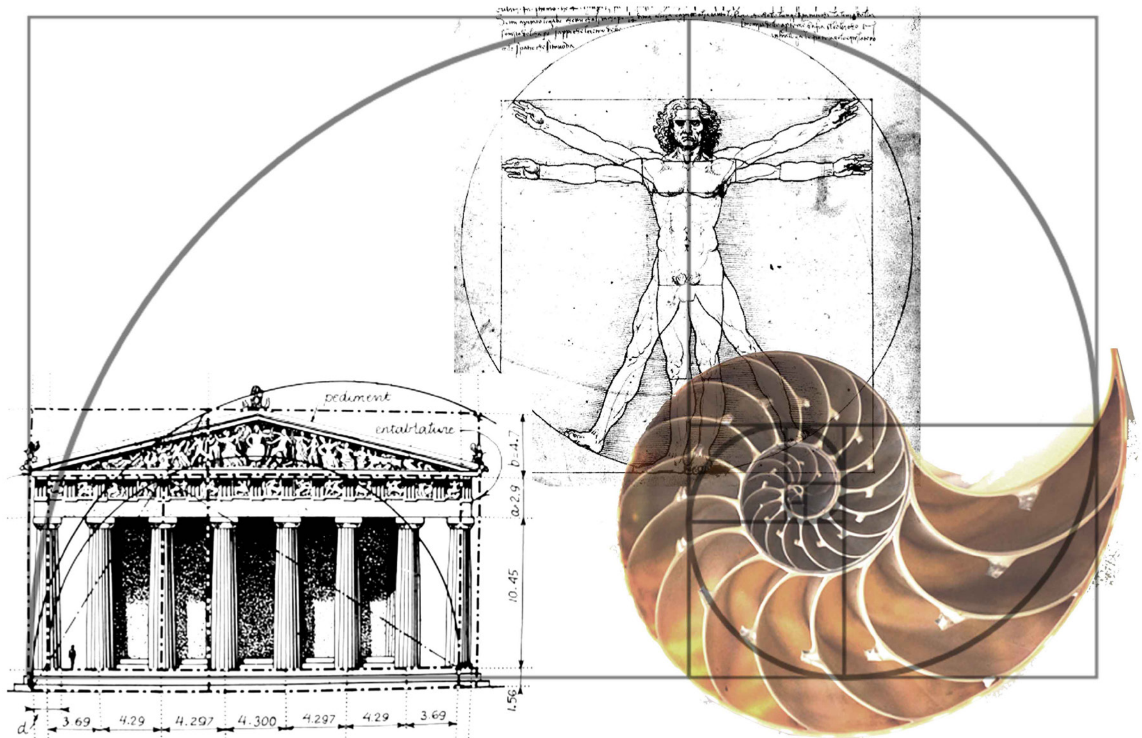
10/TECHNICAL DEVELOPMENT

TECHNICAL

10 / TECHNICAL DEVELOPMENT

10.1 / INTRODUCTION

The design of form; creation of space; and technical resolution are inseparable, accordingly the search for a relationship between man, nature and building is evident in the concept of this dissertation. This chapter is a continuation of the design process on a detailed level. The purpose of this chapter is not to produce contract documentation, but rather to communicate the development of tectonic ideas. Tectonic development explores the potential of creating new ways to deal with structure, materials, technology, and construction details in order to convey the concept and meaning.



10.1_ The relationship between man, building and nature can also be translated to a detailed level. (http://www.soulsofdistortion.nl/images/vitruvia1.jpg, http://miguelmartindesign.com/blog/wp-content/uploads/2011/01/figure7.jpg, edited by author, 2015)

10.2_ Constructed insect habitats always provide holes or cracks that create shelter for the insects (http://www.inspirationgreen.com/insect-habitats.html, edited by author, 2015)

10.2 / INFORMANTS

10.2.1
THEORY /

Regenerative theory proposes that humans and nature co-exist in a mutually beneficial relationship. This theory can be adapted by applying Steward Brand's 6 'S' approach to building, thus not only creating materials and details that respond to the environment but also creating space in the building for nature to grow. This can be achieved in the technical resolution by developing multi-functional building elements; re-using the existing materials found on site; and enhancing the existing environment by adding new ecosystems.

10.2.2
NATURE /

The informants that influenced the design of the technical solution can be narrowed down to climatic factors; insects (pollinators and their habitats); flora (plants and flowers); the living wall as an extension of the urban vision; and the humans who inhabit the building

10.3_ Diagram illustrating the tectonic approach to the building, the building emerging from nature (Author, 2015)

10.2.3
THE LIVING WALL /

The Water channel that intersects the site forms a strong axis along which the buildings on site are organized; it informed the technical solution. One of the water channel's purposes is to filter the building's waste- and rain water, therefore qualifying it as an element separate from the rest of the buildings.

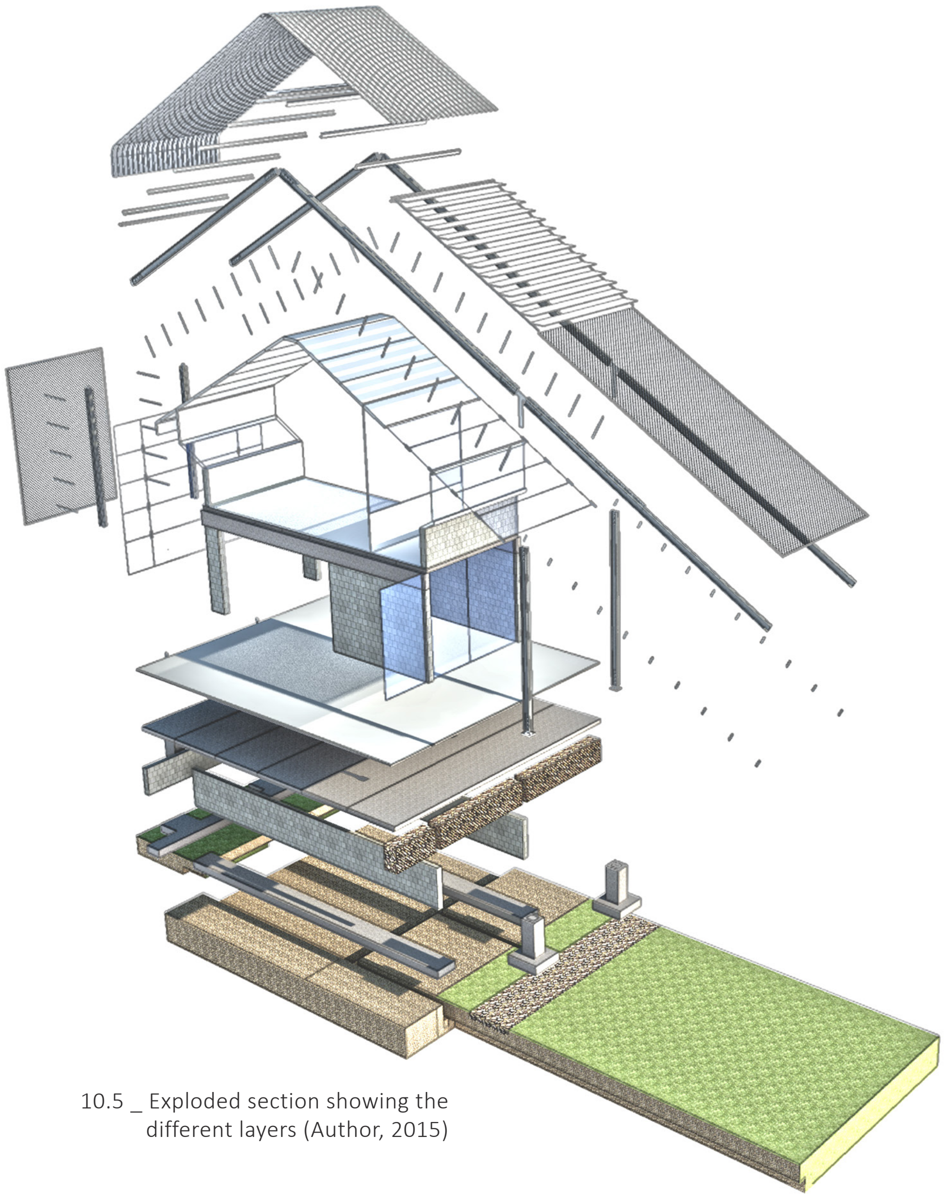
The living wall consists of recycled bricks and wood found on site. These materials were chosen for their reaction with water, seeing as the living wall represents the water collection and the filtration process.
The wall will eventually form part of the buildings along with a welded wire mesh to hold the creeper plants that grow on the façade. When the water channel reaches the end of the site, where it disgorges water into the river, the materials change to gabion walls to become more integrated with the environment and fade into the site.

10.3 / CONCEPT

The change in building forms is based on the concept of progression into nature, which is reflected in the construction of the building. The construction highlights the transition between different materials by separating the materials with only a small link to connect them.

The concept formed by the informants, can be captured in one diagram, which is an adaption of Steward Brand's 6 'S' principles. Here 'site' is added to 'structure', which formulate the 'skin' and 'services'. They are combined in the single element of the building envelope, where the structure responds to the environment. The concept can thus be illustrated as a release into nature; the building becomes part of the environment. From the conclusion of the eco-mapping, it is clear that the site consists for the most part of grasslands with only the hill and trees to provide habitats for the insects. Therefore, insect habitats had to be created in the building envelope. The insect habitats become part of the building envelope and the theory is reflected that a relationship between man and nature must be established.

10.4 _ Steward Brand 6 "S" adaption to integrate site, exploring materials (Brand, 1994: 13 edited by author, 2015)



10.5 _ Exploded section showing the different layers (Author, 2015)

10.4 / MATERIALS

10.4.1
MATERIALS DECISIONS /

The materials generated for the material palette are based on the concept of progression into nature. The material palette is divided between the living wall and the building.

Living wall / The material used for the living wall is bricks from the demolished buildings on the site. The bricks are staggered on top of each other with gaps between them to create habitats for the insects and plants to grow. The bricks will be in contact with water, so naturally moss and algae will grow to add to the ecosystems and provide nutrition for the insects.

The Building / The building will be in contrast with the living wall; therefore, instead of clay bricks, a combination of concrete bricks will be used for infill. The combination of steel frames and welded wire mesh panels for the plants create a lightweight effect. A reinforced concrete base is used to anchor the building to the ground and help illustrate the progression into nature. As the ground surface should always be permeable to allow water to seep through the soil, gaps between walkways and water channels on the side of the building is an appropriate response.

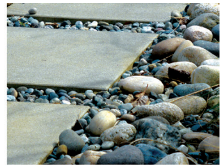
10.4.2
MATERIALS PALETTE /

MATERIALITY OF FLOOR SURFACES / Transition towards building


Planted flowers

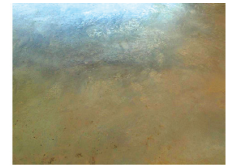

On site Grass


Grass between Concrete slabs

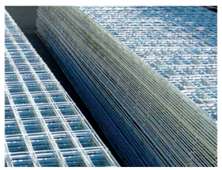

Rocks between Concrete slabs

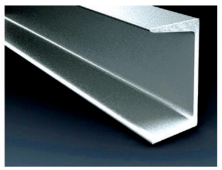

Gabion walls held together by welded wire mesh


Precast concrete slabs

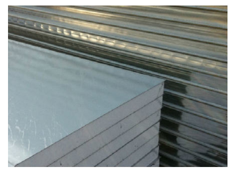

Power floated concret floor in-situ

MATERIALITY OF WALL ENVELOPE / Transition towards building

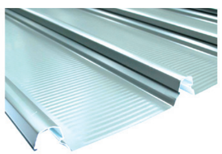

Welded wire mesh

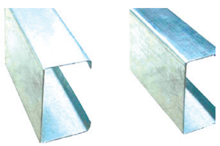

Taper flange C channel profile

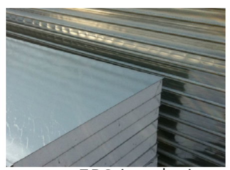

Concrete blocks


EPS insulation; galvanised metal skin

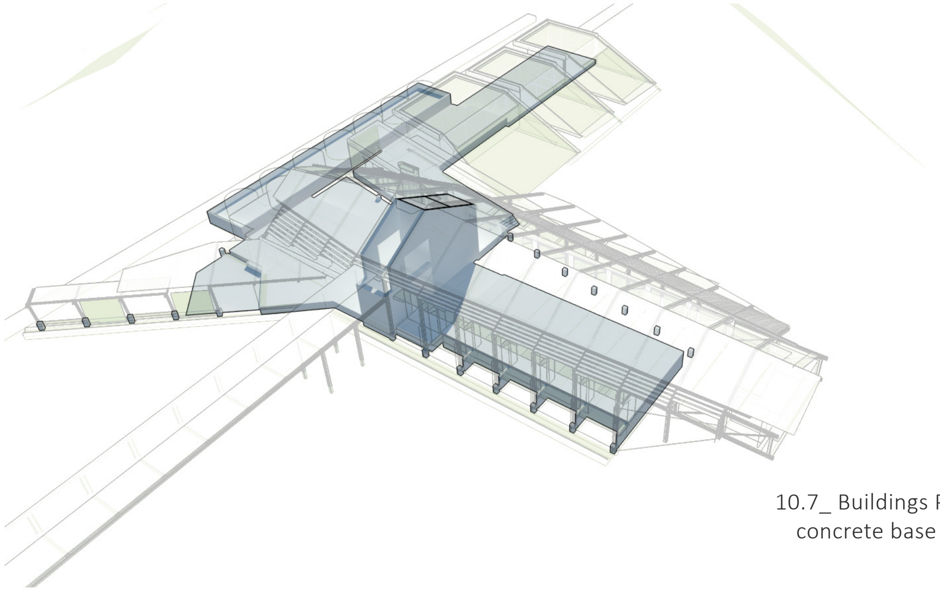
MATERIALITY OF ROOF


Concealed fix klip-lok roof sheeting

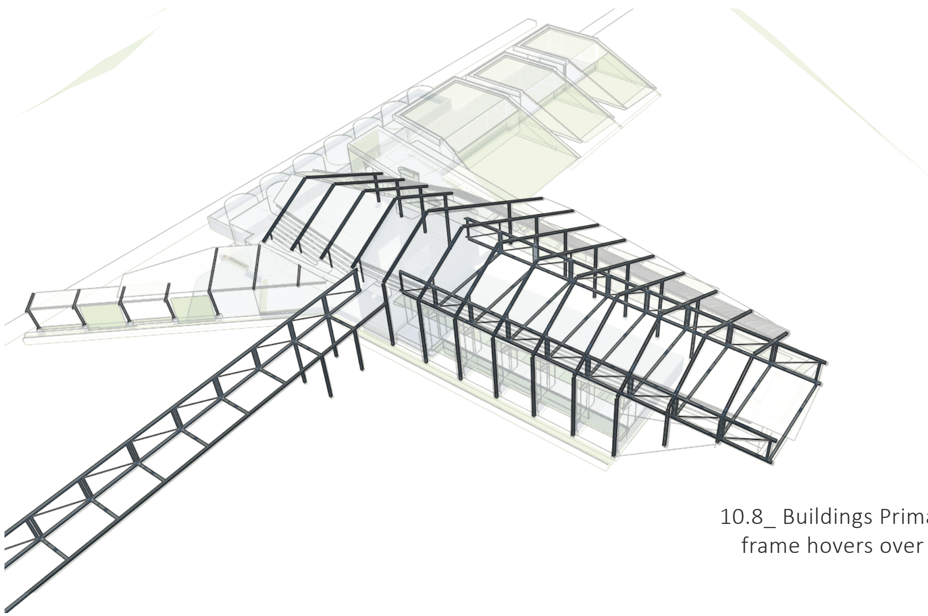

Purlin; Steel lipped C- channel


EPS insulation; galvanised metal skin

10.6 _ Material palette (Author, 2015)



10.7_ Buildings Primary structure; concrete base acts as an anchor (Author, 2015)



10.8_ Buildings Primary structure; Steel frame hovers over site (Author, 2015)

10.5 / STRUCTURE

10.5.1
PRIMARY STRUCTURE /

The primary structure is the skeleton of the building that holds everything together. It starts from the living wall, as a concrete base anchored in the ground, and is then lifted from the ground, becoming a more lightweight frame.
The lightweight frame consists of a combination of steel channels and spacers. It holds water downpipes and services for the building. A vierendeel structure also forms part of the primary structure as it holds the first floor and permits it to cantilever above the ground, allowing the natural flow of water and ecosystems to continue on the site. Both primary structures are constructed of hot formed steel members with a heavy concrete base.

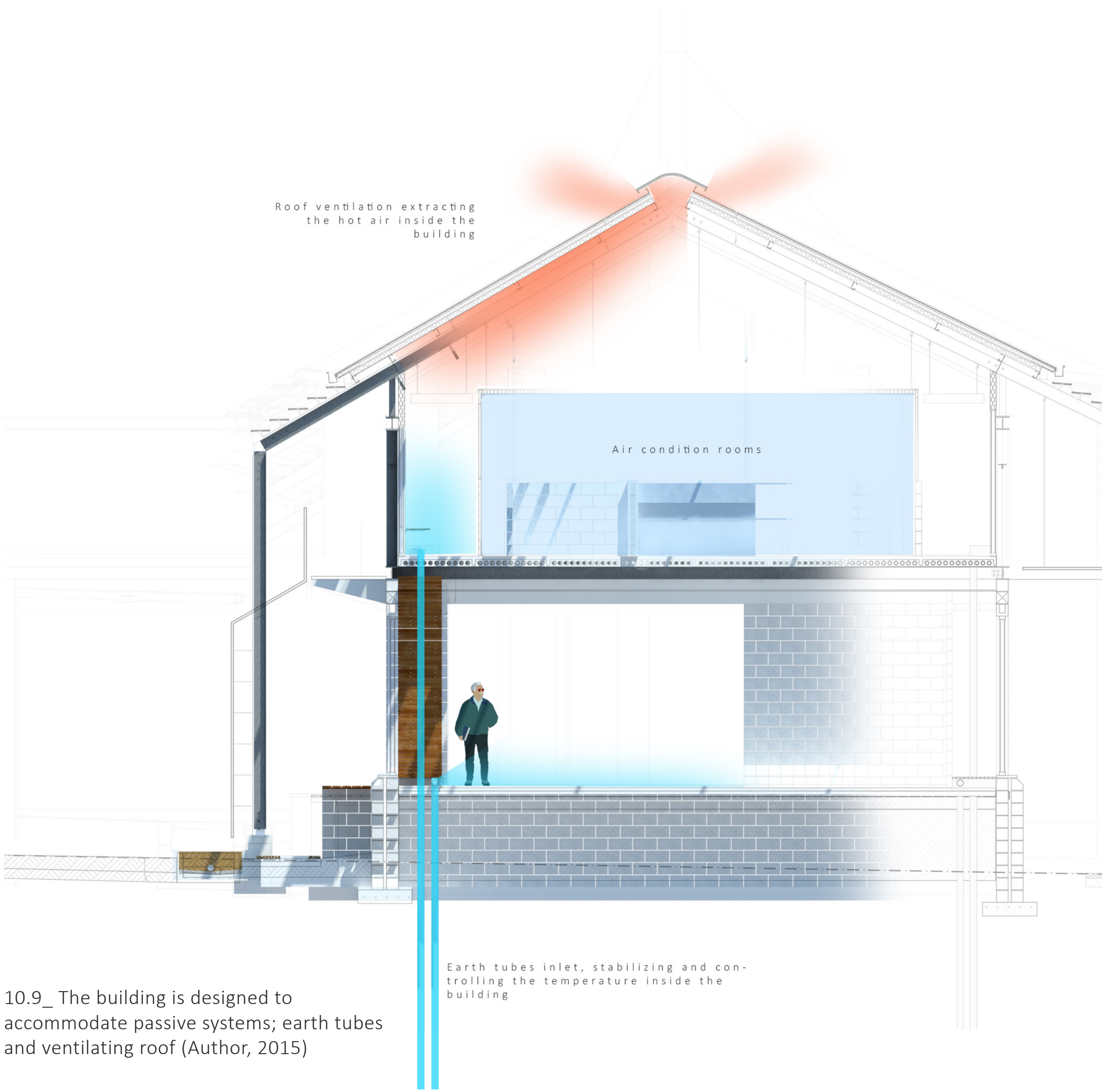
10..2
SECONDARY STRUCTURE /

The secondary structure supports the cladding and roof of the building. Apart from the steel vierendeel structure, the materials used are light steel frame materials (LSF) which consists of panels fixed onto the concrete floor with cold rolled steel C-channels, filled with insulation and fixed with treated wood panels.

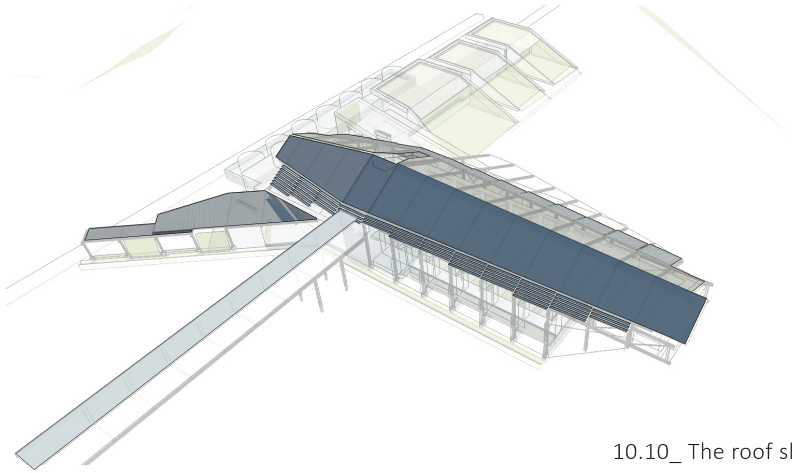
10.6 / ENVIRONMENTAL CONSIDERATION

10.6.1
CLIMATE /
The site allows for the building to be orientated north. Even with minimal existing shade on the site, the building itself should be well screened in summer.
Climatic factors were considered to create a comfortable habitable space inside the building. The placement of green screens on the northern façade with sunshades at correct angles prevents direct sunlight from entering the building. The insect habitats also require different climatic conditions, which the building can provide. The southern side of the building is shaded and mounds beside the building allow for beetles to burrow their holes in the soil. The northern side is mostly sunny with creepers allowing butterflies to create homes underneath the leaves.

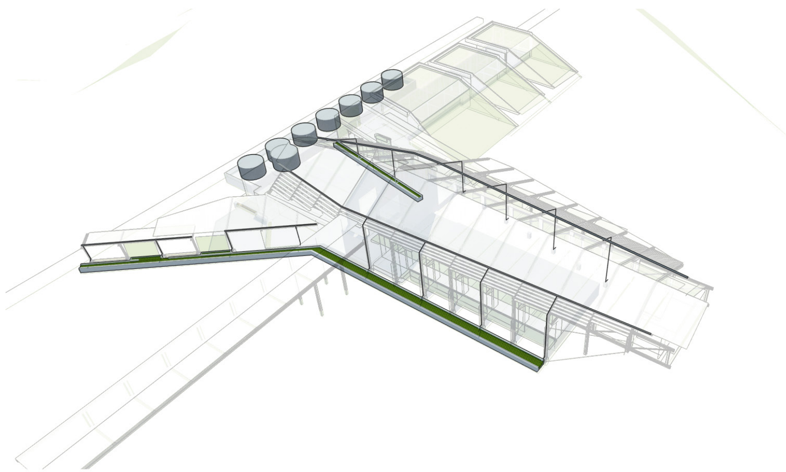
Diagram 1; illustrations of climatic factors
.
10.6.2
EARTH TUBES /
The ground floor of the building mostly consists of open-plan offices, which are ventilated through strategically placed louvered windows that can be adjusted by the occupants of the space. The temperature inside the building is controlled through the use of earth tubes that run 3 meters under the soil, where the temperature stabilizes (what is the temp.?). The tubes enter the building at the ground and first floor with the assistance of fans powered by photovoltaic panels. The stabilized air entering the rooms controls the temperature inside the building. The heat gathered inside the building is extracted through a ventilated roof and solar chimney assisted stack.



10.9_ The building is designed to accommodate passive systems; earth tubes and ventilating roof (Author, 2015)



10.10_ The roof shape allows the heat gathered in the building to rise(Author, 2015)



10.11_ Water collected from the roof is led to a central point (Author, 2015)

10.7 / TECHNOLOGY

10.7.1
FAÇADE /

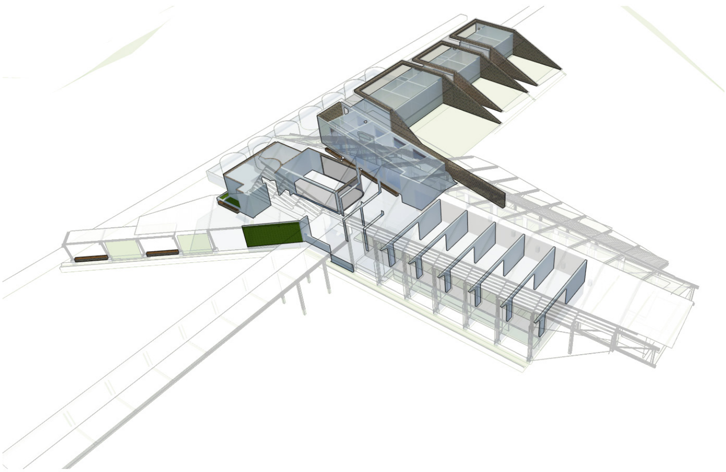
The façade of the building envelope represents the relationship between nature and the building. It is the welded wire mesh that allows the plants to grow on the façade. This green screen becomes the insect habitats and provides natural shade for the people inside the building during summer. It also creates a covered gathering space outside the building where occupants can enjoy the beauty that nature provides.

10.7.2
ROOF /

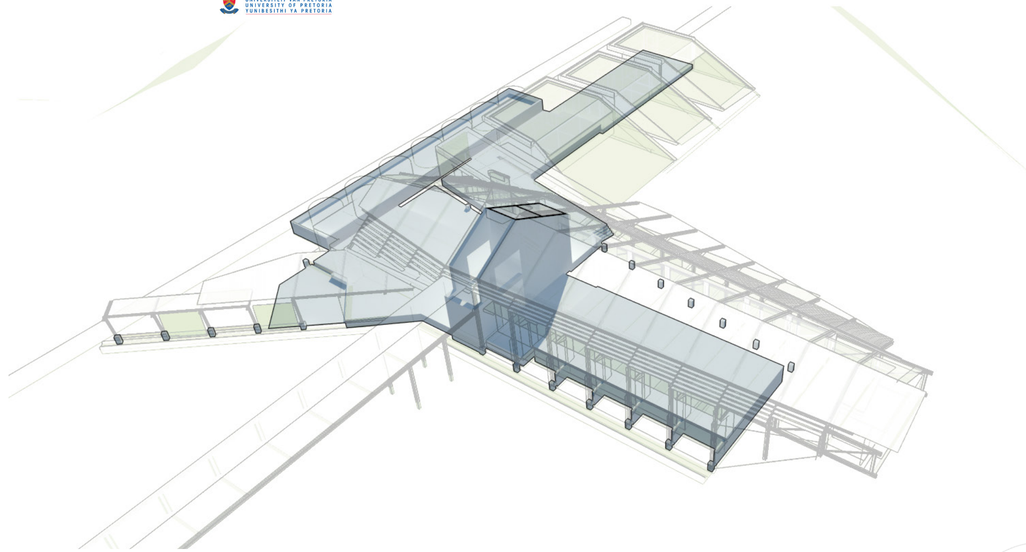
The roof is the sheltering envelope of the building. Its purpose is to protect the inhabitants of the building from weather, heat, wind and sunlight. It plays an important role in collecting rainwater and then distributing it to storage tanks. The roof form also allows the air that heats up inside the building to flow to the solar chimney.

10.7.3
SERVICE /

The services needed in the building are the air-conditioning piping that enters the insect rooms and the extraction fans that exit the rooms. The extraction fans are located in the ceiling of the roof, but are held by a steel frame that suspends from the primary structure.

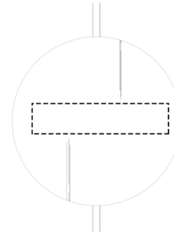


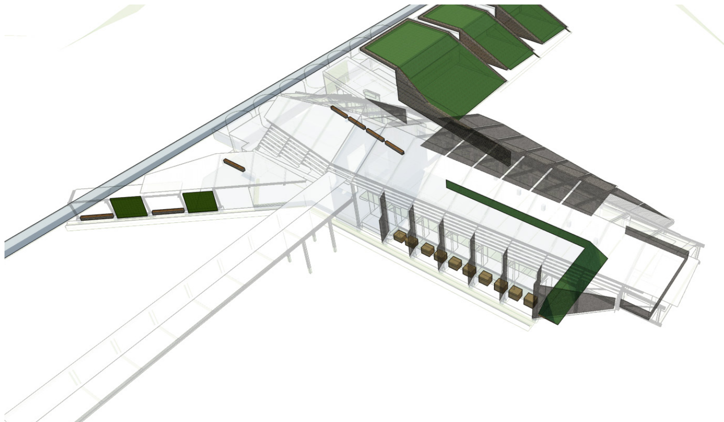
10.12_ The infill walls on the ground floor (Author, 2015)



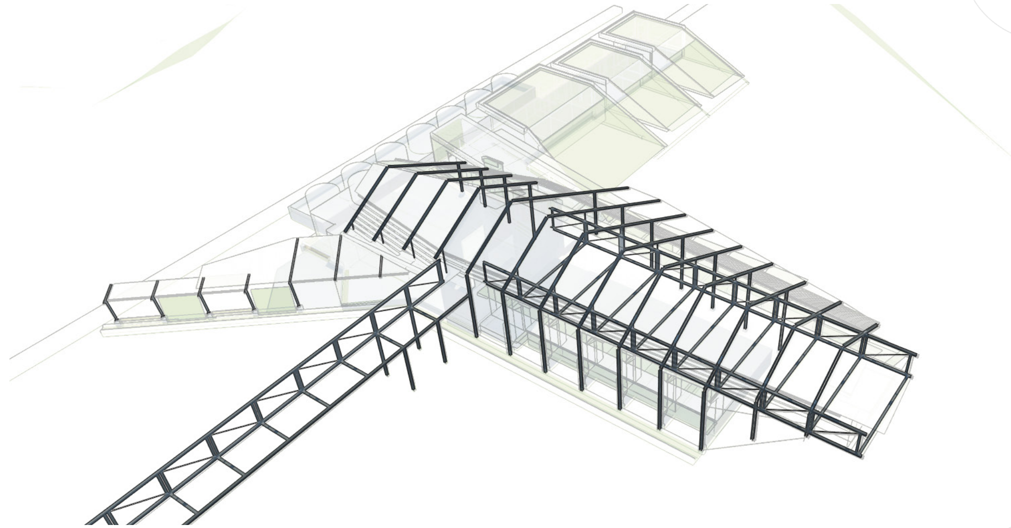
PRIMARY STRUCTURE SYSTEM /

The concrete base is the anchor of the building and intersects the environment



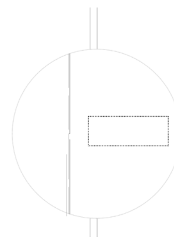


10.13_ Habitat spaces created inside and outside of the building (Author, 2015)



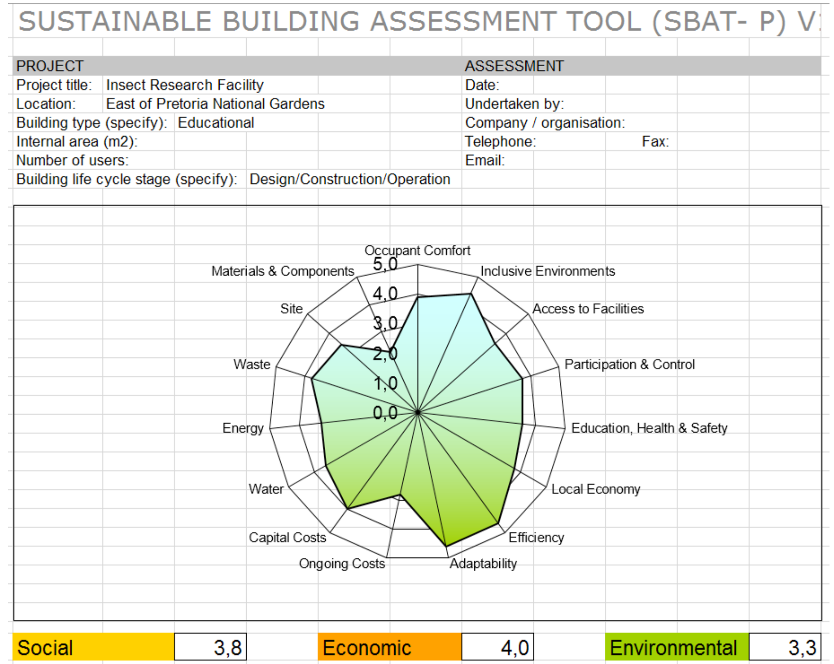
STEEL STRUCTURE /

The steel structure detatches itself from the concrete base the further it moves along north to the natural zone, it cantiliviers using the structural force of the lattace girder.



10.8 / SBAT PERFORMANCE

The SBAT analysis tool was used to rate the proposed architectural intervention.



10.14_ The SBAT analysis illustrates the proposed architectural interventions performance (Author, 2015)

10.9 / FINAL FLOOR PLANS

10.9.1
WATER CALCULATIONS

Hard surface collection in ZONE 1:
221 147m2

BUILDING 1:
Workers/12
Water Usage/12 x 5 = 60l per day
Roof Catchment/ 940.13m2

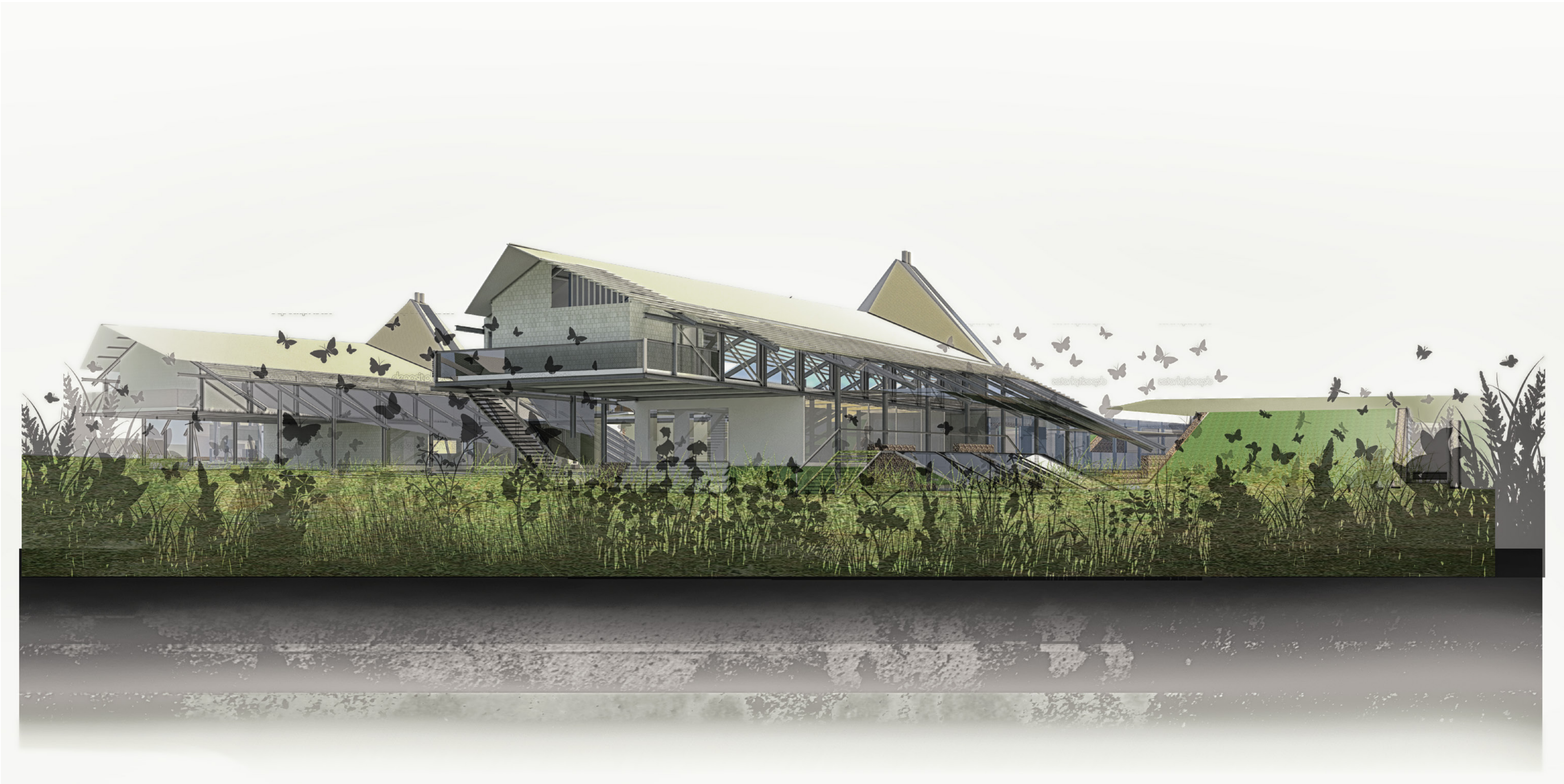
BUILDING 2:
Workers/15
Water Usage/12 x 5 = 75l per day
Roof Catchment/ 1 110.95m2

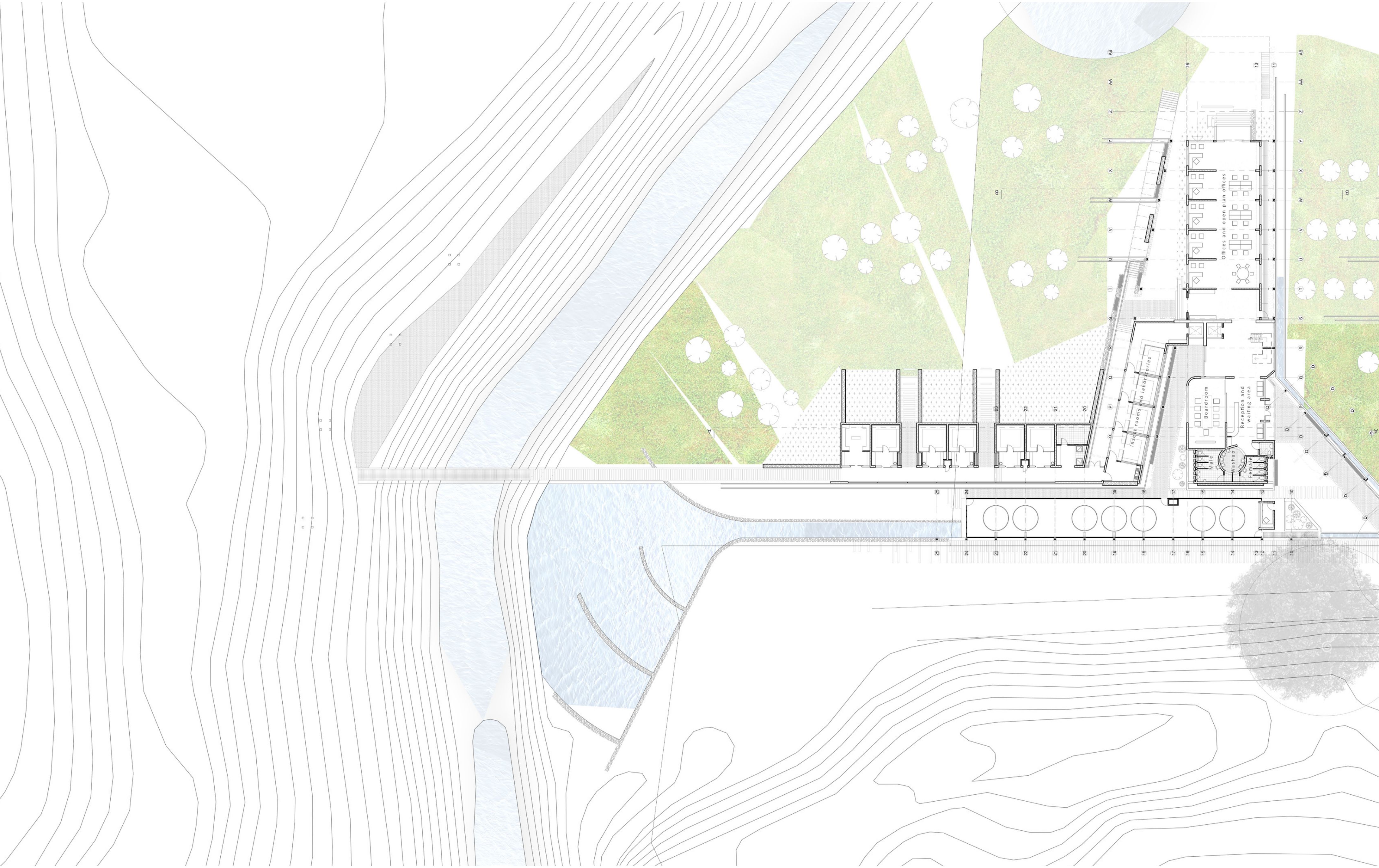
BUILDING 3:
Workers/40
Water Usage/12 x 5 = 200l per day
Roof Catchment/ 1 136.13m2

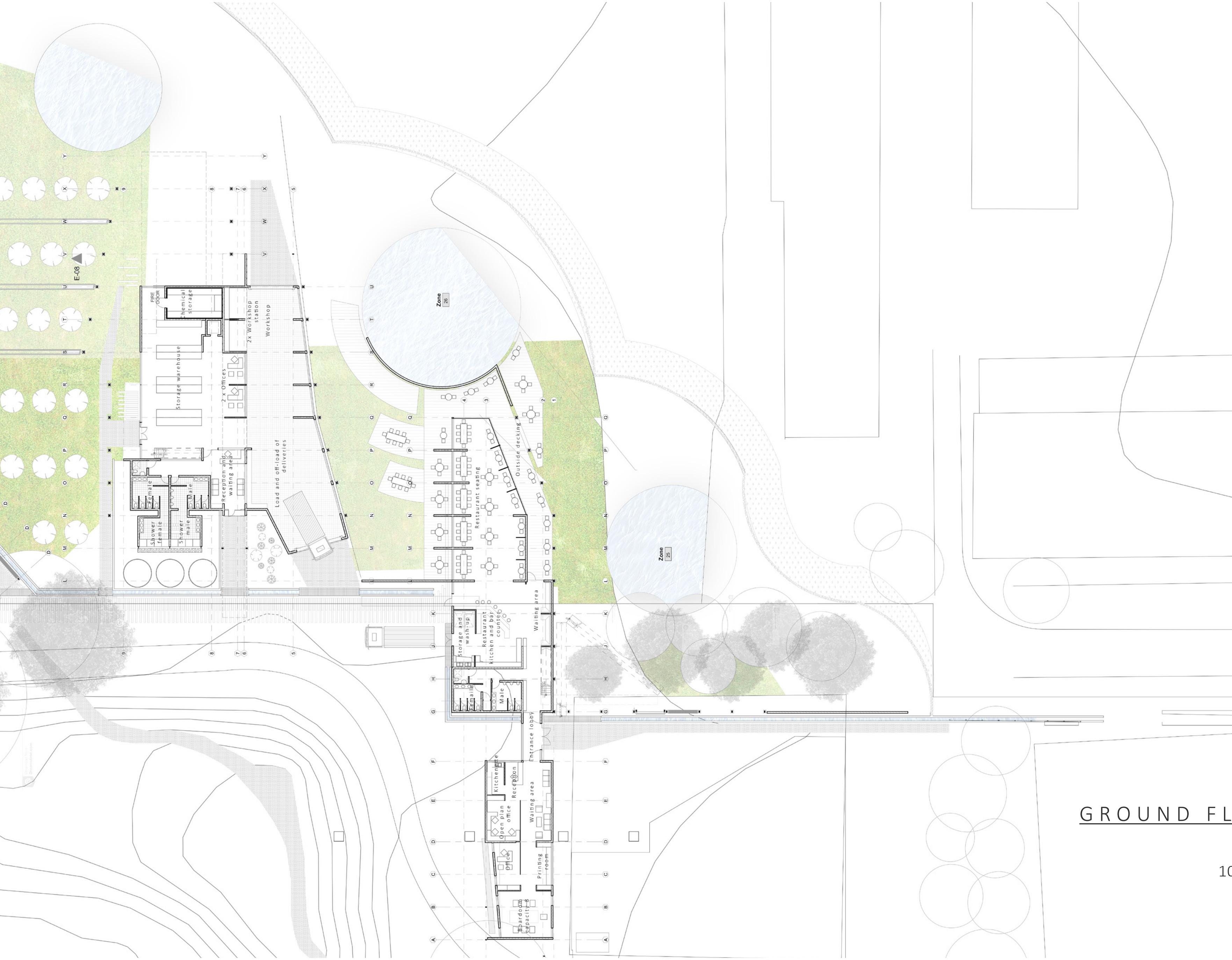
Water Storage/Water Ponds

A: V = 4.02 x 1011
B: V = 5.94 x 1011
C: V = 8.06 x 1011
D: V = 2.71 x 1012
E: V = 4.78 x 1011

10.15_ The water calculations of the macro site impacting the proposed site (Author, 2015)

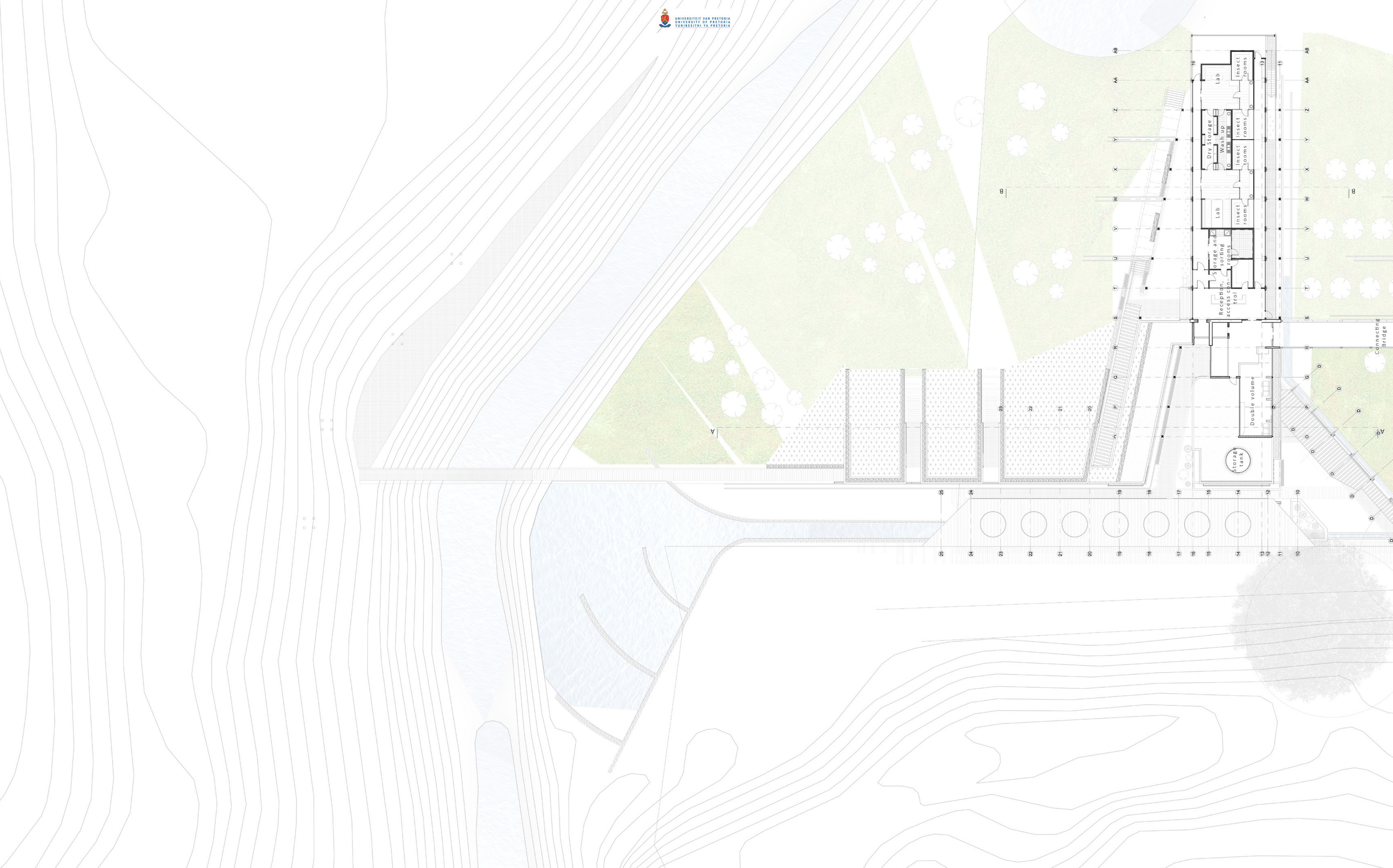



Offices and open plan offices
Insect rooms and laboratories
Boardroom
Reception and waiting area
Male
Washup
Female



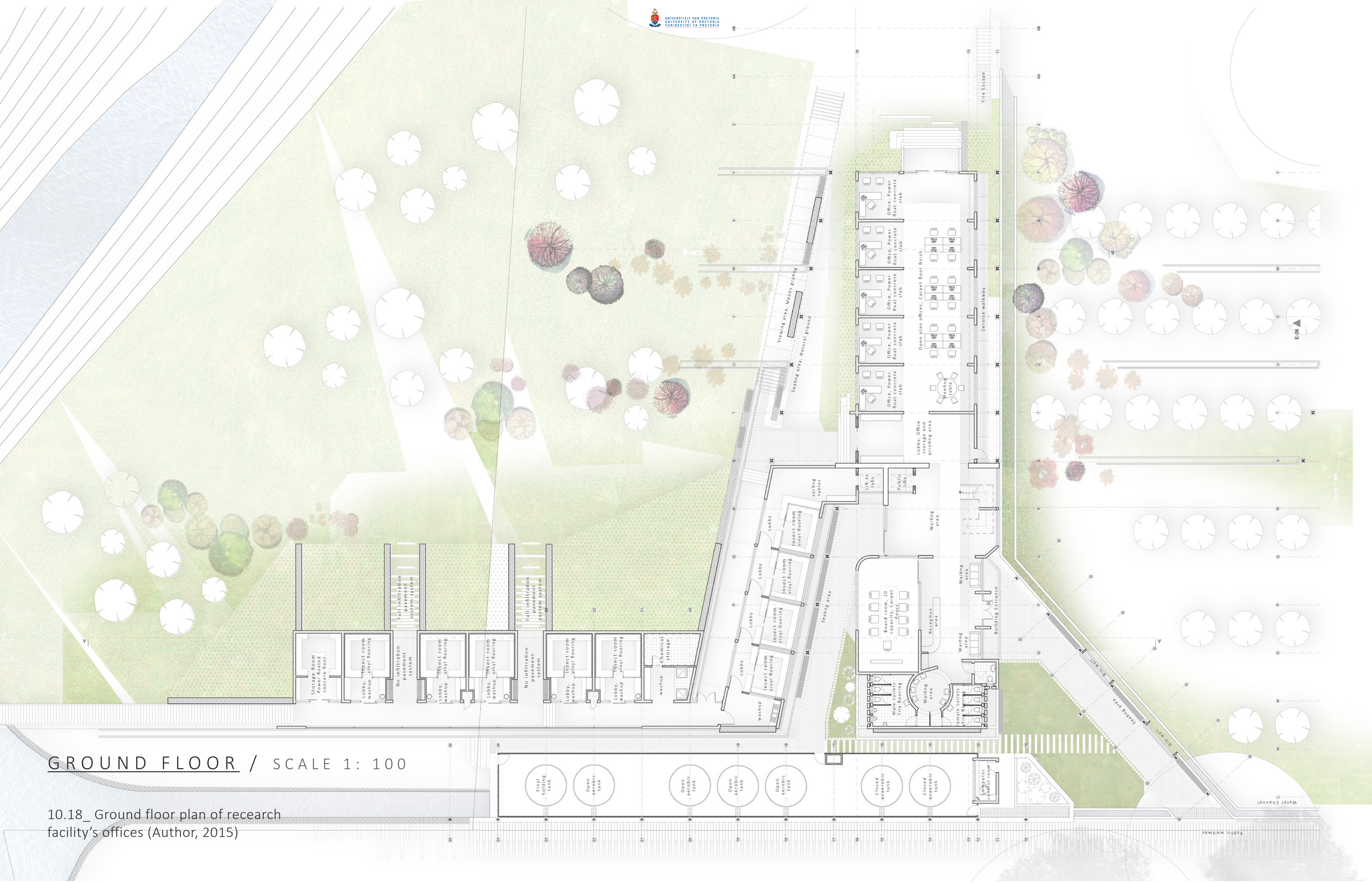
GROUND FLOOR / SCALE 1: 200

10.16_ Ground floor plan of recearch facility (Author, 2015)


Lab
Insect rooms
Dry Storage
Wash up
Insect rooms
Insect rooms
Lab
Insect rooms
Storage and sorting rooms
Reception, access con-trol
Connecting Bridge
Double volume
Storage tank

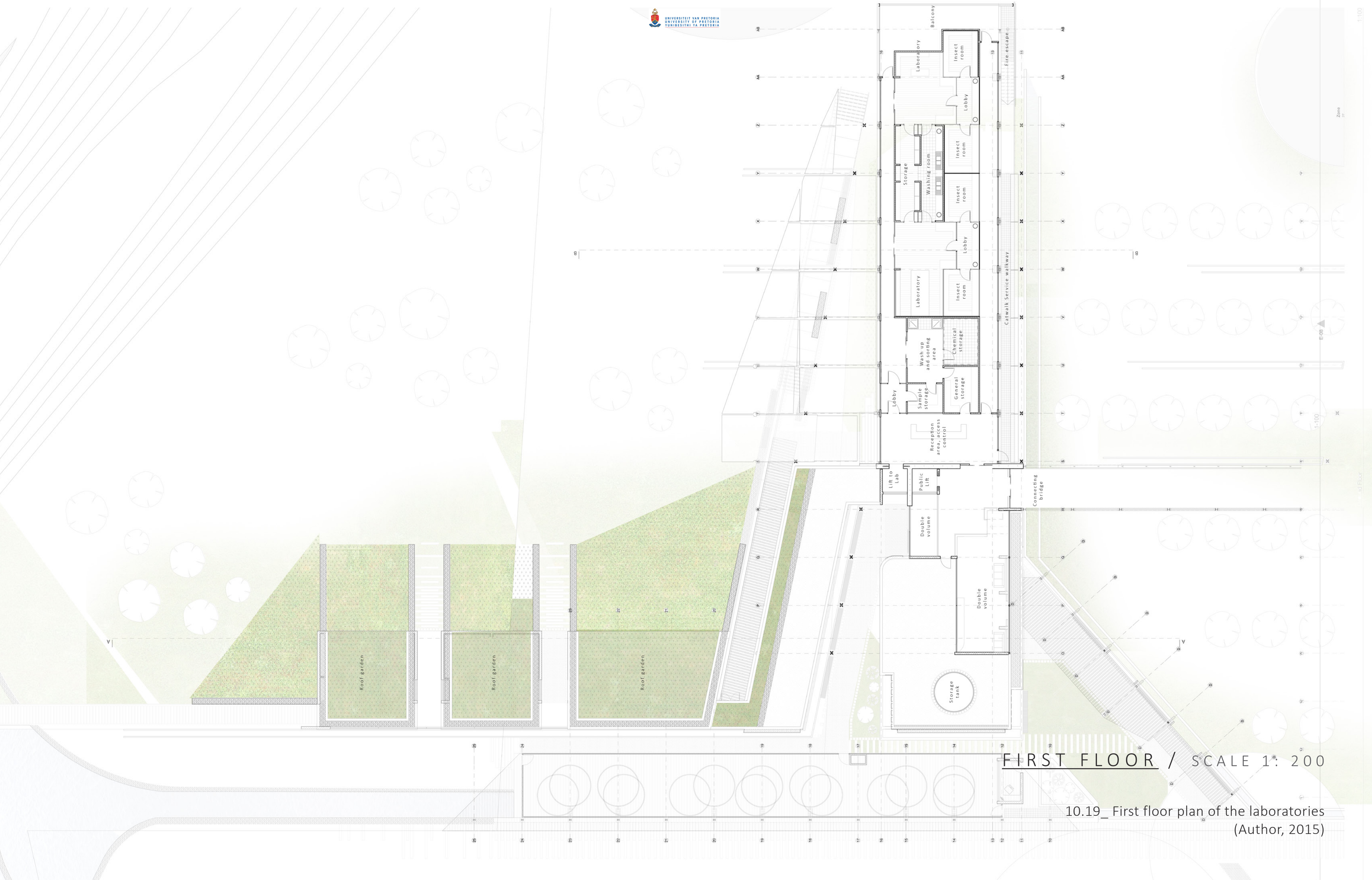
FIRST FLOOR / SCALE 1: 200

10.17_ First floor plan of recearch facility (Author, 2015)



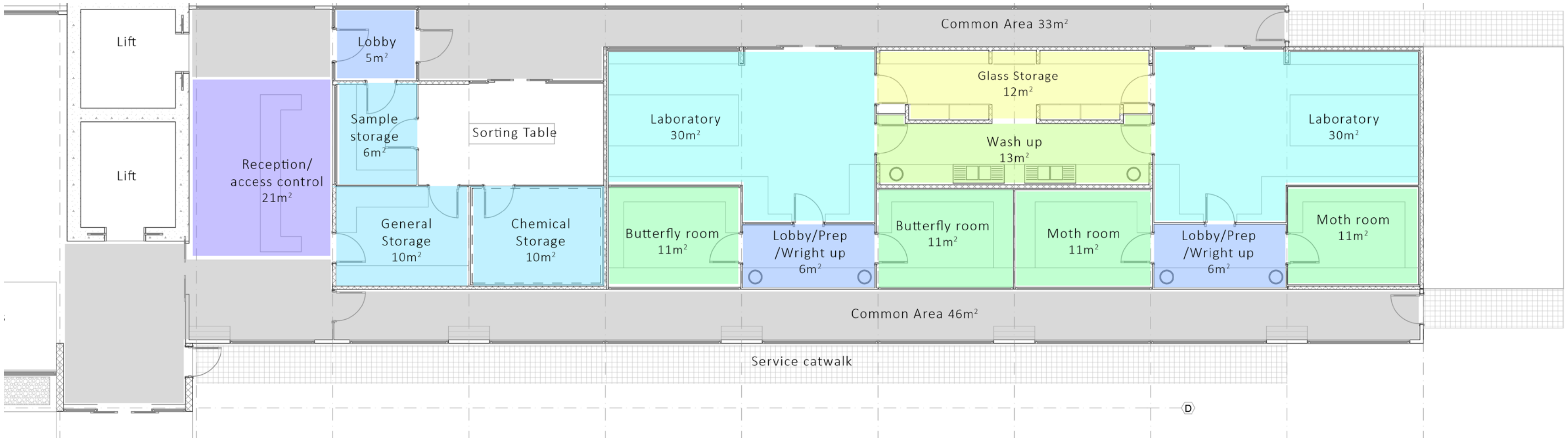
GROUND FLOOR / SCALE 1: 100

10.18_ Ground floor plan of recearch facility's offices (Author, 2015)

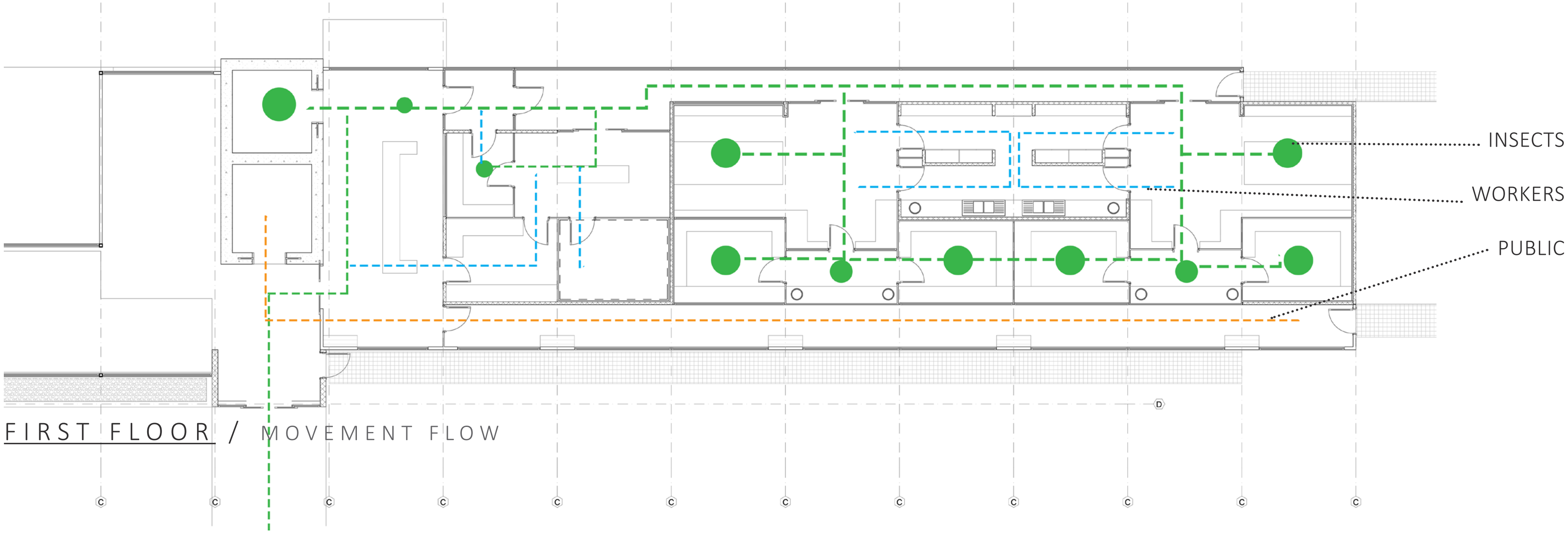


FIRST FLOOR / SCALE 1: 200

10.19_ First floor plan of the laboratories (Author, 2015)

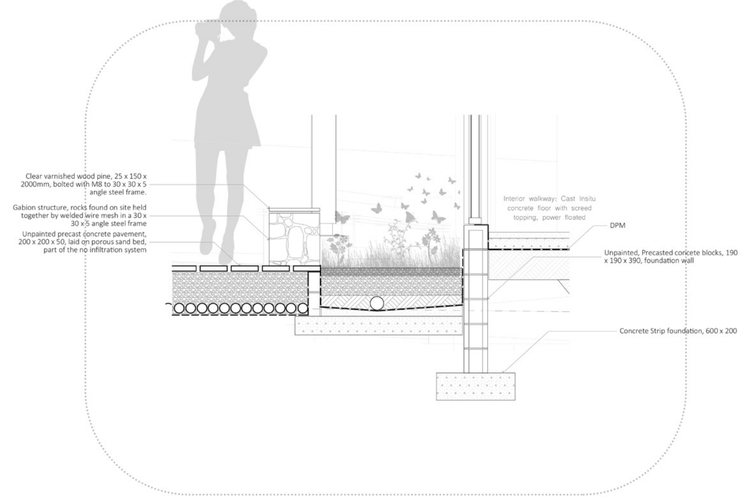


FIRST FLOOR / LABORATORY LAYOUT OF INSECT ROOMS

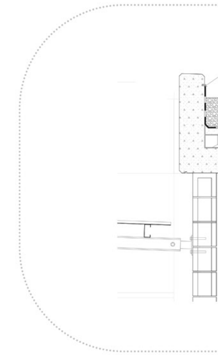


FIRST FLOOR / MOVEMENT FLOW

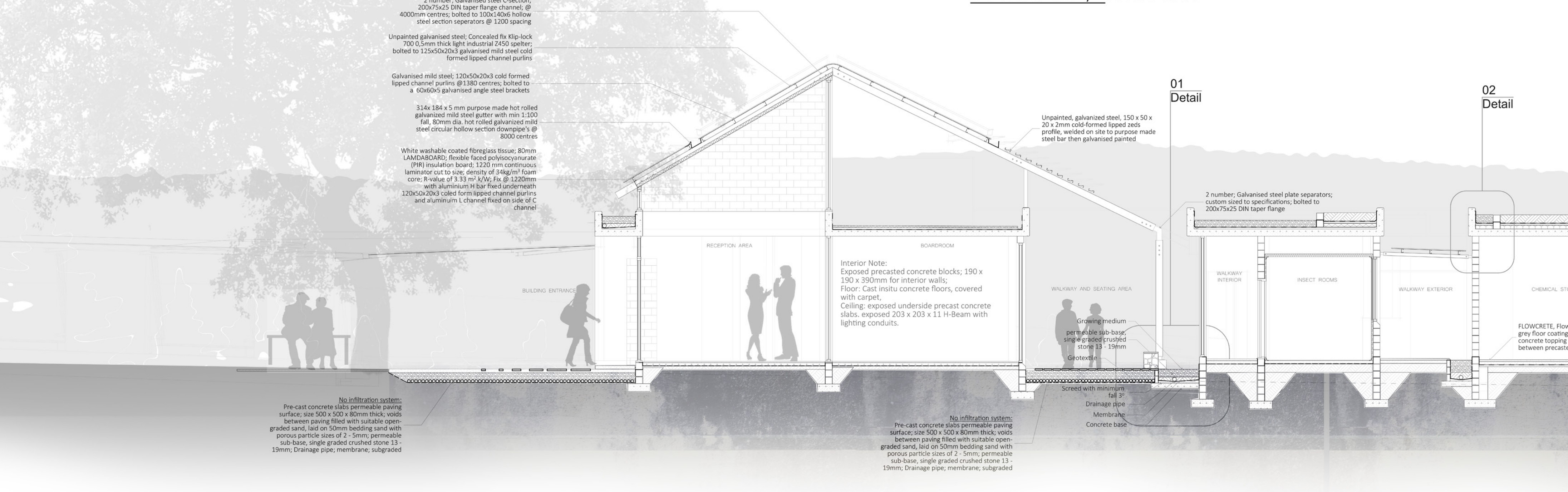
10.20_ Zoning plan (left) and the movement flow (right) of the First floor of Research building laboratories (Author, 2015)



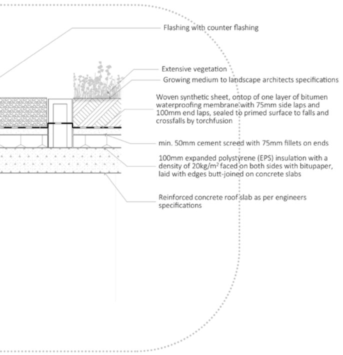
DETAIL 01 / SCALE 1:20



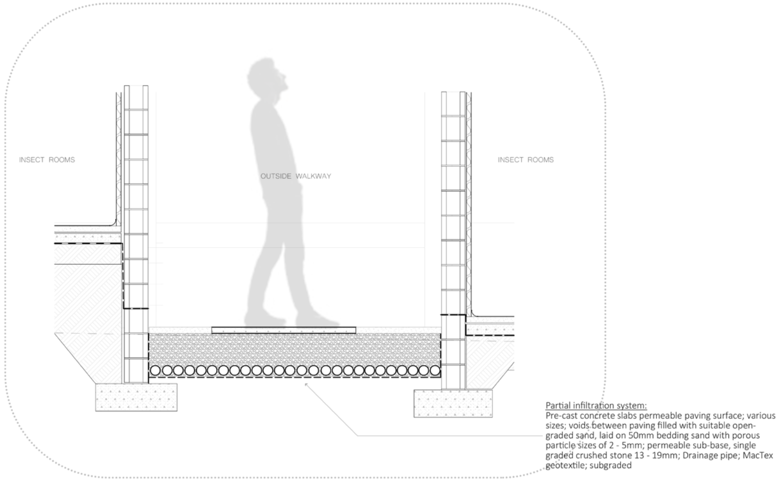
DETAIL 02



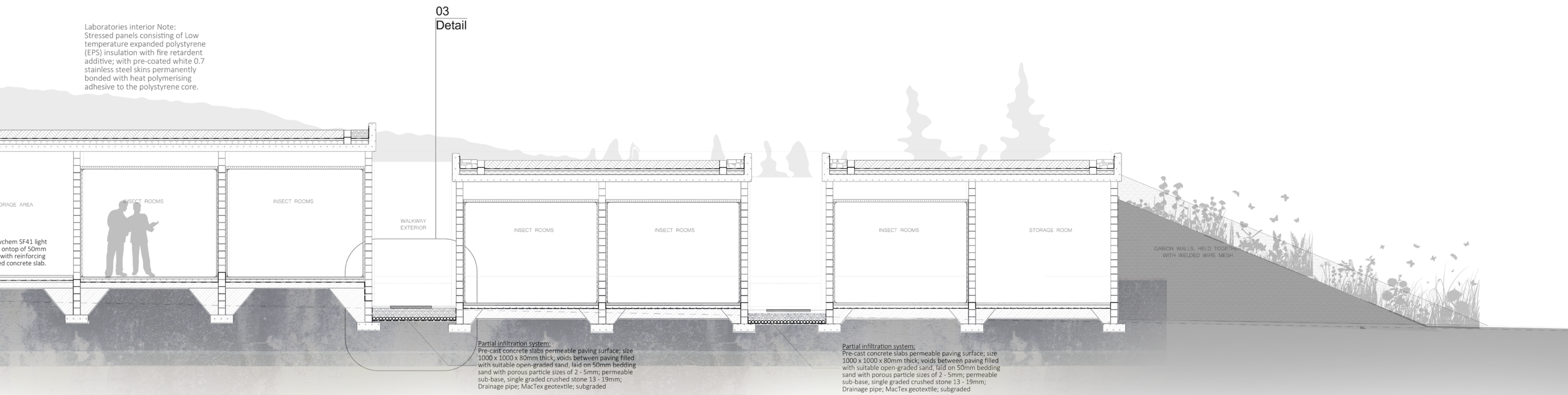
SECTION AA / SCALE 1 : 50



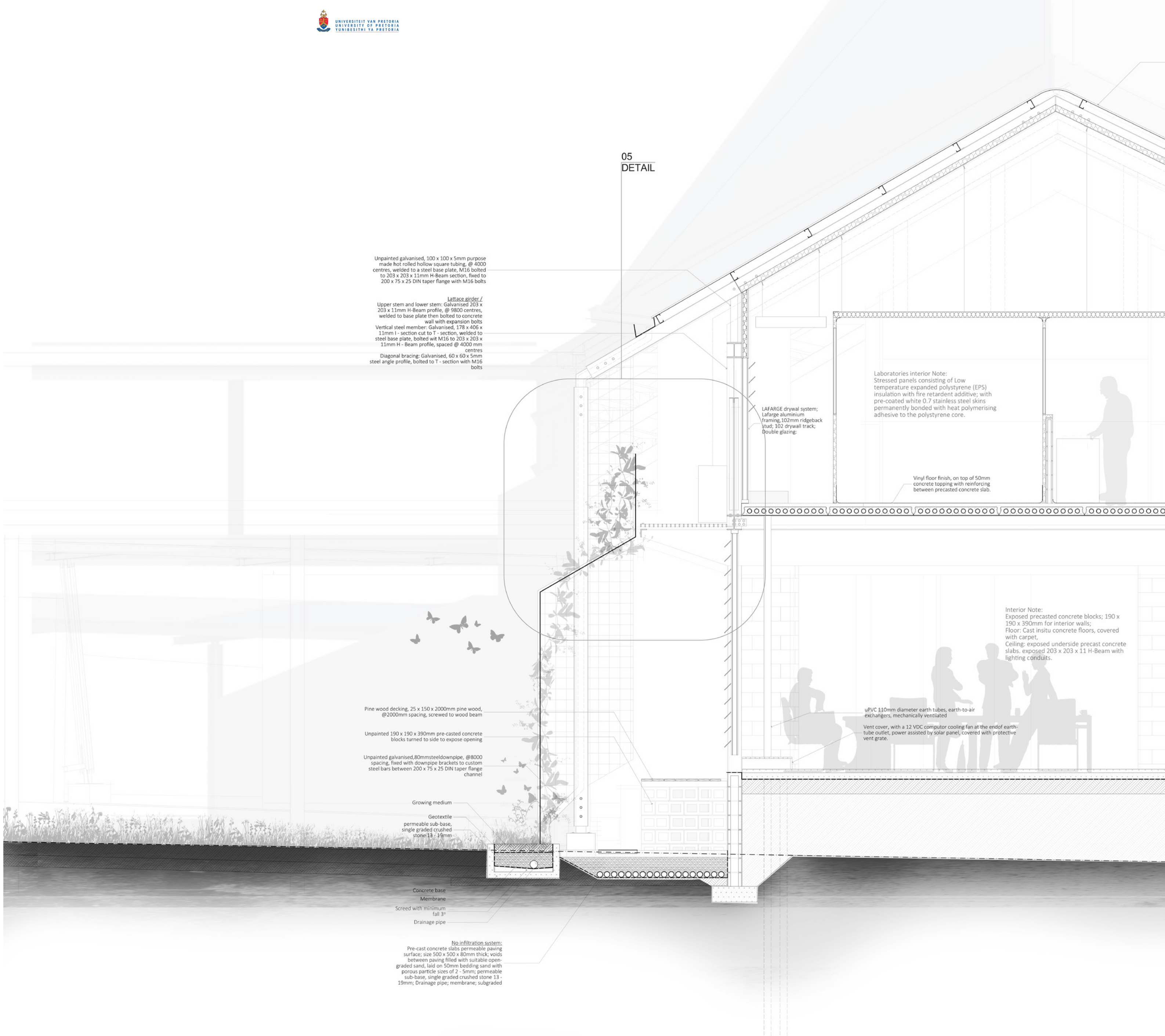
/ SCALE 1:20



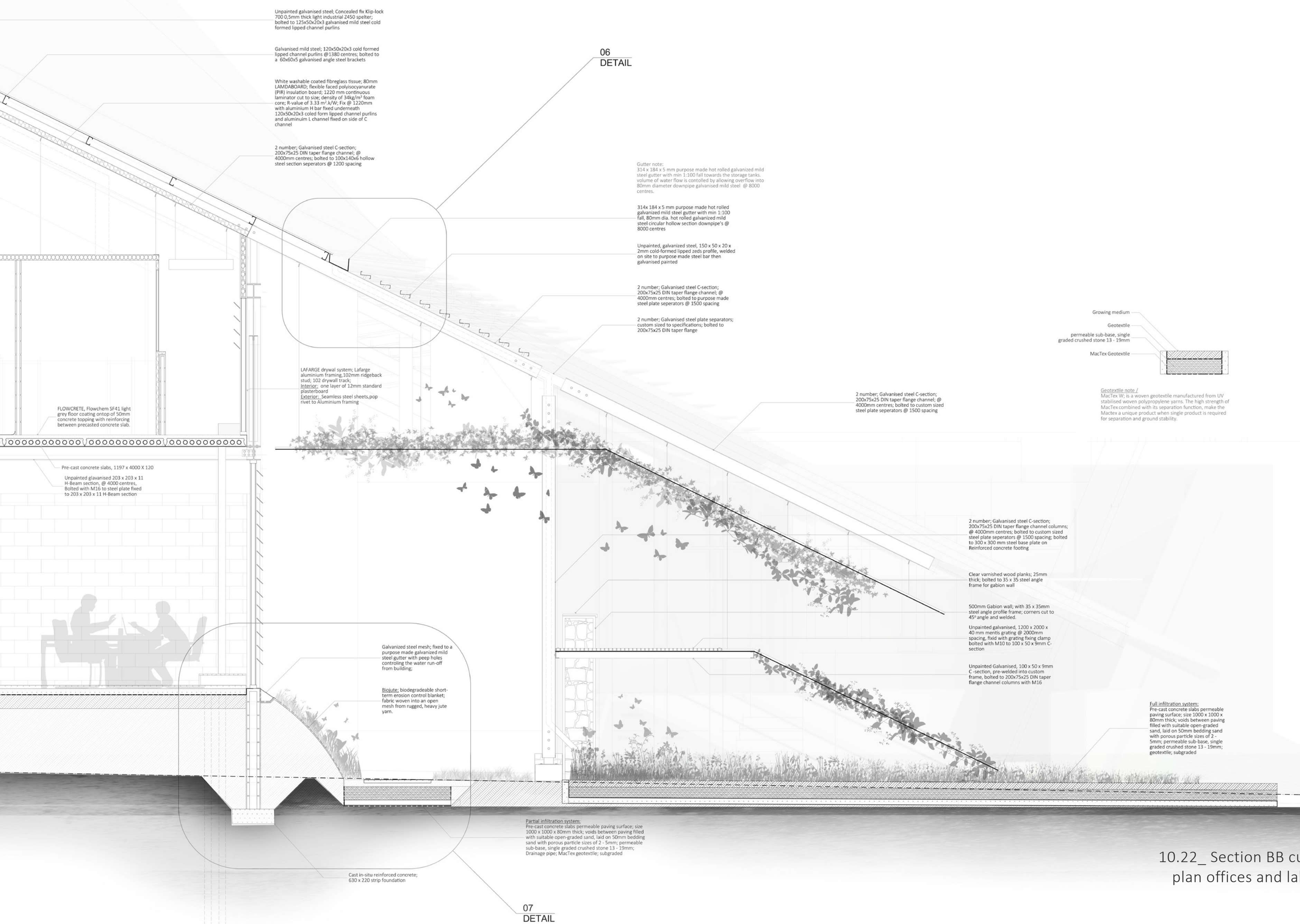
DETAIL 03 / SCALE 1:20



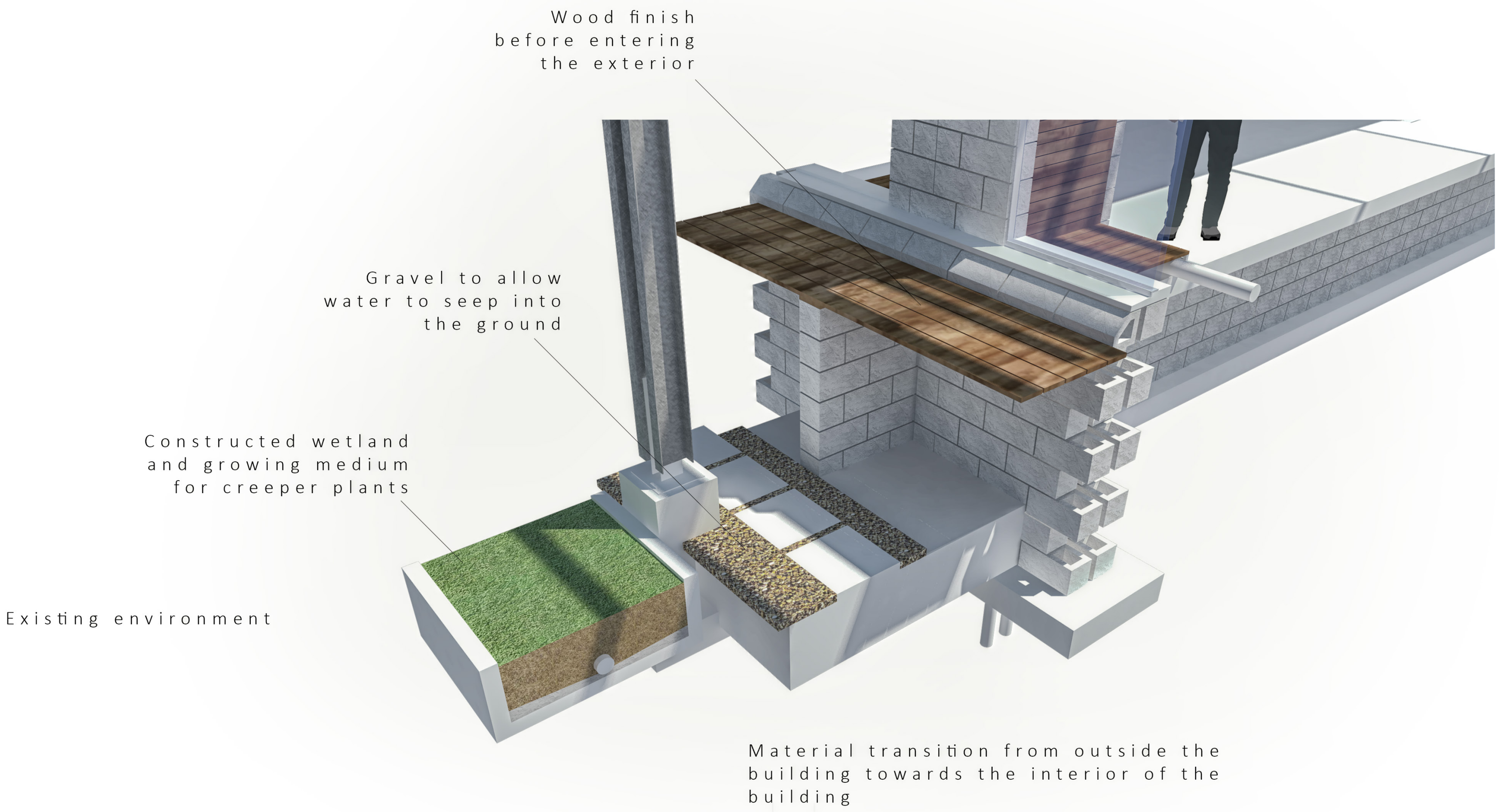
10.21_ Section AA cutting through the reception lobby to the end of the insect rooms (Author, 2015)



SECTION BB / SCALE 1 : 20



10.22_ Section BB cutting through the open plan offices and laboratory (Author, 2015)

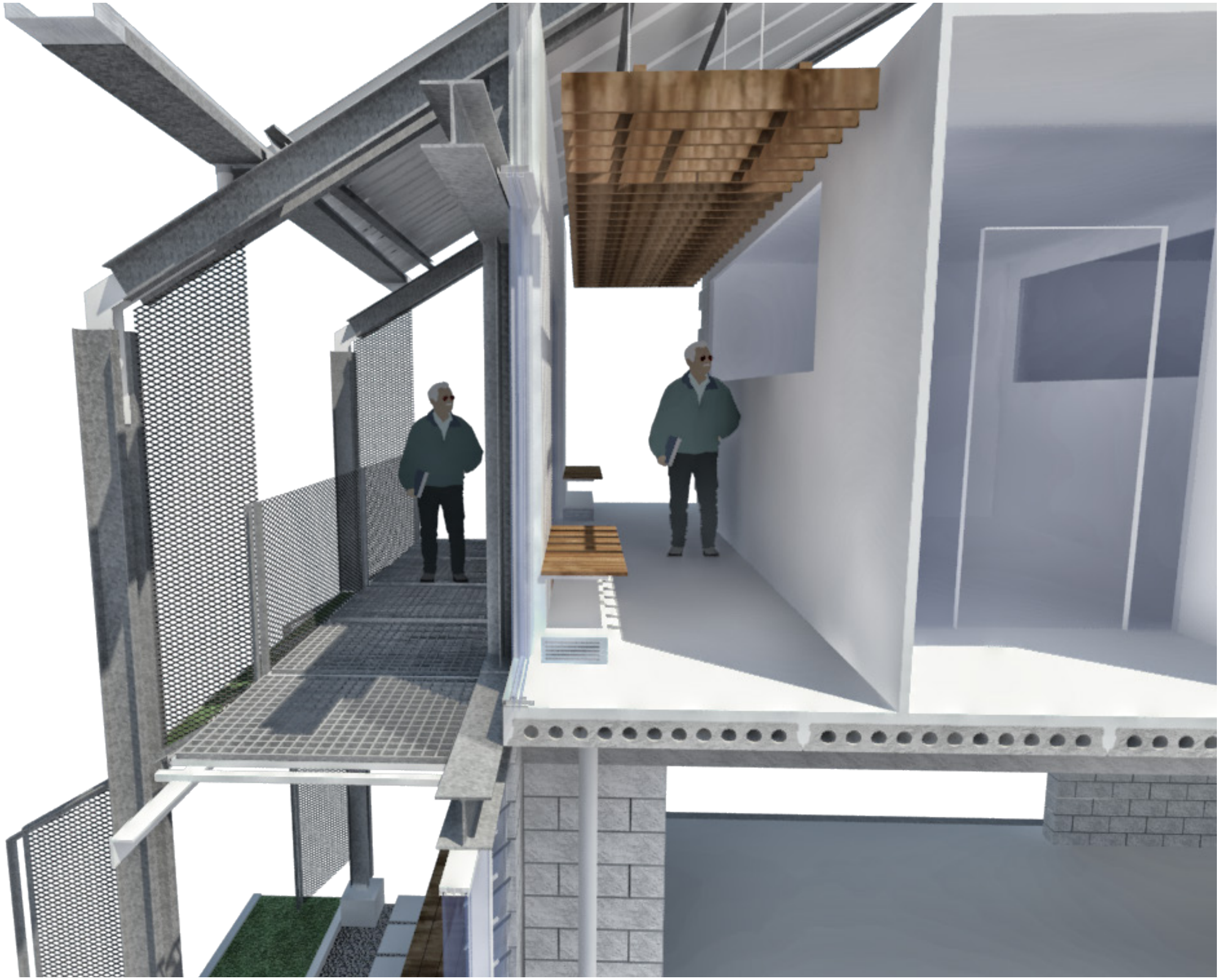


10.23_ 3D Detail of the transition from the exterior to the interior (Author, 2015)

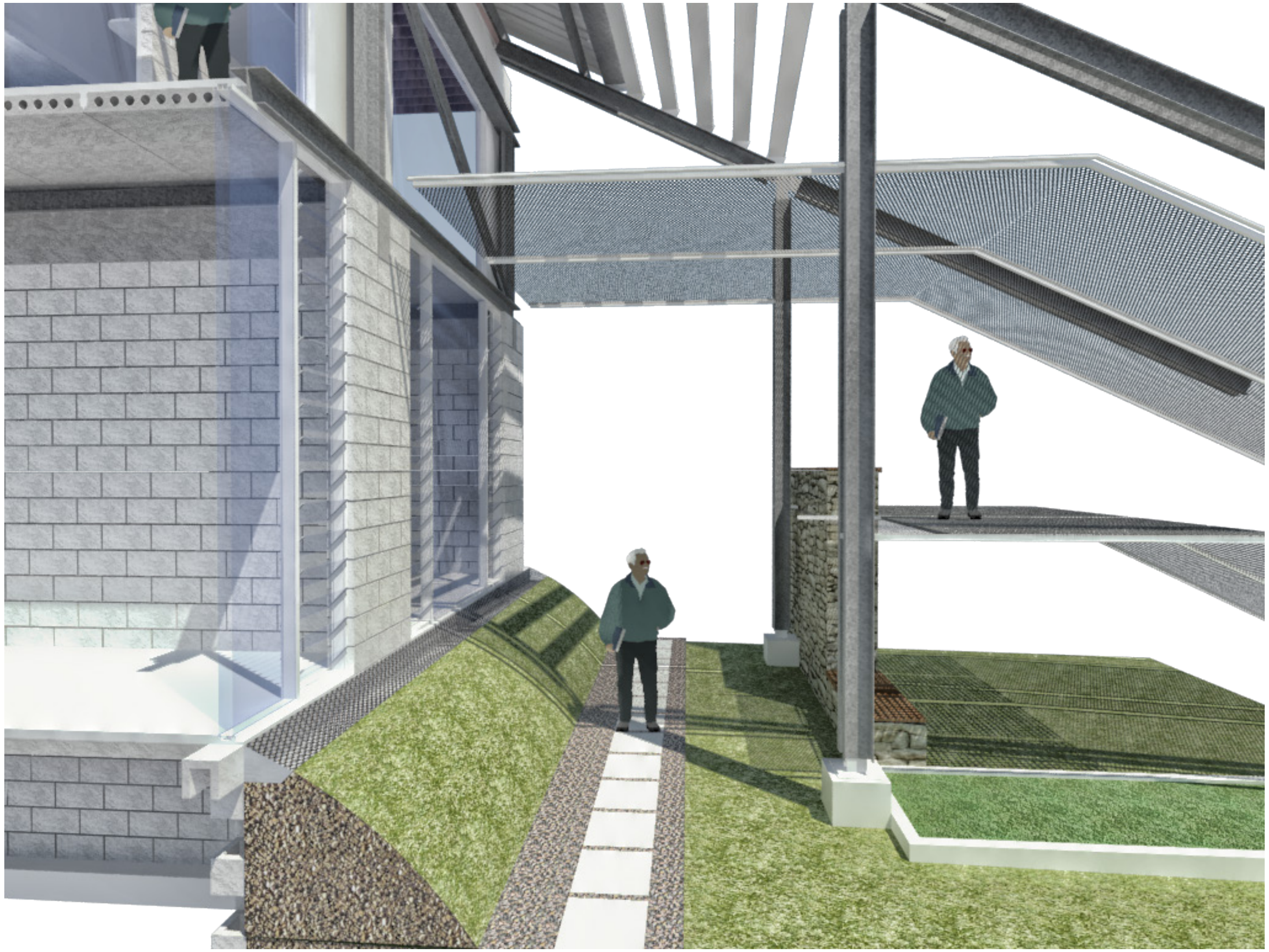
Creepers growing on the steel mesh on southern facade, provides habtats for insects

Insect Hotel, consisting of pallets and rubble creating holes and gaps for insects to populate, cool and shaded space for burrowing insects

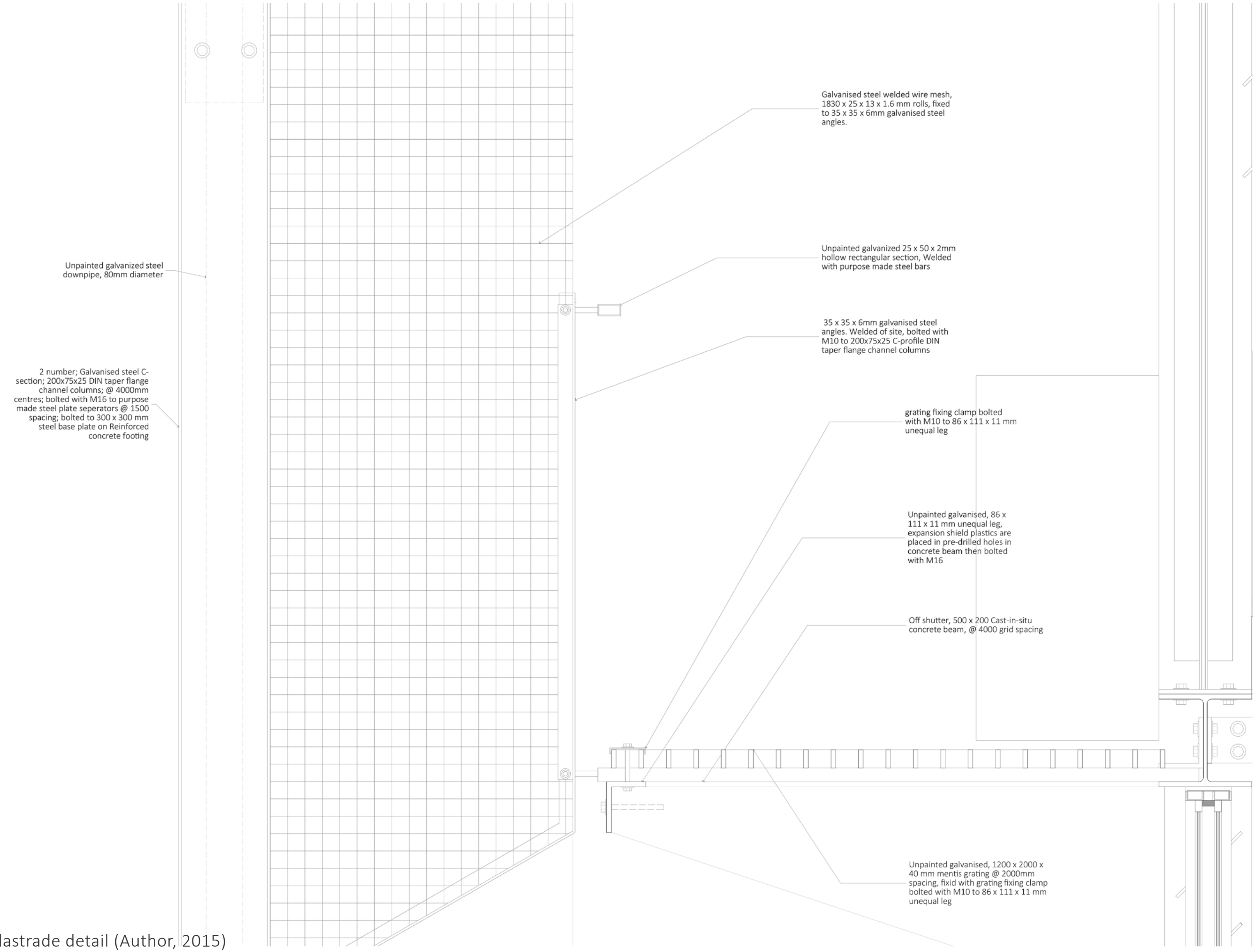
10.24_ The insect habitats on the southern condition of the building (Author, 2015)



10.25_ 3D Detail of the inside and outside space on the southern condition. The exterior being a service space and interior being viewing space (Author, 2015)

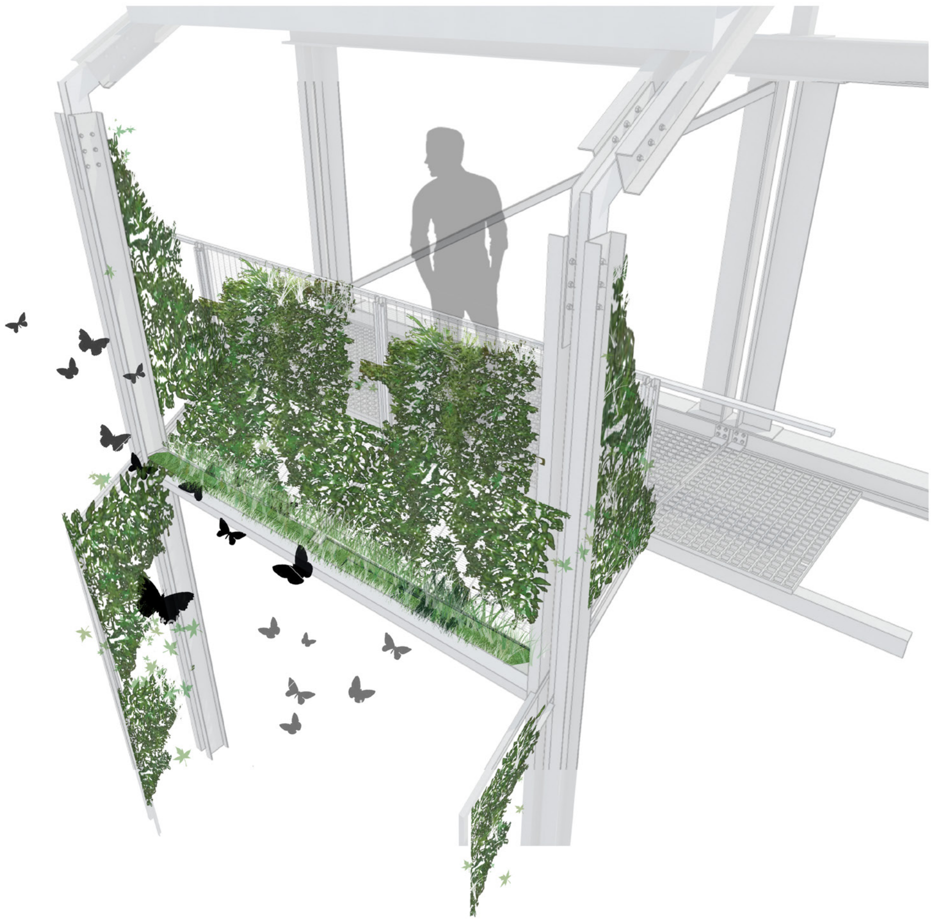


10.26_ Spaces created on the northern condition of the building for humans and insects. Steel mesh for plant creepers, creating shade for people (Author, 2015)

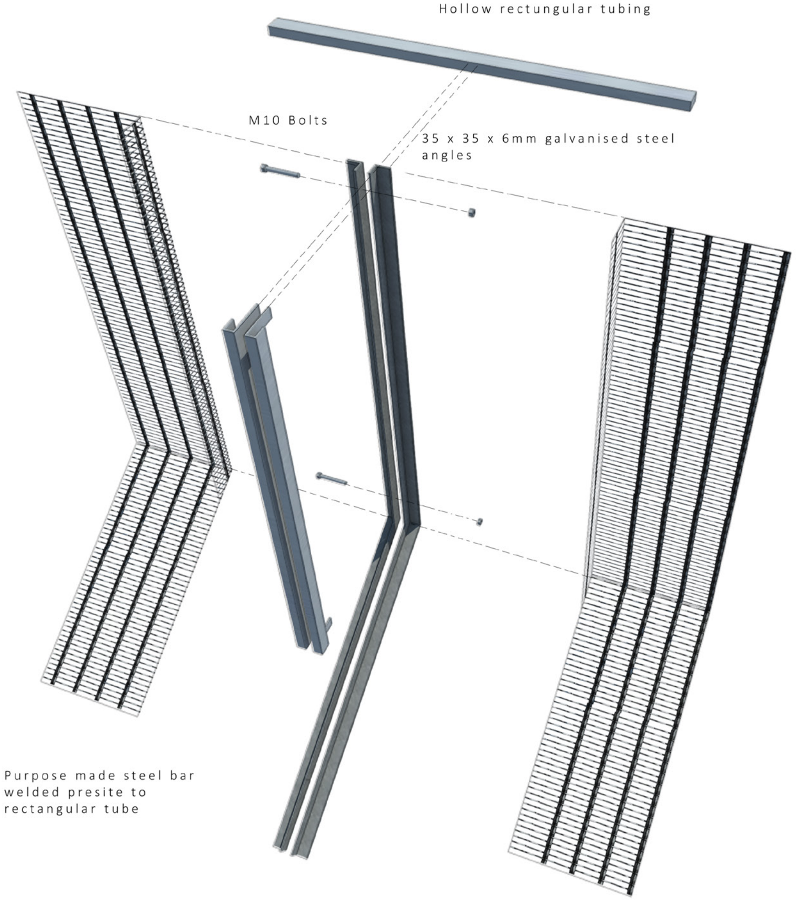


10.27_ Detail 5, balastrade detail (Author, 2015)

DETAIL 05 / SCALE 1:5

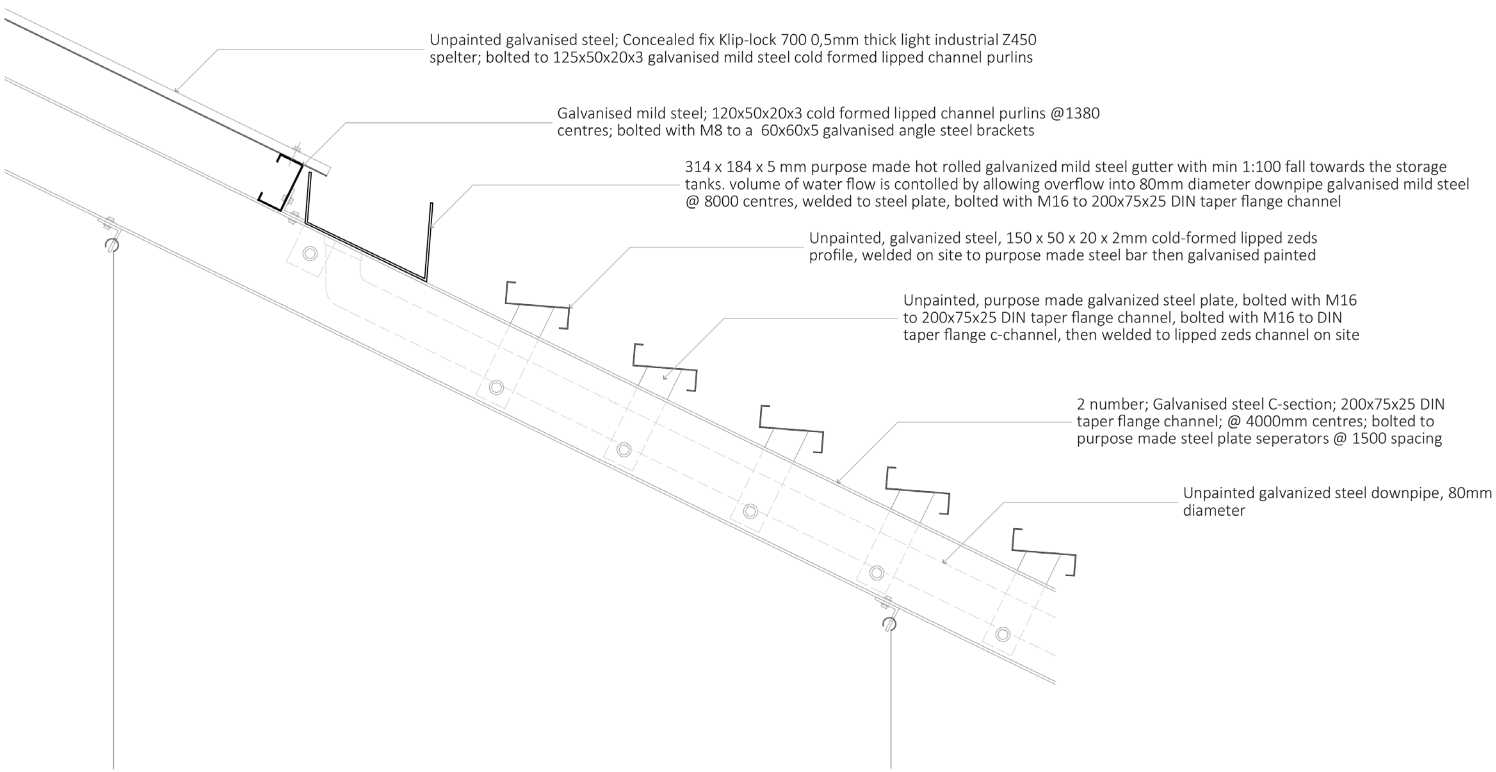


3D DETAIL 05 / INSECT HABITATS



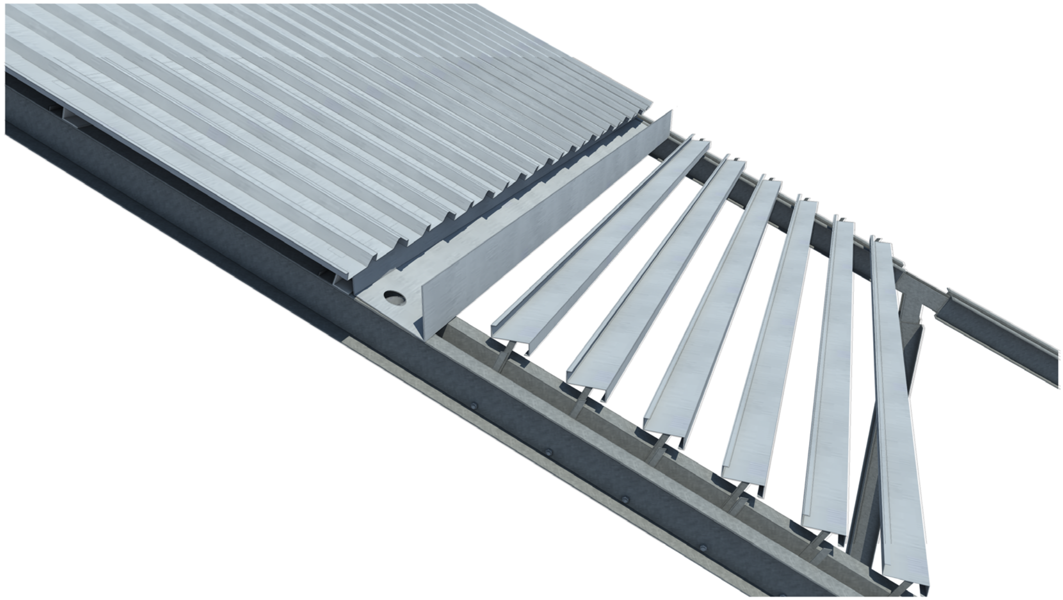
3D DETAIL 05/ EXPLODED BALUSTRADE DETAIL

10.28_ 3D balustrade detail expressing the concept of intersecting, overlapping and detaching (Author, 2015)

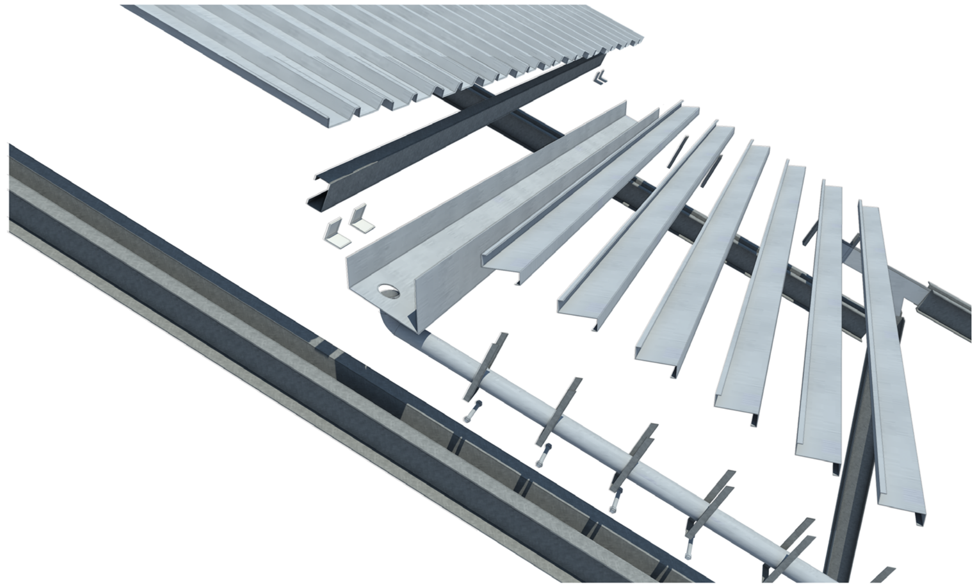


DETAIL 06 / SCALE 1:10

10.29_ Detail 6, Roofing detail of gutter and sun shading (Author, 2015)

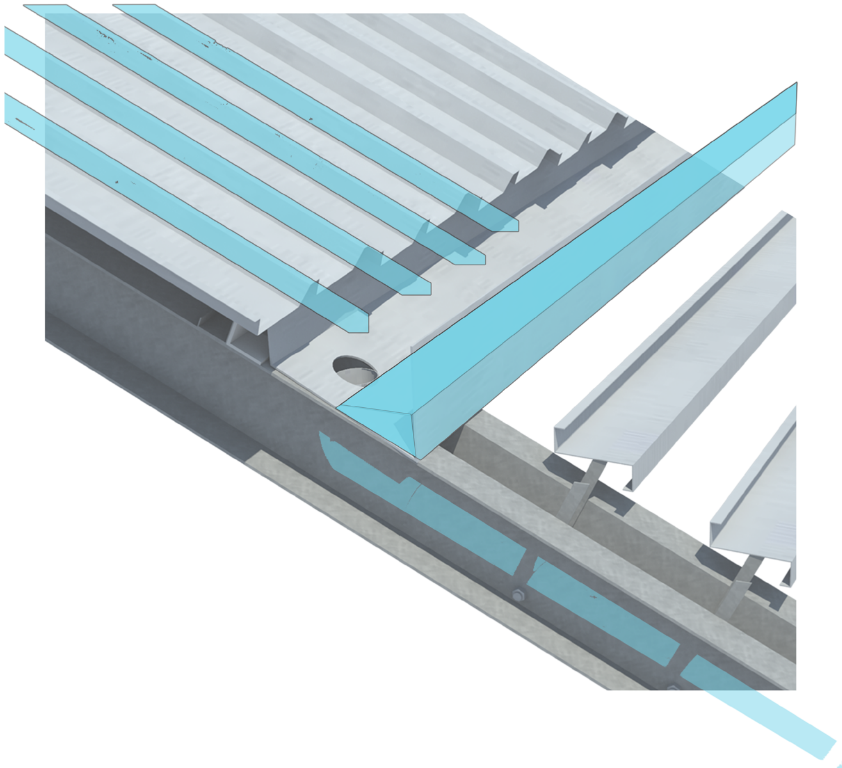


3D DETAIL 06/ MATERIALS ASSEMBLY

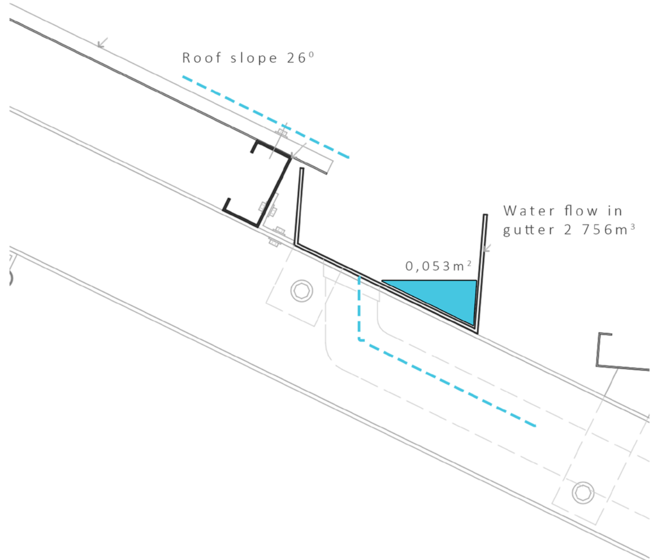


3D DETAIL 06 / EXPLODED DETAIL

10.30_ 3D exploded detail of roof construction (Author, 2015)

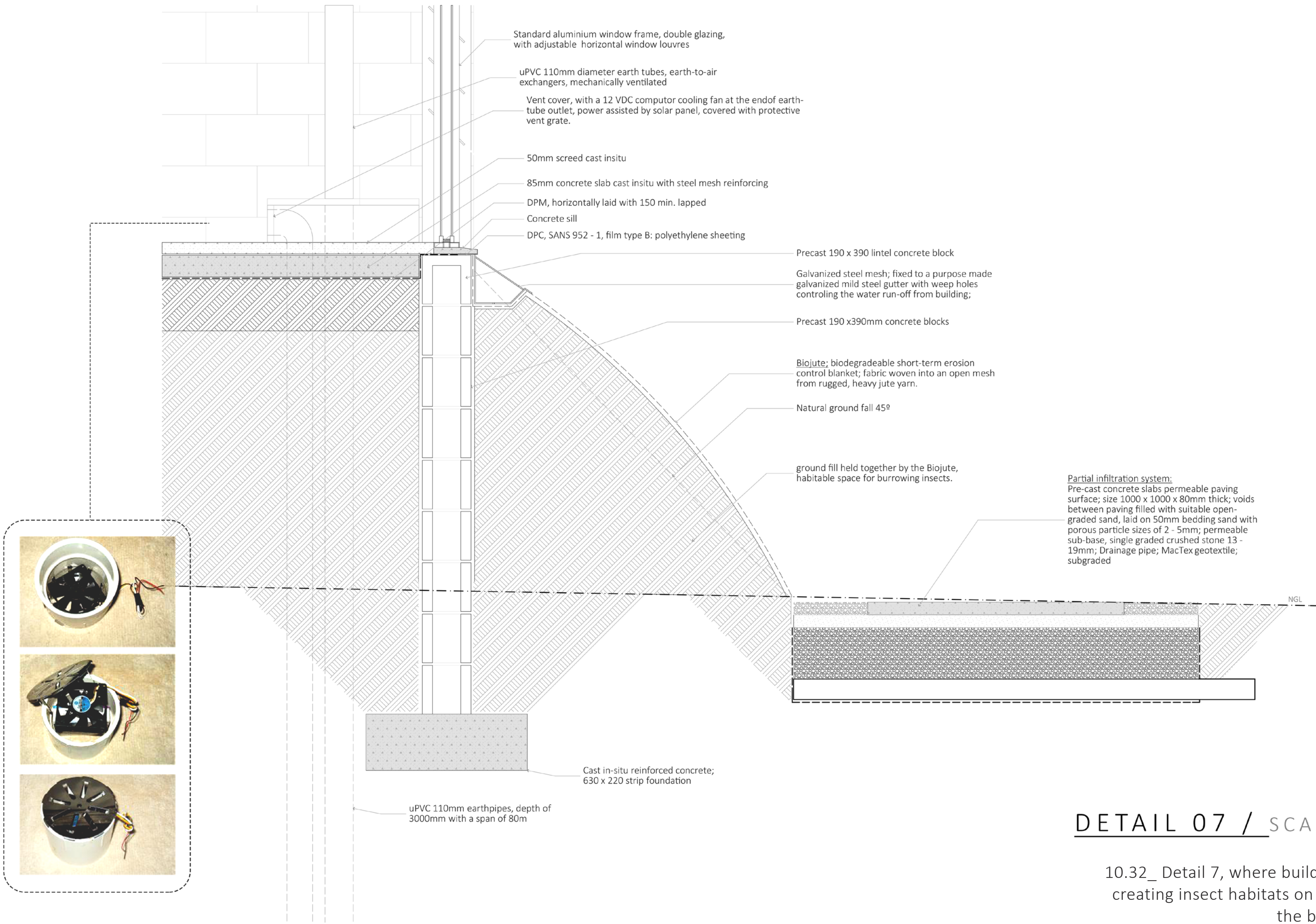


Water run-off from roof /
Roof Area north: 236 m²
Gutter capacity to hold water send water to storage tanks; 2 756m³
water overflow into 80mm diameter downpipe



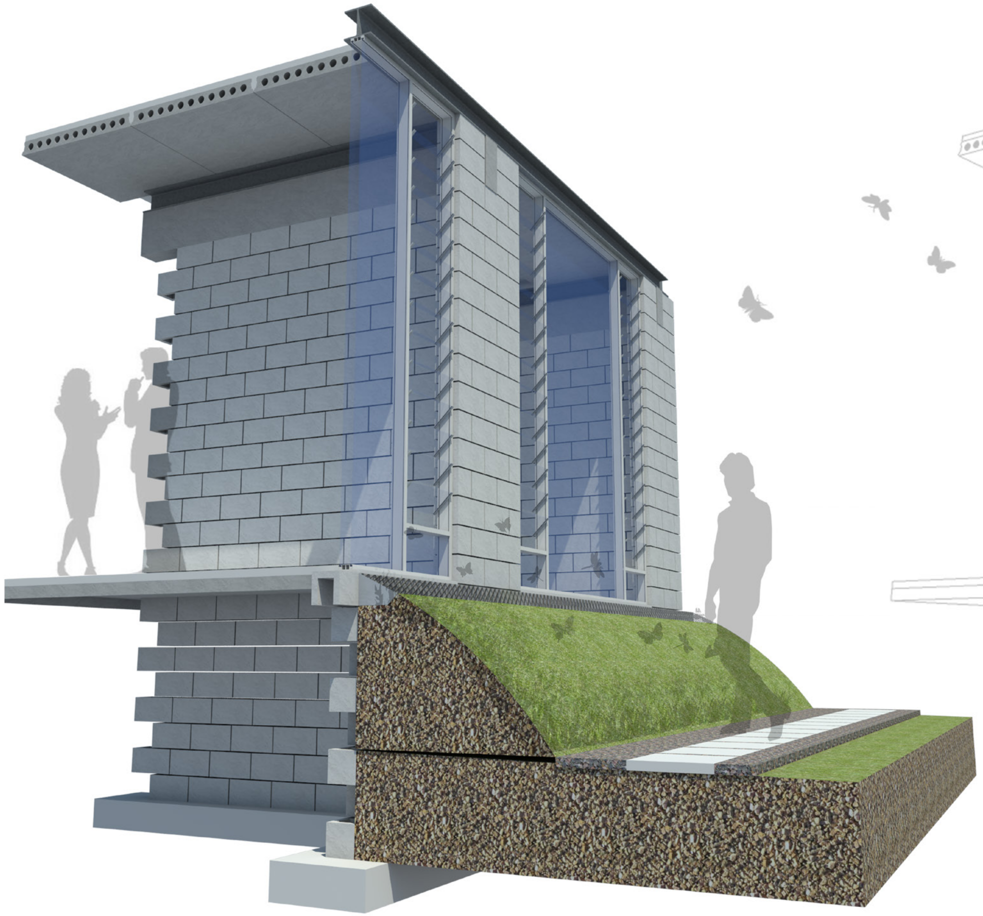
DETAIL 06 / GUTTER WATER CAPACITY

10.31_ Detail 6, Diagram explaining the use of water in the gutter (Author, 2015)



DETAIL 07 / SCALE 1:10

10.32_ Detail 7, where building meets the ground creating insect habitats on northern condition of the building (Author, 2015)



3D DETAIL 07 / MATERIALS IN CONTEXT

3D DETAIL 07 / INSECT HABITATS

10.33_ 3D Detail 7, Explaining materials and use of insect habitats (Author, 2015)


NURTURNG ARCHITECTURE
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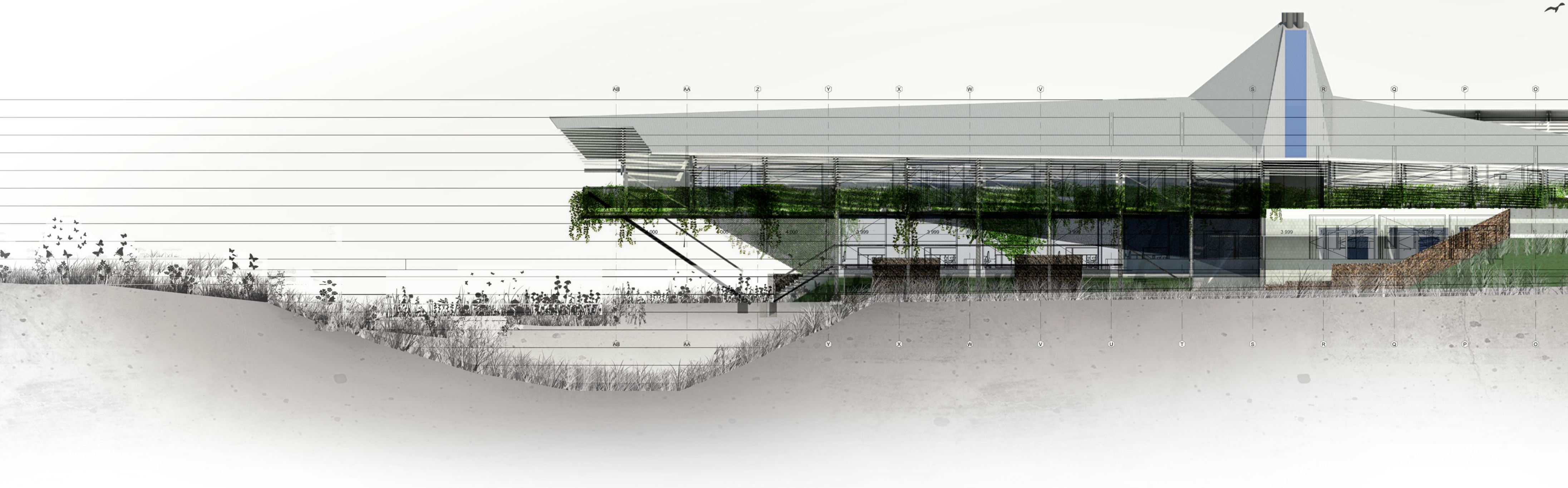
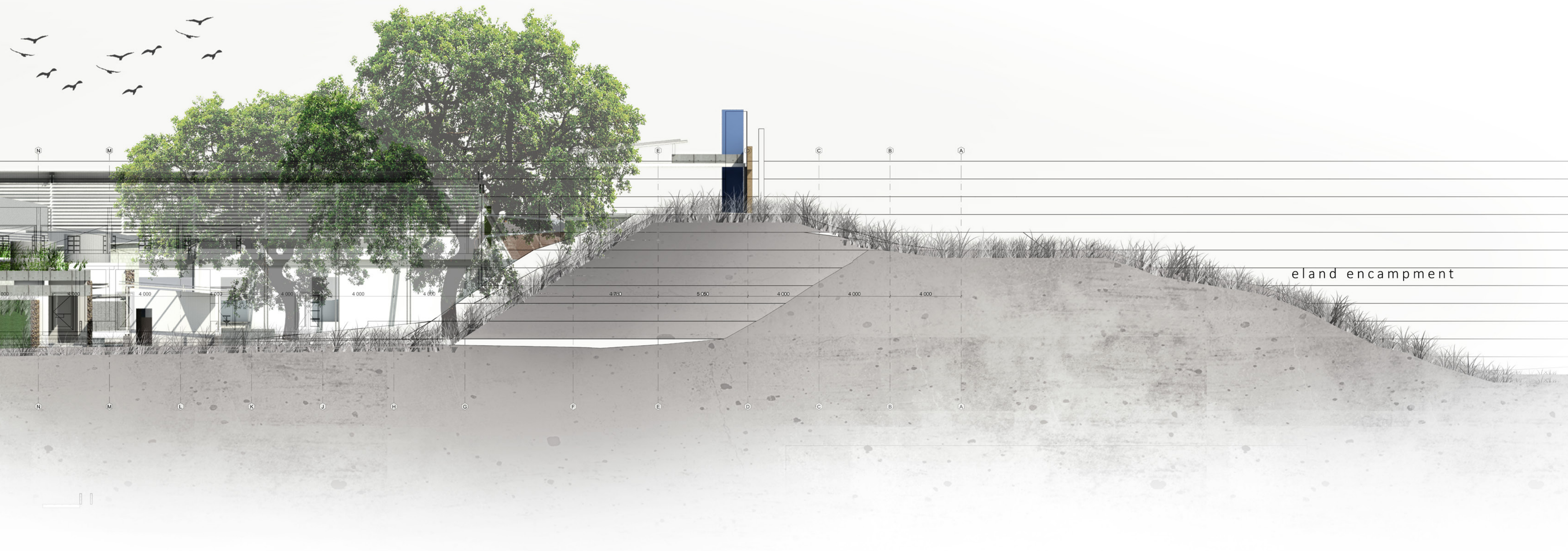
REGENERATIVE ARCHITECTURE
AN EDUCATIONAL ENTEMOLOGY RESEARCH FACILITY
IN THE FORGOTTEN ORIGINS OF PRETORIA CENTRAL
JOHANN .H. BOONZAAIER
2 7 0 9 8 2 9 1



10.34_ North elevation of entomology research facility, explaining the release into nature, the final detachment from the bio-wall (Author, 2015)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