

Frankfurt University of Applied Sciences | FB 1 Architektur | WS 20-21 | M.A. Master Architektur | M.Sc. Master Advanced Architecture

T10 | HOUSING CONSTRUCTION IN AN INFORMAL NEIGHBORHOOD IN COCHABAMBA - BOLIVIA

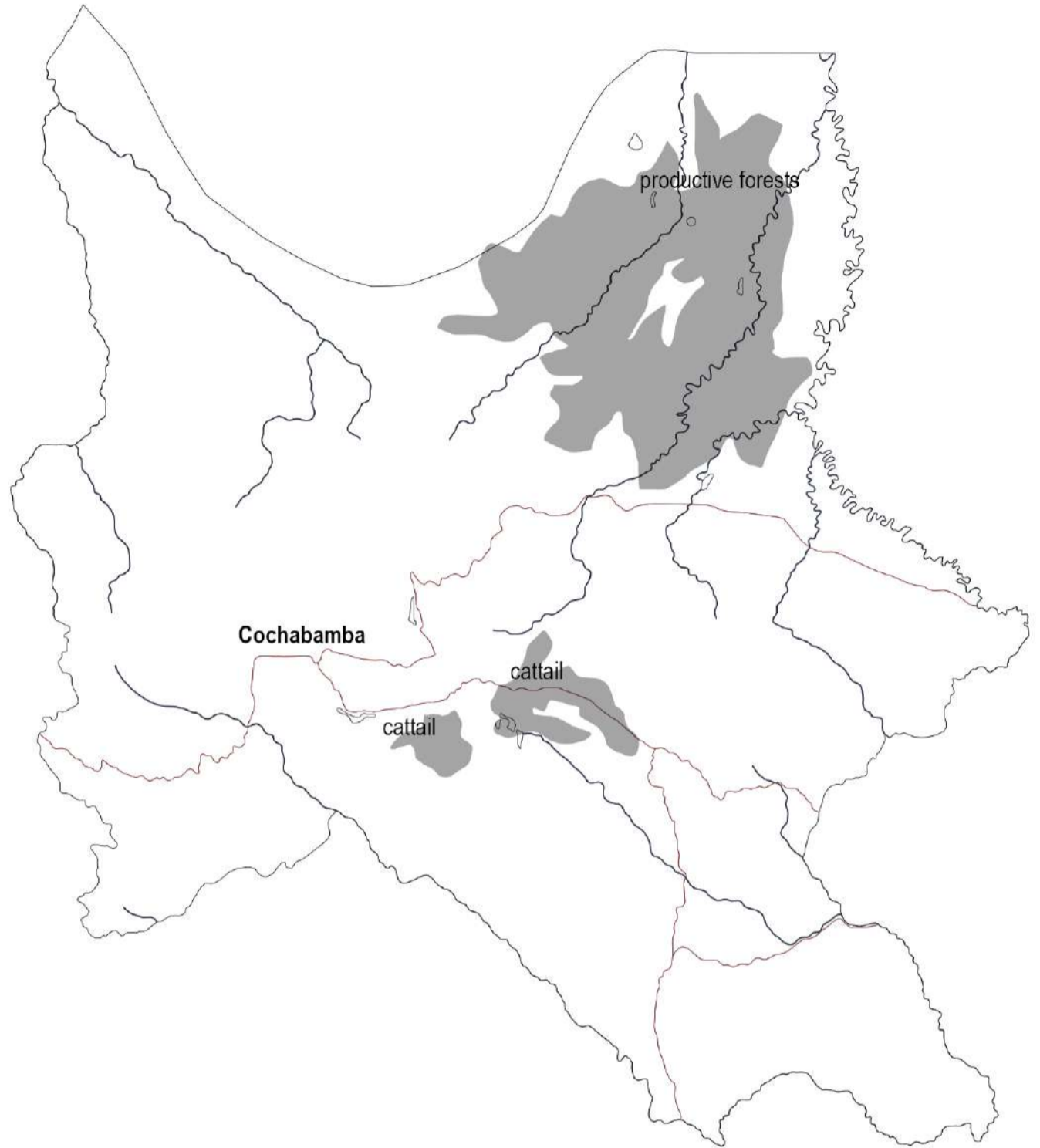
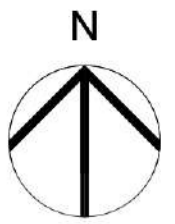
Tutors: Prof. Tatjana Vautz - Prof. Dr.-Ing. Michael Peterek

Student: Javier Fernando Challapa Miranda | M.N. 1292082



PRELIMINARY DESIGN - COCHABAMBA

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Situation description

The lack of urban planning of outskirts neighborhoods, due to their informality, did not contemplate adequate areas for green areas and common facilities, added to this, the low perception of economic resources by the local municipality and the prioritization of a multiple courts over other basic facilities and not taking into account the needs of women's groups, youth and children, results in the absence of public space. Spaces for interaction are improvised in private houses or most likely in the streets, which do not provide adequate conditions for their proper development. In addition, the predominant economic activities: informal commerce, construction trades and transportation, demand that parents are absent from their homes most of the day, leaving children and teenagers in charge of them. The absence of public space and the lack of control in the homes of this young population means that they spend most of their time in the street and are prone to be influenced to negative activities such as gangs, alcoholism, vandalism and violence. All this leads us to think that the strategy should not only respond to the basic and obvious need for the materialization of spaces, but also contemplate the participation of everyone in their design, construction and maintenance, which promotes social cohesion with sustainable approaches.

The project

The aim of this project is to design an alternative solution of urban interventions and constructing social housing based upon social participation and ecological awareness in Junta Vecinal Plan700 San Miguel – an informal neighbourhood located in district 8 in the south part of the city of Cochabamba, hosting 284 lower income families. The project seeks to show the possibilities of implementing participative projects with sustainability focus. Using local and recycled materials, sustainable energy, grey water systems management, rain water harvest systems and self-construction strategies involving the neighbours.



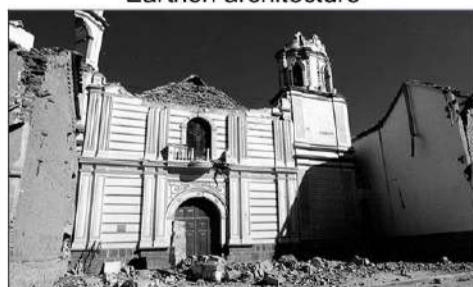
Timber production



Earthen architecture



Lack of water



Seismic susceptibility



Ayni - Mutual help



Migratory phenomenon

PRELIMINARY DESIGN - LOCATION

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Plan 700's Location

Camping

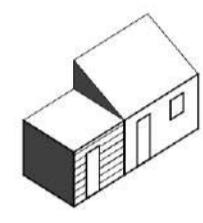


Land takeover

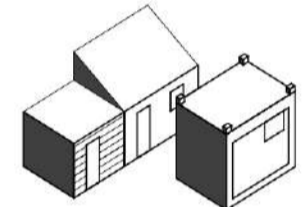


Improvised housing

Unconsolidated settlement

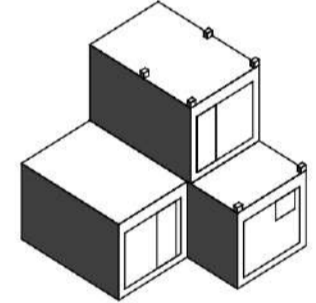


Basic rooms construction



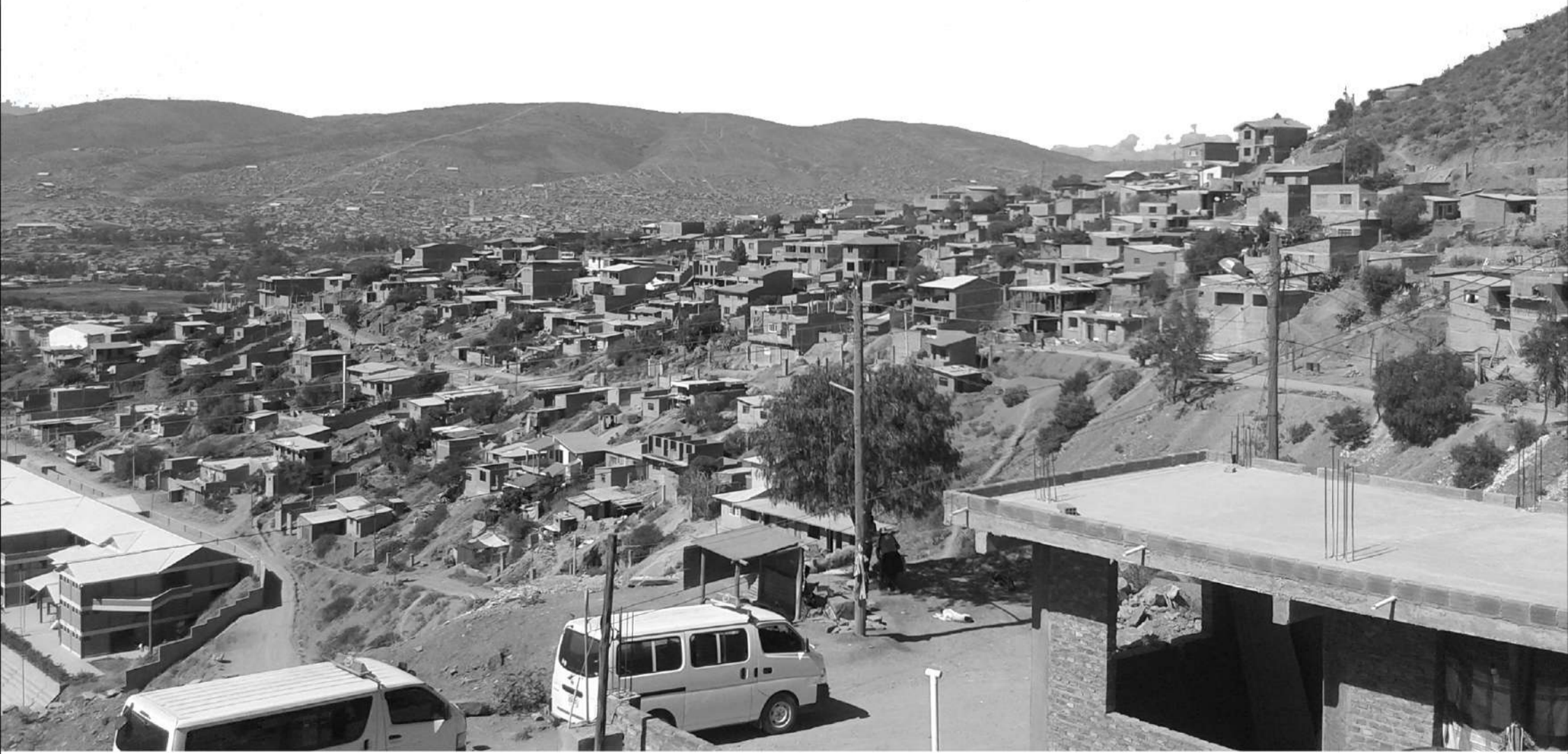
Reinforced concrete structure rooms

Saturated settlement



Unsupervised housing growth

Informal Neighborhoods



PRELIMINARY DESIGN - URBAN ANALYSIS

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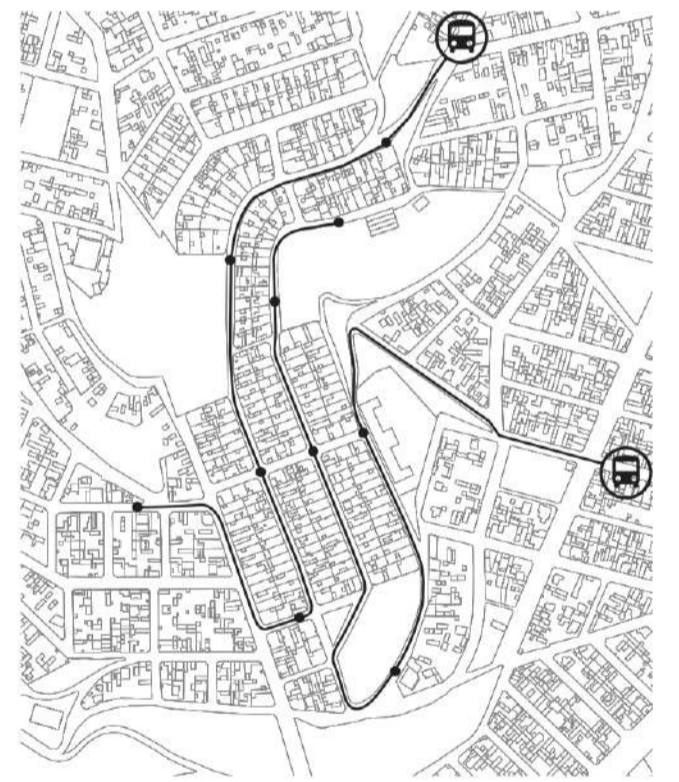
URBAN FABRIC



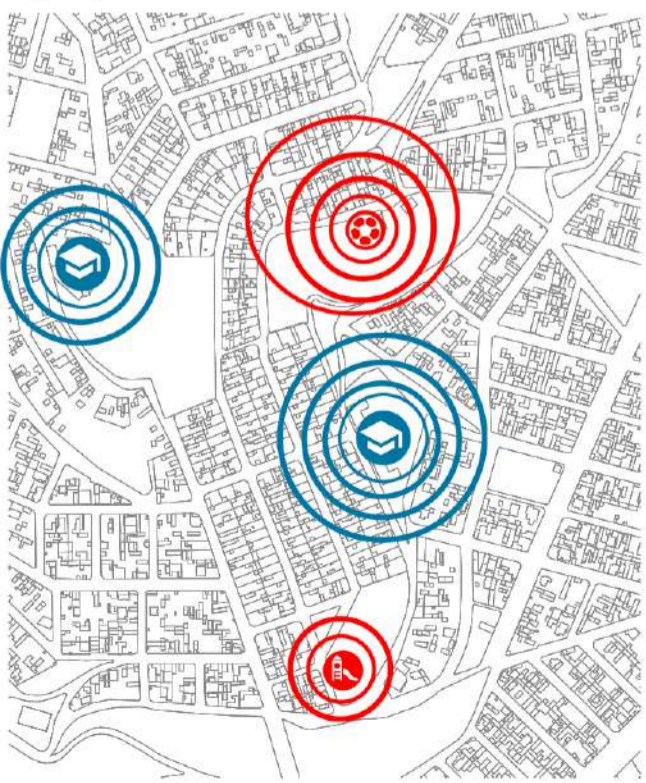
Figure plan



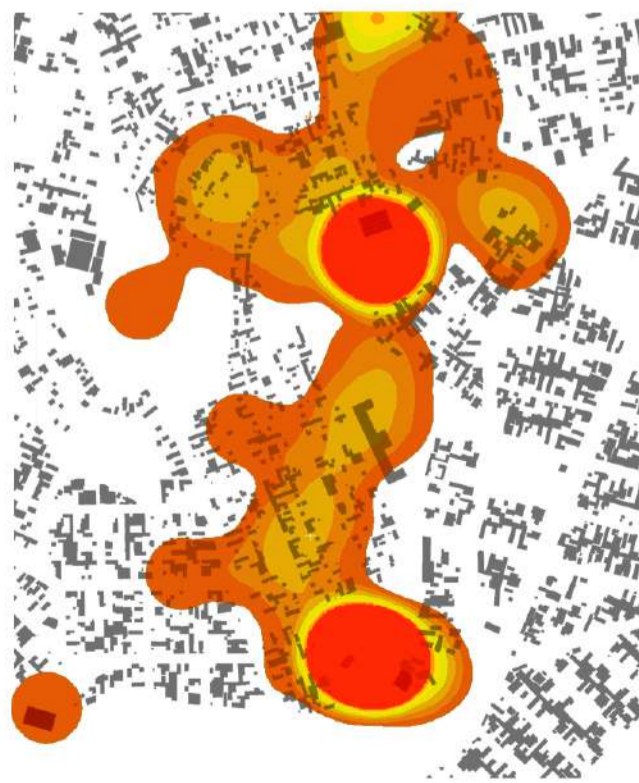
Green areas



Public transportation



Activities & uses



Daytime vitality



Night time vitality

PRELIMINARY DESIGN - STRATEGIES & CONCEPTS

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Existing infrastructure



Temporary markets



Steep geography



Weekly neighbors meeting



Fear culture



Street as playground



Concentration



Decentralize, Expand & Replicate



Fragmentation



Integrate & assemble



Individual appropriation



Collectivization / Formalization of spaces

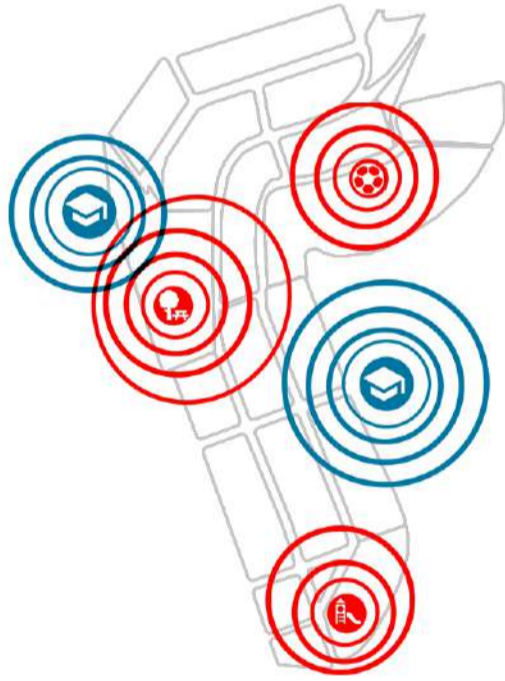


Anonymous spaces



Secure identity & Inclusion

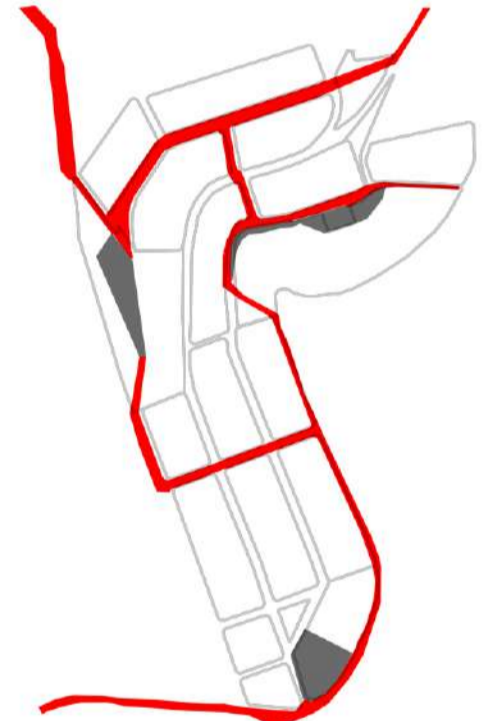
STRATEGIES



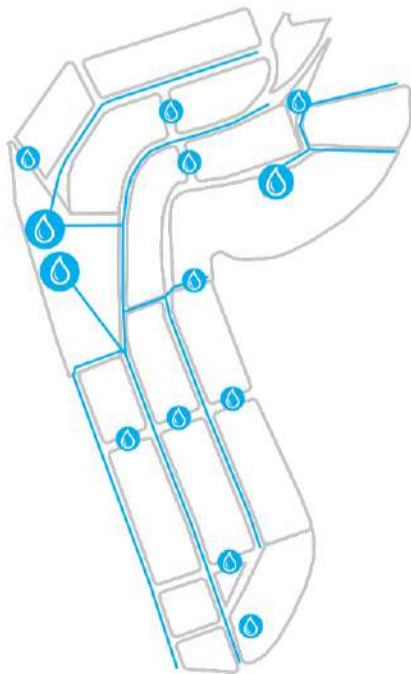
Release activity tension



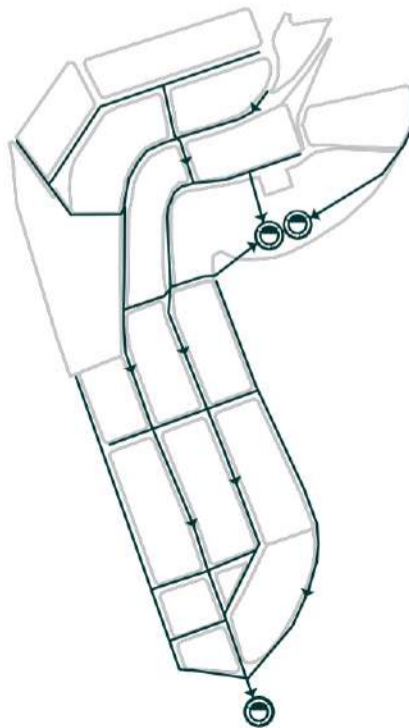
Green areas



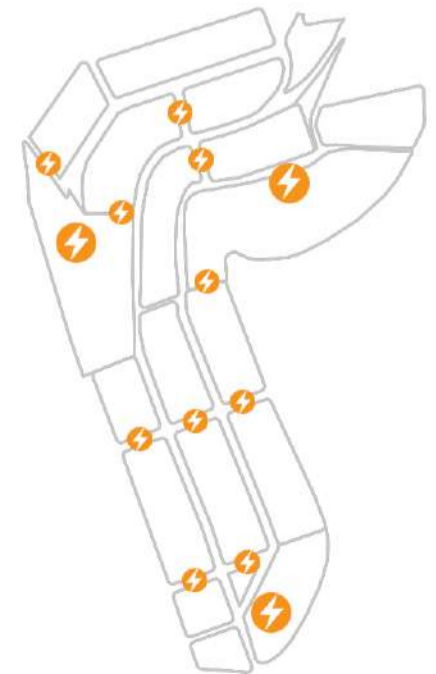
Pedestrian circuit



Water collection & distribution



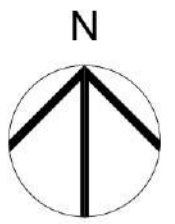
Grey & dark water treatment



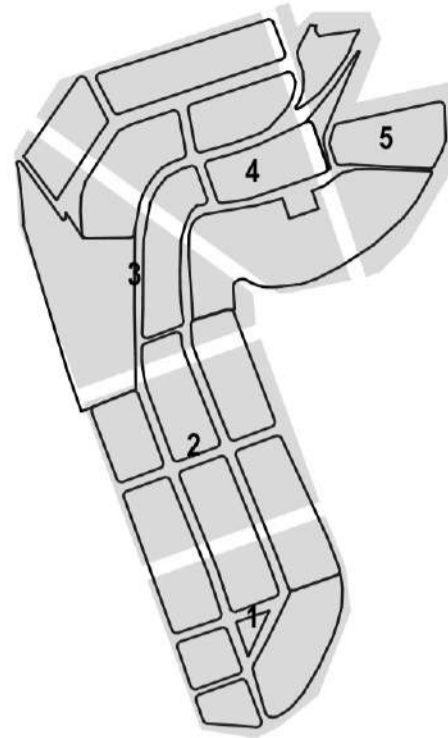
Energy collection

PRELIMINARY DESIGN - URBAN CONCEPT

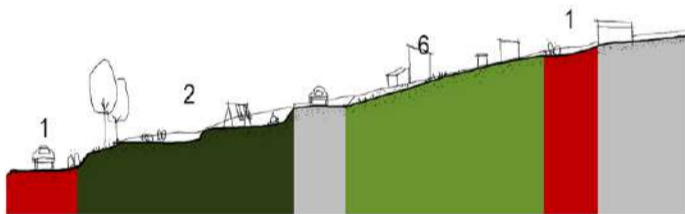
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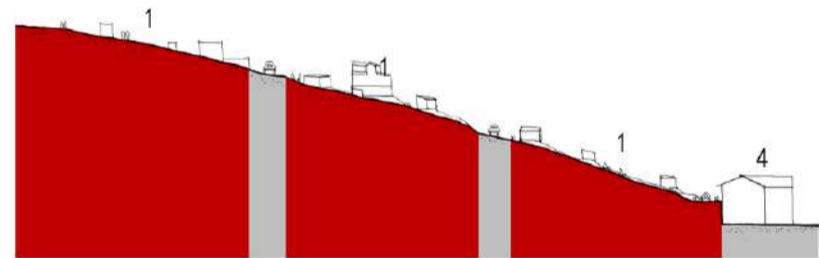
Urban intervention concept



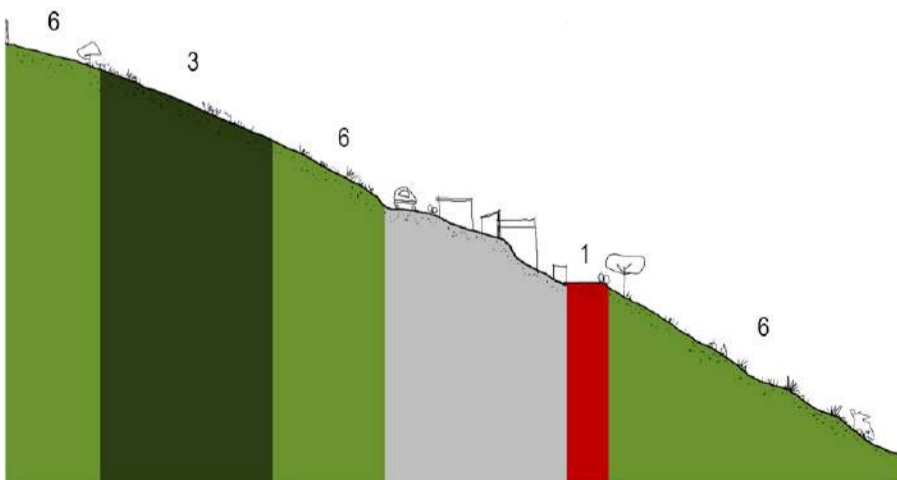
- Zone 1**
Playground, green area, south entrance & pedestrian circuit.
- Zone 2**
Pedestrian passages, east entrance (school) & pedestrian circuit.
- Zone 3**
Pedestrian passages, Park, green areas & pedestrian circuit.
- Zone 4**
Pedestrian passages, multifunctional court & pedestrian circuit.
- Zone 5**
Northeast entrance, green area & pedestrian circuit.



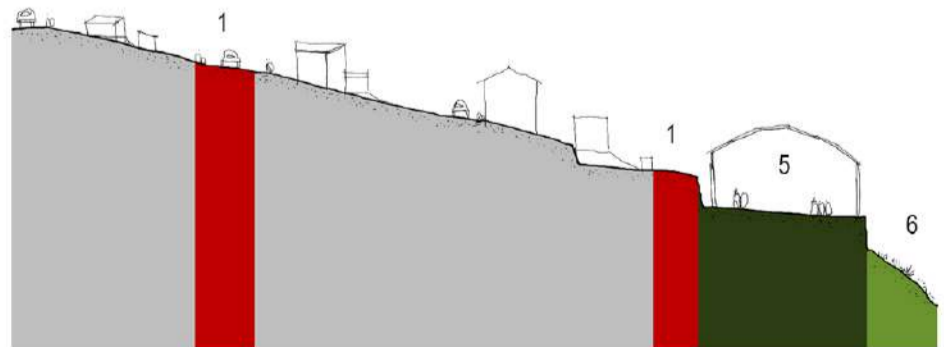
ZONE 1
Housing: 54 plots
Covered area: 26800 sqm
Slope: Moderate



ZONE 2
Housing: 105 plots
Covered area: 36000 sqm
Slope: Moderate-High



ZONE 3
Housing: 57 plots
Covered area: 35800 sqm
Slope: High

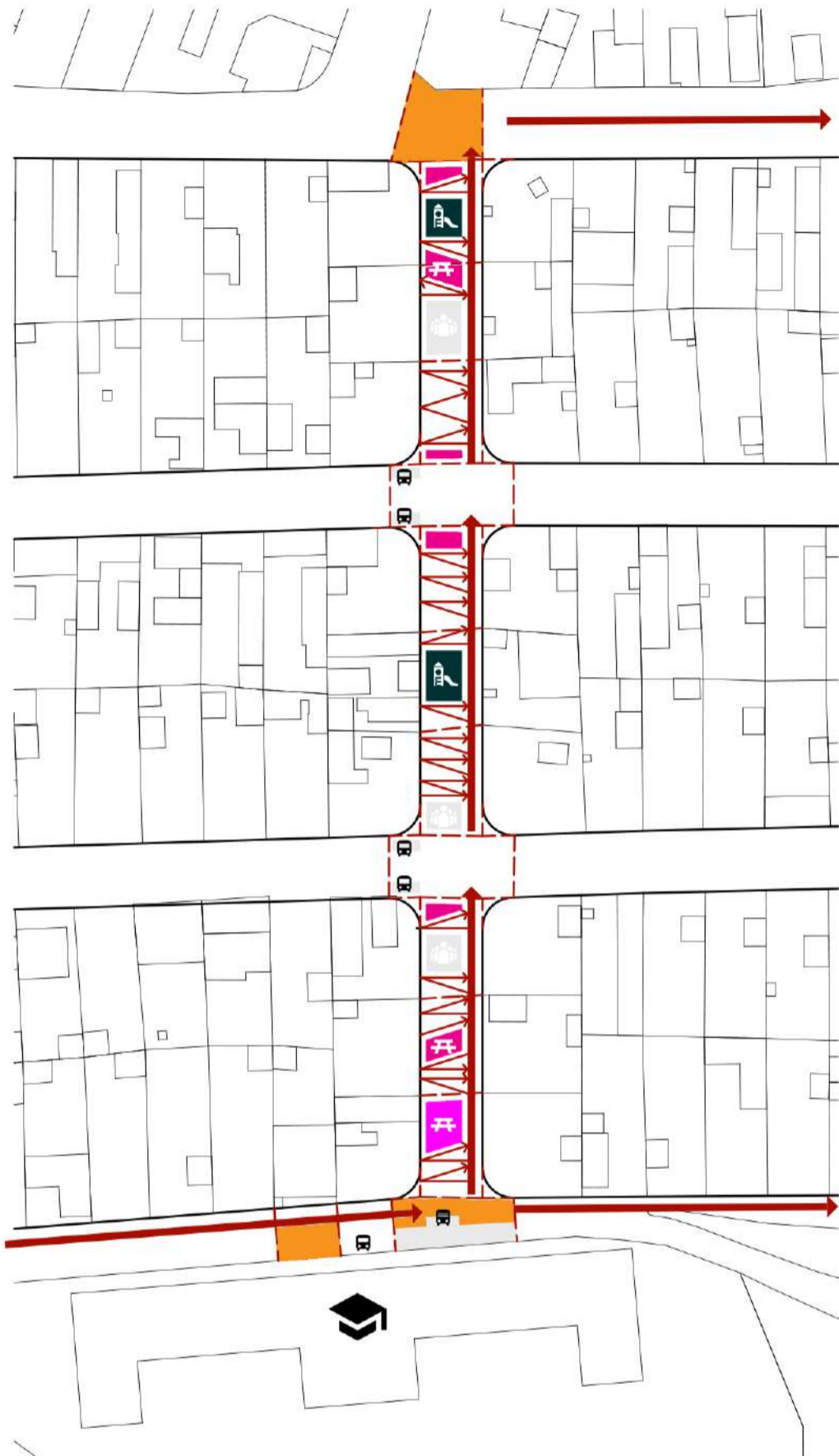
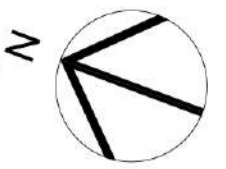


ZONE 4
Housing: 94 plots
Covered area: 40400 sqm
Slope: Moderate-high

- 1 Pedestrian circuit
- 2 Playground
- 3 Park
- 4 School
- 5 Multifunctional court
- 6 Green area

URBAN DESIGN - SITE

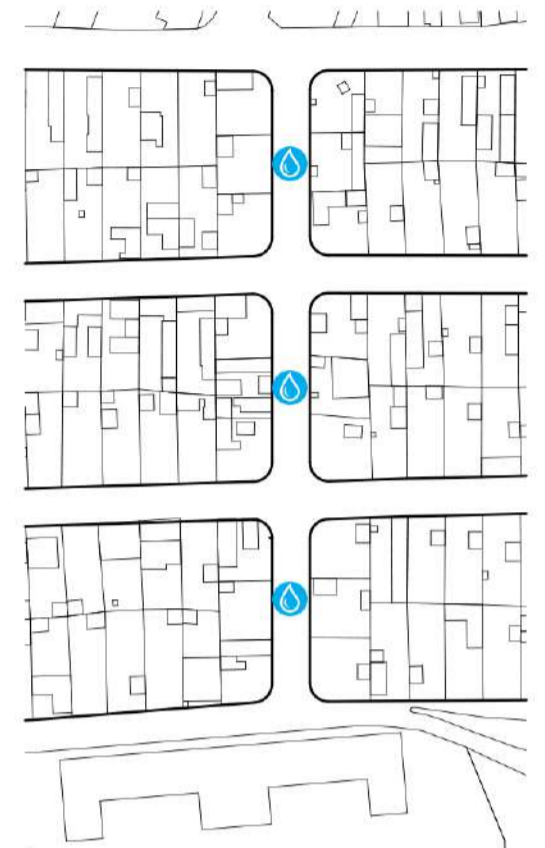
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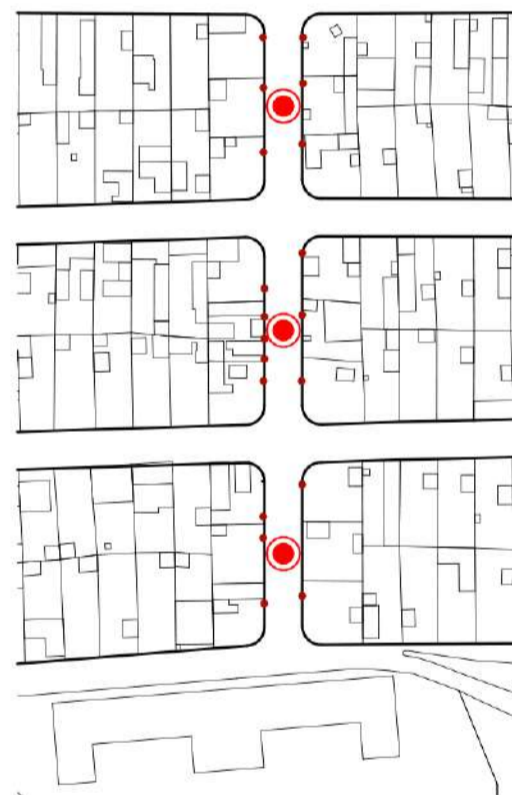
Site concept / Scale 1:1000



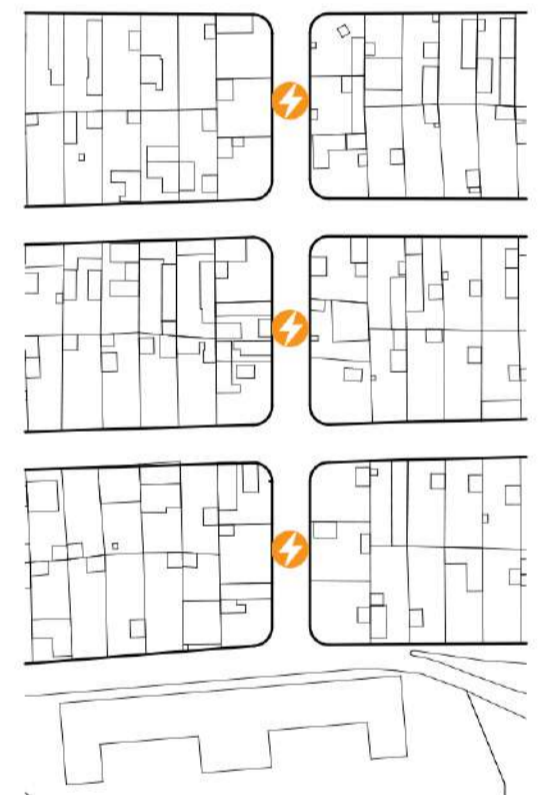
Green structure



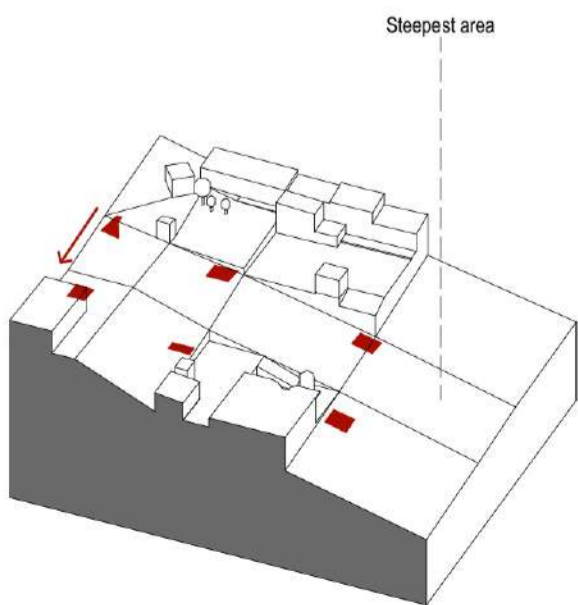
Water collection



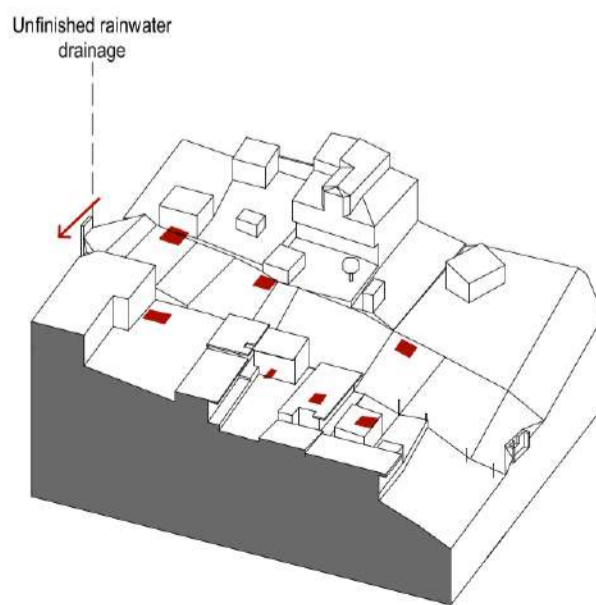
Spaces of interaction



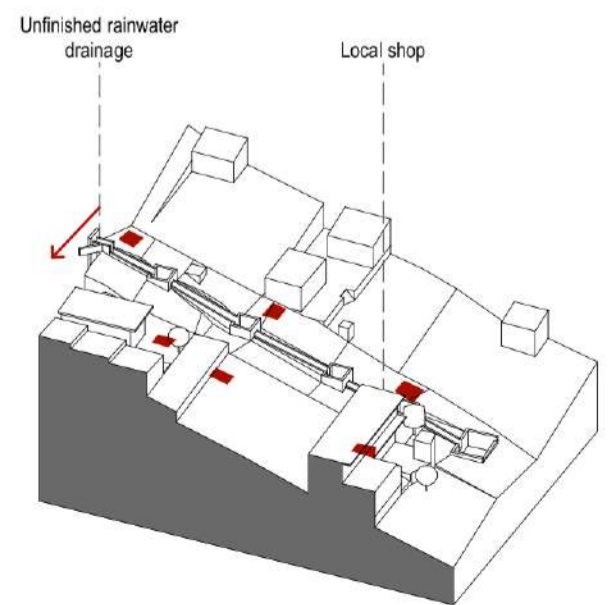
Energy collection



Passage 1 | Block Q - O



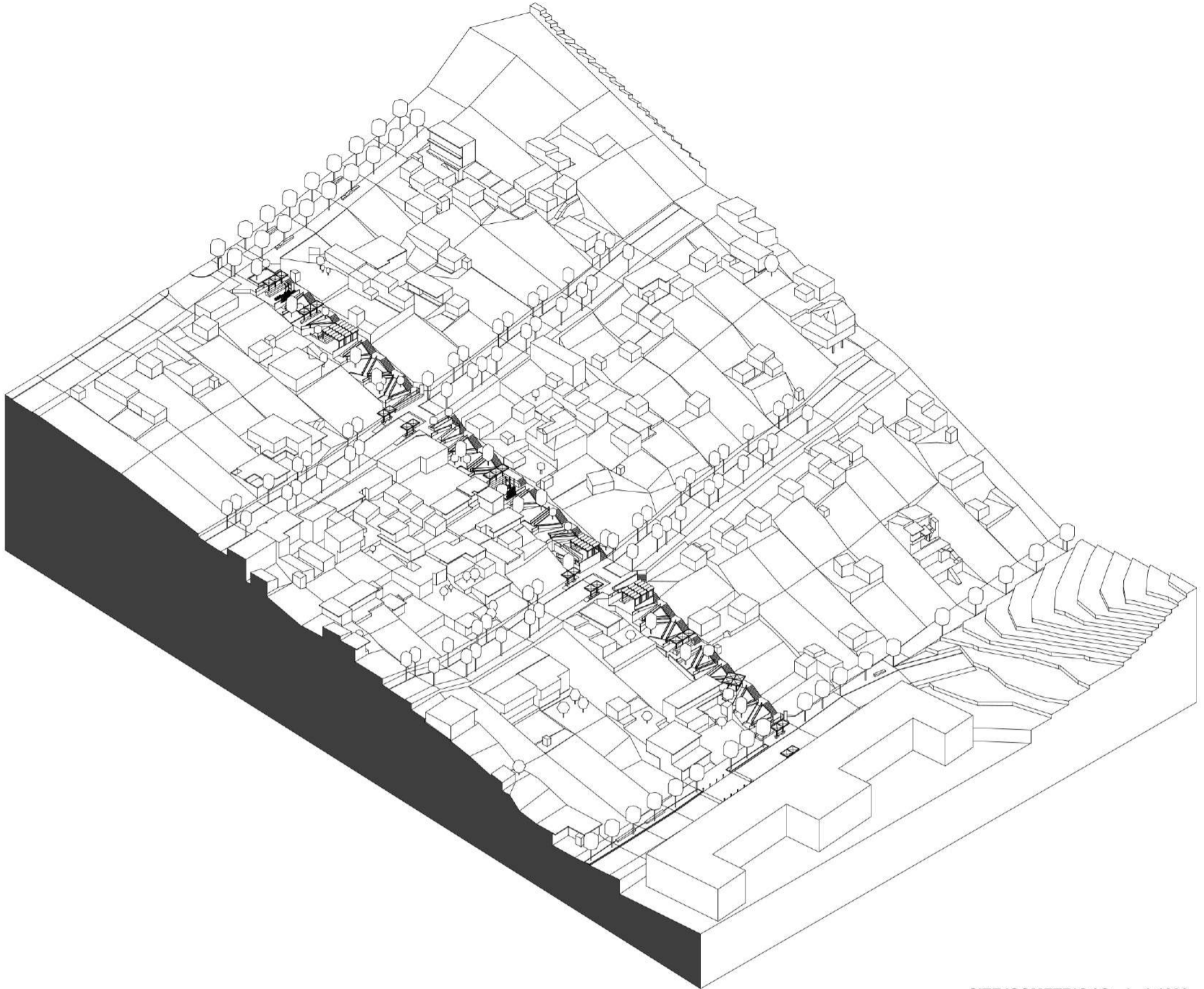
Passage 2 | Block R - N



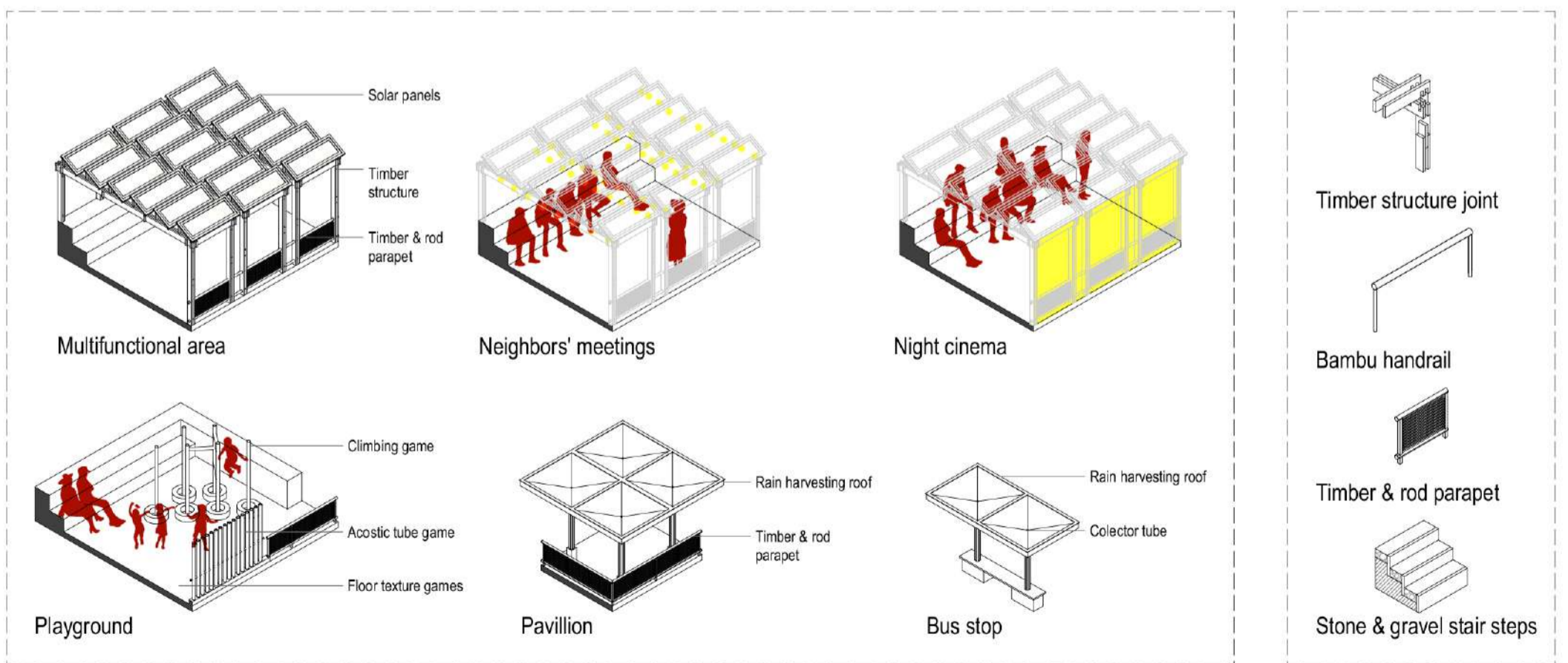
Passage 3 | Block S - P

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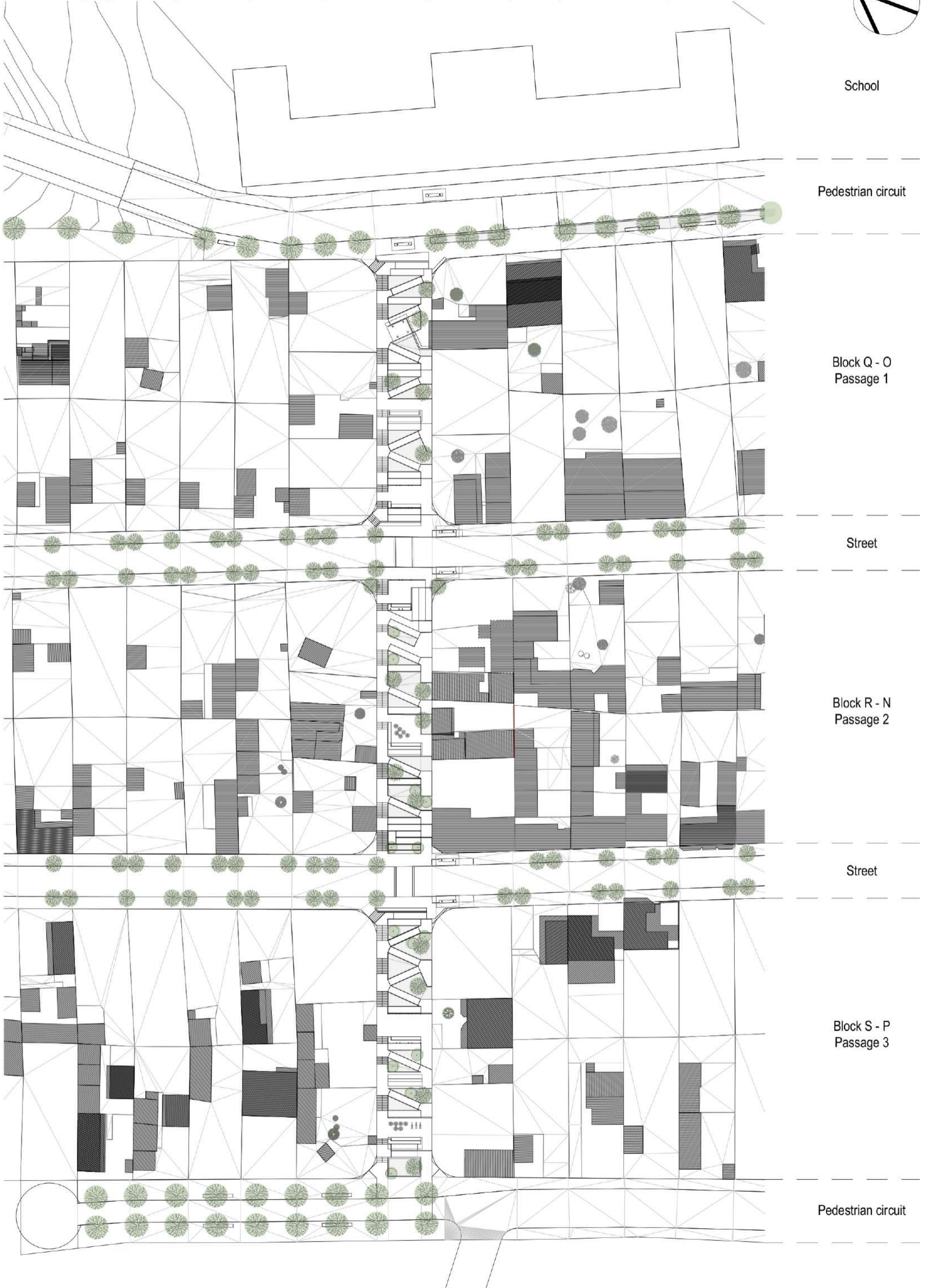
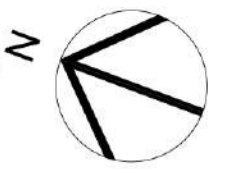


SITE ISOMETRIC / Scale 1:1200



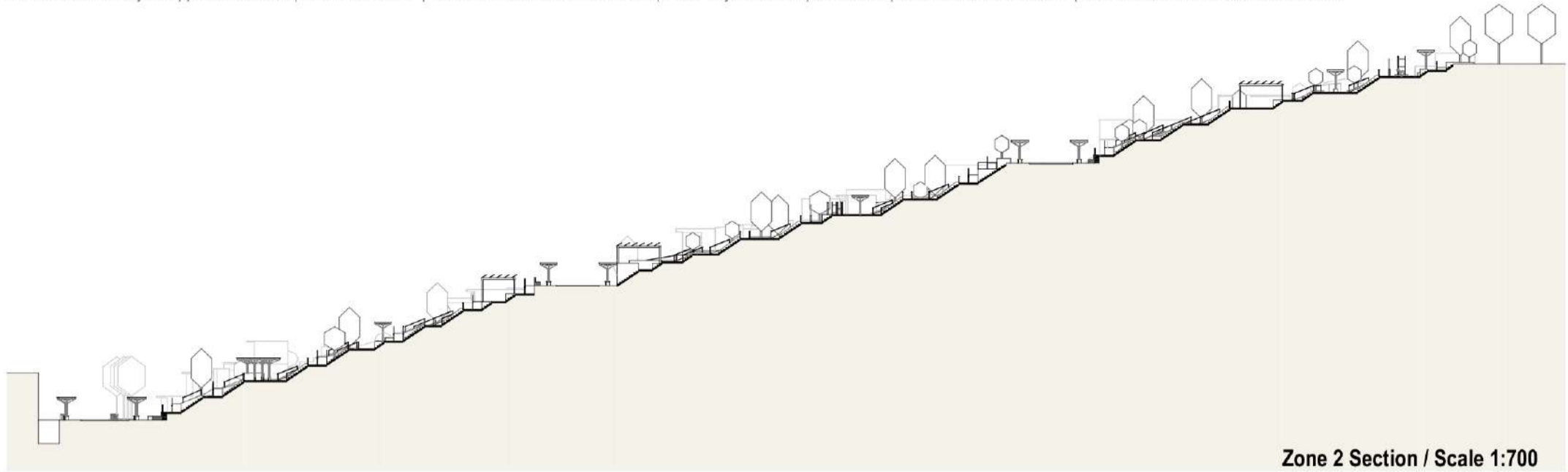
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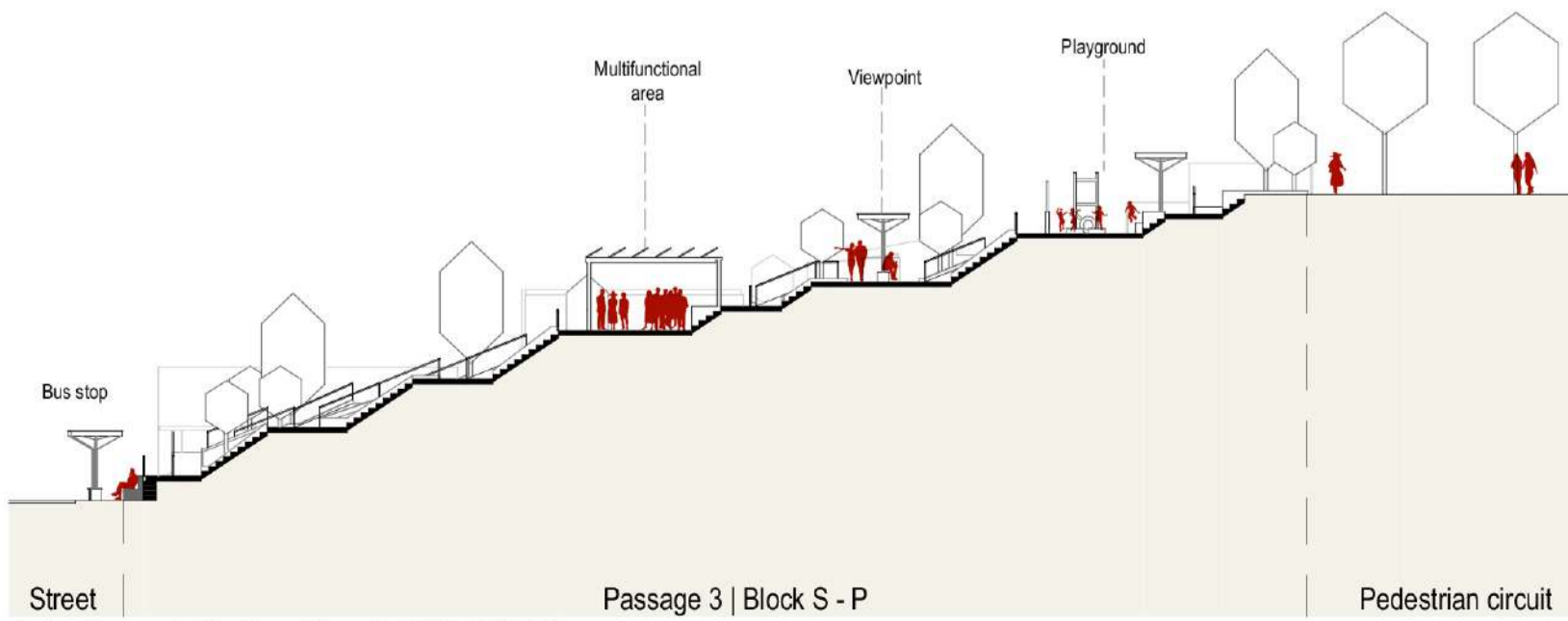
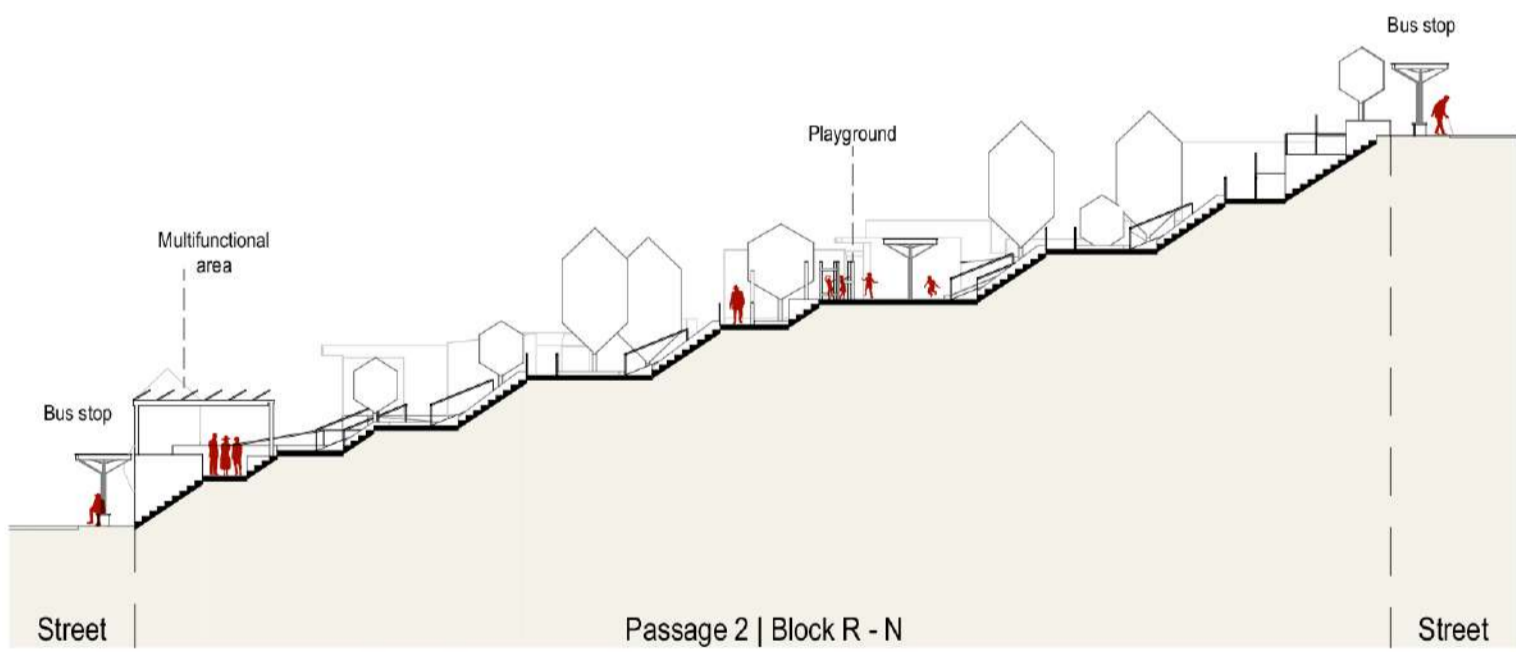
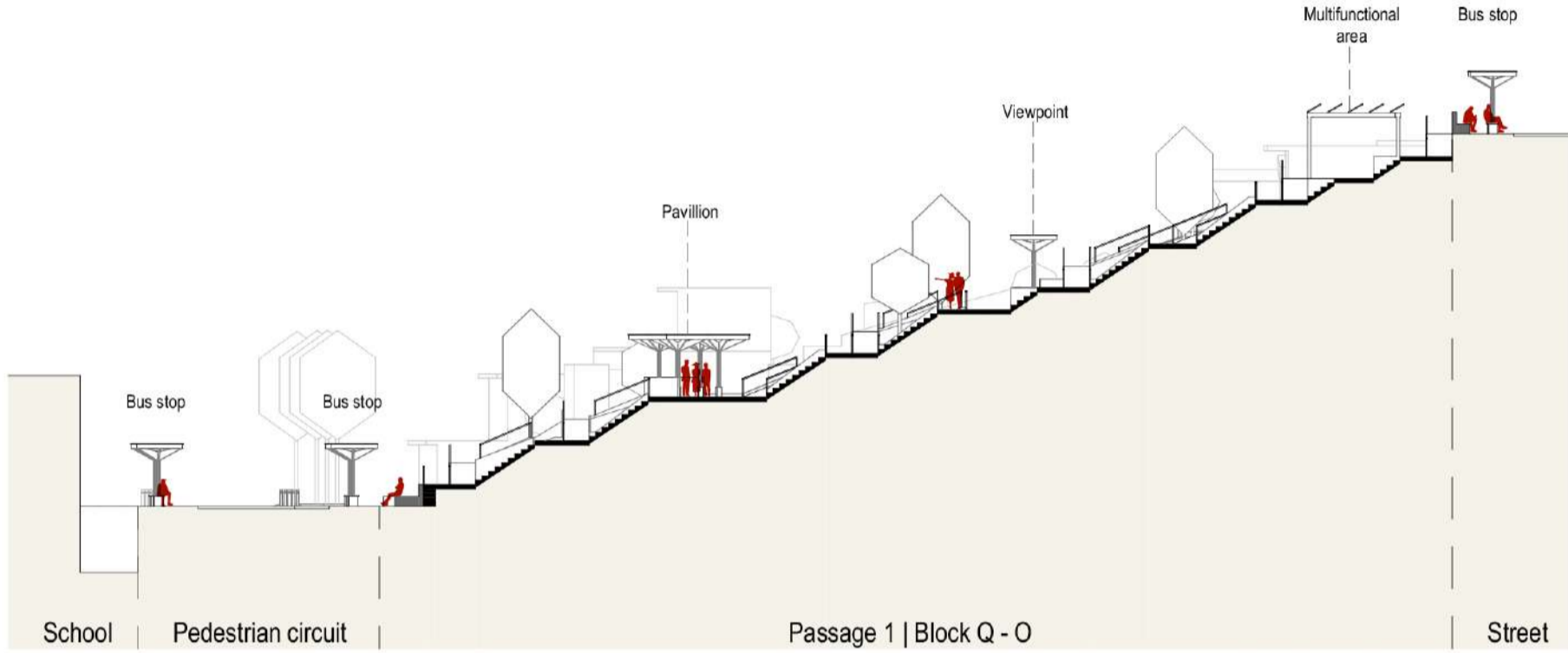


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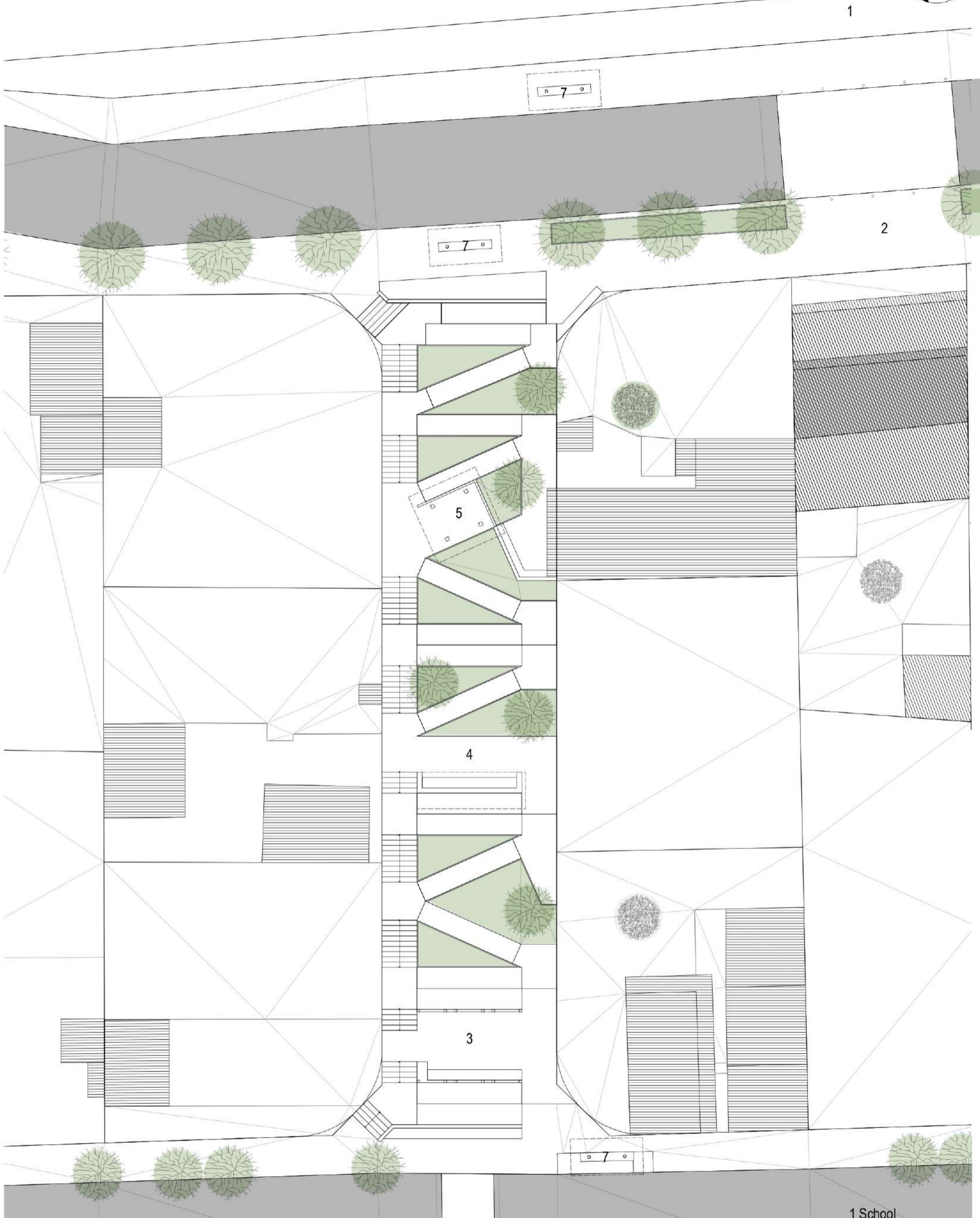
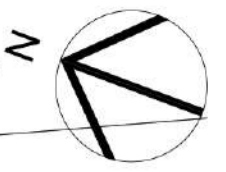


Zone 2 Section / Scale 1:700



URBAN DESIGN - SITE

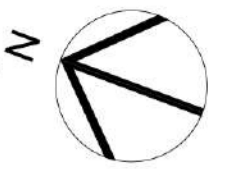
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- 1 School
- 2 Pedestrian circuit
- 3 Multifunctional area
- 4 Viewpoint
- 5 Pavillion
- 6 Playground
- 7 Bus stop

URBAN DESIGN - SITE

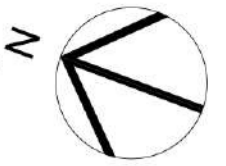
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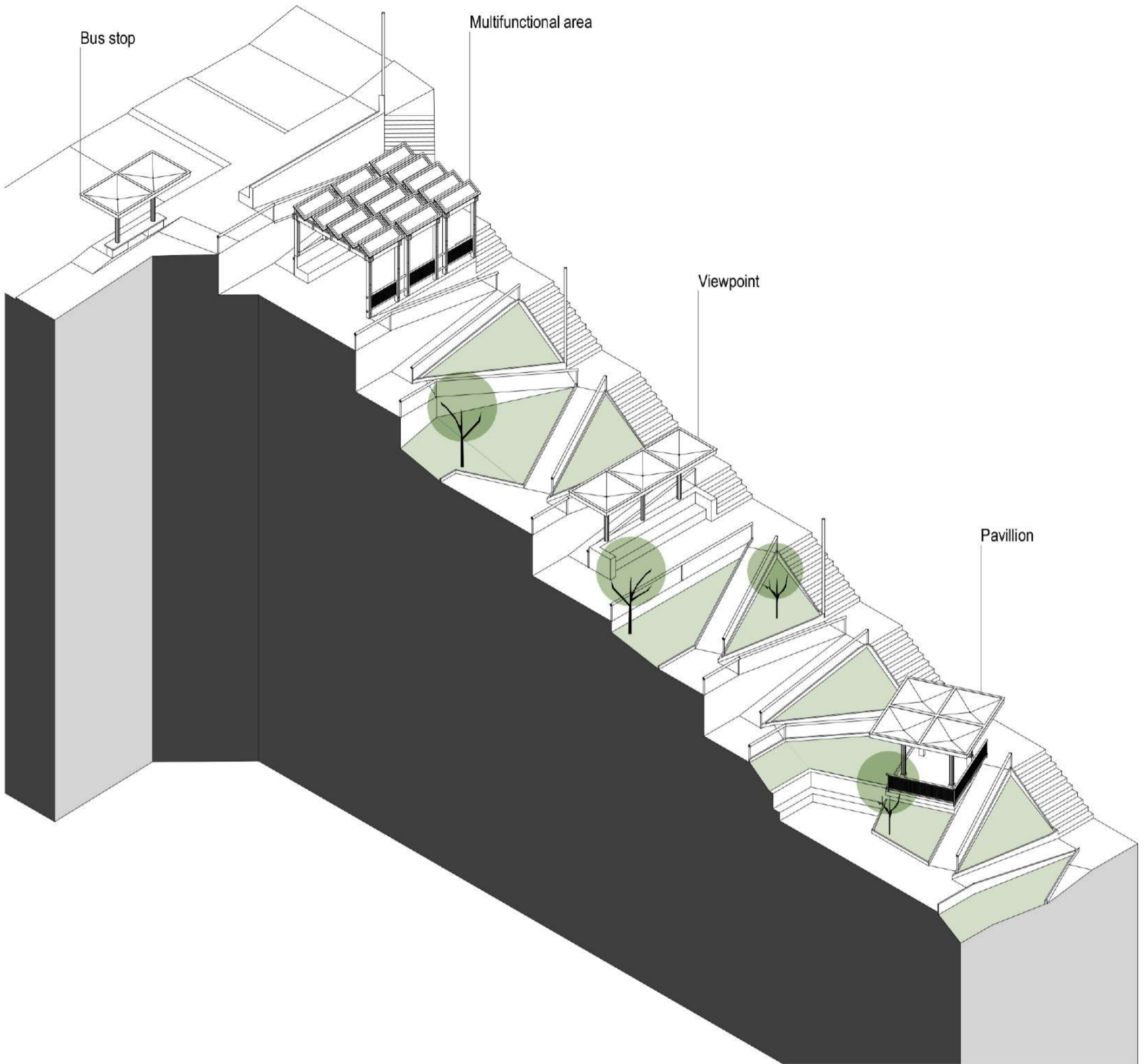
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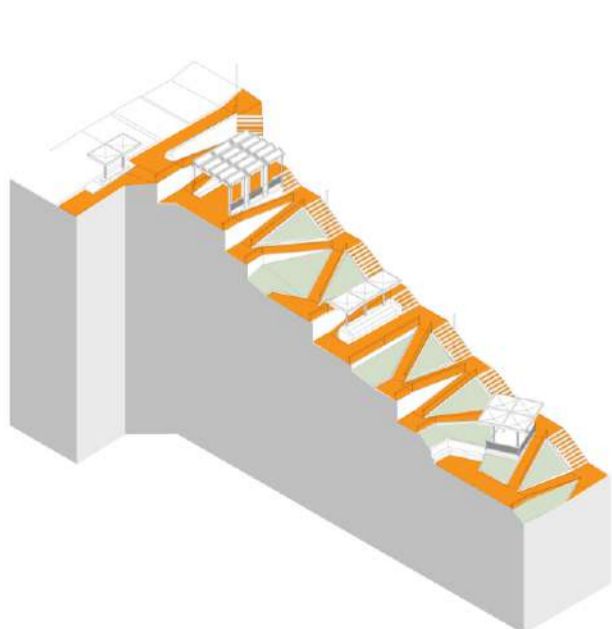
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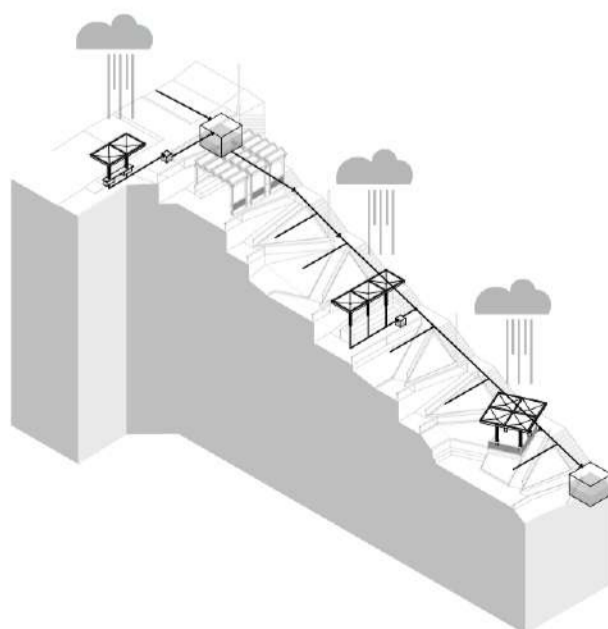
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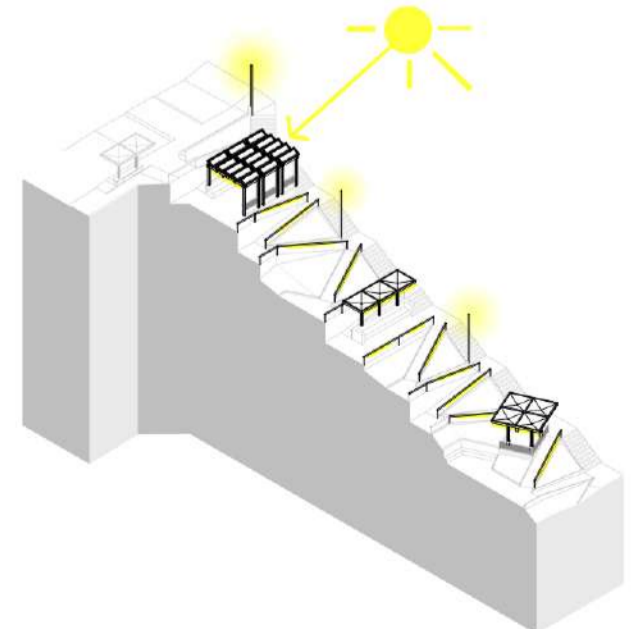
SELECTED SITE DETAIL / Scale 1:200



Permeable floor finishes



Water collection & irrigation



Energy collection & illumination

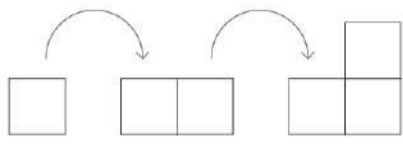
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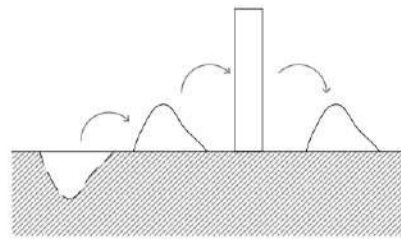


HOUSING DESIGN - THE MODULE

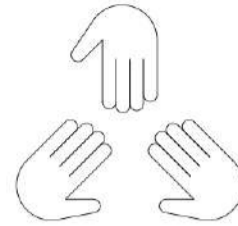
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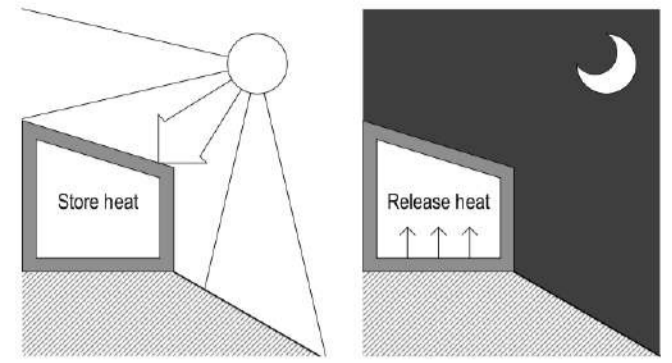
Progressive modular growth



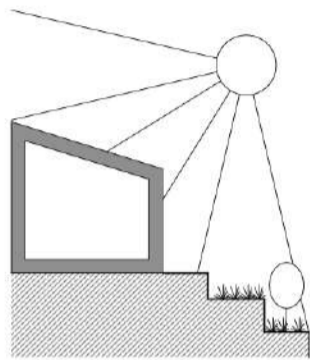
Minimal environmental harm



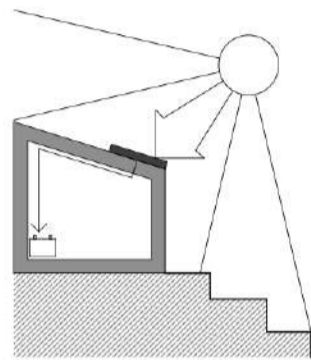
Participatory construction / Assisted self construction



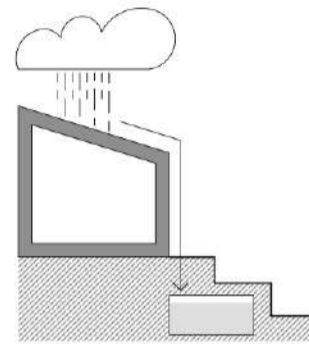
House as Battery



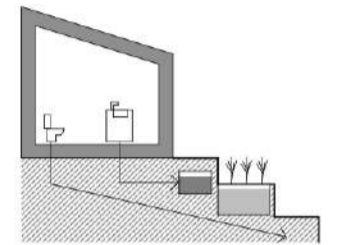
Terrain as Food Supplier



House as Power Plant



House as Water Provider



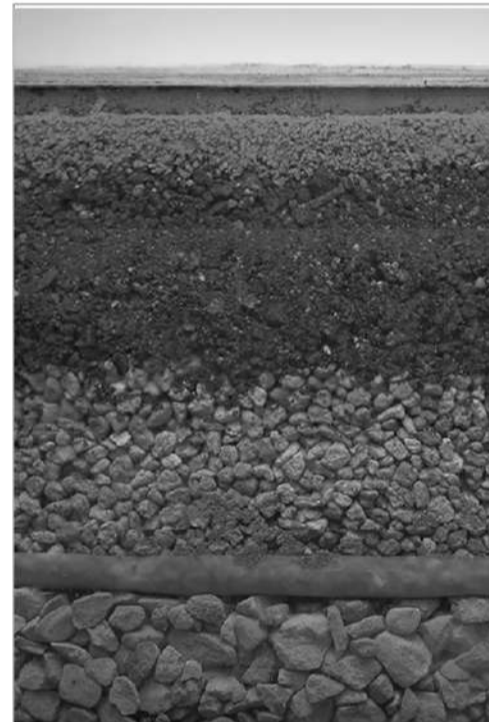
House as Plant Treatment



Rammed earth



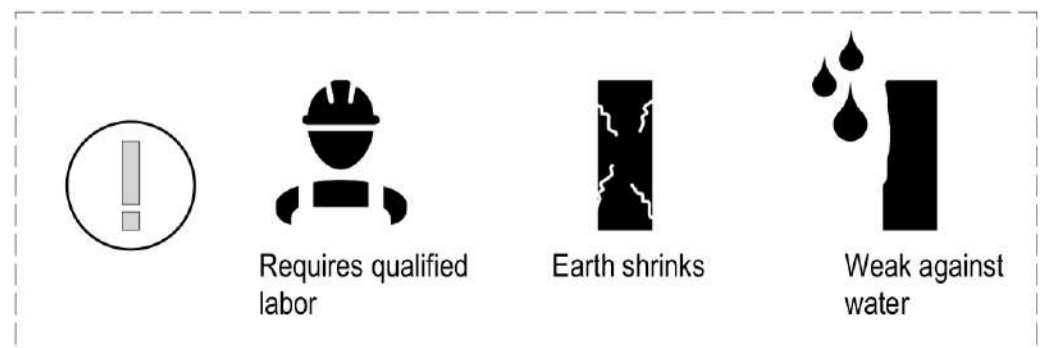
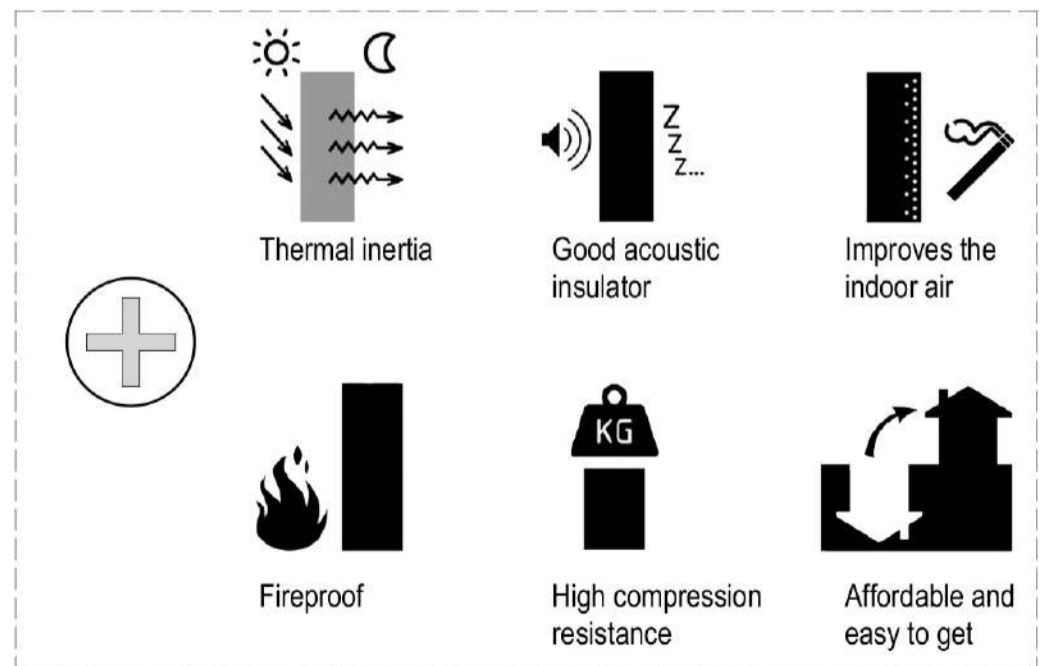
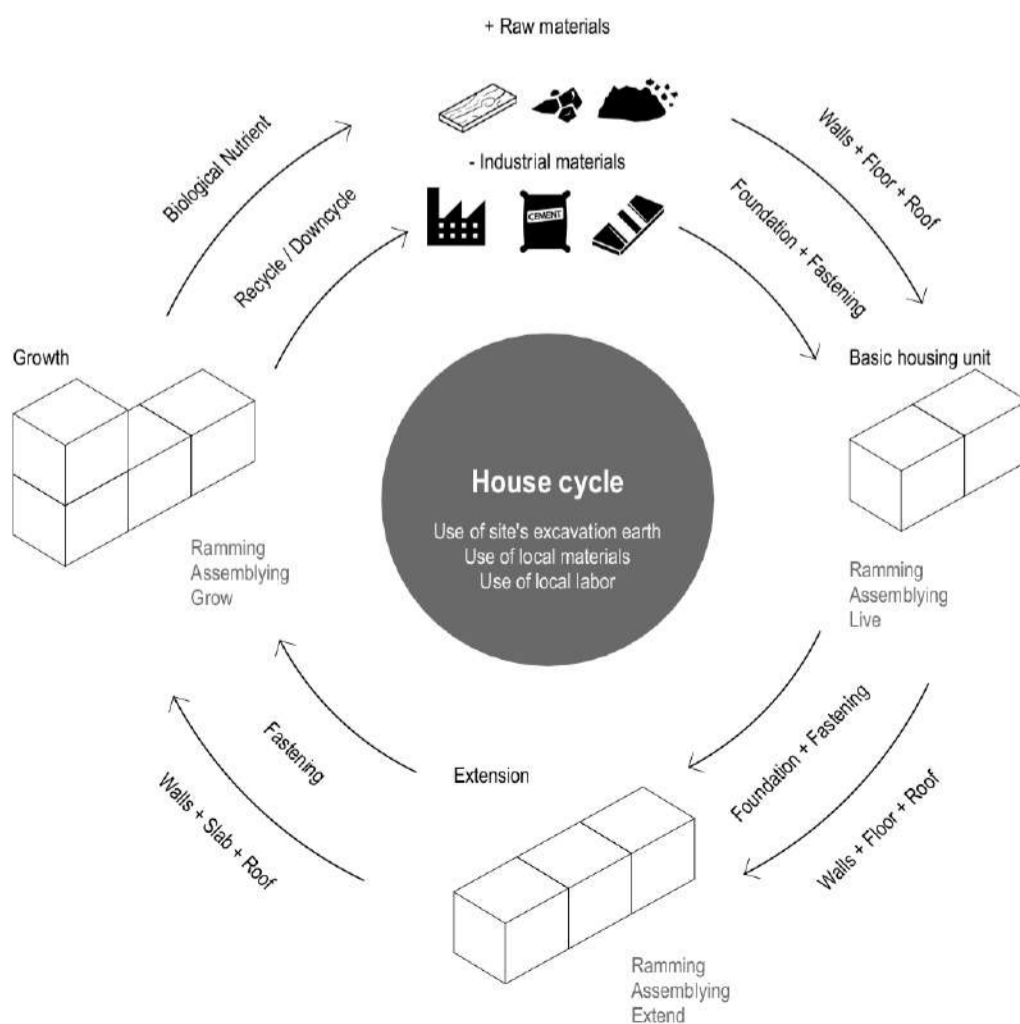
Wattle & daub



Rammed earth floor

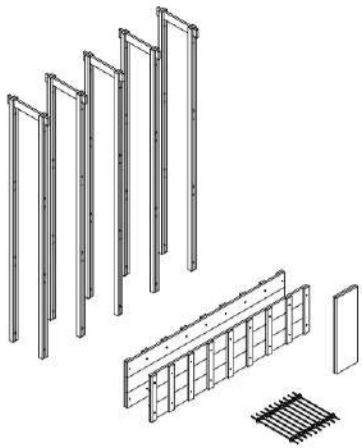


Wooden structure roof

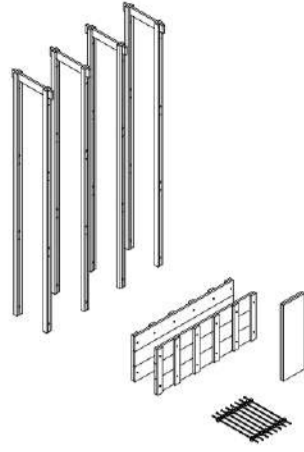


HOUSING DESIGN - THE MODULE

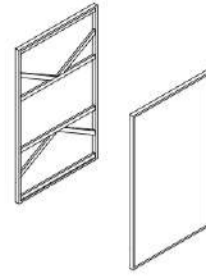
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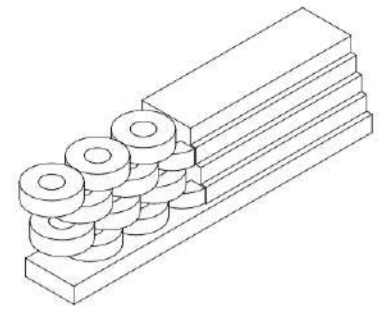
Formwork A (0.60m x 2.40m)



Formwork B (0.60m x 1.50m)



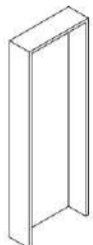
Wattle & daub wall (1.20m x 2.80m)



Tire retain wall



Door A (0.80m x 2.60m)



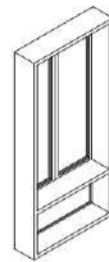
Door B (0.90m x 2.60m)



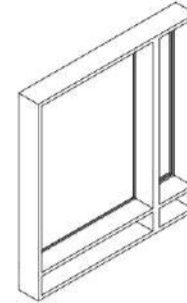
Door C (1.20m x 2.60m)



Window A (0.60m x 2.60m)



Window B (1.20m x 2.60m)



Window C (2.4m x 2.60m)

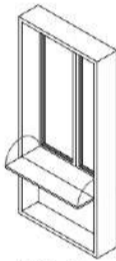


Sunshading panel (0.50m x 1.78m)

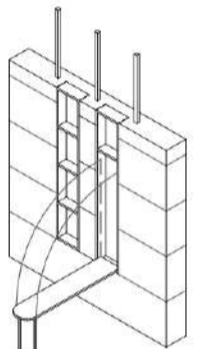
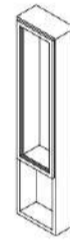


Innerwall storage (0.30m x 2.00m)

Windows + shading + additional function



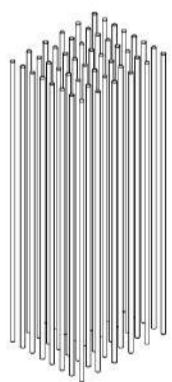
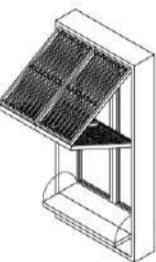
Window + table



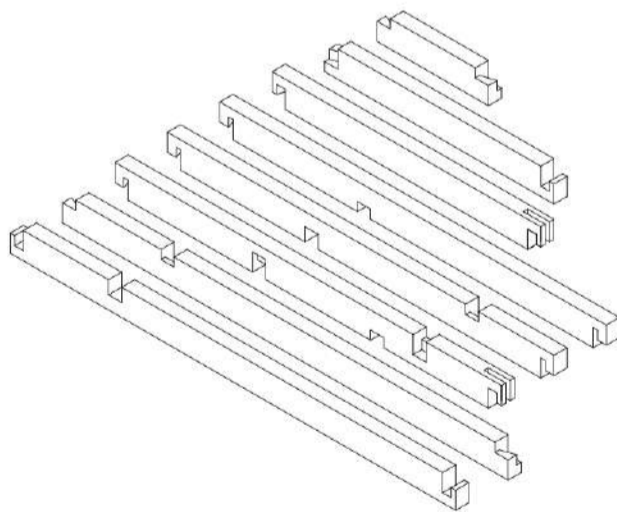
Utility wall



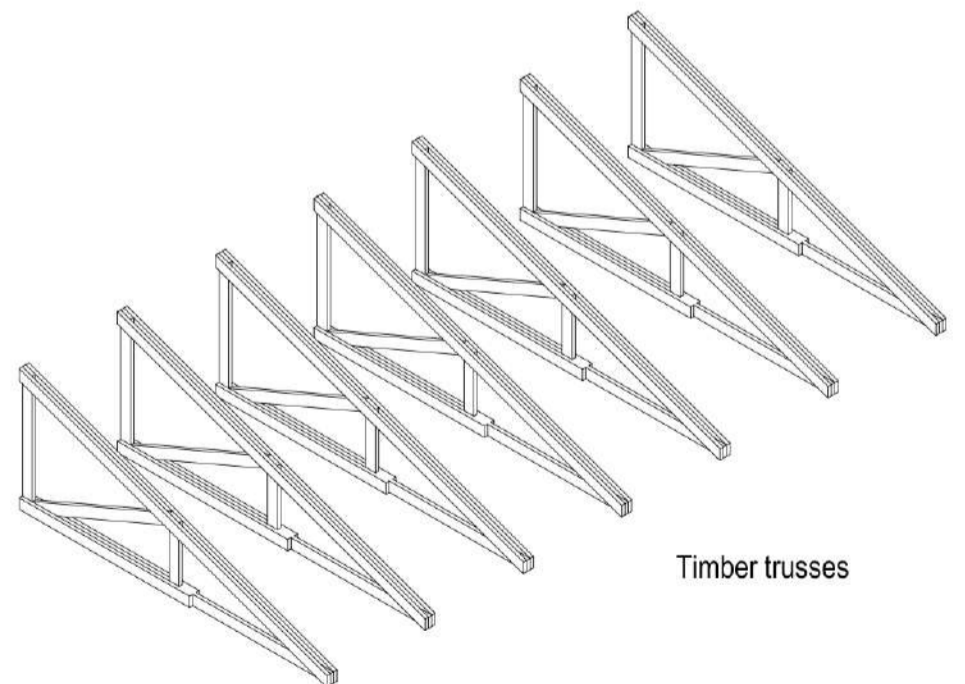
Window + seat



Timber wall reinforcement

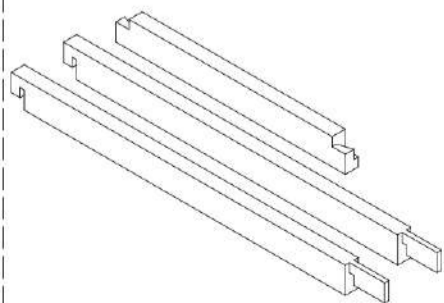


Timber structural beams

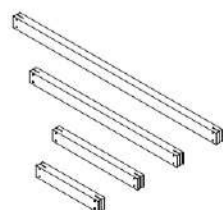


Timber trusses

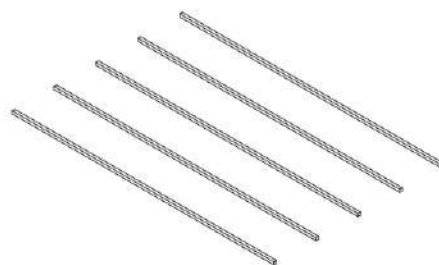
Progressive growth parts



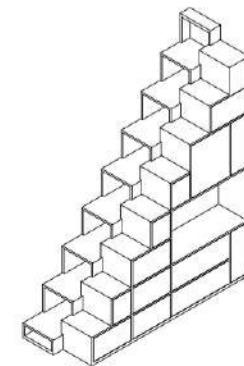
Timber structural beams



Timber slab beams



Timber tracks

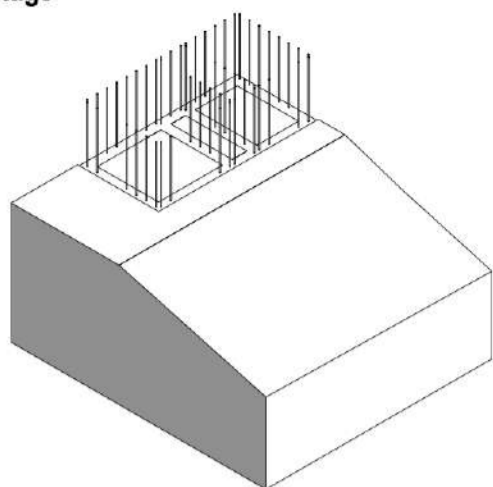


Timber stair

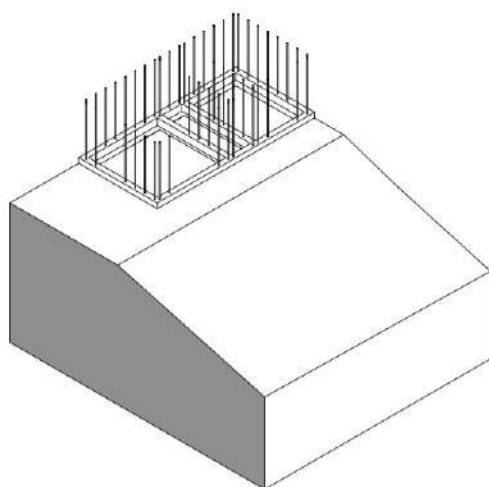
HOUSING DESIGN - THE MODULE

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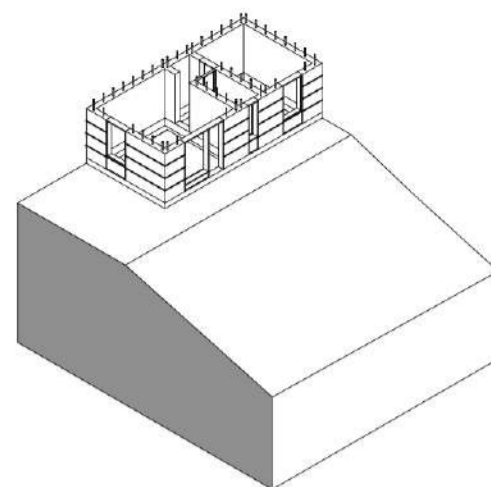
Initial Stage



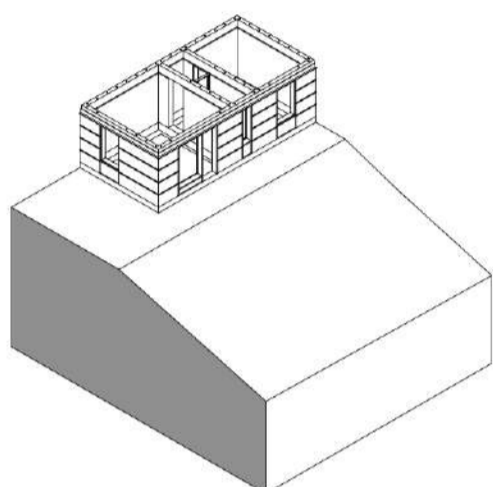
1. Foundations + Timber reinforcements



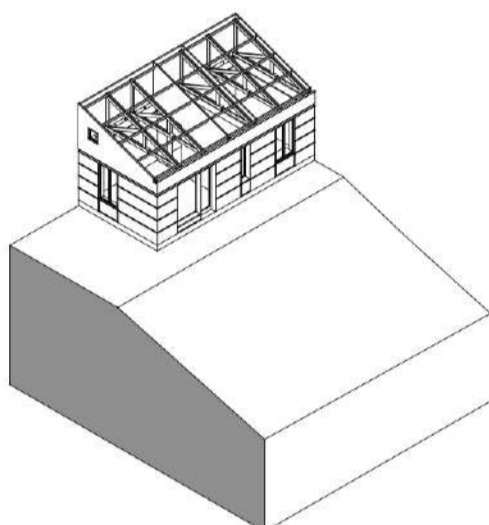
2. Reinforced concrete foundation beam



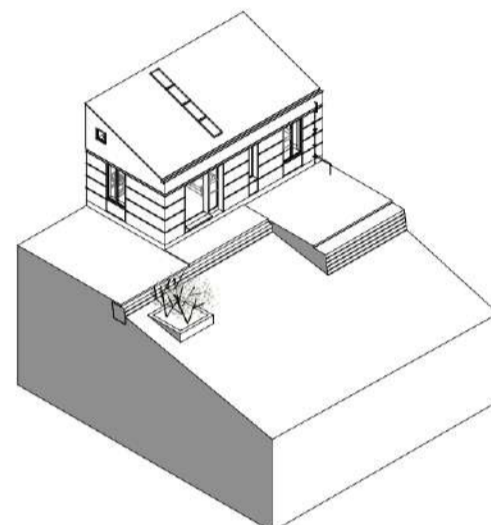
3. Rammed earth walls
+ Timber windows & doors frames



4. Structural timber beams

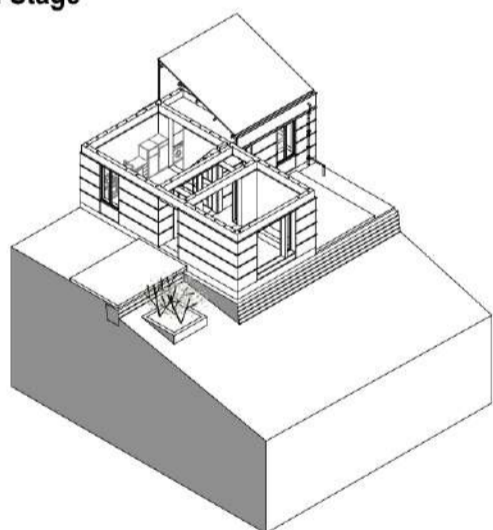


5. Roof structure
+ Wattle and daub parapets

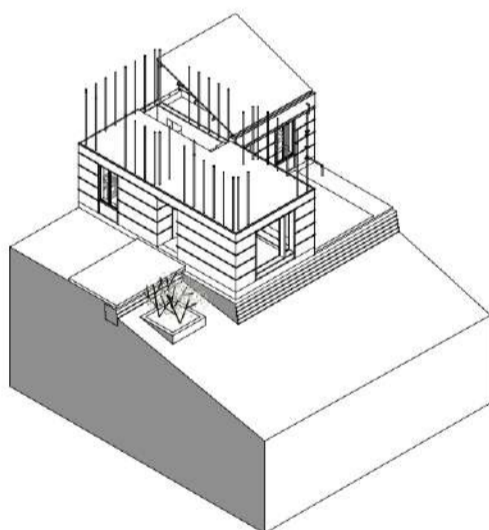


6. Roof + Solar panels
+ Rammed earth floor
+ Rainharvesting system
+ Artificial wetland system

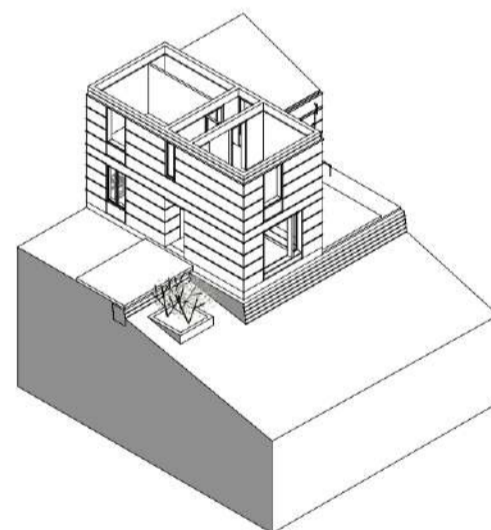
Second Stage



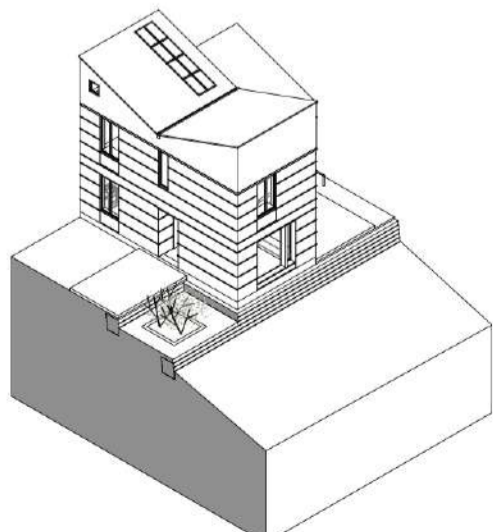
7. Tire retain wall
+ Reinforced concrete beam
+ Rammed earth wall
+ Structural timber beams



8. Slab
+ Timber reinforcement connection



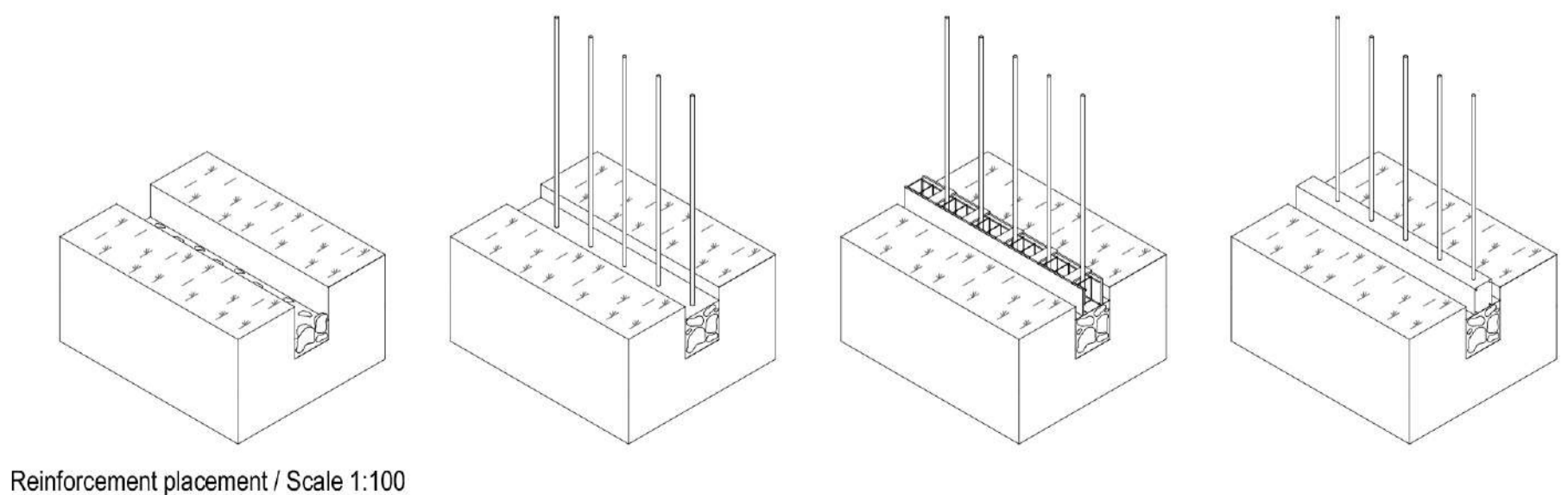
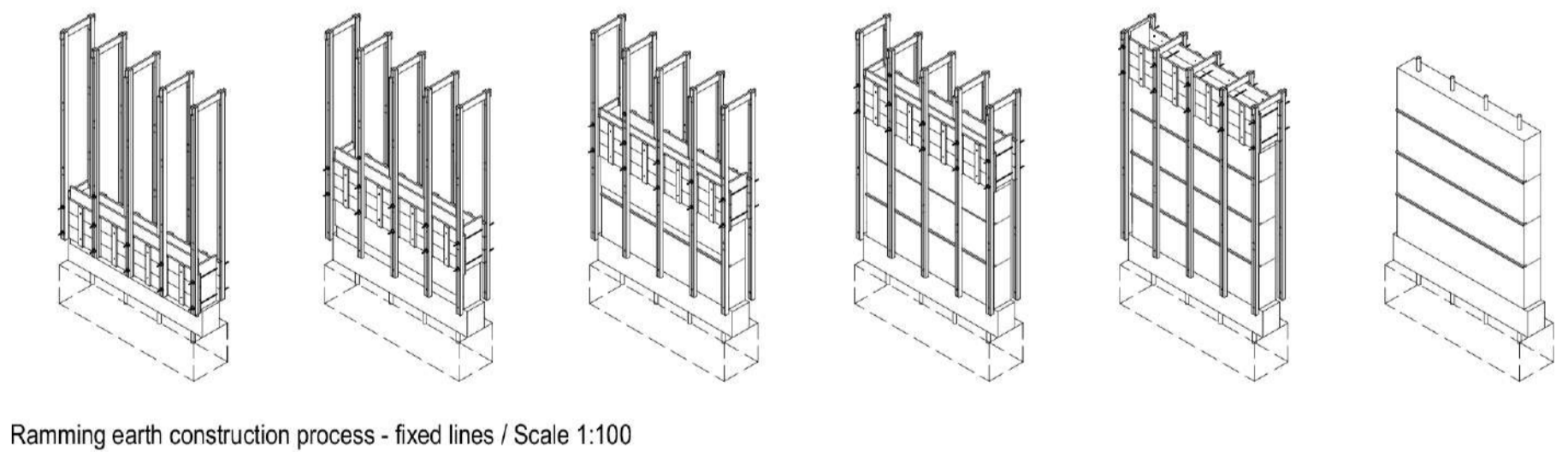
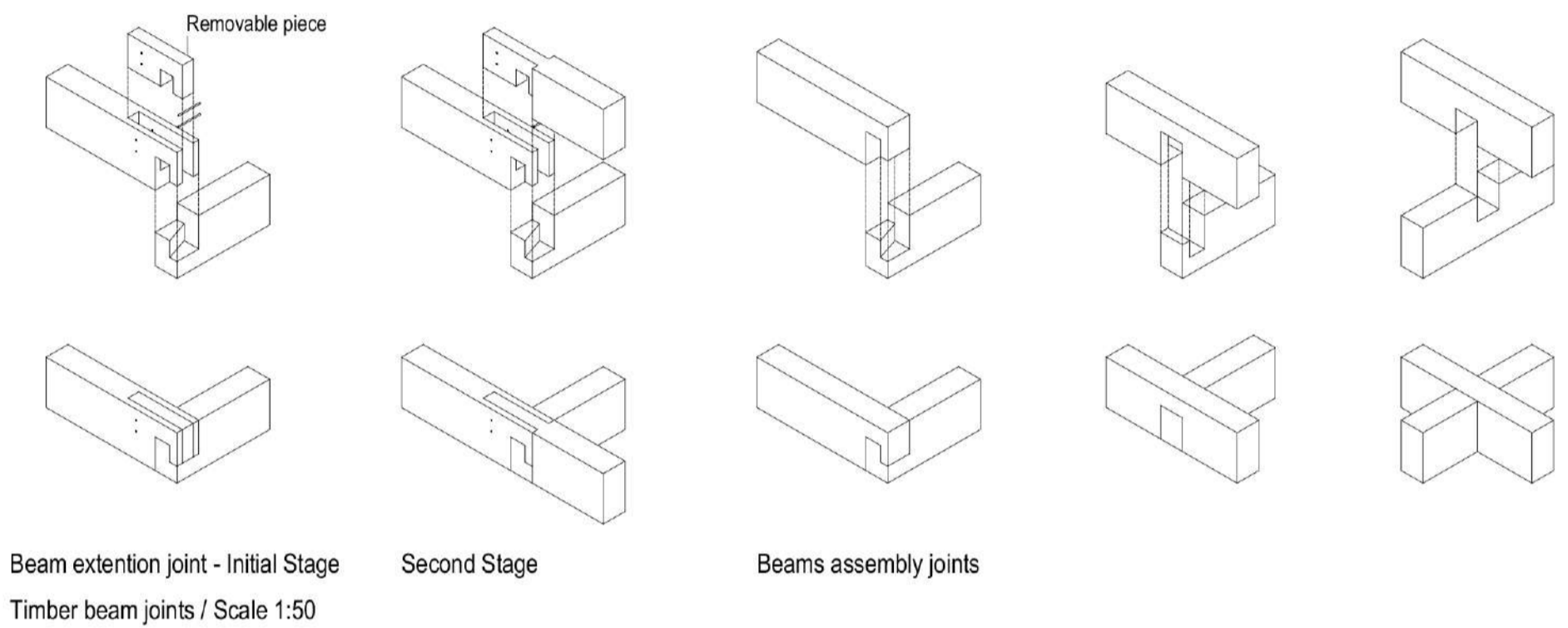
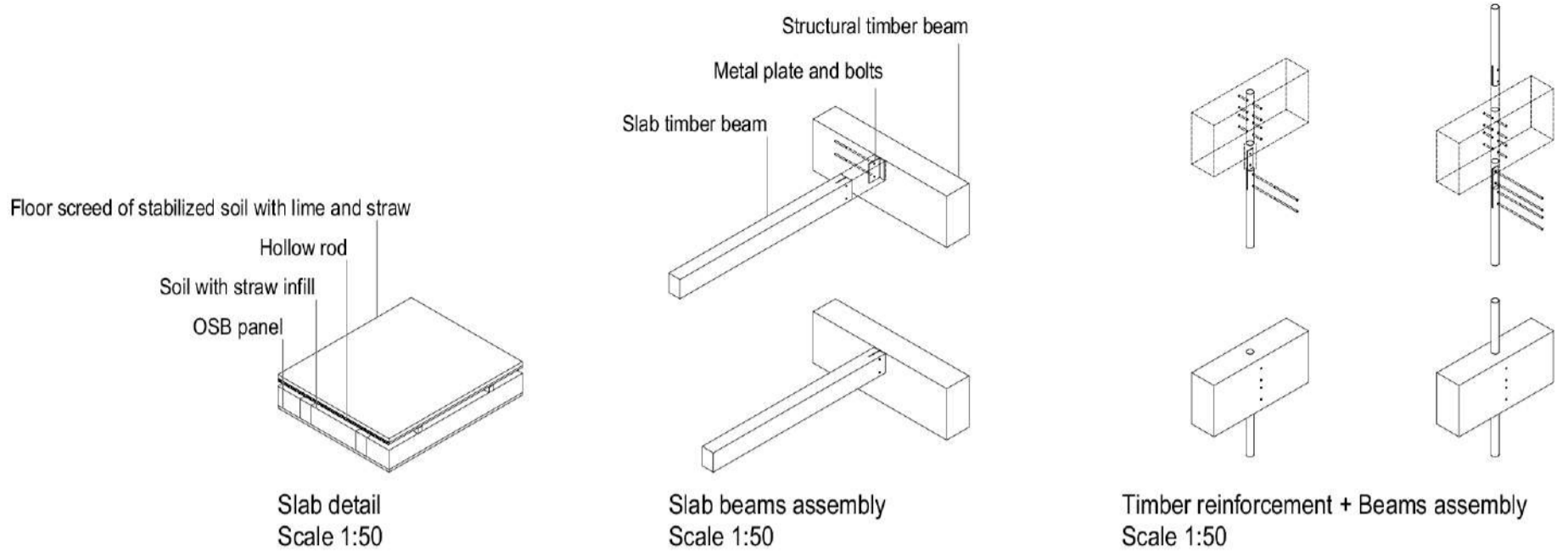
9. Rammed earth walls
+ Timber windows & doors frames
+ Structural timber beams



10. Roof + Solar panels
+ Landscaping

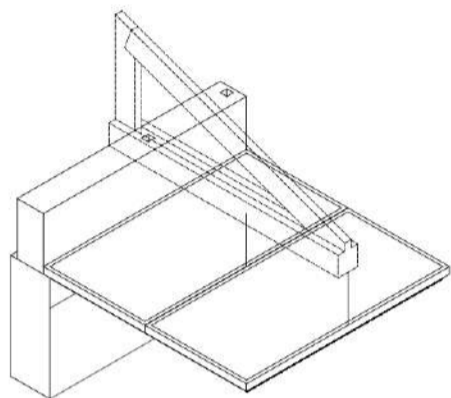
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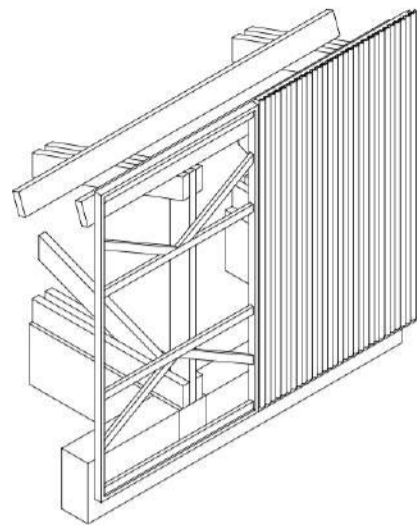


HOUSING DESIGN - THE MODULE

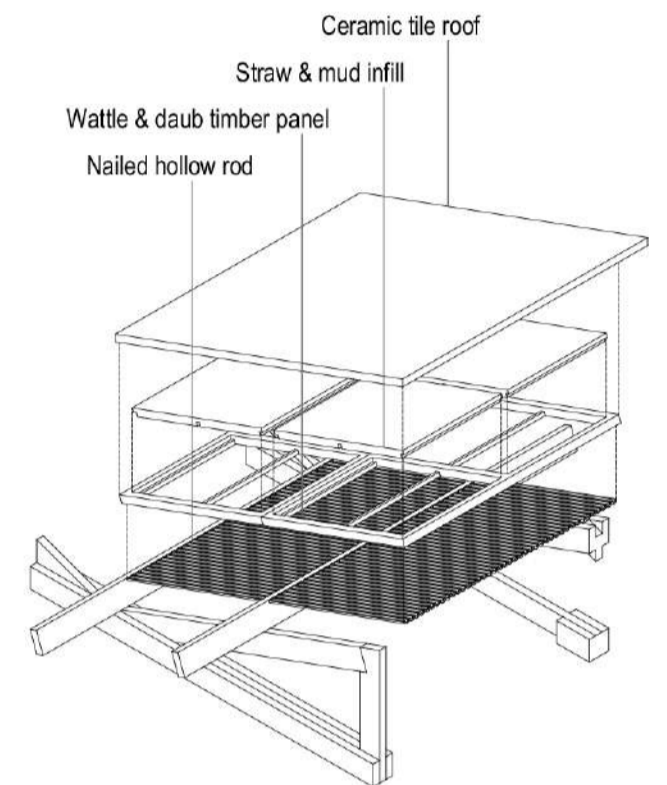
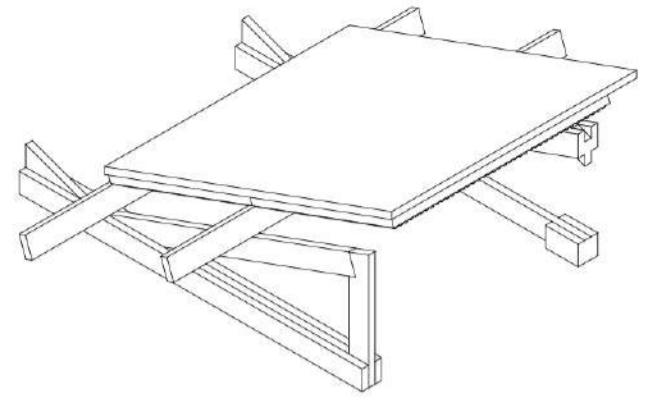
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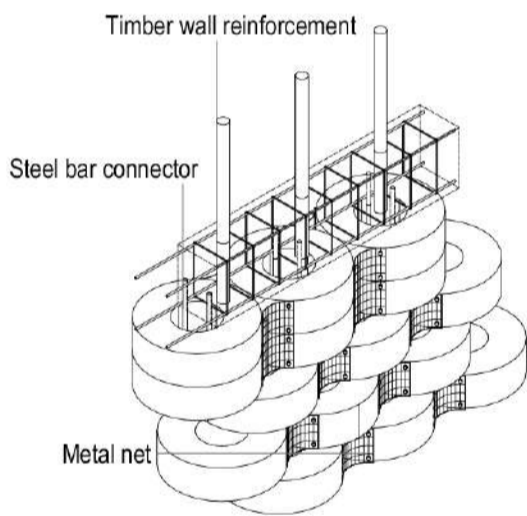
Suspended ceiling detail



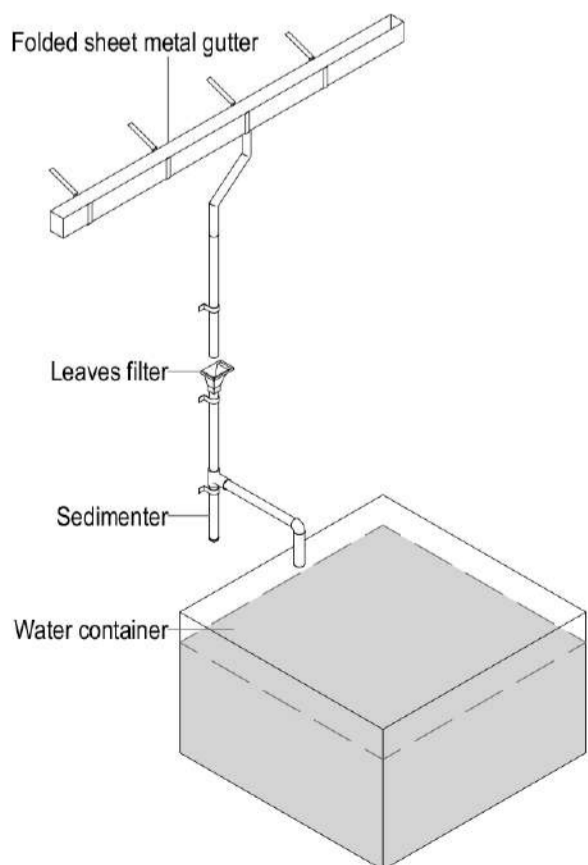
Wattle & daub envelope detail



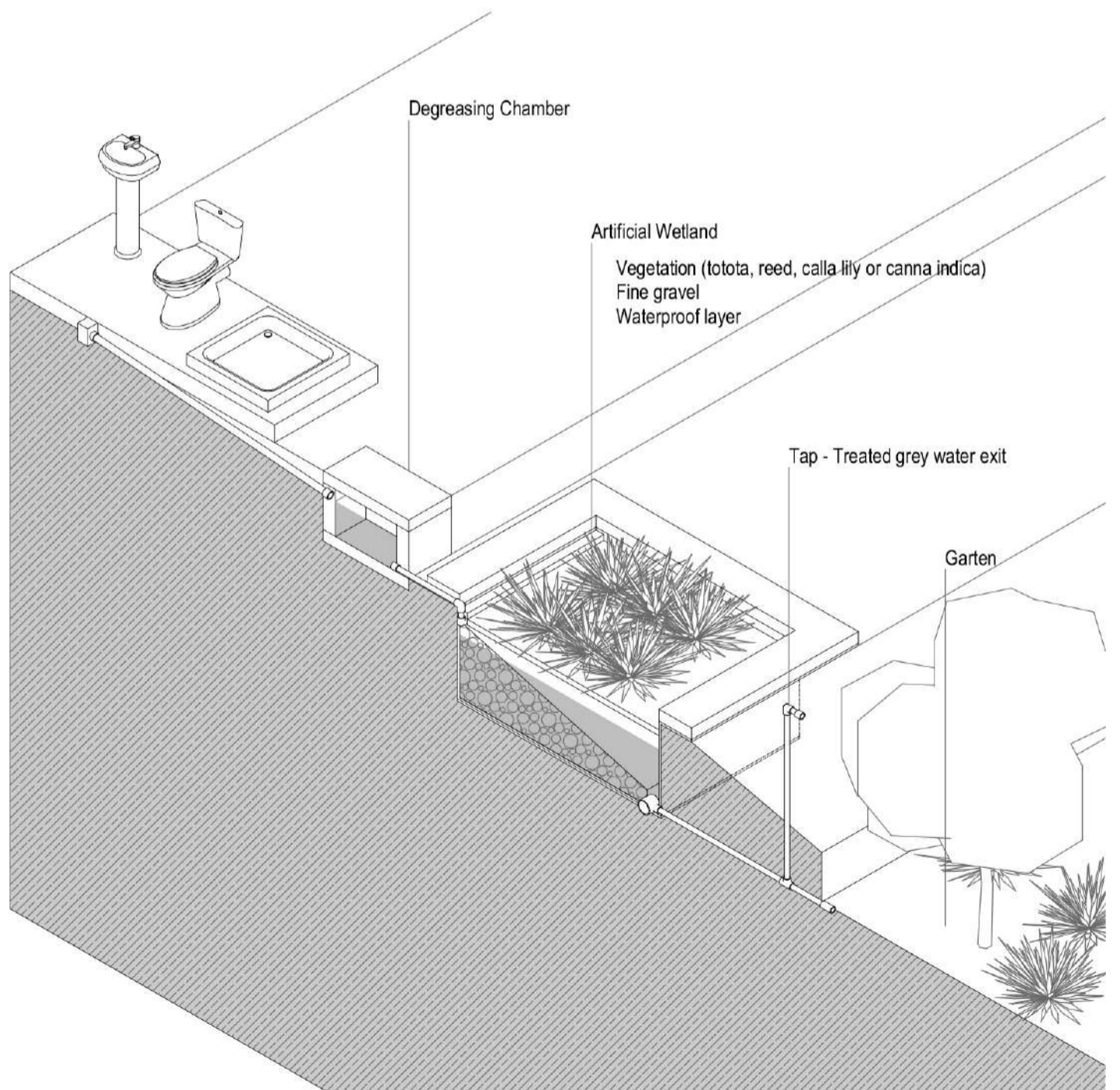
Roof ceiling detail



Retain tire wall



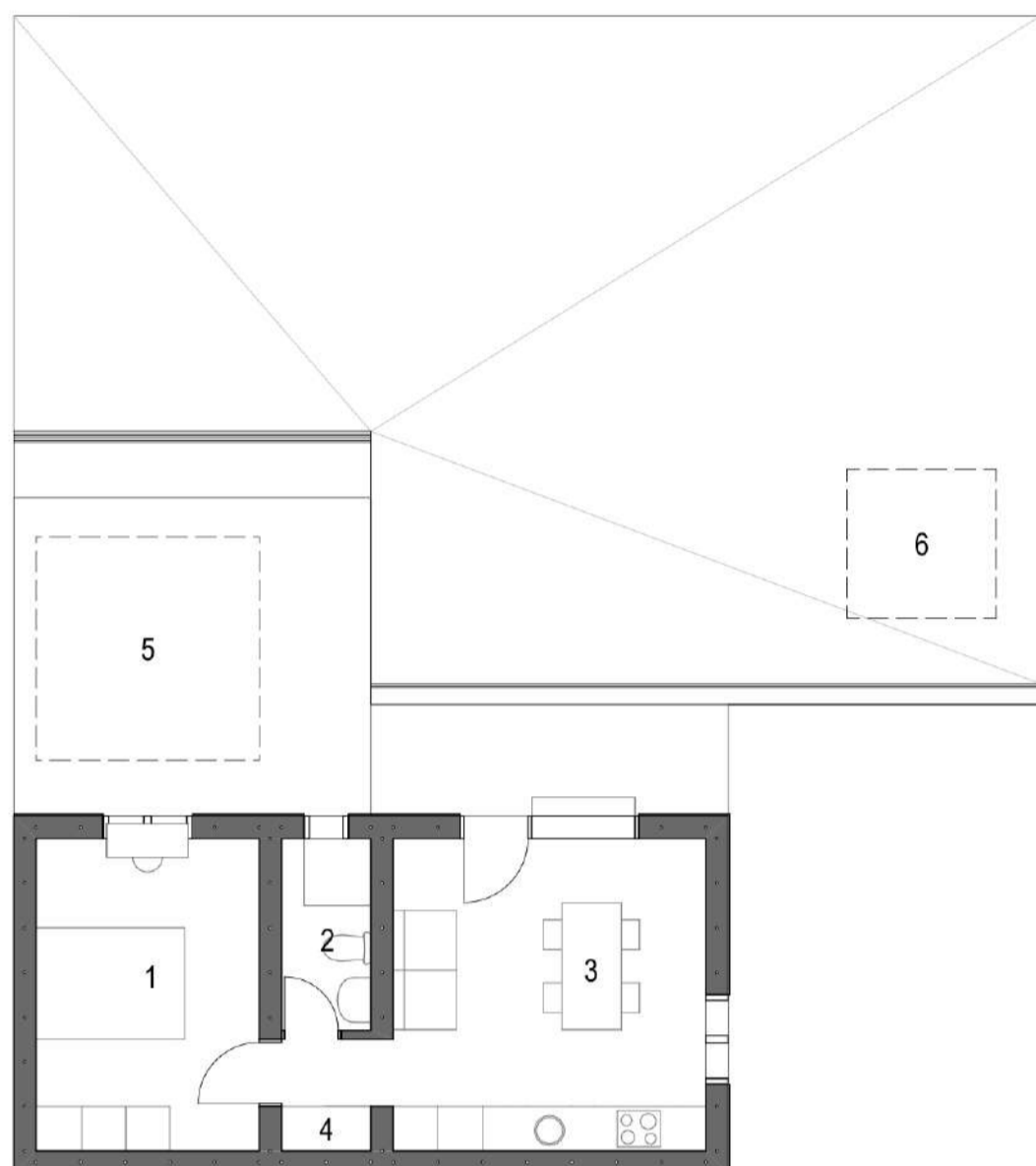
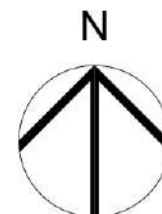
Rainwater harvesting system



Artificial wetland system - Grey water treatment

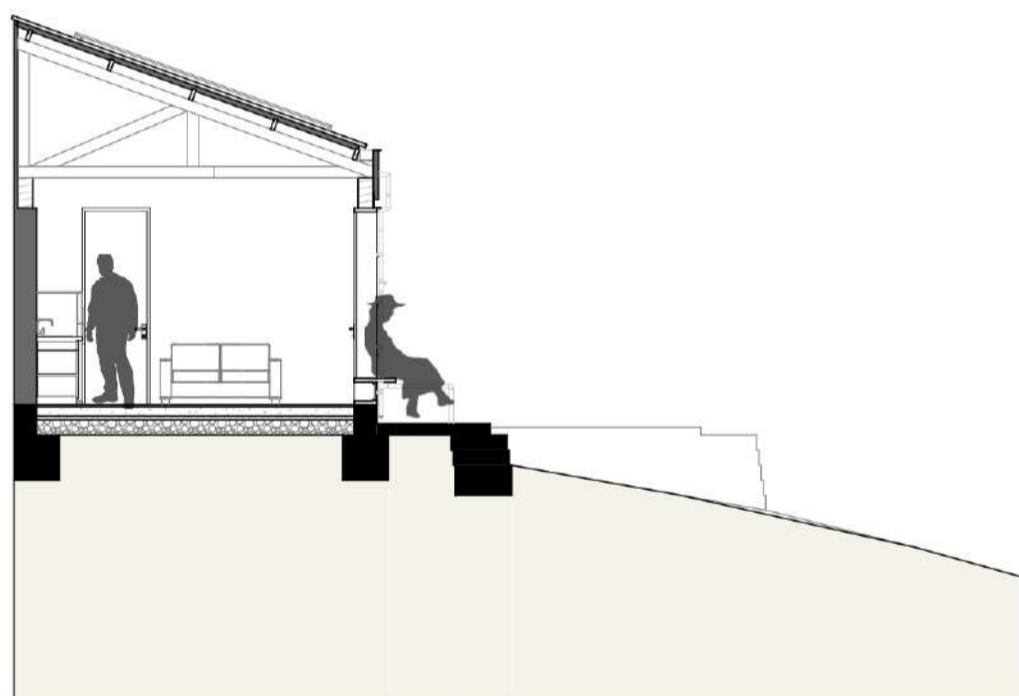
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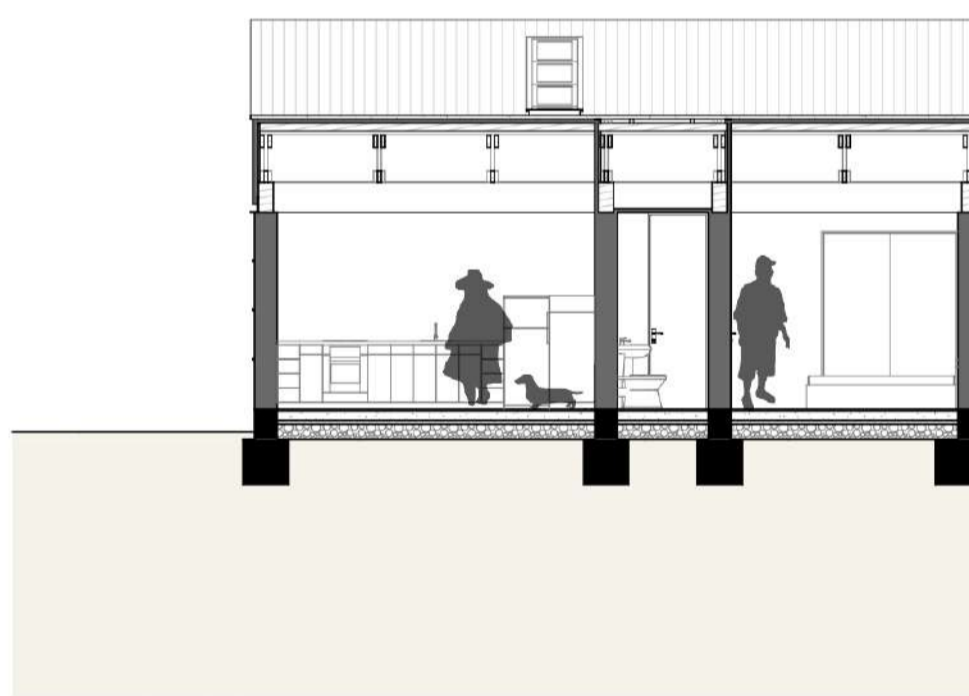


- 1 Bedroom
- 2 Bathroom
- 3 Kitchen - Living
- 4 Storage
- 5 Watertank
- 6 Artificial Wetland

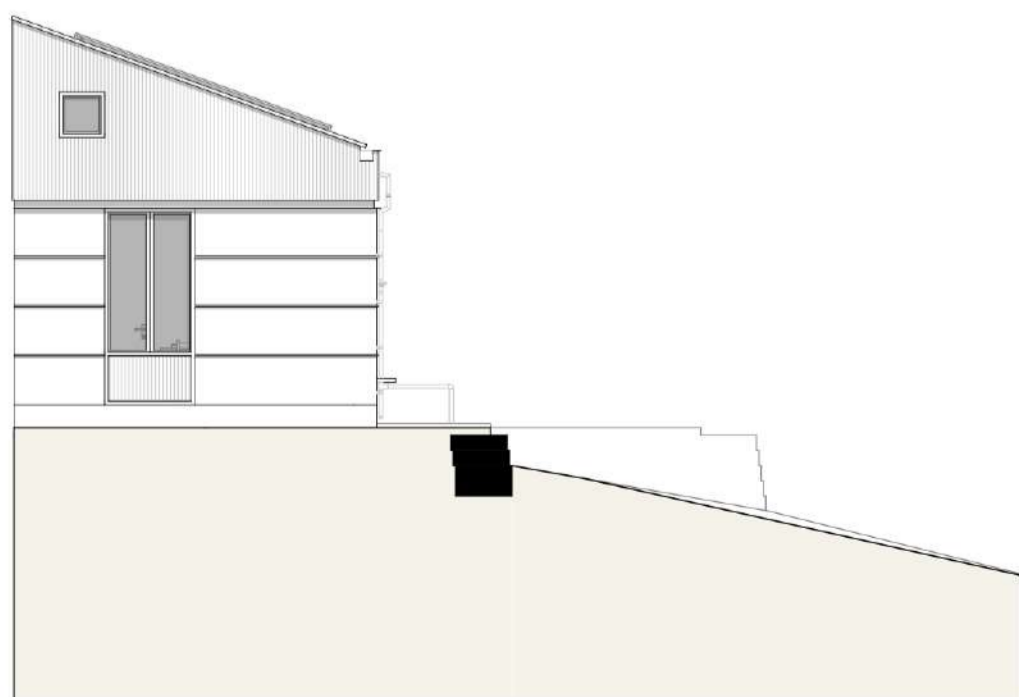
Ground floor
Area: 46.08 m²



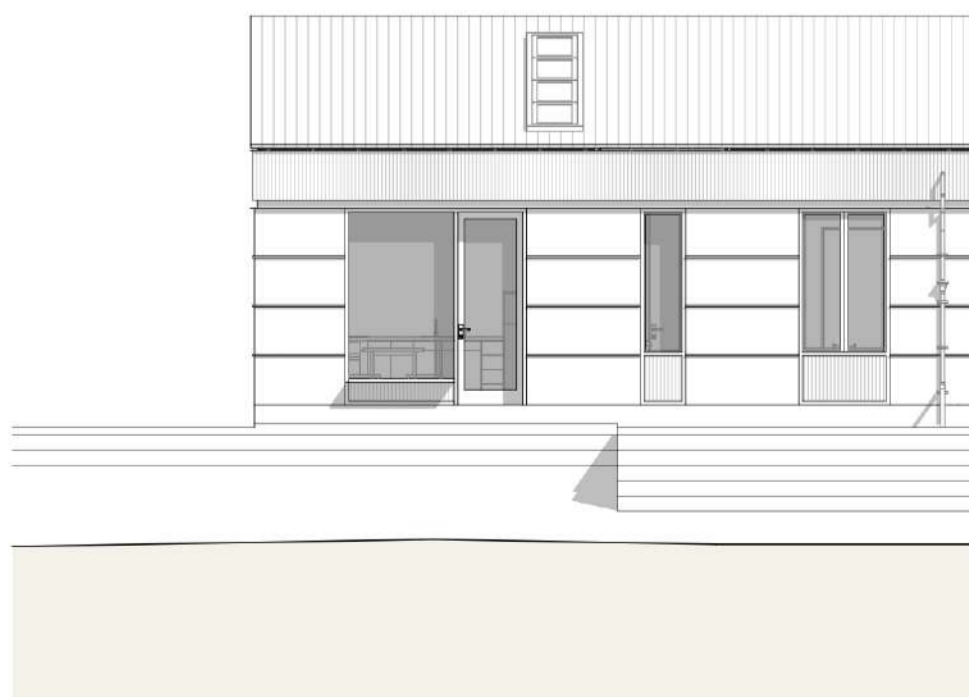
Transversal Section



Longitudinal Section



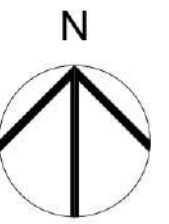
Lateral Facade



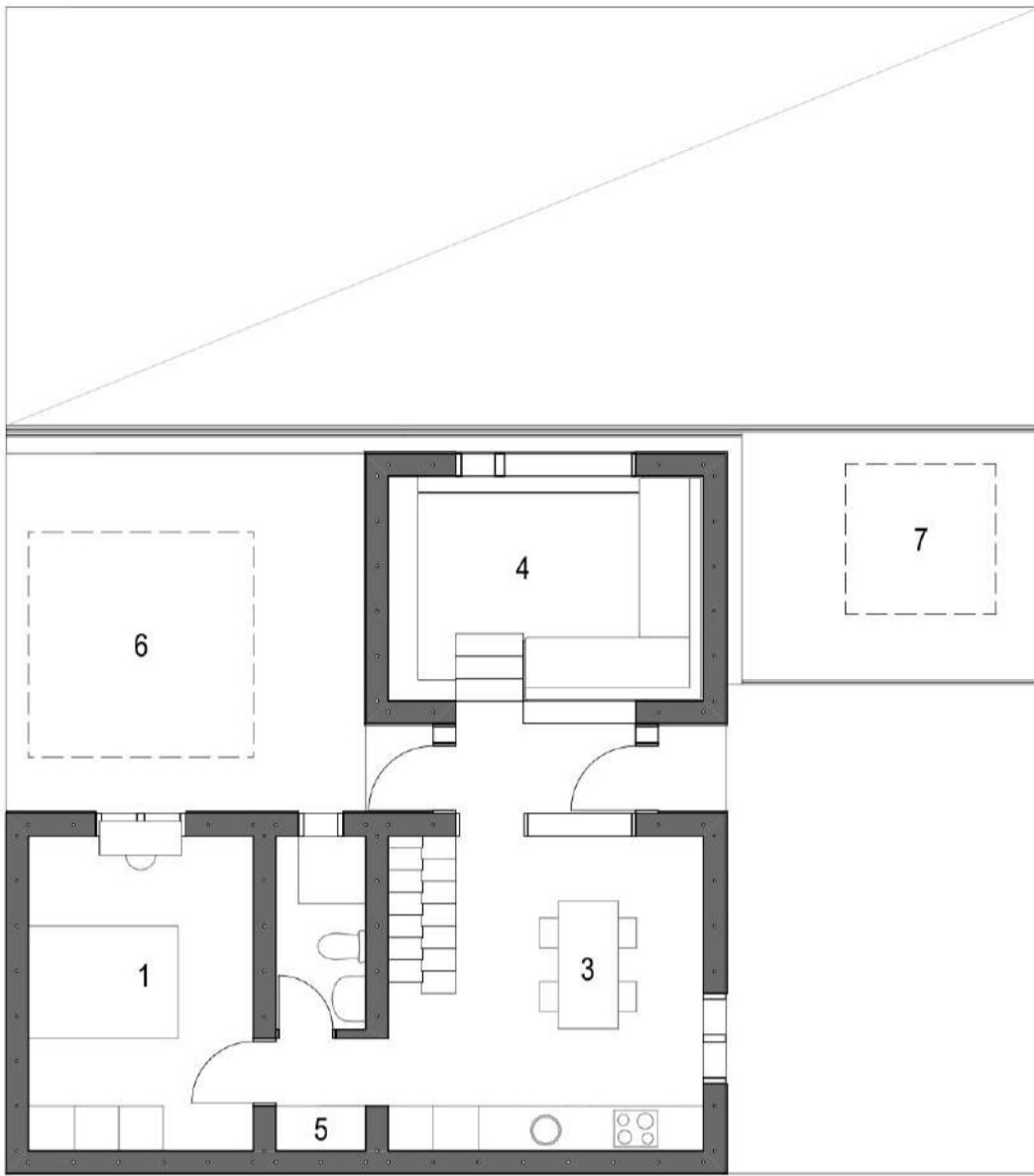
Front Facade

HOUSING DESIGN - THE MODULE

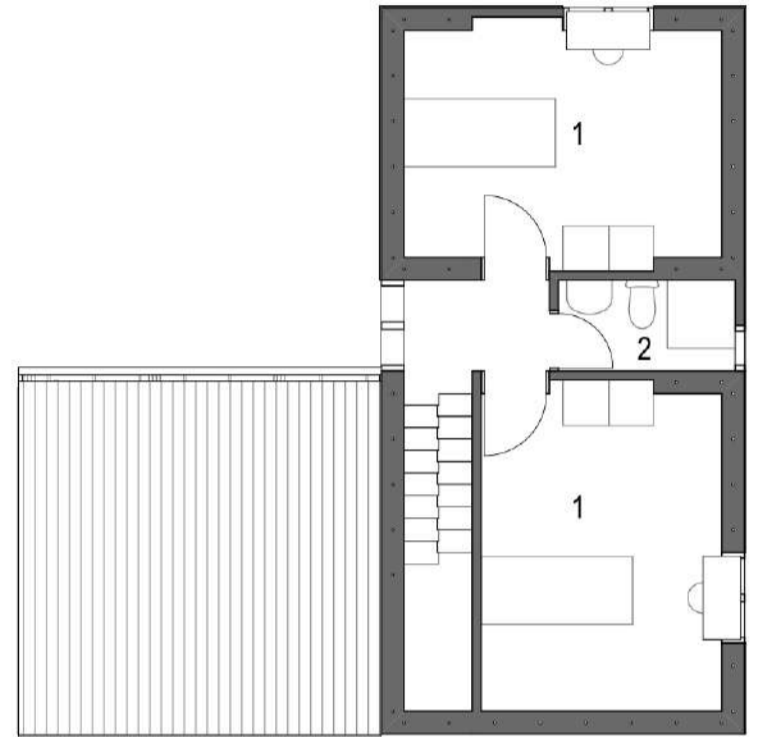
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- 1 Bedroom
- 2 Bathroom
- 3 Kitchen
- 4 Living room
- 5 Storage
- 6 Watertank
- 7 Artificial Wetland



Ground floor
Area: 69.12 m²



Upper floor
Area: 42.30 m²



Transversal Section



Longitudinal Section

HOUSING DESIGN - THE MODULE

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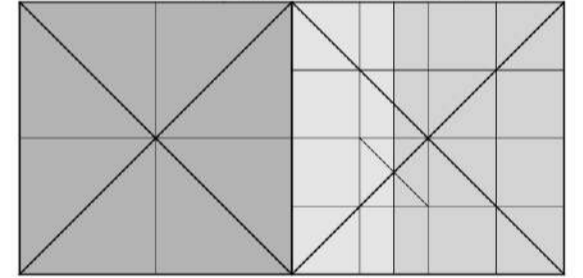


Lateral Facade



Front Facade

SECOND STAGE / Scale 1:100



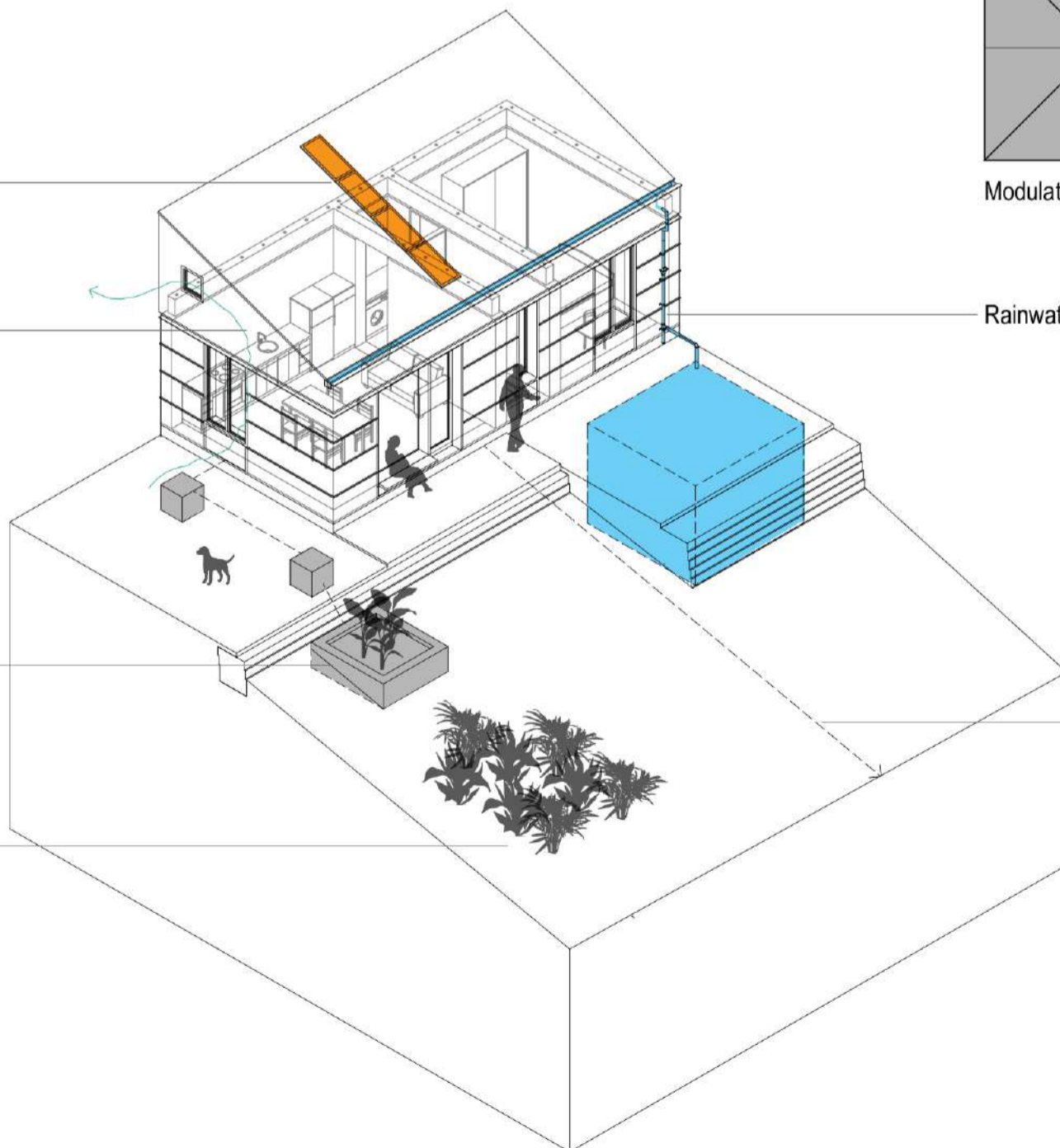
Modulation

Solar energy harvesting

Natural ventilation

Grey water treatment /
Artificial wetland

Garden



Rainwater harvesting

Black water treatment /
Urban artificial wetlands

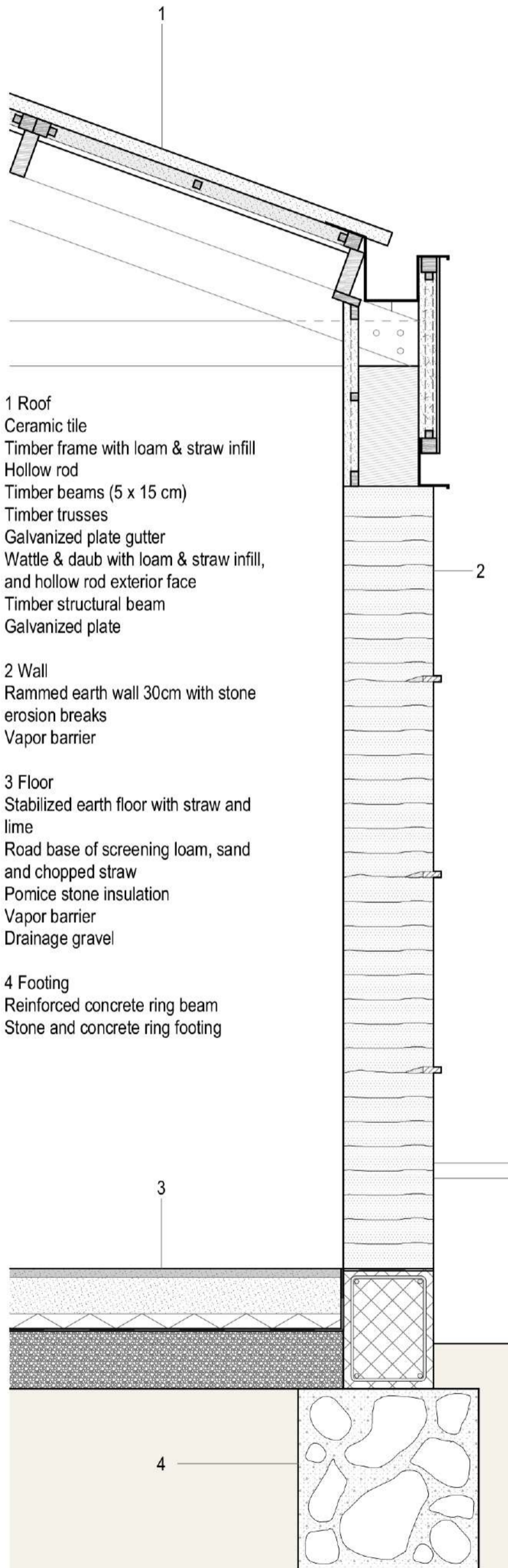
HOUSING DESIGN - THE MODULE

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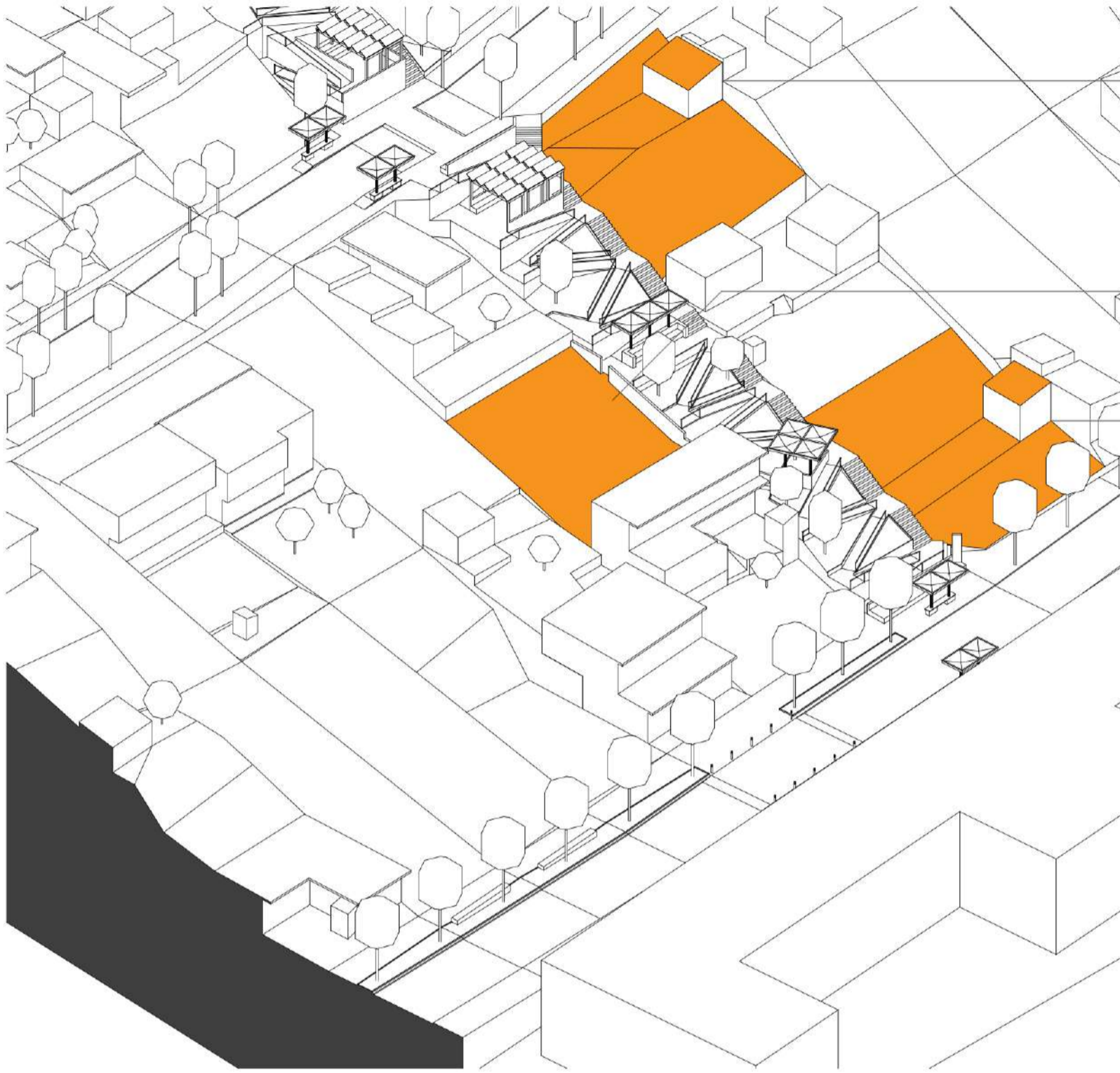
HOUSING DESIGN - THE MODULE

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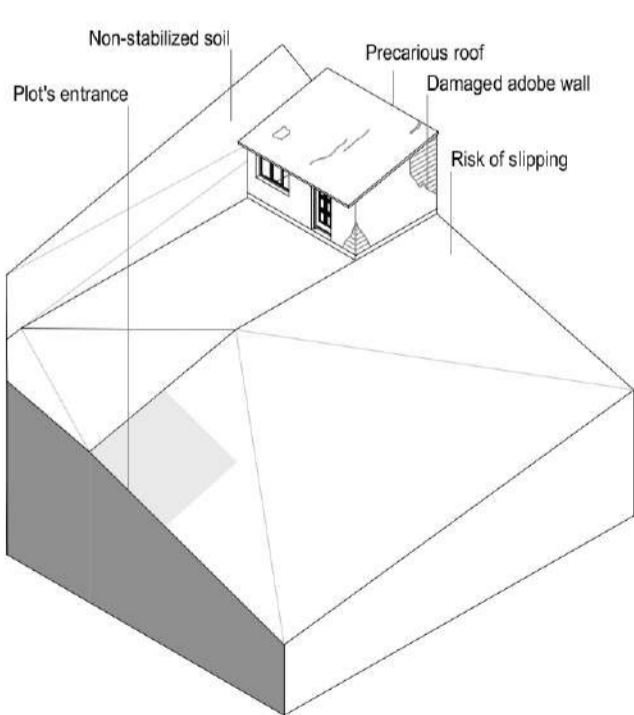
CASE 1



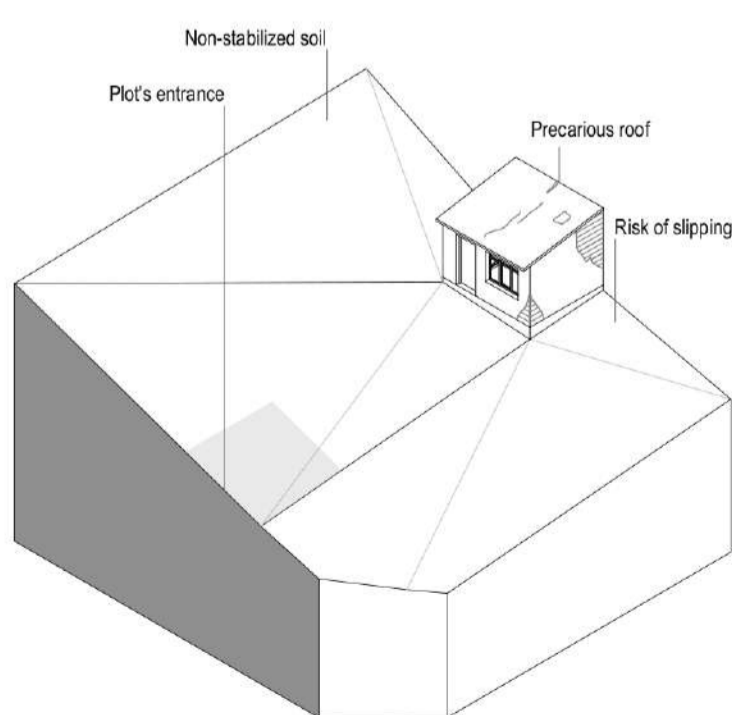
CASE 3



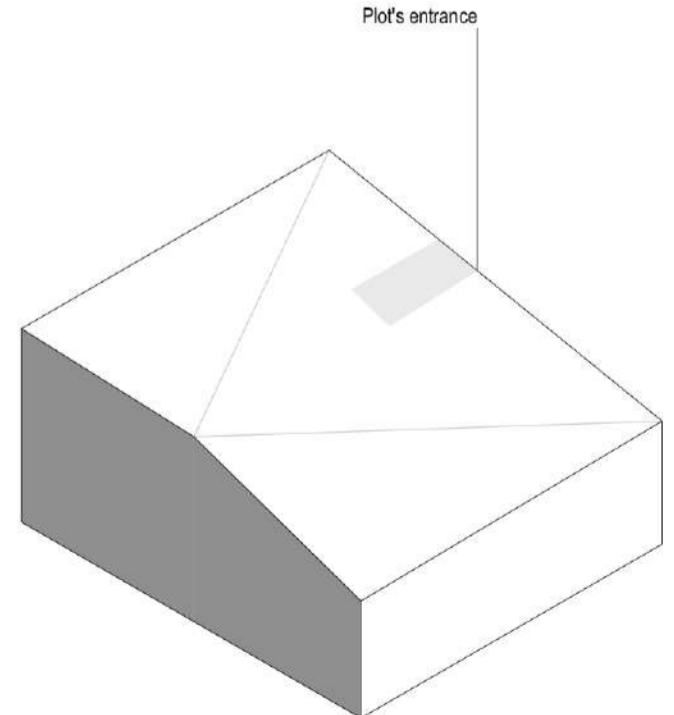
CASE 2



CASE 1



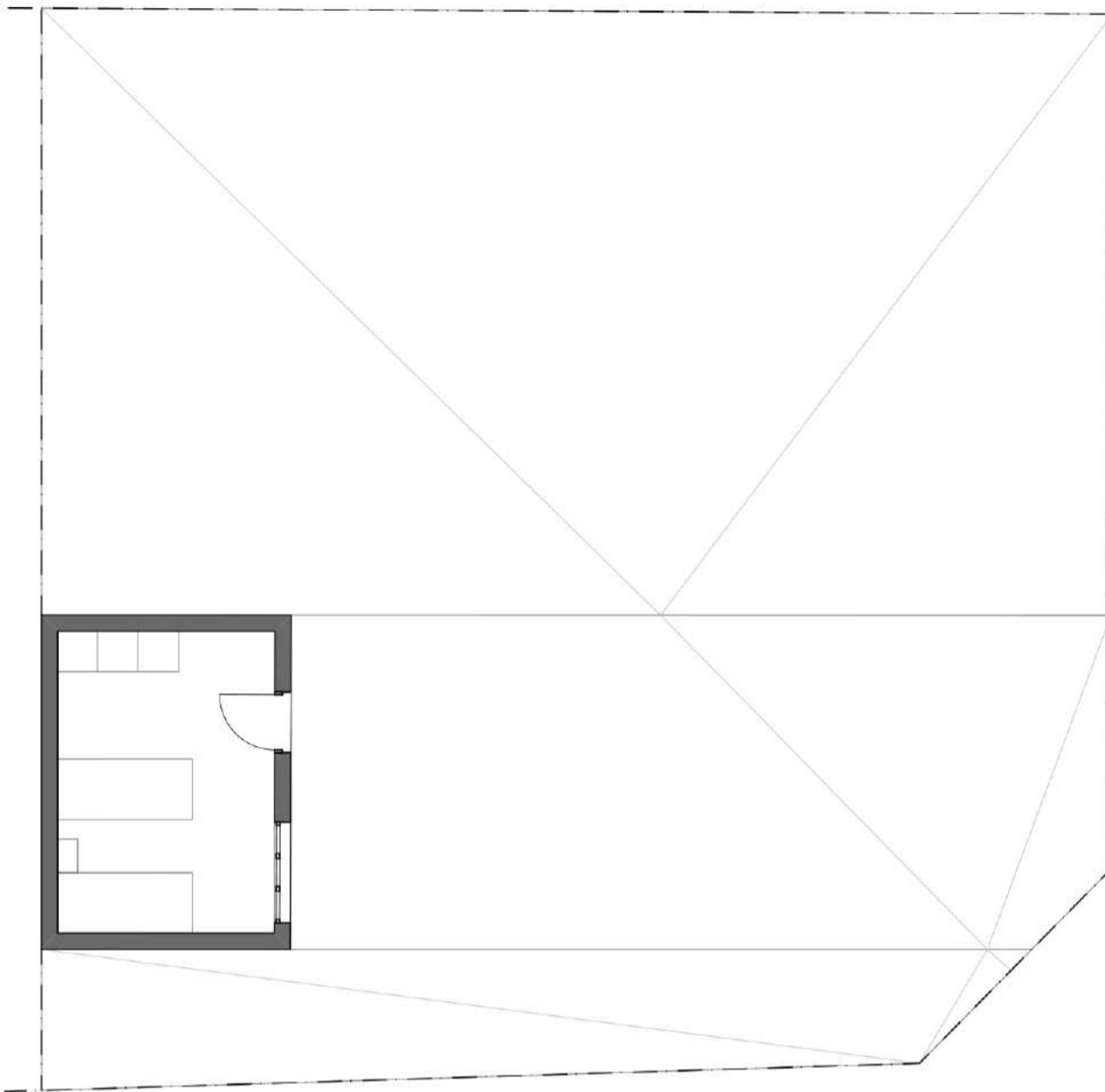
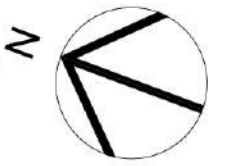
CASE 2



CASE 3

HOUSING DESIGN - CASE 1

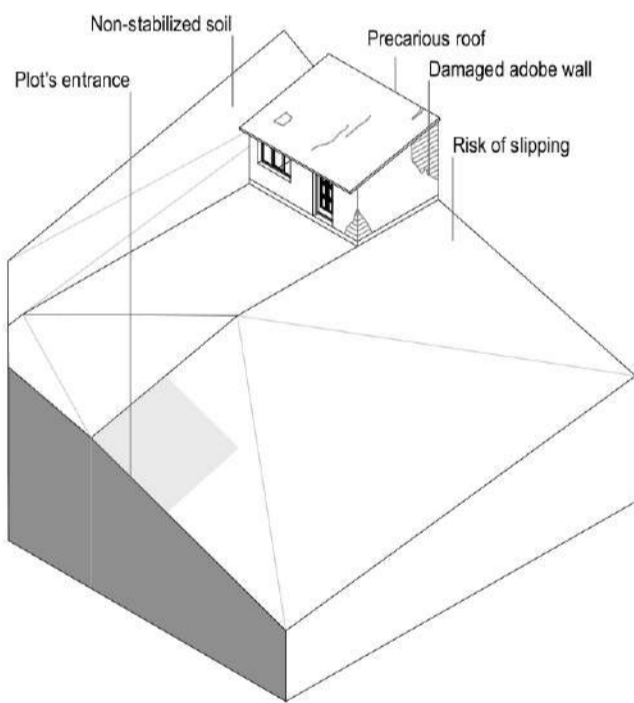
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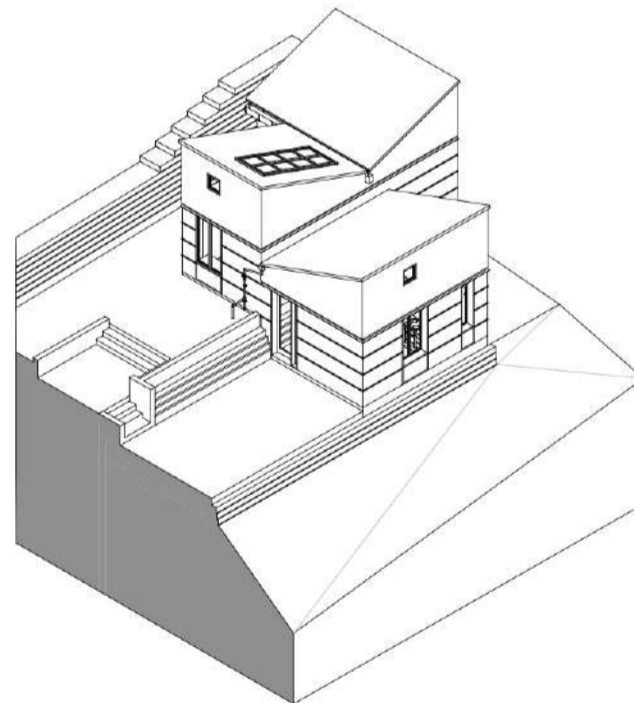
Original State - Ground floor
Scale 1:100



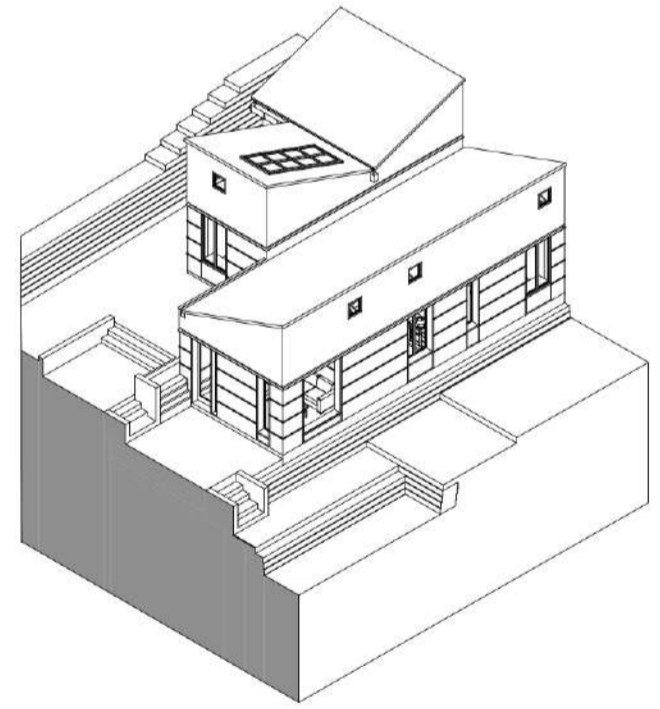
Family composition



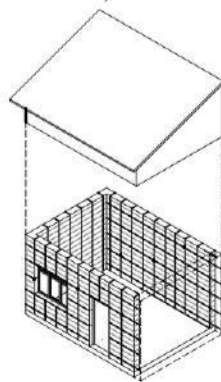
Original Stage



First Stage



Second Stage



- + Increase height
- + Roof replacement
- + Rope reinforcement
- + Replace damaged wall
- + Stabilize the foundations
- + Retain tire wall



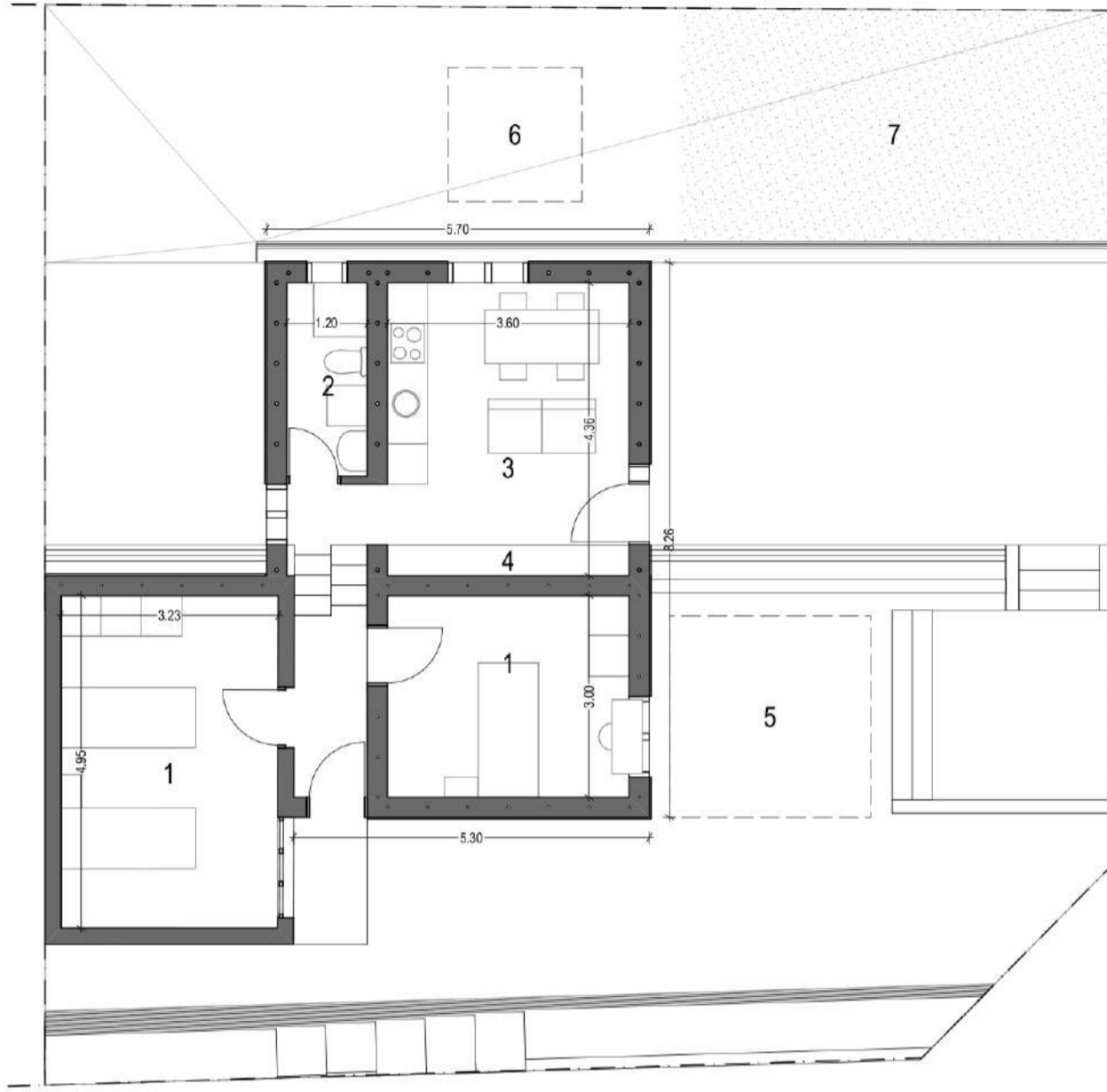
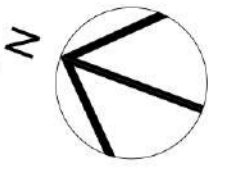
- + Rainwater collection during the year:
30 m³ / 56 % requirement
4 months of rain season 100%
- + Total Intervention: 65.96 m²
20.35 m² / Existing adobe construction
45.61 m² / Extension



- + Rainwater collection during the year:
45 m³ / 82 % requirement
4 months of rain season 100%
- + Total Intervention: 99.70 m²

HOUSING DESIGN - CASE 1

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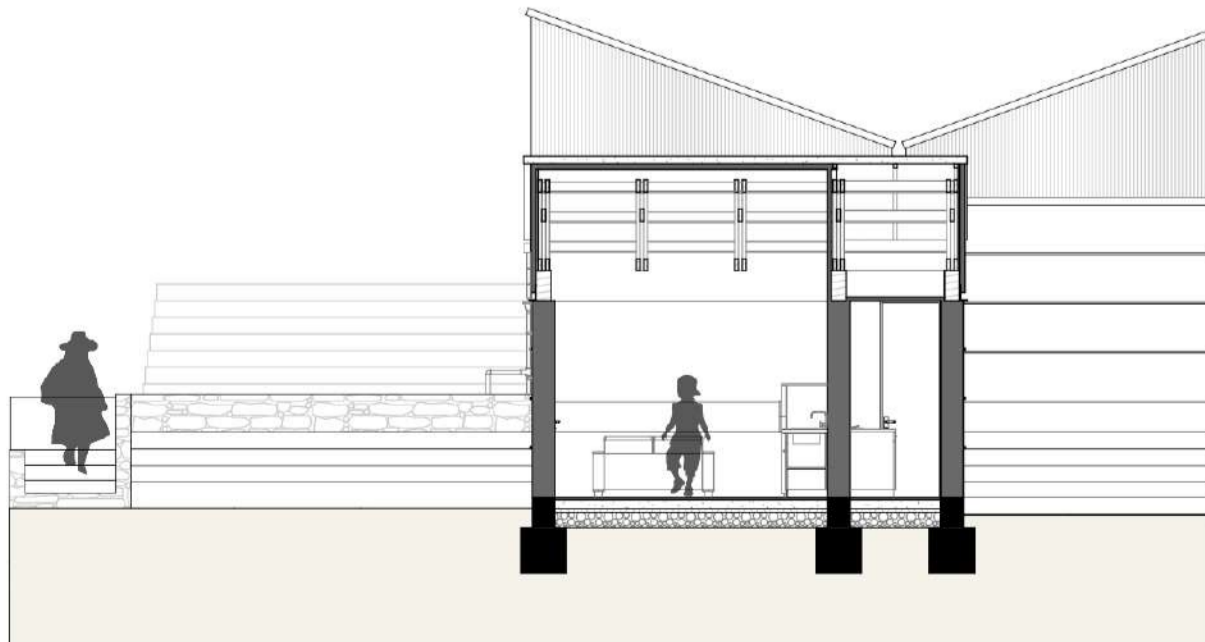


- 1 Bedroom
- 2 Bathroom
- 3 Kitchen - Living
- 4 Storage
- 5 Watertank
- 6 Artificial Wetland
- 7 Garten

Ground floor



Transversal Section



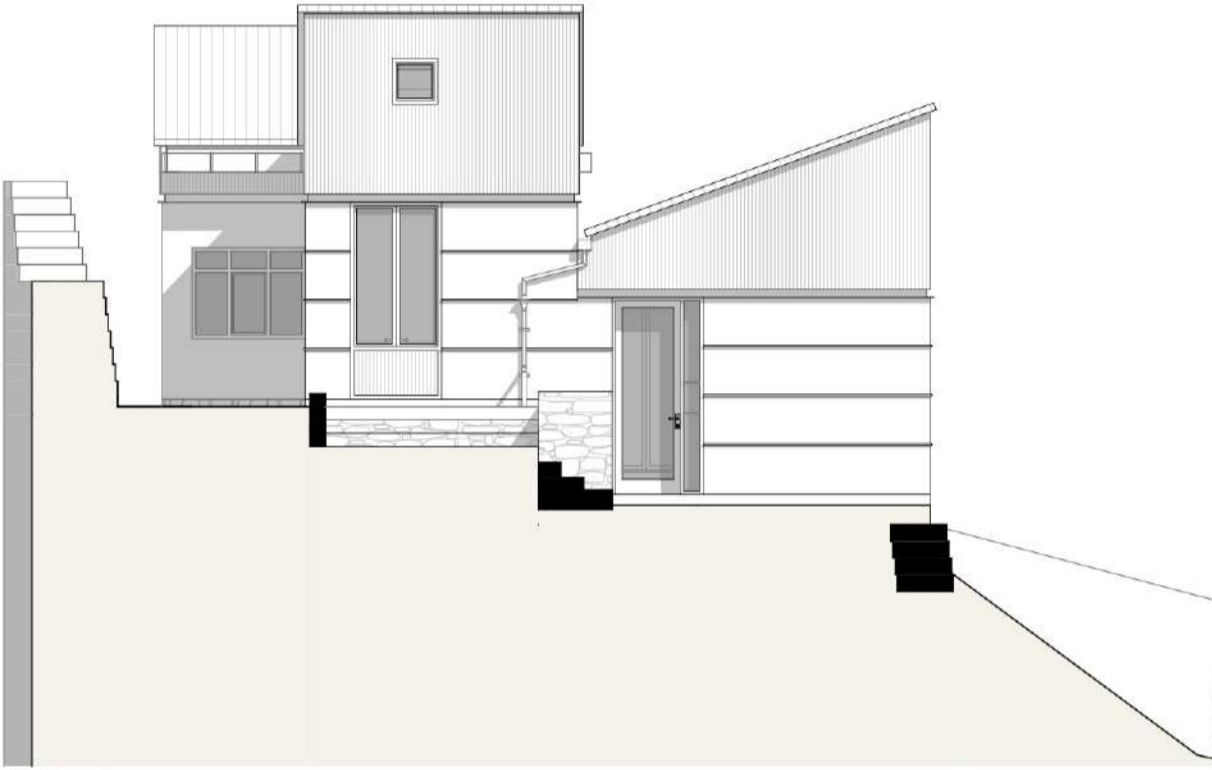
Longitudinal Section

HOUSING DESIGN - CASE 1

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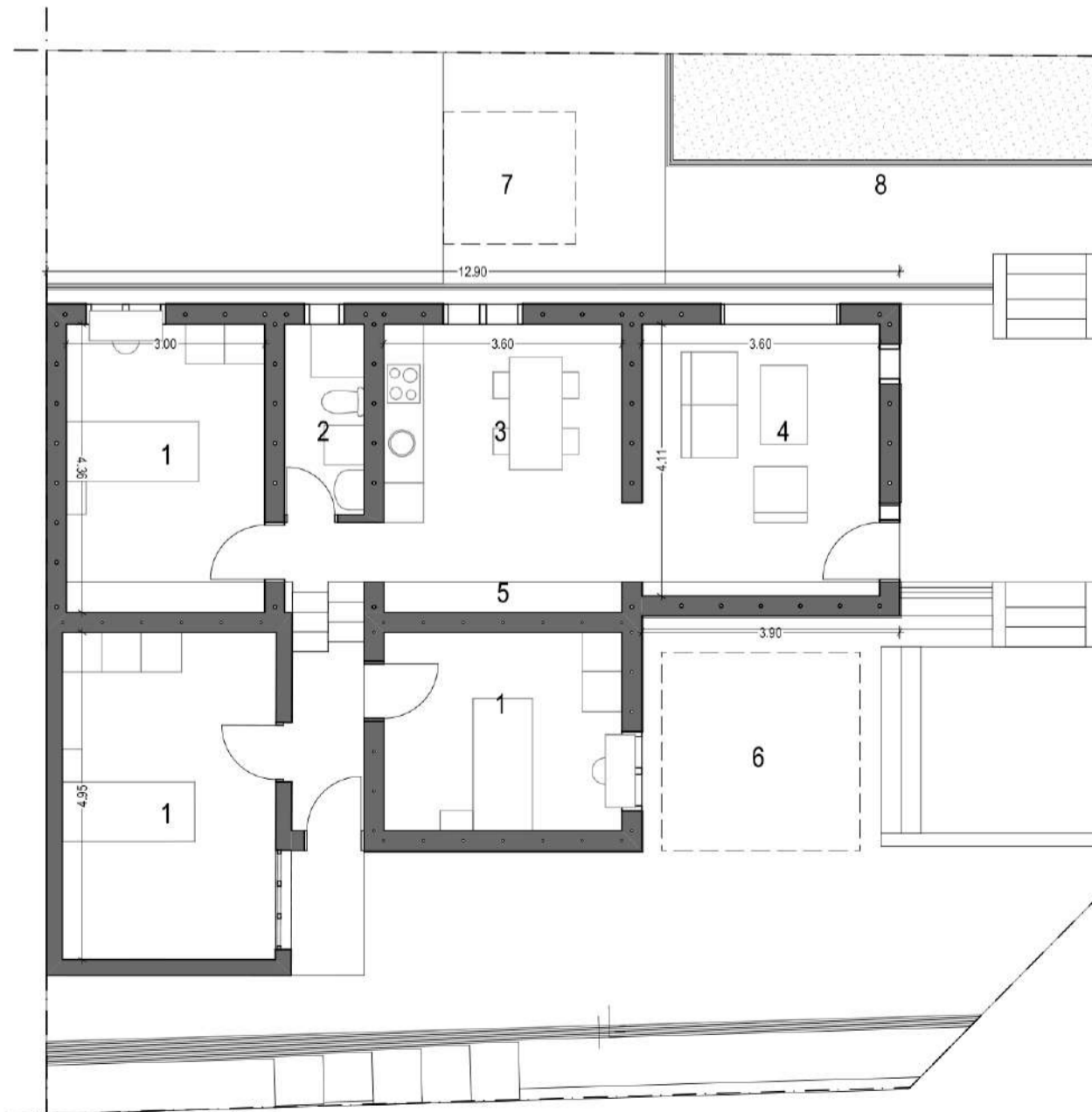
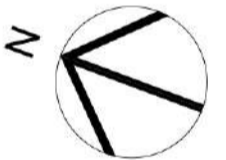


East Facade



South Facade

CASE 1 FIRST STAGE / Scale 1:100

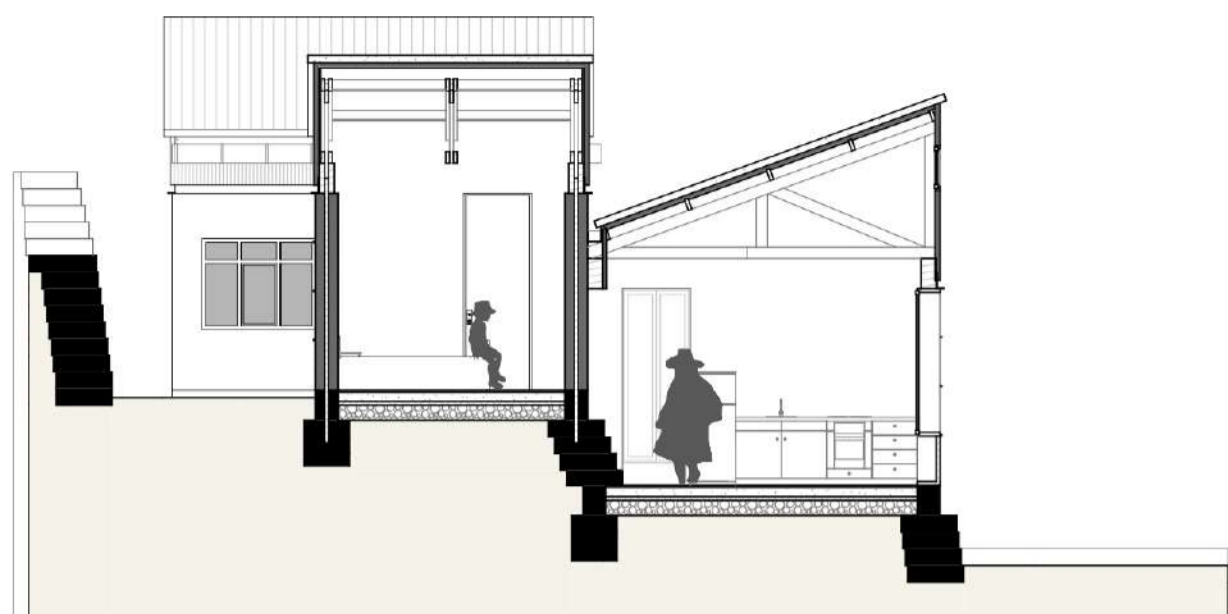


Ground floor

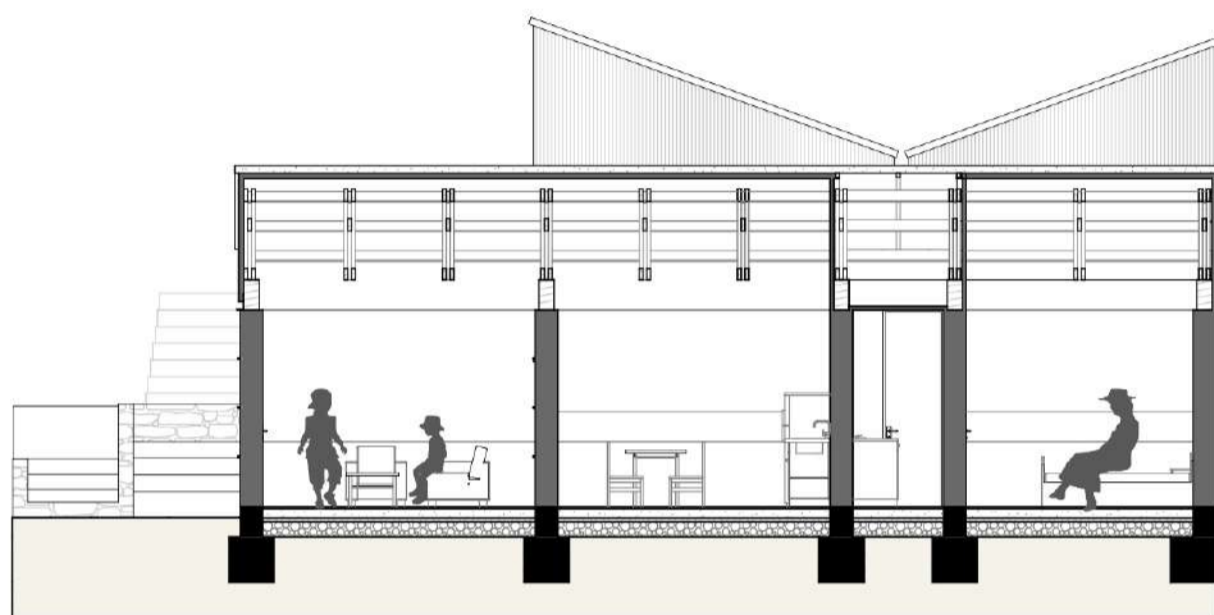
- 1 Bedroom
- 2 Bathroom
- 3 Kitchen
- 4 Living room
- 5 Storage
- 6 Watertank
- 7 Artificial Wetland
- 8 Garten

HOUSING DESIGN - CASE 1

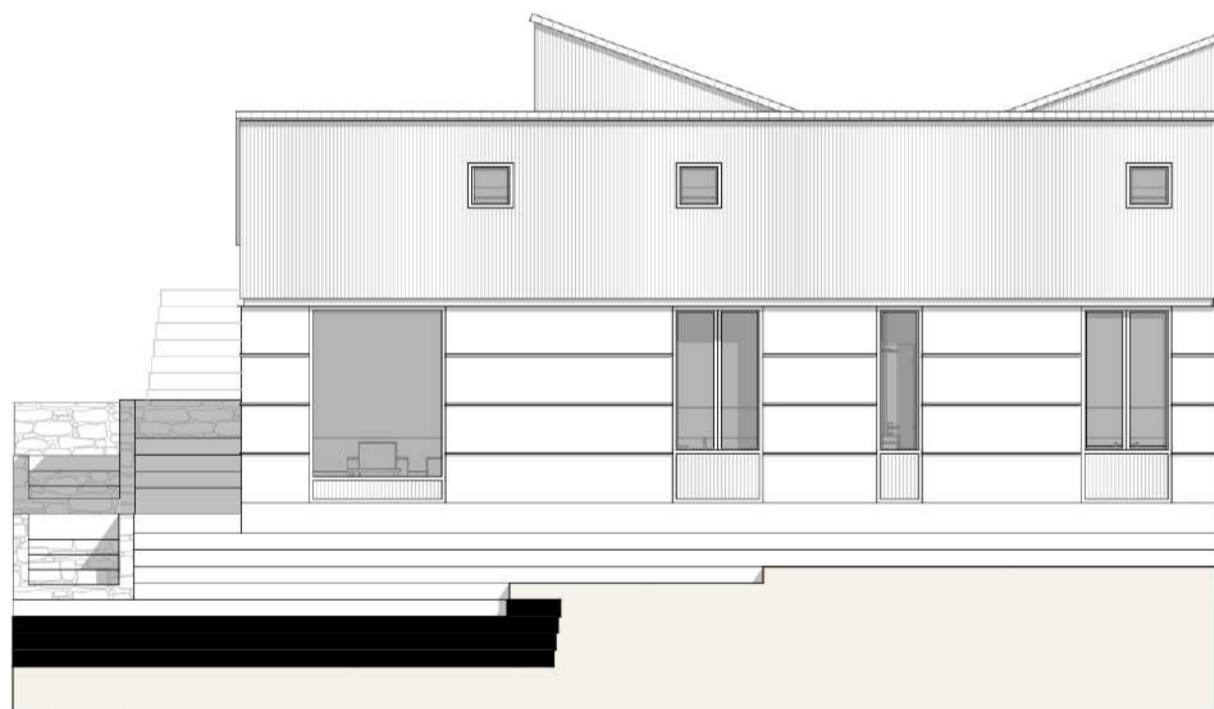
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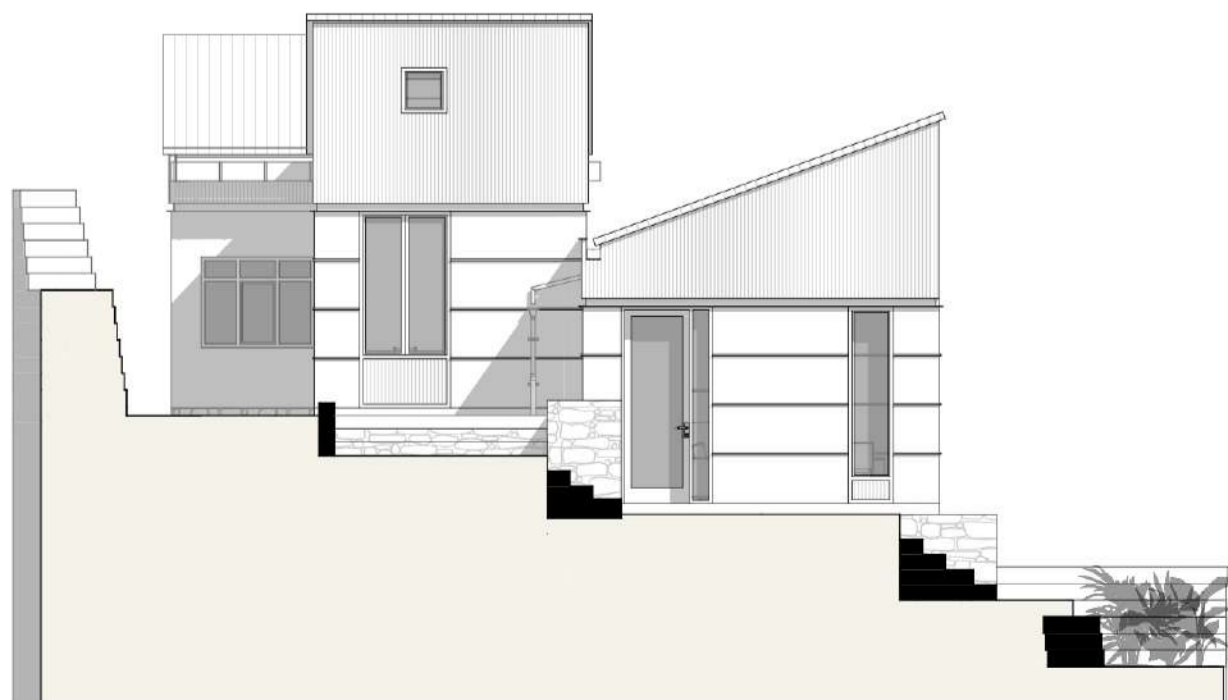
Transversal Section



Longitudinal Section



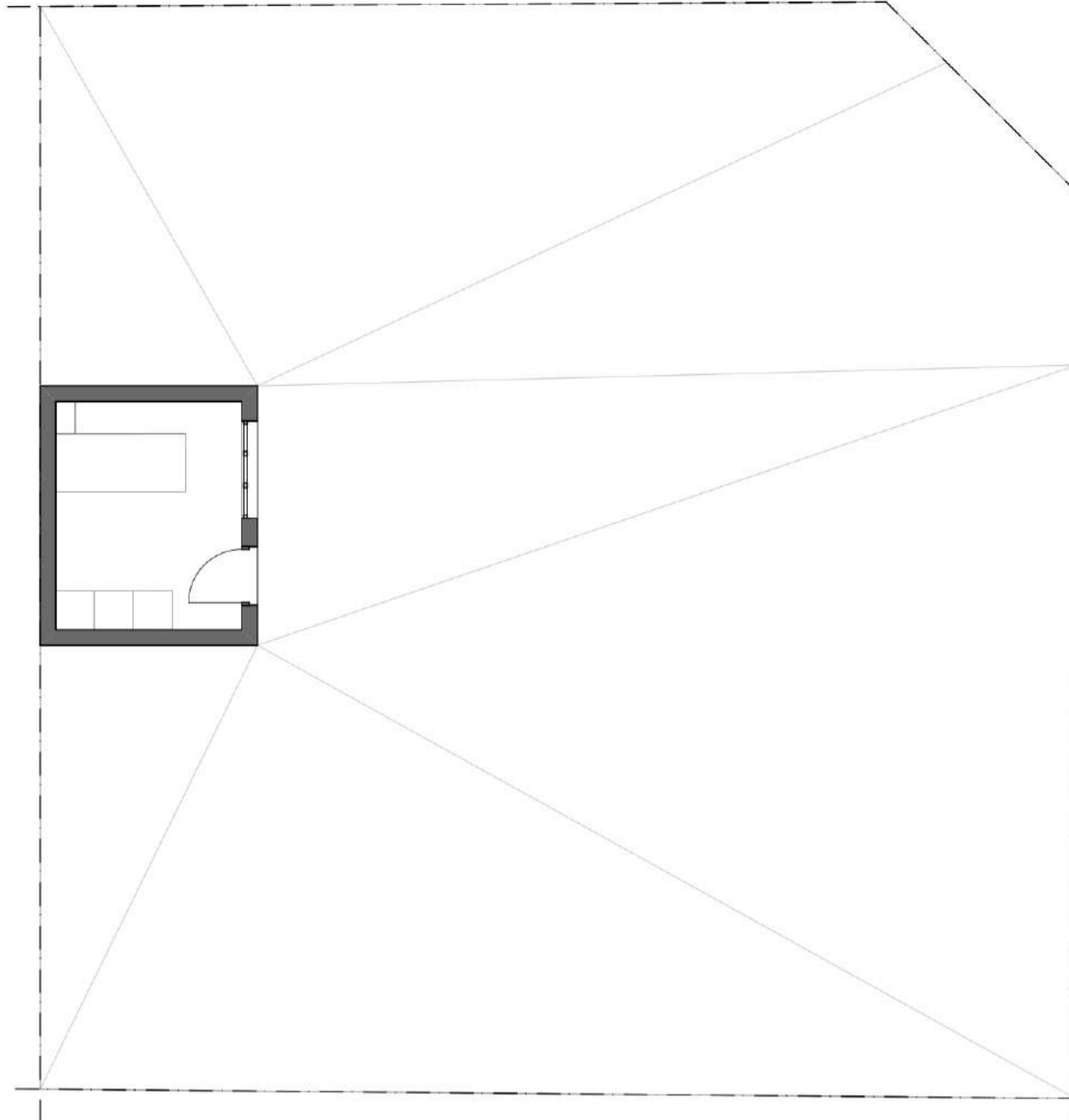
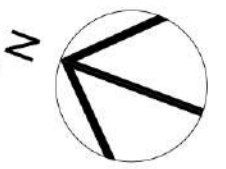
East Facade



South Facade

HOUSING DESIGN - CASE 2

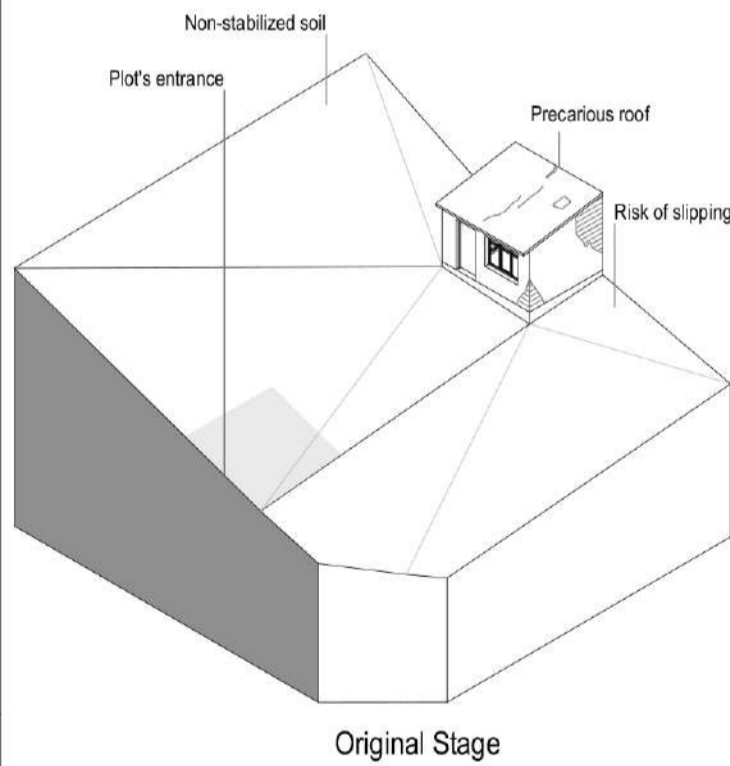
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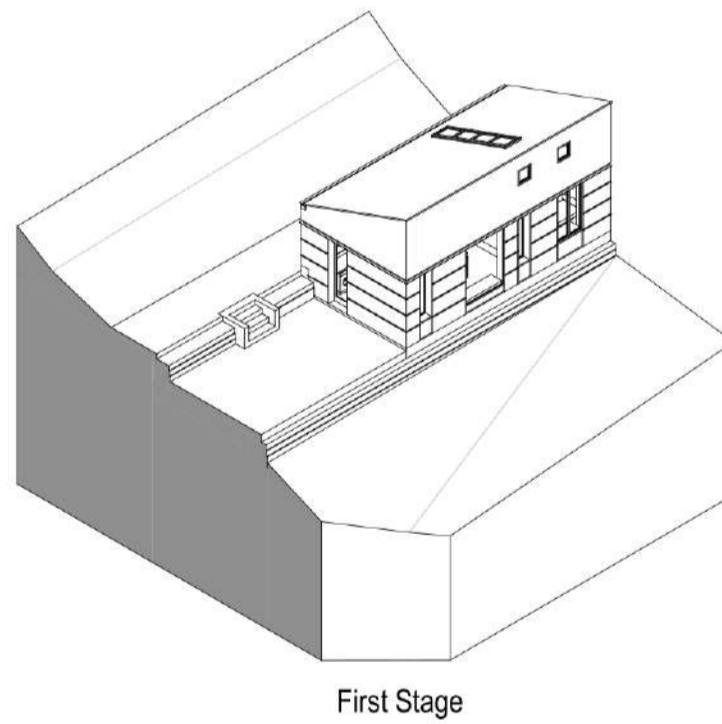
Original State - Ground floor
Scale 1:100



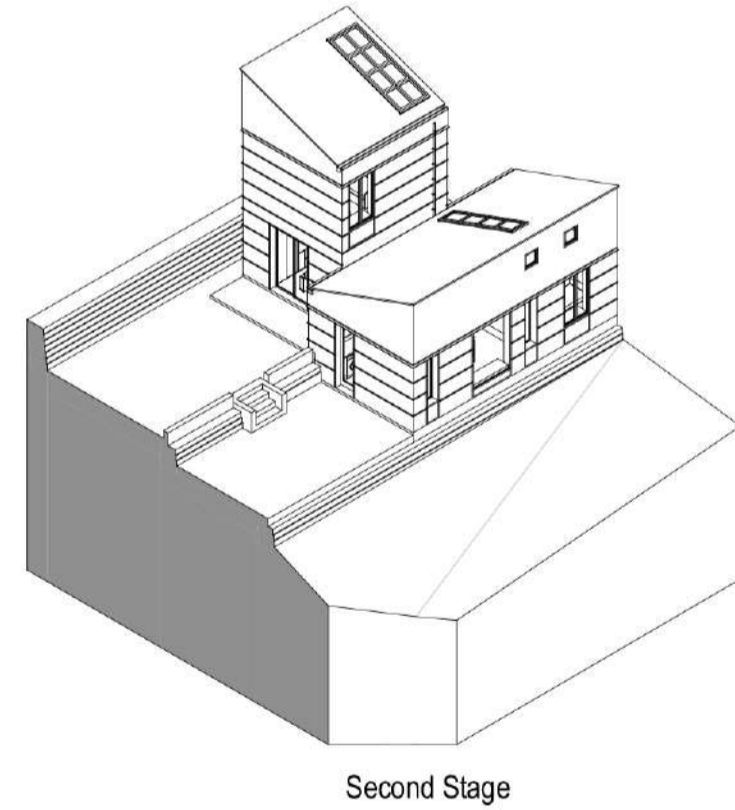
Family composition



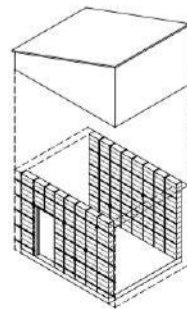
Original Stage



First Stage



Second Stage



- + Increase height
- + Roof replacement
- + Rope reinforcement
- + Rammed earth walls
- + Stabilize the foundations
- + Retain tire wall



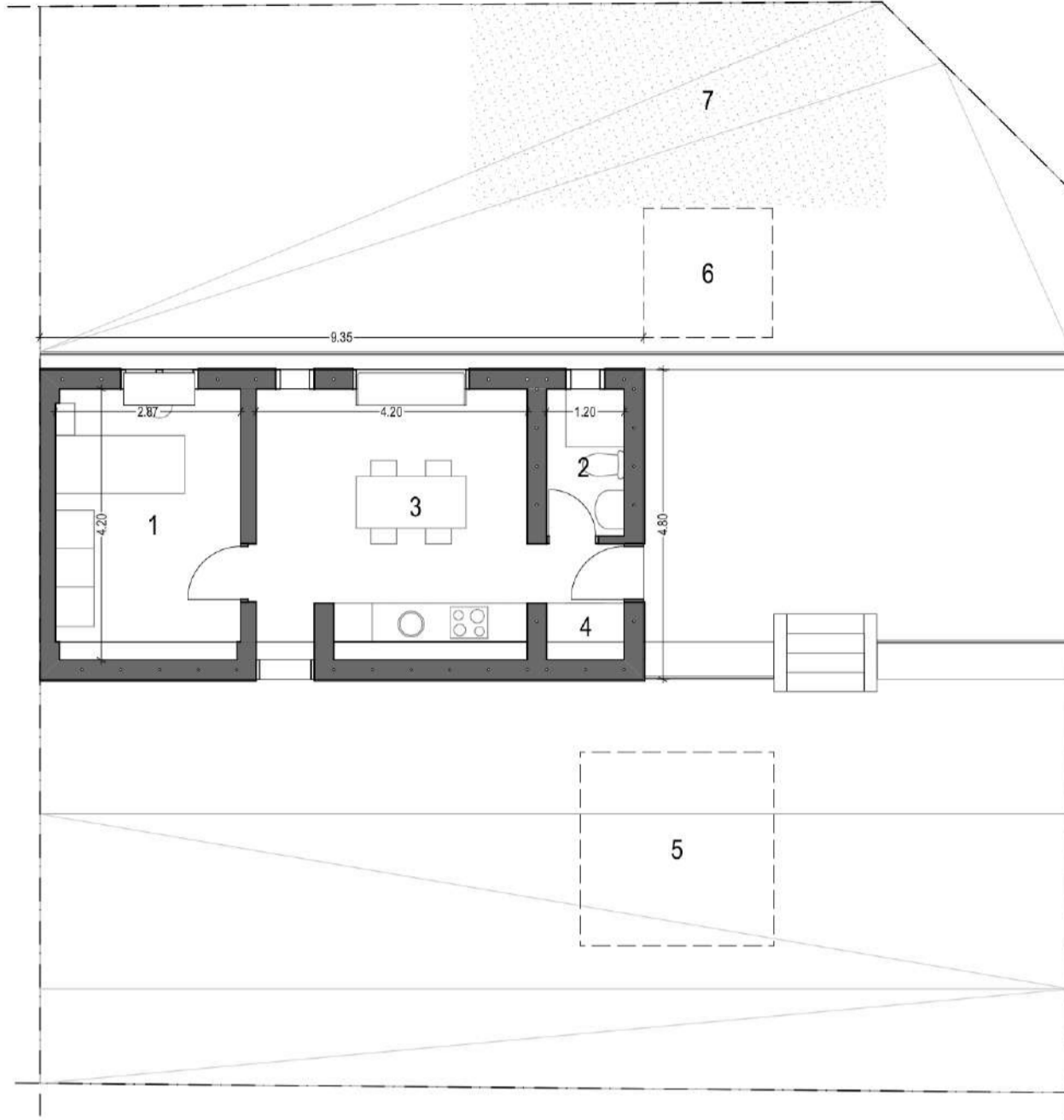
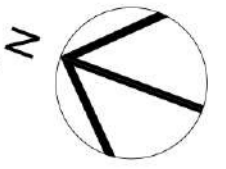
- + Rainwater collection during the year:
20 m³ / 36 % requirement
4 months of rain season 100%
- + Total Intervention: 44.88 m²
13.13 m² / Existing adobe construction
31.75 m² / Extension



- + Rainwater collection during the year:
26 m³ / 48 % requirement
4 months of rain season 100%
- + Total Intervention: 85.49 m²

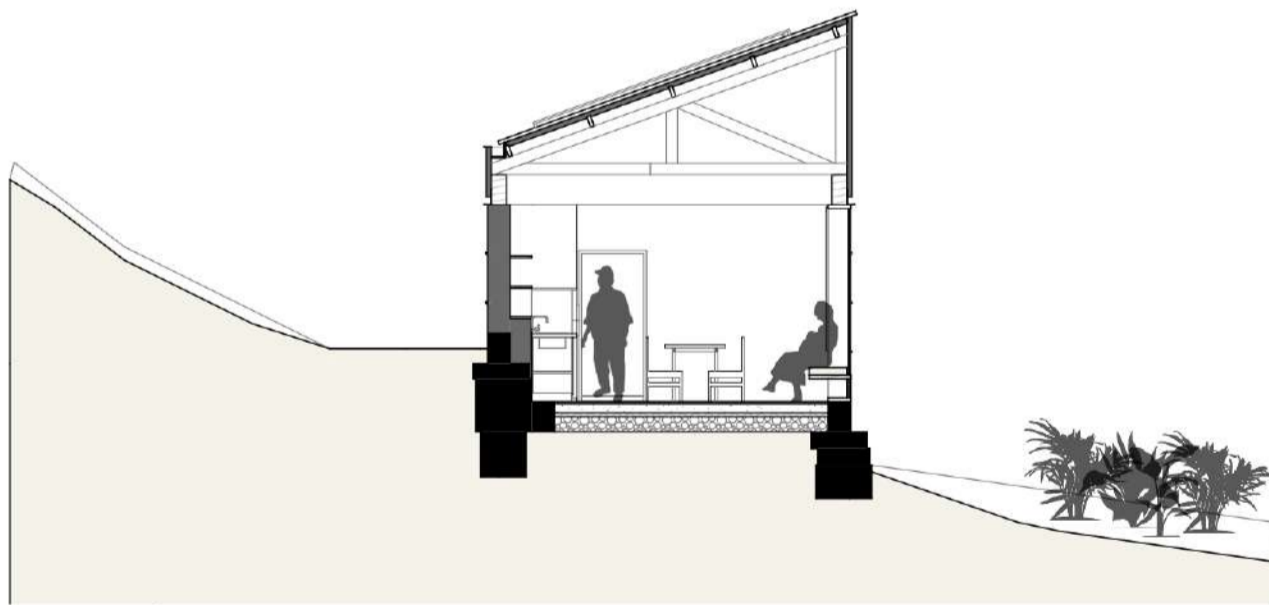
HOUSING DESIGN - CASE 2

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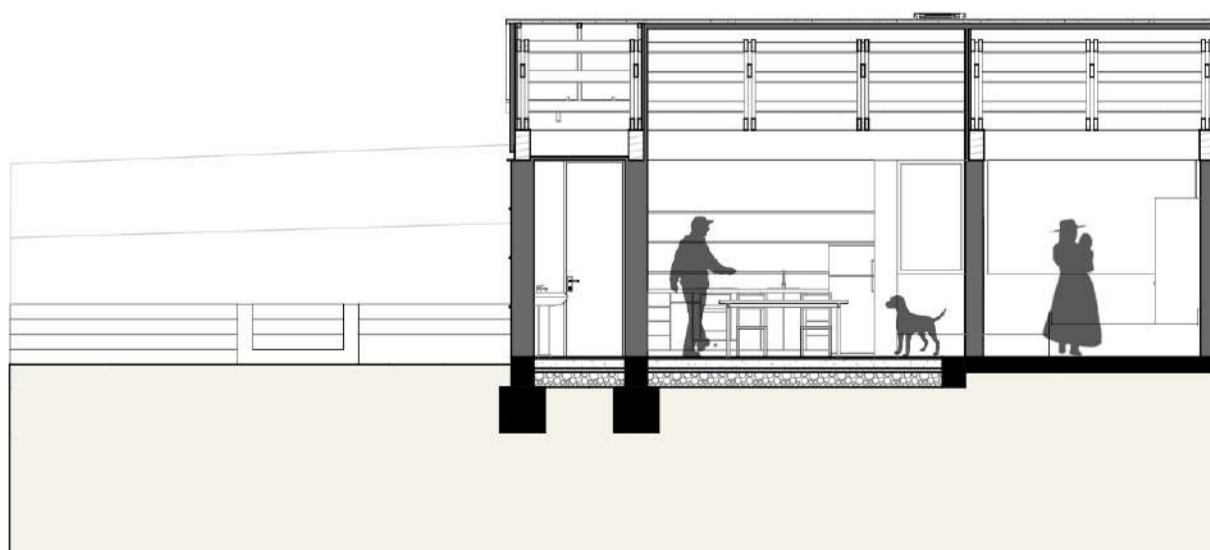


Ground floor

- 1 Bedroom
- 2 Bathroom
- 3 Kitchen - Living
- 4 Storage
- 5 Watertank
- 6 Artificial Wetland
- 7 Garten



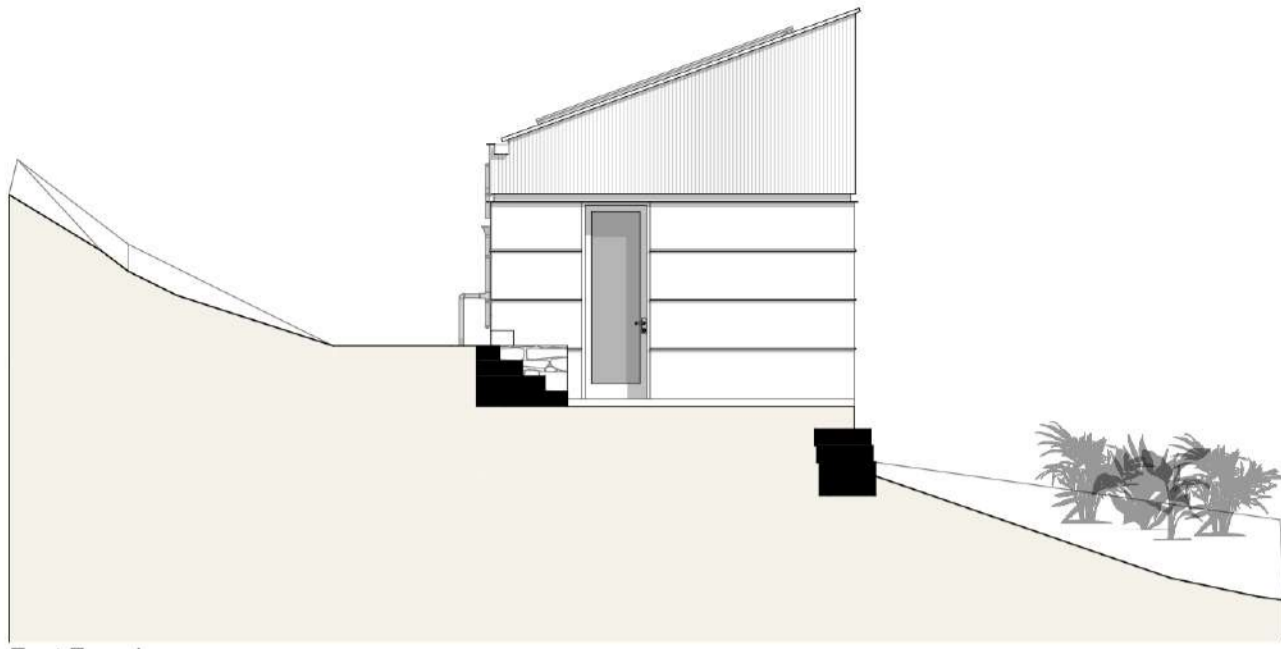
Transversal Section



Longitudinal Section

HOUSING DESIGN - CASE 2

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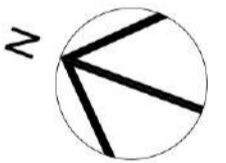


East Facade

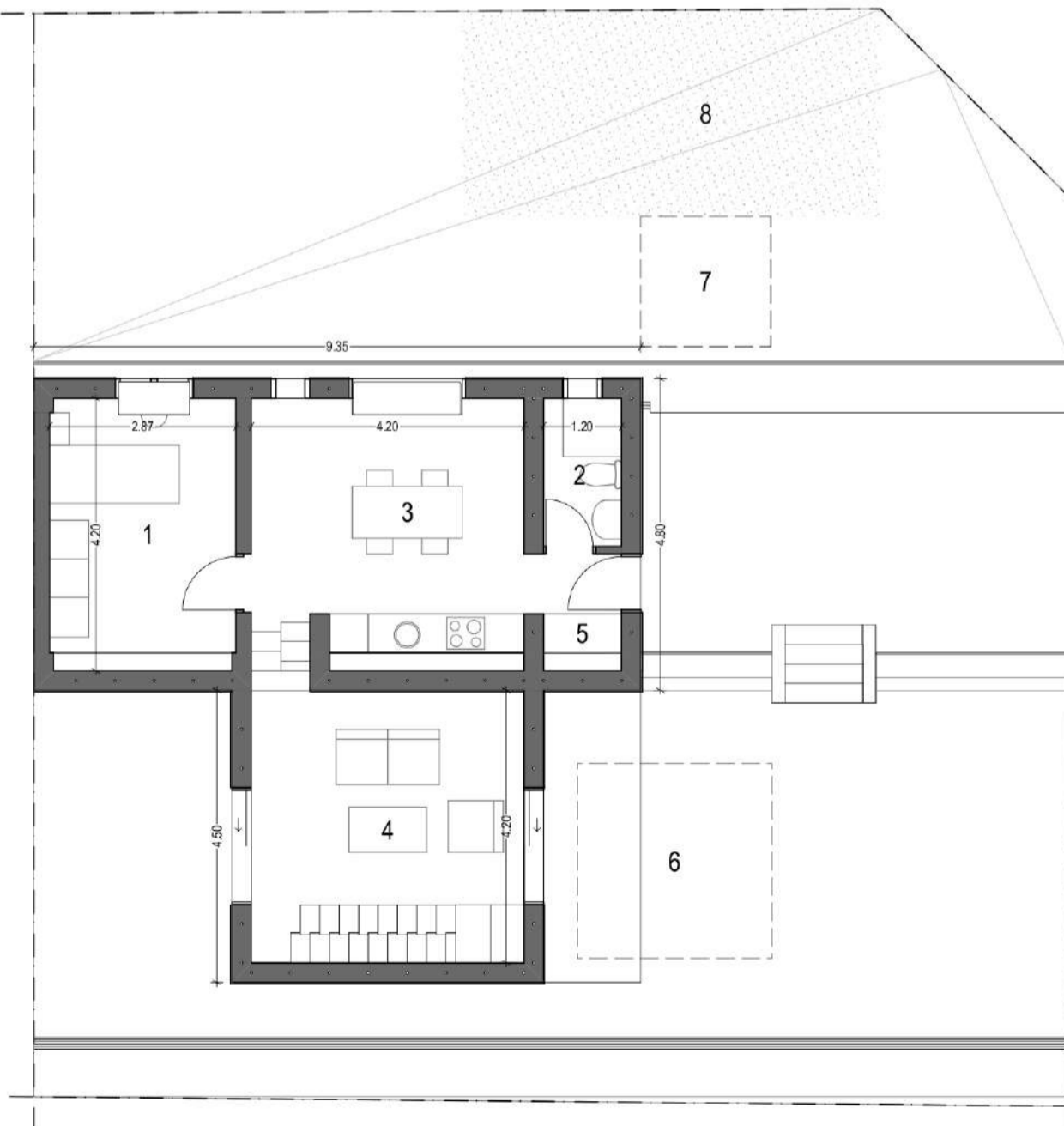


South Facade

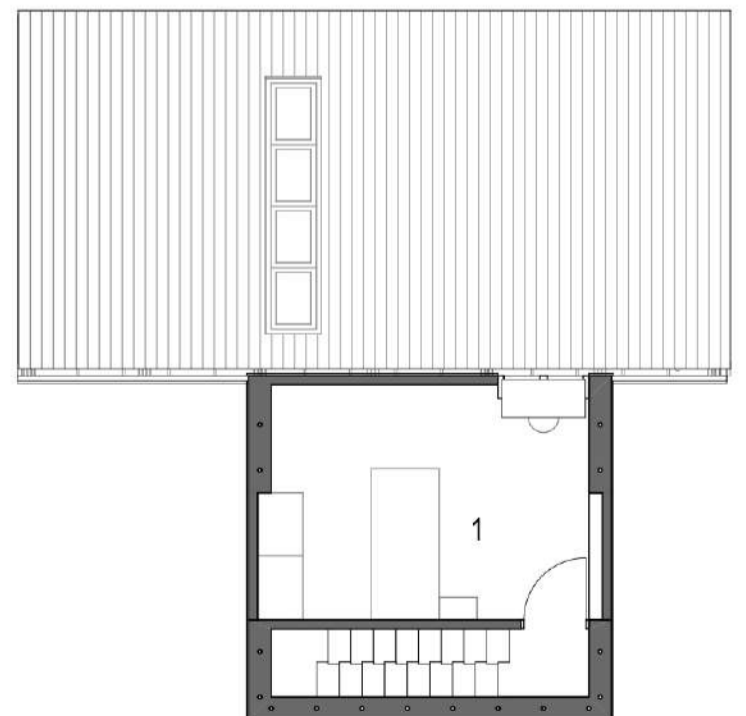
CASE 1 FIRST STAGE / Scale 1:100



- 1 Bedroom
- 2 Bathroom
- 3 Kitchen
- 4 Living room
- 5 Storage
- 6 Watertank
- 7 Artificial Wetland
- 8 Garten



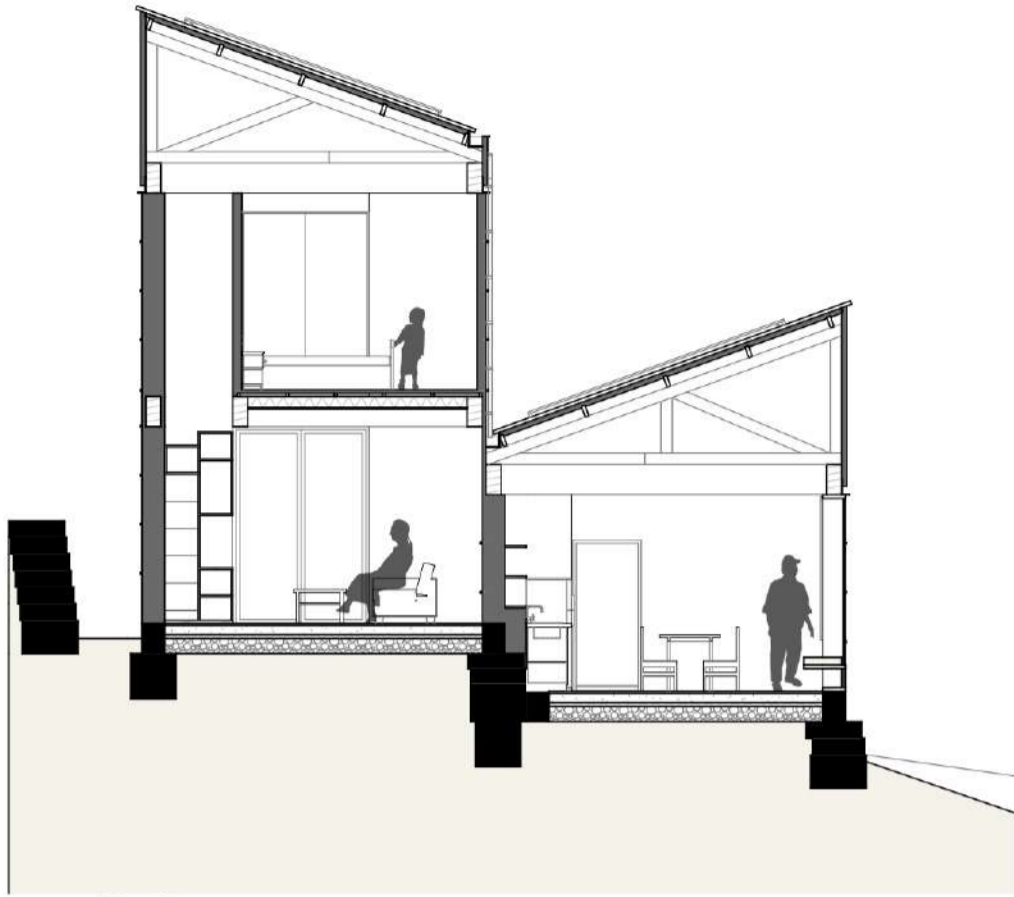
Ground floor



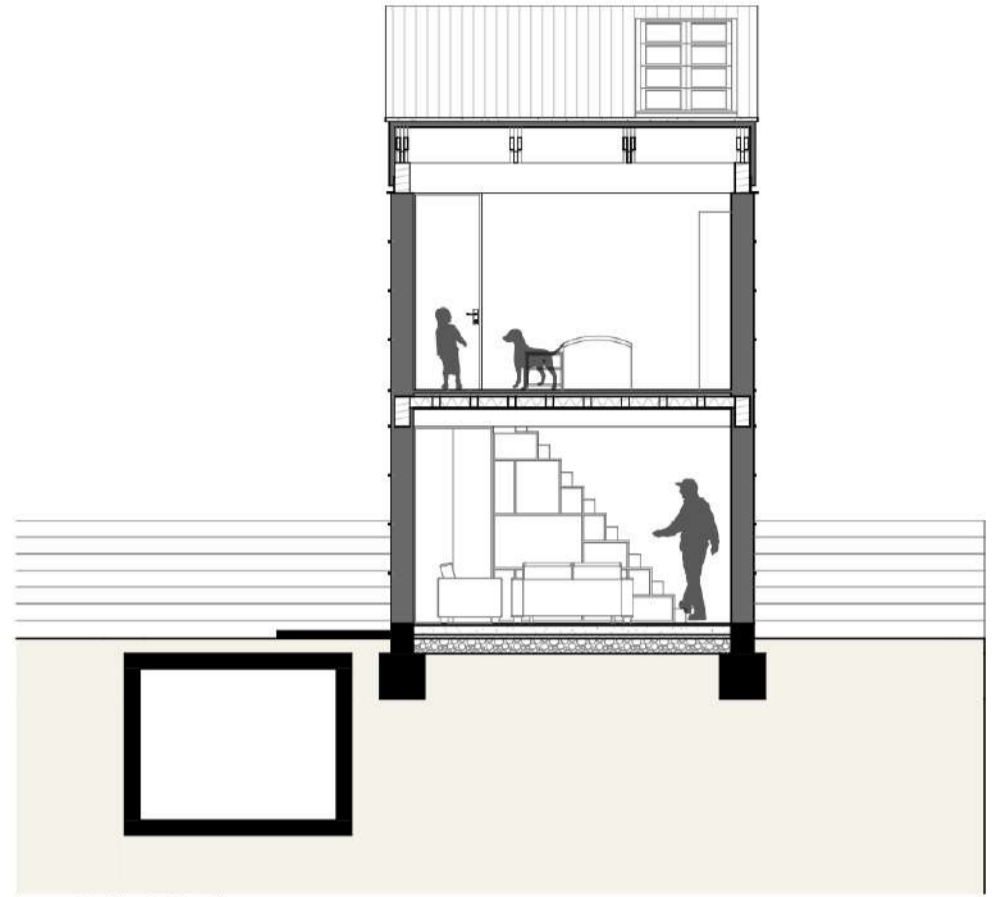
Upper floor

HOUSING DESIGN - CASE 2

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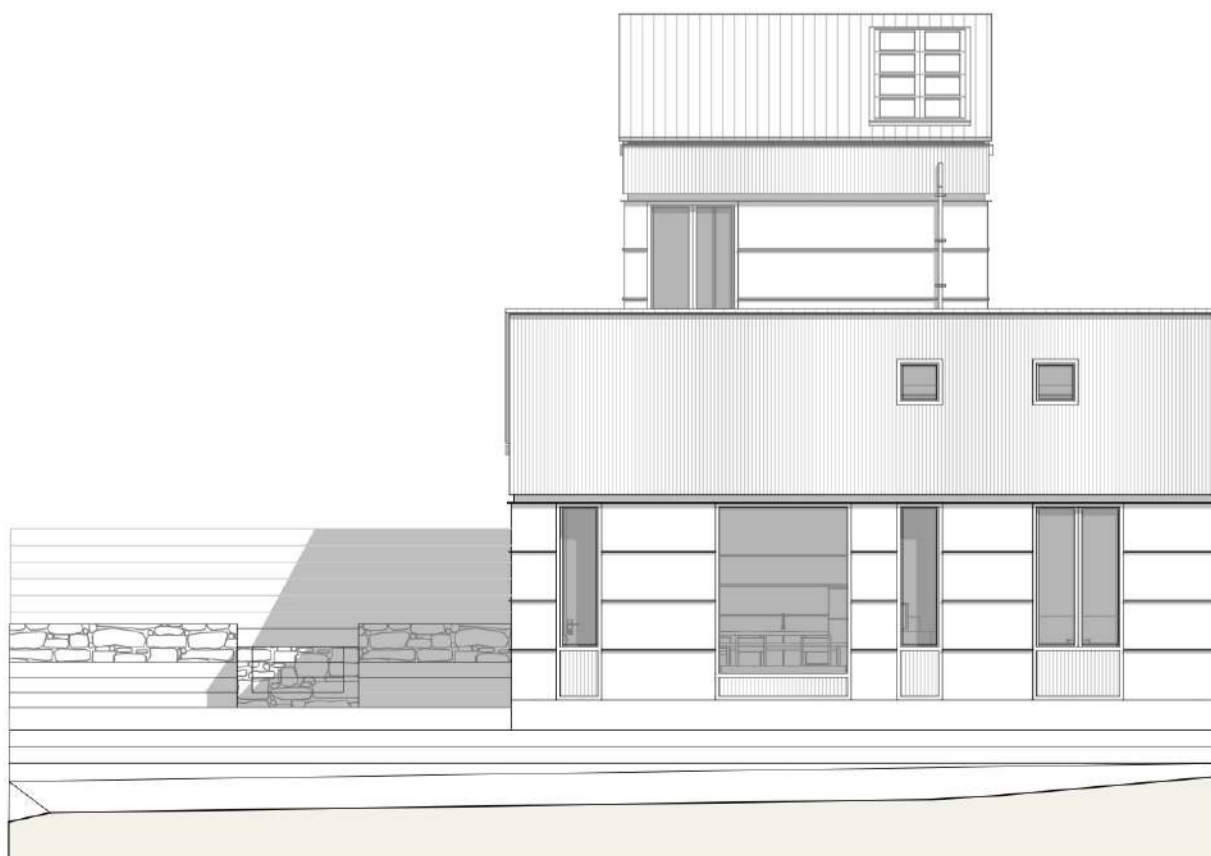
Transversal Section



Longitudinal Section



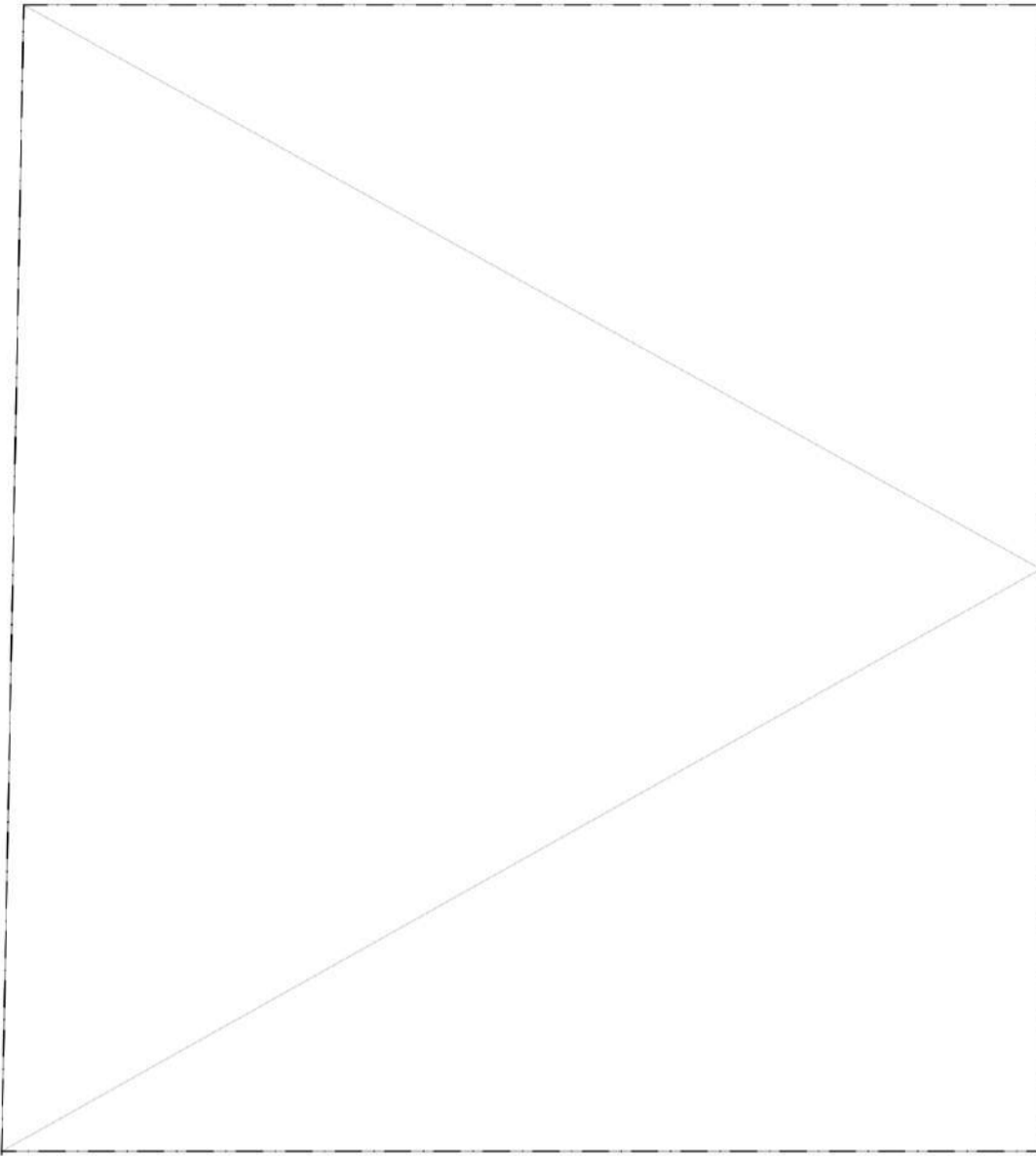
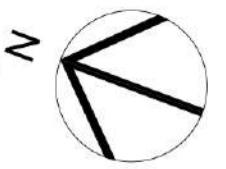
South Facade



East Facade

HOUSING DESIGN - CASE 3

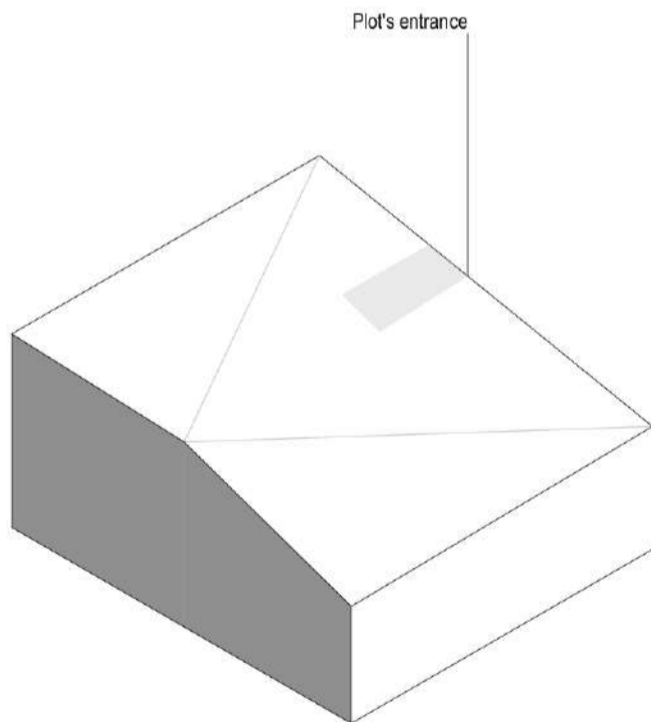
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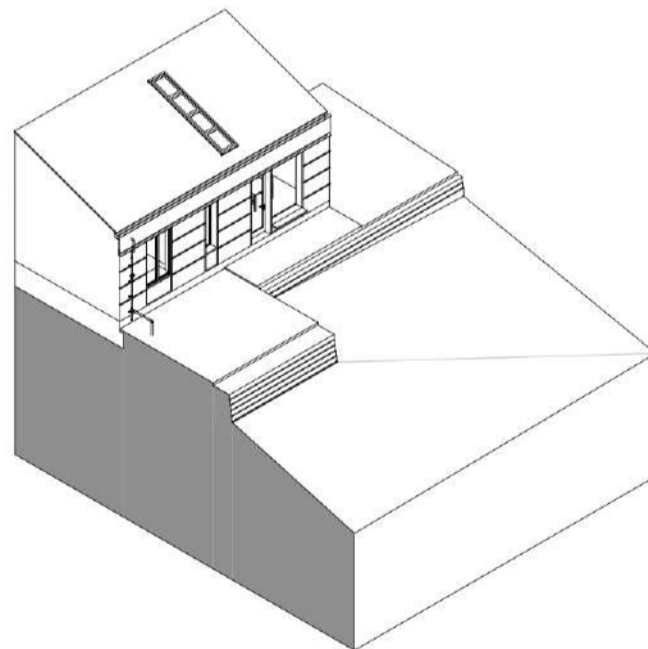
Original State - Ground floor
Scale 1:100



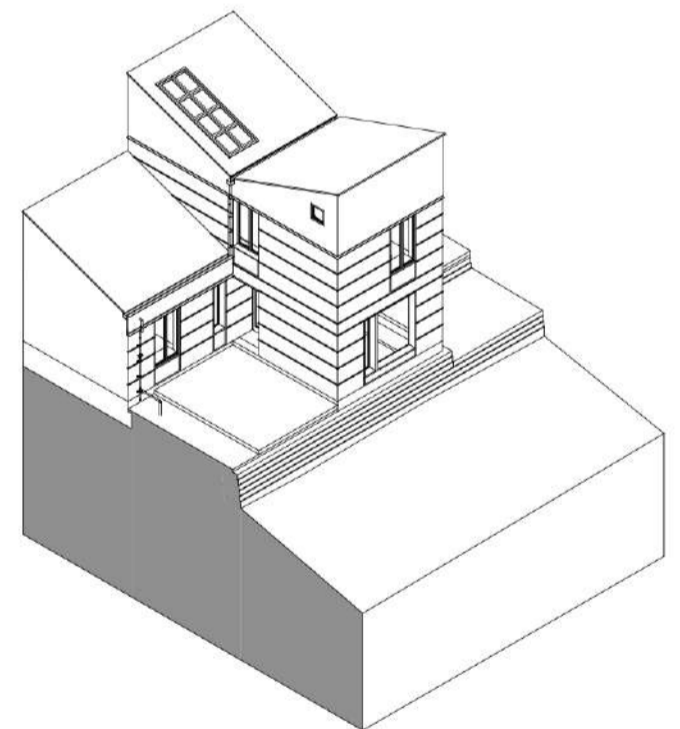
Family composition



Original Stage



First Stage



Second Stage



+ Housing module apply



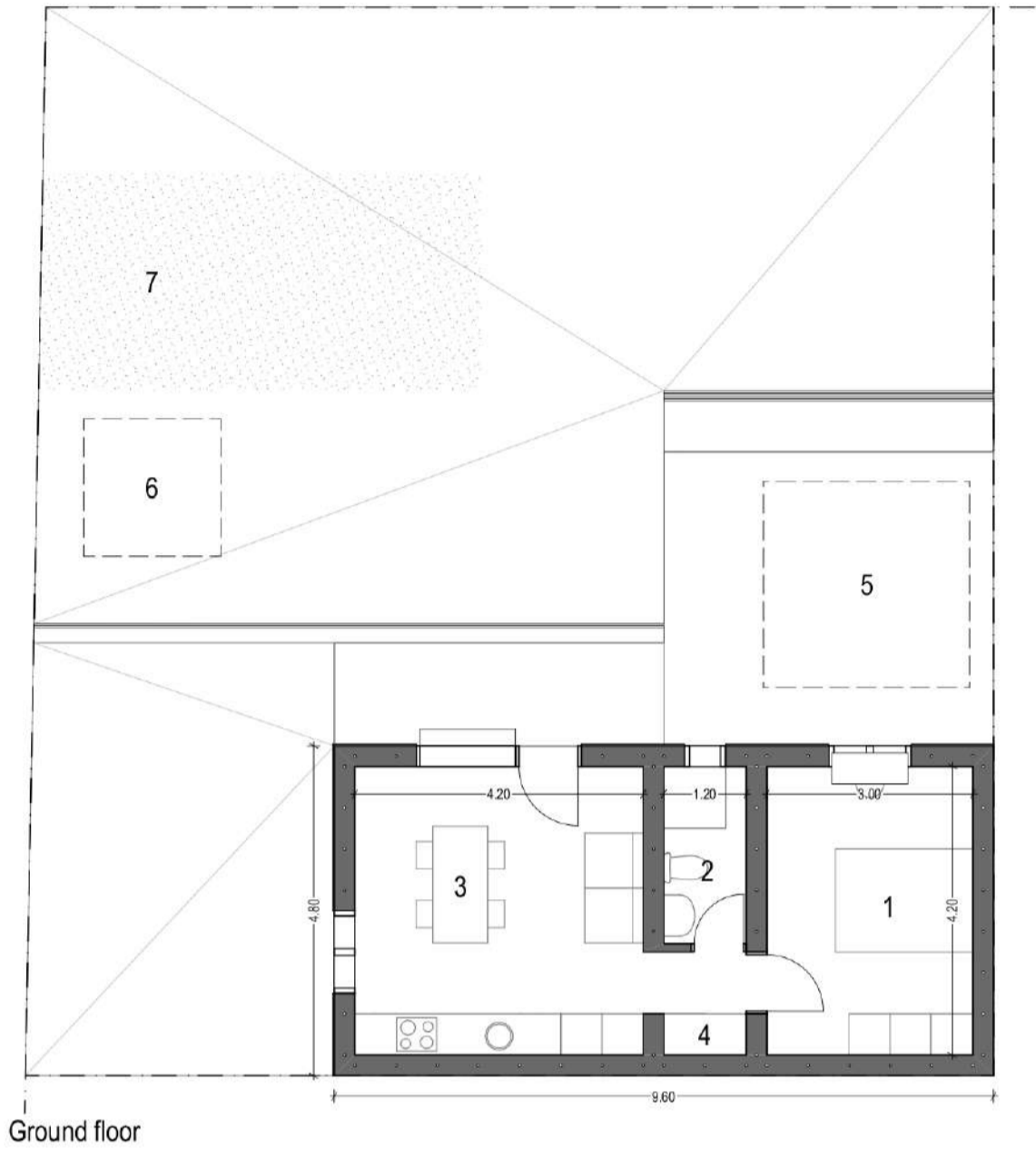
+ Rainwater collection during the year:
20 m³ / 55 % requirement
4 months of rain season 100%
+ Total Intervention: 46.08 m²



+ Rainwater collection during the year:
30 m³ / 42 % requirement
4 months of rain season 100%
+ Total Intervention: 112.42 m²

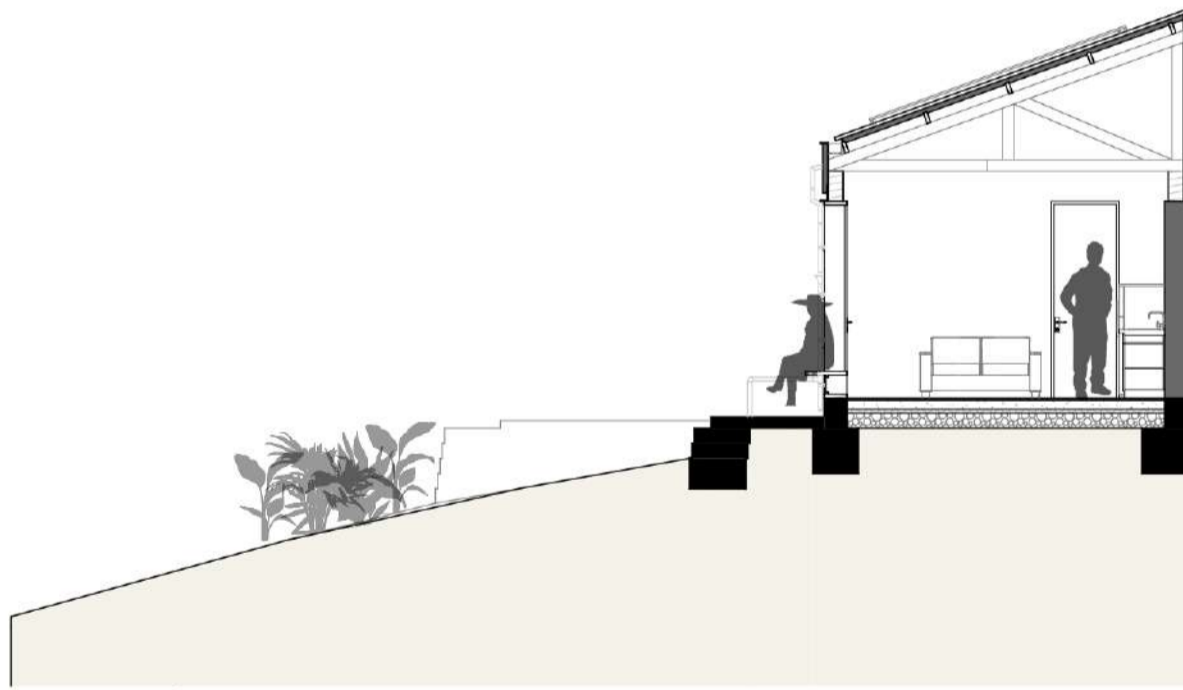
HOUSING DESIGN - CASE 3

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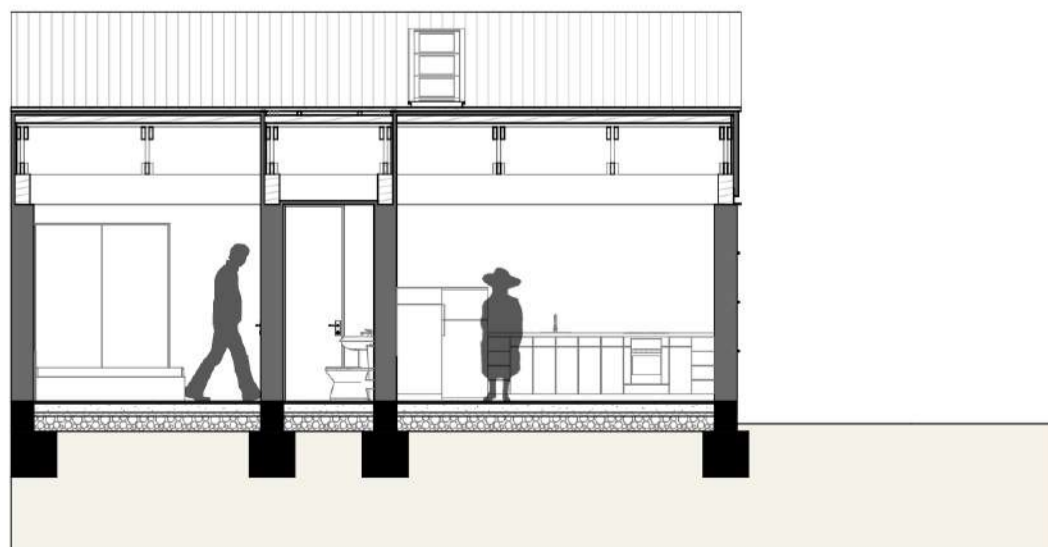


Ground floor

- 1 Bedroom
- 2 Bathroom
- 3 Kitchen - Living
- 4 Storage
- 5 Watertank
- 6 Artificial Wetland
- 7 Garten



Transversal Section



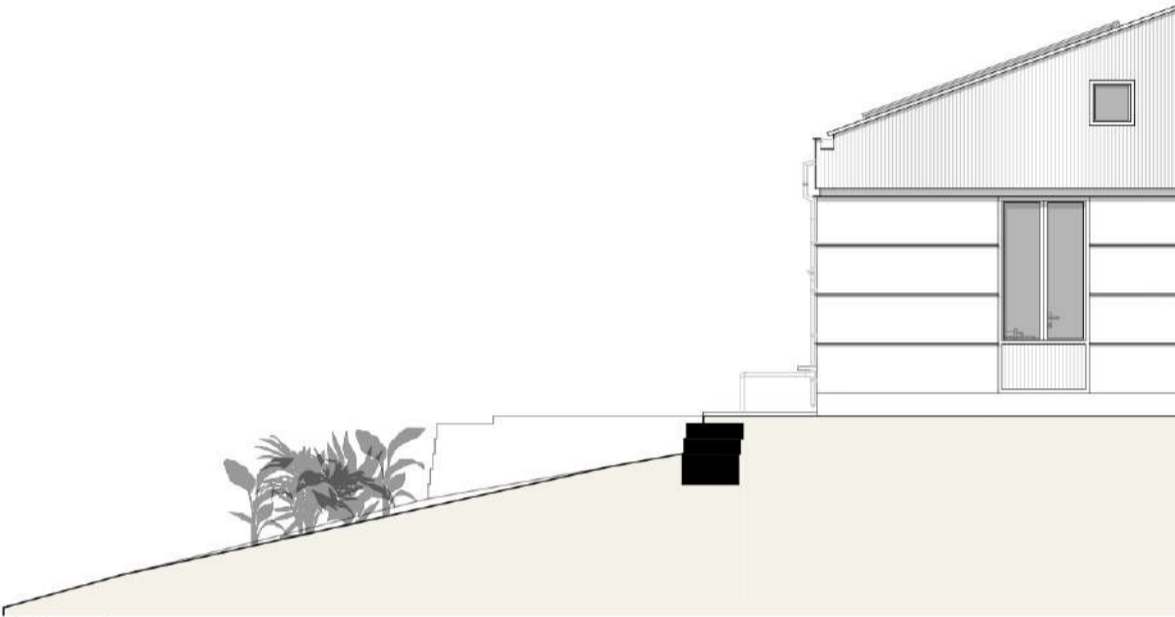
Longitudinal Section

HOUSING DESIGN - CASE 3

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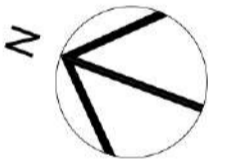


East Facade

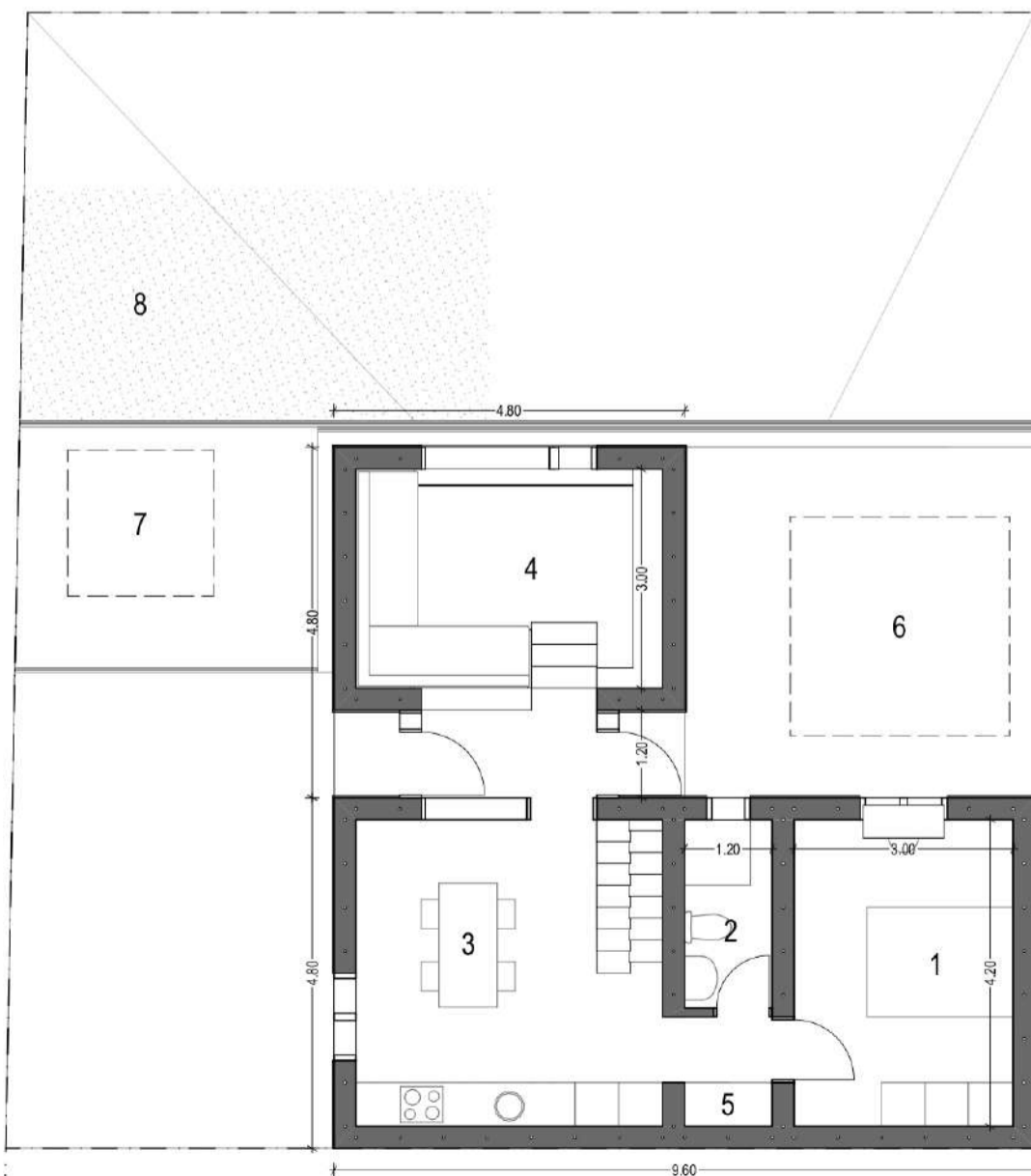


North Facade

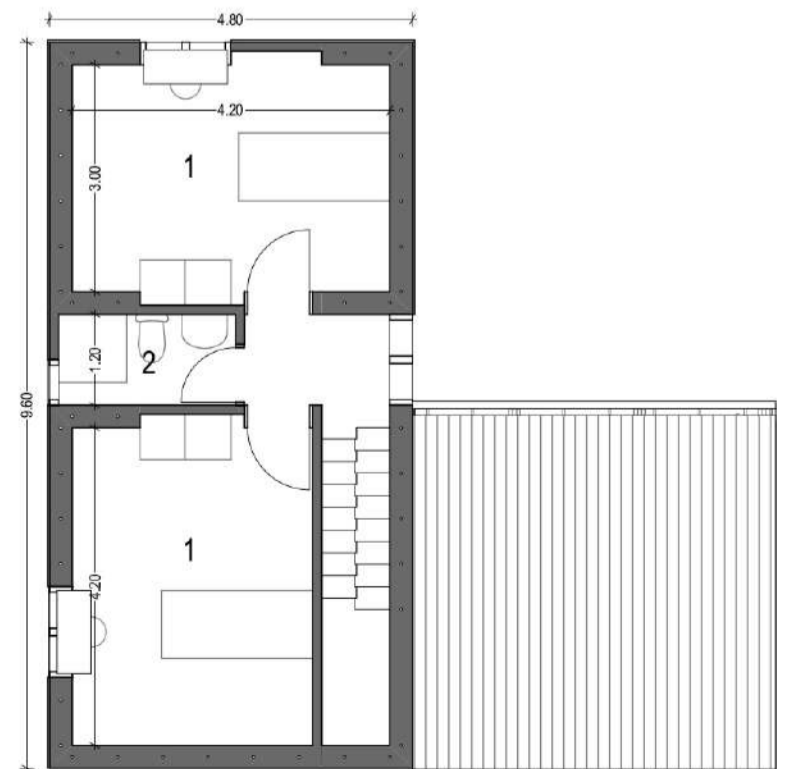
CASE 3 FIRST STAGE / Scale 1:100



- 1 Bedroom
- 2 Bathroom
- 3 Kitchen
- 4 Living room
- 5 Storage
- 6 Watertank
- 7 Artificial Wetland
- 8 Garten



Ground floor



Upper floor

HOUSING DESIGN - CASE 3

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Transversal Section



Longitudinal Section



South Facade



East Facade

