Green Layers

Jiro Akita
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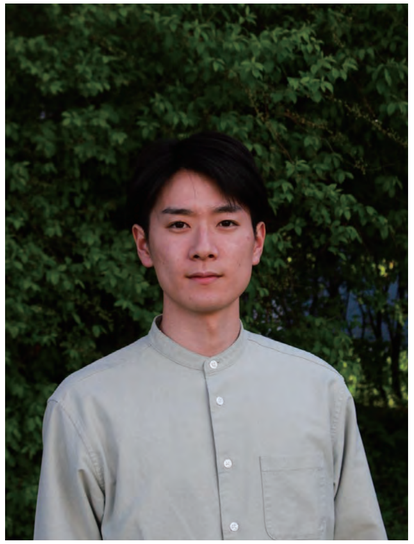
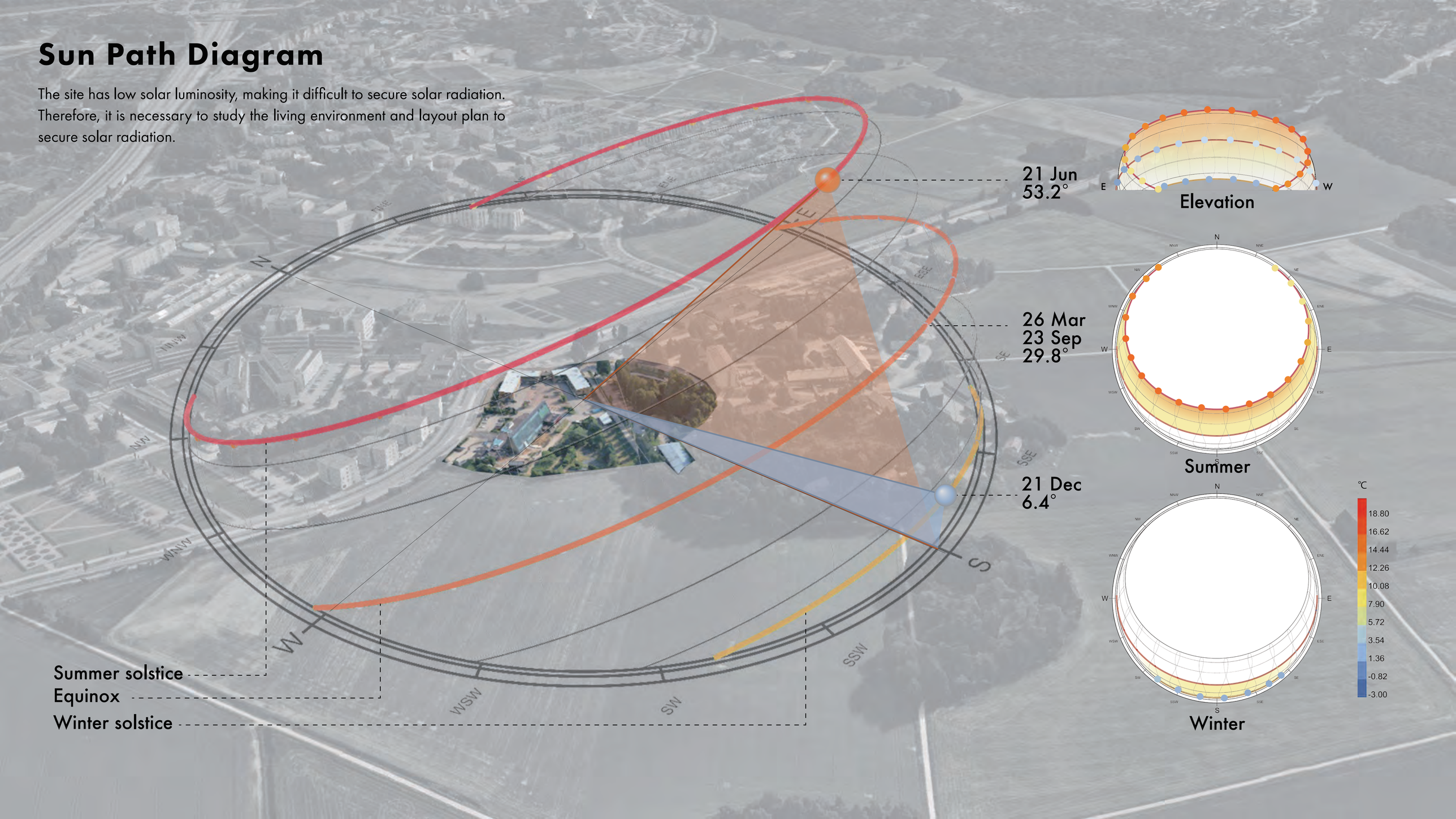


Taichi Kaga
Kyoto University

Presentation no. 21
JAPAN

Sun Path Diagram

The site has low solar luminosity, making it difficult to secure solar radiation. Therefore, it is necessary to study the living environment and layout plan to secure solar radiation.



Elevation

Summer

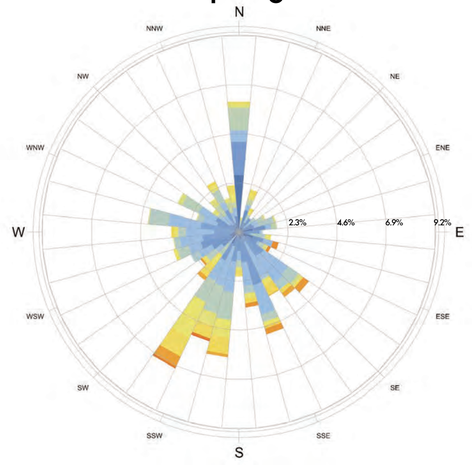
Winter

Seasonal Environmental Analysis

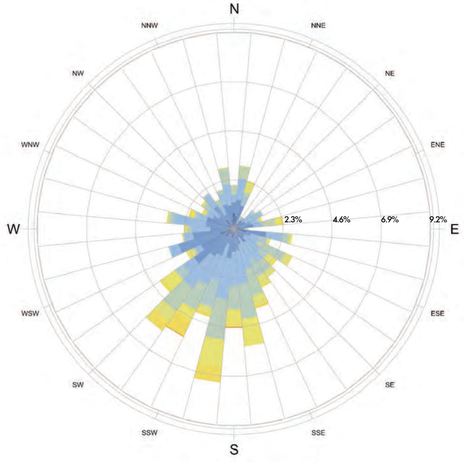
The wind is found to blow predominantly from the south throughout the year, and the living environment is considered to take in the scent of plants and fresh air carried by the wind. It can also be seen that solar radiation is extremely low in winter.

Seasonal Wind Diagram

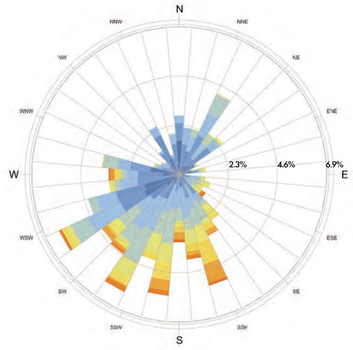
Spring



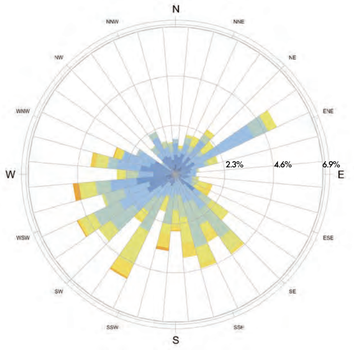
Summer



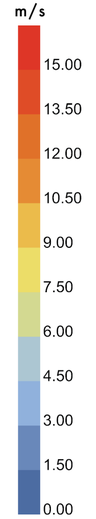
Autumn



Winter

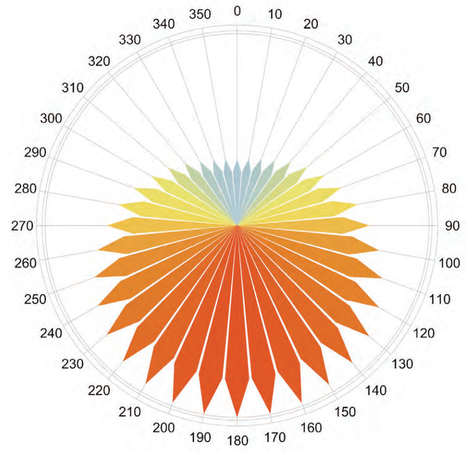


Wind Speed(m/s)
City: HELSINKI
Each closed polyline shows
frequency of 2.3% / 50 hours

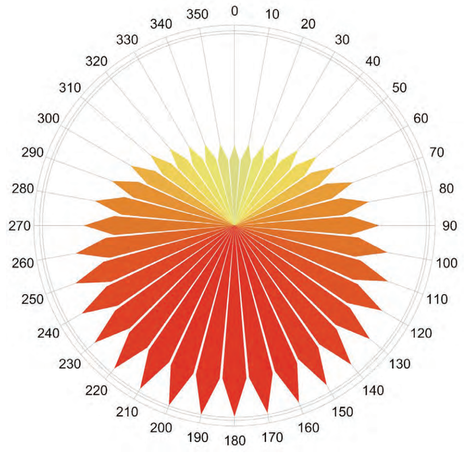


Seasonal Solar Diagram

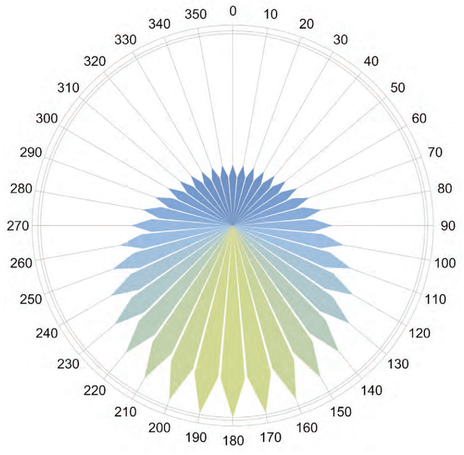
Spring



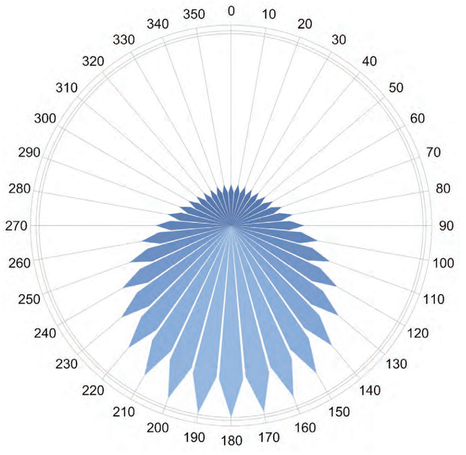
Summer



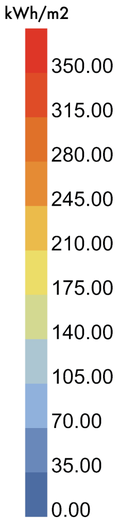
Autumn



Winter



Total Radiation(kWh/m2)
City: HELSINKI



Site Analysis

Vikki area is aiming for “15 minutes to everywhere”, equaling to 1.2km circle. Although for now this circle includes university institution, workplaces, transportation hubs and some greenery spaces, our target site should meet a program for creating community and more green spaces.

Outline of Viikki

Helsinki Viikki Campus

established in the late 1980s / early 1990s

Viikki Nature Reserve

valuable natural habitats
, including forests, wetlands, and meadows

Green Initiatives and Sustainability

various eco-friendly projects
and organizations

Library

Laboratory

Canteen

Campus

Housing Area

Ranch

Viikinoja

B

D

A

C

Tram Sta.

Research Field

0.6km

1.2km

Legend

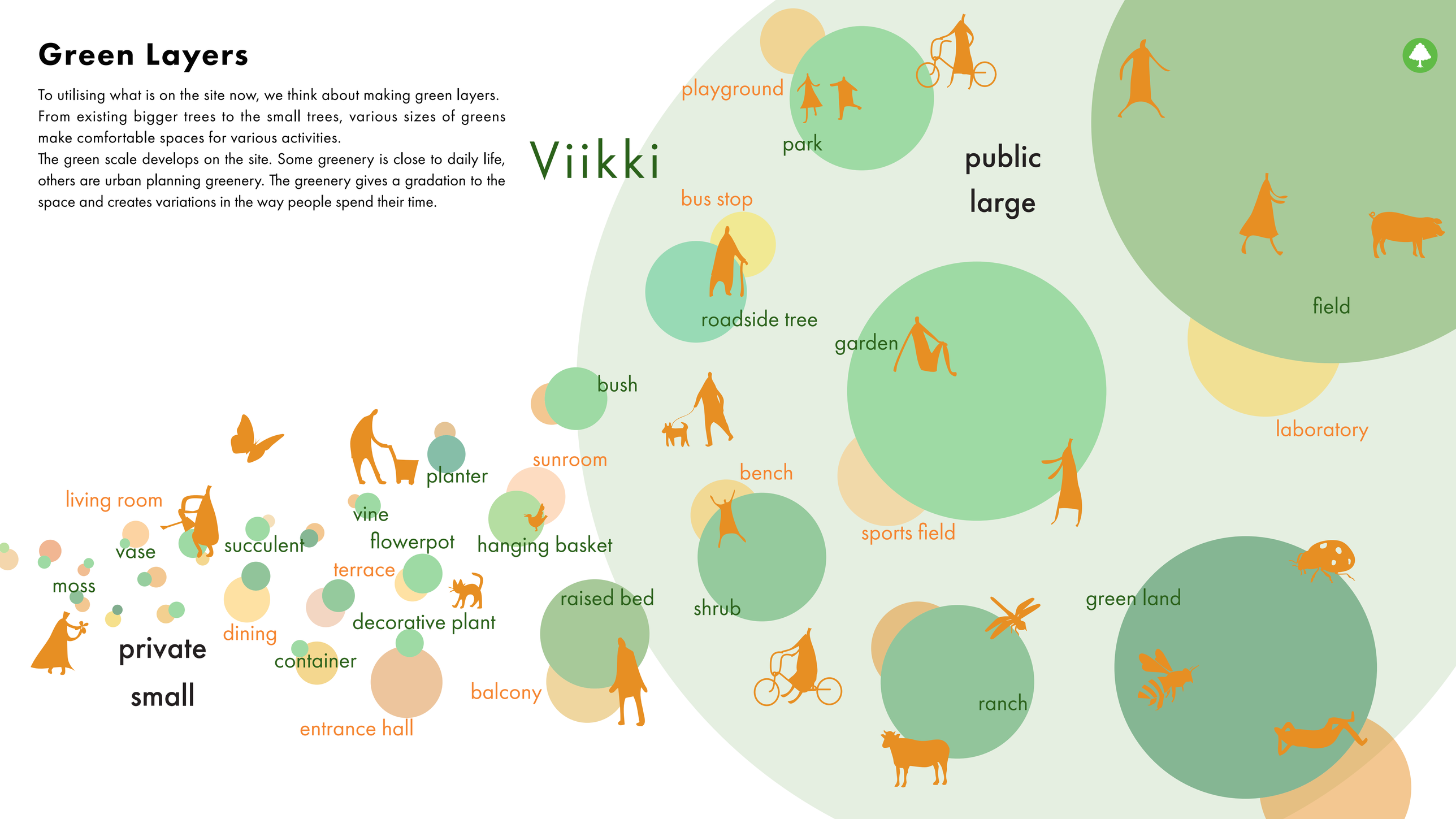
- RESIDENTAL AREA
- CENTRAL FUNCTION AREA
- UNIVERSITY FUNCTION AREA
- WORKPLACE AREA
- RESIDENTAL AND COMMERCIAL BUILDINGS AREA
- GREEN AREA
- TRAM LINE

Idea Plan published by City of Helsinki

0 100 200m

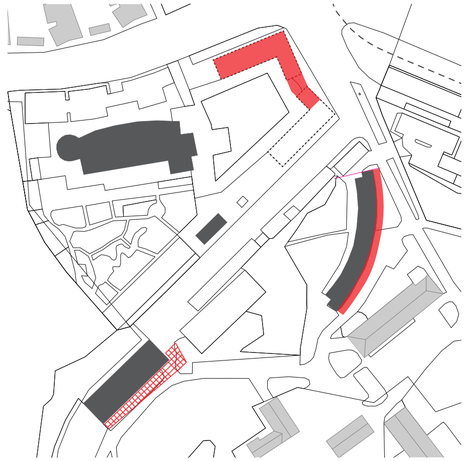
Green Layers

To utilising what is on the site now, we think about making green layers. From existing bigger trees to the small trees, various sizes of greens make comfortable spaces for various activities.
The green scale develops on the site. Some greenery is close to daily life, others are urban planning greenery. The greenery gives a gradation to the space and creates variations in the way people spend their time.



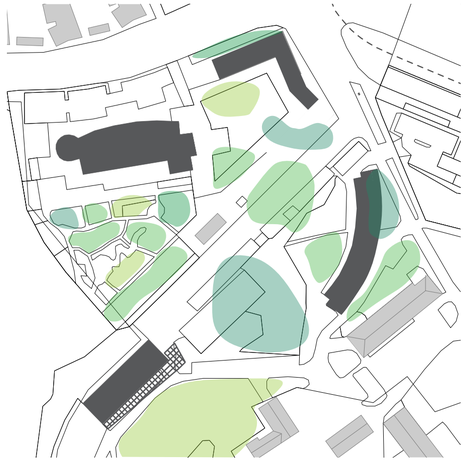
Master Planning

In planning the whole project, the idea is to make use of the existing elements. The trees in the courtyard of the site will be incorporated into the new masterplan, shaping the relationship between the new buildings. In Building B, the existing foundation is reused to reduce the environmental impact.



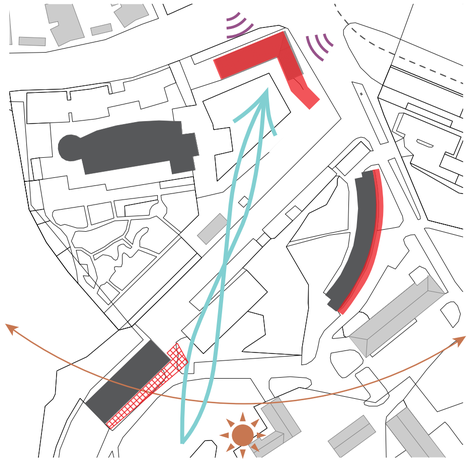
Existing Structure + Upgrade

The structure of existing buildings is quite unique and efficient. At the Building A, we add curved terrace in a southern side to the existing apartment building. At the Building B, we use the existing foundations in order to reduce CO2 and keep green in innergarden.



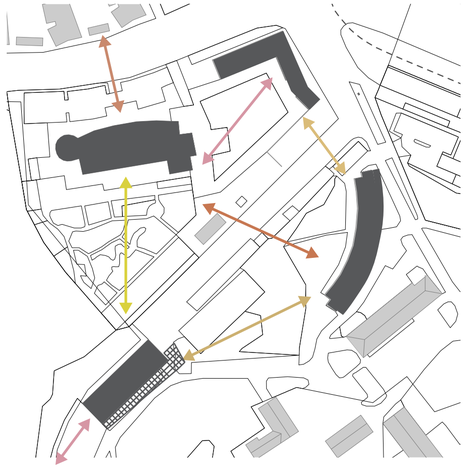
Green Typologies

The various plants scattered throughout the site create green spaces, each contributing to a lush environment. As a result, residents' lives become enriched, fostering a sense of coexistence. People provide space for the plants, and in return, the plants offer a gentle environment to people.



Environmental Conditions

Incorporating environmental requirements into the design creates a comfortable living environment. Our apartment effectively harnesses solar heat, allows for pleasant airflow filtered through the trees into the room and blocks out noise from the road.



Harmonized Relationships

Each building interacts with one another, in terms of activities. For instance, professors living in Building B enjoy beer on the front porch of Building D on weekends. Families residing in Building A explore the history of Viikki at the museum in Building C.

Green Plan

Greenery is interconnected inside and outside the dwelling. An open outside and a quiet, private inside are created. Even within a single dwelling unit, a gradient spatial composition is created.

TREE LAYERS


spruce

birch

yew

pine

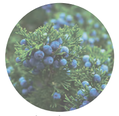

plum


fir


sea buckthorn


cedar


rowan


juniper


cherry


lingonberry


raspberry


bilberry


apple tree


currant

GRASS & SHRUB LAYERS


geranium


lupine


daisy


foxglove


meadowsweet


boxwood


heather


rosemary


heath rush


sesleria caerulea


molinia


reed canary


willow


cotton


dwarf birch


crowberry

GREEN LEGEND

Evergreen Tree

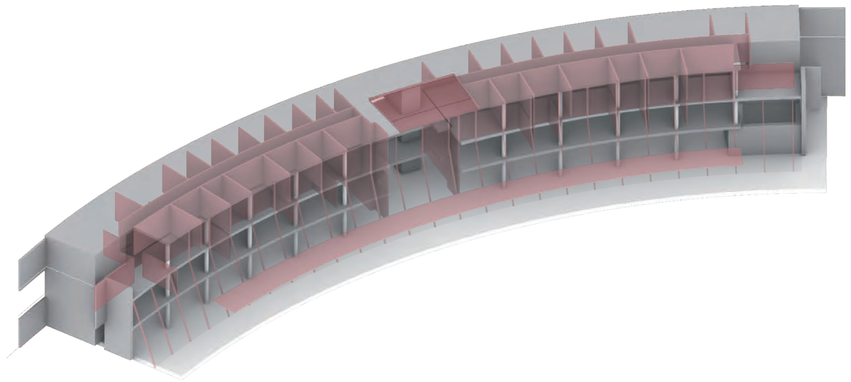
Deciduous Tree

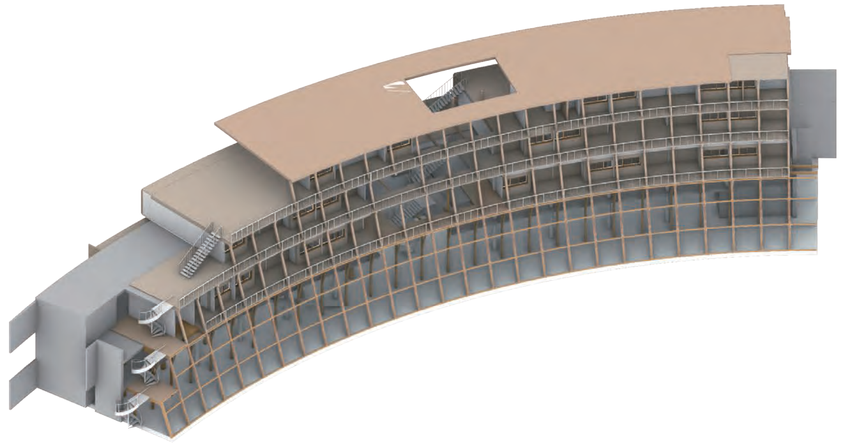
0 100 200m

Building A

Building A - Enriching with wood

Thanks to the lightness of the wood, we can enrich the old structure with added floor areas and semi-open common spaces.
By expanding the whole building with new wooden envelope, but also keeping the core structure made of concrete, we could make a dramatic transition while keeping the environmental impact at minimum.





Old Building

Concrete is long lasting structure but has weak thermal performance and can be enroded rapidly if it is exposed to rain and air. Also the existing steel and glass facade on the inner side is thermal weak point.

New Building

We keep the concrete structure and cover it with wooden extension. Facade will be reconstructed with wood and high-performance glass.

Building A
- Common Area

By adding extra layer to the inner facade of the building, it become possible to make a welcoming public corridor inside of the building.
Ground floor will be dedicated for nursery space for new residents and babies of lecturers coming to the campus, and public space, cafe. First floor will host meeting rooms and coworking room for students and teachers.

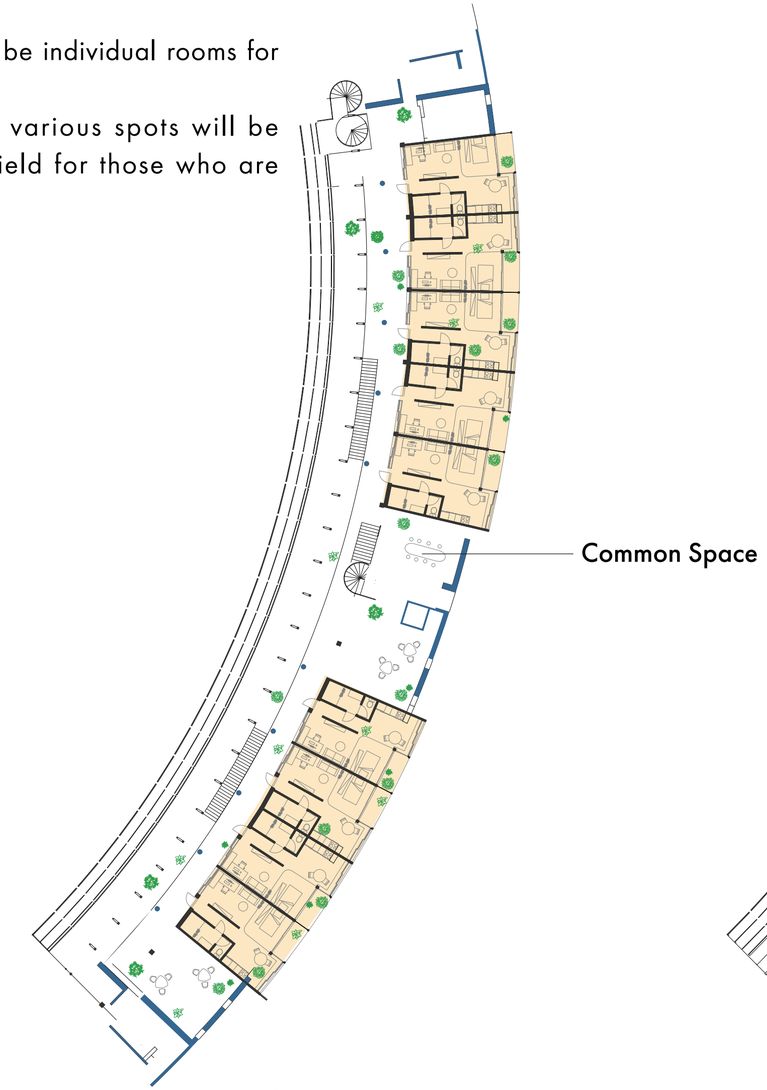
GF 1F

Existing Concrete Structure

0 50 100m

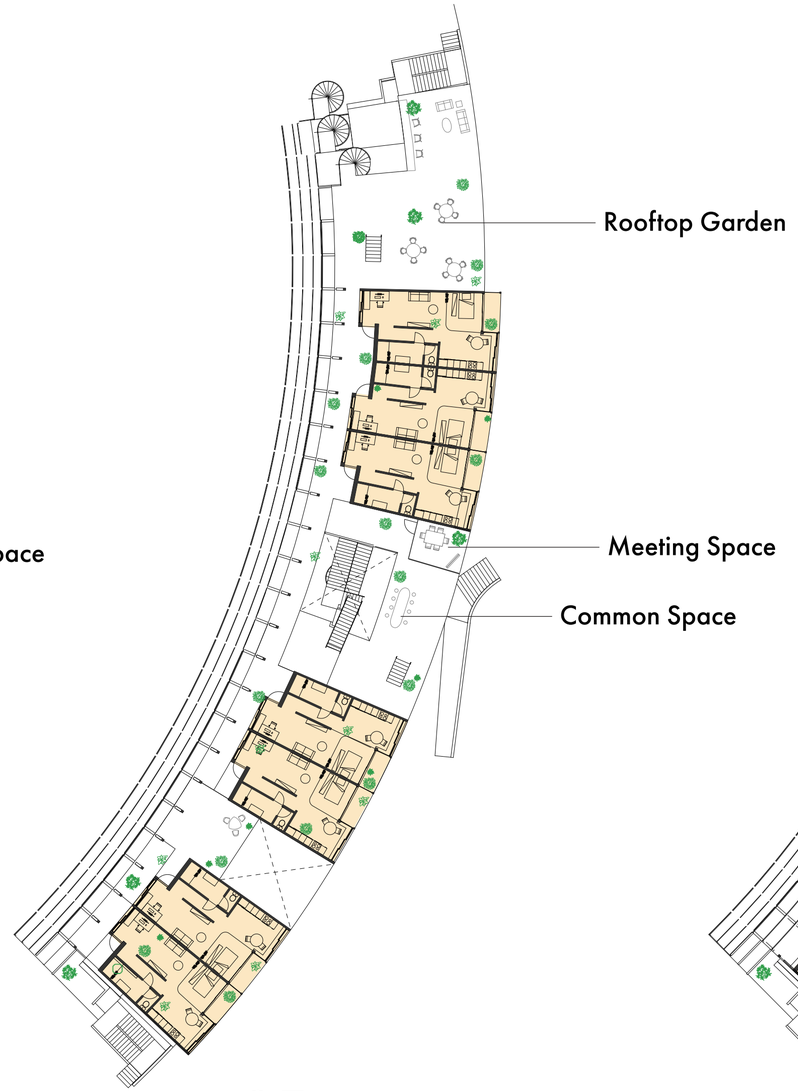
Building A - Plans

2-4F(Residences)
3 floors on top will be individual rooms for short-stay.
Common space in various spots will be a communication field for those who are staying here.



2F

Existing Concrete Structure



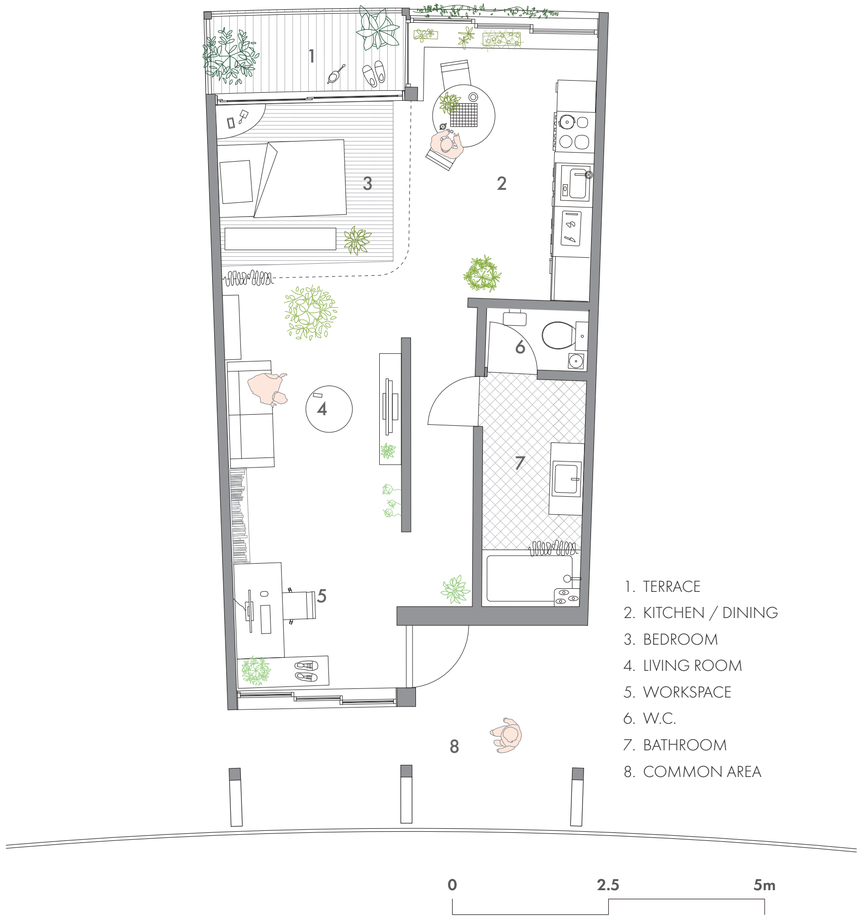
3F

4F

0 50 100m

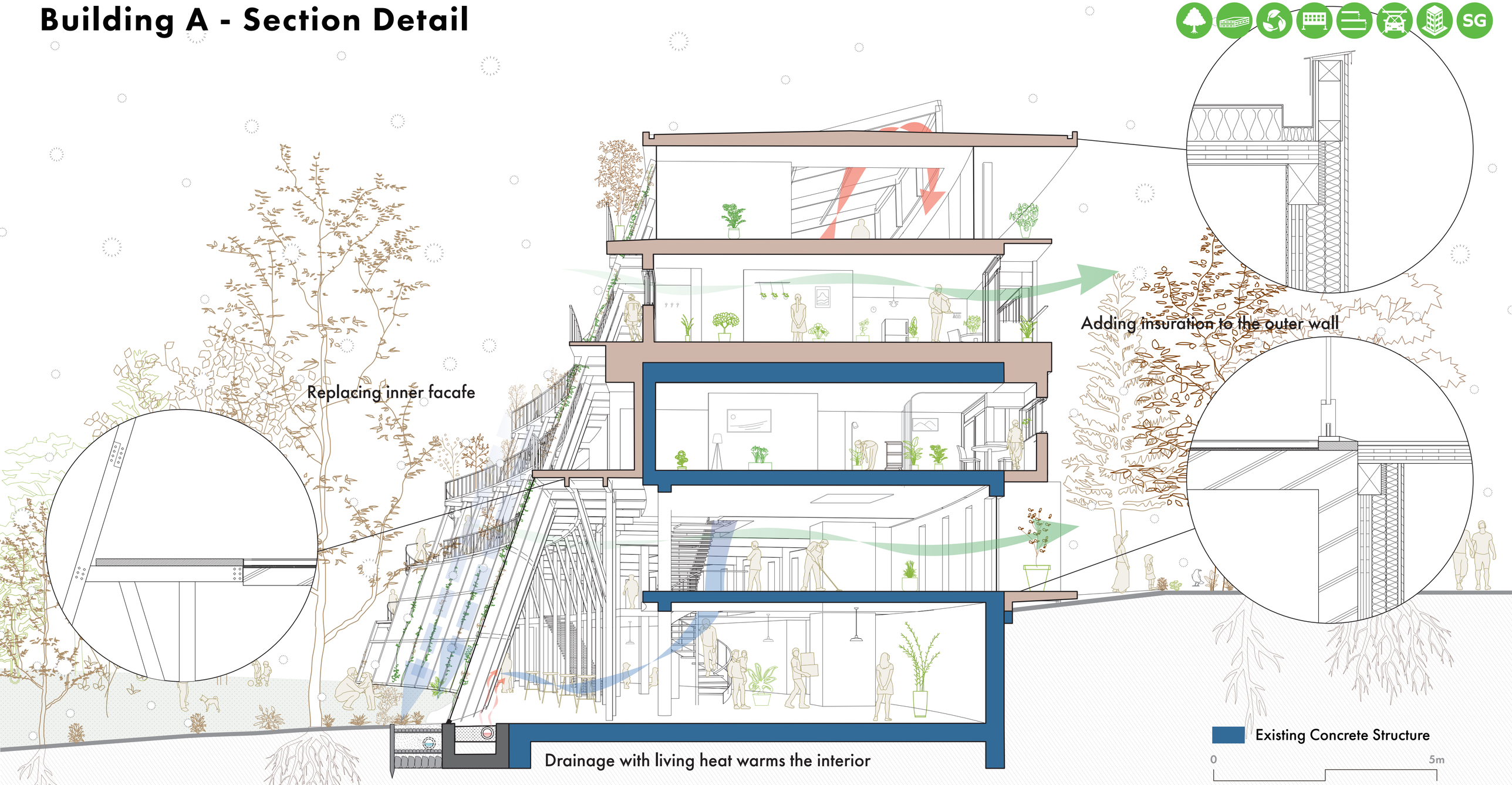
Building A - Unit Plan

With large window with high- perfoming glass and air-tight frame, we enable seamless experience of L- scale Green outside to the S-scale Green inside the room.



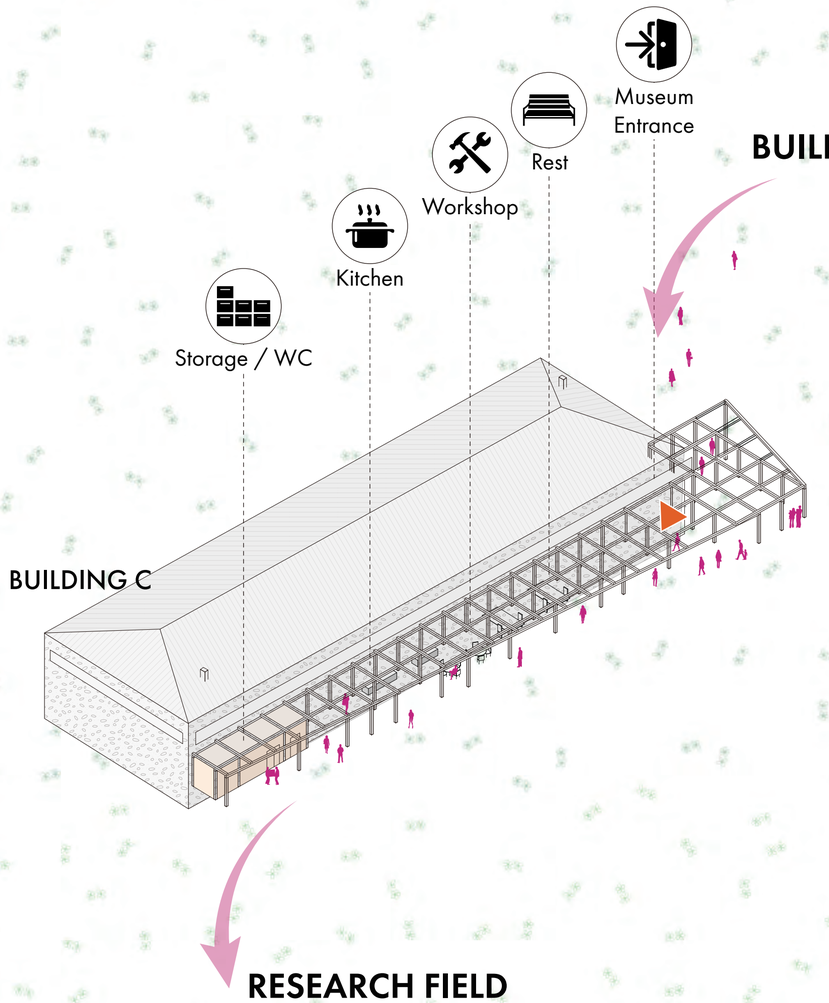
1. TERRACE
2. KITCHEN / DINING
3. BEDROOM
4. LIVING ROOM
5. WORKSPACE
6. W.C.
7. BATHROOM
8. COMMON AREA

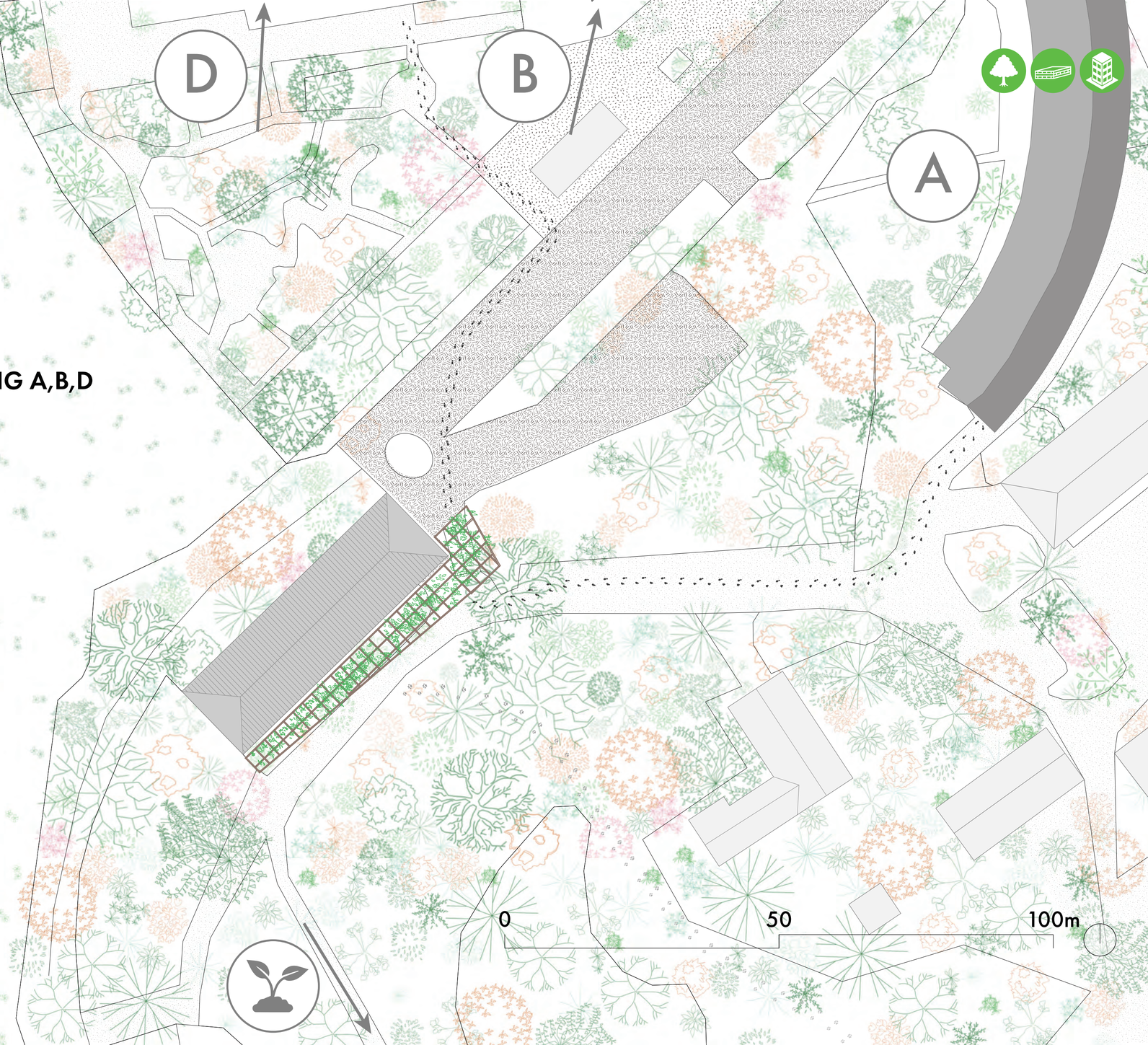
Building A - Section Detail



Building C

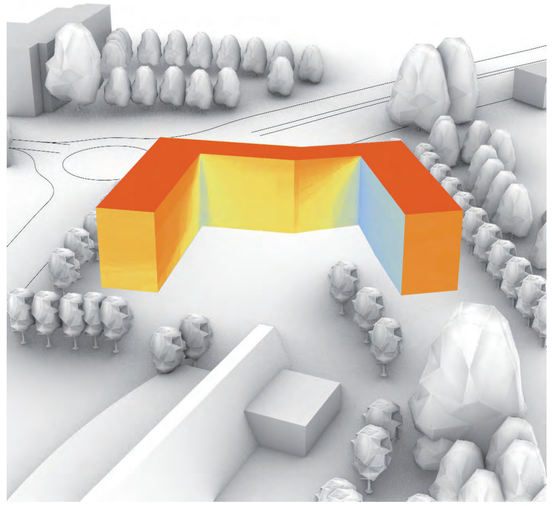
Building C was used as a museum and contained useful exhibits. However, the difference in elevation had caused the building to lose its relationship with the other buildings. We plan a wraparound pagola which is composed of timbers with a shape that draws people in, shaping people's activities in front of the historic exterior wall.





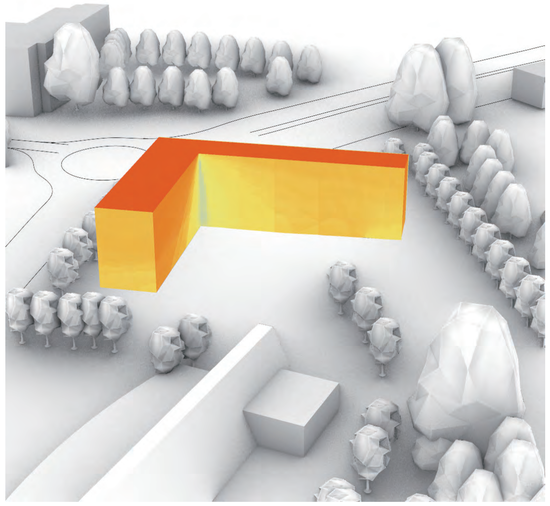
Building B

Building B - Volume Study



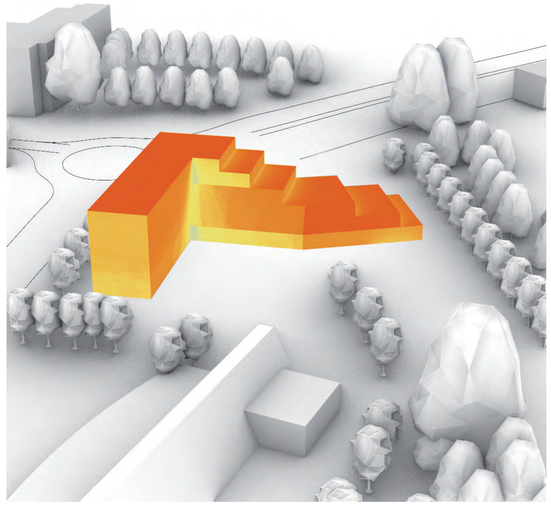
STUDY 1 :
Pile up on the existing footprint

There is a place with a little heat gain on the south façade.



STUDY 2 :
Remove the southern part

Low heat gain is resolved, but heat gain varies among units and is unbalanced.

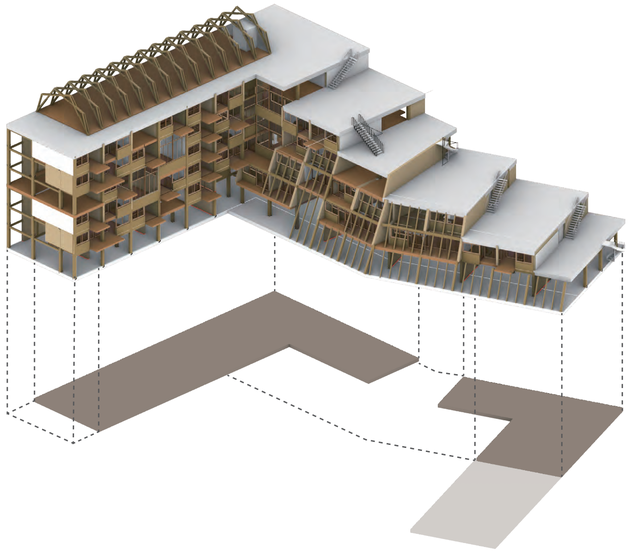


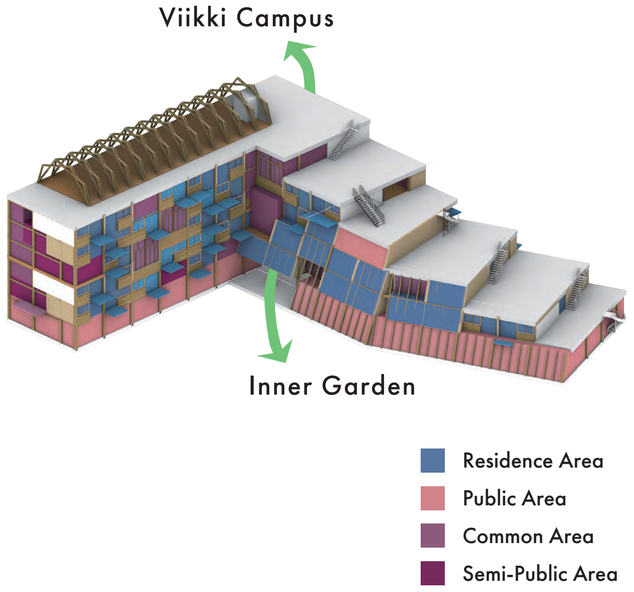
GREEN LAYERS :
Terrace steps & Tilted facade

Unbalanced heat gain is resplved. West façade can get better heat gain, which hermonize with the building A too.

Building B - Space Diagram

Reusing existing foundation dramatically reduces carbon footprint. the new building will be made of CLT from Finland, with light weight that can be supported with existing soil condition and foundation, and lower carbon footprint.





On the footprint of the existing building

To reuse the existing foundation, we put the new building on the footprint of the existing building.

New activities added

Ground floors are opend for public and pedestrians can walk through the building. Residence units are piled up on the upper floors, mixing with common areas and semi-public areas.

Building B - Plans

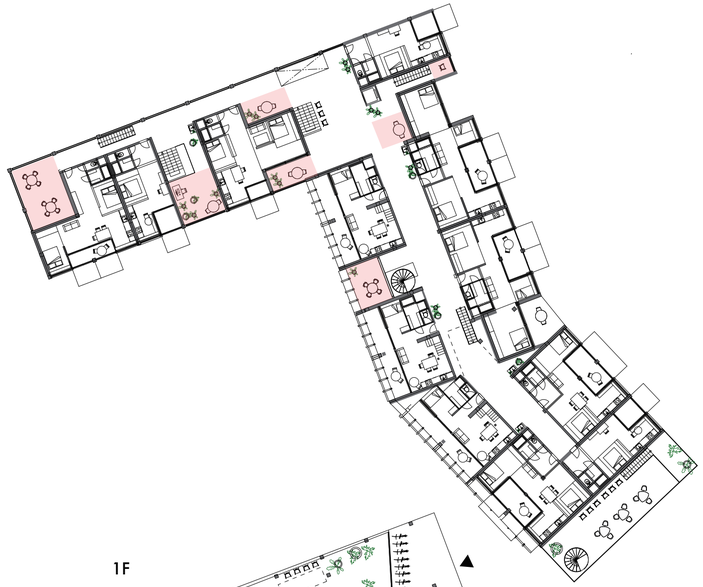
Ground floor will accomodate services, parking and some public functions, such as library and sauna.

GF

1F

Building B - Common Area

Common areas will provide residents space for various activities such as socialising, remote working spaces or inner playing space for children in cold winter. Common area has large window to catch as much heat as possible and connected together working as a big heat tank.



1F

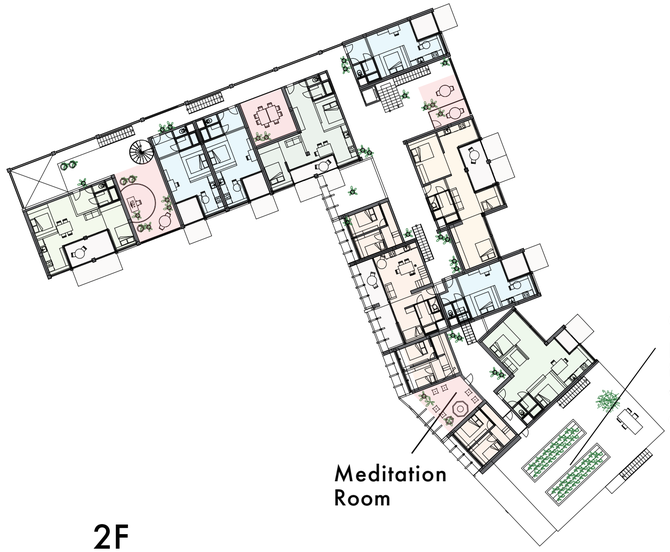
GF

0 25 50m

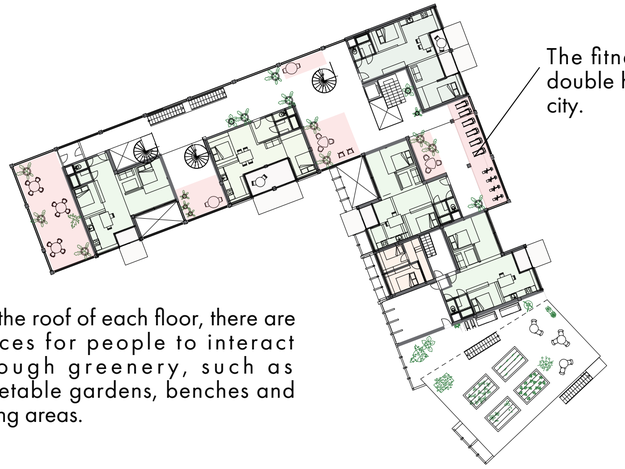
Common Area

Building B - Plans / Sunlight Analysis

Various types of units will be combined to accomodate diverse range of residents. By making pocket, we encourage residents to have more communication .



2F



On the roof of each floor, there are places for people to interact through greenery, such as vegetable gardens, benches and eating areas.

3F

The fitness space is open with a double hight and has a view of the city.

4F

Inserting different dwelling units creates various common areas with a workspace for professors in the gaps.

5F

- Common Area
- Studio Unit
- 2-Bedroom unit
- 3-Bedroom Unit
- 3-Bed Duplex Unit
- Sunroom
- Terrace

0 50 100m

1F: with trees

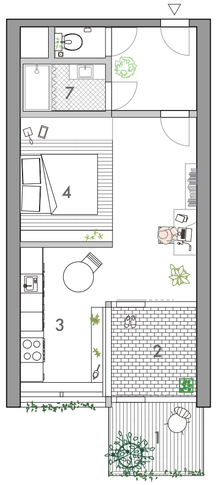
In Summer, deciduous trees around the building block intense sunlight, which reduces the total amount of heat grain from sunlight.

1F: with no trees

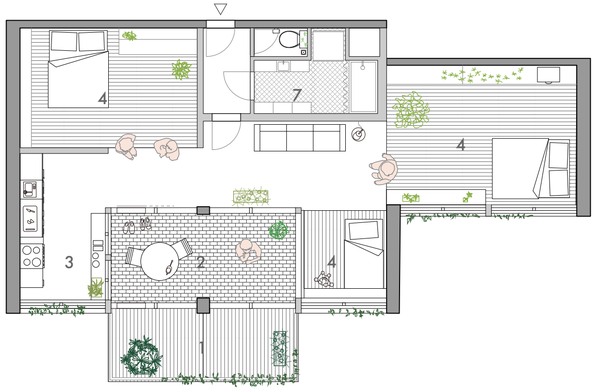
Building B - Unit Plan

Various types of units will be combined to accomodate diverse range of residents. By making pocket, we encourage residents to have more communication .

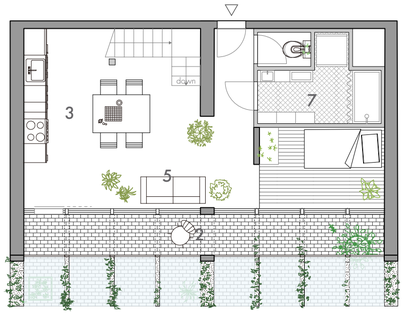
STUDIO



3-BEDROOM



3-BEDROOM : DUPLEX



1. TERRACE
2. SUNROOM
3. KITCHEN / DINING
4. BEDROOM
5. LIVING ROOM
6. WORKSPACE
7. W.C. / BATHROOM

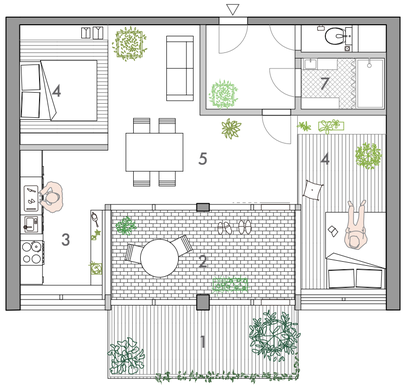
0 5 10m

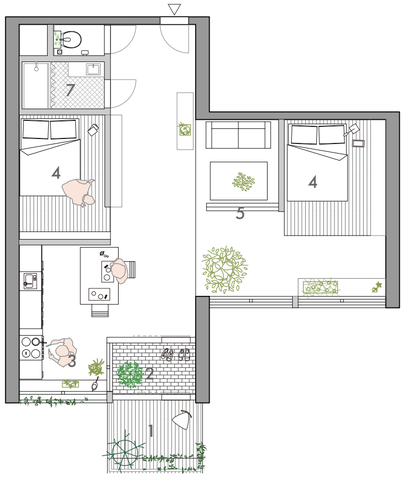
Studio Apartment

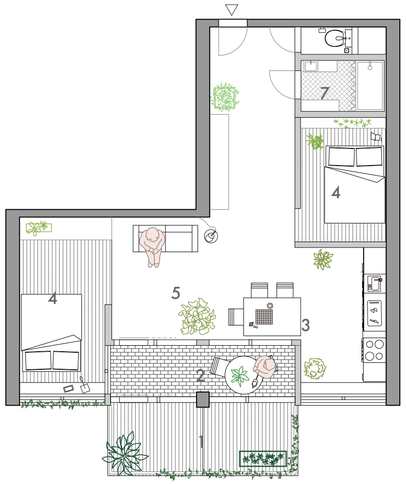
Building B - Unit Plan

Various types of units will be combined to accomodate diverse range of residents. By making pocket, we encourage residents to have more communication .

2-BEDROOM







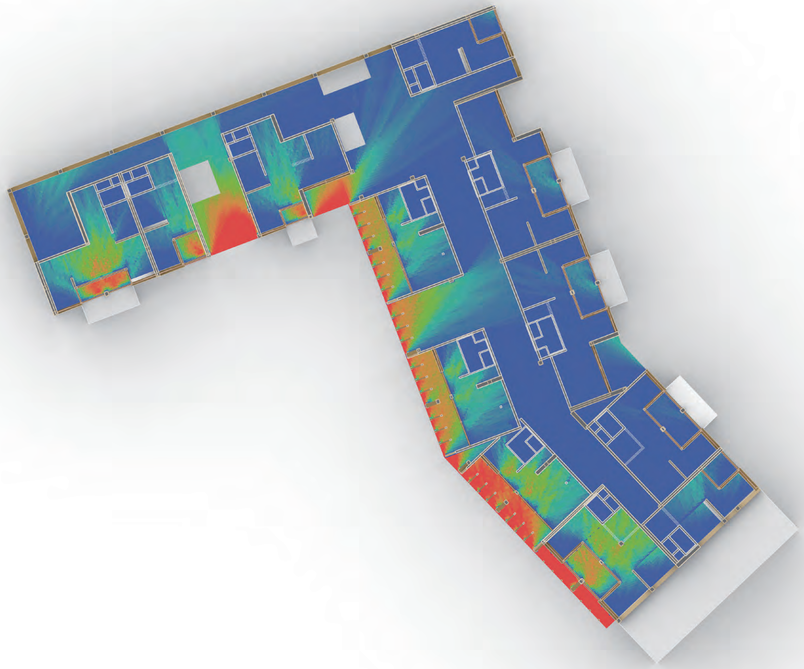
1. TERRACE
2. SUNROOM
3. KITCHEN / DINING
4. BEDROOM
5. LIVING ROOM
6. WORKSPACE
7. W.C. / BATHROOM

0 5 10m

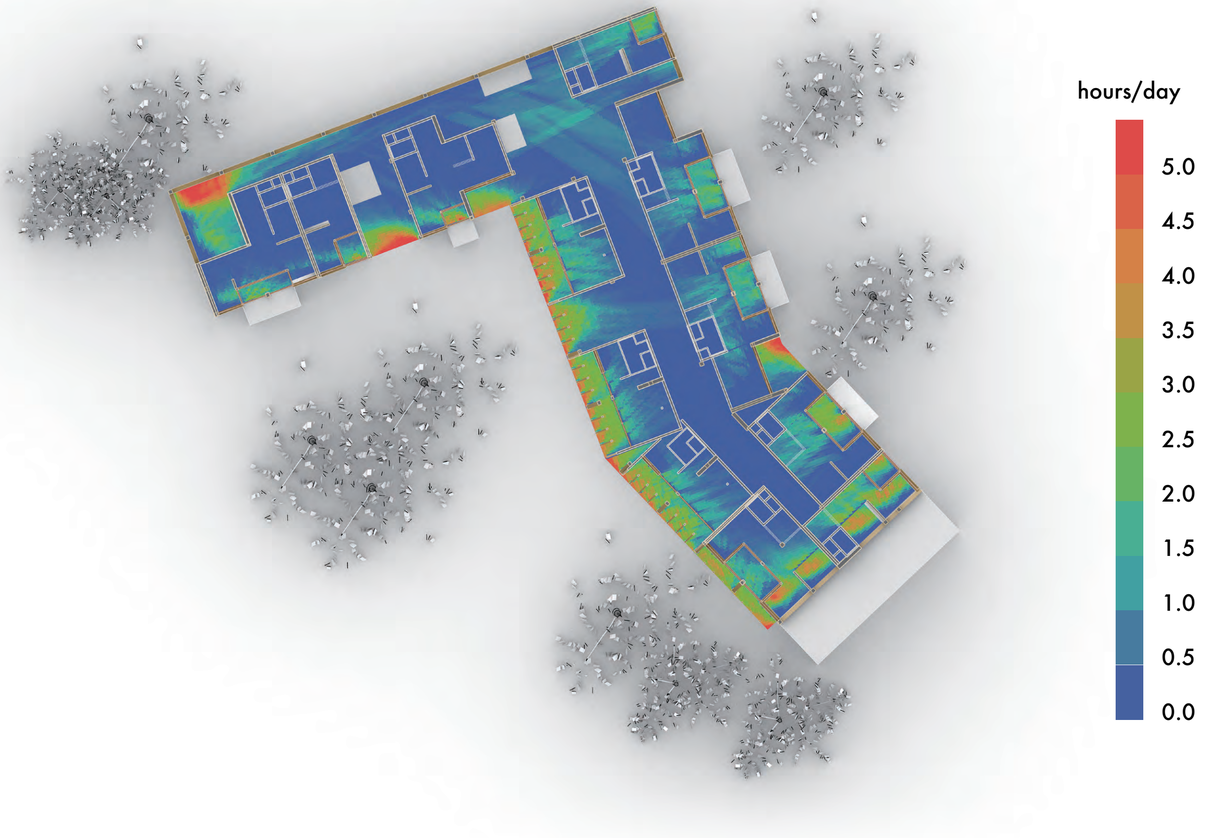
2-Bedroom Apartment

Building B - Themal Comfort

The dwelling units were provided with sufficient solar radiation and daylight hours thanks to the introduction of sunrooms and the regulation of the trees.



Winter (Oct. - Mar.) Direct Sun Hours



Summer (Apr. - Sep.) Direct Sun Hours with Trees Shade

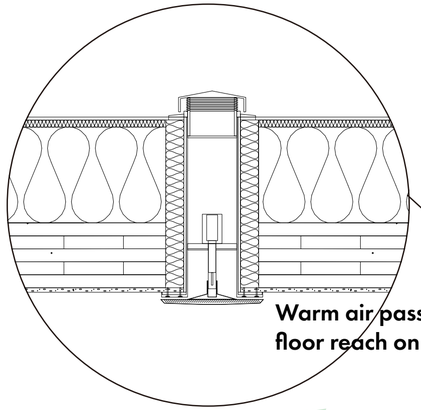
Building B - Rooftop Garden

The rooftop forms a garden linked to the university's biotechnology research field. The timber-framed space receives heat from the floor below, providing the best possible environment for plants and is open to residents.

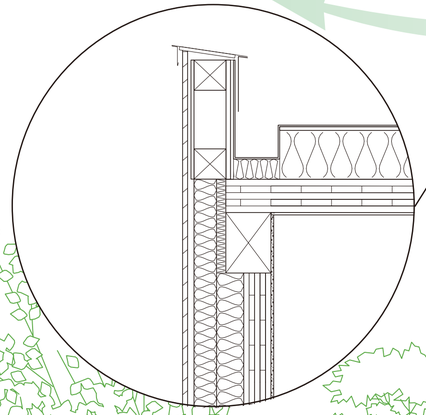
Building B - Section Detail

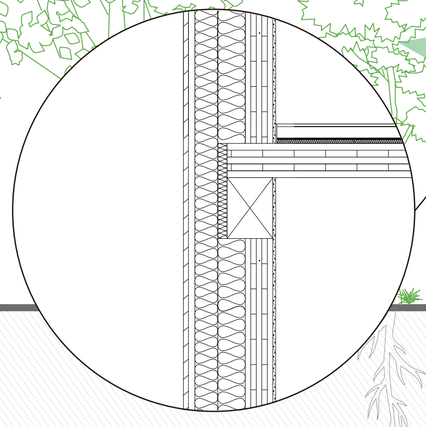
International SG Save Result

Heating needs〔kWh/m2〕	13.8	< Limit value 15
Cooling needs〔kWh/m2〕	7.5	< Limit value 15 (with tree shade in Summer)
Lighting autonomy 300 lux	72.0 %	> 60.0% Required
	61.2%	> 60.0% Required(with tree shade in Summer)

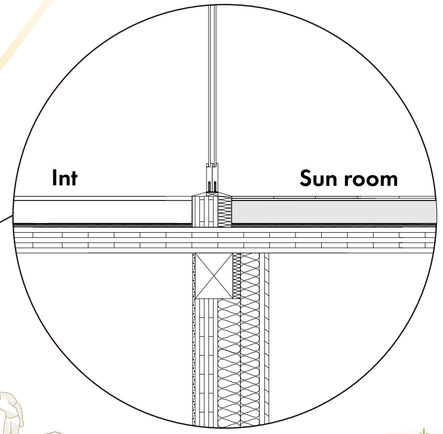


Warm air passing between each floor reach on rooftop garden.

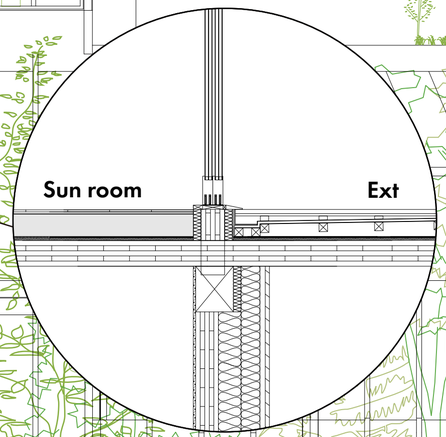




Sunlight (summer)



Sunlight (winter)



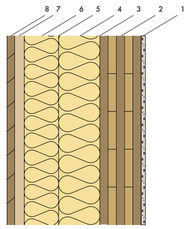
Fresh air passing through plants

Belt of Deciduous Trees

0 5 10m

Construction Detail

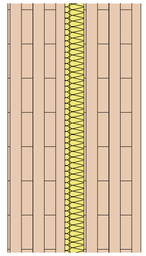
Outer Walls
400mm



1.12.5 mm Gyproc GNE 13 Normal
2. 120 mm CLT element
3. 0.2 mm ISOVER Vario® Xtra
4. 120 mm ISOVER Uni Board 35
between 120 mm Wooden stud
5. 0.4 mm ISOVER Vempro wind barrier
6. 100 mm ISOVER Façade board 300
7. 28 mm nailing battens/ventilation battens
8. 22 mm 120/50 Wooden façade

Fire Protection: EI90
Sound Reduction: Rw 46dB
U Value: 0.14W/m²K
Carbon Footprint: 19.6kg/m²
Weight: 91kg/m²

Partition Walls(CLT)
350mm



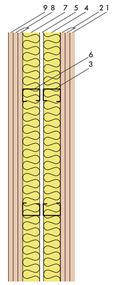
CLT 150mm
(60mm chared)

ISOVER
Cavity Wall Board 32
50mm

CLT 150mm
(60mm chared)

Fire Protection: EI60
Sound Reduction: Rw 67dB
Carbon Footprint: 24kg/m²
Weight: 155kg/m²

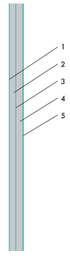
Partition Walls
175mm



1. 12.5 mm Gyproc GHE 13 Habito®
2. 2x12.5 mm Gyproc GNE 13 Normal
3. 45 mm Reinforcement stud,
Gyproc GFR DUROnomic®
4. 45 mm ISOVER Piano® Sound Board
5. 10 mm Air gap
6. 45 mm Reinforcement stud
, Gyproc GFR DUROnomic®
7. 45 mm ISOVER Piano® Sound Board
8. 2x12.5 mm Gyproc GNE 13 Normal
9. 12.5 mm Gyproc GHE 13 Habito®

Fire Protection: EI90
Sound Reduction: Rw 64dB
Carbon Footprint: 36kg/m²
Weight: 52kg/m²

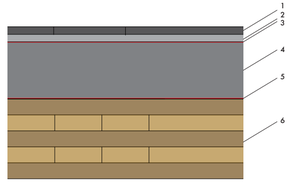
Glass
39mm



1. 3 mm ECLAZ one
2. 15mm Argon gass
3. 3mm FL
4. 15mm Argon gass
5. 3 mm ECLAZ one

Thermal transmittance U:
0.61 W/m²K
SHGC: 0.60
Visible transmittance: 77.0%
SC: 0.68

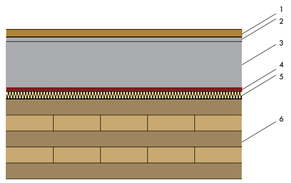
Waterproof Floor
400mm



1. 20 mm Ceramic Slab Tile
2. 20 mm WEBER: webertop
3. 0.2 mm ISOVER: Vario KM Duplex
4. 150 mm ISOVER: EPS insulation boad
5. 0.2 mm ISOVER: Vario KM Duplex
6. 210 mm CLT element

Transmittance 0.17 W/m²K
Resistance 5.81 m²K/W

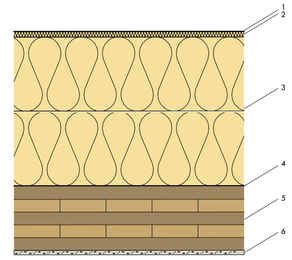
Inner Floor
400mm



1. 14 mm Parquet
2. 12 mm Foam
3. 120 mm weberfloor 150 dura
4. 12 mm Aprobo Decibel 4
5. 20 mm Glava footstep impact
sound board
6. 210 mm CLT element

Fire Protection: EI60
Sound Reduction: Rw 65dB
Carbon Footprint: 45kg/m²
Weight: 274kg/m²

Roof
601mm



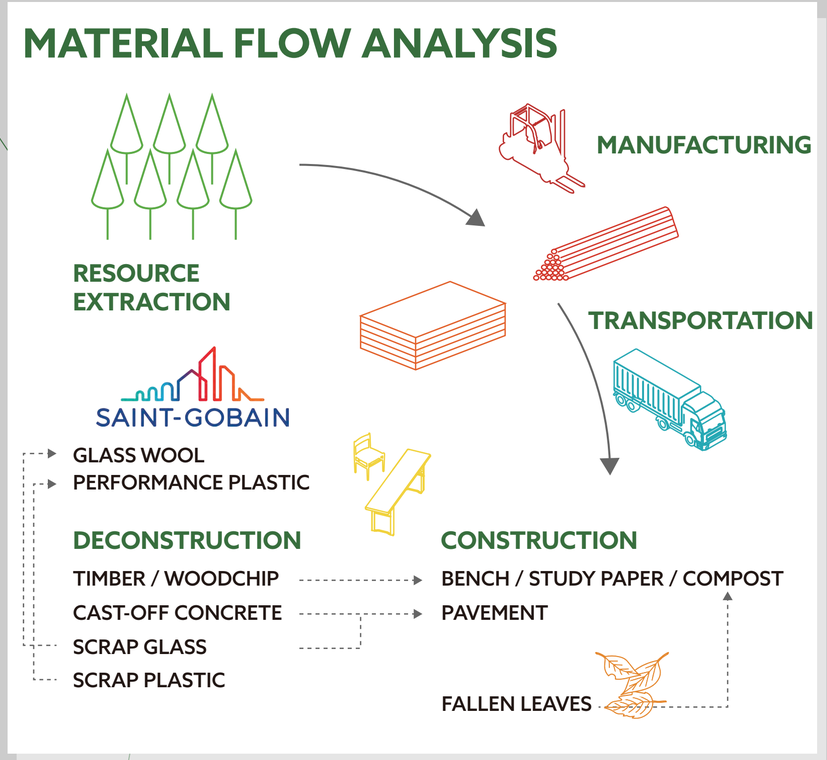
1. 6 mm Waterproofing
2. 20 mm ISOVER ROBUST Ceiling Board
3. 380 mm ISOVER ROBUST Ceiling Panel
4. 2 mm Underlay felt
5. 180 mm CLT element
6. 12.5 mm Gyproc GNE 13 Normal

Fire Protection: EI90
U Value: 0.07W/m²K
Carbon Footprint: 46kg/m²
Weight: 123kg/m²

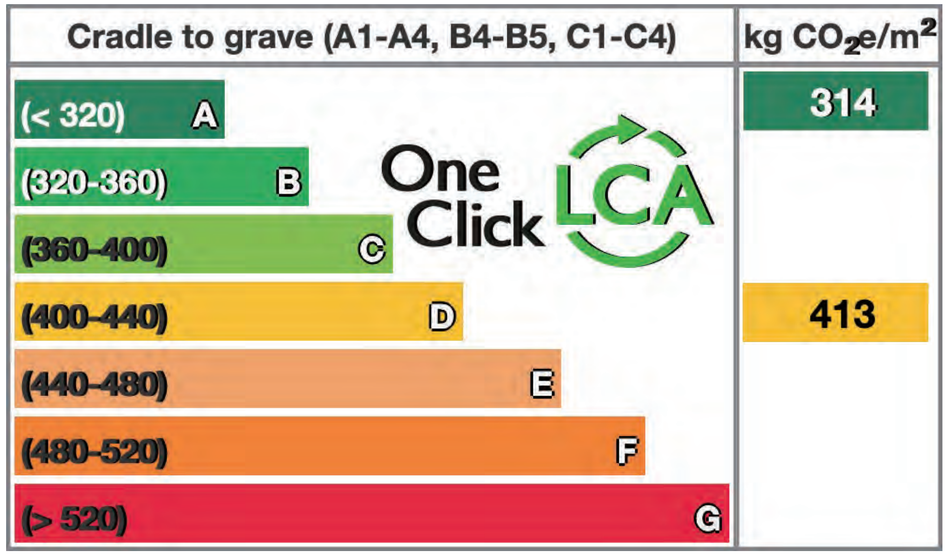
Material Map

Materials are mainly sourced in Finland. Production close to the site reduces CO2 emissions and stimulates local industry. The CLT used for walls and slubs is manufactured in Kauhajoki, Hoisko and Kuhmo, with relatively low transport costs. The Saint-Gobain Group is present in Finland and can adapt its glass, insulation and equipment to the project.

MATERIAL FLOW ANALYSIS



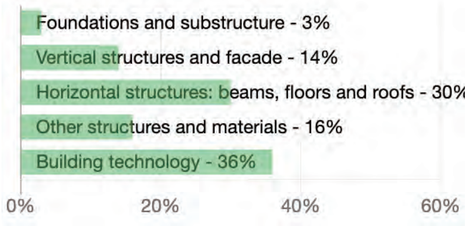
Building B - LCA

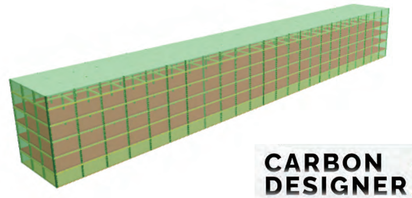


Green Layers

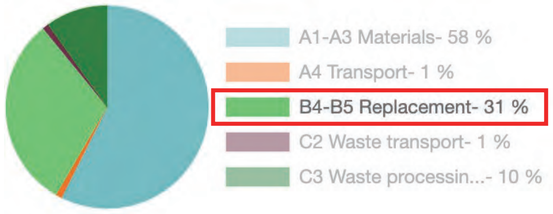
Reusing foundations not only reduces CO2 emissions but also contributes to maximum preservation of existing trees.

Baseline



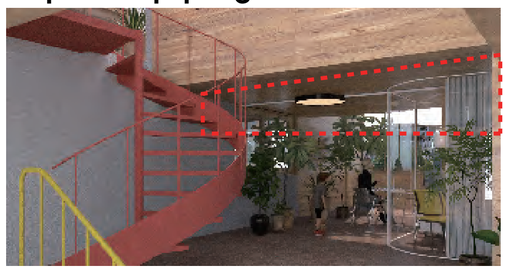


CARBON DESIGNER 3D

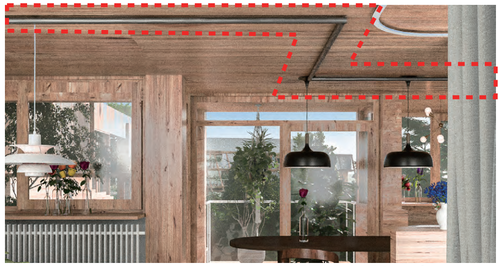


The exposed piping allows the wooden structure to be seen in the space, keeping the floor height high, leading to a reduction in material usage costs, and making maintenance and replacement easier.

Exposed piping in views



Common Area



Studio Unit

GREEN LAYERS - 10 indicators of CO_2 reduction by One Click LCA

1. LCA is calculated for 60 years
2. Offer large spaces for plants
3. Use timber / CLT mainly
4. Compare and select sustainable materials
5. Build several floors on the existing foundation
6. Piling up floors vertically
7. No underground parking
8. Easy to replace exposed equipments
9. Avoid complex shapes
10. Use Saint-Gobain products

All the 10 goals achieved !

Green Layers