THE BROOMBRIDGE HONEYBEE PRODUCTION CENTRE

An Experimental Urban Factory in the Tolka Valley area.

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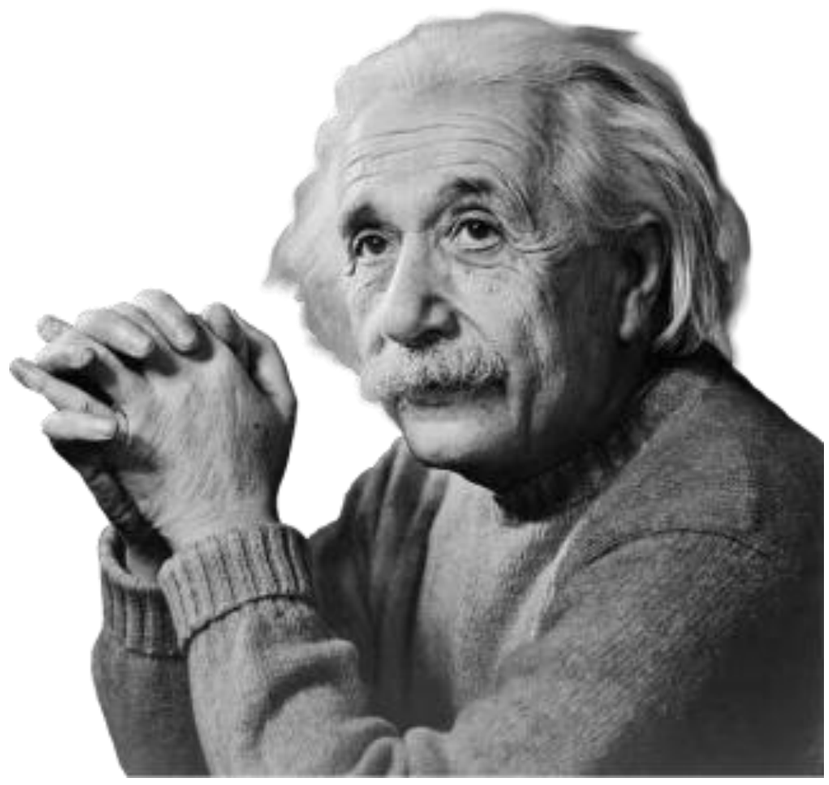
TABLE OF CONTENT

"If the bee disappeared off the face of the Earth, man would only have four years left to live. No more bees, no more pollination, no more plants, no more animals, no more man.“

Albert Einstein



ACKNOWLEDGEMENTS

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ABSTRACT

Not only humans are affected by the impact of climate change. In the same way climate change hits the most vulnerable people; it also endangers vulnerable species. The rapid urbanisation further poses significant challenges to biodiversity, including habitat fragmentation, loss of species diversity, and altered ecological dynamics.

“Biodiversity is vital, not just for its intrinsic worth but also because of the wide-ranging ecosystem services and social benefits it delivers for our quality of life (our health and well-being) and for the social and economic fabric of the city.”

(Dublin city development plan 2022-2028, 2021)

Therefore, the integration of biodiversity considerations into architectural design and urban planning practices is essential for promoting ecological sustainability, enhancing ecosystem services, and fostering human well-being. As professionals of the built environment, architects play a huge role in supporting such biodiversity by creating habitat opportunities for various plant and animal species as part of new developments.

This thesis project aims to explore how various design strategies, such as green roofs, urban greening, and wildlife-friendly habitats (for instance, the experimental vertical bee tower farms), not only contribute to the aesthetic value of the architecture but also create habitats for insects, birds, and other organisms. This project also aims to explore the potential of biomimicry. Biomimicry is the practice of emulating nature's design principles and strategies, offering a promising approach for creating sustainable and innovative architectural solutions (Benyus, 1997). With a focus on enhancing ecological sustainability and fostering a harmonious relationship between human activities and the natural environment, this project intends to be part of a “biodiversity promotion” that can help mitigate the loss of natural habitats in the urban area of Cabra and promote the richness of biodiversity of the Tolka Valley Park.

INTRODUCTION

There is no doubt that climate change is one of the most pressing global challenges we are facing now (IPCC, 2022). There is also no doubt that concrete steps have been developed at global, European, national, and local levels not only to mitigate the causes of climate change in Ireland but to further adapt to its impacts. For instance, Chapter 10: Green Infrastructure and Recreation of the Development Plan 2022-2028 of the Dublin City Council sets out a series of urban greening policies and objectives that can assist the city in adapting and becoming resilient to the effects of climate change while also playing a role in climate mitigation. Such policies and objectives are described in section 10.5 of Chapter 10. It is encouraging to notice that a thoughtful analysis of the challenges for protecting, developing, and managing the green infrastructure has been undertaken and that strategic approaches will be pursued by the Dublin City Council. In particular, sub-section 10.5.2 'Biodiversity' shows the importance of conserving biological diversity within the Irish ecosystem. It states that "Biodiversity is vital, not just for its intrinsic worth but also because of the wide-ranging ecosystem services and social benefits it delivers for our quality of life." Furthermore, it is recognized that "urban pressures, habitat loss, climate change, pollution, invasive species and human behaviour are some of the constant challenges to conserving and restoring biodiversity.

It is important to remember that according to 'the National Biodiversity Data Centre', 85 per cent of Ireland's EU-protected habitats and species are in a 'bad' or 'inadequate' status. Of the species that have been assessed, one in every fifth is threatened with extinction. Likewise, Irish pollinators are also in decline, with three of the 101 species have become extinct and more than half have undergone substantial reduction. As outlined in the 'Objective of Dublin City Council List' at GIO10 in section 10.5.2, "measures to protect and increase the populations of native wild bees and other pollinators" should be persuaded.

• Importance of Pollination

Pollination is of utmost importance for both natural ecosystems and human societies. It is essential for the reproduction of flowering plants. The process by which pollen grains are transferred from the male reproductive organs (anthers) to the female reproductive organs (stigma) of flowers allows for the fertilization and the production of seeds and fruits. In Ireland, approximately 78% of wild plants require bee pollination and more than 1200 crops are pollinated by bees. Without bees, many plant species would not be able to reproduce and would eventually decline or become extinct. Pollination is also good for the economy. For instance, €53 million is the annual value of pollinators for human food crops in Ireland (AIPP, 2021).

78%
of wild plants in Ireland require bee pollination

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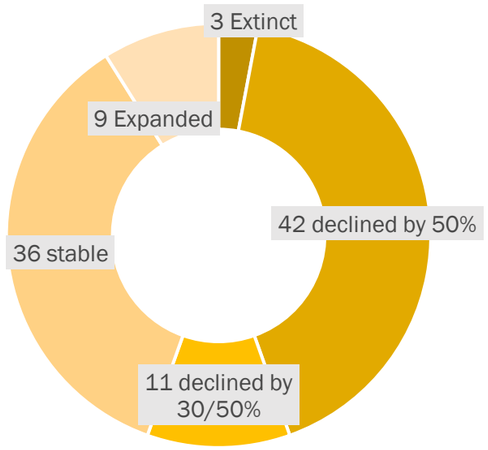
• Bee decline in Ireland

Bees play an important role in Ireland's ecosystem and agriculture industry. There are several species of bees in Ireland, including the honeybee (Apis mellifera), bumblebees, and solitary bees. Of the 101 species, three of the total have become extinct and more than half have undergone substantial declines in their numbers since 1980 (AIPP, 2021). The main reasons of Ireland’s bee decline are:

- HABITAT LOSS. The loss of flower rich meadows across Ireland.
- HABITAT FRAGMENTATION. Many natural habitats, like grassland meadows, have now been reduced to small patches with large zone of housing or intensively farmed land in between. When these remaining patches are destroyed, bees may not be able to move to the nearest area of suitable habitat because too far for them to fly.
- CLIMATE CHANGE. The habitats where bees and other insects live may disappear or shift position too quickly for them to adapt to the change.



About Biomimicry

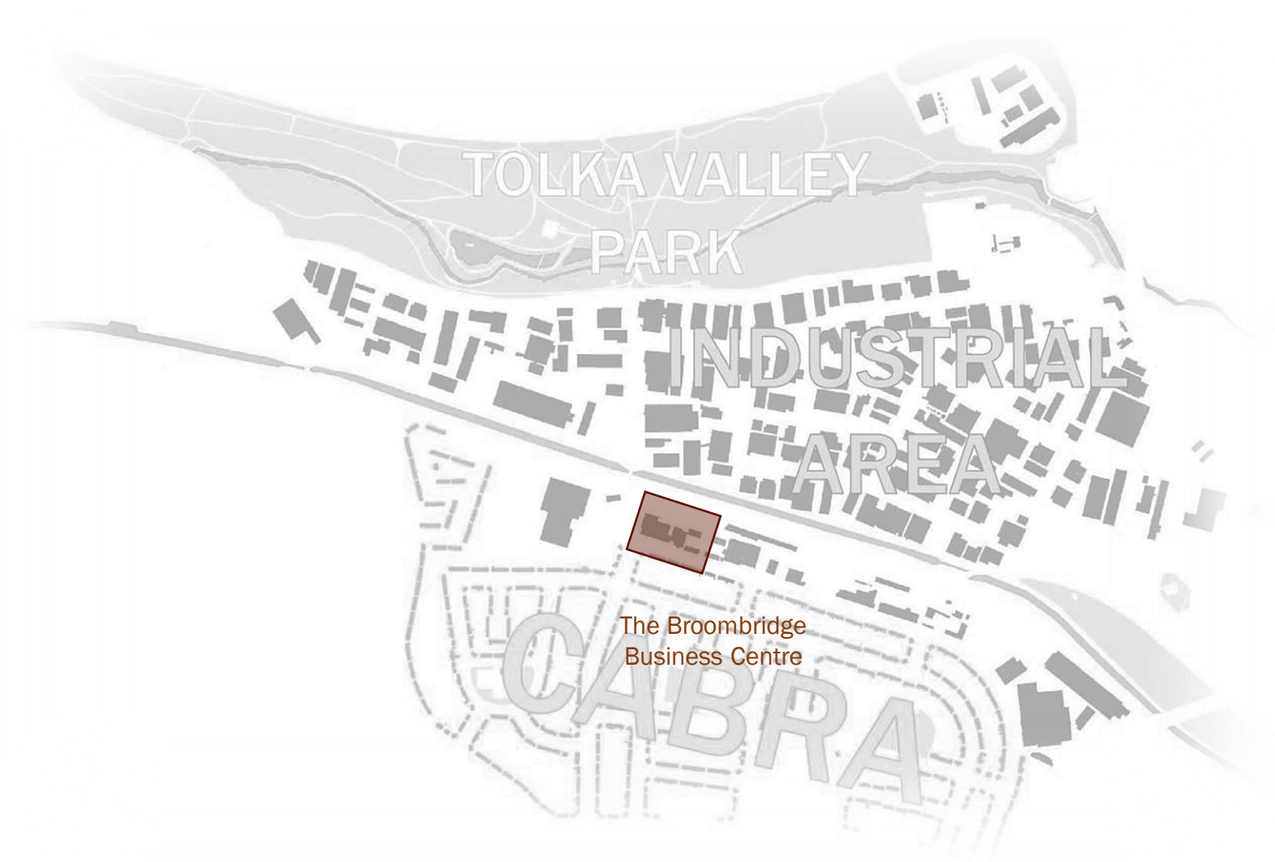
Biomimicry in architecture is an innovative approach that draws inspiration from nature's design principles, processes, and systems to create sustainable and efficient built environments. It involves emulating nature's forms, functions, and strategies to solve human design challenges. Nature, in fact, can be emulated not only in terms of functional efficiency but also as a model for circular processes, energy efficiency, self-adaptation, recycling and reuse. In order to achieve a sustainable design for the human environment, there are two different design approaches: one goes from 'biology to design', the other from 'design to biology'. In the biology-to-design approach, also known as the ‘Bottom-Up’ approach, a biological phenomenon suggests a new way to solve a human design challenge (Biomimicry Guild, 2007). However, when biological knowledge influences human design, the collaborative design process initially depends on people knowing the relevant biological research (Pedersen Zari, 2007). On the other hand, in the design-to-biology approach or ‘Top-Down’ approach, the innovator starts with a human design challenge, identifies the core function, and then reviews how various organisms or ecosystems are achieving that function (Biomimicry guild, 2007). In this thesis project, biomimetic approaches will be employed to foster a more sustainable and harmonious relationship between human-made environments and the natural world. By studying nature's design strategies and integrating them into architectural design, the aim is to create environments that are not only efficient and functional but also in harmony with the surrounding ecosystem.

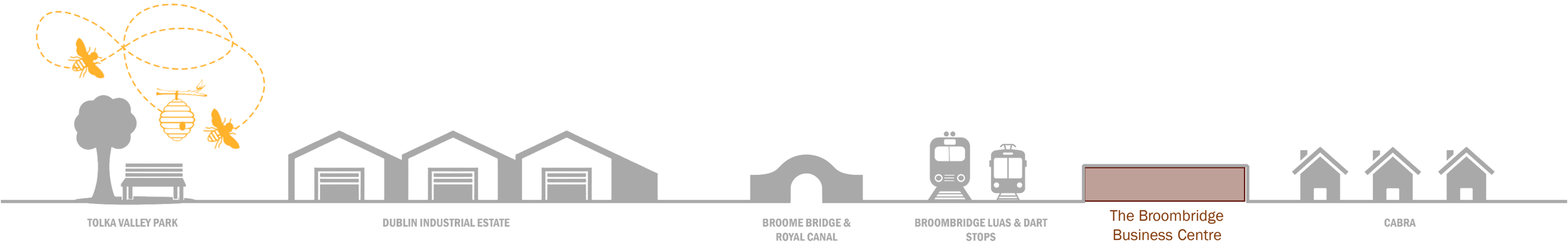
"Biomimicry is a practice that learns from and mimics the strategies found in nature to solve human design challenges—and find hope.“

Janine Benyus

SITE ANALYSIS & MASTERPLAN STRATEGIES

The existing Broombridge Business Centre facility is situated at a strategic crossroads in a buffer area between the Cabra residential suburb and the Dublin Industrial Estate. The close proximity of the Broombridge Luas and Dart stops, the Broome Bridge, and the Royal Canal enhance the building's excellent connectivity and advantageous location. The Tolka Valley Park with its diverse, natural and tranquil landscape, is also just few minutes away. Through a comprehensive analysis of the various architectural and contextual factors, I intent to shed light on the numerous possibilities that can be harnessed to transform this building into a truly remarkable space.
Therefore, a thorough analysis of the Tolka Valley Park ecology (Figure 1, page 12) and a series of strategies at macro level, will be now exposed. The architectural intention is to achieve a sustainable and innovative solution that not only considered the building as an “organism” itself, but as part of an ecosystem where the relationship between human activities and the bee environment is supported and encouraged.





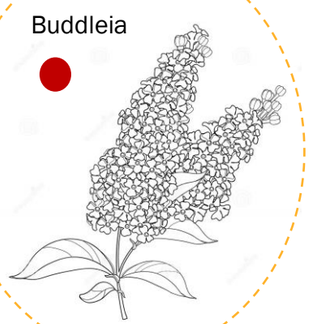
- ## The Tolka Valley Park Ecology

The Tolka Valley Park is an important regional park in eastern Ireland, running on both sides of the Tolka River. It is spread over 140 hectares and follows the Tolka Valley for 8km from Mulhuddard to Ashtown. Two wetland "cells" were constructed between the stream outflow and the pond in 1999 and 2010 to treat the incoming waters of the Finglaswood Stream. Planted with reeds, bulrushes, sedges and yellow irises, the construction of the wetlands has been a success on many fronts: trapping pollution, reducing foul odours, making the pond more pleasant, and creating a new habitat for local biodiversity. In her article, Paddy Woodworth refers to this ecological solution as an "unsung miracle". "It's a rare pleasure to witness the birth of a stretch of biodiverse parkland" where "wildlife flourishes", she further claims. In addition, Tolka Park already hosts several excellent bee pollinator flowers (figure 1, page 12) that can serve as a food source for the current and future bee population living within the surrounding.

Figure 1
The Tolka Valley ecology map

The flowers highlighted with a yellow circle are Bee Pollinator flowers

Buddleia

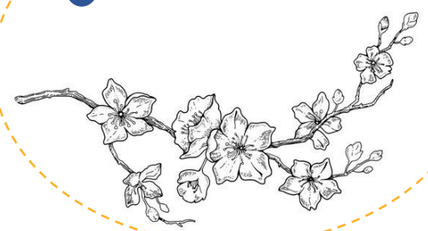


Honeysuckle

Crab Apple

Elder

Cherry



Blackthorn

Bullrush

Broom

Ivy

Guelder Rose

White Clover

Dog Rose

Blackberry Bramble

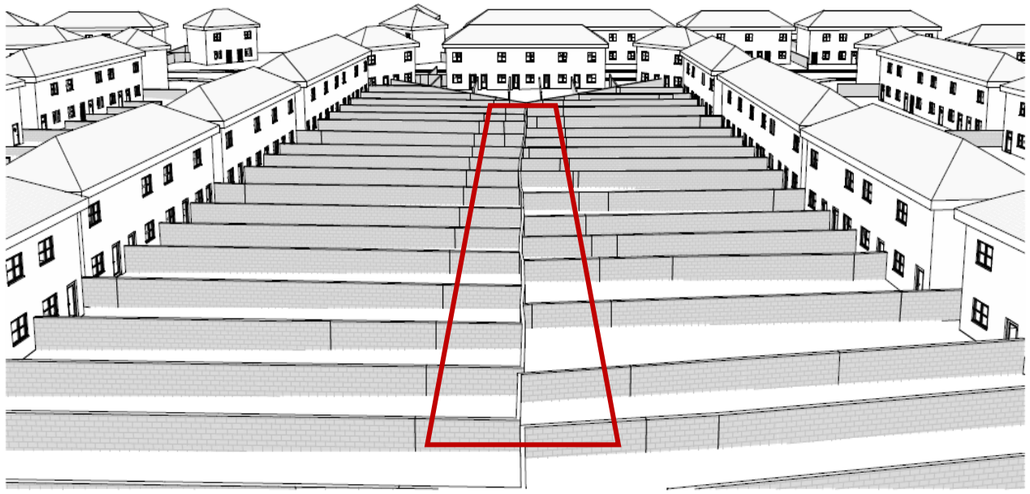
Spindle

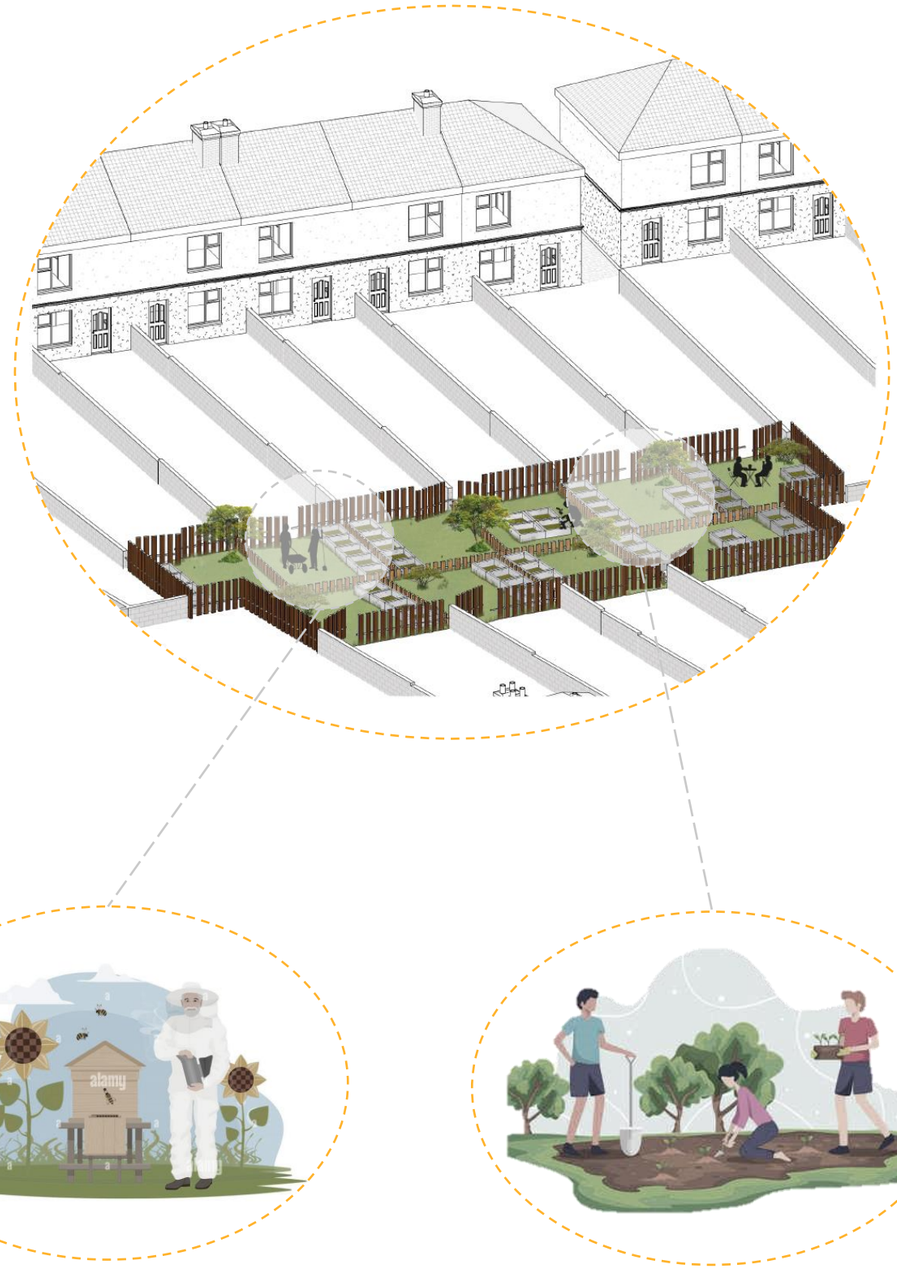
Gorse

• The Potential of existing Back Gardens

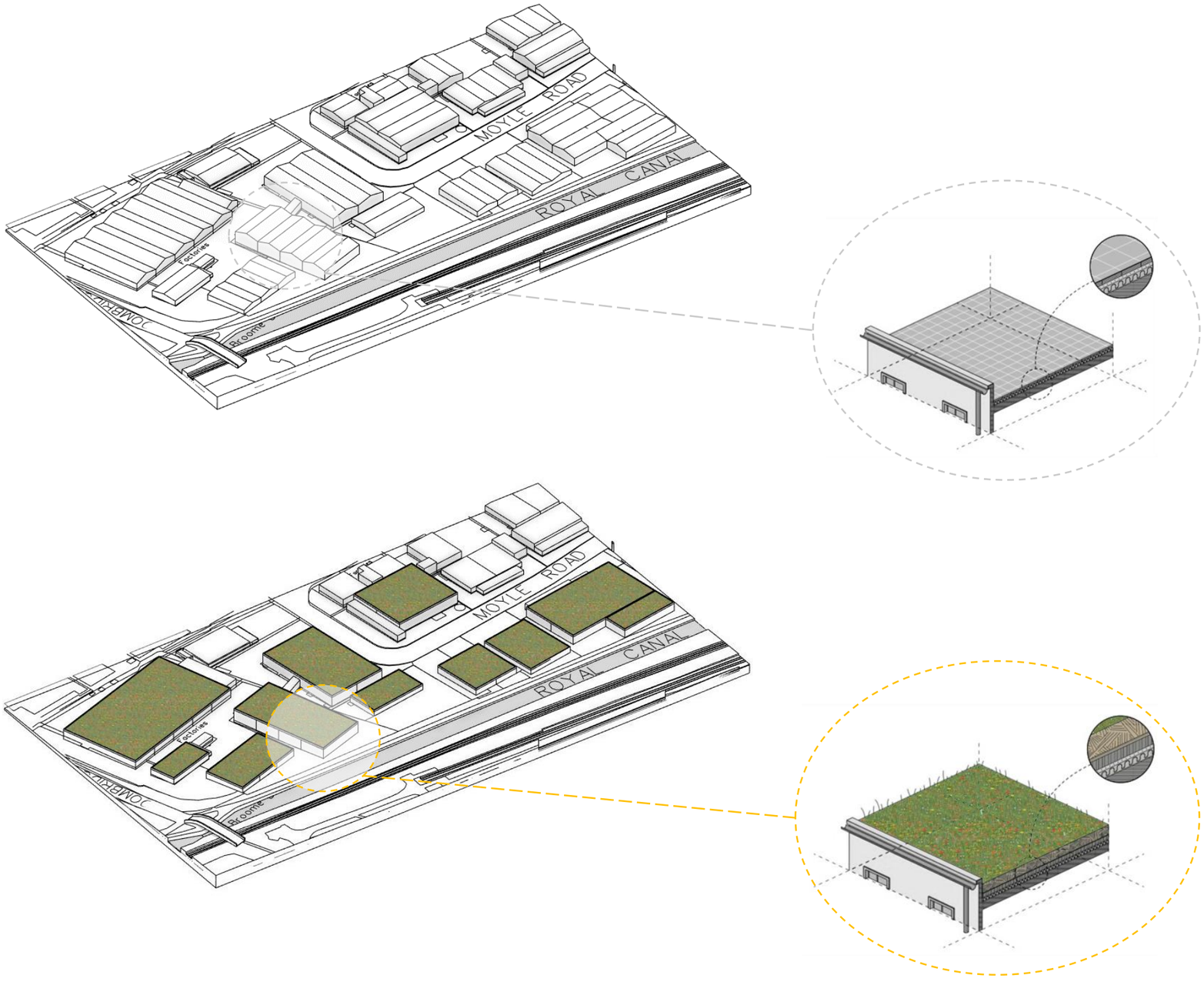
Back gardens in Ireland have significant potential for various purposes, ranging from recreation and relaxation to food production and biodiversity conservation (Fallon, 2017).
As matter of fact, by incorporating native plants, creating habitats such as bird feeders, nesting boxes, or insect hotels, and avoiding the use of harmful chemicals, existing back gardens can attract and support a diverse range of pollinators, birds, butterflies, and other beneficial organisms (Fallon, 2017). To unlock their full potential, it is also important to consider factors such as garden design, plant selection, sustainable gardening practices, and wildlife-friendly approaches. By maximizing the benefits and functions of back gardens, individuals can create beautiful, productive, and environmentally friendly spaces that contribute to the well-being of both humans and nature.

Back Garden Existing Condition





- The Potential of a “NO ROOFS UNUSED” policy



The Dublin Industrial Estate between the Broombridge Business centre and the Tolka Valley Park comprises a variety of buildings and facilities tailored to the needs of industrial enterprises. Some of these buildings are substantially vacant or underutilized, and a series of mixed-use and redevelopment plans have been proposed by the Dublin City Council. However, in its present conditions the estate can be considered as an ‘HABITAT LOSS’ for the biodiversity of the surrounding.

Introducing the concept of a "NO ROOFS UNUSED" policy in this project, will maximize the potential of underutilized rooftop spaces. Instead of leaving rooftops empty or neglected, this policy encourages their transformation into functional and productive spaces. For instance, green roofs can contribute to urban greening efforts, enhancing aesthetics and providing environmental benefits such as improved air quality, temperature regulation, and stormwater management. They can also support biodiversity, providing habitats for pollinators.

The city of Utrecht has been part of an attempt to reinvigorate the biodiversity in the city introducing a “NO ROOFS UNUSED” policy (Boffey, 2020). Every roof in the district of Utrecht is to be “greened” with plants and mosses or have solar panels installed. The plan is driven by the success of a similar scheme for the municipality’s bus stops. In 2018, The municipality completed the installation of green roofs on its 316 bus stops, capturing fine particles of air pollution, storing rainwater, and providing cooling during the summer months.

Utrecht was rated in a 2019 study by Natuur & Milieu the fastest growing city in the Netherlands, as the most “sustainable” in the country (Boffey, 2020).

PROPOSED MASTERPLAN

The implementation of a “No ROOF UNUSED” policy, together with the encouragement of wildlife in the back gardens of the Cabra estate, will result in a urban ecosystems that help to mitigate the loss of natural habitats and promote the prosperous biodiversity of the Tolka Valley Park. Such architectural refined solutions will also grant unrestricted aerial mobility to the present and future colonies of bees (Figure 2, page 16) and engender an exponential surge in the area's honey production.
Therefore, the creation of a honeybee production factory at 288, Bannow Road aims to address these challenges by providing food and shelter to the bees and by promoting the production of honeybee within an urban setting.

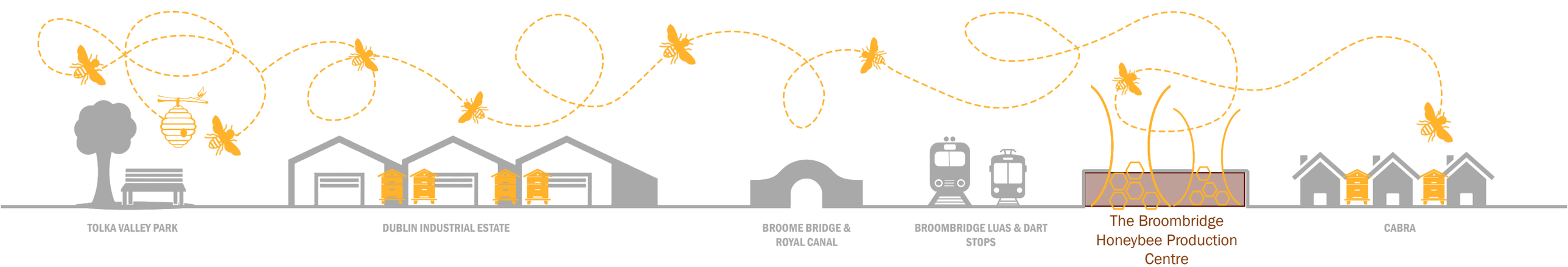
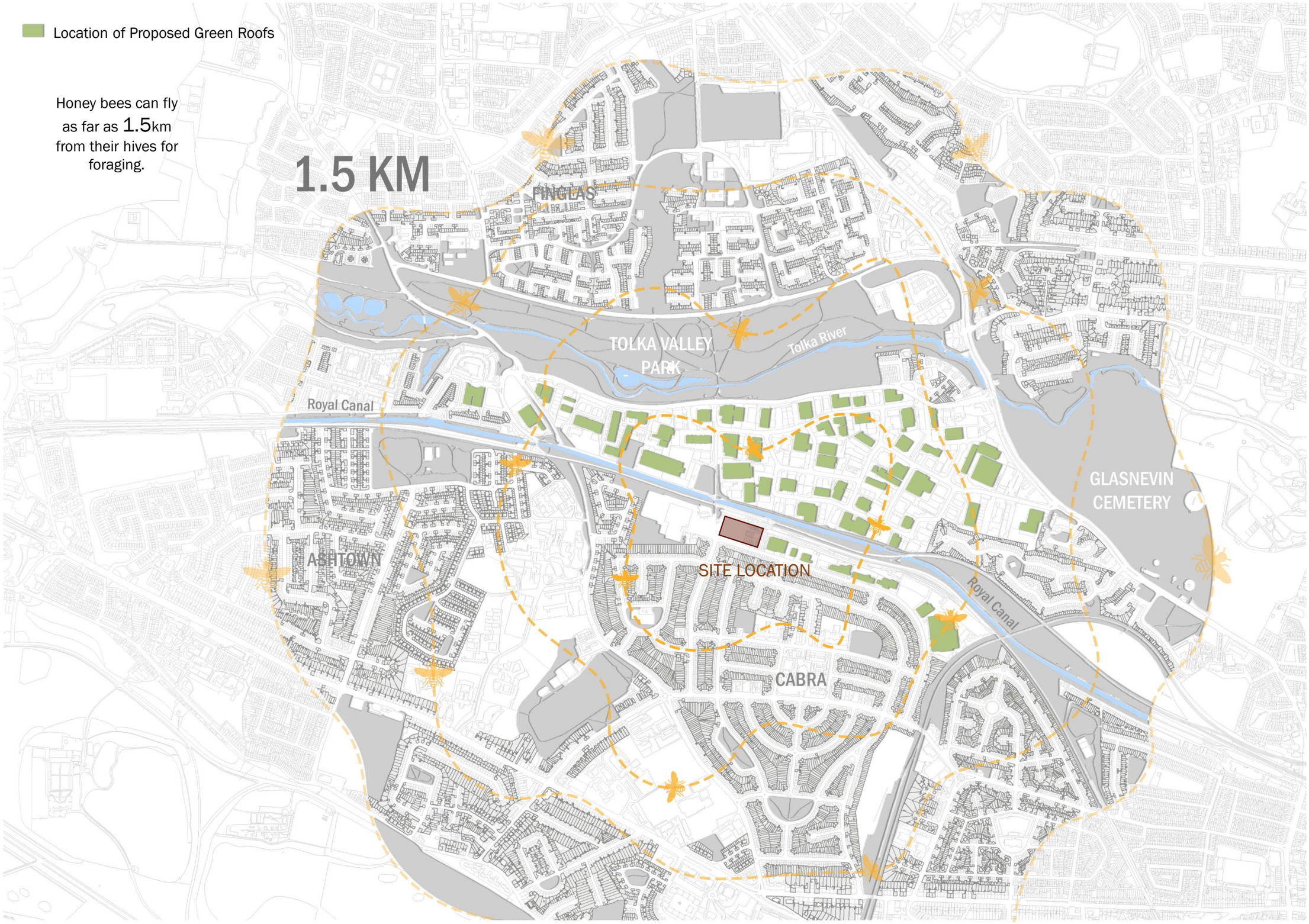
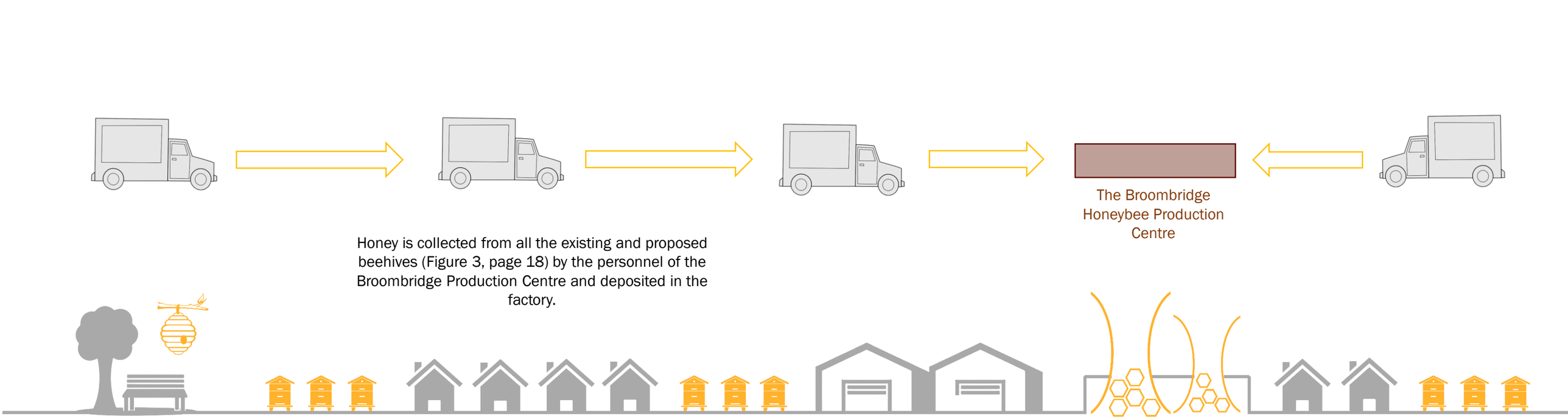


Figure 2
Proposed Masterplan showing bees flights



The establishment of a urban honeybee production centre represents a promising opportunity to combine environmental conservation, sustainable food production and community engagement (Rutter, 2022). As a matter of fact, the centre not only provide a suitable habitat for the bees, it will also contribute to raise awareness in the local community about the importance of such pollinators and their role in the food chain. Undoubtedly, informing people about the importance of bees and the threats they are facing, it can inspire individuals to take action, encouraging changes in behaviour and promoting sustainable practices. Additionally, the centre will support the local economy serving as the main hub for processing, bottling, and exporting all the honey extracted from nearby beehives (Figure 3, page 18).
In summary, by recognizing the significance of bees and taking proactive steps to support their populations, we can contribute to the preservation of biodiversity, to the production of sustainable local honeybee and to the promotion of educational opportunities for the community.



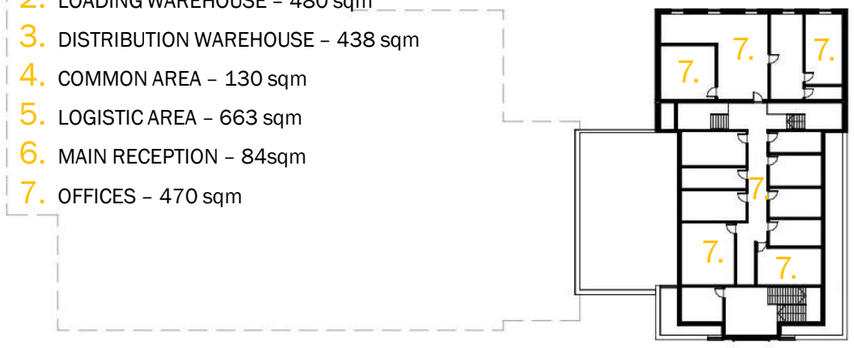
Honey is collected from all the existing and proposed beehives (Figure 3, page 18) by the personnel of the Broombridge Production Centre and deposited in the factory.

Figure 3
Proposed Masterplan

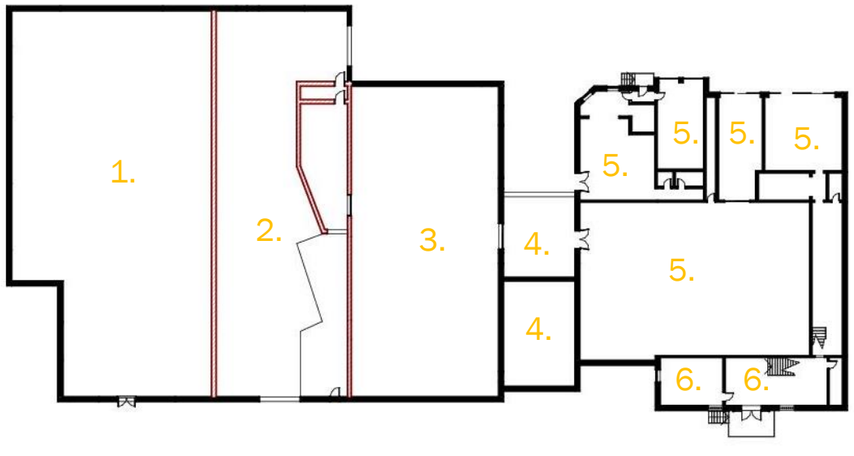
EXISTING BUILDING CONDITIONS

Currently, the Broombridge Business Centre is a professional provider of affordable commercial property, offering flexible lease terms to small and medium-sized enterprises. It comprises of three main warehouses designated for storage, loading and distribution purposes, along with a common area and a two-story building that includes logistic zones and offices. Constructed no earlier than the late 90s, the facility is situated at the intersection of Bannow and Broombridge Roads in Cabra West. Its strategic location near the Broombridge Luas and Dart stops allows for excellent connectivity, serving as a gateway that connects different parts of the city. However, surrounded by solid perimeter walls, this building stands instead as a fortress, creating a barrier that ensures privacy and seclusion.

1. STORAGE WAREHOUSE – 680 sqm
2. LOADING WAREHOUSE – 480 sqm
3. DISTRIBUTION WAREHOUSE – 438 sqm
4. COMMON AREA – 130 sqm
5. LOGISTIC AREA – 663 sqm
6. MAIN RECEPTION – 84sqm
7. OFFICES – 470 sqm



Existing First Floor Plan

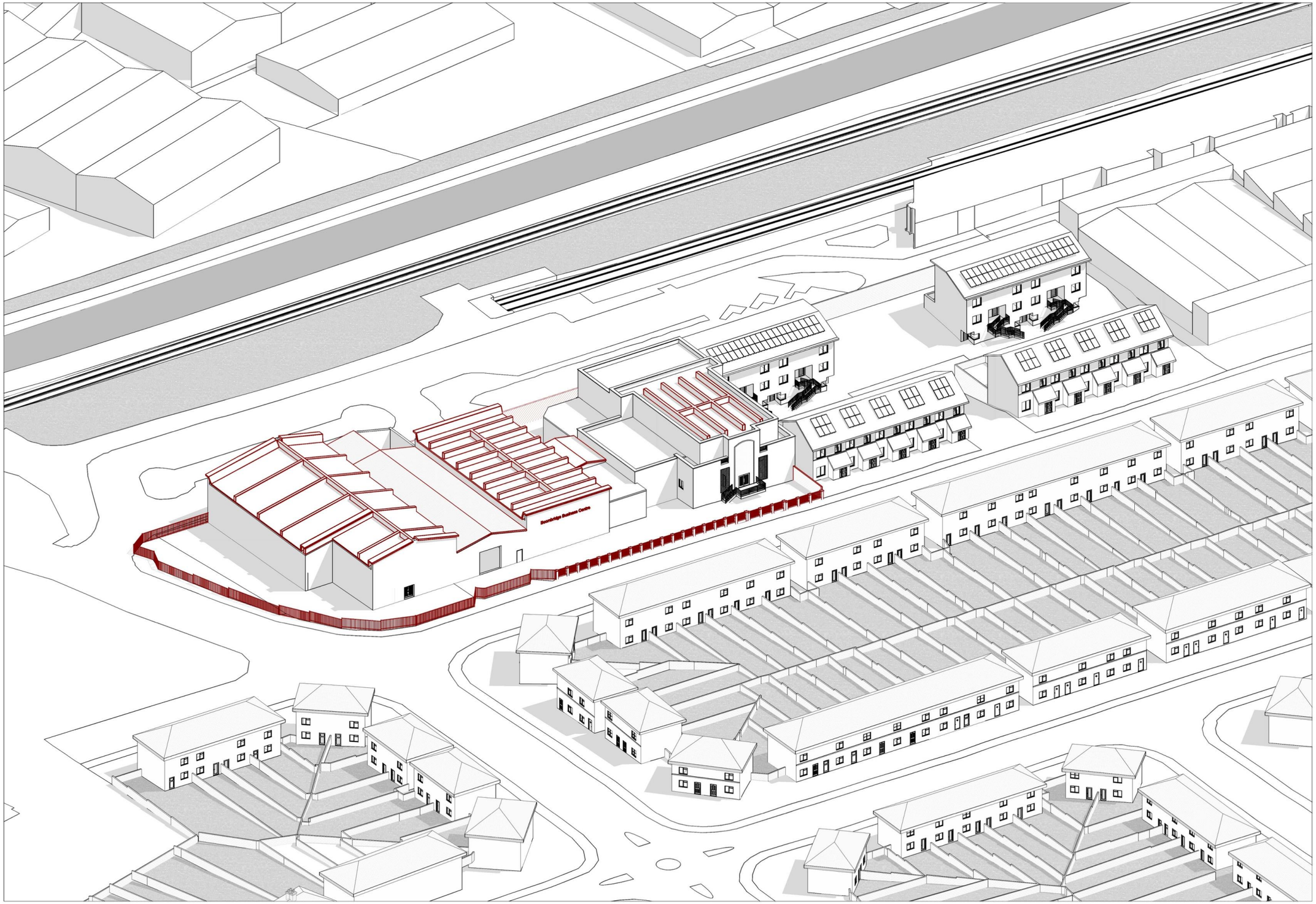


Existing Ground Floor Plan

Photo of the building front

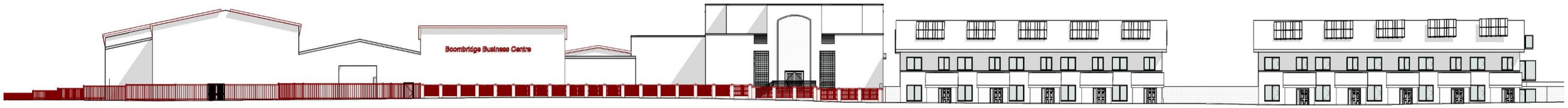
Photo of the building back

Shown in red the demolition works.



Existing Overall 3D View

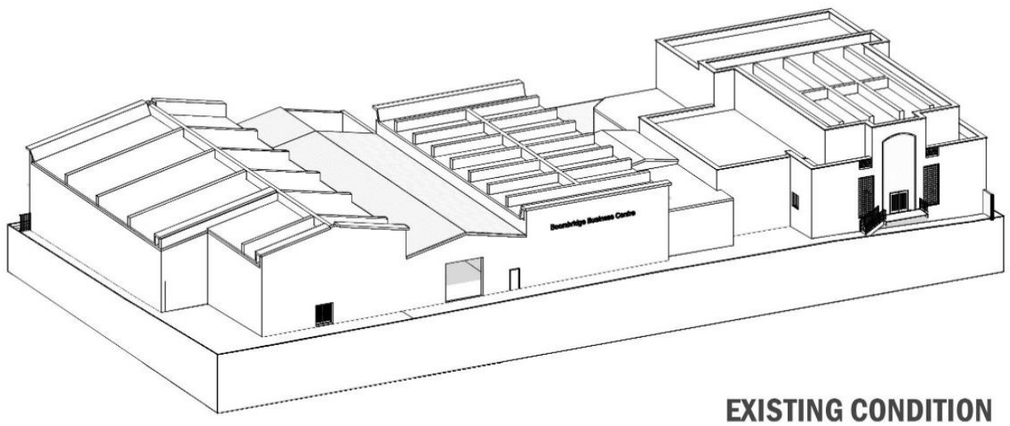
Shown in red the demolition works.



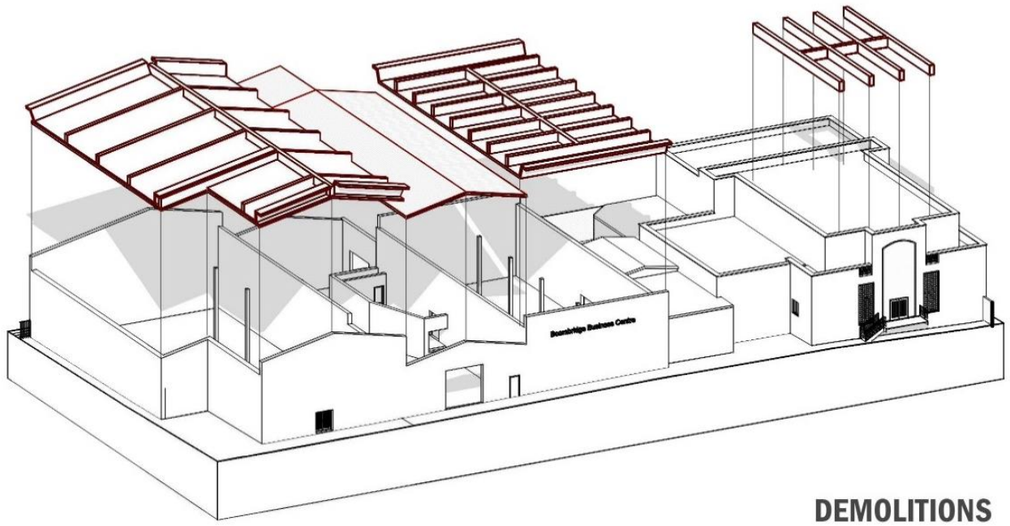
Existing Front Elevation

Existing Back Elevation

CONSTRUCTION PHASES



EXISTING CONDITION

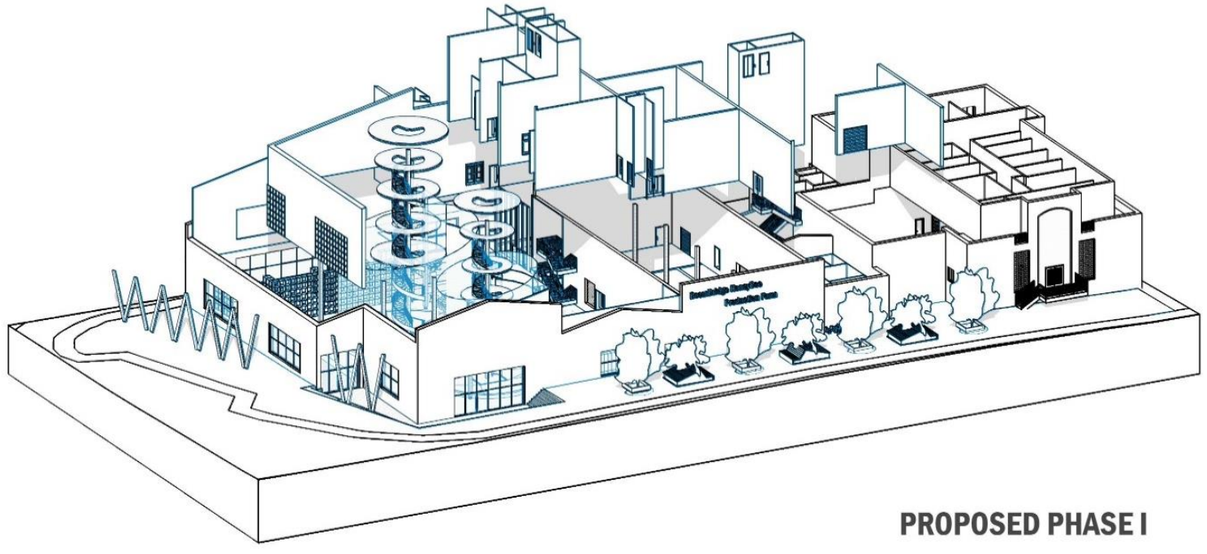


DEMOLITIONS

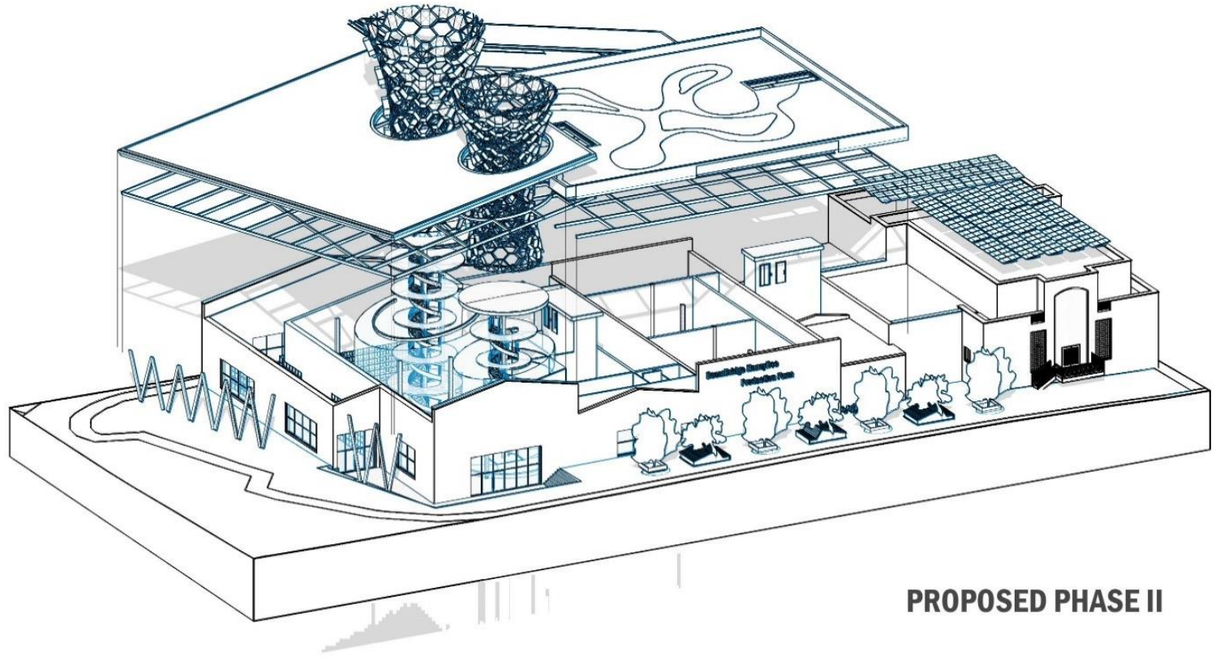
The existing building features a blockwork wall structure. To preserve the integrity of the external walls, the architectural approach will involve retaining such walls, while removing only the essential elements. Specifically, the roofs will be dismantled to accommodate the implementation of the new layout and design. This strategy allows for a transformation of the building's interior while maintaining the stability and aesthetic of the external structure.

In the initial stage of construction, the installation of new internal walls will be carried out. Simultaneously, Phase 1 will encompass the creation of the structural elements and circulation zone specifically designed for the Bee Towers. Phase 2 will prioritize the installation of the self-supported Bee Towers and the existing concrete roofs will be substituted with no.2 sloped green roofs and a flat blue roof.

It is worth mentioning that the two-story section of the building will remain unaltered, with the possibility of incorporating solar panels on its existing rooftop. This phased approach ensures the gradual integration of the Bee Towers and sustainable roofing solutions, while preserving the integrity of the existing buildings structure.



PROPOSED PHASE I



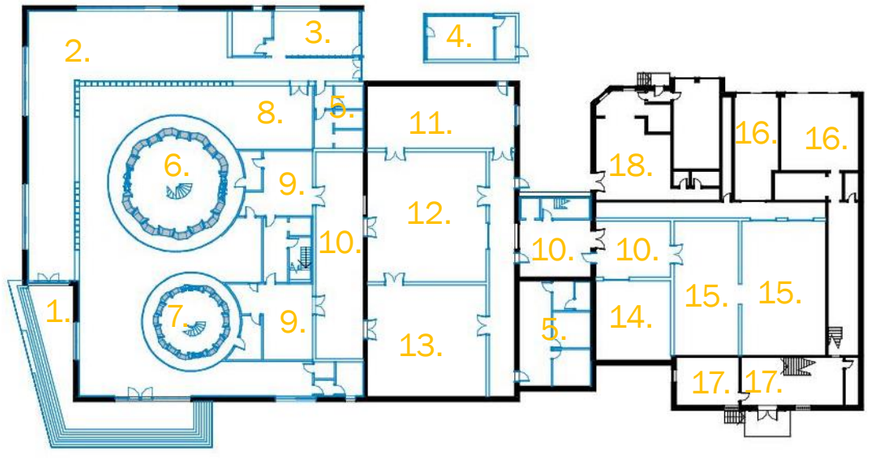
PROPOSED PHASE II

PROPOSED BUILDING

The integration of the Bee Towers, demolition of boundary walls, and replacement of existing roofs at the Broombridge Honeybee Production Centre will effectively integrate the new building with its surroundings, promoting a sense of harmony rather than acting as a barrier. This transformation will also create a seamless connection between the Luas and Dart stops and Bannow Road, facilitating convenient access for commuters. The new pathways are carefully planned to ensure easy movement for pedestrians as they traverse alongside the building. The design also includes outdoor seating areas, providing inviting spaces for relaxation and social interaction. The overall architectural approach prioritizes a welcoming and accessible environment, encouraging community engagement and fostering a sense of belonging.

1. OUTDOOR SEATING AREA
2. EXHIBITION ZONE– 250 sqm
3. CAFÉ – 40 sqm
4. HONEY SHOP – 30 sqm
5. WCs – 42 sqm
6. BEE TOWER 01 – 140 sqm
7. BEE TOWER 02 – 72 sqm
8. TRAINING AREA – 52 sqm
9. CHANGING ROOM – 80 sqm
10. CIRCULATION ZONES
11. HONEY COLLECTION AREA – 90 sqm
12. UNCAPPING AND EXTRACTION – 148 sqm
13. FILTRATION ROOM – 126 sqm
14. STORAGE AREA – 60 sqm
15. BOTTLING AND PACKAGING – 194 sqm
16. LOADING AREA - 216 sqm
17. MAIN RECEPTION – 84 sqm
18. OFFICES – 470 sqm

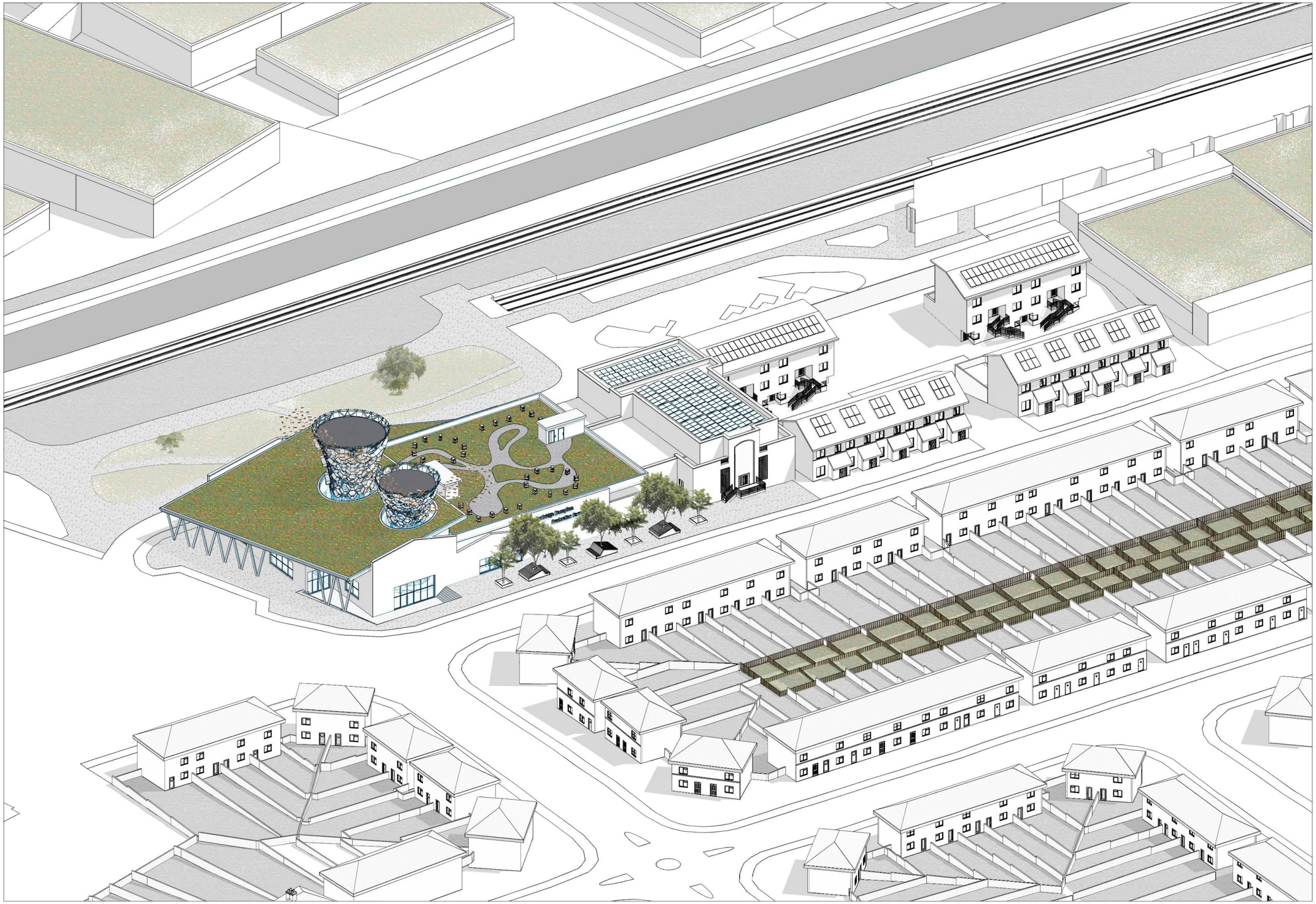
Existing First Floor Plan



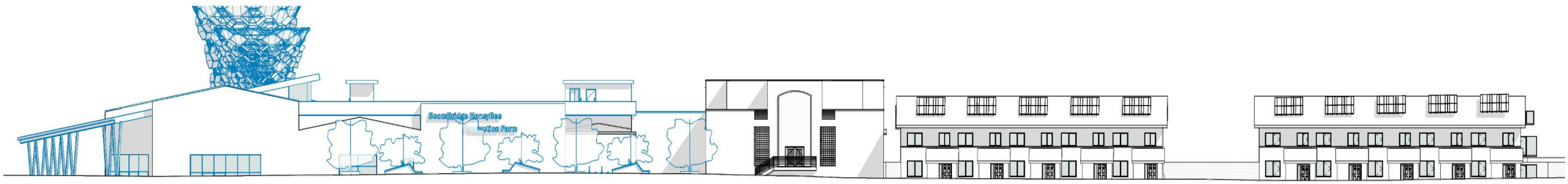
Existing Ground Floor Plan

Proposed Photomontage of the building front

Proposed Photomontage of the building back



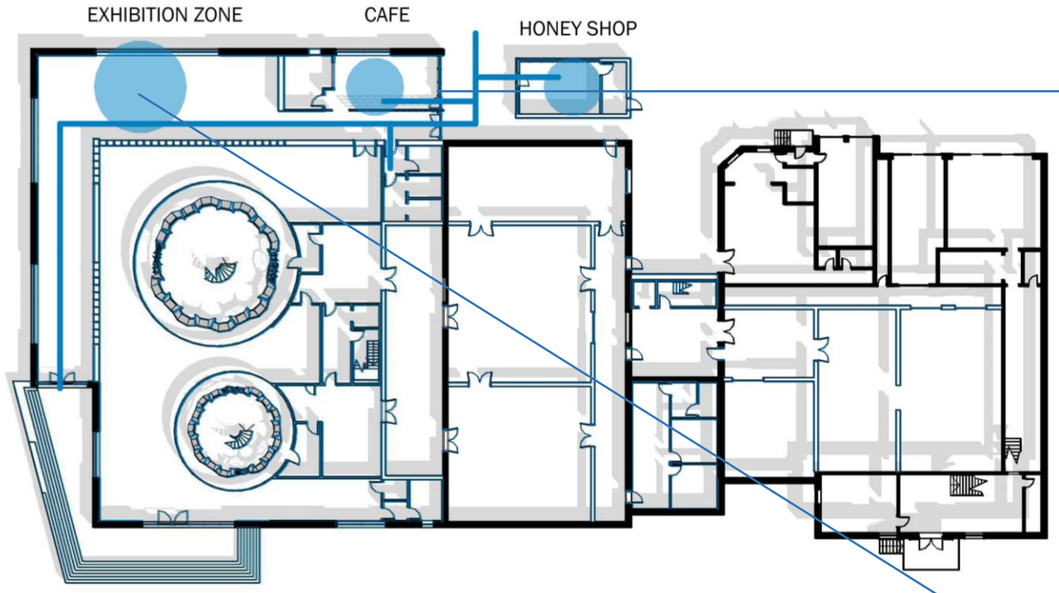
Proposed Overall 3D View



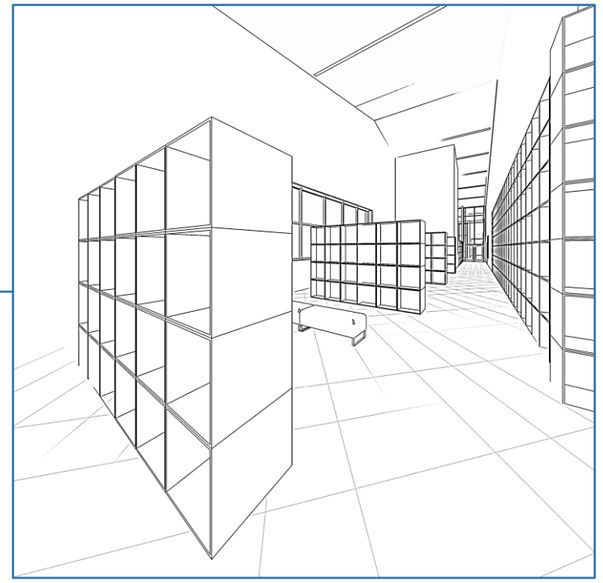
Proposed Front Elevation

Proposed Back Elevation

- Building People Flows. General Public Flow



Internal 3D View_Cafe

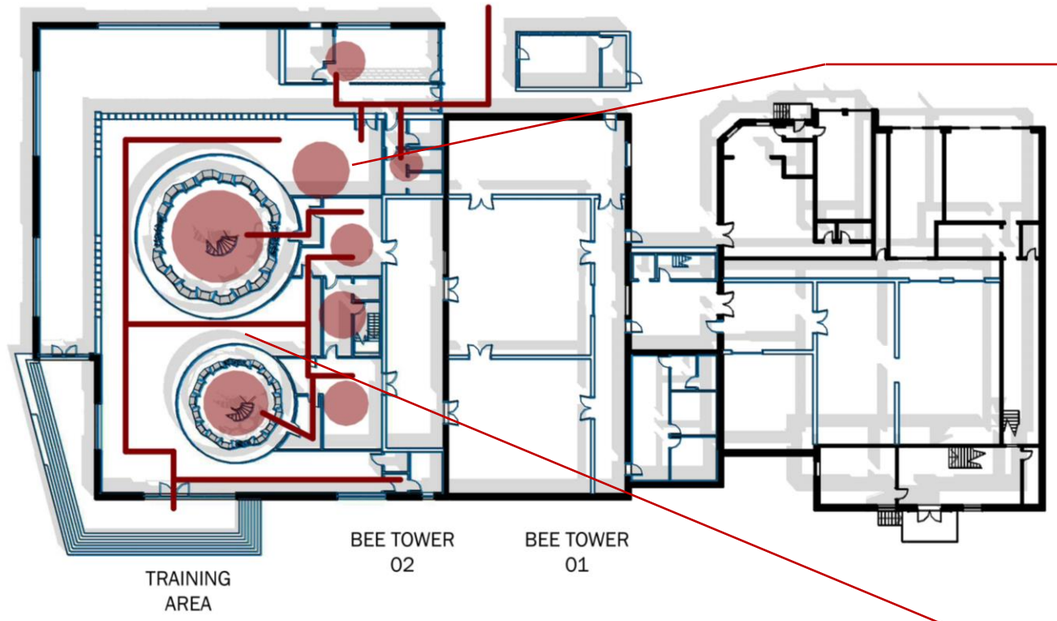


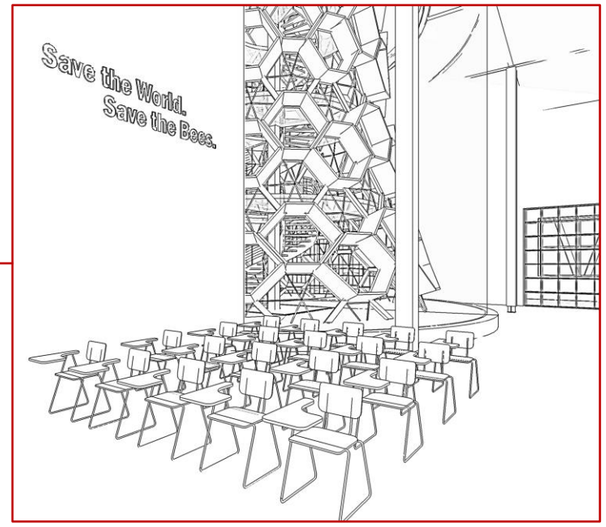
Internal 3D View_Exhibition Zone

Proposed General Public Flow Scheme

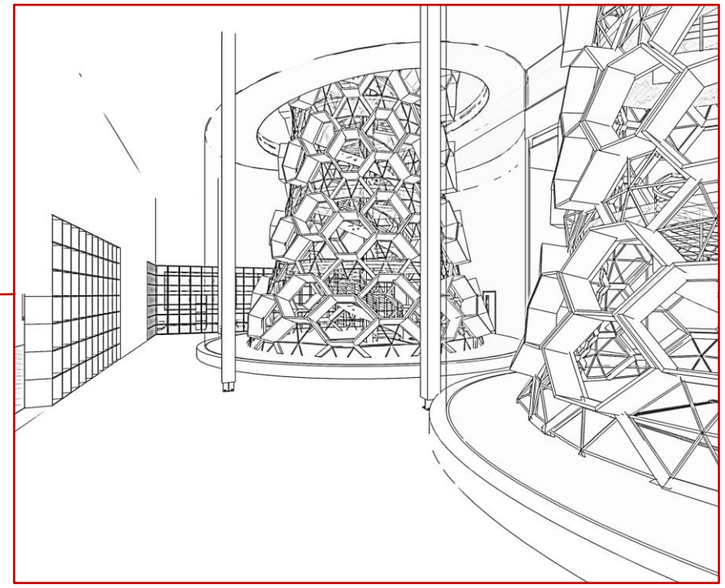
The upper left corner of the building will be dedicated to the Exhibition Zone about Bees in Ireland. Adjacent to it, a cafeteria will be conveniently located for passengers using the nearby Broombridge Luas and Dart stops. This area will be open to the general public, providing an opportunity for visitors to explore and engage. Furthermore, a standalone Honey Shop will be established outside the main building. The Shop will serve as a sales outlet for the factory.

- Building People Flows. Authorized Public Flow





Internal 3D View_Training Area

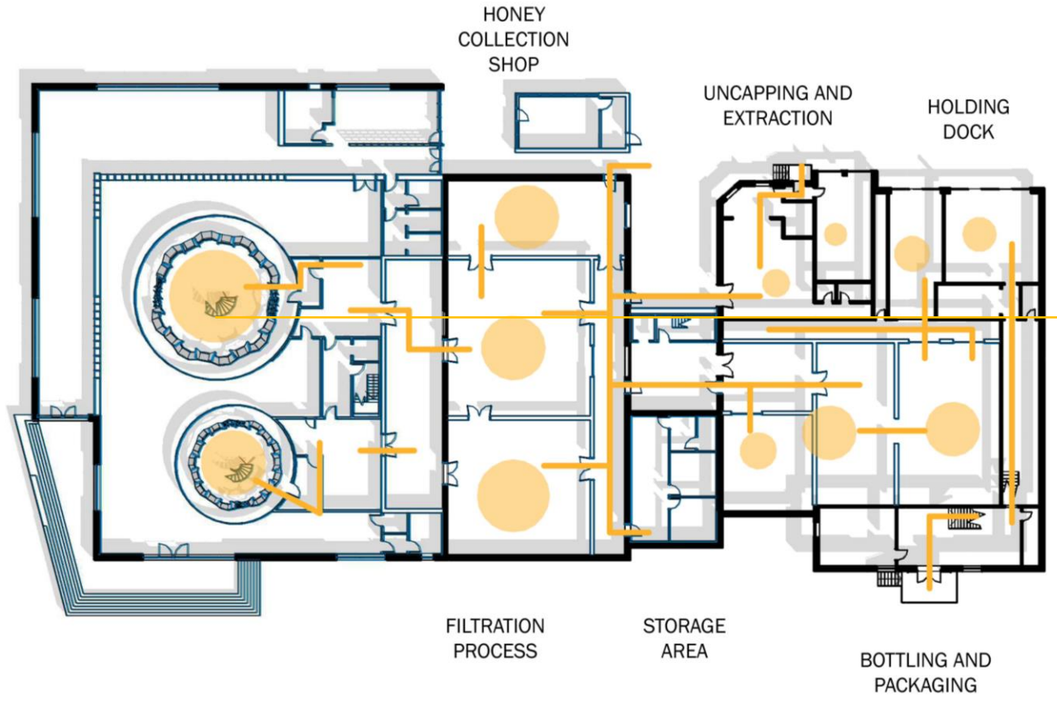


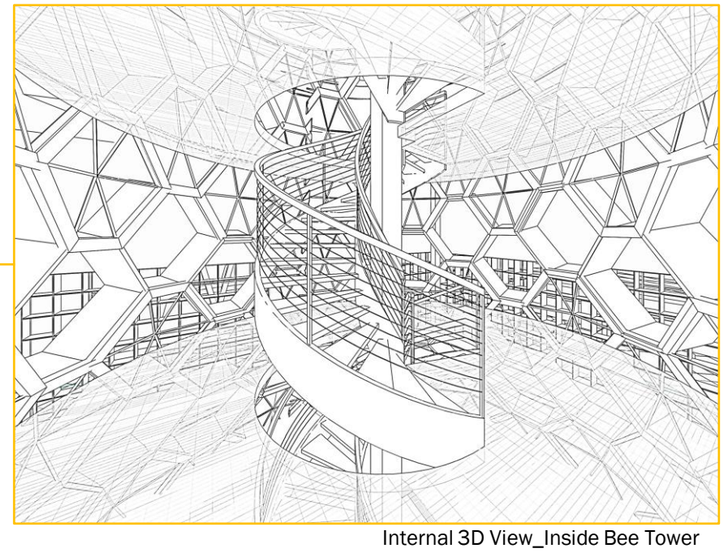
Internal 3D View_BeeTowers

Proposed Authorized Public Flow Scheme

The central section of the proposed plan will accommodate the No. 2 Bee Towers. These towers will be always accessible to the personnel of the factory and strictly by appointment to the general public. However, before interacting with the bees, individuals will be required to undergo a training. To ensure convenience and safety, amenities such as changing rooms and pressurized lobbies will be also provided.

- ## Building People Flows. Authorized Personnel Flow

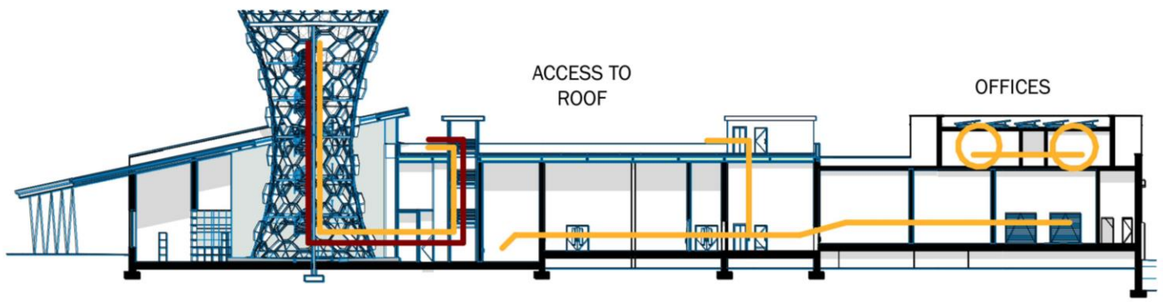


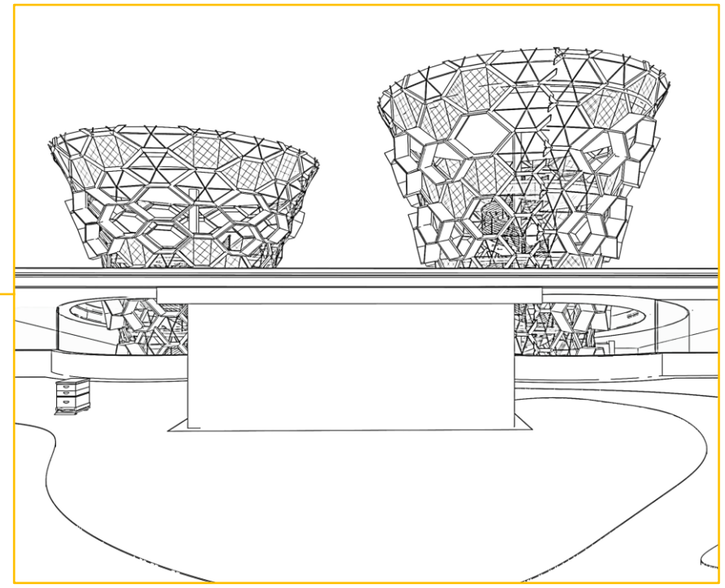


Internal 3D View_Inside Bee Tower

<u>Proposed Authorized Personnel Flow scheme</u>.

The honeybee production facility occupies the majority of the building space. It serves as the primary function of the building, where the beekeeping and honey production activities take place.



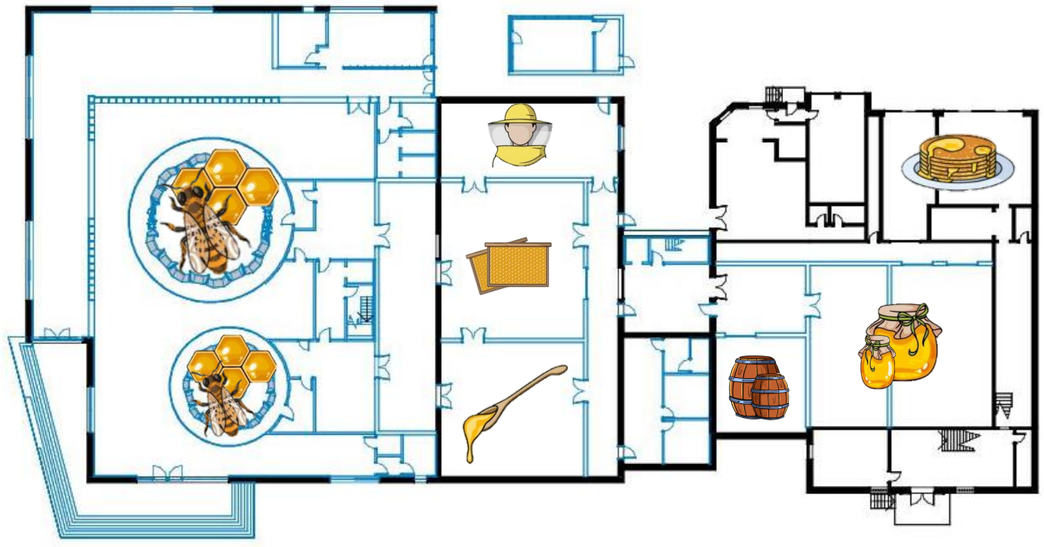


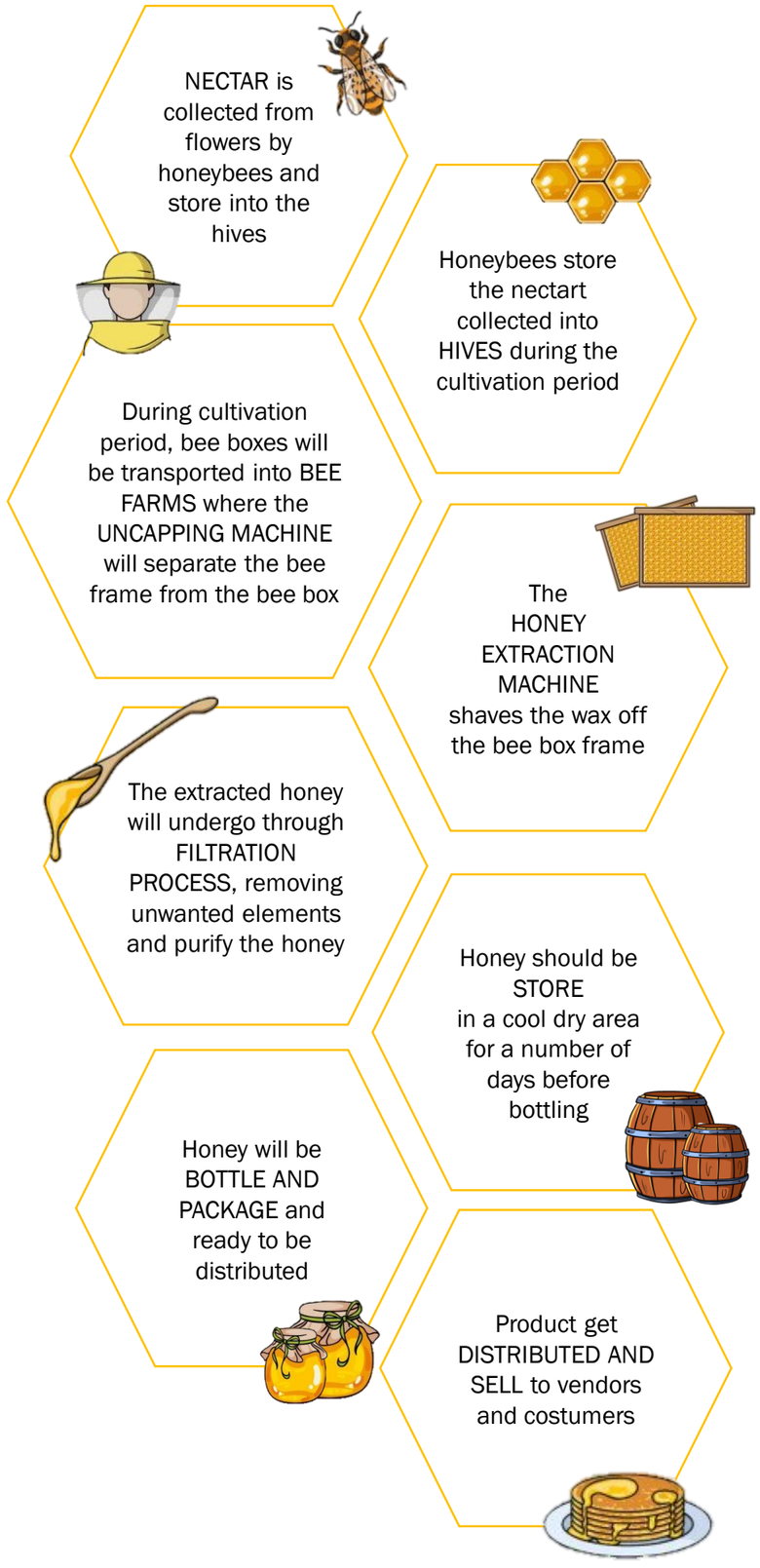
Internal 3D View_Roof

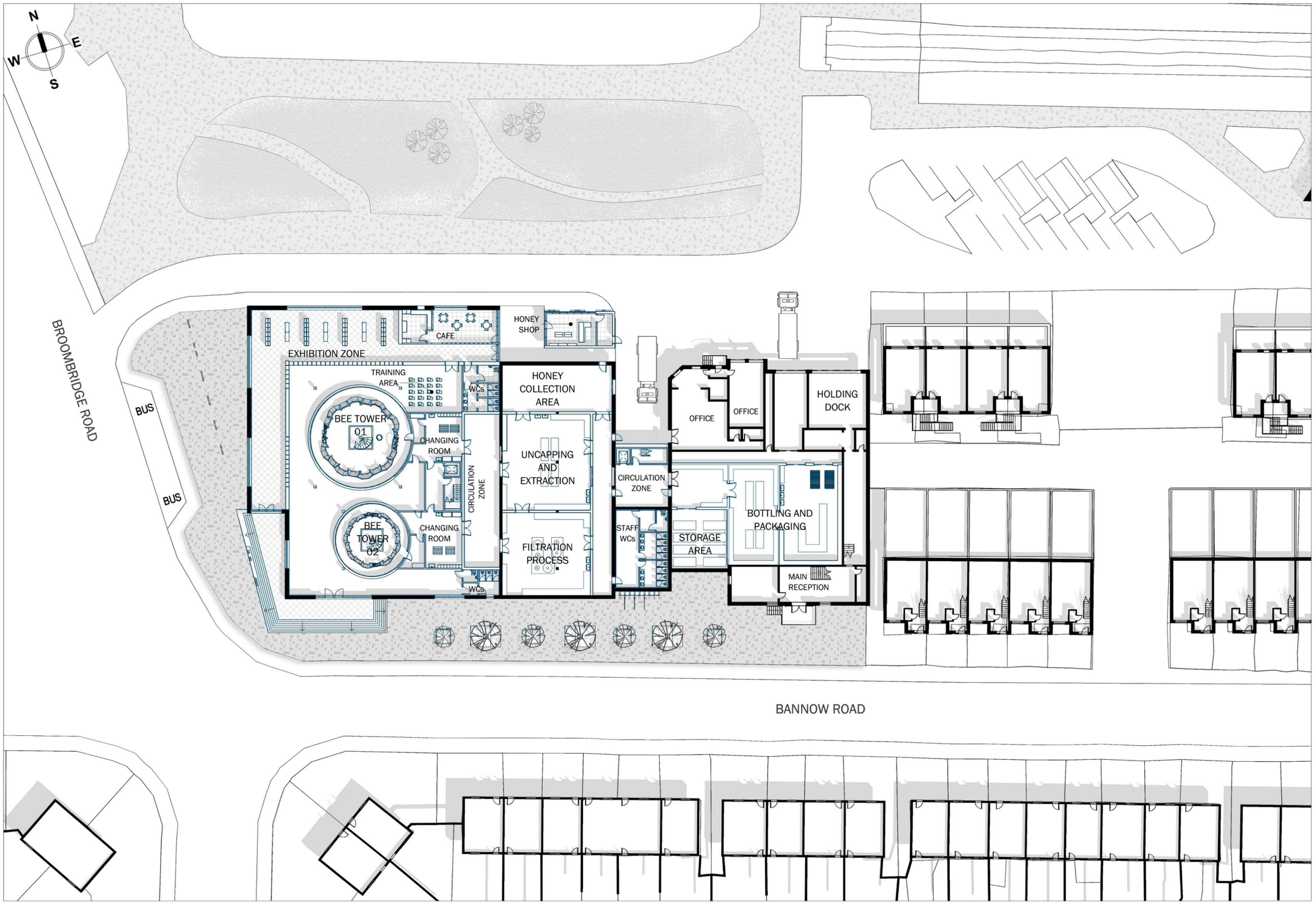
- Honey production process

Honey production process Scheme.

Honey production process in a factory involves the extraction of honey from honeycombs and subsequent processing for packaging and distribution. The process includes steps such as the removal of beeswax cappings from the honeycombs and the extraction of honey from the cells. The extracted honey is then processed, filtered, and heated to remove impurities. Finally, the honey is packaged and prepared for distribution to consumers (Burke et all, 1996).

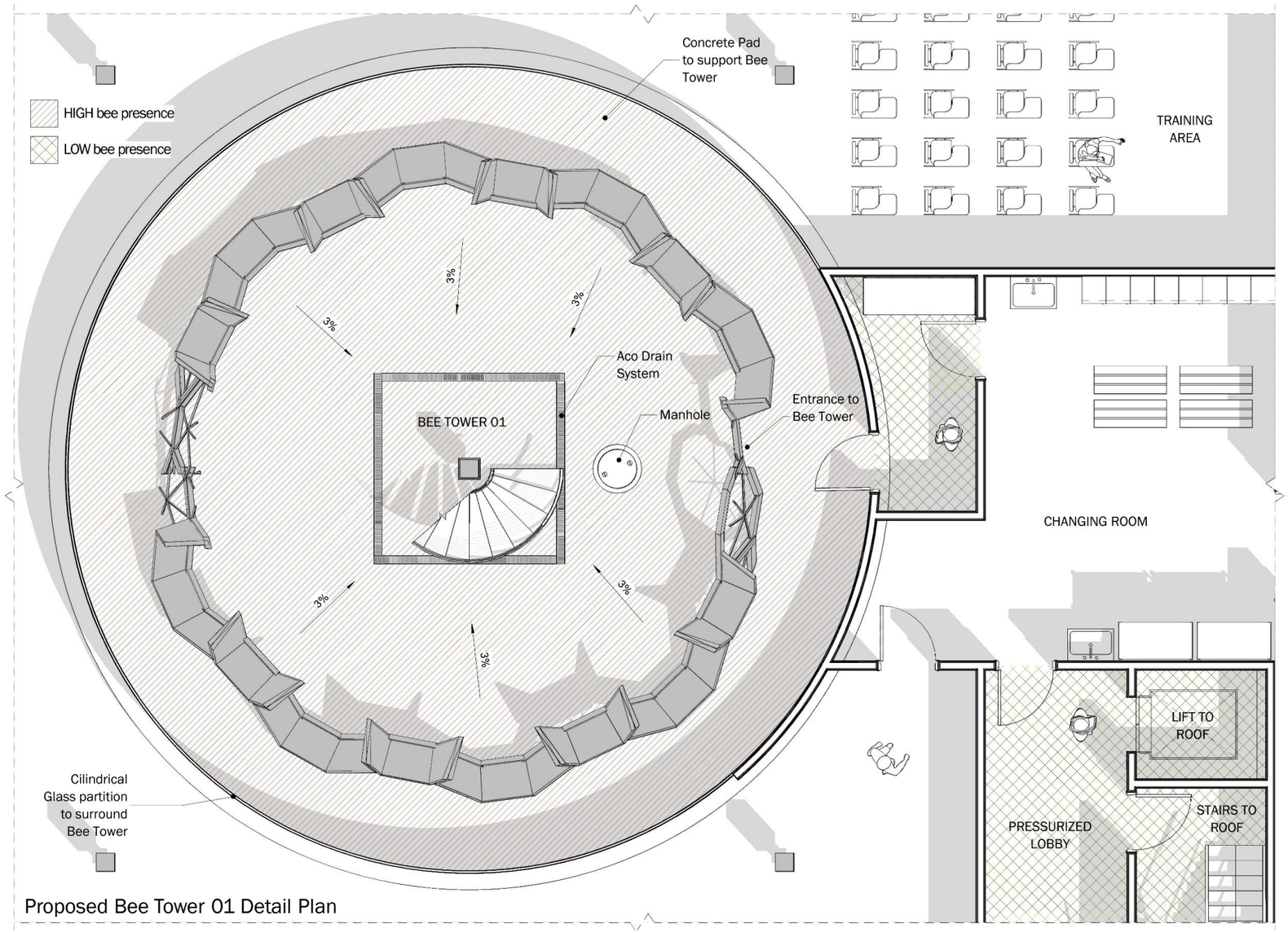






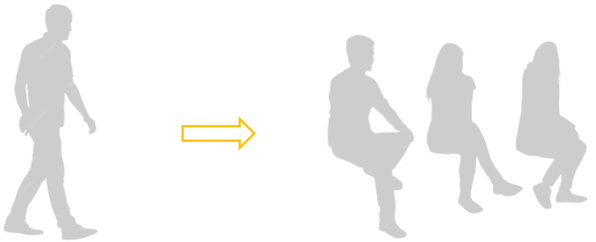
Proposed Ground Floor Plan

- # Bee Towers details. How to enter in the Bee Tower safely?



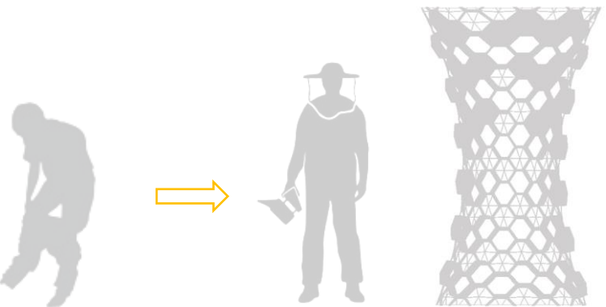
Proposed Bee Tower 01 Detail Plan

The Bee Towers are the habitat for the bees. To ensure the safety of visitors, a cylindrical glass partition will enclose the towers, providing protection against bee stings. Access to the towers will be through designated changing rooms, where visitors will wear protective clothing. From there, they will proceed to pressurized lobbies, where there may be a minimal presence of bees. This arrangement aims to create a controlled environment that minimizes any potential risks while interacting with the bees.



Access to the Visitor Centre with your ticket

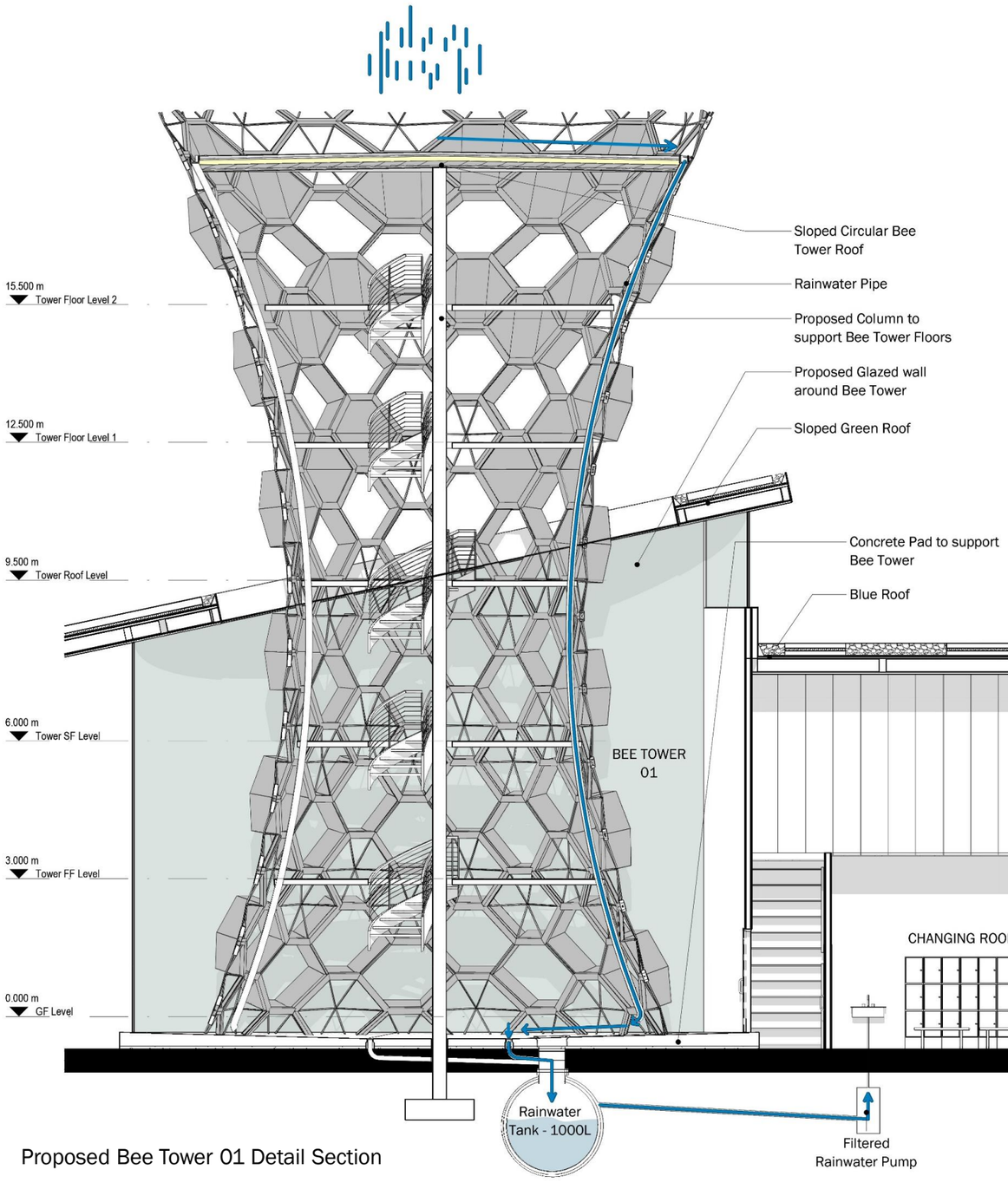
Listen to the beekeepers



Wear protective clothing

Enter in the Bee Tower and enjoy the experience

- Bee Towers details. The collection water system.



Proposed Bee Tower 01 Detail Section

The Bee Towers feature a concrete structural column that provides support for the metal grating floors. Access to different levels of the towers is facilitated by a central spiral staircase. A circular sloped roof covers the towers, serving the dual purpose of providing protection and collecting rainwater. The rainwater is harvested through a water collection system and reused within the facility, promoting sustainability.

RAINWATER

⇩

SLOPED CIRCULAR ROOF

⇩

CURVED RAINWATER PIPES

⇩

ACO DRAIN BUILT INTO THE PROPOSED CONCRETE PAD

⇩

RAINWATER TANK

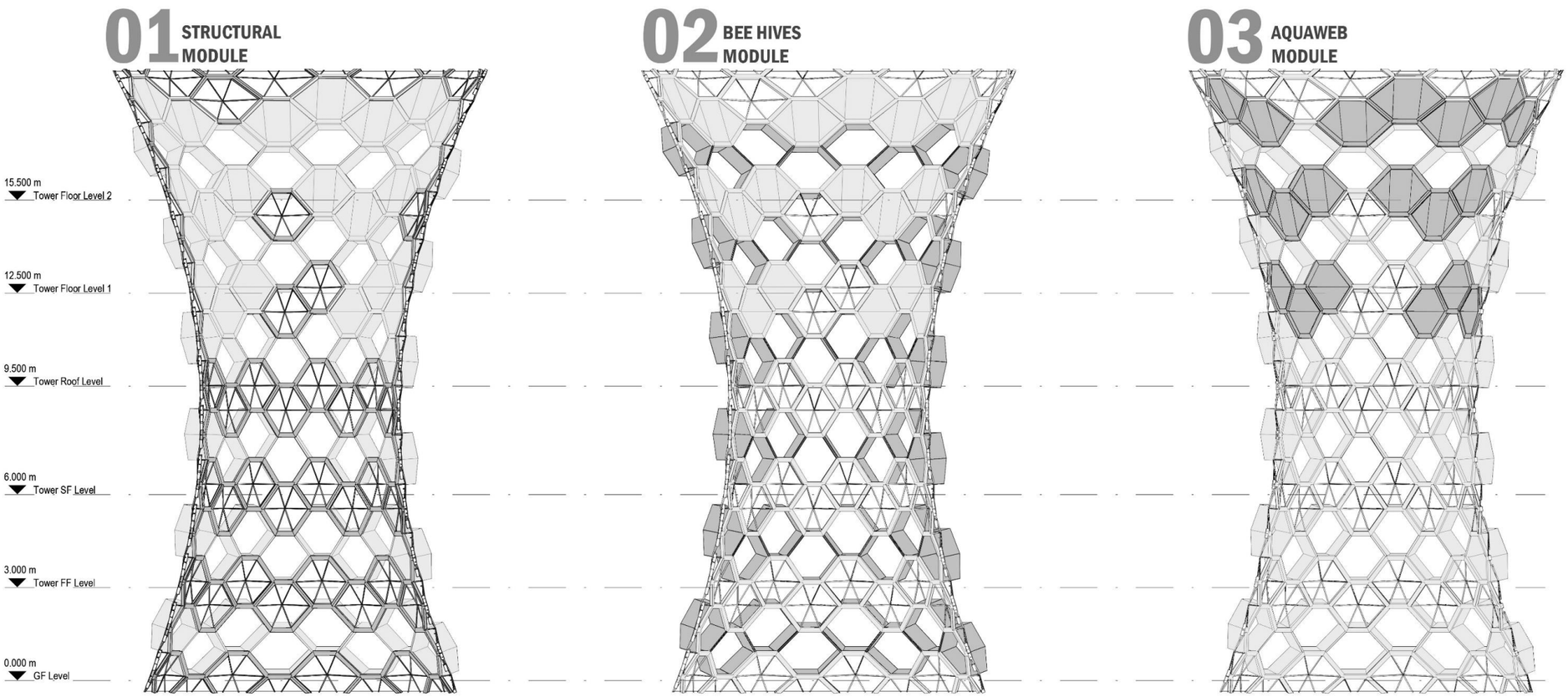
⇩

FILTERED RAINWATER PUMP

⇩

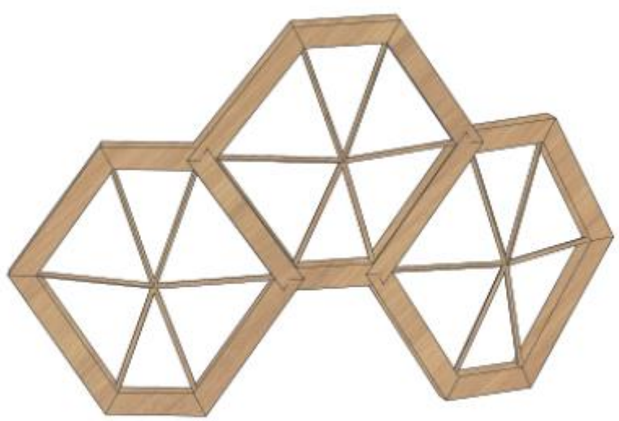
BUILDING PLUMBING SYSTEM

- Bee Towers details. The modules.



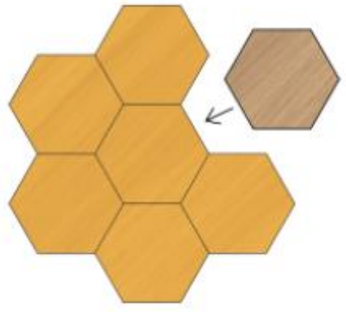
The experimental Bee Towers are innovative self-supported structures primarily constructed using timber. They are divided into three distinct modules, each serving a specific function. The first module focuses on providing structural support, ensuring the stability of the towers. The second module is designed to house the bee hives, providing an ideal environment for beekeeping activities. Finally, the third module is dedicated to water collection, in addition to the traditional water collection already explained. The concept behind these Bee Towers is to create vertical bee farms that are self-sustainable and can be easily disassembled and reassembled in different locations. By utilizing timber as the primary material, the towers promote eco-friendly construction methods and a more natural habitat for the bees. The integration of these modules allows for efficient use of space and resources, facilitating the vertical farming of bees and the collection of water within a compact and adaptable structure.

- Bee Towers details. Module 01 & 02.



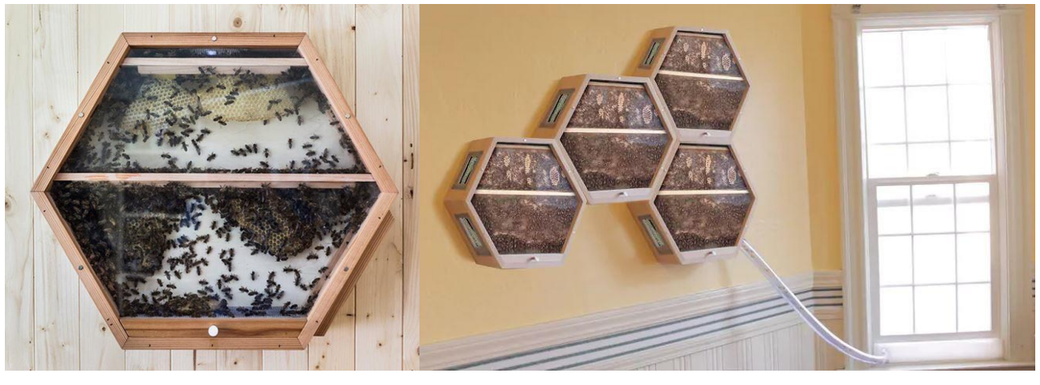
STRUCTURAL MODULE 01

The first module which serves as the structural component, adopts a hexagonal shape. Considered the strongest shapes known in nature, when multiple hexagons are arranged together, they can fully fill a given space without leaving any gaps. This efficient use of material maximizes structural integrity and strength, making hexagons the ideal shapes for various applications, including the proposed Bee Towers.



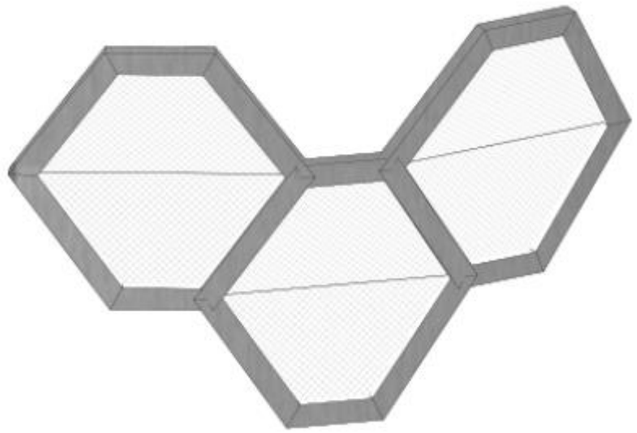
BEE HIVES MODULE 02

Michael Zaengle developed the BEECOSYSTEM, an hexagonal-shaped viewing case designed to be mounted along indoor or outdoor walls. When installed indoor, a transparent transfer tube and a simple window connection unit allows the ingress and egress of bees. The hives are modular, so you can add more hives as needed, with an entryway between the two. This system is well-suited for use within the Broombridge Bee Tower, as it can be accommodated within the structural design and easily accessed by beekeepers for honey extraction thanks to an openable glazing door.

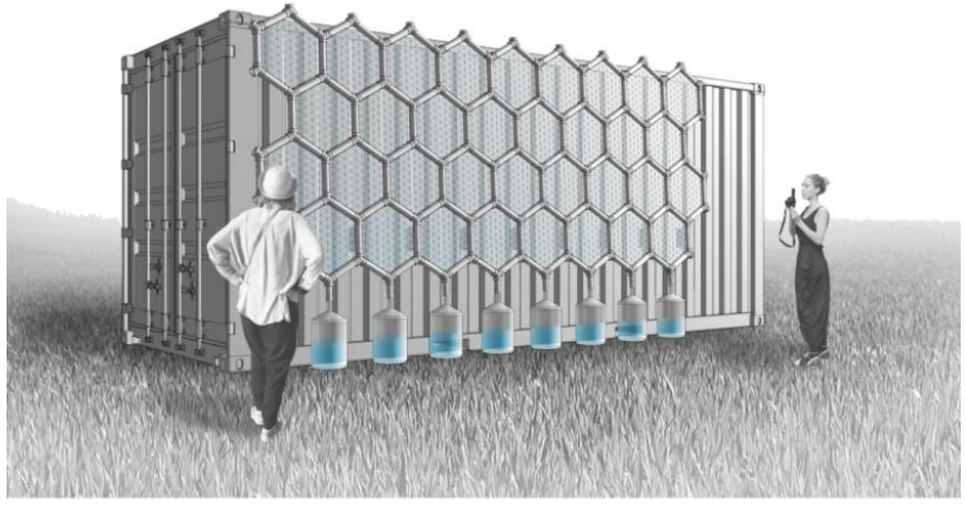


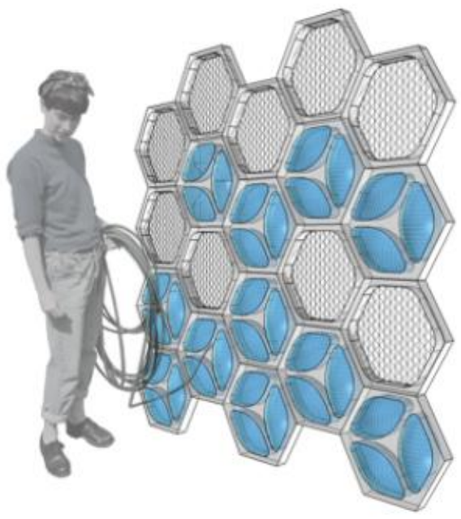
- ## Bee Towers details. Module 03.

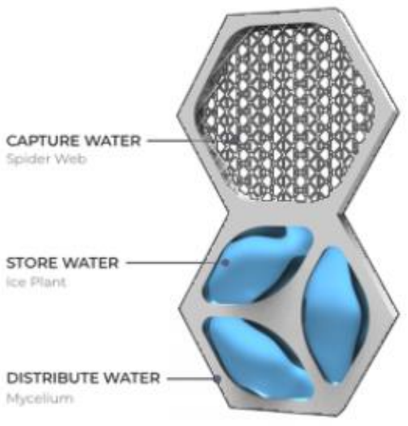
The inspiration for the third module was drawn from AquaWeb, a system developed by NexLoop. NexLoop utilized biomimicry, taking cues from how spider webs capture water. Just like in spider webs, when exposed to moist or humid conditions, the AquaWeb system attracts and spreads water across its surface, forming droplets. The radial and spiral patterns of the system aid in distributing and trapping water, while a sticky surface prevents droplets from rolling off. This innovative adaptation, inspired by spiders, can be considered a 'Bottom-Up' approach, where biological principles offer insights for solving human design challenges. In this case, the AquaWeb system effectively collects and utilizes water, ensuring its availability in a sustainable manner. The placement of this module at the top section of the Bee Towers, which experiences the highest exposure, allows for the capture of a substantial quantity of moisture from the surrounding air. The collected water will then be efficiently harvested and repurposed by the factory personnel for watering plants, promoting sustainable water usage within the facility.



AQUAWEB MODULE 03





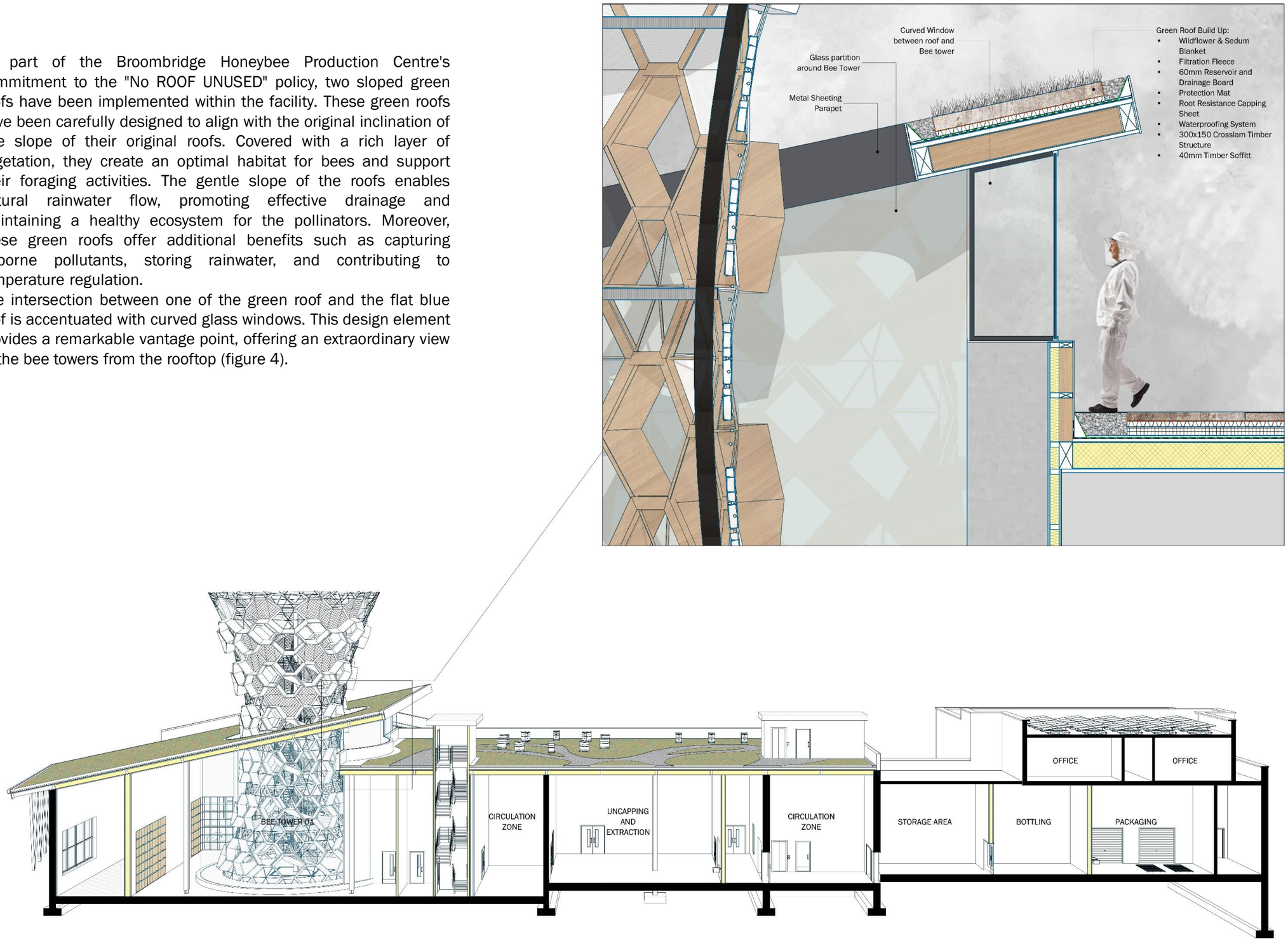


- ## Green Roof detail.

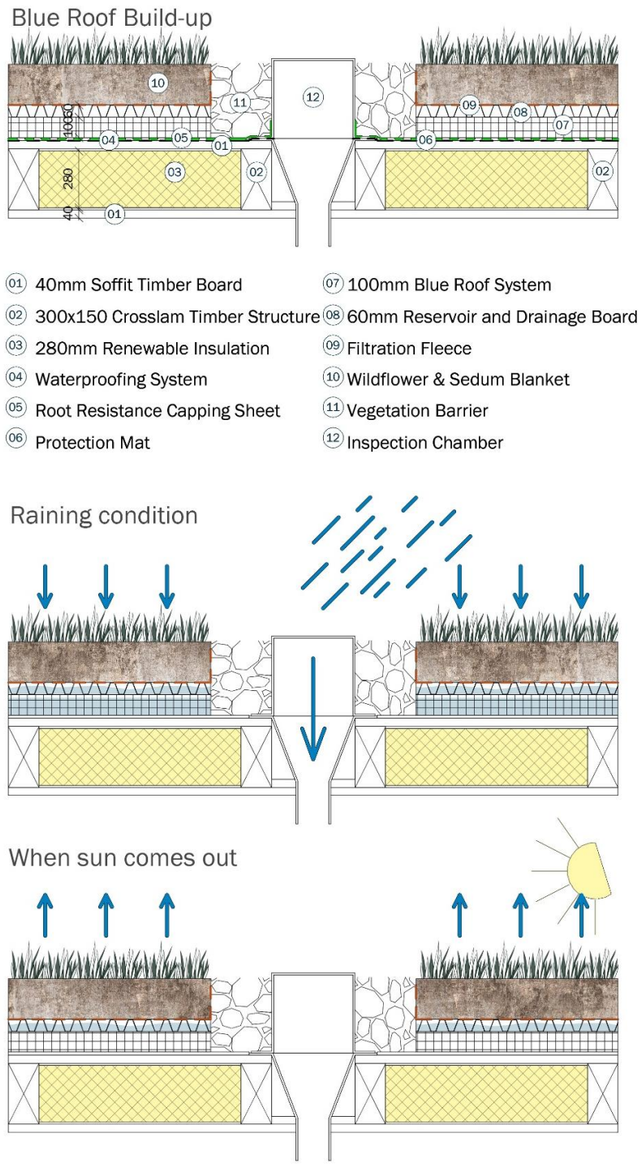
As part of the Broombridge Honeybee Production Centre's commitment to the "No ROOF UNUSED" policy, two sloped green roofs have been implemented within the facility. These green roofs have been carefully designed to align with the original inclination of one slope of their original roofs. Covered with a rich layer of vegetation, they create an optimal habitat for bees and support their foraging activities. The gentle slope of the roofs enables natural rainwater flow, promoting effective drainage and maintaining a healthy ecosystem for the pollinators. Moreover, these green roofs offer additional benefits such as capturing airborne pollutants, storing rainwater, and contributing to temperature regulation.

The intersection between one of the green roof and the flat blue roof is accentuated with curved glass windows. This design element provides a remarkable vantage point, offering an extraordinary view of the bee towers from the rooftop (figure 4).

Figure 4
Detail section thru roofs



• Blue Roof Detail.



A blue roof refers to a type of roof that is designed specifically for managing stormwater runoff. Unlike traditional roofs, which allow rainwater to flow off quickly, a blue roof is constructed with the purpose of temporarily storing rainwater on the roof surface. The stored water is then gradually released or drained away at a controlled rate.

The term "blue roof" is derived from the concept of mimicking the natural water cycle, where rainwater is retained and released slowly. Blue roofs are typically characterized by flat or low-sloped surfaces that allow for the collection and controlled release of rainwater.

The main objective of a blue roof is to reduce the burden on stormwater management systems and minimize the risk of flooding during heavy rainfall events. By temporarily storing rainwater on the roof, the rate of runoff is reduced, which can help alleviate pressure on drainage systems and prevent overloading of local waterways.

To facilitate the controlled release of stored water, blue roofs often incorporate various components such as flow control outlets, drains, or overflow mechanisms. These features allow excess water to be safely discharged, ensuring that the roof does not become overwhelmed and the building remains protected from potential water damage.

In addition to stormwater management benefits, blue roofs can also contribute to the energy efficiency of a building by providing additional insulation and thermal mass. The rooftop water acts as an insulating layer, helping to regulate the building's temperature and potentially reducing heating and cooling costs.

Overall, blue roofs serve as an innovative and sustainable solution for managing stormwater runoff, reducing flood risks, and promoting more efficient water use in urban environments.

FINAL IMAGES. Existing Elevations.

Render Existing Front Elevation

Render Existing Back Elevation

FINAL IMAGES. Proposed Elevations.

Render Proposed Front Elevation

Render Proposed Back Elevation

FINAL IMAGES. Before images.

Render Proposed Front Elevation

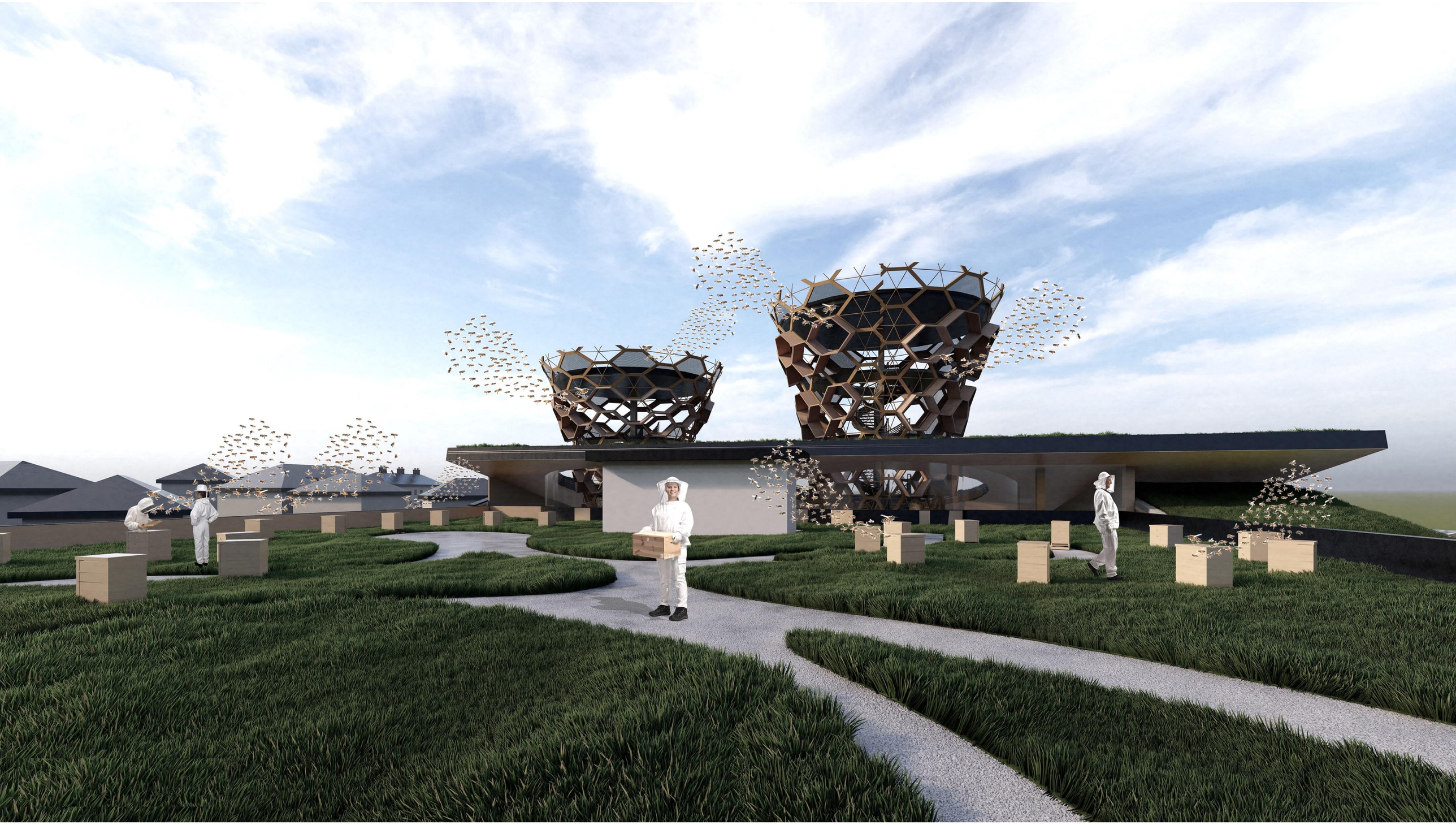
Render Proposed Back Elevation

FINAL IMAGES. After images.

Render Proposed Front Elevation

Render Proposed Back Elevation

FINAL IMAGES. View from the roof.



CONCLUSION

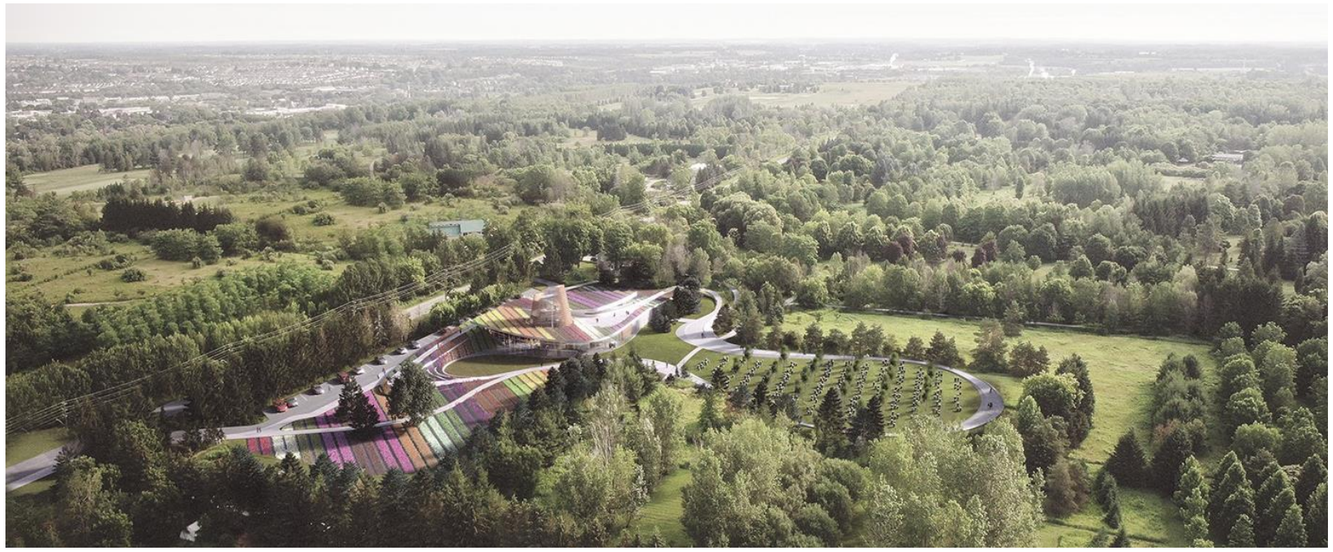
In conclusion, the Honeybee Production Centre's commitment to sustainability and the preservation of honeybee populations is exemplified through the integration of masterplan strategies and sustainable elements. The innovative Bee Towers are designed to mimic the natural habitat of bees while optimizing space utilization. Their self-sustainability lies in their efficient design and functionality, providing an ideal environment for honey production. The modular construction allows for easy replication and expansion, enabling the implementation of these towers in other locations to support bee population growth and sustainability.

Additionally, the incorporation of green roofs and a blue roof, in accordance with the "NO ROOF UNUSED" policy, showcases the Centre's dedication to enhancing the building's aesthetics and promoting environmental benefits. These roof systems contribute to stormwater management, reduction of air pollution, and regulation of temperature. They not only enhance the functionality of the facility but also demonstrate a holistic approach that aligns with the needs of honeybees, environmental conservation, and operational efficiency.

Overall, this thesis highlights the importance of integrating nature-inspired solutions in industrial settings to promote biodiversity, conserve resources, and recognize the crucial role of honeybees in our ecosystem. By embracing sustainable practices, the Broombridge Honeybee Production factory serves as a positive example for other industries, fostering a more sustainable and bee-friendly future.

Save bees, save the world.

PRECEDENT. The Honey Bee Research Centre, University of Guelph, Ontario College of Agriculture

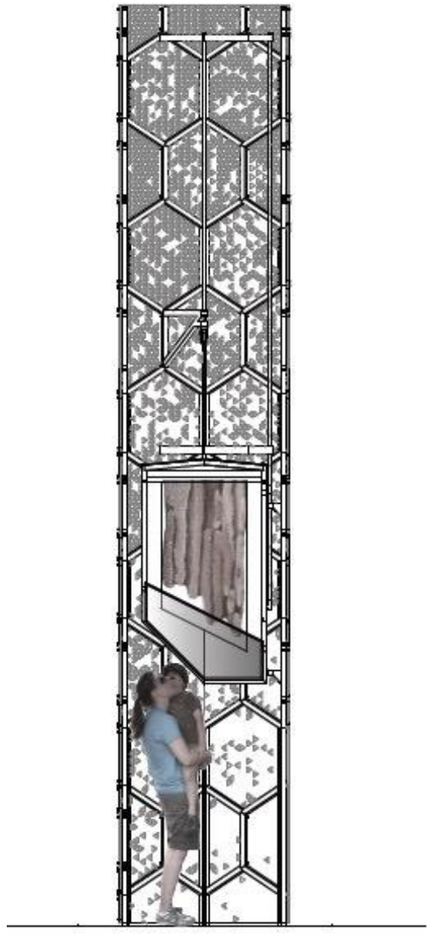


Moriyama & Teshima Architects have been chosen to design a new Honey Bee Research Centre at the University of Guelph in Canada. This project, commissioned by the university's Ontario Agricultural College, aims to create a distinctive facility dedicated to promoting sustainability, honey bee health, and well-being. The centre will be constructed using mass timber, with a focus on low-carbon design. It will serve as a hub for flexible research and education opportunities for people of all ages. The Honey Bee Research Centre (HBRC) will encompass various spaces, including a large multi-functional Discovery and Learning Space, an Exhibition Area, Research & Extraction Labs, Classrooms, a Café, and a Gift Shop. A sweeping roof structure will serve as a prominent feature in the public space. The roof and surrounding landscape will be connected through a trail that leads to the centre's iconic Interpretive Tower. This tower will not only serve as a solar chimney but also provide a friendly habitat for pollinators.

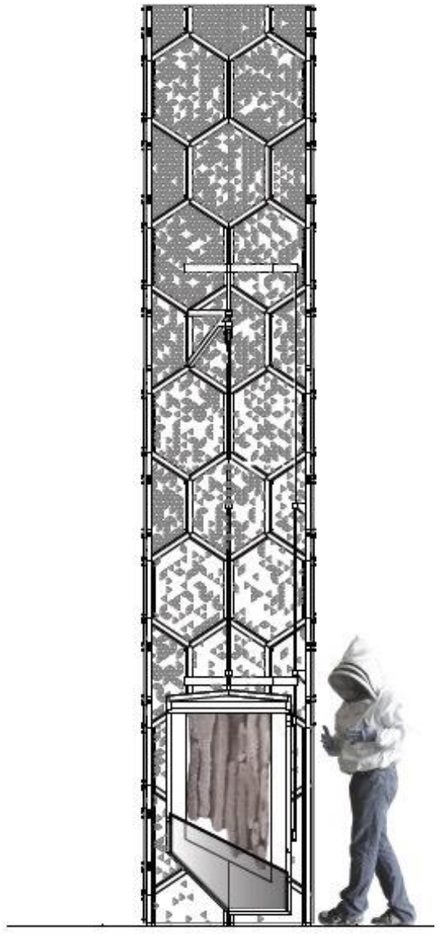
According to the president of the University of Guelph, Franco Vaccarino, honey bees play a crucial role in the world, and the university aims to be a global leader in honey bee research and conservation (Vaccarino, 2019). The HBRC is seen as a significant step towards achieving this goal and improving the health of bees and other pollinators.

PRECEDENT. Elevator B, Hive City

Elevator B is an innovative urban habitat designed to accommodate honeybee colonies. With a height of 6 meters, Elevator B is constructed using a honeycombed steel structure made from standard steel angle and tube sections. Its design incorporates perforated stainless steel panels, which serve the dual purpose of protecting the hive and its inhabitants from wind exposure while allowing for solar gain and shading. The bees reside within a hexagonal cypress box, featuring a laminated glass bottom that enables observation of the bees. This "beecab" provides warmth, protection, and ensures a separate entry access for both the bees and humans. Beekeepers can access the hive by lowering the bee cab, and this feature also offers an up-close view for visitors.



6A Section: Bee Cab Up
Scale: 1:25



6B Section: Bee Cab Up
Scale: 1:25

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