

Urban Productive cycle machine

DIPLOMARBEIT FS21

XIAO LU

Thema C 7/24 Metropolitan Hybrid Machine

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This is an interactive pdf, and was thought to be viewed with Adobe Acrobat. An interactive pdf means that during your navigation you will encounter icons that you can click on and that will take you directly to another page. click on the following elements to navigate.



circles takes you to the linked specific informations.



you will see in more detail
part of the drawing on which the icon is located.



This icon takes you to an image inherent to the
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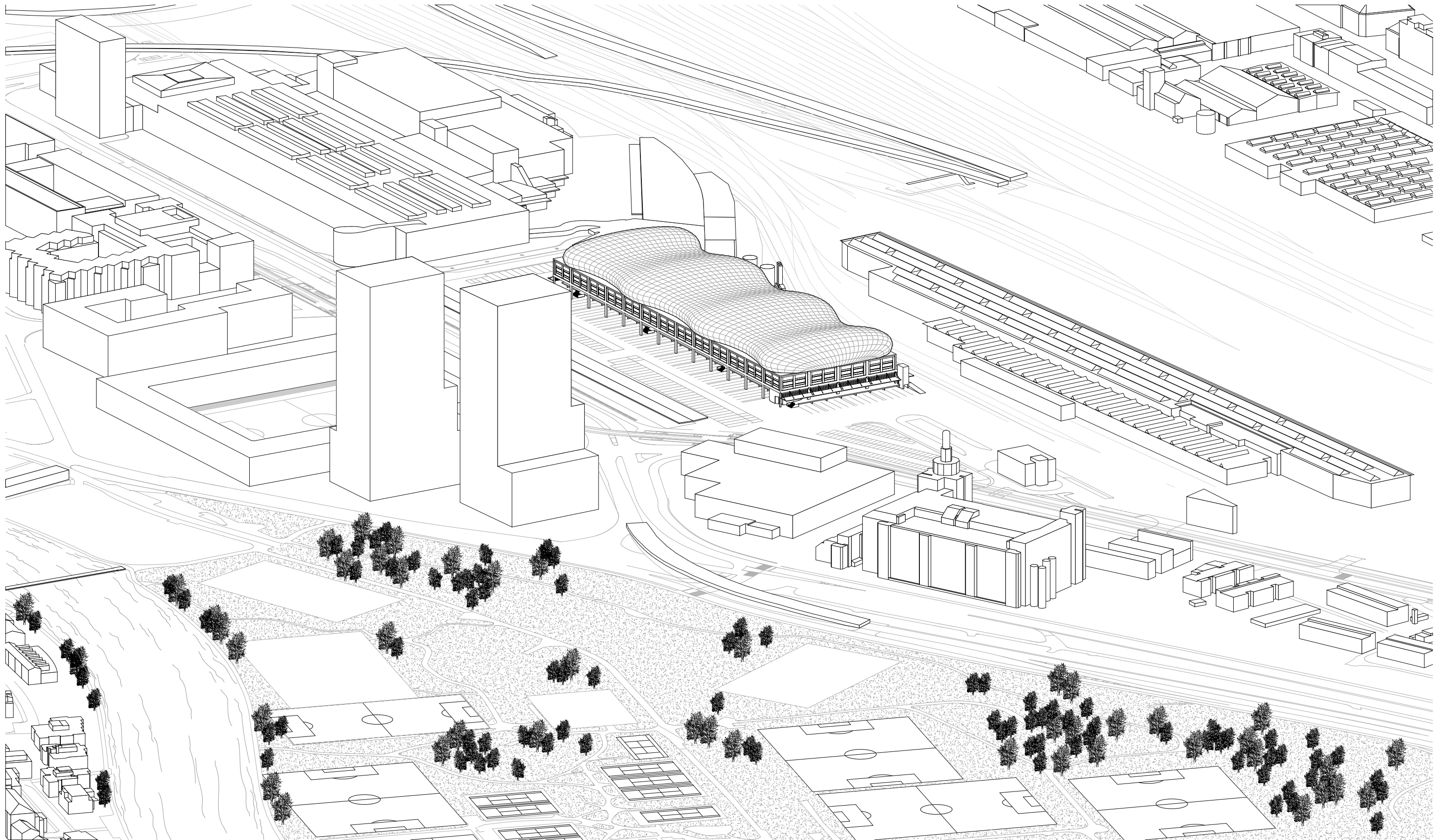


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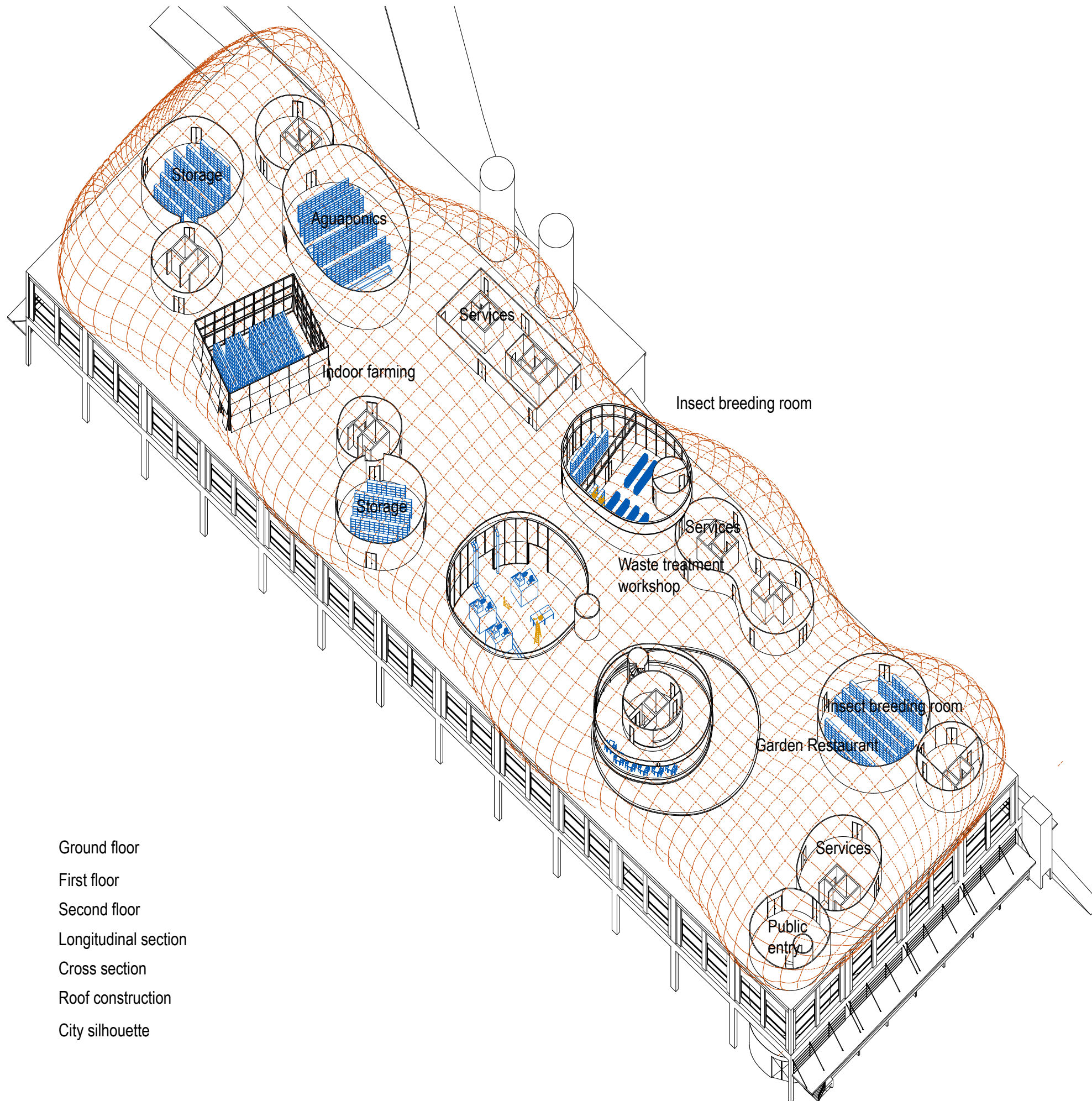


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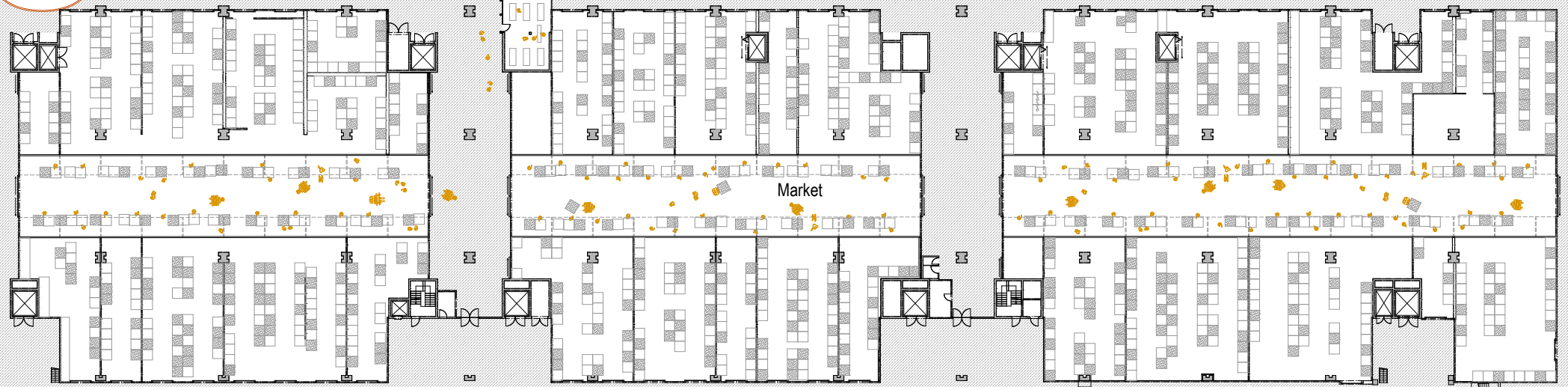
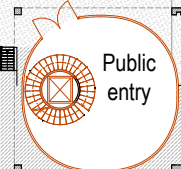
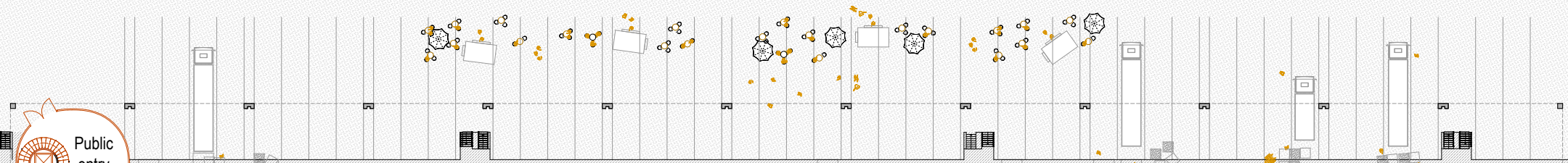
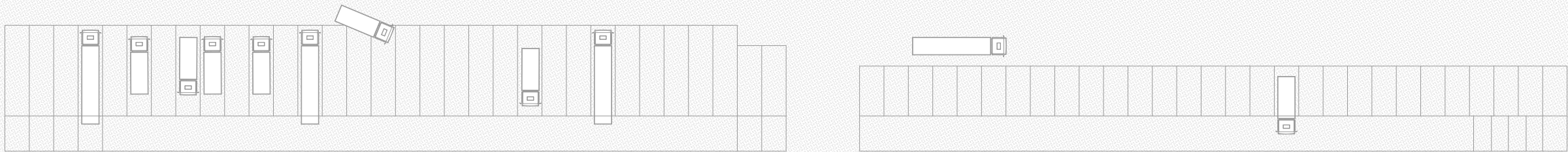
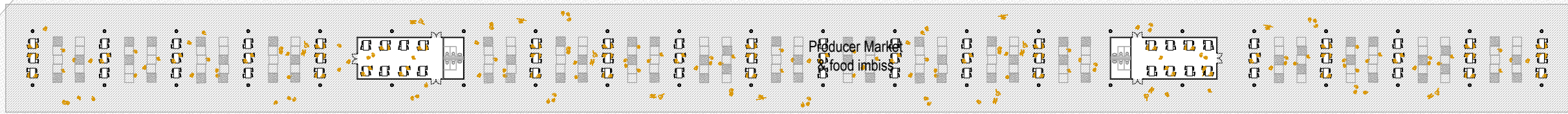


Axonometric view of situation

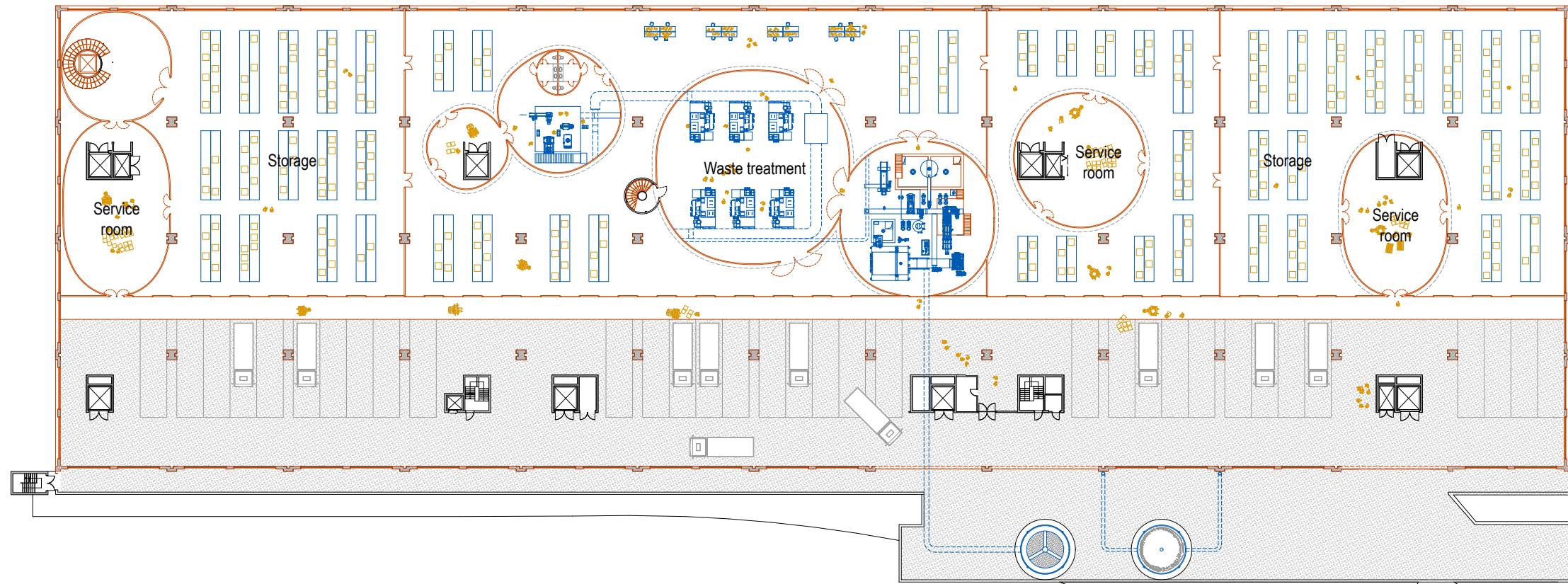
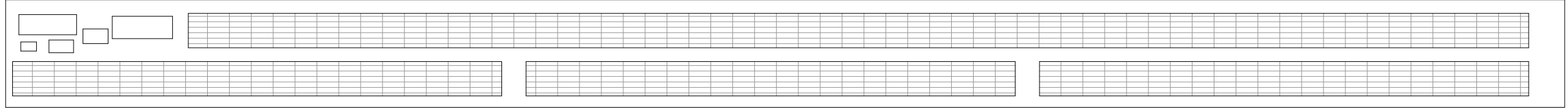


- Ground floor
- First floor
- Second floor
- Longitudinal section
- Cross section
- Roof construction
- City silhouette

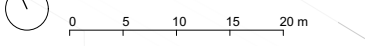
This Architecture sets out to deliver an image of coming life of new Zurich, an inspiring environment in which to have a special experience of a sustainable civic life. The spirit of the proposal starts with the circumstance of the project as an important fruit and vegetables logistic centre at the old Zurich industrial area, where almost like a forgotten place of the city in the day time, as nearly the activities of the site happens in the midnight. The new adding program aims to dance with the existing logistic function of the site together, and bring the daily civic life into it. The design is conceived as an idealised vision of factory, bringing together production activities and landscape in an almost Arcadian composition of machines and gardens. To largely respect the existing program of the site, not to obstacle the current use, the new intervention is proposed to sit on the old building. Logistic space of upper floor of existing building will be incorporated into a new arrangement with productive machines in between, where old construction will be continued and reinforced. A productive public garden will occupy the whole top floor with new roof structure. The workers at the site will be the beneficial owners of the new interventions, since the waste of the existing site is the main source of the upper production, which makes profit for the both sides. The public will see in the factory an interconnected program that delivering a big image of living beings in the every phase of life circle in the symbiotic garden around. The Garden is proposed to connect the existing public activities in the Brache along the limmat river, and to be a destination and a meeting point for citizens as the new city takes shape slowly around it.



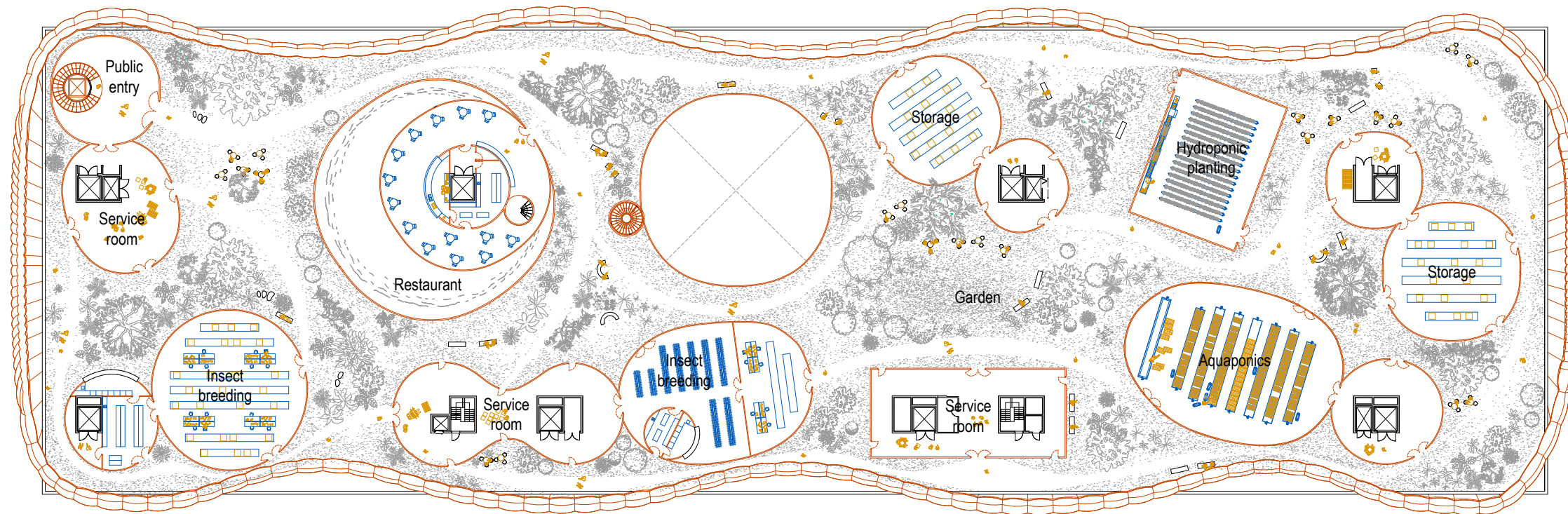
Technical rooms

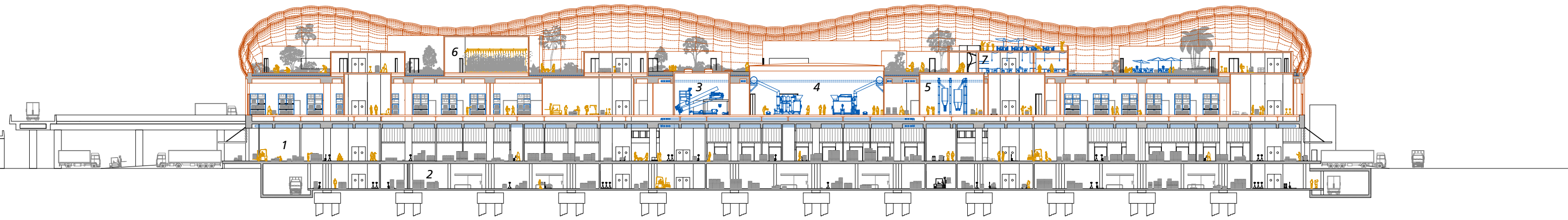
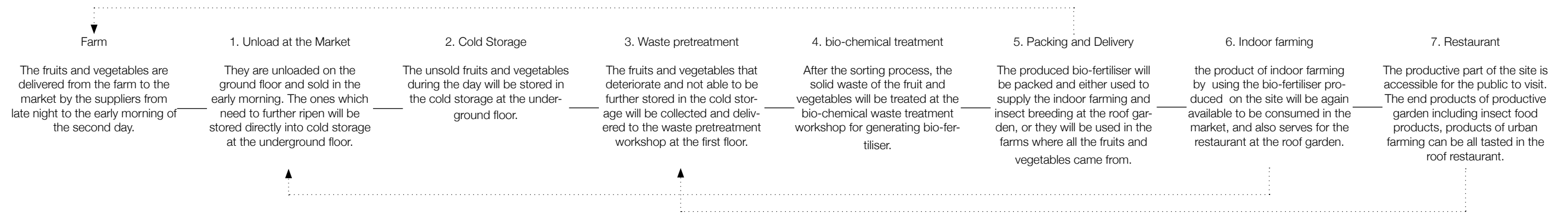


1st Floor-Production & Storage



The Plan aims to allow the user for having a spontaneous route of walking in the garden, with full of fun and surprises. The flowing plan encourages moving and available for all pop-up activities and events. A provisional and easy construction way out of wooden stud framing (partly painted) is chosen for each bubble-like space, as it should have the ability of adaption for future need and economically makable and also possibly to be recycled.



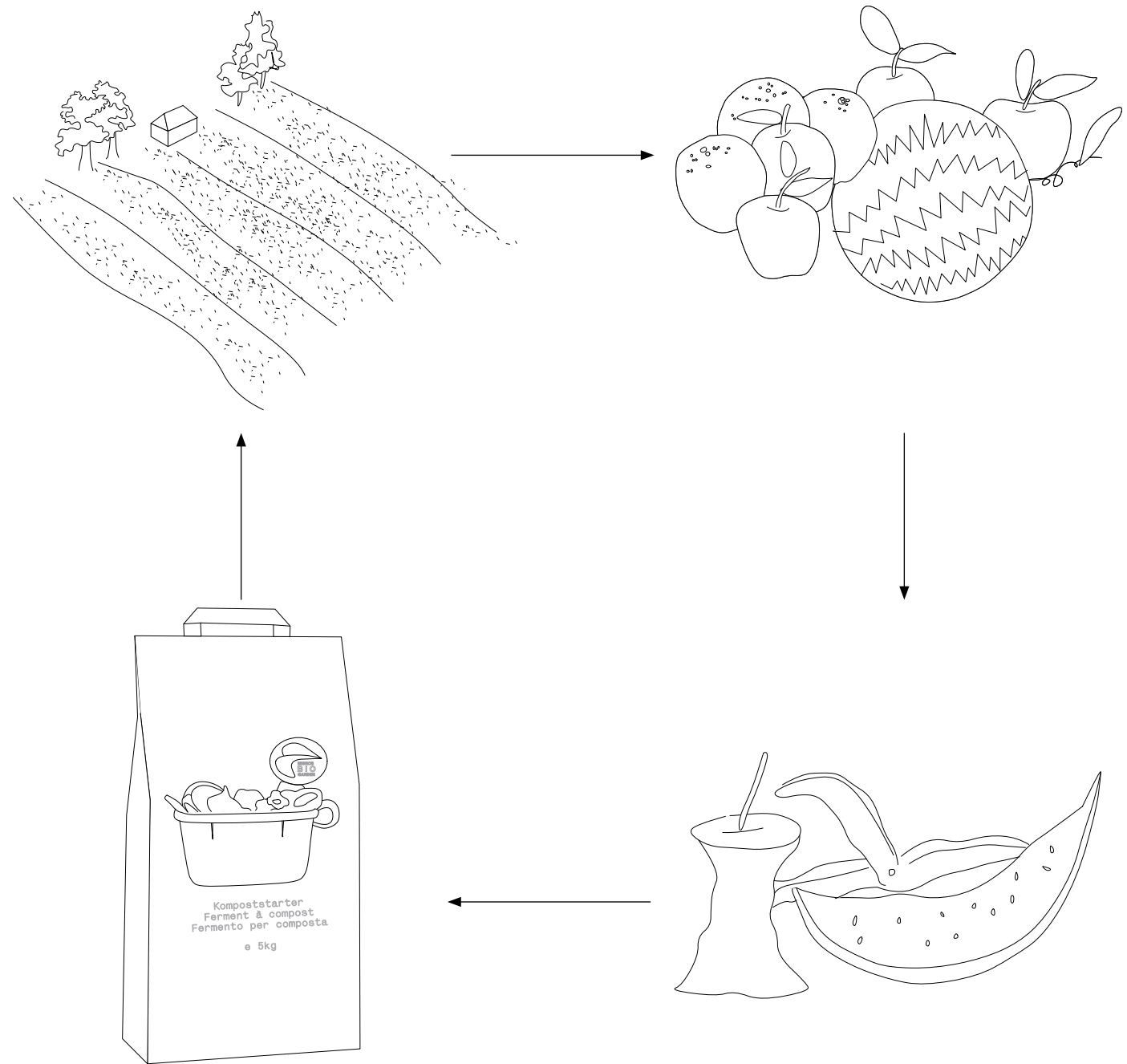


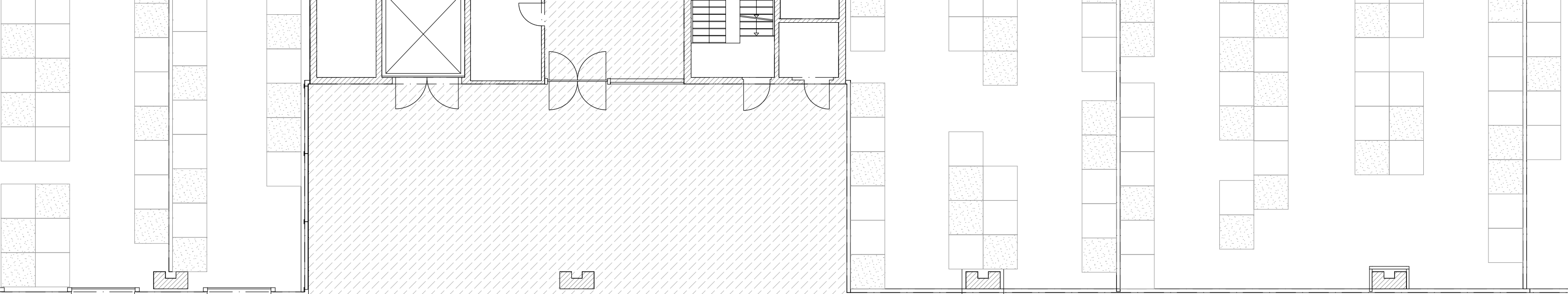
Longitudinal section

0 5 10 20 m

What does the cycle machine work for?

The strategy of adding programs to the site is finding a connections of the things that already there. The bio-fertiliser produced by the waste of fruit and vegetables of the site is the source for the insect breeding and indoor farming. They will be also brought to the farms where all the fruits and vegetables came from. Also, The water tank runs for the water cycle system of the site. It in turn means that the architecture works like a machine, which systematically manages the whole life circle of the beings and their living environment.

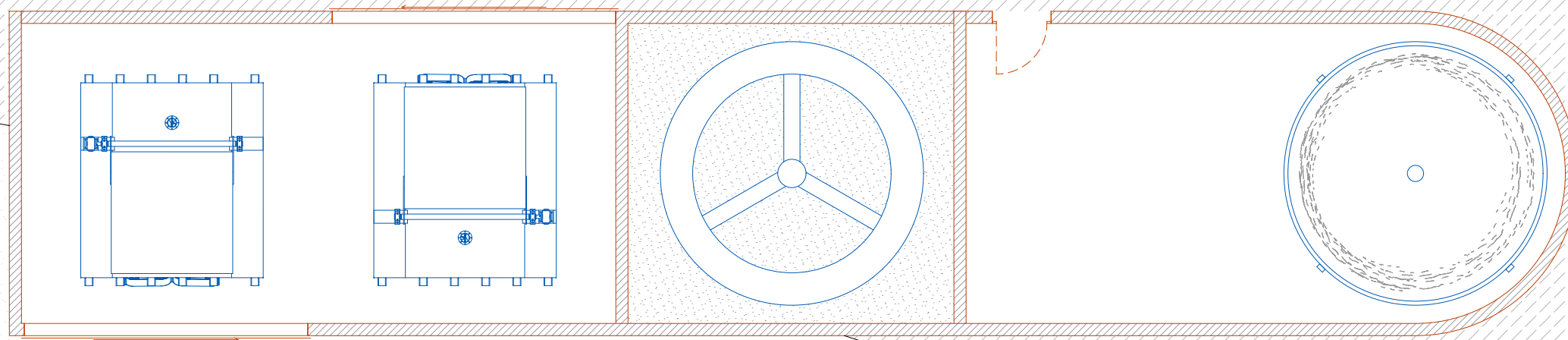




1. Fruit and vegetable waste
Receiving hopper

2. Spiral conveyor

3. Water Tank



1. Fruit and vegetable waste Receiving hopper

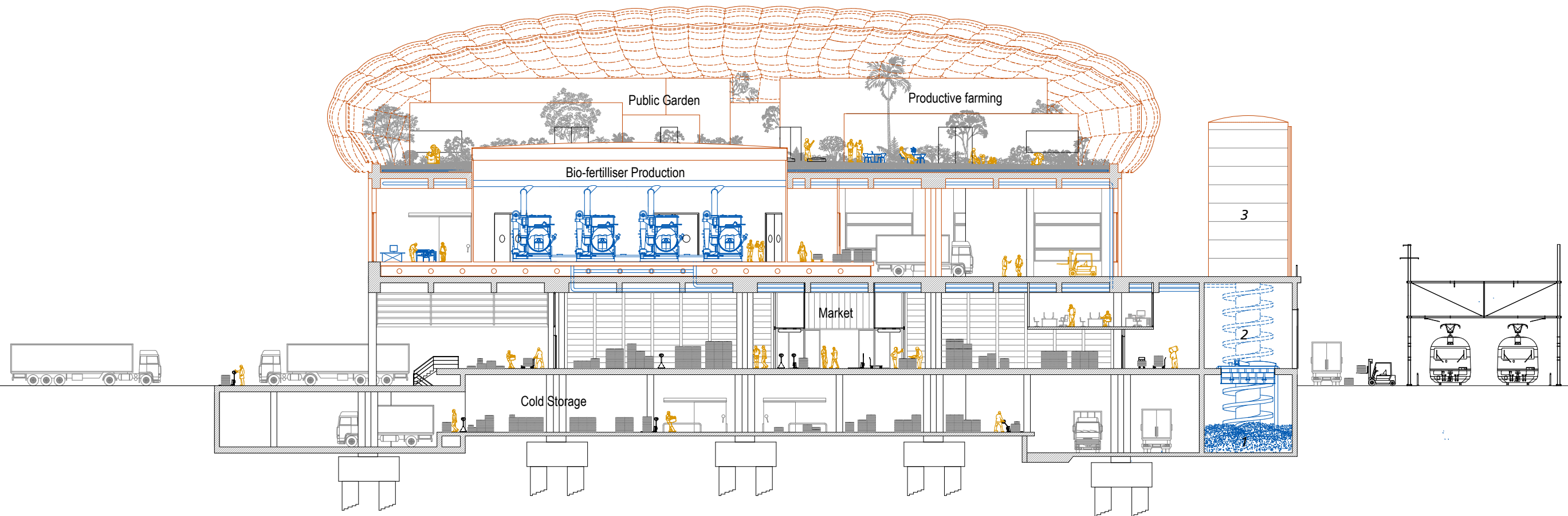
This Receiving hopper will collect two kinds of waste. One is the Fruit and vegetables from the market of the site that have not been yet consumed before it becomes rot in the storage; the other one is the kitchen waste from the surrounding of the site. They will be collected on the ground floor and stored temporarily before they are transported to the waste treatment.

2. Spiral conveyor

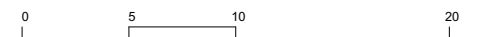
Spiral conveyor works for delivering the waste in the underground to the first floor where all the waste treatment locate. The wastes will be transported in a closed environment with pipes before they reach the relevant treatment process.

3. Water Tank

Water tanks are used to provide storage of water for use in drinking water, irrigation agriculture, fire suppression, agricultural farming, etc. It plays the key role in the water cycle system of the site. The water from the hydroponic system, irrigating system in the roof garden as well as the the water from the waste of the fruits and vegetables will be differently treated, cycled and stored in the tank. Apart from that, the water tank also works for heat exchange. It stores the heat from the cold storage of the site and supply the heat to where the bio-chemical waste treatment machine need in first floor.



Cross section



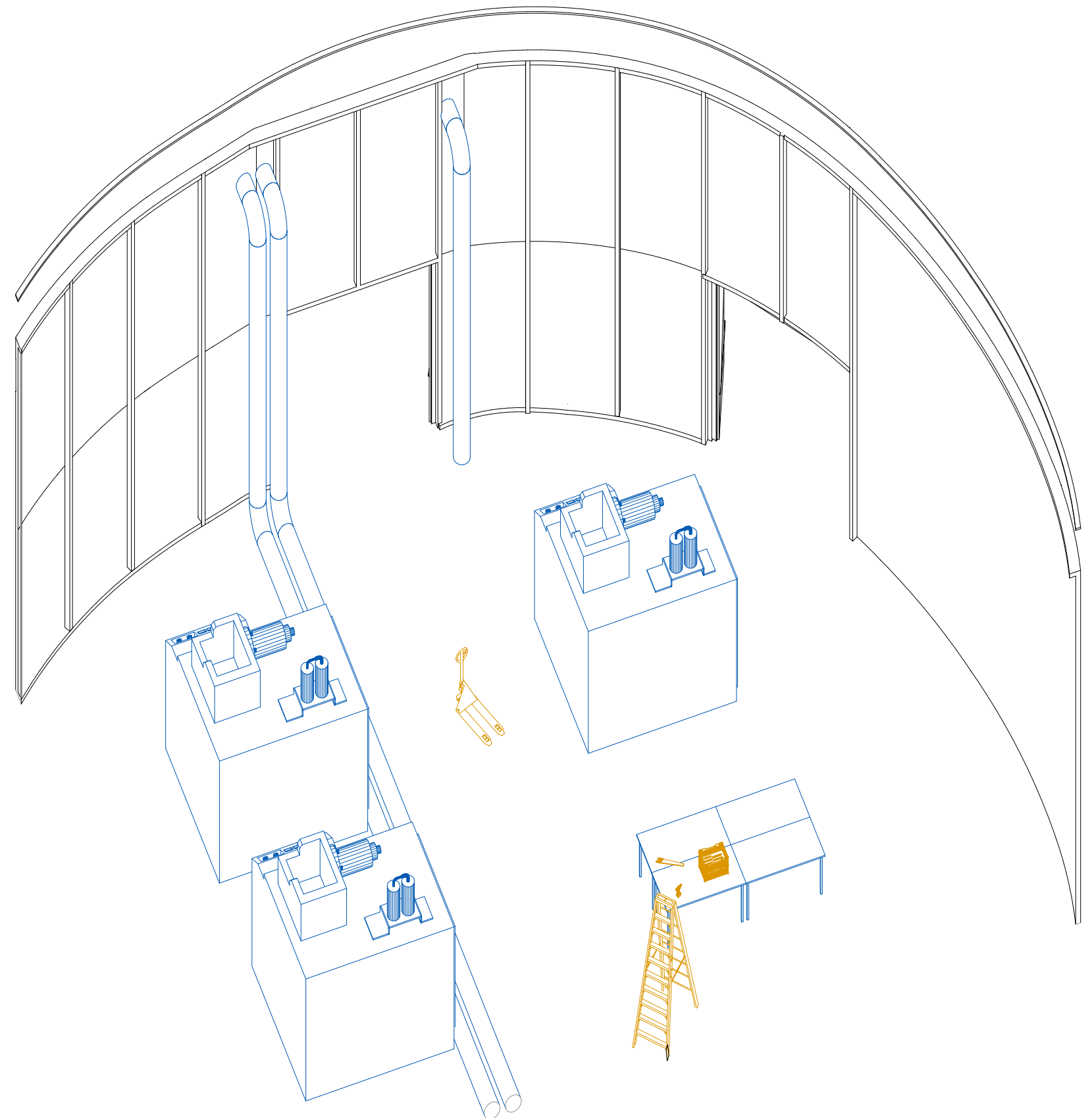
**What is process of waste treatment?
Where can the produced bio-fertiliser
be used?**

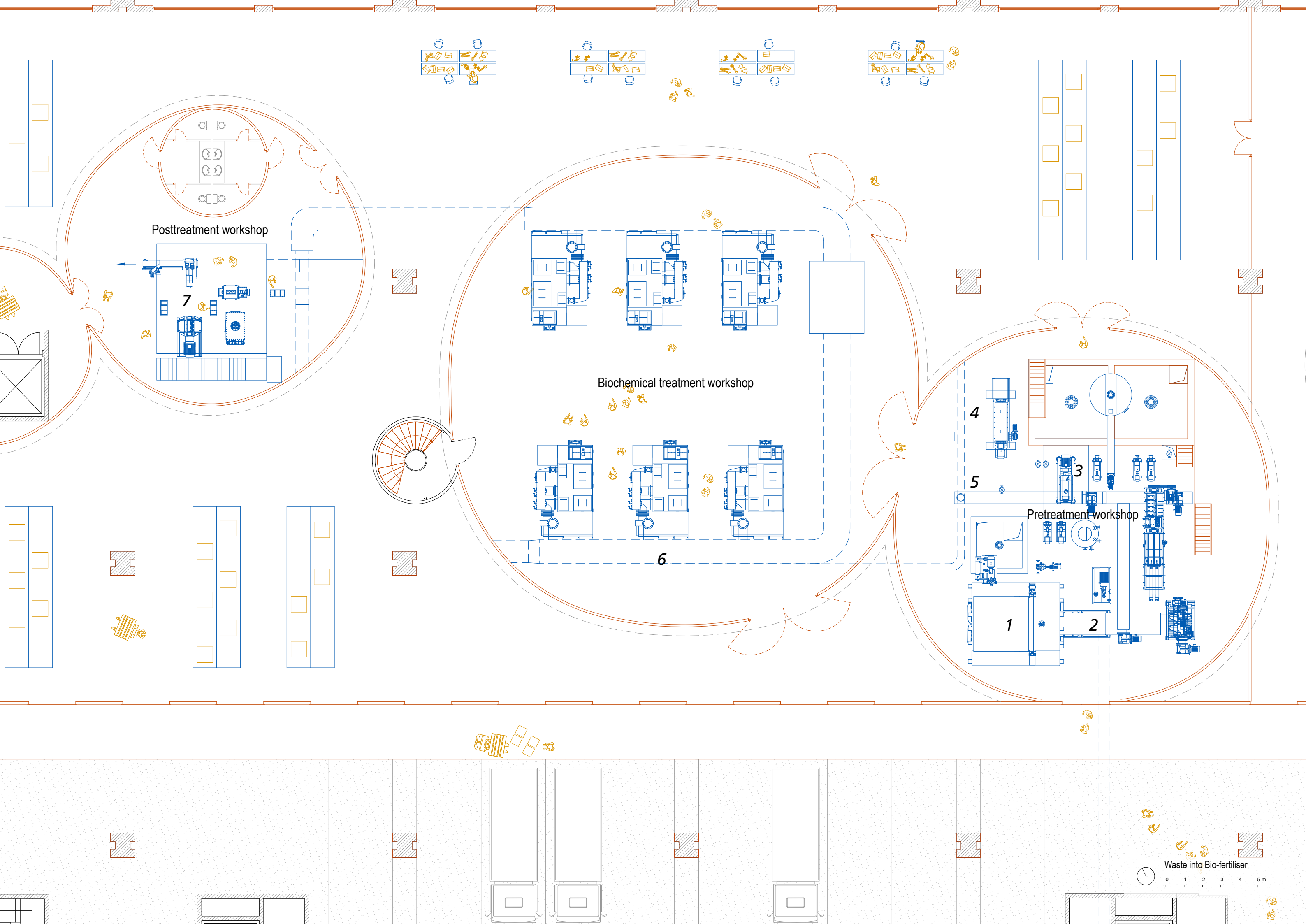
The future food production is about reproduction. Thousands tons of food waste is producing in the building site of HERDERN areal. Since all of the bio-waste can be easily treated with modern industry and reused as bio-fertiliser, it brings a huge economical potential to the fruit market of the site.

Insect breeding

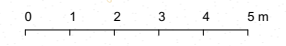
Hydroponic system

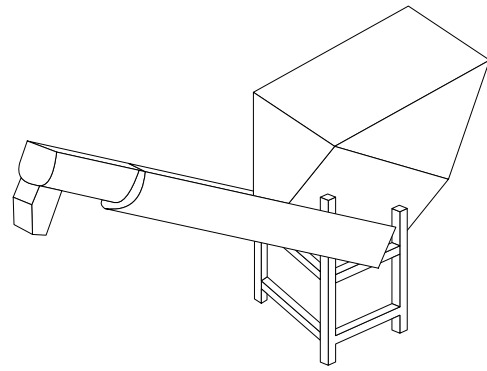
Aquaponics





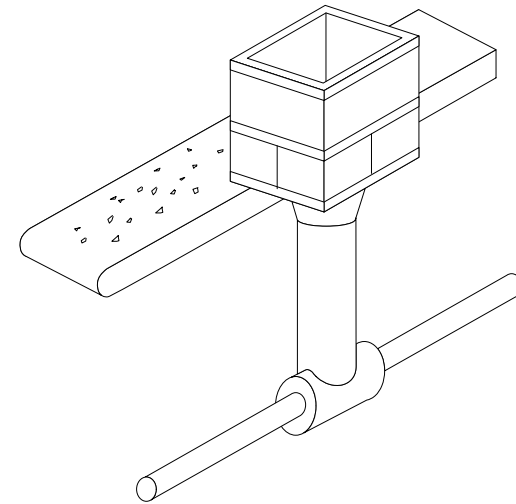
Waste into Bio-fertiliser





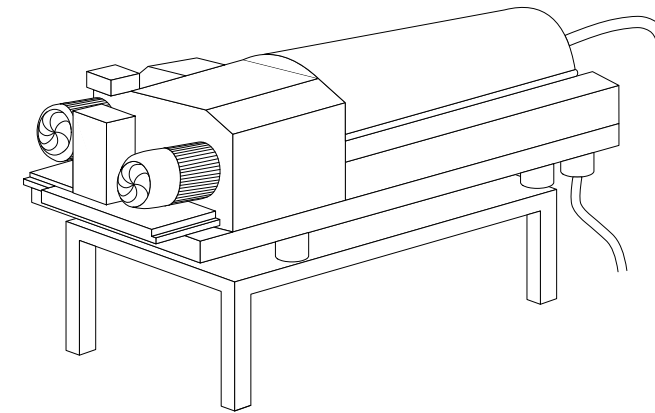
1. Receiving hopper.

Receiving hopper will be loaded with fruit and vegetables waste as well as kitchen waste from the site and surroundings.



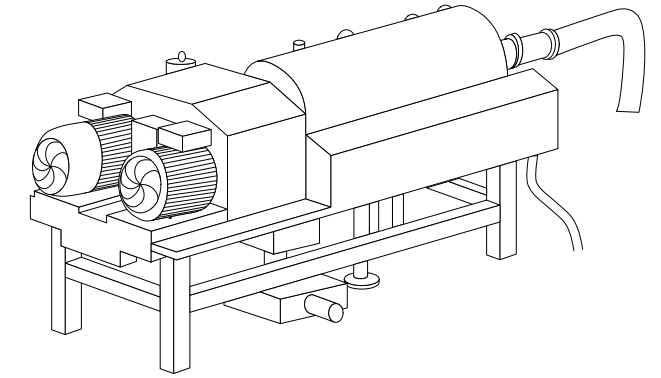
2. Sorting

Fruit, vegetables and kitchen waste will be sorted during this process. Undegradable waste such as plastic bag, plastic bottles, glass bottle as well as lunch boxes will be sorted out.



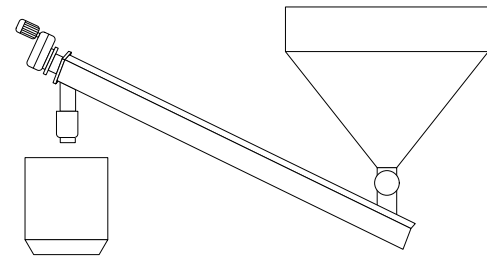
3. Decanter centrifuges

Decanter centrifuges can separate Solids and Liquids of the waste efficiently. Solid phase of the waste will be delivered to the further treatment step. Separated Liquids from the waste will be recycled and treated then stored.



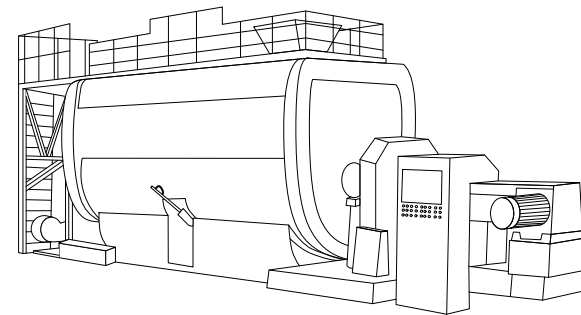
4. Tricanter

Tricanter allows the continuous separation of three phases (solid-liquid-oil) in a single process. The solid waste from last step will be further treated. In this treatment process, oil and liquid will be separated from the solid residue and recycled.



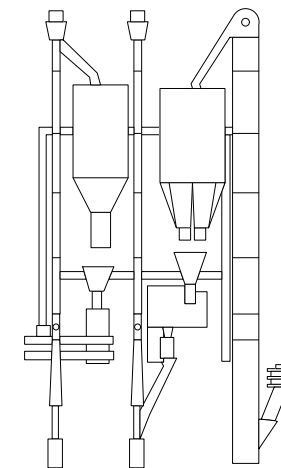
5. Storage bin

Solid residue from the pretreatment workshop will be here temporarily stored and wait to be transported to the bio-chemical waste treatment workshop.



6. Bio-chemical waste treatment machine

Using aerobic fermentation to transform the solid residue of the waste into Bio-fertiliser by adding in aerobic microorganism.
Daily processing capacity: 30t waste
Energy variety: medium and low temperature saturated steam.



7. Posttreatment

The produced Bio-fertiliser will be ground and packed in the post-treatment workshop



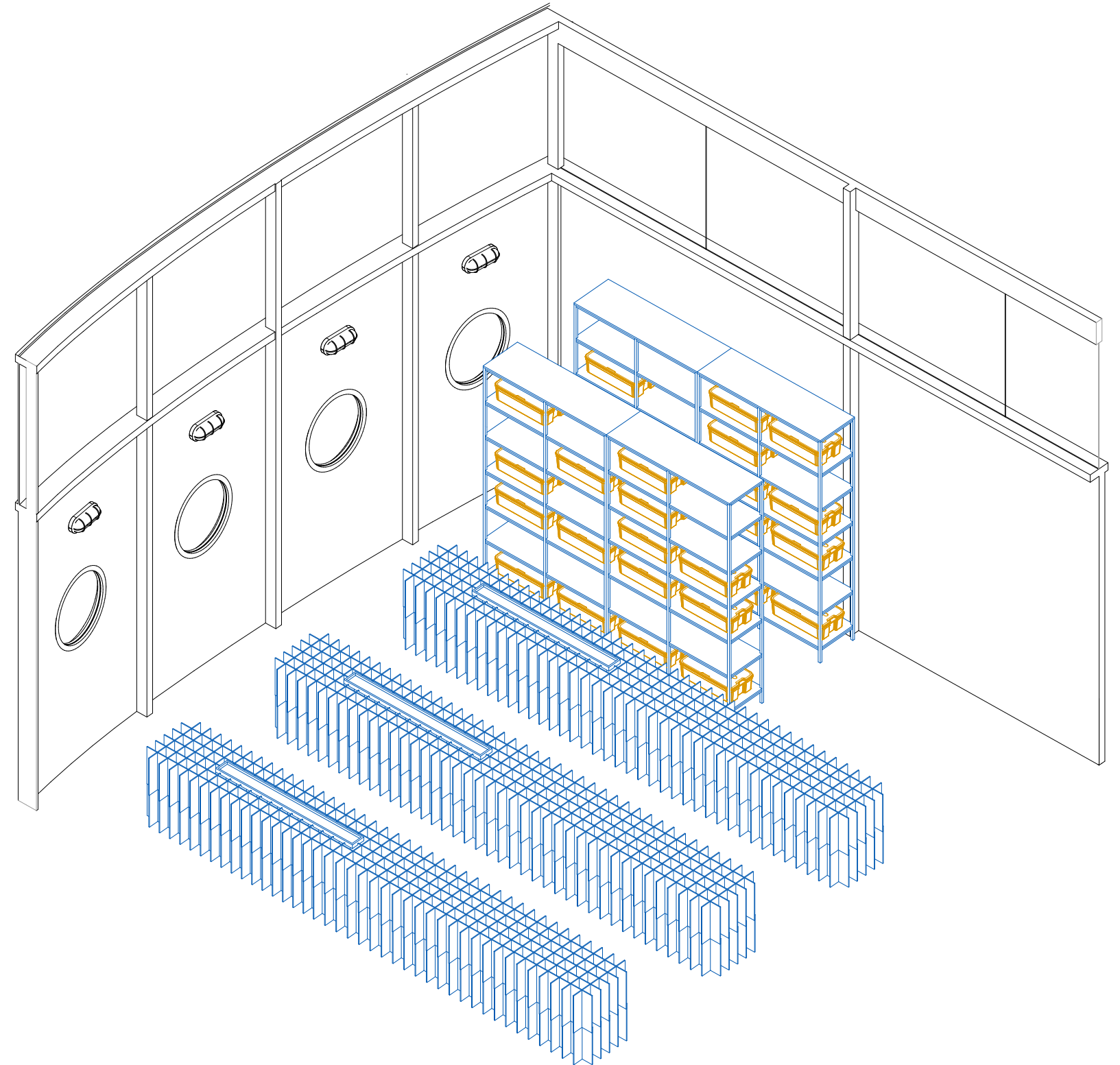
8. Bio- fertiliser product

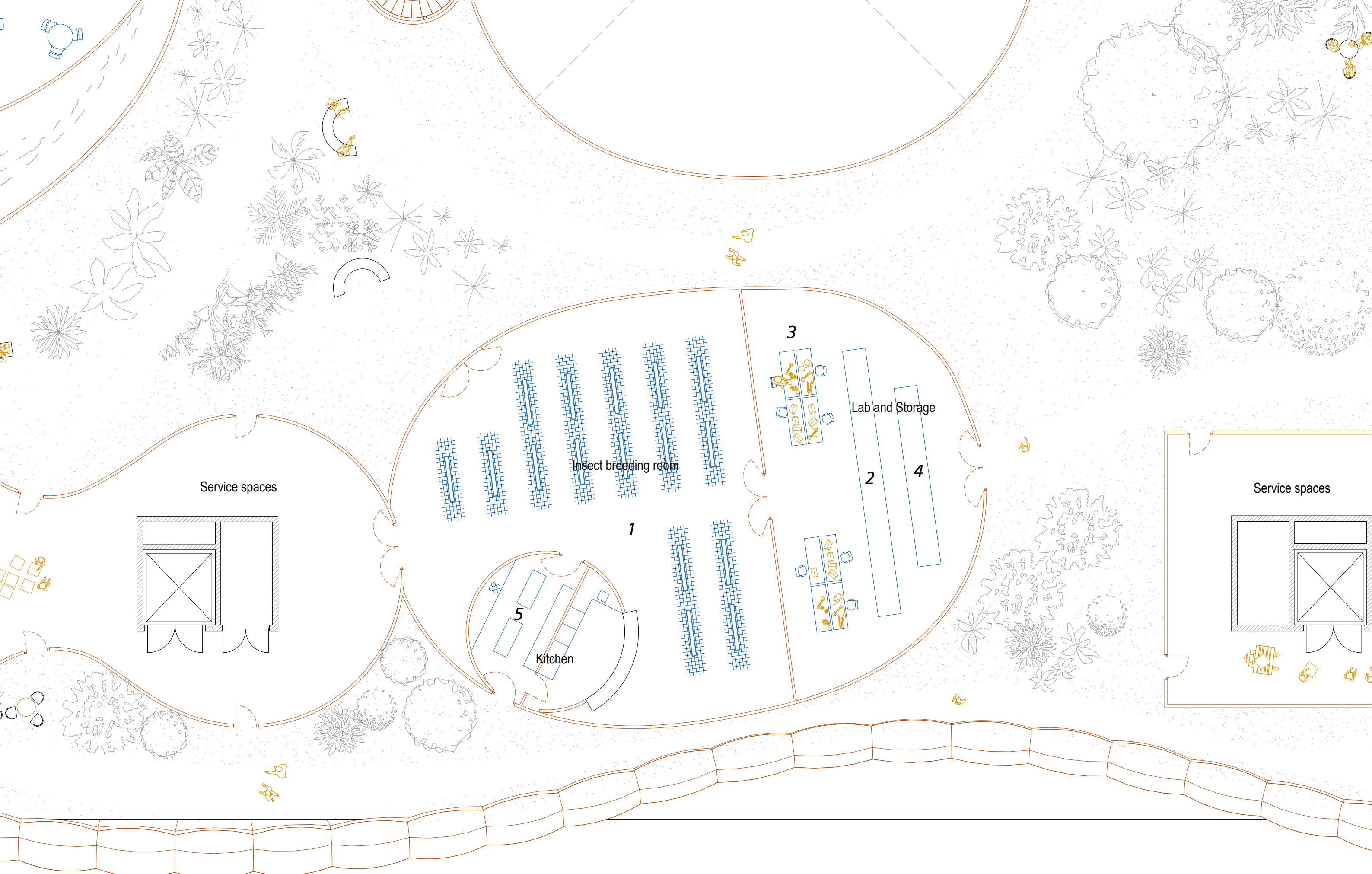
The produced bio-fertiliser will be used as sources for other productive part of the site, such as indoor farming and insects breeding. Also, it makes profit for the fruit and vegetables suppliers of the site, who actually recycled their fruit and vegetables waste and bring them back to the farm planting.



What are the conditions for insect breeding? How does the breeding process work?

Consuming insects makes it possible to consume proteins from animal sources while reducing the harmful impact on the environment. It is a real alternative to beef, as insect breeding requires 5 times less water, emits 100x less greenhouse gases and consumes 12x less feed. It is not only simply a political need, but it is also about having a fun and experience.





Service spaces

Insect breeding room

Lab and Storage

Service spaces

1

3

2

4

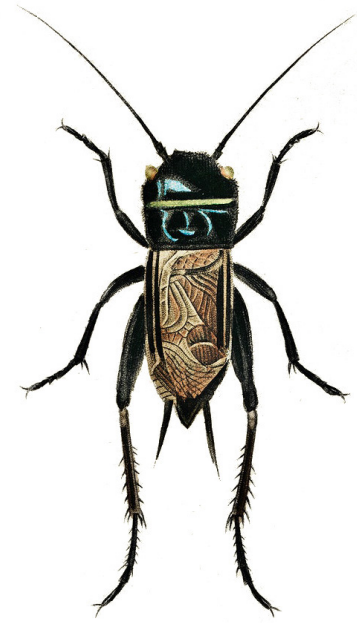
5

Kitchen



Grasshopper

Grasshoppers contain way more protein than beef with a whopping 72-percent protein content including all essential amino acids. Farming insects requires 10 times less feed and up to 100 times less water than producing beef. 80-100% of the insects is edible, which is more than double compared to beef.



Cricket

Cricket not only contains protein, comparable to fish and meat in quality as well as quantity, contain valuable vitamins, like A, B and B12 and rich in iron, zinc, potassium and calcium.



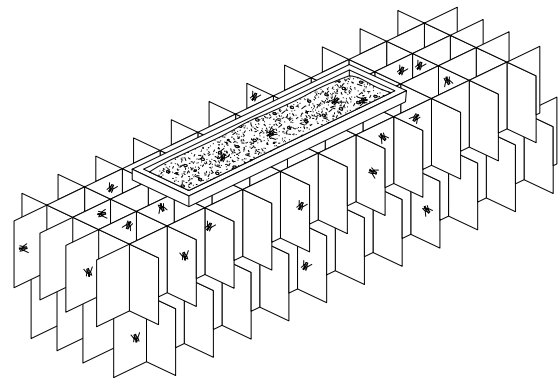
Mealworms

Farming mealworms produces less greenhouse gases in comparison with other animal proteins. This helps reducing the global warming potential of our food production



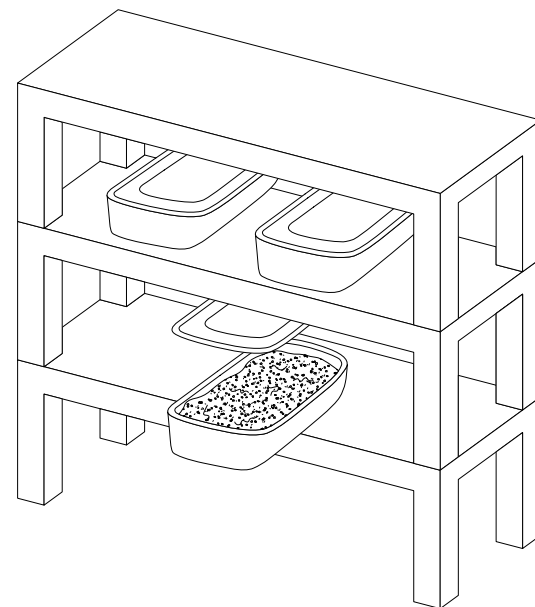
Bio-fertiliser

The bio-fertiliser generated from the fruit and vegetable waste from the site is the very good food resources for the insect breeding.



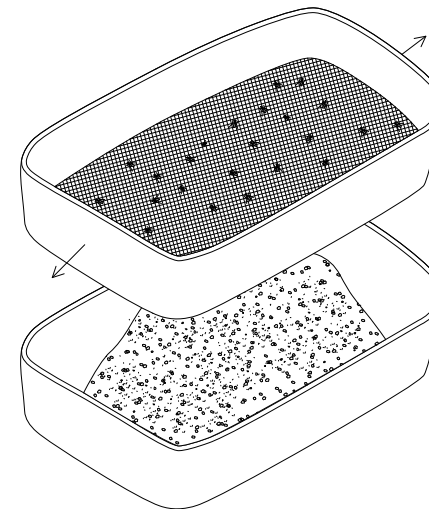
1. Grasshopper and Cricket breeding

Waffled cardboard provides suitable living environment for the grasshopper and cricket breeding, where they find a place to hide themselves and to propagate. The Grasshopper and cricket will live here about 4 weeks and leave eggs at the bottom of the waffled cardboard before they are harvested.



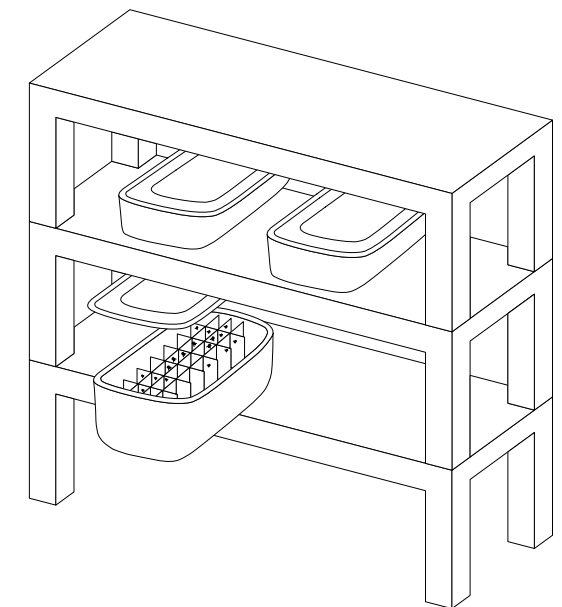
2. baby hatch

The eggs will be put in the container lid with soils to be grown into baby Grasshopper and Cricket to 10days.



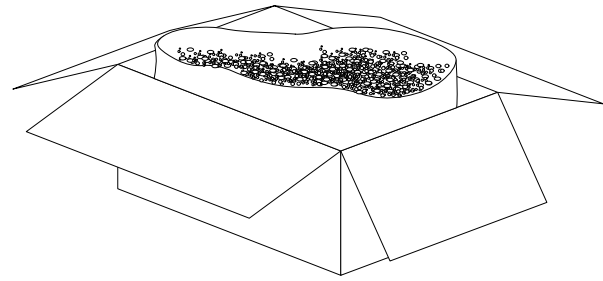
3. Screening

The soils will be screened out after the hatch



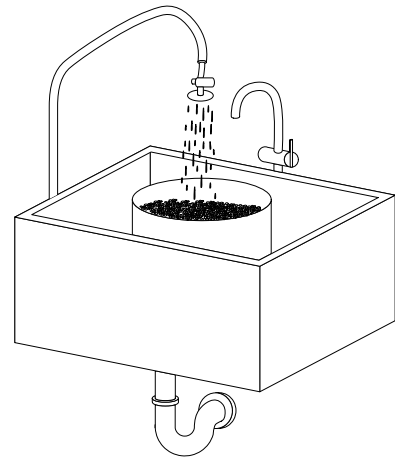
4. baby insect breeding

The baby Grasshopper and Cricket will be again put in the closed container with small waffled cardboard as well as bio-fertiliser for another 2 weeks time, before they grow mature. They will then put back to the breeding room as step 1 for another harvest.



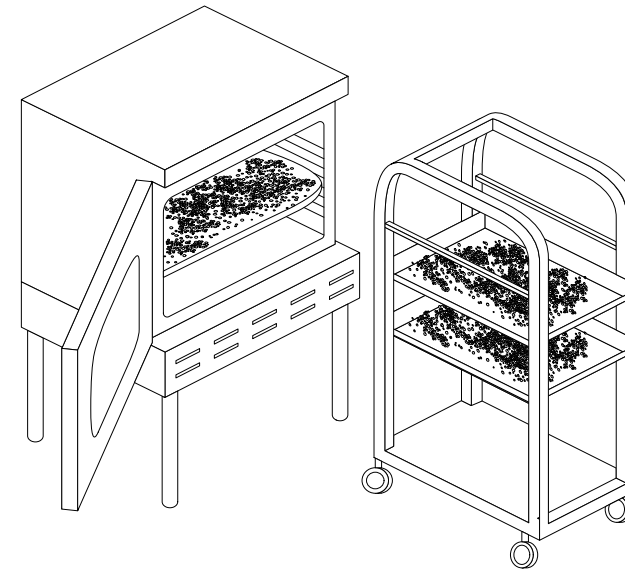
5. Packing

The insects will be put in the plastic bag and packed after their lifecycle.



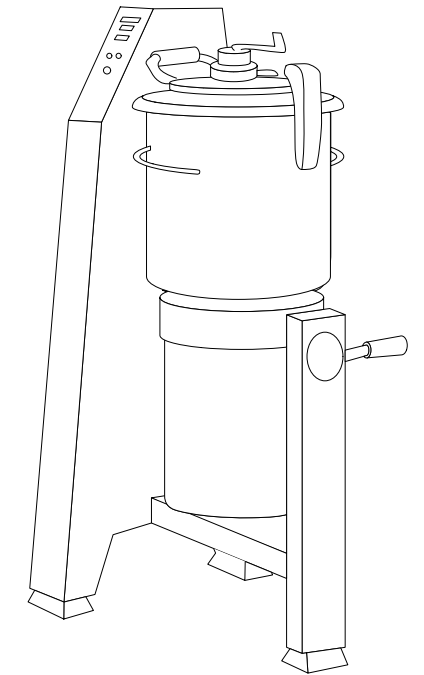
5. Washing

They will be then washed in the kitchen before they are consumed



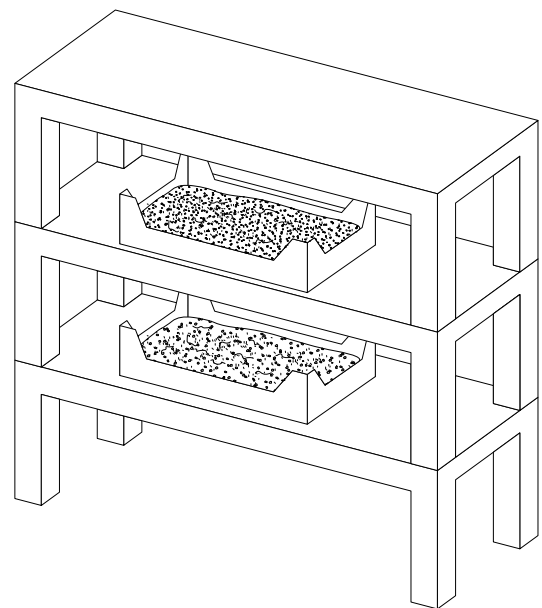
5. baking

The insects will be baked in the kitchen before they become food products



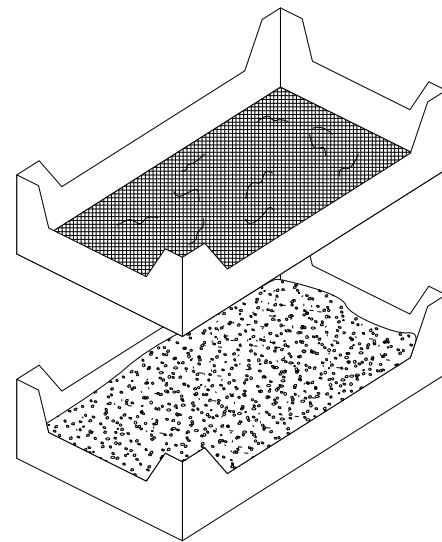
5. Vertical cutter mixers R60 T

Speed: 1800 - 3600 rpm
The Mixer can further process the baked insects into insects flour, producing by-products.



4. Mealworms breeding

The Mealworms breeding has shorter process than Grasshopper and Crickets, they will be bred in the container with soils and fertiliser on the shelf for about 1-month time



3. Screening

The Mealworms will be screened out before they are harvested.



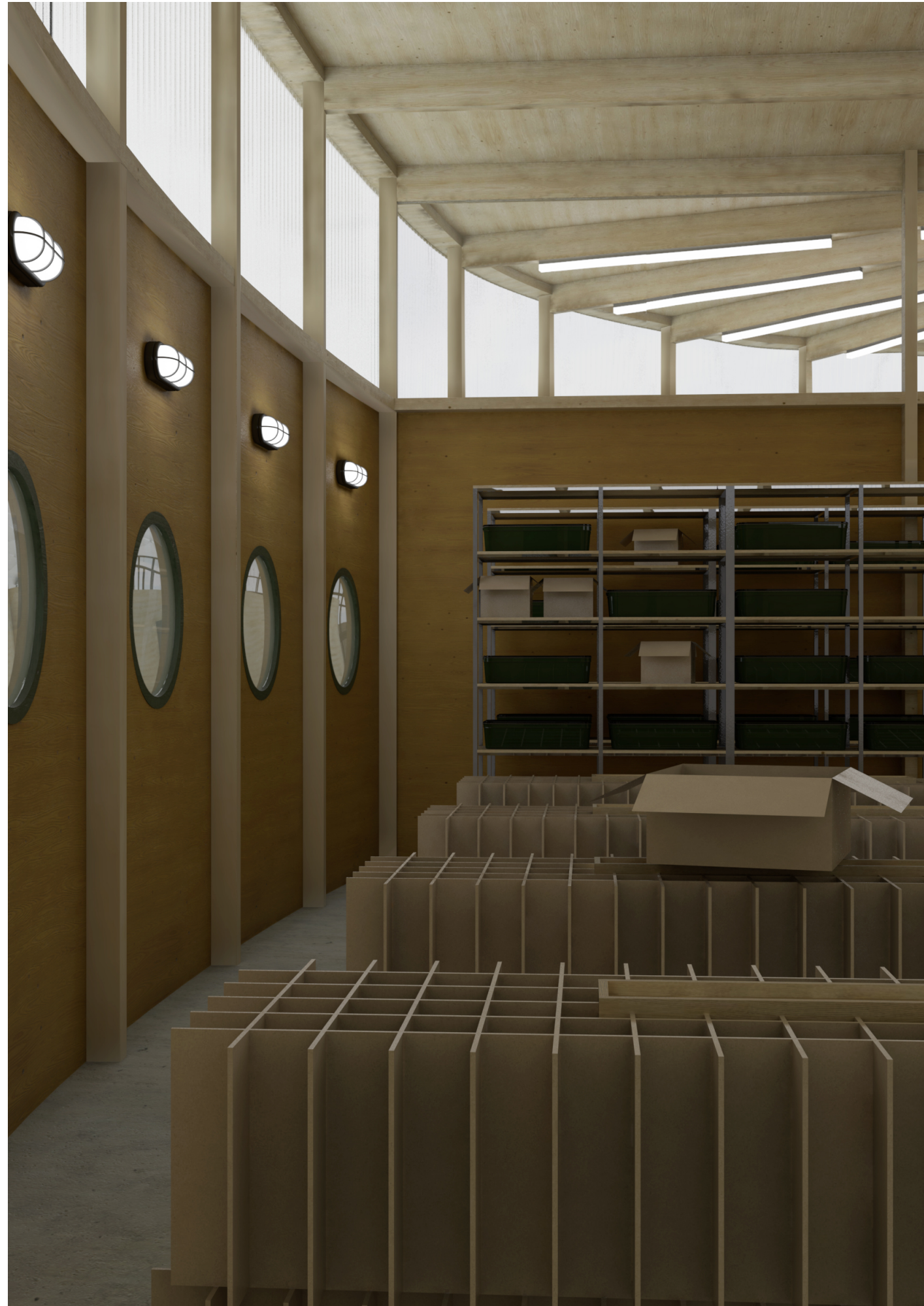
Insect products

Grasshopper, Crickets and Mealworms are the three legal insects that can be consumed in Switzerland.



Insect flour

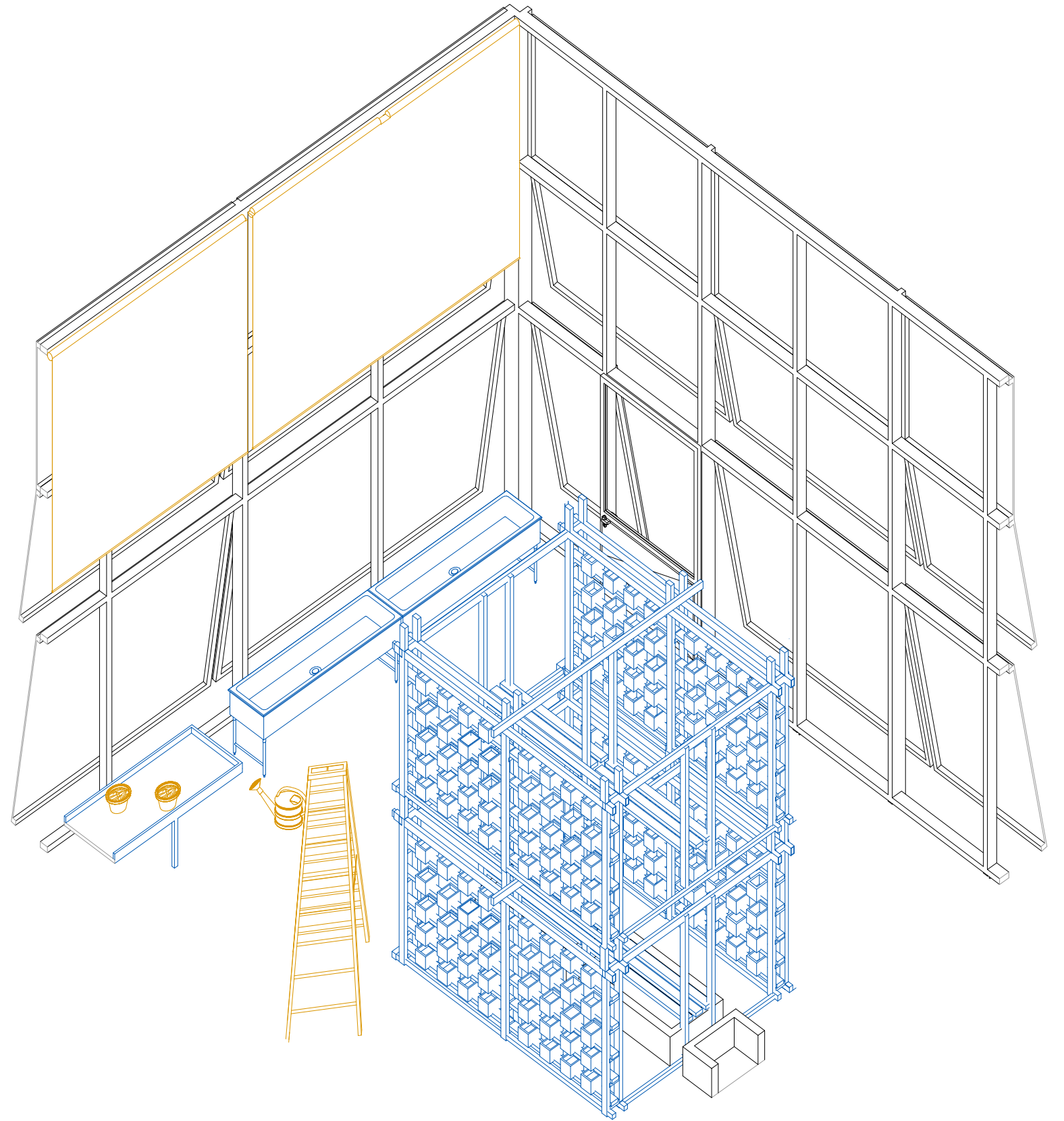
To have special taste experience, the insect flour can be easily mixed with other food product. For example, they can be mixed with pizza flour or cookies. Enjoy!

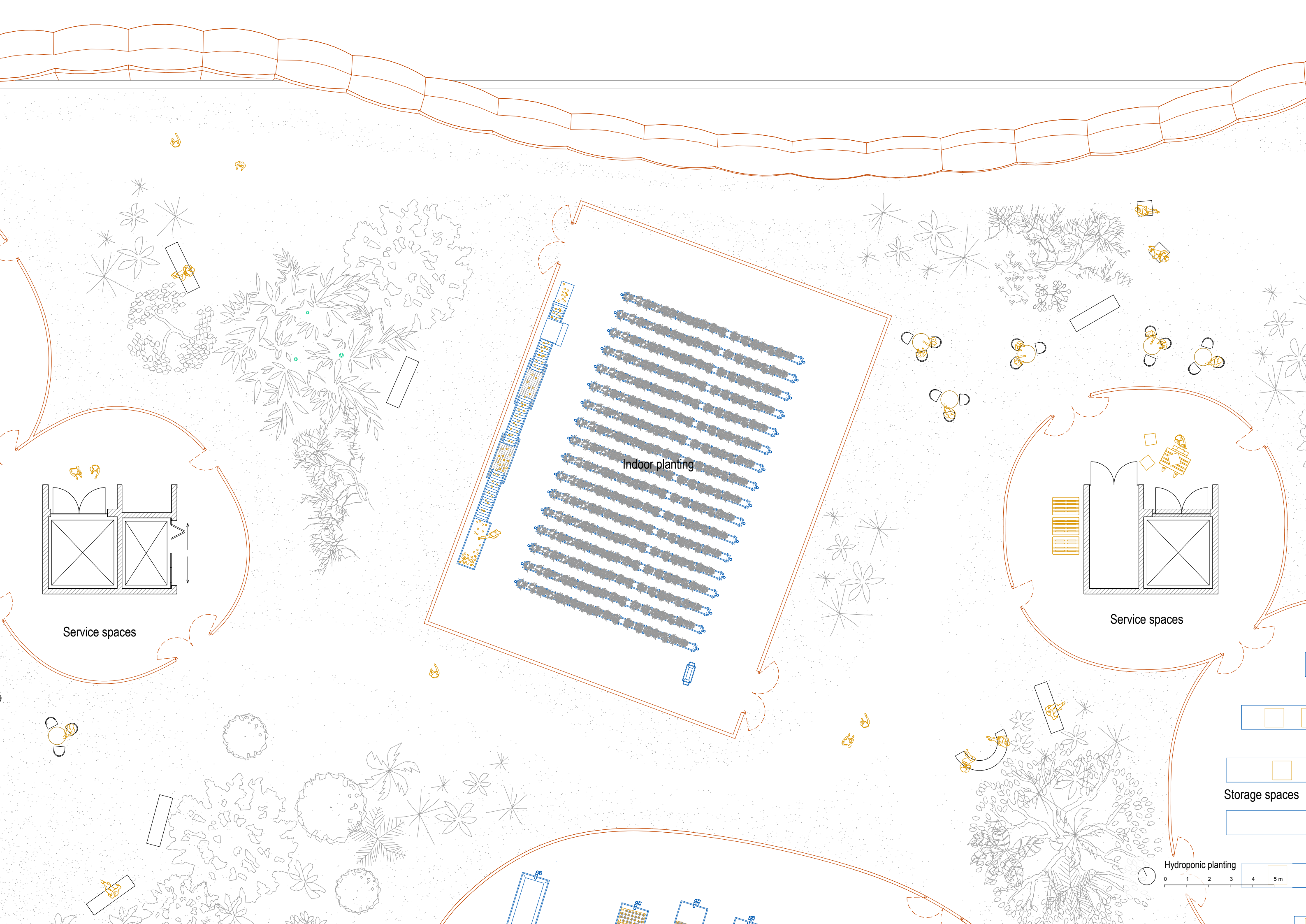


Insect breeding room

What is Hydroponic system, how does it work together with symbiotic environment?

Hydroponics is a type of horticulture and a subset of hydroculture which involves growing plants without soil, by using mineral nutrient solutions in an aqueous solvent. The nutrients used in hydroponic systems can come from many different sources, including fish excrement, duck manure, bio- fertilisers, or artificial nutrient solutions.





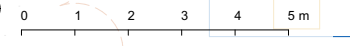
Indoor planting

Service spaces

Service spaces

Storage spaces

Hydroponic planting





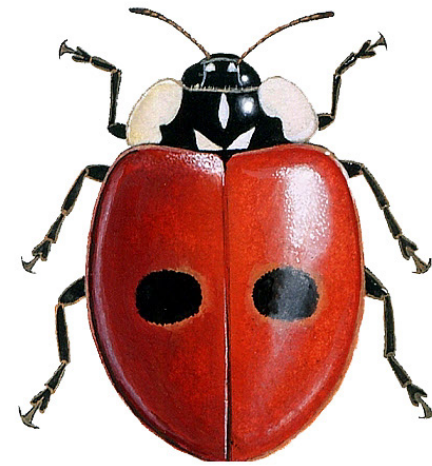
Bio-fertiliser

The bio-fertiliser generated from the fruit and vegetable waste from the site also plays an important role in the hydroponic system.



Solanum lycopersicum

The tomato is particularly suitable for growing in an aquaponics system and can be pollinated by bees or bumblebees in the cycle, which would be impossible for humans.
known as: Tomato



Adalia bipunctata

Ladybugs play an important role in the closed circuit of the hydroponic system. While pest control in the classic Agriculture is done by means of pesticides, it is possible in aquaponics system to control pests using beneficial insects.
known as: Ladybugs



Apis mellifera

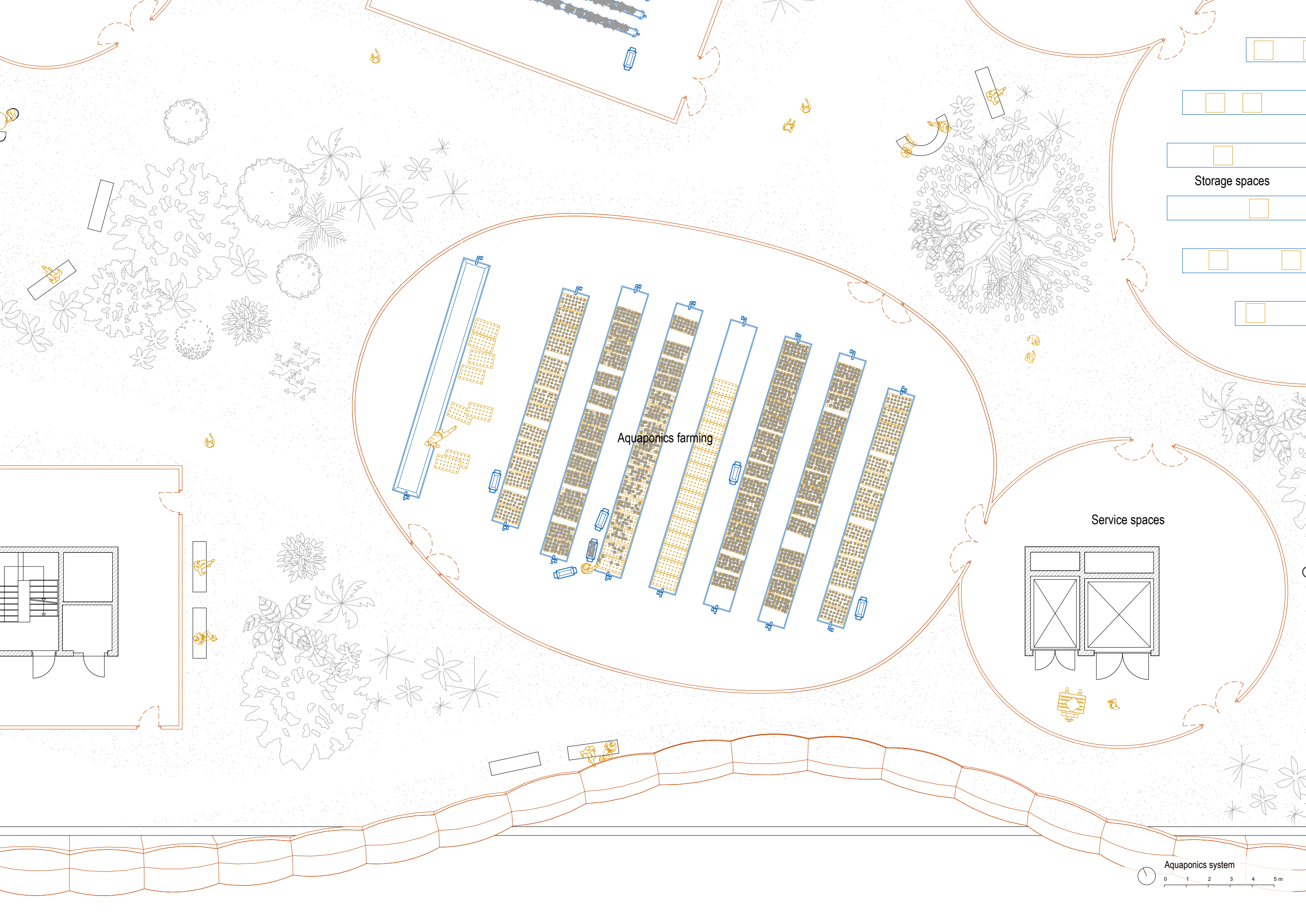
Like the ladybird, the honey bee takes on one of the most important tasks in the hydroponic system. In addition to pollinating the tomatoes, the Animals also for the propagation of plants throughout the building and for the honey production.
known as: The western honey bee



What is aquaponic system, which species are relevant for aquaponic planting?

Aquaponics refers to a process that combines the techniques of rearing fish in aquaculture and the cultivation of useful plants using hydroponics. An aquaponics system is always a combination of a closed circuit system for fish production and a hydroponic system for plant breeding, for example for vegetables and herbs.

The system works by using the excrement from fish farming as nutrients for plants. This is usually done automatically using pump systems. The nutrient input required for growing plants is therefore carried out through the fish feed.



Aquaponics farming

Storage spaces

Service spaces

Oncorhynchus mykiss



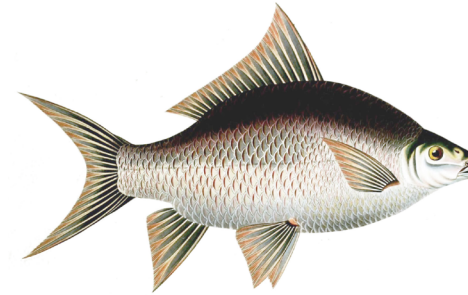
species of salmonid native to cold-water tributaries of the Pacific Ocean in Asia and North America. Freshwater resident rainbow trout usually inhabit and spawn in small to moderately large, well oxygenated, shallow rivers with gravel bottoms. Rainbow trout is often now fed in the aquaponic system.
known as: Rainbow trout

Clarias gariepinus



They are found throughout Africa and the Middle East, and live in freshwater lakes, rivers, and swamps, as well as human-made habitats, such as oxidation ponds or even urban sewage systems. The African sharp-toothed catfish was introduced all over the world in the early 1980s for aquaculture purposes.
known as: African sharp-toothed catfish

Labeo catla



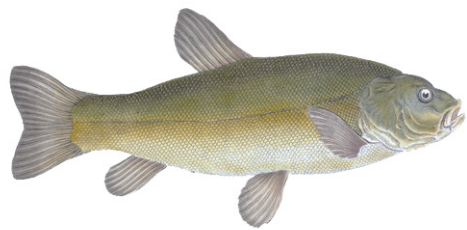
It is one of the most important aquacultured freshwater species in South Asia.[4][5] It is grown in polyculture ponds with other carp-like fishes.
known as: Catla

Cyprinus carpio



is a widespread freshwater fish of eutrophic waters in lakes and large rivers in Europe and Asia. They naturally live in temperate climates in fresh or slightly brackish water with a pH of 6.5–9.0 and salinity up to about 0.5%.[17] and temperatures of 3 to 35 °C (37–95 °F). The ideal temperature is 23 to 30 °C (73–86 °F), with spawning beginning at 17 to 18 °C (63–64 °F); they easily survive winter in a frozen-over pond.
known as: European carp

Tinca tinca



found throughout Eurasia from Western Europe. Tench feed mostly at night with a preference for animals, such as chironomids, on the bottom of eutrophic waters and snails and pea clams in well-vegetated waters.
known as: tench

Perca fluviatilis



The range of the European perch covers fresh water basins all over Europe, excluding the Iberian peninsula. They live in slow-flowing rivers, deep lakes and ponds.
known as: European perch

Esox lucius



They are typical of brackish and fresh waters of the Northern Hemisphere. Pike are found in sluggish streams and shallow, weedy places in lakes and reservoirs, as well as in cold, clear, rocky waters. They seem to prefer water with less turbidity, but that is likely related to their dependence on the presence of vegetation.
known as: Northern pike

Tilapia



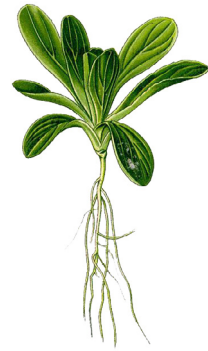
In practice, tilapia are the most popular fish for home and commercial projects that are intended to raise edible fish because it is a warmwater fish species that can tolerate crowding and changing water conditions.
Known as: Tilapia

Ocimum basilicum



Basil is native to tropical regions from central Africa to Southeast Asia. It is a tender plant, and is used in cuisines worldwide. They are now often planted in the aquaponic system.
known as: Basil

Valerianella locusta



The corn salad is rich in vitamins A and C and was previously used to purify the blood and called anti-infectious. He is specially easy to growl in the aquaponic system.
known as: corn salad

Capsicum annuum



The hot peppers or also paprika is used in addition to food also used as a herbal remedy for countless ailments helps.
known as: Paprika

Cucumis sativus



The cucumber is one of the most commonly grown cucurbits in greenhouses and can be used extremely versatile.
known as: Cucumber

Fragaria vesca



By growing them in the aquaponic system, the strawberries can be harvested, when they are consumed.
known as: Strawberry

Nasturtium officinale



watercress is well-suited to hydroponic cultivation, thriving best in water that is slightly alkaline. In many local markets, the demand for hydroponically grown watercress exceeds supply, partly because cress leaves are unsuitable for distribution in dried form, and can only be stored fresh for a short period.
known as: Watercress

Solanum lycopersicum

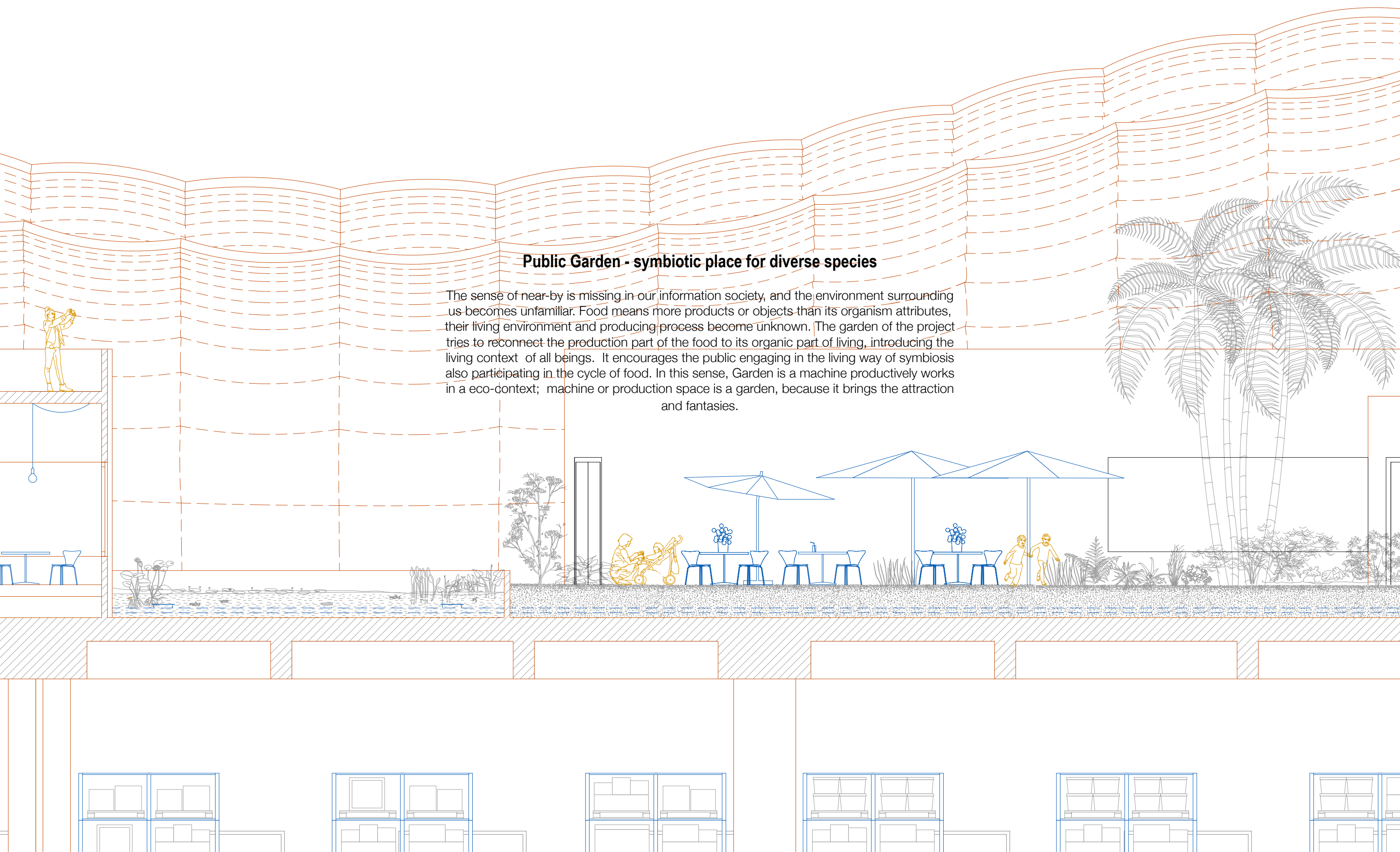


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known as: Tomato

Malus



Countless varieties of apples can be found under the name Malus. Already the Celts used the apple as food and made puree or cider out of it..
known as: apple tree



Public Garden - symbiotic place for diverse species

The sense of near-by is missing in our information society, and the environment surrounding us becomes unfamiliar. Food means more products or objects than its organism attributes, their living environment and producing process become unknown. The garden of the project tries to reconnect the production part of the food to its organic part of living, introducing the living context of all beings. It encourages the public engaging in the living way of symbiosis also participating in the cycle of food. In this sense, Garden is a machine productively works in a eco-context; machine or production space is a garden, because it brings the attraction and fantasies.



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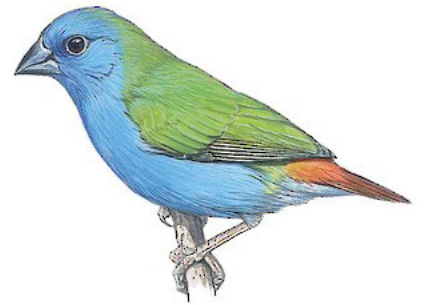
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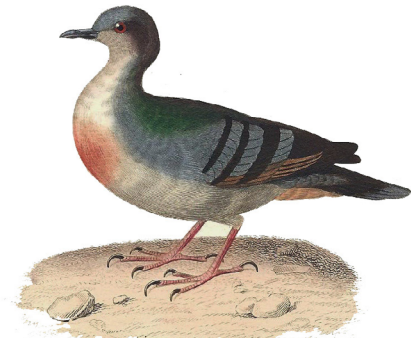
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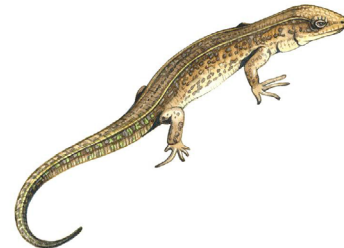
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Species of the roof garden

1. *Lamprolornis purpureus*

Like most starlings, the purple starling is omnivorous, eating fruit and insects. This common passerine is typically found in open woodland and cultivation. It is a resident breeder in tropical Africa.
known as: purple starling

2. *Sicalis flaveola*

from South America that is common in open and semi-open areas in lowlands. Typically nesting in cavities, the saffron finch makes use of sites such as bamboo branches and under house roofs - this species is tolerant of human proximity, appearing at suburban areas and frequenting bird tables. They have a pleasant but repetitious song which, combined with their appearance, has led to them being kept as caged birds in many areas.
known as: Saffron finch

3. *Melopsittacus undulatus*

Budgerigars are found in open habitats, primarily in scrublands, open woodlands, and grasslands of Australia.
known as: budgerigar

4. *Vanellus miles*

common and conspicuous bird native to Australia, particularly the northern and eastern parts of the continent, New Zealand and New Guinea. It spends most of its time on the ground searching for food such as insects and worms. It is common in Australian fields and open land.
known as: masked lapwing

5. *Geopelia cuneata*

Basil is native to tropical regions from central Africa to Southeast Asia. It is a tender plant, and is used in cuisines worldwide. They are now often planted in the aquaponic system.
known as: Basil

6. *Erythrura tricolor*

It is found in subtropical/tropical dry forest and dry savannah.
known as: tricolored parrotfinch

7. *Excalfactoria chinensis*

ranging in the wild from southeastern Asia to Oceania. In the wild, the diet of king quails consists of small bugs, seed and various grasses that are available at the time. In aviculture, all birds should be fed a variety of seeds as well as a healthy range of fruit and vegetables. During breeding, hens should be fed calcium-rich food sources such as shell grit to prevent egg binding. Newly hatched chicks should be fed high protein chick crumb mixed in with a little water. Other sources of protein include mealworms and various bugs.
known as: king quail

8. *Gallicolumba luzonica*

It lives in primary or secondary forests, and can be found at altitudes varying from up to 1400 meters above sea level. They eat seeds, berries and grubs. They are shy and secretive, and very quiet, and rarely leave the ground except when nesting.
known as: Luzon bleeding-heart

9. *Schistocerca*

Grasshoppers play a important role in the eco-system of the roof garden. they are not only the food resources for beneficial bird and other species, but also are the core source for the productive part of the site

10. *Gryllus campestris*

In the southern part of Asia including Cambodia, Laos, Thailand, and Vietnam, crickets commonly are eaten as a snack, prepared by deep frying soaked and cleaned insects. They are also import source for the productive part of the site.

11. *Culex pipiens*

The mosquitoes can be found anywhere where they can lay their eggs. Where there are bodies of water there are also mosquitoes and they lay their eggs even in small pools of water. The mosquito is considered to be the largest carrier of disease in the world - but it is the food source of many other animals.
known as: mosquitoes

12. *Anax imperator*

This dragonfly has a wide distribution; it is found throughout Africa and through most of Europe, the Arabian Peninsula, and south-western and central Asia. Dragonflies feed on pest insects in rice, acting as a natural pest control.
known as: emperor dragonfly

13. *Apis mellifera*

Bumblebees are important pollinators of both crops and wildflowers. Because bumblebees do not overwinter the entire colony, they do not stockpile honey, and therefore are not useful as honey producers. Bumblebees are increasingly cultured for agricultural use as pollinators, among other reasons because they can pollinate plants such as tomato in greenhouses by buzz pollination whereas other pollinators cannot.
known as: Bumblebees

14. *Aglais urticae*

The butterflies are important pollinators for the fauna. The strikingly colored butterfly can be found all over Europe and feeds on the nectar of the plants.
known as: Butterfly

15. *Pelophylax esculentus*

Basil is native to tropical regions from central Africa to Southeast Asia. It is a tender plant, and is used in cuisines worldwide. They are now often planted in the aquaponic system.
known as: Basil

16. *Trachemys scripta elegans*

The red-eared slider originated from the area around the Mississippi River and the Gulf of Mexico, in warm climates in the South-eastern United States. They live in areas of calm water, where they are able to leave the water easily by climbing onto rocks or tree trunks so they can warm up in the sun. It is an omnivorous animal that eats insects, crayfish, shrimp, worms, snails, amphibians and small fishes, and aquatic plants
known as: Red-eared slider

17. *Podarcis muralis*

these rock iguanas may be an important means of distributing seeds to new areas.
known as: rock iguanas

18. *Cycas revoluta*

native to southern Japan including the Ryukyu Islands. It is one of several species used for the production of sago, as well as an ornamental plant. It can grow into very old specimens with 6–7 m (over 20 feet) of trunk.
known as: Sago palm

19. *Dendrobium*

In the family Orchidaceae. It is a very large genus, containing more than 1,800 species that are found in diverse habitats throughout much of south, east and southeast Asia
known as: Orchids

20. *Theobroma cacao*

native to the deep tropical regions of Meso-america. Its seeds, cocoa beans, are used to make chocolate liquor, cocoa solids, cocoa butter and chocolate.
known as: cacao tree

21. *Carica papaya*

A tropical fruit plant. The papaya is a small, sparsely branched tree, usually with a single stem growing from 5 to 10 m (16 to 33 ft) tall, with spirally arranged leaves confined to the top of the trunk.
known as: papaya

22. *Prunus armeniaca*

The apricot is very suitable for crossing with nectarines, plums and peaches.
known as: apricot tree

23. *Chamaedorea*

A genus of 107 species of palms, native to subtropical and tropical regions of the Americas.[2][3] They are small palms, growing to 0.3–6 m (1 ft 0 in–19 ft 8 in) tall with slender, cane-like stems.
known as: Palm tree

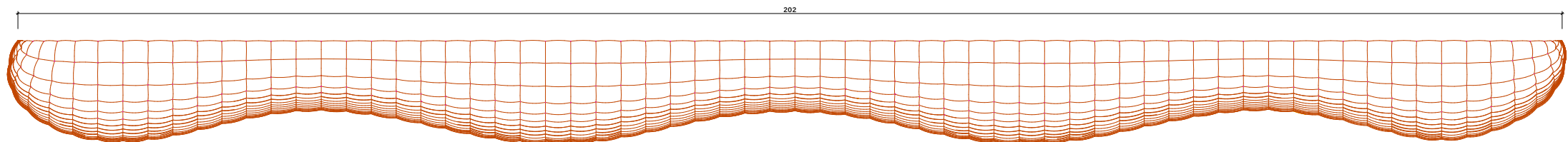
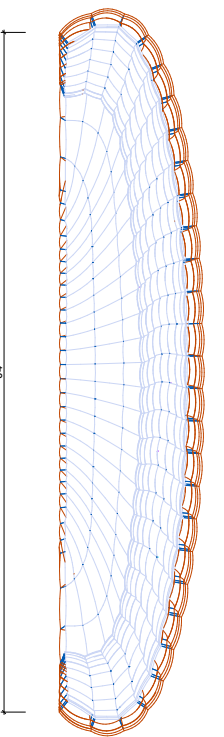
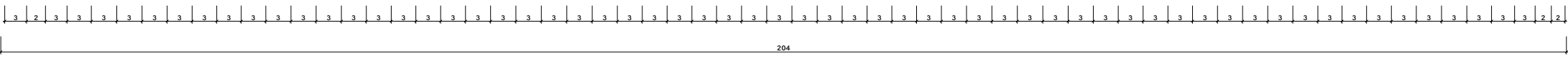
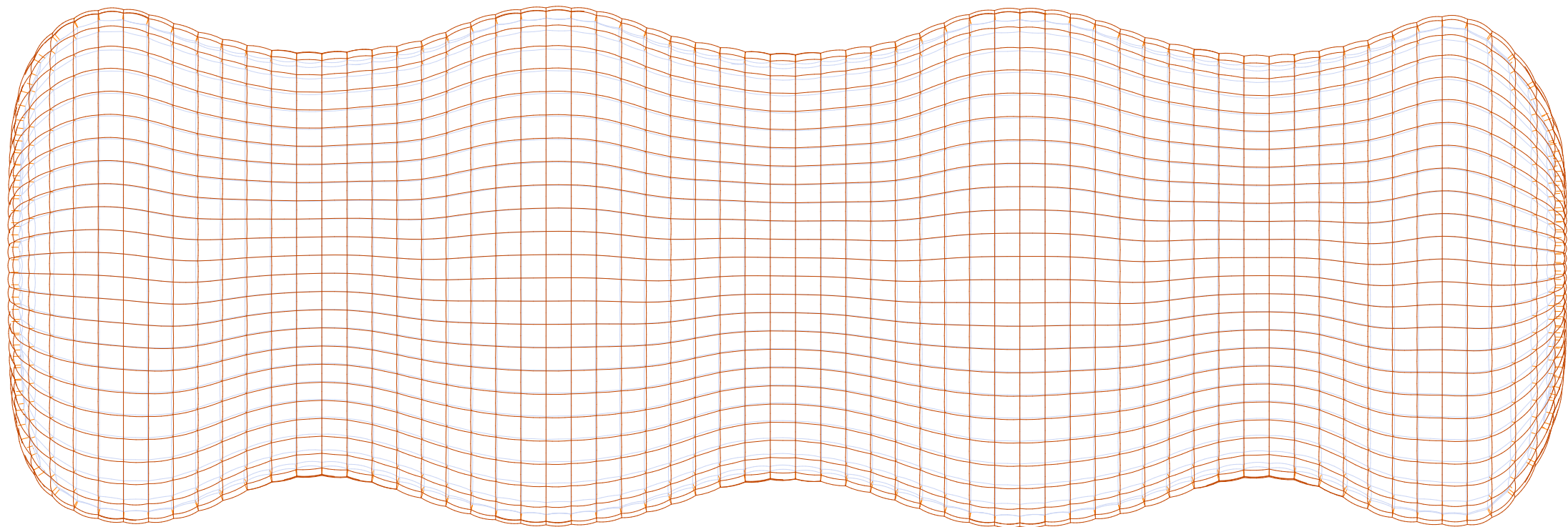
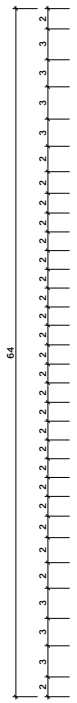
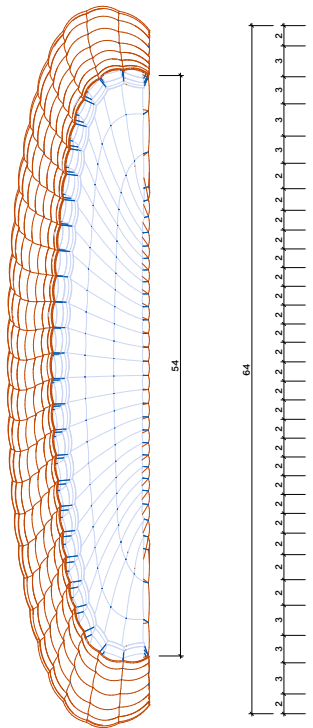
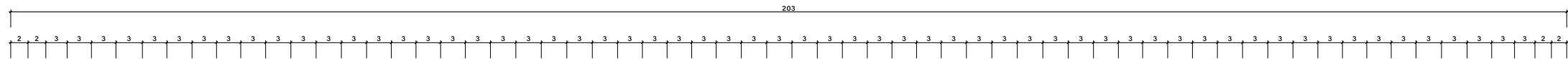
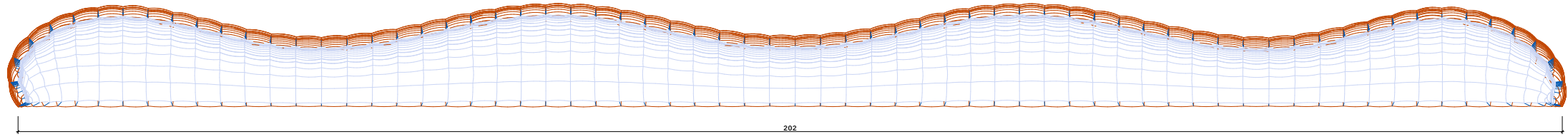
24. *Musa acuminata*

A species of banana native to Southern Asia
known as: banana tree



Garden restaurant





Pneumatic roof structure

The pneumatic roof consists of double layers of PTFE membrane material, connected with binder cable in each unit. The 1 meter cavity between two layers is the air layer, which allows inflating air to pump up the whole structure, stabilized with the steel cable. Since the loads are subdivided into each air bubble unit of 3 * 3 meter, and also of course the light weight structure itself, the pneumatic roof can span a large distance without column support, which enables a big flexibility of the plan below. Also, The PTFE material enables an abundant daily light inflow for the garden space below.

