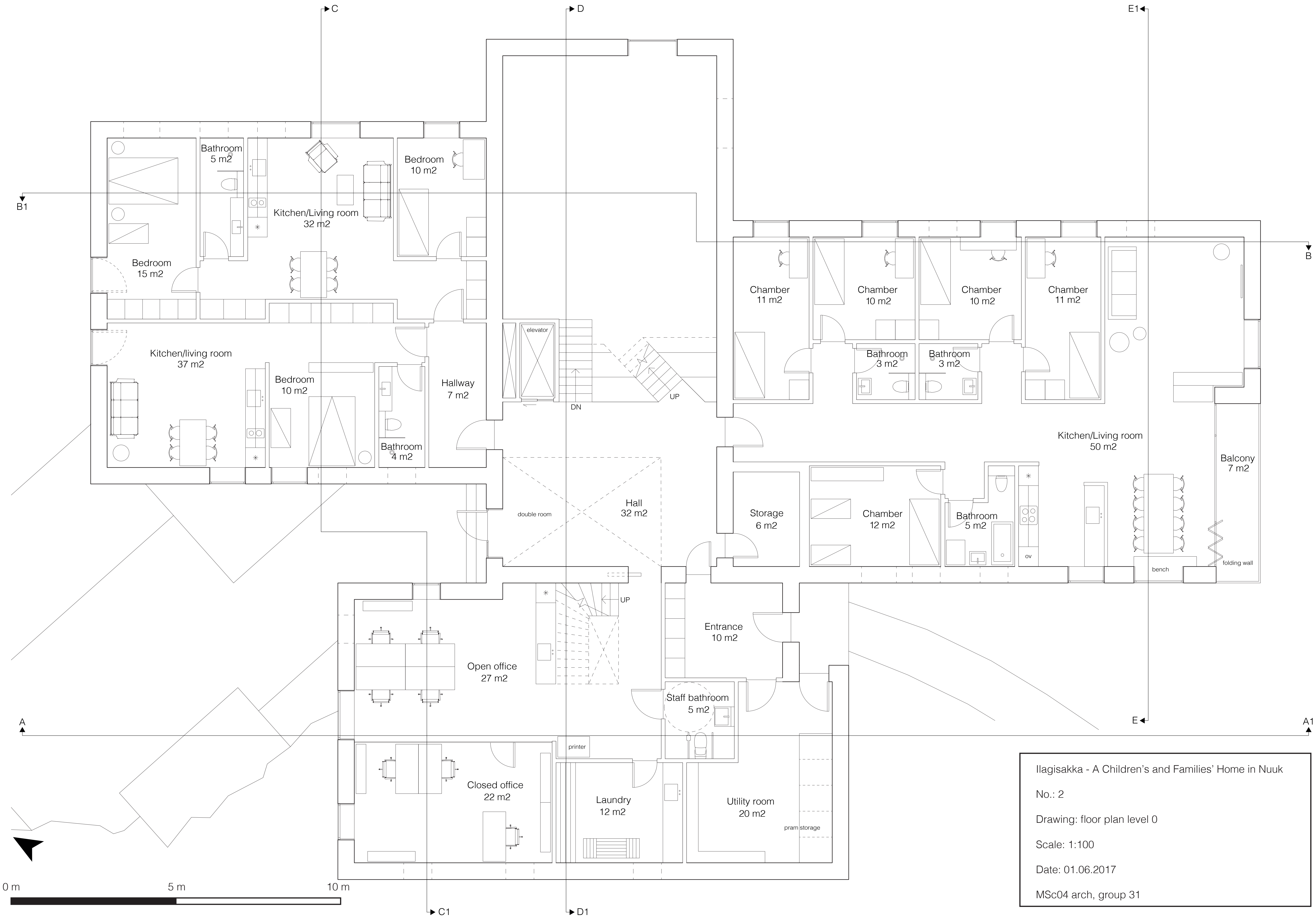
No.: 1

Drawing: floor plan level -0,5

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children’s and Families’ Home in Nuuk

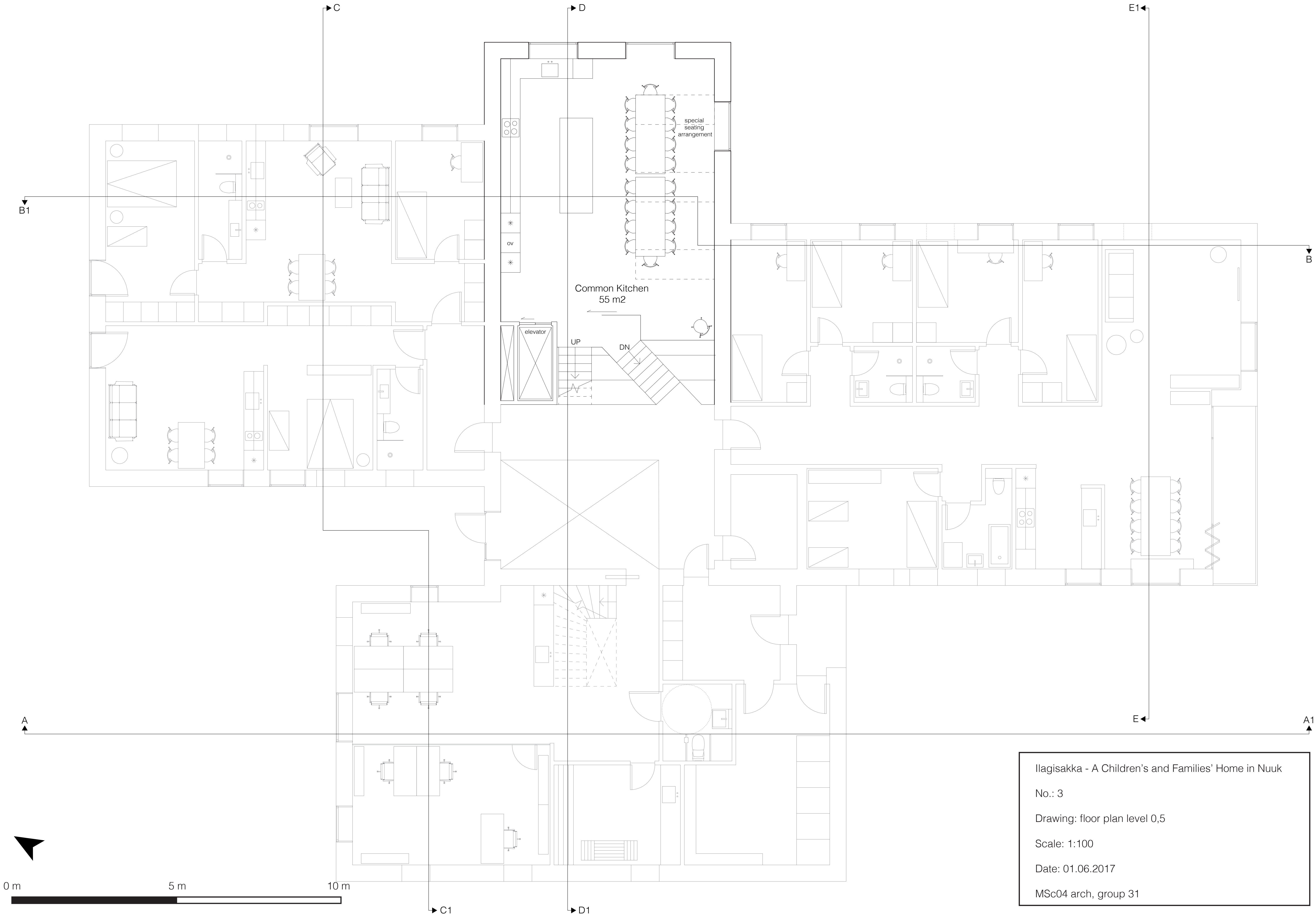
No.: 2

Drawing: floor plan level 0

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children's and Families' Home in Nuuk

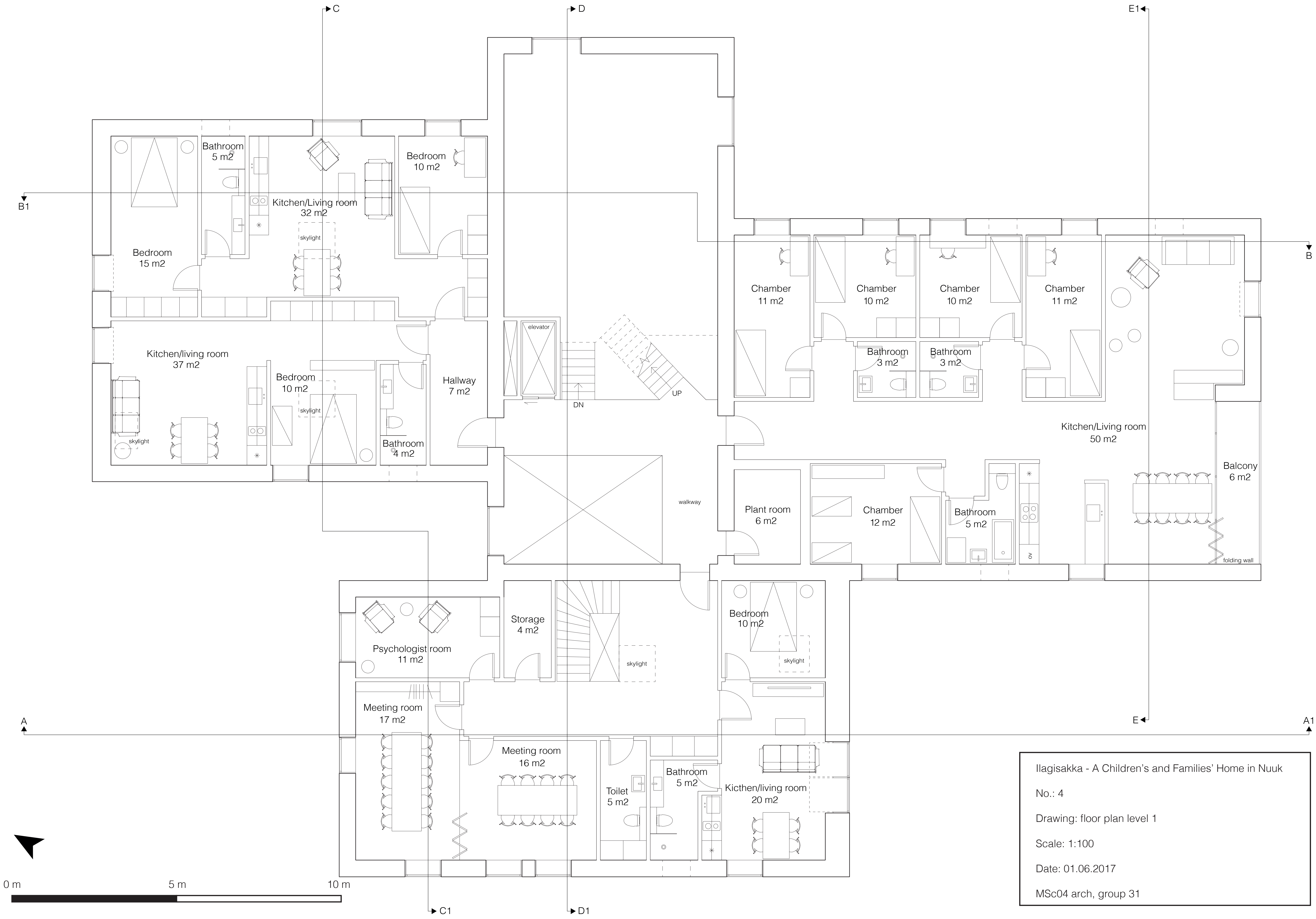
No.: 3

Drawing: floor plan level 0,5

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children's and Families' Home in Nuuk

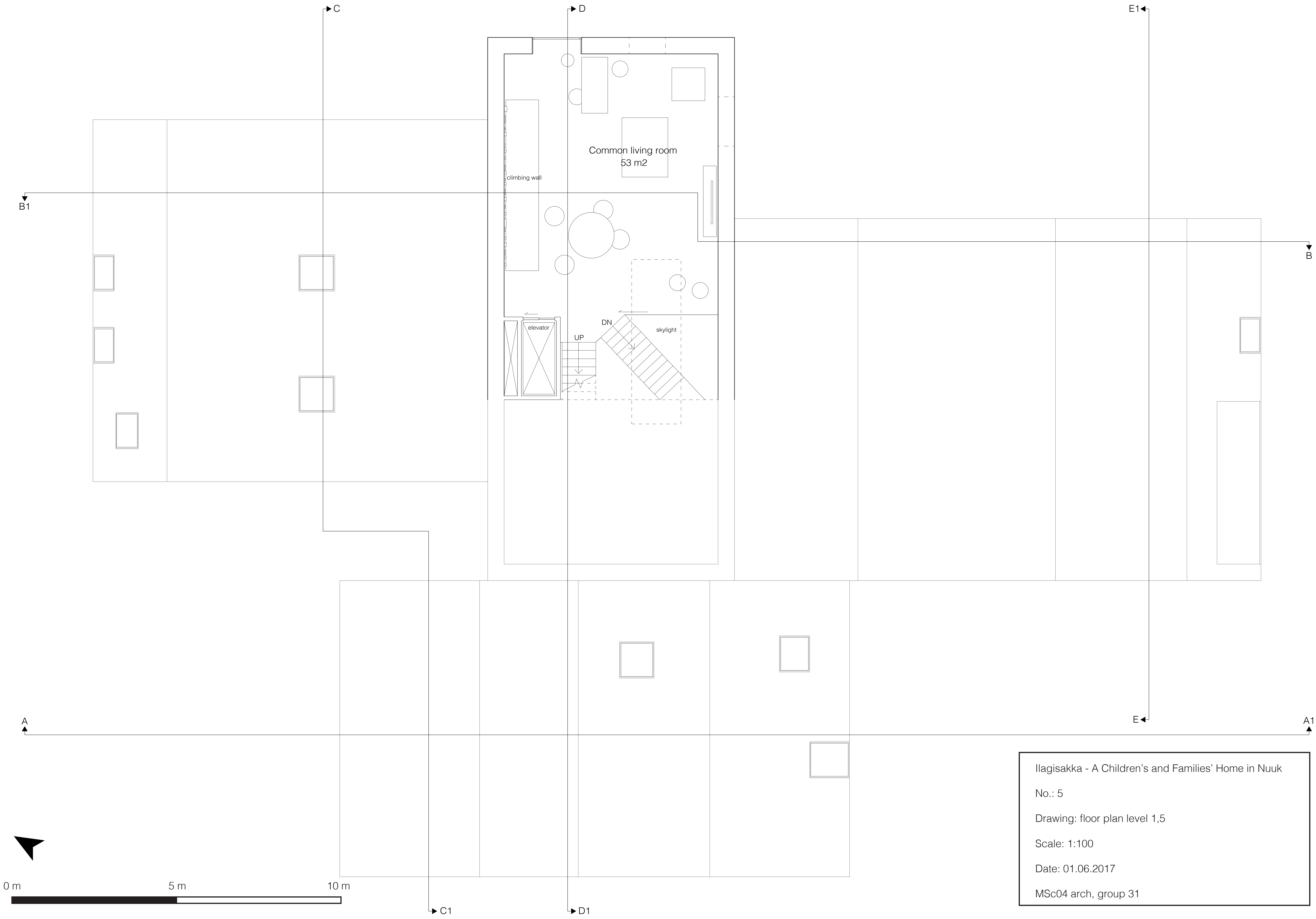
No.: 4

Drawing: floor plan level 1

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children’s and Families’ Home in Nuuk

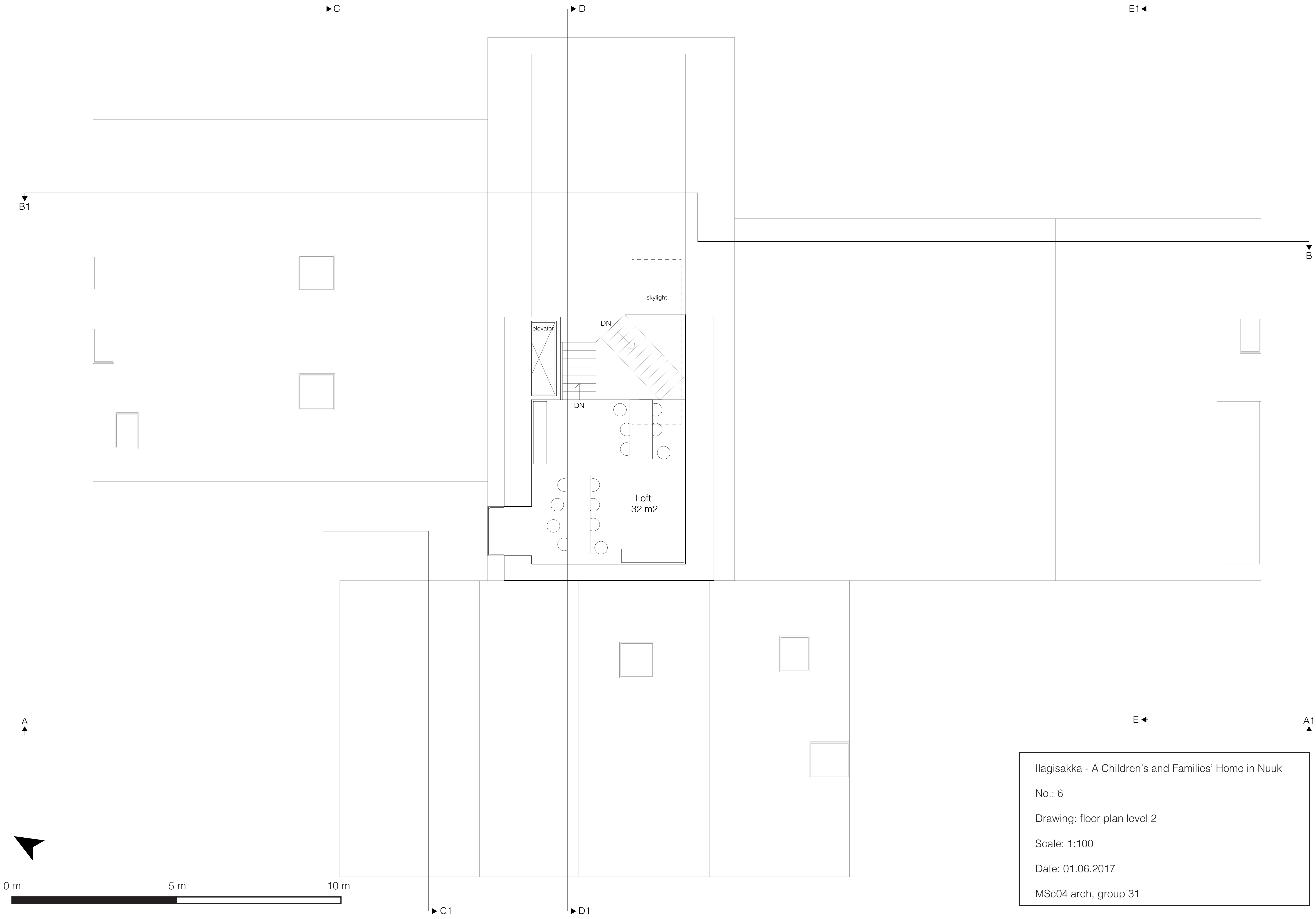
No.: 5

Drawing: floor plan level 1,5

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children's and Families' Home in Nuuk

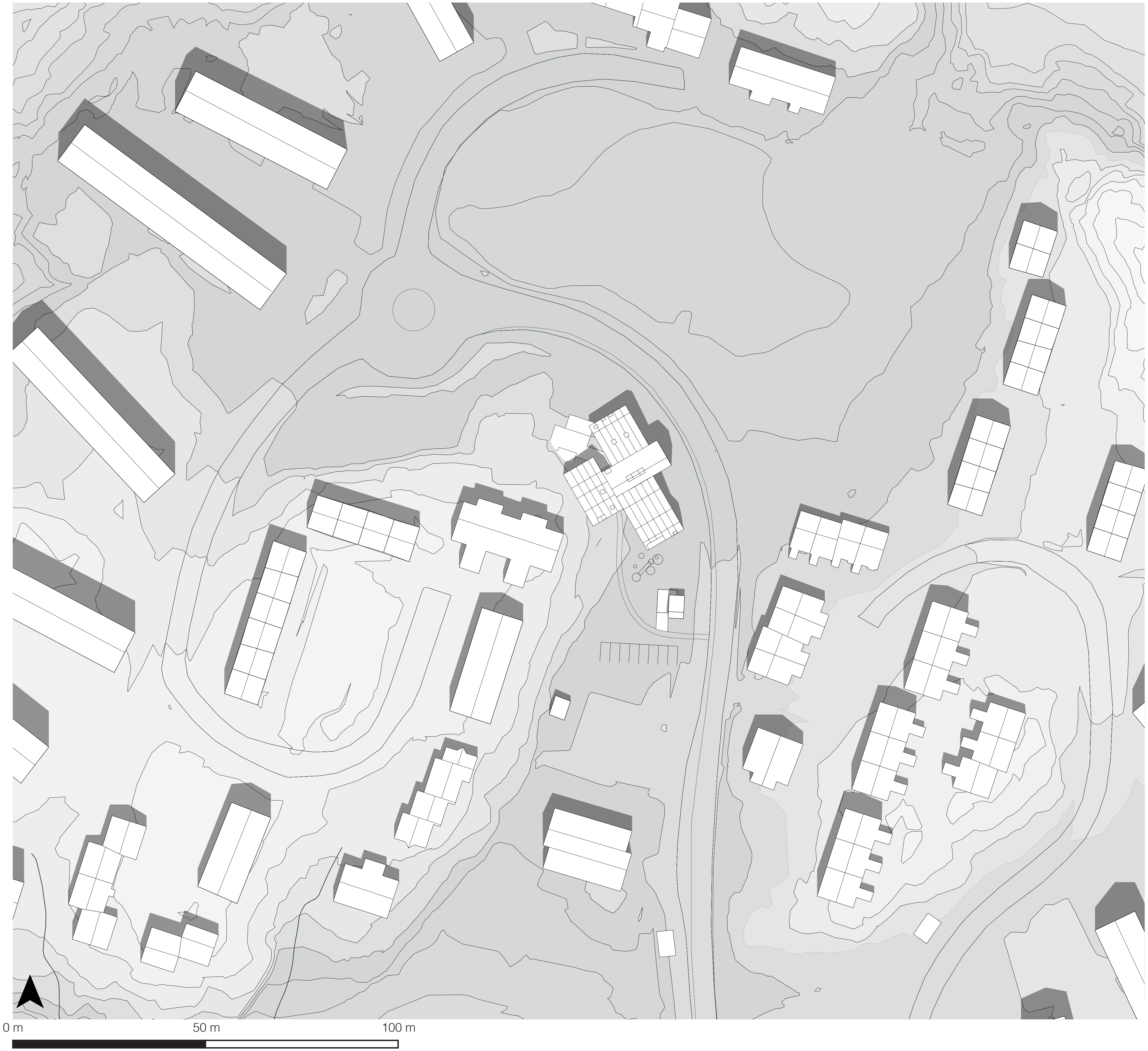
No.: 6

Drawing: floor plan level 2

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children's and Families' Home in Nuuk

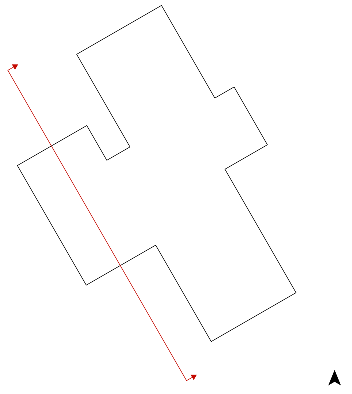
No.: 7

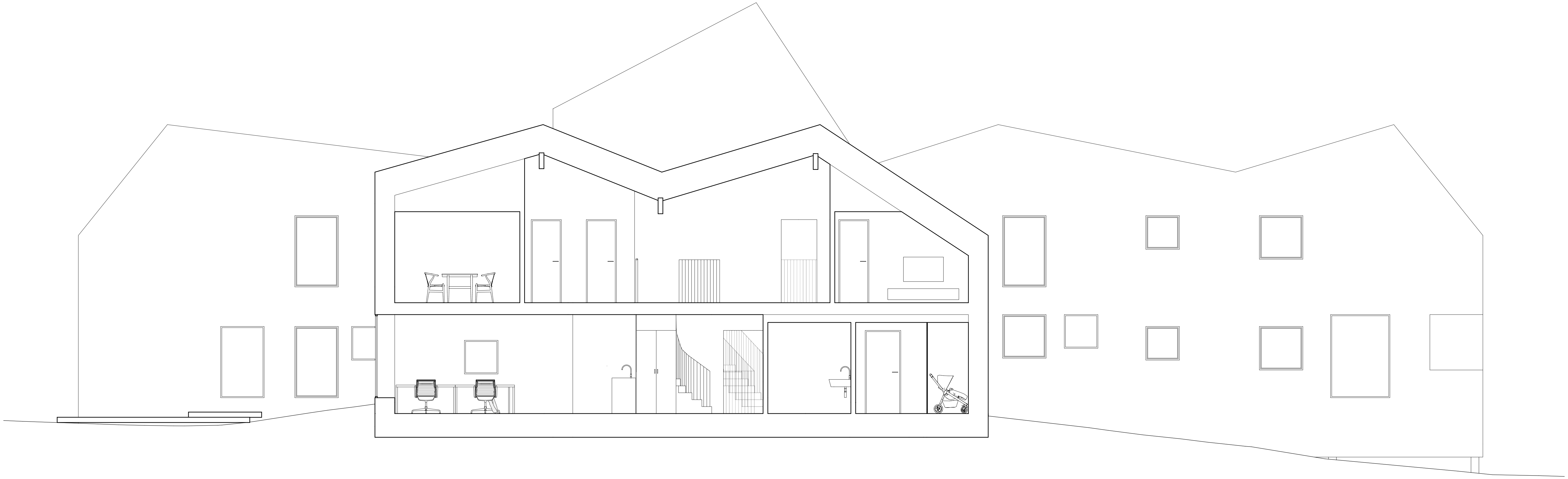
Drawing: site plan

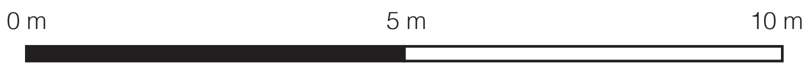
Scale: 1:1000

Date: 01.06.2017

MSc04 arch, group 31







Ilagisakka - A Children's and Families' Home in Nuuk

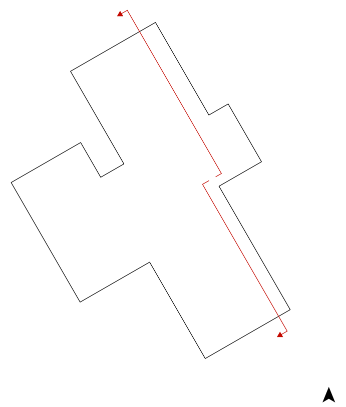
No.: 8

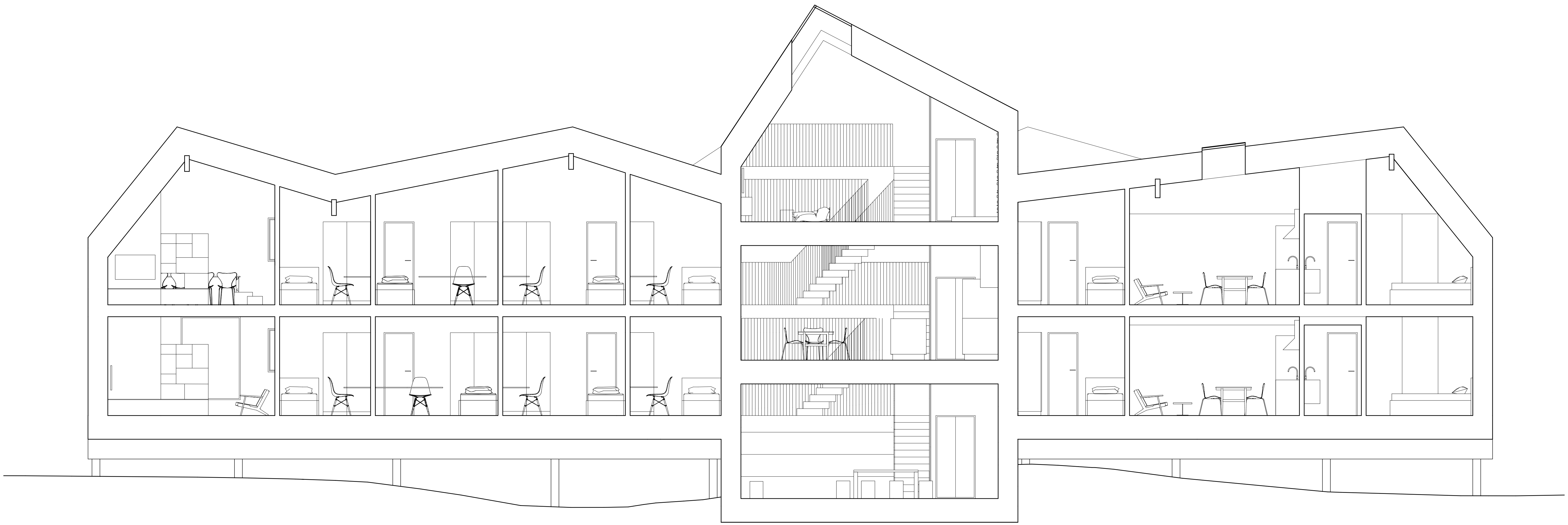
Drawing: longitudinal section A-A1

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31





Ilagisakka - A Children's and Families' Home in Nuuk

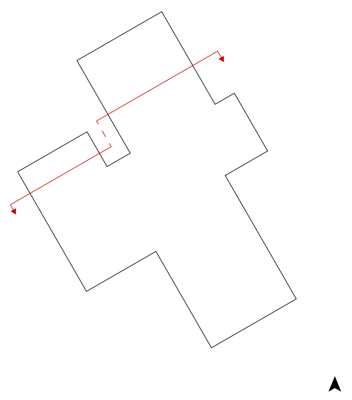
No.: 9

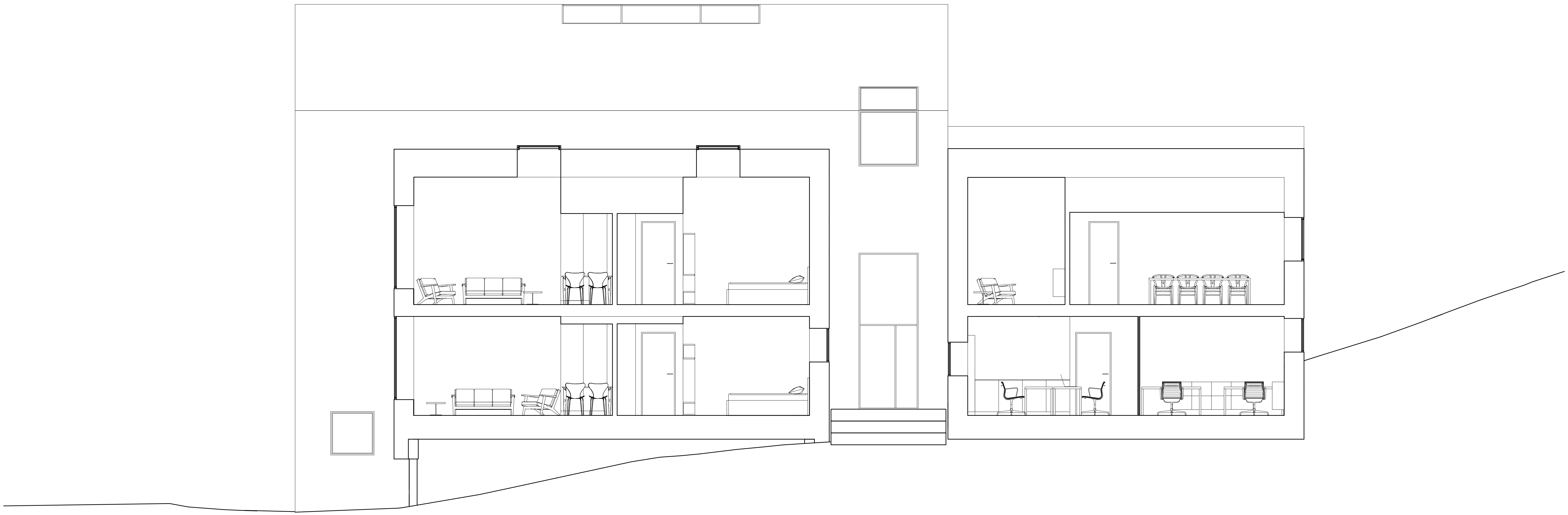
Drawing: longitudinal section B-B1

Scale: 1:100

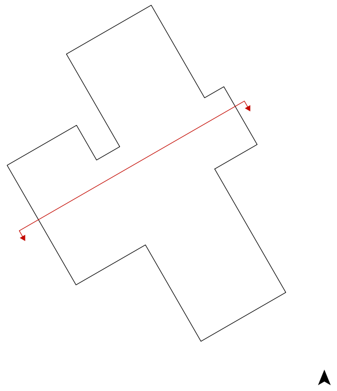
Date: 01.06.2017

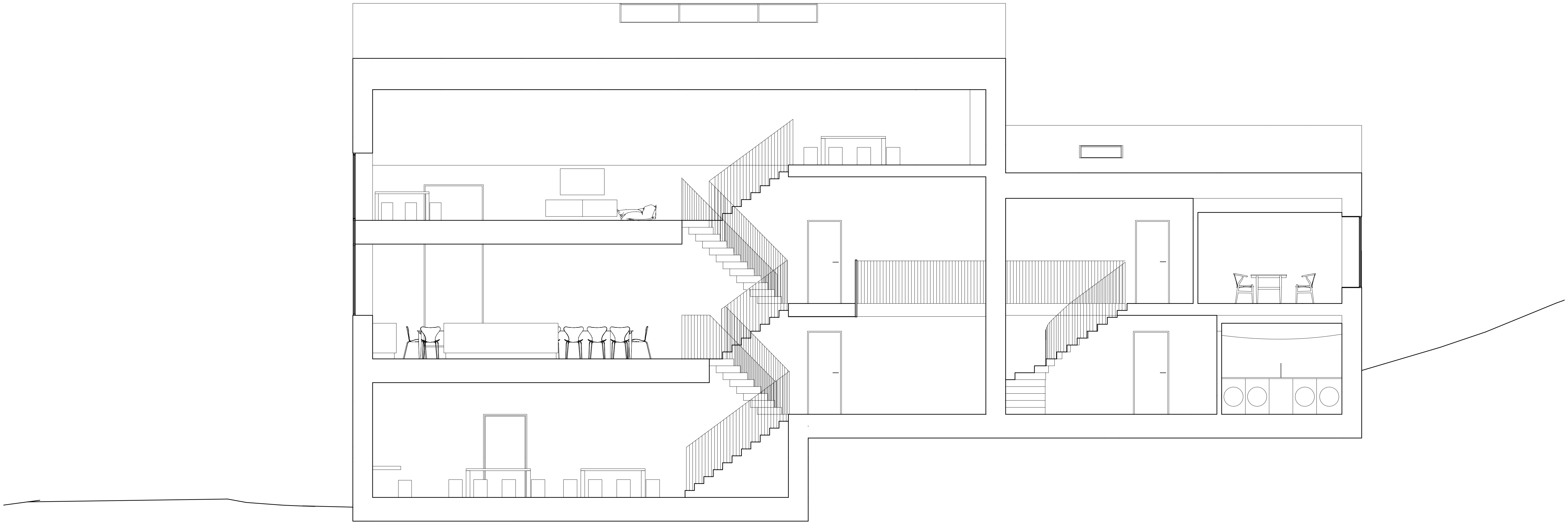
MSc04 arch, group 31





Ilagisakka - A Children's and Families' Home in Nuuk
No.: 10
Drawing: cross section C-C1
Scale: 1:100
Date: 01.06.2017
MSc04 arch, group 31





Ilagisakka - A Children's and Families' Home in Nuuk

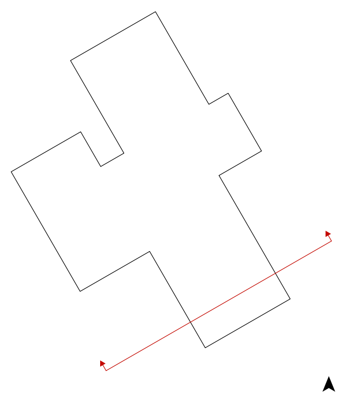
No.: 11

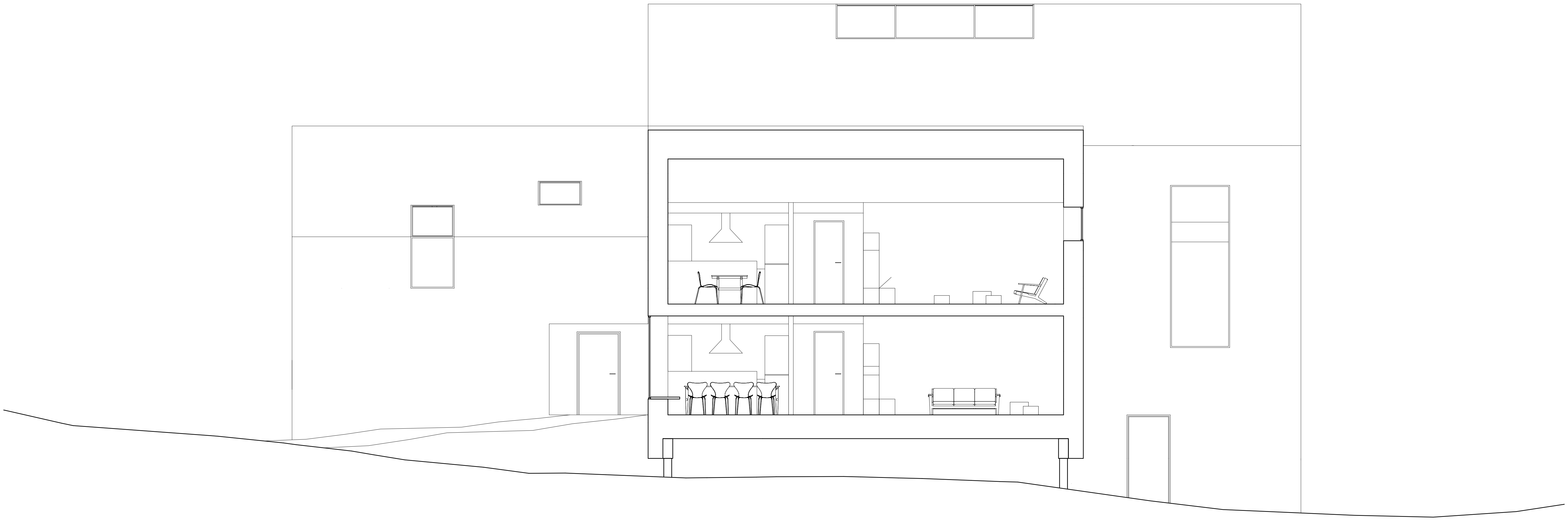
Drawing: cross section D-D1

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31





0 m 5 m 10 m

Ilagisakka - A Children's and Families' Home in Nuuk

No.: 12

Drawing: cross section E-E1

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31

0 m 5 m 10 m

Ilagisakka - A Children's and Families' Home in Nuuk

No.: 13

Drawing: facade south-east

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31

0 m 5 m 10 m

Ilagisakka - A Children's and Families' Home in Nuuk

No.: 14

Drawing: facade north-east

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31

0 m 5 m 10 m

Ilagisakka - A Children's and Families' Home in Nuuk

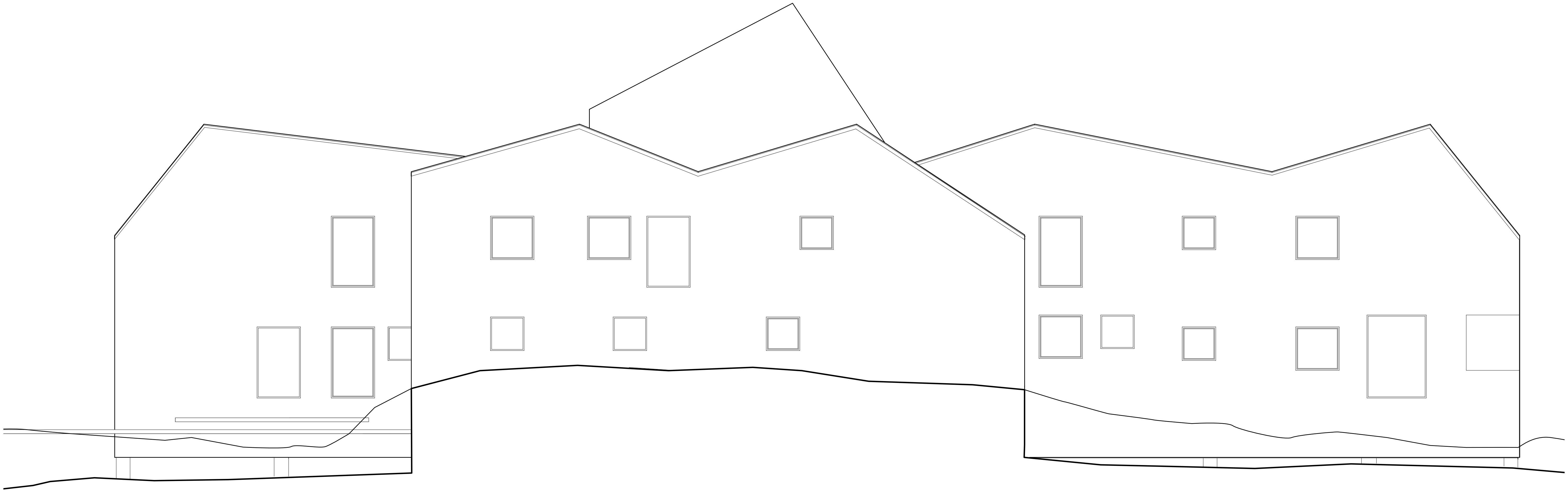
No.: 15

Drawing: facade north-west

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children's and Families' Home in Nuuk

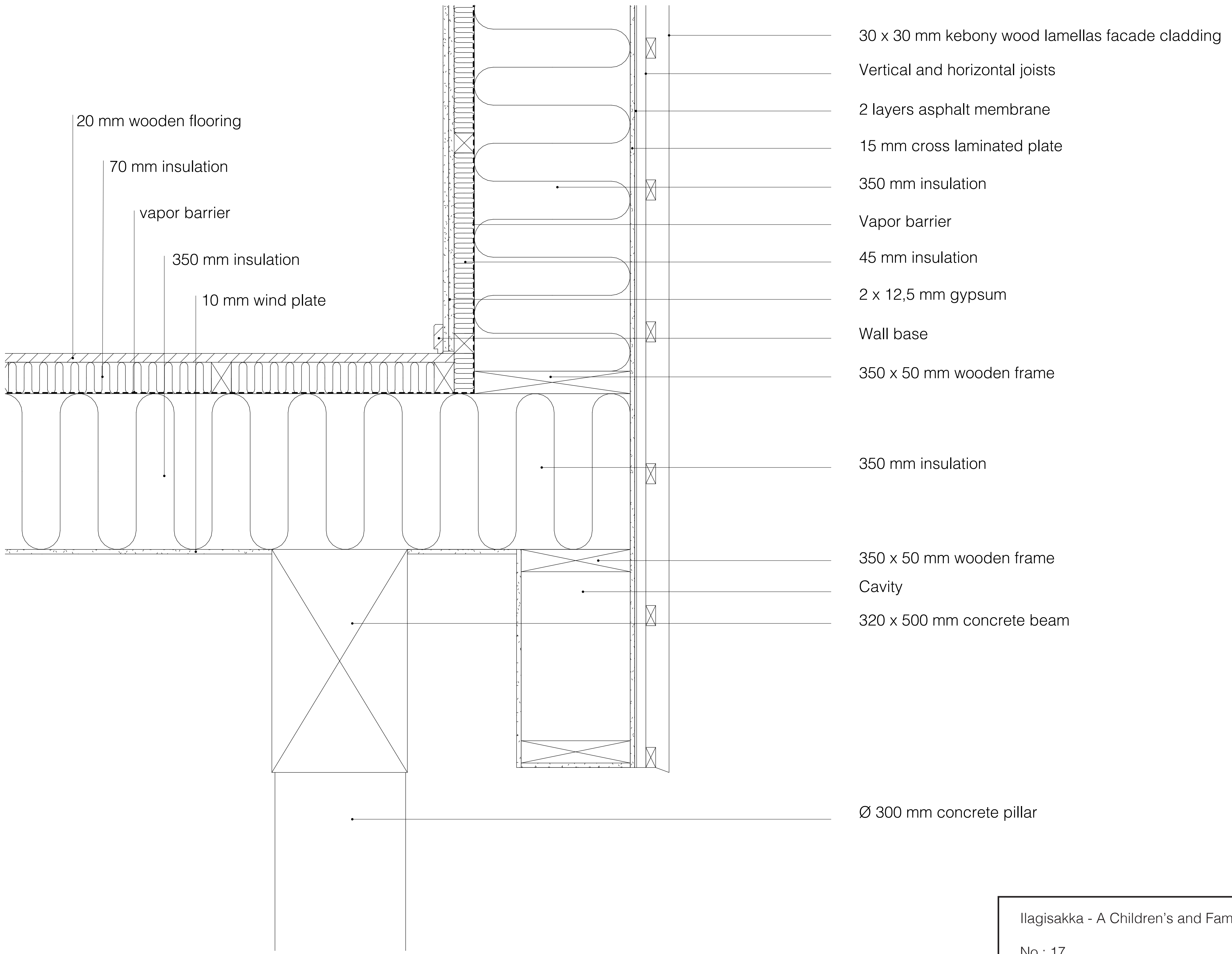
No.: 16

Drawing: facade south-west

Scale: 1:100

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children's and Families' Home in Nuuk

No.: 17

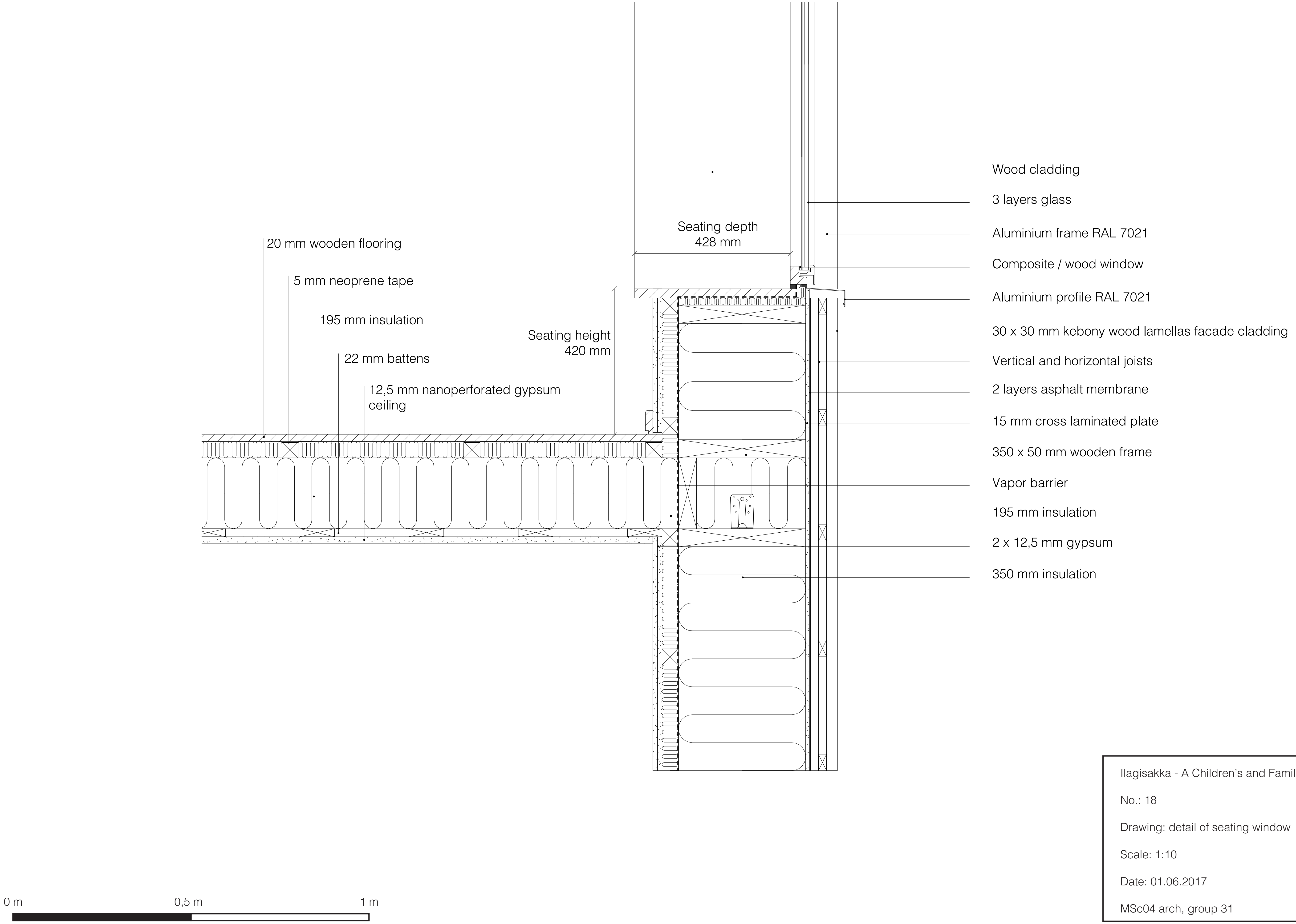
Drawing: detail of terrain deck

Scale: 1:10

Date: 01.06.2017

MSc04 arch, group 31

0 m   0,5 m   1 m



Ilagisakka - A Children's and Families' Home in Nuuk

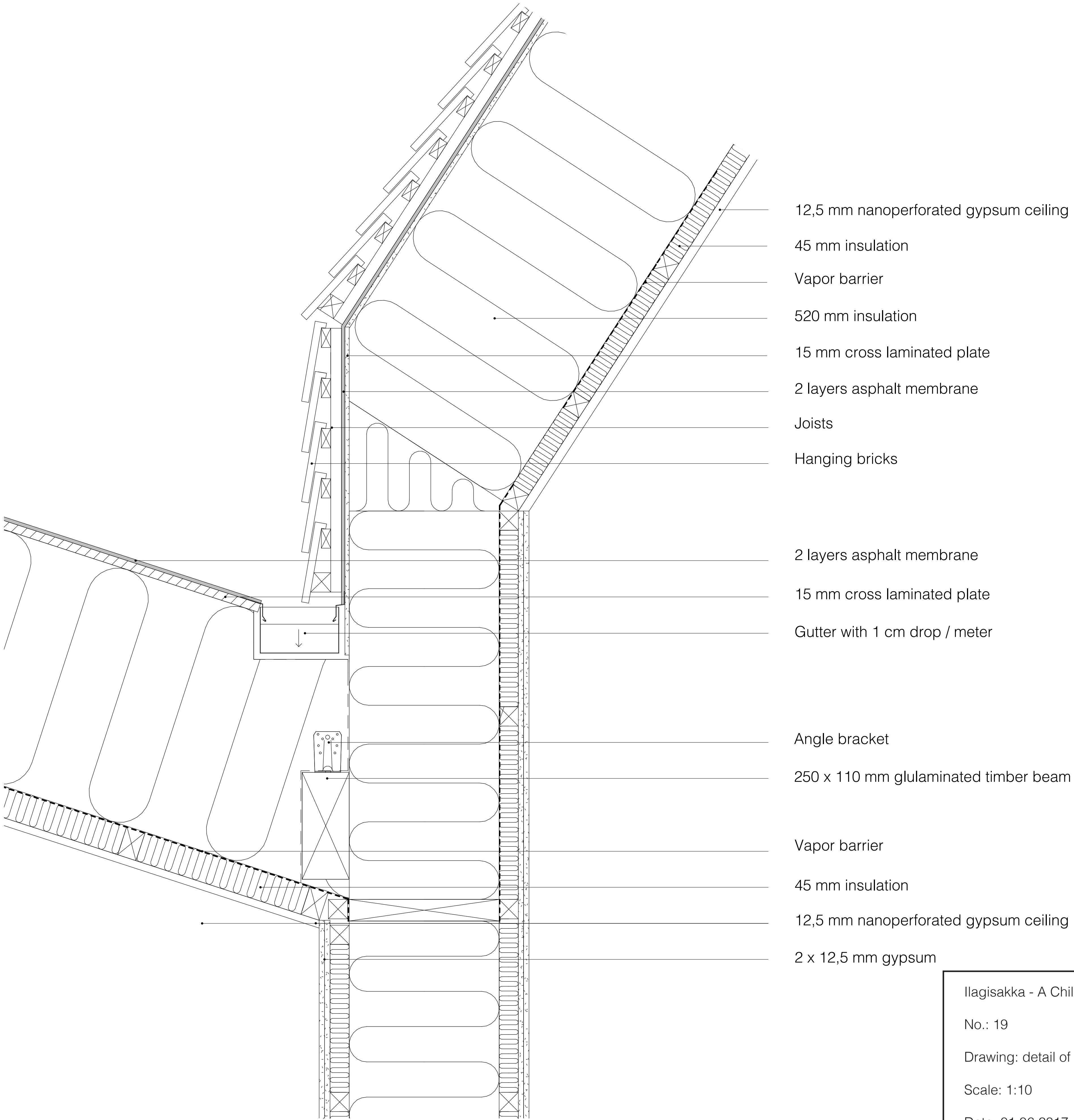
No.: 18

Drawing: detail of seating window

Scale: 1:10

Date: 01.06.2017

MSc04 arch, group 31



0 m 0,5 m 1 m

Ilagisakka - A Children's and Families' Home in Nuuk

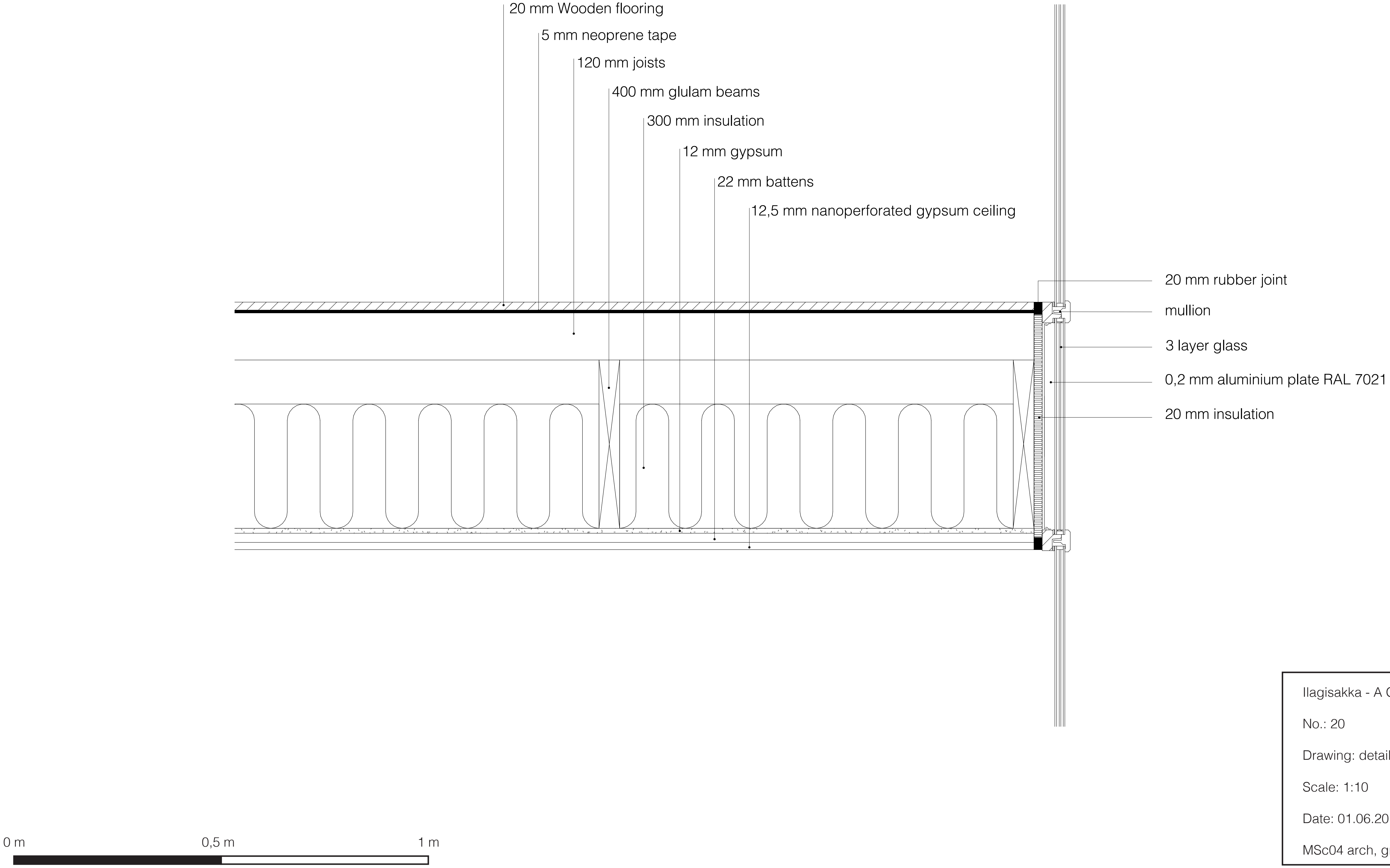
No.: 19

Drawing: detail of gutter

Scale: 1:10

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children's and Families' Home in Nuuk

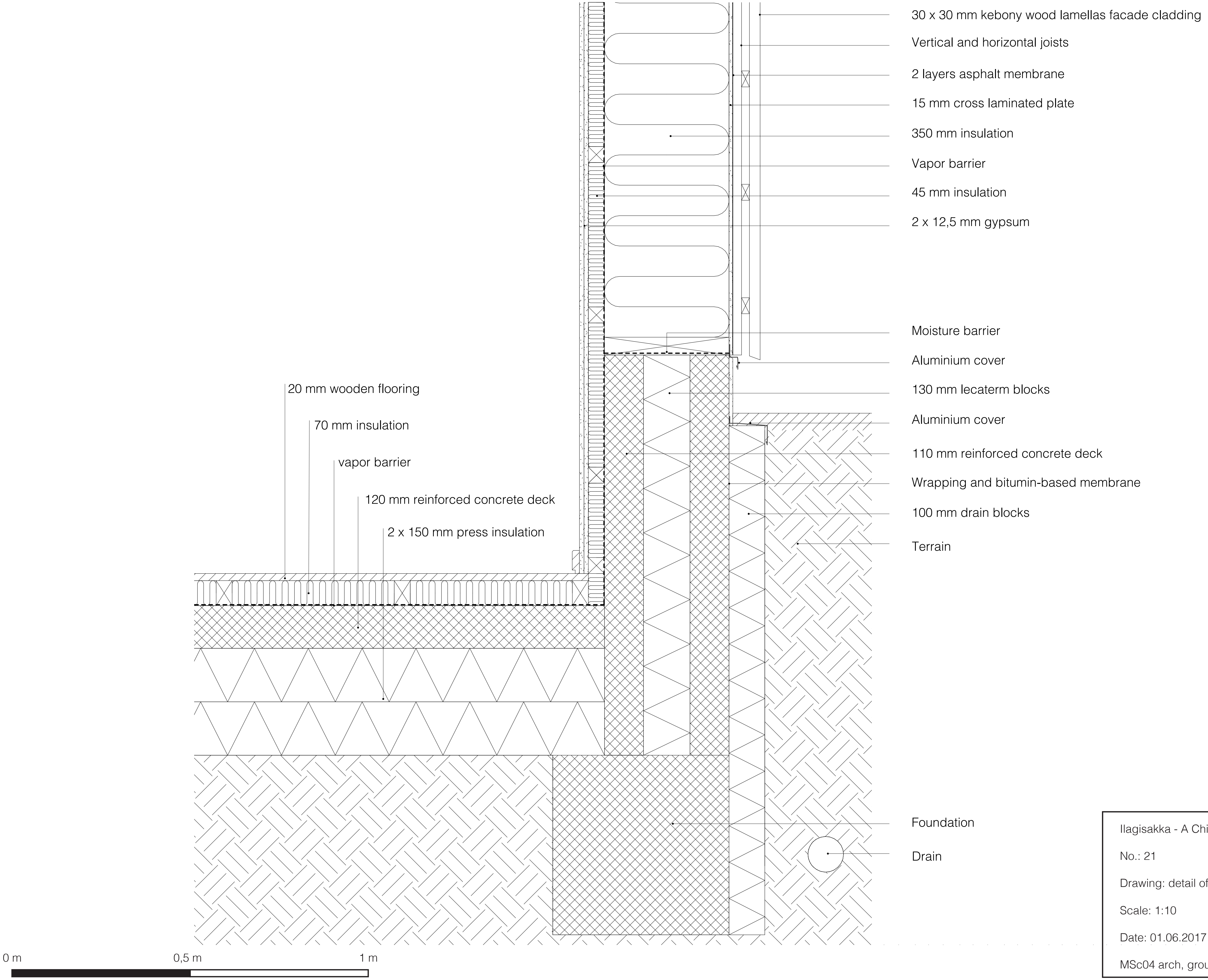
No.: 20

Drawing: detail of intermediate floor

Scale: 1:10

Date: 01.06.2017

MSc04 arch, group 31



Ilagisakka - A Children's and Families' Home in Nuuk

No.: 21

Drawing: detail of meeting between wall and terrain

Scale: 1:10

Date: 01.06.2017

MSc04 arch, group 31