Let it Flood

Housing Against Flooding in Kävlinge

Zainab Majid

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Acknowledgement

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Abstract

Global warming and climate change is getting a serious issue and a great environmental threat that affects many aspects of life and our ways of living on this planet. The negative effects of climate change are endangering our communities, health and economy.
Global warming can be considered as a main reason for sea rising levels, extreme heat which is responsible for many forests' fires, severe drought and disastrous floods.
Actions from different fields and various scientific backgrounds have been taken to limit this serious environmental problem. Architecture appeared strongly in defensing against climate change in form of sustainability. Many designs have been done with giving much care for greenery in form of green roofs, and also by using environment friendly materials. All small details mutter and help limiting the global warming, but they are still taking much time and their effects will appear in long terms. However, time may be running out to fight climate change, but we are not running out of solutions.
In the last few years weather has been changing quickly in Sweden, and flooding is one of the problems that appears taking dangerous turn. Floods are threatened people's homes, memories and health. In 2015 heavy rains led to floods that affected the transportation in Västra Götaland in south west Sweden as well as floods in Malmö city when more than 40 families were suffering from this problem.

This research work presents the different technics and architectural ways that have been used and new ideas proposed to fight floods, as well as applying one architectural (building level), reasonable model with a practical applicability on a housing project in Kävlinge, Skåne Country in Sweden, with an enhancement on the model, to work in its best conditions and suit the weather in this site and fit humans' needs in a Sweden.

Contents

Introduction

The idea of this thesis research and project came up responding to the noticeable change in climate. Looking back into the previous years and what we are having for weather nowadays wakes up many questions about what we are facing and going to face in the near future from serious challenges.

The thesis work explores the possibilities of building on sites with flood risks and designing living areas which can provide safety while a flood occurs.

The first part of the work explores theoretically the expected changes in climate in Sweden and how this change can affect the rise in sea levels and the number of floods happening in addition to three different reference projects that show how architecture can fight against the new challenges which follow climate change. The second part of this work presents a design proposal for a new site in Kävlinge in Sweden where it is a site with flood risk. This site has been chosen to have a design to an attractive neighbourhood where people can and want to live, enjoy the closeness to water and at the same time feel and be safe.

Climate Change and Global Warming

Recently, we have started to hear frequently about climate change and global warming and how it is affecting the natural recourses on our Earth as well as all the disasters that are tensioning the organization and the routine of our daily lives. It is actually frighteningly noticeable how weather has changed from winter before few years to this winter or from summer before to summer time in these recent years and how heat waves started to threaten people's lives which we did not used to hear about before.

The Intergovernmental Panel on Climate Change anticipates that climatic deterioration in form of extreme heat, drought and heavy rainfall, is going to happen more frequent in the coming years. This makes the situation worse and finding solutions that can help in controlling the climate change has been a must.

Global warming is a real problem occurring now and compounding exponentially. However, this problem can be stopped aggravating by us. We are the ones "human beings" who led our planet to this point and no one else can stop it.

Definition

Global warming can be defined as a gradual increase in the degree of the lowest layers of the atmosphere surrounding our Earth, as a result of increased emissions of greenhouse gases since the beginning of the industrial revolution. This phenomenon occurs gradually and not at once as a result of storing the cover layer around Earth amounts of heat emitted from the sun's rays, and the increase in the concentration of gases such as carbon dioxide. Global warming is a disaster in itself according to the enormous changes that affect the Earth in case if the increase in temperature will continue, even threatening human lives, when the phenomenon will lead to the extinction of many organisms on ground and in water (Ayman, 2015).

Reasons

Scientists divide themselves into two groups. First group consists of scientists who say that global warming is a natural phenomenon and that the earth's climate testifies naturally warm and cold periods, citing to the iced or cold period somewhere between the 17th and 18th century in Europe. This interpretation relieves the responsibility of polluting companies; when most of scientists, who may not deny that this phenomenon is naturally happening, agree on the fact that confirms being the increase of polluting gases such as Azote and Carbon dioxide strengthen global warming.

While the other group of scientists has attributed global warming to pollution as the only reason where they say that this phenomenon is similar to glass greenhouses where gases strengthen the heating effect of sunlight waves.

What distinguishes the Earth from other planets in the solar system is the atmosphere that surrounds it, and the continuation of life depends on the presence of the atmosphere and the stability of its components (Shiraz, 2014). Cutting forest's trees affects the stability of atmosphere's components, where the trees keep the balance of oxygen and carbon dioxide in the atmosphere. In addition, the

huge industrial revolution is one of the strong reasons that led to the climate change. Whenever human societies become more complex and depend on the machinery, more energy will be required and the rise in the demand for energy means burning more fossil fuels which poison the atmosphere. This should make us pay more attention to climate change and global warming.

Effects

Climate Change and Global Warming in Earth's surface lead to an abnormal rise in temperature in summer time as well as severe decrease in winter. This unbalanced temperature's level causes a change in types of weather as wind patterns and the amount of rain. The change in climate can lead to environmental, social and economic consequences which can be unpredictable.
Global Warming affects also the amount of melted snow at the poles and snow that covers the Greenland which will cause floods due to increased amount of water. As a result to the water level rise, many areas near to beaches can sink.

Recent reports published by the British government on this subject mentioned a fear of ice melting in Greenland which will lead to a sea level rise of about 7 meters over the next thousand years (Shiraz, 2014).

European Environment Agency warned of the rapid change resulting from global warming as rising temperatures will eliminate three-quarters of snow on the peaks of Alpine by 2050, causing devastating floods in Europe.

“ Arctic ice is rapidly disappearing and the region may have its first completely ice-free summer by 2040 or earlier. ”

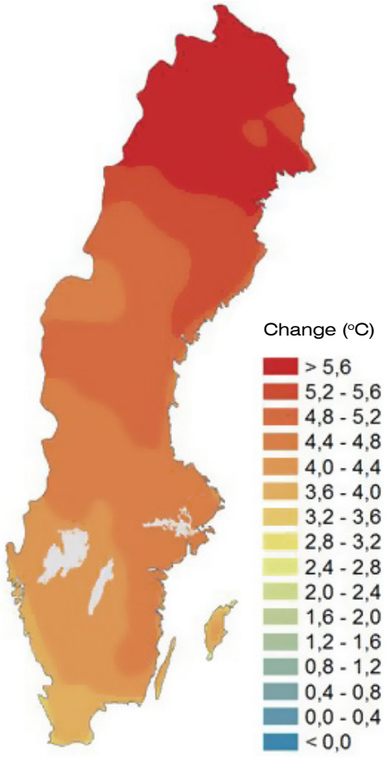
Source: National Geographic News

Climate Future in Sweden

As other countries on Earth, Sweden is being affected by climate change and people have started to notice this dramatic change.

Recent analyzes showed how the climate may change in Sweden. The new results confirmed previous findings that approved that we are getting higher temperatures and more precipitation. The analyzes clearly stated that the climate is affected by emissions of greenhouse gases (SMHI, 2015).

The average temperature for the whole Sweden increases by the next turn of the century with 2-6 degrees, depending on the amount of emissions of greenhouse gases. The warming is greatest in northern Sweden. The average rainfall increases by up to 50%, mostly in northern Sweden and the heavy rainfall will increase by about 20% across the whole country. Number of days with snow cover is expected to decrease by 40-80 days (SMHI,2015).



The temperature may increase in Sweden up to six degrees to the end of the century (SMHI,2015).

Floods

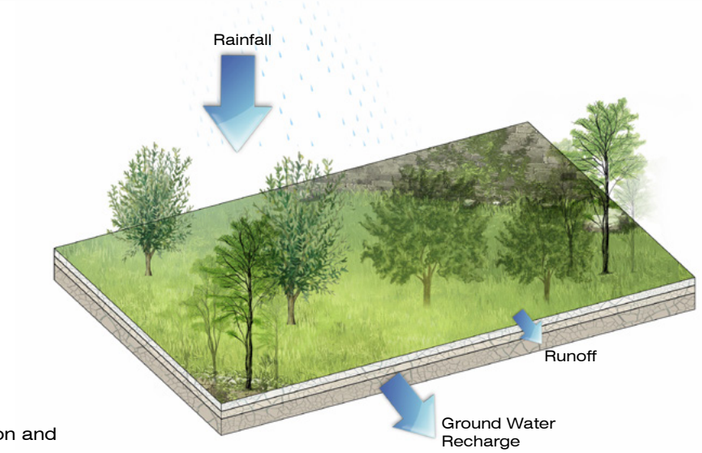
Our Earth is the water planet and without this critical resource we cannot be living. Since the beginning of life on Earth, water has been one of the columns which everything existing depends on.
Since the floods started happening frequently recently as a result of climate change and global warming, many people started to consider oceans, rainfalls and other water sources more or less as a threat. Climate change has increased severe storms and heavy rainfalls which impact conditions of water to be more aggressive threating both natural and built environment.
Understanding a flooding is connected to understanding water, and to understand water we should start with understanding our climate and weather.

A man standing in deep water when the annual monsoon rains come in Calcutta, India and the river floods (Vitale, n.d.)

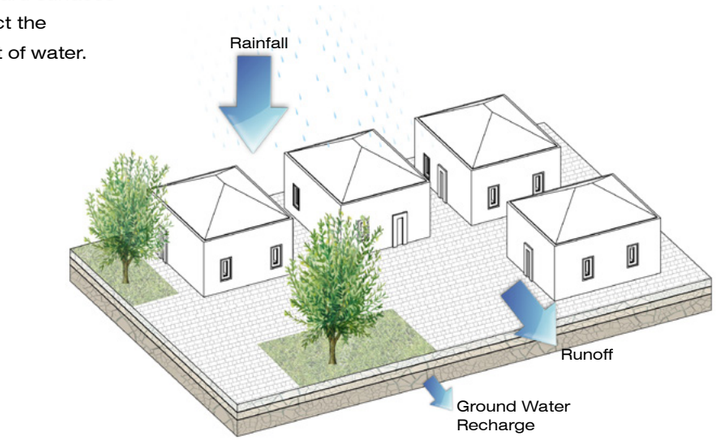
Definition and Reasons

Globally, floods have been one of the major natural disasters that annually cause the most deaths and greatest economic damages. The power of moving water is great and when a flood happens it can carry cars, trees and even houses with it.

A Flooding occurs when temporarily rainfalls or melted ice become more than usual and rivers overflow their banks and ground water systems and soil cannot handle all that amount of water. Floods can also occur in coastal areas when sea level rises due to strong wind which creates high waves or a tsunami. Most of the floods take hours before really happen and start by giving some signs helping people to prepare themselves and evacuate, while other floods just happen suddenly and these can be very dangerous because they do not give a clear warning before they happen and they sweep many things in their path (National Geographic, n.d.).
Climate change on Earth points out to a rise in number of heavy storms that are going to occur in the next fifty years, which leads to an increase in the amount of floods (Mayer and Bhatia, 2009).
Decreasing areas with vegetation is one of the reasons that lead to floods. Vegetation and natural soils have the ability to absorb big amounts of water and removing them cause an increase in floods. Human activities such as building and replacing lawns with hard surfaces of pavement affect the absorbed amount of water.



Removing vegetation and replacing it with hard surfaces of pavement affect the absorbed amount of water.



Types of Floods

There are different types of floods that happen because of different reasons. One type of floods is the regional floods which happen seasonally when rainfalls combine with melted snow and make a rise in water level in rivers.

Flash floods occur with a small warning which is not enough to warn and evacuate people and this type of floods gives disastrous results in numbers of deaths. Another type of floods is the coastal flooding which can happen because of seasonal peak tides and heavy storms that create aggressive water waves that hit cities which are located on or close to the shores.

Tsunami which is caused by earthquakes undersea, movement in the tectonic plates or by a volcanic action, leads to generate water waves that appear as walls which can travel miles of distances and reach the coastal water. This can cause huge floods and enormous and serious damages and risks.

Water can also sweep muds creating landslide and mud flows when slopes become not stable and start losing parts which slide with water flows. This type of floods can cause in removing vegetation and affects transportation and vehicles access (Watson and Adams, 2011).

Storm Frank in the UK (Admin, 2016)

Floods' History in Sweden

As in the whole world flooding is a natural disaster that causes the highest number of deaths. In Sweden it usually does not go that bad, but damages in materials can be big even here. It is common in Sweden with floods in the spring when the snow melts and when rain sweeps through the country as well as sea level rise. Flooding caused by heavy rainfall occurs in northern Sweden mainly in summer or autumn, while those in southern Sweden can occur around all whole year.

Floods here are mainly caused by the large supply of water to lakes and rivers from heavy rainfall or snowmelt. The natural seasons shift allows high water and minor flooding to recur regularly in the northern parts of the country during snowmelt time.

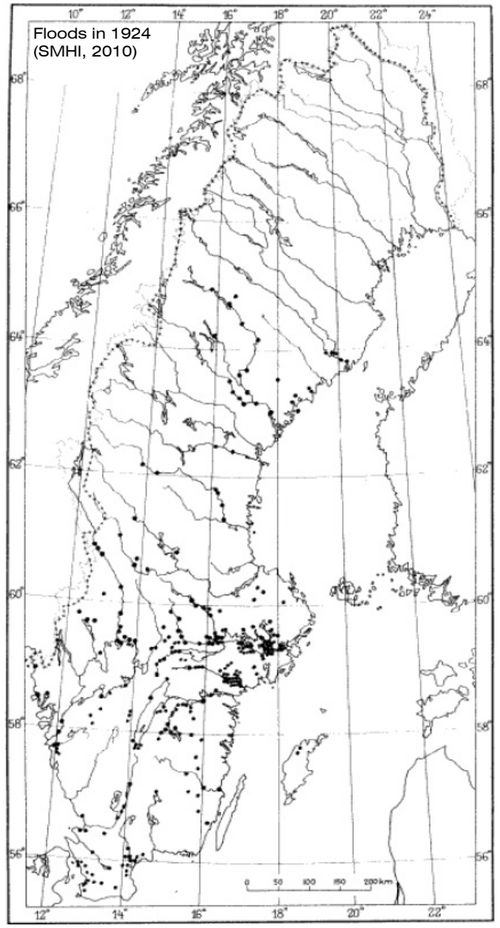
In the low-lying coasts, for example in Helge in Kristianstad, high sea levels complicate the problem of floods during high flows. The most disastrous floods occur when dam constructions collapse. Sweden has affected by a small number of dam failures and the worst occurred in 1985 at Noppikoski in Dalarna (SMHI, 2014).

A flooding in Sweden (Alfredsson, 2012)

Year 1924 has been largely characterized by floods. They started as early as in March to occasionally continue until mid of October. The climax was reached in May. It started to happen in Skåne and Halland in connection with heavy ice melting, and after that floods occurred mainly in the eastern parts of central and southern Sweden, particularly in Mälarelandskapenand Östergötland. In June floods started to reach the northern parts in southern Norrland and Dalarna (SMHI, 2010).

Year 2000 was described as the wettest year which was measured up in Sweden, with two spectacular floods. A Flooding in Glafsfjorden in Arvika in November led to one of the most extensive rescue operation which has ever happened in Sweden in connection with a flood (Lindström, 2002).

The floods continued to occur with different levels of strength and recently in September 2014 around 40 families in Malmö city in southern Sweden were affected by the strong flood that happened because of the heavy rainfalls. These families were forced to leave their homes which were full with water, and stay in other places. Beside the emotional side, the damages required an amount of money to carry out maintenance work.



Floods' Future in Sweden

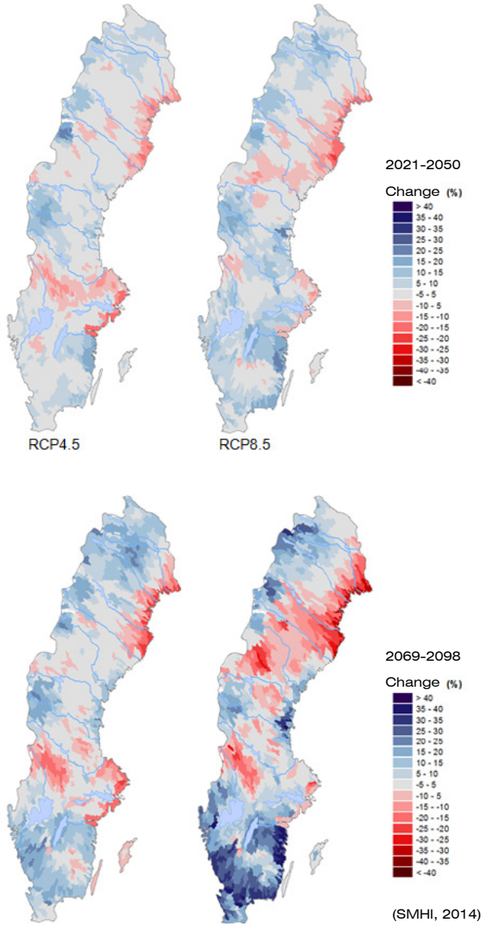
Many reports based on results from different software programs predict that heavy rainfalls will continue happening in Sweden causing severe local floods.

Climate development has great significance for the future of flood risks in Sweden. Essentially, there are three conditions that may change if the climate will continue to change because of global warming. The first condition is the rise in temperature, which leads to shorter and more unstable winters. This reduces the spring floods in many areas, while flooding due to winter rainfall increases. The second condition is the change in rain precipitation. It is expected that there will be an increase in rainfalls mostly in the northern and western Sweden. Seasonal distribution changes will appear with more rainfalls under the cold half-year and less during summer time. The combination of increased winter rain precipitation and higher temperature gives an increase in floods in winter. The third condition is the increase in evaporation. It compensates the effect of the increased rainfall in many areas, especially in southeastern Sweden (Carlsson, Bergström, Andreasson och Hellström, 2006).

The future development of the risks of flooding depends on the combined effect of these three

changes mentioned above. Changes will be different in different parts of the country and may differ between streams and lakes with various sizes and conditions.

The analysis to the right gives a general picture of the future of flood risk. This analysis presents a result of 100-year floods change in climate's future. With a 100-year floods means that this event on average occurs or exceeds once in 100 years.
In northern- eastern parts and coasts, the floods are expected to decrease. In these parts, floods usually occur during spring, which in a future warmer climate will be less than today.
In the north-western parts and southern coasts and in the southern mountain regions, it is calculated showing an increase in flood risks in the future, because of the increased rainfall.



(SMHI, 2014)

Response of Architecture

Architecture and Climate Change

Climate is described to be a form of uncontrollable nature. Extreme weather conditions, drought, floods and the environmental stresses force us to create new design ways for buildings and societies and development, since our current land development and sprawling is causing much tense to the environment which leads to the climate change and global warming.
The form and patterns of buildings and cities have been a result of social, ecological and climate situations from time to time. Recently, scientists are informing us that the climate is changing and cities specially ones close to water should response to that change, because infrastructure, buildings, transportation and power will be affected whenever a flood happens by cause of see level rising and heavy rainfall.
Change has been always part our Earth and our development on it, and architecture can be a significant factor in this change. Architects are considered to be part of the problem of climate change, when our buildings and building works are responsible for large percentage of the carbon dioxide emissions that worsen the issue of greenhouse gases.
Nowadays people and societies started to concern about climate change and more sustainable strategies started to appear in everyday life with collaboration with cities and governments. In the architectural side, sustainability and green architecture appeared strongly. Sustainability has been linked with reusing and creating environmental relationships.

Architecture and Floods

In recent years, the world has suffered from a large number of strong floods which wake up many questions about climate, spatial planning of cities and the vulnerability of society.

An increased number of buildings of all types and with different functions are becoming threatened by floods. Floods become as a threat and a cause for property damage and life safety risks when we do not put much care to them when planning cities and designing buildings.
Architecture on both buildings' and landscape's level has given many opportunities that help in alleviating the effects of floods, and each building site can be considered as a turning point to start with.

Commonly, architecture which handles the issue of floods aims to minimize the direct effect of flooding and water flows with high speed and power, as well as taking indirect effects into account. Indirect effects can be for example having contamination in buildings' materials and rot.

Reference Projects/ Inspiration

Designing buildings for flood risk results in a variation of types and ways of building. This variation is a result of difference in cultures, economy and climate situations. Architects take into account many requirements that suit the country as well as future development and climate change. A design for flood risk cannot be limited.

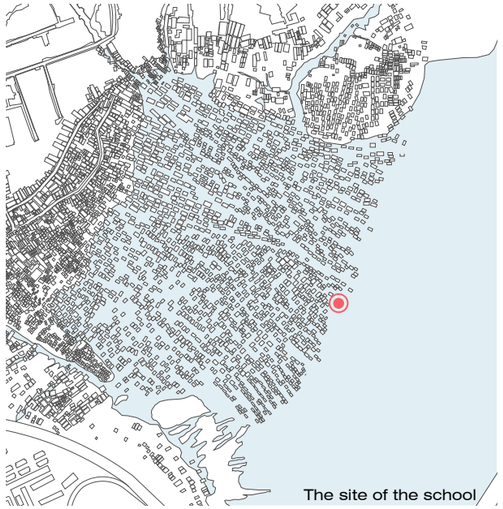
Two ways were mostly used for protecting a house or a building from floods and provide life safety. The first one is by relocating the whole building or community away from areas where floods mostly happen. This way of defense against floods is essentially directed to communities close to coasts when sea level starts to change and affects safety requirements.
The other way is by elevating the building and raises it to be above the expected level of floods. This can be by placing a building on a piles or columns and using the ground floor as parking space or as storage. However, this way of building can face technical and aesthetic challenges.

The following pages present various types and cases of designing for flood risks in different countries with diverse cultures and site situations.

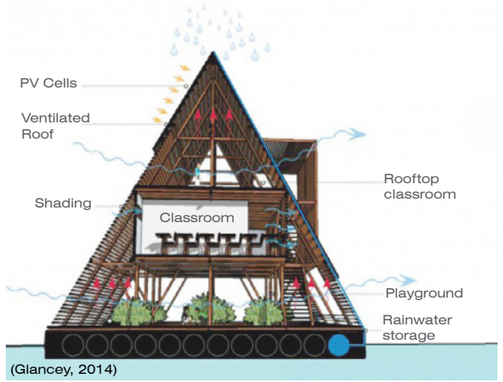
Makoko Floating School

This floating school consists of a floating structure which is built for the historical water community of Makoko. It is placed on the lake in heart of Lagos which is the largest city in Nigeria.
The design in this project has taken a contemporary approach in addressing the social and physical needs of the community in aspect of the impact of global warming as well as the rapidly urbanizing African context. It is a project which is developing a floating concept to fight unstable climate changes and global sea level changes.
The essential aim of this project is to achieve a sustainable alternative of building systems and urban water culture for the increased population of Africa's coastal regions.

This school is designed and built in 2013 by using local materials and with help of a naval architect who is called Erik Wassen. It is an extension and a part of an existing school in the Shanty Town. Makoko floating school provides classrooms for up to 100 kids on two floors in a structure of three floors in a triangle frame. It is a timber structure standing on 256 blue plastic barrels which is the floatation platform (Glancey, 2014).



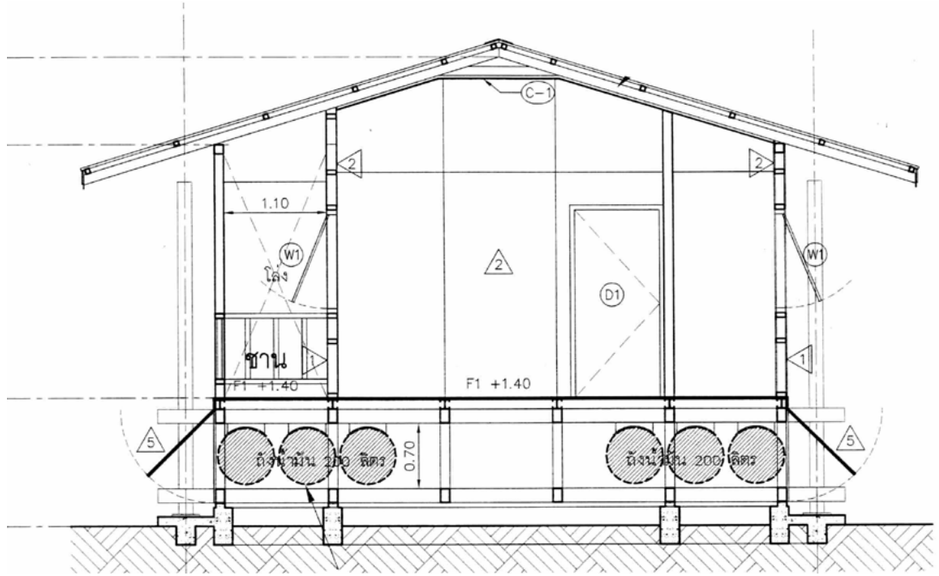
The site of the school



(Glancey, 2014)

The Makoko Floating School (Baan, 2013)

Same way of designing as in Makoko floating school in Nigeria, many houses in Thailand were designed to fight the impact of intense flooding but with a slight difference. These houses in Thailand are placed on ground instead of water. The floatation platform which consists of plastic barrels makes the house ready to float whenever a flood occurs. People in poor areas in Thailand were suffering from the consequences of floods but this way of building using cheap local materials could make a great transformation in their situation.



The Flood-Proof House

The flood proof house is located in Stinson Beach in California in the USA and it is designed by Studio Peek Ancona. It is designed to be used in zones with flood risks and can remain complete and unharmed after a sea level rise, flood or tsunami.
The house is built of parts with a prefab steel frame and local materials for cladding. It is designed to be suitable for both local customization and global application (Contemporist, 2010).

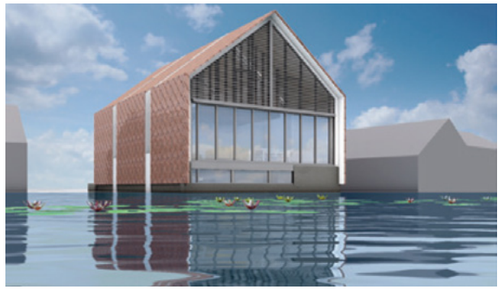
The concept used in this house is commonly used in coastal areas. It is about elevating the whole house above the predicted rise in sea level keeping the ground floor free to handle and allow water flows or tsunami to thrust under the used part of the house.

Flood-Proof House by Studio Peek Ancona (Damonte, 2010)

Formosa, the Amphibious House

This type of buildings can work in zones with flood risks and it is created by a British design team- Baca Architects, which is specialized in architecture for waterfronts. The amphibious house is a house which is placed on ground and rises during times of flooding.
Baca Architects have completed a home for a private client, which floats with the water level rise. This private house is located on an island in the UK just 10 meters from the River Thames that goes through Marlow town in Buckinghamshire.

When a flood occurs as water in the River Thames rises, the ground water on the island will also rise. The dock under the house will be filled with water gradually from the ground, and the house starts rising. The guide posts extend for almost 4meters above the ground level so that when a strong flood happens the house would stay retained between the posts.
The house has flexible pipes which extend up to three meters allowing services in the house to stay clean and undamaged, so that after a flood everything returns to its normal situation and people continue their daily lives without being affected (Willett, 2014).



Formosa, the Amphibious House (Willett, 2014)

Design Project

Aim of the Project

Water is a natural resource that keeps Earth to be the most suitable planet to have life on it. Water cannot be considered as a problem because without it life will not continue to exist. It is a free gift of nature and it cannot be counted as a threat. We are currently misusing this resource and our ways in handling water are not sustainable. What we reached to from instability in our climate and the frequent natural disasters are also a result for our misusing for the resources on Earth.

In this thesis project I would like to present a complex of housing units that gives a solution to the problem of floods in Kävlinge city in Sweden besides a meeting space for this complex and the neighborhoods around it. This design solution allows buildings to be more flexible to storms and floods which affect many functions in the society.

The aim of this design project is taking climate change extremes into account and constructing a positive circle of events that aims to adjust the negative impact of buildings and urban development on our environment as well as creating a new relationship between architecture and climate change through a design that leads to a reduction in the impact of floods and heavy rainfalls and providing safety factors and solutions that help in changing the event of a flood from being a threat to a creation of a new enjoyable experience.

One of the main aims of this project is to show that the key opportunity is how we design and with challenging architecture we can eliminate the thoughts about avoiding building on some parts of cities and manifest that architecture can be part of every site.

Choice of Method

The reference projects that have been presented in the previous pages have had different conditions in terms of weather, economy and cultural backgrounds. These reference projects have showed various ways of building on sites with risk of flooding.

Makoko floating school in Nigeria has been a result of expanded community on water using local materials to construct a light and cheap construction that can float on water. The flood proof house in California is presenting the method of lifting up the whole house above the expected water flood level. This way of designing gives a significant solution for sites with frequent events of flooding but it can create aesthetical issues as well as isolating the house from being part of the site or integrating it with its surroundings.

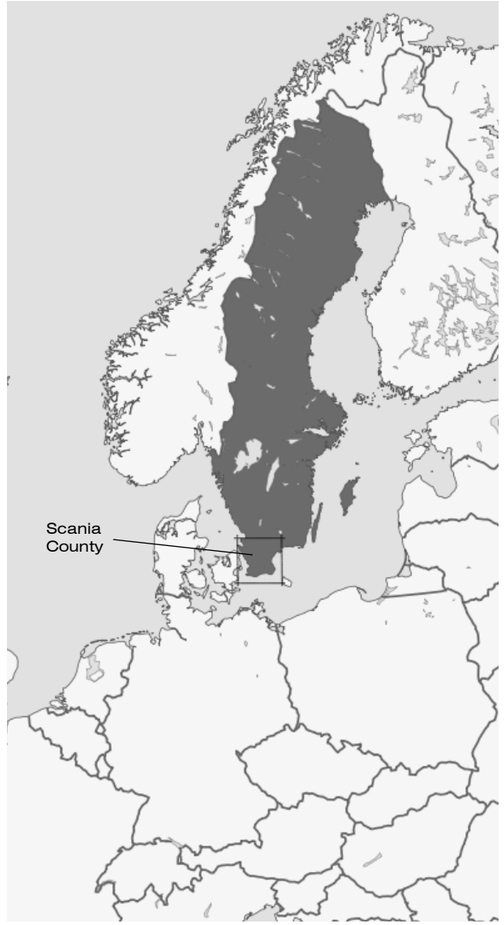
In this project I have chosen the principle used in Formosa, the Amphibious House in UK to apply it on the housing units which I am designing in Kävlinge. This way of building is the most flexible one and it can be adapted to any type of floods, weak or strong flood events. Furthermore, this method keeps the house in contact with its surrounded surfaces, vegetation and neighborhoods when placing the house in the same level as all other buildings which are neighboring it.

Historical Background

- City -

Kävlinge is a municipality in Scania County in southern Sweden. It is an attractive residential municipality which is located in the middle of an expanding region and offers accommodation with quality of life and opportunities for good enviroment.
The strength of the city goes to the good communications, strong population growth and the good economy of the municipality.

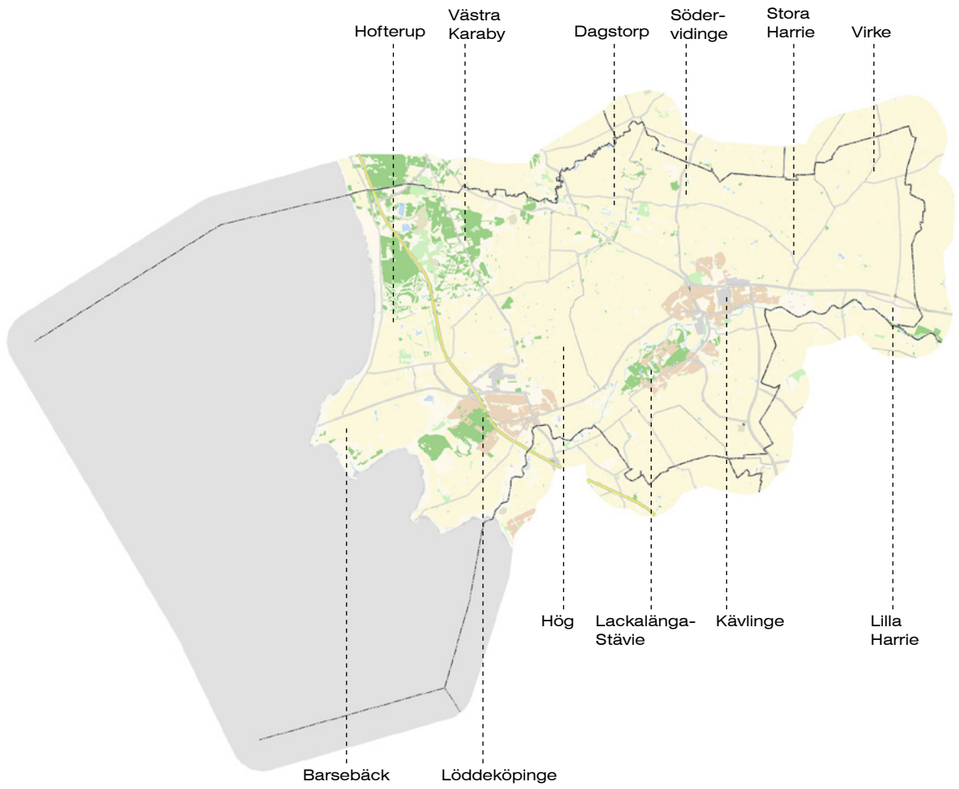
Back in history, the first settlement in the region Kävlinge occurred along the coast and from there colonized the land along with the river of Kävlinge. Remains from the Stone-age show that settlements existed in the area as early as 5,000 years ago.
The current Kävlinge founded in the middle of 1800s and at that time it consisted of 13 small towns. These towns were Barsebäck, Dagstorp, Hofterup, Hög, Kävlinge, Löddeköpinge, Lackalänga, Lilla Harrie, Stora Harrie, Stävie, Södervidinge,Virke and Västra Karaby. At the municipal reform in 1952, a large number of municipalities in the area formed.
Nowadays, Kävlinge Municipality is a result of union of these smaller municipalities and it is divided into 12 districts where Lackalänga and Stävie merged together (Kävlinge Kommun, 2015).



Scania County in Sweden

Facts about Kävlinge

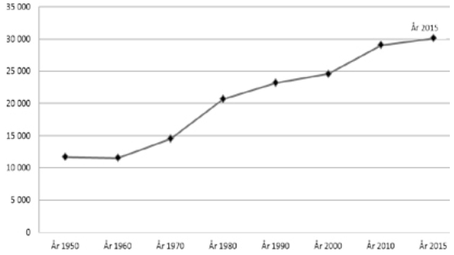
Population: At the turn of 2015/2016, the population was 30,104 individuals.
Area: 154 km²
Central District: Kävlinge
Major Districts: Kävlinge, Löddeköpinge, Furulund, Hofterup and Dösjebro.

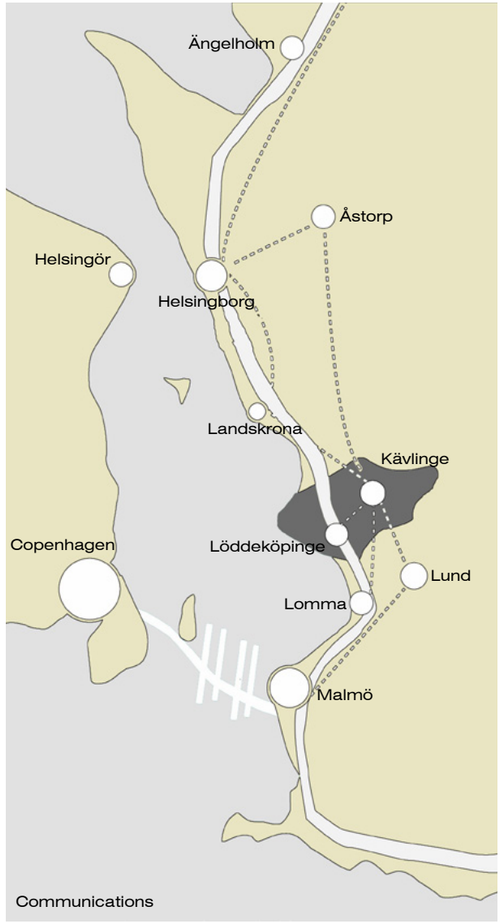


The 12 different districts in Kävlinge Municipality

In 1886 the railway between Malmö and Billesholm was ready. The railway pulled through Kävlinge which in that time would become an important railway junction. The community was developed as the railways were built and Kävlinge became a municipality in 1902 (Kävlinge Kommun, 2015).
Communications and trade have always been important for the region of Kävlinge and it is still considered as a significant railways hub where it is well connected to the surrounded cities.

Kävlinge has had a positive population growth since the unification in 1974. In the middle of the 90s the population stagnated for few years and then towards the end of the decade it started turning to a strong growth. In recent years, Kävlinge has been one of the municipalities in Sweden which had the highest population growth. The diagram below from the statistics of the municipality shows the population growth between 1950 and 2015.





Communications

Future of Kävlinge

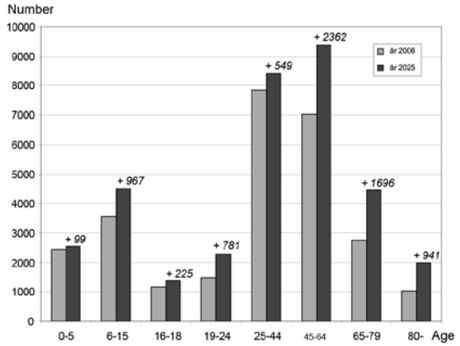
Kävlinge now has many strength points such as the good location in the region, closeness to a large labor market, the attractive natural and cultural environments and good accommodation possibilities. The river of Kävlinge counts as the biggest water stream in southern Scania and adds a lot to the good natural life. The municipality wants to continue developing the city and keep the character of being famous as a high quality residential city.

The main goal of Kävlinge is to create a good living environment for local residents and to reach this result, it is required to put a plan for the development based on people's different living conditions and that invites the involvement and participation. It is planned that the municipality will be able to offer different types of accommodation in attractive sites as well as creating more public meeting spaces. Today Kävlinge is dominated by small villa houses which represent three quarters of the total percentage.

In recent years, Kävlinge belonged to those municipalities whose population increased proportionally in southern Sweden and has also been one of the municipalities in Sweden that had the highest population growth which is 2.7% per year.

With an average growth of 1.5% per year, Kävlinge will have about 35 000 inhabitants by 2025, which means an increase with about 7000 inhabitants.
This growth in the population will be followed by a need for new residential buildings. The municipality is planning to build 3400 housing units between 2010 and 2025.
The district Kävlinge will have highest number of new construction for housing which will be 1900 housing units. Löddeköpinge which is located on the seaside will have 760 new housing units (Kävlinge Kommun, 2015).

The diagram below shows the growth in population between different ages.



Prediction for population changes in Kävlinge (Kävlinge Kommun, 2015).


River of Kävlinge creates an attractive environment for living

Choice of Site

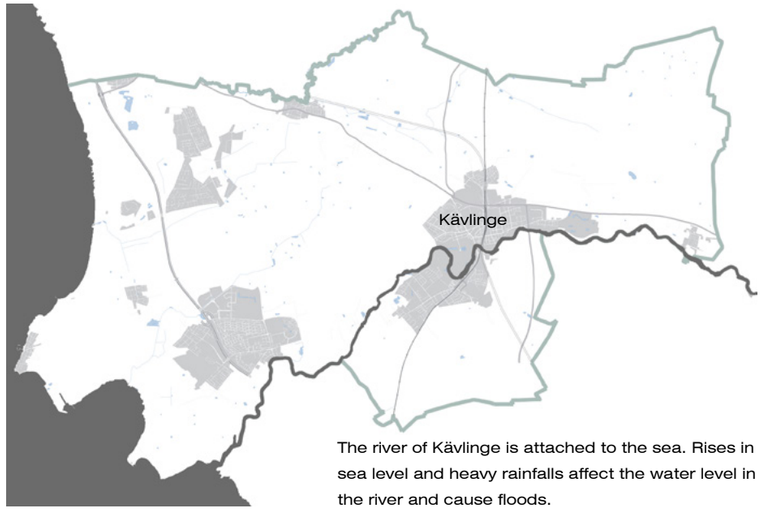
For the design project I have chosen the central district Kävlinge to choose a site from, where it is planned to have 1900 new housing units and the train station in it has an important meaning to the development of the city. This development will support the trade, services as well as the social and cultural activities which in its turn will lead to a change in the residential structure in Kävlinge which is now dominated by villa settlements.

The district Kävlinge is planned to have a variation in types of housing units and apartment's buildings are needed. Not only housing units but also more offices, cafes and other public places are planned to increase in the district Kävlinge to create lively neighbourhoods.

From the research and analysis of SMHI, effects of climate change on south-western Sweden which is Scania is part of shows that the temperature in southern Sweden will increase by approximately 5 ° C by year 2100. Annual precipitation in southern Sweden will also increase by approximately 15% by 2100. Rainfall intensity is expected to increase. The analysis shows that the extreme high flow situations will be significantly common in the future than today.

Scania will be affected by the rising sea levels harder than other parts in Sweden where the land is higher.

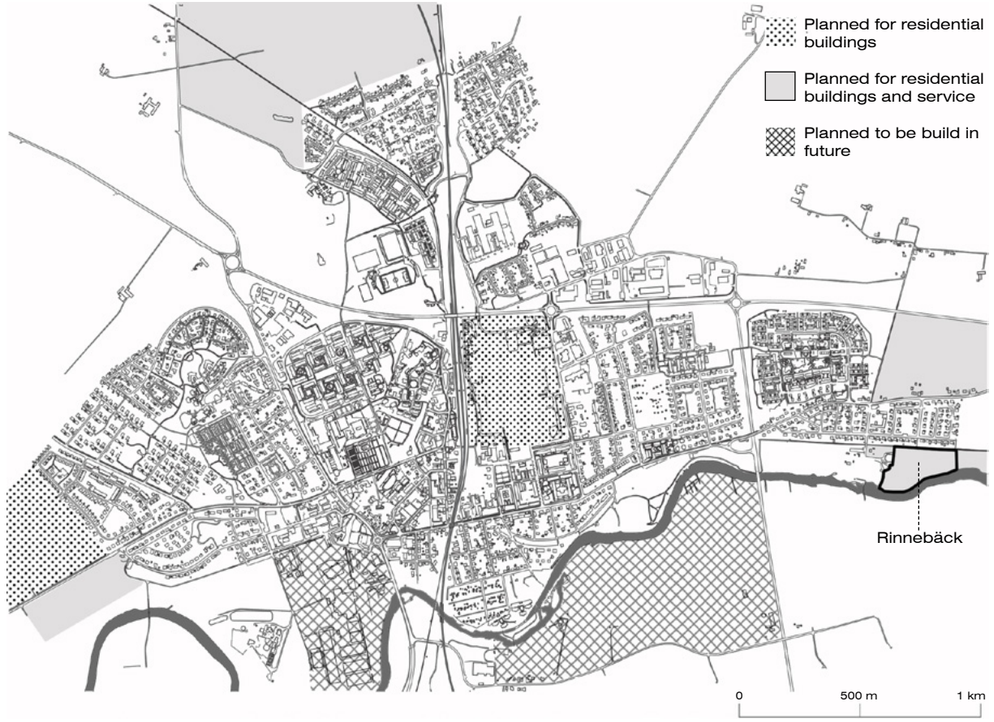
Investigations and a study on climate and floods made by SWECO, 2009, showed that areas adjacent to the river of Kävlinge are located at levels below +3 M. These areas are at risk of flooding caused by both high water levels in the sea and high flow situations in the river.



The river of Kävlinge is attached to the sea. Rises in sea level and heavy rainfalls affect the water level in the river and cause floods.

The district Kävlinge year 1947 (Staffanstorp, n.d.). Flooding from the river of Kävlinge has historically mainly affected the colony cottage areas close to the river.

The district Kävlinge nowadays. The river of Kävlinge has always been part of the development of the city. The district has been expanding along the river.



The site which I have chosen to work with is called Rinnebäck. It is one of the areas where the municipality has planned to build residential buildings on.

The site Rinnebäck is located on the river of Kävlinge where there is a risk for flooding. It is one of the areas which are located relatively low in relation to the river of Kävlinge.

Analysis of Site

The site Rinnebäck is located on the eastern edge of the district Kävlinge where it is bounded by open fields from east. From north the site is bounded by a residential area which is dominated by villa houses for mostly families. Rinnebäck is bounded from west by an agricultural field and from south by the river of Kävlinge.

Even if the site is located on the boundry of the district Kävlinge, it is still counted as a potentially close place to the centre of the district and many other important functions. The central station of Kävlinge can be reached from the site Rinnebäck by a bicycle within 7 minutes and it is 25 minutes walking, where it is almost the same distance to the public library and the medical centre.

The diagram on the following page shows the distances between the site chosen for the design project and other public functions around.

Cultural Theatre
Medical Centre
Swimming Hall
Library
Central Station
Sports Hall

SWOT analysis

The strengths of the site return to the significant natural values where it is bounded by water and surrounded with a lot of greenery and vegetation.

The weakness that appears clearly in the site is the lack in connection between the pedestrian path above the chosen site and the river where it is hard to reach the water when there are no paths that lead to the edge of the river. In addition, there is a lack in connection between the two sides of water and this issue appears not only in this site but also in almost whole of the district of Kävlinge.

The opportunities lay on the ability of exploring the significant strengths of the site such as creating a residential area with a deep communication with nature.

The biggest threat in this site is the risk of floods where it is located low in relation to the level of water in the river of Kävlinge.

Identity

The chosen site in Rinnebäck is an open landscape today, but the residential area above it gives an architectural identity to the place. The area has mostly small family houses with the common type of roofs which is the gabled roof, with a traditional slope of Scania Country. The roofs are mostly covered with tiles in red or black.
The area as in the whole district of Kävlinge has particularly red bricks on the facades of houses. New built houses started to have plaster facades as a variation and in most cases in bright colours such as white. There are houses which are built in red bricks but their new additions have plaster facades or wood panels with light colours.

Site Comparison

The chosen site for the design project has been compared with the residential area which is located above it. This residential area is dominated by villa houses for families which consist mostly of one story high houses.

The site fits around 38 villa houses where they cover almost the whole site. When we assume that in each house live two adults and in half of the number of houses live one child in each home while the other half has two kids in each family, the statistic becomes:

38 Families
76 Adults
57 Kids


50%

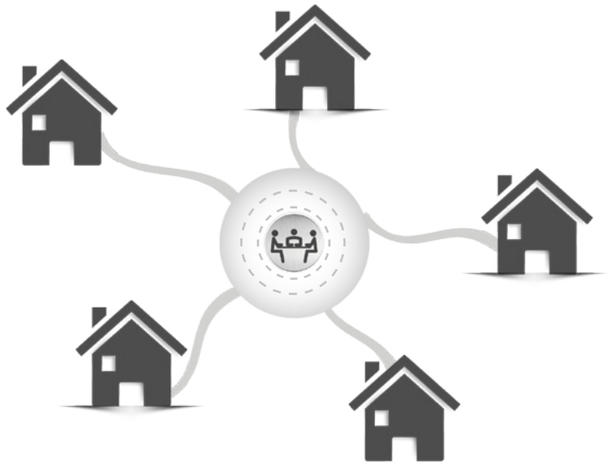

50%

Process

Today's environmental problems which reduced biological diversity, reduced the natural resources and polluted land and water mean that we run a risk in the conditions of the future of the coming generations. Our lifestyle brings future risks worldwide as floods and rising sea levels. This trend must be broken by including sustainable development.

This project takes into account sustainability in an integrated approach of design and preparations for future changes into a social and creative aspect.

Kävlinge has historically and in the present time been an important transportation hub. The older routes, railways expansion and modern highways cross the municipality and provide good connections to the surrounding municipalities and city centre.
From this characteristic of the city, the idea of connecting the housing units in the design project to a public meeting space is taken. The meeting space is in form of a bridge which small lifted outdoor corridors are linked to. All houses are linked to these corridors that lead to the bridge which is considered as a lively centre and a social space in the site. The public bridge and the narrow corridors provide an emergency escape and a possibility for evacuation from the houses and site in case if a flood occurs where the bridge is leading to a higher area. The bridge is creating a space where people can celebrate the event of a flood or comforting each other when gathering and sharing same situation.

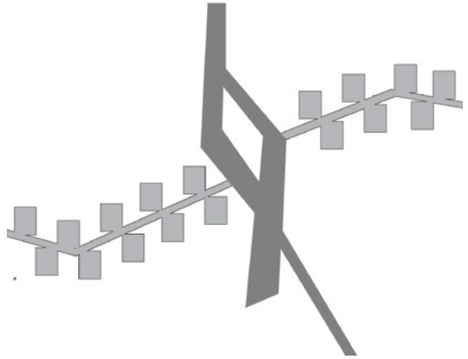


The structure and distribution of the complex of the housing units is taken from the urban structure of the district Kävlinge where the railways are linking the city to the other cities around while the river of Kävlinge is dividing the land into two parts.

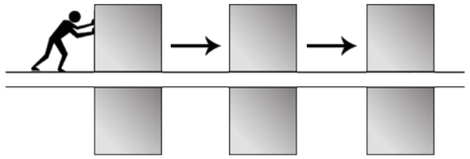
In the design project, the bridge is taking the function and task of the railways. It is linking the northern part of the district with the other side of the river, while the narrow corridors between the houses are dividing the site into two parts.

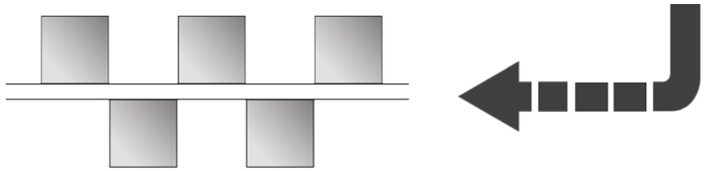
The shape of the narrow corridors between the housing units allows the houses to be shifted from each other and not on the same line. In this way the houses will get more daylight from east and west as well as providing privacy for the families living in these houses when the windows are not facing each other.

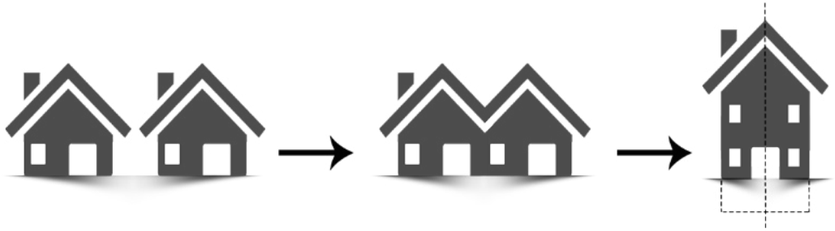
The space under the bridge is a common car parking for the individuals living in this site. The idea is in having a variety from the common trend in Kävlinge when having a shared car parking space rather than a private one for each house.



The houses are able to get more daylight from north and south when they are pushed to not face each other.

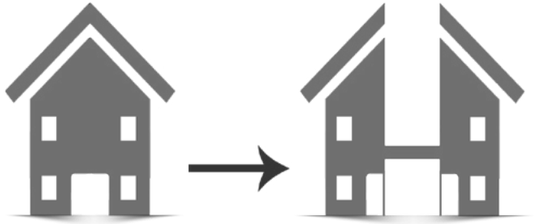




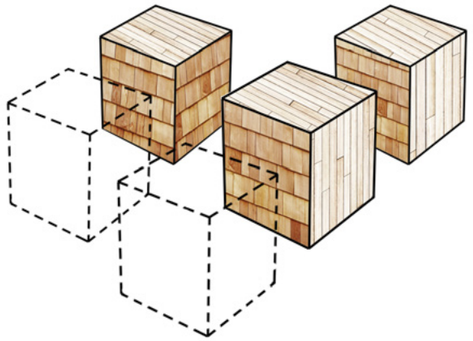


In aspect of suitability in saving land for greenery, each two houses- two families are put together in one house but in two separated and private housing units with tripling the number of floors to change from one story high houses to two stories and a basement.

The shape of the houses is taken from the traditional houses with gabled roofs. The narrow lifted corridors cut the shape into two units creating houses with shed roofs.



The choice of materials has been influenced by the buildings in Kävlinge which are characterized by the last century's brick architecture. The new housing units will have wooden facades as a type of variation. However some facades will have wood shingle siding which memorize about the use of bricks in Kävlinge and create a communication between the old and new.
The facades which are facing other facades in this housing complex will have wood shingle siding while the other facades and roofs will have wooden panels with a lighter tone. It is like one complete object in wooden panels and whenever it's been cut, you get the wood shingle siding.



Drawings and Illustrations

The site has 26 villa houses and each house has two housing units. When we assume that in each housing unit live two adults and in half of the number of houses live one child in each home while the other half has two kids in each family, the statistic becomes:

52 Families
104 Adults
78 Kids

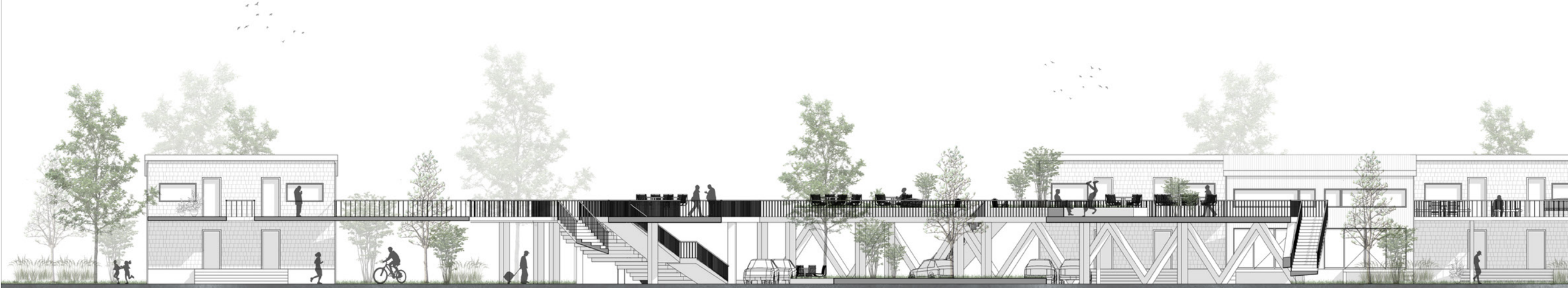

50%


50%

When comparing this statistic to the statistic of the site comparison on page 65, it can be seen that this housing complex will be occupied by larger number of families and at the same time keeping large parts of the site as an open public landscape.

Site Plan 1.1000

The public bridge in the site offers more than just a possibility of crossing the river of Kävlinge, the bridge prioritizes also on being an attractive meeting and gathering space and enjoying the experience of being lifted and close to water. The bridge creates a public promenade with sitting areas for relaxing.
The space under the bridge which is a common car parking for the individuals living in this site and their guests gives parking space for 27 cars.



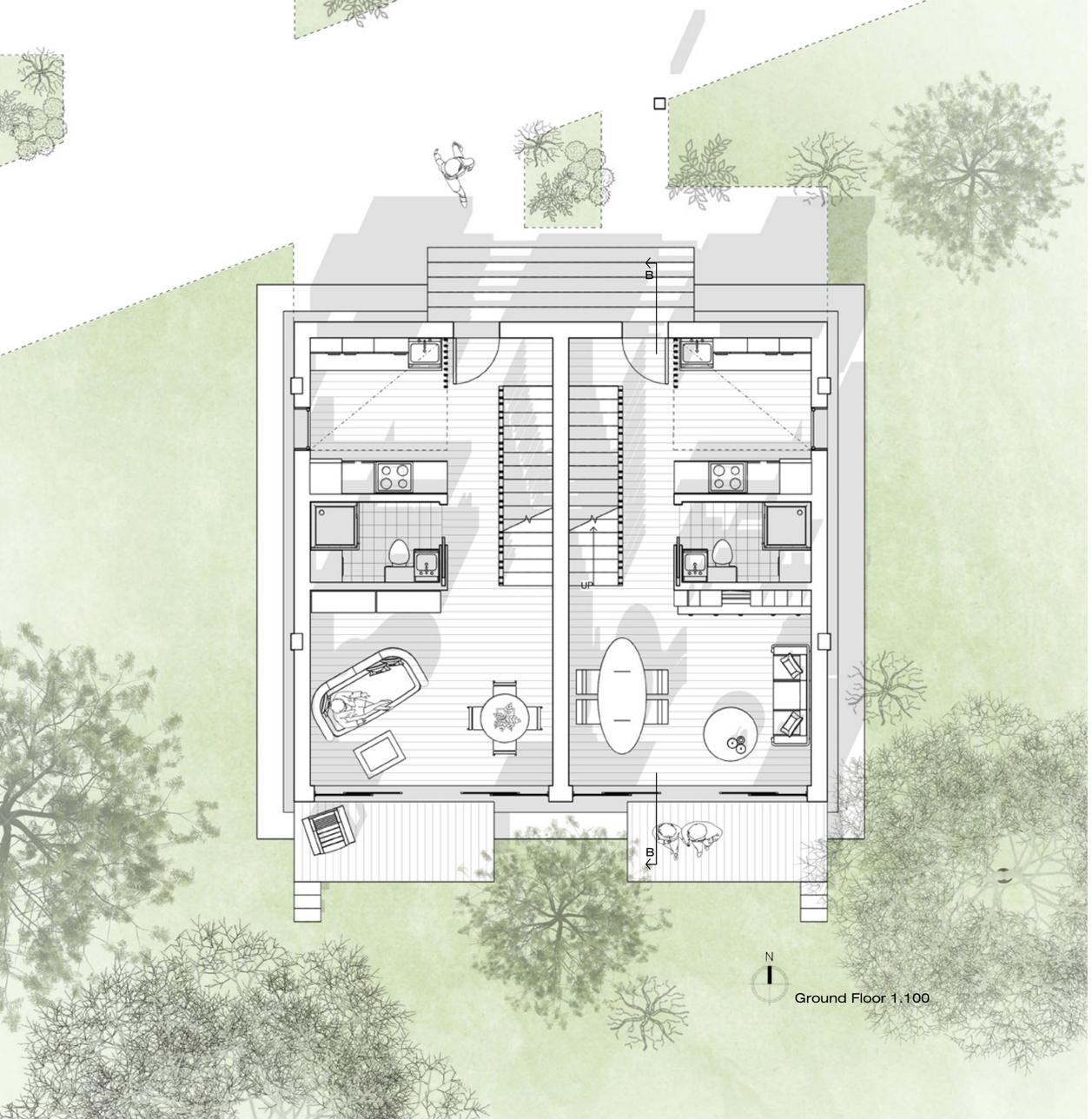
Section A-A 1.200

House Type 1

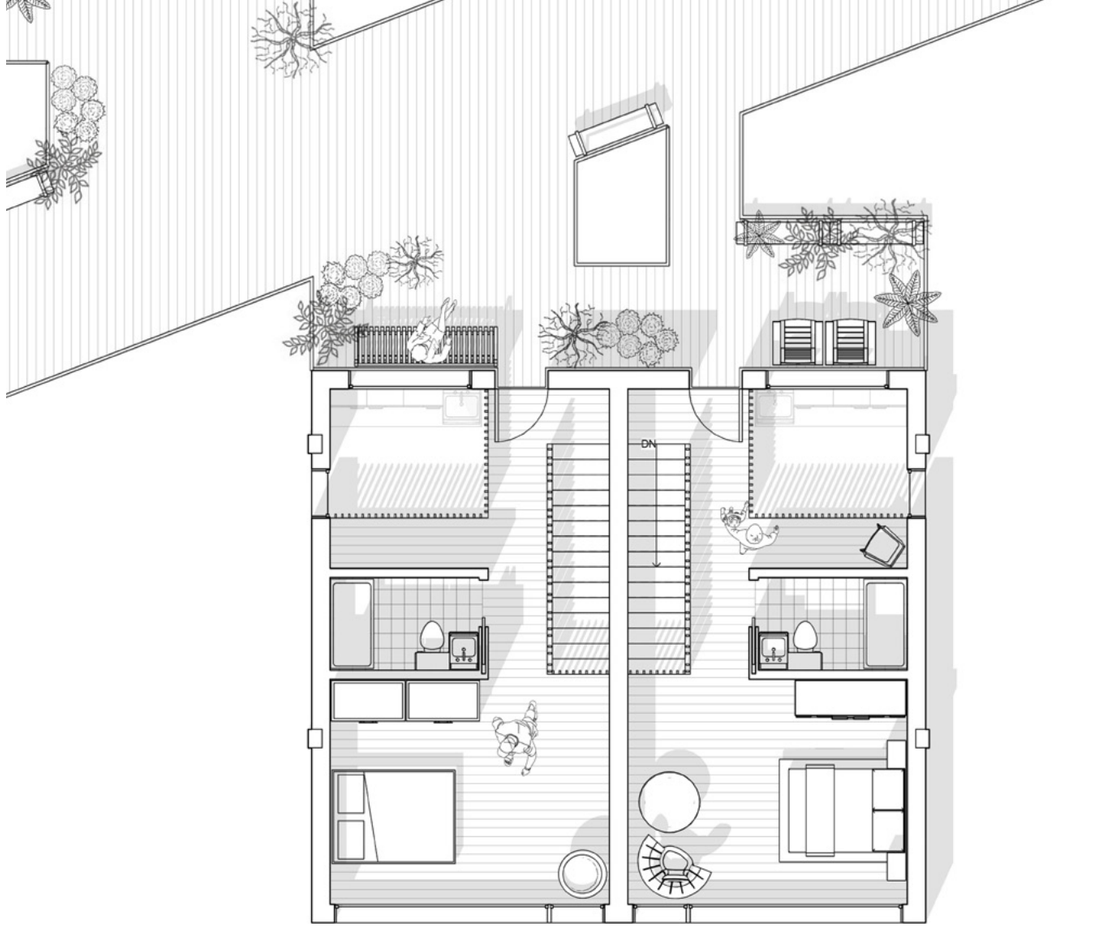
This type of houses is linked to the narrow corridors from north

Basement 1.100

N



Ground Floor 1.100



There is such as equalization between the two types of houses. The terrace in this type is facing north while the garden is facing south. In the other type, the terrace faces south while the garden faces north.

First Floor 1.100

N

Section B-B 1.50

1. Wooden Panels
   Roof battens
   Drainage
   Roof underlay sheet- moisture protection
   Air gap
   Insulation
   Airtight layer
   Insulation
   Wooden panels- Interior

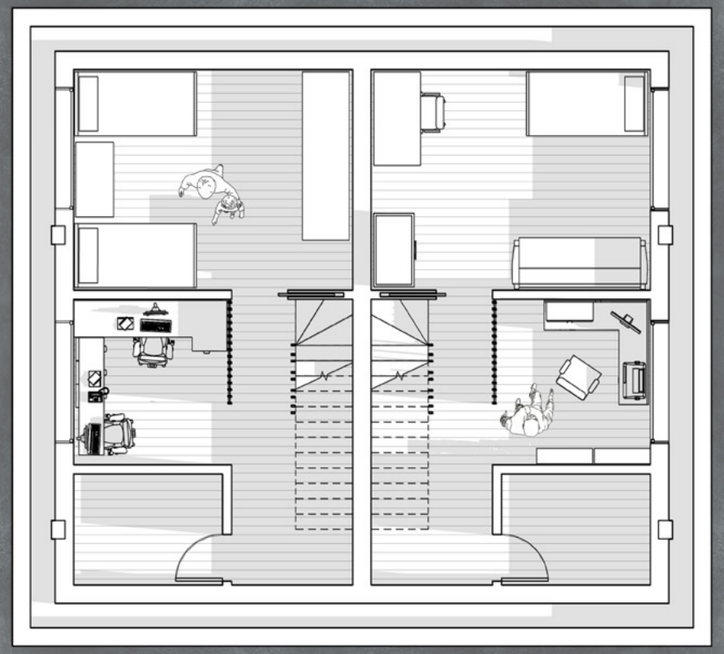
2. Wooden Panels
   Drainage
   Wind protection
   Insulation
   Airtight layer
   Interior insulation layer
   Wooden panels- Interior

3. Plaster
   Reinforced rough plaster
   Lightweight concrete blocks
   Gypsum board

Living Room- House Type 1

House Type 2

This type of houses is linked to the narrow corridors from south



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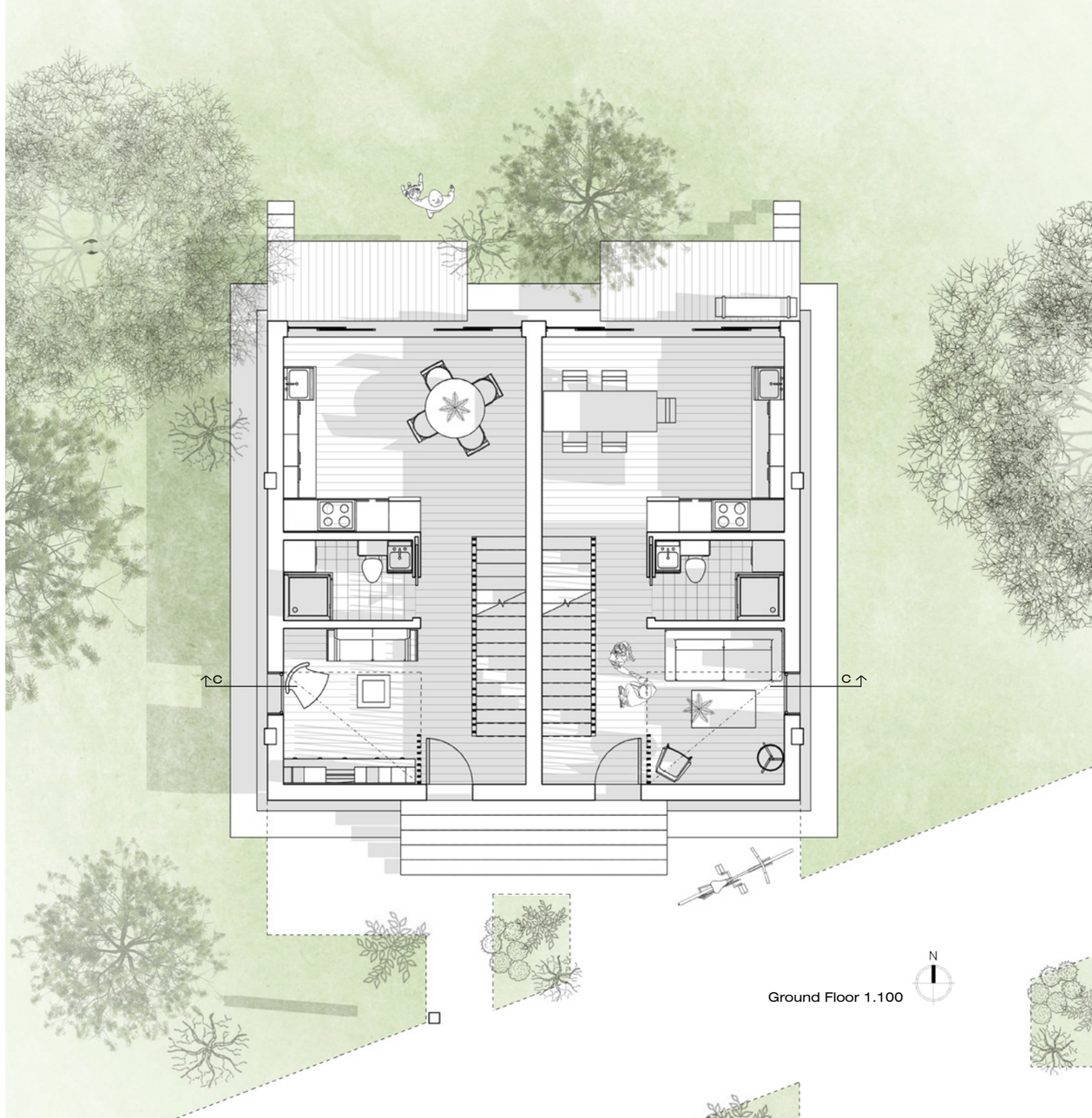
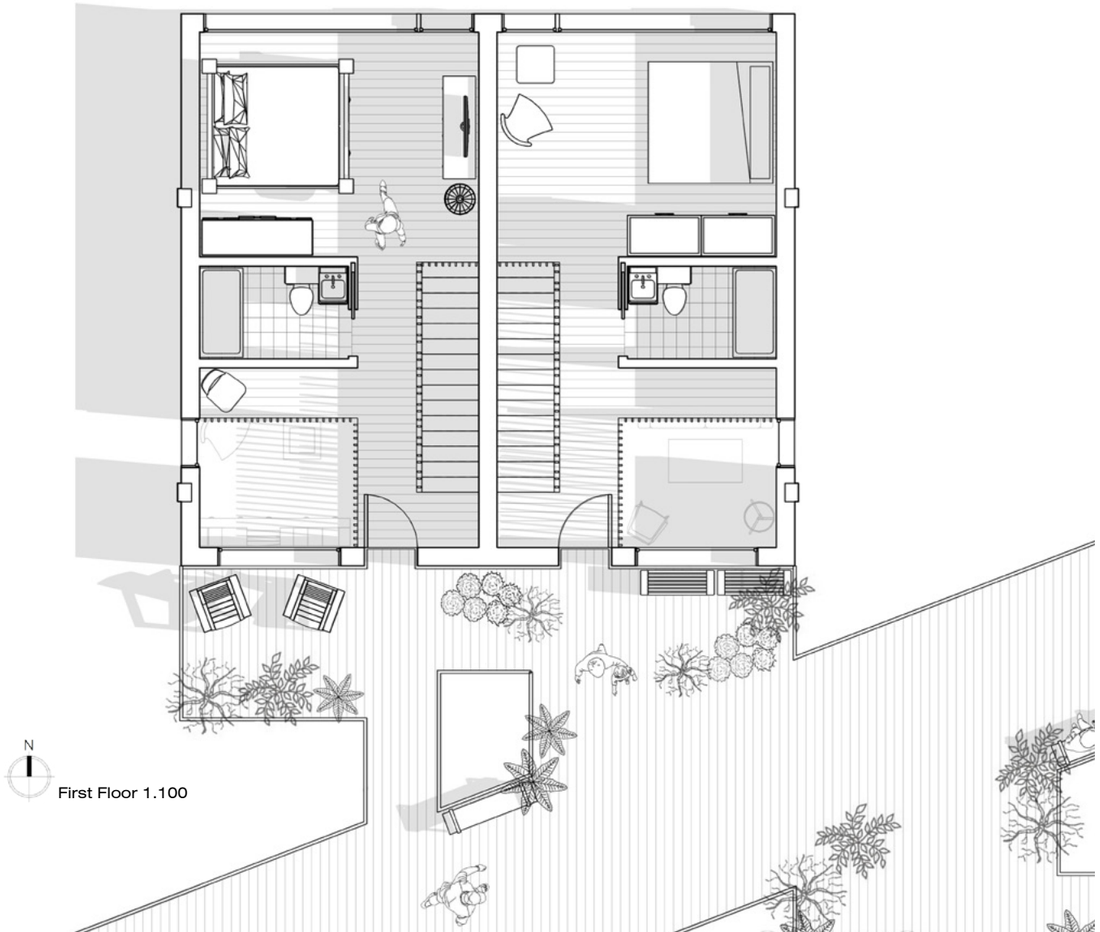
Basement 1.100



N

Ground Floor 1.100

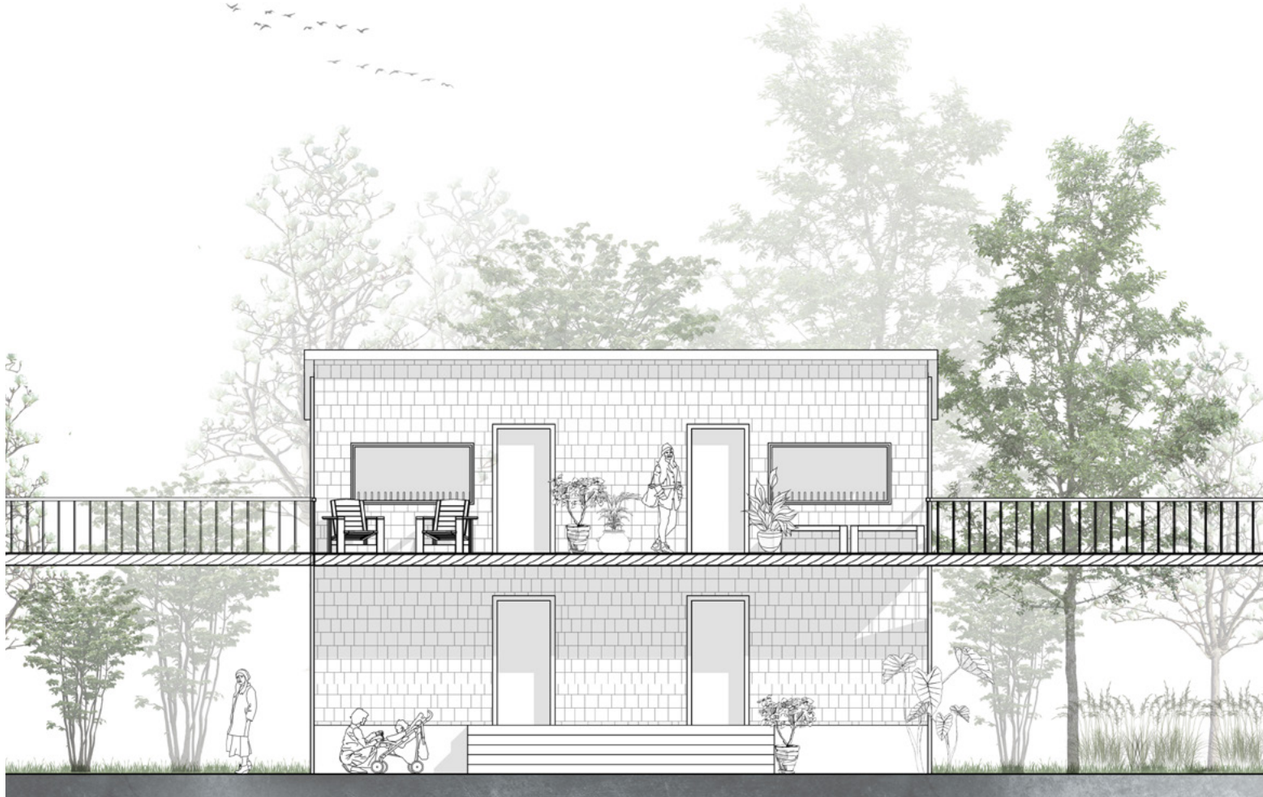
The open space in the first floor allows daylight from south to reach the living room in the ground floor.



First Floor 1.100

Kitchen- House Type 2

Facade towards North 1.100



Facade towards South 1.100

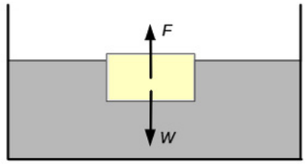
Section C-C 1.100

Living Room- House Type 2

The Houses have terraces on the narrow corridors which are linked to the social space on the common bridge. These terraces can be counted as a compensation for the gardens on the ground when it is flooded. This space is for people, plants as well as animals and insects when a flood occurs.
The narrow corridors are mostly for people living in the site, but they are also welcoming other people to investigate and enjoy sitting on the benches facing the open landscape and water.

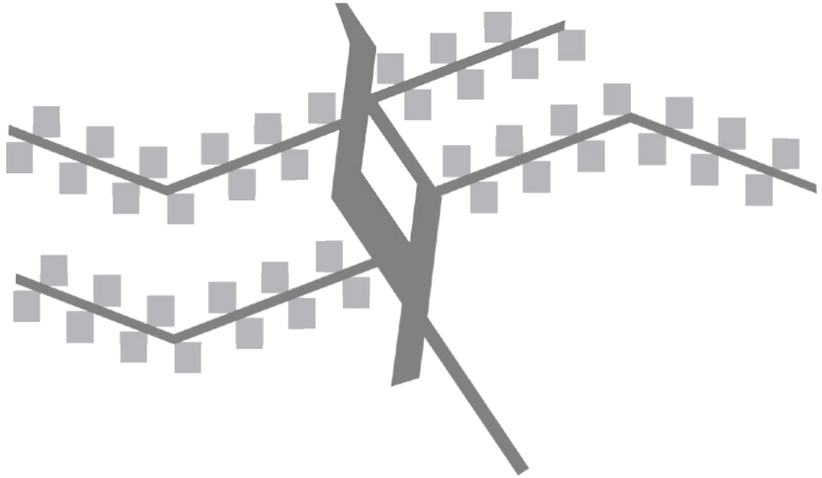
When a flood occurs as water level in the river rises, the ground water on the site will also rise. The dock under each house will be filled with water gradually and the house will start rising.
The guide posts keep the houses in their places.

The force that leads the houses to the floatation condition can be described in Archimedes' principle. This principle indicates that any object sunken in a fluid, is buoyed up by a force equal to the weight of the fluid displaced by the object.



Future of Site

The proposal presented in this thesis project is densifying the existing way of living keeping the areas of the chosen site as an open landscape for common and public use.
In future, these open parts can be filled with more housing units if the development in population will require this type of densification.



Photos of Model

Conclusion and Reflections

The purpose of the thesis work is to design a proposal for a site where there is a risk for floods and make it as an attractive neighbourhood that is taken into account in the city. It examines how housing units can defend against floods and provide safety using new technics in architecture.

Through research and reference projects, knowledge and inspiration as well as experience was acquired and landed in a design proposal for Rinnebäck in Kävlinge. The project resulted in a neighbourhood which is linked to the existing small-scale buildings and structures in the city but at the same time it created a contrast in densification as well as a variation in usage of materials.

Methods of designing for zones with flood risk should be taken in consideration when climate change is already happening. This new challenge should drive innovation to the best practical methods in design, development and greater understanding to the relation between choices and the challenge of climate change.

The Environment Agency states that it will never be possible to prevent floods but we can conduct them through reducing the impact of floods. Therefore, we should start thinking like if a flood will occur tomorrow and design for the worst conditions to manage the bad impacts.

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Thanks !