9 /DESIGN

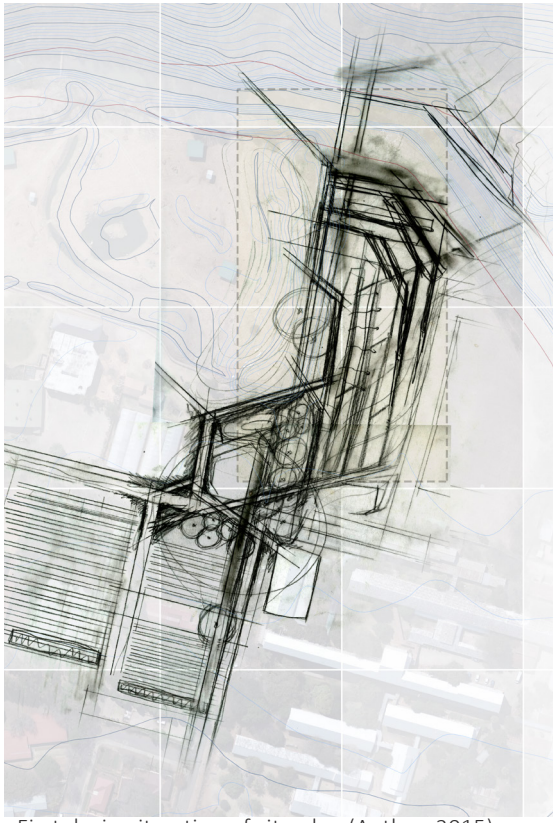
9.1 / DESIGN DEVELOPMENT /

Finding the relationship between man, nature and building

DESIGN 01 / The first design sketches delineate the boundaries of the project site. Connections to neighboring sites are shown and space is left for the school to use their sport fields. The development of as much vegetation and natural ecosystems as possible creates a natural barrier between the two sites. The water channel, as a strong axis, follows a straight path to the Apies River. The walkways and footprints of the building are carefully placed to not harm existing habitats, but to instead enhance the ecosystems in already damaged areas (refer to Section 8.1.2).

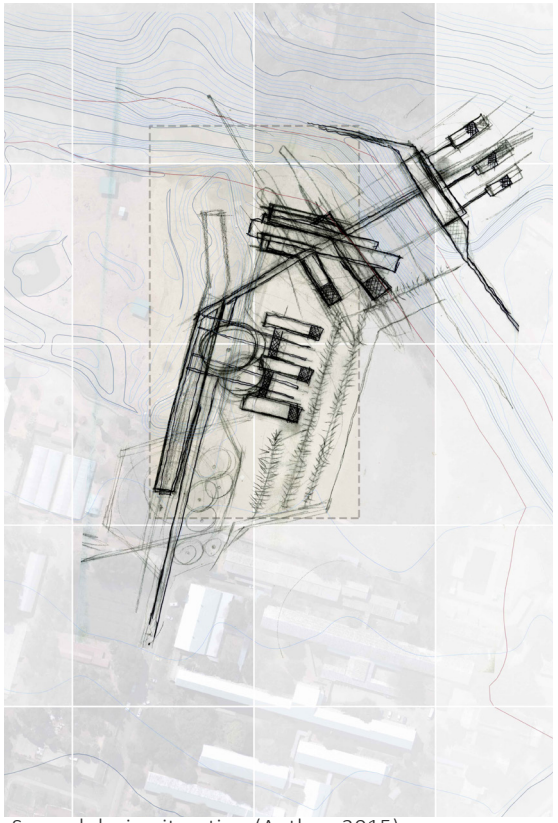
DESIGN 02 / The second design is intuitive and emphasizes the approach to the site in the form of building cantilevering from the hilltop on site. The existing Eland encampment border runs straight across the middle of the hilltop; therefore, the entire hill cannot be utilized. The second response is to place the research buildings facing north and in the middle of the natural created ecosystems, where insect species can be quickly captured for research. Different research buildings are placed further north to accommodate different insect species and the bee sanctuary is north of the Apies River, away from people.

DESIGN 01



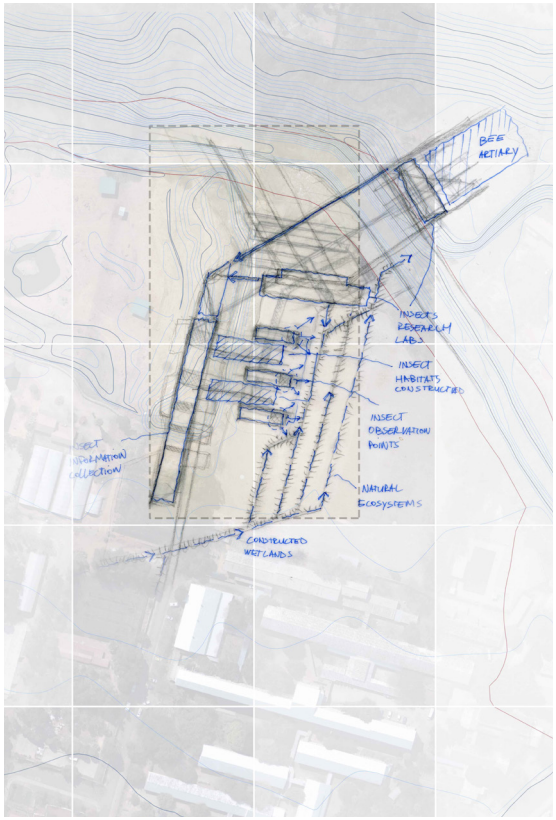
9.1_ First design iteration of site plan (Author, 2015)

DESIGN 02

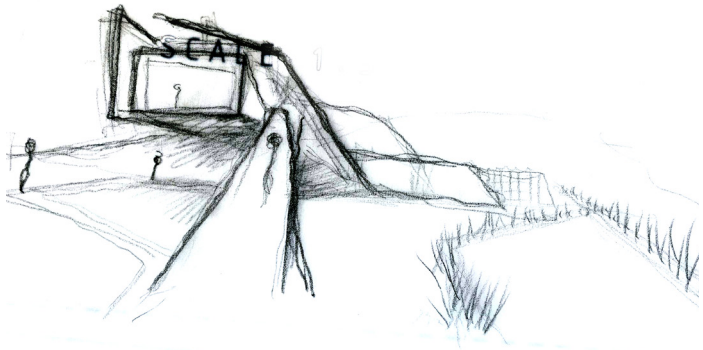


9.2_ Second design iteration (Author, 2015)

DESIGN 03

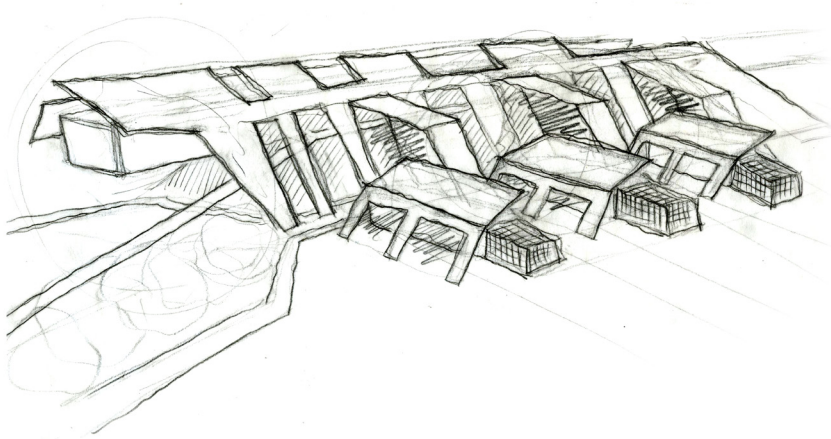


9.3_ Third design iteration that developed further (Author, 2015)

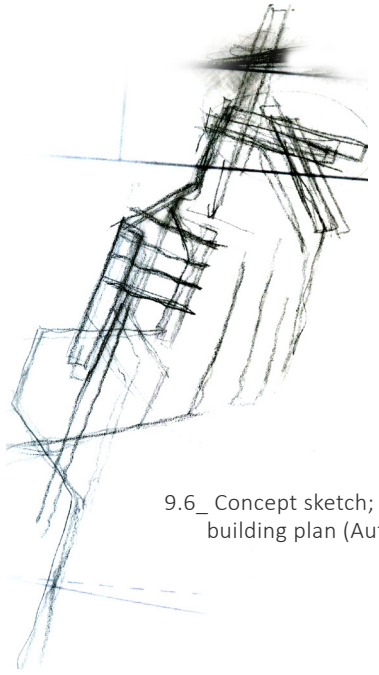


9.4_ Concept sketch of the extention of the zoo department with the wetland insect habitats on the left (Author, 2015)

DESIGN 03 / In the third iteration the architecture is simplified and specific programs are assigned to the buildings. The water channel is more defined where it becomes an artificial wetland and water route to enhance the insect habitats. The public route brings visitors up close and personal with the insect habitats. The proposed building, however, is disconnected from the public and does not define the entrance to the research building or define itself enough as a building belonging to the zoo. The strong water axis leading to the Apies River is also lost and does not serve a purpose for the research building.

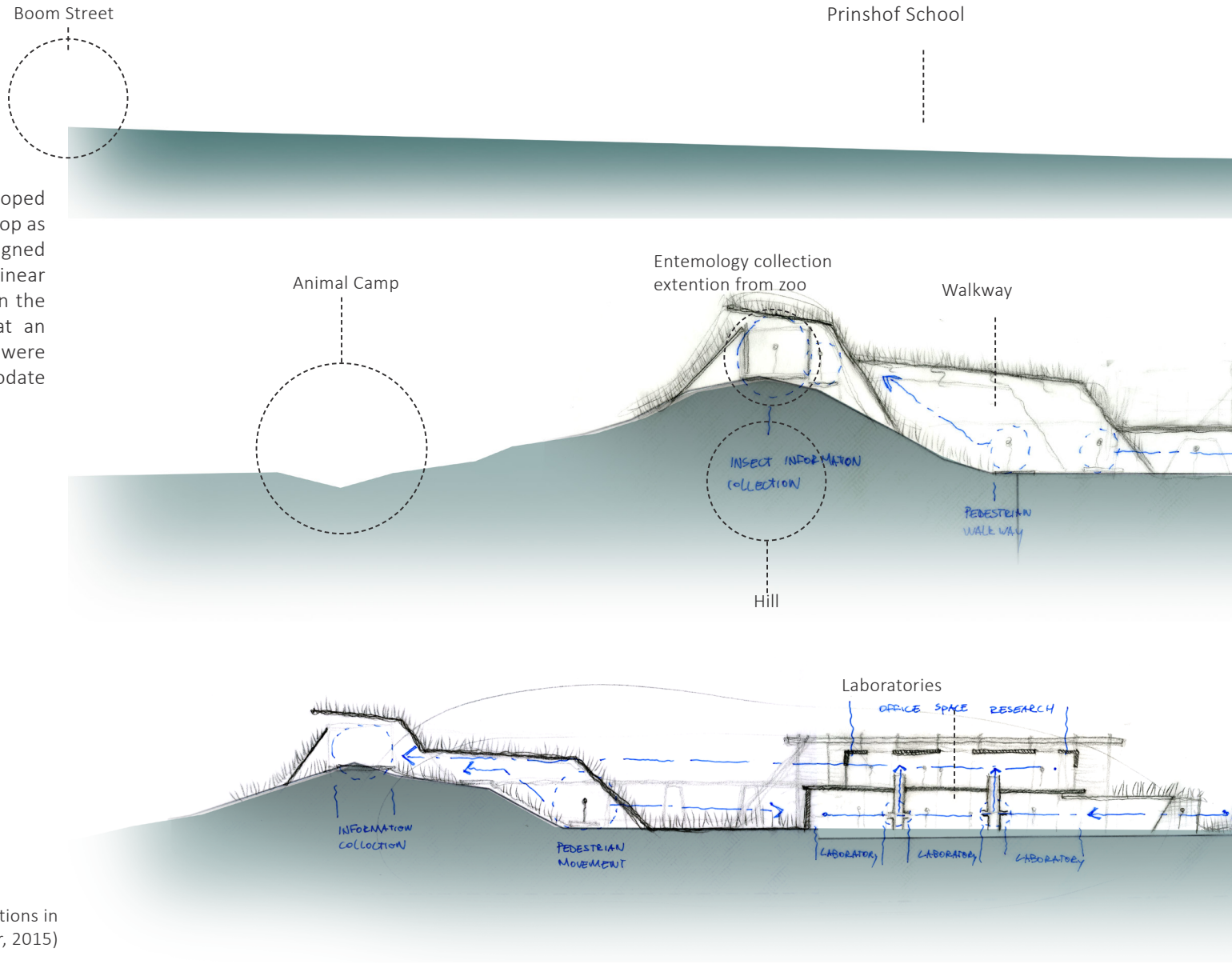


9.5_ Concept sketch; aerial view of the research facilities with the laboratories (Author, 2015)

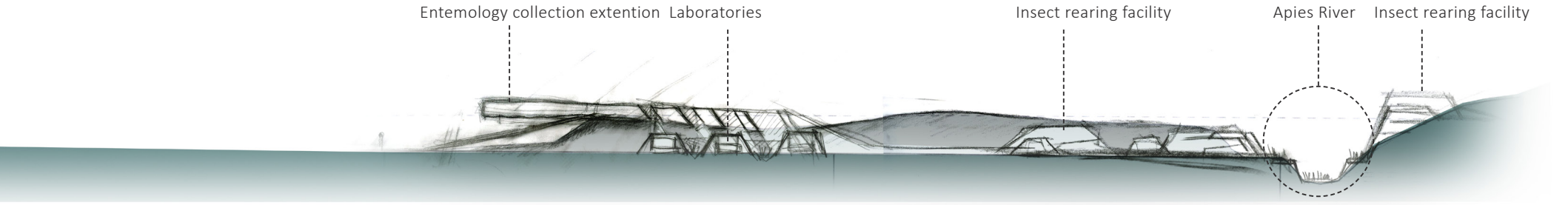


9.6_ Concept sketch; diagram of building plan (Author, 2015)

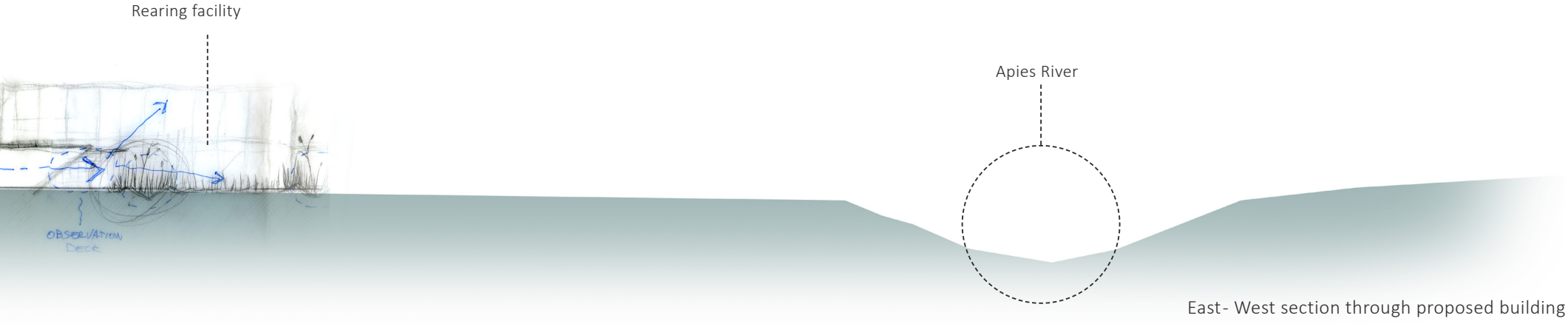
The following sections and elevations were developed from Design 03. Inspiration was drawn from the hilltop as the building started to form. The building was designed with the hilltop and site instead of against it; a linear building is created that defines the spaces between the structures. The roofs were intuitively designed at an early stage to form part of the site, sloped roofs were created to control water run-off and to accommodate the vegetation that grows on the building.



9.7_ Concept sketch; sections and elevations in relation to the site and hill (Author, 2015)



East elevation displaying the buildings relation to Boom Street and the Apies river



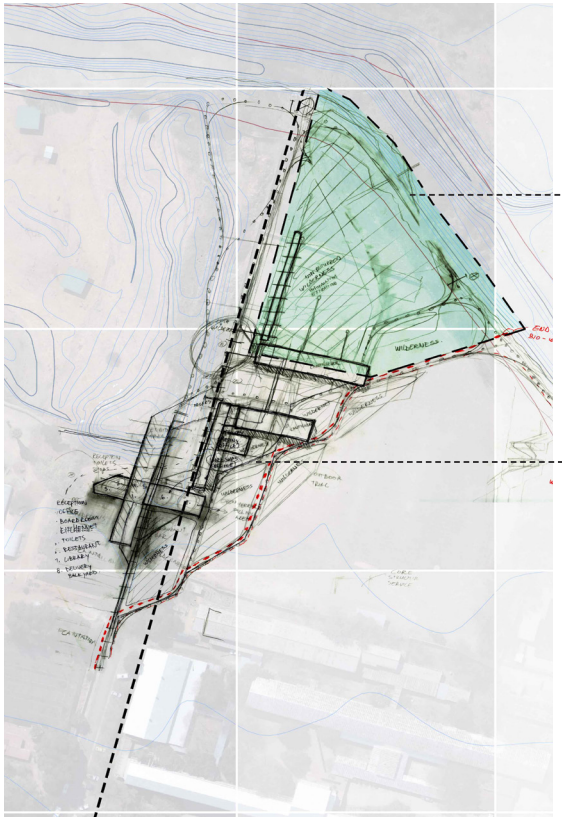
East- West section through proposed building

East- West section through proposed building

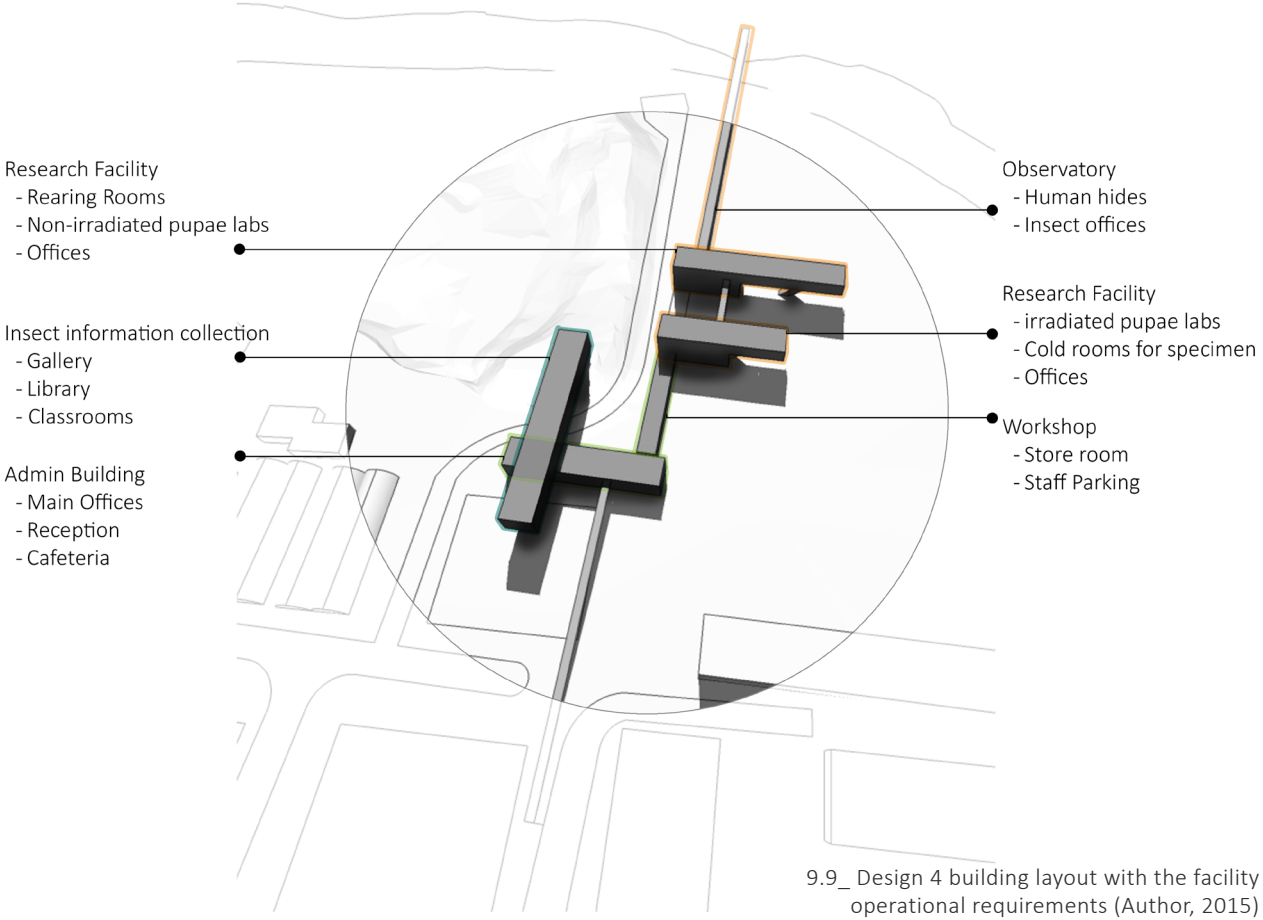
9.1.1
DESIGN 04 DEVELOPMENT

DESIGN 04 / This iteration of the layout moves the entomology collection building to the south of the site. An administrative building is included to define the entrance of and control access to the research facility. Pedestrian movement is defined between the public and people employed at the research facility and parking for employees' vehicles is separated from the delivery route into the site. The building defines the entrance space south of the site, whilst the north of the site is zoned to promote natural growth of vegetation and insect habitats. The public route is determined by the natural barriers that the constructed wetland creates between public and private. The building cantilevering from the hilltop defines the approach to the entrance and becomes part of the entomology department of the zoo; creating a connection between the zoo area and the research facility. The axis of the water channel towards the Apies River has a prominent effect on the layout of the building. This axis controls the water filtration and manages the waste water collection from the buildings. It gains educational value as part of the building program.

DESIGN 04



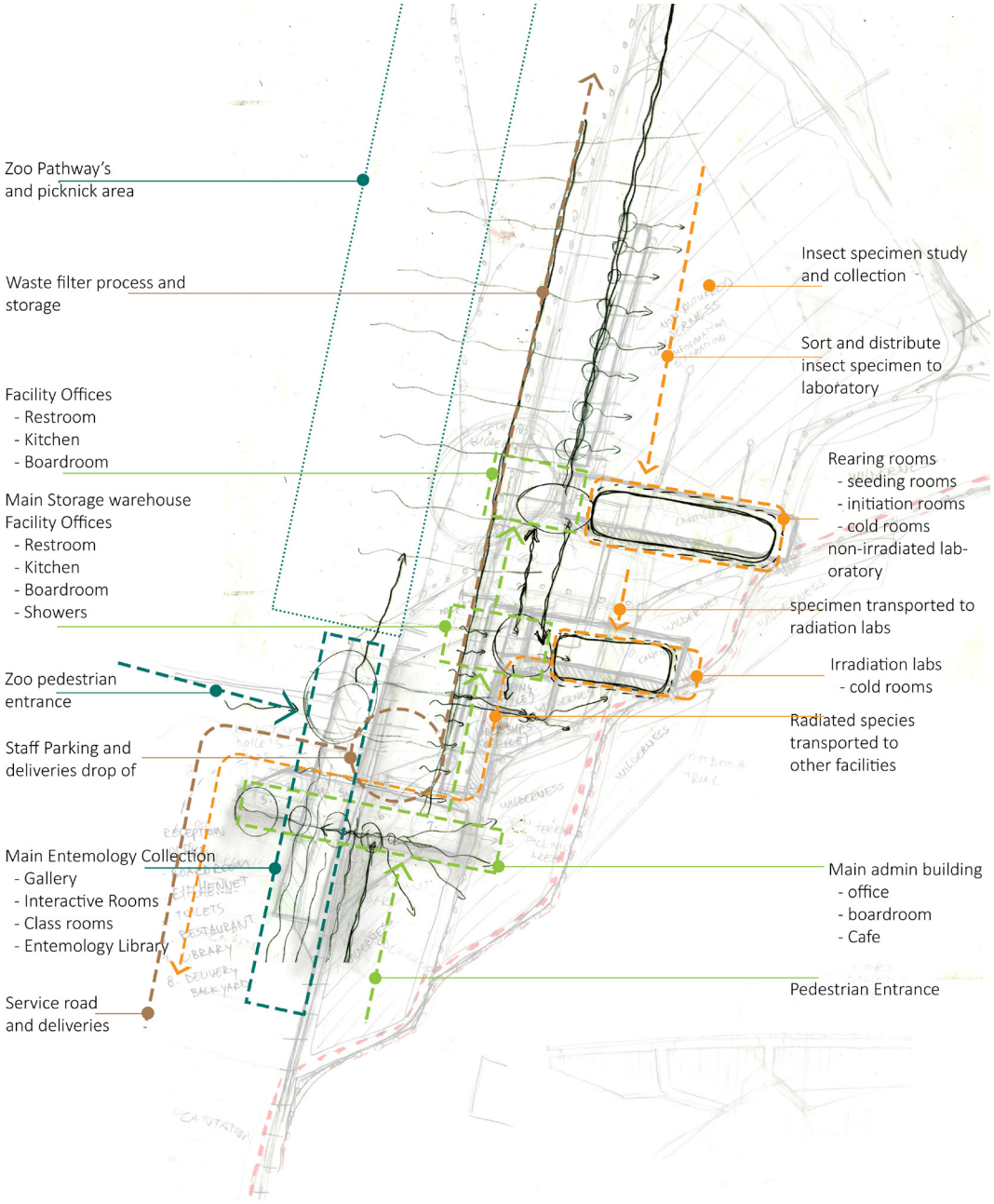
9.8_ Concept sketch; design 4 site layout and is the final layout that will be further developed (Author, 2015)



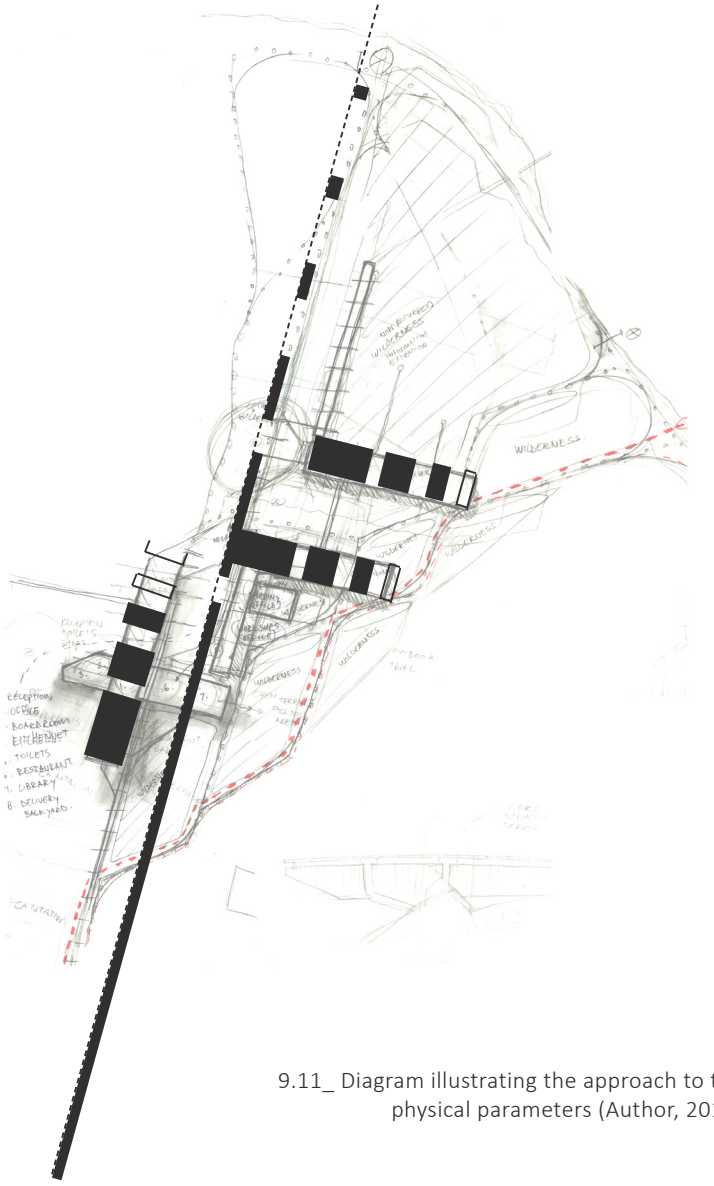
9.9_ Design 4 building layout with the facility operational requirements (Author, 2015)

DESIGN 04 / Program

The design layout is further explored in terms of movement, roof layout, physical parameters, biological parameters, facility operational requirements and environmental parameters. All these factors influence the final outcome of the design.



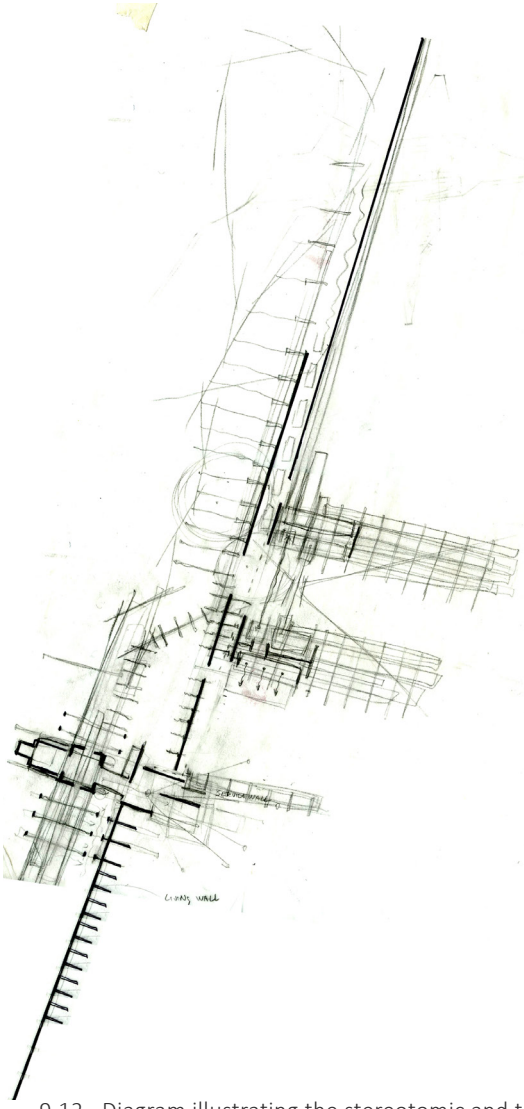
9.10_ Bubble diagram illustrating the program throughout the layout (Author, 2015)



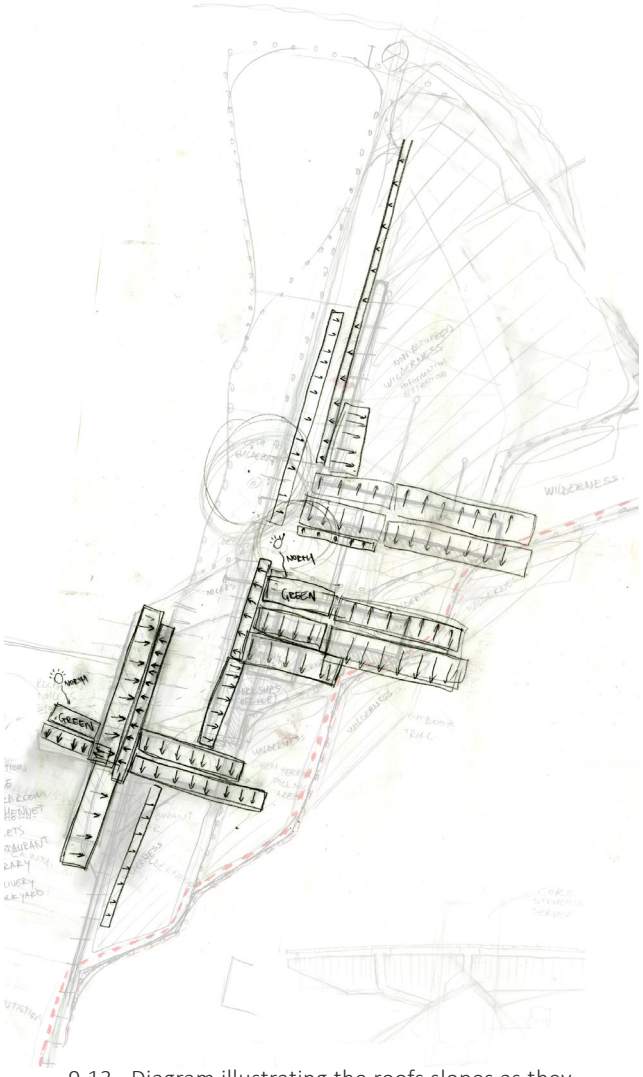
9.11_ Diagram illustrating the approach to the physical parameters (Author, 2015)

DESIGN 04 / physical parameters

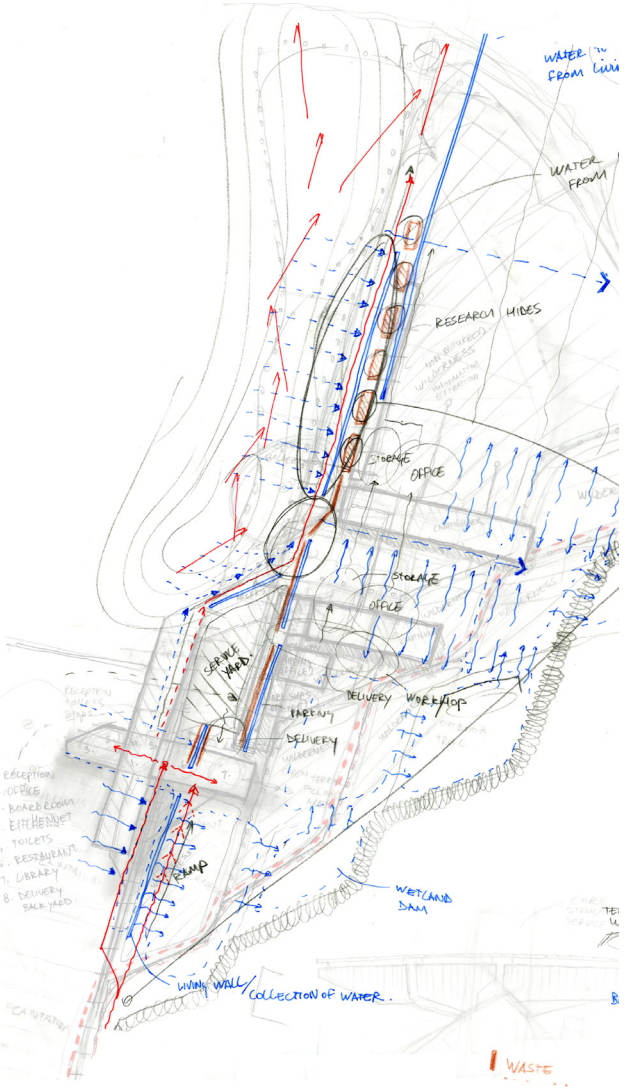
The physical parameters of the building correspond with the concept. They form an appropriate relationship with the environment. The building changes gradually as it nears the natural zone in the north; its mass changes to a more lightweight structure that illustrates the building's adaptation to form part of nature. The water channel axis, which is the living wall, reflects this concept by changing in size as it develops through the site and ultimately thinning out as it becomes part of nature.



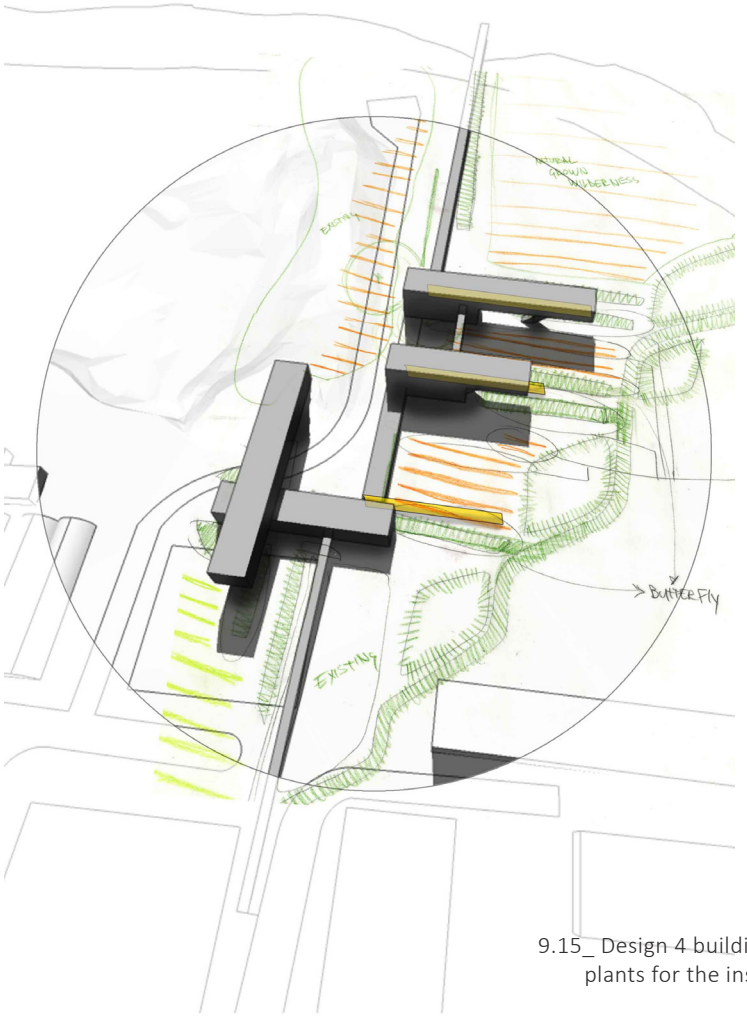
9.12_ Diagram illustrating the stereotomic and the tectonic of the structure (Author, 2015)



9.13_ Diagram illustrating the roofs slopes as they direct the water flow (Author, 2015).



9.14_ Diagram illustrating the movement between public and private (Author, 2015)



9.15_ Design 4 building layout with the different plants for the insect habitats (Author, 2015)

DESIGN 04 / Biological parameters

The biological parameters form an integral part of the building program and therefore must be properly designed for. As the purpose is to accommodate insect habitats on site, appropriate nutrition and shelter must be provided so that the insects populate the site in a more natural way. Indigenous plants and flowers that provide appropriate nectar and nutrition for these insects are listed in Table 8.27. The insects require plants and flowers to bloom throughout the year; if there is enough nutrition and appropriate shelter the insects will not need to migrate to other sites for food or shelter.

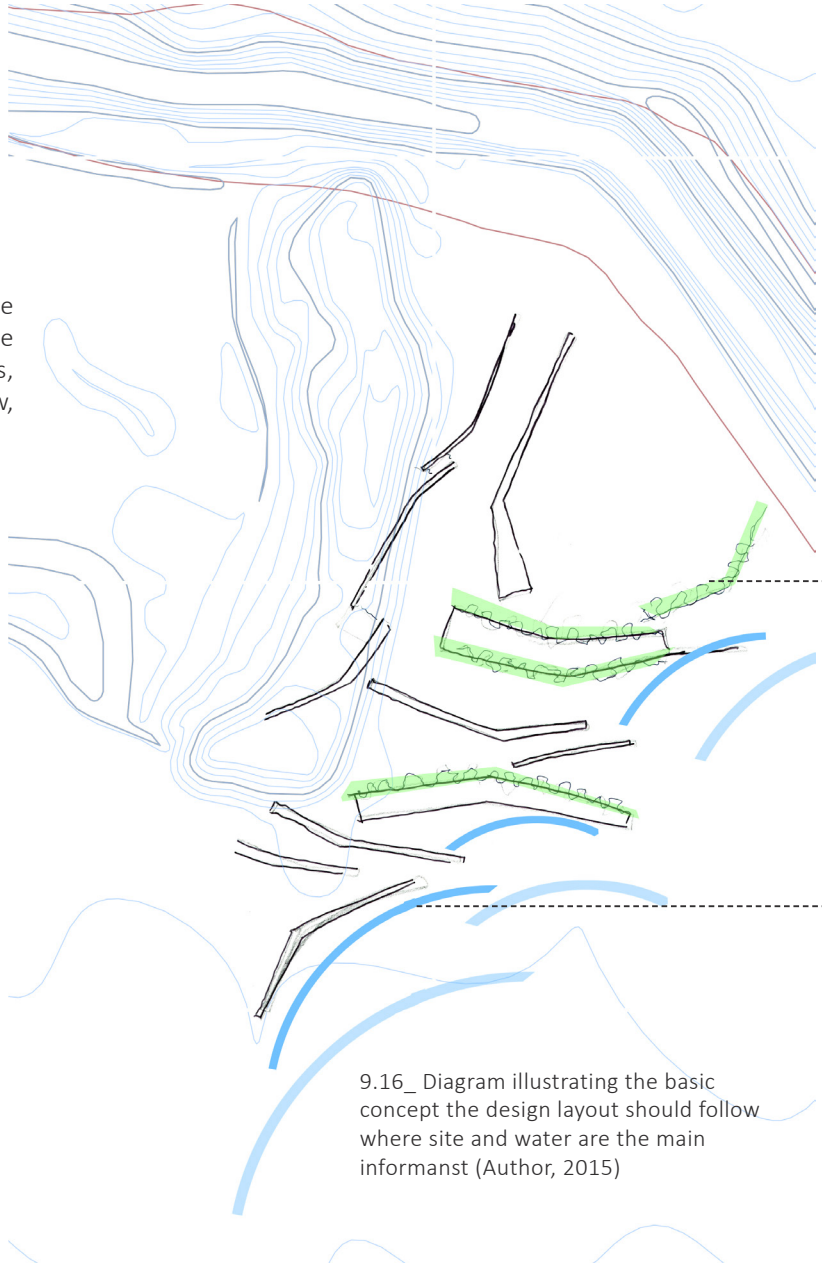
1. Target insect species: The insect group that uses flowers as a food source are classified as the 'order':

- Hymenoptera: Bees, wasps, and ants
- Lepidoptera: Butterflies and moths
- Diptera: Flies
- Coleoptera: Beetles

2. Number of species: Mass rearing of one or more species in one facility will impact on facility design.
3. Scale of production: Small scale research facility, laboratory.

9.2 / FLOOR PLAN ITERATION / Spatial exploration

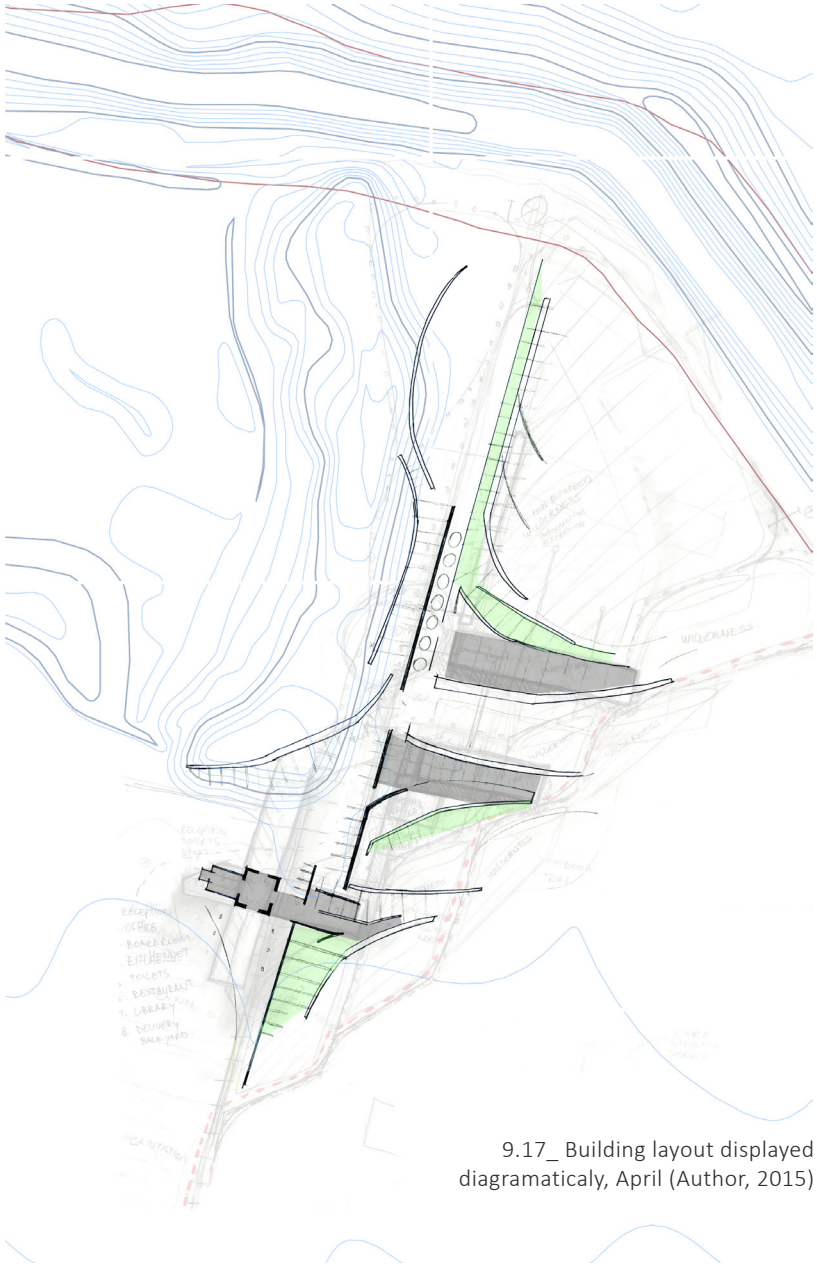
The basic shape of the design layout is to morph with the site rather than against it. The main informants of the building shape are the site and environmental conditions, where the building is shaped to direct the water flow, thus the building becomes part of the site.



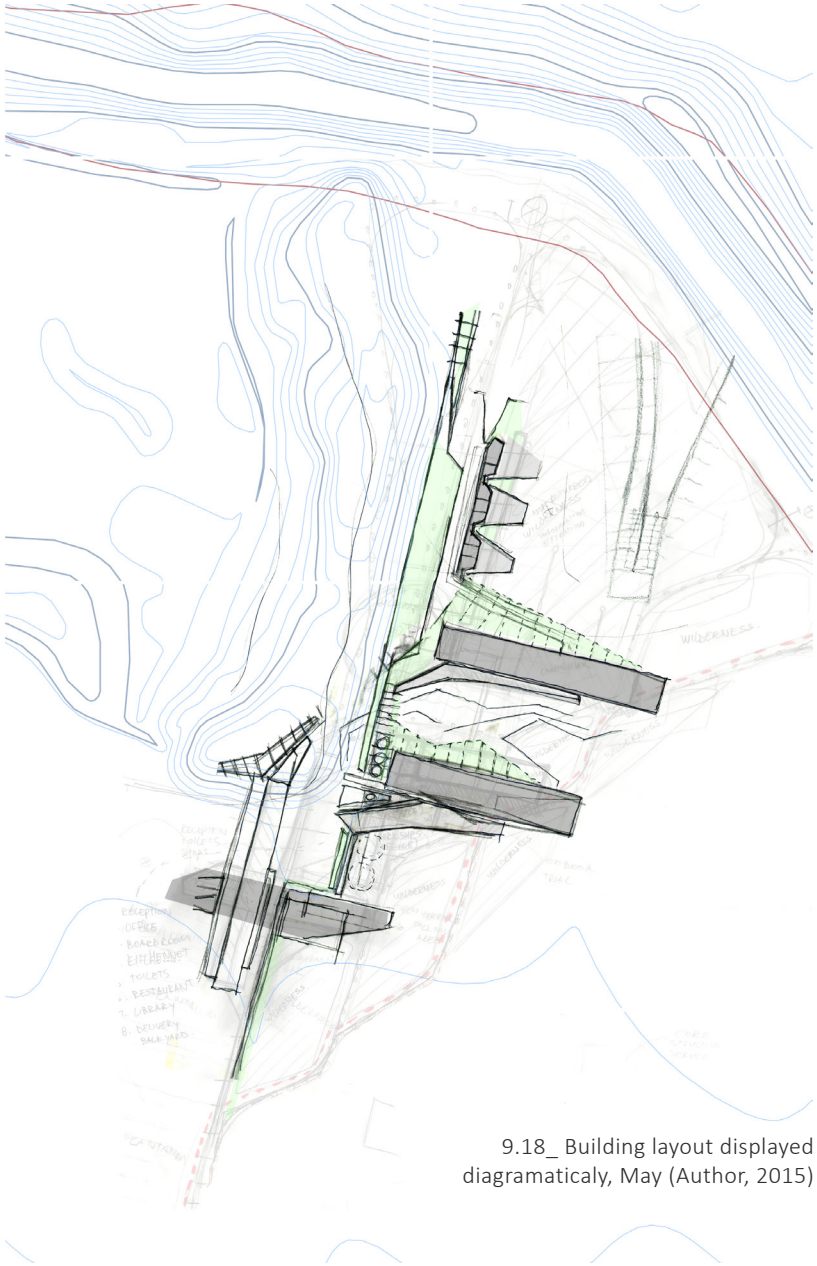
The Green indicates the site becoming part of the building.

The Blue indicates the water flow through the site. It shows how the building can manipulate the direction of flow to direct the water where it needs to go.

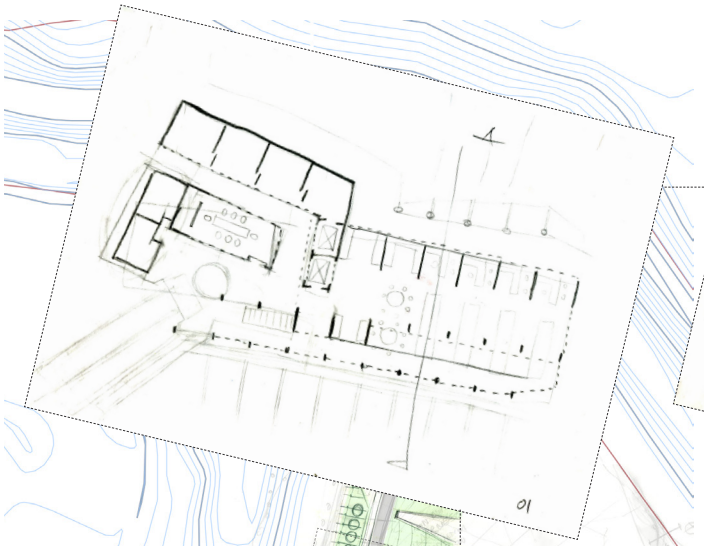
9.16_ Diagram illustrating the basic concept the design layout should follow where site and water are the main informanst (Author, 2015)



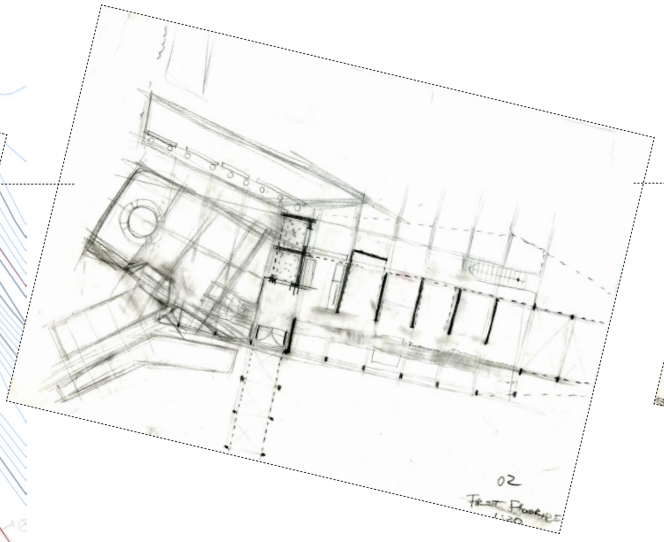
9.17_ Building layout displayed diagramaticaly, April (Author, 2015)

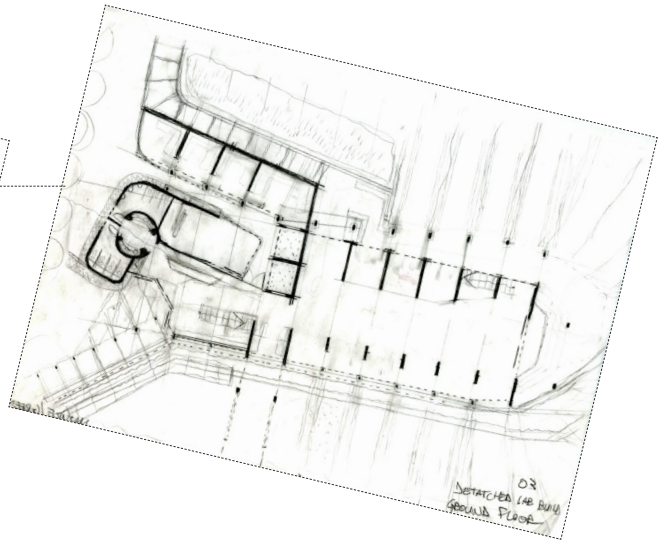


9.18_ Building layout displayed diagramaticaly, May (Author, 2015)



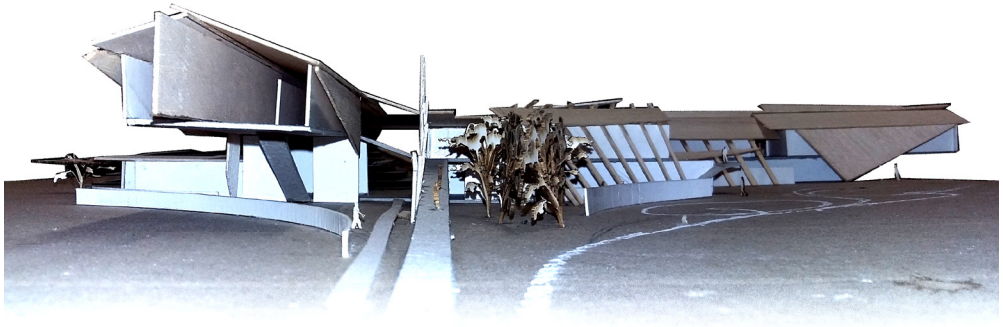
9.19_ Floor plan of building layout, May (Author, 2015)

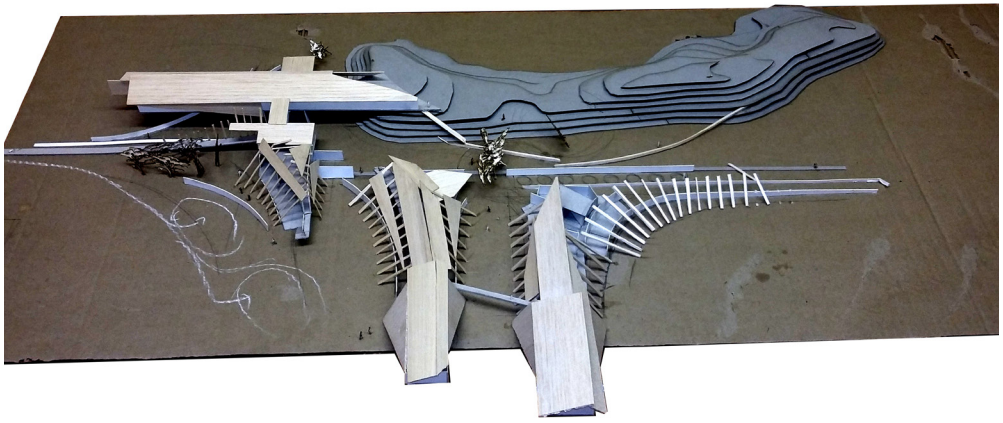


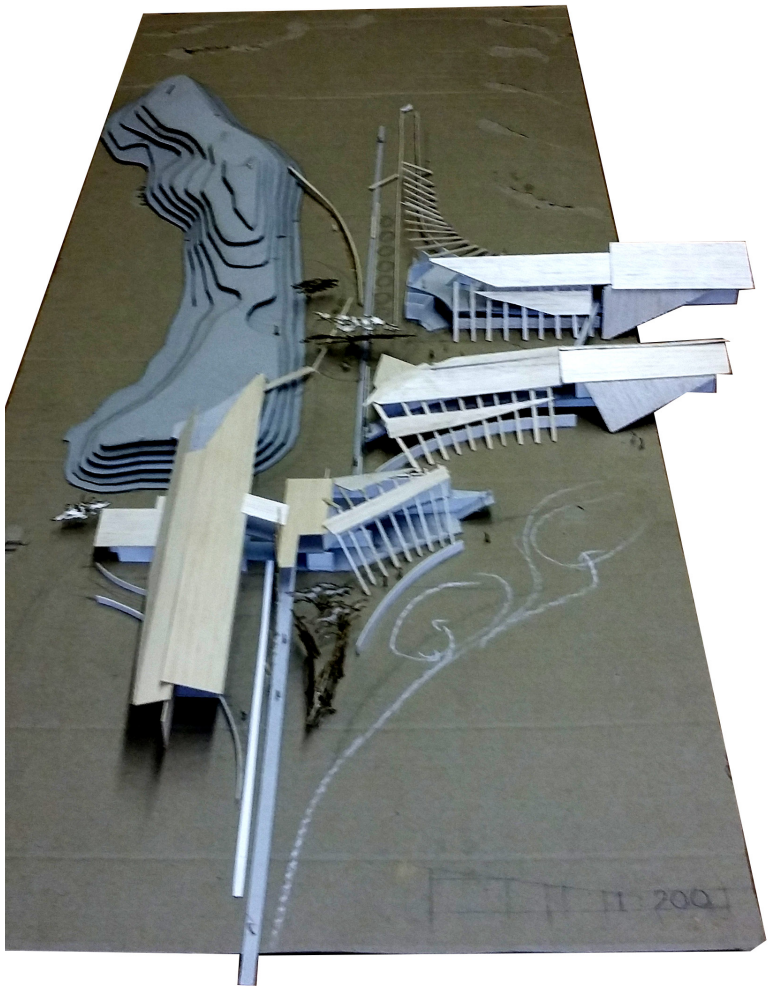


9.20_ (From left to right) Floor plan iterations, June / July (Author, 2015)

9.2.1
MODEL



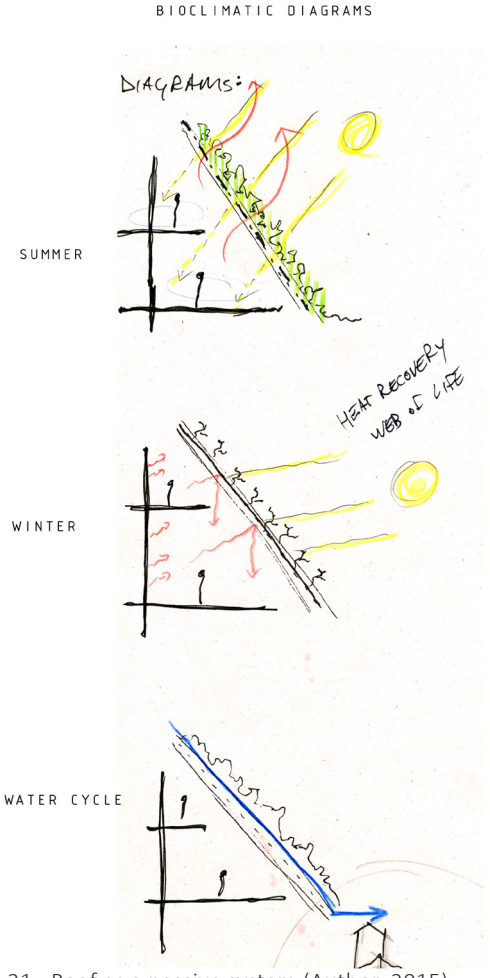




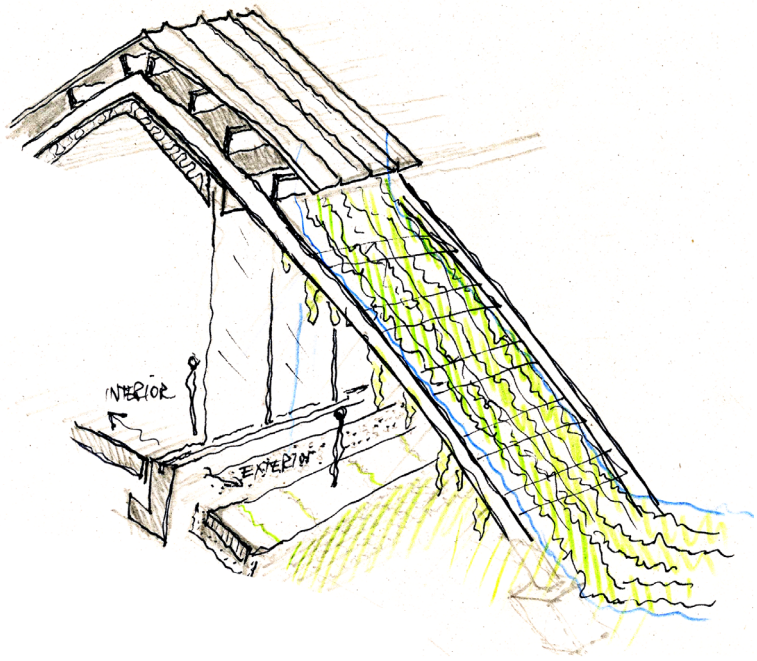
9.21_ Model built of design in June
(Author, 2015)

DESIGN 04 / Roof intention

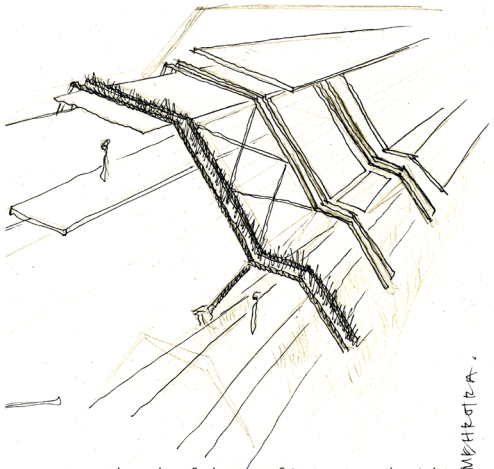
The roof is designed to fulfill different functions that relate to the design informants of regenerative theories. It plays the most important role in this design. The main function of the roof is to create the reciprocal relationship between man and his environment; this is where nature and man reach an equilibrium for co-existence. The roof ultimately becomes the façade of the building and the façade of the building becomes the ground, and vice versa. The envelope of the building is one element that hosts various functions; allowing plants to grow on the façade accomplishes these. The plants create habitats for the insects and provide a service for the inhabitants of the building. Humans create the structure that allows insect population and nature provides a free service for the humans. A mutually beneficial relationship is therefore achieved.



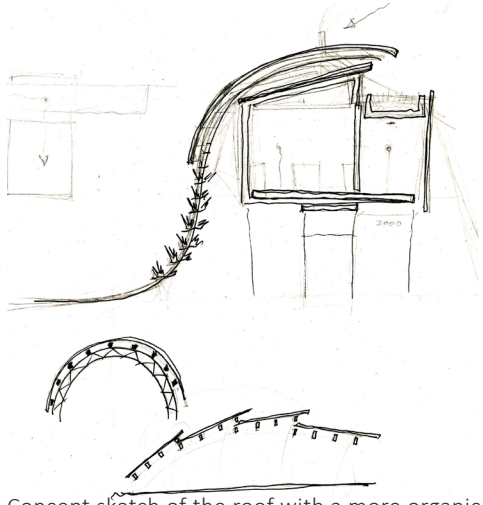
9.21_ Roof as a passive system (Author, 2015)



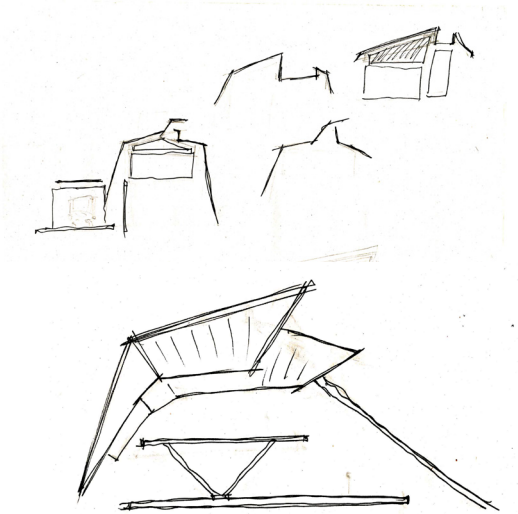
9.22_ Concept sketch of the roof as an important role in the building design (Author, 2015)



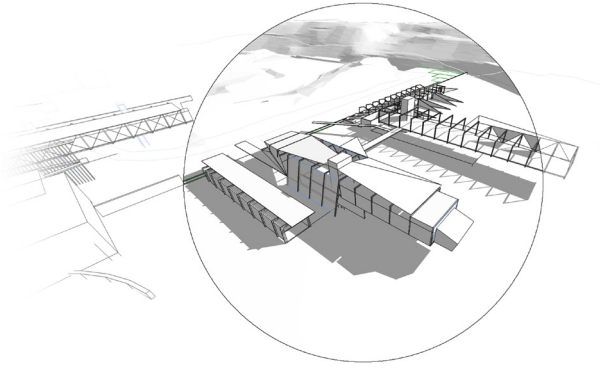
9.23_ Concept sketch of the roof integrated with the concept of the living wall (Author, 2015)

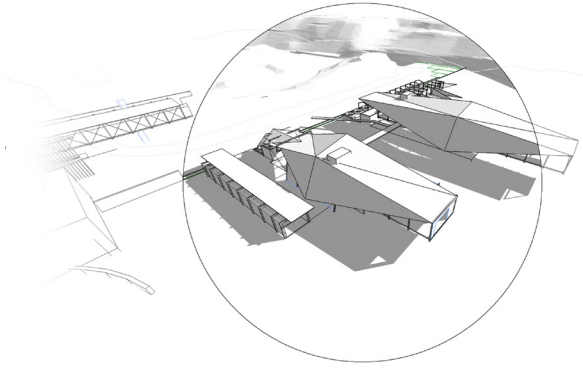


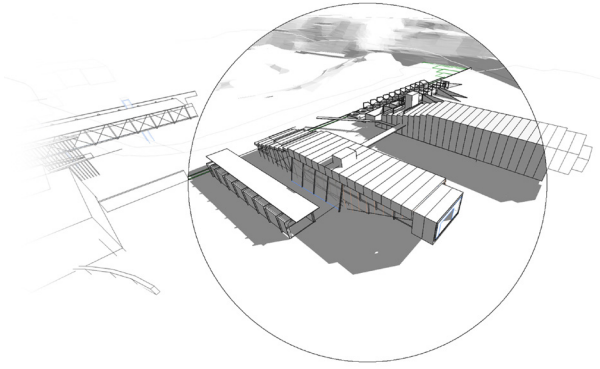
9.24_ Concept sketch of the roof with a more organic form to integrate more with the environment (Author, 2015)



9.25_ Exploring more ways the roof could be to accomodate more functions (Author, 2015)





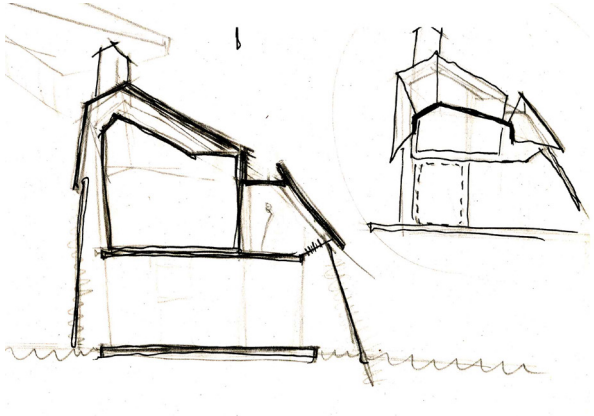


9.26_ (from left to right) 3D exploration of roof iterations (Author, 2015)

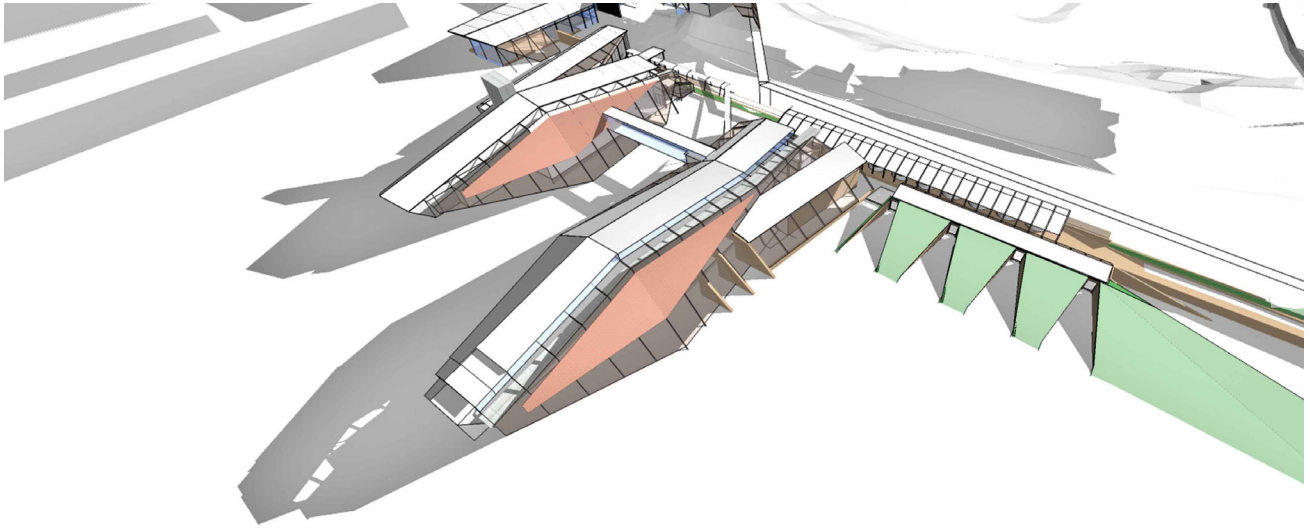
The following iterations pursue the concept of the roof adapting to the façade and integrating with the site. It evolved from the idea that the water flows from the sky to the soil.

The roof shape starts to form in an organic way, however, the construction would be problematic as the building should lift from the ground. A more structural solution is required.

Shaping the roof from a structural aspect, but still keeping in touch with the concept, results in more design iterations of the roof. The roof becomes the design aspect that binds the various elements together.

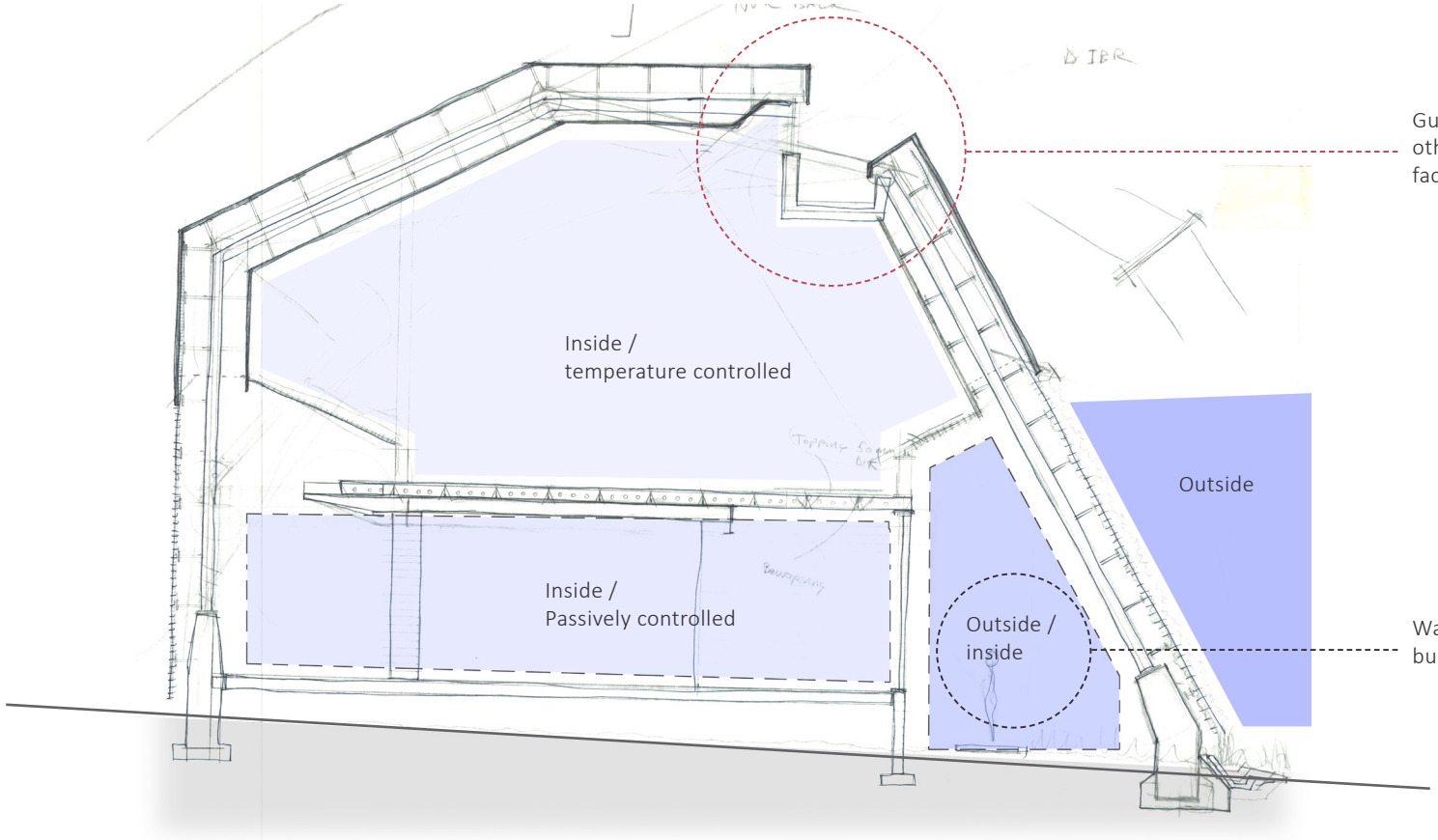


9.27_ Concept sketches that led to the final roof shape (Author, 2015)

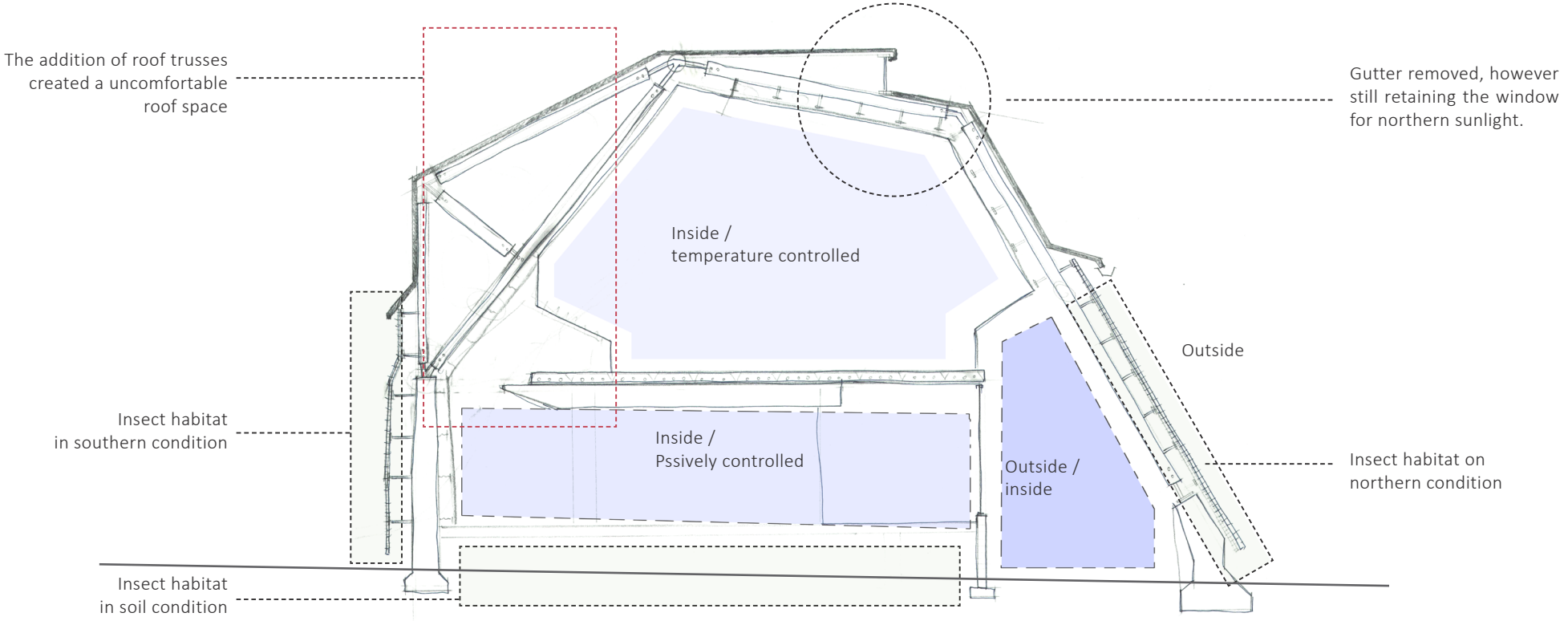


9.28_ 3D exploration of final roof shape (Author, 2015)

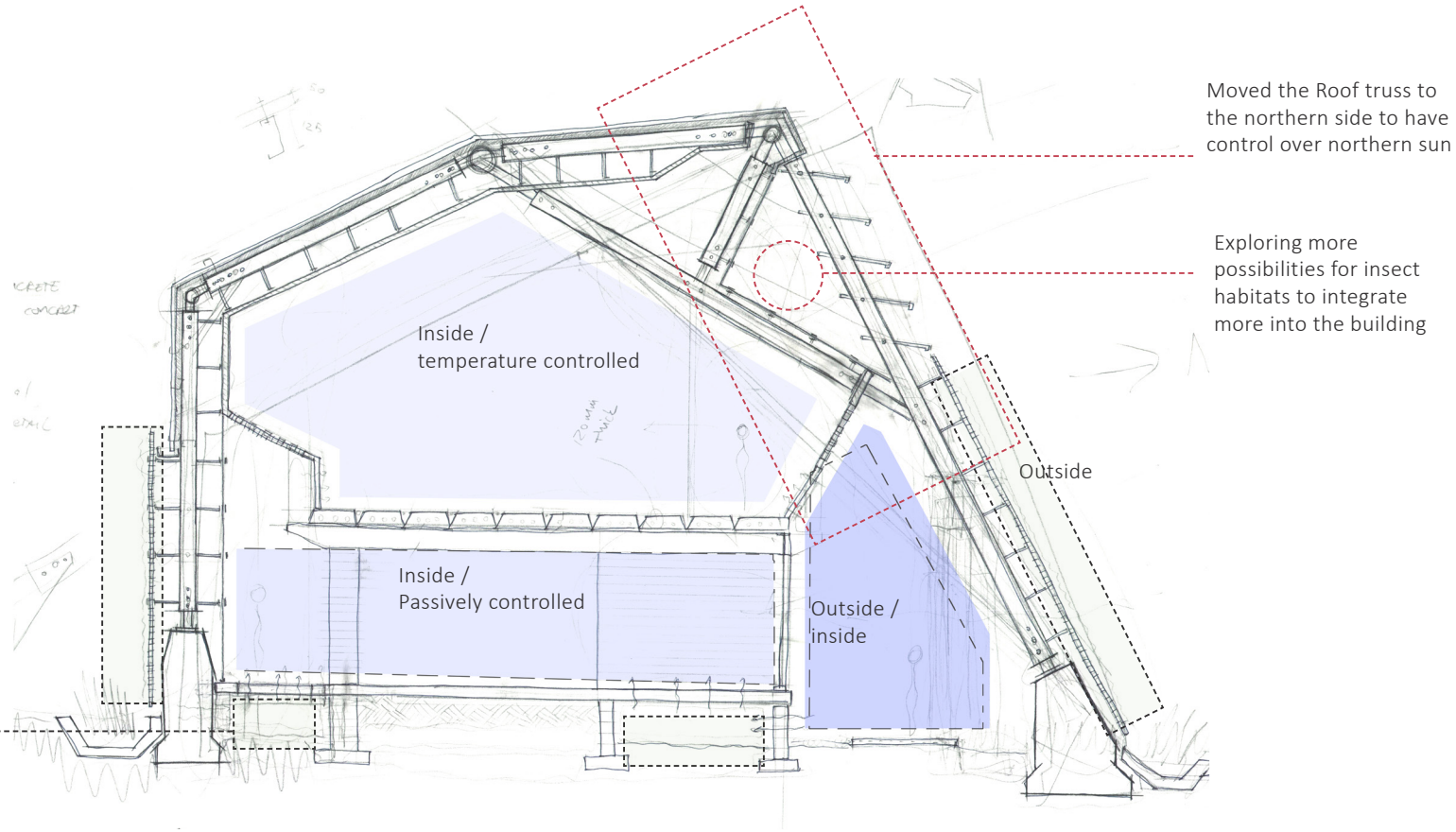
The final iteration of the roof concludes in a single line drawing that allows the building to be formed and shaped in many possible ways. This shape follows the concept and allows the design to become adaptable in its requirements.



9.29_ The first section to be iterated illustrating the different habitable spaces. (Author, 2015)

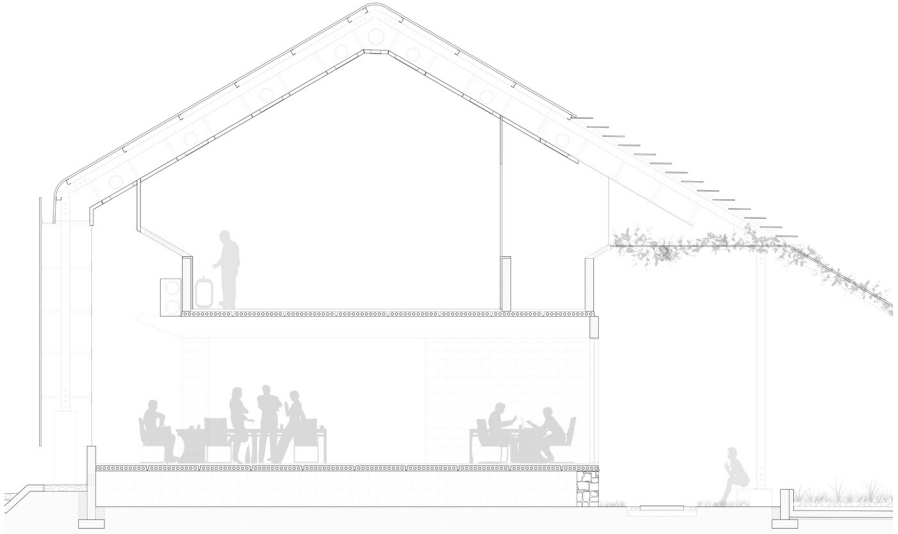


9.30_ Changes made to the section. (Author, 2015)



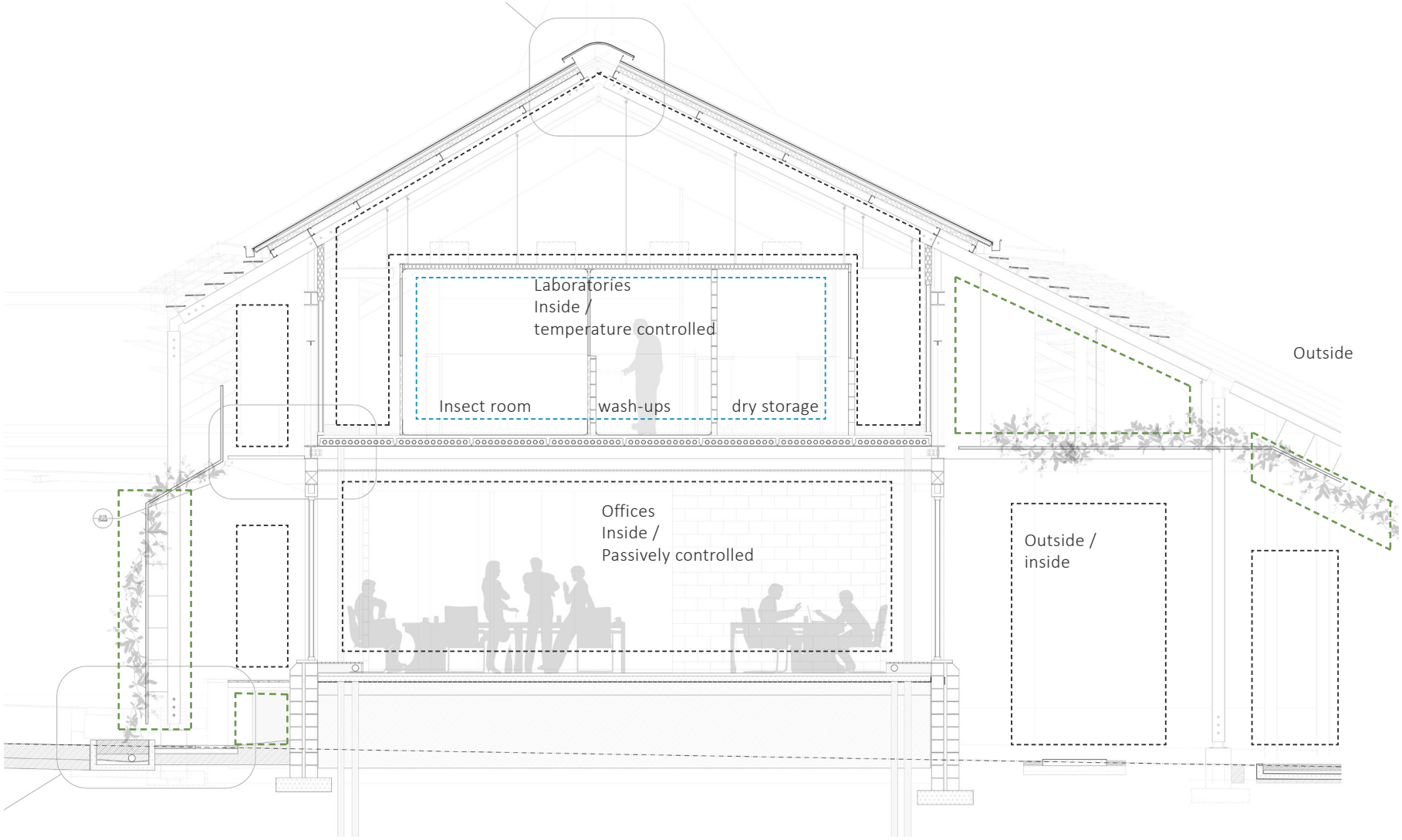
9.31_ Changes made to the section. (Author, 2015)

The shape of the laboratories followed the shape of the roof. Although it works diagrammatically, it was found to be problematic from a practical point of view. The insect rooms requires a certain temperature and need mechanical assistance. The current volume of the laboratories is too big to achieve a certain temperature quickly. As seen in figure 9.29, the laboratories shrunk to achieve an effective volume to cool down mechanically.



9.32_ 2 September section. (Author, 2015)

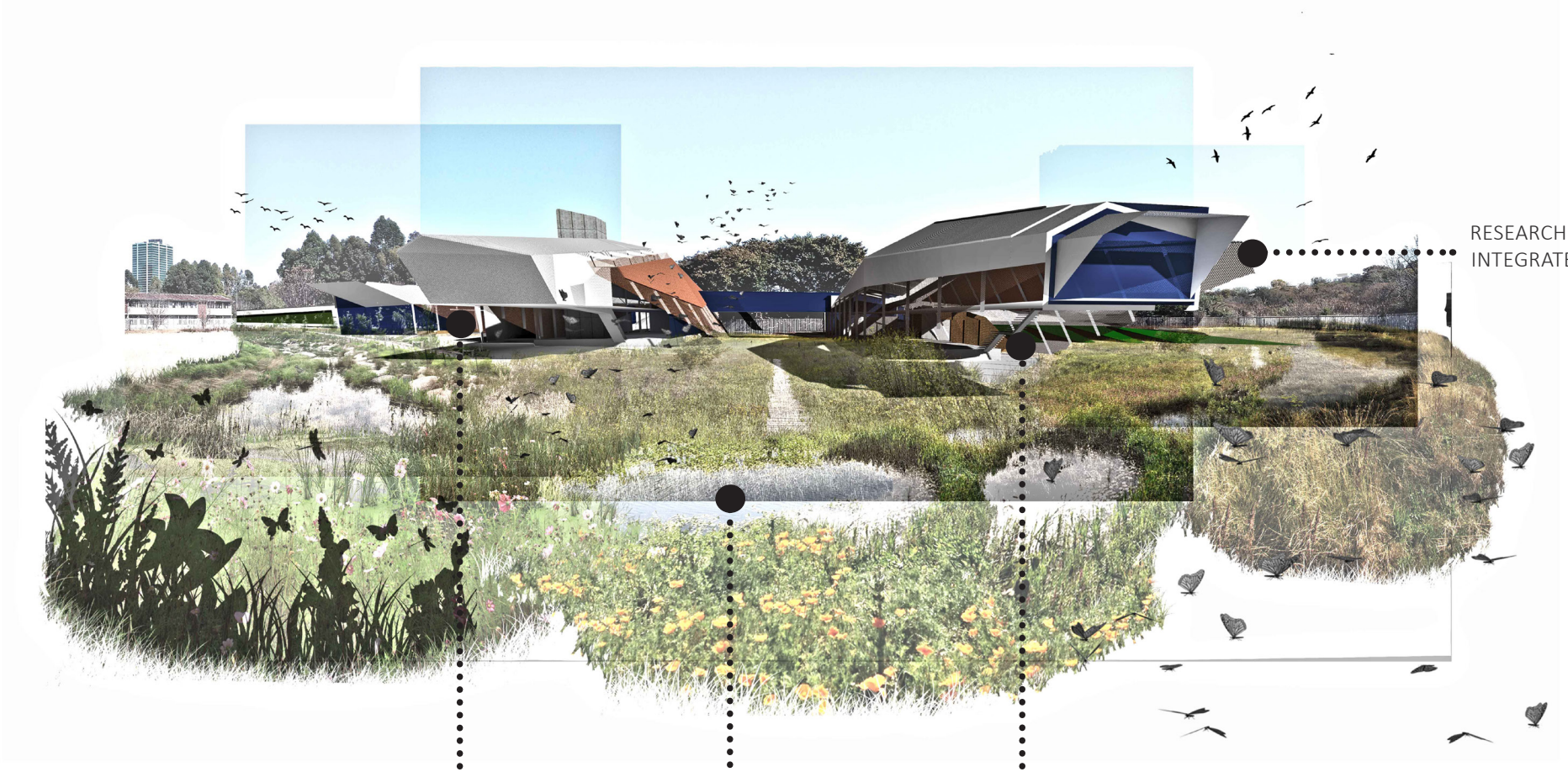
9.33_ 2 September section 3D model exploring spatial implications. (Author, 2015)



9.34_ 30 September section. (Author, 2015)

PERSPECTIVE VIEW / ENTEMOLOGY COLLECTION DEPARTMENT

9.35_ Final Design renders in July; Entrance to the Entomology collection department the extension from the zoo (Author, 2015)



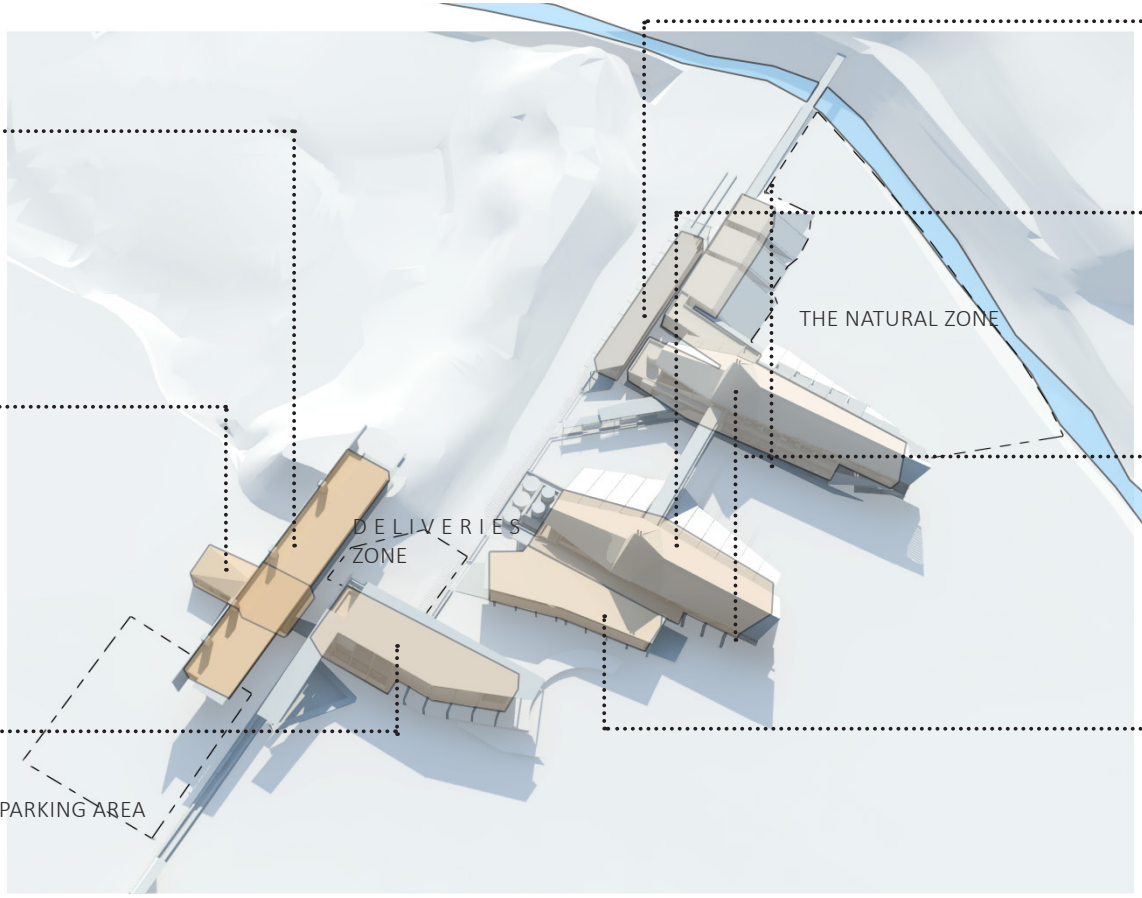
PERSPECTIVE VIEW / RESEARCH FACILITY

9.36_ Final Design renders in July; View of the two research facilities on site, view of ecosystems and insect habitats (Author, 2015)

ENTEMOLOGY COLLECTION /
All the insect and ecosystem information stored and viewed in this building, open to public, an extention of the Zoological gardens

ADMINISTRATION BUILDING /
Offices and boardroom where the administration of the building happens and the public not entering through the Zoo are controlled

Restaurant and library/
This area also open to public and school area where the insect and ecosystem information is also stored in book format.



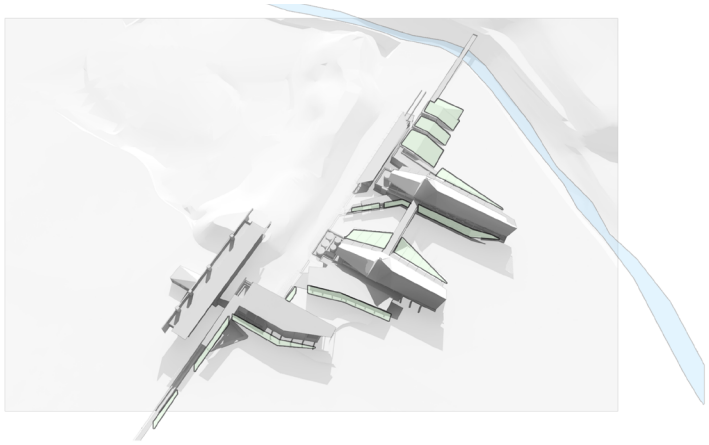
ECO-MACHINE /
This nursery is for the establishment of healthy growth for the plants that is required to clean the wast water from the facility

RESEARCH LABS/
The first floor rooms is allocated for the study of insects as part of the ecosystem services

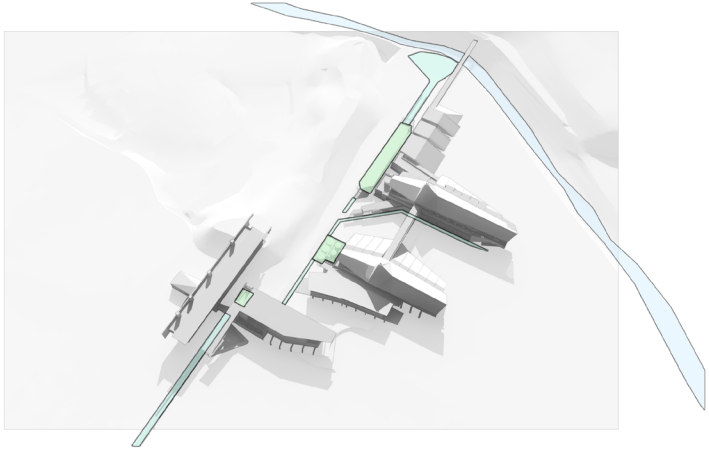
STORAGE WAREHOUSE/
This ground floor level is for the storage of all equipment used on site, special allocation for chemical storage.

WORKSHOP/
This area is allocated for unload and loading of deliveries. It also serves as a workshop for site equipment and fixing of facility equipment

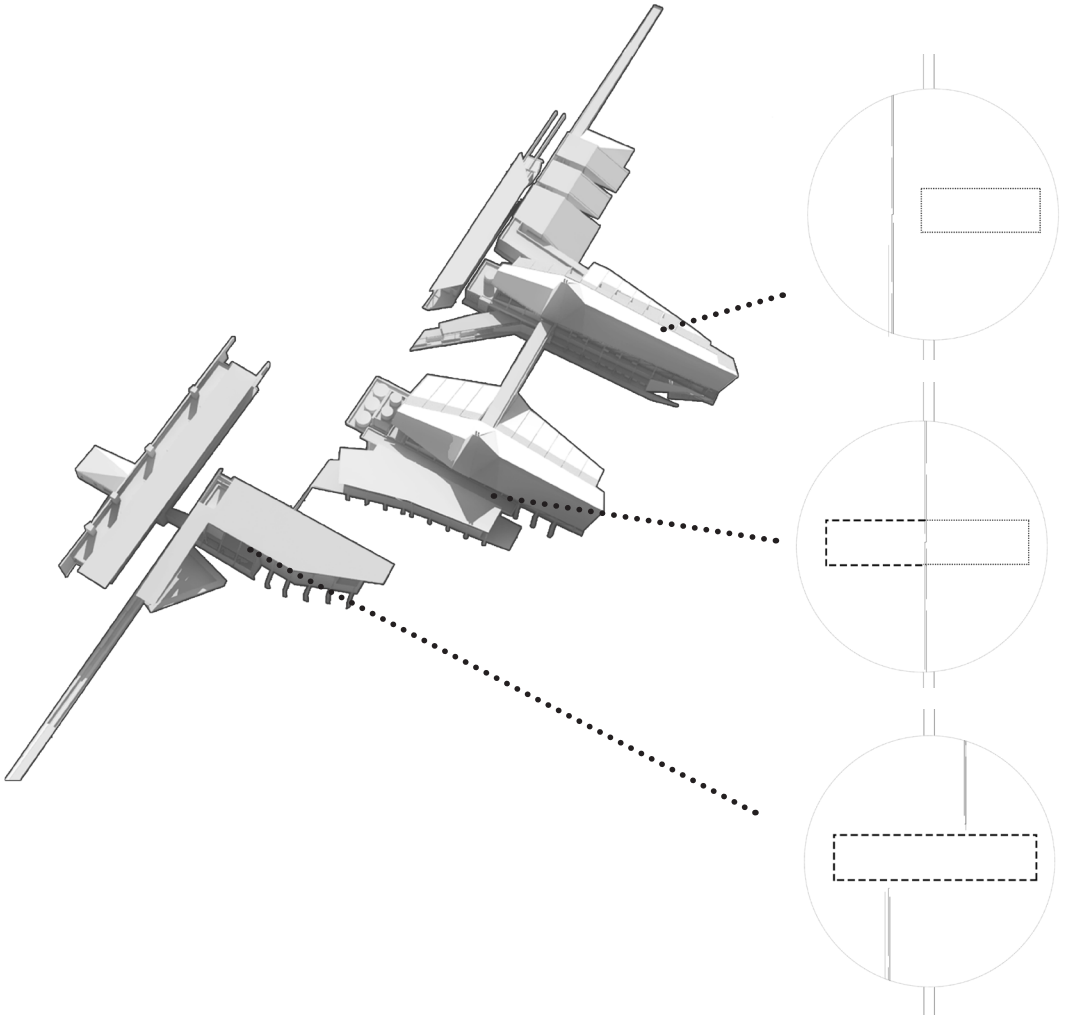
9.37_ Program Building zoning (Author, 2015)



3D EXPLORATION/ RECIPROCAL ELEMENTS



3D EXPLORATION/ WATER SYSTEM



9.38_ Program Building zoning (Author, 2015)