

PALEIS SOESTDIJK AS A
CIRCULAR ESTATE.



Design Booklet

By

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Figure 1: Picture of the front of Paleis Soestdijk

RESEARCH TEAM.

Main supervisor:	Andy van den Dobbelsteen
Second supervisor:	Nico Tillie
Graduation board member:	Stefan van der Spek
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	Charlotte Uiterwaal
Land agent Paleis Soestdijk:	Hester Lode



Figure 2: Picture of the back of Paleis Soestdijk

INTRO.

This booklet serves as a visual supplement to the thesis report. It contains all important visuals, diagrams and drawings that were created during this graduation project. The first part contains the material created during the research and analysis phase of the project. The rest of this booklet contains the elaboration of the design itself.

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ANALYSIS.

To create a fitting strategy and design for the estate, one must know and understand the estate. Therefore, extensive analysis and research into the area are necessary. For this project, there is a focus on the historical context and development of the estate, an analysis of the estate itself and an analysis of the existing and potential biomass streams.

LOCATION.

These two maps show where Paleis Soestdijk is situated, compared to the whole of NL and well-known cities (such as Amsterdam/Utrecht)

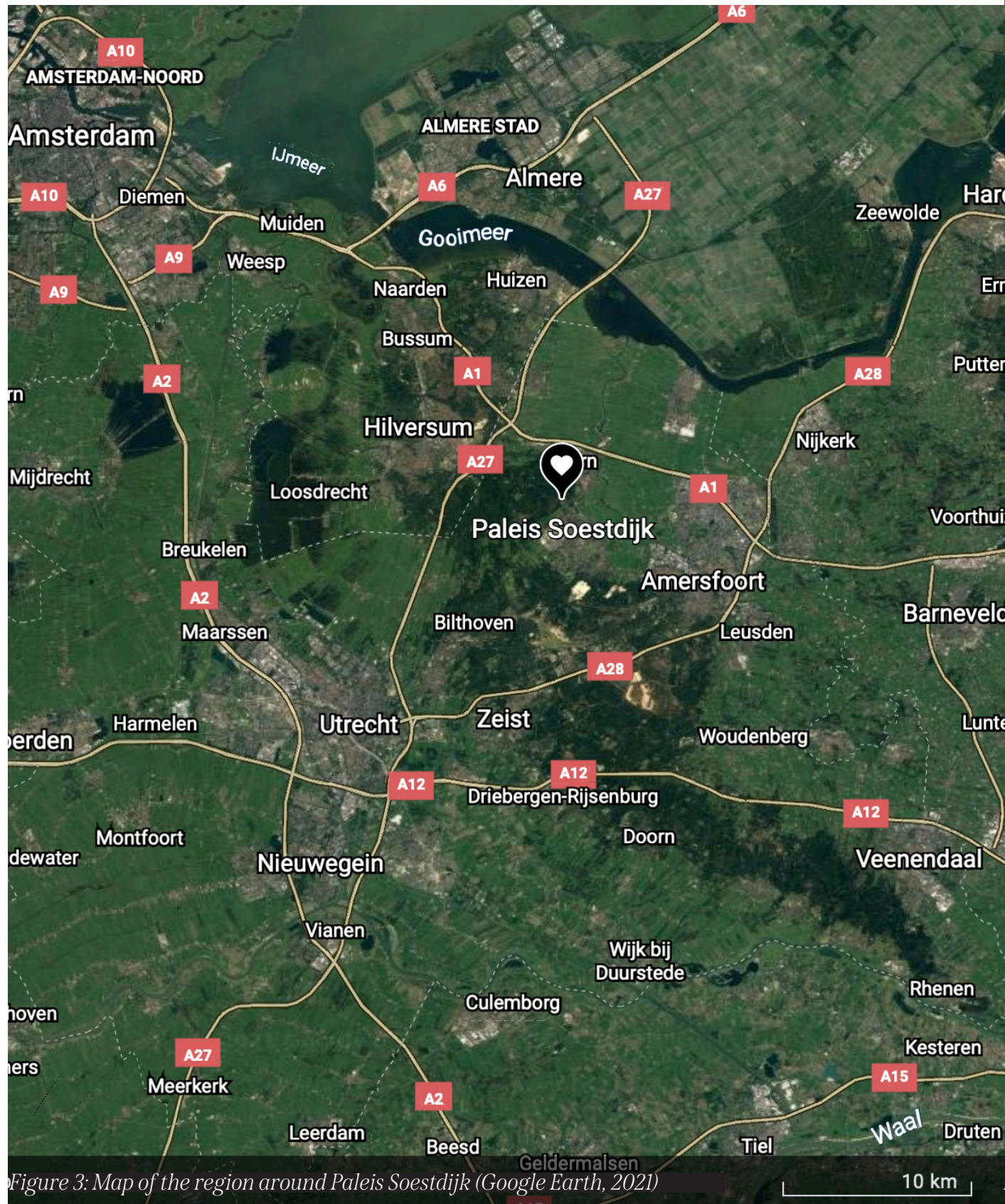


Figure 3: Map of the region around Paleis Soestdijk (Google Earth, 2021)



Figure 4: Map of the Netherlands (Google Earth, 2021)

CONTEXT.

This map is a good display of the nearby ecological structures that the estate of Paleis Soestdijk is part of.

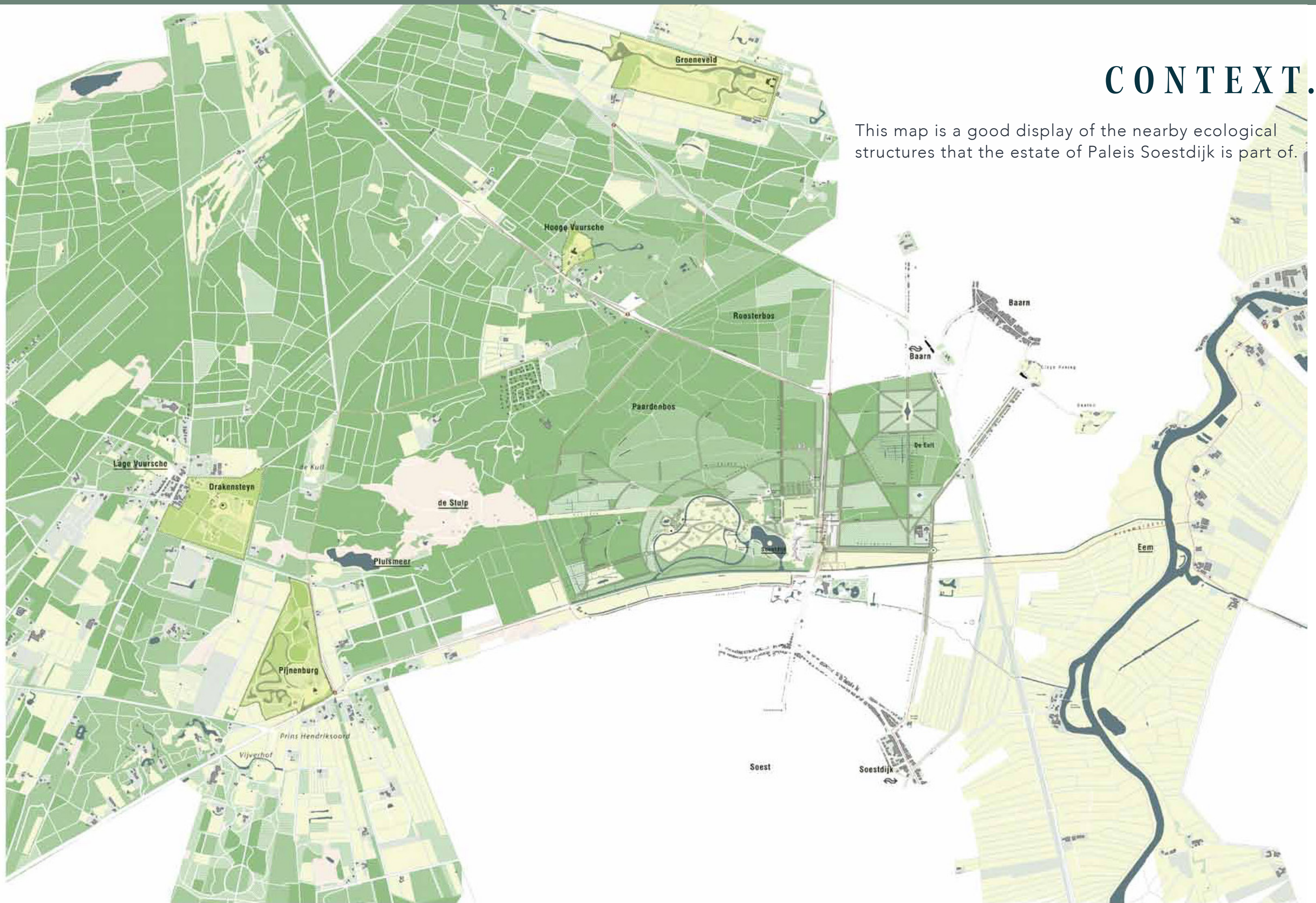


Figure 5: Map of the Ecological Structures around Soest and Baarn (Paleis Soestdijk, 2019)

ELEVATION.

On the map the height differences on the estate are visible. Concluded from this map can be that water naturally flows to the lower parts of the estate, mainly the Paamgracht and the pond.

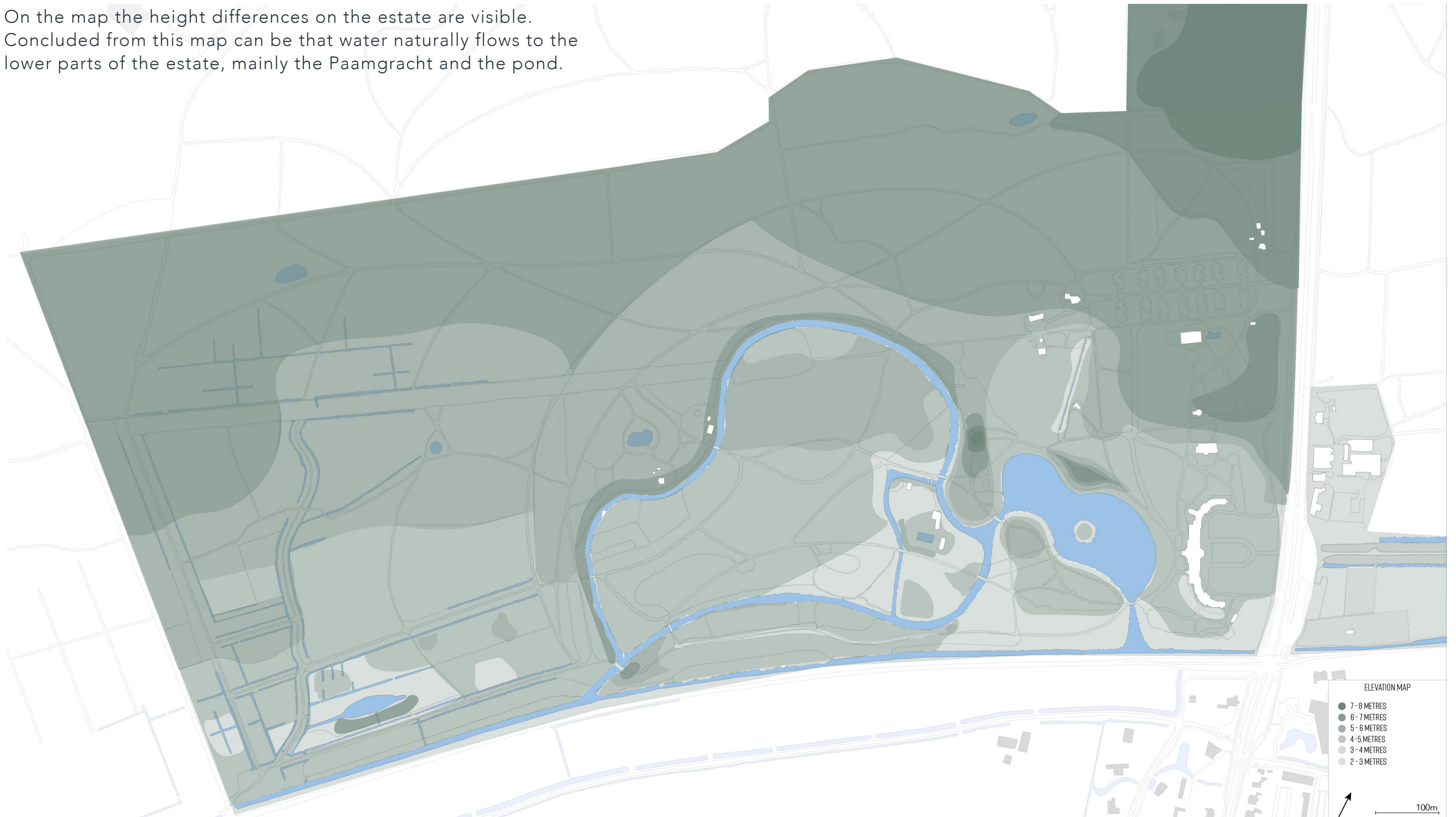


Figure 6: Map of Paleis Soestdijk with the elevation

FOREST.

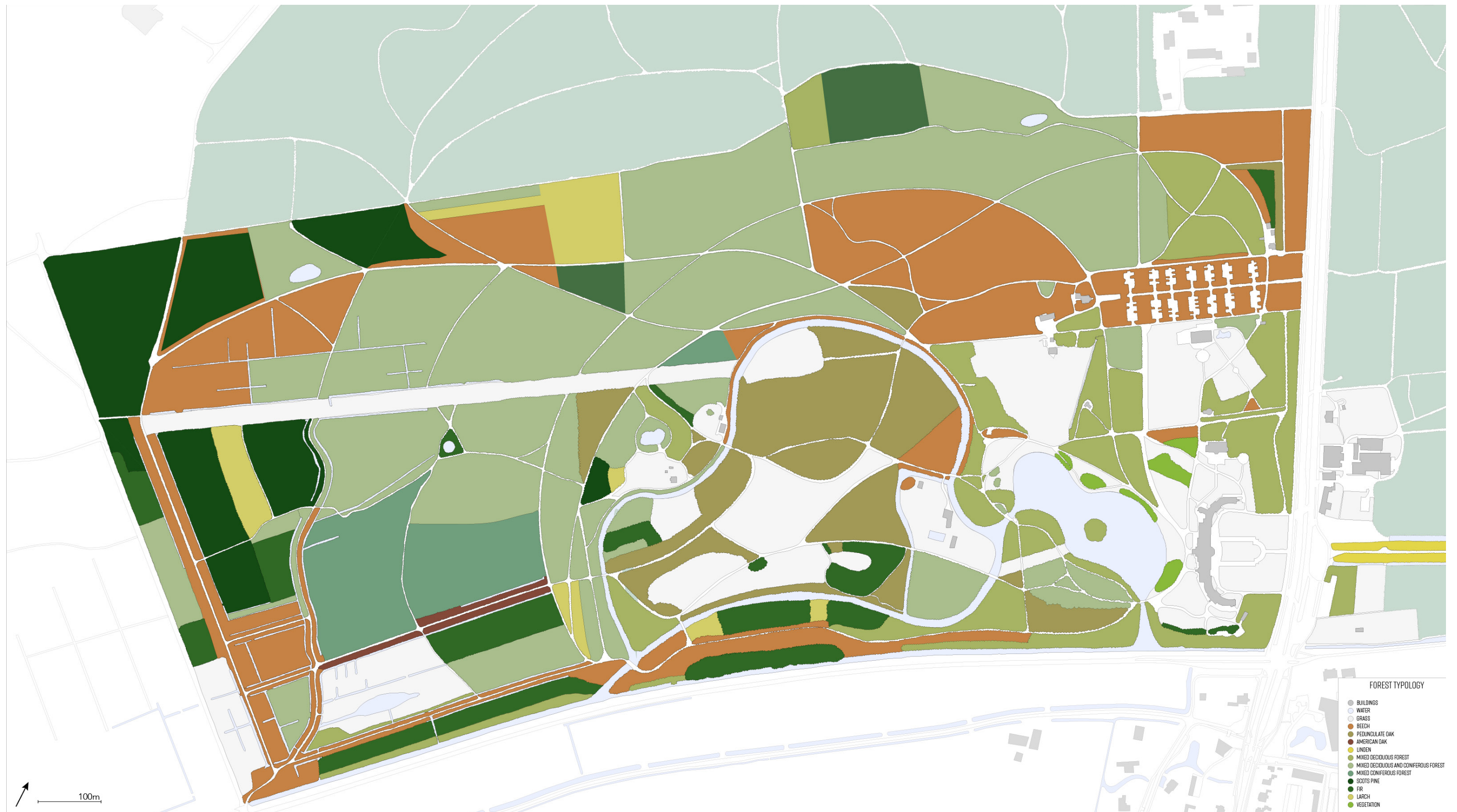


Figure 7: Map of Paleis Soestdijk with the types of trees

HISTORIC DEVELOPMENT.

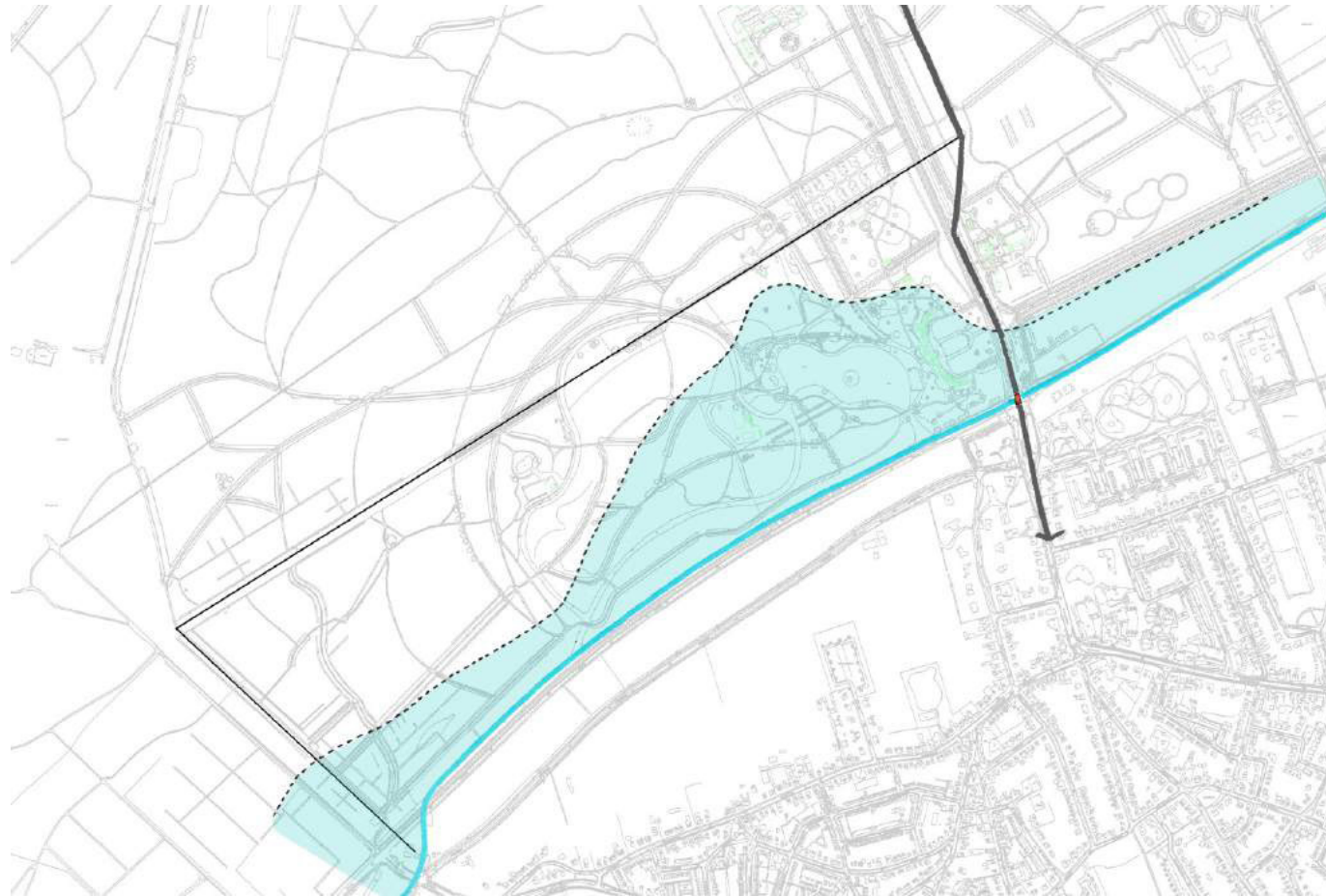


Figure 8: Reconstruction of the landscape before 1637 (Stichting in Arcadie, 2019)

Figure 8 shows the landscape before there was any building happening. The blue shows the peat land that was created with the Paamgracht at the bottom. The large black arrow is the Soesterdijk which is now the base of the Amsterdamsestraatweg.

Figure 9 shows the situation after Cornelis de Graeff, first owner of Soestdijk, built a hunting lodge and used the estate for leisure purposes, mainly hunting. Figure 10 shows a painting of de Graeff and his family with in the back a house that was probably the dwelling that was built at Soestdijk.

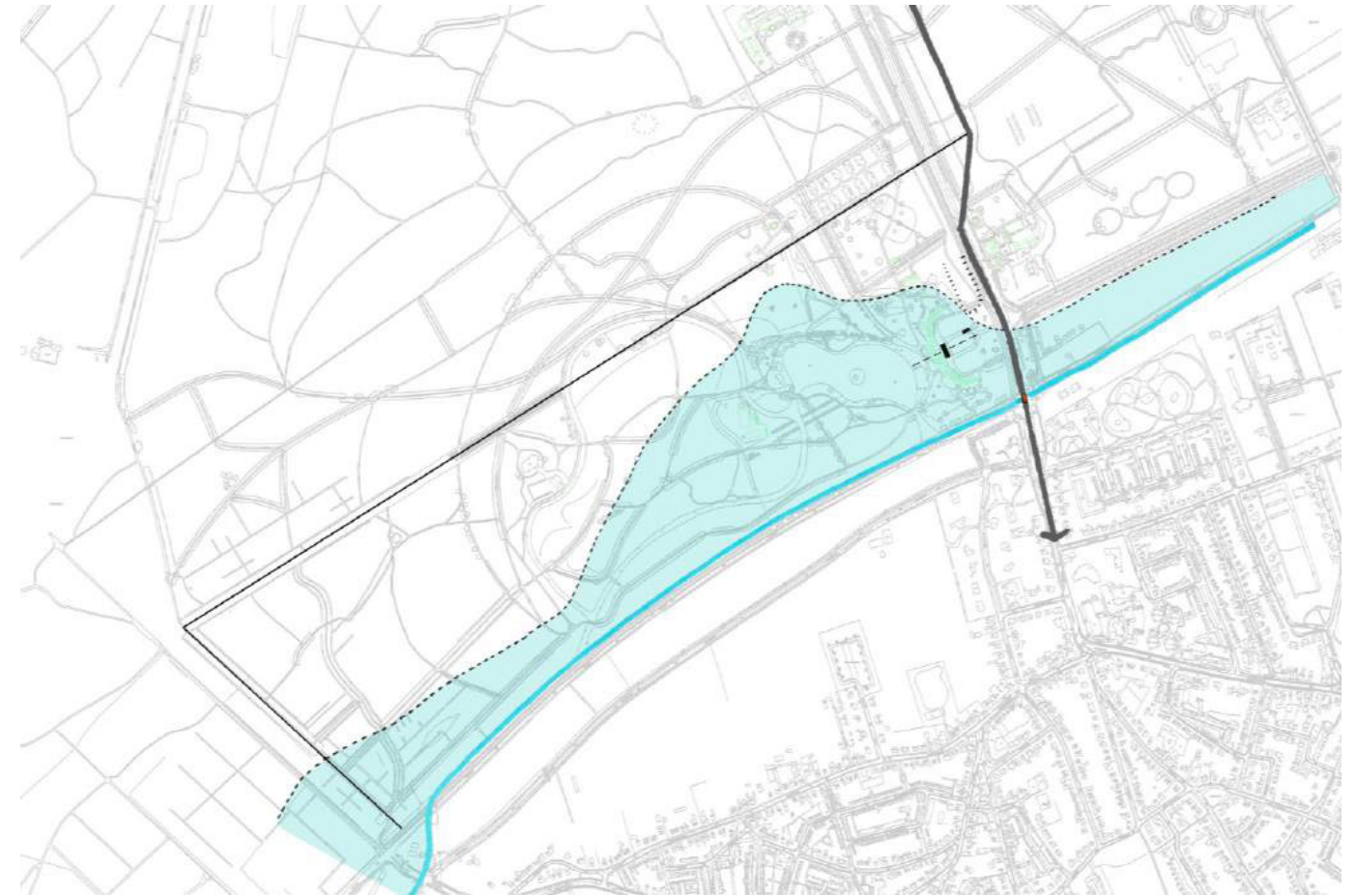


Figure 9: Reconstruction of the landscape 1637-1674 (Stichting in Arcadie, 2019)



Figure 10: Aankomst op Soestdijk van Cornelis de Graeff met zijn echtgenote en zonen (Van Ruisdael, 1660)

HISTORIC DEVELOPMENT.



Figure 11: Reconstruction of the landscape 1674-1702 (Stichting in Arcadie, 2019)



Figure 12: Reconstruction of the landscape 1702-1795 (Stichting in Arcadie, 2019)

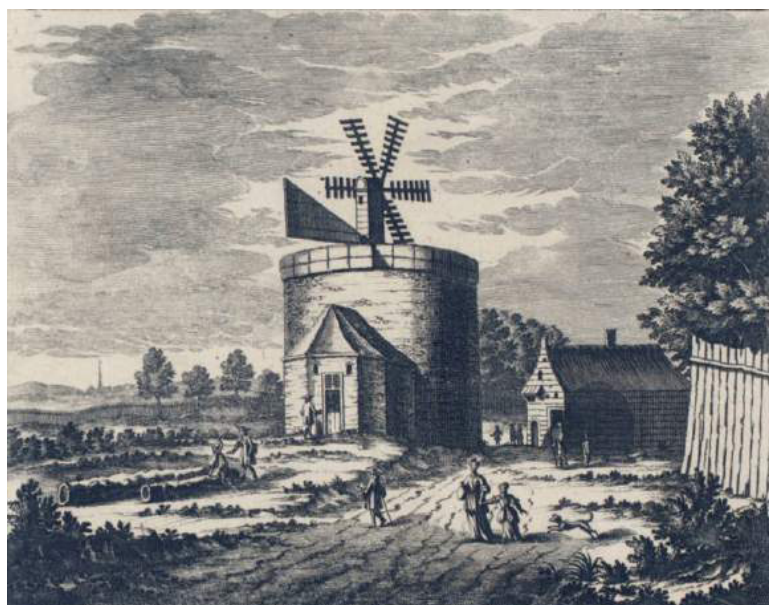


Figure 13: Water tower (Valck, 1695)

In 1674, stadhouder Willem III and his wife Mary Stuart become the owners of Soestdijk and they let architect Maurits Post build a nice hunting lodge and the first structures of a formal garden were introduced. Some of those avenues are still visible today (figure 11)

Figure 12 shows the expansion of the formal gardens style on the estate.

In figure 13 an etching of the estate during the late 17th century/early 18th century can be found, the water tower is already visible in this.

HISTORIC DEVELOPMENT.



Figure 14: Reconstruction of the landscape 1795-1815 (Stichting in Arcadie, 2019)

Figure 14 shows the influence of Louis Napoleon on the estate of Paleis Soestdijk, who resided there during the French Invasion.

Figure 15 shows the situation after the estate was gifted to Willem II and his wife Anna Paulowna. For them a truly royal, russian-style palace with two arched wings was created and J.D. Zocher made a plan for the estate grounds. Even though Zocher died before the plan could even be realised, his son continued the plan and created the signature pond, the route with hide and reveal principle and therefore unique viewpoints of the palace that are still there today (see figure 16).

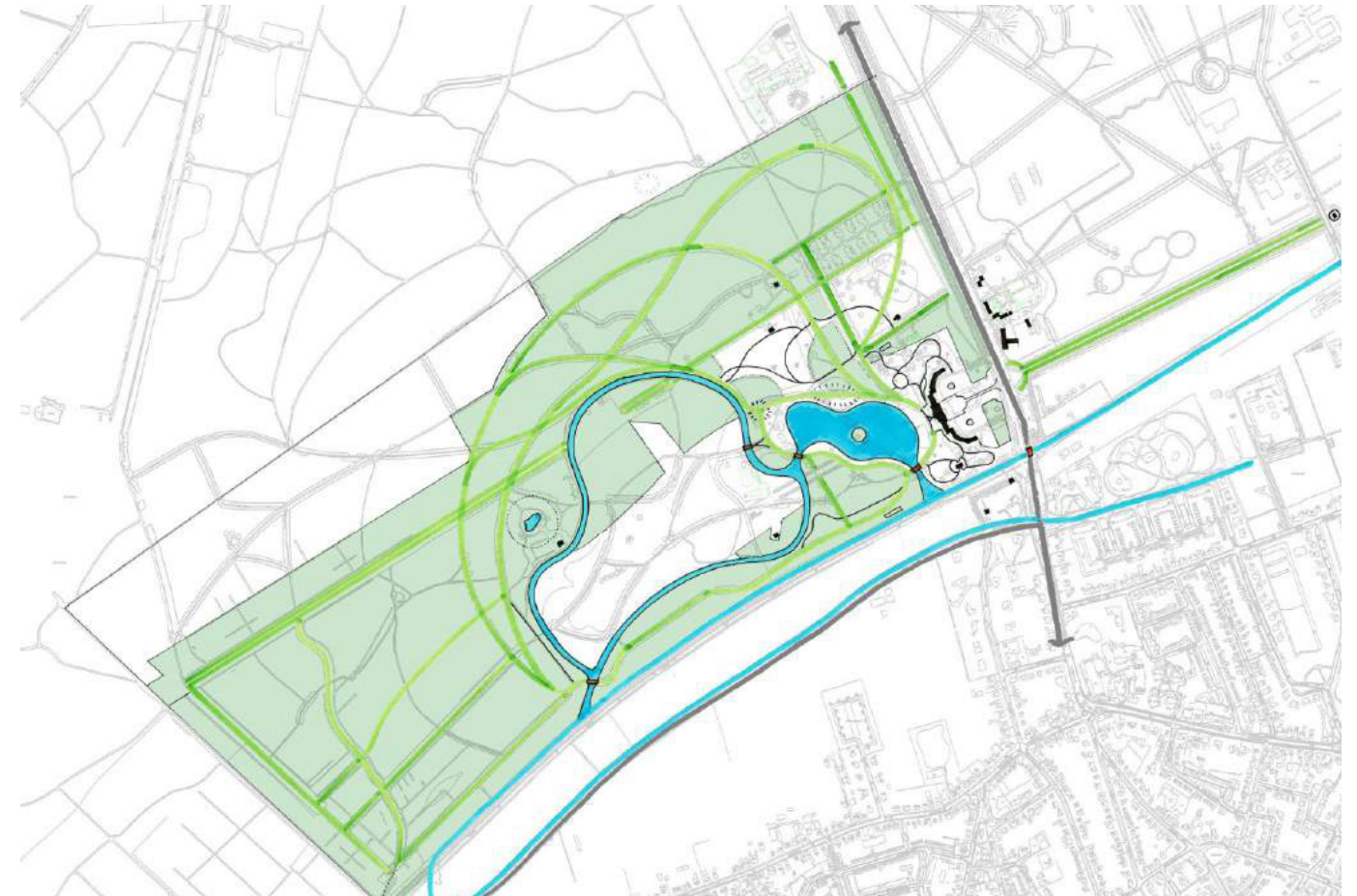


Figure 15: Reconstruction of the landscape 1815-1830 (Stichting in Arcadie, 2019)



Figure 16: View of Soestdijk (Bierweiler, 1830)

HISTORIC DEVELOPMENT.



Figure 17: Reconstruction of the landscape 1830-1865 (Stichting in Arcadie, 2019)

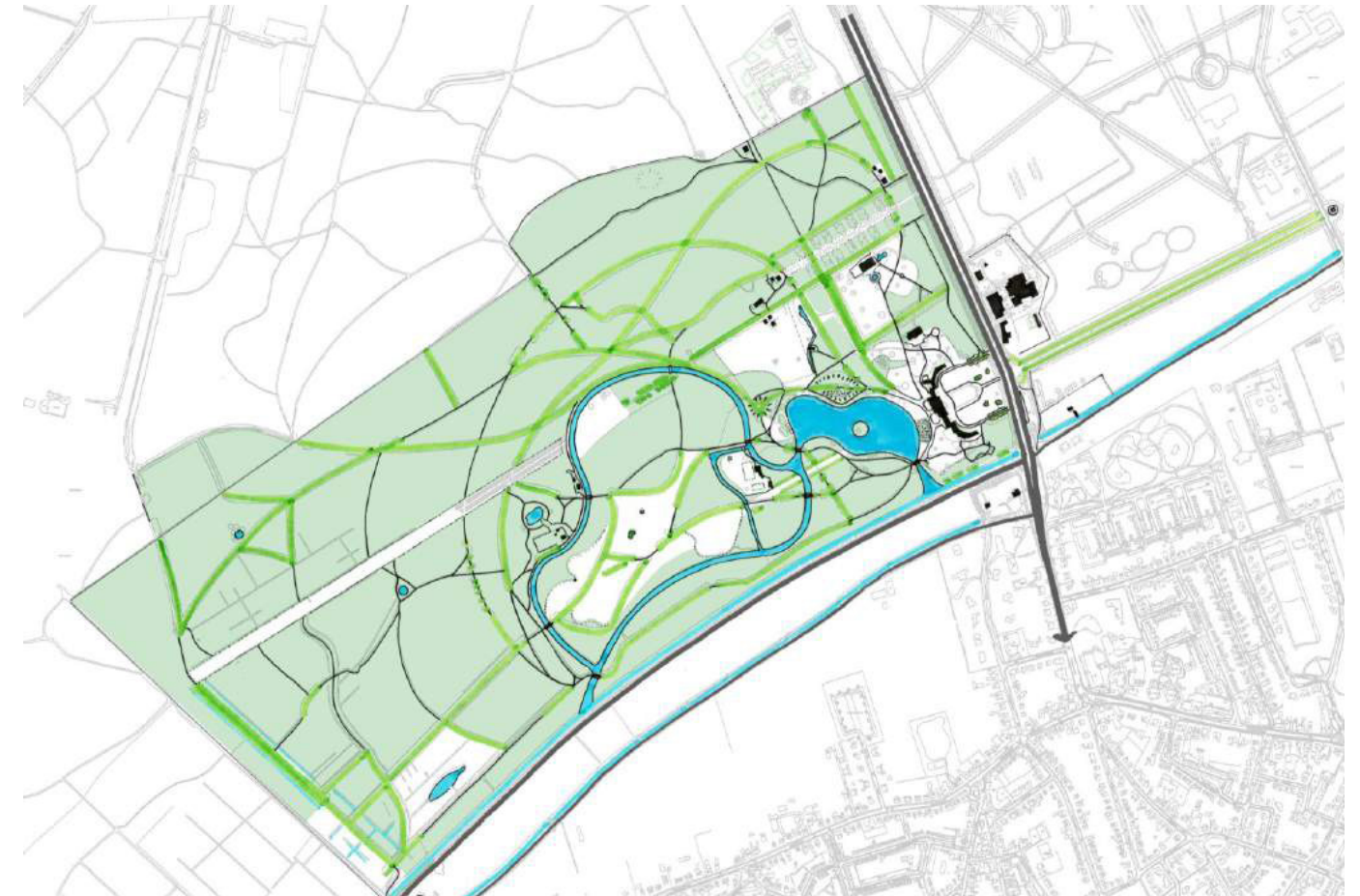


Figure 18: Reconstruction of the landscape 1937-2004 (Stichting in Arcadie, 2019)



Figure 19: The greenhouse (Collectie Eemland, 1879)

Figure 17 shows the changes on the estate between 1830 and 1865. Remarkable are the two greenhouses present on the estate. As can be seen on the photograph in figure 19 they were quite remarkable.

Unfortunately they were only quite shortly on the estate, they were probably removed in the late 19th century. In figure 18 it can be seen that they are no longer there in 1937 and a new greenhouse is constructed at the same location.

Since the estate of Soestdijk was the residency of queen Juliana and her husband Bernhard, there were quite some changes to the estate during that time. First of all, a few functions were added such as a sport facility, cinema and offices. Next to that, due to the protection of the queen and her family, the military police was based on the north side of the estate

SIGHT AXES.



Figure 20: Map of Paleis Soestdijk with sight axes

PROGRAM.

On the map all different buildings and important items on the estate are indicated

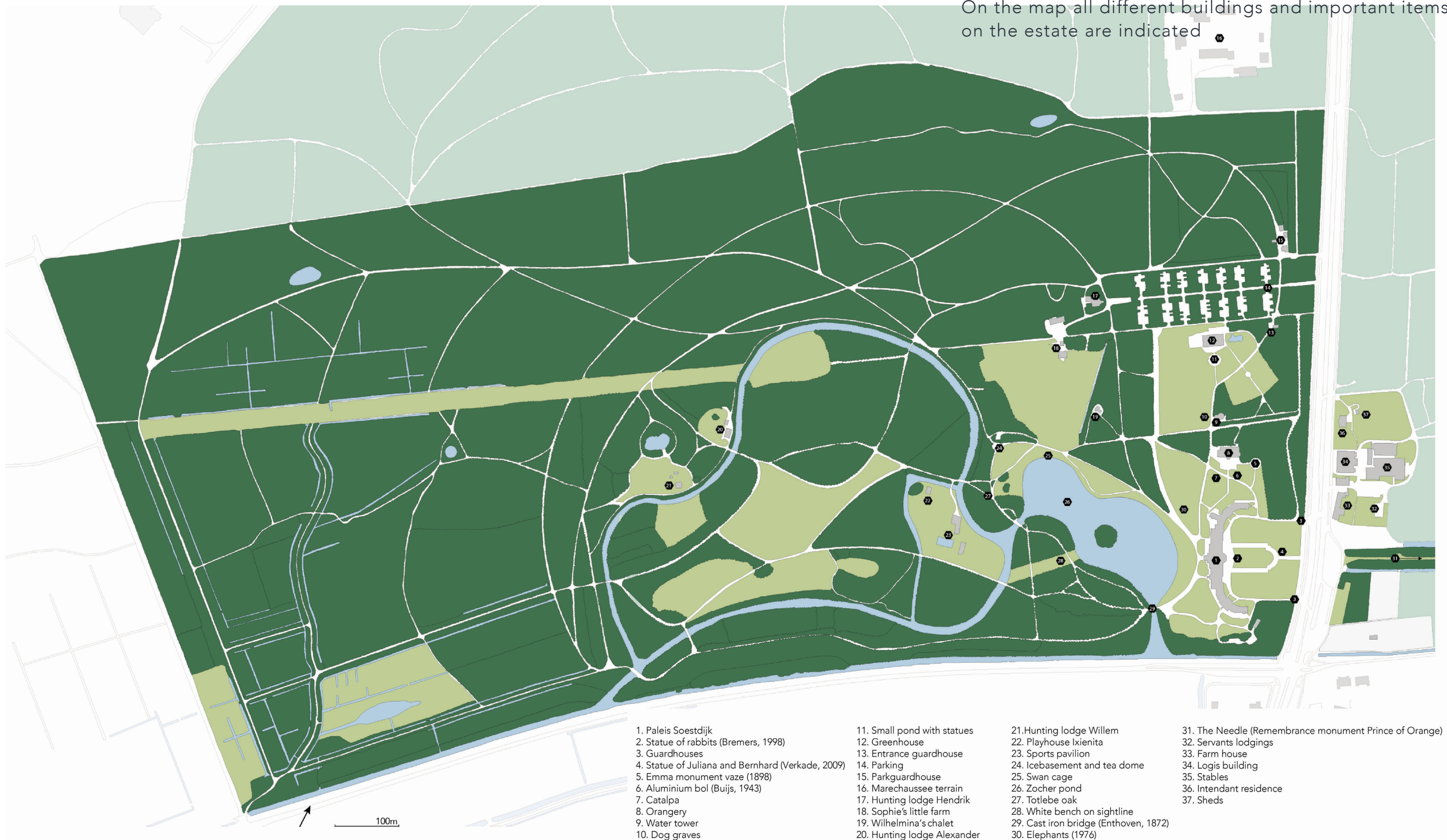


Figure 21: Map of Paleis Soestdijk with the program

VISUAL TOUR.



Figure 22: Photograph of backside Paleis Soestdijk



Figure 23: Photograph of the statue of Juliana & Bernhard with in the back the palace



Figure 24: Photograph of a bridge on estate Paleis Soestdijk



Figure 25: Photograph of the Orangery

VISUAL TOUR.



Figure 26: Photograph of the water ornament and greenhouse



Figure 27: Photograph of the small glass building



Figure 28: Photograph of the water tower



Figure 29: Photograph of the greenhouse during first visit Paleis Soestdijk

BIOMASS ANALYSIS.



Figure30: Map with available biomass streams

POTENTIALS.



Figure31: Map with potential biomass streams

CIRCULAR PLAN.

This part will elaborate on a plan for the estate of Paleis Soestdijk that will utilise the different biomass sources and the possibility of producing food, by connecting them and converting them to products that can be used for other purposes on the estate.

STARTING POINT.

While working on the plan for the estate of Paleis Soestdijk, the idea came to mind that ideally there would be four levels on the estate. The first being the most lively, where the palace is and the main functions of the estate are. The second level is a residential area. The third level is the park and forest through which routes are laid down for visitors to walk around. The final level is the most left part of the forest which will be reserved for more quite purpose, mainly for the animals that live on the estate.

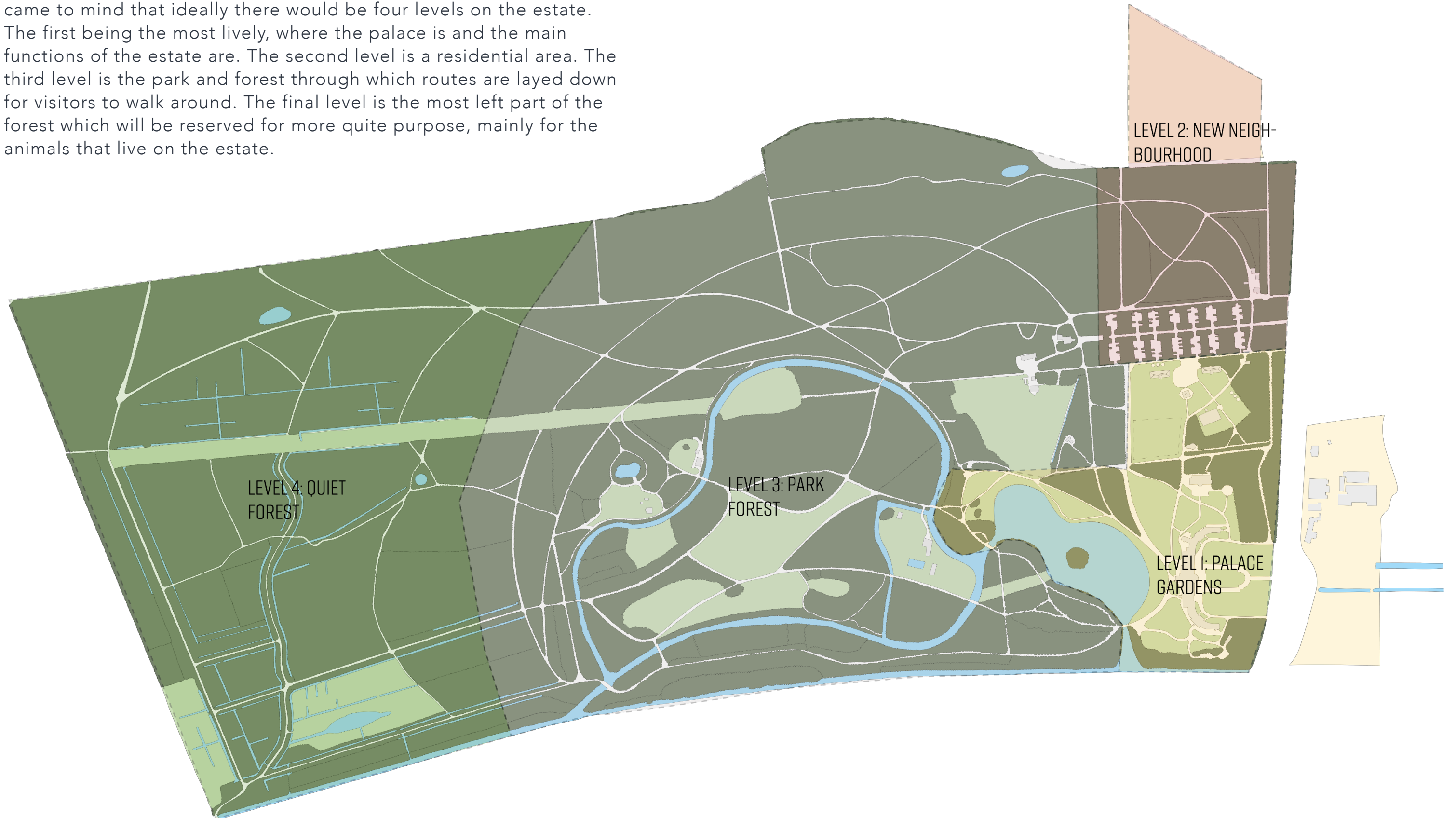


Figure32: Map with levels of livelihood

PROCESS.



Figure 33: Sketch of a version of the plan



Figure 34: Sketch of a version of the plan

PROCESS.

On this page and the one before a few impressions of the sketches and studies that I did for the plan for Paleis Soestdijk can be found. There are many more but these show mostly what the direction was that I was leaning towards. Some things stayed, some things evolved and many things changed a lot.

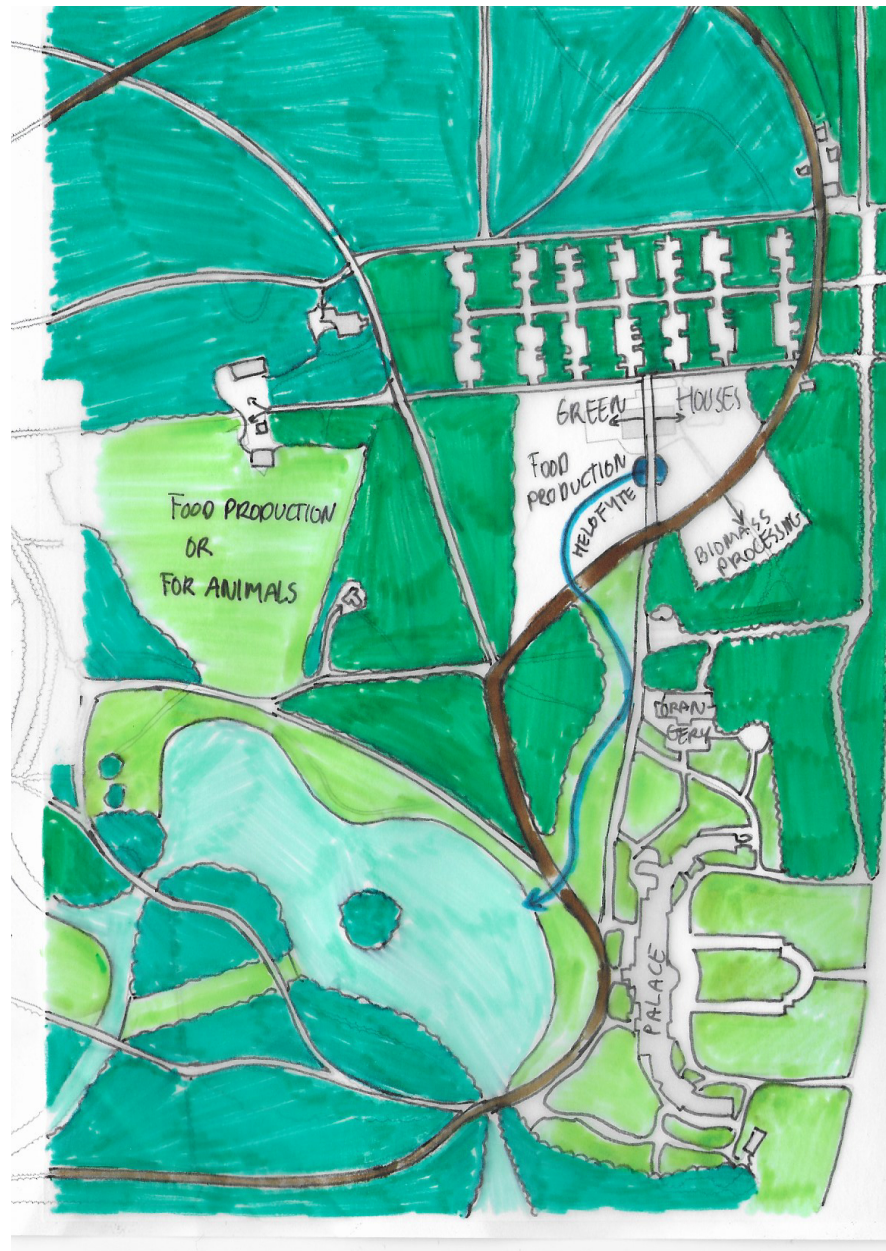


Figure 35: Sketch of a version of the plan

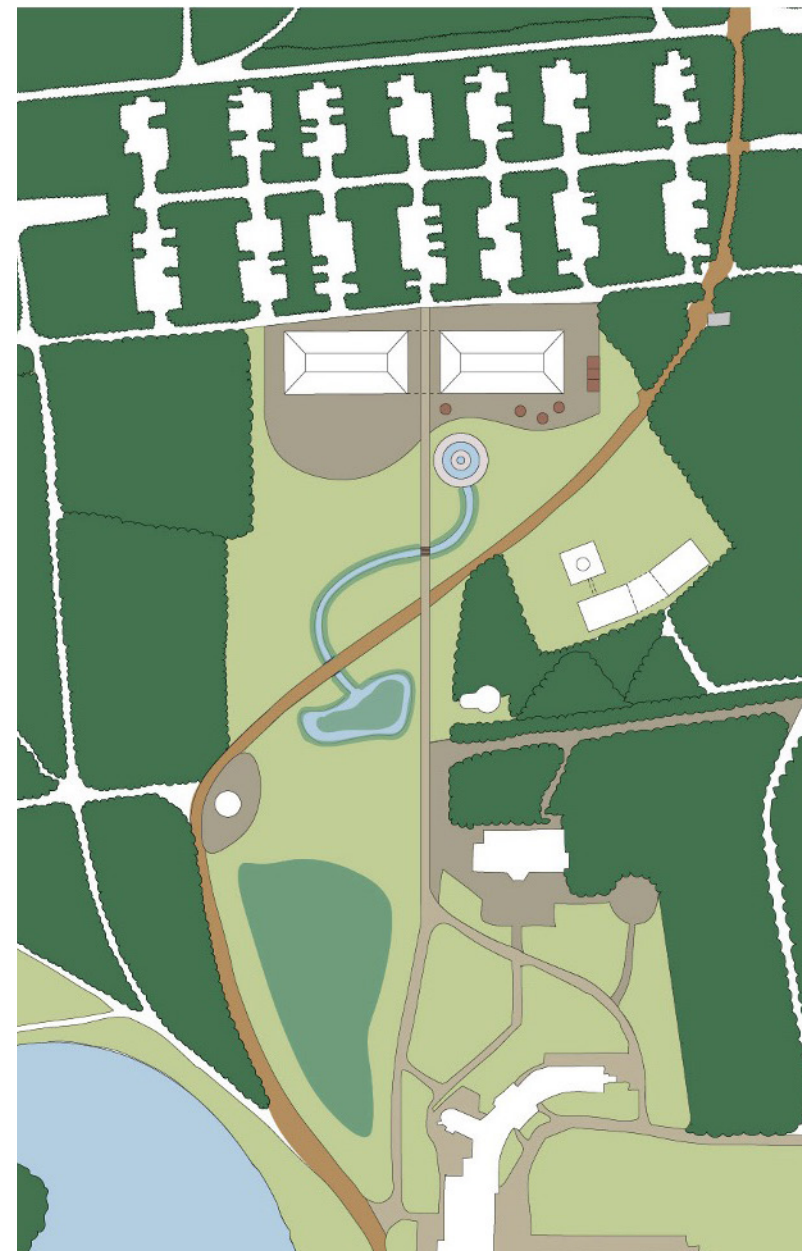


Figure 36: Version of the plan



Figure 37: Path study



Figure 38: Path study

PLAN.



Figure 39: Plan for Paleis Soestdijk

NEW ENTRANCE.

In the map below, in red, the change of entrance can be seen. The entrance is now on the corner of the greenhouse area and when you enter the estate it is a bit disorienting. The idea is to move the entrance to the middle of the greenhouse area and let the new greenhouses form the entrance to the estate.

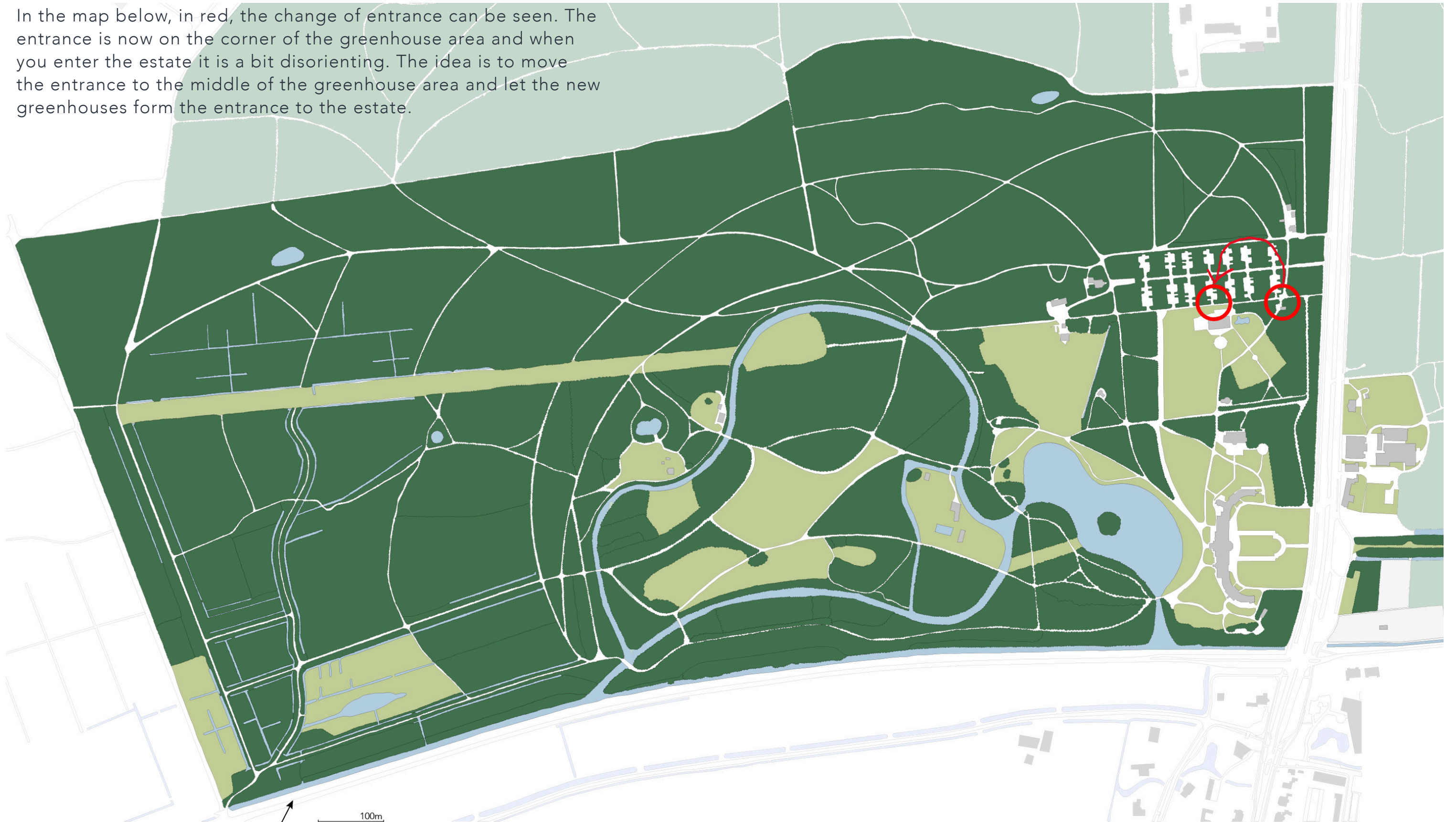


Figure 40: Map of the estate with the entrance change indicated

NEW SIGHTLINE.

When moving the entrance, this also creates the opportunity to create a sight line from the entrance to the palace.



Figure 41: Map of the estate with the new sightline indicated

ZOCHER'S PATH.

In Zocher's plan and something that was probably also executed, the path coming from the former entrance extended more, see red arrow. At the end of that arrow there is already a small glass house, randomly placed there (figure 42). This glass house could be an attraction for visitors to walk that way instead of directly to the palace. Especially if it gets the function of a small exhibition place or else.



Figure 42: Image of small glass house



Figure 41: Map of the estate with the Zocher Path indicated

BIOMASS ROUTE.

A route that takes the visitors around the estate and showing all parts that are connected to the circular strategy.



Figure 43: Map of the estate with the Biomass route indicated

BIOMASS.

Central is the solving of the different biomass streams on the level of the estate, in other words: closing the biomass cycle locally.

STARTING POINTS.



Figure 44: Map of the estate with an indication of the amounts of biomass

STARTING POINTS.

In order to identify and illustrate the biomass plan, research was done into the types of biomass and the way to process biomass. The figures on the left show some thoughts that I had during that research and the diagram below shows the sources and possible purposes of biomass on the estate of Paleis Soestdijk.

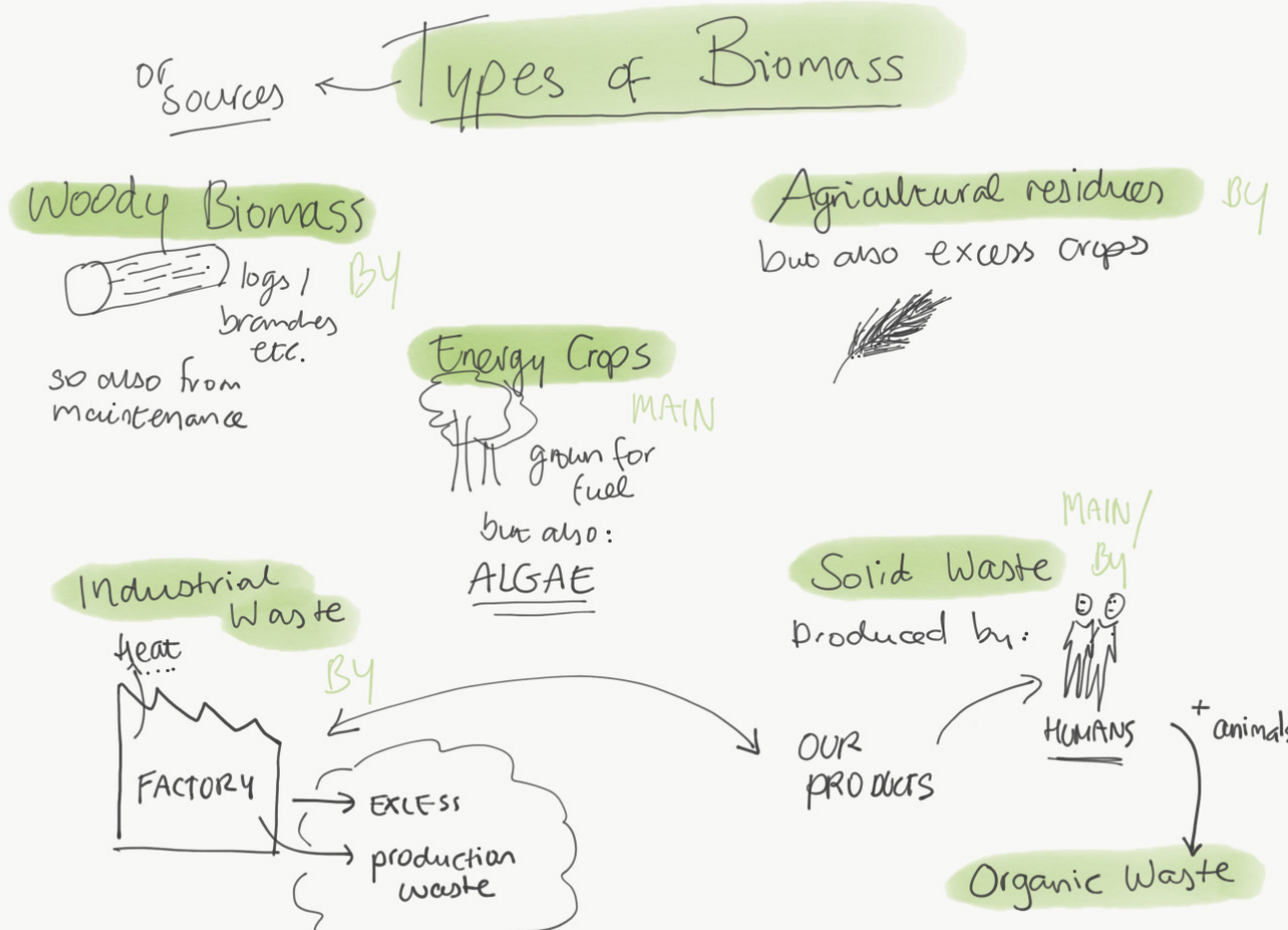
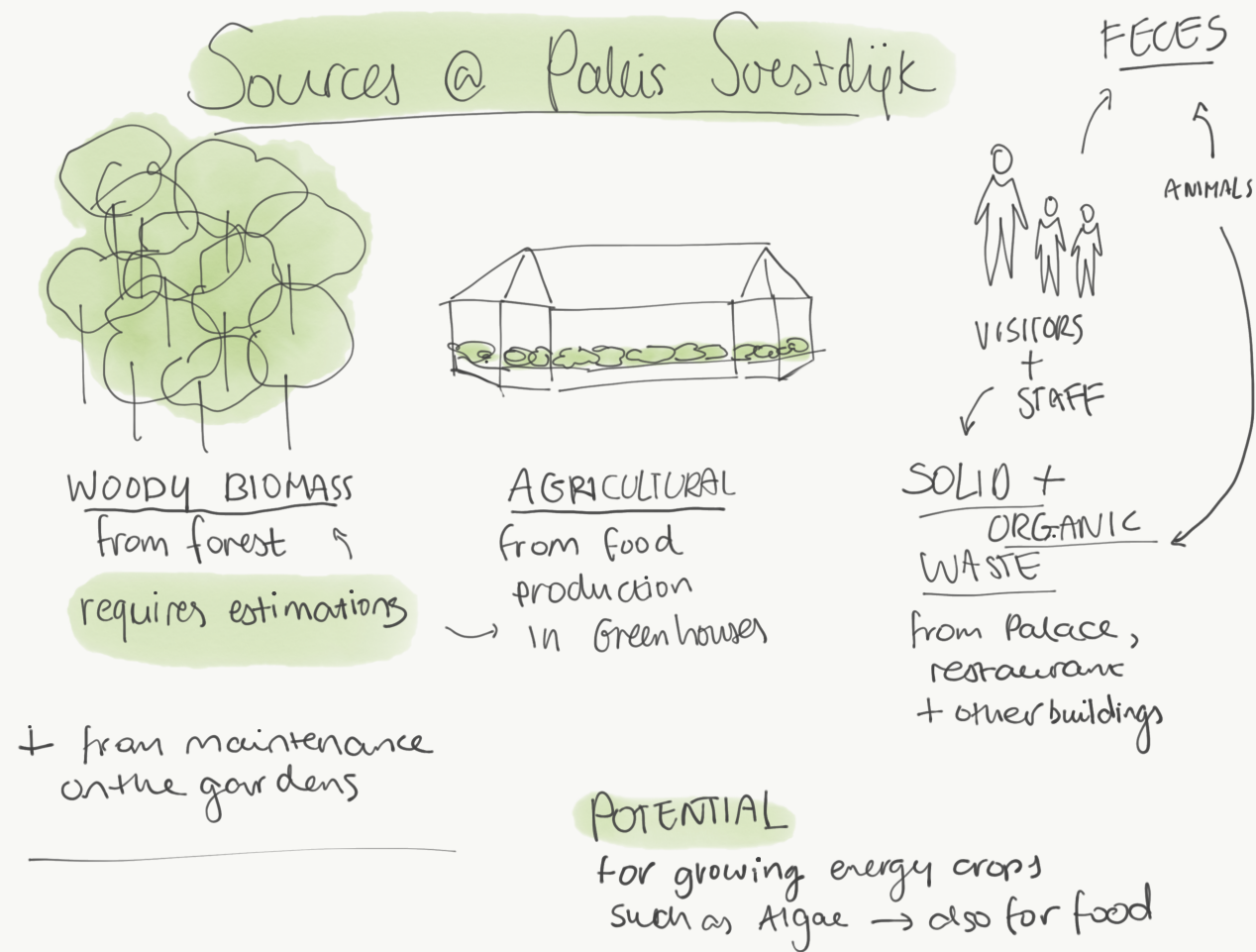


Figure 45 & 46: Process sketches of first ideas about biomass

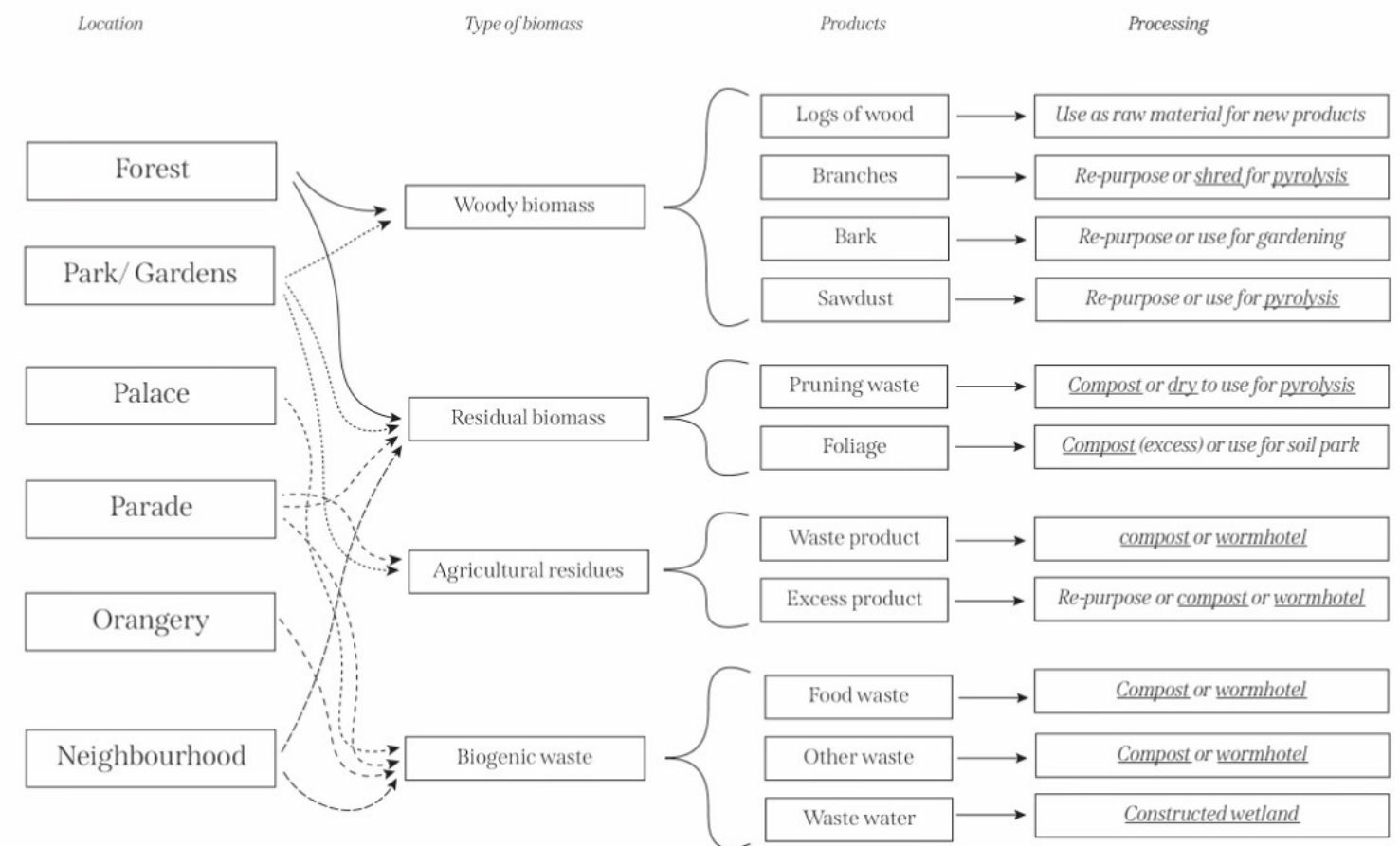


Figure 47: Diagram of the sources and purposes of biomass on the estate

POTENTIALS.



Figure 48: Map of the estate with the potentials of biomass

THE BIOMASS CYCLE.

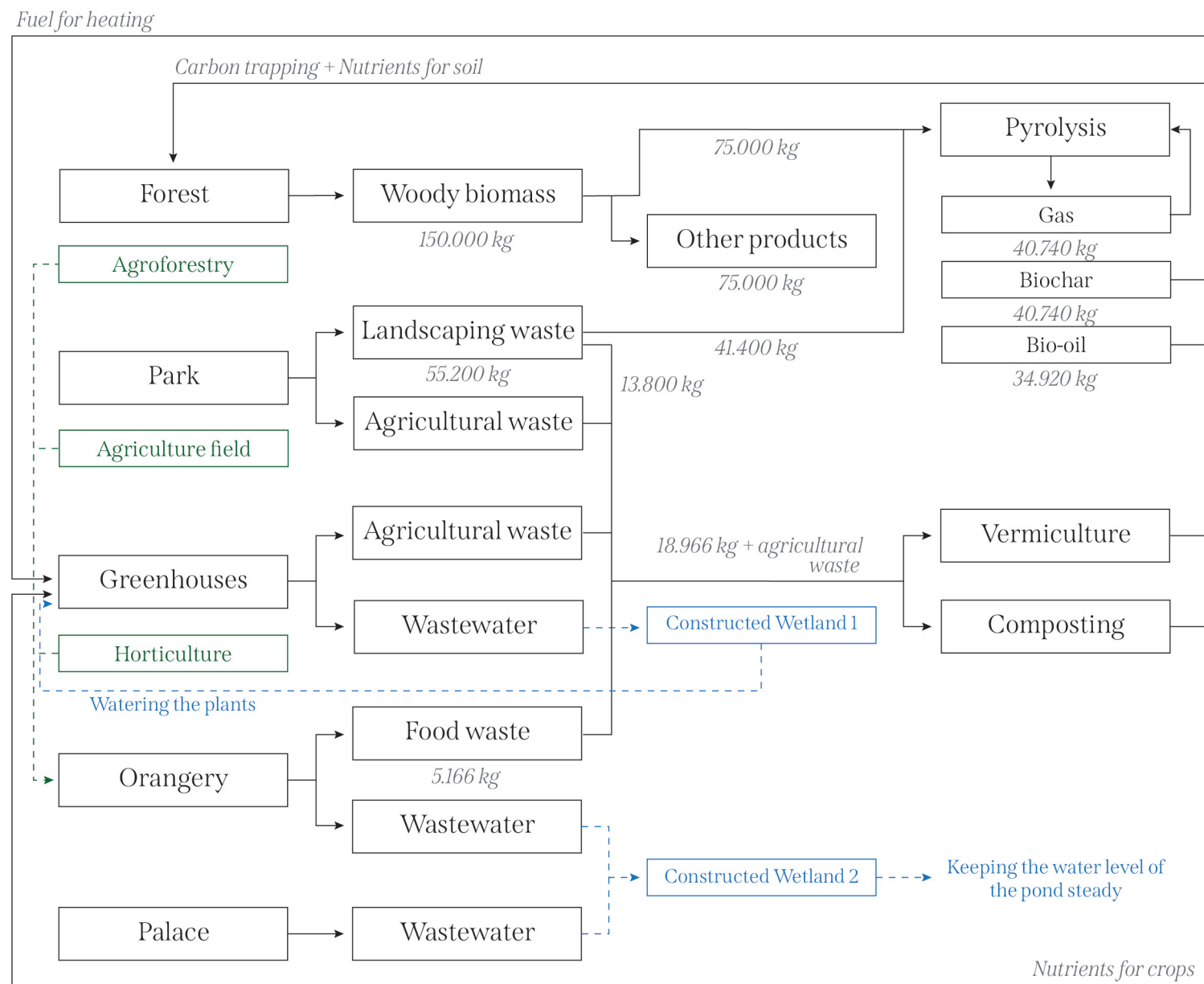


Figure 49:Diagram of the biomass cycle

Figure 50: Map of the estate

THE PLAN.

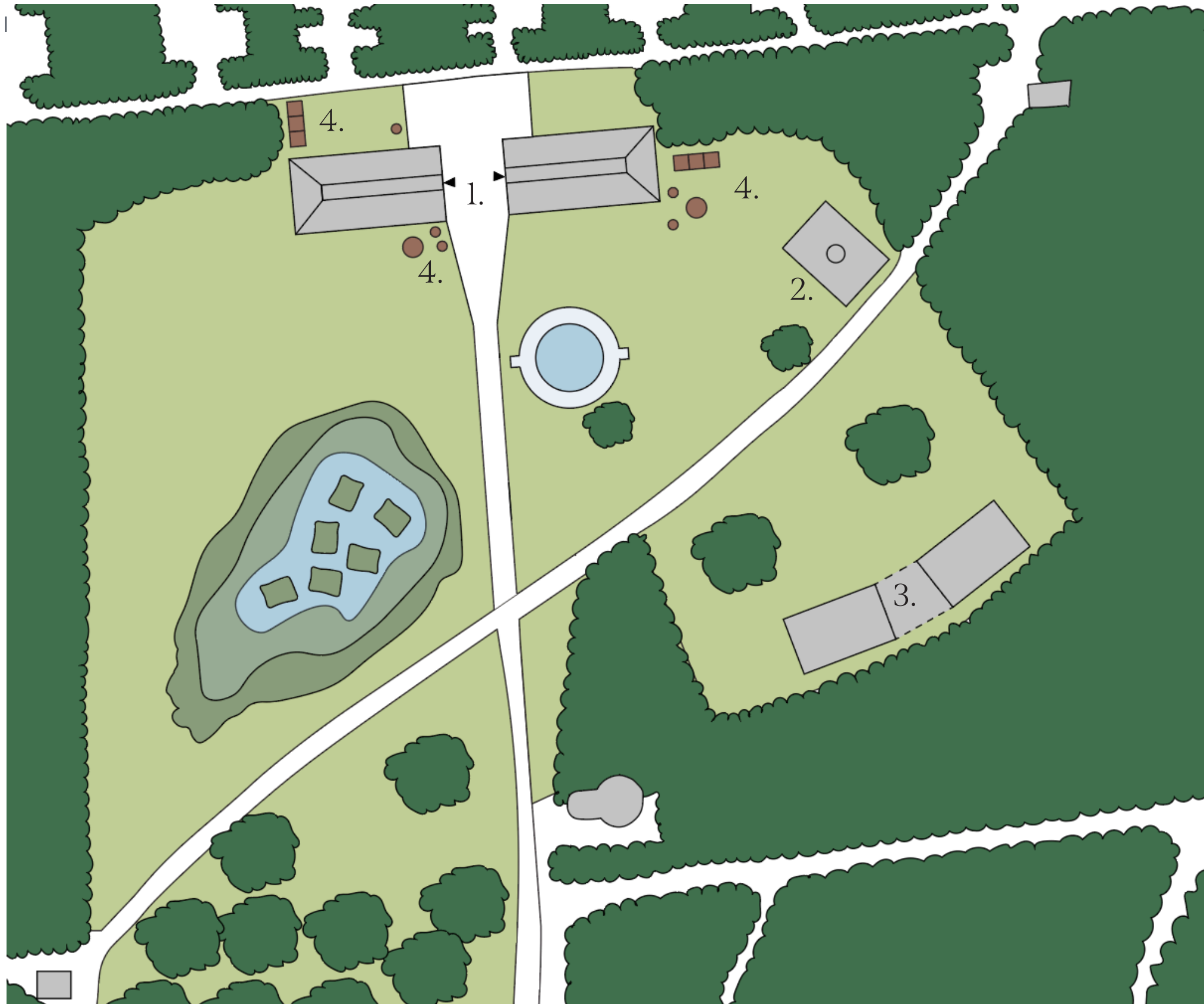


Figure 51: Zoomed in map of the estate

1. Greenhouses

Food production + agricultural waste + place where the bio-oil is heated for heating. Excess heat recovered from ventilation is used to dry the biomass in the sheds

2. Pyrolysis reactor

Here dried biomass is converted to gas (re-used to keep the reactor going), biochar (for carbon trapping) and bio-oil (can be used for heating purposes)

3. Drying sheds

Here the woody biomass and residual biomass is first collected and dried. Than shredded, and further dried in the second shed.

4. Composting/vermiculture

Here the food waste combined with residual biomass is converted to fertiliser for the plants. There are compost bins, compost barrels and worm hotels.

CONVERSION OF BIOMASS.

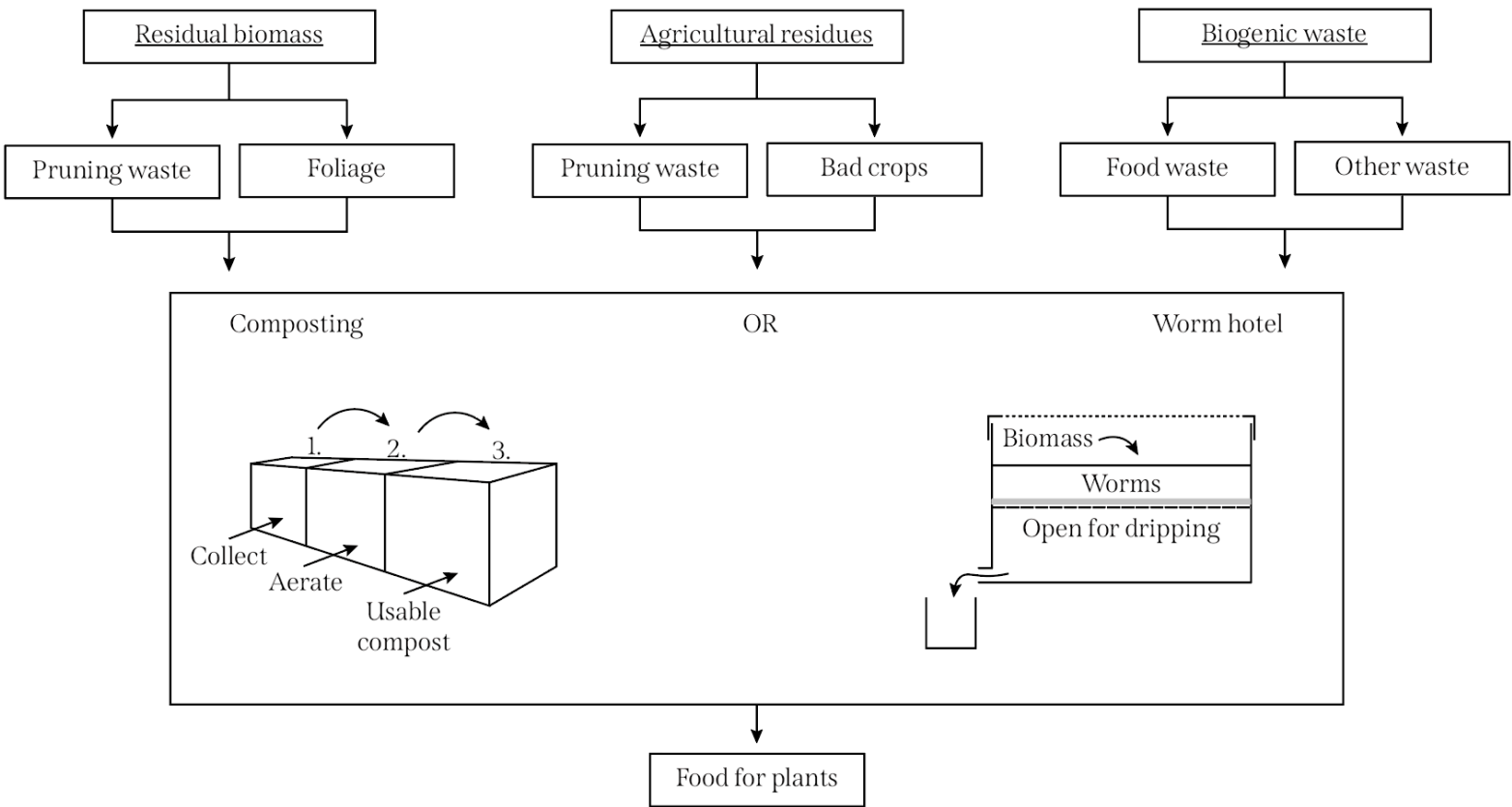


Figure 52: Diagram biological conversion

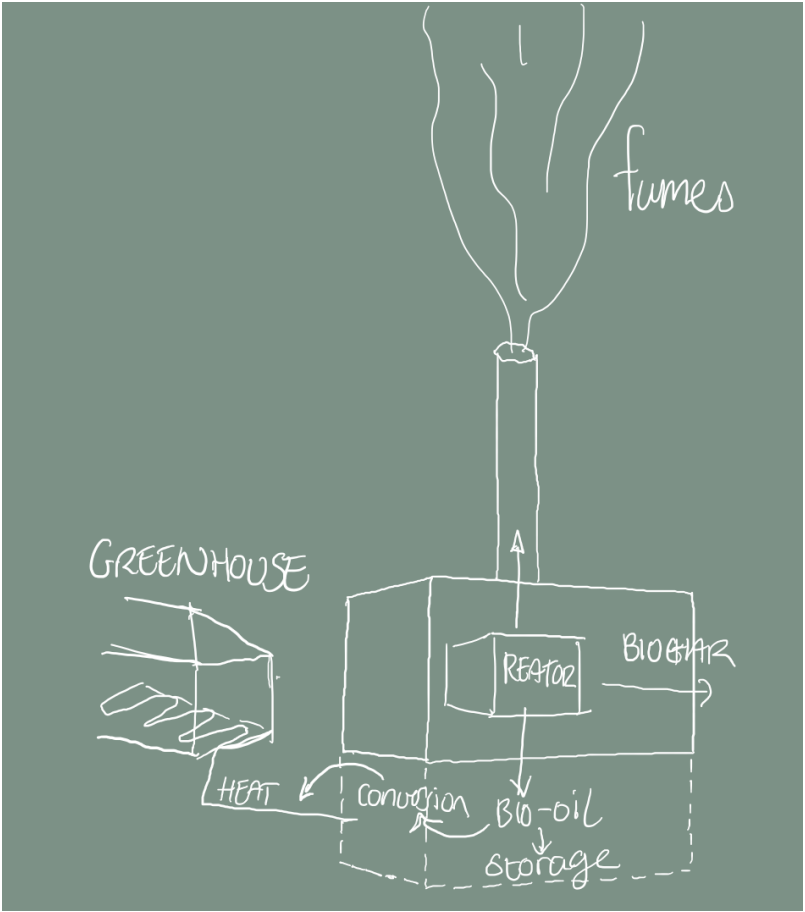


Figure 54: The way the reactor works sketch

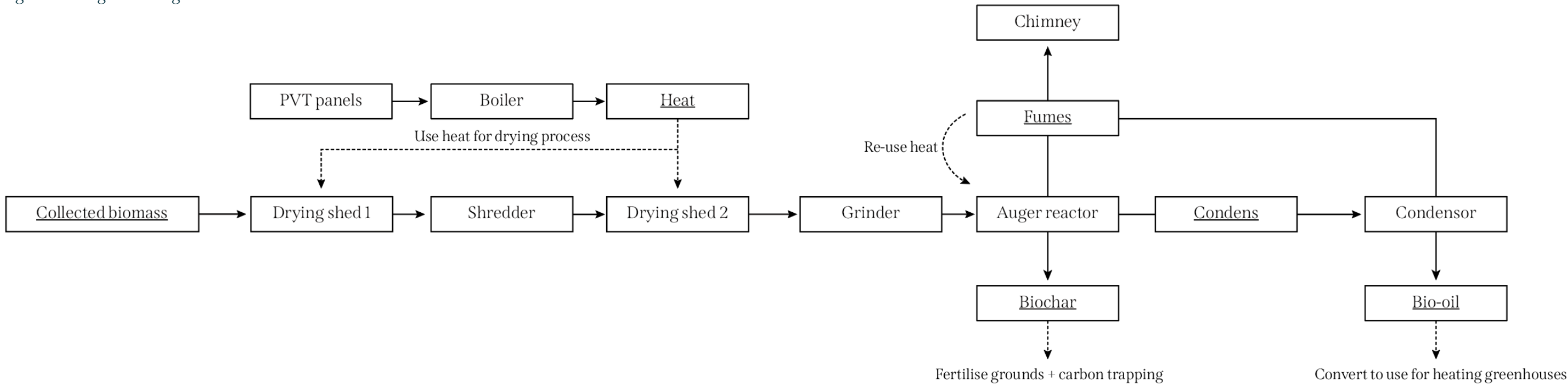


Figure 53: Diagram thermochemical conversion

WASTEWATER.

Solving the liquid form of biomass and mayor wastestream
on the estate of Paleis Soestdijk

PROCES.

Below there are a some sketches of the wastewater management plan

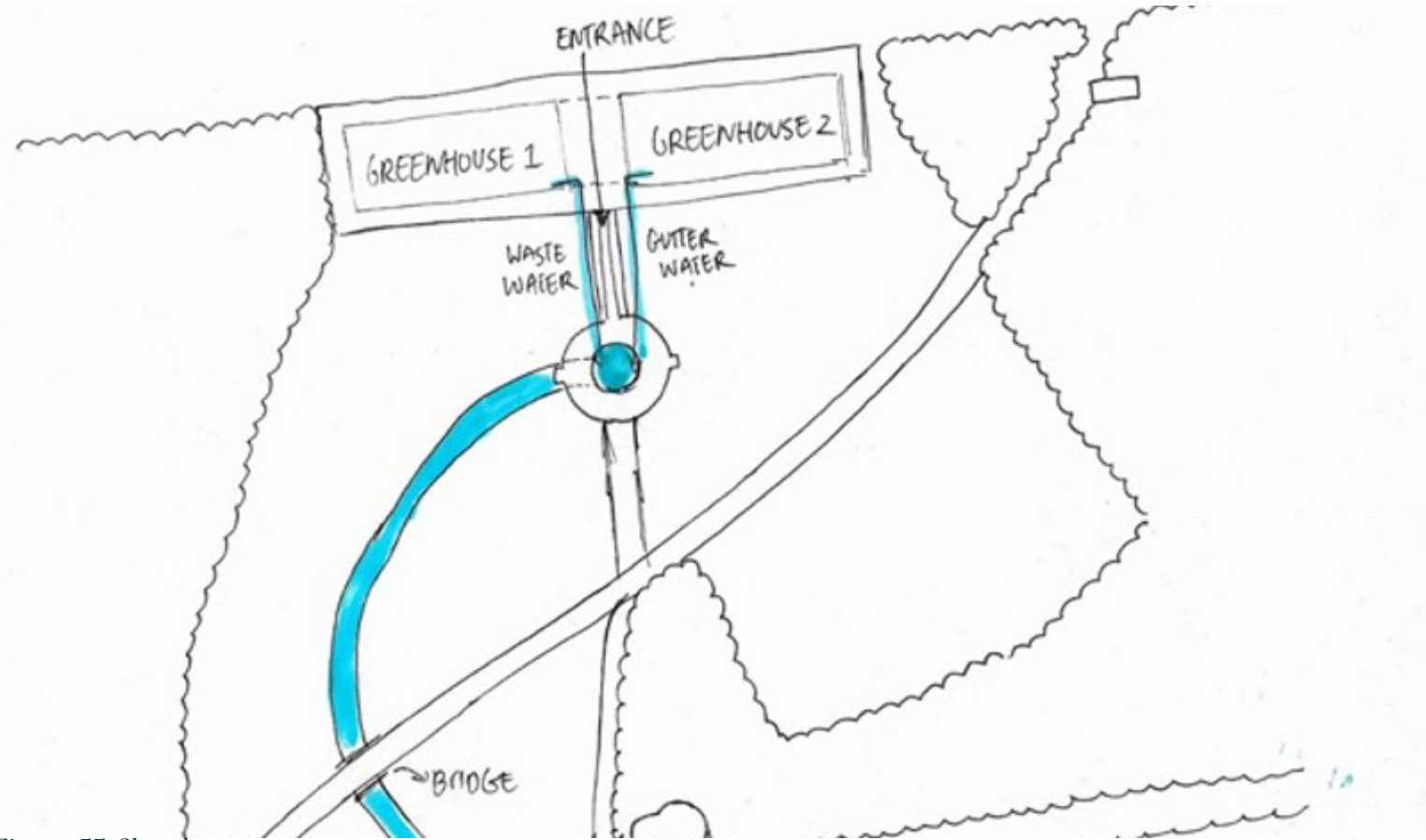


Figure 55: Sketch wastewater management

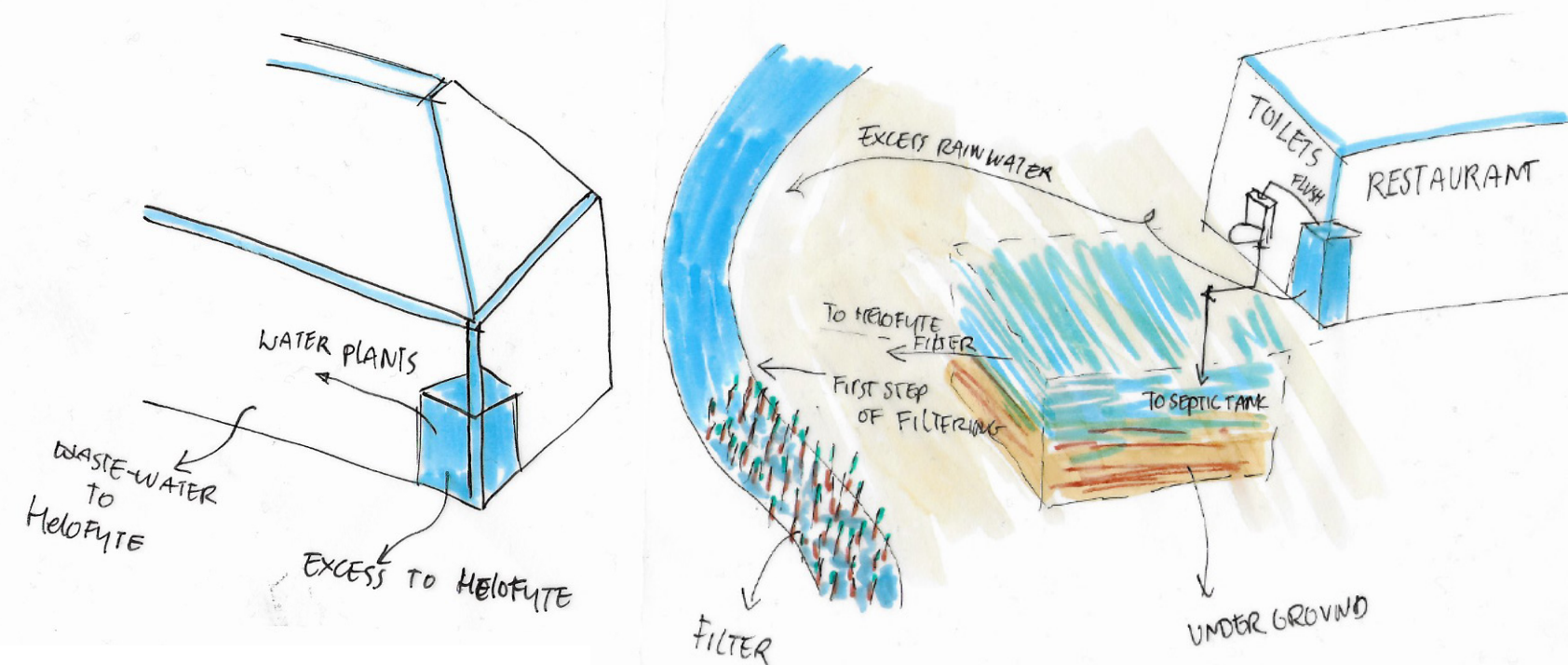


Figure 56: Sketch wastewater management greenhouses

Figure 57: Sketch wastewater management Orangery

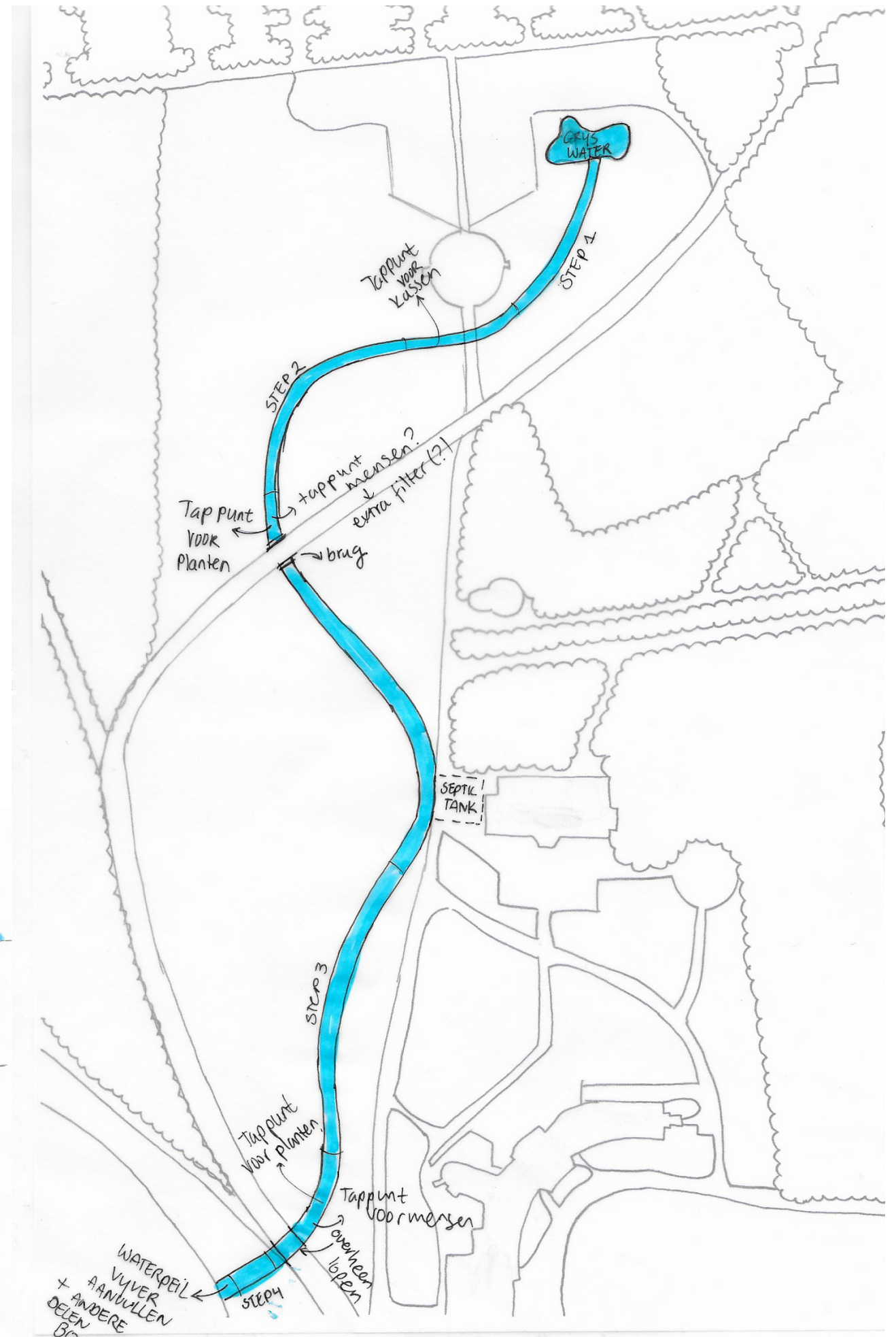


Figure 58: Sketch plan wastewater management

POTENTIALS.

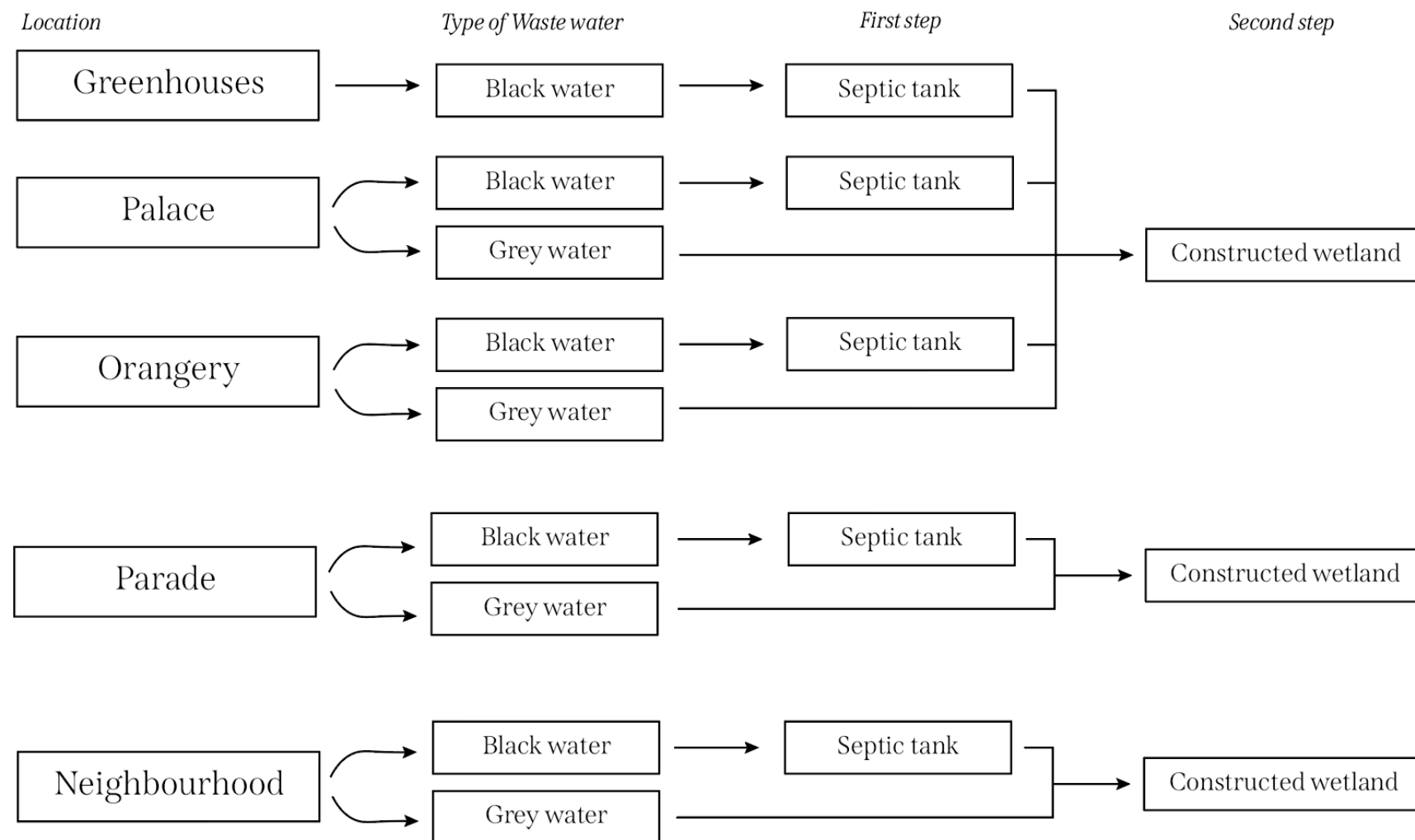


Figure 59: Diagram wastewater streams

Figure 60: Map with types of wastewater streams and conversion

PLAN.

The plan for the wastewater streams is that they are essentially divided into two different systems. The first system converts the wastewater from the greenhouse area into cleaner water that can be used to water the plants inside the greenhouses and the second constructed wetland system converts the wastewater from the orangery and palace into cleaner water that can be used to keep the level of the pond and pump water to the dryer parts of the estate.

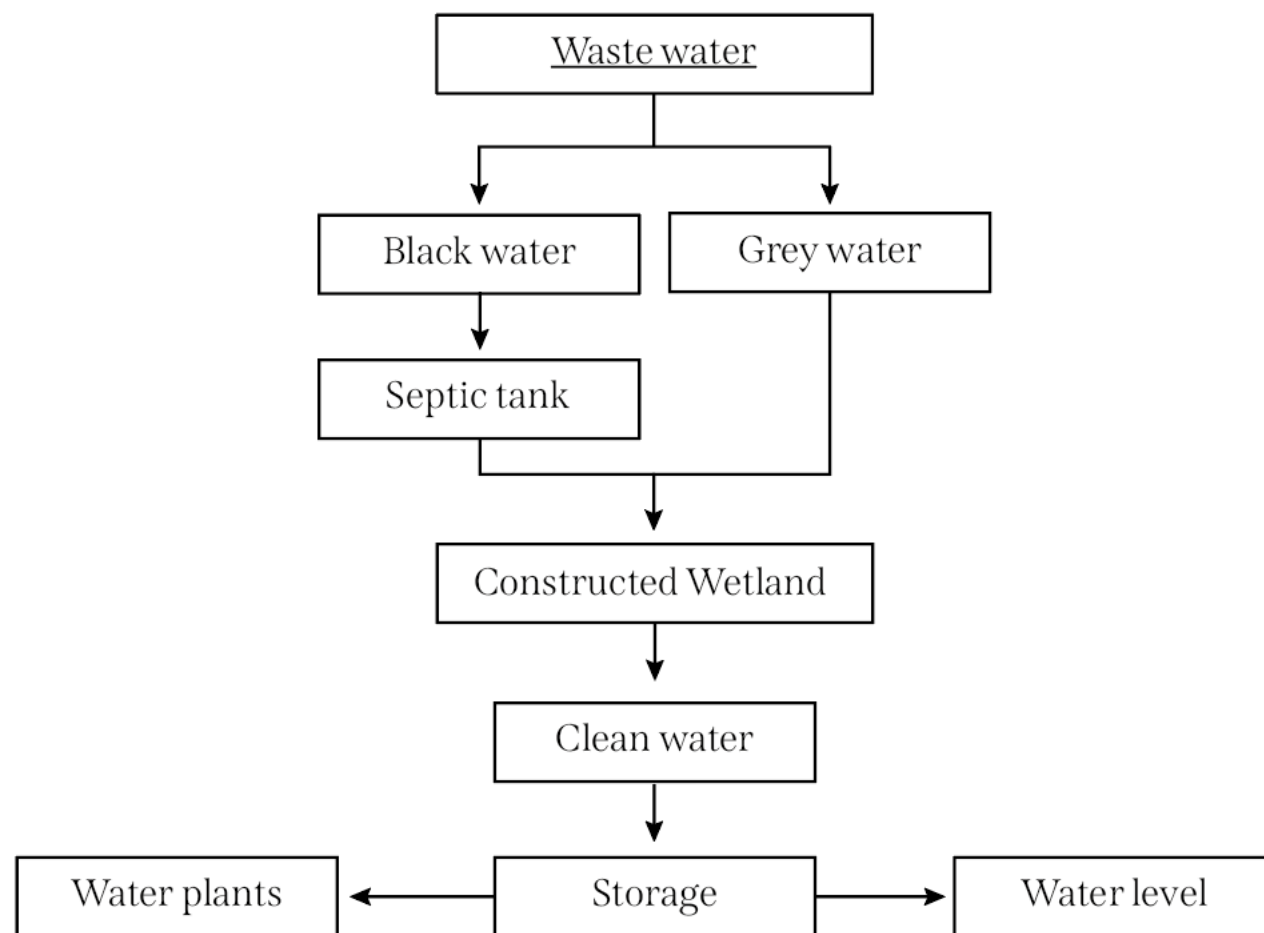


Figure 61: Diagram of wastewater conversion

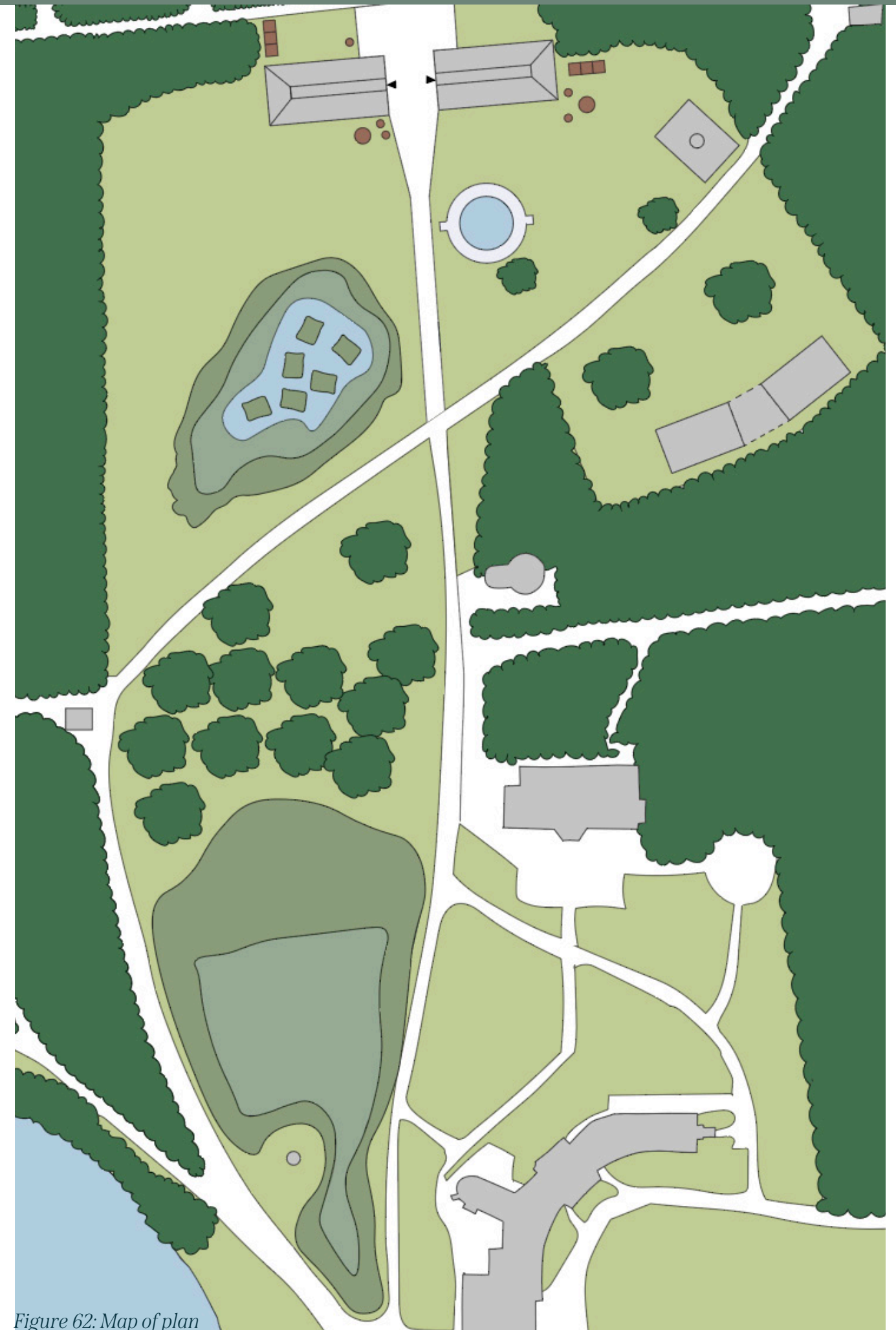


Figure 62: Map of plan

CONSTRUCTED WETLANDS.



Figure 63: Image of Floating treatment wetland

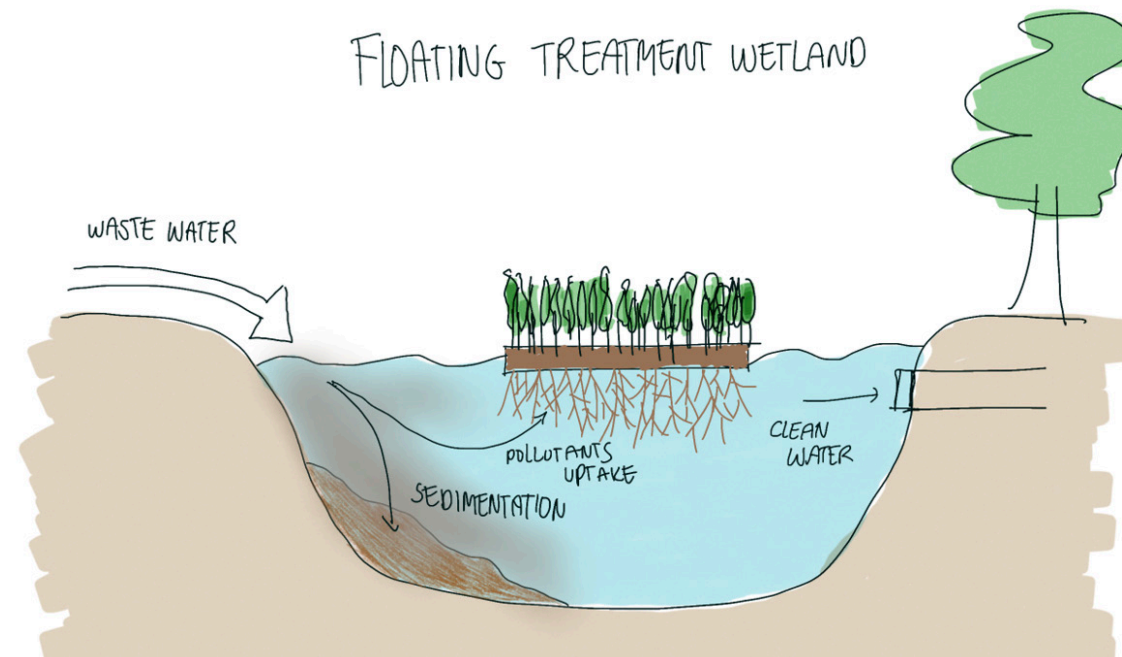


Figure 64: Floating treatment wetland

Constructed wetland 1

The constructed wetland situated in the greenhouse area is based on the floating treatment wetland. Small islands with helophyte plants float through the water basin. An example of such floating island can be found in figure 63.



Figure 65: Image of Surface flow wetland

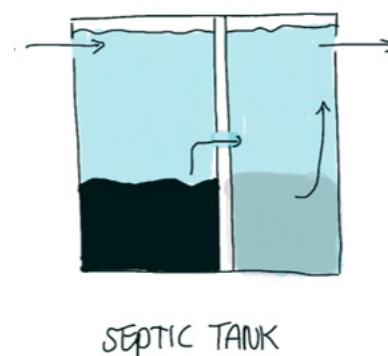


Figure 66: Septic tank principle

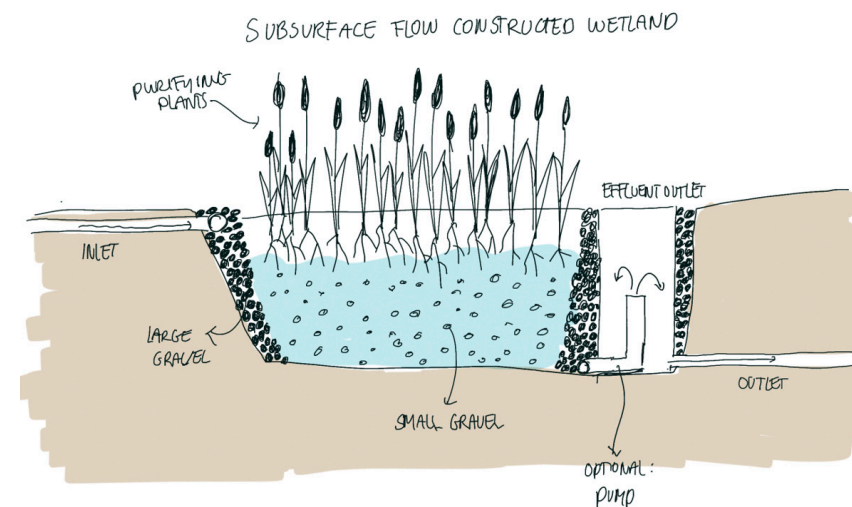


Figure 67: Subsurface flow CW principle

Constructed wetland 2

The second system is more complex, due to the fact that there is black water that needs to be filtered. The water goes through three stages of filtering. The first is in the septic tank, in which the large solid parts are sedimented to the floor of the tank. After that it goes into the wetland, which is in the first filtering stage a Subsurface flow CW, meaning that the water does not reach the surface. After that it is effluently moved to the second filtering in a surface flow CW. Here the water is more visible on the surface. See image 65

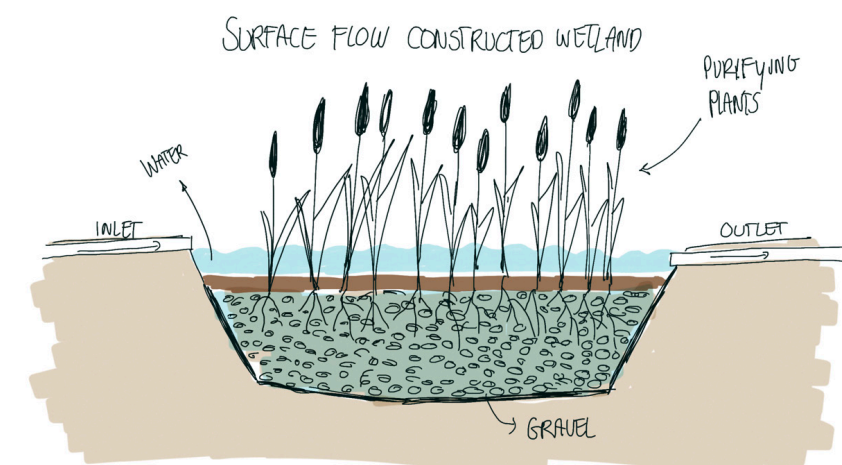


Figure 68: Surface flow CW principle

FOOD PRODUCTION.

In order to fully close the cycle, food production is necessary.

PLAN.



Figure 69: Map of the estate with the indication of types of food production

FOOD PRODUCTION.

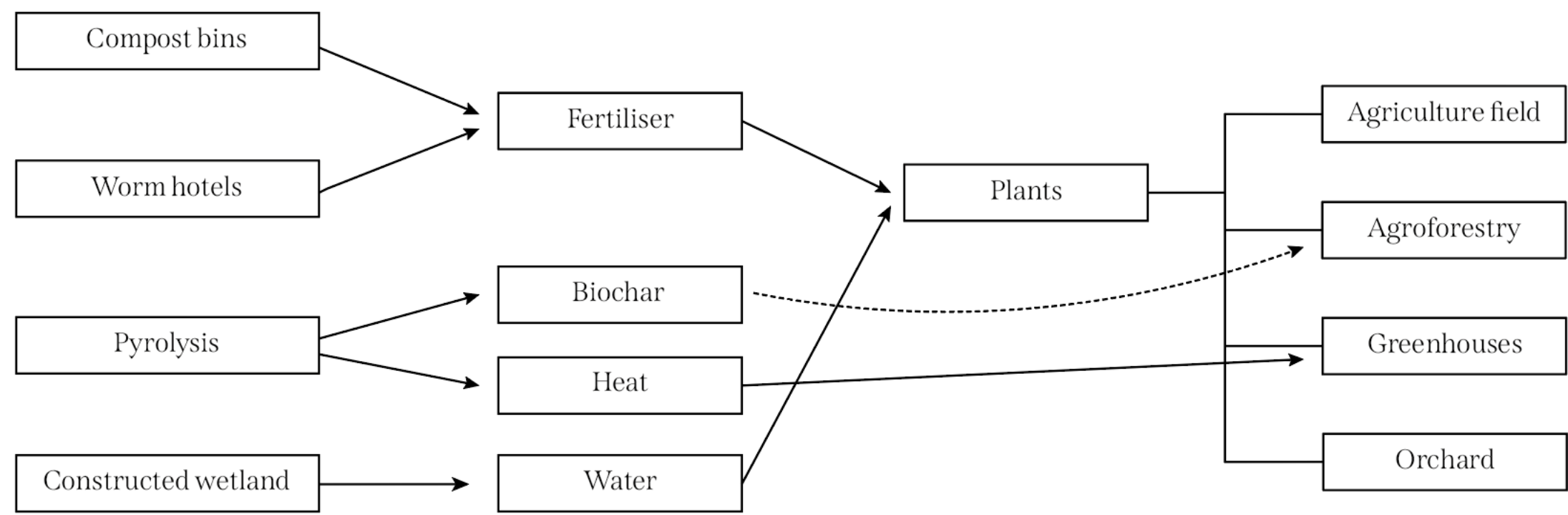


Figure 70: Diagram of Food Production on the estate



Figure 71: Example of the type of agroforest



Figure 72: Example of the agricultural field



Figure 73: Image of the orchard

GREENHOUSES.

Central in the circular plan for Paleis Soestdijk is the creation of two greenhouses which form the entrance of the estate for visitors, as well as introduce food production for the horeca function on the estate and at the same time educates the visitors on the topics of food production and biomass conversion.

THE BEGINNING.

Already from the beginning of the project there has been a fascination with bringing back the greenhouses to the estate of Paleis Soestdijk. In figure 75, 76 and 77 old pictures from the late 19th century can be found that show how the greenhouses looked.

Below an image that I created for one of my first presentations can be found, it shows that the idea is to recreate the greenhouses. But in a modern way. By utilizing the elements around it and making it fully self-sufficient. Eventually this idea evolved to the current idea for the estate and the greenhouse design within that idea.

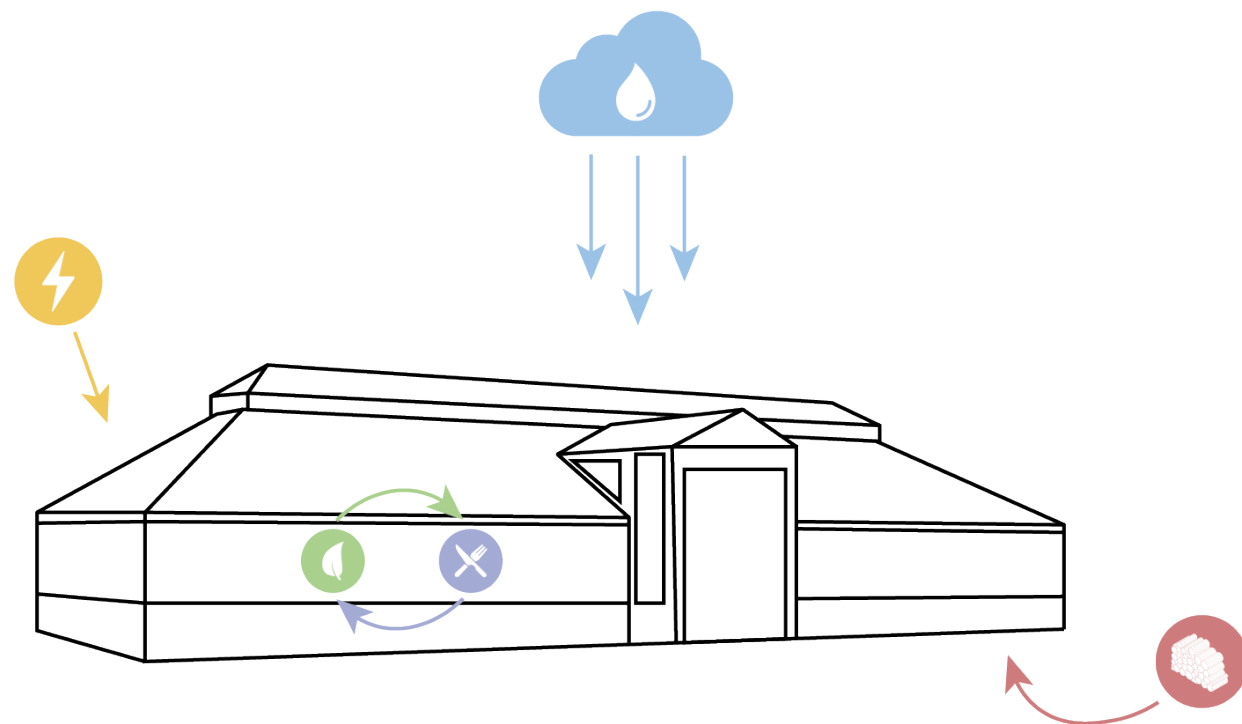


Figure 74: Concept for the greenhouses



Figure 75: Old images of the greenhouses (Collectie Eemland, 1879)



Figure 76 & 77: Old images of the greenhouses (Collectie Eemland, 1879)

PROCESS.

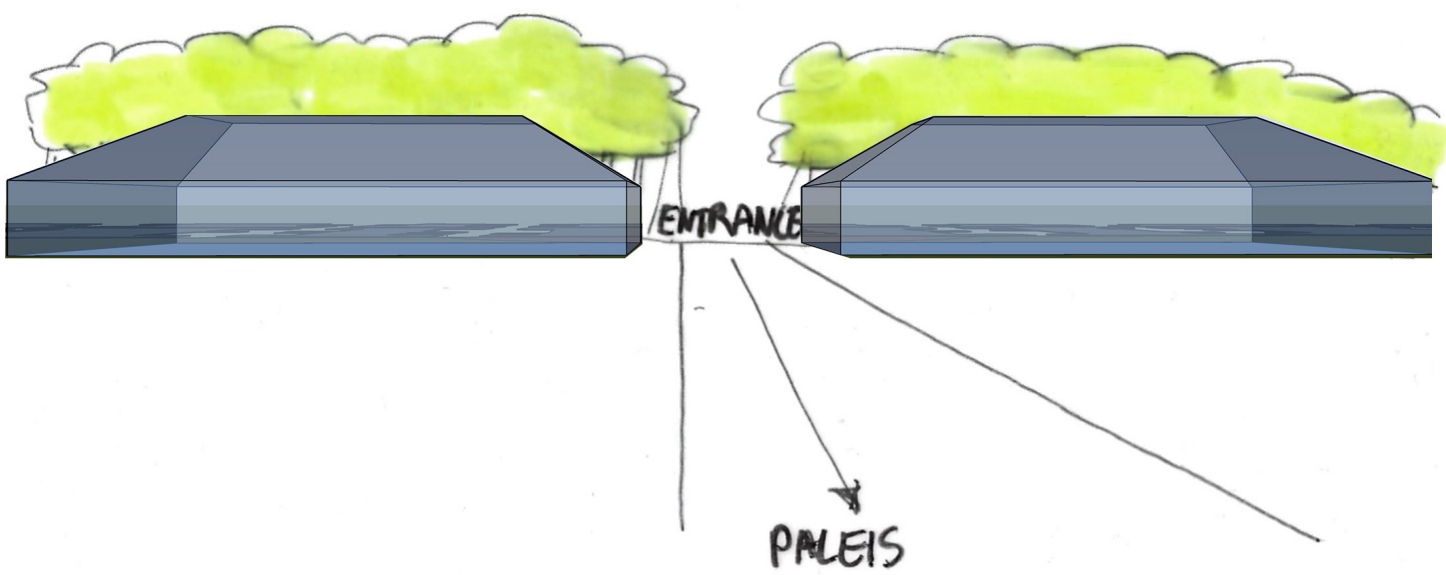


Figure 78: Impression of an design idea for the greenhouses

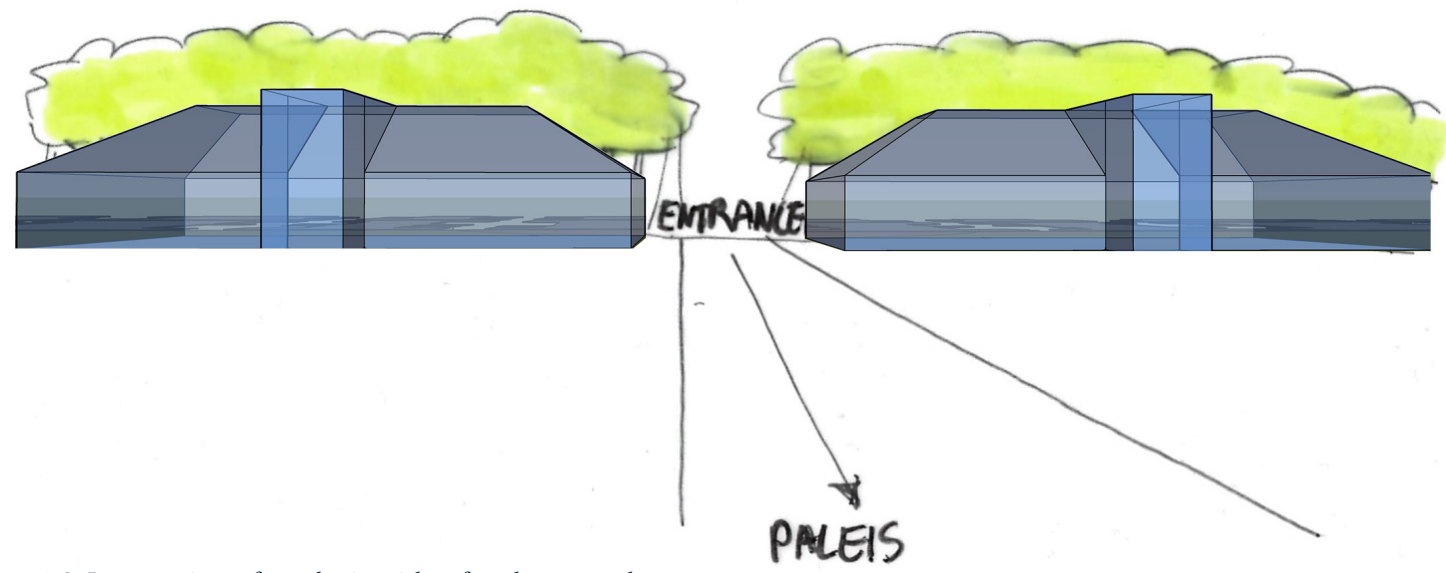


Figure 79: Impression of an design idea for the greenhouses

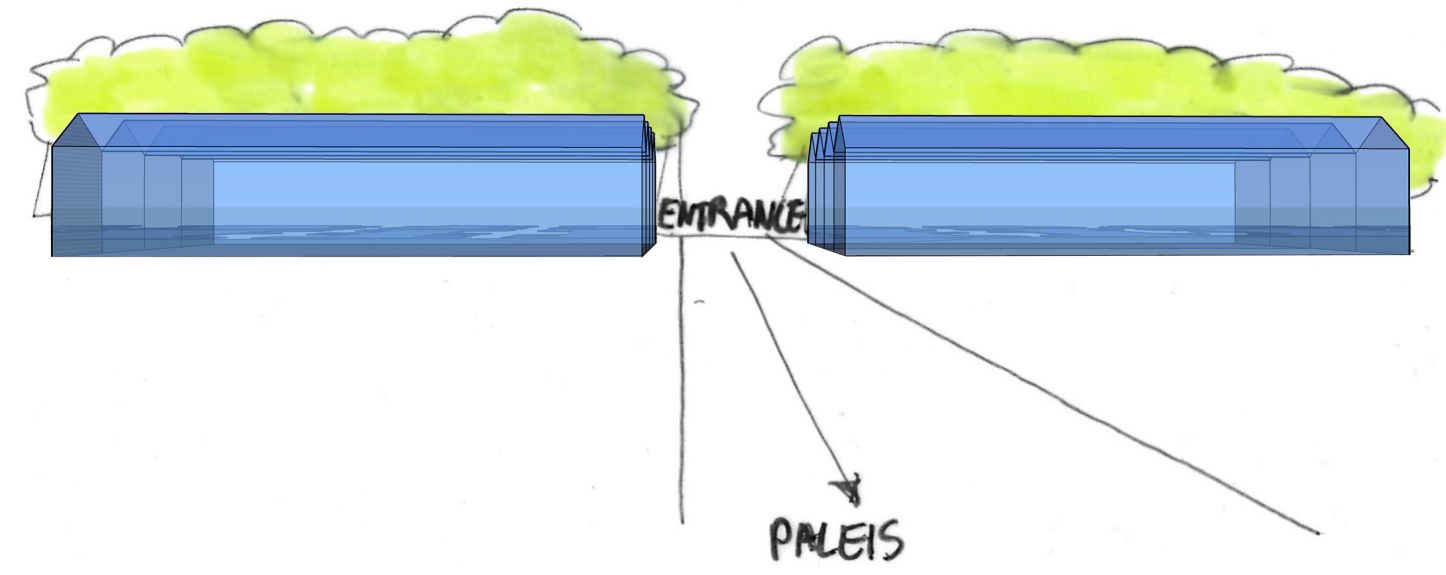


Figure 80: Impression of an design idea for the greenhouses

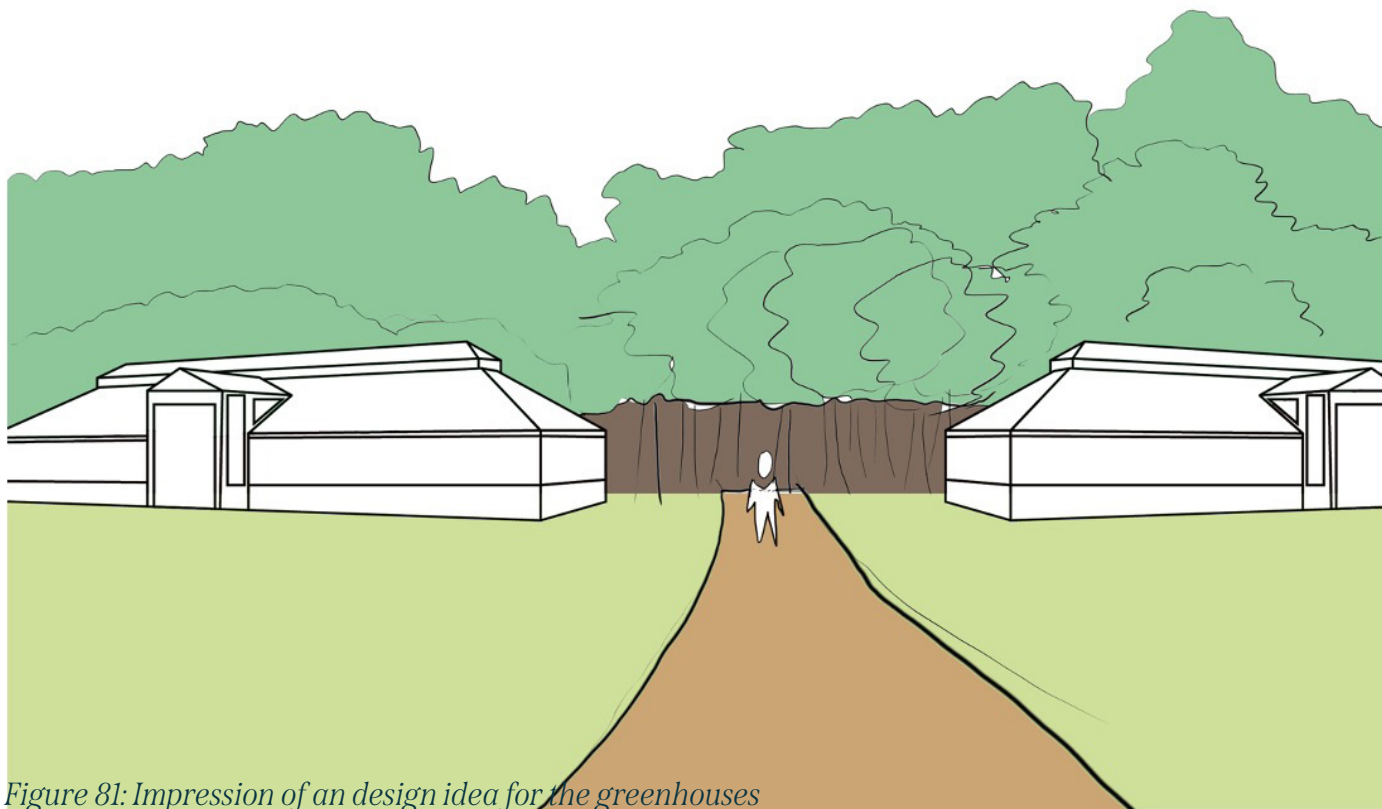


Figure 81: Impression of an design idea for the greenhouses

BOTH SUSTAINABLE

TRADITIONAL

↑ regular

TRADITIONAL FOOD PRODUCTION

Greenhouse methods with natural/sustainable pesticides + food for the plants

The use of animals

VS. MODERN

↑ smart glazing

MODERN HIGH TECH FOOD PRODUCTION

New methods

- techniques with lighting
- Algae (?)
- space saving methods

Figure 82: Impression of an design idea for the greenhouses

PROCESS.

On this page and the page before, there are a few impressions of the phases that the design of the greenhouses went through. Some ideas stayed, some evolved and other were discarded almost immediately.

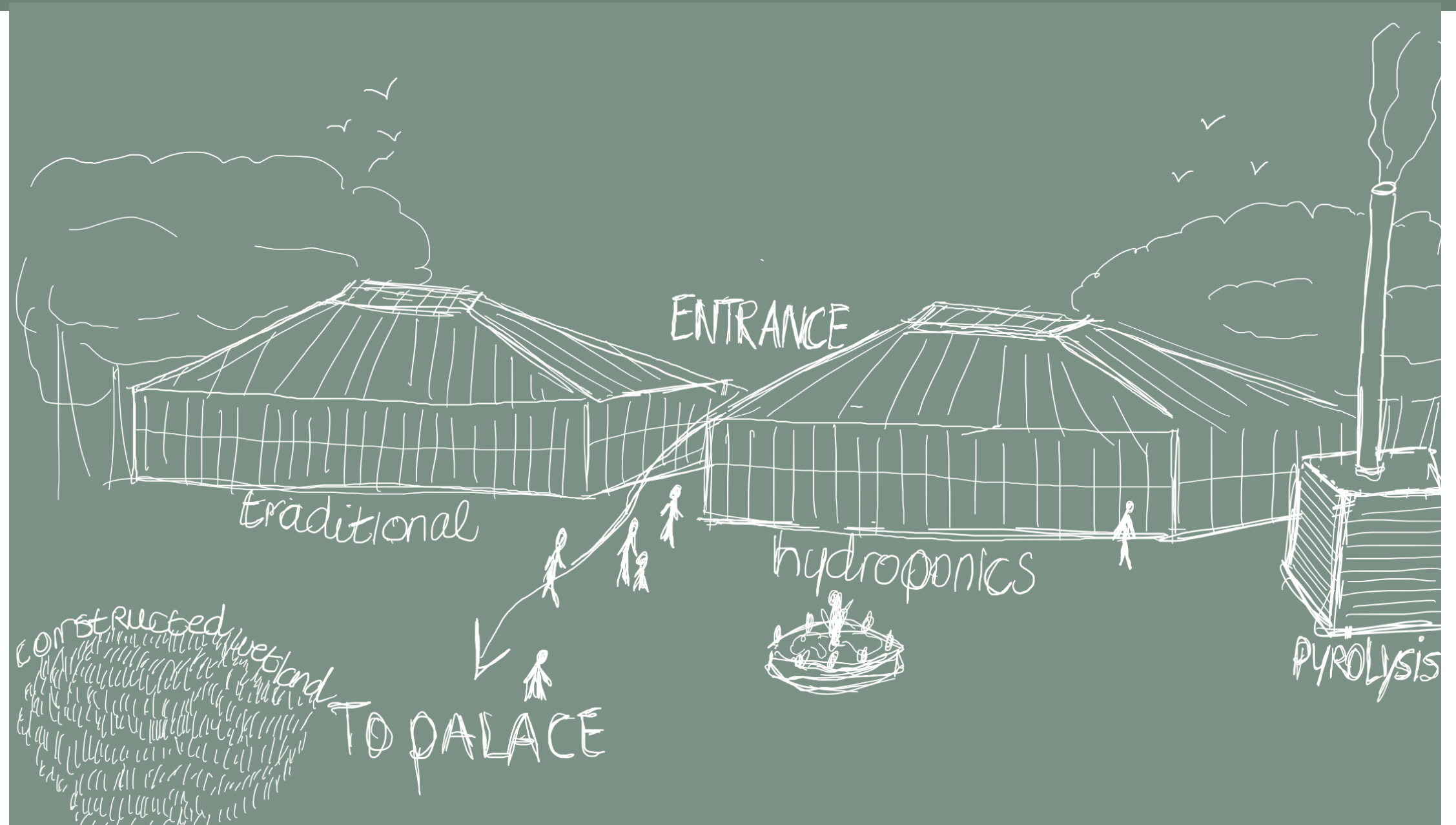


Figure 83: Impression of an design idea for the greenhouses



Figure 84: Impression of an design idea for the greenhouses

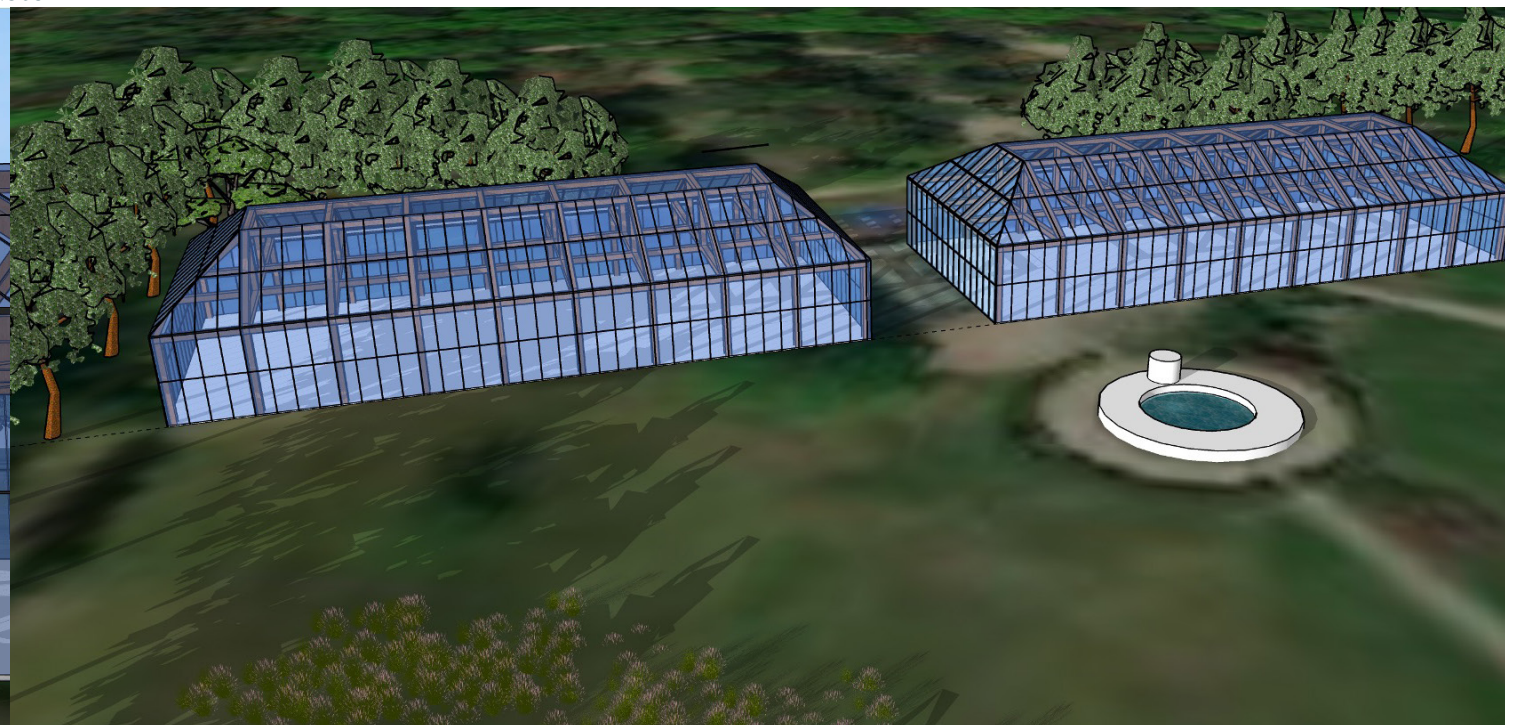


Figure 85: Impression of an design idea for the greenhouses

FLOOR PLAN 1:100.

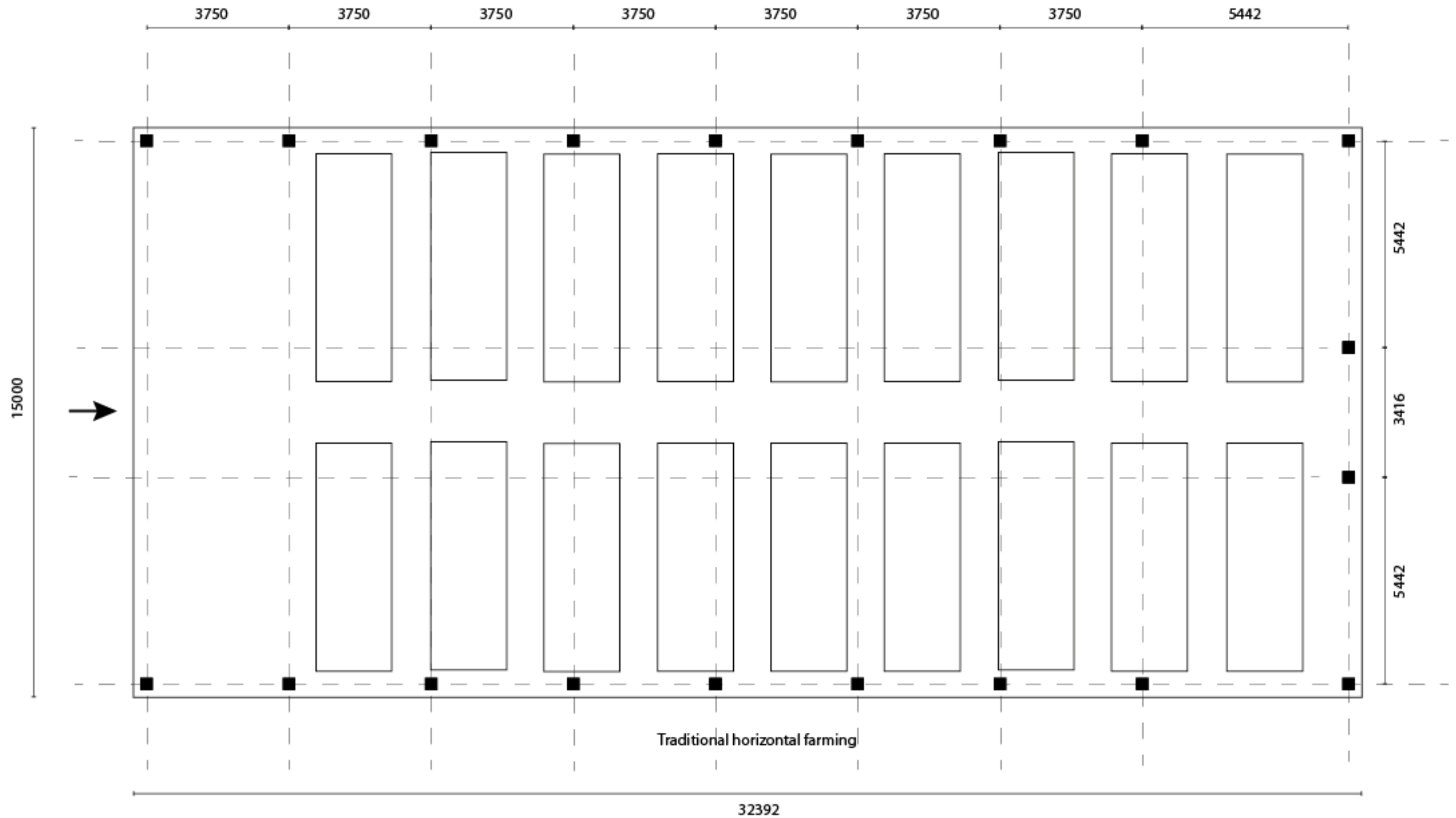


Figure 86: Floor plan of traditional greenhouse

FLOOR PLAN 1:100.

Explanation

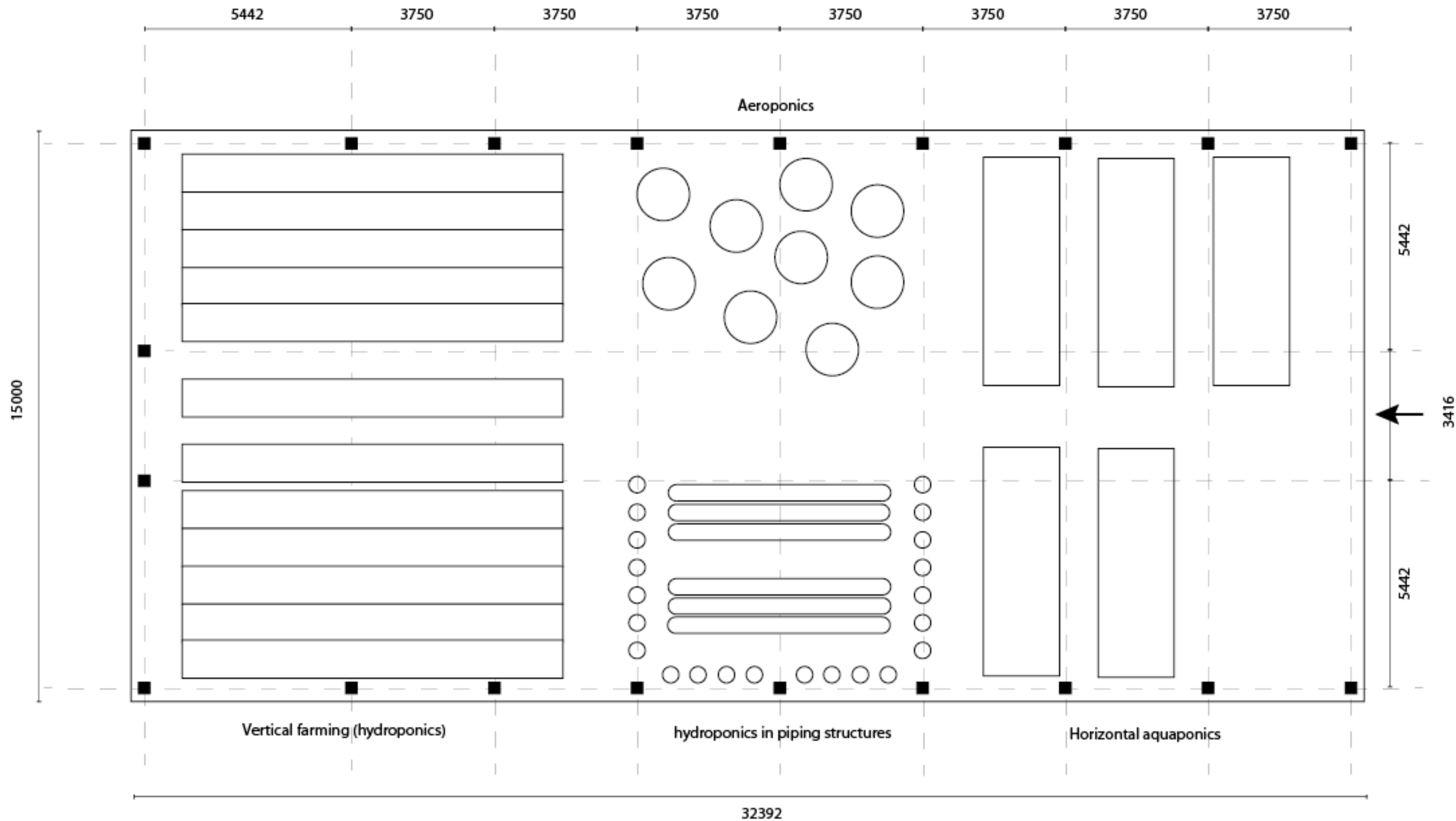


Figure 87: Floor plan of experimental greenhouse

SECTIONS 1:100.

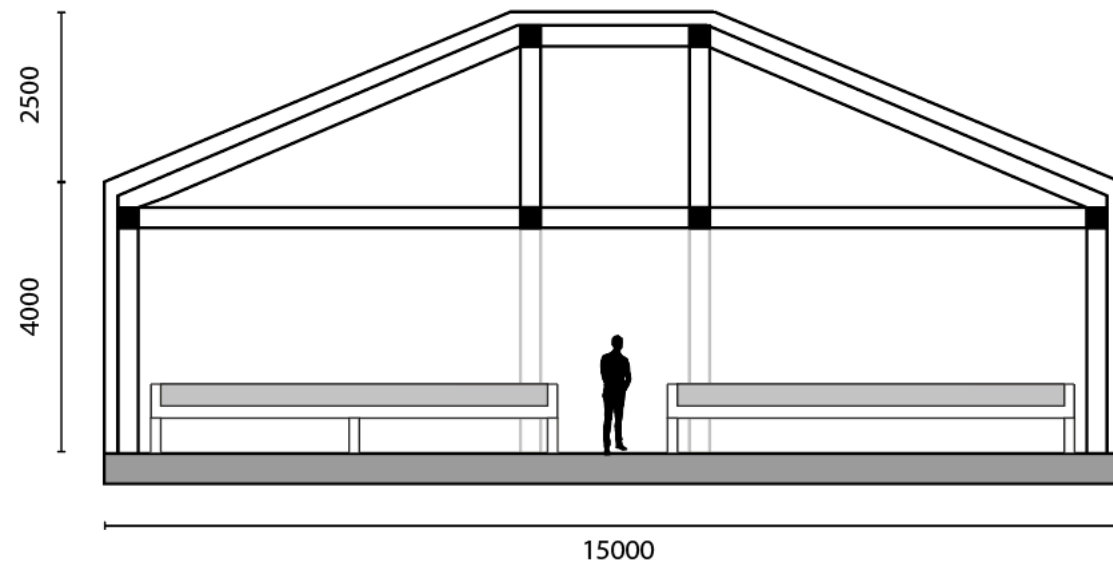


Figure 88: Section of greenhouse traditional

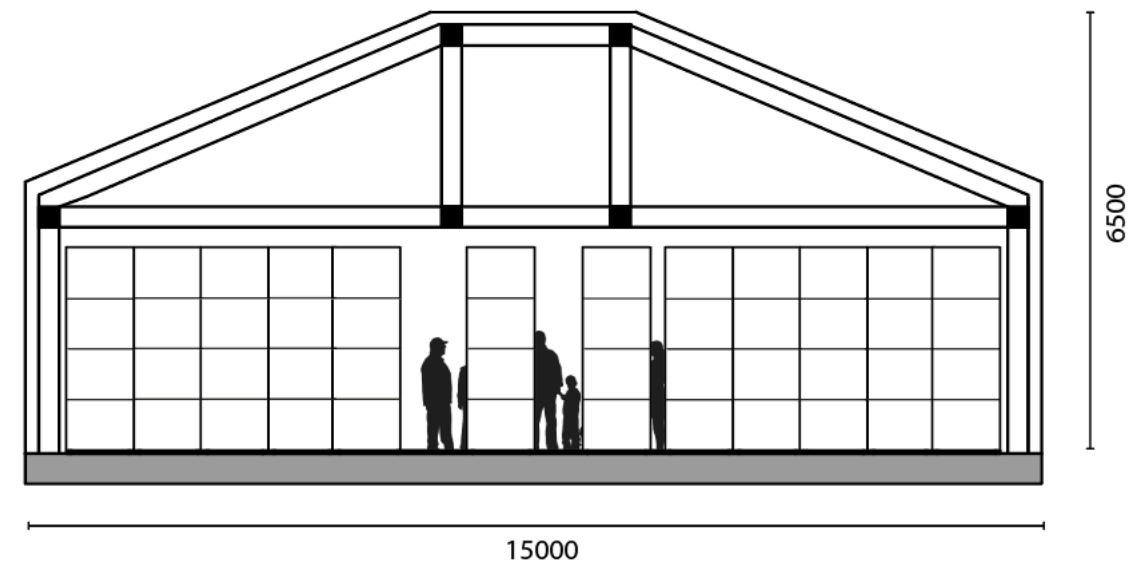


Figure 89: Section of greenhouse experimental

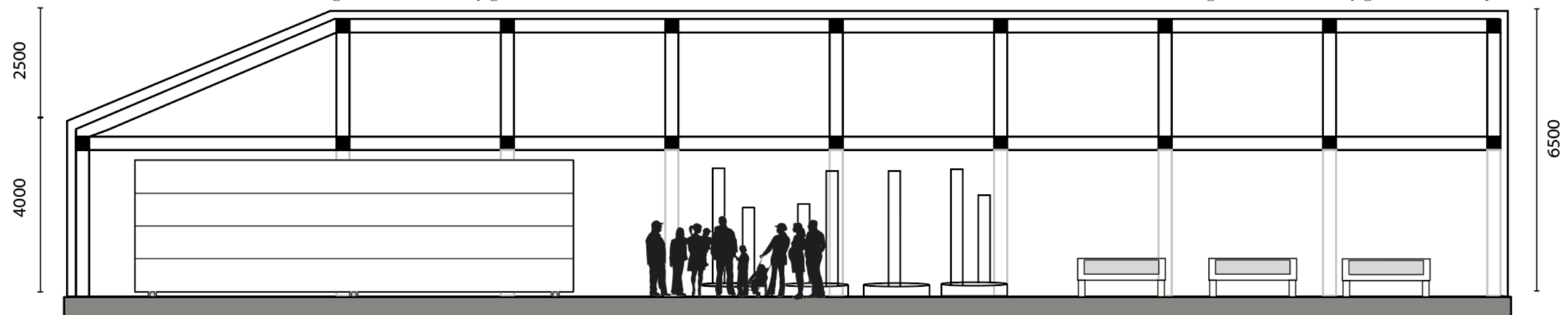


Figure 90: Section of greenhouse experimental

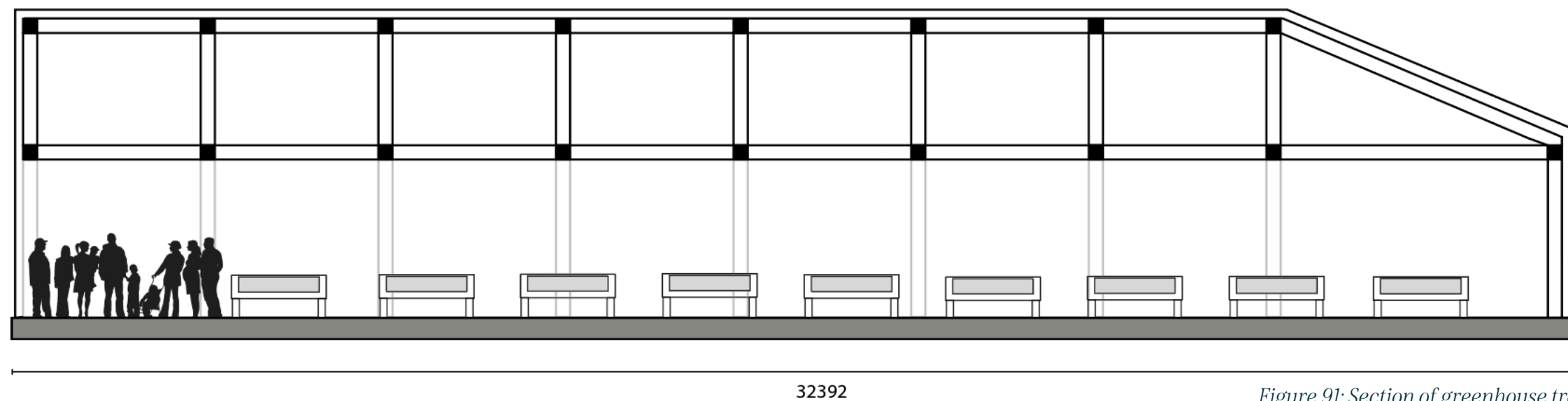


Figure 91: Section of greenhouse traditional

ELEVATIONS.

Traditional greenhouse
Other is the same

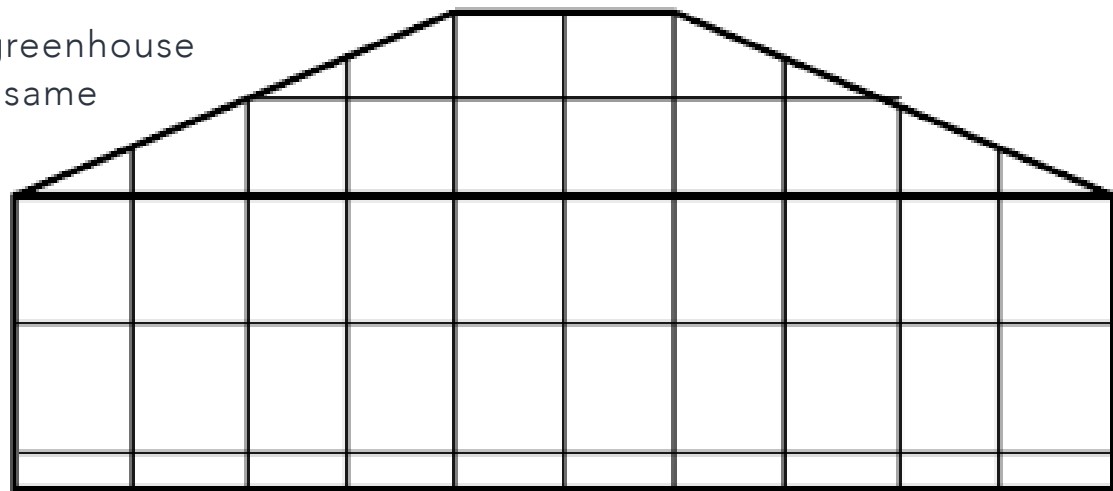


Figure 92: West facade

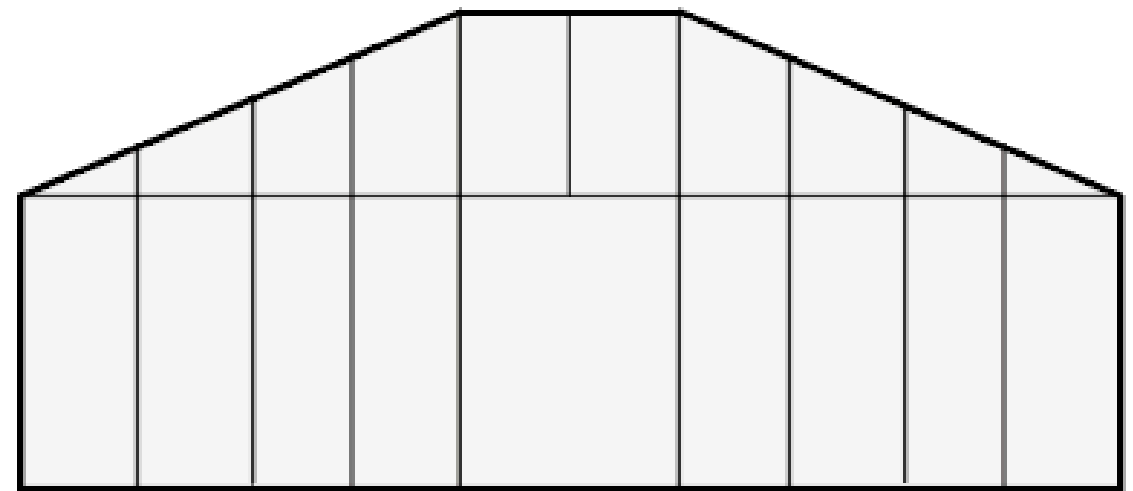


Figure 93: East facade with doors

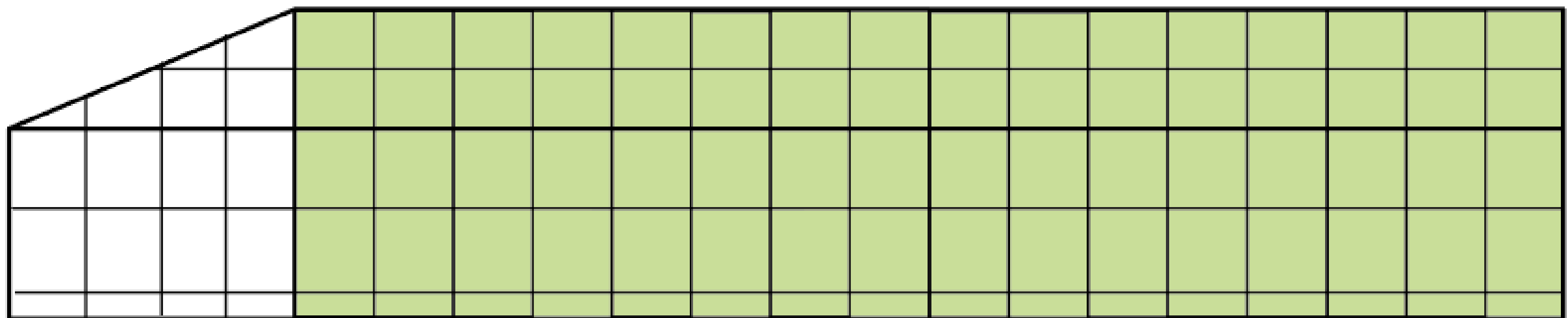


Figure 94: South facade with BIPV in green

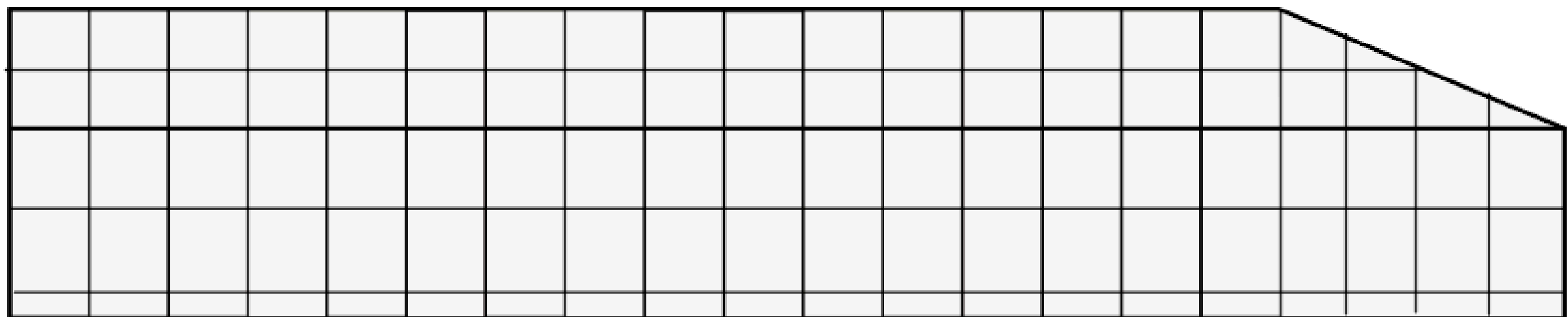


Figure 95: North facade

3 D VIEW.

Shows the CLT wooden structure that is the main structure

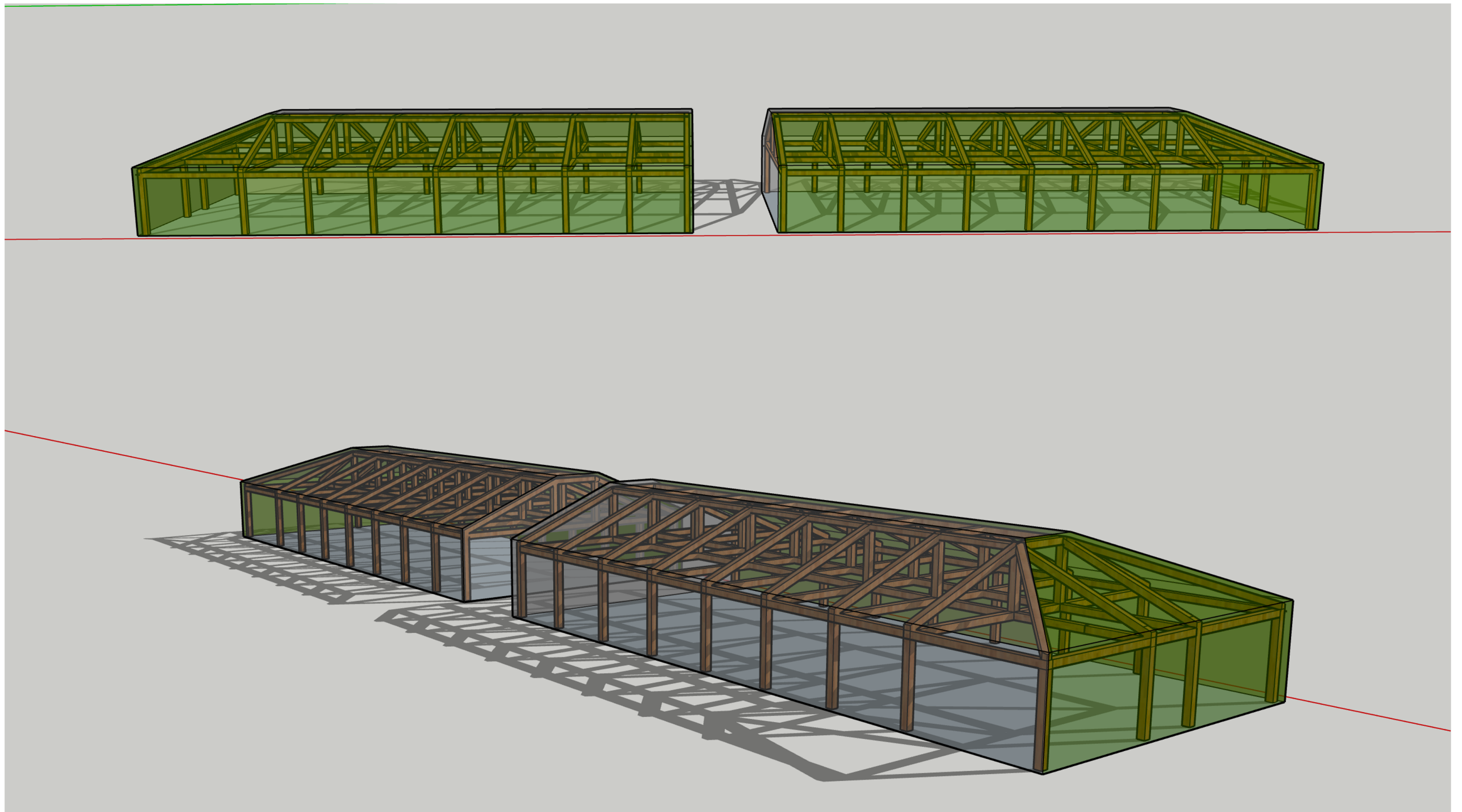


Figure 96: Snapshots of structure of the greenhouse

CLIMATE DESIGN.

This section will contain the elaboration of the climate design choices that were made. For further information on the climate design, go to the report.

VENTILATION.

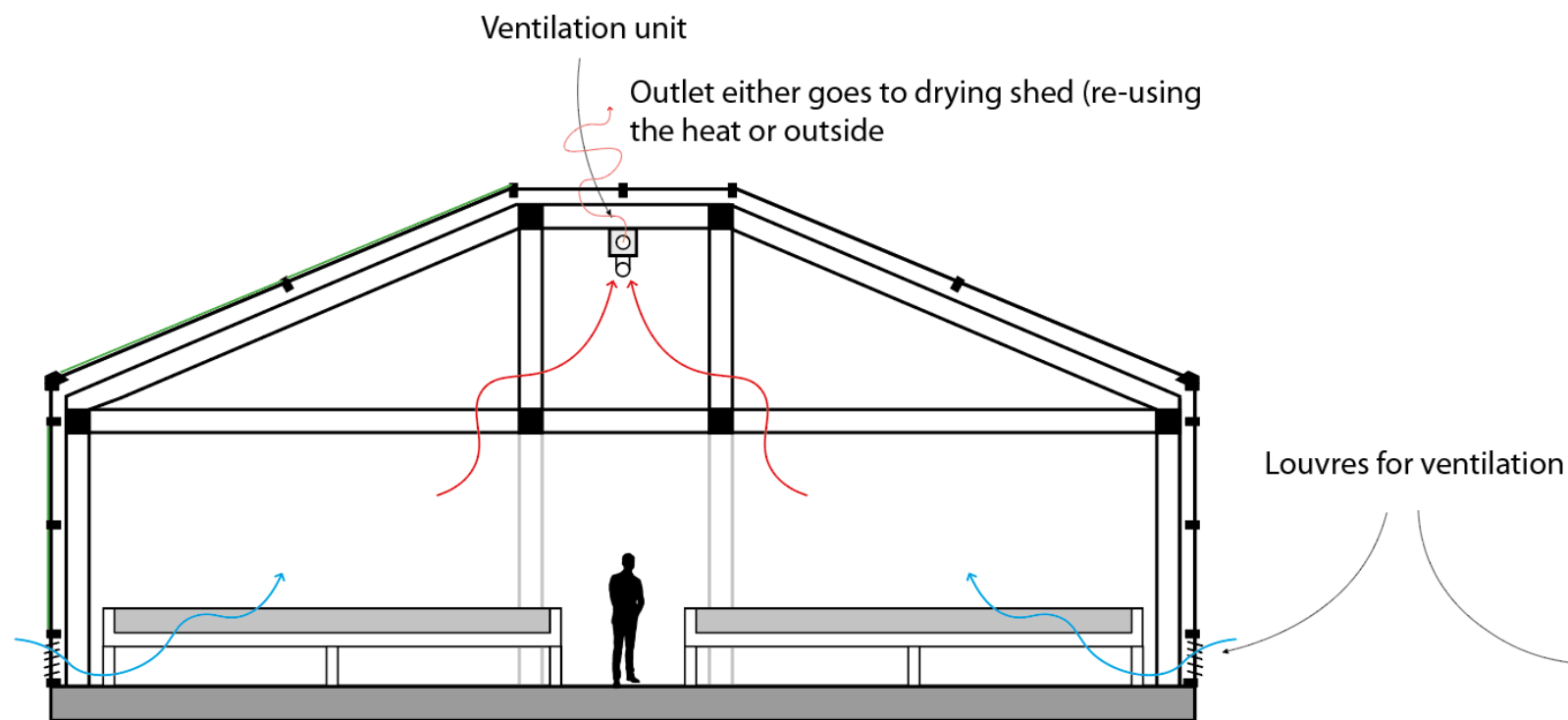


Figure 97: Climate design section Ventilation Winter

Winter situation

Most of the year this is the situation inside the greenhouse. Fresh air is getting in through the lower side of the facade through louvres and when the air has refreshed the space it is then sucked out of the air by a ventilation unit.

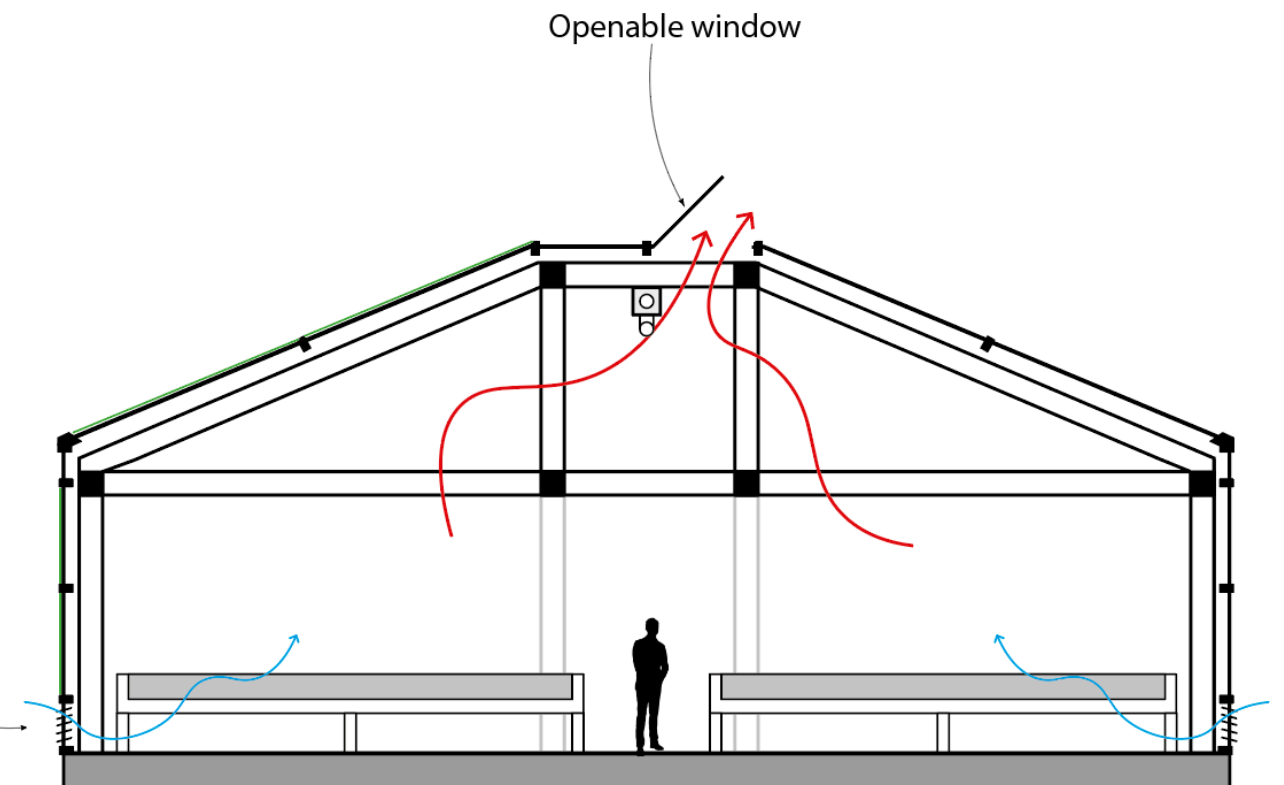


Figure 98: Climate design section Ventilation Summer

Summer situation

On really hot summer days it might be preferable to cross ventilate, therefore the roof can open and the air can just ventilate through. Even the doors on the east side could be opened as well, to further allow cross ventilation.

HEATING / COOLING.

Explanation

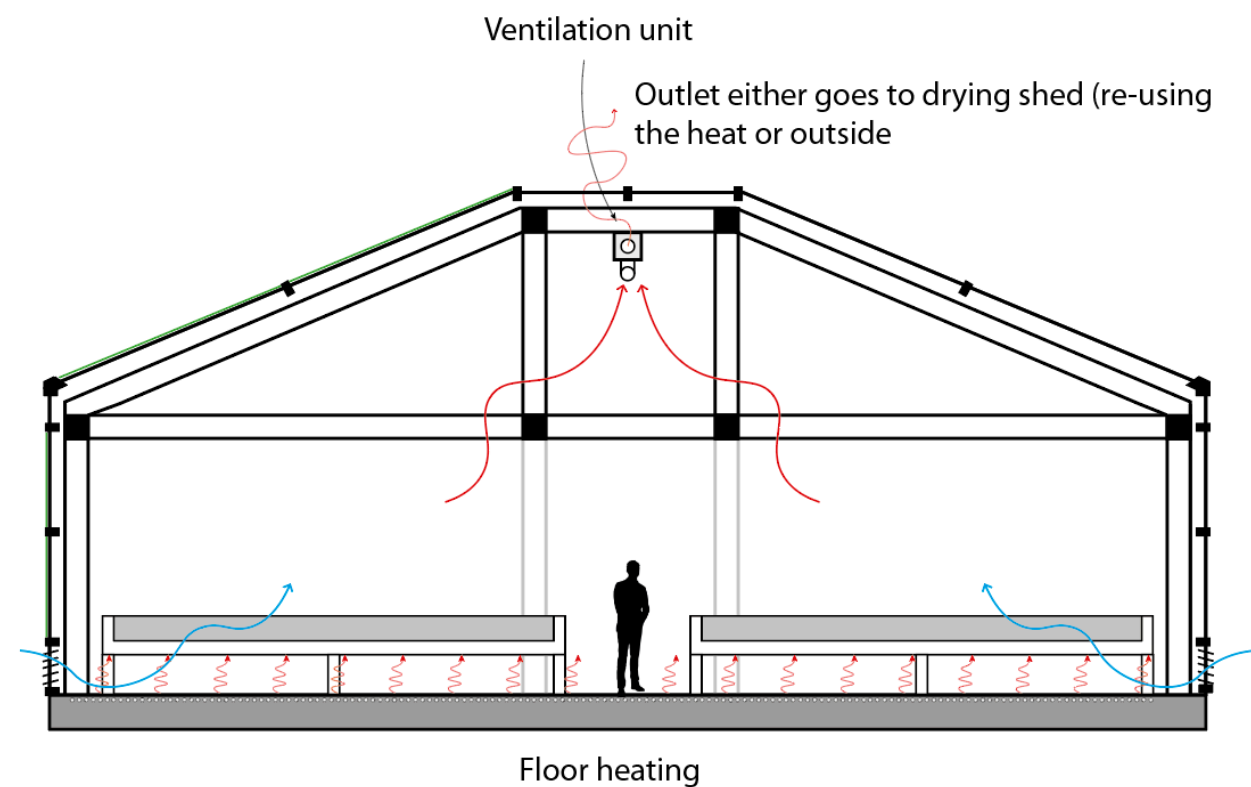


Figure 99: Climate design section Heating

Winter situation

In colder weather the greenhouse is heated by the floor heating. The heat is provided by an bio-oil fueled boiler that is supplied by the pyrolysis on the estate. The hot air is extracted by the ventilation unit and can be repurposed as for the drying process of the biomass.

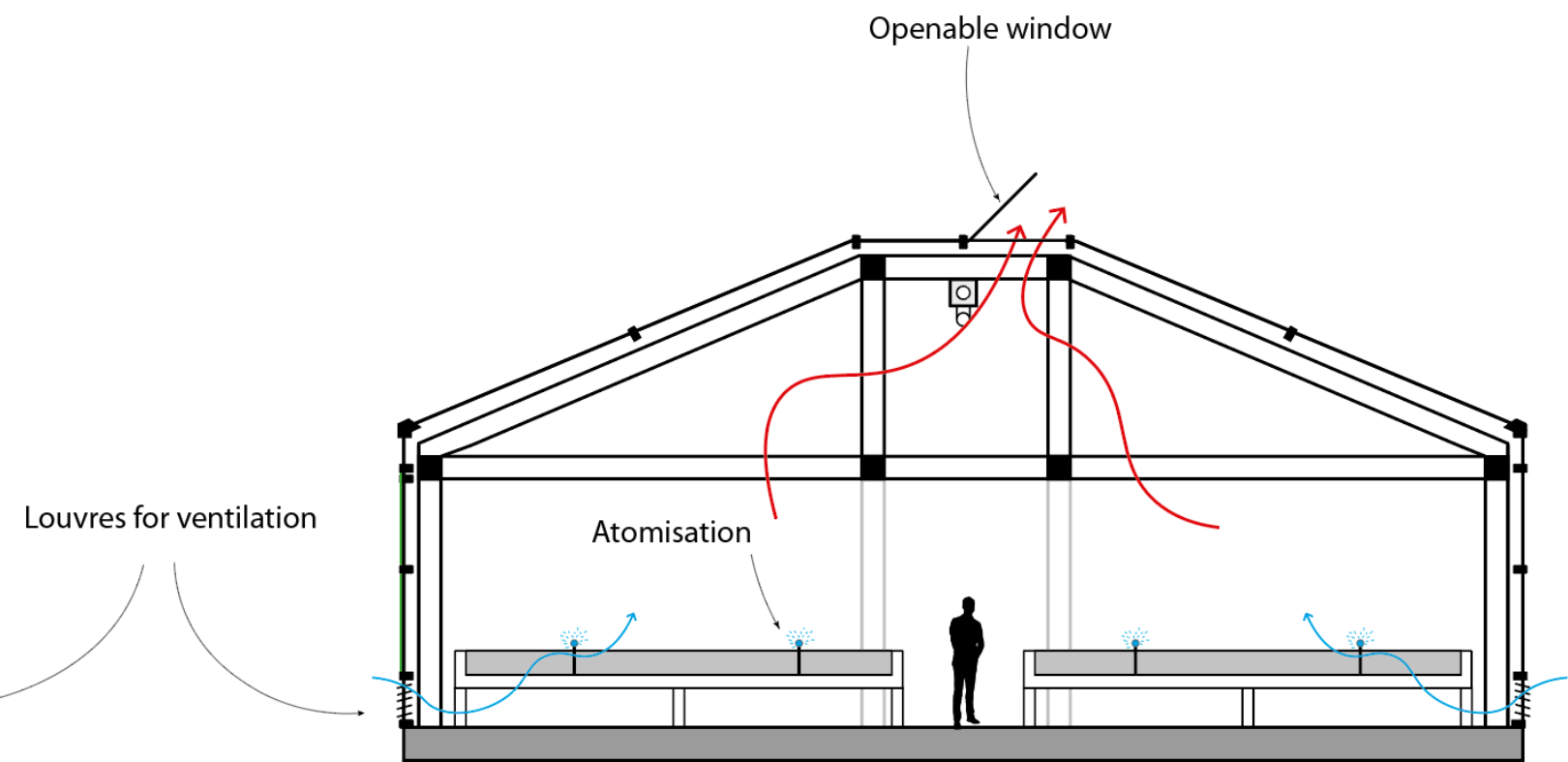


Figure 100: Climate design section Cooling

Summer situation

During warmer days there is not heating needed. The facade is opened as much as it can and in order to ensure that the plants do not overheat an atomisation system has been installed. The plants can therefore cool down with cold evaporated water.

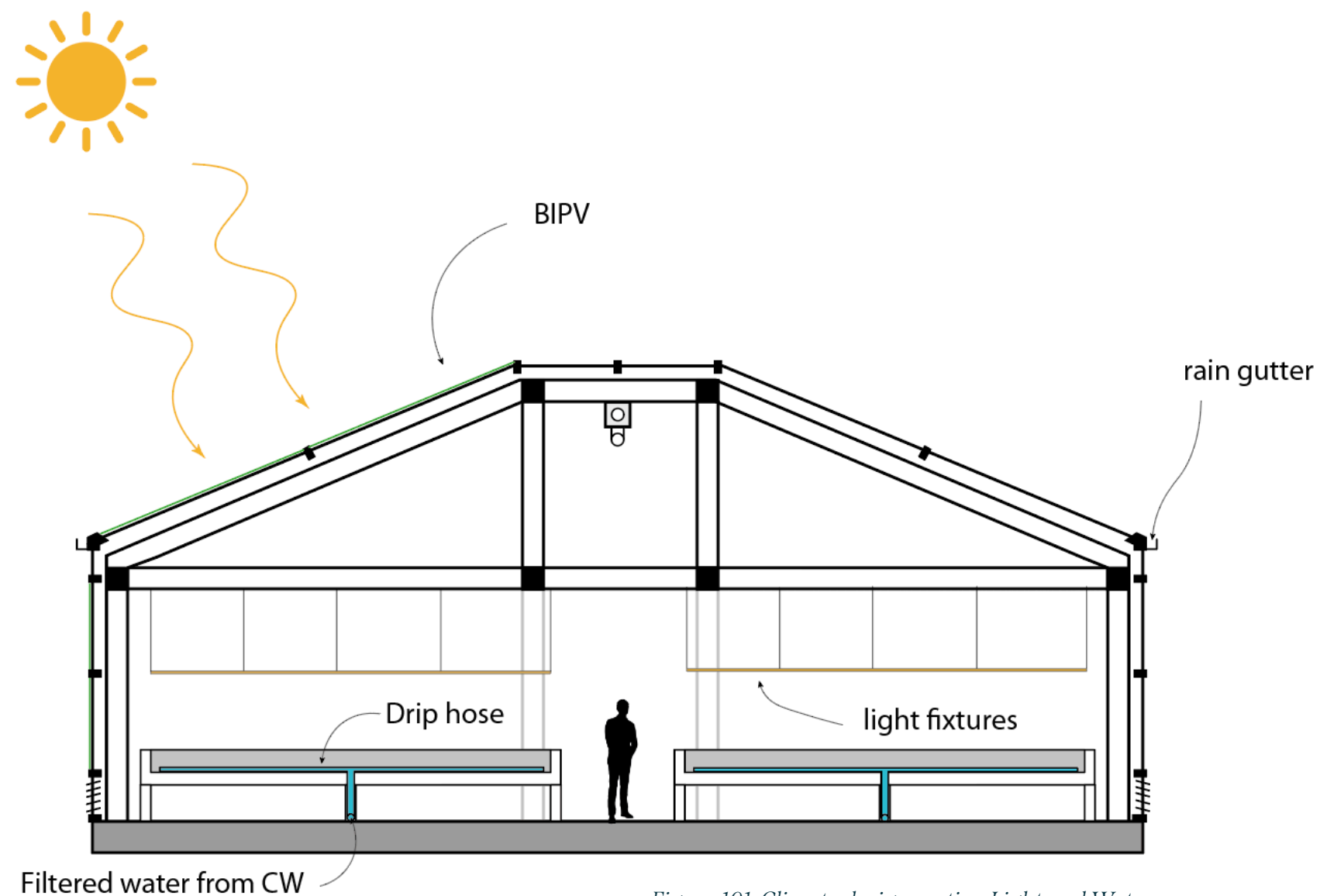


Figure 10I: Climate design section Light and Water

Lighting

As mentioned in the report, for plants to grow lighting is very important. Unfortunately on most days in the Netherlands there is not enough light intensity with normal daylighting. Therefore smart LED light fixtures are installed to ensure that the plants get enough light.

Watering

The watering of the traditional greenhouse can be seen in the section. There are so-called driphoses inside the planters that allow the water to gradually flow into the planters, without overwatering the plants. The water comes from the constructed wetland. To which also the wastewater of the greenhouse goes to. That means the rainwater falling on the roof and the small amount of wastewater from the food production.

TITEL.

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FACADE DESIGN.

The detaillling of the facades of the greenhouses can be found in the section below. For further information about the choices for certain materials, go to the report.

1:40 FACADE DETAILLING.

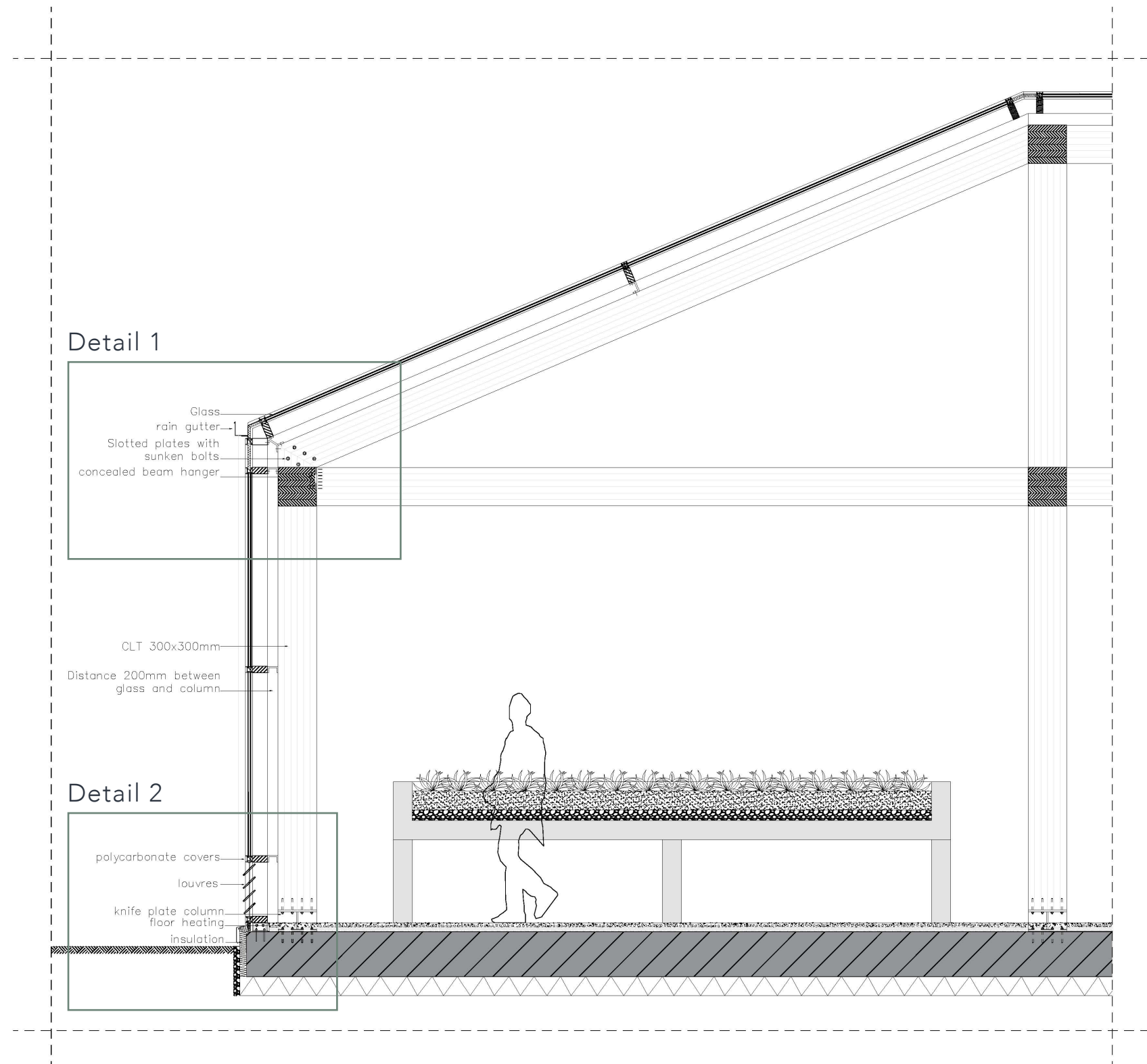


Figure 102: Vertical Facade section

1:5 DETAIL.

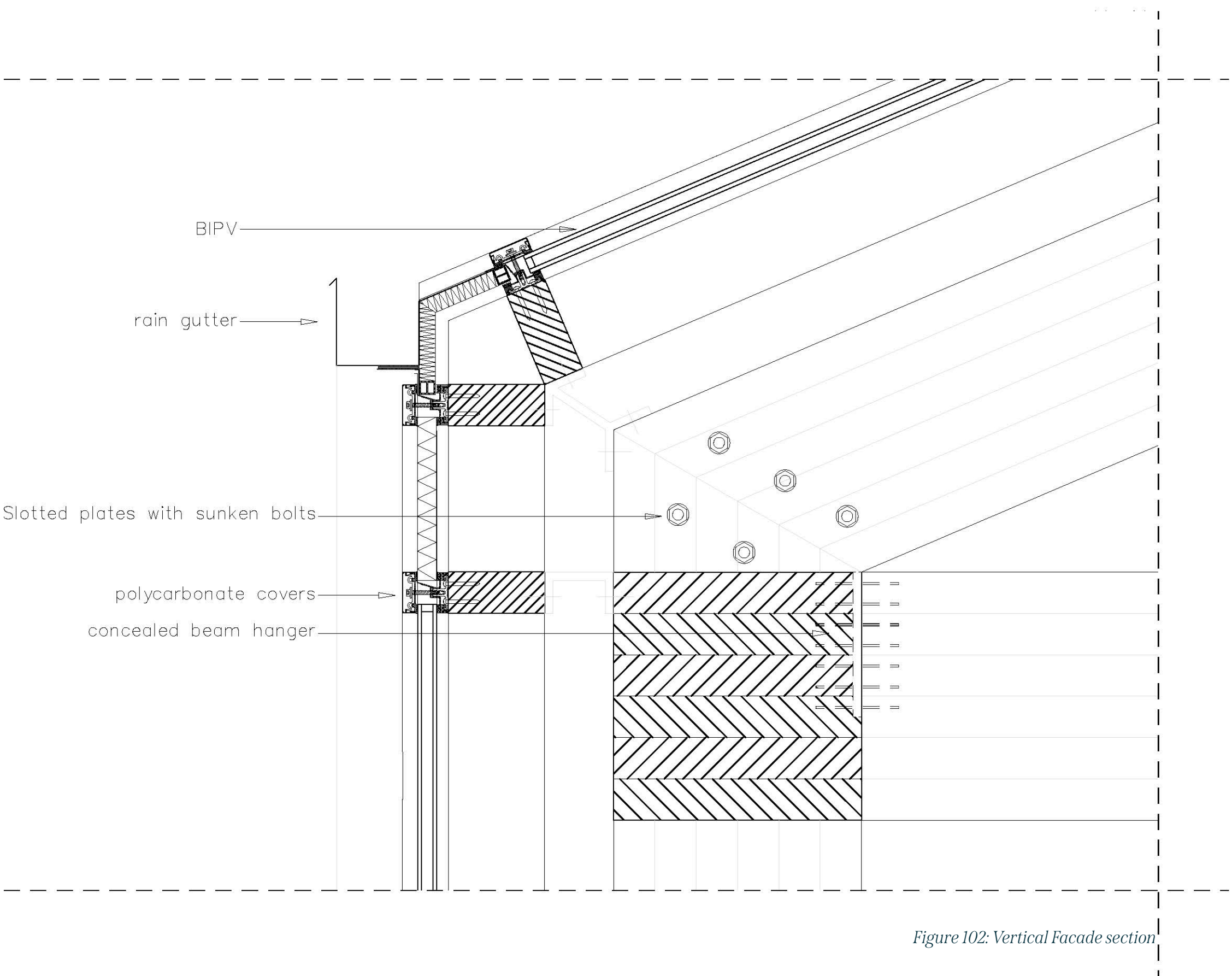


Figure 102: Vertical Facade section

1:5 DETAIL.

Vertical detail of the foundation

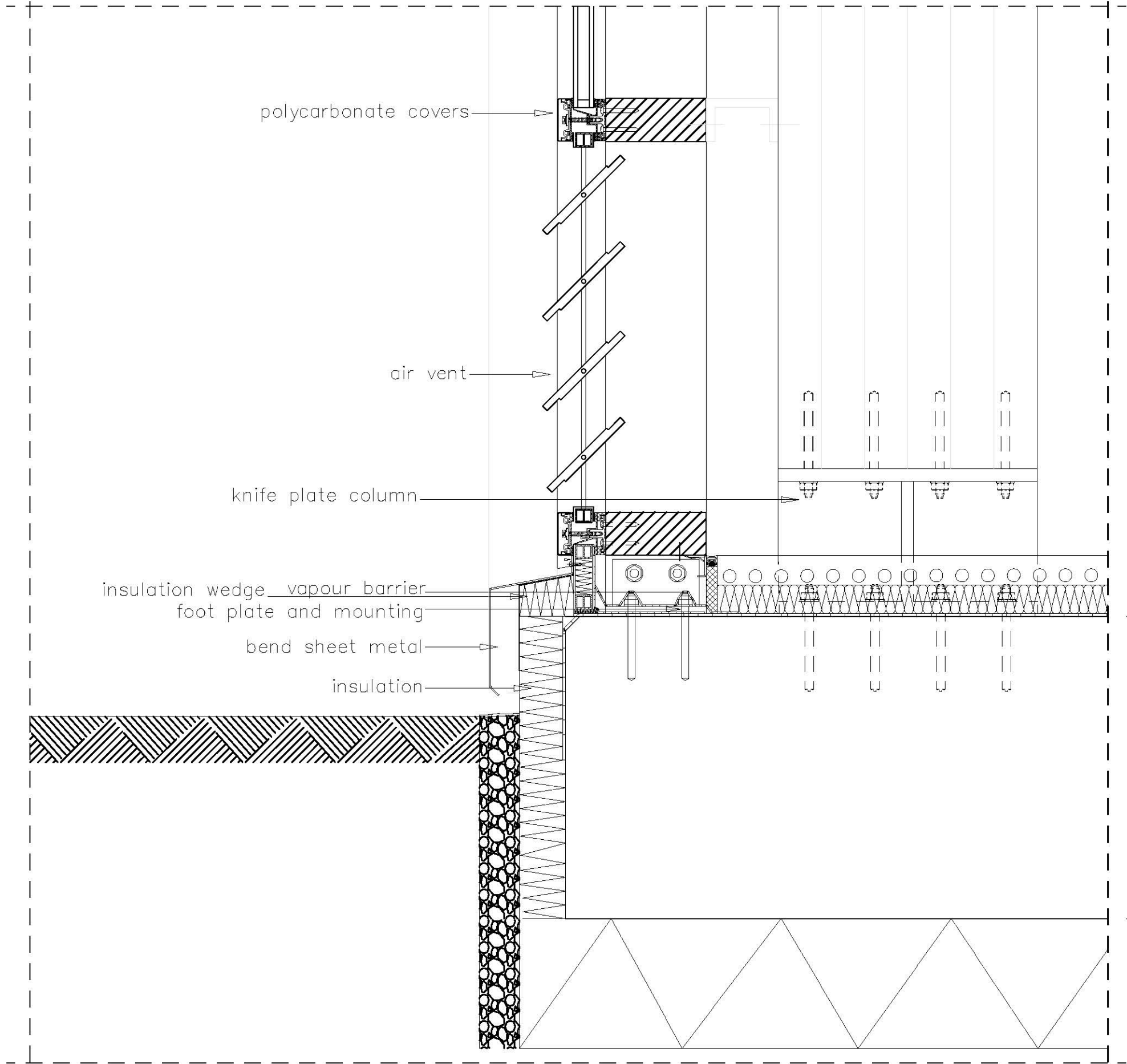


Figure 102: Vertical Facade section



Figure 1: Picture of the front of Paleis Soestdijk

ACKNOWLEDGEMENTS.

This booklet contains an impression of the work that I have done during this graduation project.

Paleis Soestdijk was a dream to work on. It is a special location of rich historic value and endless potential. Incorporating my gained knowledge on biomass, wastewater management and food production in a circular plan could be difficult at times, but in the end it all came together nicely.

I would like to thank my mentors, Andy and Nico, for their expertise, guidance and patience with me during this project. Charlotte and Rosan from MeyerBergman Erfgoed have been a great help during this project as well. Thanks to their assistance and hospitality, I had all the information that I needed and the possibility to visit the site and palace multiple times.



Figure 1: Picture of the front of Paleis Soestdijk

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Figure 5: Paleis Soestdijk. (2019). Landgoed Paleis Soestdijk. Ruimtelijk kader voor de duurzame ontwikkeling Paleis Soestdijk. [page 6]

Figure 8: Stichting in Arcadie. (2019). Paleis Soestdijk - Tuinhistorische verkenning en waardestelling [page 22]

Figure 9: Stichting in Arcadie. (2019). Paleis Soestdijk - Tuinhistorische verkenning en waardestelling [page 24]

Figure 10 : Van Ruisdael, J. I. (1660). Aankomst op Soestdijk van Cornelis de Graeff met zijn echtgenote en zonen [painting]. https://nl.m.wikipedia.org/wiki/Bestand:Jacob_Isaacksz._van_Ruisdael_-_Aankomst_op_Soestdijk_van_Cornelis_de_Graeff_met_zijn_echtgenote_en_zonen_-_182_-_Amsterdam_Museum.jpg

Figure 11: Stichting in Arcadie. (2019). Paleis Soestdijk - Tuinhistorische verkenning en waardestelling [page 26]

Figure 12: Stichting in Arcadie. (2019). Paleis Soestdijk - Tuinhistorische verkenning en waardestelling [page 32]

Figure 13: Valck, G. (1695). Water-Molen die de Fontein doet Springen staande in de Dier-Gaarde [Etching]. In Paleis Soestdijk - Tuinhistorische verkenning en waardestelling.

Figure 14: Stichting in Arcadie. (2019). Paleis Soestdijk - Tuinhistorische verkenning en waardestelling [page 36]

Figure 15: Stichting in Arcadie. (2019). Paleis Soestdijk - Tuinhistorische verkenning en waardestelling [page 38]

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Figure 29: Collectie Eemland. (1879). Foto's van de kassen. [Photograph] In Paleis Soestdijk - Tuinhistorische verkenning en waardestelling.

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Figure 76: Collectie Eemland. (1879). Foto's van de kassen. [Photograph] In Paleis Soestdijk - Tuinhistorische verkenning en waardestelling.

Figure 77: Collectie Eemland. (1879). Foto's van de kassen. [Photograph] In Paleis Soestdijk - Tuinhistorische verkenning en waardestelling.

