



# Garden of displaced roots

Written and Illustrated by **Neethi Joseph**

## **Dedication**

*To all great architects who strived to make a difference by using meaningful design as a tool for problem solving.*

*The cover page depicts a robust plant with blooms of different colours and size : A sense of communal living*

# Acknowledgements

Completing this final study to the level of detail attained would have been impossible without the help of an array of people and I would like to extend my sincere gratitude to each one of them. First and foremost I thank the Almighty for all the graces bestowed.

I am extremely obliged to my committee **Dr. Ray Pentecost**, **James Michael Tate** and **Dr. Robert Brown** for their endless support, guidance, and willingness to listen patiently without which I wouldn't have been able to deliver my best.

I wholeheartedly thank **Dr. James Haliburton**, studio coordinator, for his valuable comments and suggestions to improve and add depth to the study. I specifically thank my studio mates for their valuable inputs.

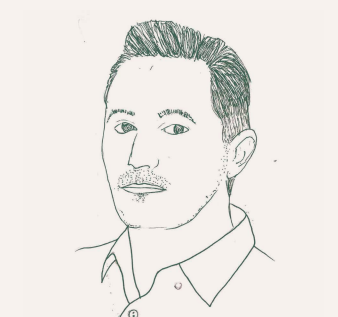
It's my privilege to extend my gratitude to the **Department of Architecture**, Texas A&M University.

I would have never been successful without the enthusiastic support of my family- Mr.Shaji Joseph, Mrs.Mini Shaji, Mrs.Nithu, and Mr.Salith Rashnad. I am grateful for the support of my friends. A special mention to Ms. Naeema Ali for helping me with landscape design. I thank Ms. Indu S and Mr.Vishnu for their critical suggestions and support. I thank Mr.Kurian Job, Mr. Akshaye Anitha Pradeep, and Ms. Tanya Mathews for being super supportive roommates.

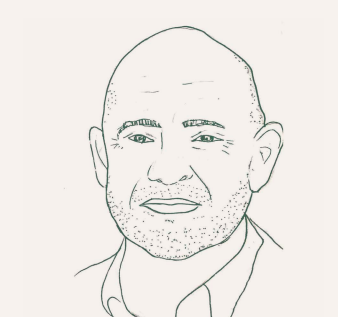
I am grateful to everyone who has helped in different stages of my work to complete this final study.



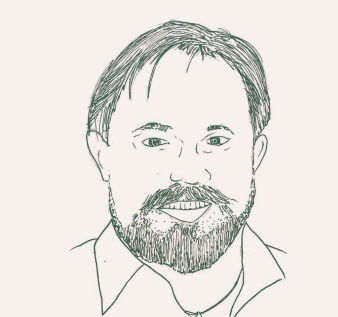
**Dr. A. Ray Pentecost** FAIA  
*Chair*



**James Michael Tate**  
*Member*



**Dr. Robert Brown**  
*Member*



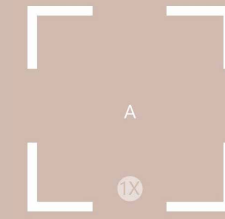
**Dr. James Haliburton**  
*Studio Professor*

# Essence

## Introduction

Garden of Displaced roots

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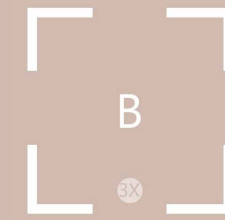
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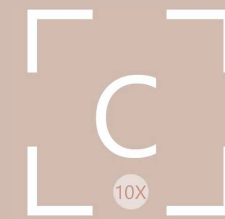
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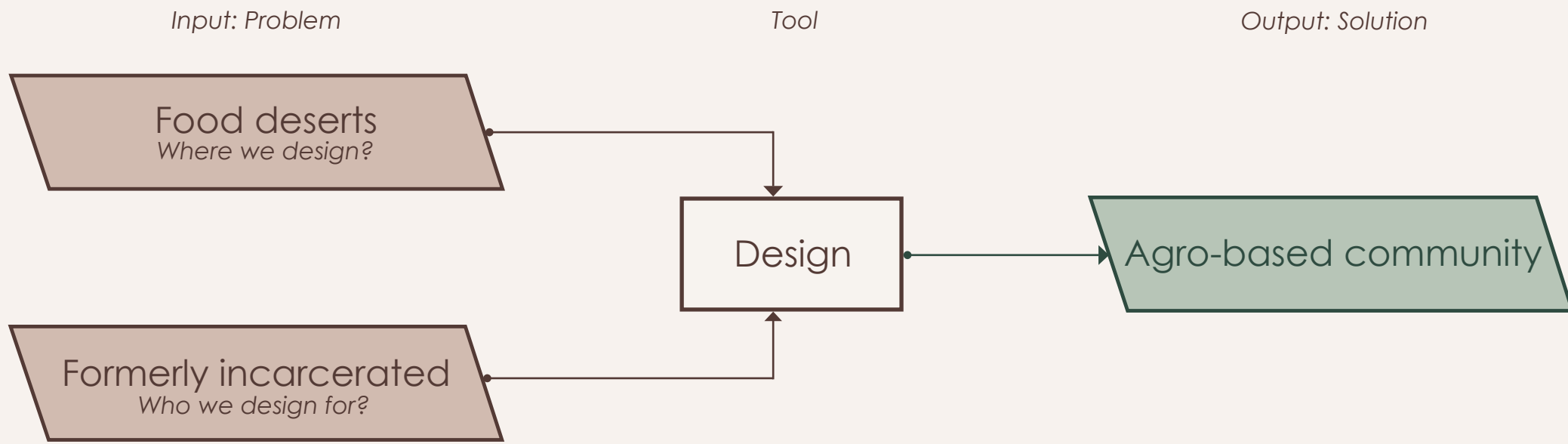
# Introduction

*The Art & Science of Web Design by Jeffrey Veen*

“GOOD DESIGN ISN’T DECORATION  
GOOD DESIGN IS PROBLEM SOLVING”

## Garden of Displaced Roots

The garden of Displaced Roots creates an affordable agro-based community accessible to underprivileged and disenfranchised segments of society because they were formerly incarcerated. The project hybridizes living and working programs organized in a fluid manner. The project serves as a vital platform to focus on the necessities like shelter and food over the notions of luxuries.

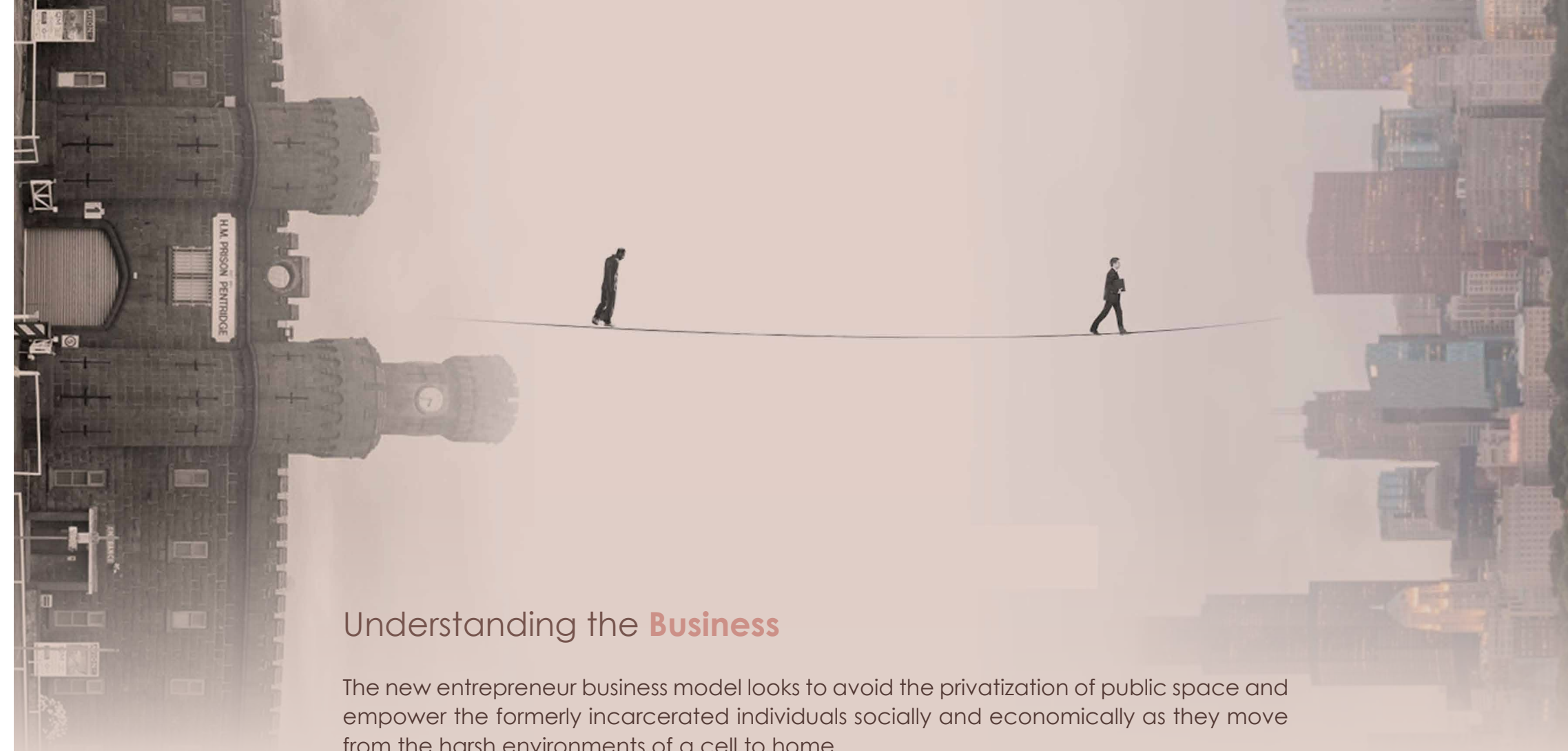
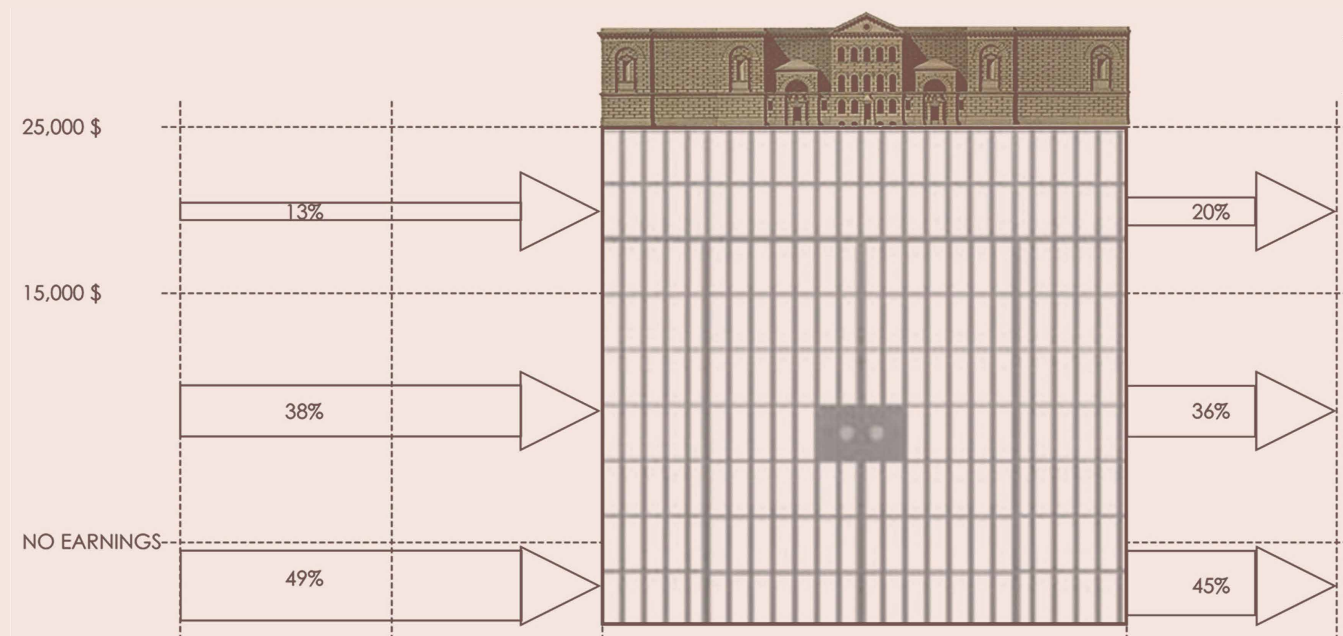


# FROM CELL TO HOME

## Understanding the User

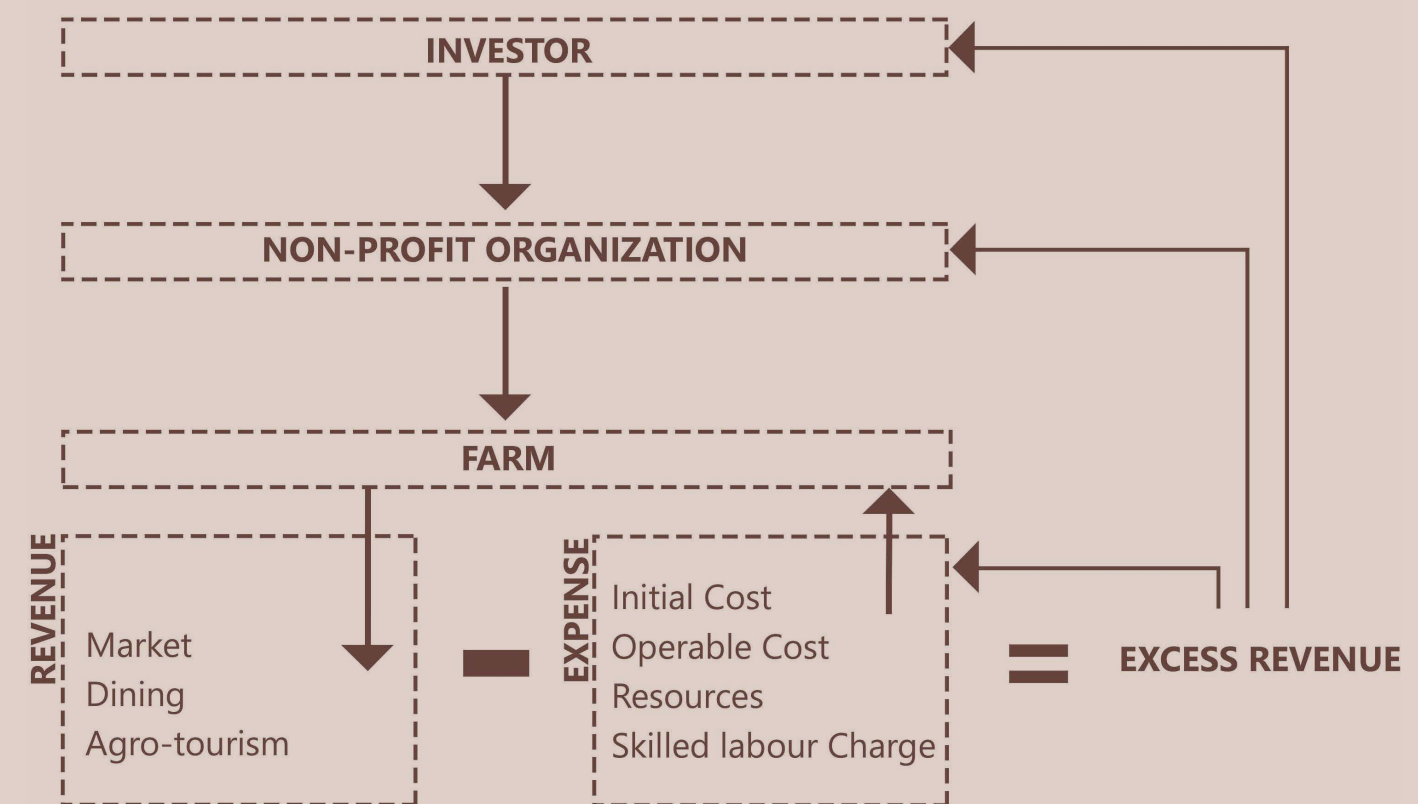


Nearly 50% of ex-convicts were unemployed before their imprisonment and after their release, 45% of individuals continue to be unemployed. Lack of employment opportunities forces them to destroy wealth, create debt, get involved in illegal activities and return to prison. **The project reinforces their sense of identity and community.**



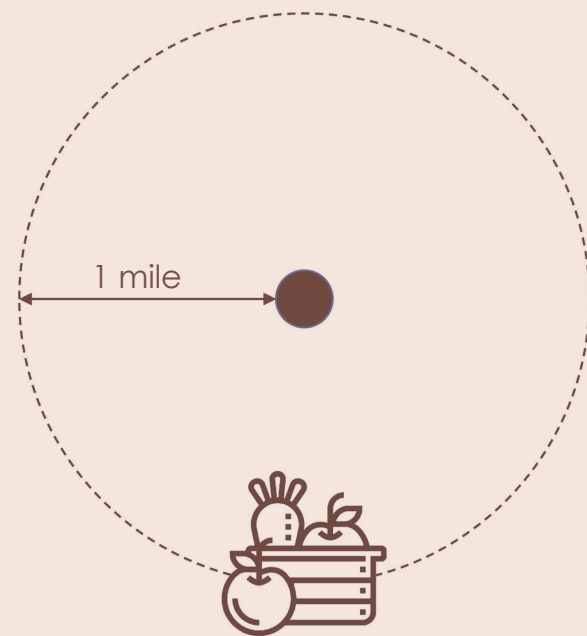
## Understanding the Business

The new entrepreneur business model looks to avoid the privatization of public space and empower the formerly incarcerated individuals socially and economically as they move from the harsh environments of a cell to home.

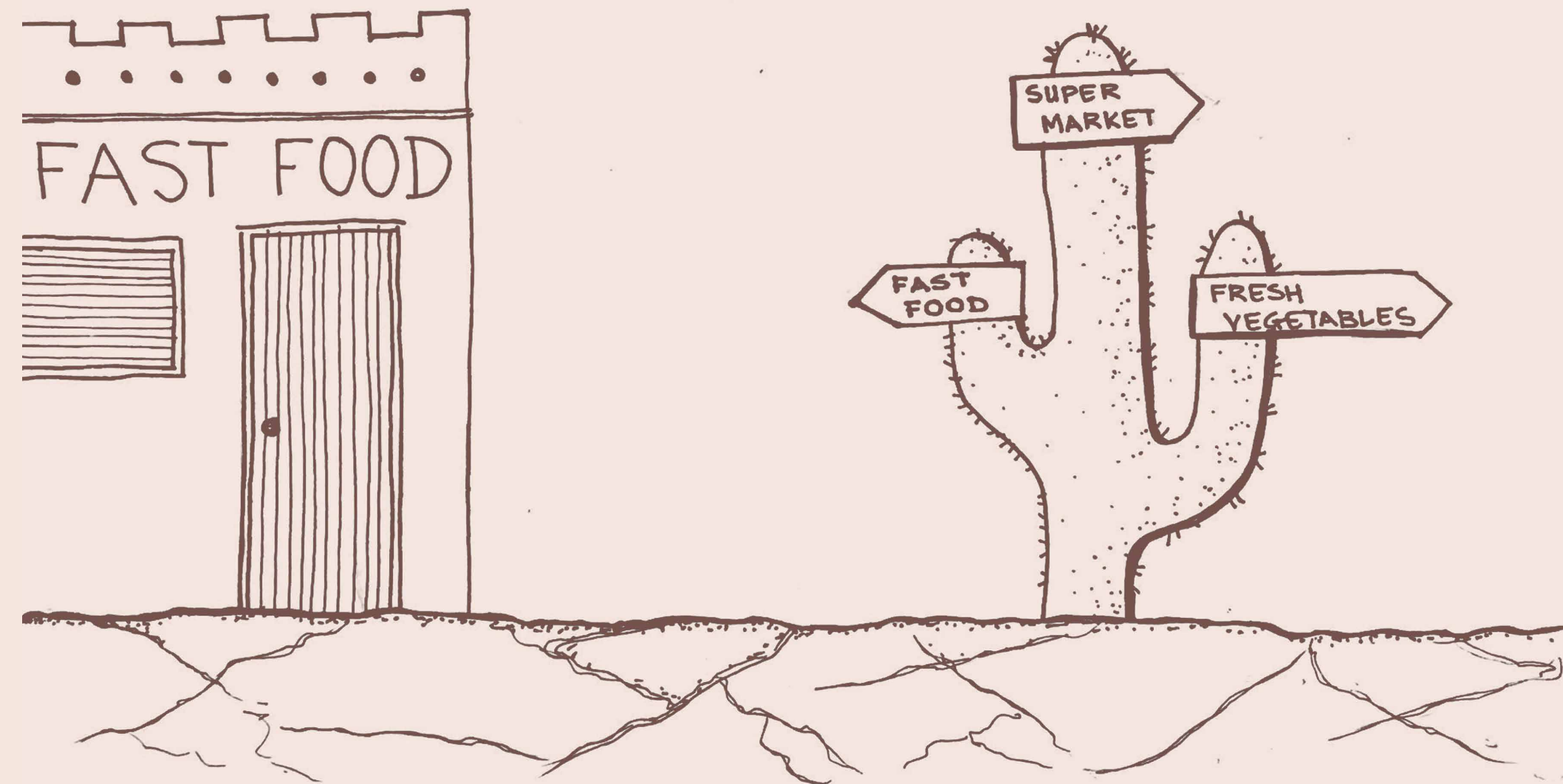


## Understanding the **Context**

The food desert is defined as geographical areas where individuals without a vehicle must travel a distance more than a mile to access fresh food. Individuals living in food deserts find it difficult to get culturally appropriate food.

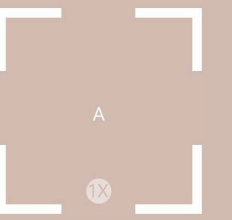


Processed foods are sold in convenient stores and corner delis. These zones have less than three times the number of supermarkets in a regular urban area.



“SOCIETY NEEDS GOOD IMAGE OF ITSELF  
THAT IS THE JOB OF THE ARCHITECT.”

*Walter Gropius*



PART A

## **Green Mile**

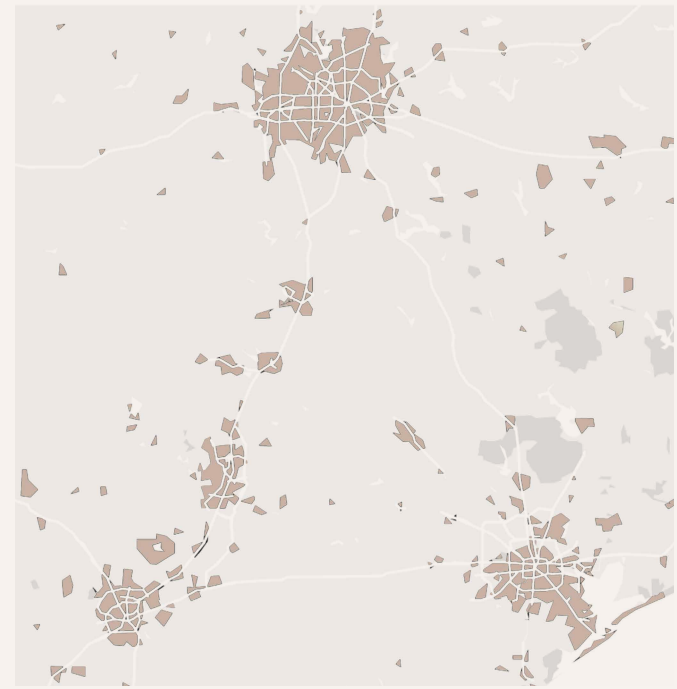
*Urban design as a tool  
for Problem Solving*



# Context



World Map

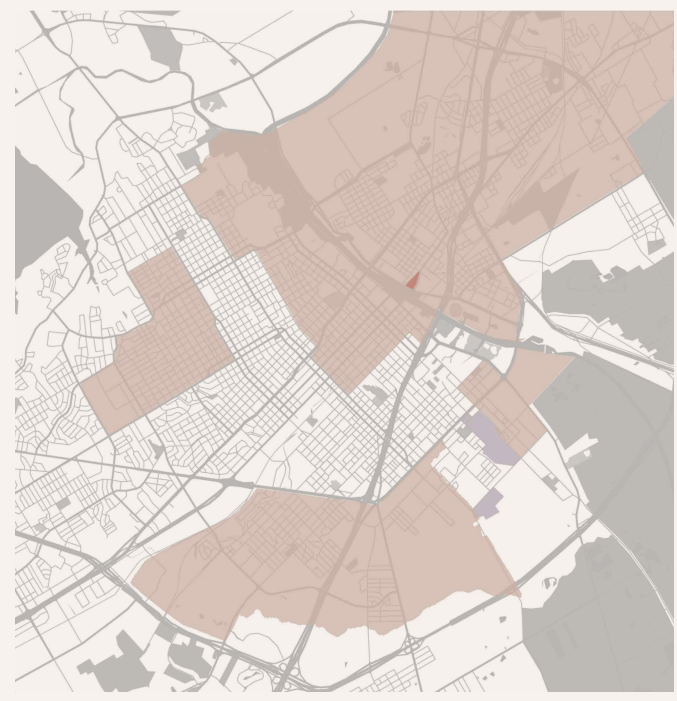


Texas Triangle

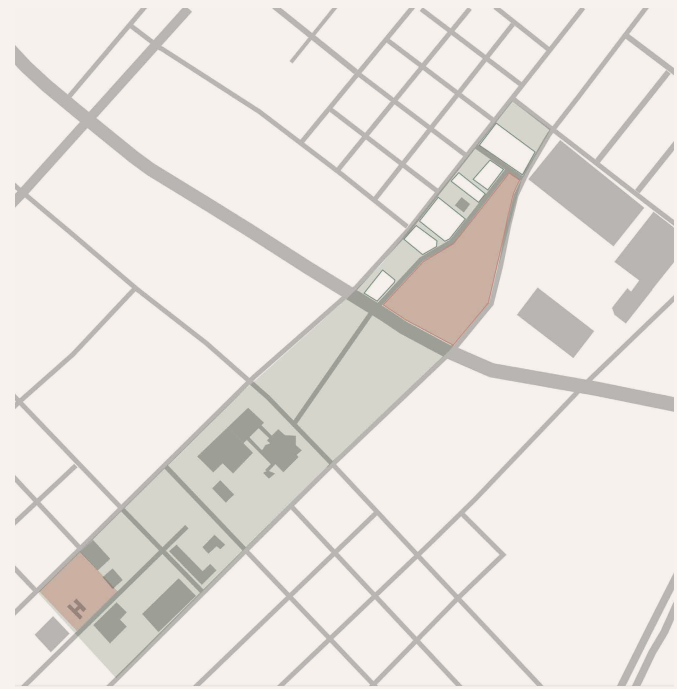
## Understanding the Context

Fifty percent of the Texas population will reside within the Texas Triangle by 2030. The Texas triangle connects the major cities of Dallas, Houston, and San Antonio.

The site is situated in downtown Waco, Texas. Even though Waco is central to the three major cities, it is the largest food desert within the Texas Triangle. The project site location is in proximity to the farmers market. **The project envisions reimagining the biggest food desert in the Texas triangle as an agro-based tourism district.**

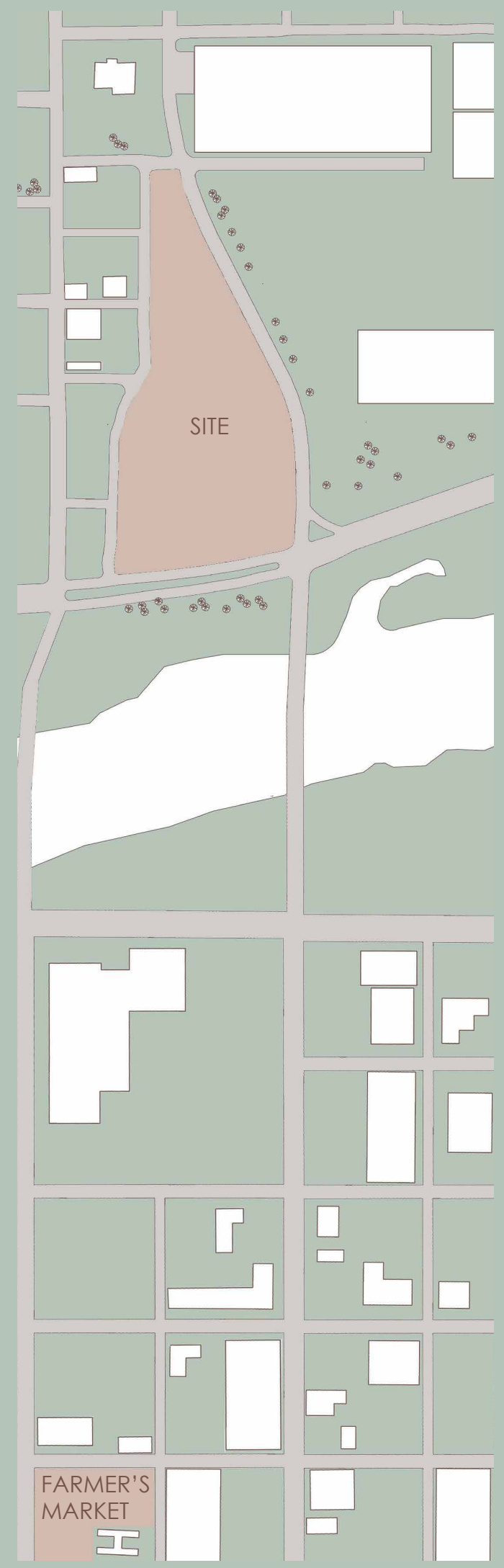


Waco's Food deserts



Waco Downtown

Existing plan



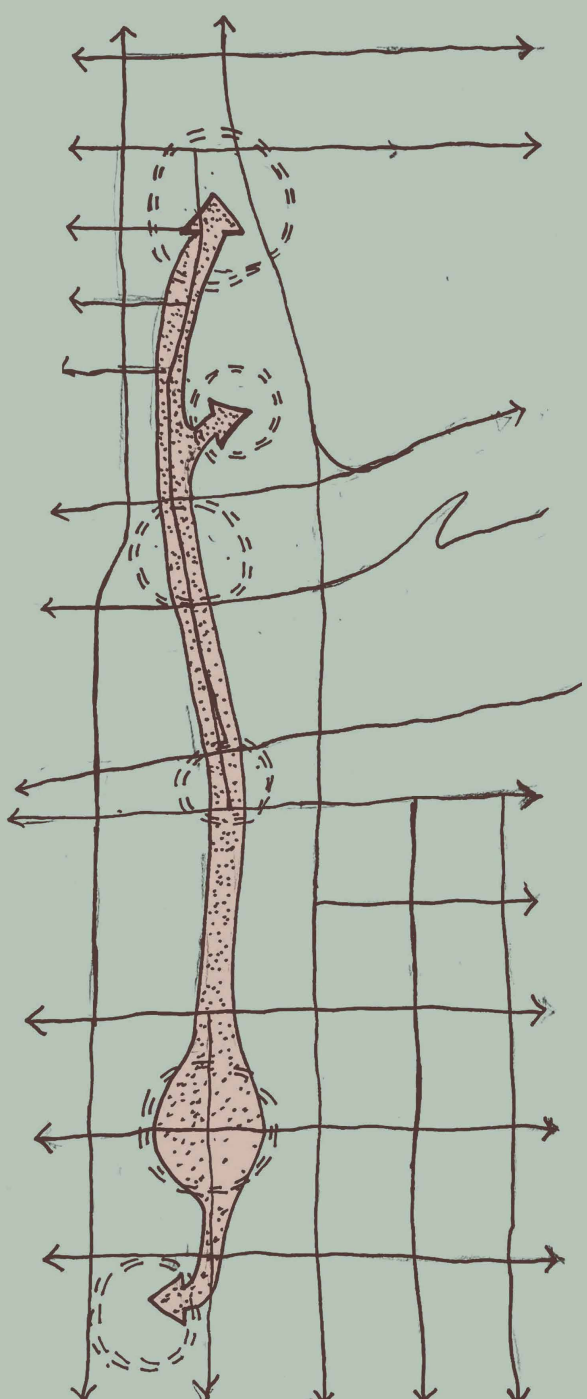
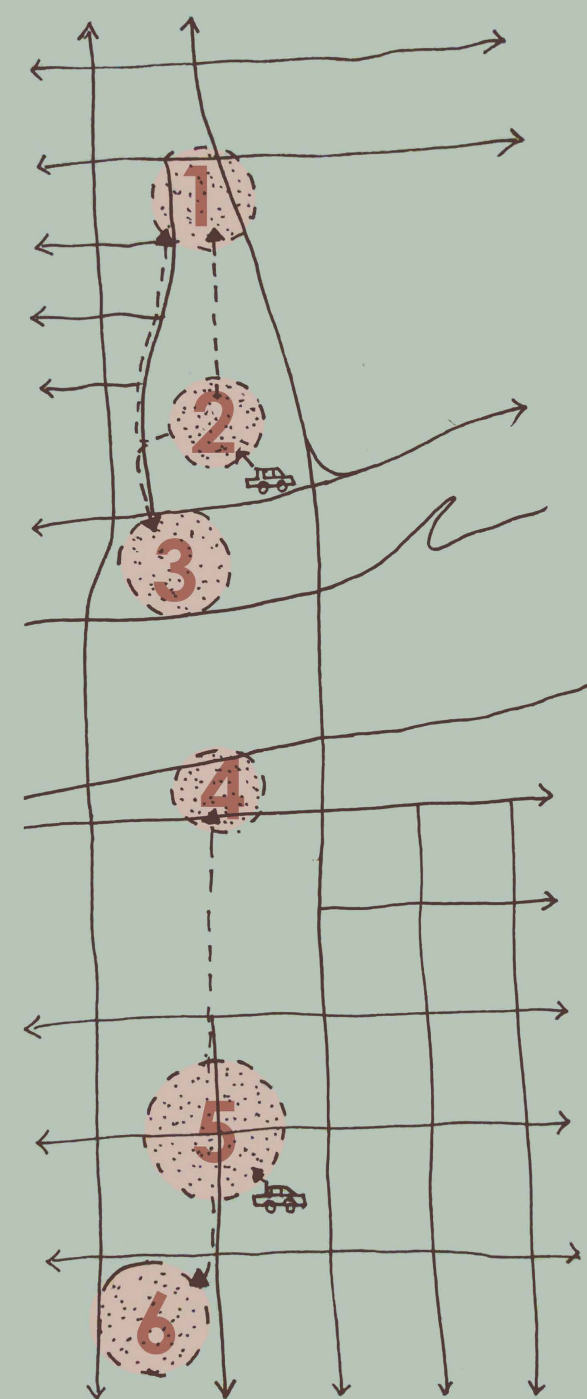
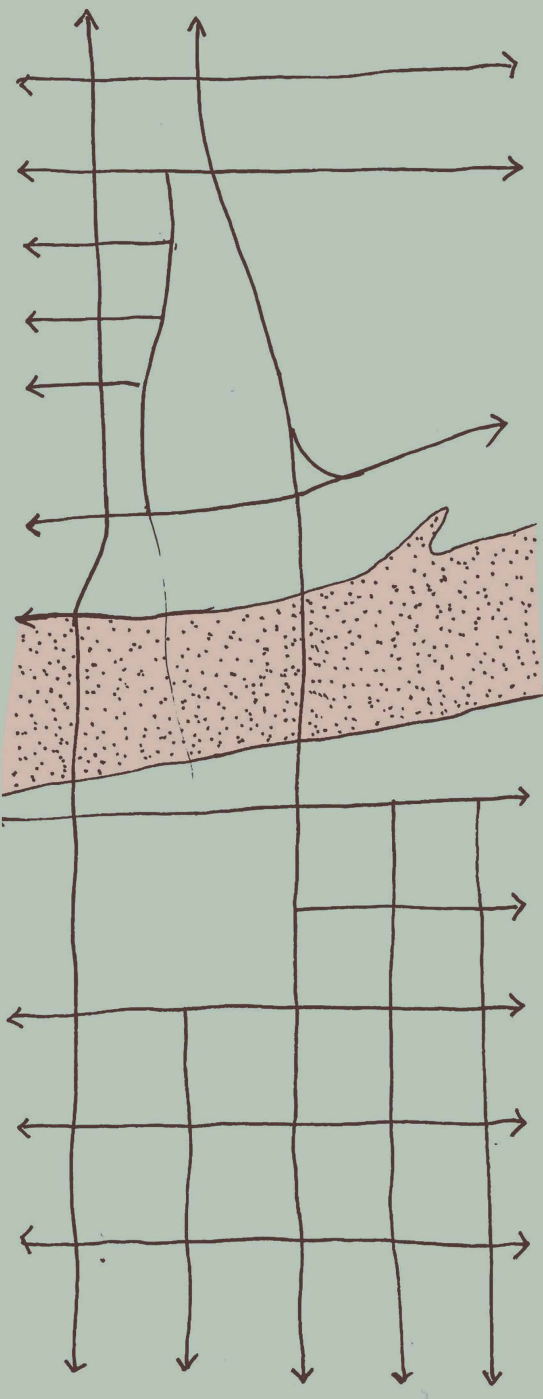
## Reimagining Waco downtown

The site design encompasses architecture, landscape, and infrastructure aids to build on broken urbanism by generating social interaction nodes in Waco downtown.

A series of green connectors or green corridors embedded with infrastructural furniture are proposed to provide the connection of the site to the farmers market which is a mile apart. Hence, it is called the green mile. It creates a seamless visitor experience, enabling visitors to directly engage in the landscape.



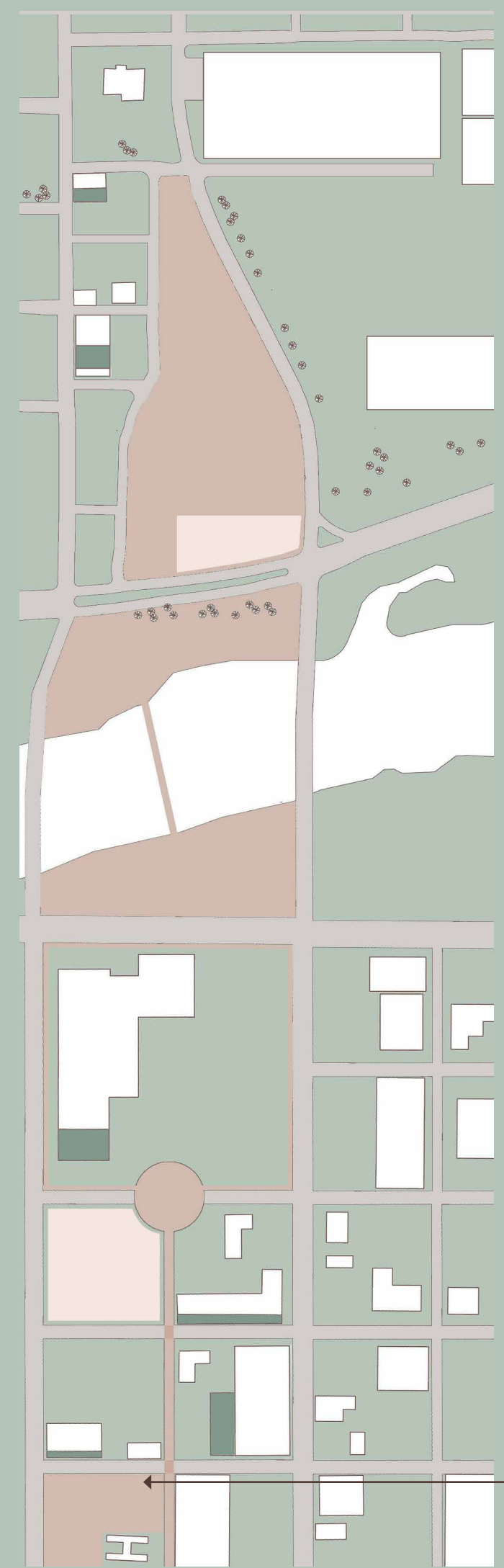
# Urban design



The green mile is divided into two zones by the river. The 2 zones are connected by the suspended pedestrian bridge.

Each zone has 3 major nodes arranged in a linear pattern. The parking in both zones is provided in proximity to the central node.

The 6 nodes and the green network which continuously connect them encourages the culture of walking that promotes healthy active living.



**Legend**

- Grow house
- Open recreation
- Parking

## Engaging public space for contextual movement

The bottom-up approach seeks to occupy and engage in-between brown field spaces in Waco. The brown fields and buildings' south and west facades are converted to greenhouses to maximize food production. We propose that these lands are operationalized for food production to eliminate food shortage due to the growing population in the Texas triangle.

The green mile facilities are not only free and open to the public, but it is owned and maintained collectively by the community.

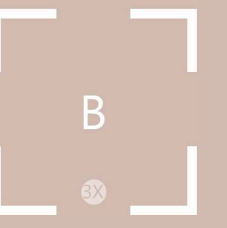


Farmer's Market  
Scale  
100' 400' 800' 1200'  
Green Mile

Proposed plan

“ARCHITECTURE IS BOUND TO SITUATION.  
AND I FEEL LIKE THE SITE IS A METAPHORICAL  
LINK, A POETIC LINK, TO WHAT THE BUILDING  
CAN BE.”

*Steven Hall*



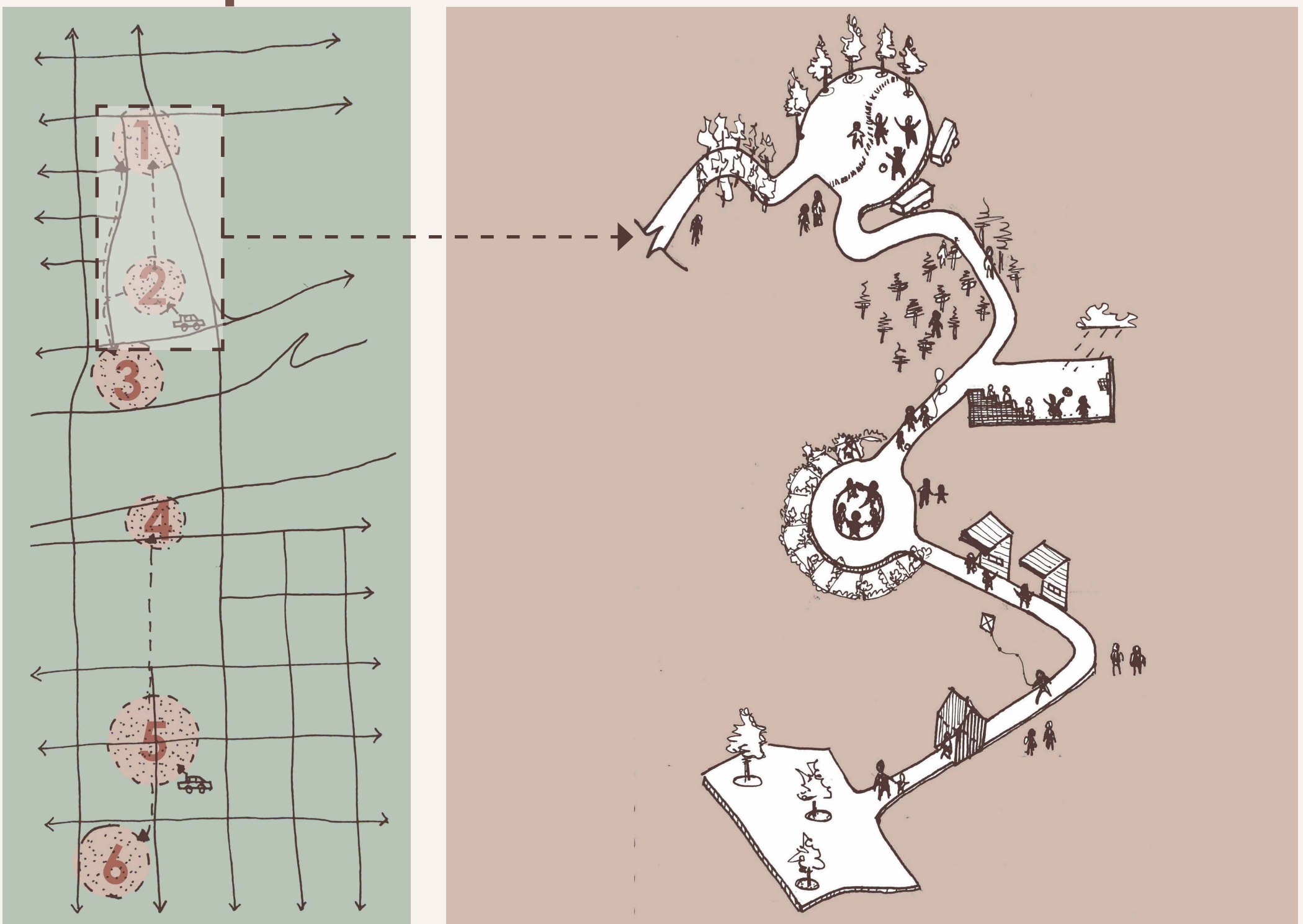
PART B

## Green Node

*Site design and Landscape  
design as a tool for Problem  
Solving*



# Concept



# FARM TO TABLE

**Flowing from farm to table**  
 The project is conceived as a cyclical, self-sufficient system that integrates all aspects of food. Here, the diverse spatial experience educates the visitors on the flow of food from the farm to the table.





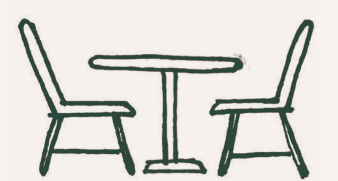
# Design Program

The project hybridizes living and working programs organized in a fluid manner. Despite prioritizing the notions of luxuries, the project serves as a vital platform to focus on necessities like shelter and food.

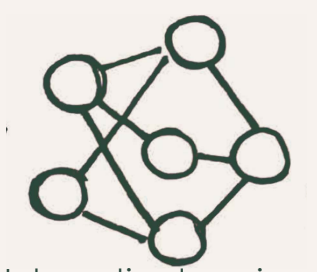
## Anchoring a cultural and economic nucleus

The program centers on the economic necessity and cultural estrangement of a sensitive group. Economic necessity centers on maximizing the value generated from the land. An ideal method for food production is a hydroponic cultivation system in grow houses rather than traditional farming.

Cultural concerns include institutions and amenities provided by the neighborhood. The food industry will continue to evolve to be more creative, less wasteful and more environmentally friendly. The adaptable and flexible built environment can cope with the evolutions from diverse human needs and environmental factors.



Dining



Interactive learning



Grow House



Market



Walking trail



u-pick



Spiritual wellbeing



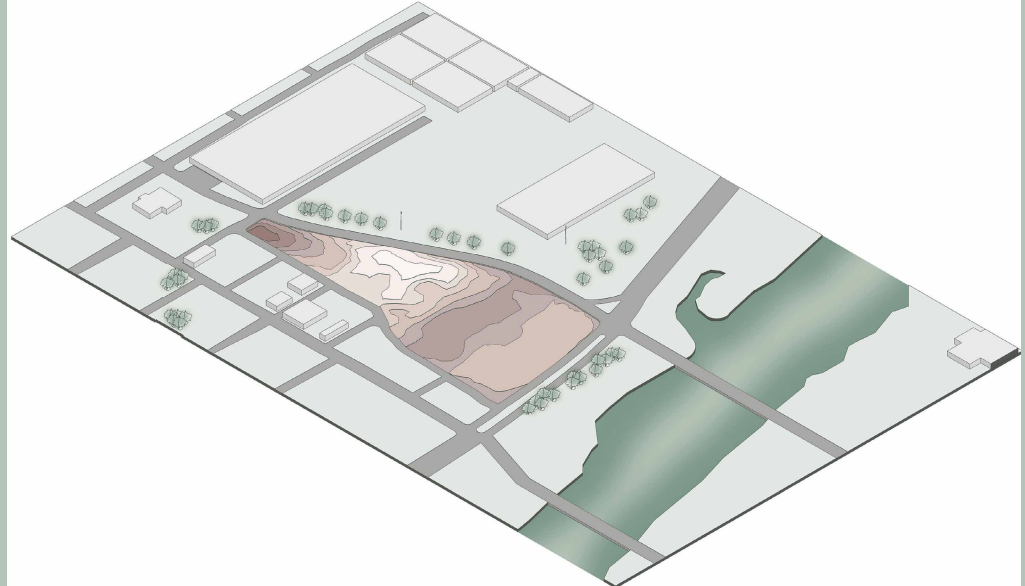
Sustainable living



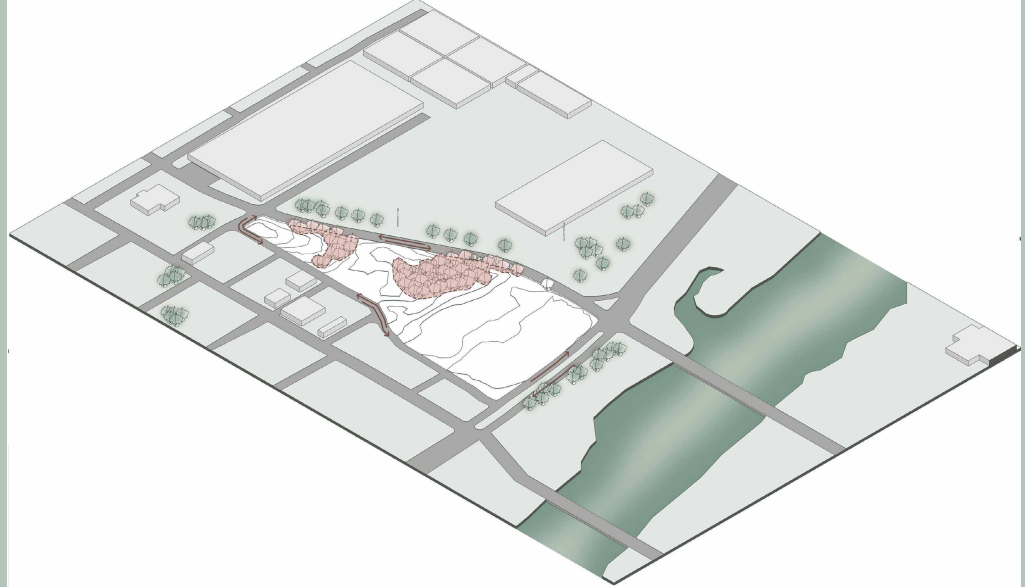
Social life



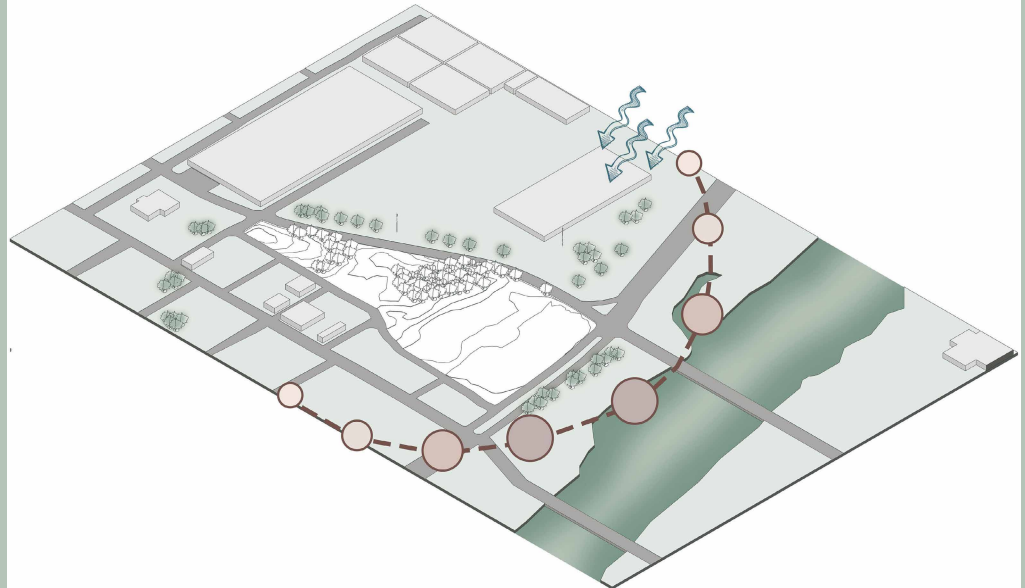
# Site Analysis



Topography



Existing Site Feature



Climate

## S Strengths

- » Proximity to farmers market
- » Low slope topography
- » High onsite vegetation

## W Weaknesses

- » High number of unused or less efficiently used plots in surrounding.
- » Higher heat gain since trees on South of site are taken off.

## O Opportunities

- » Future expansion of project.
- » Less noise due to traffic and adjacent sites

## T Threats

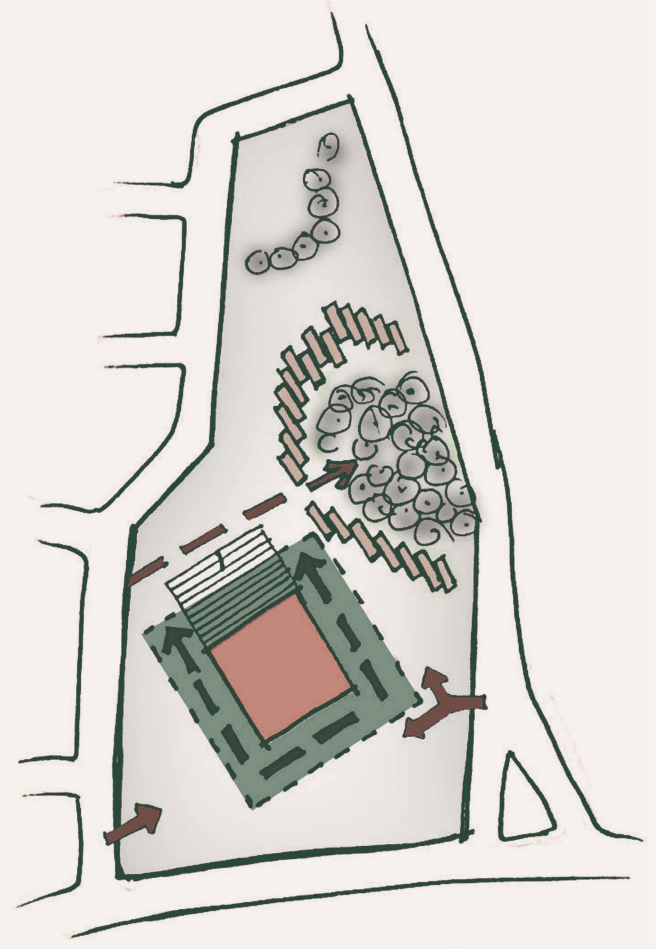
- » Shade of trees should not affect the functioning of greenhouses.
- » Illegal activities in surrounding areas



# Parti diagrams

## Exploring spatial relationship and connectivity

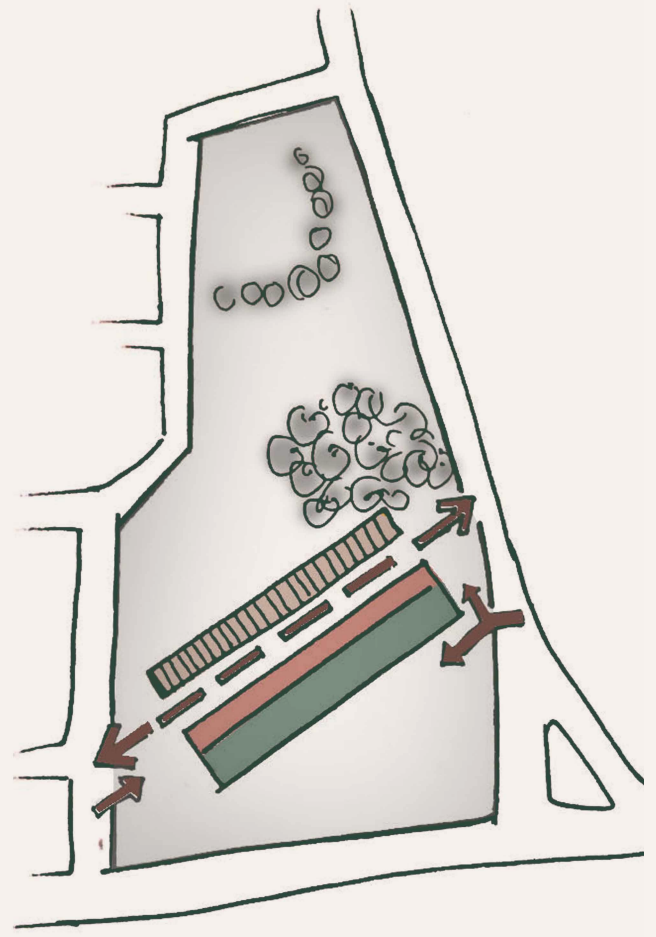
The greenfield site development of the site focuses on minimum disturbance. Hence, the footprint of the major built environment is minimized and planned to the south side of the site in both gaming layout options.



Gaming option A

The primary site organization begins with stacking the market space on the first floor and grow house on the second floor. The user has a radial path of movement which is shaded by the grow house which has a larger footprint.

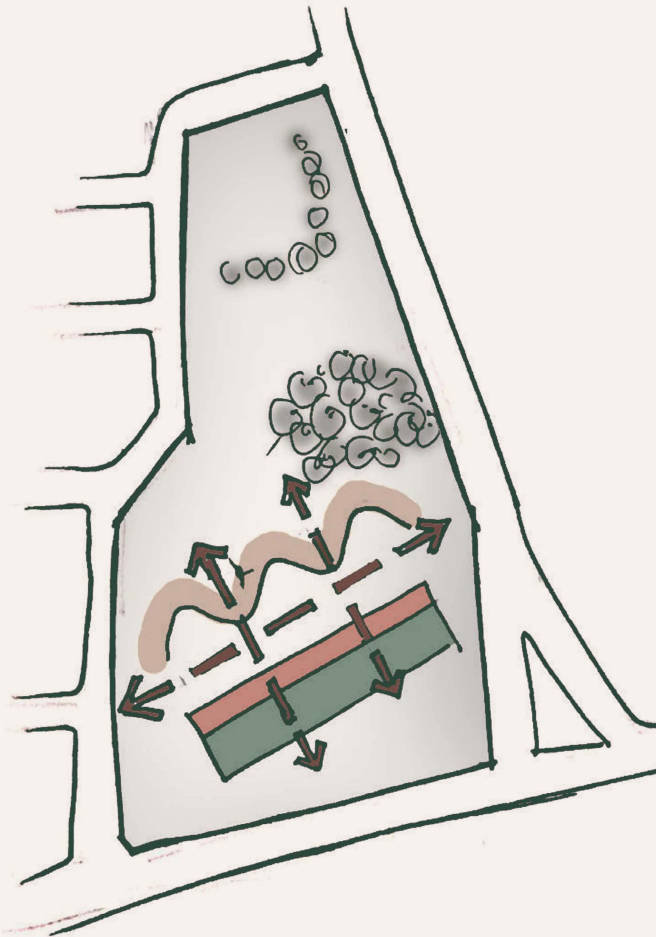
- |   |  |
|---|--|
| <b>Pros</b>                                   | <b>Cons</b>                                  |
| - Easy user access to market space            | - Farm-table flow not visible to visitors    |
| - Thick vegetation zone in proximity to homes | - Weak relation between live and work spaces |



1

The primary site organization begins with separating the living and working spaces by a primary axis. It is the most important axis because it reflects the natural movement of people through space.

- |  |  |
|--|--|
| <b>Pros</b>                                    | <b>Cons</b>  |
| - Street act as social spaces                  | - Streets are not appropriate for social activities. |
| - Strong relation between live and work spaces | - Housing units lack lighting and ventilation        |

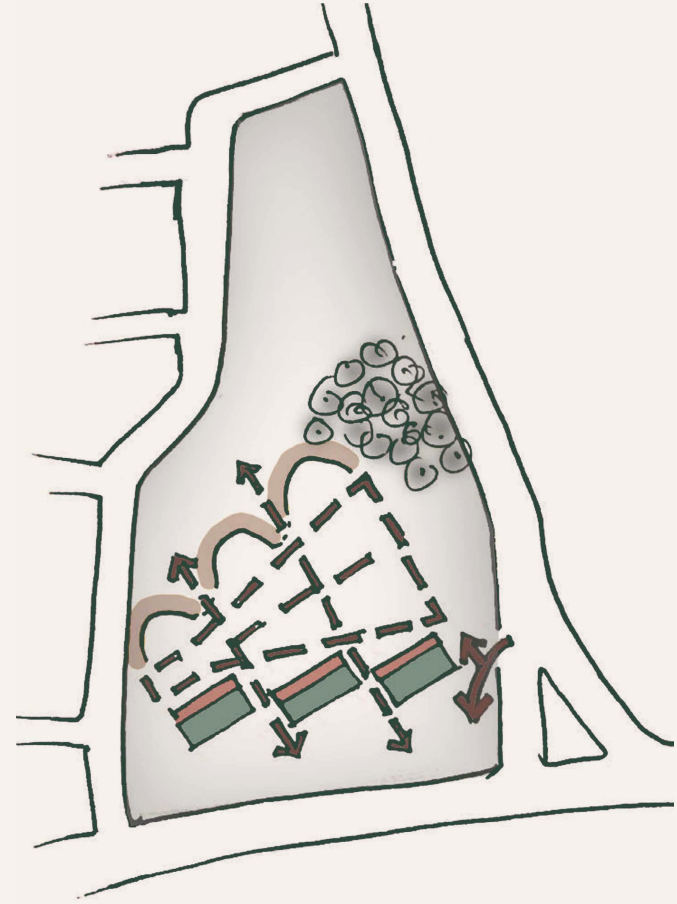


2

Gaming option B

The buildings are bisected with two secondary axes which act as pedestrian pathways from the parking. The housing units are staggered to maximize ventilation and create social interaction spaces.

- |   |                                 |
|---|---------------------------------|
| <b>Pros</b>   | <b>Cons</b>                     |
| - Staggered units allow more lighting and ventilation | - Access from parking to market |
| - They form public and private social zones.          |                                 |



3

The main axis develops into the central plaza which integrates and separates these distinct spaces for privacy and safety. All other spaces within the site are connected to the central plaza.

- |  |
|--|
| <b>Pros</b>  |
| - Large central plaza encourages social activities |
| - Easy access from parking to market               |



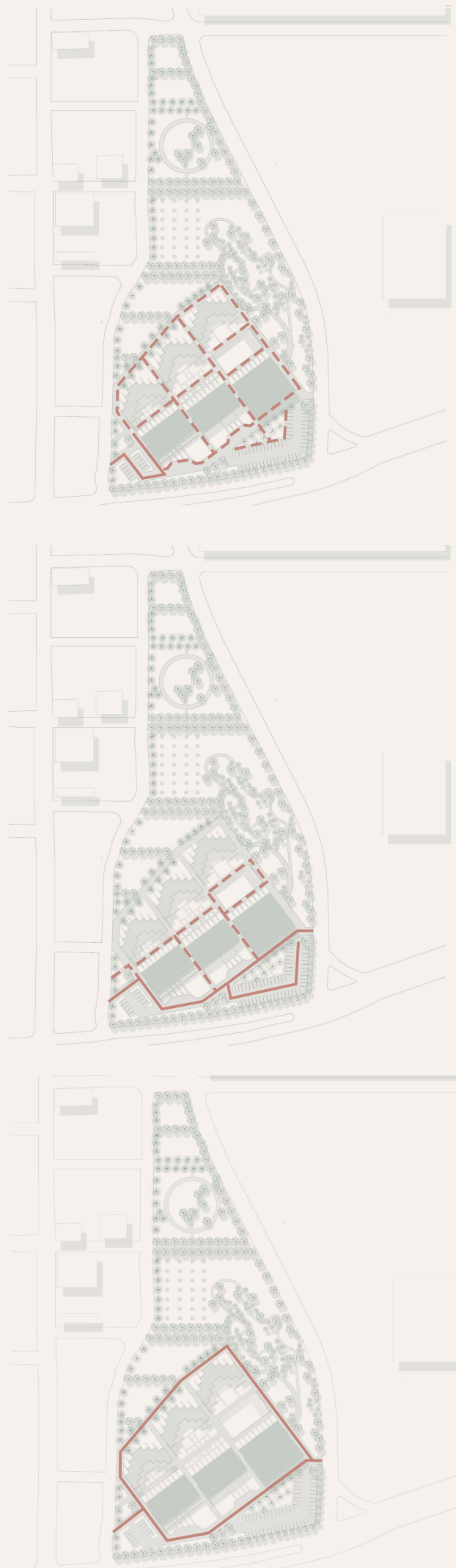
# Site plan

## Choreographing hierarchy of movement

The relationship between the individual and the urban environment is how one moves through space. The arrival to the larger experience of the Garden of displaced roots is from the east and west roads for better pedestrian, bicycle and vehicular access. The site promotes pedestrian motion hence the parking and visitor drop off is in proximity to the entrance.

The vehicular access to the site beyond the parking and drop-off is limited to food trucks to the east of central plaza, service vehicles to the loading dock and fire trucks during emergencies have a vehicular loop along the periphery of the built space.

As the users move from the site entrance to the central plaza, the spaces are sequentially choreographed. They view the grow houses which produce food through the large curtain wall systems, then the market which sells the produce followed by the restaurants that serve the produce as food.



- Legend
- Vehicular path
  - - - Pedestrian path

Resident Circulation

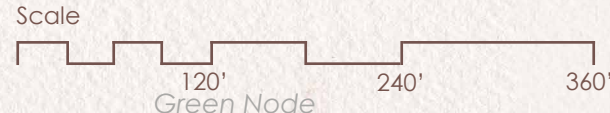
Visitor Circulation

Service Circulation



- Legend
- 1 Entry
  - 2 Dropoff
  - 3 Public parking
  - 4 Staff and resident parking
  - 5 Service entry
  - 6 Grow buildings
  - 7 Public central plaza
  - 8 Food truck/ open exercise
  - 9 Nature trail
  - 10 Housing
  - 11 Private Social Plaza
  - 12 U-Pick zone
  - 13 Food and Beverage Plaza

Site Plan





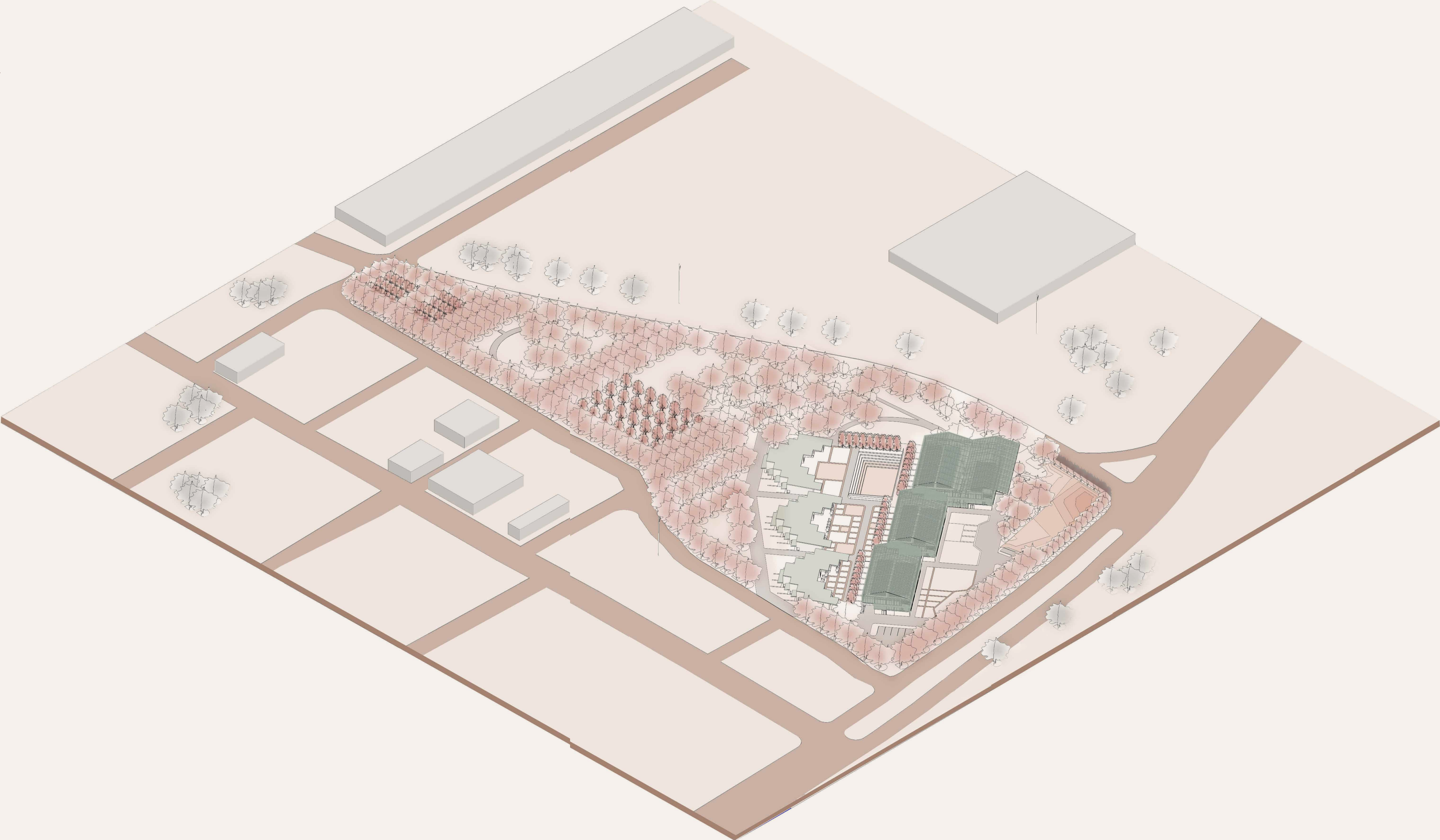
# Site Axonometry

Both a **destination** and a **journey**

The grow house and central plaza serves as both a destination experience, as well as a node in the green mile journey. As visitors move along the axis, the project uses multiple framed openings to create a focus on the central plaza. This framed space is a space of gathering and movement that captures the collective energy of the residents and visitors to engage in active dialogue.

The central plaza emphasizes gathering and food cultivation. A grid system of pathways in the central plaza encloses English kitchen gardens and social spaces. The grid spaces have varied scales to accommodate groups of varied sizes. The dense kitchen gardens growing herbs, fruits and vegetables give identity and provide privacy for the housing units. As the pedestrian pathways from the central plaza extend, it narrows and gestures toward the zone of existing trees, linking the built environment to the urban wilderness. It has multiple walking loops of different difficulty levels.

The large curtain walls of the grow houses promote the view towards the parking. Hence, the parking is shaded by a green roof which has a bigger role of reducing the heat island effect.



Site Axonometric view



# Site Details

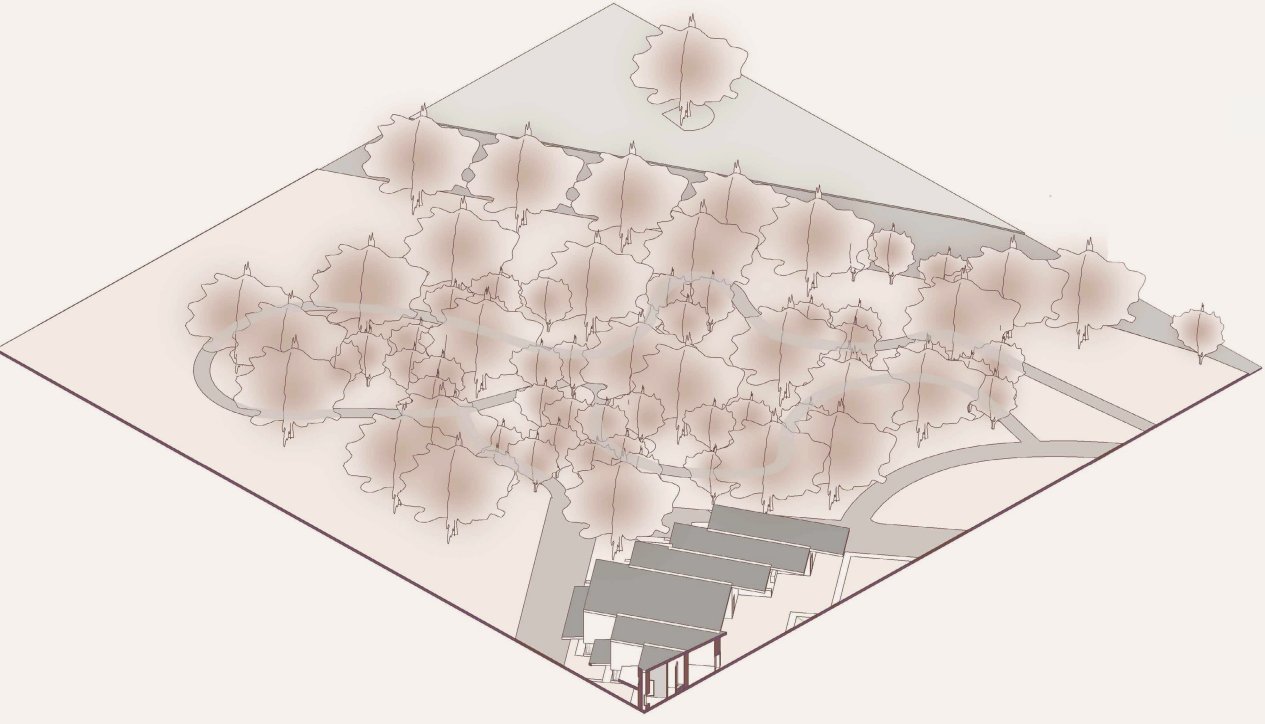
## Encouraging **pedestrians**

From the perspective of a car user traveling along this path, there is a sudden break in the roads with a line of trees which encourages pedestrian movement.

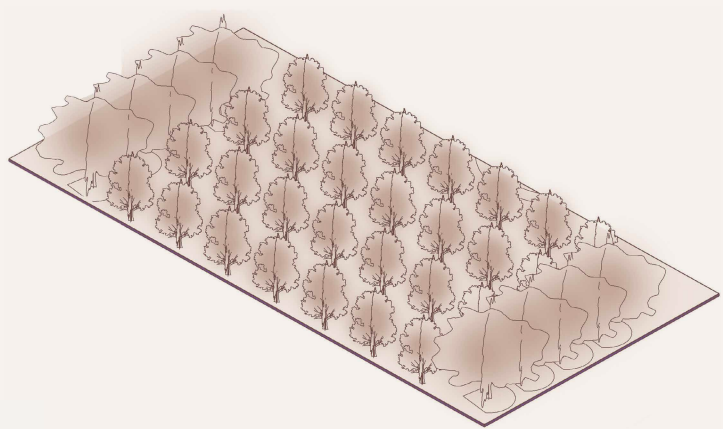
The row of tree layers is organized to separate and connect the differential programs which include two u-pick zones with a food and beverage zone located centrally. The u-pick zone involves native Texan trees of blackberry, fig, and pecan.



- Legend
- Low density
  - Medium density
  - High density
- Urban Wilderness



Walking trail



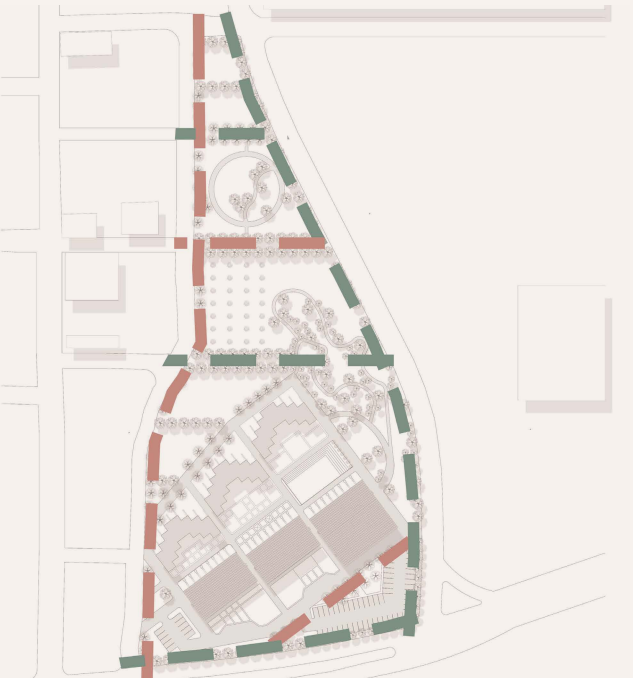
Low density u-pick

## Adopting the **neighborhood grid**

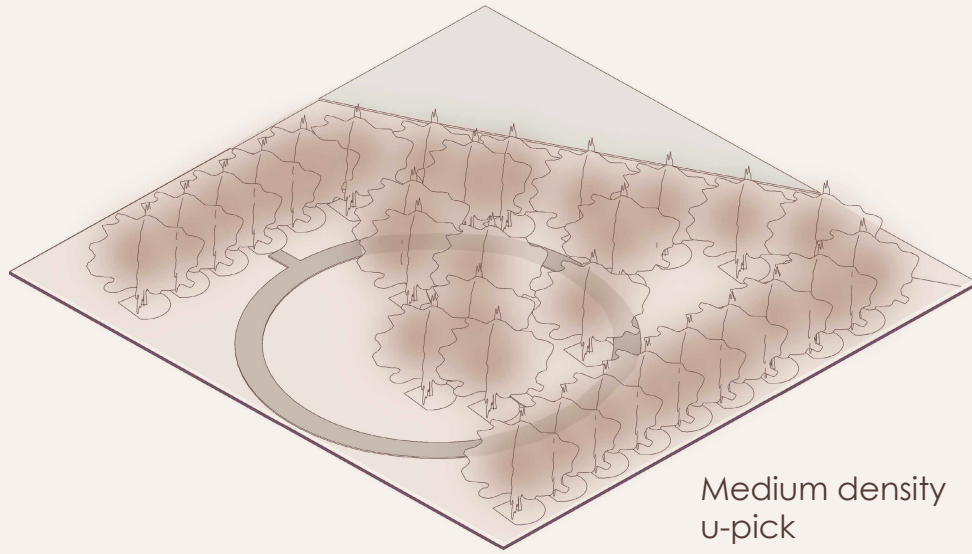
Arrayed from south to north, the landscape is organized into four different enclosures created by trees aligned along the linear path of roads. From this point, the planting density increases and begins to embody greater degrees of biodiversity.

## Planting the **enclosures**

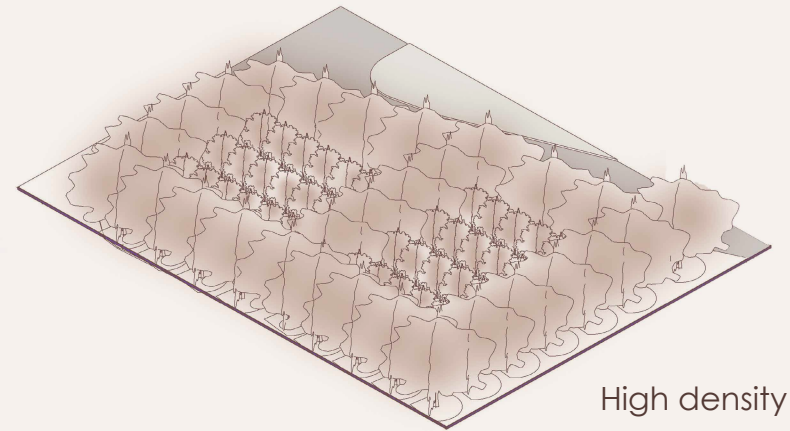
An array of trees run along the site's edge, easing the creation of enclosures. The trees include deciduous native trees on the west boundary and evergreen native trees on the east and south boundaries to maximize sunlight and heat gain in the greenhouses during the winter.



- Legend
- Evergreen trees
  - Deciduous trees
- Planting Design



Medium density u-pick



High density u-pick

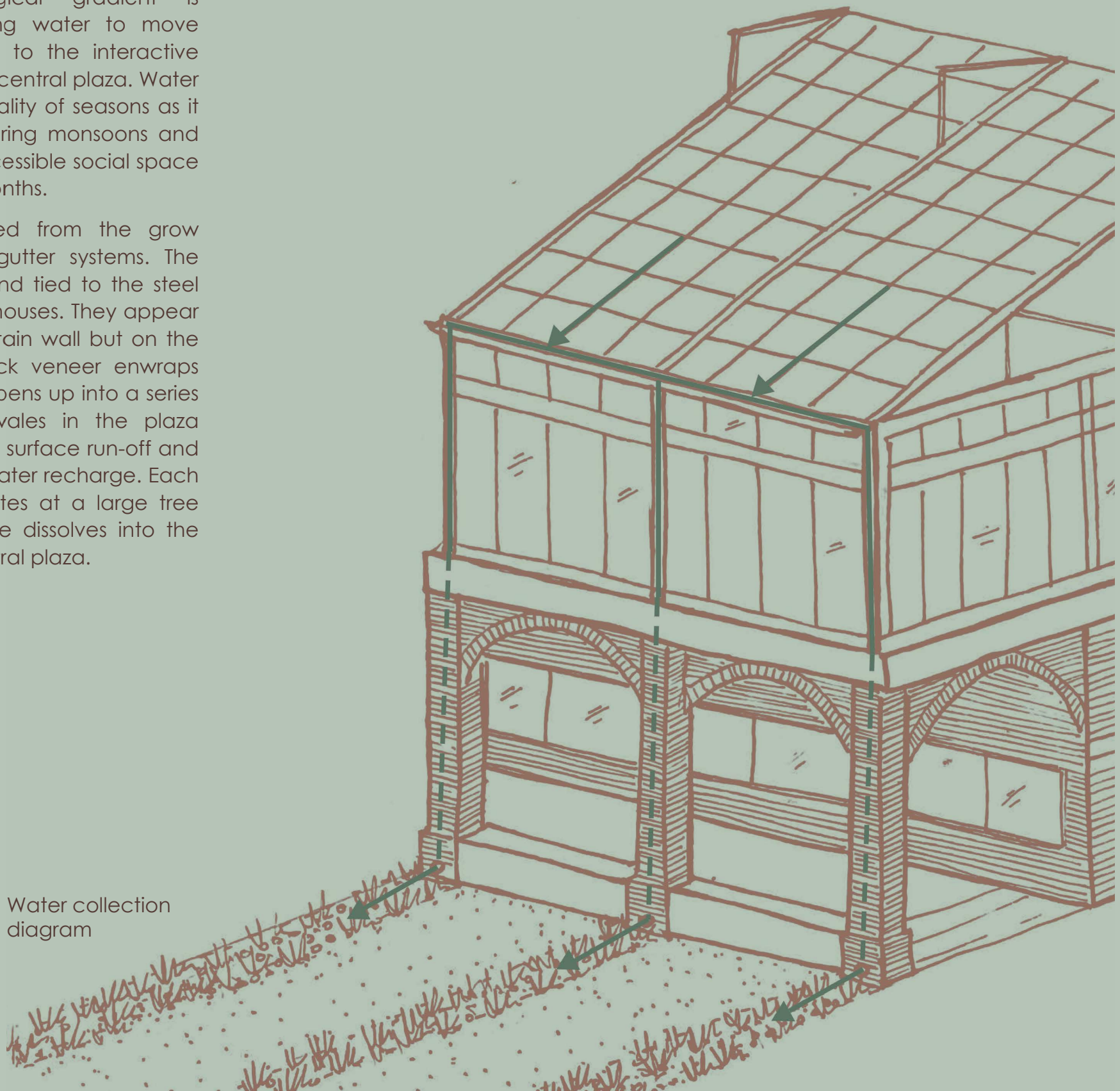




# Uninterrupting water flow to shape spaces

The site's hydrological gradient is uninterrupted, allowing water to move freely across the site to the interactive rainwater basin in the central plaza. Water basin displays temporality of seasons as it is filled with water during monsoons and transforms into an accessible social space throughout the dry months.

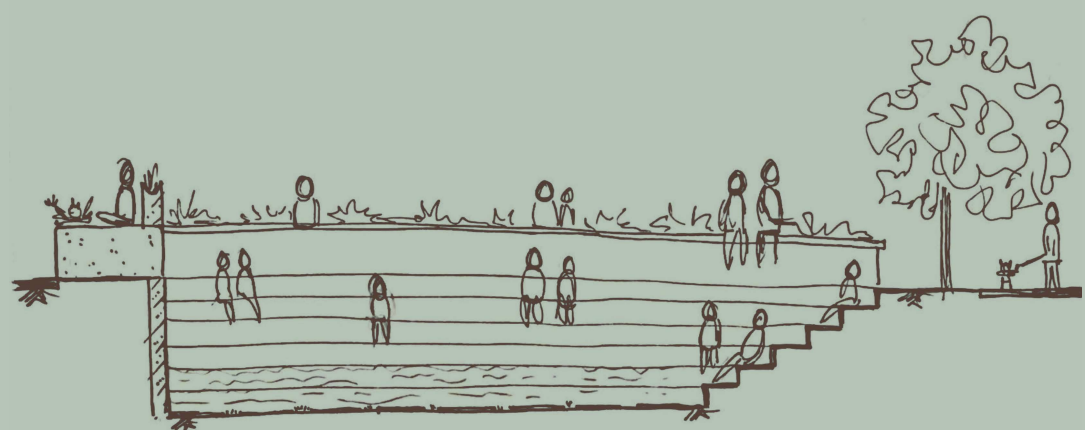
Rainwater is collected from the grow house rooftop with gutter systems. The gutters are aligned and tied to the steel columns of the grow houses. They appear exposed with the curtain wall but on the ground floor, the brick veneer enwraps the gutter system. It opens up into a series of parallel mini-bioswales in the plaza space to minimize the surface run-off and increase the groundwater recharge. Each mini-bioswale terminates at a large tree base. The architecture dissolves into the landscape of the central plaza.



Water collection diagram

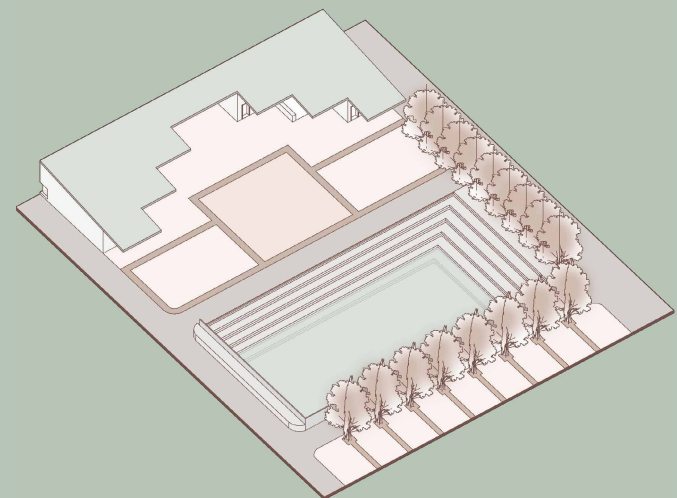
*Rooftop Rainwater collection*  
 Rain water harvested = 0.623 x Catchment area x Rainfall depth  
 Annual Rainfall depth= 34.7 inches  
 Catchment Area= 25,909 sq.ft  
 Rainwater harvested= 0.623 x 25,909 sq. ft x 34.7 inches  
 Rainwater harvested= 560 kGa  
 Assume: Efficiency of Rainwater harvesting system= 75%-90%  
**Total Annual Rainwater harvested= 420 kGa - 500 kGa**

*On-site Storm water collection*  
 Storm water runoff = (Catchment area x Rainfall depth) / 231  
 Catchment Area= 402,788 sq.ft  
 Storm water runoff = (402,788 sq.ft x 34.7 inches)/ 231  
 Storm water runoff = 60 kGa  
 Assume: Efficiency of Storm water harvesting system= 75%-90%  
**Total Annual Onsite storm water harvested= 45 kGa- 54 kGa**

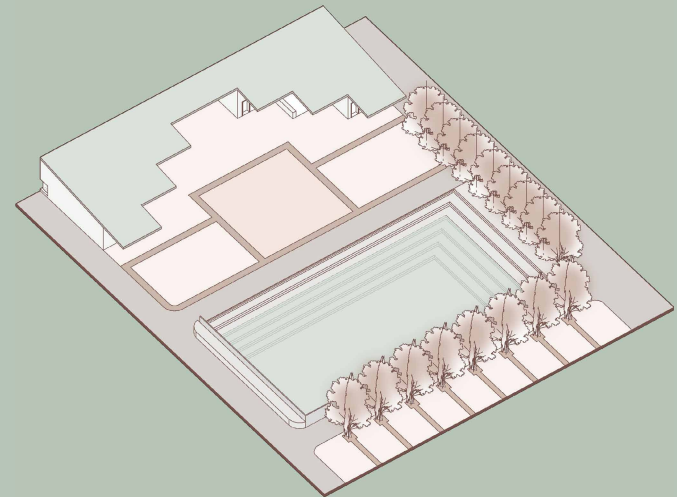


Concept diagram

# Temporality of water

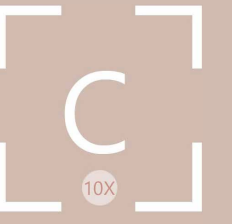


July (Driest Month)



May (Wettest month)

“WE SHAPE OUR BUILDINGS;  
THEREAFTER THEY SHAPE US.”



PART C

*Winston Churchill*

# Green Metropolis

*Architecture as a tool for  
Problem Solving*



# Grow house design

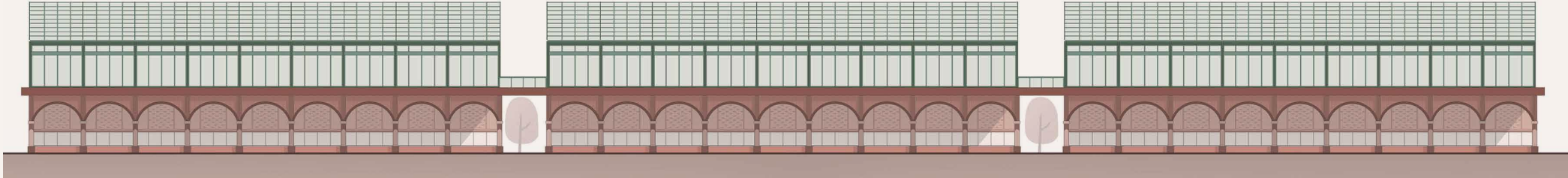
According to the international building code, the occupancy types are merchandise (M), assembly group (A2) and Utility (U).

## Allowing solar heating, ventilation and light

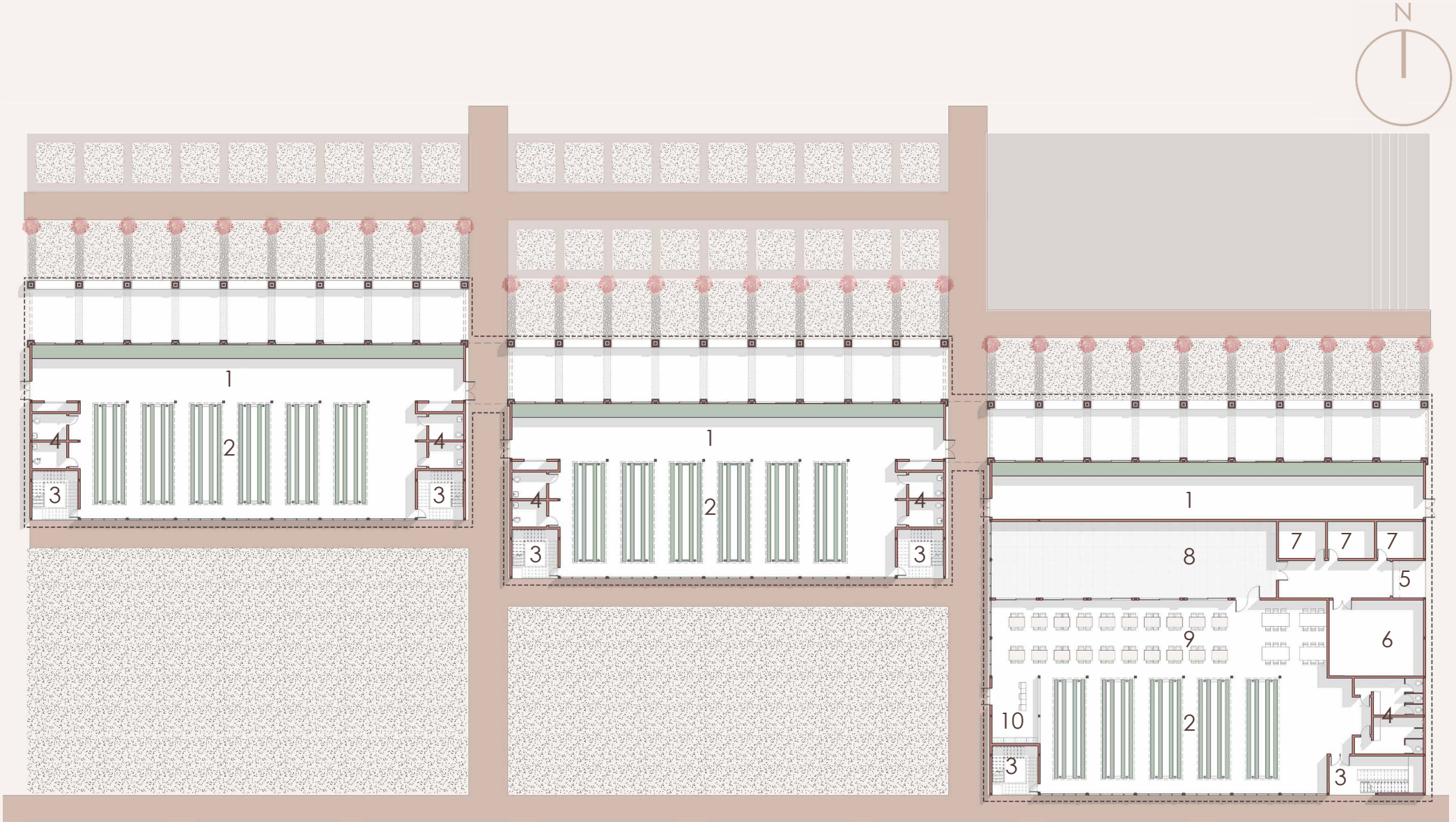
The project deploys three linear grow houses which are oriented along the cardinal direction. The building is organized on two floors. On the first floor, the grow houses are positioned towards the south to maximize the passive solar heating and market on the north to provide shade for users. The second-floor hosts just the grow house. Due to the stack effect, the hot air rises to the higher level while maintaining the market as a relatively cooler zone.

## Connecting spaces

The service blocks are positioned on the east and west ends of each of the three grow houses. It comprises restrooms for men and women, fire escape staircase and storage. The loading dock, cold storages, preparation area, and restaurant kitchen are located in the grow house with proximity to the service entry. The double-height restaurant dining is abutted by the growing beds in the greenhouses and the glazed windows of the kitchen to experientially educate the users.



North Elevation



Floor Plan - Level 1

Legend

- 1 Market
- 2 Grow House
- 3 Fire Escape Stairs
- 4 Restrooms
- 5 Loading dock
- 6 Prep Area
- 7 Cold Storage
- 8 Kitchen
- 9 Dining
- 10 Waiting Area





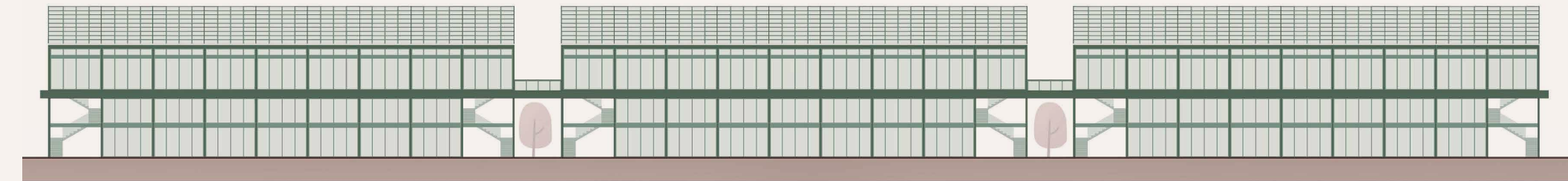
## Connecting spaces

The three buildings are connected on the second level by mini-bridges. The mini-bridge allows them to view the central plaza and urban wilderness.

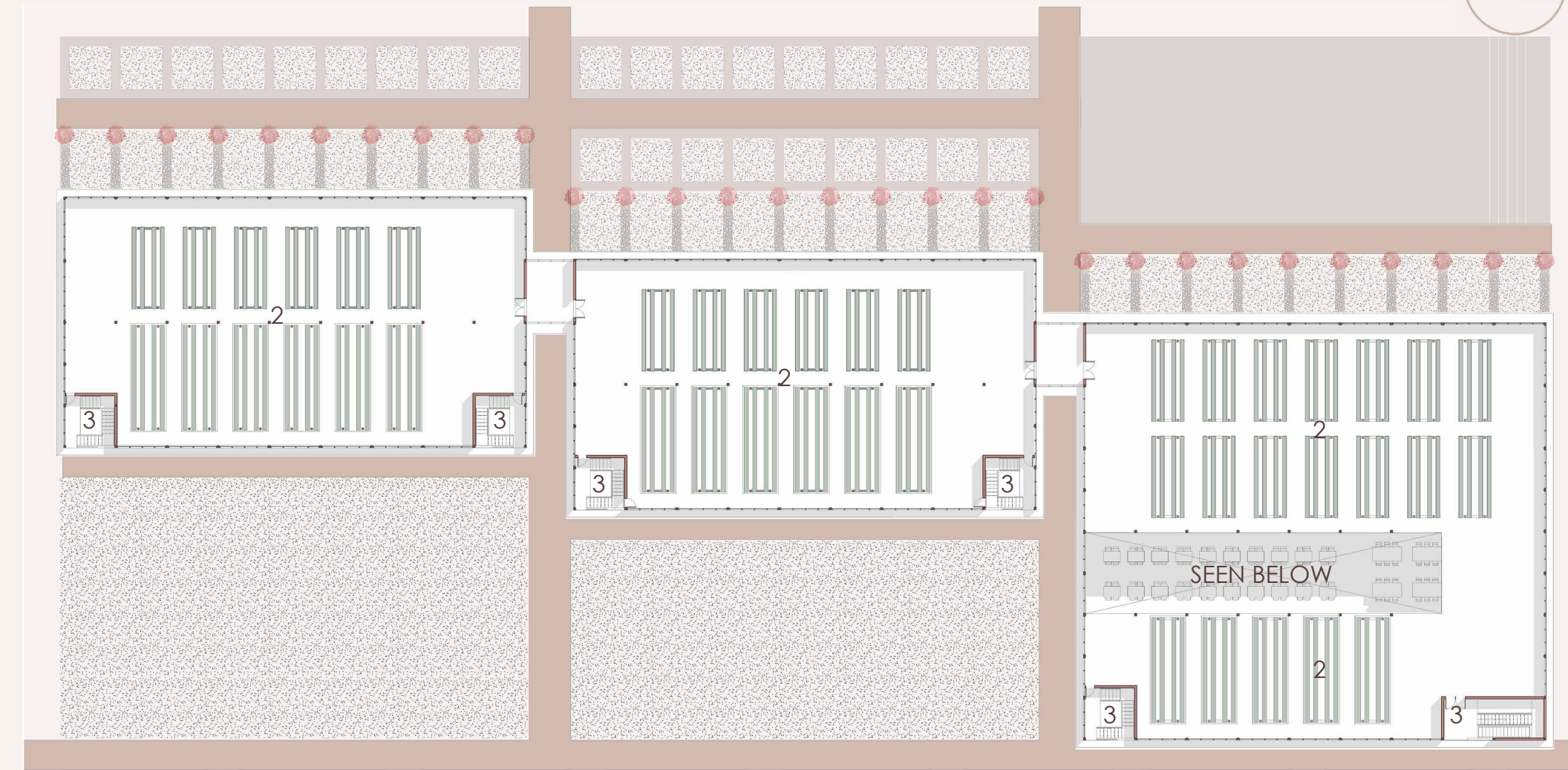
## Reading the *façade tectonics*

The large curtain wall envelope instills visual education of food grown in addition to the natural lighting and thermal function of the greenhouse. The type 2 construction building has a steel structure with a brick veneer on the first level and curtain wall system on the second level.

As the users experience the built environment from the central plaza, the clear distinction in function is reflected in material selection. The brick facade and arches evoke the traditional sense of the market in contrast to the diaphanous curtain wall system hung on a steel frame that enables viewing through a facade inhabited with life. Meanwhile, the user experiences the building tectonics of the south facade differently. The massive curtain walls evoke an industrial character when viewed from the parking lot.



South Elevation



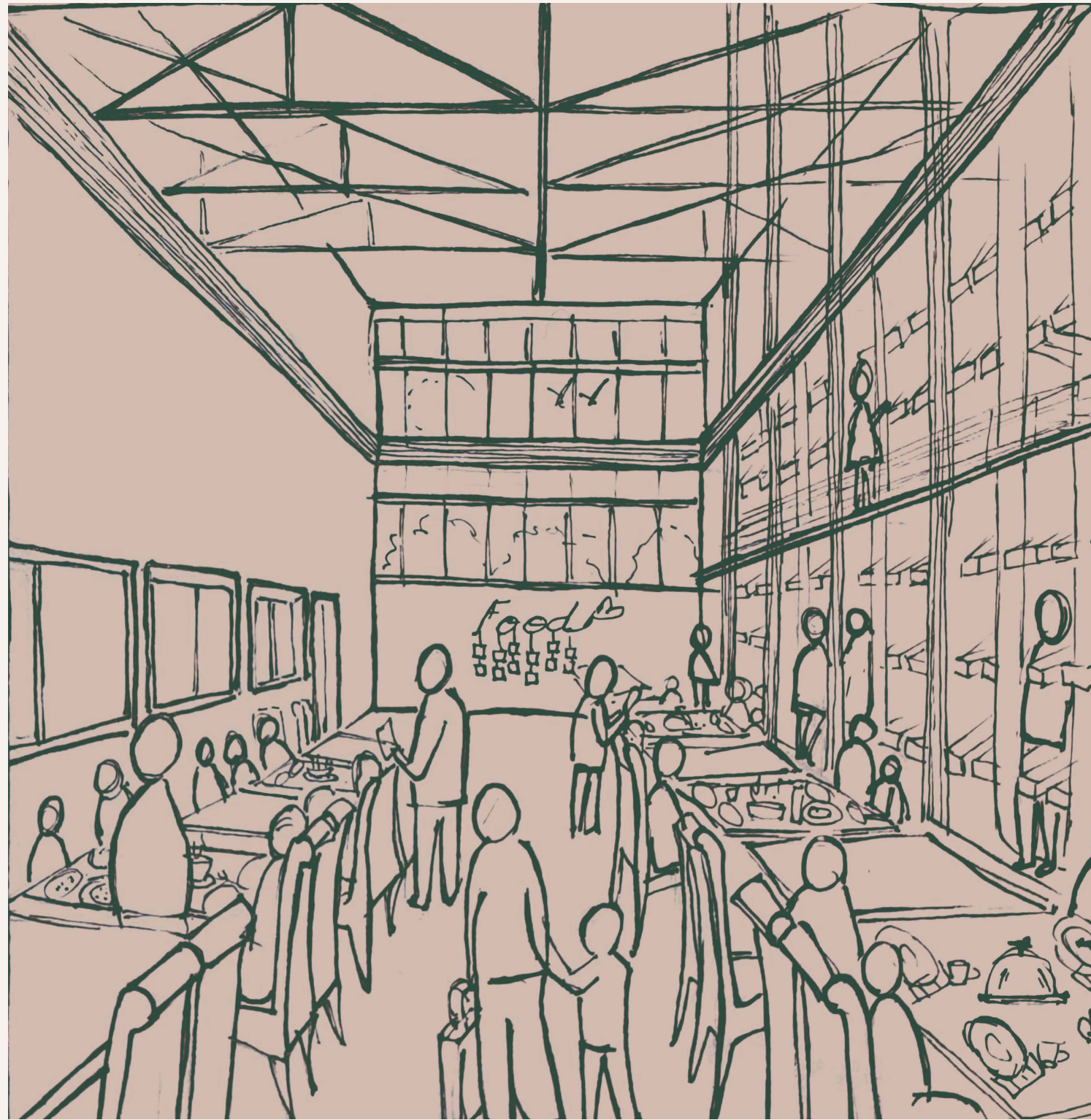
Floor Plan - Level 2

### Legend

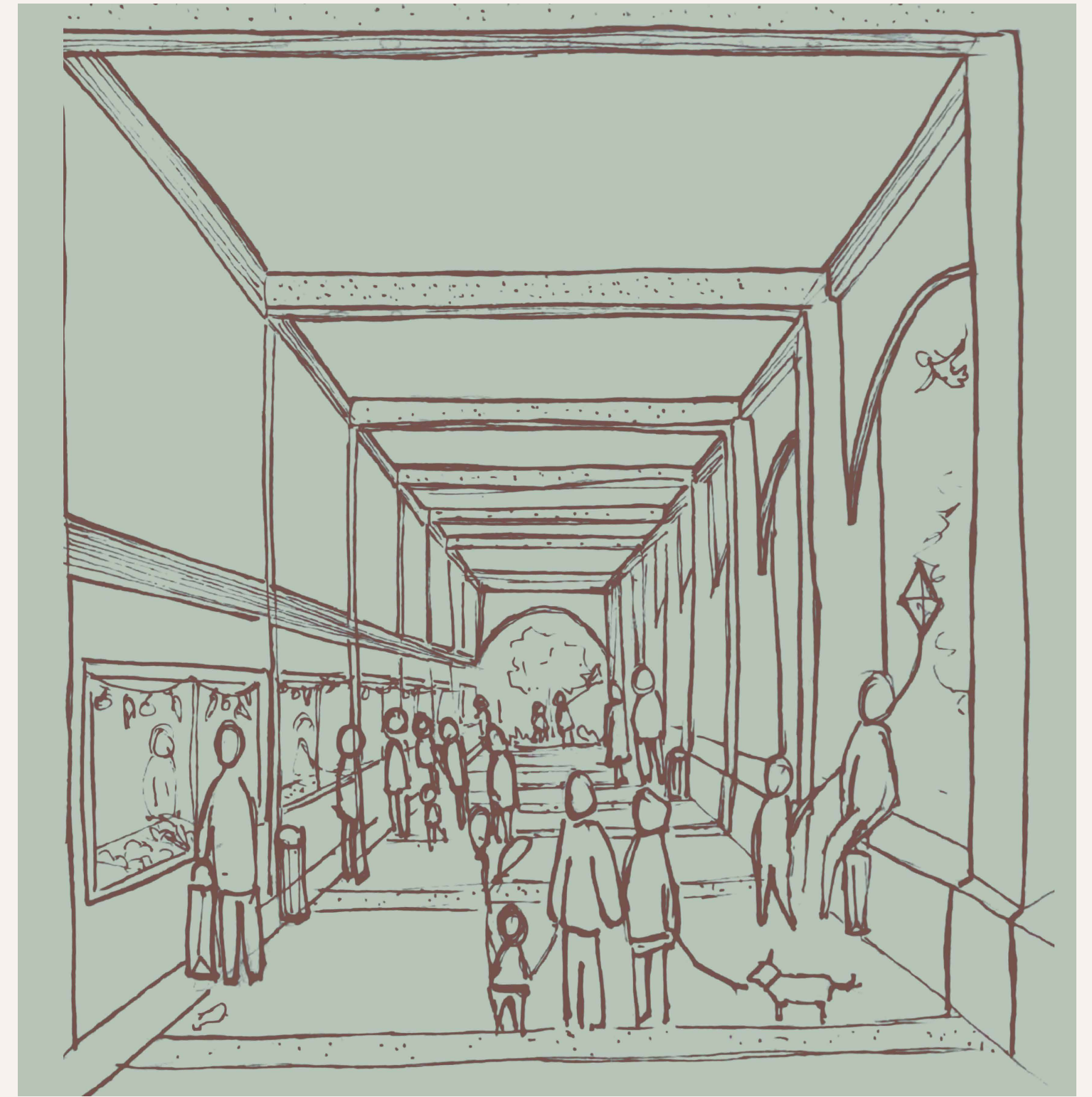
- 1 Market
- 2 Grow House
- 3 Fire Escape Stairs







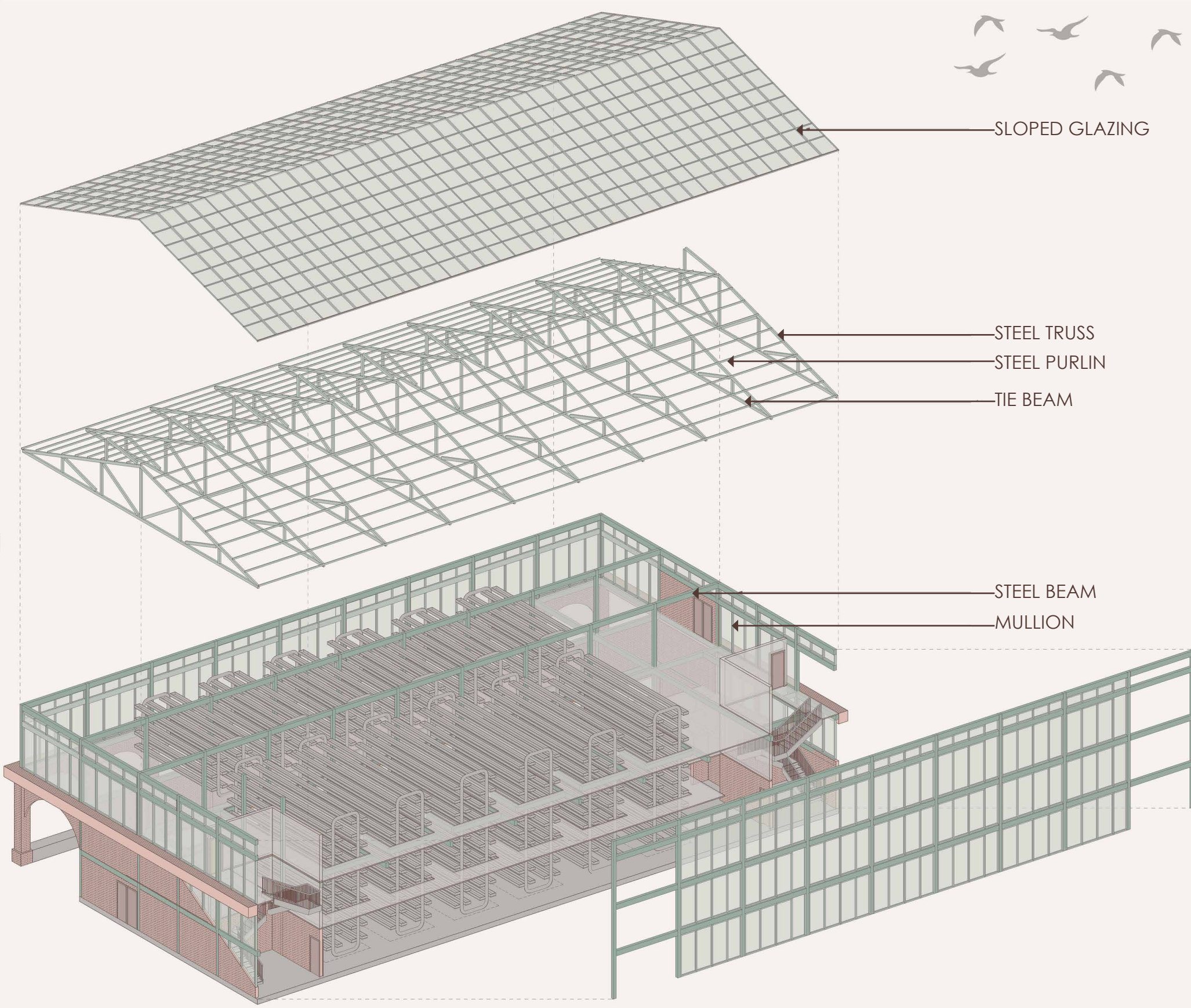
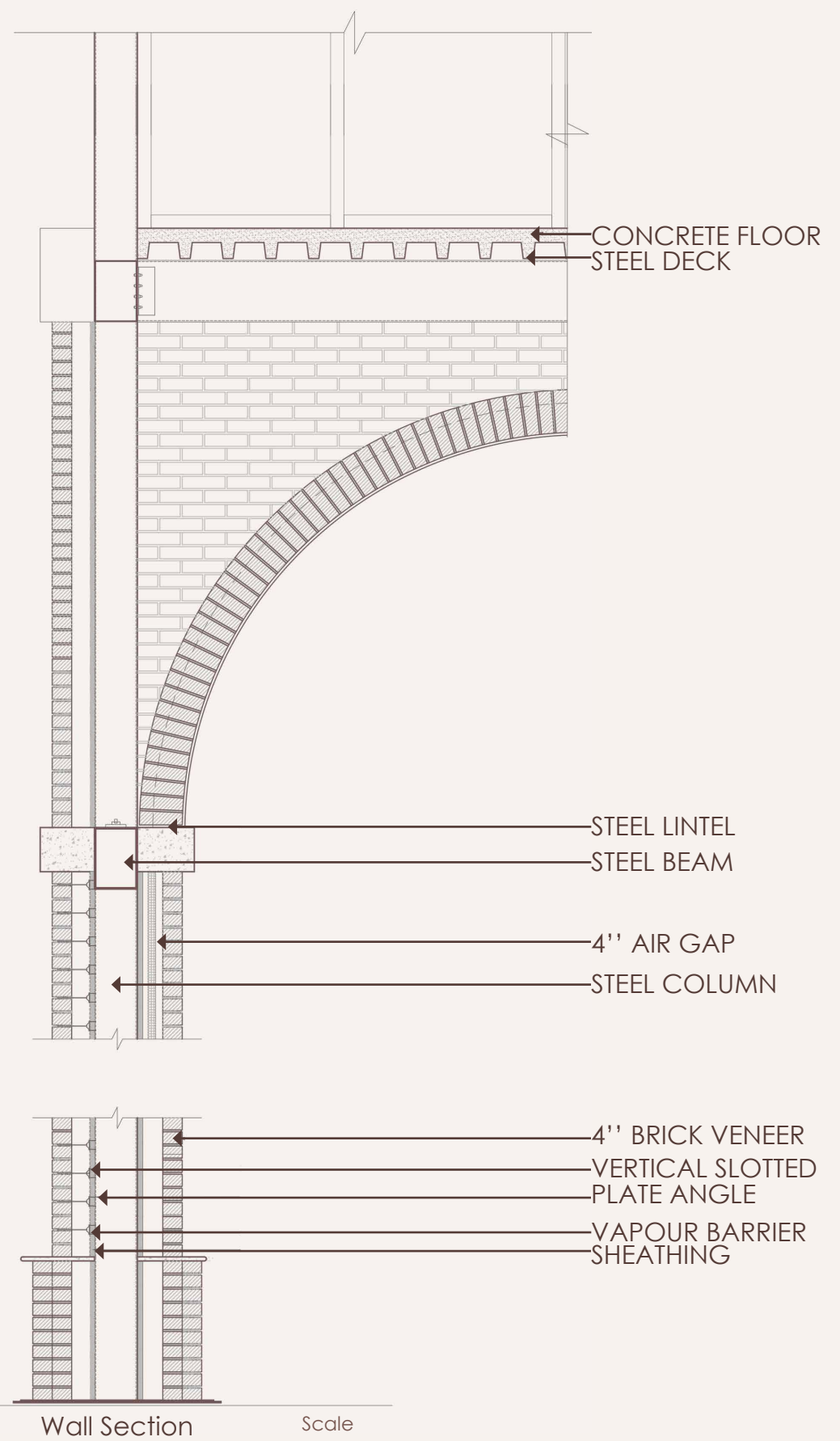
Interior view- Dining



Interior View - Market Pavilion



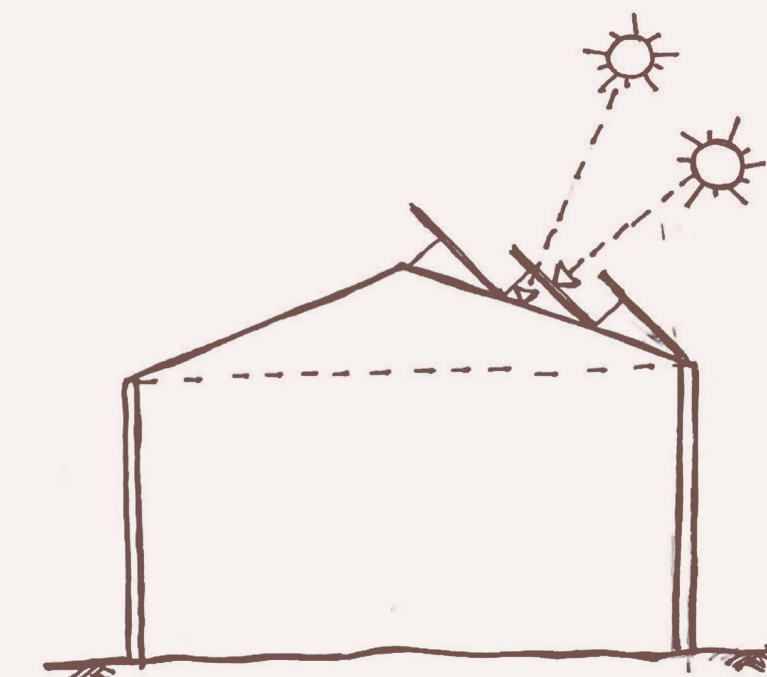
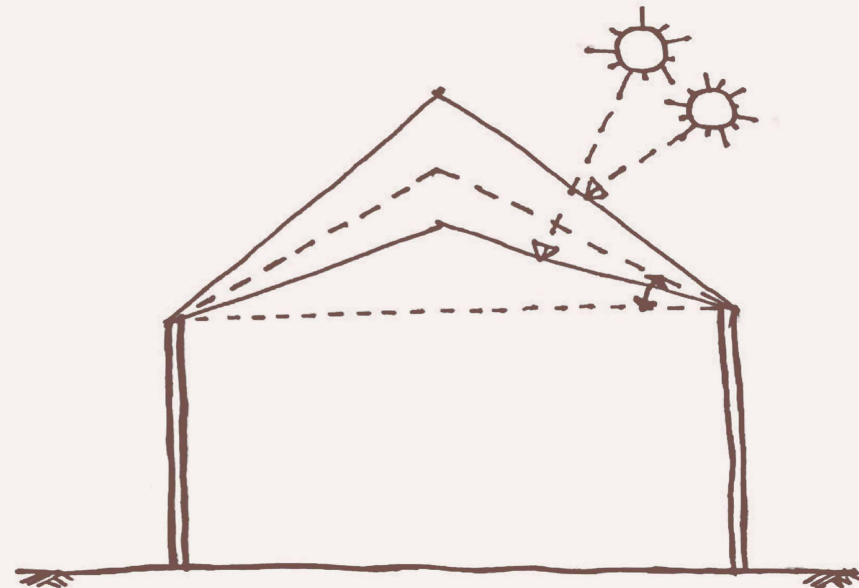
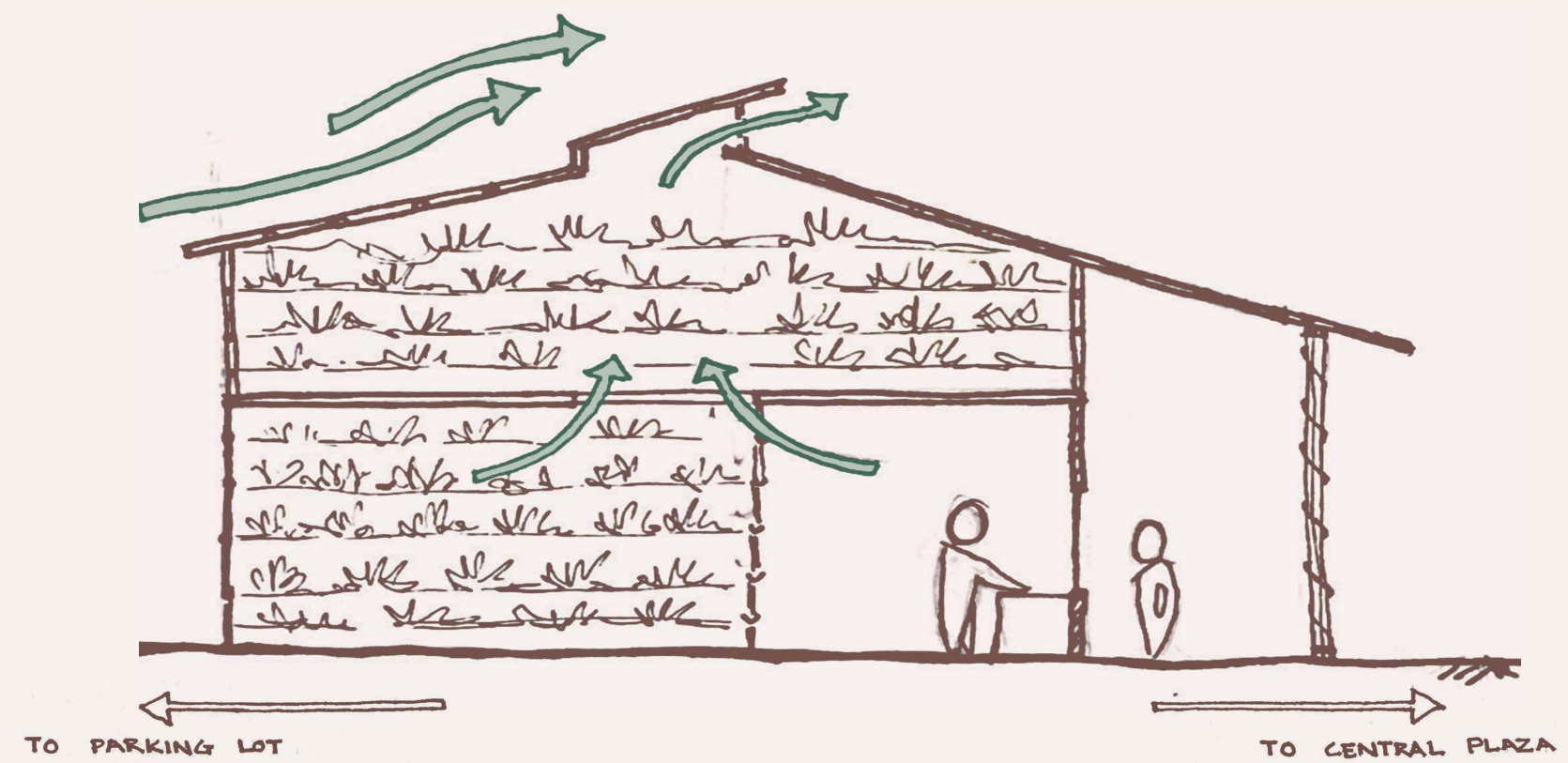
# Architectural Assembly



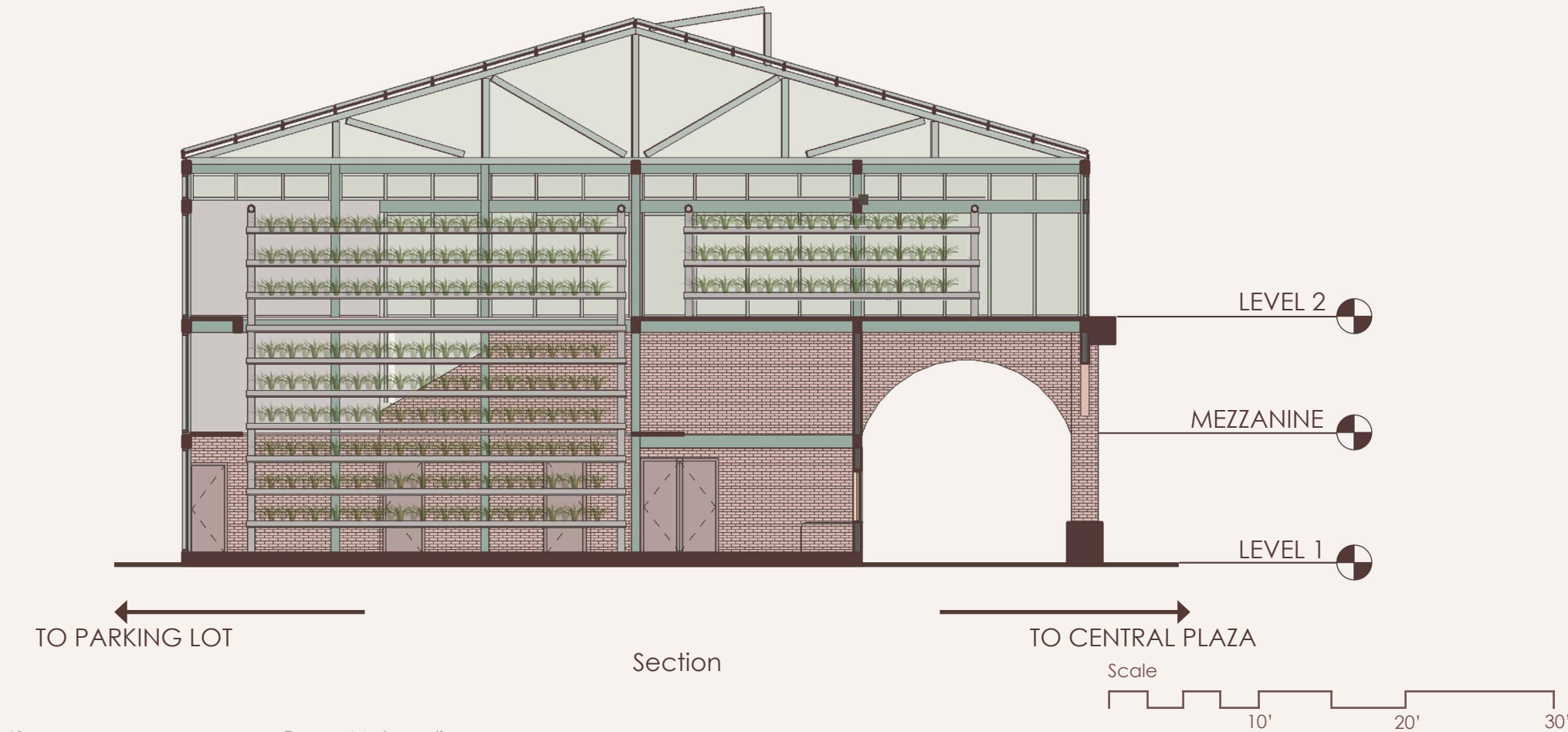
Axonometric View



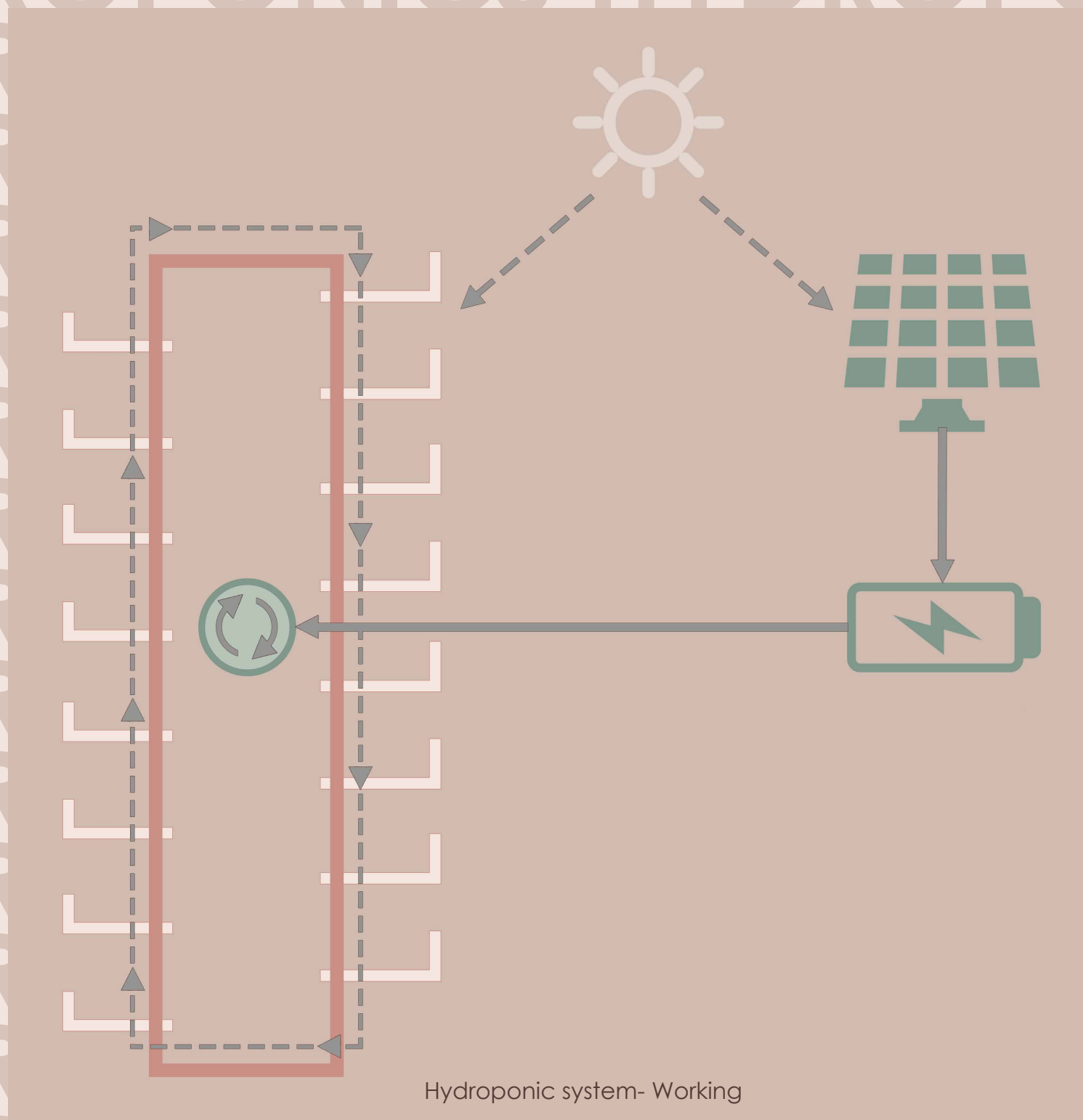
# Building systems



The building form has a glazed gable roof with a slope suitable for solar panel positioning.



Average direct solar radiation = 5.35 W/sq.ft/day  
 Roof area (south facing)= 12,950 sq.ft  
 Average daily solar power = 70 kW/day  
 Assume: Number of cloudy and rainy days= 20  
 Average annual solar power = 70 kW/day x 345  
**Average annual solar power = 24,150 kW/year**



### Producing **food in all seasons**

Texas has extreme climates during different seasons. Hydroponic systems ensure lower risk, increased viability, cost efficiency due to higher growth rate, year-round food production, minimal use of resources, and nutrient efficiency.

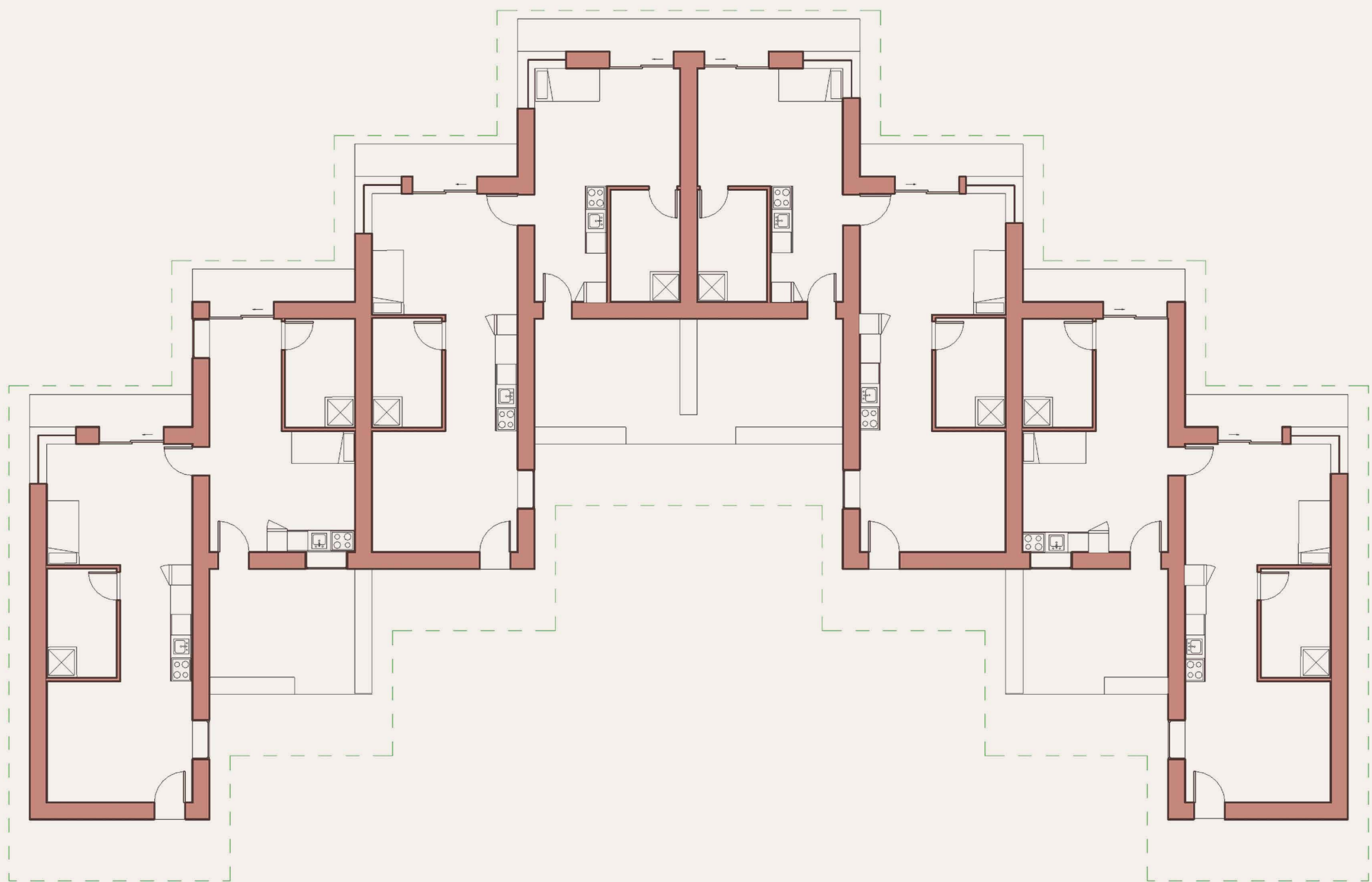
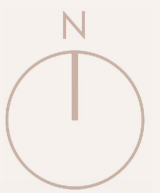
The hydroponic system continues from the ground floor to the second floor. The first level has a perforated metal floor mezzanine for easier access to the growing beds for the workers. The floor slabs have perforations for lighting. The hydroponic system is designed to cycle its growing beds on a conveyor system. The growing beds are fed with water at the bottom segment of the conveyor system and they receive more natural lighting on the higher segment of the conveyor system on the second floor. The system uses the solar power generated to cycle the growing beds using a pump.

### Lighting to **maximize growth**

In addition to natural lighting, the hydroponic system has integrated artificial lighting since different plants grow at different rates with different wavelengths of light. For example, tomatoes require shorter wavelengths of light like blue whereas the lettuce requires higher wavelength light colors like red and orange.

# Living with community

According to the international building code, the shelter home occupancy type is Residential (R2).



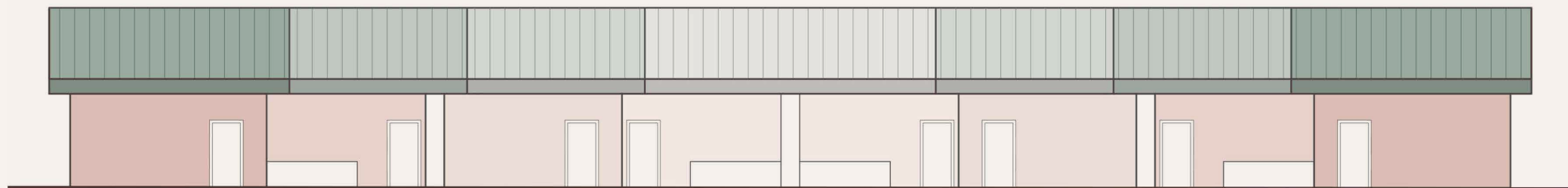
Housing Plan

## Living with community

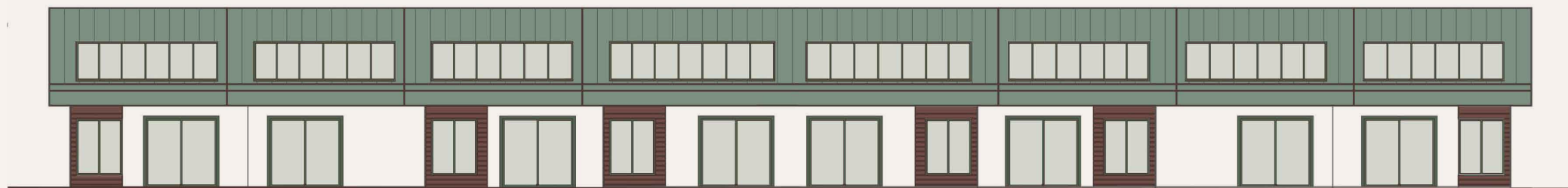
The homes as a shelter initiates sustainable living in a comfortable space that is economically profitable and aesthetically appealing. This integrated community is building a sharing platform that will meet the aspirations of the users and be a catalyst for better communication between the formerly incarcerated collective and community.

## Reinforcing individuality through privatization

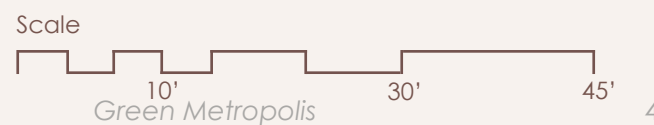
The housing prototype separates the social space as public spaces towards the central plaza and private spaces. The staggered layout maximizes natural lighting within the units and social space enclosures of both privacy levels. All 24 single-story live-work homes have a flexible plan with a sense of intimacy and individuality.



South Elevation

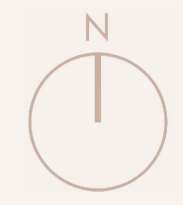


North Elevation





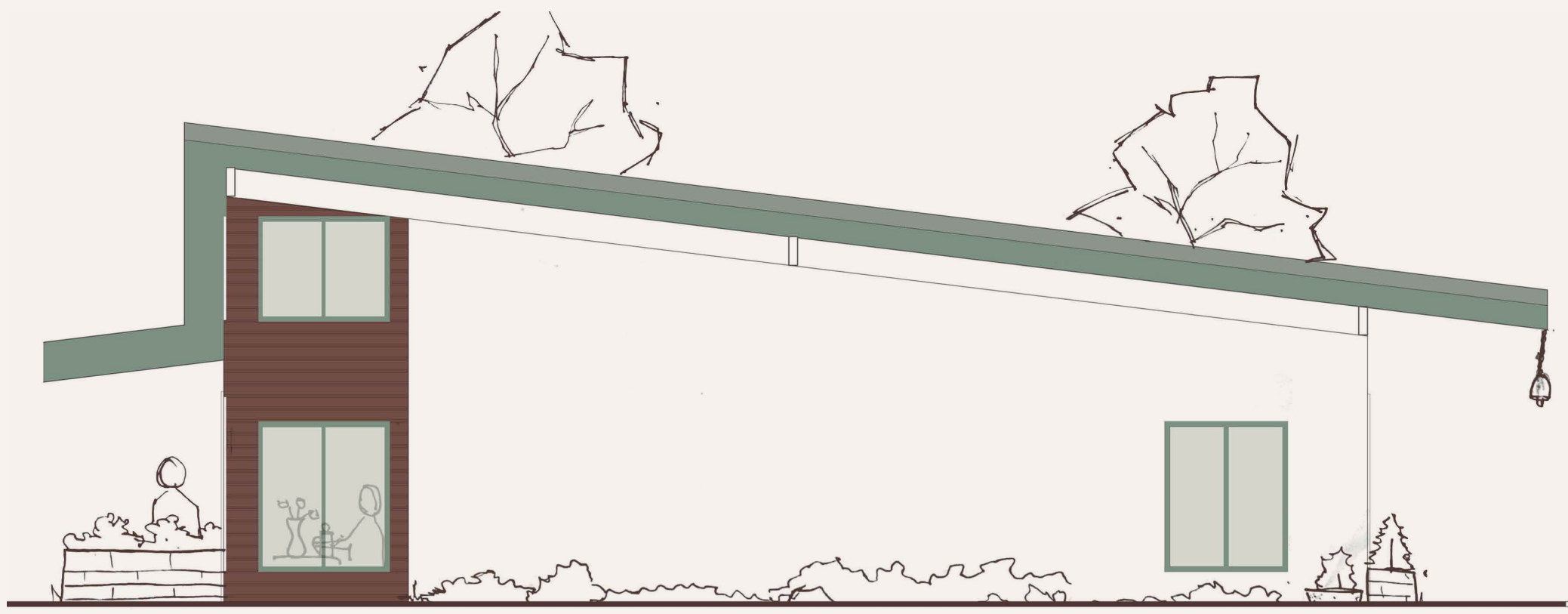
# Home design



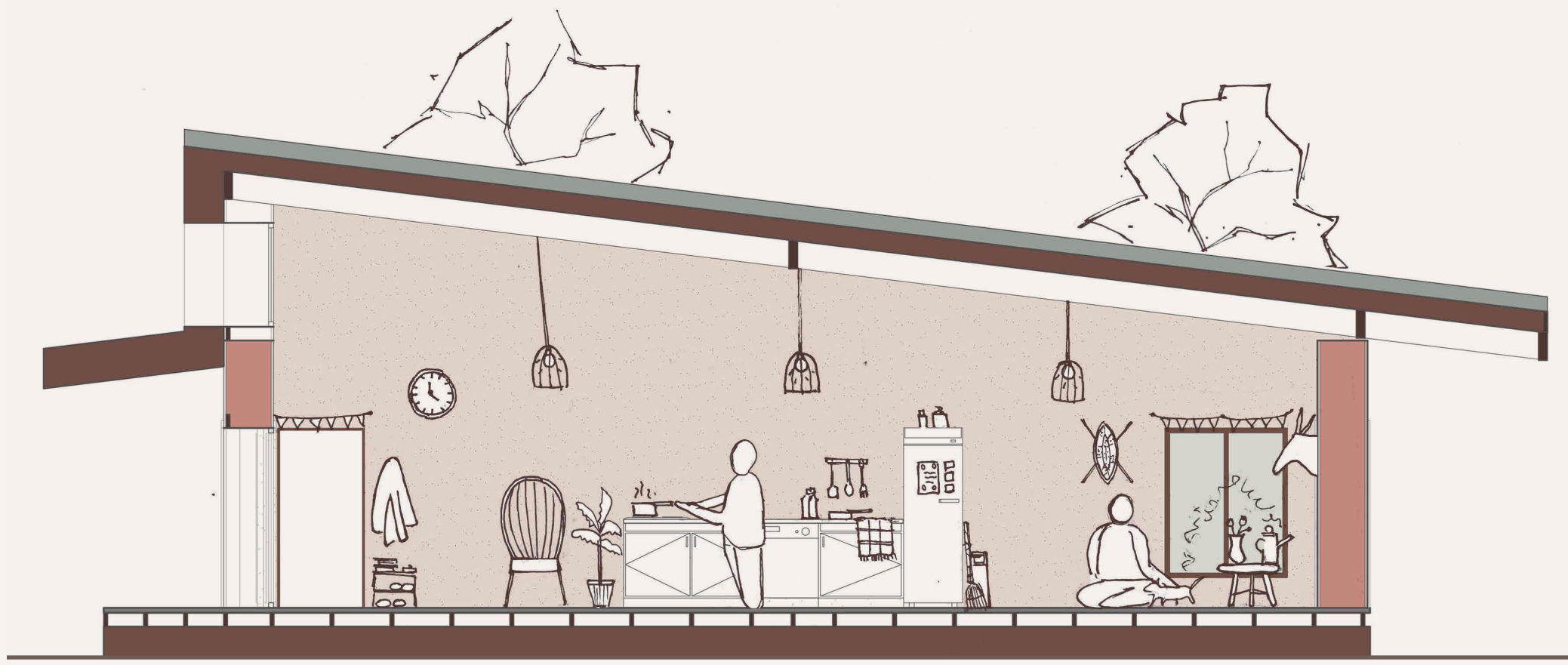
Every unit has a separate sleeping space with north lighting and proximity to the private garden. The workspace is located in proximity to the central plaza public space on the south side. The workspace can be closed to function as a kitchen or semi-open to function for cultural activities like pottery and other crafts. The kitchen and restroom act as the buffer between the live and workspaces.

## Achieving energy efficiency

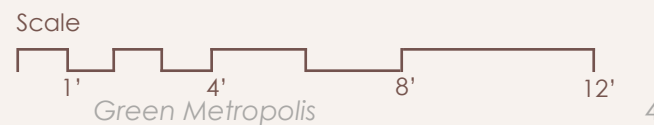
The units have simple single pitched south sloping roofs to drain the rainwater to a direction and accommodate solar panels for photovoltaic electricity. It features energy efficiency due to the simple passive ventilation design by the linear positioning of fenestrations, the use of photovoltaic electricity, and natural north lighting through the clerestory windows.



West Elevation

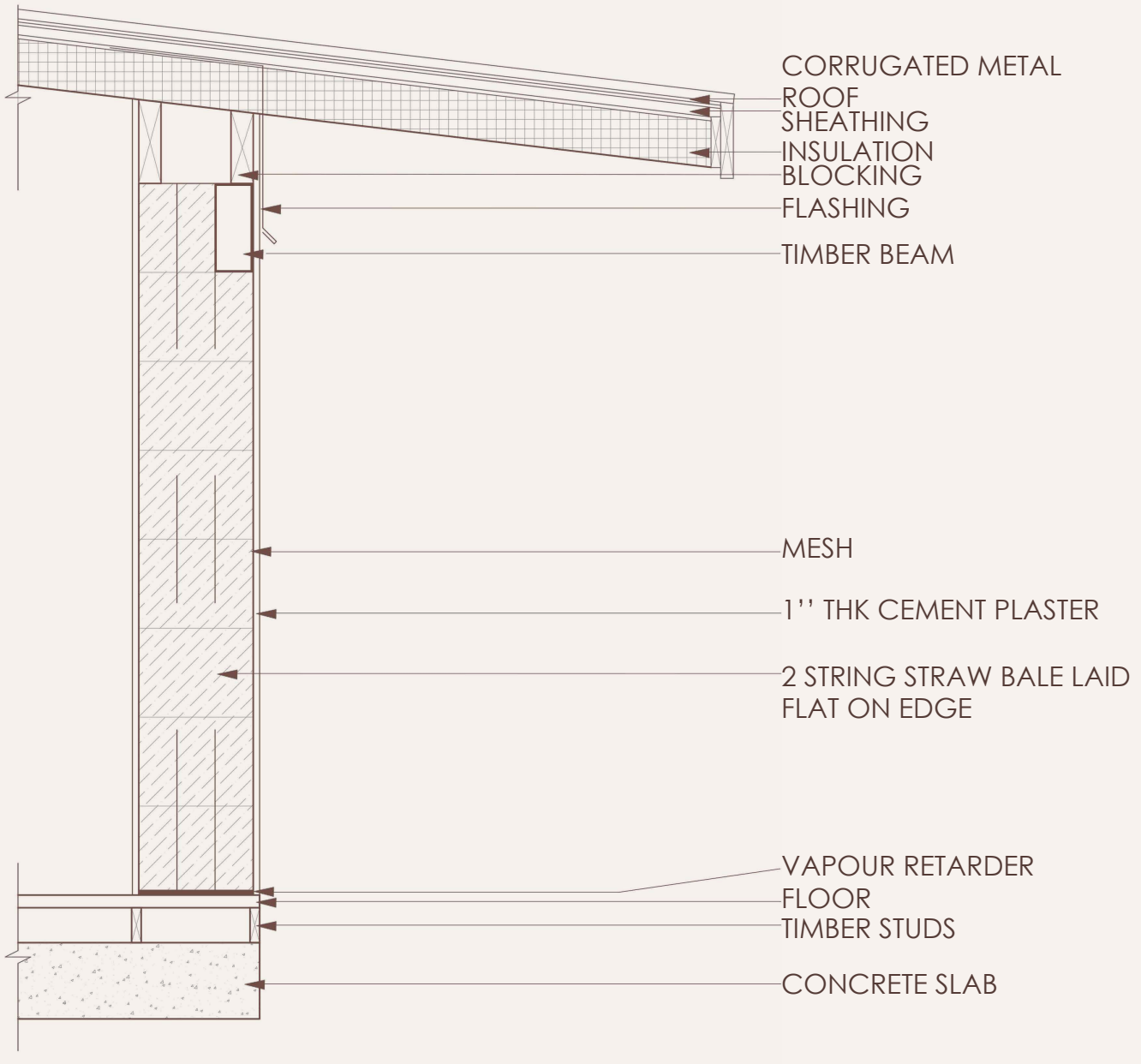


Section





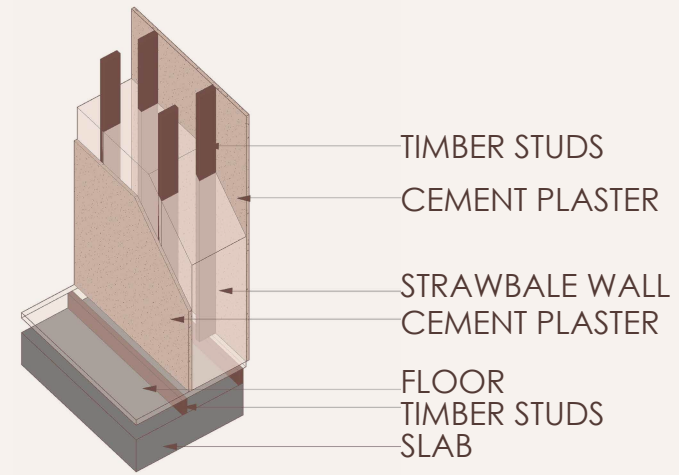
# Architectural Assembly



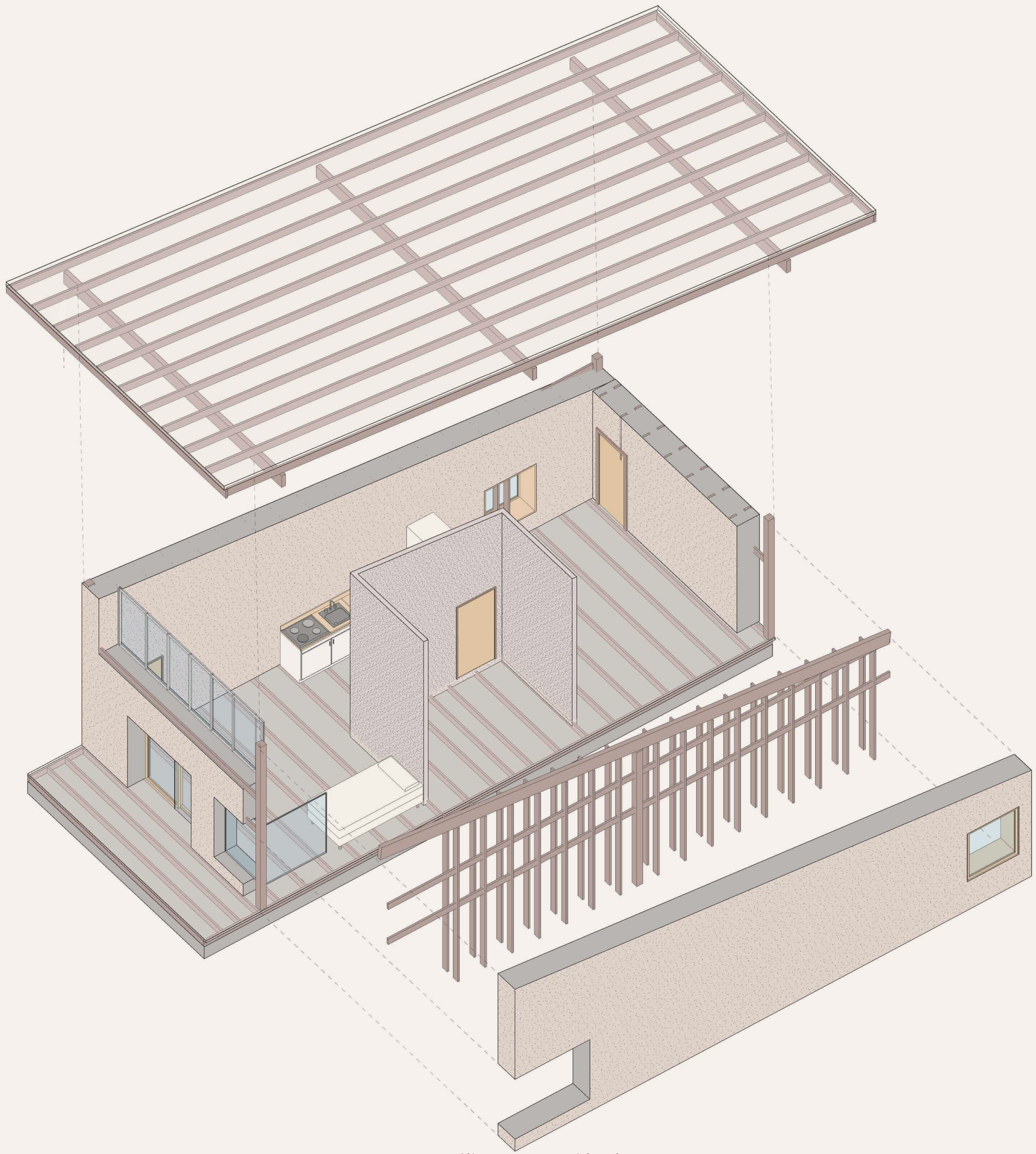
Wall Section

## Building with locally available resources

The housing units have minimal impact on ecological resources. The straw bale infill between the timber framework delineates the units with corrugated metal sheet roofing. Both straw bales and timber ensure less wastage of resources, transportability distance less than 200 miles and reusability. Although the units are oriented along the north-south axis, the interior temperature is lower due to the straw bale walls with cement plaster. Cement plastered straw bale walls provide thermal mass, insulation, and improved fire rating.



Wall Section



Site Axonometric view



# Conclusion

*Norman Foster*

**“AS AN ARCHITECT YOU CAN DESIGN FOR THE PRESENT, WITH THE AWARENESS OF THE PAST, FOR A FUTURE WHICH IS ESSENTIALLY UNKNOWN.”**



The sketch portrays a place for all. Each plant represents individuals with different cultures, tradition and religion. Each plant is nurtured by satisfying their individual requirements (support for creepers, water for lotus) and collective requirements (water and sunlight for all plants) to reinforce a sense of individuality and sense of community.

The essence of the project was to utilize design as a tool for problem-solving. The Green mile connection strategy ties a neighborhood together, enhancing and solidifying its identity as an agro-tourism destination.

The model can be implemented to revive other cities and further alter the dialogue between food production and population growth. The business model aids a thoughtful investment to empower formerly incarcerated individuals instead of mere charity. Similar projects can house and empower different less privileged groups like the homeless, orphans and refugees by understanding the user needs to use design as the tool for problem-solving.

## About the author



Neethi Joseph is an aspiring architect. Her childhood hobby of playing with legos and her passion to sketch and experiment colors of nature on canvas attracted her to the art of building. Years later, when these inborn interests coupled with her resolve to truly make a difference, she chose architecture as a career.

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- [7] Yu Media Group. "Waco, TX - Detailed Climate Information and Monthly Weather Forecast." *Weather Atlas*, [www.weather-us.com/en/texas-usa/waco-climate](http://www.weather-us.com/en/texas-usa/waco-climate).

The Garden of displaced roots presents how different scales of design is used as a tools for problem solving. Architecture can empower the diverse voices of the public realm and the environments in which they exist.



NEETHI JOSEPH