SPACE FOR COMMUNITY

MASTER THESIS

SPACE FOR COMMUNITY

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ABSTRACT

The project is made as an alternative design for the space in the middle of one Prague´s district. The building site is surrounded by different and interesting spaces all around, including park, industrial area and residential area.

The project contains different types of residential buildings, which are family houses and multi-storey buildings. The emphasis is put on social sustainability, especially on interaction between tenants, and the cohousing principle was adopted for its design.

The project focuses on sustainable part of design, the aim is to make zero-energy building with quality living in terms of functionality and indoor climate.

ACKNOWLEDGEMENT

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INTRODUCTION

Buildings are at the centre of our lives. From the emotional to the architectural value, buildings occupy a key place in society as a whole. The characteristics of a building, its design and feel, and its technical standards not only influence our productivity, our well-being and our moods, they also define how much energy is consumed by building, and how much heating, ventilation and cooling energy is needed. Yet, the energy performance of our buildings is generally so poor that the levels of energy consumed in buildings makes building sector one of the most significant CO2 emissions sources in Europe. [Economidou, 2011]

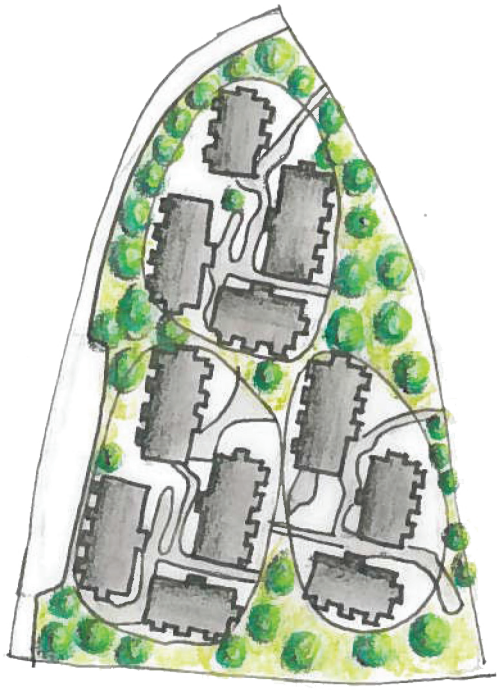
At the suburbs of Prague, capital city of Czech Republic, is intensive development of multi-storey residential houses. Dwellings are being quickly designed without consideration about sustainability and indoor climate. The quantity of dwellings is more important than quality in such developments.

This trend used to be applied on the edge of Prague, where huge complexes were developed, but now this development came closer to the historical centre of Prague, where residential buildings started to cover every open space, including green places and old unused factory areas.

Example of this trend is in central part of Prague, in city part Žižkov, where is being built very ambitious residential building complex consisting more than 1300 dwellings. This project is going to be built in three stages, from which the first stage started to be built these days.

Next to this area was built in year 2012 residential park with ten buildings. This project was developed by the same developer so the next of the project will have similar appearance.

All buildings in this complex have four floors. Between three, respectively four blocks is common open area. Around the buildings is greenery with no function with plants without consideration of the existing ecosystem, and the environment. From the architectural point of view, the houses do not respect their surrounding, since next to this complex is typical suburban development of small family houses with pitched red roofs. The buildings have poor consideration for indoor climate, otherwise they could not be that close to each other. They lack any consideration of sustainability, with no systems reducing or producing electricity.



The future building complex is going to consist of nearly 1300 dwellings, and with office spaces. [Metrostav] The built ratio of existing houses is 100%, and the future design is going to be 200%. This means very dense or very high development, which is against the character of the place. Next to this area is hilly park, which provides nice walk and view on the city and future development is going to create unwanted boundary with the park, and will spoil the view.

On the south of the area is unused cargo train station, which will be turned into shopping mall and more residential buildings and offices. The first project was designed, that the train station will be demolished, but Prague citizens and Prague Authority step against it so the building became cultural heritage. [Nákladove nadrazi Zizkov] The project is still open and is not sure what will happen with this area in the middle of the city.

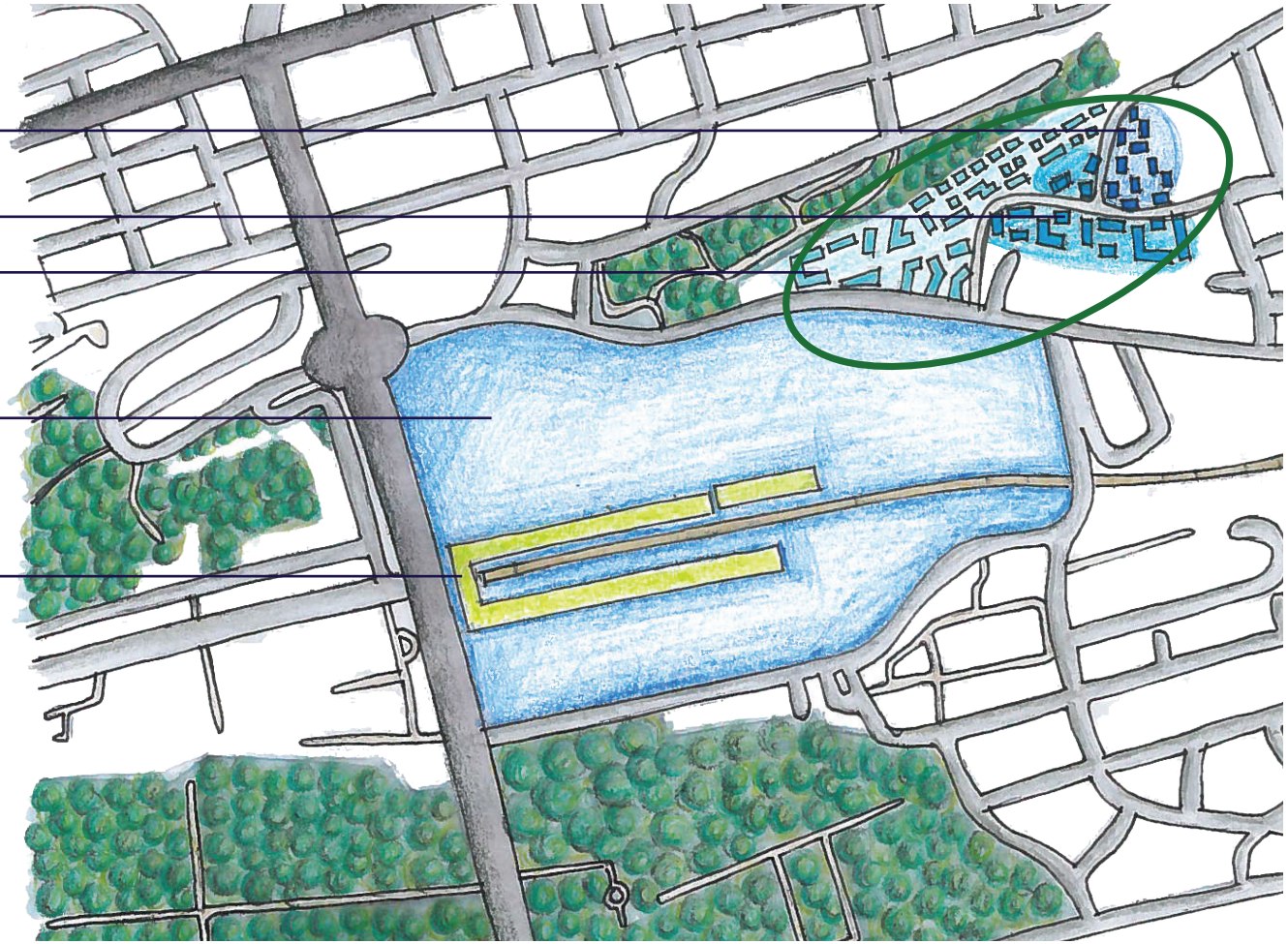
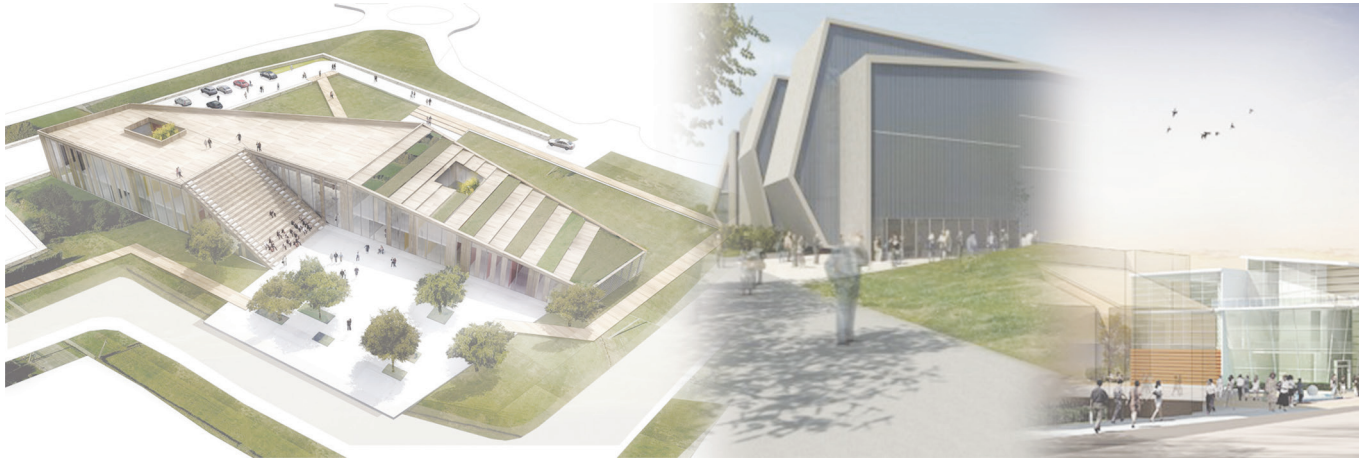


Figure x- map of future residential complex

FUNCTION

Human scale, variety in form, a design that promotes socialising, facilities for common use, a tenure that allows resident participation, a stimulating and safe place for play, and a mix of different households living together. These criteria might make up a policy of liveability. [Subdivision for People and the Environment, 2001]



The aim of this thesis is to find alternative solution for the whole area. My project will deal with creating quality residential housing, in contradictory of existing apartments, with enhancement of community and sustainability. The idea is to introduce cohousing principles in the country, where sustainability is not usually considered in building industry. Important part of the project will be also its connection to the near park at the north, existing residential complex at east and industrial zone at south. Bringing the park and green areas into the building area will be enhanced, instead of creating boundary between these two environments. The task is to create self-sustainable neighbourhood that will have its own water, energy, resources and waste treatment, that will be considered and implemented at the beginning of the design phase.

The project focuses on creating the sustainable living. That also means to provide other functions on the site. Mixed use of a site encourages sustainable use of land. Diversity of activities on the site means less need to travel, so smaller reliance on the car. Place like this is more attractive and has a better quality than single-function site. Community well-being is greatly enhanced by the proximity of opportunities to enjoy diverse recreation, cultural and social opportunities.

Creating cohousing also means creating common spaces and community houses. The importance and desired functions of the space will be analysed.

The principle of cohousing is not well known in Czech Republic. This philosophy is coming to Czech from Germany and new initiatives, mostly founded by unsatisfied tenants, who want to change their lifestyle, are being established around the country. However, no cohousing projects have been done in Czech country yet. Therefore this project will also try to fulfil representative function as the first cohousing neighbourhood in Czech Republic.

METHODOLOGY

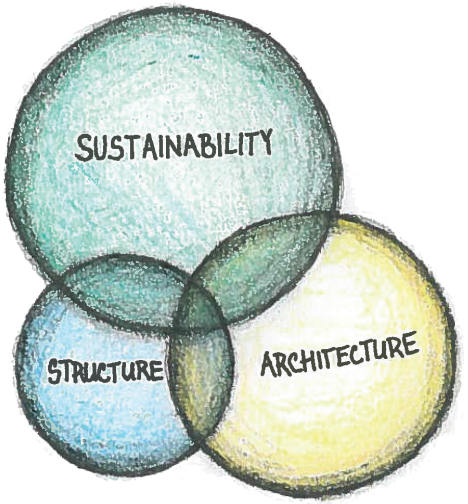
The future of building design is found in Integrated Design Process. Integrated design process is essential for effective management of the sustainable design process to ensure that efficient coordination is maintained. [Zimmerman]

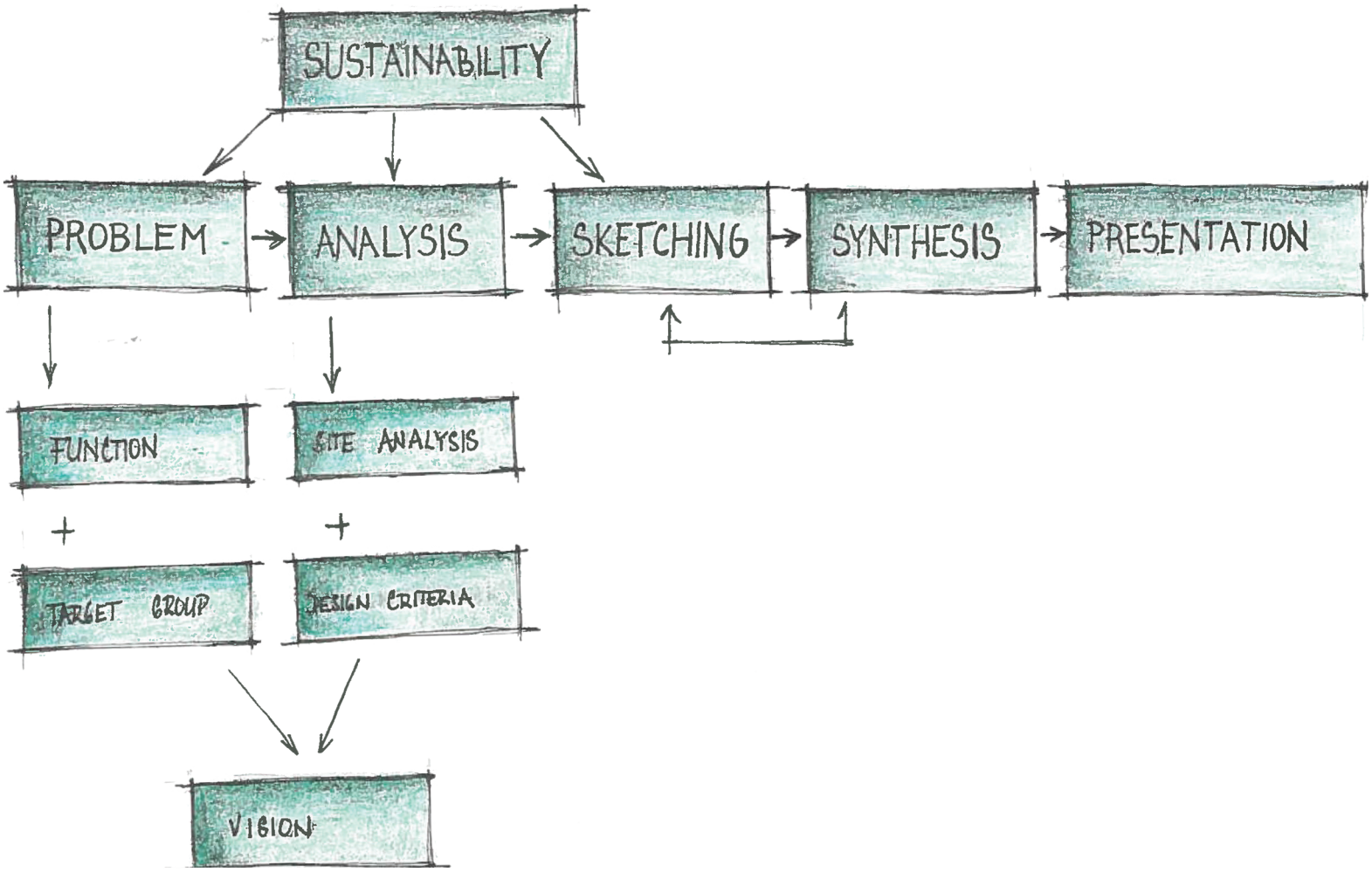
The main topic of this master thesis is sustainability. Sustainability is important part of building industry, and influences a lot all parts of design process, from the initial stages. Sustainability will be investigated at the beginning, where the problem will be presented and defined. Taking sustainability into consideration from the beginning, the integrated design process is used as a method.

While talking about integrated design process, we can define Integrated Building Concept as solution where all construction elements are integrated into one system, that reaches architectural quality together with environmental performance, such as energy efficiency, responsible using of materials, ecological loads and indoor climate. [Heselberg, 2007]

Integrated Building Concept used in this project places most importance on sustainability. As sustainability in this case we can understand energy performance, consideration for natural environment, and indoor climate. The second part of a concept is architecture, which includes the functionality, architectural connection with environment and appearance of a building. The last part is structure, which consists of tectonic honesty of a building, and technical systems. All these part of a project must be in harmony and work as one whole system. [Heselberg, 2007]

Most important part of this project is sustainability. Its definition will be specified at the beginning, together with function and motivating users. Later on during the process the site will be analysed, and design parameters will be defined. Designing cohousing residential complex, the emphasis will be put on the functionality of layouts. The emphasis will be placed on energy and water treatment, as well as indoor climate. The calculations of energy use and indoor conditions will be done during the process.




SUSTAINABILITY
PROBLEM
ANALYSIS
SKETCHING
SYNTHESIS
PRESENTATION
FUNCTION
SITE ANALYSIS
+
+
TARGET GROUP
DESIGN CRITERIA
VISION


COLLINGSWOOD
NEW JERSEY
COLLINGSWOOD
COLLINGSWOOD

PROGRAM

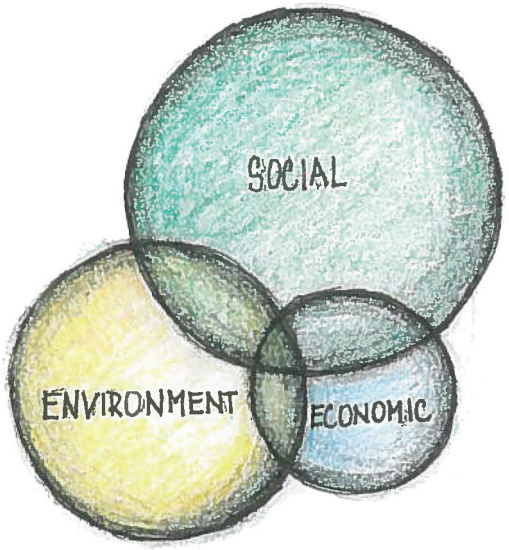
SUSTAINABILITY

Sustainable development is a noble and necessary aspiration. It is a visionary development paradigm; and over the past 20 years governments, businesses, and civil society have committed to sustainable development goals. Sustainable development is a fluid concept and various definitions have emerged over the past two decades. Despite an on-going debate on the actual meaning, a few common principles tend to be emphasized. [Drexhage & Murphy, 2010]

The term sustainability is starting to be broadly known and used, however the understanding of it differs. The most widespread definition of sustainability is based on Brundtland report from 1987, where it is, in other words, defined as ability to meet the needs of present generation without compromising the needs of future generations. [Drexhage & Murphy, 2010]

In other words, it can be understood that sustainability means to consume only that much as produce. Taking non-renewable resources into account, it is not possible to achieve pure sustainability. But by sensitive usage of those resources, minimizing the environmental impact and being responsible towards to world around us, the mankind can come very close to sustainability.

In the Brundtland report, the sustainability is further divided into three branches: social, environment, and economic. We cannot look at those aspects like as at three separate issues, but more as at one issue approaching from three different angles, while each one supports the other. All three aspects must be covered in sustainable design, in this project, the emphasis is put on social sustainability.



SOCIAL SUSTAINABILITY

Despite the variable importance conceded to each of the dimensions conforming sustainability, the social one has evidenced to be the more problematic in terms of definition and measurement, given the broad and diverse range of issues covered by its definition and the blurred separation between theoretical approaches and normative considerations. [Pareja-Eastaway, 2012]

In general it can be understood that the social sustainability refers to individuals to achieve a balanced quality of life, with social equity and justice, and to community engagement, which includes aspects of social cohesion and inclusion. [Pareja-Eastaway, 2012]

How to define social sustainability in architecture? Architecture is made by people for people, it maximally depend on people around and especially users. Especially while designing residential building and building with mixed use, the users are the most essential part of design process. Without understanding and prioritizing social sustainability, buildings, no matter how environmentally sustainable, are not truly sustainable. [Bollo, 2012]

In my understanding, achieving social sustainable architecture is by balancing user's needs, providing him connection with surrounding and other occupants and giving him feeling of well-being and belonging.

To provide the occupant the feeling of belonging, we consider the balance between privacy and connection with community. Having private dwellings together with shared community space seems like the right way to go. This concept is not new and was established in Denmark and adopted the name cohousing.

COHOUSING

Housing, private and public, across the developed and developing world is everywhere pretty much the same, and pretty terrible. It seems set up to crowd together unrelated and hermeneutic nuclear families whose only link with each other is that they have been brought together by some mindless central casting to play bit parts in an incomprehensible urban drama. As much attention is devoted to ensuring privacy as money will allow, with no attention to providing for community, ever. [Subdivision for People and the Environment, 2001]

The cohousing idea has arisen from communities with vision of home as a part of community. Today's trend in residential-building sector is to provide as much privacy as possible, but humans are social creatures and living in communities give them just benefits, so many initiatives form against today's form of housing.

The intention of cohousing is to endorse an attitude of meaningful community awareness. This is achieved through the mindful design of the neighbourhood with the purpose of promoting physical, social, and emotional well--being. [Lyon, 2012] It reacts on the anonymity in today's residential houses. The term cohousing describes housing arrangement that is developed and managed by residents themselves, it combines the autonomy of private individual dwellings with the advantages of community living, such as community buildings and land, with cars left on the edge of the area to create pedestrian-friendly area. [Subdivision for People and the Environment, 2001] Users living in this type of housing usually share goals and values, that might be concern for safety, or promoting sustainability. Thanks to the common spaces, the area of dwellings can be smaller, and the community can support each other in recycling and energy and water saving. Ride sharing and promoting other ways of transport help decrease the individual's carbon footprint. Common garden provides enough food for all occupants. When having community area within the building complex, people travel less for the entertainment. Many communities are founded on the principles of sustainable living in which sustainability is a lifestyle. [Lyon, 2012]

COHOUSING CASE STUDIES

Baugruppe is a building initiation established by tenants, who are seeking for alternative way of living in the cities. Most of the projects are being built in Berlin, Germany. The common character of Baugruppe projects is involvement of clients from the initiate stages of design, common spaces for tenants and sustainable principles. The idea behind Baugruppe comes from cohousing principles. [Chan, 2010]

In the district of Berlin with many Baugruppe projects, there is a striking dominance of young families. This is attributable in part to a wish for shorter routes to shopping facilities and ones place to work, but also to a growing awareness of environmental factors and rising energy prices.

R50

The residential house from Ifau und Jesko Fezer architects is situated in Berlin. This project is a part of a BauGruppe initiation. The building was nominated on Mies van der Rohe Award 2015. It has six floors and 19 apartments. [archdaily]

It is situated between various residential buildings in dense area of Berlin. The other residential buildings are mostly detached, and some of them create blocks and yards in the middle. All buildings are surrounded by greenery and places for free time.

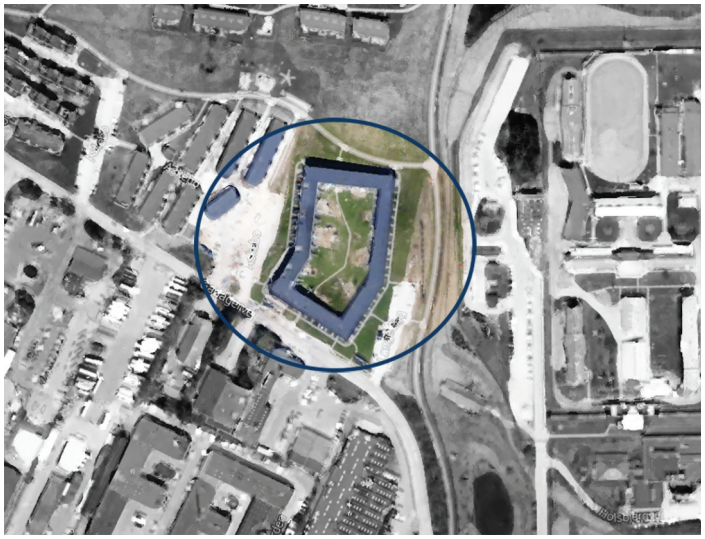
The buildings layout is influenced by tenant's wishes, each apartment is specific, however on the same layout, and therefore flexibility of living is

achieved on simple rectangular layout. On each floor are three apartments. Each apartment differs in room organisation, and even the area. Apartments are distributed around the core, which is the stairs with elevator. The toilets and bathroom are inside the layout, since they do not require daylight. The position of kitchen and bathrooms are on each floor changing just a bit, so the building services and fittings can run through the whole building.

The structure is made from concrete skeleton, with modular independent timber façade that is both fixed and flexible. The structure is compact and therefore efficient.

The spaces for community include the common space with kitchen and terrace at the top floor, and the common balconies all around the layout. Under the ground there is a common space that connects the building with the public street. [Archdaily]

The common balconies provide connection with other tenants, but also decrease the connection of the apartment with street and surrounding. Because of that and because of the simple layout the house seems to be enclosed from the surrounding, but open to itself.



Lange Eng

Residential house located at suburb of Copenhagen, has 54 dwellings and common house with kitchen, movie theatre, café room and recreational rooms.

The shape of the complex traces the shape of the site, it is enclosed from the surrounding and create its own space in the middle. Common spaces are oriented in the corners of the layout, which makes them quite far from some dwellings that are at the opposite site. The main common space, which consists of kitchen and dining room, is next to the one of the entrances to the inside yard.

Dwellings are oriented to the garden in the middle. The garden is enclosed from all four sides, which creates safe place for children to play and also private feeling, as well as quiet space without noises from the street. All apartments are double floor, and almost all have the same layout and same area. They have simple rectangular layout, which enables some flexibility inside the dwelling.

These two cohousing projects are opening for interaction between tenants, but are closed in relation to their surrounding. The aim of my project is a bit different, because being first cohousing project in Czech republic, it should open for public and not create a boundary between the complex and the environment.

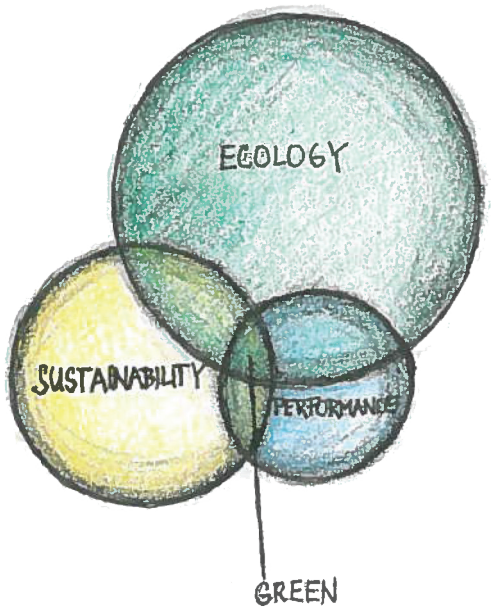
ENVIRONMENT

The environment has now become a major constraint on human progress. Fundamentally important through social sustainability is, environmental sustainability or maintenance of life-support systems. Environmental sustainability seeks to sustain global life-support systems indefinitely. [Goodland, 2002]
The quest for environmental value in architecture, for a harmonious balance between man and his surrounding, is not new. For centuries, particularly in domestic and vernacular architecture, people adopted this approach out of necessity. [Gauzin-Müller, 2002]

From the environmental viewpoint, buildings account for nearly half of all energy consumption and raw material use around the globe. By thoughtful design, using advanced technologies and promoting high-performance buildings it is possible to achieve environmental sustainability. When talking about environment, it must be also mentioned the term ecology. Ecology studies interactions between organisms and environment- ecosystem. As ecological architecture can be defined architecture, that preserves those interactions and the ecosystem on the site, preserves and enhances biodiversity on the site and minimises pollution during construction and operation of a building. So now there is not possible to talk just about sustainable building, but we have to find broader definition, that connects sustainability, ecology and effectiveness of applied solutions in building design. Inclusion of these three terms can be called the green architecture. [Attmann, 2010]

To achieve environmental sustainability, the project will deal through integrated design process with five main environmental issues relevant to the urban scale and architecture. Those sections are:

- Landscaping
- Passive and active solar systems
- Systems generating electricity
- Rain water collection, grey water reuse
- Sustainable materials



LANDSCAPE

Healthy landscapes provide a wide diversity of ecosystem. A sustainable landscape helps to regulate climate and energy use by mitigating the effects of sun and wind, reducing pollutants, and taking up carbon dioxide, they reduce storm water and flooding through plant water uptake and water infiltration, recharge, and evaporation in soils. Landscapes are important for human health and well-being. (Bassuk & Trowbridge, 2010)

Sustainable landscapes are responsive to the environment, re-generative, and can actively contribute to the development of healthy communities. Sustainable landscapes sequester carbon, clean the air and water, increase energy efficiency, restore habitats, and create value through significant economic, social and, environmental benefits. [Designing our Future]

Natural features of a site can suggest the most appropriate location for boundaries, services or roads. So it is beneficial to place the building according to natural landscape patterns of the area. Design decisions based on analysis of natural processes can solve more than one design issue. Successful neighbourhood has open and green spaces that respect natural features and are accessible. Making efficient use of the land by productive landscaping with orchard and vegetable garden can be visually and aesthetically pleasing. Shelter trees and small plantings near a building can reduce or divert wind, it can reduce heat loss from the building and shelter entrances. Trees can be planted for shade.

Diverse neighbourhood will more encourage interaction and be sought as an attractive and interesting place to live. The consideration of future development is often appropriate, and also water or parkland. The neighbourhood area should include space for leisure time, meeting outdoor facilities and agricultural production.

PERMACULTURE

Permaculture is a design process based on ethics and design principles, that guides us to mimic the patterns and relationships we can find in nature and can be applied to all aspects of human habitation, especially agriculture. [What is permaculture]

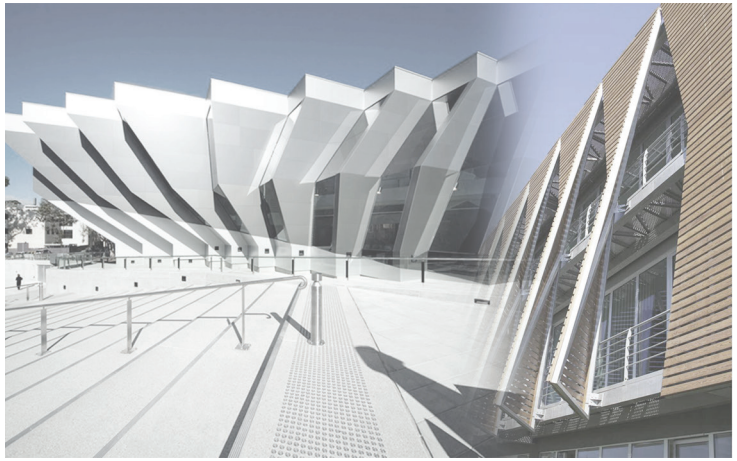
Permaculture is the philosophy of making the landscape and design in sustainable and ecological way. Permaculture is also lifestyle. It creates landscapes using natural principles. Planting local plants according to their needs, creating diverse environment and incorporating plants that produce food are just some principles of permaculture. [Harland]

One of the main principles of permaculture is to create food self-reliance. Community can grow its own food and vegetable in sustainable way, which can totally cover their needs, or they can even trade it on local market. To provide diverse environment, the food garden do not have to be separated from flower garden. It is desirable to mix it. The food garden do not need straight edges and have special place, it can be around pathways, on green roofs, and all around the landscape. The diversity creates pleasant environment, and also creates healthy ecosystem and decreases the need of pesticides because different types of plants can support each other.

Other principle of permaculture is connected with sustainability and supports the idea of cohousing. Community that recycles the waste, grows their own food, trades their products rather than sells and takes care on their environment can create sustainable and healthy place to live.

PASSIVE AND ACTIVE SOLAR SYSTEMS

Most renewable energy comes either directly or indirectly from the sun. Sunlight, or solar energy, can be used directly for heating and lighting homes and other buildings, for generating electricity, and for hot water heating, solar cooling, and a variety of commercial and industrial uses. [Renewable Energy World]



Sun gains are renewable and sustainable resource of energy, and there are two possibilities for capturing it, through passive and active solar energy systems.

To create efficient building design with passive systems, we must understand the sun path. The sun path is much shorter and lower in winter than in summer, so at winter the east and west facades do not receive any significant amount of solar radiation. The appropriate strategy is therefore to face the wall and window area to the south, or slightly east or west. [Heiselberg, 2007]

Passive systems include thermal masses, which are walls or floors made from heavy material, and right orientation and dimensions of multiple-glazed windows. To trap the heat inside, it is important to have enough insulation on exterior walls. Design must be balanced in the way to maximally profit from heat gains but at the same time not overheat the space, which is achieved by thermal mass, which can behave also as natural cooler, shaders on windows or other protection in summer months.

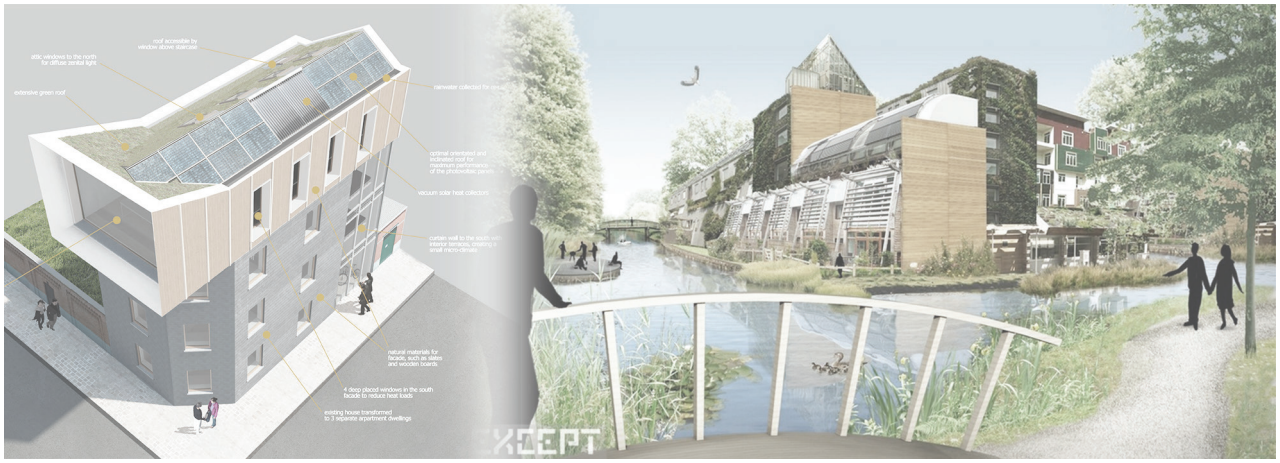
Active solar systems use the same principle as passive systems, but they use a fluid, such as water, to absorb the heat. These systems include solar collectors, heat pumps.

Photovoltaic cells convert sun gains to electricity by using thin sheets of silicon. By using appropriate amount of photovoltaic cells with right orientation, we can dramatically reduce the electricity consumption of a building, it can be even reduced to zero, making the building zero energy building.

Solar cells must be carefully integrated into the design, to be in harmony with architecture of the building, and will not disturb the appearance of building.

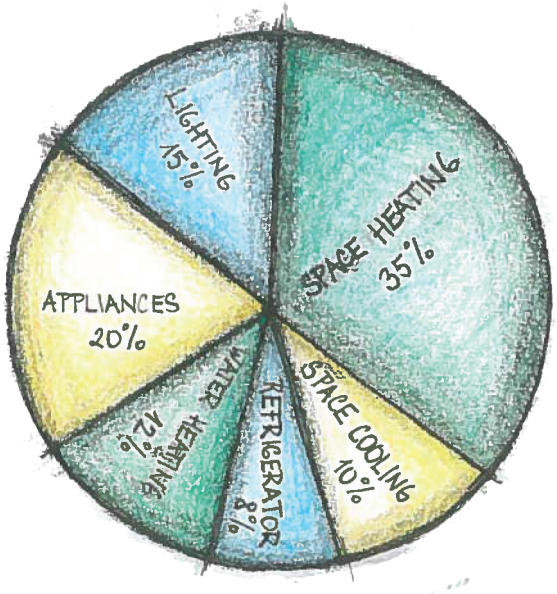
NET ZERO ENERGY BUILDING

Building industry accounts for approximately 40% of energy consumption and for the same percentage of emissions in Czech Republic. By designing sufficient buildings with their own energy production from renewable resources, is possible to rapidly decrease energy consumption in cities and therefore its pollution and emissions. [Sopoliga, 2012]



The complex will be generating its own energy from renewable resources. The great challenge of electrically self-sufficient buildings is not on site power generation, but long term storage of energy in relation to seasonal changes of energy availability. [Net Zero Energy Building] The storage devices are very big, complex and inefficient. Easiest way of energy supply is through grids that exclusively use renewable energy. [Net Zero Energy Building] The building will have greatly reduced energy demand by passive and active strategies that will be balanced by an equivalent energy generation from renewable sources. Energy consumption and production on annual basis will be analysed during the design process.

The diagram shows the usage of energy in building. While we cannot reduce energy usage of appliances and refrigerator, by thoughtful design we can rapidly reduce the energy usage for space heating, cooling, water heating and lighting.



RAIN WATER COLLECTION, GREY WATER REUSE

While the amount of freshwater on the planet has remained fairly constant over time—continually recycled through the atmosphere and back into our cups—the population has exploded. This means that every year competition for a clean, copious supply of water for drinking, cooking, bathing, and sustaining life intensifies. Freshwater makes up a very small fraction of all water on the planet. While nearly 70 percent of the world is covered by water, only 2.5 percent of it is fresh. [Freshwater Crisis]

Understanding of interrelationship of water is essential for planning for sustainable development of site. Water flows over the land in patterns. Topography, soils, and plant communities determine where water will pool, soak, spread or concentrate.

Fresh water is essential part of our lives. Decreasing fresh water consumption is possible by using fresh water only on activities, where fresh water is necessary, such as drinking and bathing. For other activities, where is possible to use non-drinkable water, is profitable to use rain water, or grey water. Rain water can be contaminated by bacteria and dust, so it is impossible to drink it, but it can be stored and used for splashing the toilet, washing machines, or garden irrigating. Using rain water collecting tanks is very profitable in terms of saving water. Tanks collect and store rain water usually from rooftops and natural rain water tanks, such as ponds, collect water from landscape.

Grey water is water from bathrooms and washing machines. It may contain traces of dirt, food, and some cleaning products. It contains also bacteria from households and human body, therefore cannot be stored, because bacteria can reproduce and be harmful to human health. In small amount, those bacteria can be valuable fertilizer to plants and there are many systems which transport grey water directly to garden. [About greywater reuse]

The diagram shows the usage of water in typical household. Green colour corresponds to water that must be drinkable, while yellow could be replaced by rain water, and green by grey water. That means that just 50% of consumed water must be fresh, so we can save up to 50% of water.

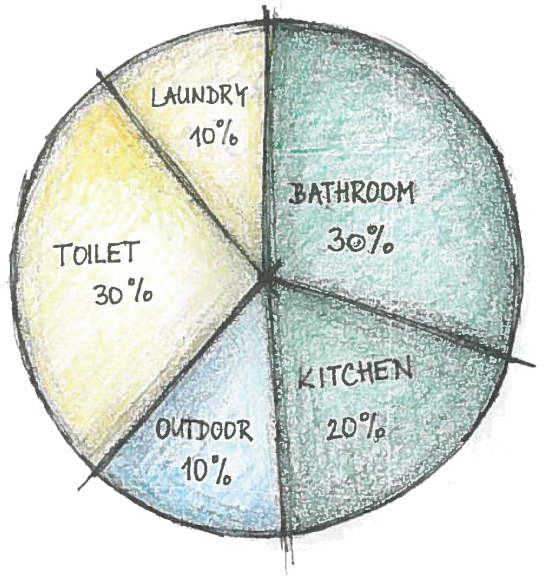


Figure x- Water use in typical household

SUSTAINABLE MATERIALS

We live in a material world. How our society uses materials is fundamental to many aspects of our economic and environmental future. In our current global setting, building construction results in 50% of all CO2 emissions worldwide. Five to ten tons of cement is used to build the average middle class house, and for every ton of cement manufactured, a ton of CO2 is released. Thermally efficient, low CO2 emission, structurally sound and inexpensive materials and technologies exist, some of which have been used for centuries. [Workgroup, 2009], [Roux & Alexander]

Sustainable building materials are materials with low embodied energy. This is the energy consumed by mining, manufacturing and transporting a particular product. [Roux & Alexander]

Materials sustainability is measured by its durability, maintenance level and recyclability. [Attmann, 2010] In this sense, the most sustainable materials are those that are recycled. Recycling is essential ingredient of green building that reduces non-renewable input. Especially important is to reuse environmentally unfriendly materials that can leach toxic into soil or ground water, as well as un-renewable heavy metals or chemicals.

As sustainable materials we also understand renewable materials, such as wood or earth, and local and unprocessed building materials that minimize transport and manufacturing energy, and therefore air pollution. Local manufacturing also creates local employment, so the money stays within the community.

The reduction of the natural resource consumption should be targeted right from the start, at the design stage. The calculation and control activities should focus on the building´s natural resource use, such as water, energy, landscape, and waste management. [Attmann, 2010]

RECYCLING

Every year, millions of tons of construction and demolition materials are produced. The material that is not used during construction, or is produced during demolition or renovation activities, is sent to landfill, and only around 40% is reused, recycled or sent to waste-to-energy facilities. [Waste, 2010] *But reuse of recycled materials is beginning to stand out as an innovative, highly effective and artistic expression of sustainable design.* [Metcalf, 2011]

Many common building materials have today its recyclable alternatives. Producing composites with some form of the previously used material can lower the energy requirement and emissions up to ninety percent.

As an examples of these materials can be concrete with recycled aggregates. The aggregate can be crushed coarse concrete from previous construction, coal, fiberglass or glass. Some of the recycled aggregates can even improve the concrete properties, such as insulating properties, such as Misapor, or appearance, such as brick or metal aggregates.

Reclaimed wood can be used also as a building material, or into interior. It creates interesting architectural element, especially while mixing different types of wood with different colours.

Recycled can be also steel, corten steel is used facades, as well as plastic.

When talking about sustainable and renewable materials, it must be mentioned that vegetation can also work as a material. The greenery on surfaces has a cooling effect on summer, due to evaporation. It decreases the pollution levels in the air by photosynthesis, filtrate the rain water through the soil and provides thermal insulation for surfaces.

The disadvantage of green roofs and walls is that the maintenance can be required. By planting local and low-maintenance plants this can be reduced and the irrigation system using grey water can be used for watering the plants.

INDOOR CLIMATE

As concerns grow regarding energy costs in the management of healthful and comfortable environments in buildings, there has been increasing concern about the quality of the indoor environment on two fronts. On one hand, leakages through bad windows and bad insulation can lead to high changes in temperature indoors and increase of energy consumption. On the other hand, buildings can be built too tightly, reducing the flow of fresh air and allowing pollutants to concentrate; moreover, the ever-increasing use of synthetics and new materials within buildings can pose new risks to health.

Ultimately, we spend about 90% of our time in indoor environments, between home and school or the workplace. [Indoor air quality]

Indoor climate is important for our well-being and health. Good indoor climate can save energy and is pleasant for occupants. It is important to adjust the building to the climate and to ensure having good microclimate inside the building. [Heiselberg, 2007] The pleasant indoor climate will be achieved with sustainable principles, without using many energy demanding systems. The indoor climate will be analysed during the design process in the BSim program.

Lightning

Natural light is important for health and well-being. It is also influence the appearance of internal spaces. The general rule is to maximise daylight without direct glare, and to provide light deeper in the room. The daylight must be considered at the earliest moment of the sketching phase.

In order to decrease energy consumption for lightning, every room, including bathrooms and toilets should have access to daylight. Size and position of windows must be considered, according to sizes, especially depths of rooms.
Windows that admit daylight in buildings are important for the view and connection they provide with the outdoors. The view of dwellings must be considered, because the view completes the dwelling design and the light creates completes the architecture.

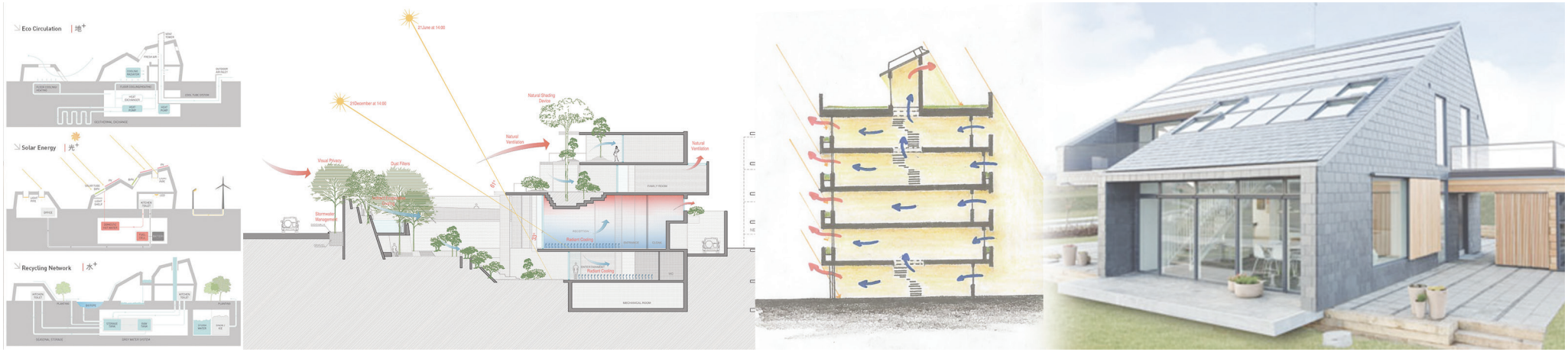
Temperature- Heating, Cooling

According to Czech regulation the indoor air temperature in residential buildings should be 20C. The temperature in summer should not exceed 26C for more than 100 hours annual and 27C for 25 hours.

To provide good indoor air temperature, it is desired to maximise heat gains in winter and minimise during summer, while getting enough daylight whole year. The right temperature will be achieved by passive solar strategies, good ventilation and natural cooling.

Ventilation

To be able to easily control the natural ventilation



the wind speed should be reduced, especially from north and east, from where the wind is usually colder. Also, by reducing the wind speed around the building the heat losses are lowered. Windscreens can deflect air to higher levels, create turbulence or absorb wind energy. [Heselberg, 2007] The landscape and vegetation can help to create good ventilation conditions.

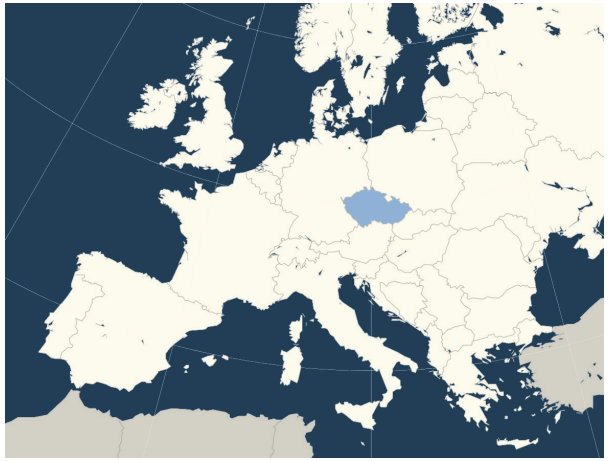
It must be ensured, that each room has enough fresh air. Good ventilation conditions provide windows that are oriented on both sides of the room. That is not sometimes possible, so then one-sided ventilation must be provided. It is also beneficial to design stack ventilation for exhaust air. This design must be considered early during the design phase.

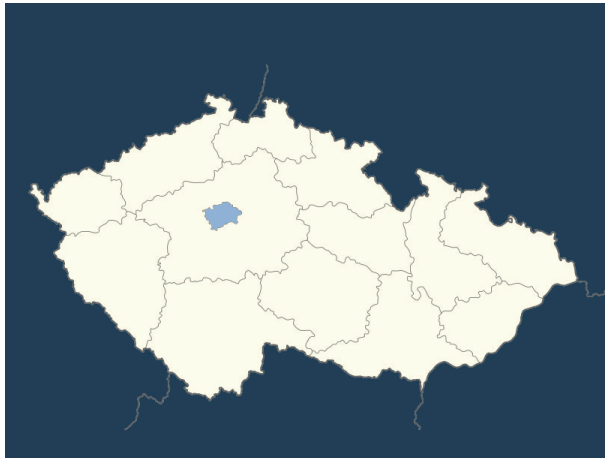
For the design of natural ventilation is important relation between the temperature and wind speed to estimate the ventilation capacity. [Heselberg, 2007]

SITE ANALYSIS

PRAGUE, CZECH REPUBLIC

Czech Republic is situated in the centre of Europe. It is small country with approximately 10 million inhabitants. Czech Republic exists 22 years, before that was part of Czechoslovakia. It is a democratic state since 1989 and it is part of European Union. It is in mild continental climate zone, with cold winters and hot summers. It has many mountains, lakes and beautiful nature.



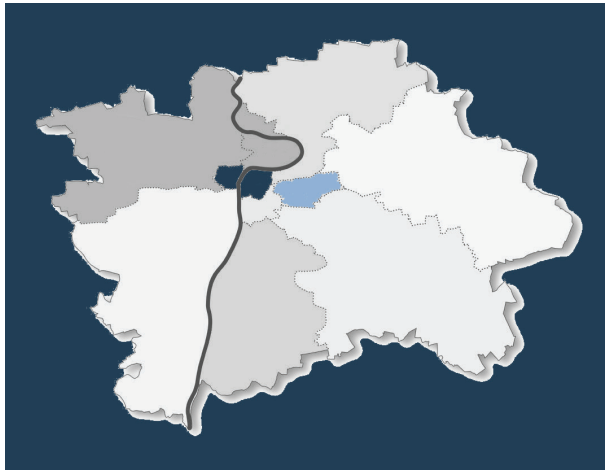


Prague
Prague is the capital city of Czech Republic, its agglomeration began from 8th century and has nearly 1,3 million inhabitants. The city centre is situated around the river Vltava. It is situated in the middle of region Bohemia, the biggest region of Czech Republic. It is approximately 250 meters above sea level.

Žižkov
The site is situated in the city district called Žižkov, near the city centre of Prague, nevertheless, it is in quite neighbourhood. Žižkov does not have good name as a Prague district, it has a reputation as a run-down neighbourhood, where are cheap pubs and dangerous streets after midnight. This is not true and it comes from the history, when the district was home for many workers.

Most of the city buildings in Žižkov is from the end of 19th and the beginning of 20th century, most of them is well maintained and reconstructed. Most of the buildings in the centre of the district were built before 1920 and were supposed to be torn down and replaced with prefabricated blocks of flats in late 70s. Fortunately this plan was realised just from small part because meanwhile revolution started and politics did not influence the architecture anymore.

Now it is a beautiful neighbourhood with biggest cemetery in Czech Republic, parks, shops and shopping malls, and also University of Economy. [Trojan] Most of the neighbourhoods are detached or attached family houses, as well as typical city blocks and prefabricated blocks of flats.



SURROUNDING EXPLORATION

Žižkov is diverse district, with family houses as well as new multi-storey buildings, the pictures on the top are taken on the way to the building site from the metro station, which is in 15-minute walking distance. The near district centre has wide streets and higher city blocks. While walking towards the site, the surrounding changes significantly. Main street toward the site goes around the old cargo station, which is now unused, and on the site are old shipping containers and construction material and rubbish. The greenery around is full of waste and is everything but pleasant. But then the visitor approaches the park, which is well maintained and full of walking people and blossoming trees. While walking towards the site from south, there is industrial area so it has again different atmosphere.

Fig. 1q- City centre, Žižkov tower at the back

Fig. 2q- City centre Žižkov

Fig. 3q- Old cargo train station

Fig. 4q- The park

Fig. 5q- Industrial area

SITE EXPLORATION

This map was made on the site and shows the most important features on the site, together with closest surrounding, that influence the site. From each side of the site the surrounding is unique and different, and will be discussed during the analysis.

FAMILY HOUSES

PARK

NEW RESIDENTIAL BUILDINGS

PART OF OLD CARGO STATION, STORAGE, GARAGES

INDUSTRIAL BUILDINGS

The site itself has calm and quiet atmosphere and is used as an extension of the park for people with dogs, as well as connection of south and north of the district for walking public.

On the site is no greenery except grass and couple of trees on the east and on the slope. Because of the lack of other plants and solid type of soil, the rain water does not soak and stays on the surface for long time.(Figue 3A) Pictures shown on the next side were taken many days after the last rain, and the water was still present on the site, so the water plan must be considered and the site must be sloped toward the place with pond or toward empty green area, where the water will have time to soak.

Through the site goes gravel path from the park towards the residential buildings, along those paths are benches, which do not make real sense, because there is no nice view towards any direction, and I have not seen anybody used them. (Figure 8A)

Between the park and site is physical and psychical barrier in form of concrete wall, which was most possibly created to avoid landslides of the ground from the park, but since the slope between the park and site is fully planted by young trees, it is now irrelevant. (Figure 4A)On the edge between the site and park are dense and wildly grown young trees, without any maintaining and the place is full of waste and rubbish. (Figure 5A)

Through the site goes broad and new asphalt road, that was built together with new residential buildings situated on the west of the site. (Figure 2A)This small neighbourhood consists of eleven four-storeys buildings, and is very nice, but also quite dense and while stepping in the middle of the blocks, it is also quite dark.

Right now the construction process is in progress on the southern part of the site, where new residential buildings are being built. (Figure 9A)The whole area will have underground garages, so right now huge earth works have been made and lot of soil was lifted and has no future purpose on the site so is transported somewhere else. This earthwork is a huge interference into landscape, since it influence also underground water and environment.

Fig. 1A- Slope on the north of the building site

Fig. 2A- Slope and road in the middle of the site

Fig. 3A- Water soaking in the middle of the site

Fig. 4A- Wall under the slope of the site

Fig. 5A- Trees on the north of the site

Fig. 6A- Pathways through the site

Fig. 7A- Eastern part of the site

Fig. 8A- Benches around the path going through

Fig. 9A- Road and building construction

SPACE IDENTITY

This map has been made to have general understanding of the site in bigger context. Having orange spaces meant for living, and red spaces for other activities, such as work or leisure time, it is possible to understand the sense of the neighbourhood.

The site is now unused area. While the north part of the site is connected with the park on the north, it has grass surface and therefore can be used for sport activities, the southern part of the site is devastated, since it was used as material storage during the construction of the new neighbourhood that is situated on the east of the site. On the south-west, there is an old cargo station, which does not have any purpose recently and the place suffers by that. Around the cargo station is industrial area. The main road with trams goes from the south-west and gets to the north where it turns to the east. On the west and further north from the site the space is almost purely residential, with many family and multi-storey houses.

Looking at the colours next to the site, the site has much to offer. The project will be mostly residential, therefore the connection between the adjoining neighbourhood is desired, as well as the connection with the park. On the other side, the connection with the non-residential area is not desired and visual barrier should be designed.

RELATIONSHIP OF SITE

Knowing the typology of spaces around the site is important, so we know what types of functions are around the site and what functions should be designed on the site. The community must have the in walkable distance all functions necessary to their daily life, such as shops, schools, facilities for free time and places for work.

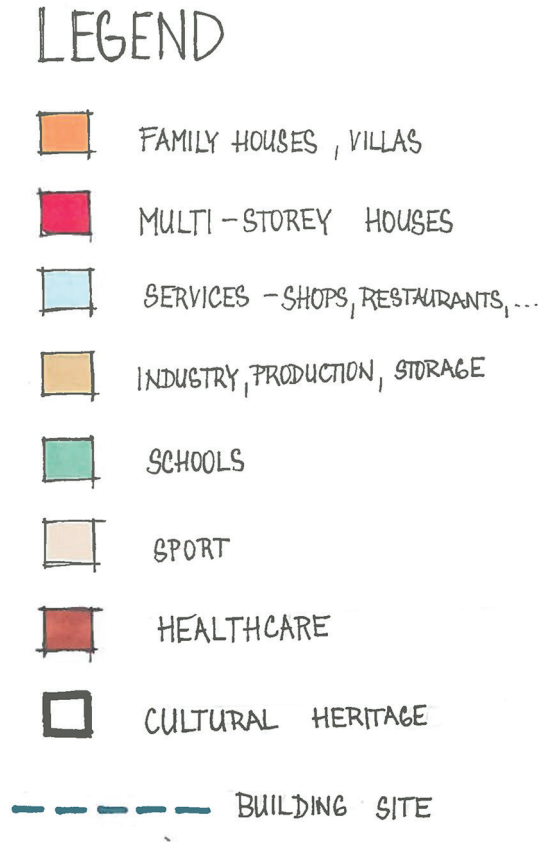
On the north side of the site, coloured with red colour are multi storey residential blocks, from which some have shops at the ground floor. Those blocks were mainly built during the same time period, and most of them are renovated. The shops are smaller with groceries, cosmetics, and also more specialised shops, restaurants and bars, so there is no need to add more shops on the building site.

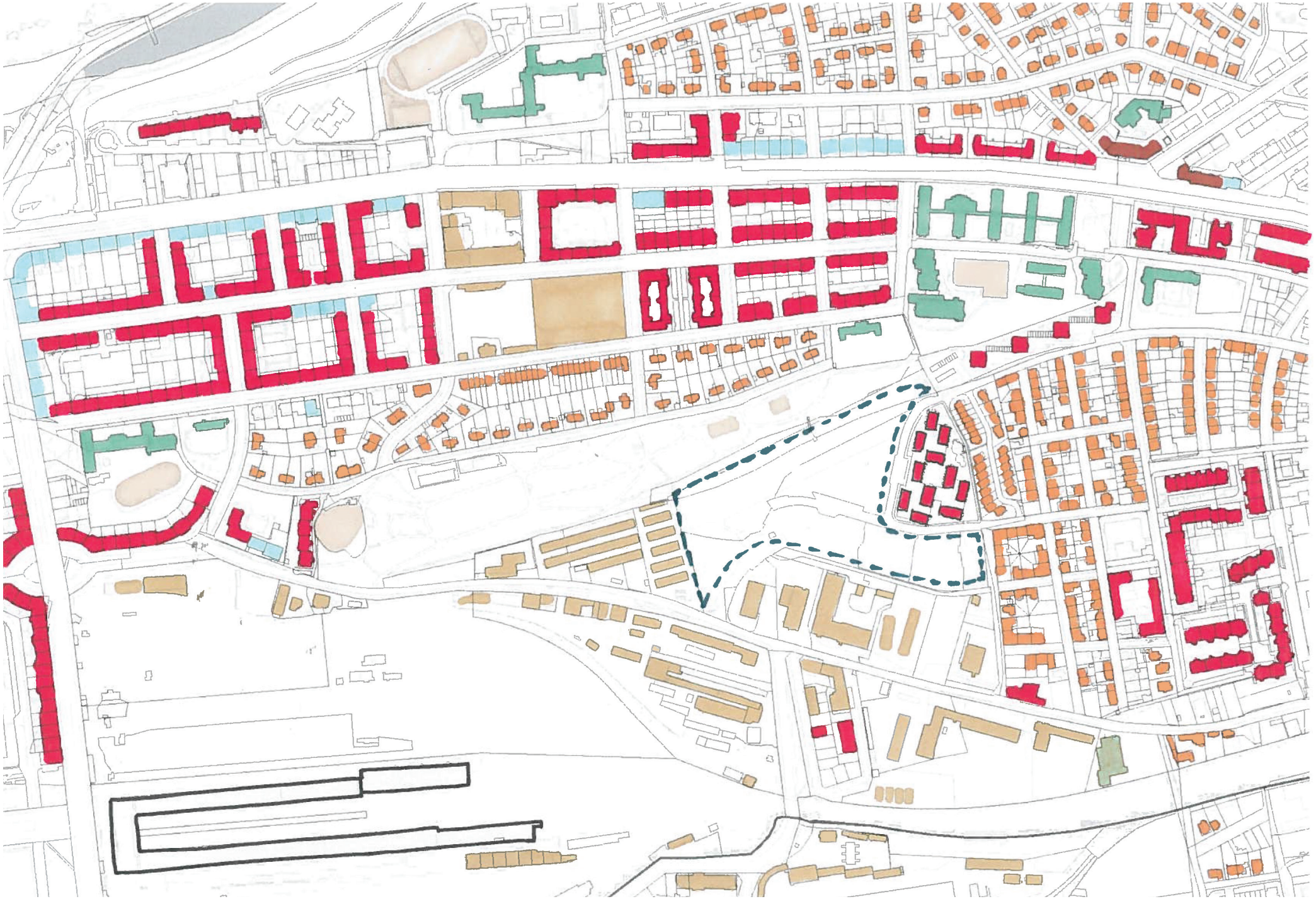
Orange colour represents family houses, most of the houses are semi-detached 2 or 3 floors high, with private gardens. Those houses represent the majority of a surrounding of the site, so the space have atmosphere of a suburban space, but with small distance to the city centre and to the public places.

There are couple of schools around, for children of all ages, from primary school to university, which means great place for families. Building on the north-east from the site is the kindergarten, which has the direct access to the park, so could have also access to the orchard that is planned on the site, therefore could be supplied from orchard by local food and could use the gardens as a place for activities and learning. Next to kindergarten is the University of Economy with dormitory and sport field. On the further north from the site is with green colour high school with sport field, and on the east is primary school with kindergarten.

On the south of site are mostly industrial buildings, small companies and storages, and on the place of old cargo station is the station building which became cultural heritage.

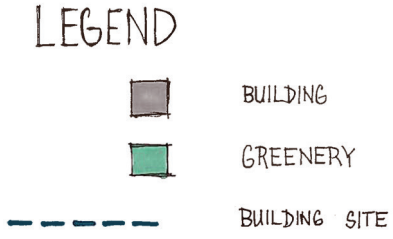
From this map is visible that the environment provides interesting and diverse neighbourhood that suits to the design of cohousing residential buildings.





VEGETATION

Vegetation must be analysed, open green spaces and potential green corridors must be found and preserved. The types of vegetation should be analysed, so the new landscape consists of the same local plants and trees.



On the map are with green colour illustrated green spaces with high trees, the private gardens that are also full of greenery are not illustrated. However, the neighbourhood is very green, with park next to the site, that is possible to connect with orchard and greenery on the site, and also big green cemetery on the south, and other park in the west.

The green striped area shows the possible green corridor that could be designed on the place of new development. The two parks do not have any ecological significance, because they are too small, but if they would connect in green corridor, the biodiversity will increase and therefore it could benefit the environment.

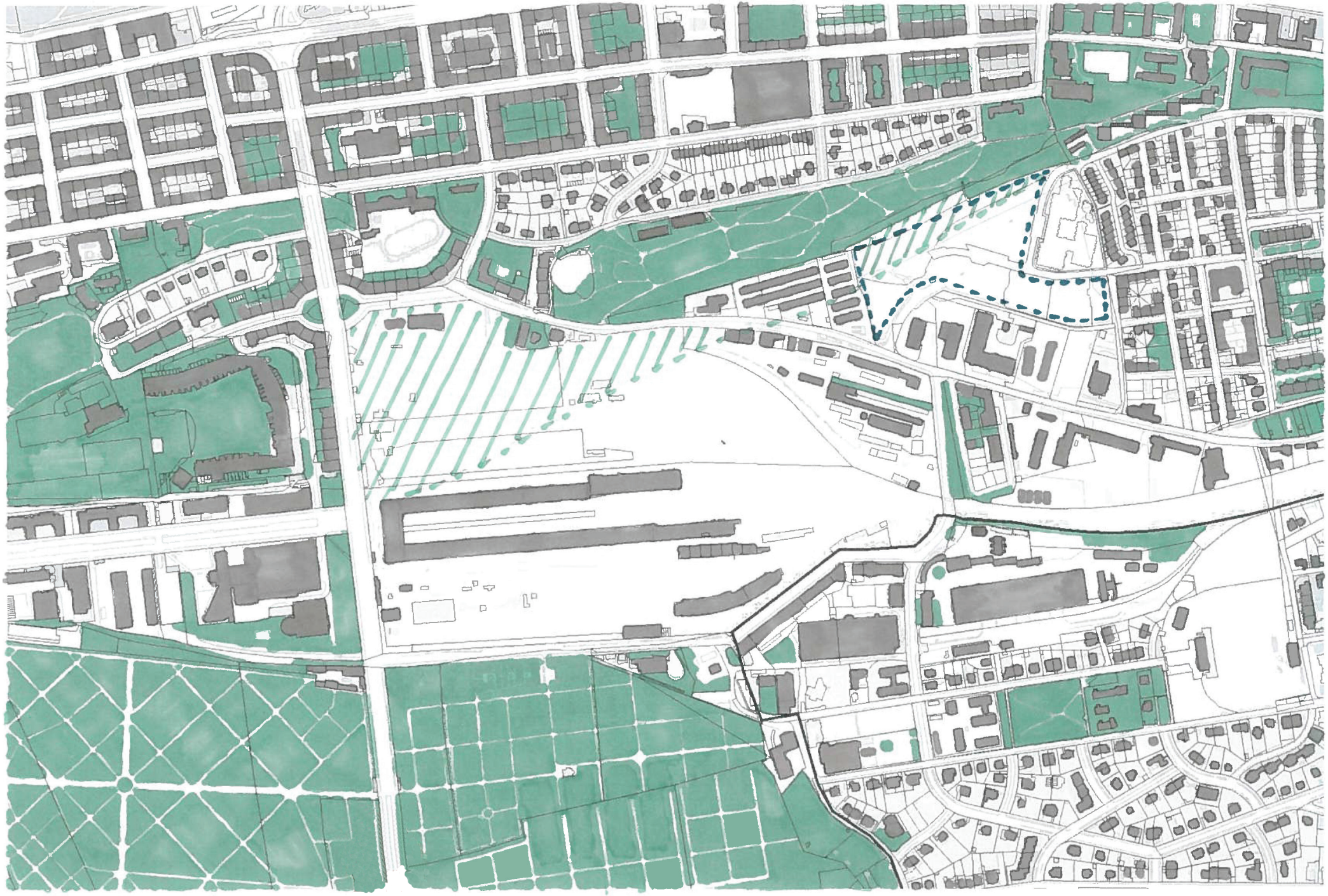


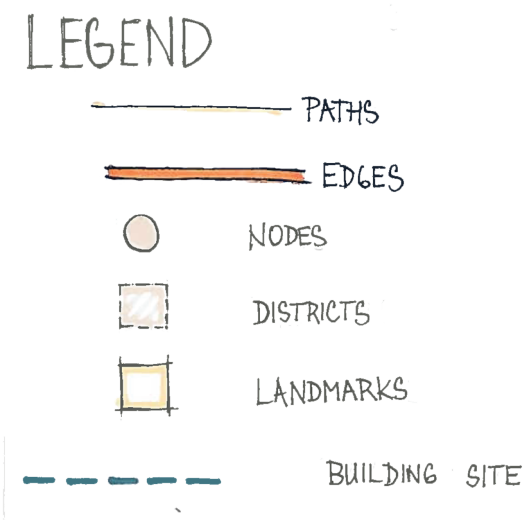
IMAGE OF THE SITE

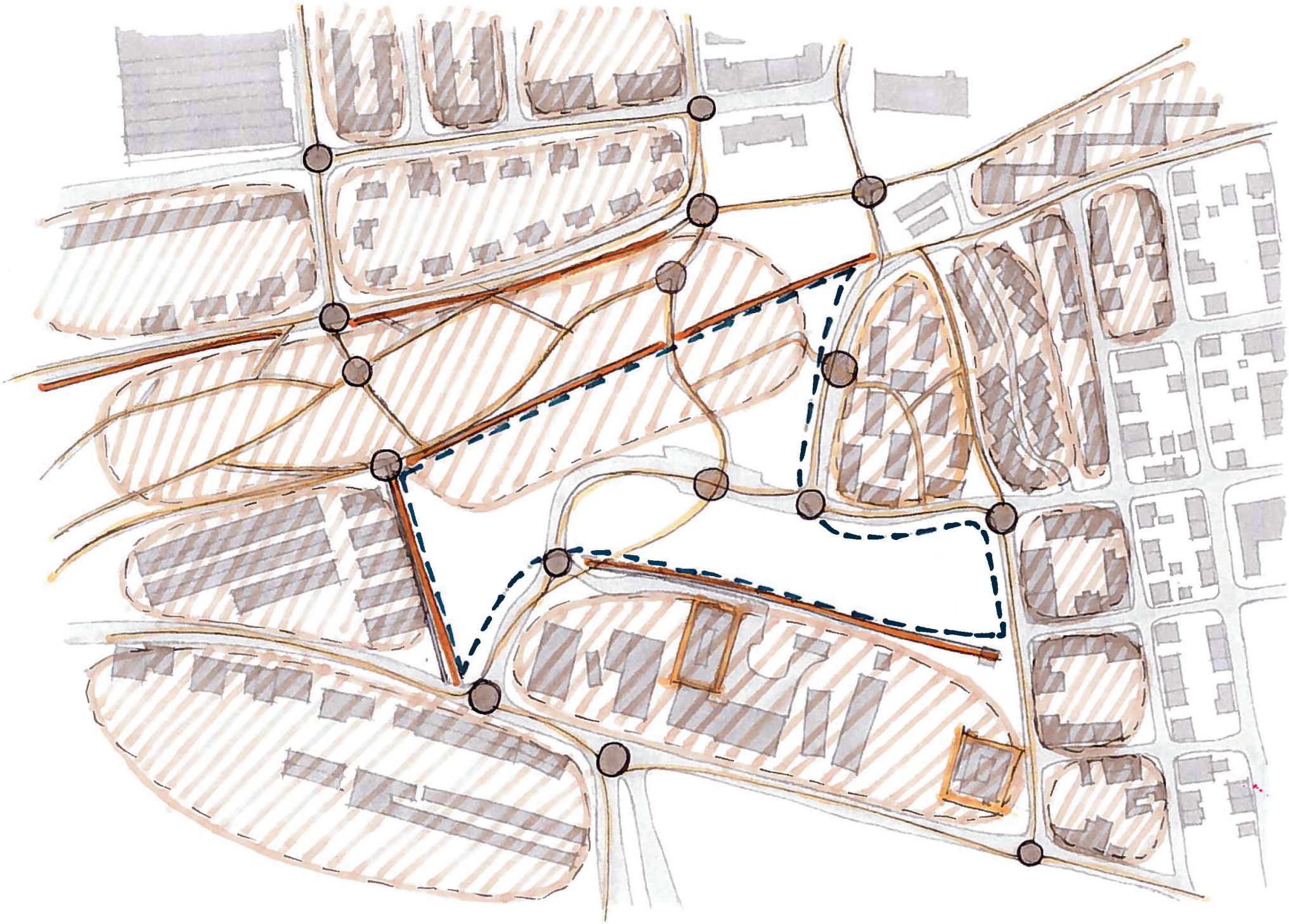
Theory of Kevin Lynch described in book Image of the City consists of five main elements, paths, edges, districts, nodes and landmarks. Paths are channels of movement in the city. They can be roads, streets, or alleys. Edges are linear elements not used as paths. They are boundaries, linear breaks in continuity. As edges we can understand walls, river banks. Districts are areas with common characteristics. Nodes are places where some feature concentrates or where the paths cross. And landmarks, which cannot be entered, but works as reference point. [Lynch, 1960]

The surrounding is full of paths, some of them are roads, some of them just pavements or just walkways. All of those walkways should be preserved, so the connection between neighbourhoods is not disturbed. On the intersections of paths are nodes, just the most important ones are illustrated. Some of them are very close to the site. When designing public space, it is beneficial to consider spaces near those intersections.

The neighbourhood does not have many landmarks, only two landmarks we can talk about are high industrial buildings on the north from the site, they are considered as landmarks because they differ from the surrounding development, they are higher and with colourful façades.

Around the site is possible to find some visual edges. The most visible ones are between the industrial zone and the site, and also the site and the park. This edge creates discontinuity between the park and the site and in the design this two areas will be merged and connected into one district without the edge.





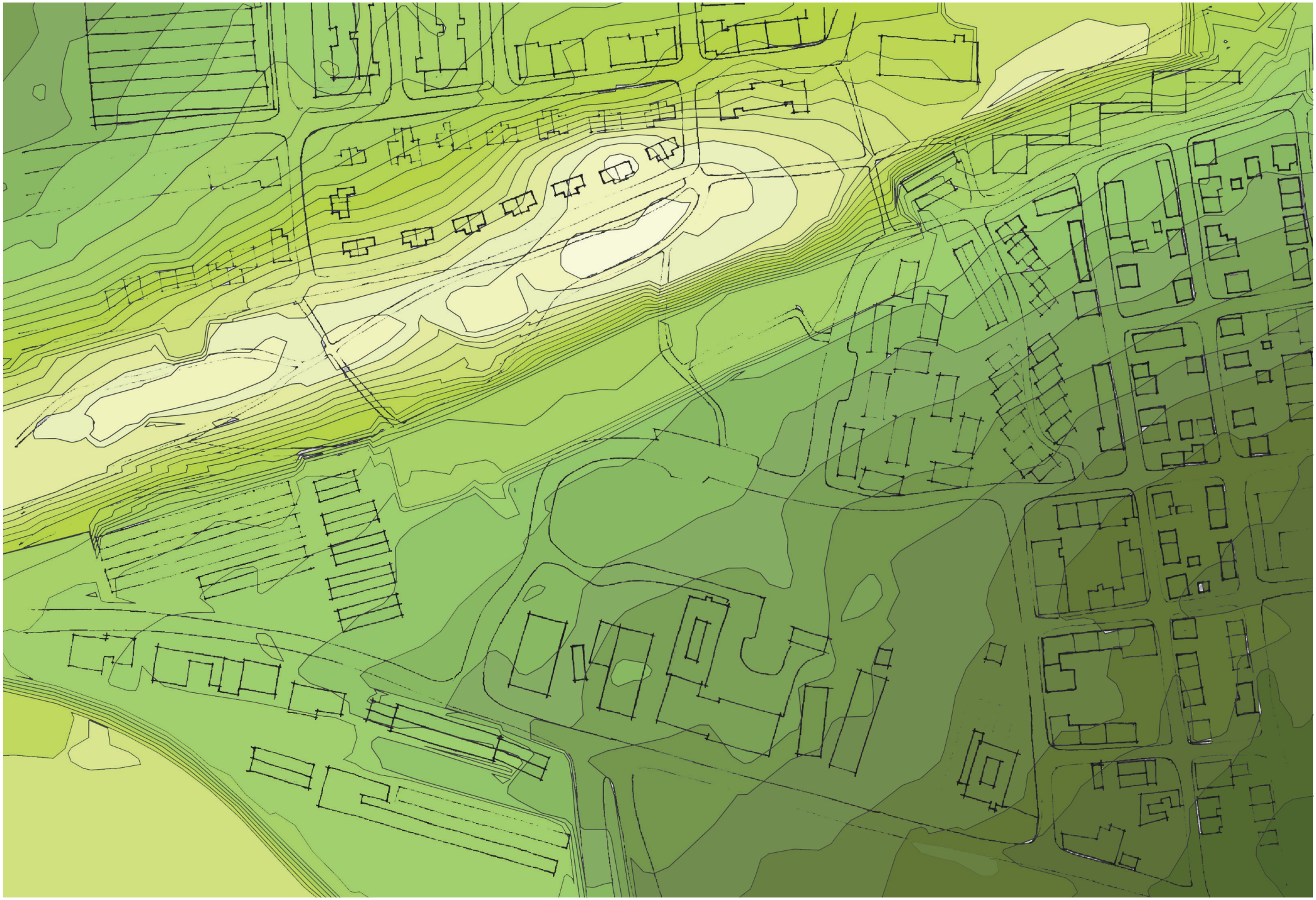
GEOLOGY, WATER

Geology is important for creating landscape. Looking at the contours of the site can tell a lot of where the future building should be, where are possible views and where is possible to create landscape features, such as ponds or parking spaces.

The site is on hilly landscape, the high difference between the highest and lowest point on the site is 10 metres. This must be taken into consideration, and the landscape must be considered.

The park that is on the north side of the site slopes sharply down towards the site. On the site itself is the slope still going slowly down towards the south-east. Because of the slope and the park houses on the north do not have any view on the site, nevertheless the height of buildings must be considered in relation to those houses and the sun.

Because of the hilly landscape, the site can suffer from water streams at stormy weather. That will be eliminated by creating a watercourse for storm water and creating a soaking space at the low point.



COMMUNITY IDENTITY

Look little bit closer and see more the relationship of site and other buildings around can make the design more specific and show what different connections can be done and which parts of site relate to different surrounding and therefore can have different atmosphere and therefore different approach.

Around the building site are mostly family houses, attached or single, with maximum three floors and big garden around the house. Because houses have their own outside spaces, the surrounding lacks open community spaces, such as square. There is a playground in the park, but it is quite small and the space lacks other leisure functions, for other users.

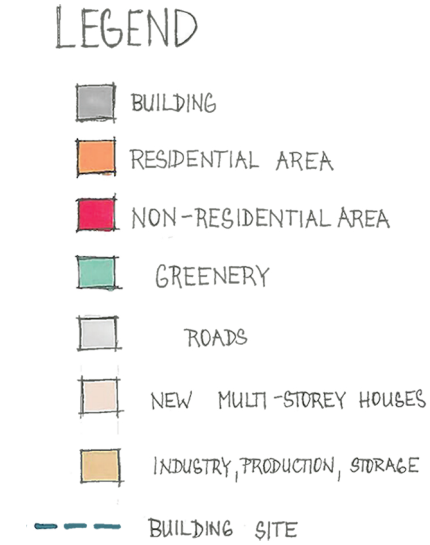
Therefore it would be appropriate to create public space, urban or green, and space for younger people, such as skate-park, or football field.

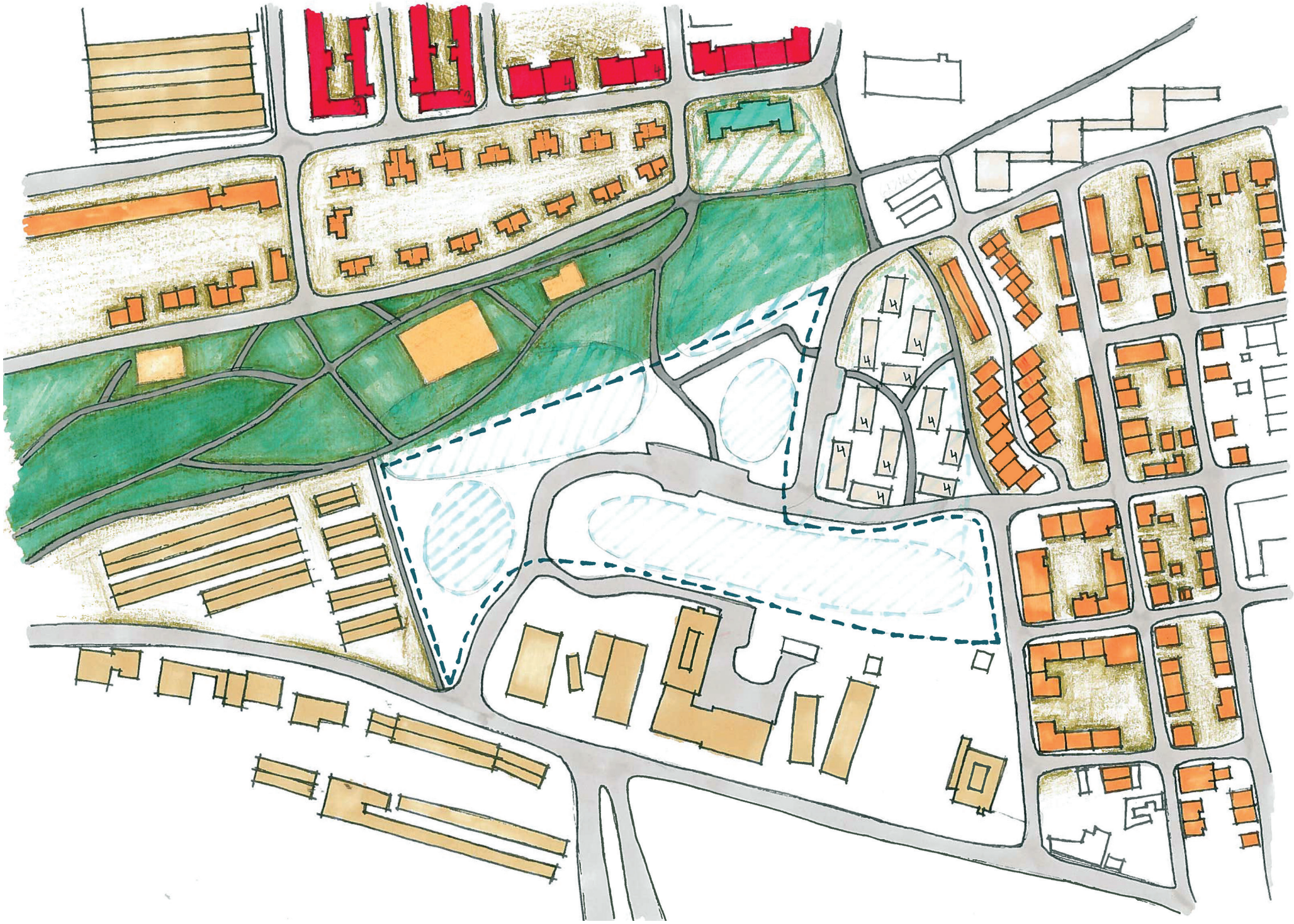
With light blue colour are represented places that have different atmosphere, different identity. One space is between two pathways on the east part of site, where could be public space, since it is close to many public paths. Other space is surrounded by industrial buildings and new road and last one is near the park which should continue in same sense, so the edge between the park and site is eliminated.

Near the site are two bus stops, providing good connection with the city centre. The nearest tram stop is 10 minutes on the north from the site.

Through the site goes new road, with sidewalk and planted trees around and parking spaces. This road should be implemented into the project as a part of design.

In the park is dense network of paths for walkers and bicycles. These paths continue also through the site and are important connection of park with southern part of the area. It is important to preserve them, and integrate them to design.





CLIMATE

Understanding the climate is extremely important for designing the indoor climate, energy consumption and landscape. While precipitation is important for landscape and water reuse, the temperature and sunlight gives the possibility to design methods that will decrease energy consumption. Those methods cannot be used randomly, but with sensitive consideration of climate.

Temperature

The climate in Czech Republic is continental, which means that it is not influenced that much by the sea. That creates big temperature differences between seasons, that are greater than in Denmark While in summer the temperature is around 20-25 degrees, and can come on few days even above 30 degrees, in winter the temperature can decrease towards -20 degrees.
Prague is approximately 260 meters above sea level, and usually is there warmer weather than it the rest of the Republic, because of the dense development and many hard surfaces. The table on the next page shows average temperatures and their typical range.

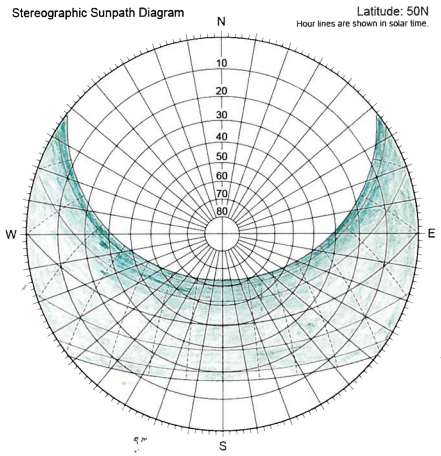
The temperature table shows that there will be a possibility of overheating the buildings in the summer. The vegetation and trees around the buildings can decrease the air temperature for even 2-3 degrees, but the calculations about the overheating must be done. Creating shading in summer and good ventilation system will decrease the risk of overheating to minimum.

The next table shows the temperatures below zero during months. As visible, during the winter most of the days of the months are frosty. This table also shows the number of days with rain during the months. Mostly it rains half of the days in the month, which stays almost the same whole year.

Precipitation

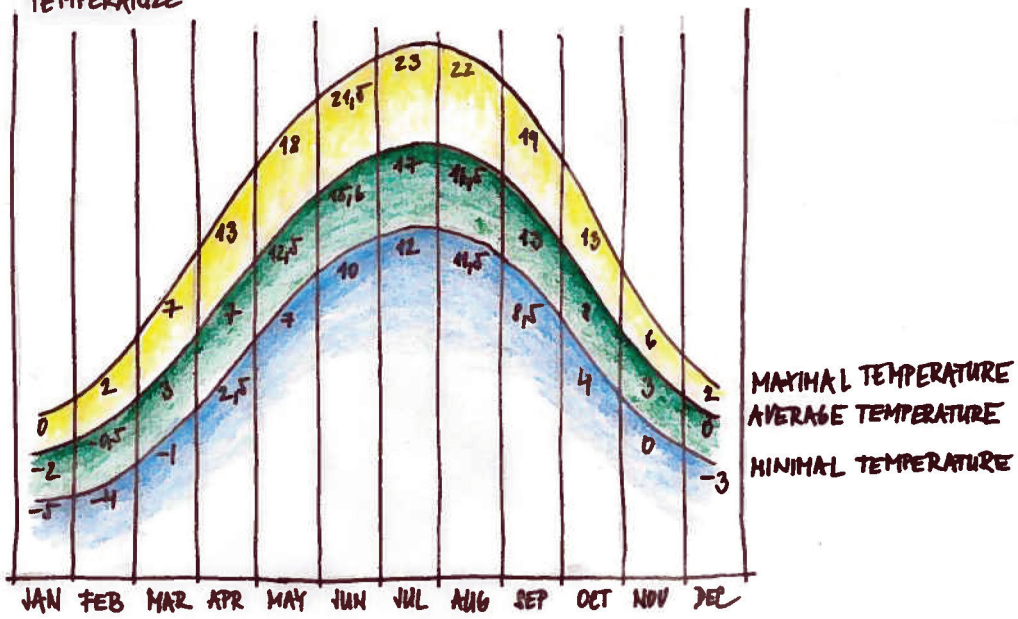
The rainfall changes significantly during the year. The biggest probability of rain is during the late spring and summer, which helps to buildings to cool down during higher temperatures. During winter the rain is rare, because the temperature is mostly below zero, so it usually snows.

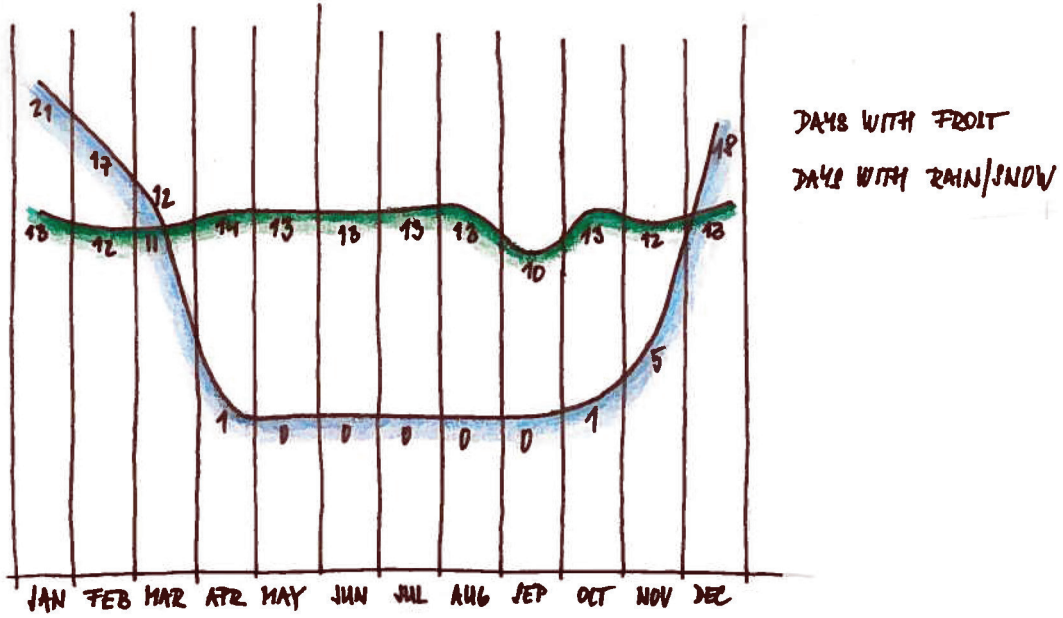
Having rainfall in mind, it is possible to design a pond that will catch rain water in summer months, when can be used later for toilets and washing machines. Because of the high rain fall during the whole summer, the artificial irrigation of vegetation is not necessary. It must be also acknowledged that during winter, the temperature stays most of the days below zero, so there is not possibility using grey water as alternative water for households, so another solution must be found.



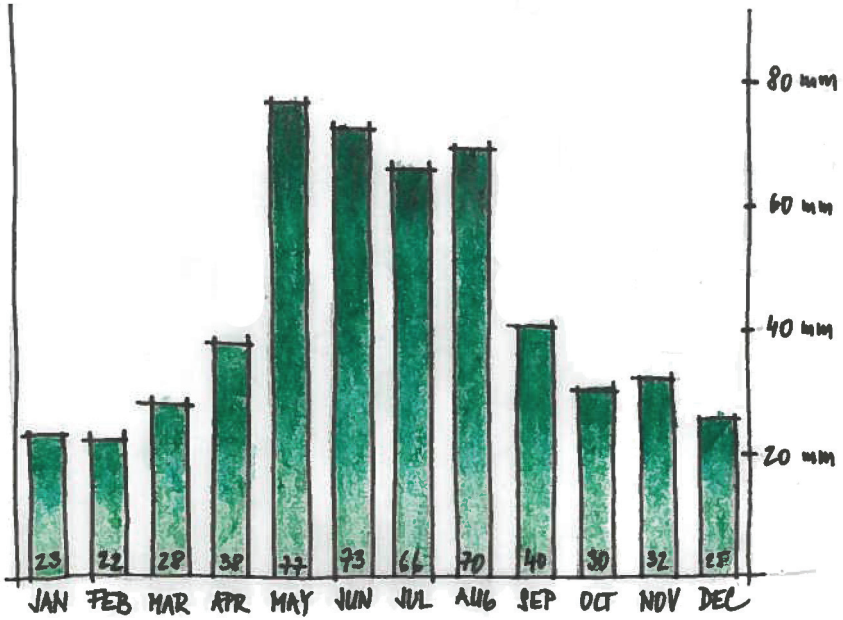
Next table shows the average day length and sunlight during the months. This is important, while designing proper daylight in building and passive solar strategies. As visible from the table, while the sunlight in summer is long and therefore the overheating of rooms must be considered, the sunlight during winter is very short, so the solar strategies will not be that efficient.

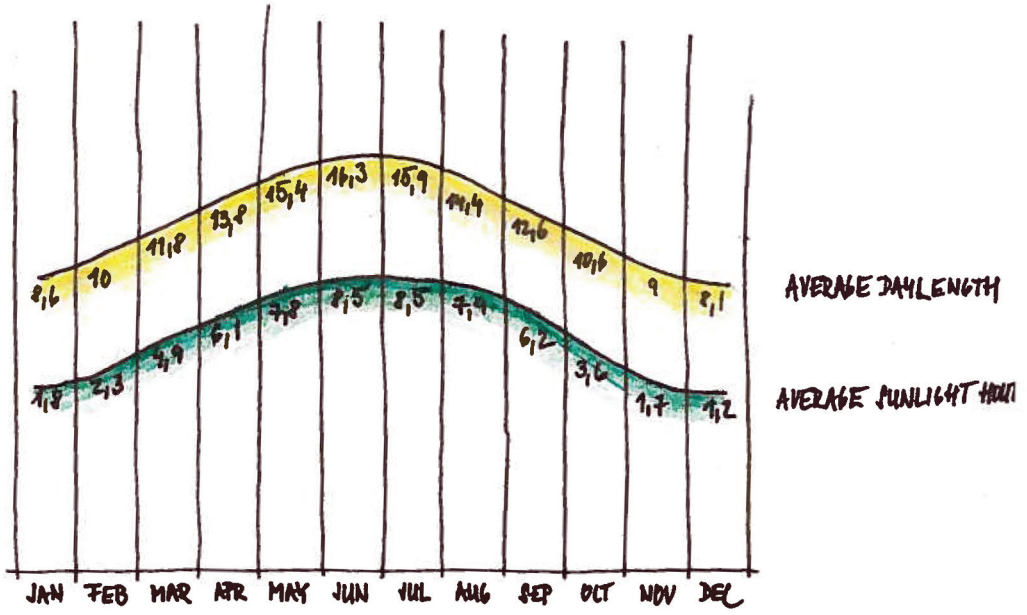
TEMPERATURE

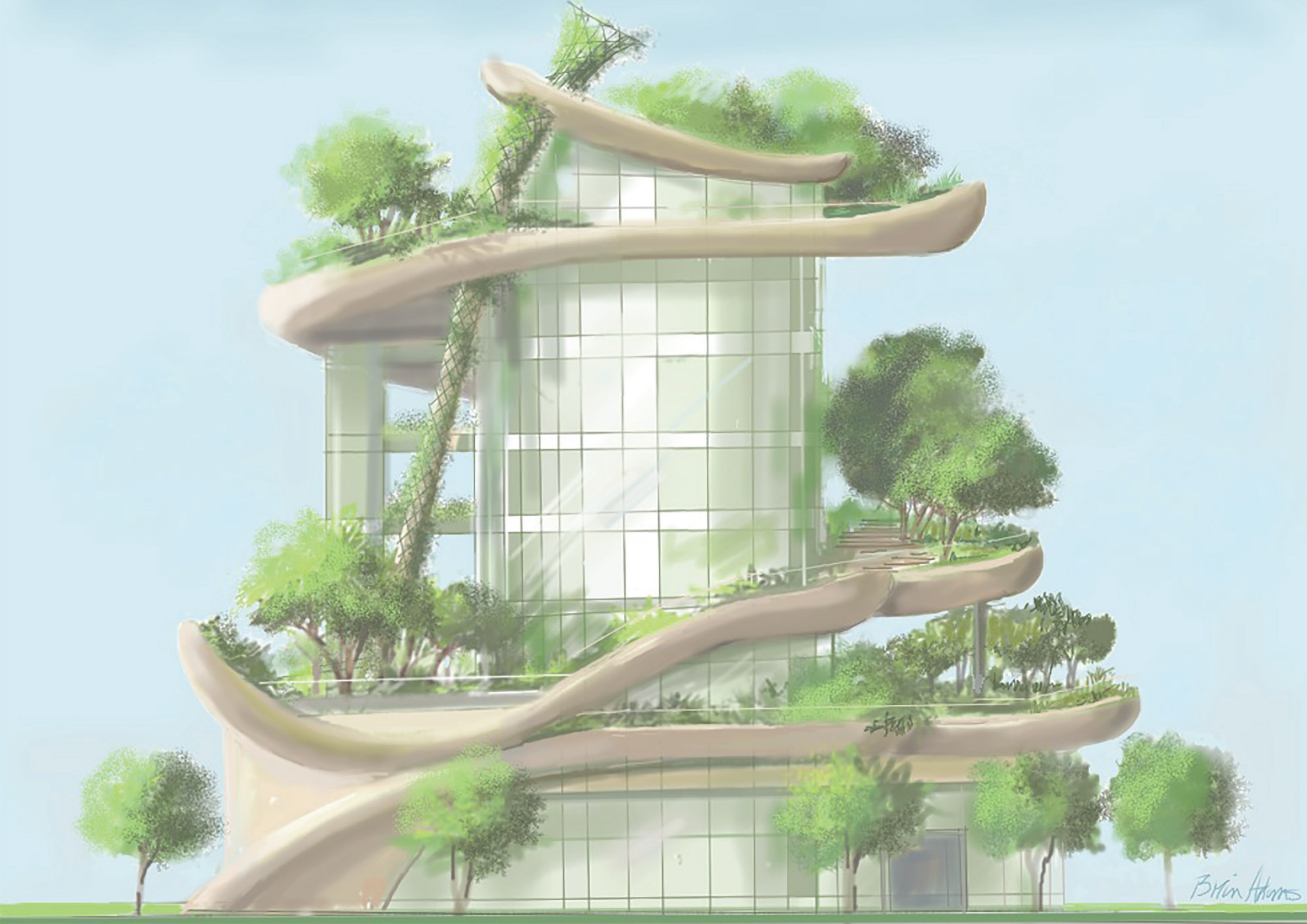




PRECIPITATION







DESIGN PARAMETERS

RELATION

Green spaces can go a long way towards renewing cities. So, too, can housing developments and neighbourhoods that facilitate community interaction. Bring these things together, and you have the makings of a vibrant urban community. Design that is conducive to social interaction can encourage a sense of community and this is advocated as an improvement on the current situation that often involves the creation of physical barriers to social interaction in our suburbs. [Subdivision for People and the Environment, 2001]

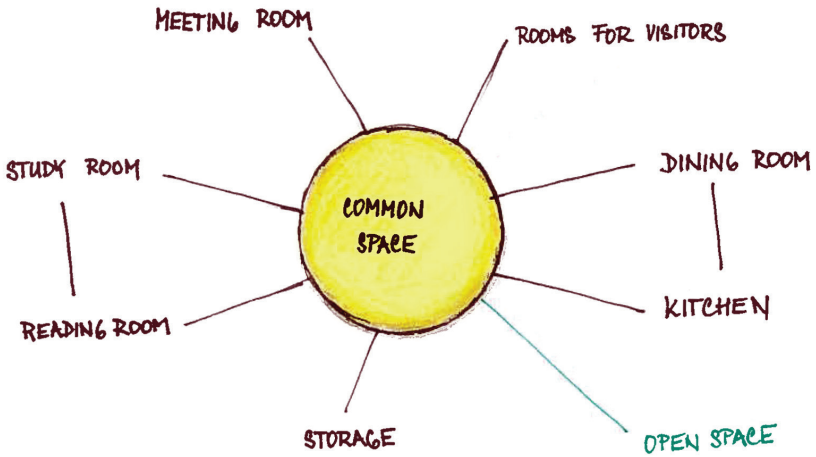
From the site analysis we can take much knowledge. As mentioned there, on the site are now just paths, paths with benches without use. Together with complex surrounding, this is the main feature of the site. So the paths must be considered as the part of the design, even could be enhanced as important part of the site, because now the main purpose of the area is to connect. Connect spaces between each other. Connect park with buildings. Connect south with north. Connect people together. Connect suburban and urban qualities on one place.

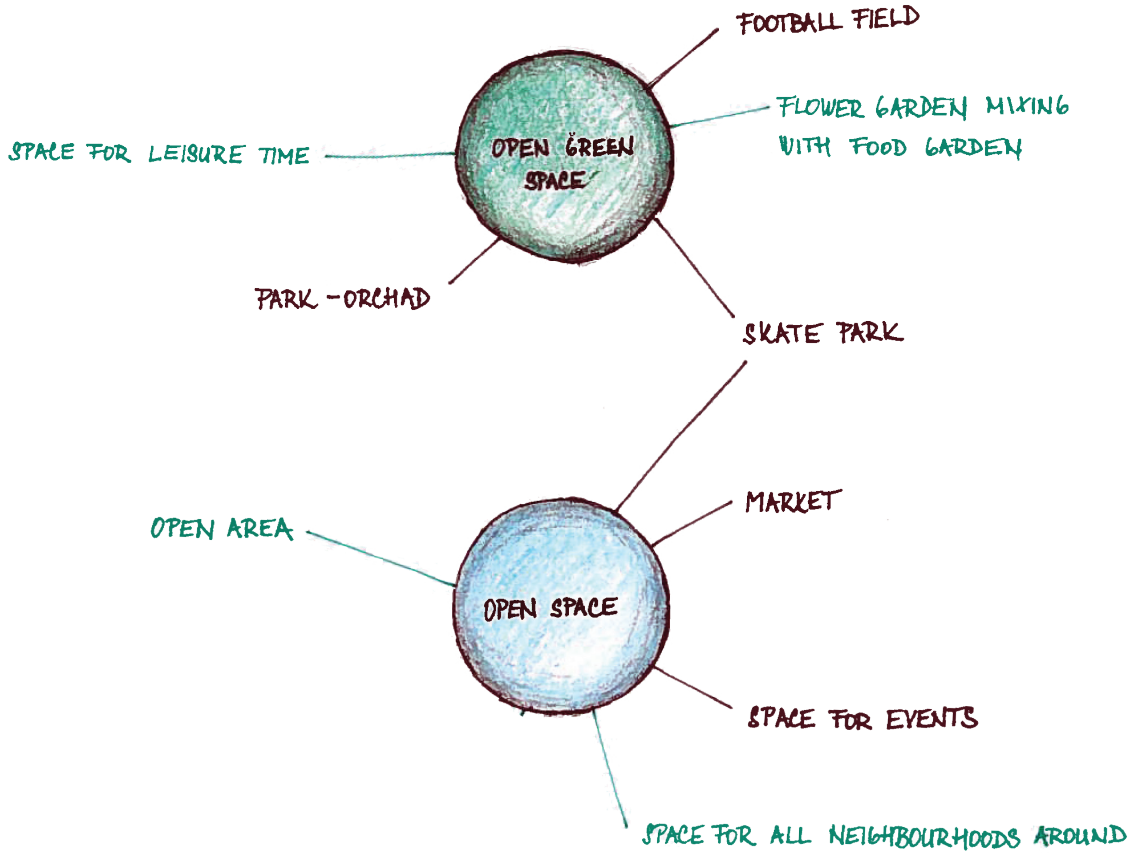
The neighbourhood lacks the open spaces, space that would give identity to the community, space that will be the main meeting point for whole community, not only for residents of new complex. This place should be both green and urban. The bubble diagram shows what those spaces should consist and what feeling should be achieved in the area. This designed main public space does not need to be just one space in the middle with paths going towards it from all the direction like sun rays. This space could be spread around, with smaller areas with different functions. The path can be this main public space.

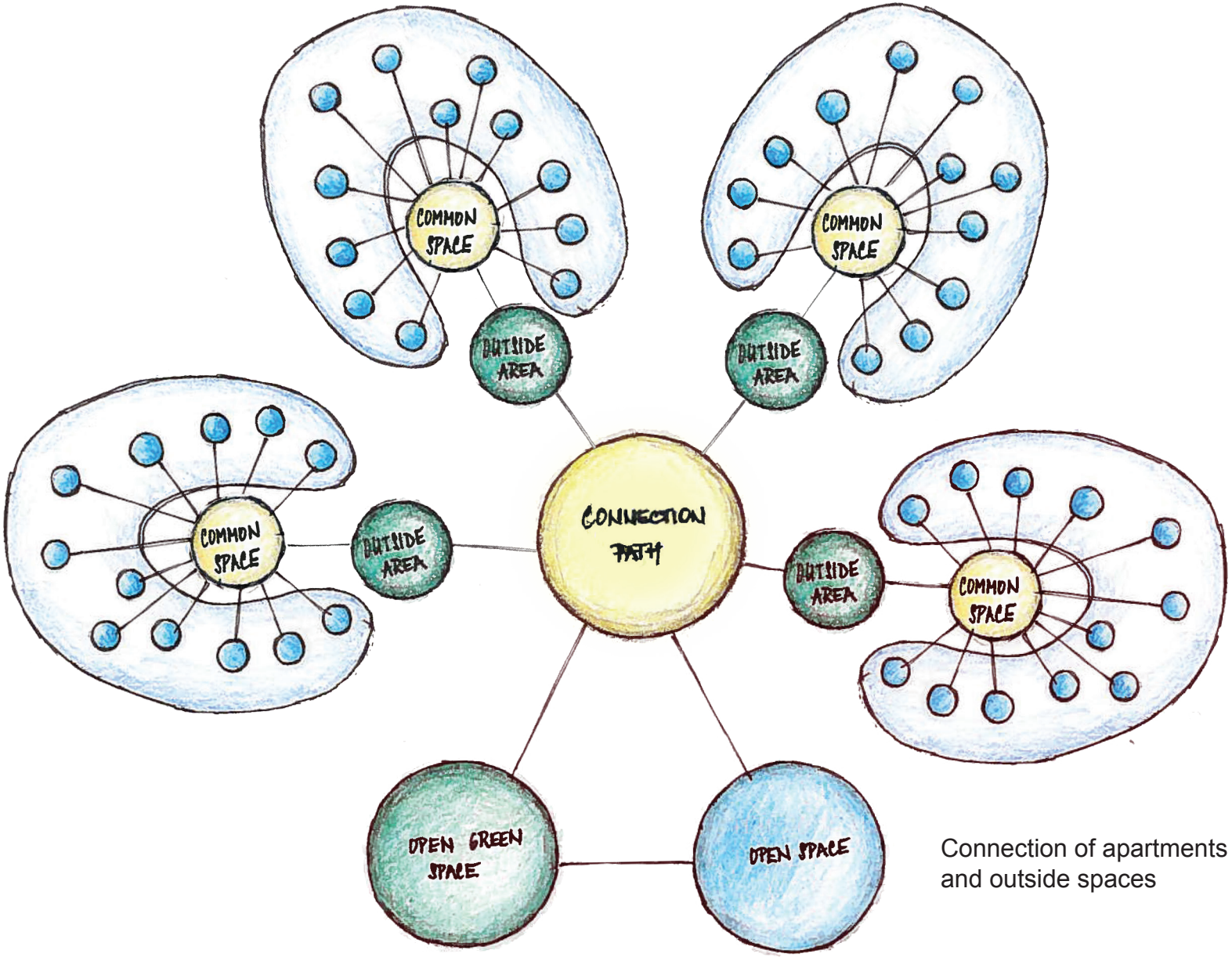
The total area of the building site is approximately 30 000 m². if we calculate one dwelling approximately 70 m², we get that with built ratio around 100% there will be between 350-450 dwellings. The common space with kitchen and dining will be designed for each building. When the space is common for too many dwellings, the people became too anonymous and they do not work as a community.

The common room is the heart of cohousing building. The rooms that will be common for tenants are chosen to provide socialisation between the tenants, as well as services. Main common space is kitchen with dining room, where common dinners and lunches will take place. Another important room is meeting room, where all tenants meetings take place, as well as some presentations, discussions and so on, but the function of the meeting room could also have the dining room. Library and study room will be equipped room with computers, sofas and bookshelves. The common space has to have also storage for bikes, outdoor equipment and others, laundry room and equipped workshop where tenants can repair anything they want. Important rooms are also rooms for visitors of tenants, since they will not have space in their own dwelling for visits.

To enhance the community to use the common space, it must be within the building with covered and heated connection with all the dwellings.


MEETING ROOM
ROOMS FOR VISITORS
STUDY ROOM
COMMON SPACE
DINING ROOM
KITCHEN
READING ROOM
STORAGE
OPEN SPACE

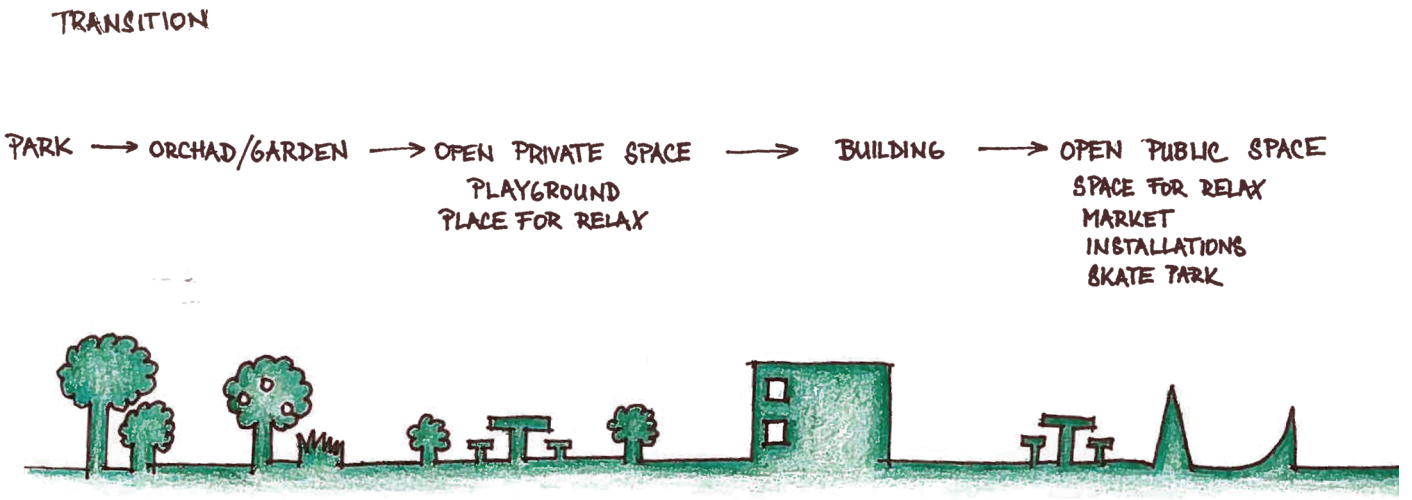

FOOTBALL FIELD
FLOWER GARDEN MIXING WITH FOOD GARDEN
SPACE FOR LEISURE TIME
OPEN GREEN SPACE
PARK - ORCHAD
SKATE PARK
MARKET
OPEN AREA
OPEN SPACE
SPACE FOR EVENTS
SPACE FOR ALL NEIGHBOURHOODS AROUND



Connection of apartments with common spaces and outside spaces

TRANSITION

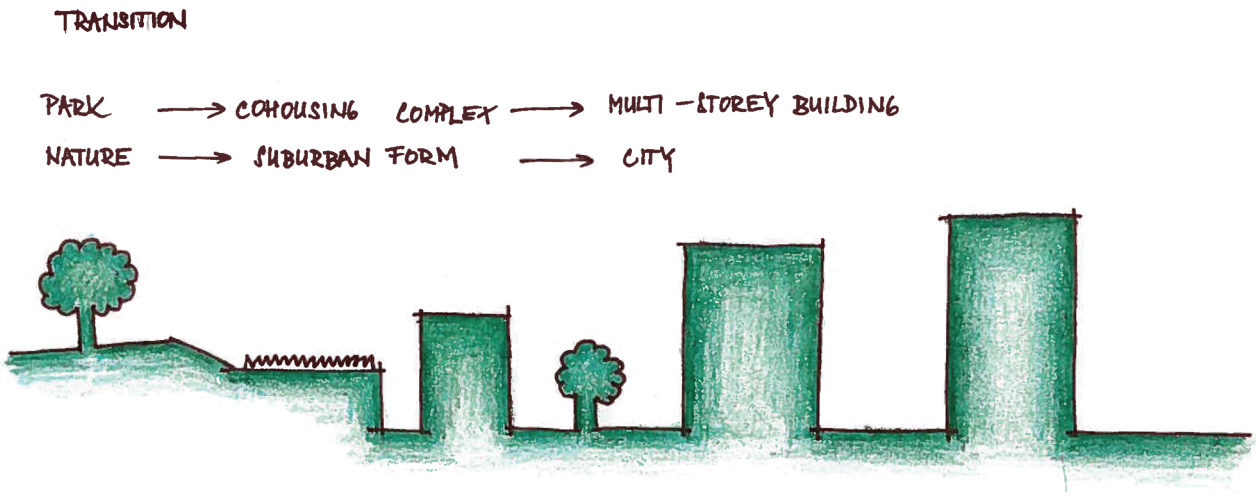
Transition is an in-between space. In architecture is defined as the connecting space between two different spaces. Architectural spaces are incomplete without transition spaces. Transition spaces make physical and visual link between spaces. The architecture connecting those spaces can be seen as a path- path towards sustainability.



As said before, the purpose of the design will be also to connect different spaces that surround the site. To connect spaces, it is important to define qualities of the spaces that differ, and qualities that spaces have in common.

Even though the site could be divided into different places with different character, it is important not to approach those spaces differently, but as one entity and connect those different spaces. The density and height of houses will differ, but the overall appearance must be united and the transition should be soft.

The site has different atmosphere in different parts. To connect those parts together, it is important to take the qualities from both suburban and urban spaces. The design should be a transition between those parts, connection between the park and the city.



USERS

To achieve social sustainability in residential type of building, it seems as essential feature to provide user the sense of belonging within the community, within the environment that surrounds him, within the building he lives in. By triggering those well-being feelings, the user can appreciate his surrounding, and be encouraged to preserve it in the way it is, and therefore adopt behaviour patterns that helps to protect the environment and together with thoughtful design, the building can be truly sustainable.

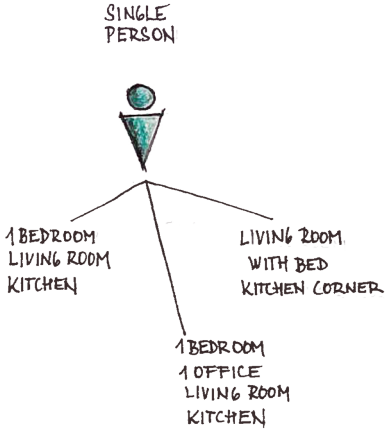
When we think about typical families in Czech Republic, it quite differs from Danish standards. People in Czech Republic are not moving very often, they seek homes for their whole life. Children stay with their parents much longer, they stay at home even during studies, and if they study in different city, they always come back home every weekend. They definitely move out only when they start their own family. That creates a challenge to the design of dwellings to provide flexibility of layouts for young families, to have the possibility to live in the same dwelling for their whole life and that the layout can adjust to their actual needs.

Another new trend in lifestyle is to have own space for working at home. Even though project will focus on cohousing and therefore many functions will be in common space, people during their work do not want to be disturbed, so are searching for privacy and this must be included in the building design. The designed office within the dwelling, can work as different room in the future, which gives the flexibility to the dwelling in case that the number of tenants in the dwelling increase.

The diagram at the top shows different possibilities for people alone, for couples, and for different sizes of families. Different people prefer different sizes and different organisation of dwellings. By making a diagram with some room scenarios we can find that sometimes the same dwelling repeat for different users, which will narrow more the room programme in the whole complex.

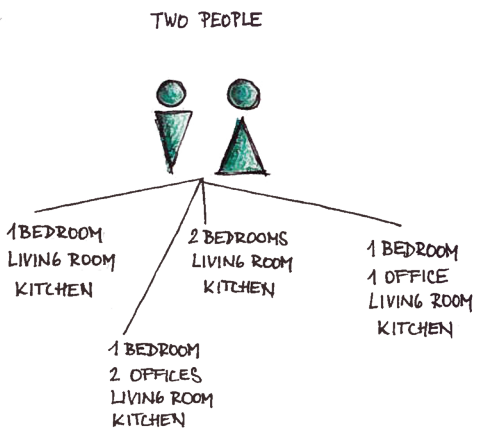
Living alone is not very common, but there days when is difficult to say what is traditional family, it is important to count also with this group of people, some people can get divorced, or do not get married at all and focus on the carrier. Especially in the cohousing type of building, one member of the family can live in his own dwelling, having his family across the hall. While some alone living people do not stay very often at their home, some can have visitors most of the time, so those people prefer different types of dwelling size.

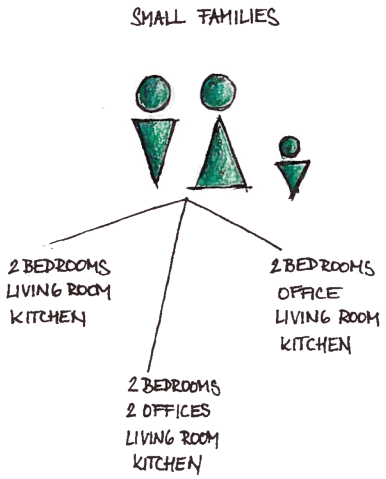
As two people living together is understood couple, or elderly couple, or two roommates, students. That is because near the building site is university, so also students seeking for alternative living can live in the cohousing complex.

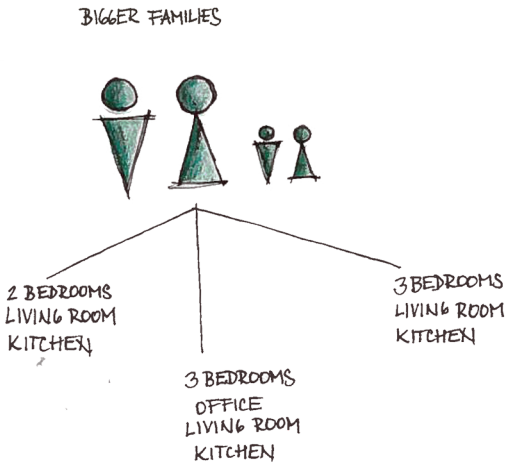


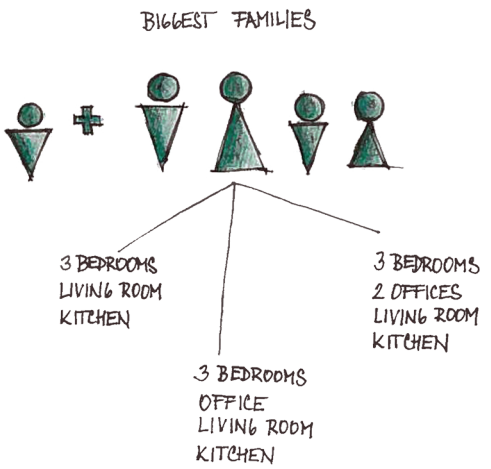
Other group of users will be families, families with one child, two children, or more children. The typical family does not exist, people are getting married and divorced, or parent live alone with children. Even though the families are different, they usually demand similar area of dwelling, and similar rooms.

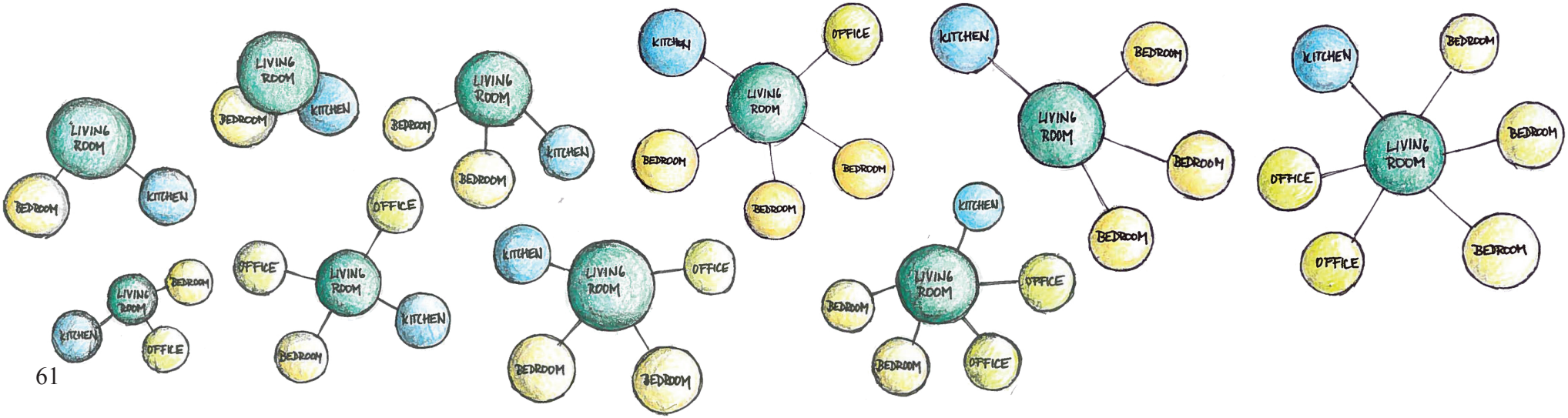
Some of the dwelling arrangements are repeating, so there are 10 different types of dwellings, from 3 to 7 rooms. Next bubble diagram shows all of the dwelling types.


TWO PEOPLE
1 BEDROOM
LIVING ROOM
KITCHEN
2 BEDROOMS
LIVING ROOM
KITCHEN
1 BEDROOM
2 OFFICES
LIVING ROOM
KITCHEN
1 BEDROOM
1 OFFICE
LIVING ROOM
KITCHEN


SMALL FAMILIES
2 BEDROOMS
LIVING ROOM
KITCHEN
2 BEDROOMS
2 OFFICES
LIVING ROOM
KITCHEN
2 BEDROOMS
OFFICE
LIVING ROOM
KITCHEN


BIGGER FAMILIES
2 BEDROOMS
LIVING ROOM
KITCHEN
3 BEDROOMS
OFFICE
LIVING ROOM
KITCHEN
3 BEDROOMS
LIVING ROOM
KITCHEN


BIGGEST FAMILIES
3 BEDROOMS
LIVING ROOM
KITCHEN
3 BEDROOMS
OFFICE
LIVING ROOM
KITCHEN
3 BEDROOMS
2 OFFICES
LIVING ROOM
KITCHEN


LIVING ROOM
BEDROOM
KITCHEN
OFFICE

ORIENTATION

The orientation is important for pleasant feeling. Right orientation can help to reduce the energy consumption, but orientation according to the sun path is just one aspect of orienting the building. Local topography, the requirements of privacy, the pleasures of a view, reduction of noise and climatic factors of wind must be also taken into consideration. [Olgyay, 1992]

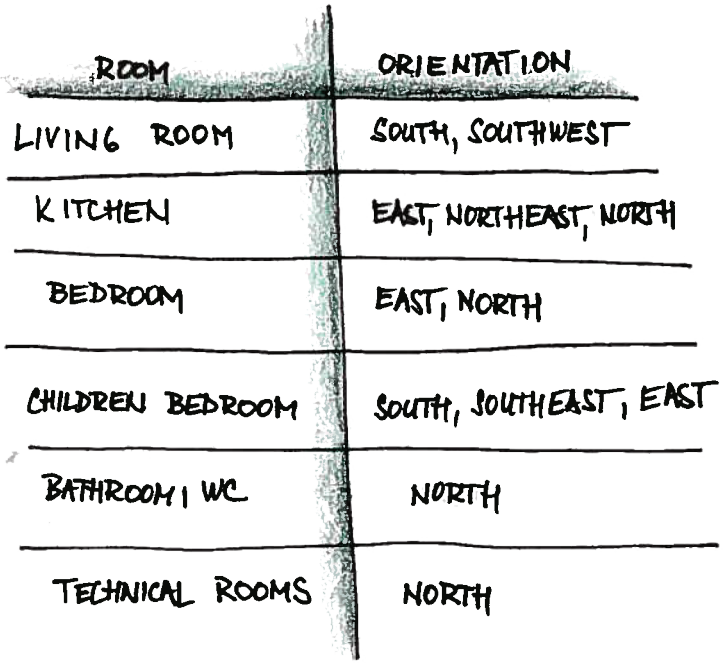
The site slopes down towards the south, which is favourable, but taking also other aspects of site analysis, view on the south does not offer nice picture. Having industrial area on the south of the site, the visual barrier must be designed in order to provide nice view from the windows. The view to the north and east allow much better view.

Green area that will consist from at least 50% eatable plants and trees, will be designed around the houses to provide nice view.

The right orientation can be used for passive heating or cooling. While south facing rooms get most of the sun and therefore can use passive heating systems, the north facing rooms can stay cool most of the day. The orientation of the room is chosen according to its occupancy, time and duration.

An orientation 15-30degrees east of south is often favoured, because the room gets more morning than afternoon sun, which enables the house to heat from early in the day. Orientation of the room west of south means that it will retain its morning chill later into the day, but will carry over afternoon heat to the evening.

Rooms used most of the day should have south orientation, rooms that are not used that often are facing the north. The chart shows the best orientation of rooms in the dwelling.



BUILDING EFFICIENCY

The building complex will be zero-energy, with connection to the grid. First the energy consumption will be decreased by using passive strategies, and then the energy need will supplied by solar cells, which will be integrated into the design. To consider overall energy consumption of the building, the embodied energy of materials is considered, so local and natural materials with low embodied energy will be used.

Optimizing the energy use and indoor climate will be considered from couple of points of view: heating, cooling and lighting.

The heating in the building will be optimised at the beginning by choosing the compact volume of the building, with maximum surfaces towards south, with optimal areas of glazing. The sunspaces may be introduced to maximise heat gain in winter.

Cooling will be provided by using materials with higher possibility of accumulation, so the stable temperature will be achieved without excessive overheating. The plants will be introduced to provide evaporative cooling near hard surfaces.

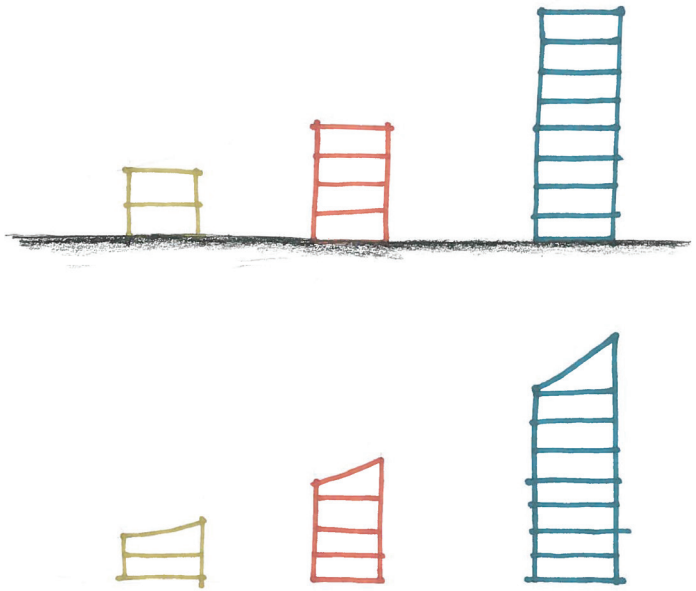
Good daylight is one of the most important features in dwelling. The daylight analysis will be done during the design process, the thickness of a building will be chosen to get daylight also in the middle of the building.

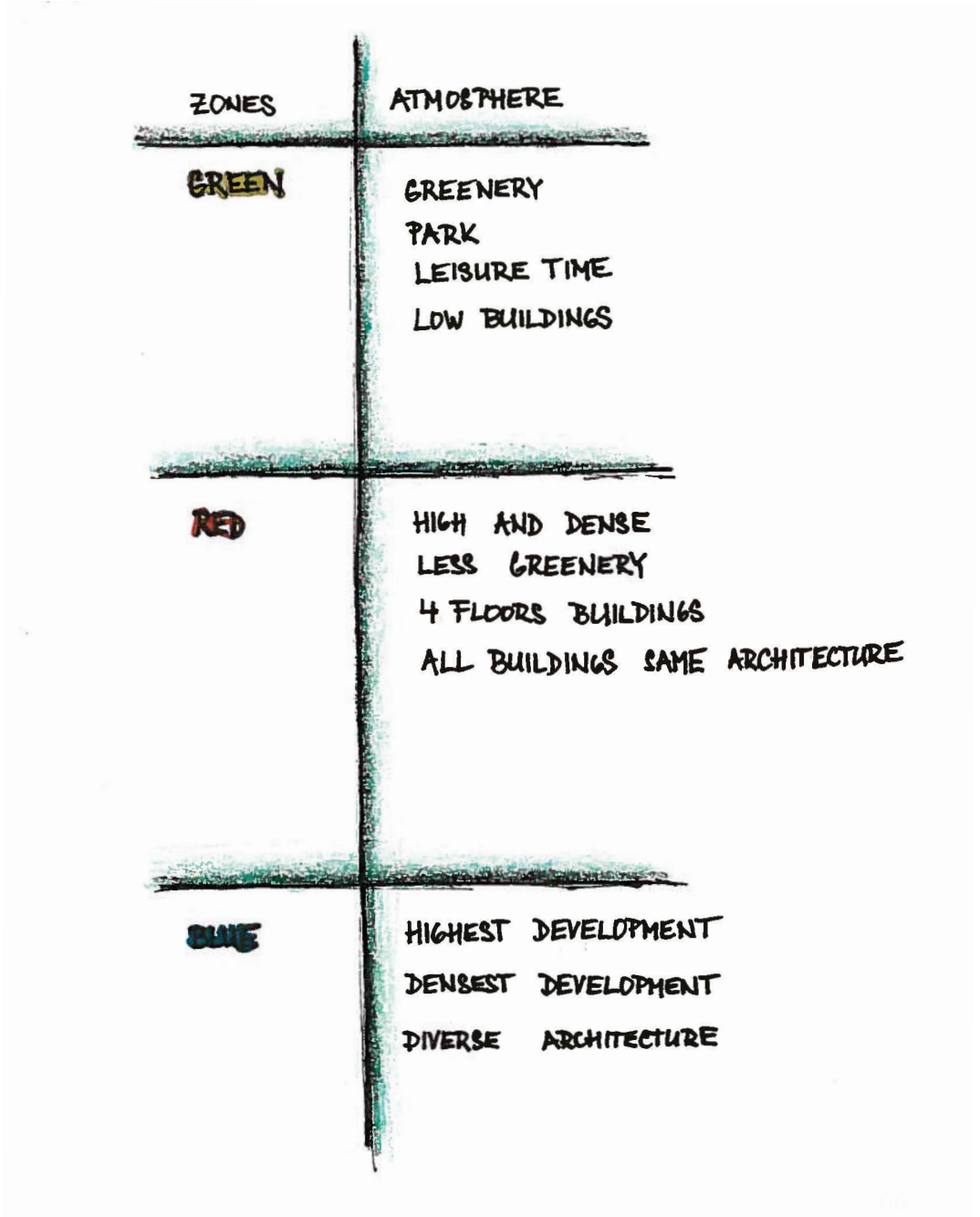
CONCEPT

ENVIRONMENT

In general, three different spaces around the site can be found. First, shown by green colour are family houses together with park. Those buildings have suburban, natural character. Red colour represents new residential neighbourhood, which has urban atmosphere, but still is quite low, with 4 storey buildings, and quiet atmosphere. By blue colour is highlighted industrial area, which consists of high buildings and hard surfaces, with no pleasant architecture or space.

All those three areas interact with the site and are connected to it. They all are using the site as the pathway and connection between those spaces and this connection cannot be destroyed, but enhanced and maintained to provide smooth transition.

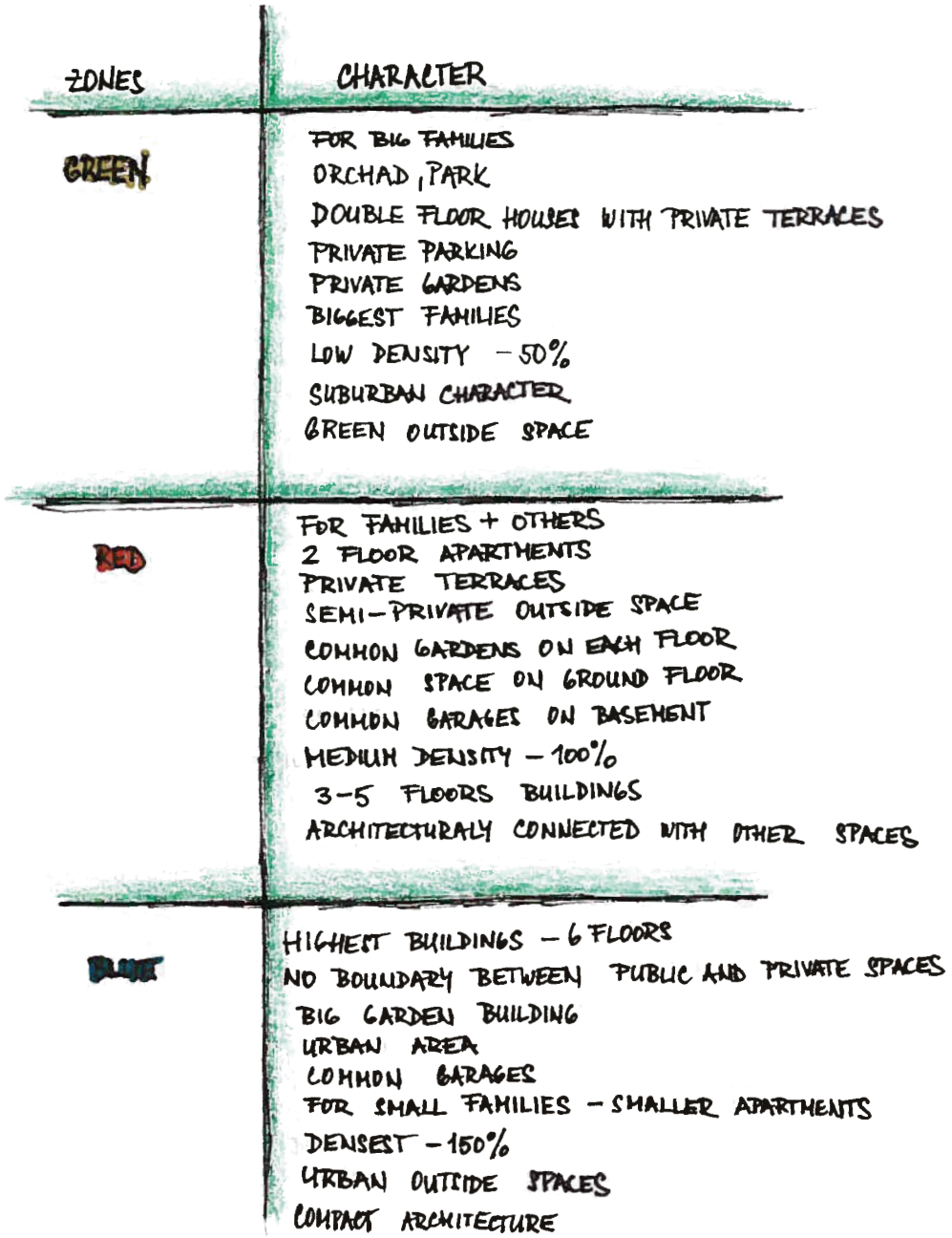


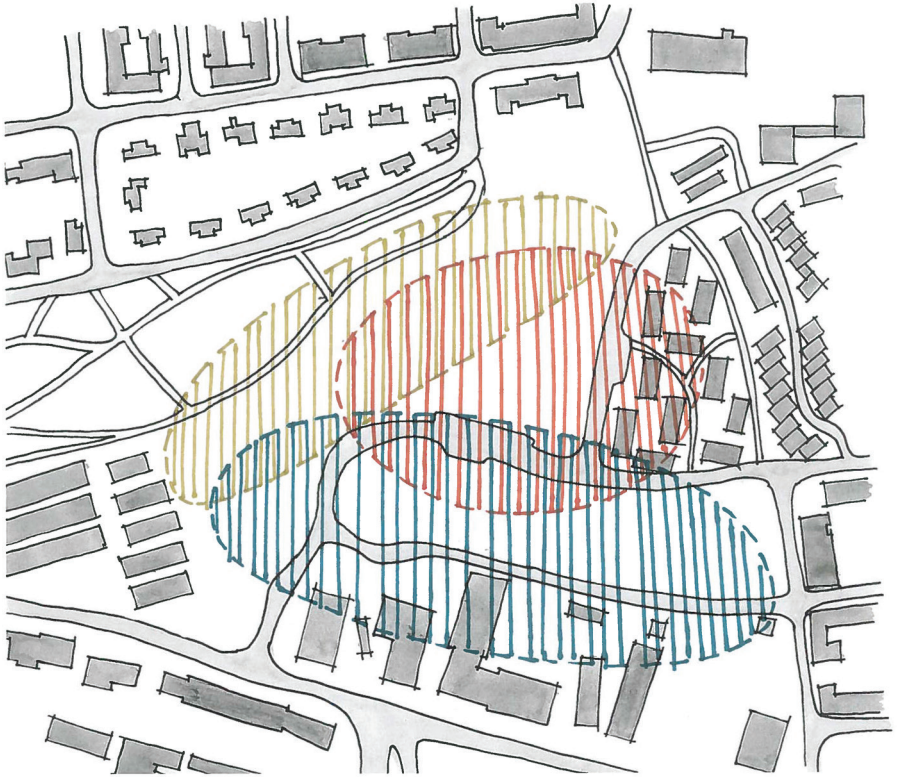


SPACES ON SITE

These three spaces can be extended into the site and keep the characteristic of the spaces they are connected to, with more defined characteristic, that is desired. Those spaces should not be disconnected with each other, but be connected, by similar architecture, same concept, used materials, and also be connected literally by paths and walkways.

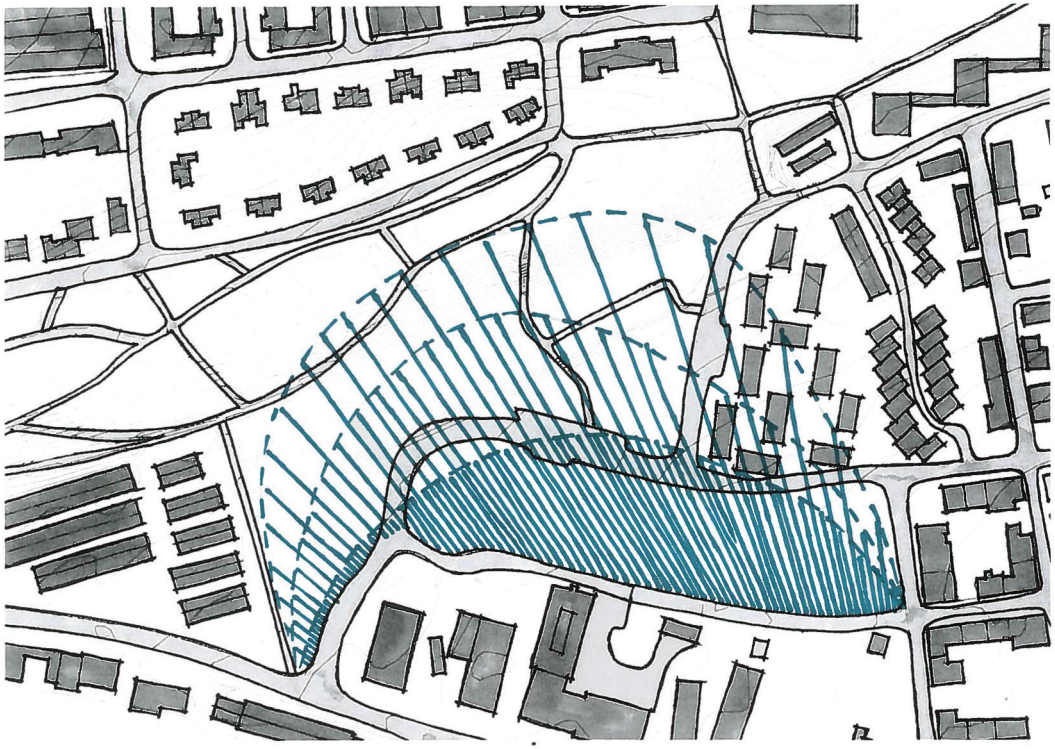
Spaces will have different qualities, and therefore will be for different target users, but they could also mix into each other, not creating boundary between the different types of buildings. As well as mixed use of site emphasises socialisation between users, apartments for different users should be mixed together.





CONNECTION OF PARK AND URBAN SPACE

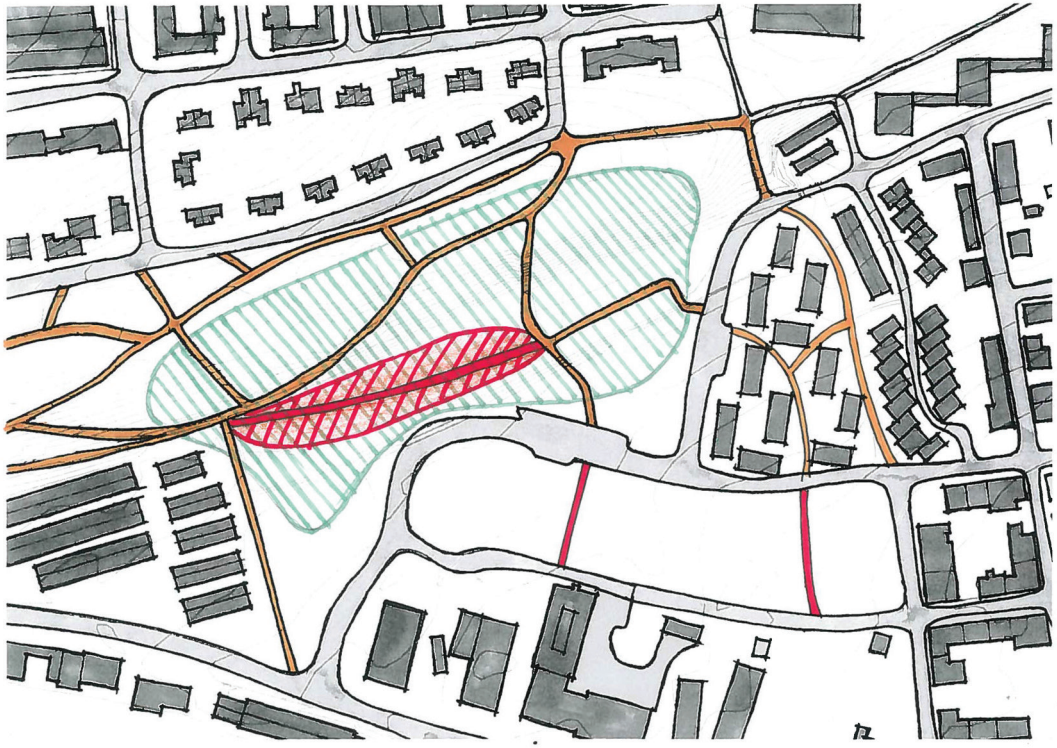
Now the park and area around both have clearly defined boundaries, this boundary should be blurred, with no visual edge between park and the site. The natural area slowly transforms to urban area, the greenery is decreasing and is substituted by more urban spaces, trees are changing into lower vegetation and grass areas and building heights are rising, while going from the north to south.

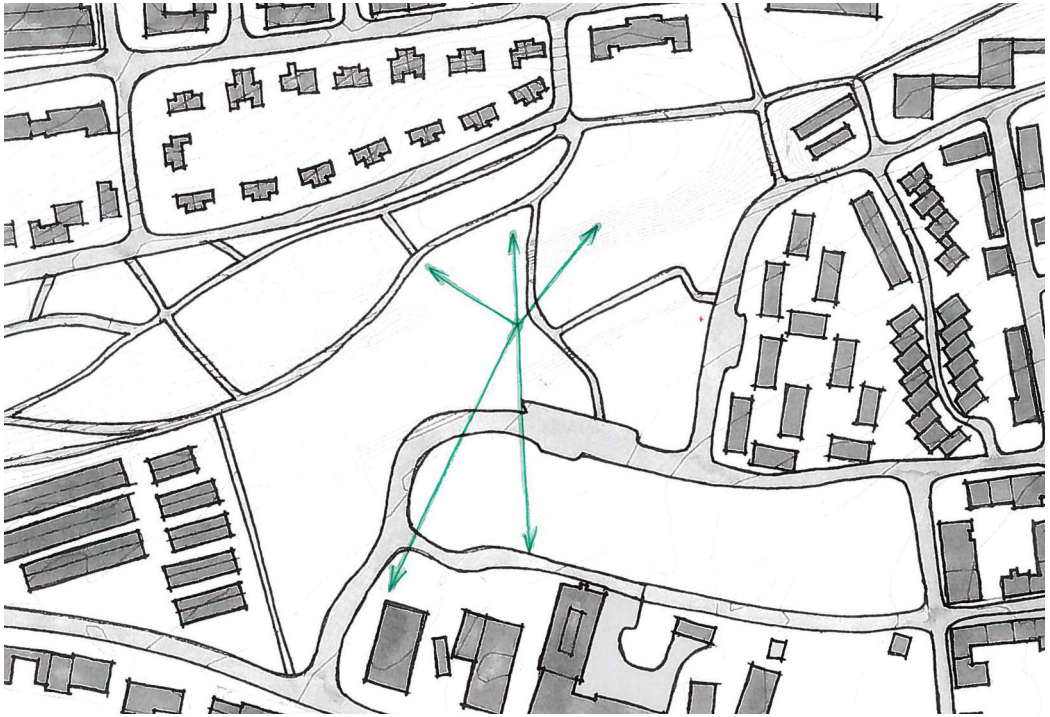


PATHWAYS AND VIEWS

On the site is already situated couple of pathways, which are well placed and therefore will be preserved. On the lower part of the site, the space lacks some pathways that will be designed together with master plan. The site is also missing pathway connecting east and west of the site, and that space is widely used by people walking dogs, since it is flat big space without trees, so this open space should be maintained or substituted by another space to provide same qualities for public.

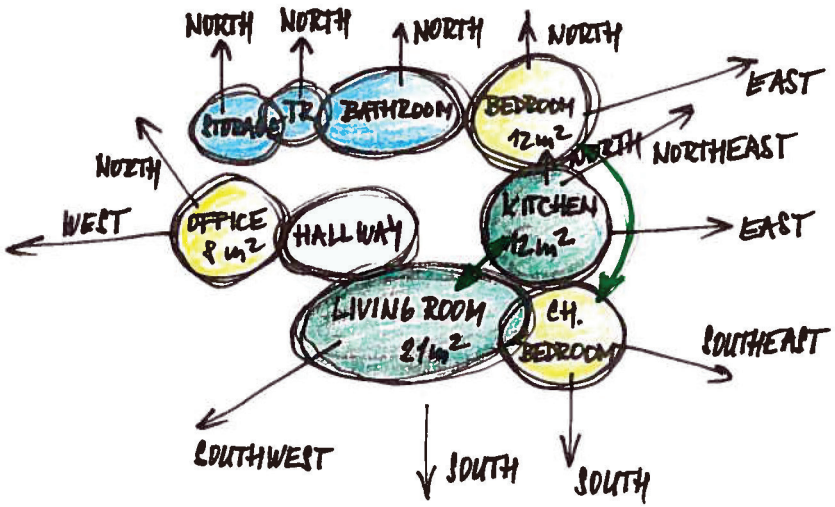
The view to any side is not very pleasant for now, so there is a need to create nice space to be enjoyable to look at. View towards the park and the hill he sits on can be nice, as well as view towards the future commercial area on the southwest. The view towards south will be also maintained, since it provides most benefits from solar gains.





BUILDING LAYOUT

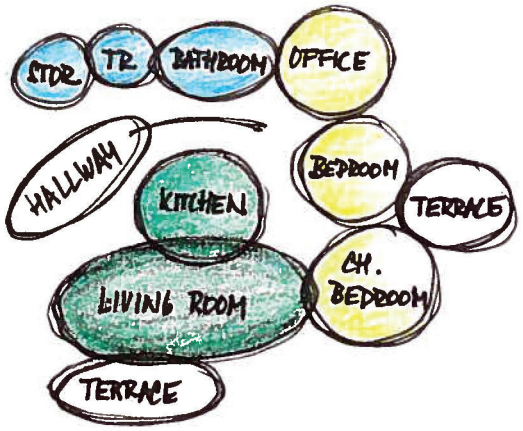
Understanding the layout at a small scale and maintaining the qualities for each room within the dwelling from orientation and dimension point of view has the same importance as urban plan of the area and must be designed together from the beginning of design.

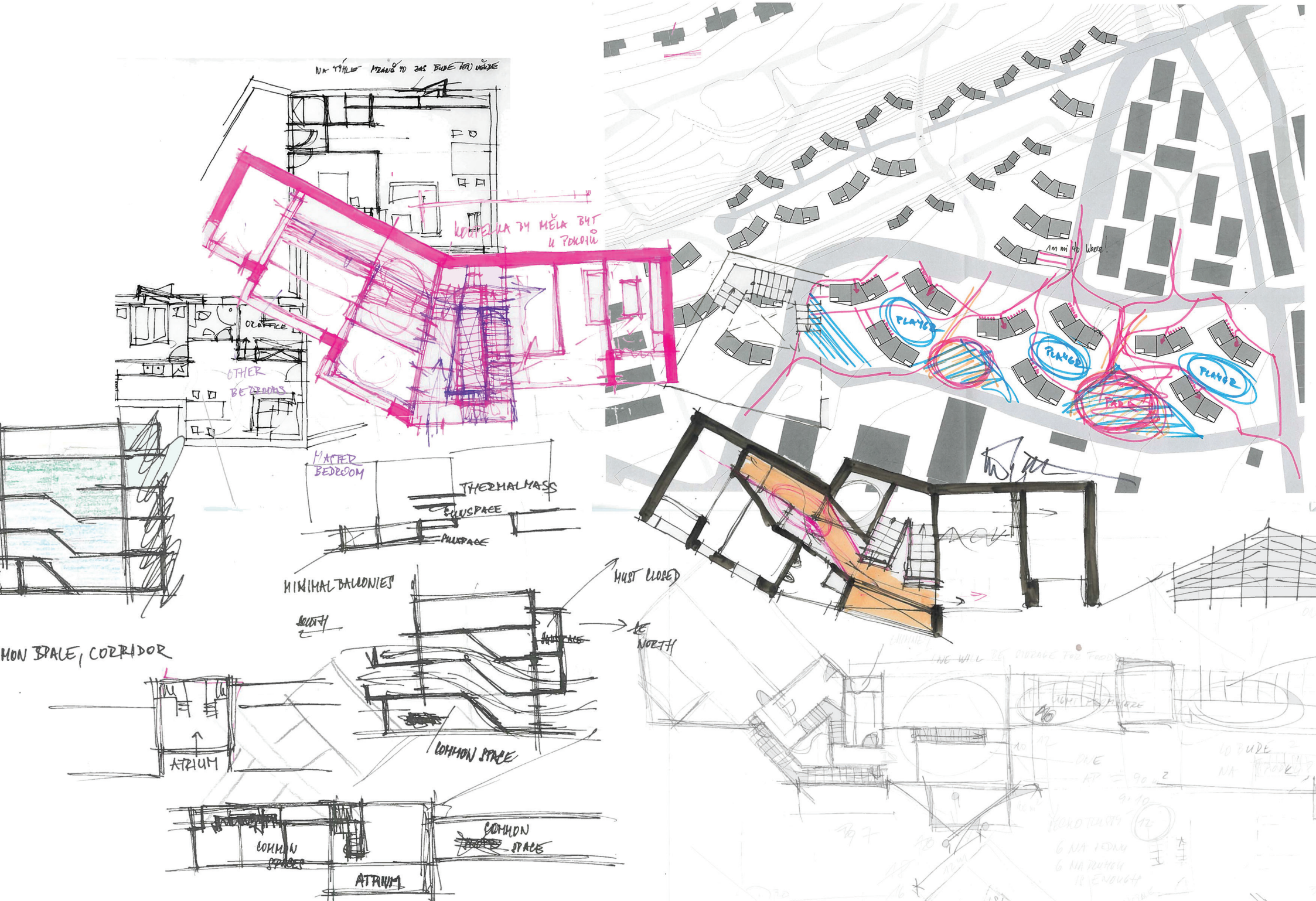


Layout of a building
The layout of the building should be compact for decreasing the energy consumption for heating. The surface on the south should be maximised, because southern walls do not suffer that much from heat losses.

To provide daylight from two sides, which will be also beneficial for ventilation purposes, the building will have vertical transportation for two dwellings at each floor.

Layout of a dwelling
In general is possible to say, that the dwellings will have 3- 7 rooms plus hall and bathroom with toilet. Now, when the dimensions and orientation is known, it is possible to start making layout studies and establishing desired qualities within each room and dwelling.

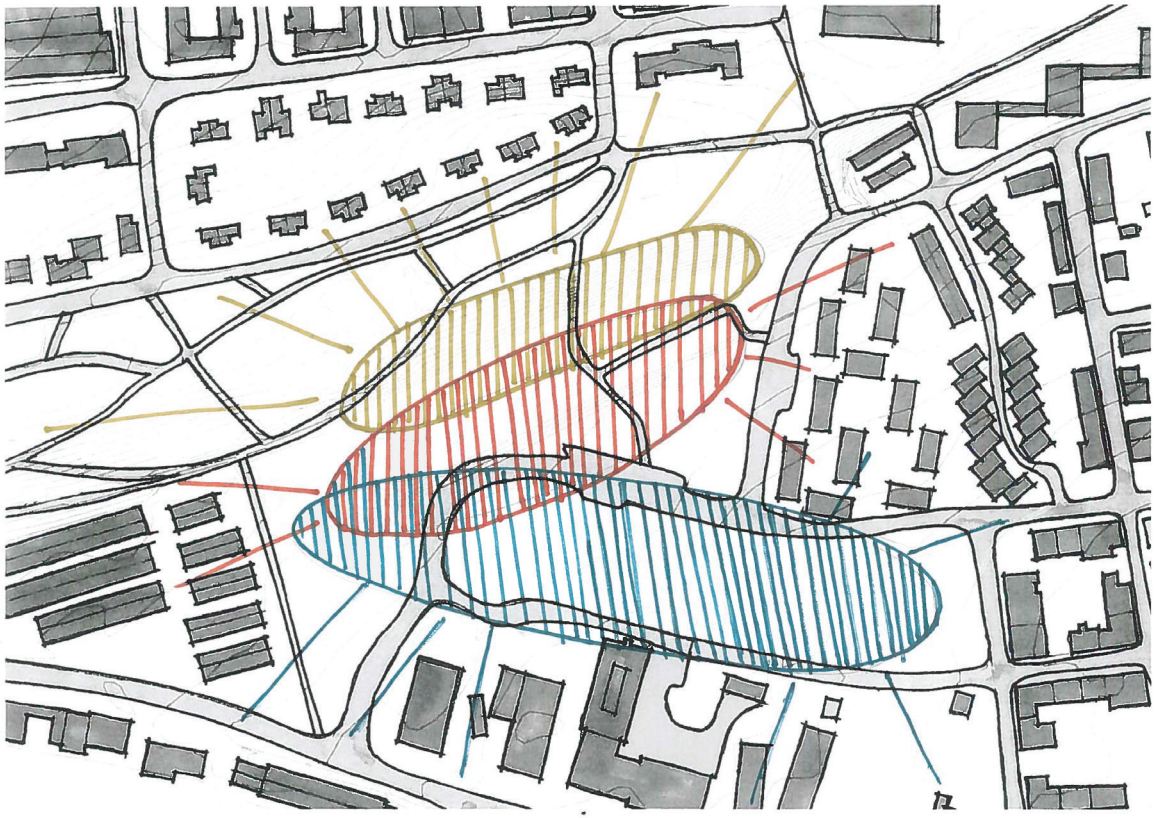


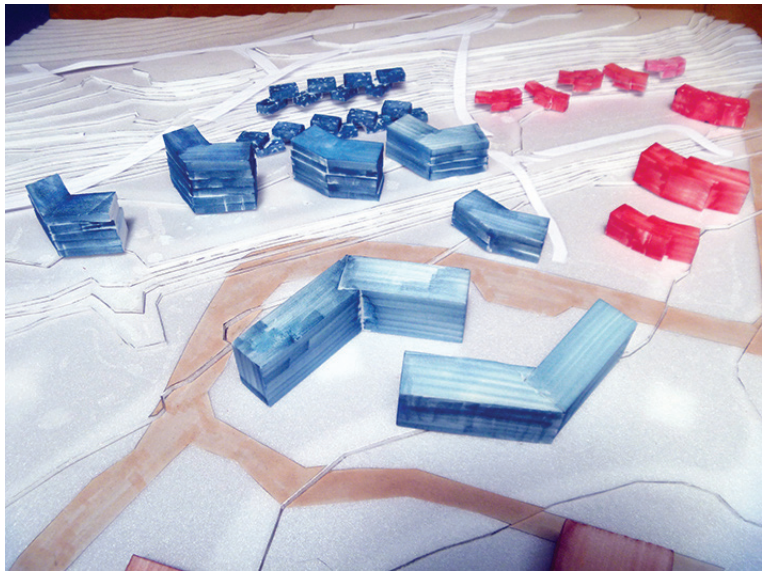

OFFICE
OTHER BEDROOMS
MASTER BEDROOM
THERMAL MASS
SOLUSPACE
MINIMAL BALCONIES
SOUTH
MUST CLOSED
NE
NORTH
ATRIUM
COMMON SPACE
COMMON SPACE
ATRIUM
COMMON SPACE
PLAGE
PLAGE
PLAGE

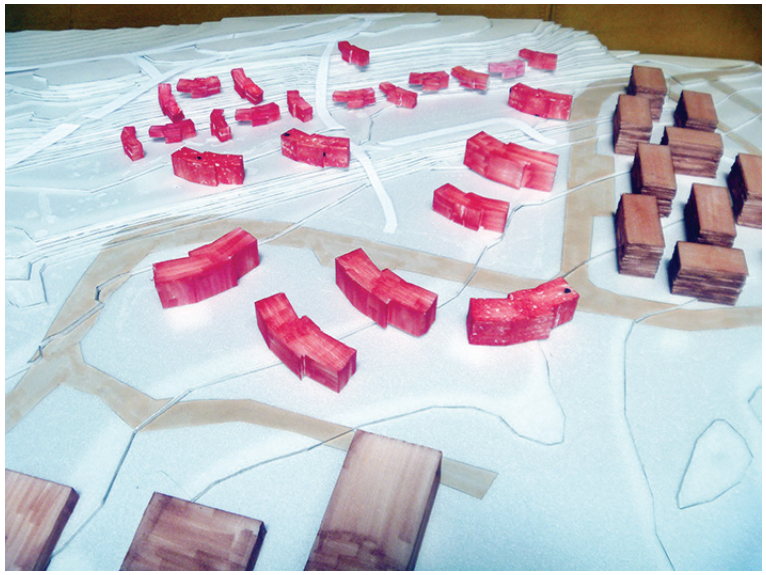
DESIGN PROCESS

SITE SCALE

The site was divided into three spaces with three different types of buildings. Family houses at the northern part of the site, middle houses in the middle and bigger residential houses at south. At the beginning those houses shared just orientation, which gave fragmentation appearance for the site, so later the same buidling form was found, with different scale.

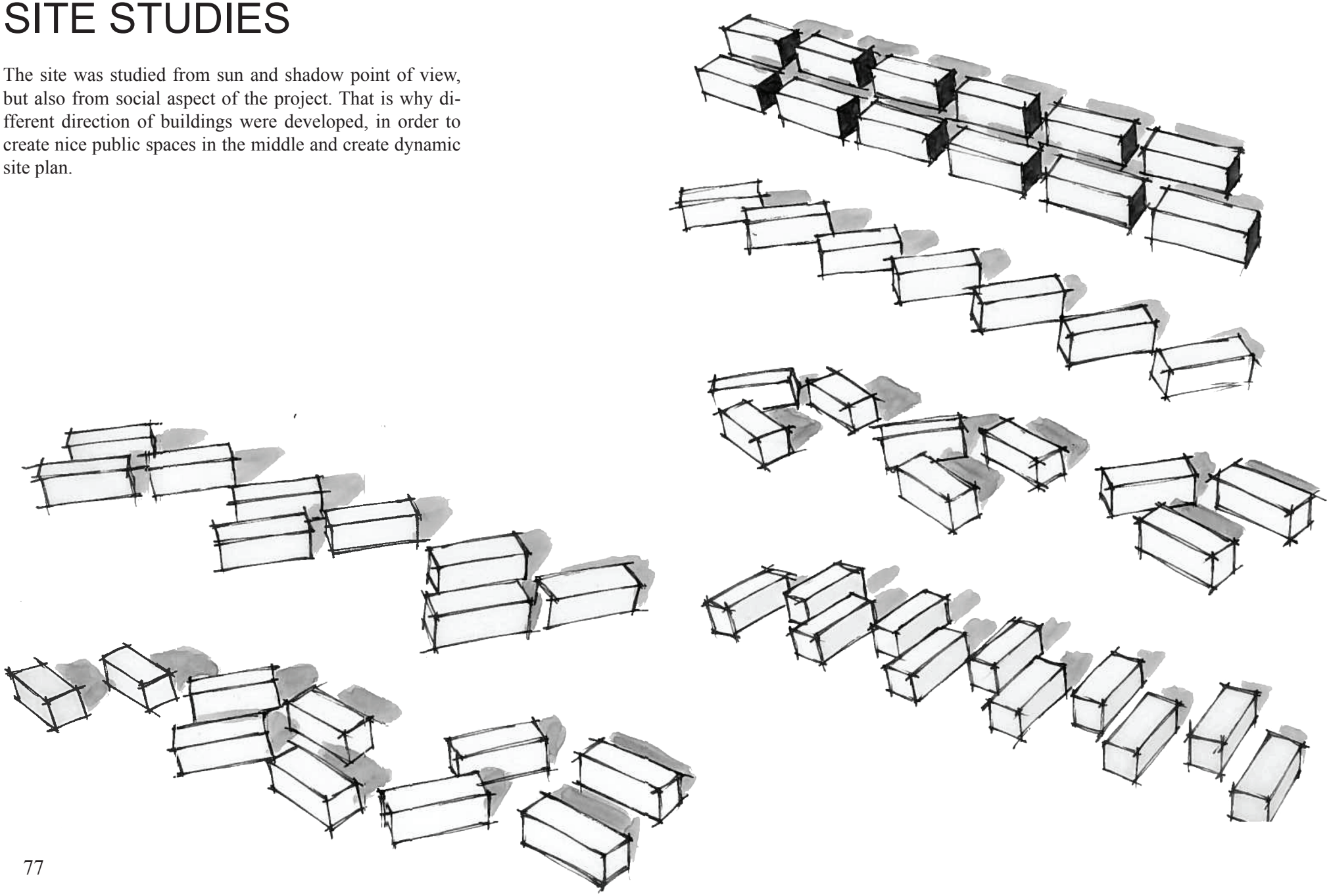






SITE STUDIES

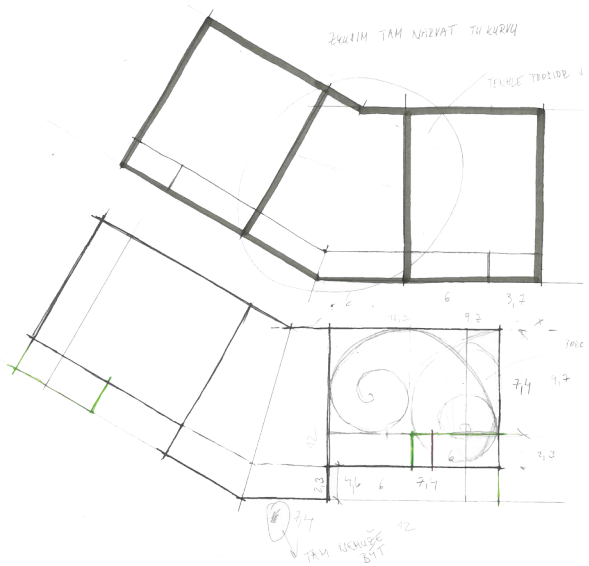
The site was studied from sun and shadow point of view, but also from social aspect of the project. That is why different direction of buildings were developed, in order to create nice public spaces in the middle and create dynamic site plan.

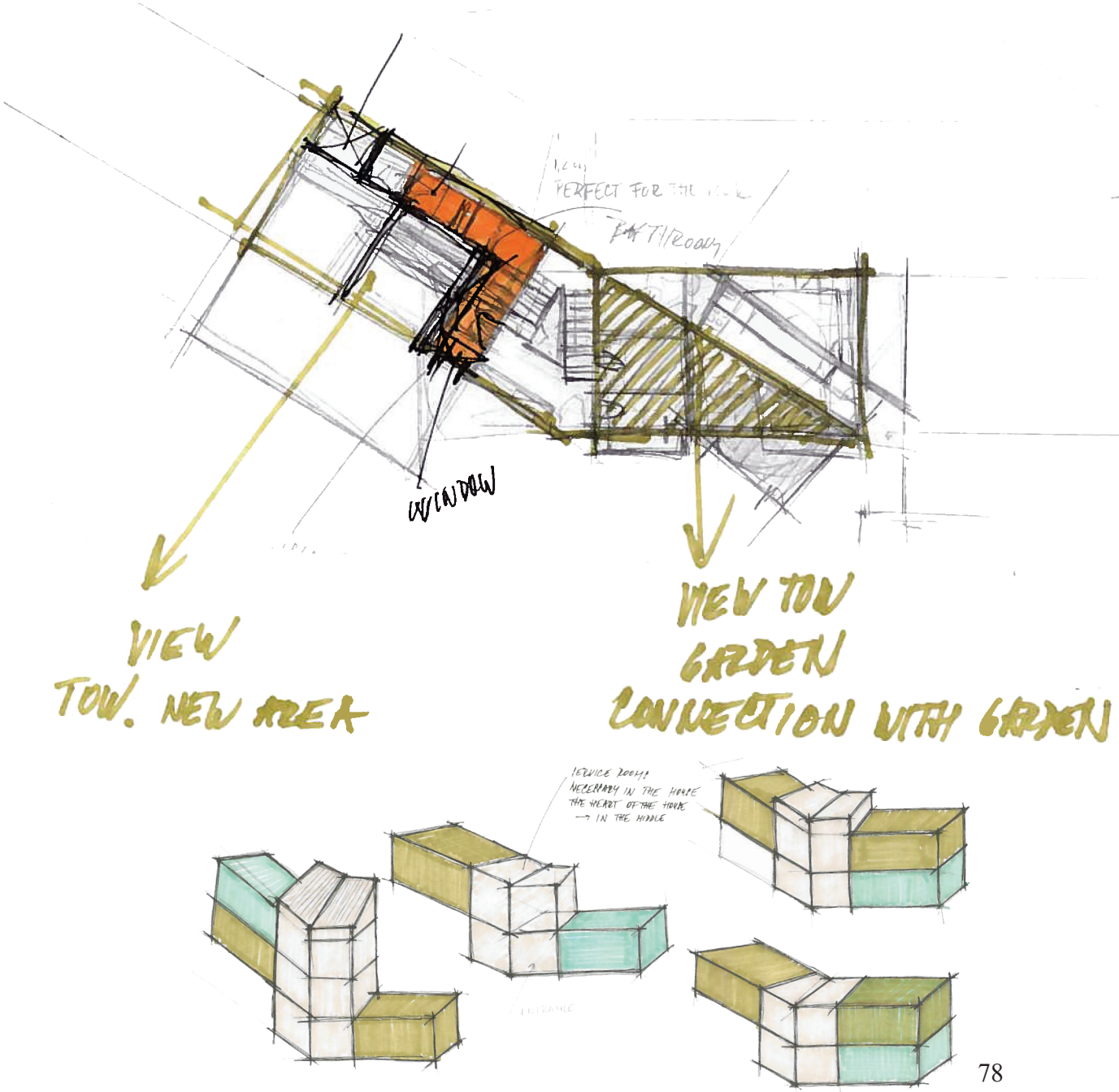


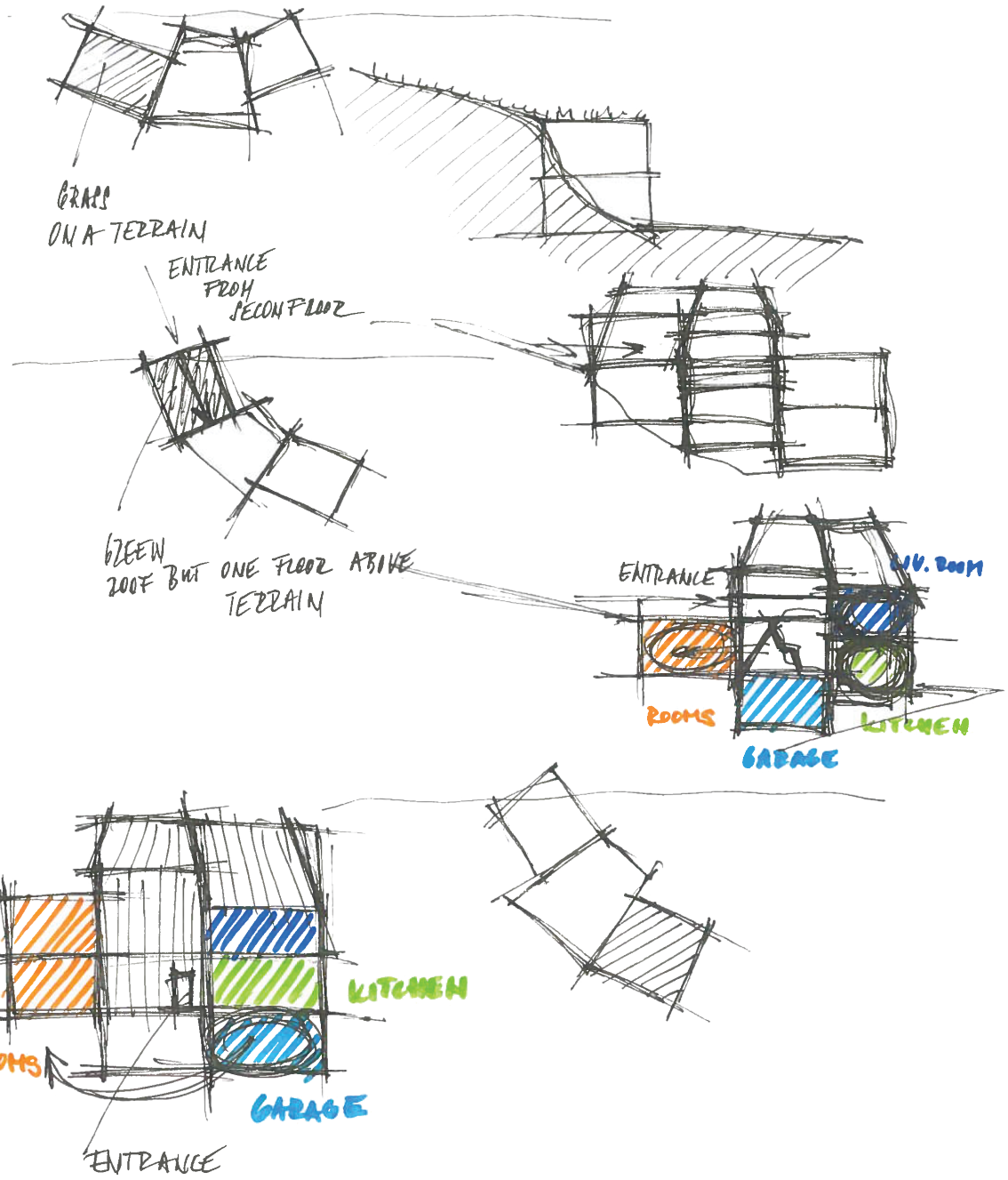
BUILDING FORM

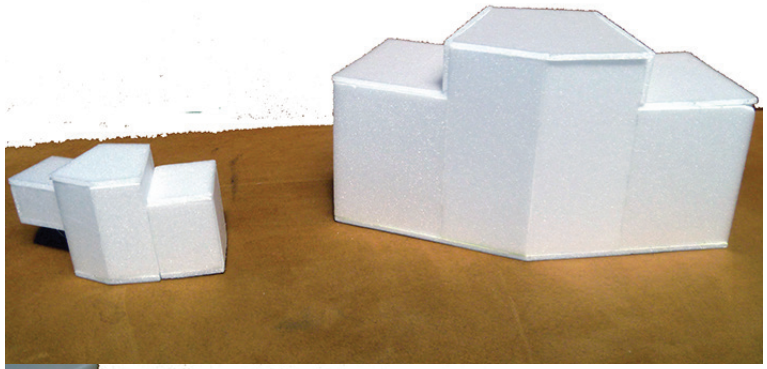
The layout was chosen according to desired directions, connected to view and indoor climate. The façade area was maximised towards south and southwest, to get sunlight in the building till late at the evening.

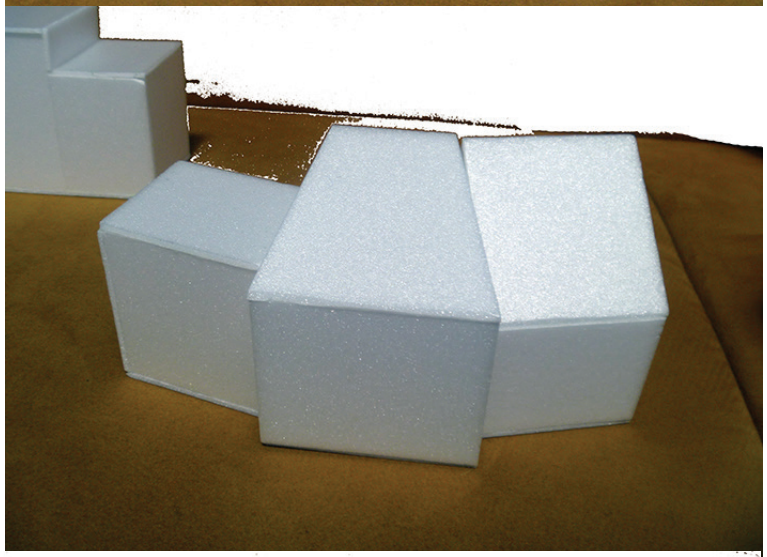
The houses were divided into three parts, the middle being transportation area and connection of other two spaces.

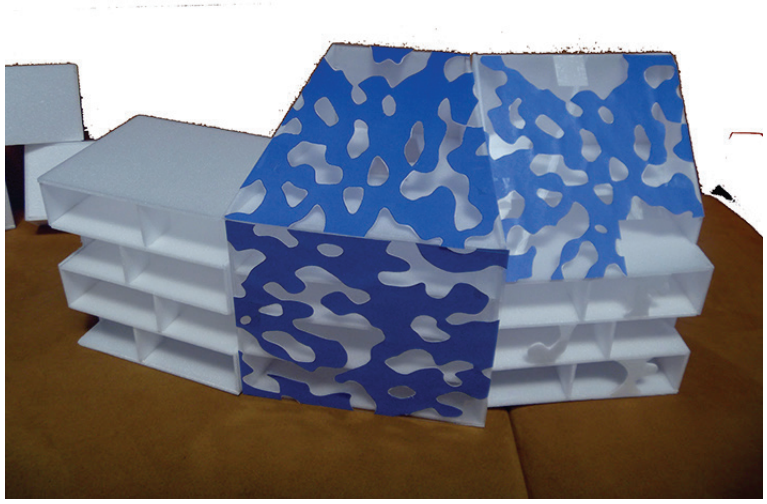





GRASS
ON A TERRAIN
ENTRANCE
FROM
SECOND FLOOR
GREEN
ROOF BUT ONE FLOOR ABOVE
TERRAIN
ENTRANCE
LIV. ROOM
ROOMS
KITCHEN
GARAGE
KITCHEN
ROOMS
GARAGE
ENTRANCE

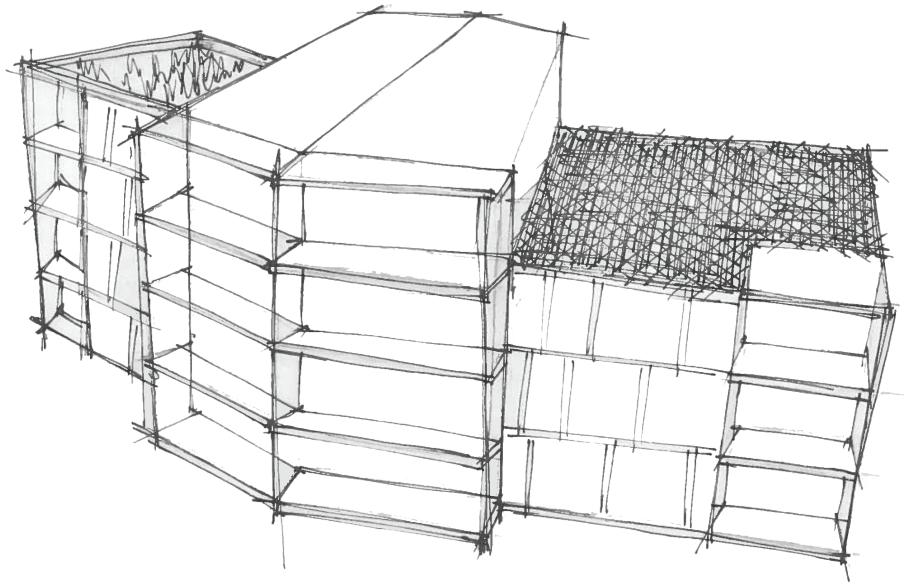






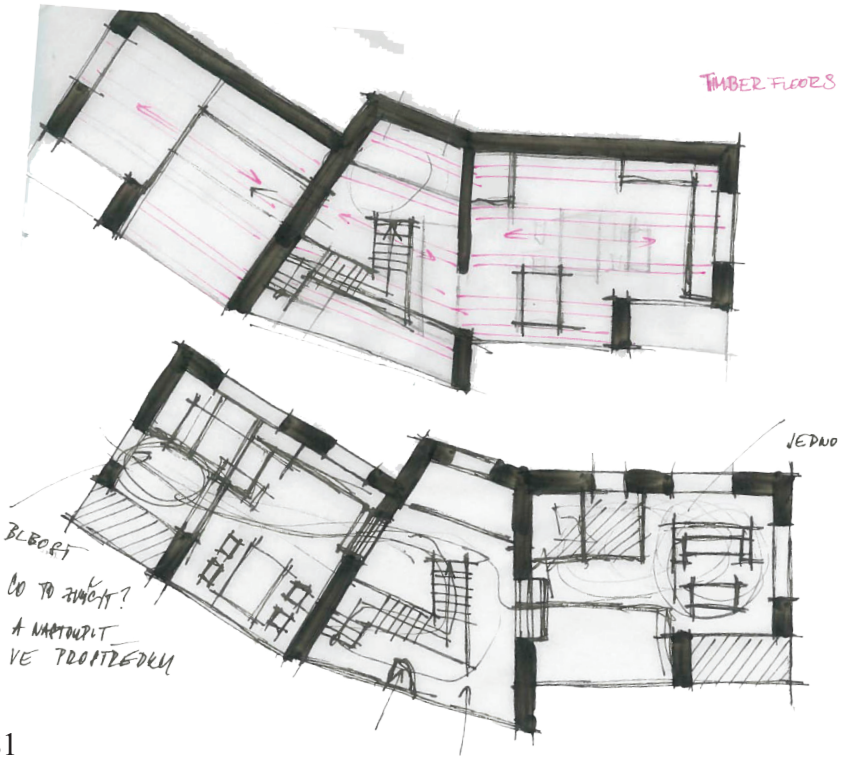
BUILDING SHAPE

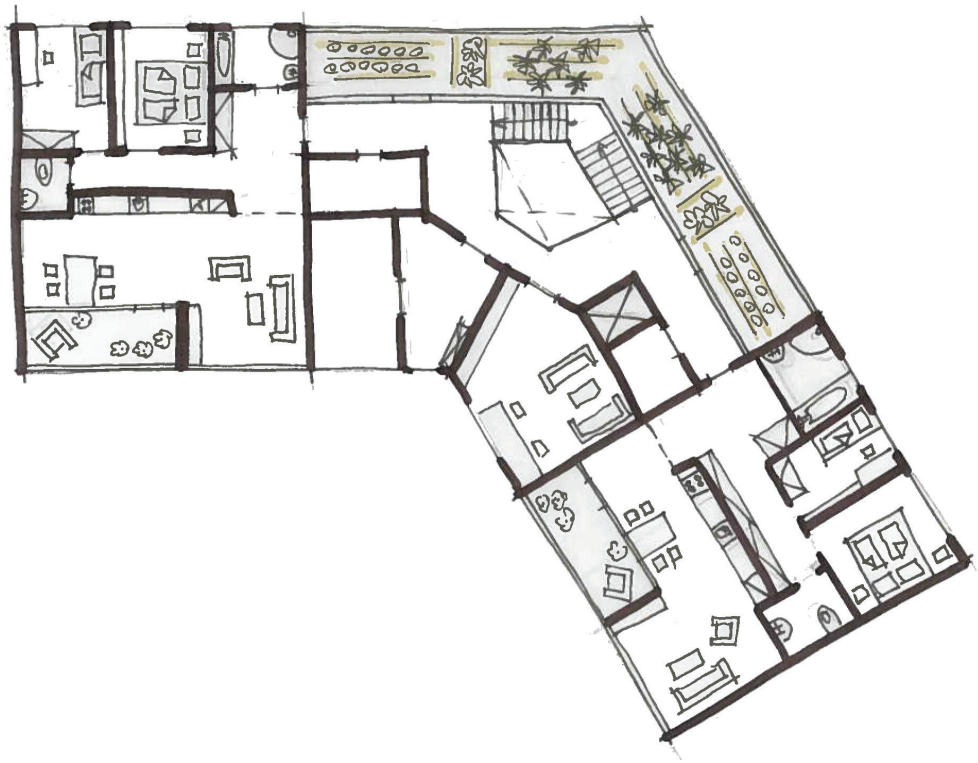
The middle part of the house was designed to connect other two spaces, functionally, and also aesthetically, the middle part share front edge with left part and the back edge with the right part. The right volume has pitched roof with angle 40 degrees which is the best angle for sun panels in Czech Republic, [solarpaneltilt] And the left volume has flat roof, with green space at the top. The middle part has the roof also for solar cells, with angle 23 degrees.

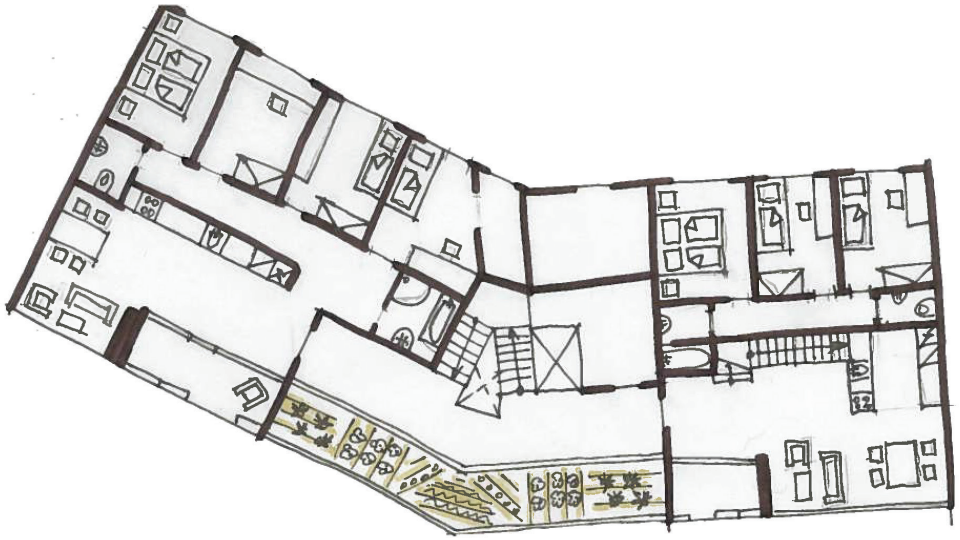


APARTMENTS

While designing apartments the emphasis was put into functionality and daylight. All rooms have to have access to daylight, bathrooms and toilets included. Having in mind the orientation of different rooms, common spaces were put together on south, services and bathrooms at north., with hallway in the middle of the dwelling.
Each apartment was designed with balcony, that is pushed inside the building form, to be able to provide total closure of the balcony space.
In the middle, were the transportation area is, are placed greenhouses on each floor, to provide the community with enough food.







FAMILY HOUSE- INDOOR CLIMATE

Every design of the building was analysed in Daylight Visualizer, to ensure that dwellings will be well lighted, and therefore also save energy for artificial lighting. Apartments were also analysed in BE10 and BSIM program. First was analysed the building with big southern windows, to see if the rooms are getting overheated during the summer. As construction material was chosen wood, because it has the lowest embodied energy. First was analysed the construction with maximum area of windows towards south, but in this case the construction suffers from huge overheating.

Key numbers, kWh/m² year

Energy frame in BR 2010

Without supplement	Supplement for special conditions	Total energy frame
63,9	0,0	63,9
Total energy requirement		73,7

Energy frame low energy buildings 2015

Without supplement	Supplement for special conditions	Total energy frame
36,9	0,0	36,9
Total energy requirement		64,5

Energy frame Buildings 2020

Without supplement	Supplement for special conditions	Total energy frame
20,0	0,0	20,0
Total energy requirement		54,0

Contribution to energy requirement

Heat	45,7
El. for operation of bulding	1,9
Excessive in rooms	23,1

Net requirement

Room heating	34,6
Domestic hot water	0,0
Cooling	0,0

Selected electricity requirements

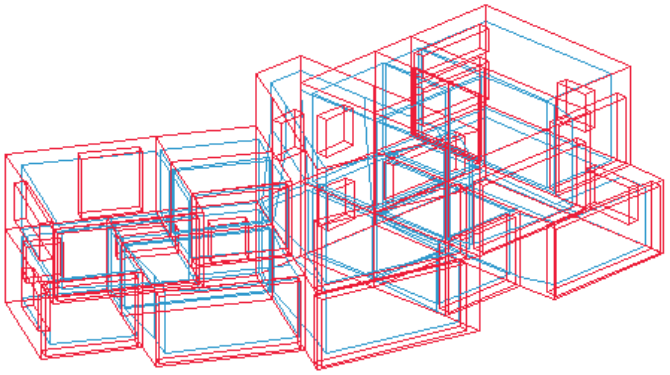
Lighting	84,4
Heating of rooms	0,0
Heating of DHW	0,0
Heat pump	0,0
Ventilators	1,3
Pumps	0,0
Cooling	0,0
Total el. consumption	26,5

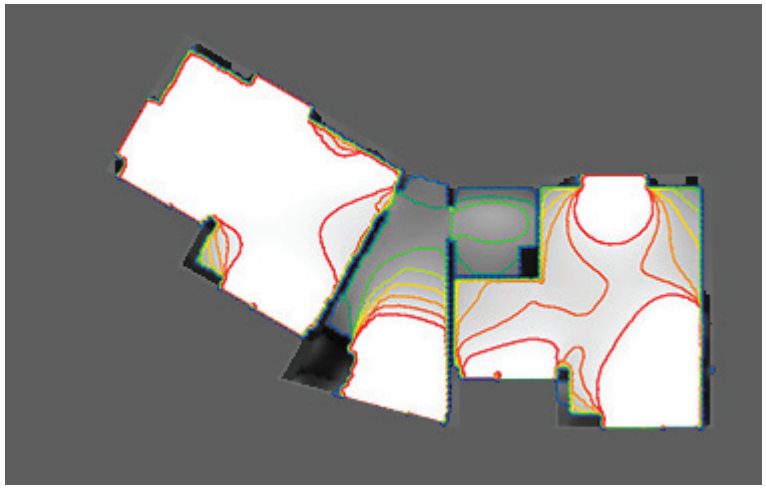
Heat loss from installations

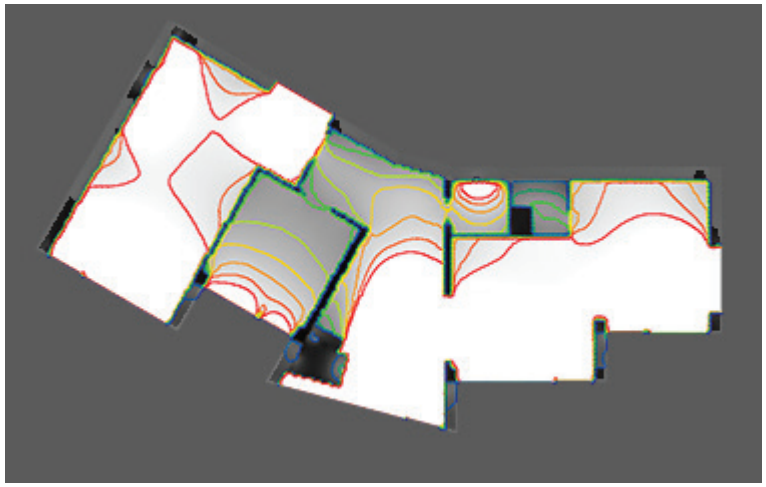
Room heating	11,2
Domestic hot water	0,0

Output from special sources

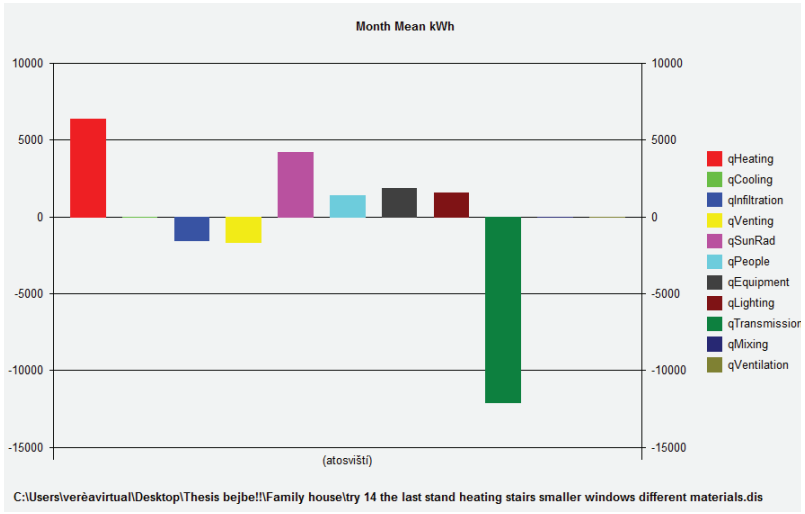
Solar heat	0,0
Heat pump	0,0
Solar cells	0,0
Wind mills	0,0

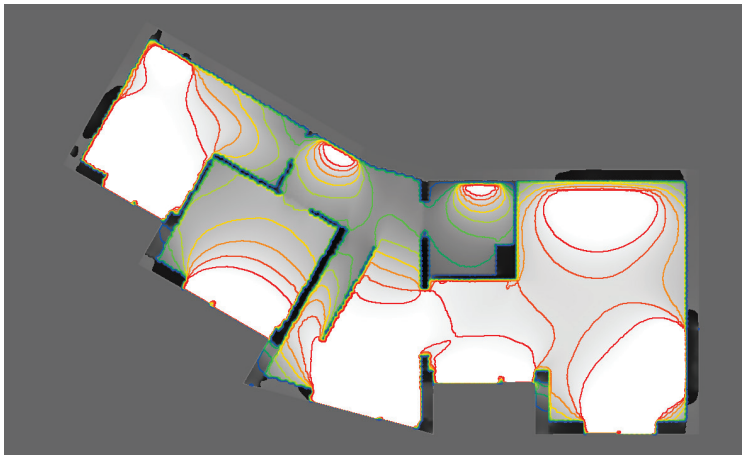


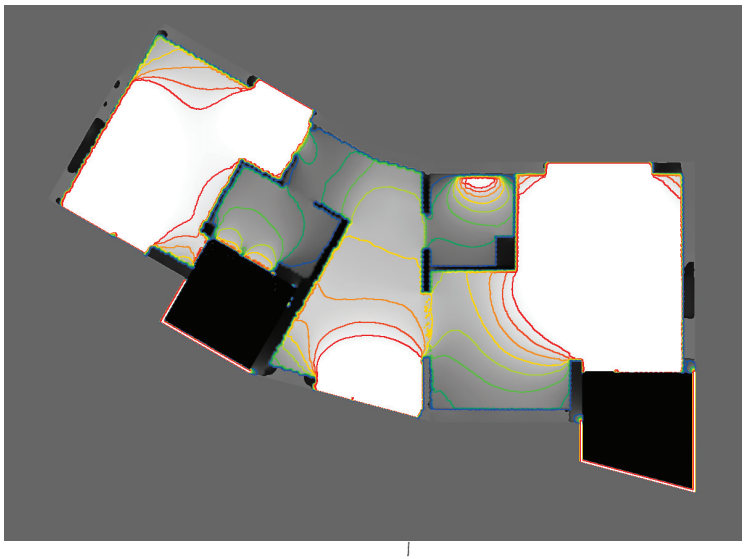


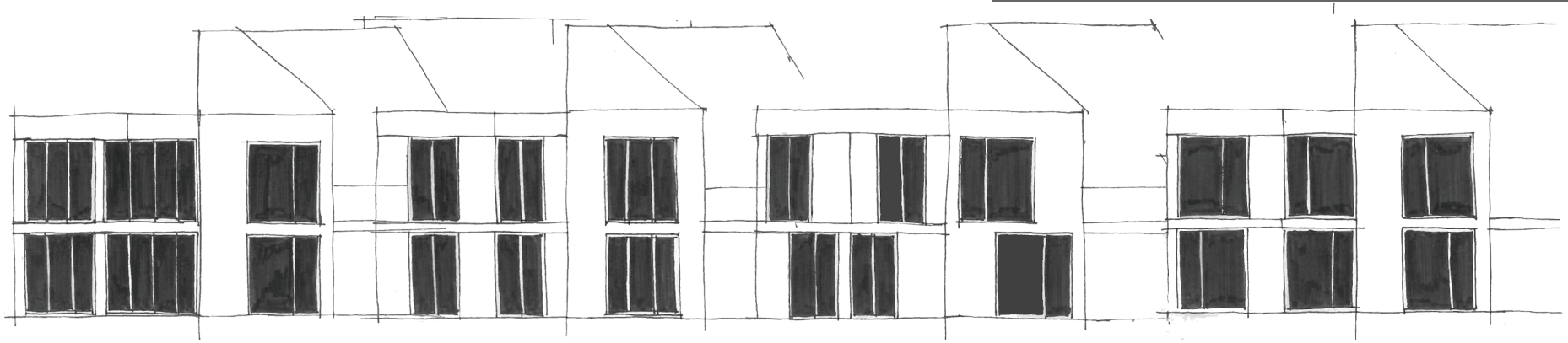


Then the area of the windows towards south was reduced, the overhangs from balconies were introduced. To eliminate any overheating, the material for middle volume was chosen concrete, instead of wood, to provide material with bigger heat accumulation. Now the structure overheats only for maximum 6 hours above 27 degrees during the year. With reduced windows the structure has still good daylight conditions.









As visible from the picture showing the results from BE10 analysis, the construction now fulfils the BR20 requirement. Adding the area of two roofs of solar cells, we get a value less than zero, which fulfils my goal, having zero-energy building.

Key numbers, kWh/m² year

Energy frame in BR 2010

Without supplement	Supplement for special conditions	Total energy frame
63,9	0,0	63,9
Total energy requirement		30,1

Energy frame low energy buildings 2015

Without supplement	Supplement for special conditions	Total energy frame
36,9	0,0	36,9
Total energy requirement		24,9

Energy frame Buildings 2020

Without supplement	Supplement for special conditions	Total energy frame
20,0	0,0	20,0
Total energy requirement		18,6

Contribution to energy requirement

Heat	26,0
El. for operation of bulding	1,7
Excessive in rooms	0,0

Net requirement

Room heating	14,8
Domestic hot water	13,1
Cooling	0,0

Selected electricity requirements

Lighting	84,4
Heating of rooms	0,0
Heating of DHW	0,0
Heat pump	0,0
Ventilators	1,1
Pumps	0,0
Cooling	0,0
Total el. consumption	26,3

Heat loss from installations

Room heating	11,2
Domestic hot water	0,0

Output from special sources

Solar heat	0,0
Heat pump	0,0
Solar cells	0,0
Wind mills	0,0

Key numbers, kWh/m² year

Energy frame in BR 2010

Without supplement	Supplement for special conditions	Total energy frame
63,9	0,0	63,9
Total energy requirement		-1,2

Energy frame low energy buildings 2015

Without supplement	Supplement for special conditions	Total energy frame
36,9	0,0	36,9
Total energy requirement		-6,3

Energy frame Buildings 2020

Without supplement	Supplement for special conditions	Total energy frame
20,0	0,0	20,0
Total energy requirement		-3,9

Contribution to energy requirement

Heat	26,0
El. for operation of bulding	1,7
Excessive in rooms	0,0

Net requirement

Room heating	14,8
Domestic hot water	13,1
Cooling	0,0

Selected electricity requirements

Lighting	84,4
Heating of rooms	0,0
Heating of DHW	0,0
Heat pump	0,0
Ventilators	1,1
Pumps	0,0
Cooling	0,0
Total el. consumption	26,3

Heat loss from installations

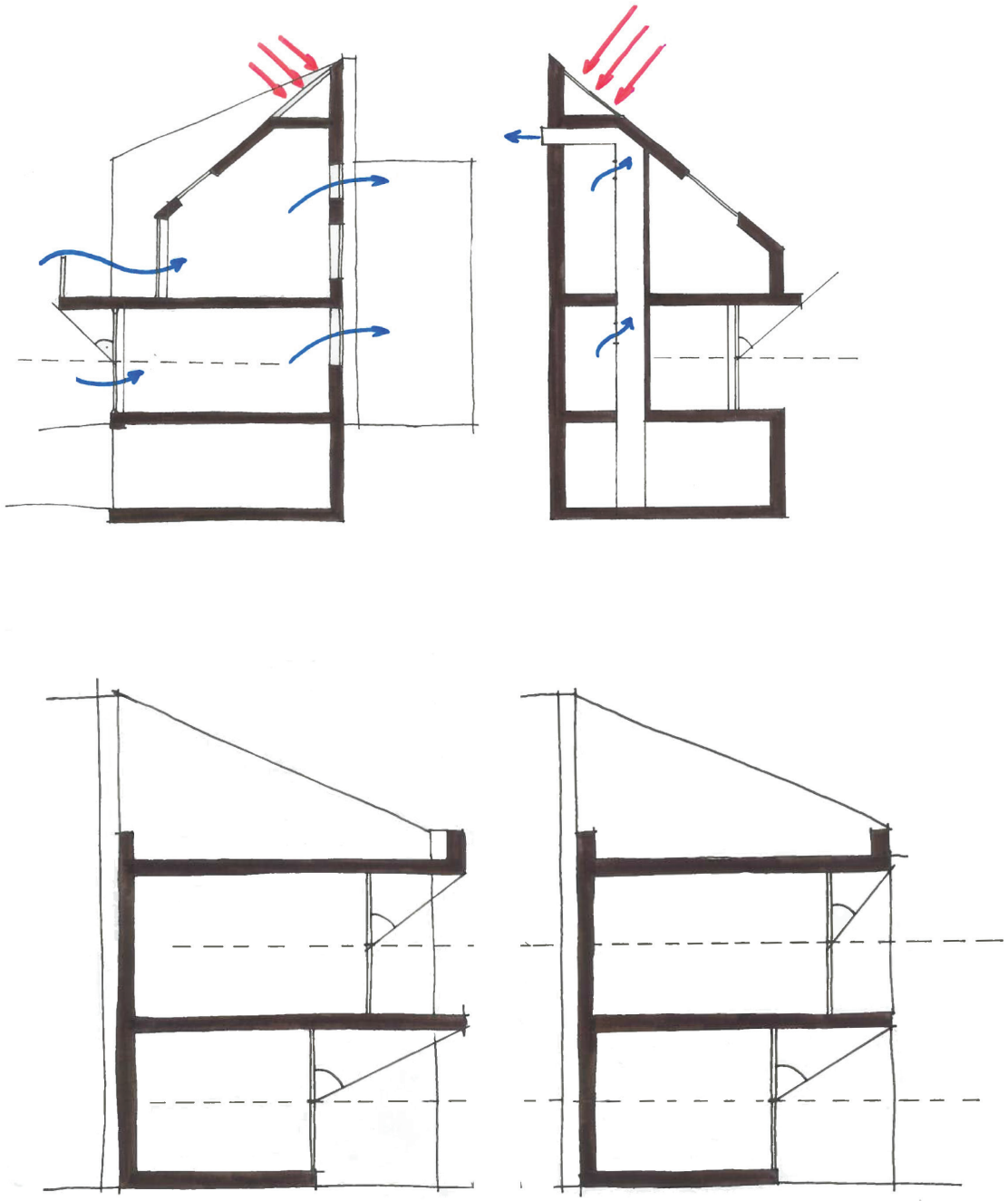
Room heating	11,2
Domestic hot water	0,0

Output from special sources

Solar heat	0,0
Heat pump	0,0
Solar cells	12,5
Wind mills	0,0

Basic consideration about ventilation was done. Cross ventilation through the building is more efficient than single sided. Above rooms in first floor was created sun space with floor as thermal mass for heating the living room under the space.

Different length of overhangs was analysed in BE10, and the one with better characteristic was used.

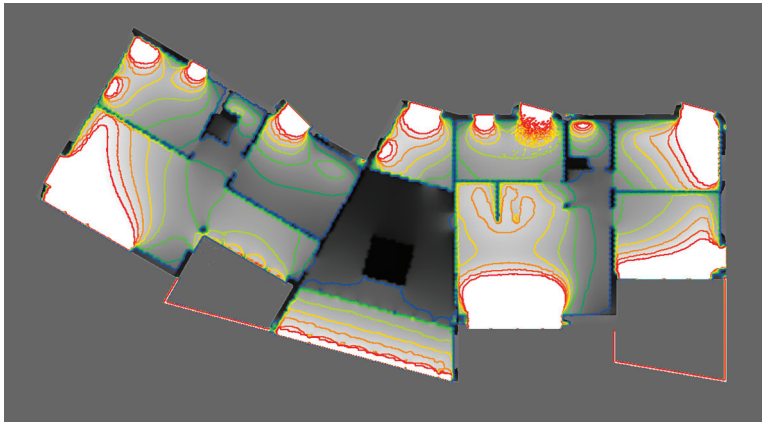


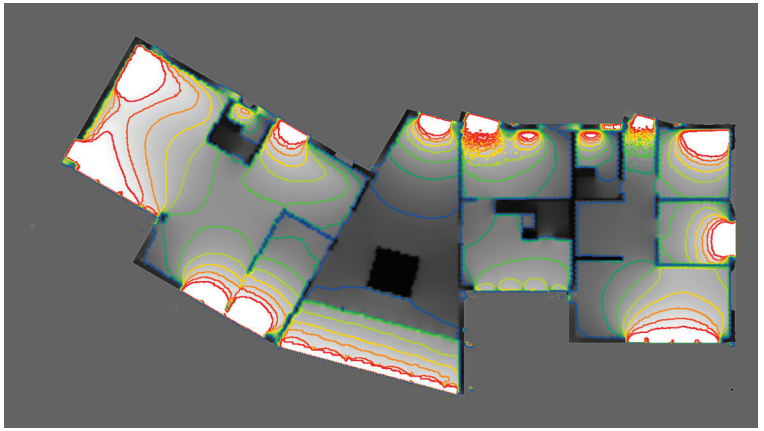
RESIDENTIAL- INDOOR CLIMATE

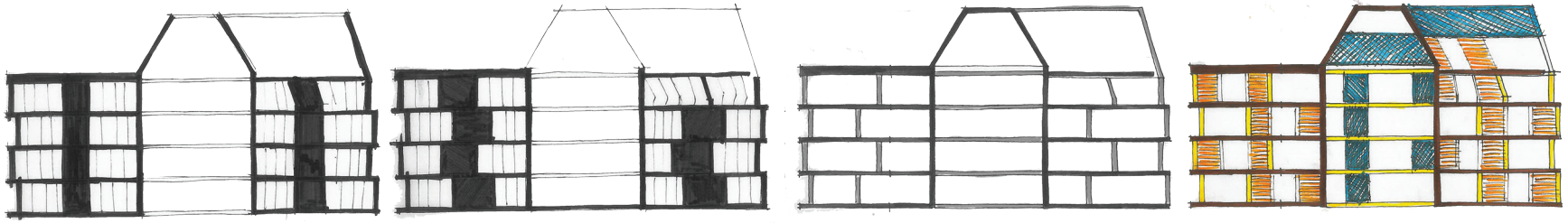
Indoor climate and energy analysis was made also for residential building. The principle of the building is similar as the family house, which are big southern windows with balconies as overhangs. Pitched roof on the middle and right volume was used for solar cells. The middle volume was again designed from concrete, to work as thermal mass for smaller differences of temperature between day and night, and summer and winter.

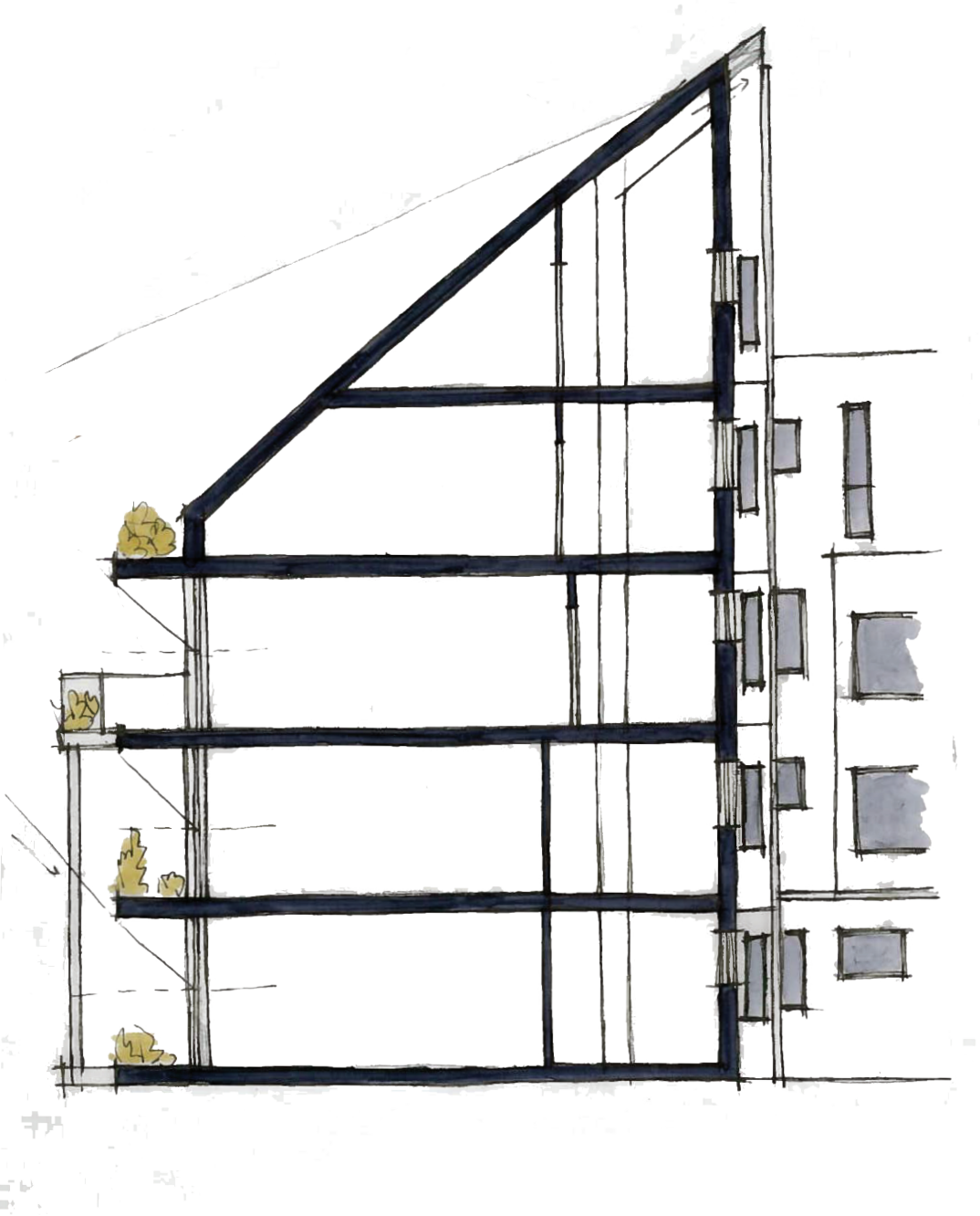
On the balconies were designed green spaces, that have cooling effect and also aesthetic and ecological quality.

On next page are results from BE10 analysis. First is the energy consumption without active systems, the next one calculates also solar panels in designed space on the roof and façade. The building then is zero-energy.WW









Key numbers, kWh/m² year

Energy frame in BR 2010

Without supplement	Supplement for special conditions	Total energy frame
54,3	0,0	54,3
Total energy requirement		25,3

Energy frame low energy buildings 2015

Without supplement	Supplement for special conditions	Total energy frame
31,1	0,0	31,1
Total energy requirement		23,5

Energy frame Buildings 2020

Without supplement	Supplement for special conditions	Total energy frame
20,0	0,0	20,0
Total energy requirement		17,1

Contribution to energy requirement

Heat	9,0
El. for operation of bulding	6,5
Excessive in rooms	0,0

Net requirement

Room heating	8,5
Domestic hot water	17,9
Cooling	0,0

Selected electricity requirements

Lighting	92,2
Heating of rooms	0,0
Heating of DHW	0,1
Heat pump	4,3
Ventilators	2,0
Pumps	0,1
Cooling	0,0
Total el. consumption	34,2

Heat loss from installations

Room heating	0,4
Domestic hot water	4,8

Output from special sources

Solar heat	0,0
Heat pump	17,9
Solar cells	0,0
Wind mills	0,0

Key numbers, kWh/m² year

Energy frame in BR 2010

Without supplement	Supplement for special conditions	Total energy frame
54,3	0,0	54,3
Total energy requirement		0,2

Energy frame low energy buildings 2015

Without supplement	Supplement for special conditions	Total energy frame
31,1	0,0	31,1
Total energy requirement		-1,6

Energy frame Buildings 2020

Without supplement	Supplement for special conditions	Total energy frame
20,0	0,0	20,0
Total energy requirement		-0,9

Contribution to energy requirement

Heat	9,0
El. for operation of bulding	6,5
Excessive in rooms	0,0

Net requirement

Room heating	8,5
Domestic hot water	17,9
Cooling	0,0

Selected electricity requirements

Lighting	92,2
Heating of rooms	0,0
Heating of DHW	0,1
Heat pump	4,3
Ventilators	2,0
Pumps	0,1
Cooling	0,0
Total el. consumption	34,2

Heat loss from installations

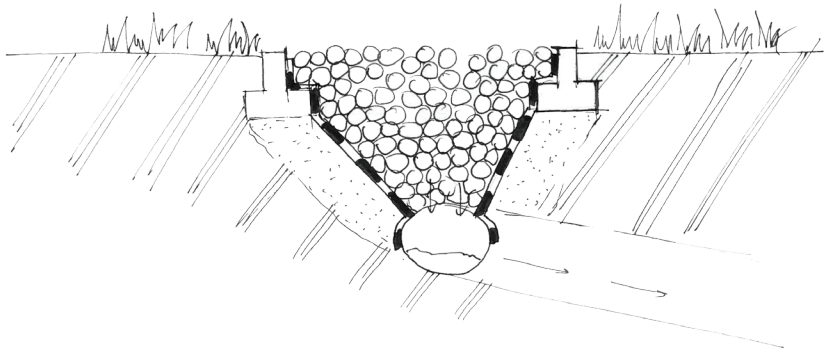
Room heating	0,4
Domestic hot water	4,8

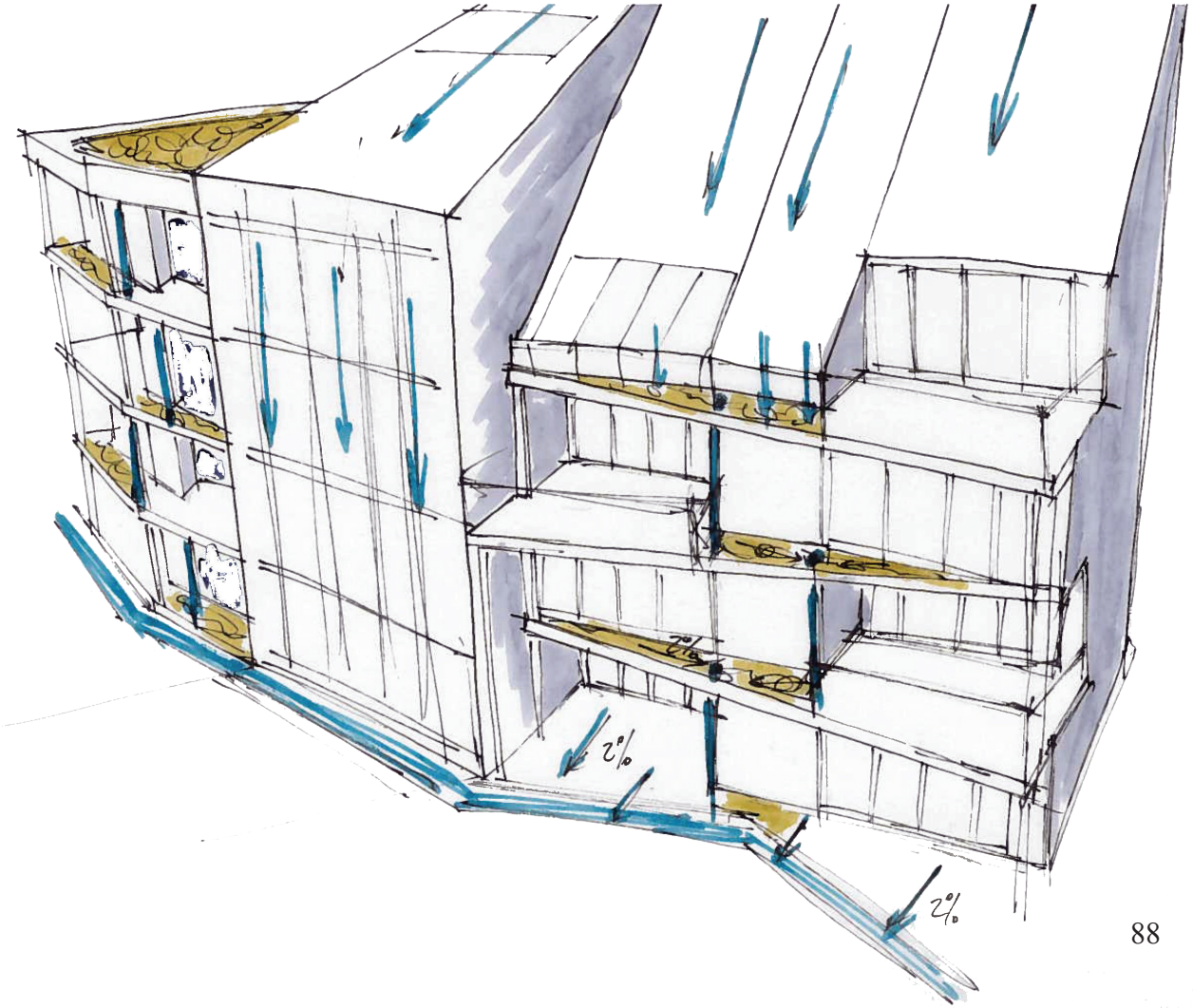
Output from special sources

Solar heat	0,0
Heat pump	17,9
Solar cells	10,0
Wind mills	0,0

RAIN WATER TREATMENT

Having pitched roof with big area, the solution for maintaining water must be found. Under the roof on balconies are green spaces, and since they are under the overhang from the balconies above, they do not get natural irrigation by rain water. Artificial watering would not be very smart and sustainable, so the water falling on pitched roof goes by gravity on the balcony below. There the balcony is sloped by 2% towards the pipe in the middle of green area, as shown on the sketch. The pipe is going down on the next balcony, there the pipe going on the balcony below is moved towards right, and on the floor below left, so the water have to travel through the soil that is on 2% sloped surface, so some amount of water takes the soil and plants, the rest of water goes down one floor below. The water that does not soak into the soil on any floors, travel on ground floor, where the surface is sloped 2% from the building, where the gravel covers pipe that transfers water into basement, where water tank collects it for household reuse in toilets or washing machines.

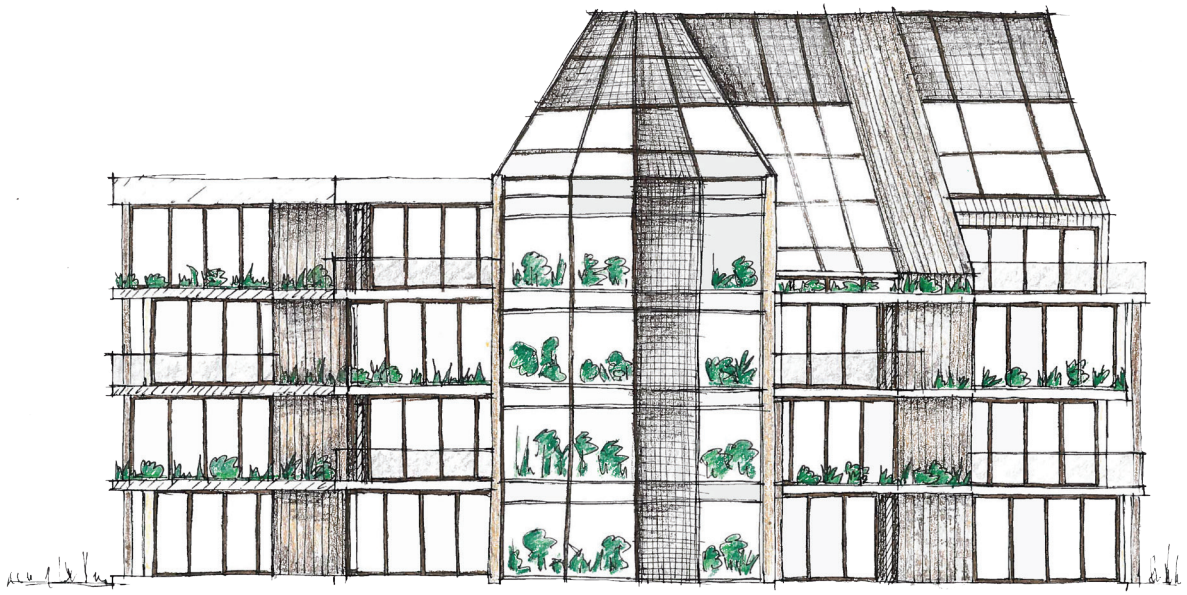


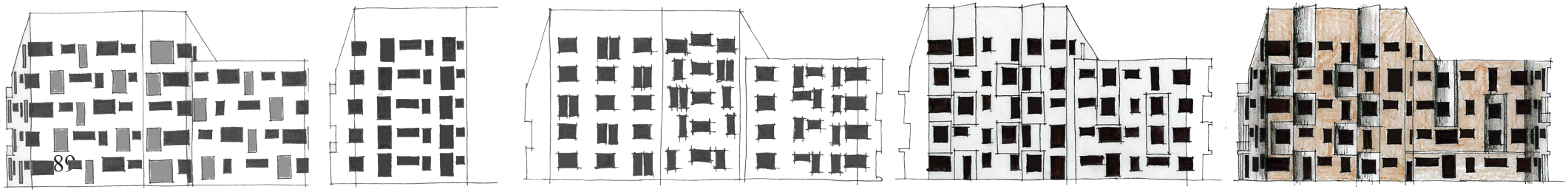


FACADES

The facade facing south is mainly made of glass. The middle volume has the area fully made from double façade, having greenhouse behind. The greenhouse is divided from the hall by glass façade. On the sides of the building the horizontality is the main feature of the façade, made by balconies that are popping out. This horizontality is interrupted by the wooden element, connecting the floors and going up to the roof. Another horizontal element is translucent photovoltaic panels going on the side of the double façade, since the roofs do not provide enough space for solar cells.

Different possibilities for the façade on the back and front of the house were studied, together with different direction of wooden cladding.





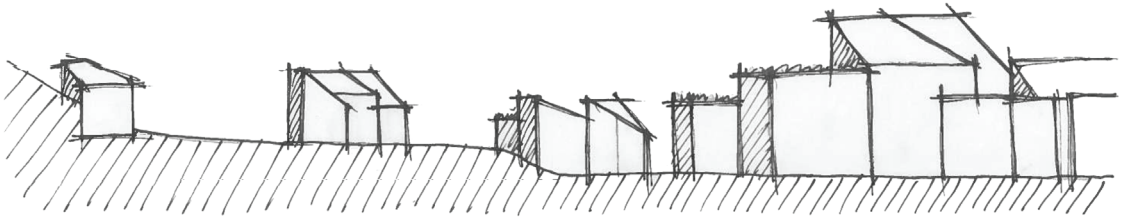
MASTER PLAN

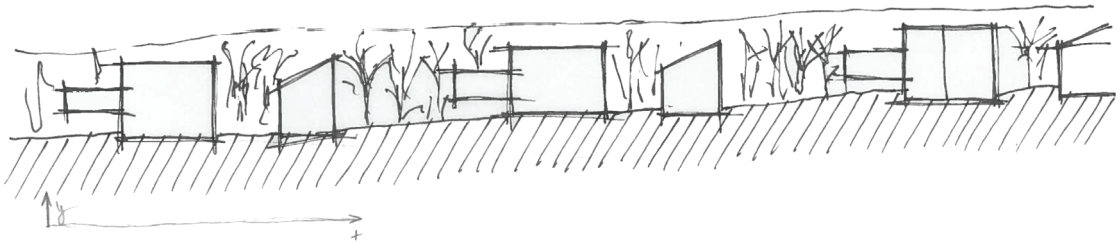
The master plan was divided into three spaces, according to site analysis. The houses mix a bit together, but they mostly rising from north to south.

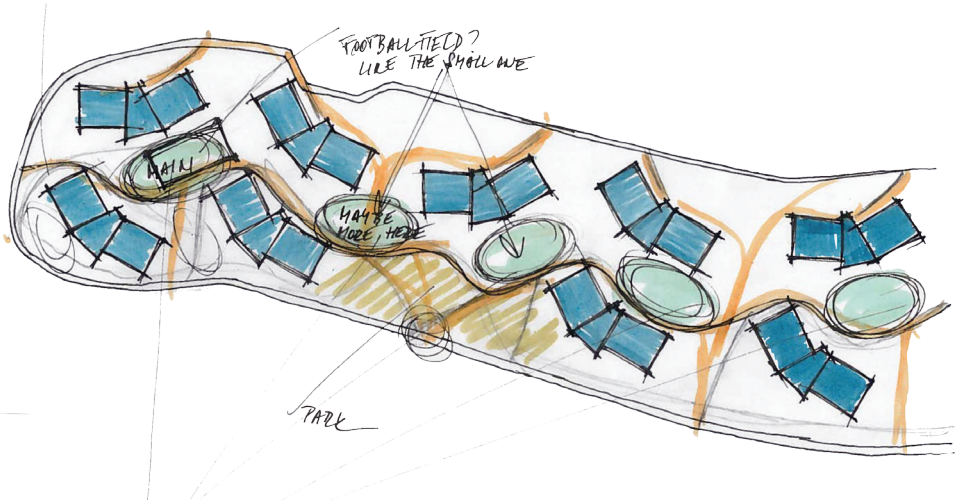
Parking spaces were chosen to be outside, to minimise digging and big changes in landscape. However, family houses have their own parking spaces under the house, profiting from the slope on the site.

On the south of the site was created green barier against the industrial area, with denser green space in the middle.

The main pathways were designed, to connect spaces and make a nice walking experience for a public.

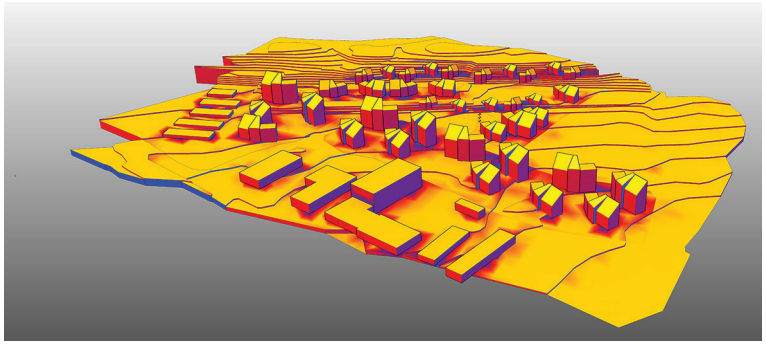


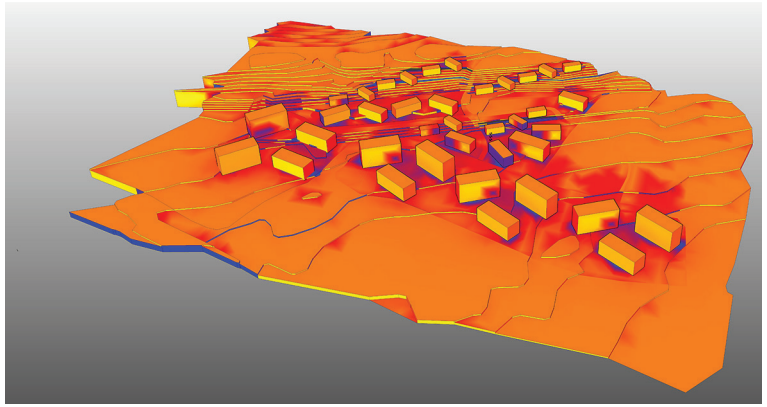


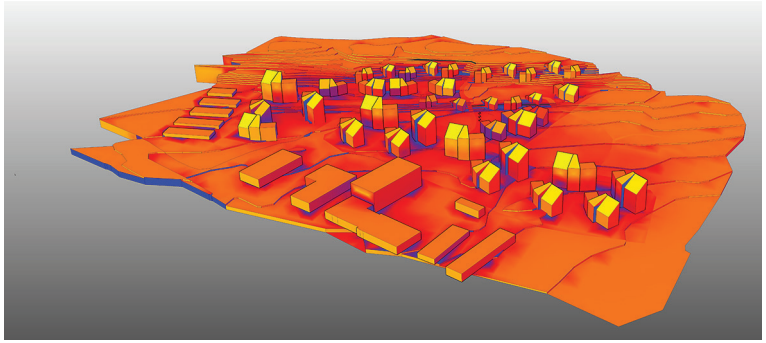


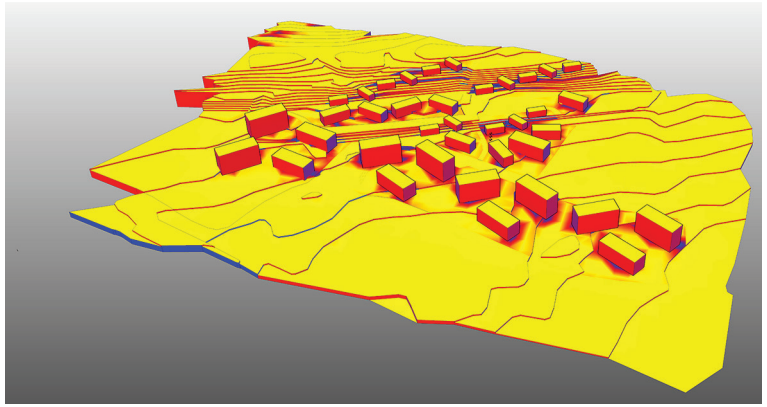
SUN ANALYSIS

The site plan was analysed, and the spaces between houses were optimised to get enough direct sun to each building.







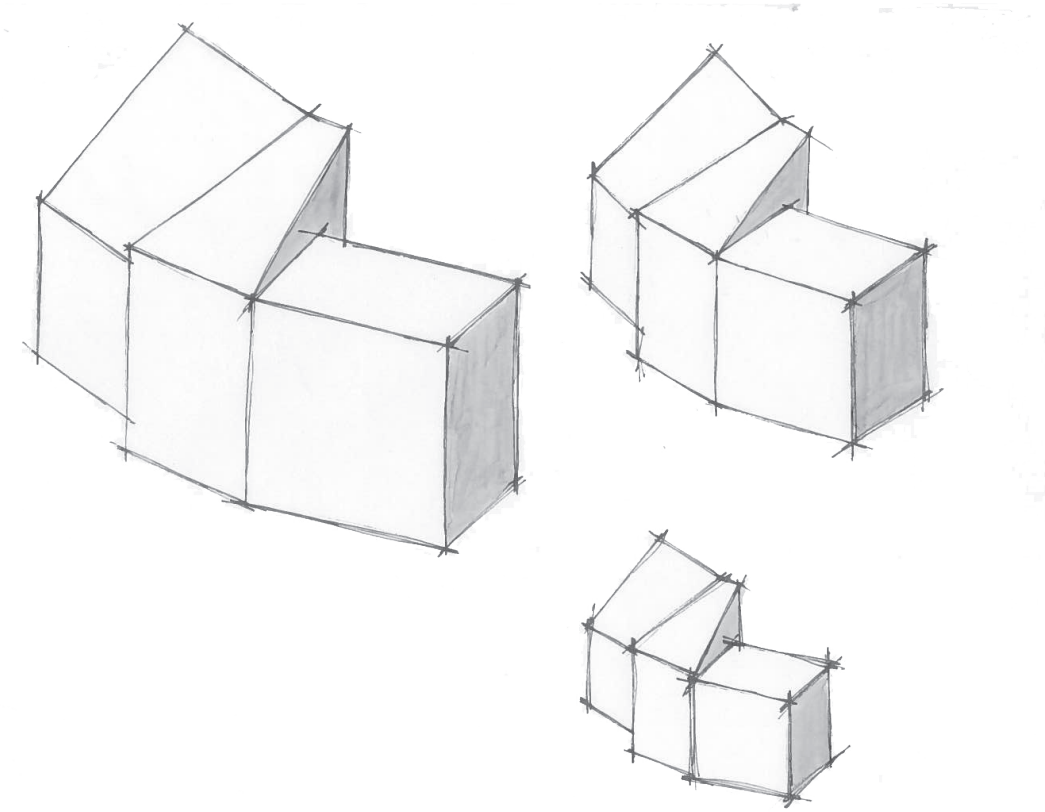


PRESENTATION

SITE PLAN

Building orientation was chosen from two different perspectives. One was to maximise southern area of the facade and use the passive sustainable strategies to its benefit. Buildings like that would share the same orientation and have very similar qualities, but it would be too static and uninteresting, and also it will not challenge people to interact. To show it on the analogy, people will more likely interact between each other, while sitting in the circle and seeing at each other rather than sitting in a row. The same orientation of the buildings would cause anonymity and not realizing the atmosphere of the neighbourhood. The biggest connection within the neighbourhood would be by orientating the houses into the circle, but by having in mind also sustainable part of the design, I have chosen having two different orientations of the buildings, having the distinction of approx. 60 degrees. By that public spaces are designed between the building with different functions. The harmony between having a privacy and view was tried to balance with connection and awareness of other houses and neighbourhood.

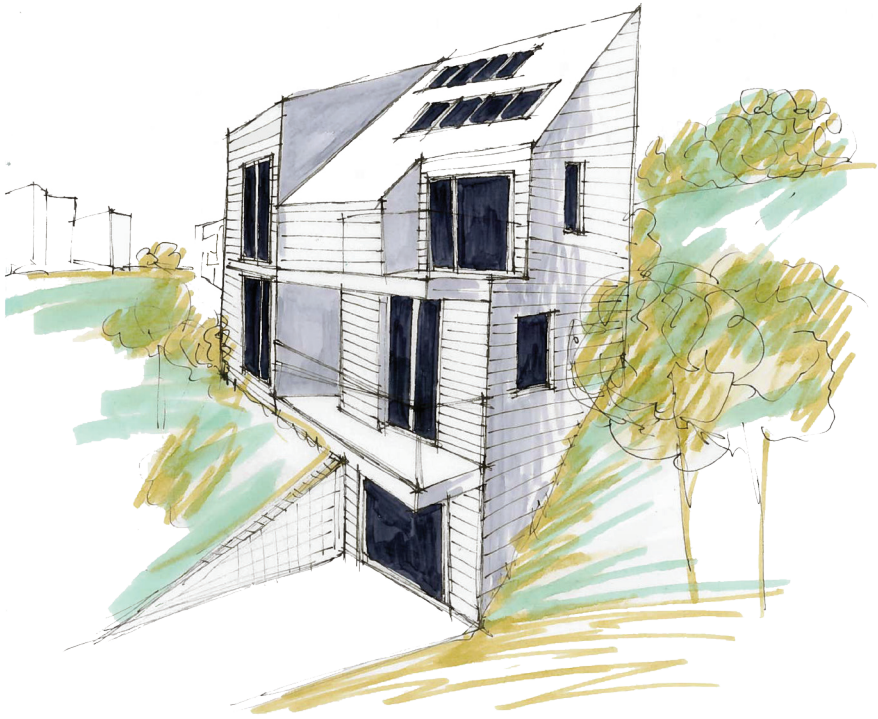
The structure is compact with minimising surface towards north and maximising it towards south. The shape of the building consists of three parts, middle part being the transportation area. All buildings share the same layout, but the scale is different.



FAMILY HOUSE

The smallest houses are family houses for families with two or three children. They have private parking spaces and outside areas. Those houses are situated on the hill, taking the advantage of the slope for parking and integrating into the landscape.

Houses are situated on the site in two different directions. Those houses also differ a bit in the building layout, house, whose main façade is perpendicular to the slope, is smaller, and reacts on slope in different manner than house whose main façade is parallel to the slope.



While entering the house, first we get to the staircase hall, whose part is double high. The hall´s walls and floor are made from concrete, to accumulate heat.

On ground floor is situated kitchen with dining, which is practical, while coming home with groceries. Dining space has access outside, making the extension of dining space possible. This space has windows on both sides, making the cross ventilation possible.

On the other side of the entrance are two bedrooms they also have direct connection to outside areas.

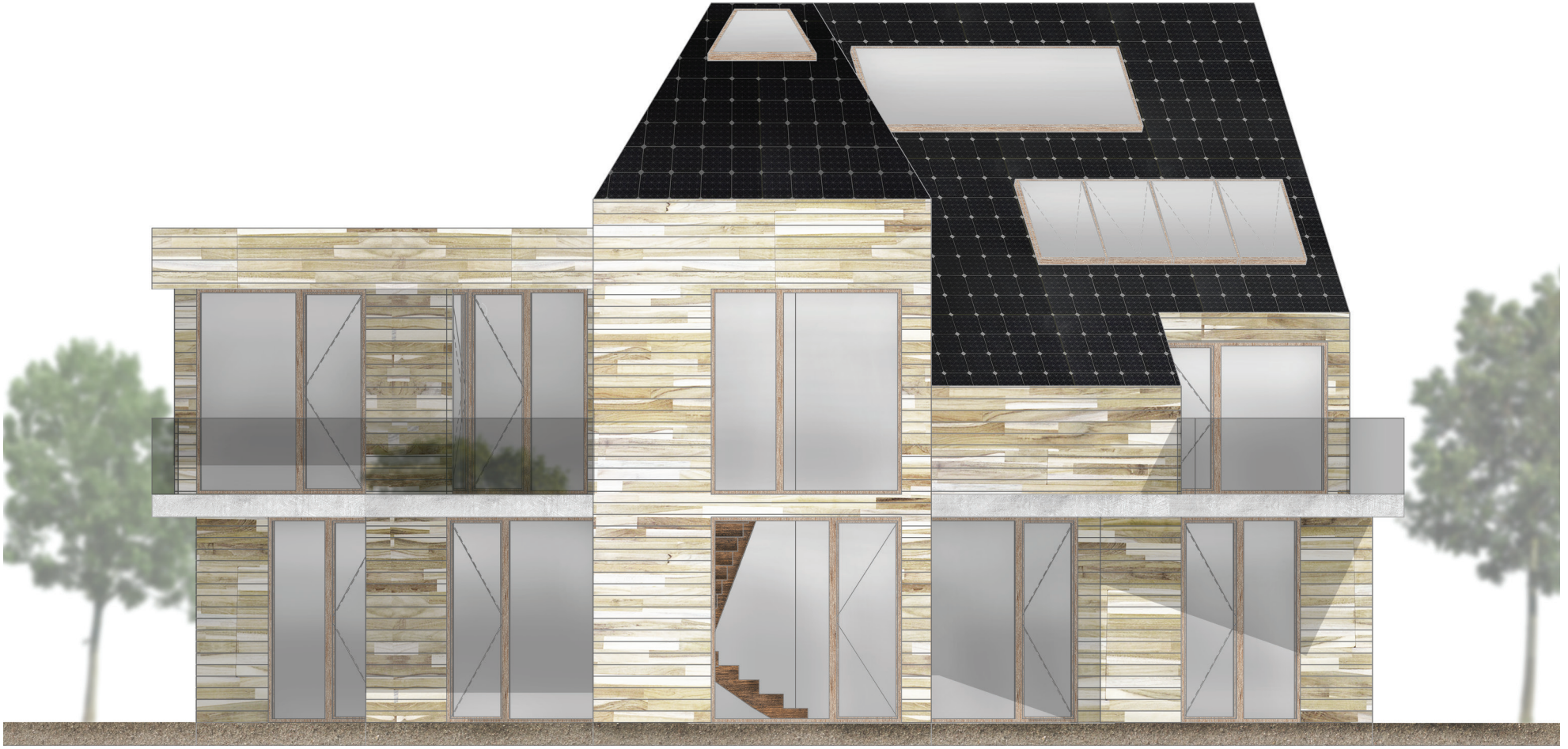
0 1 2m

On first floor is living room. The room is disconnected from kitchen and dining room, because different qualities of spaces were desired. While most important for kitchen was practical accessibility while coming home and the connection with outside, in living room was more important the view outside. Living room faces towards south, respectively southwest, and gets the overall view on the new neighbourhood.

On the left side from the staircase hall is master bedroom and small office. On each floor is bathroom.

Living room and also master bedroom have both accesses towards their balconies, which are also overhangs for the rooms on ground floor. The balcony is partly covered by greenery.


0
1
2m



Family houses are situated at the sloped area next to the park, and the park enters between houses. The vegetation around are local plants that grows wildly, without need of any maintenance. Residents can plant between wild grass and plants vegetable or fruit trees, according to their taste.

The structure is made of wooden beams and columns, with concrete core in the middle. As cladding was chosen reclaimed wood.

MIDDLE HOUSE

The bigger buildings are 1,5 times bigger than the family houses in each direction. They consist of four dwellings with common spaces in the ground floor, which are connected also to family houses. They have three floors, which is one floor more than family houses and one floor less than residential houses. Middle houses accommodate single people or couples, which are intended to be the most involved into the community, so the houses are in the middle between family houses and residential houses.

The design of those houses was just conceptually considered, to show the common spaces and typical floor.

RESIDENTIAL BUILDINGS

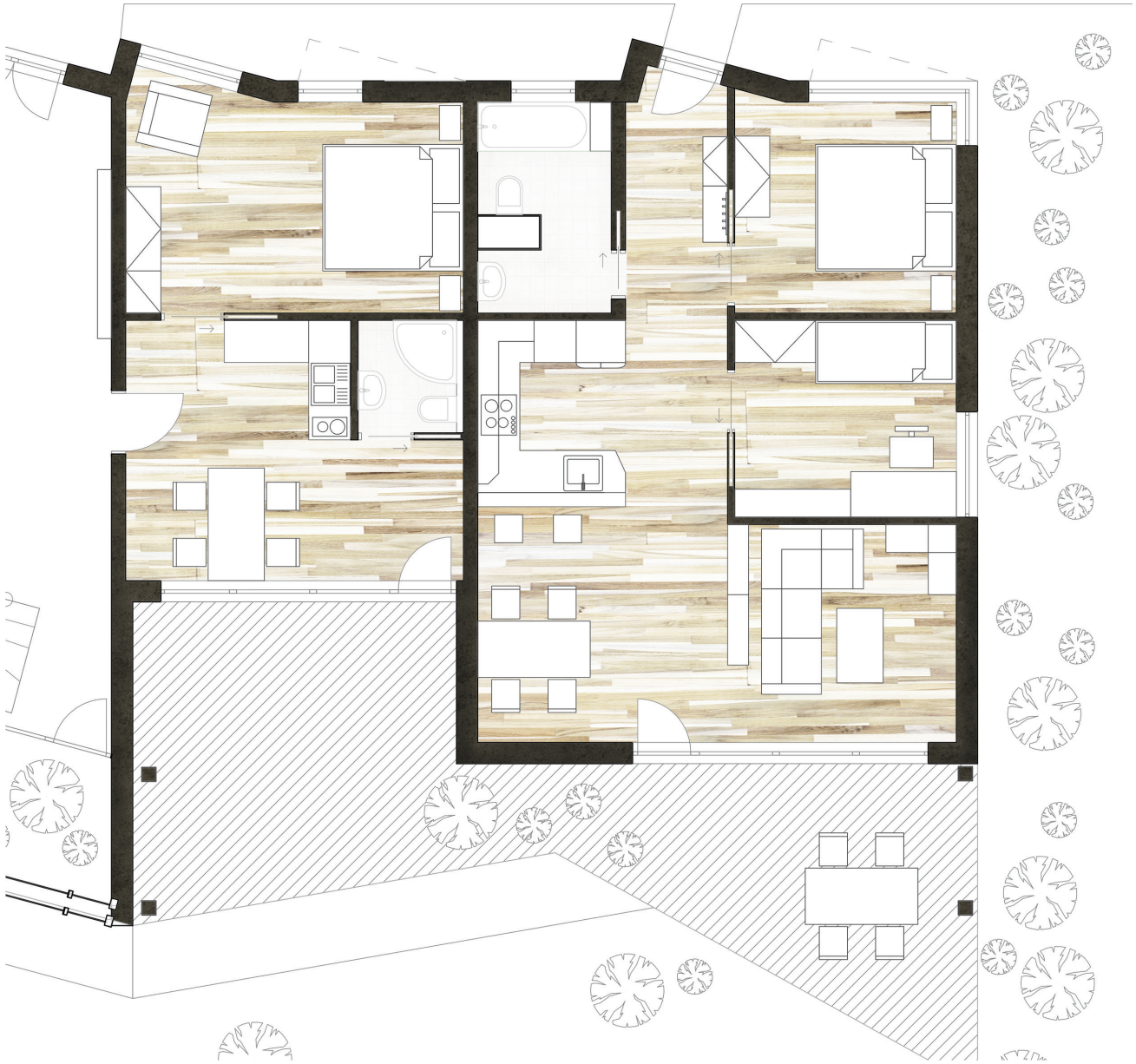
The biggest are residential houses, which are mostly situated on the southern part of the site. The scale of those buildings is twice as big as family houses, while sharing the same concept of layout. The houses consist of eight dwellings, with two smaller apartments and common space at ground floor and six apartments in three floors. In the middle is transportation area, with greenhouses oriented towards south, enclosed by double façade, accessible from the main hallway on each floor.

The entrance to the building is at northern side. Secondary entrance is also at south, with direct connection to the common space.

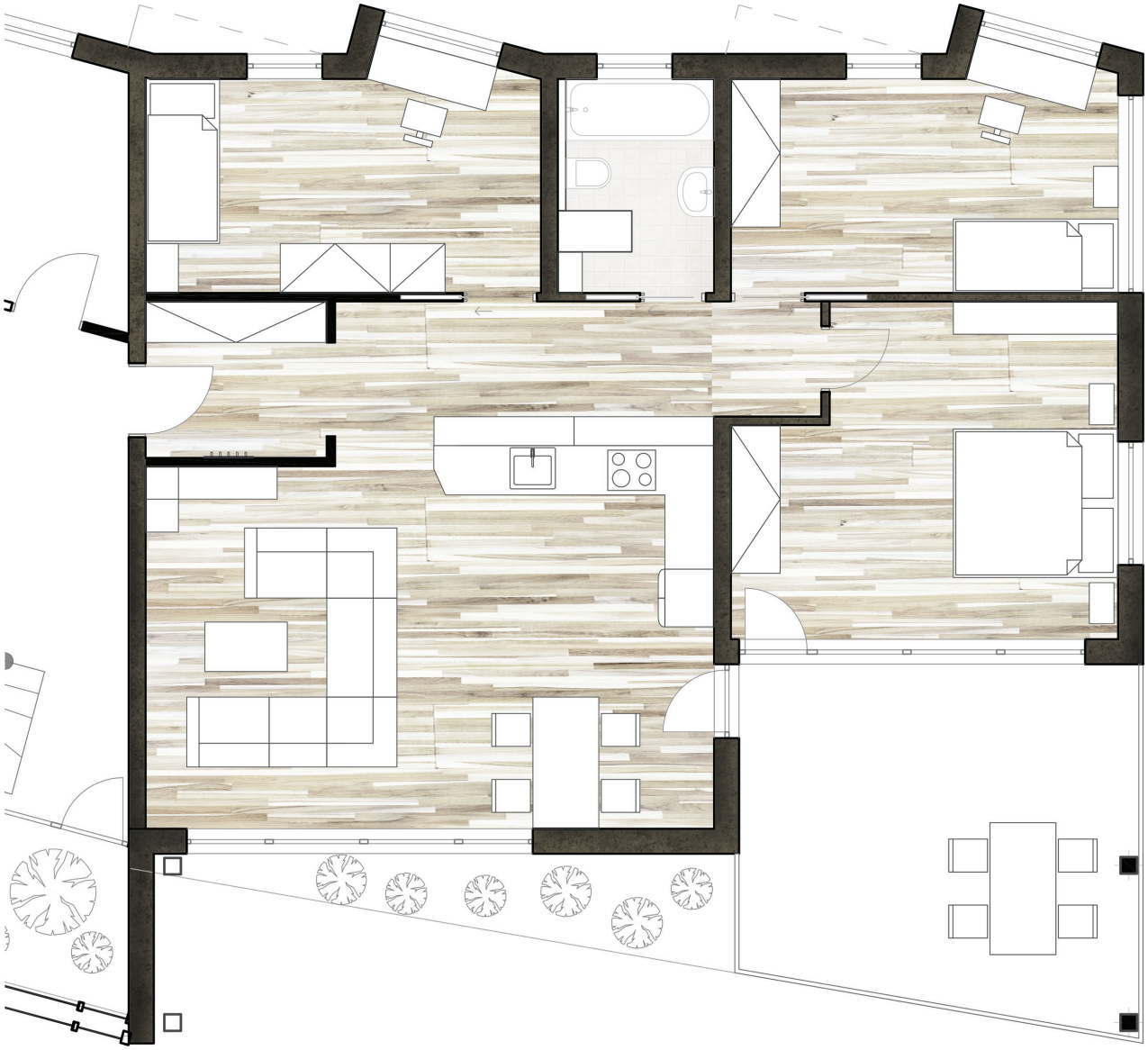
On the site of the entrance is designed covered parking space for bikes.

Common space is designed on half of ground floor, it has kitchen, dining room, and relax area with couches, piano and pool.

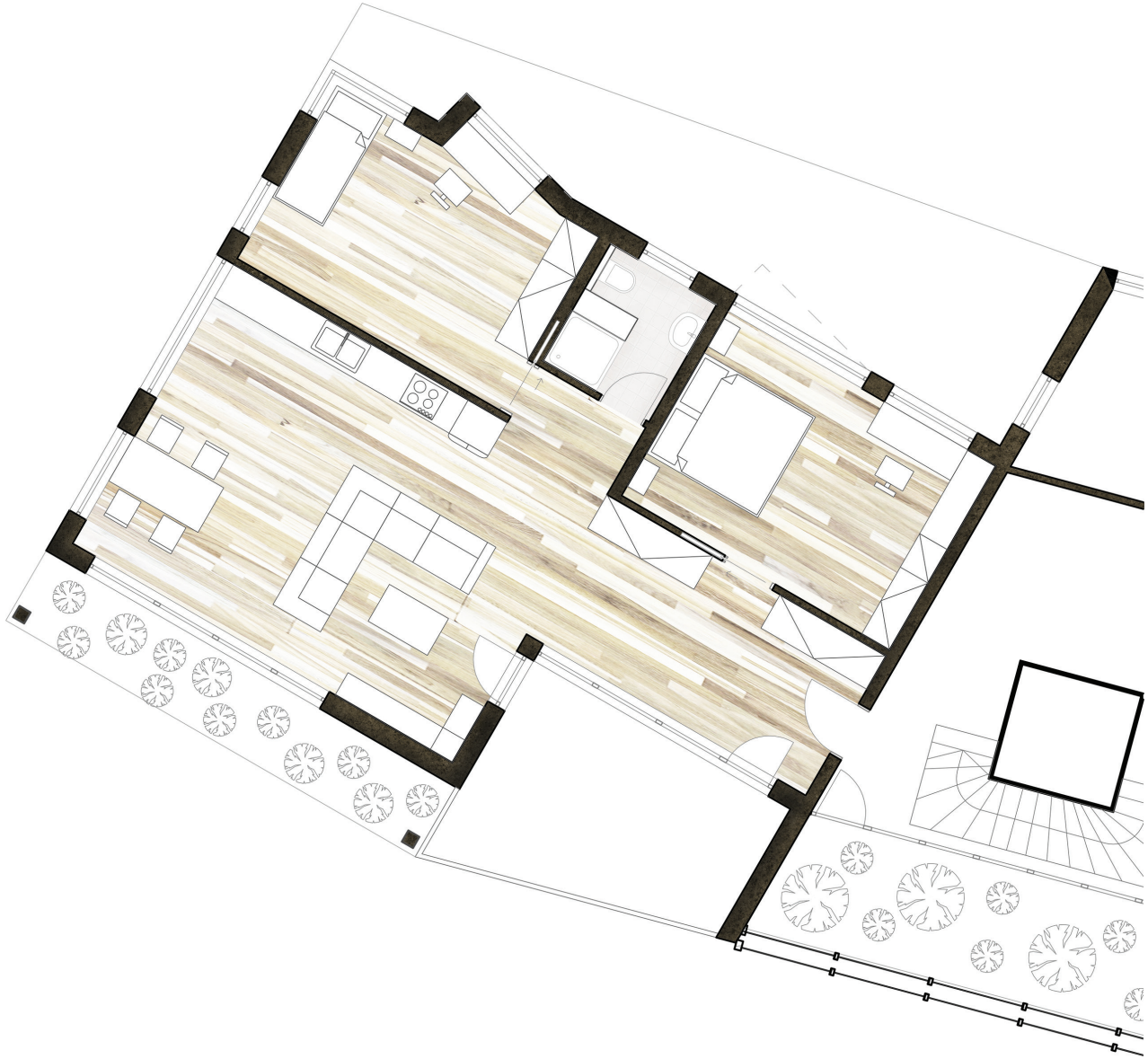
On the other side of ground floor are two small dwellings. One dwelling is accessible from the main hall and is designed as visitor room for residents' visitors, but could be rented by single person or couple. Next to it is dwelling with two bedrooms, accessible from the path outside.



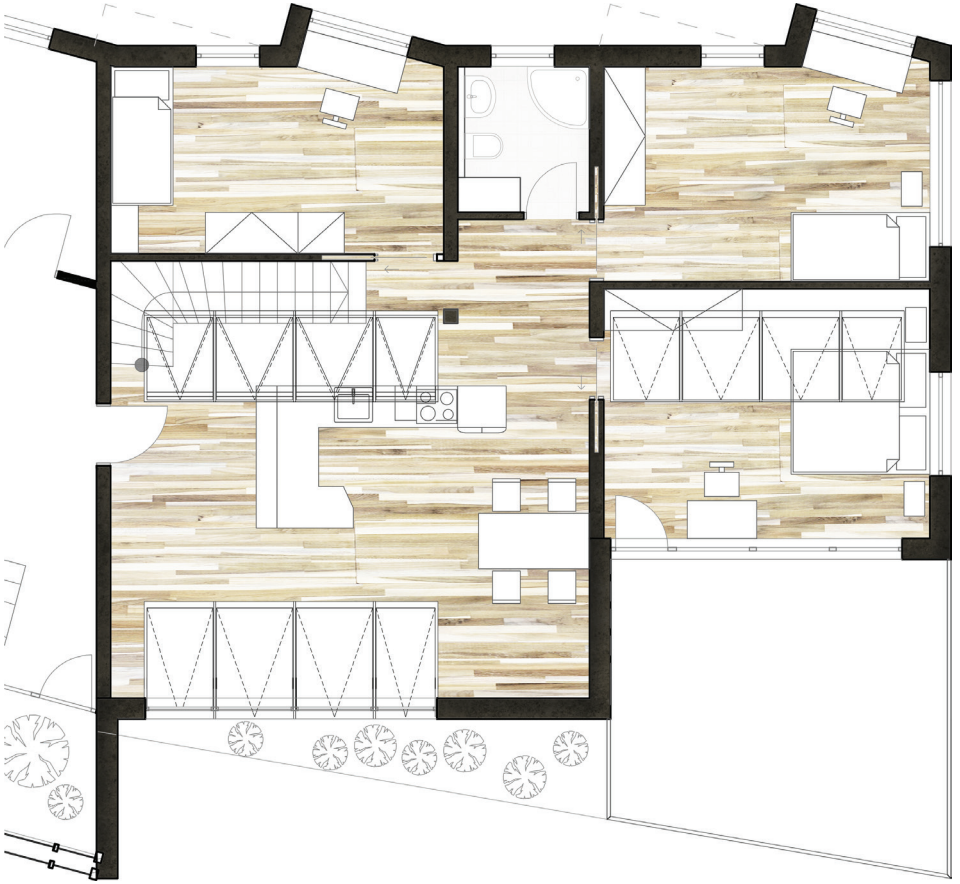
On the right side from the hallway are bigger apartments, with area approximately 100 m2. They have two or three bedrooms, and big common rooms that are connected as one big space.

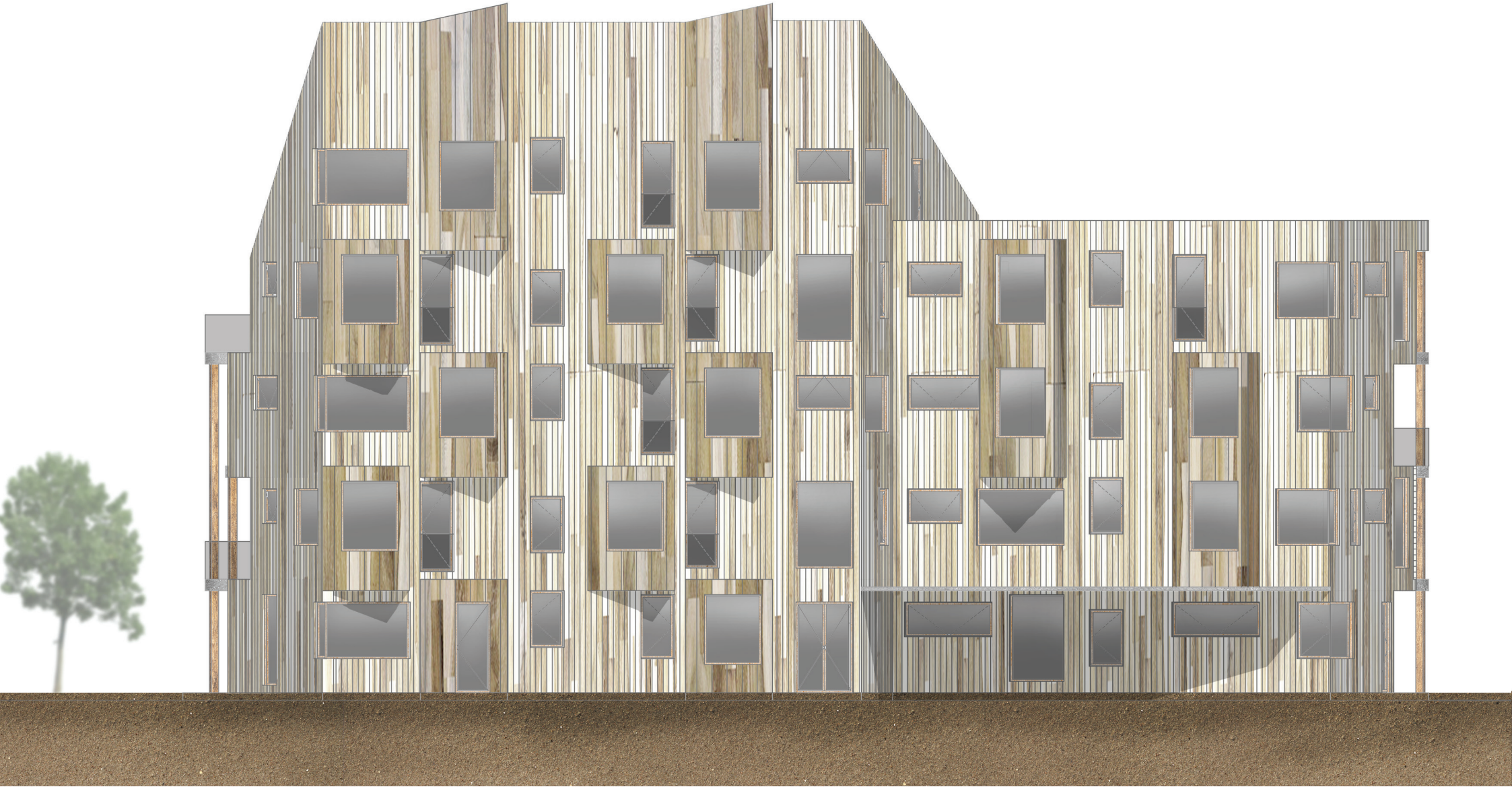


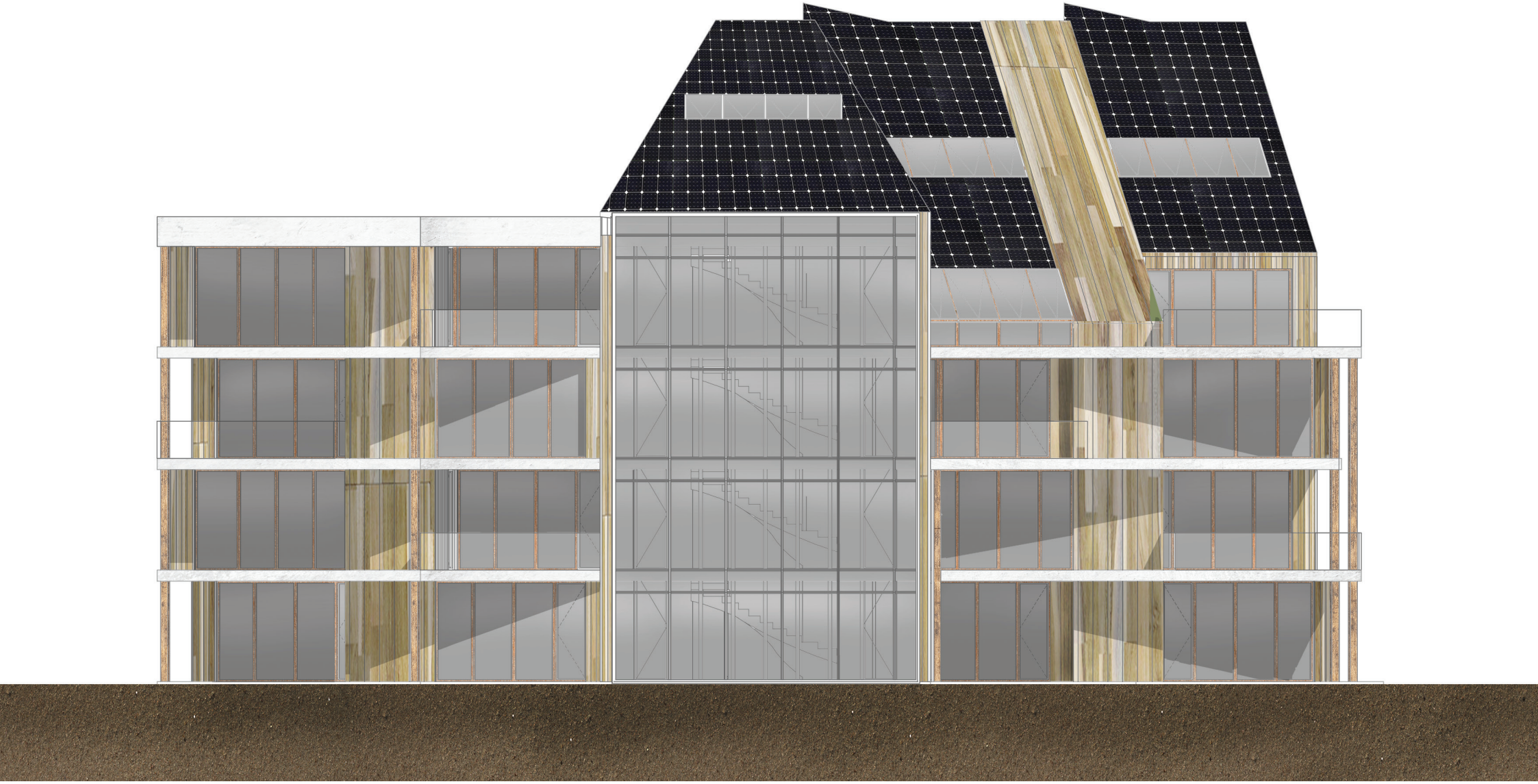
On the left side of the hallway the dwellings are a bit smaller, having usually two rooms facing northeast and also with big common open area.



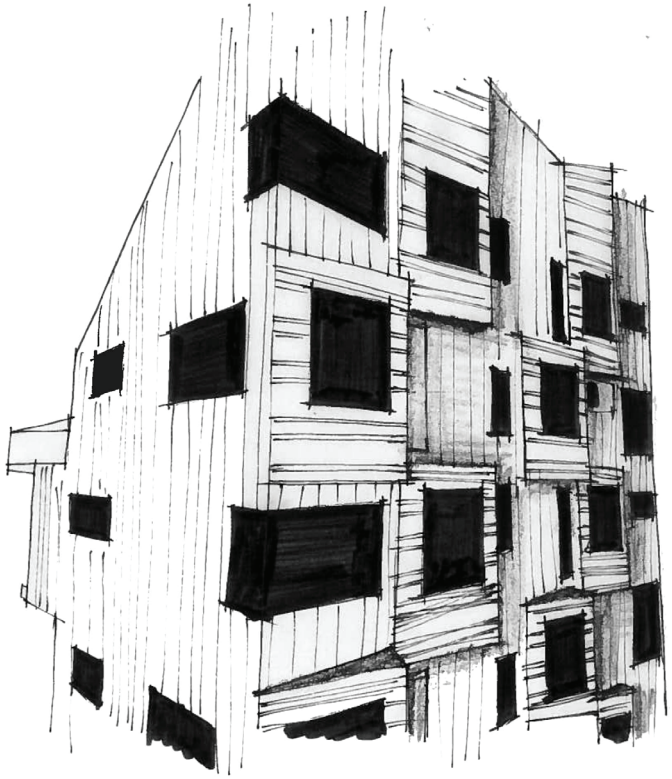
On the last floor, at the volume where the roof is pitched, is big apartment on two floors, it has four rooms, with one room and living room at the top floor, to provide better view outside. .

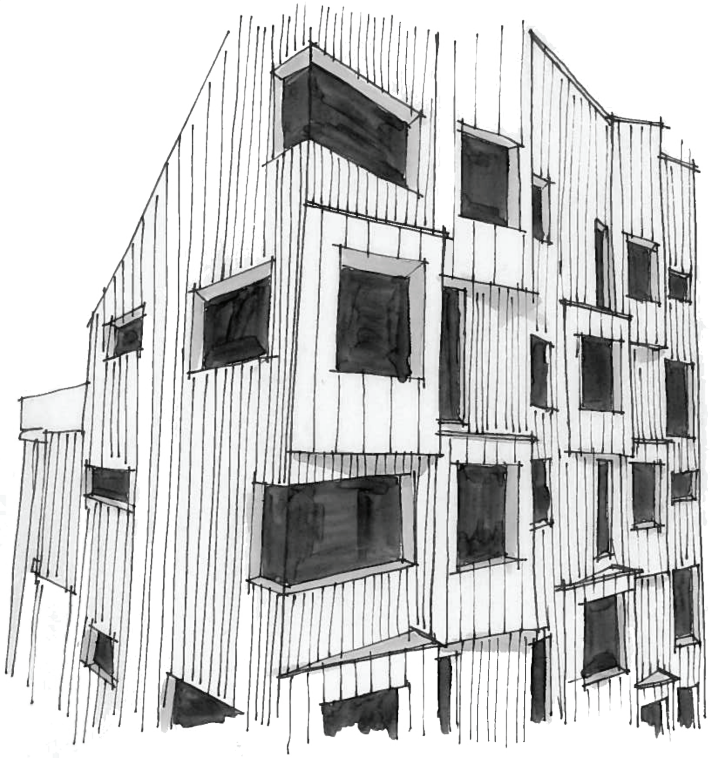


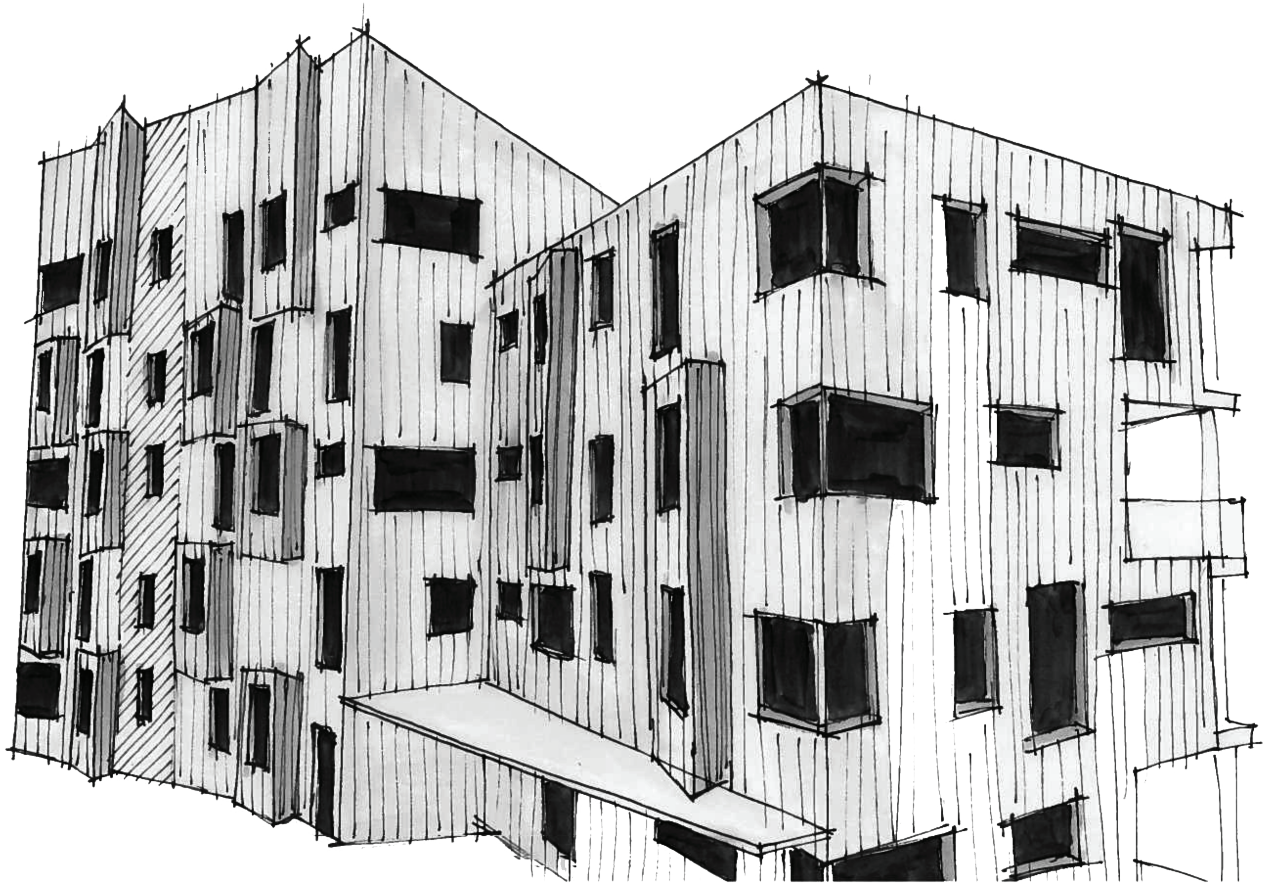


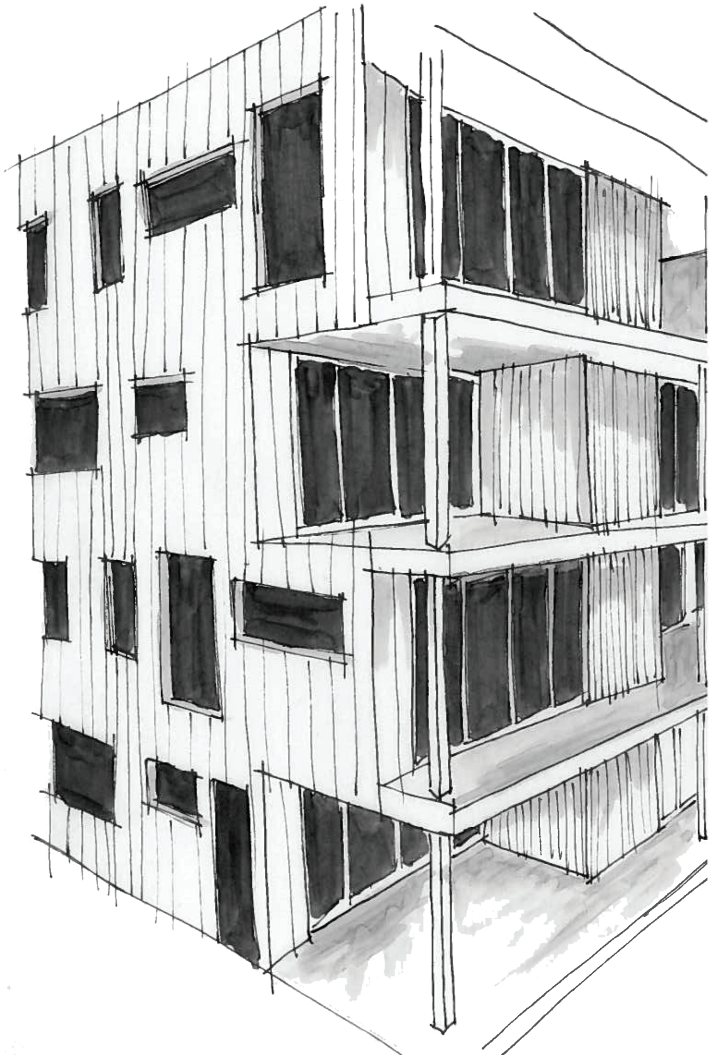


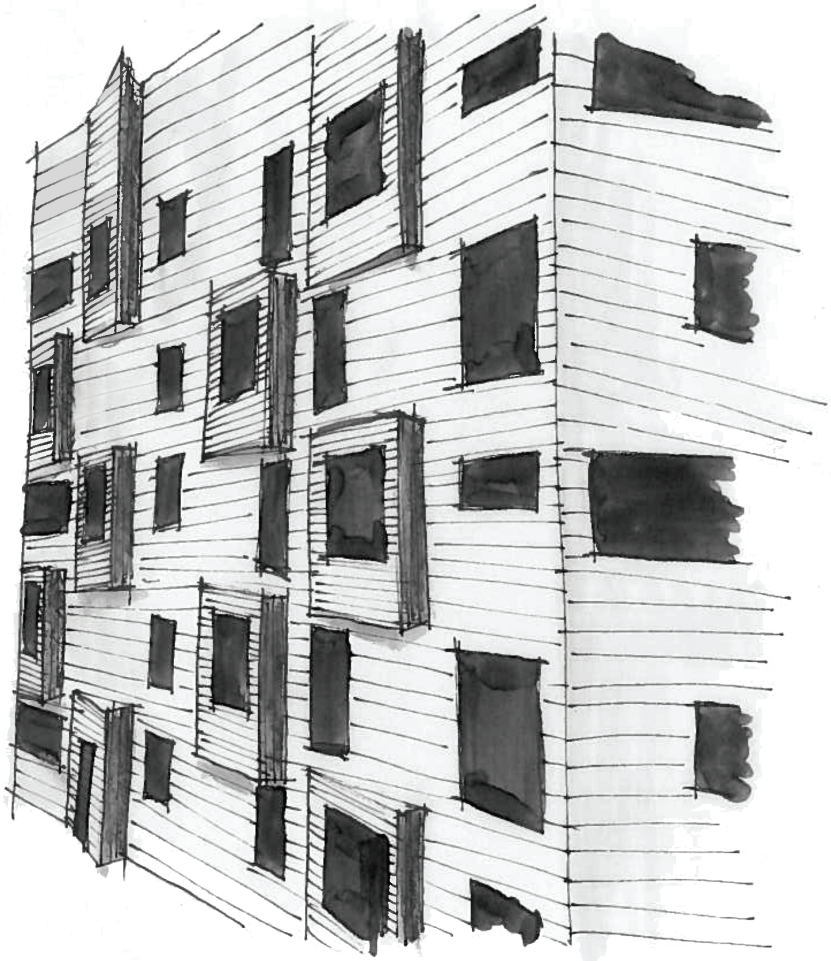
Working desks inside the rooms are designed on pop outs, that are oriented towards east. To emphasize them in the facade, sketches with different cladding were done, and then was chosen vertical wooden cladding with different scale on basic facade and pops-outs.

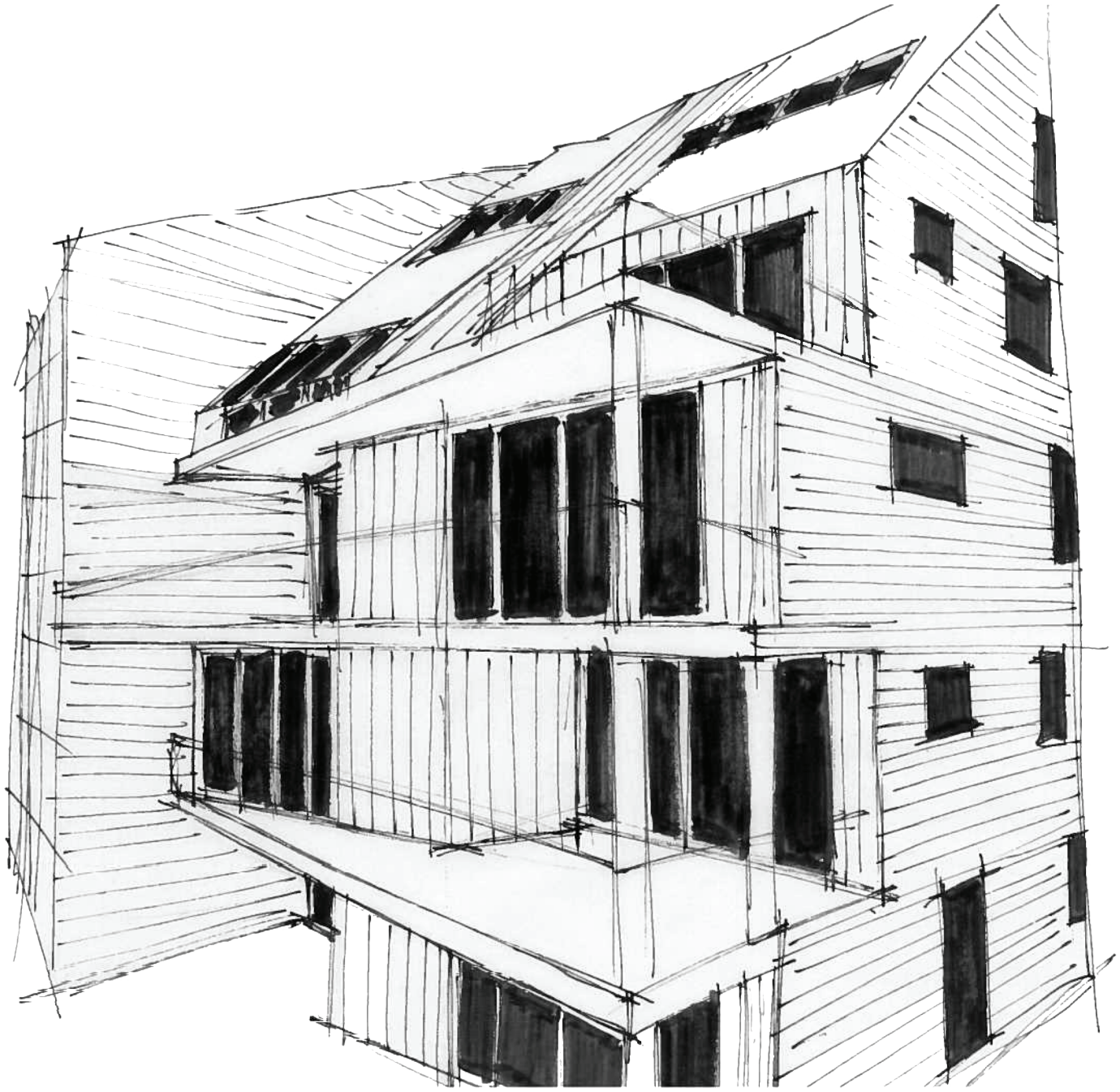






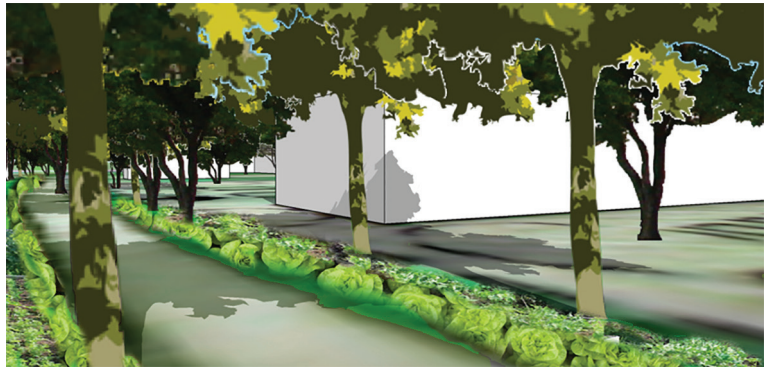






PATHWAYS

Old pathways were preserved on the site, and some more main pathways were designed. There is a gravel pathway leading to every building, and there are also bigger sealed pathways, that provide walk through the site. Around those main pathways were designed stripes of vegetable garden, to visualise sustainability for public and to enhance the experience, of walking through sustainable and community neighbourhood. The path is not straight, but creates corners for different spaces, from playground to exhibition area.



REFLECTION

This thesis is designing sustainable neighbourhood, adopting the cohousing principle. The site plan and surrounding was developed conceptually, with emphasis on pathways through the site. On the site were desgined three different houses sharing the same architecture, the result is interesting and enjoyable neighbourhood, that would for sure work better on the site than intended development.

Because of the size of the site and complexity of the design, the master plan was not developed further, due to lack of time. Also the houses lack further detailing such as construction details, or load calculations. These weaknesses will be hopefully fixed on the exam.

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