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**FIGURE 6.1**

*Day 258, Cairns*

*(Lorraine Loots, 2013)*

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*chapter six*

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# DESIGN DEVELOPMENT

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6.1 PREFACE

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The architectural design goal with this dissertation project is to facilitate the processes of three core outcomes: to **heal the site** through **remediation**; to **heal the urban inhabitants** of the city through **education, awareness** and **treatment**; and, finally, to **celebrate** the equal standing of both in order to be reconciled as **reciprocal partners**.

The proposal that aims to remediate the site was established very early on in the design process. The outcomes thereof will be discussed accordingly. The **architectural investigation** that is intended to emerge out of a biophilic approach experienced major **evolution** during the course of the year, due to several directions that biophilic design presents. These different outcomes will be discussed and reflected upon to determine how they did not achieve the design intentions to the fullest degree.

**Design revisions** took place during the course of the year, as the theoretical framework was constantly re-evaluated in order to achieve most of the principles of biophilic design in a holistic manner. These principles and their application on plan, section, detail, and in the spatial experience of the building will be discussed and finally synthesized as a holistic **design resolution**.

## 6.2 SITE PROPOSAL & DEVELOPMENT

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### BIOREMEDIATION

In understanding the site within its developmental environment, it becomes evident that the traces of **site contamination** are fortunately not due to heavy industrial activities, but have however been caused by **construction activity** during the building of the adjacent Gautrain infrastructure. The soil conditions have suffered on a surface level due to **compaction** through **erosion** and human activity. The topography of the site has been altered, disrupting the inherent flood plains of the site; however the most destruction to the natural state of the site is due to the **loss of vegetation and biodiversity** caused by the construction activity and a **lack of conservation**.

#### 6.2.1 THE CONSTRUCTED WETLAND

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The first strategy consists of the implementation of a **constructed wetland** where the appropriate site qualities already exist. The wetland will remediate the site in multiple ways, which include the **management of erosion** and **surface water runoff**, increasing the **biodiversity** of the site by attracting different animal species, and finally **accommodating multiple indigenous plant species** that can facilitate the remediation of the existing soil conditions.

#### 6.2.2 PERMACULTURAL AND AGRICULTURAL ACTIVITIES

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The second strategy involves the implementation of multiple approaches to **cultivate fresh produce** for **human consumption**. The size of the site together with its ideal orientation presents an opportunity for **open urban agricultural plantations** to be laid on around the building and across the site. Fruits and vegetables that require optimal sun exposure will predominantly be planted and harvested in the open areas of the site. **Specialized permaculture activities** such as hydroponics and soilless planting, will be implemented within the building as well as between the existing columns of the Gautrain infrastructure by means of **vertical farming**. Fruits, vegetables and herbs that are commonly more sensitive and acquire more controlled conditions will be cultivated in these areas to ensure optimal yield. The practices of food cultivation through urban agriculture and permaculture would not only **remediate soil conditions** and increase biodiversity, but also **motivate a common interest** among multiple parties to conserve and maintain ecological conditions on site.



**FIGURE 6.2**  
*Photos of brownfield  
characteristics of site  
(Author, 2016)*





### 6.2.3 APPROPRIATE PLANTING PRACTICES

The most natural restoration of a site is achieved by setting other natural systems in place - by **eradicating invasive plant species** and replacing them with **indigenous species** that optimally make use of the soil they are planted into, and in exchange facilitate **soil remediation** through the absorption of unwanted zinc levels and other contaminants in the soil. The following trees, plants and shrubs are to be planted on site to facilitate this process to not only ensure the health of the landscape, but also **alleviate human allergies** commonly experienced due to inappropriate planting practices in urban conditions. Most of these plants will thus have a **lower oPAL score** and will depend on insects for pollination, rather than wind.

▲  
**FIGURE 6.3**

*Indigenous tree species with low oPAL scores*  
(Author, 2016)

**FIGURE 6.4**

*Permacultural and agricultural activities*  
(Author, 2016)



**FIGURE 6.5**

*Constructed wetland*  
(Author, 2016)



## 6.3 DESIGN EVOLUTION

### 6.3.1 PROGRAMMATIC DEVELOPMENT

The design process for the building presented multiple interpretations of the theoretical design informants and conceptual drivers. Of all the principles associated with biophilic design that have been discussed in the concept chapter, the **characteristics of nature** (*The Evolved Human-Nature Relationship*) transcended all scales of investigation and was considered as an appropriate starting point from which to generate both the architectural form and the programmatic development.

As mentioned, the site lies between the **urban condition** of Pretoria to the north-west and the **natural condition** to the south-east, and is currently an **undefined threshold space** between the two conditions. Thus the initial programmatic decision suggested that the more public functions, such as the auditorium, exhibition spaces and restaurants, should be placed closer to the urban condition, and the most private, such as the treatment facility and culinary school towards the natural condition.

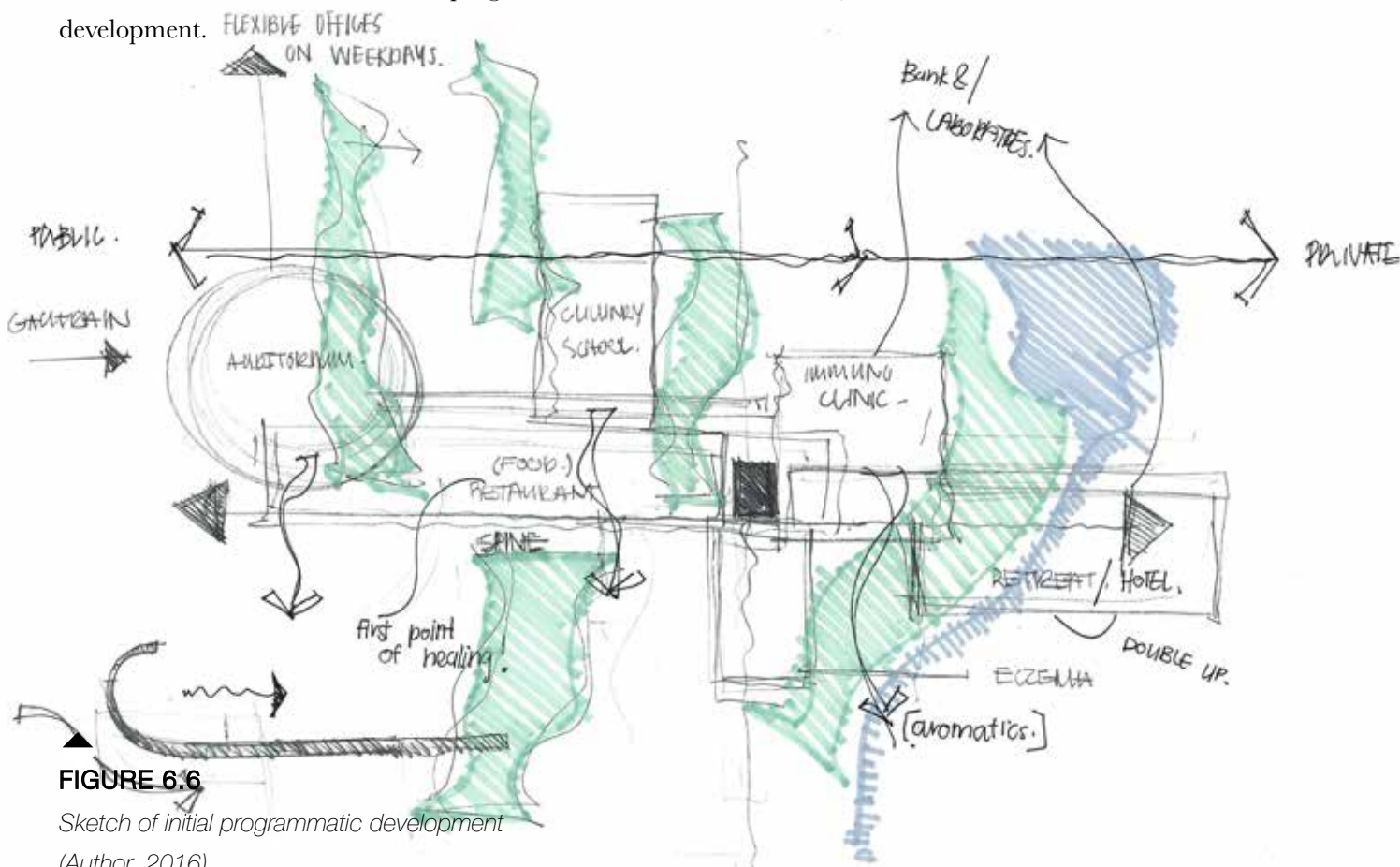
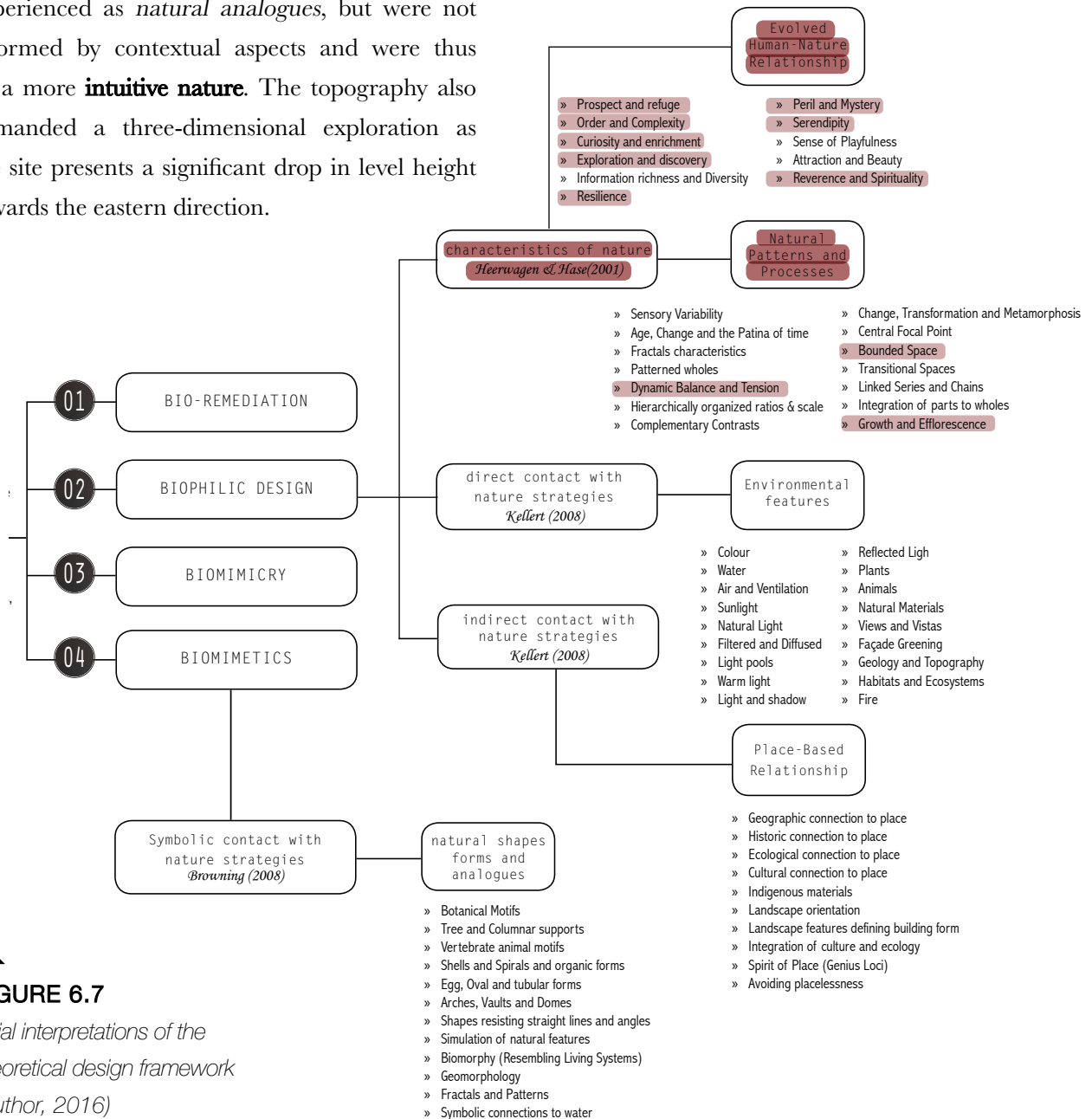


FIGURE 6.6

Sketch of initial programmatic development  
(Author, 2016)

### 6.3.2 INITIAL CONCEPTUAL TRANSLATIONS

The early design explorations were initiated by translating the **intangible qualities of nature**, in the belief that the physical and tangible linkages will be applied at a later stage. **Geometries and lines** were intended to be **organic** so as to be experienced as *natural analogues*, but were not informed by contextual aspects and were thus of a more **intuitive nature**. The topography also demanded a three-dimensional exploration as the site presents a significant drop in level height towards the eastern direction.

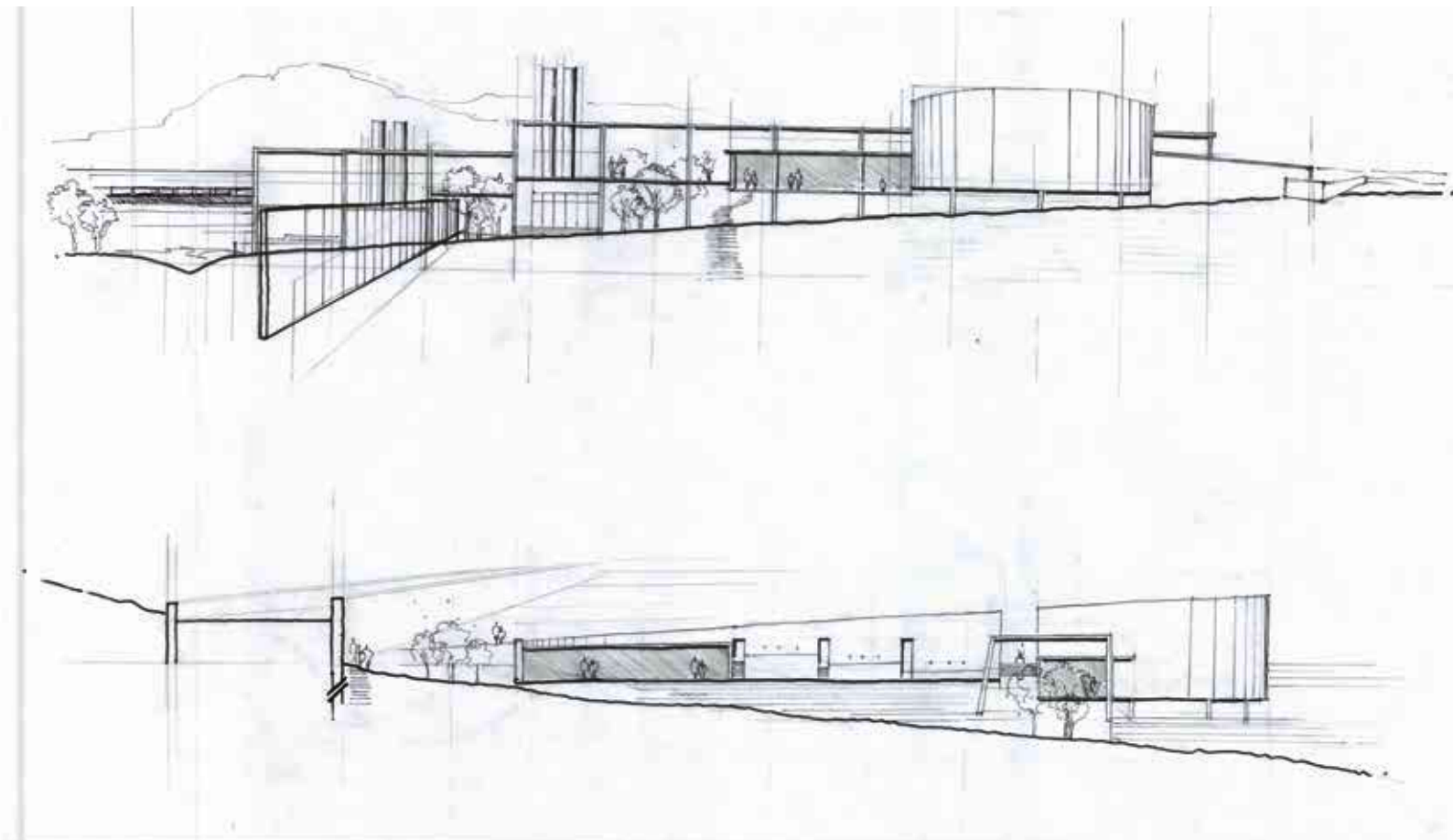


**FIGURE 6.7**  
*Initial interpretations of the theoretical design framework (Author, 2016)*





▲  
**FIGURE 6.8**  
*Plan Development for June Design Crit*  
(Author, 2016)

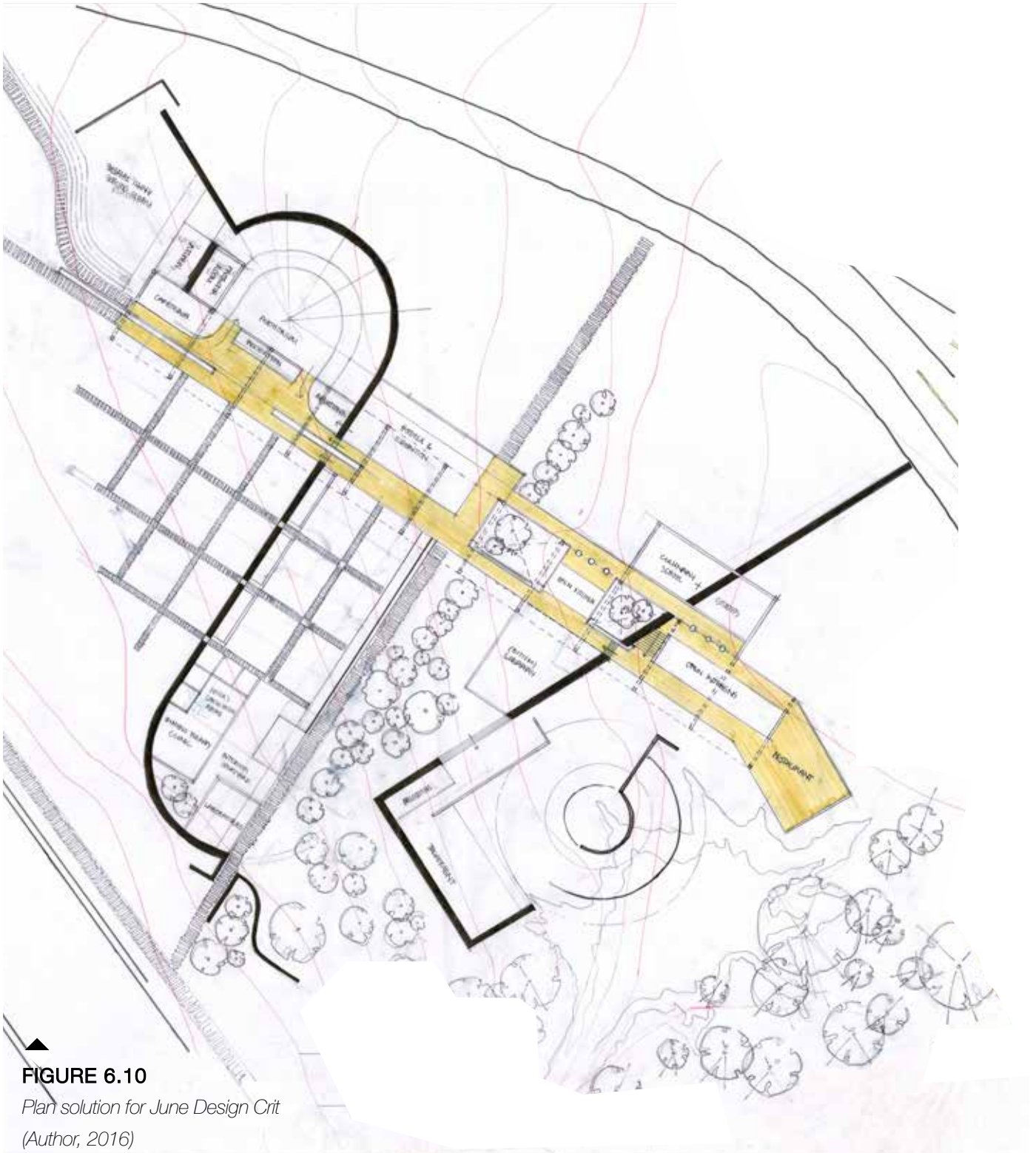


**FIGURE 6.9**

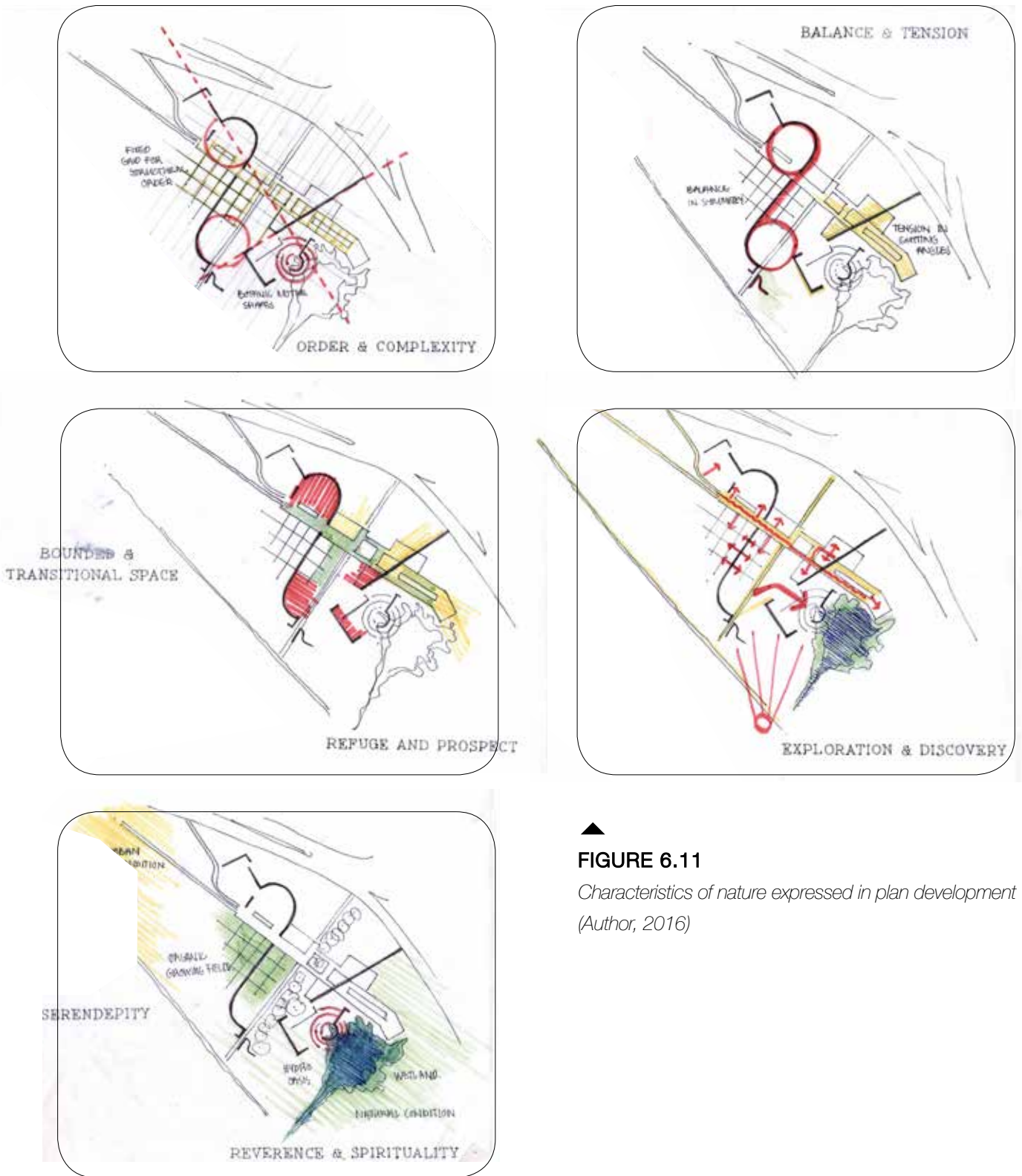
*Section Development for June Design Crit*

*(Author, 2016)*

6.3.3 MID - YEAR DESIGN OUTCOME



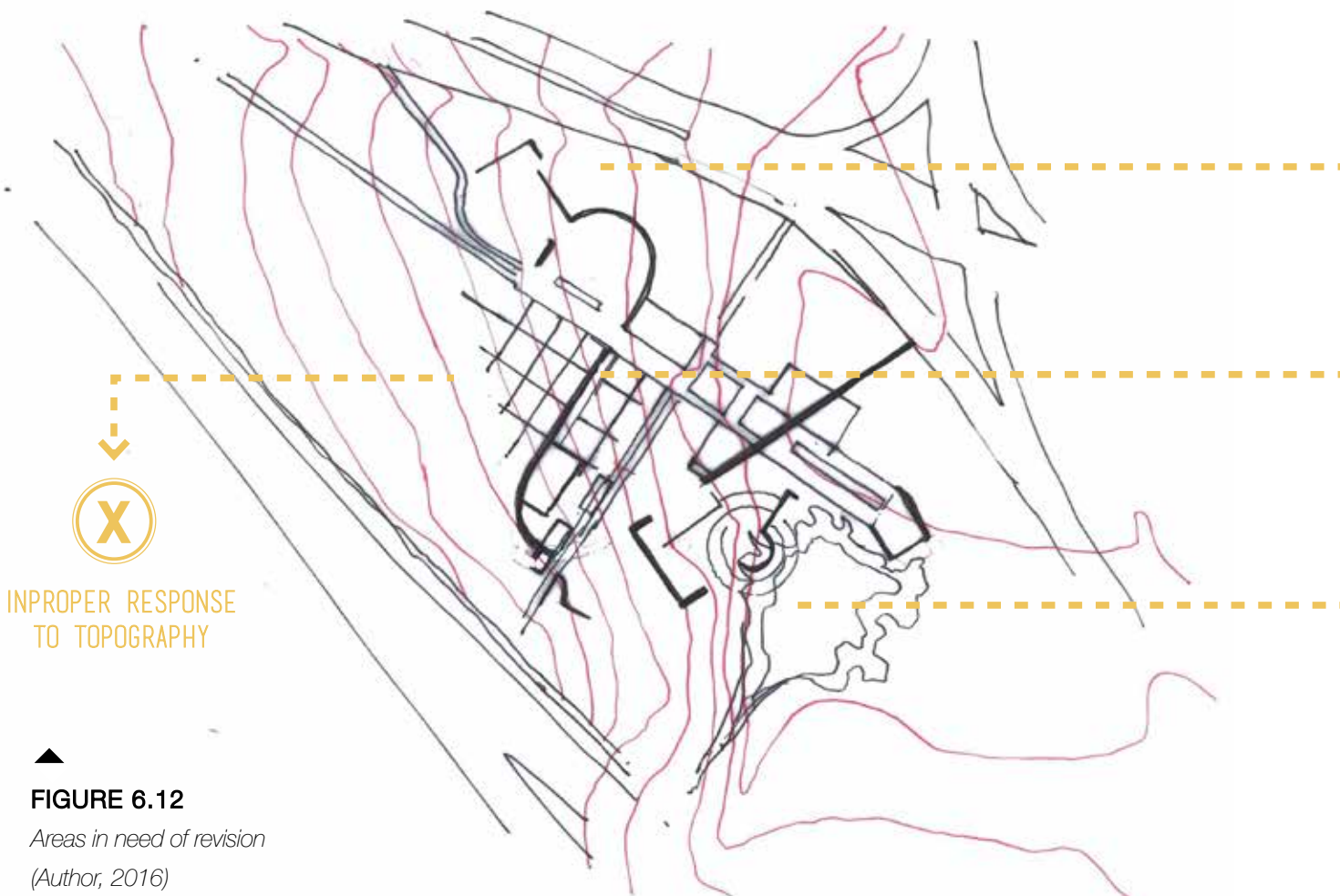
**FIGURE 6.10**  
*Plan solution for June Design Crit*  
(Author, 2016)



▲  
**FIGURE 6.11**  
*Characteristics of nature expressed in plan development*  
(Author, 2016)

The first design outcome attempted to visualize how the intangible qualities of nature could ensure that the building is experienced as an **alternative habitat**, without merely blurring the boundaries between building and nature. It was primarily focusing on one aspect of biophilic design, causing the architectural form to develop **in isolation from its contextual environment**. This iteration was still very diagrammatic and lacked an appropriate sense of scale.

Although progress was made in how the architectural language was being developed through theoretical informants, it did cause the building to be **divorced from contextual informants**. It was thus necessary to **revisit the theoretical framework**, take a few steps back, and reinterpret it in correlation with the contextual informants. It became clear that biophilic principles should be embedded within one another, by interpreting them cautiously on **different scales** to ensure a **holistically viable outcome**.



▲  
**FIGURE 6.12**

*Areas in need of revision*  
(Author, 2016)



NO CONNECTION WITH  
STREET CONSITION



INPROPER ORIENTATION FOR  
OPTIMAL SOLAR USE



LOCATION OF WETLAND AND  
AREA OF RECIPROCITY

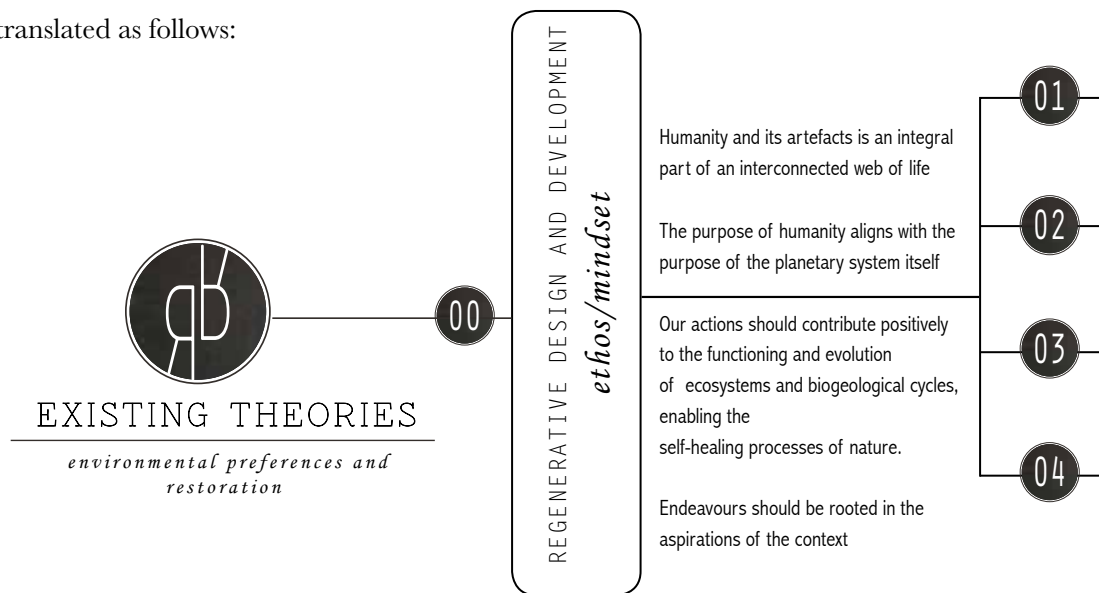
**FIGURE 6.13**

*Model for June Design Crit*  
(Author, 2016)



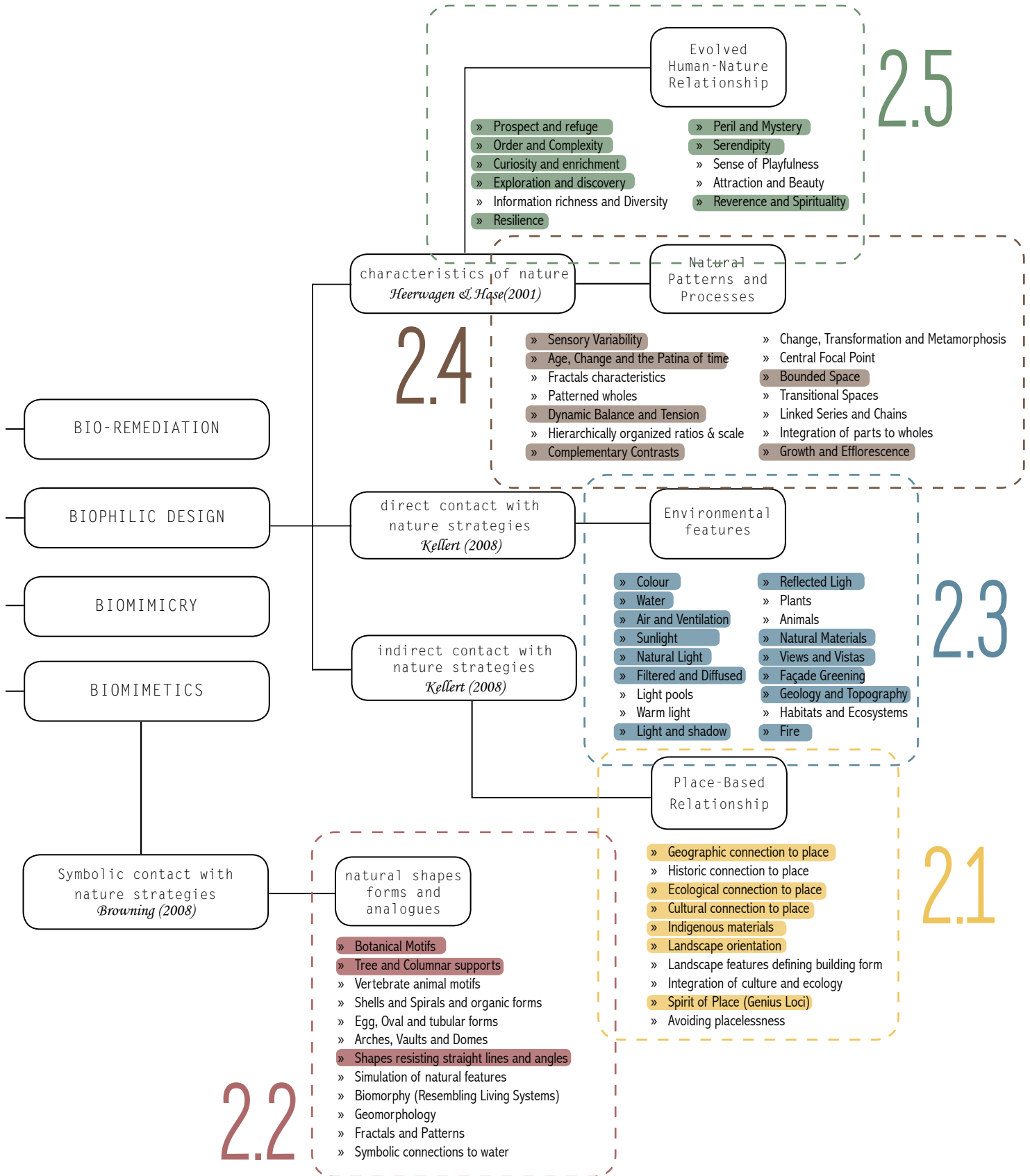
## 6.4 DESIGN RESPONSES TO BIOPHILIC PRINCIPLES

Upon reflection it became clear that the theoretical framework had to be reorganized in terms of what approaches had to be dealt with and in what order to ensure that a synergy would exist between them. The **biophilic principles were reinterpreted to become inherently relevant to the context** and were translated as follows:



▲  
**FIGURE 6.17**

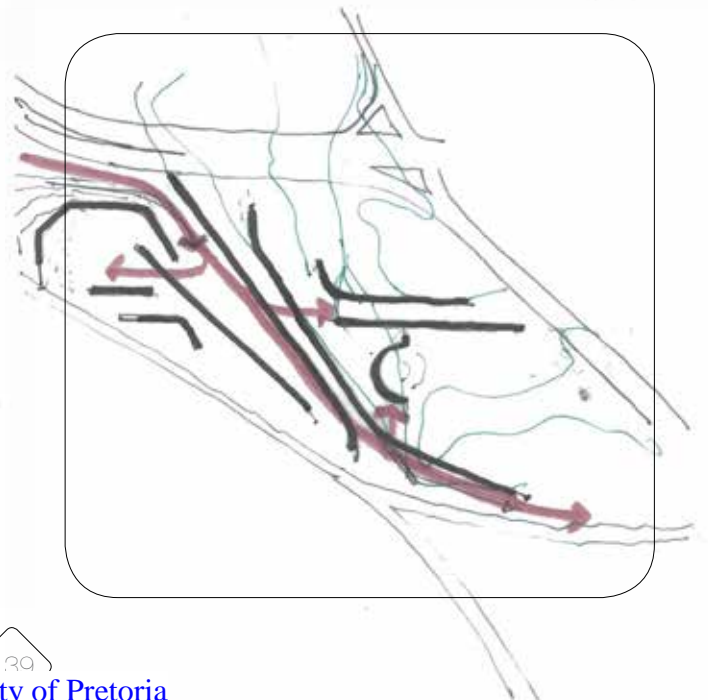
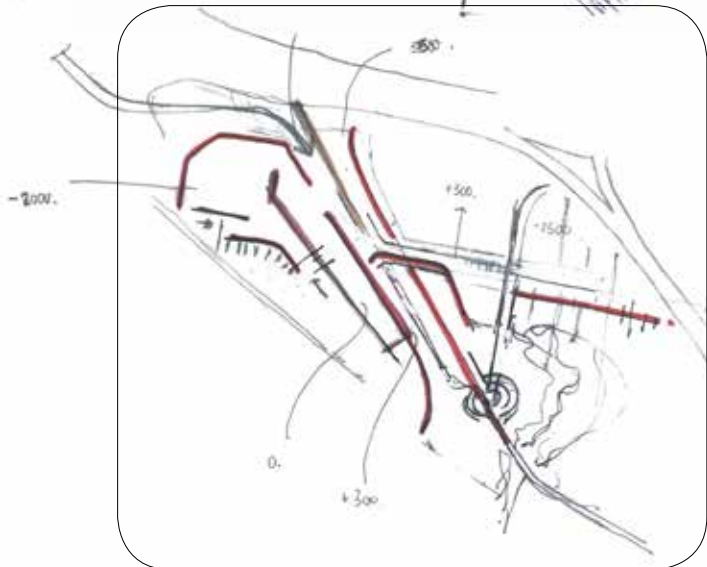
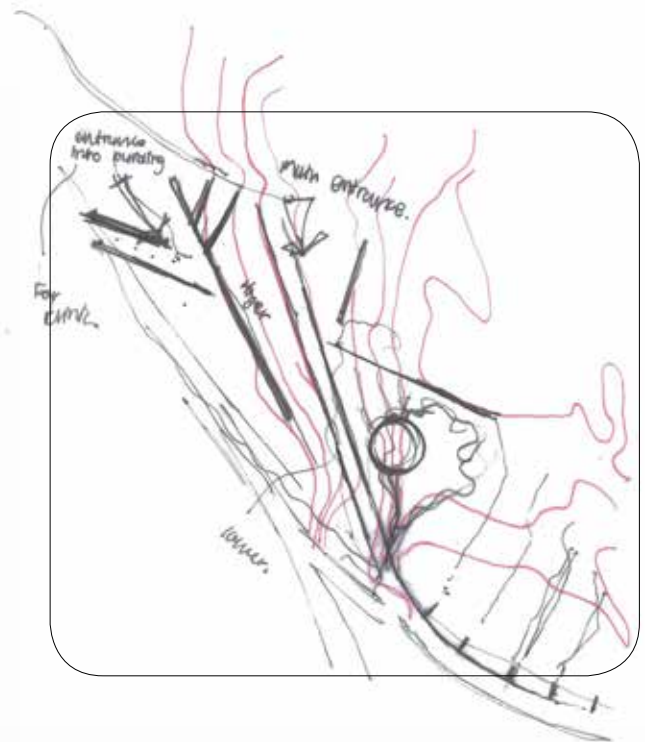
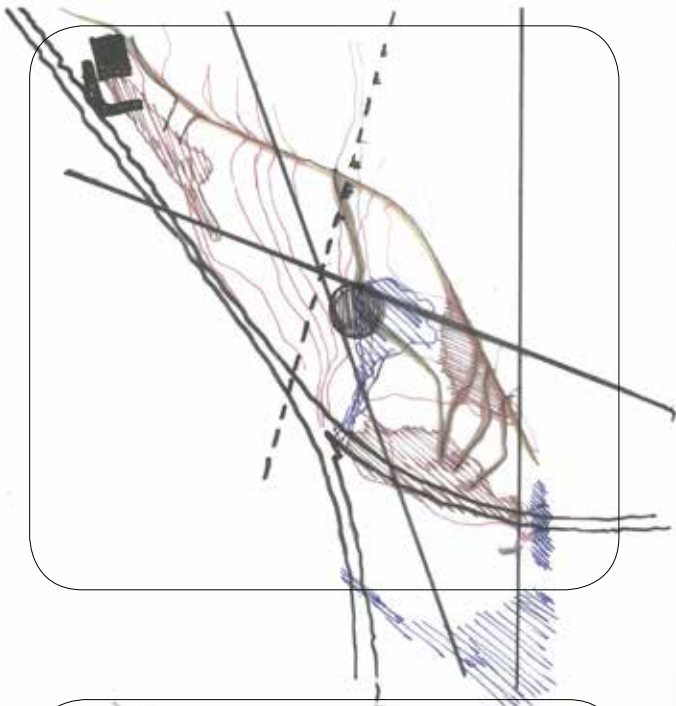
*Revision of theoretical framework application  
(Author, 2016)*







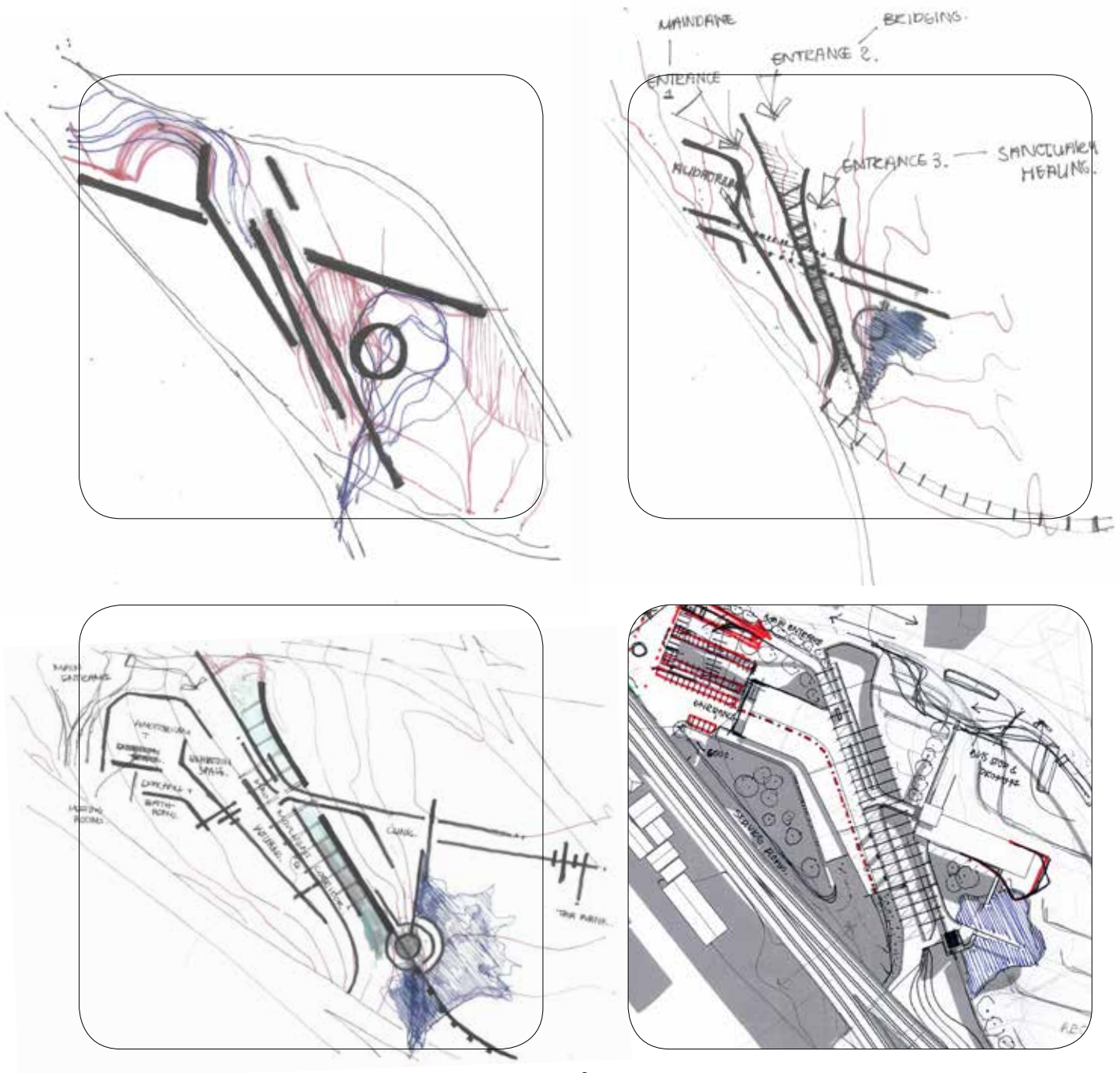
6.41 PLAN DEVELOPMENT

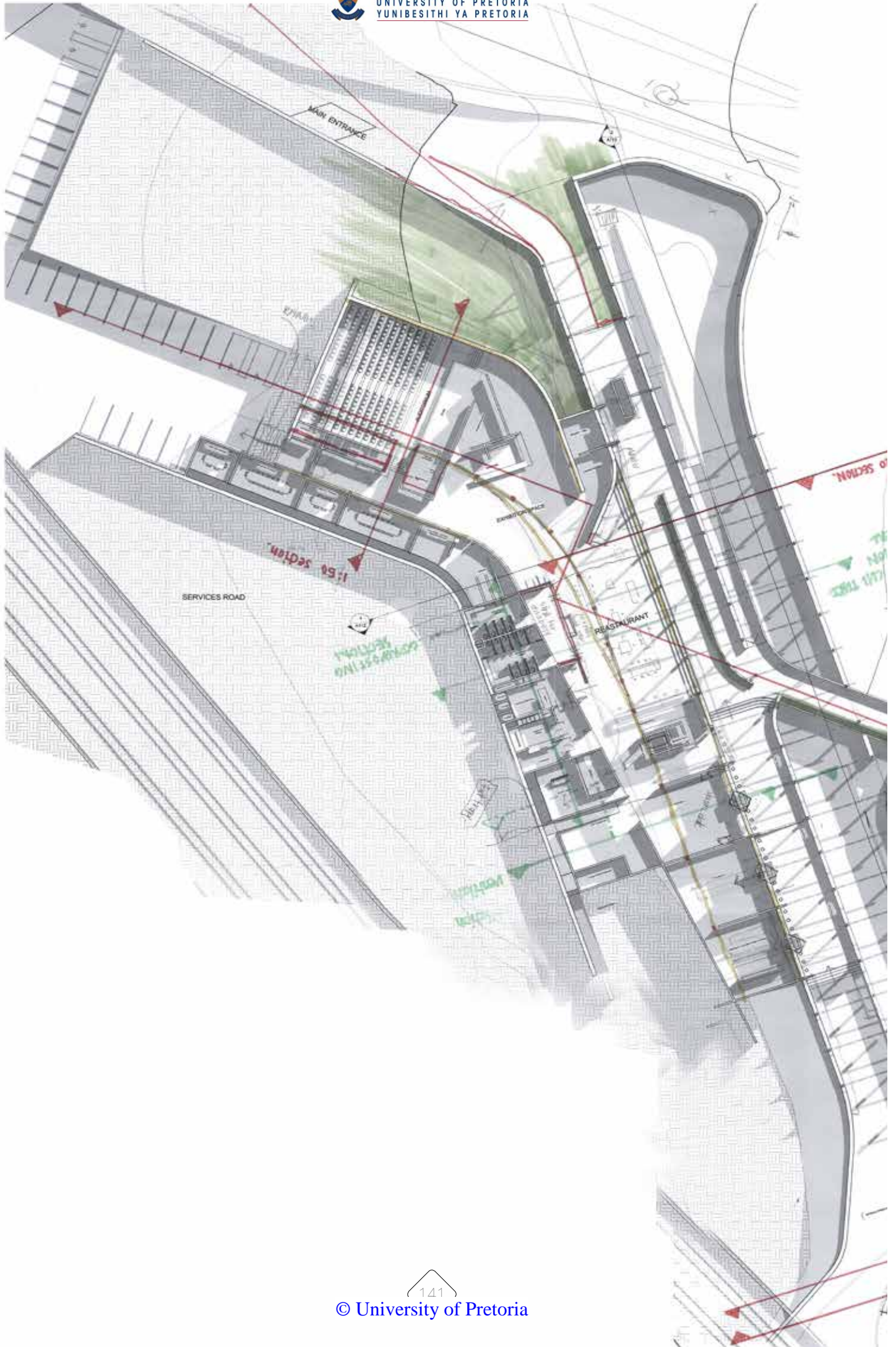


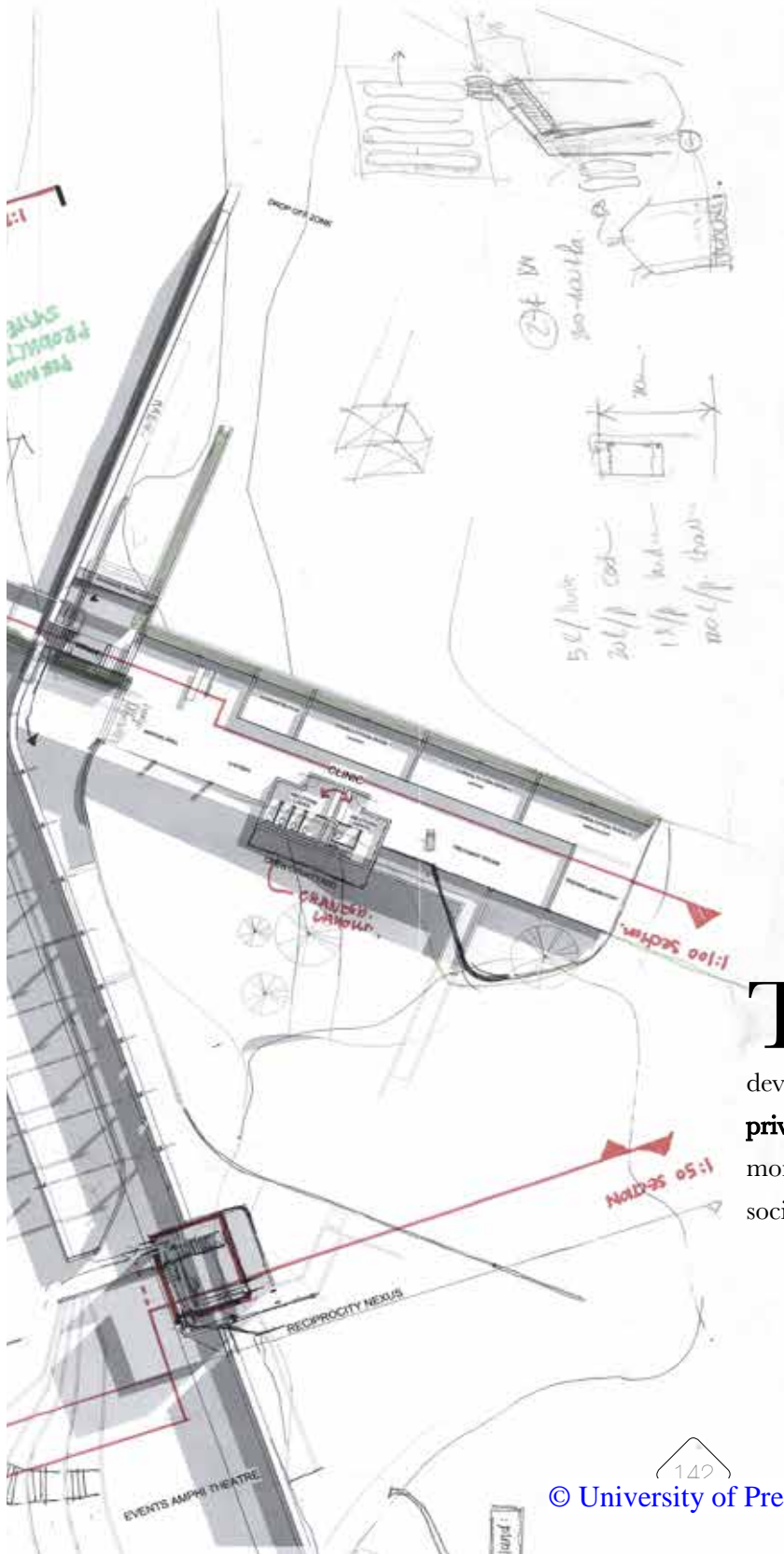
**FIGURE 6.14**

*Revised plan development sketches*

*(Author, 2016)*





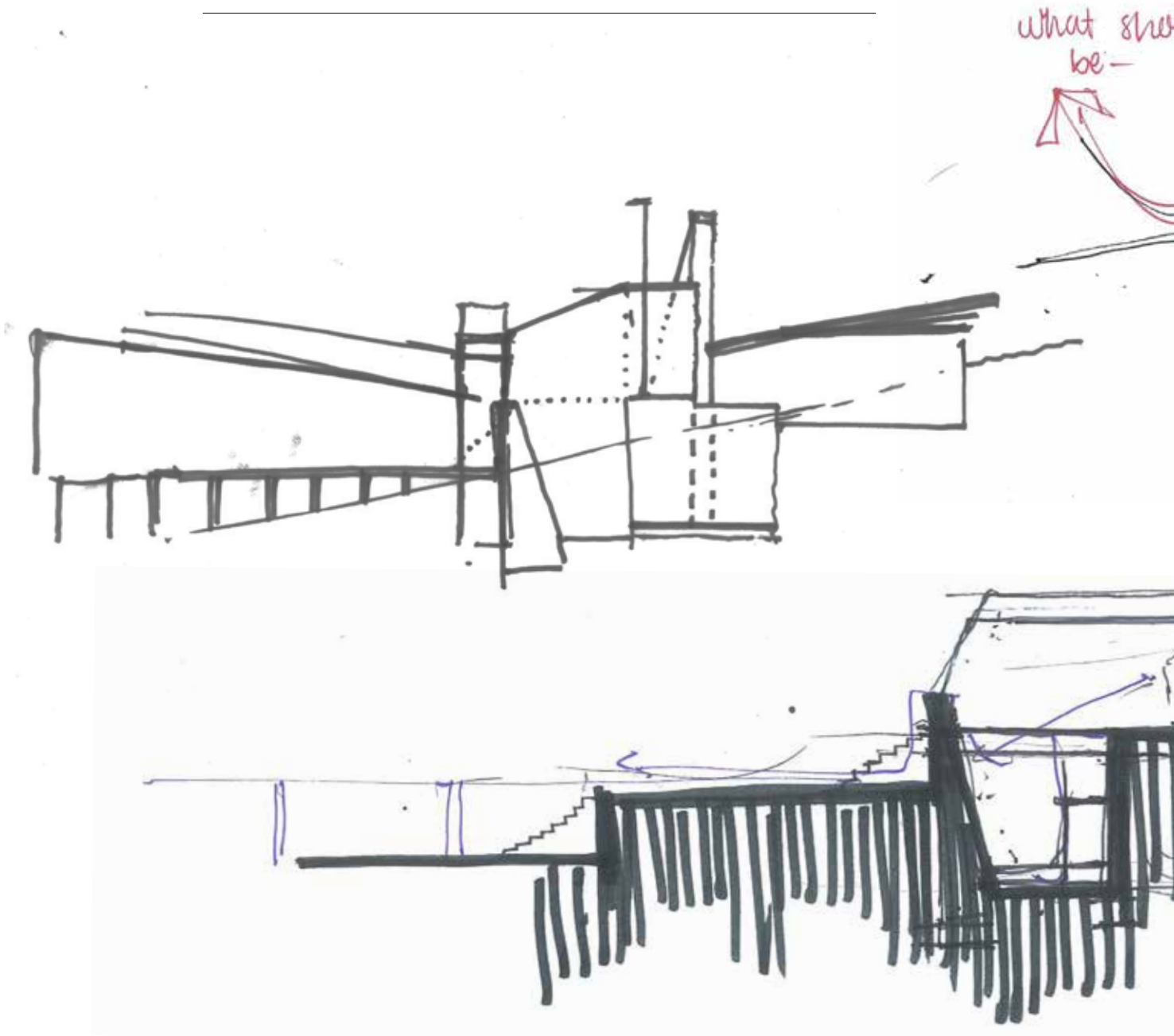


The initial approach to the programmatic development is still relevant in terms of **public and private spatial organization**; however, it responds more appropriately to the inherent movement and social patterns that currently exist on site.

FIGURE 6.15

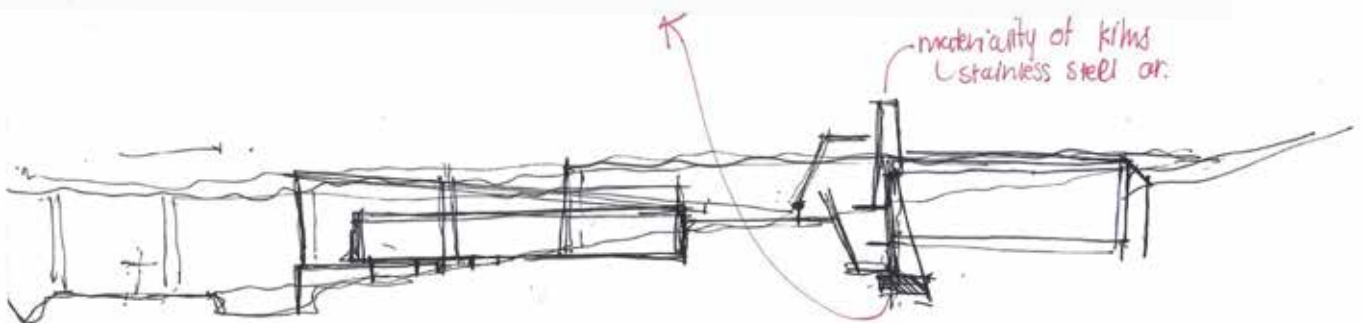
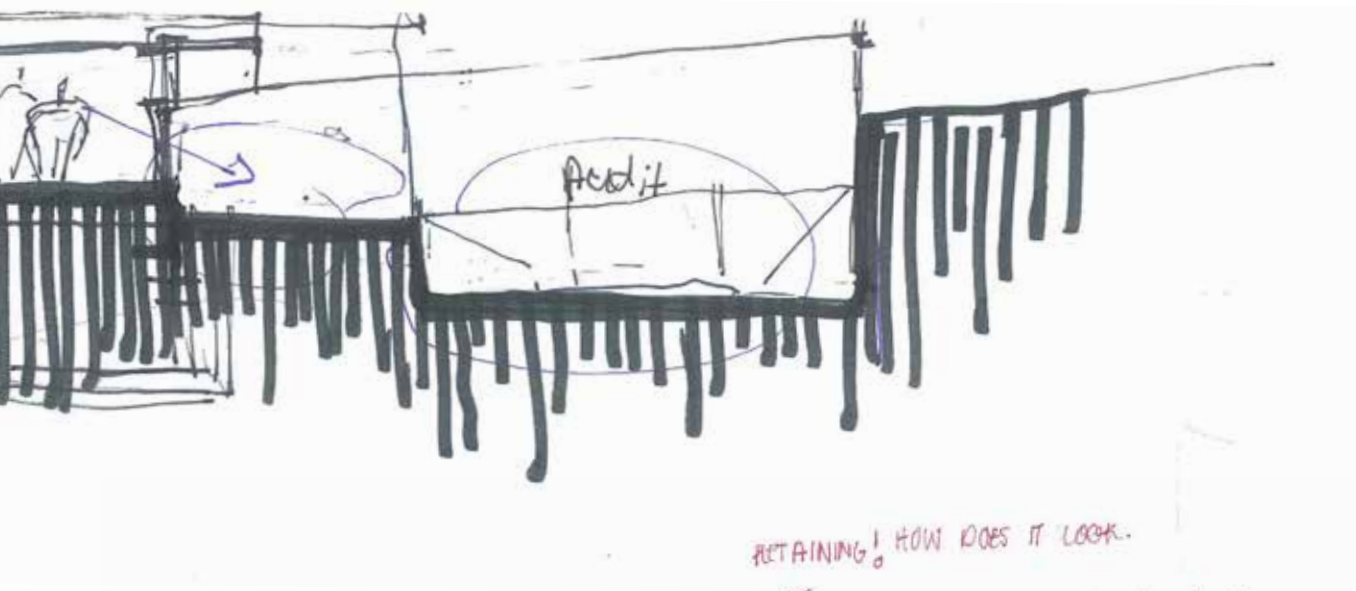
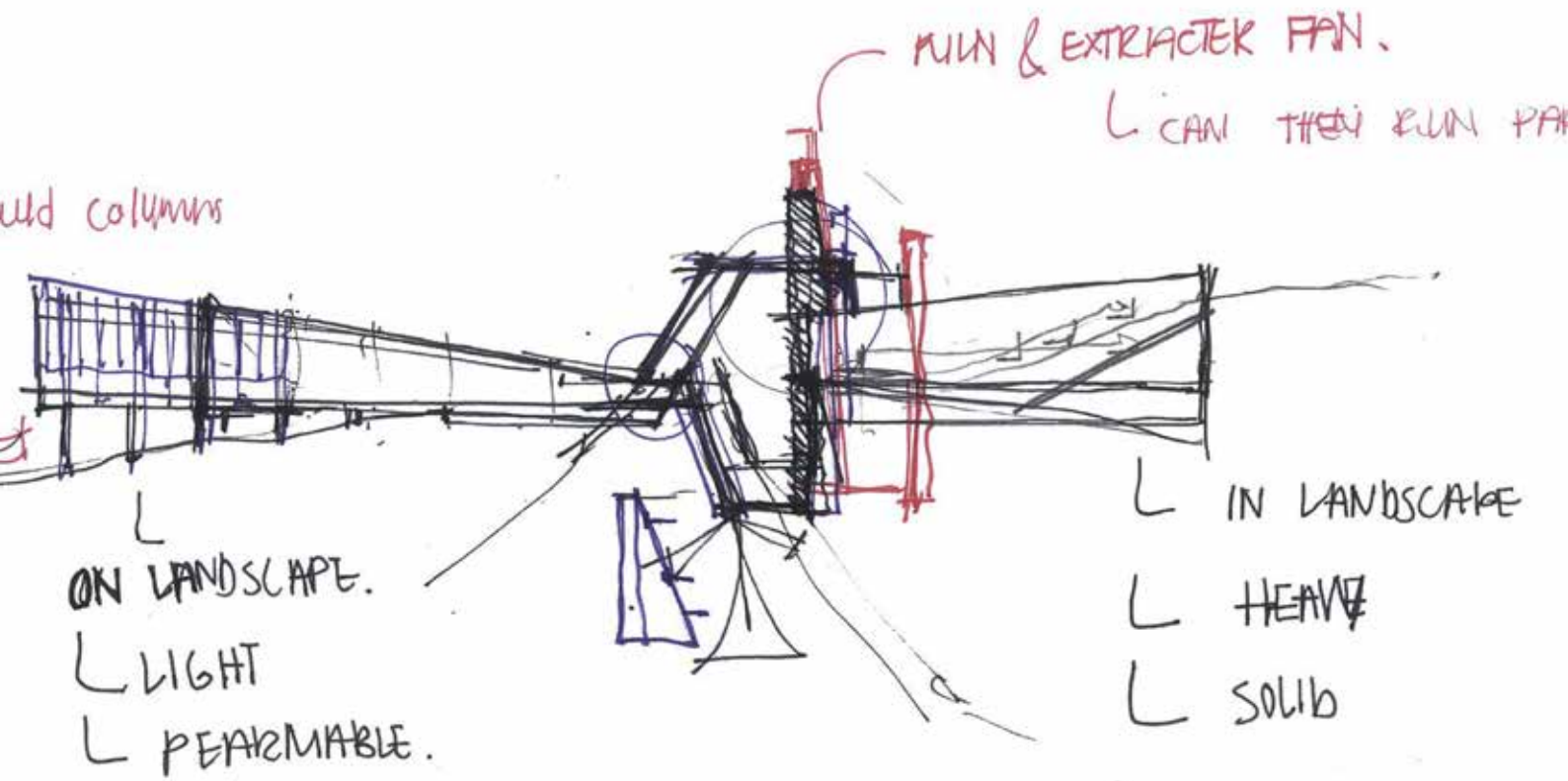
◀ Plan Revision B (Author, 2016)

6.42 SECTION DEVELOPMENT



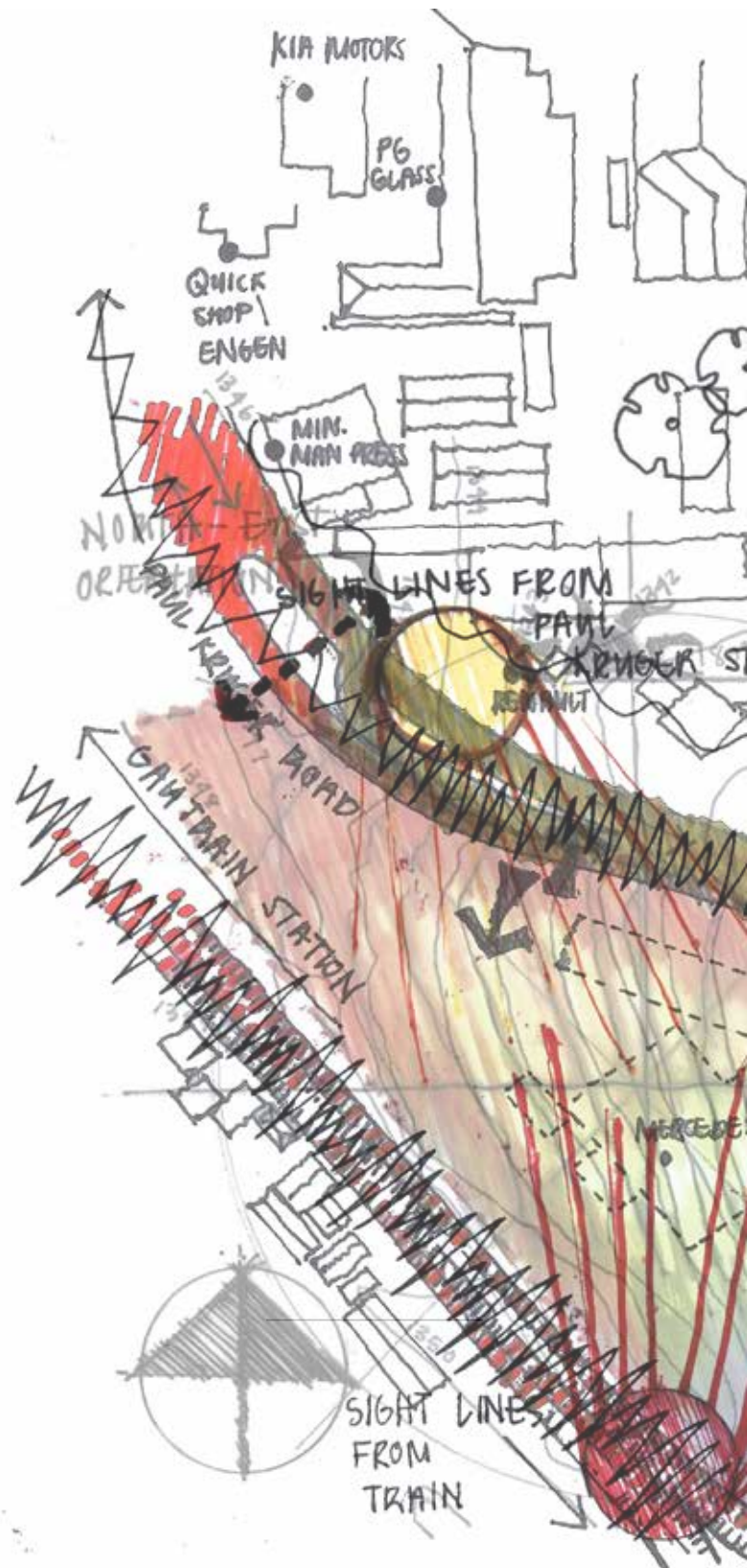
▲  
**FIGURE 6.16**

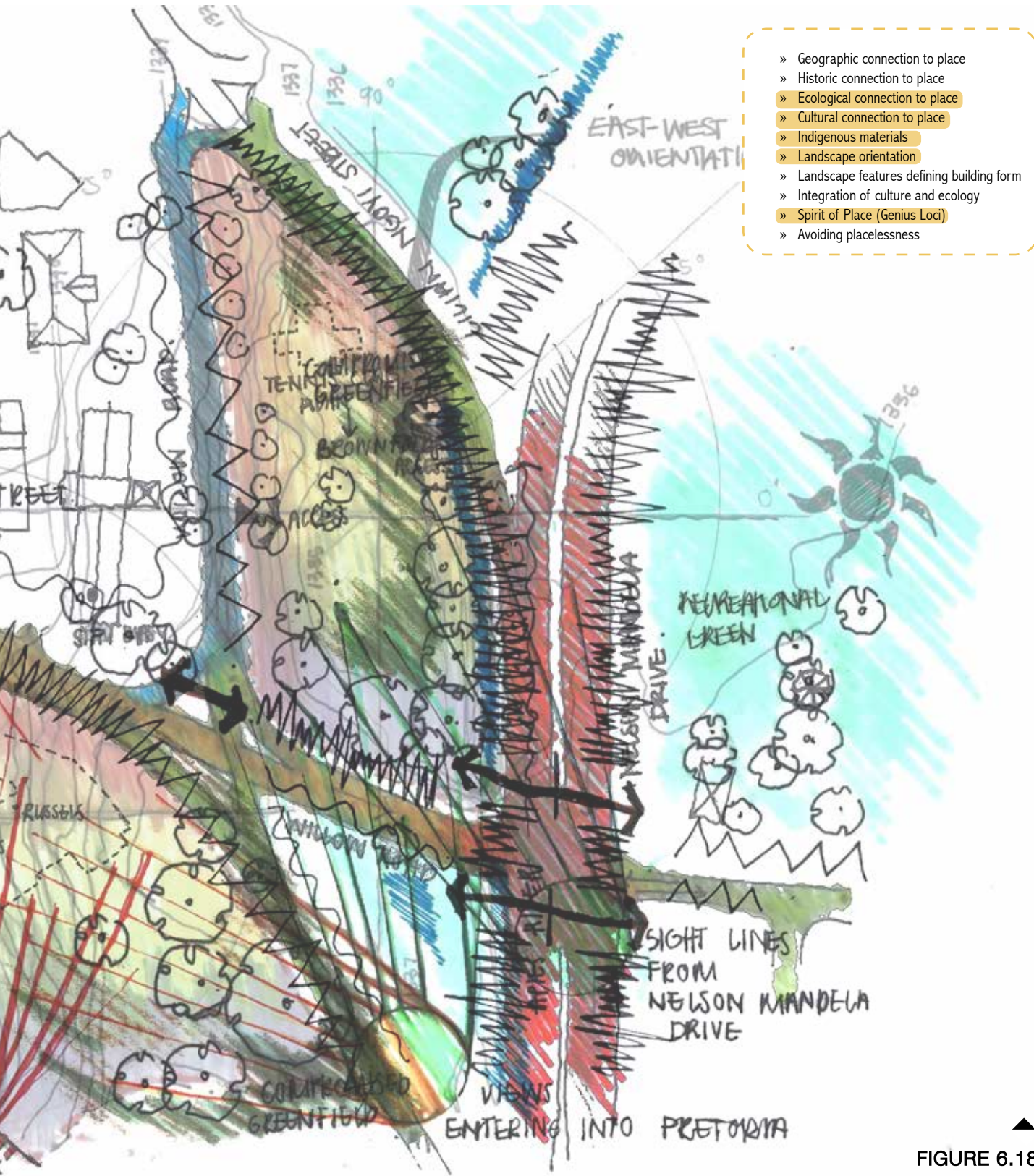
*Process sketches of section development  
(Author, 2016)*



6.4.3 PLACE - BASED AND VERNACULAR  
RELATIONSHIPS

The principles of *place-based and vernacular* connections that are implemented in the conceptual development of the building are illustrated in the following diagram. These include a **geographic connection** to place through a **response to contours**, for the building's form will mainly be defined by the site's contours. The architectural interventions will take place between the urban and natural edges of the site, serving as a **geographical and ecological mediating device**. **Cultural connections** to place will be achieved on an **urban scale** by **establishing linkages** to and from the historic Berea Park, Pretoria Station and Freedom Park, where the building will become the **nexus of these linkages**. Ideal **landscape orientation** for the building will be achieved by having two distinct axes. Finally, the *Spirit of Place* (*Genius Loci*) will be enhanced by celebrating the dynamic characteristics of the site, which are those of an **oasis among the havoc of the daily urban commute** that surrounds the site.





**FIGURE 6.18**

*Illustration of place-based and vernacular analysis of existing energies on site (Author, 2016)*





## 6.4.4 NATURAL SHAPES, FORMS AND ANALOGUES

The primary structure of the building together with the development of the plan, will make visual references to natural forms through the application of **biomimetic qualities** (Kellert & Calabrese, 2008: 35). *Botanical motifs and organic forms* that resist straight lines and angles will be implemented in the organisation of space in the plan in order to facilitate **optimal movement** within the building. Transitional and movement routes will also be defined by an **ordering structure** that symbolizes *tree and columnar* supports.

- » Botanical Motifs
- » Tree and Columnar supports
- » Vertebrate animal motifs
- » Shells and Spirals and organic forms
- » Egg, Oval and tubular forms
- » Arches, Vaults and Domes
- » Shapes resisting straight lines and angles
- » Simulation of natural features
- » Biomorphy (Resembling Living Systems)
- » Geomorphology
- » Fractals and Patterns
- » Symbolic connections to water

## 6.4.5 ENVIRONMENTAL FEATURES

**D**irect contact between humans and nature will be achieved through the implementation of environmental features that will be elaborated on in the Technification chapter. These include the following:

*Natural materials* such as stone, timber and vernacular bagged brick will serve as **affiliating tools** throughout the building. The *colour* range of the **material palette** is deliberately wide to demonstrate and celebrate the diversity present in nature.

**P**lanting & facade greening is another natural tool that will support natural habitats and ecosystems in the internal spaces. Most of these facades will be **productive green walls** where specific fruits, vegetables and herbs that require

more controlled conditions will be grown. These walls will become the **production core** of the building. *Water* harvesting strategies together with the **wetland** will meet irrigation demands and provide a **direct natural experience**.

**N**atural ventilation will be achieved by means of **cross ventilation**, for the main building axis is directed towards the **predominant north-eastern wind direction**. Operable window openings and a porous structure together with **evaporative cooling** will create cool internal spaces. **Solar chimneys** will also be important elements within the design of the kitchen and cooking spaces to improve the thermal comfort of these spaces.

**D**ue to the multiple building orientation axes, *natural sunlight* can be manipulated in various ways through **screens and overhead structures** that will *filter, reflect* and *diffuse light*, create *light pools*, and generate playful animations with *light and shadow*.

**B**y exposing all kitchens of the culinary school to the main circulation route of the building, the act of cooking food through heat and *fire* are celebrated as a natural process of life that stimulates multiple **sensory experiences** such as **smell** and the **feeling of heat**.

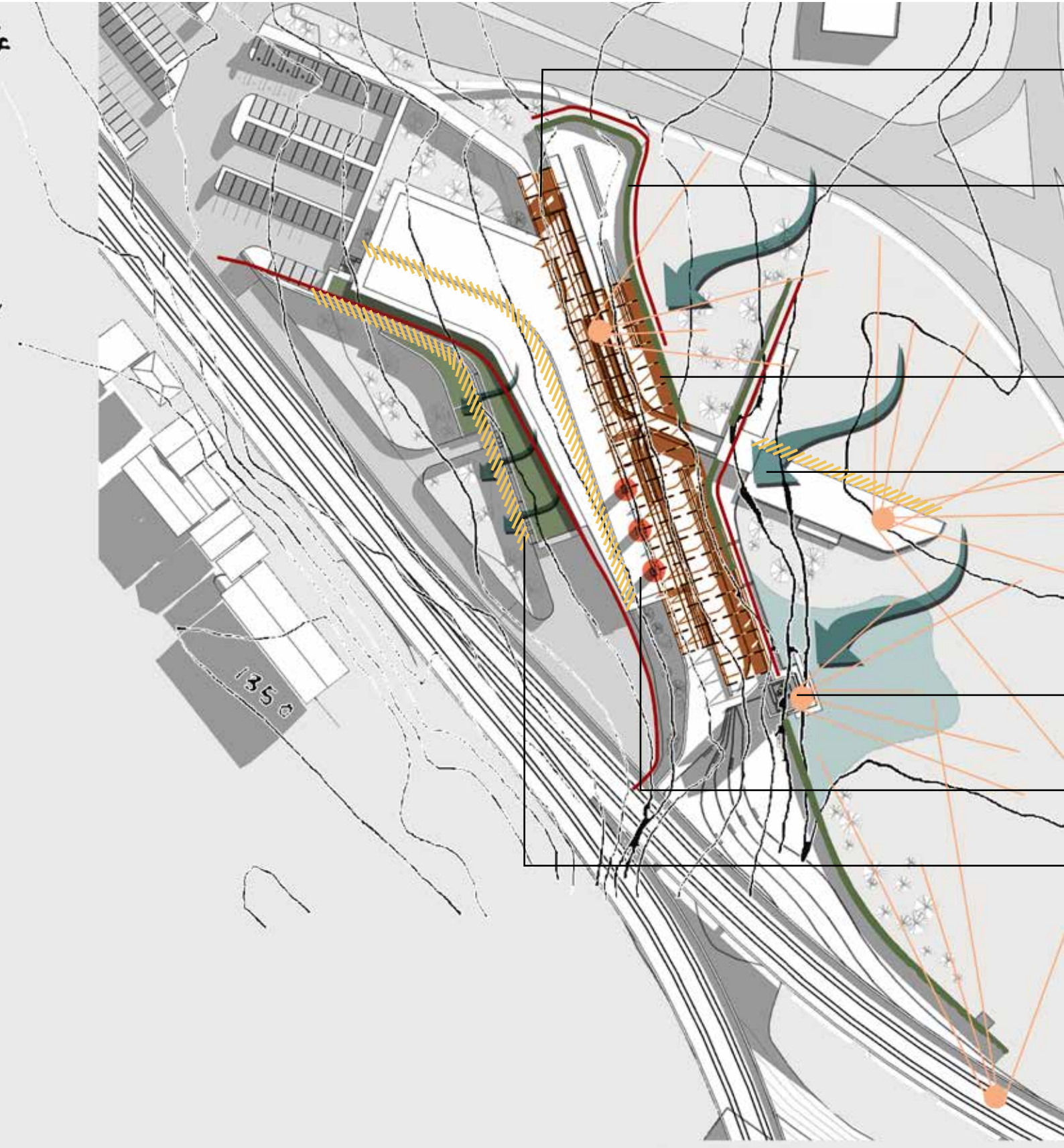
**V***iews and vistas* will be implemented towards landmarks such as UNISA and the surrounding hilltops through multiple **indoor and outdoor transitional spaces**, and the **terracing** of the building that takes full advantage of the slope of the site.

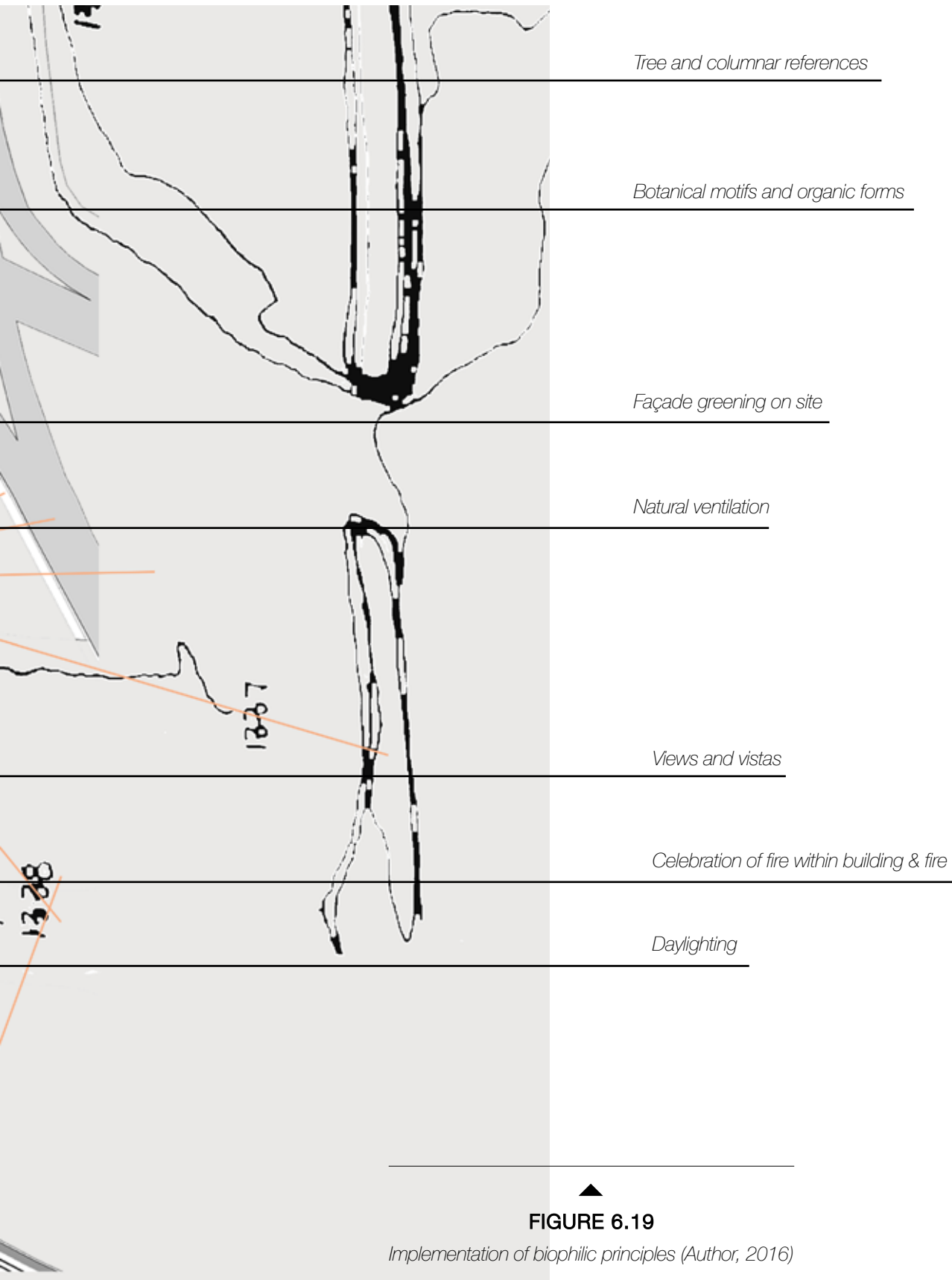
- » Colour
- » Water
- » Air and Ventilation
- » Sunlight
- » Natural Light
- » Filtered and Diffused
- » Light pools
- » Warm light
- » Light and shadow
- » Reflected Light
- » Plants
- » Animals
- » Natural Materials
- » Views and Vistas
- » Façade Greening
- » Geology and Topography
- » Habitats and Ecosystems
- » Fire

## 6.46 NATURAL PATTERNS AND PROCESSES

**P**rocesses that are commonly associated with nature will largely be implemented in the design by **celebrating the properties, textures** and **different uses of materials** throughout the building. Material choices and applications will ensure *sensory variability* and demonstrate *age, change and the patina of time*. *Complementary contrasts* will also be achieved by the juxtaposition of different material properties with one another. These **material choices** will be discussed in the Technification chapter.

- » Prospect and refuge
- » Order and Complexity
- » Curiosity and enrichment
- » Exploration and discovery
- » Information richness and Diversity
- » Resilience
- » Peril and Mystery
- » Serendipity
- » Sense of Playfulness
- » Attraction and Beauty
- » Reverence and Spirituality



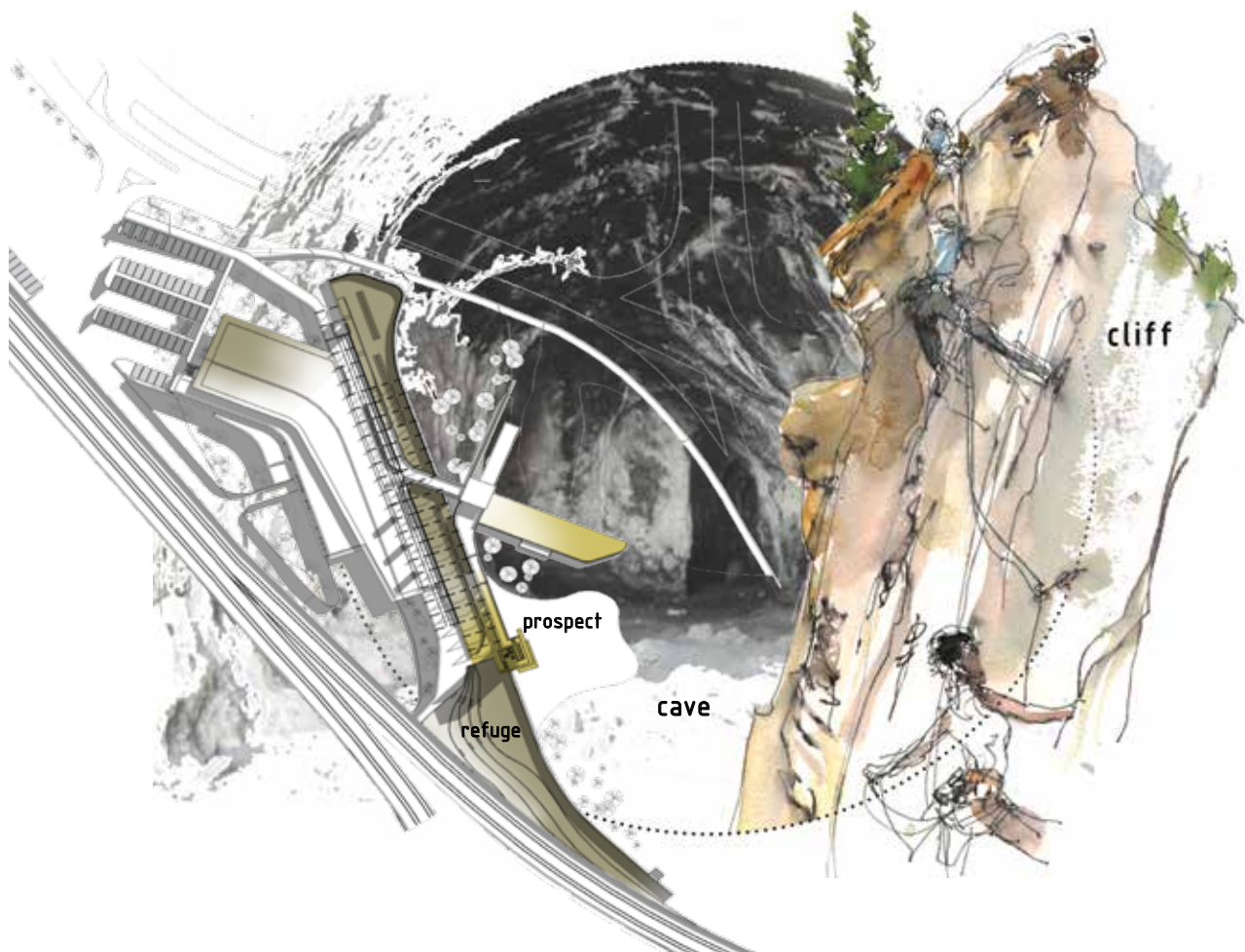


**FIGURE 6.19**

*Implementation of biophilic principles (Author, 2016)*

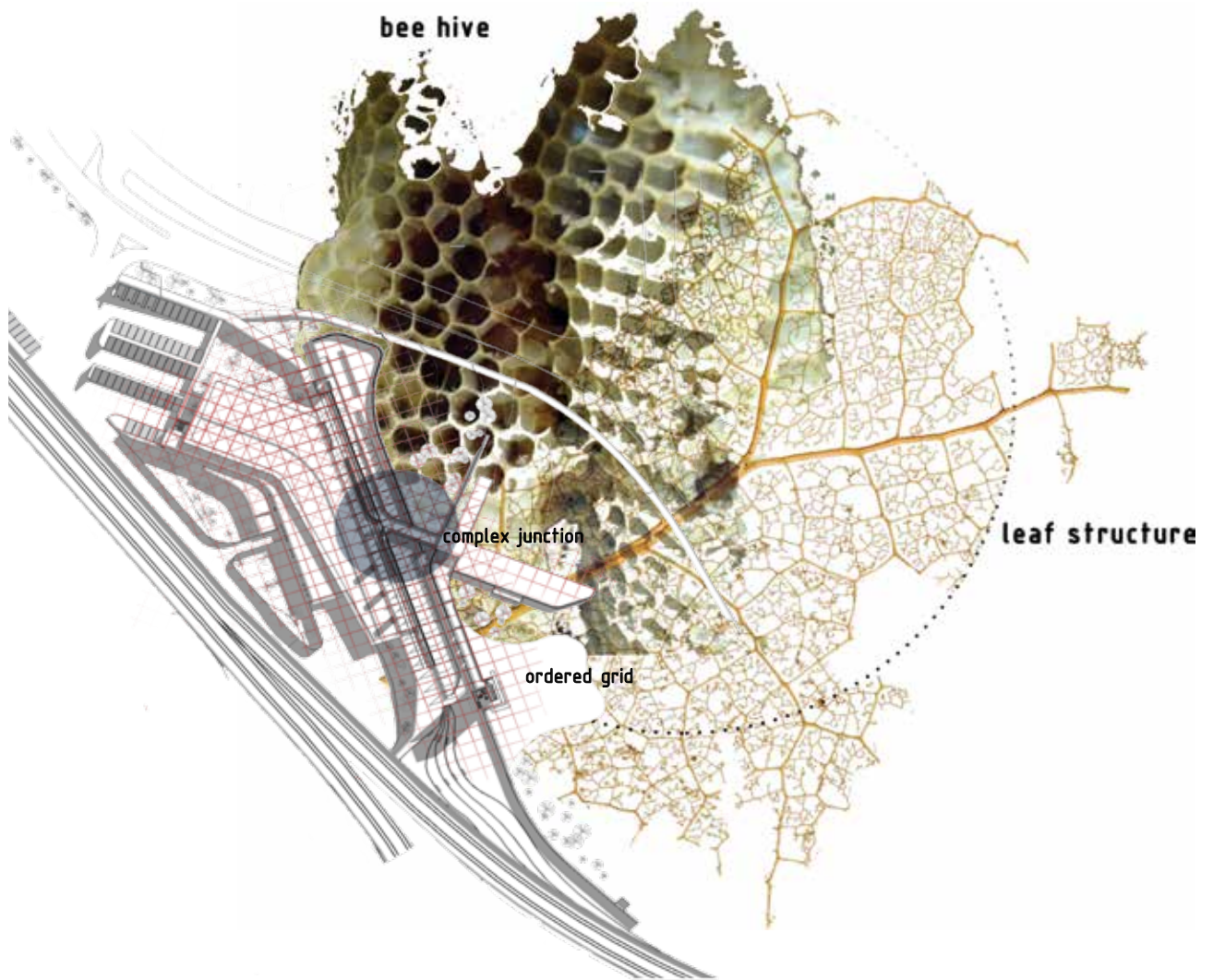
6.47 THE EVOLVED HUMAN - NATURE RELATIONSHIP

The **intangible characteristics of nature** will contribute to the formal and programmatic development of the building by **imitating the following experiences** commonly felt in nature. These will be illustrated accordingly:



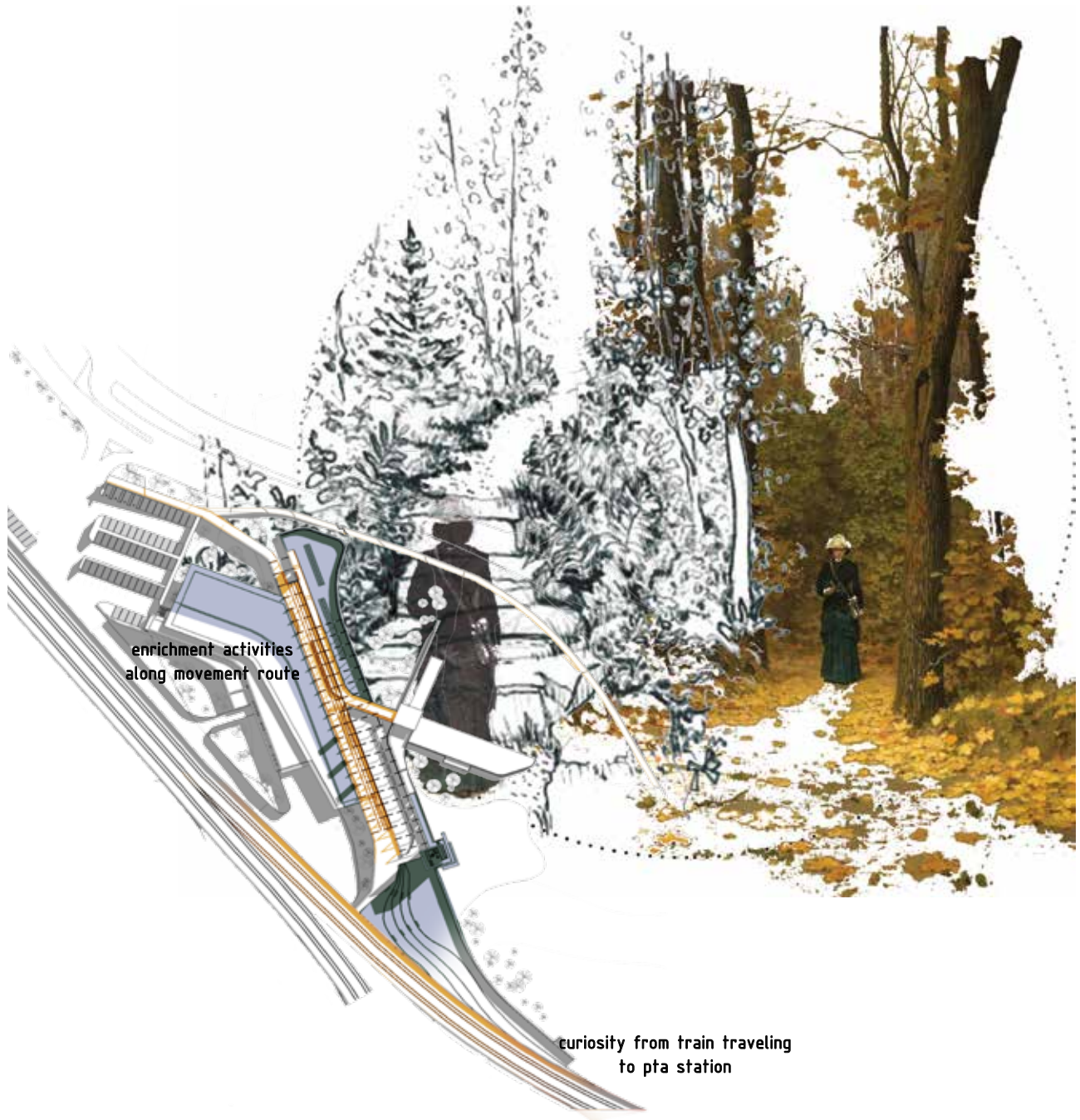
**FIGURE 6.20**

*Prospect and refuge (Author, 2016)*



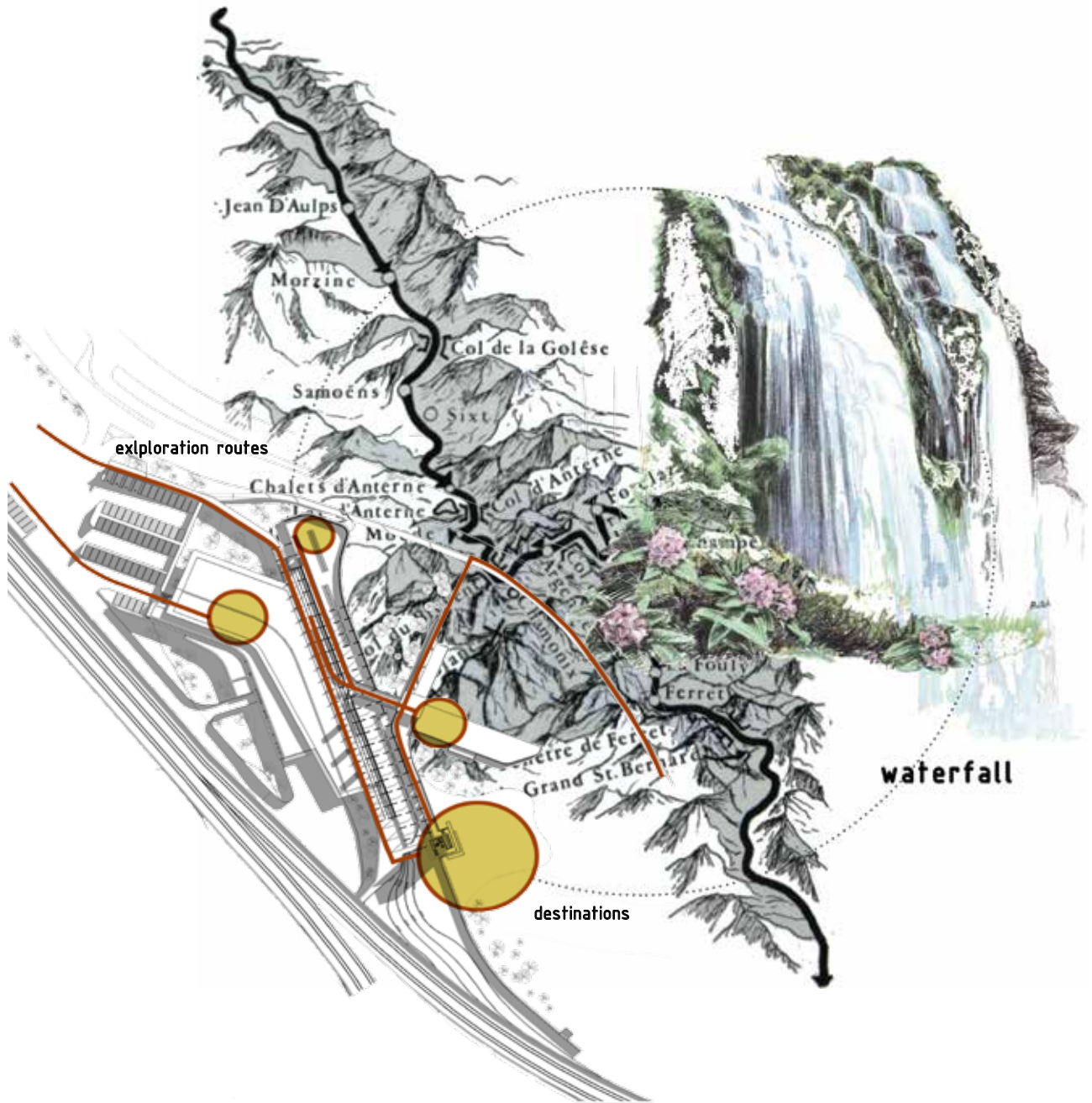
**FIGURE 6.21**

*Order and complexity (Author, 2016)*



**FIGURE 6.22**

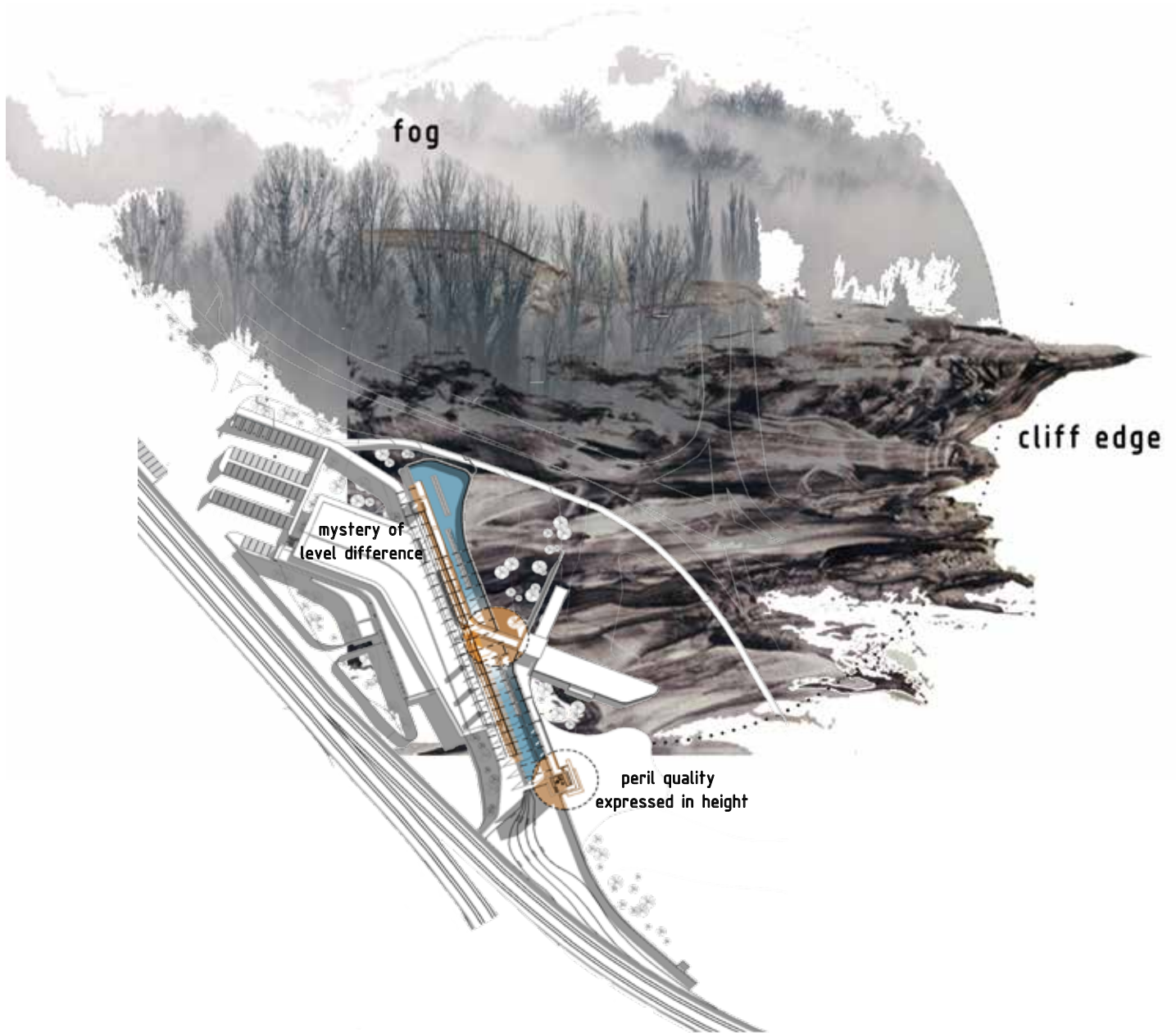
*Curiosity and enrichment (Author, 2016)*



**FIGURE 6.23**

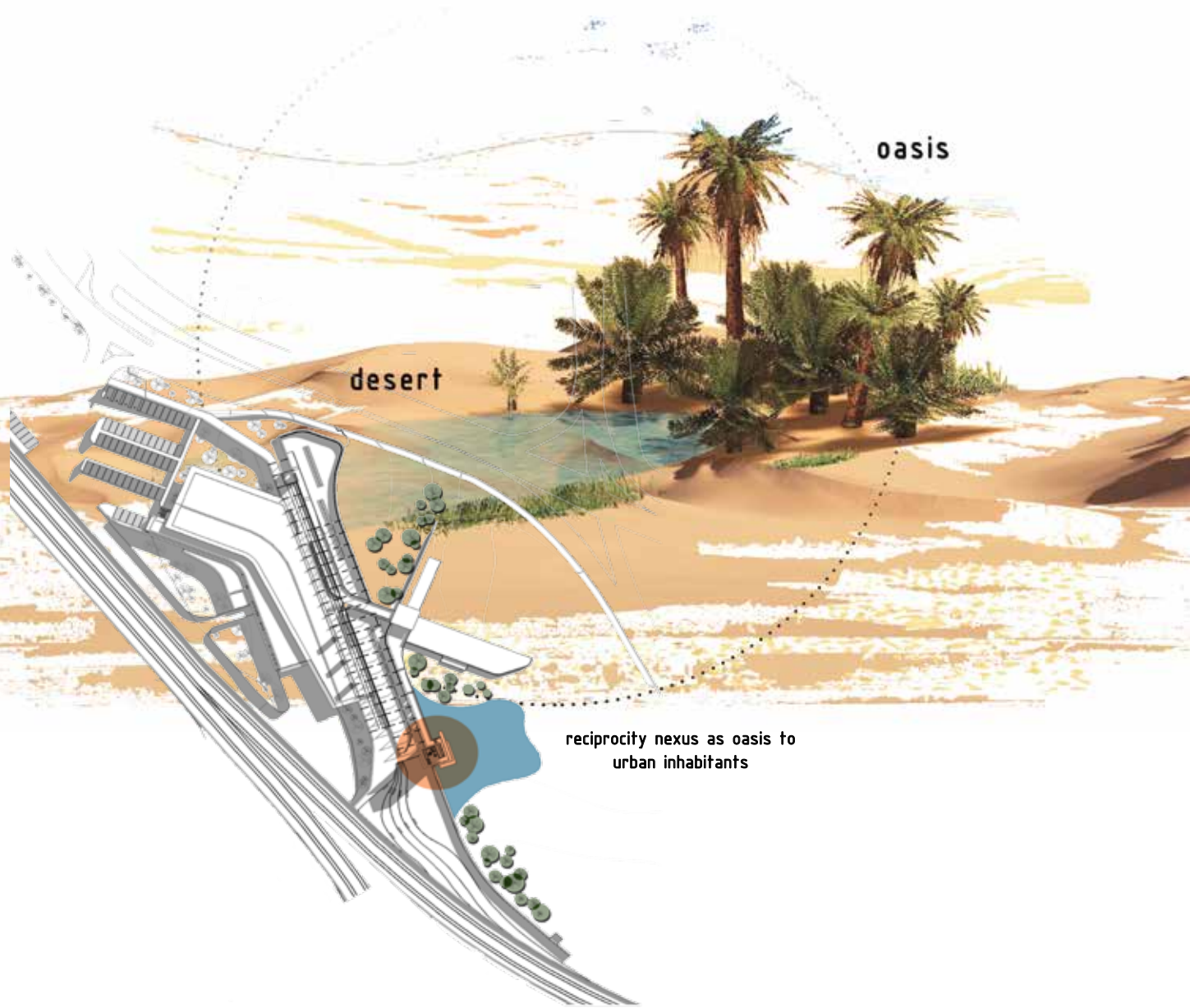
*Exploration and discovery (Author, 2016)*





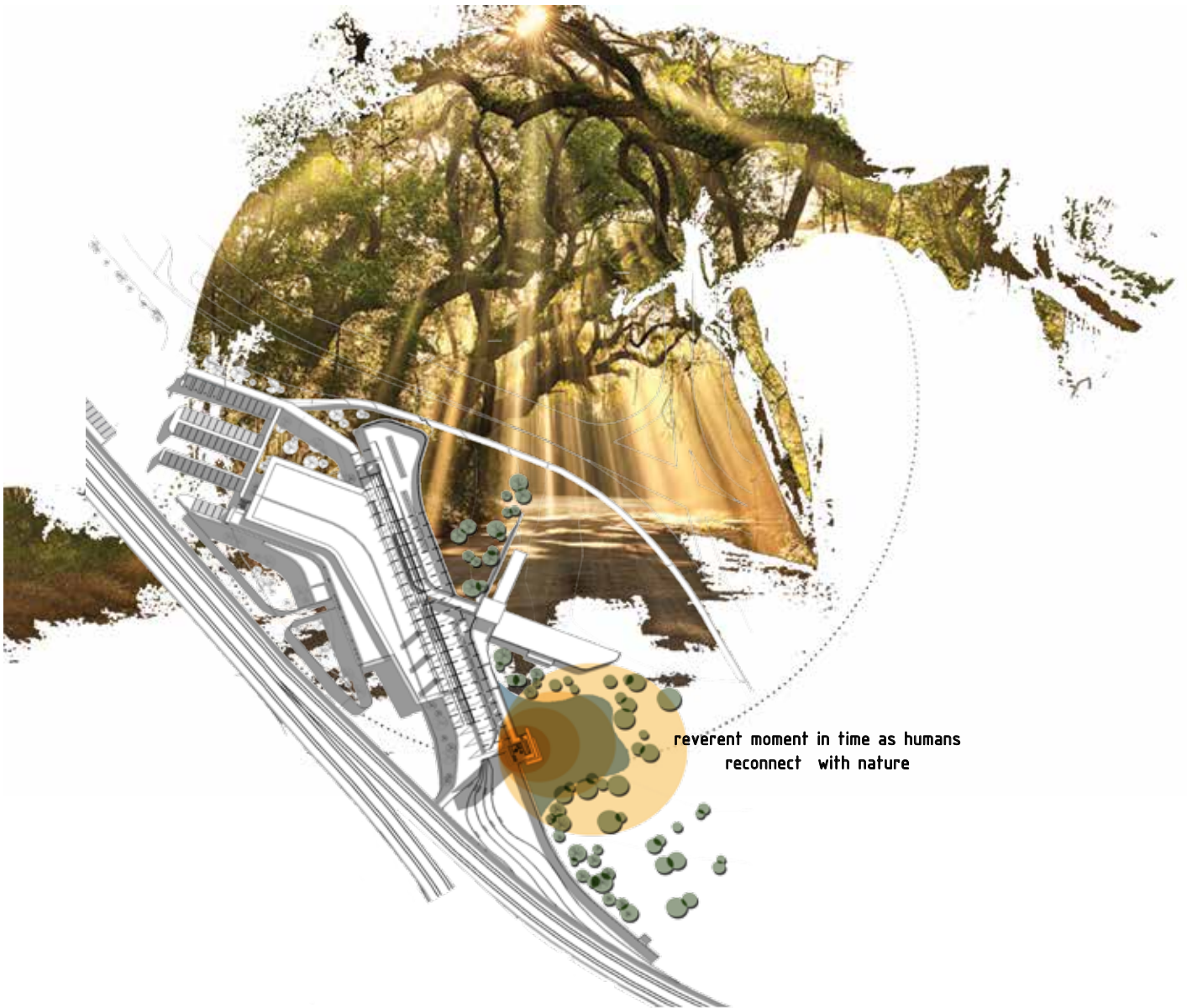
**FIGURE 6.24**

*Peril and mystery (Author, 2016)*



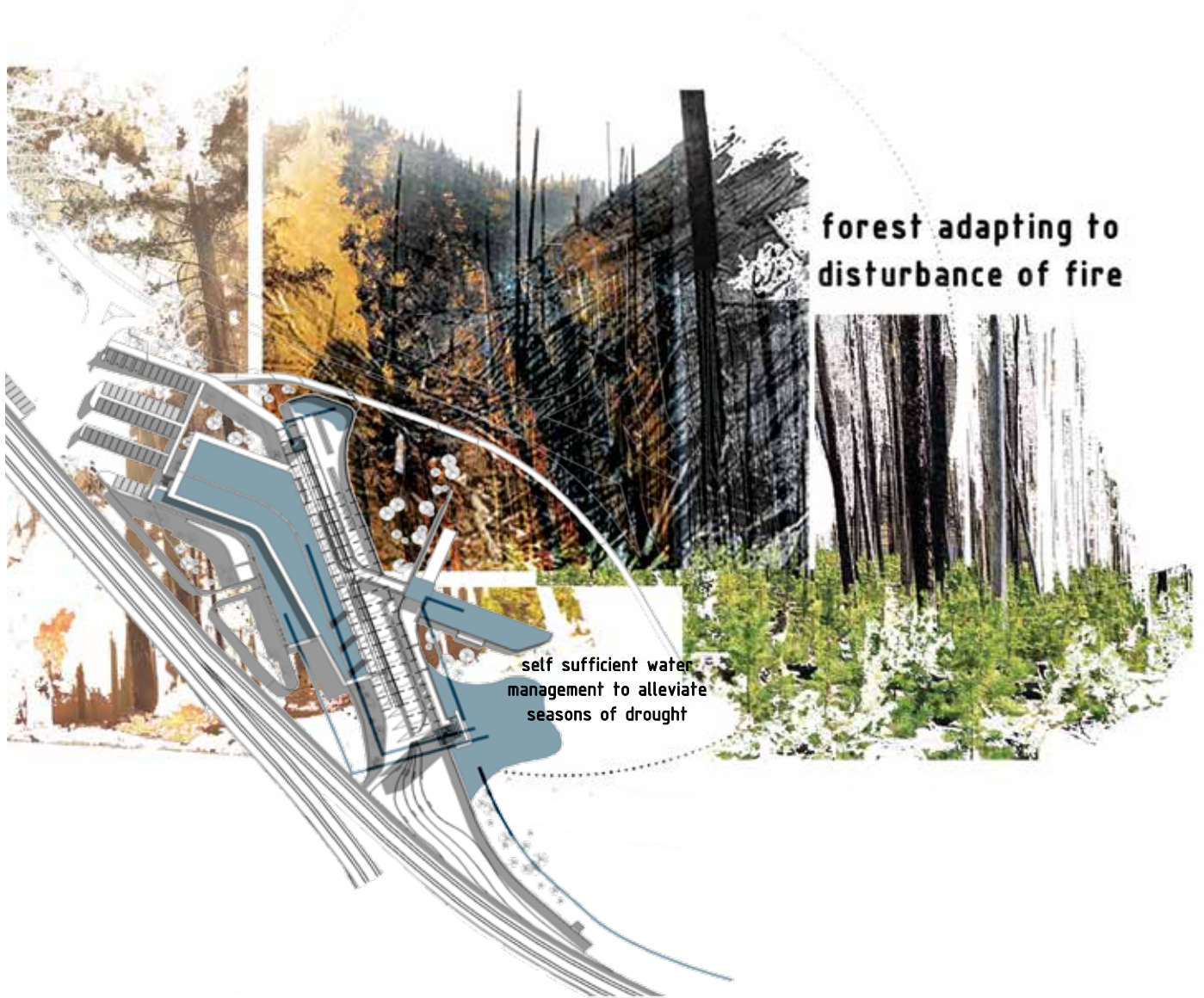
**FIGURE 6.25**

*Serendepity (Author, 2016)*



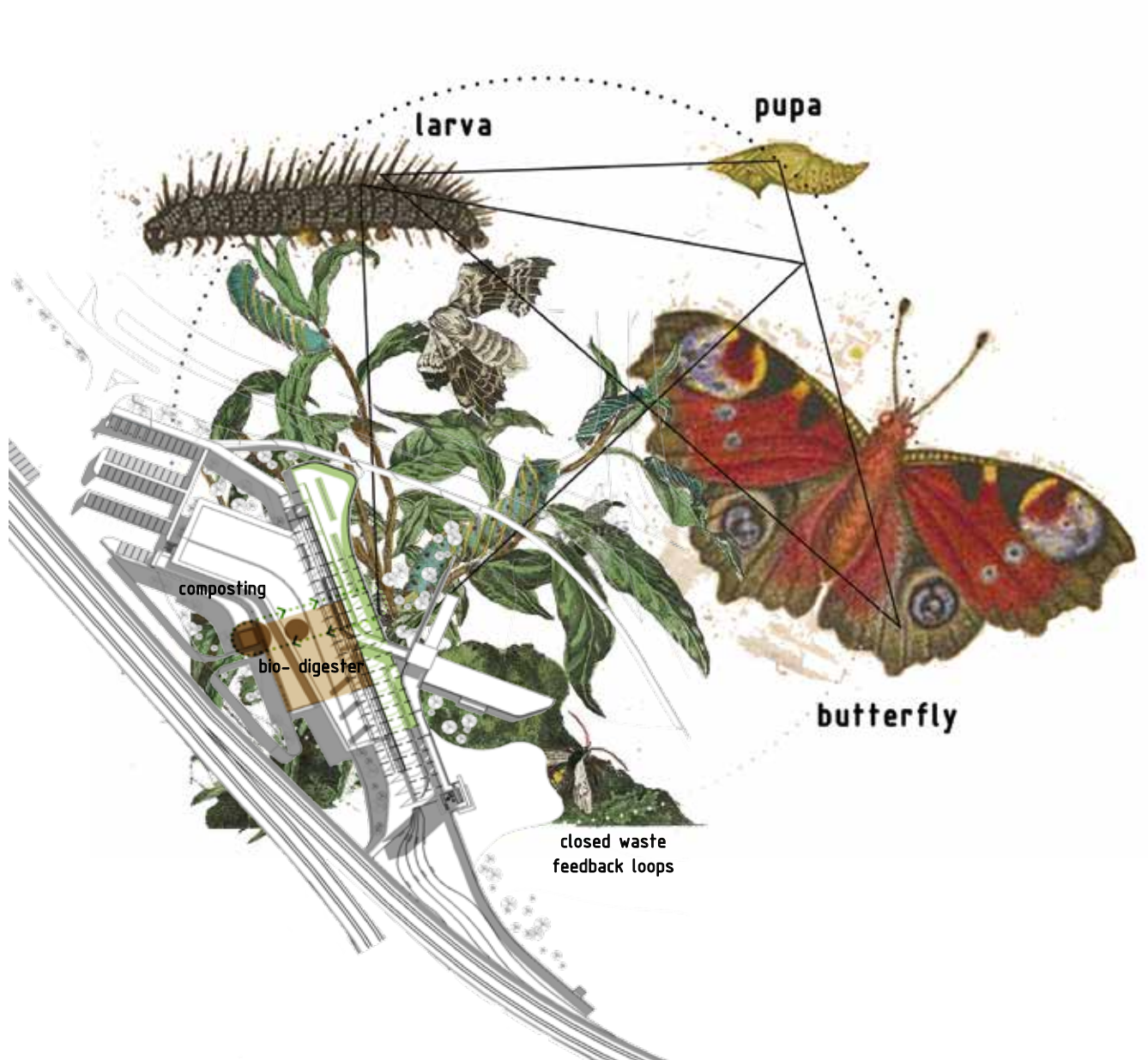
**FIGURE 6.26**

*Reverence and spirituality (Author, 2016)*



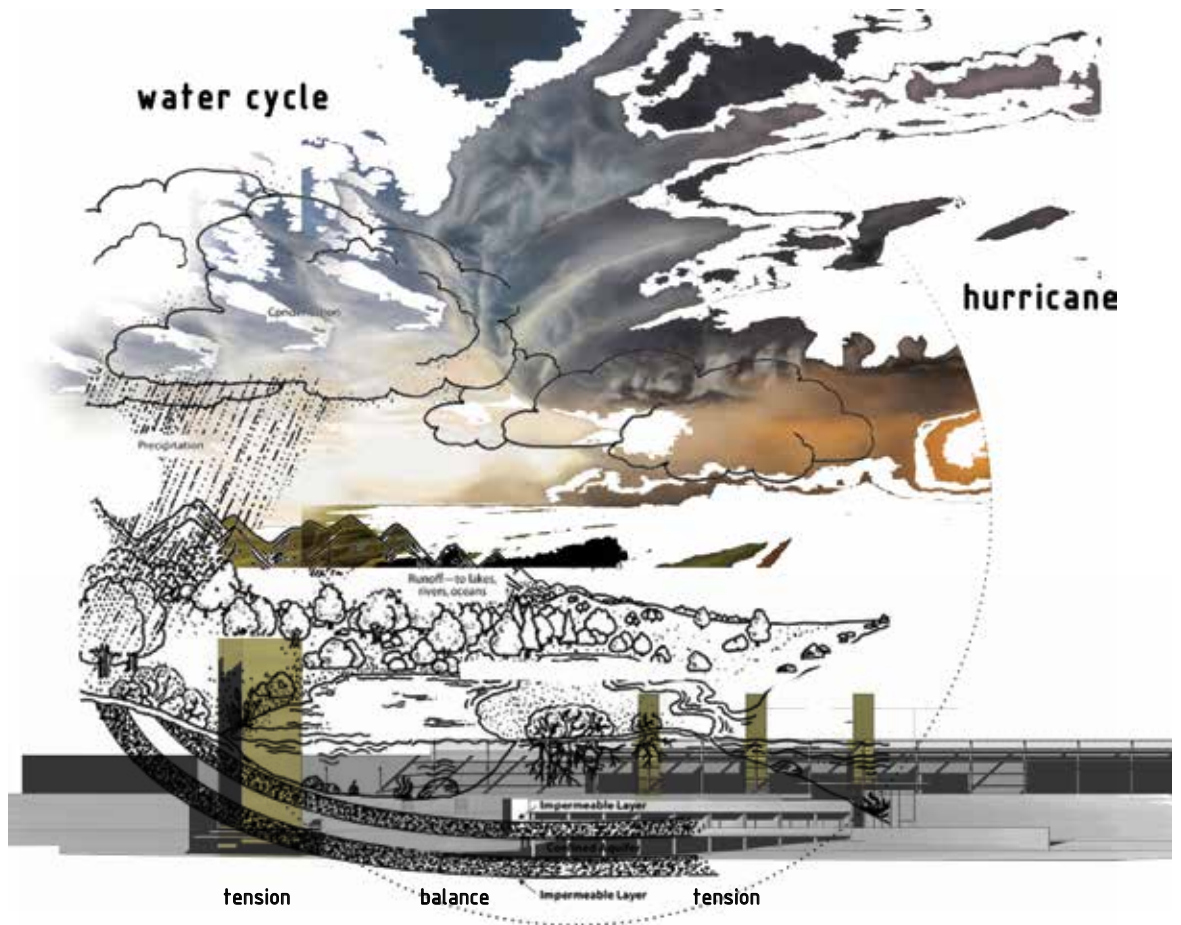
**FIGURE 6.27**

*Resilience (Author, 2016)*



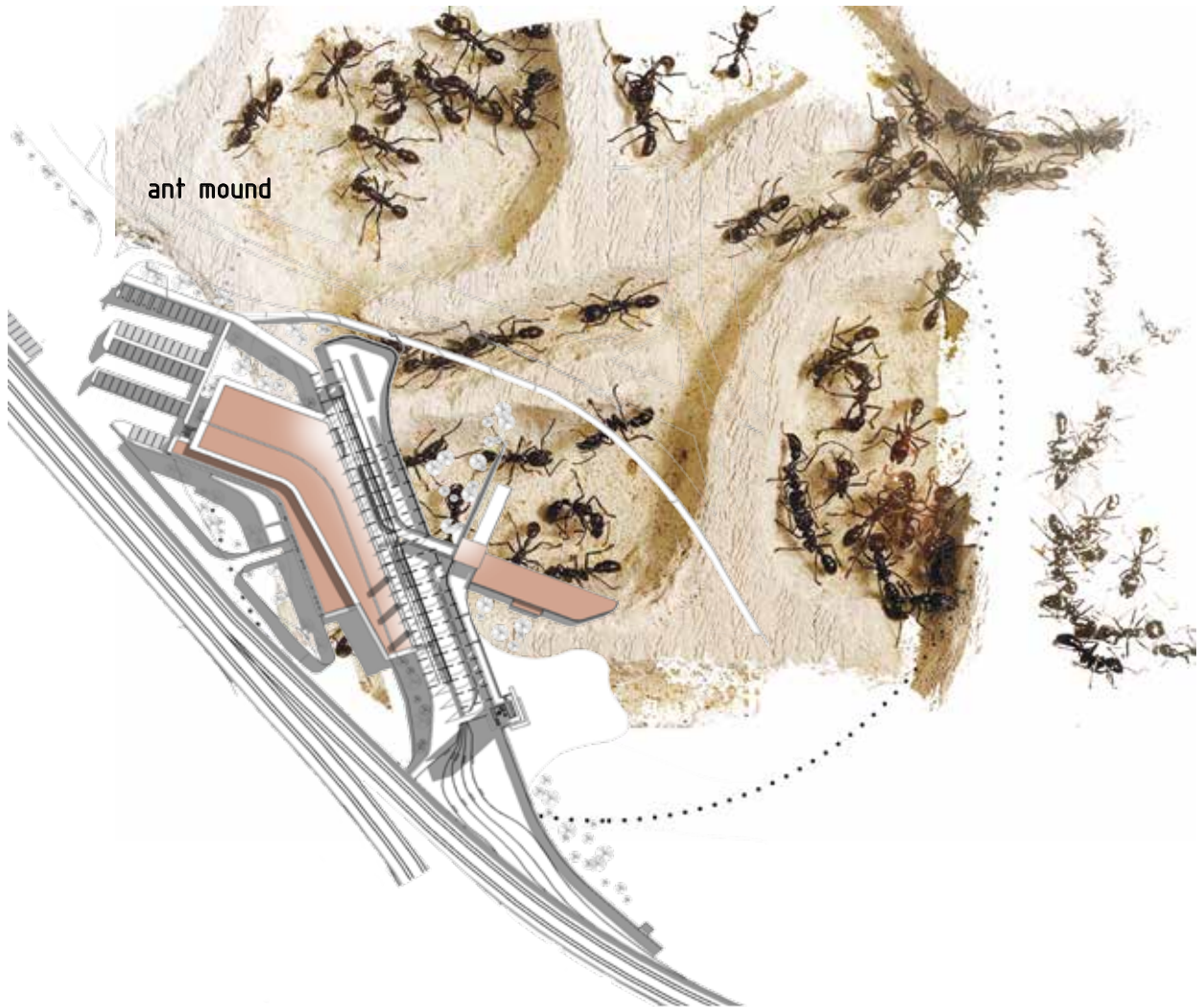
**FIGURE 6.28**

*Growth and efflorescence (Author, 2016)*



**FIGURE 6.29**

*Dynamic balance and tension (Author, 2016)*



**FIGURE 6.30**

*Bounded space (Author, 2016)*

## 6.5 FROM DISCONNECTION

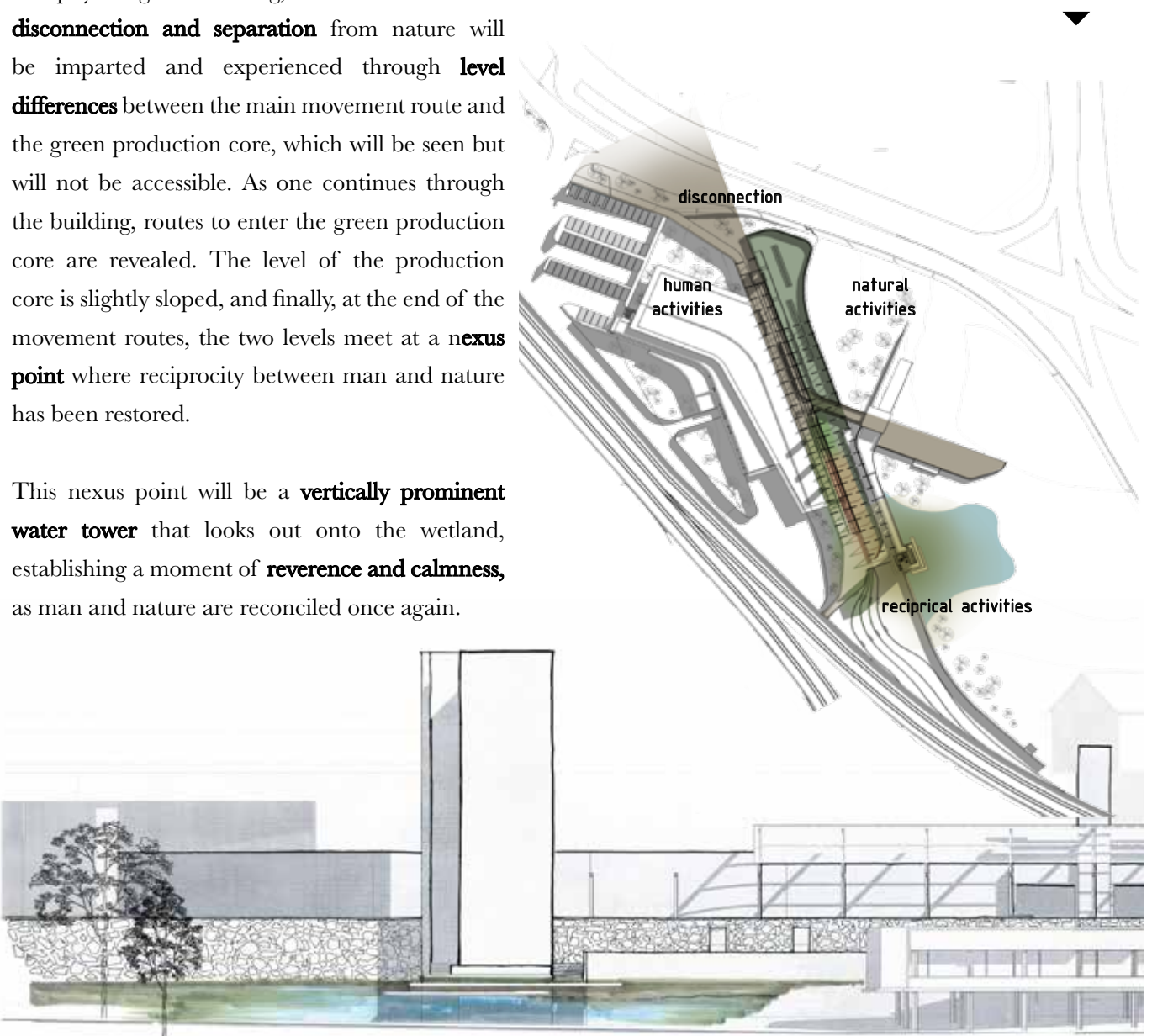
## TO A NEXUS OF RECIPROCITY

The **main circulation route** will articulate the transition between two states. As people enter the building to start the process of psychological or physiological healing, an awareness of **disconnection and separation** from nature will be imparted and experienced through **level differences** between the main movement route and the green production core, which will be seen but will not be accessible. As one continues through the building, routes to enter the green production core are revealed. The level of the production core is slightly sloped, and finally, at the end of the movement routes, the two levels meet at a **nexus point** where reciprocity between man and nature has been restored.

This nexus point will be a **vertically prominent water tower** that looks out onto the wetland, establishing a moment of **reverence and calmness**, as man and nature are reconciled once again.

FIGURE 6.31

*Illustration of transition from disconnection to reciprocity*  
(Author, 2016)

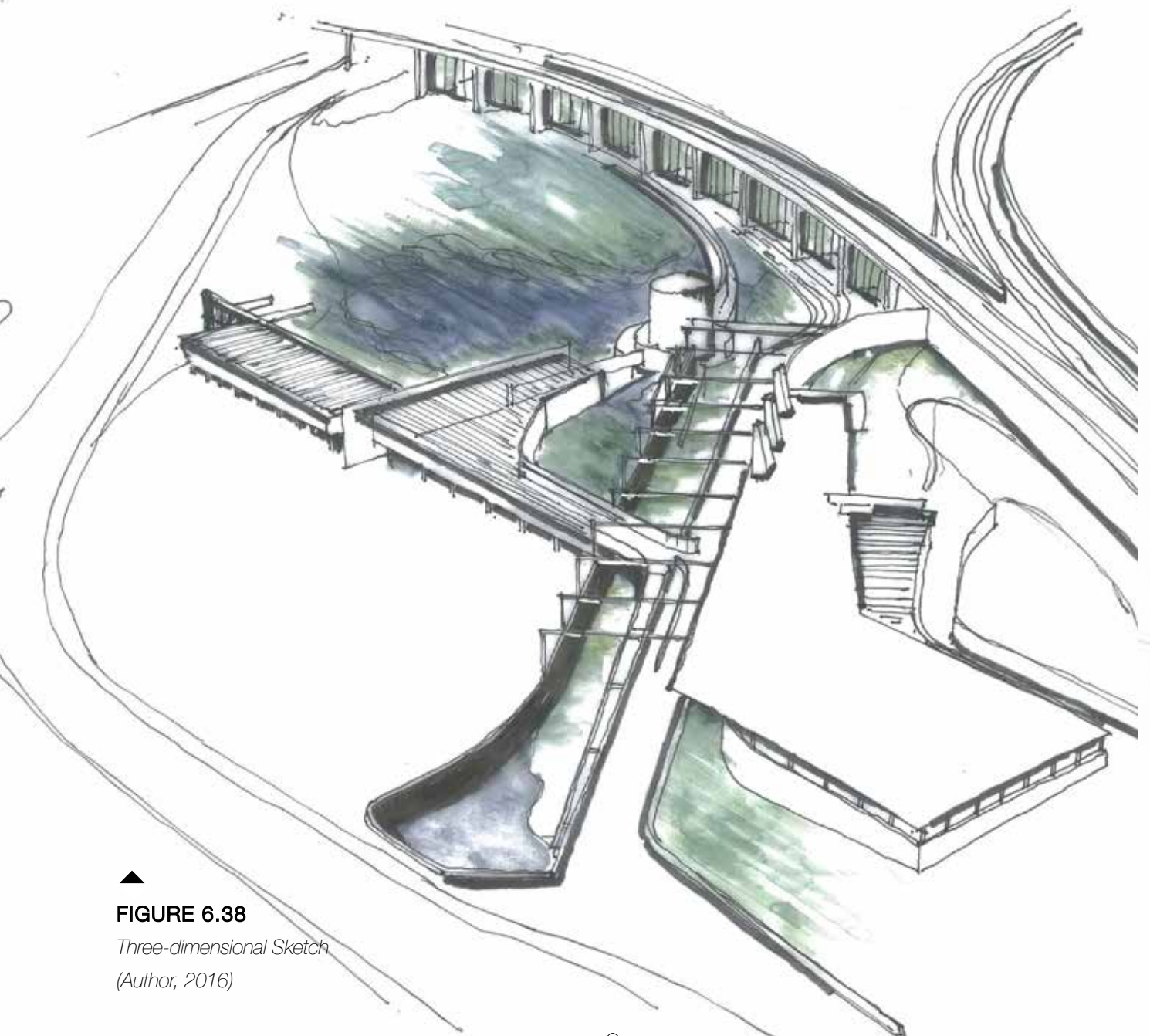




## 6.6 DESIGN ITERATION

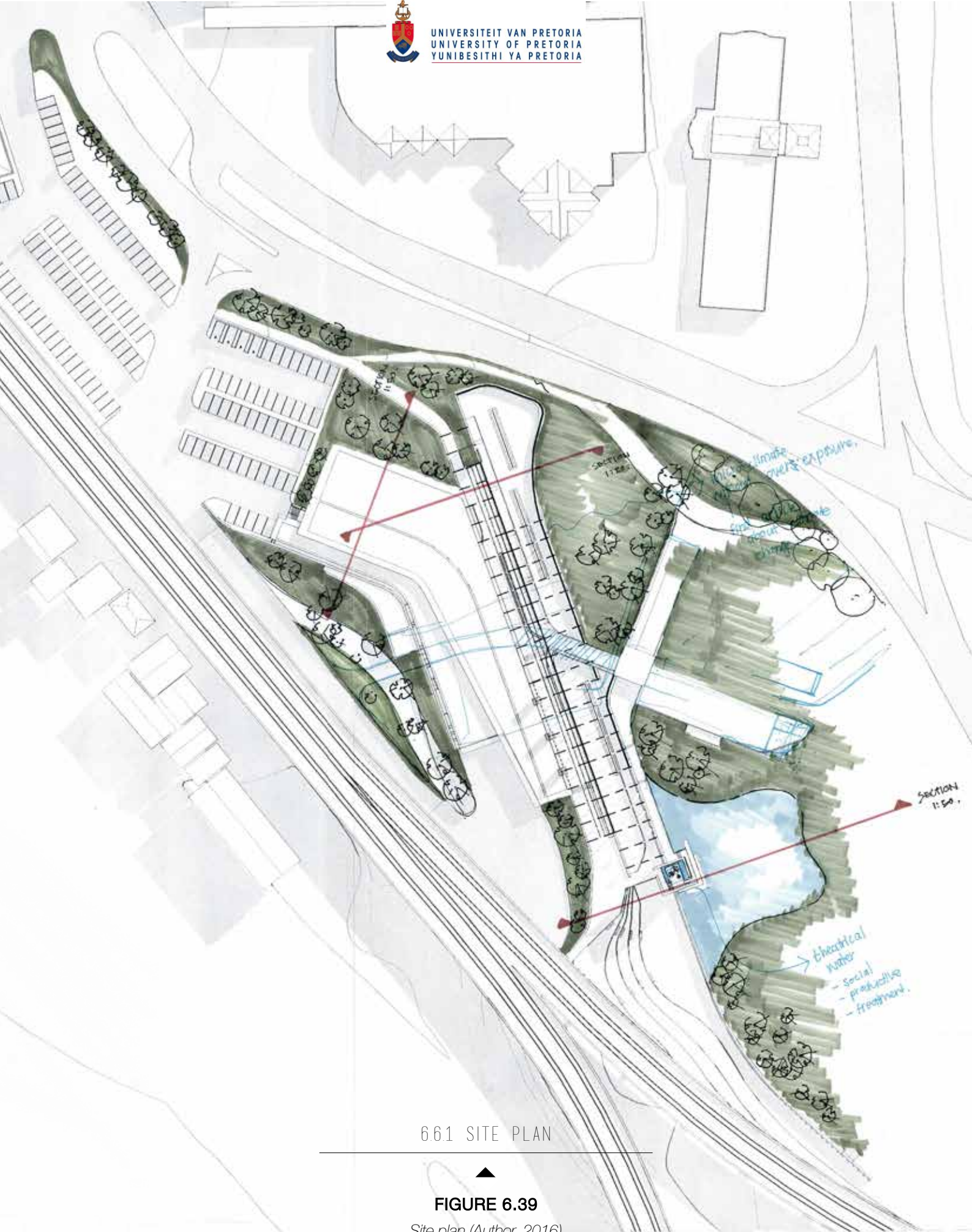
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The final design iteration fulfils the three core concepts of **healing and the celebration** on a programmatic, spatial and experiential level, and facilitates a deeper exchange between the social and ecological landscapes of the site.



▲  
**FIGURE 6.38**

*Three-dimensional Sketch*  
(Author, 2016)

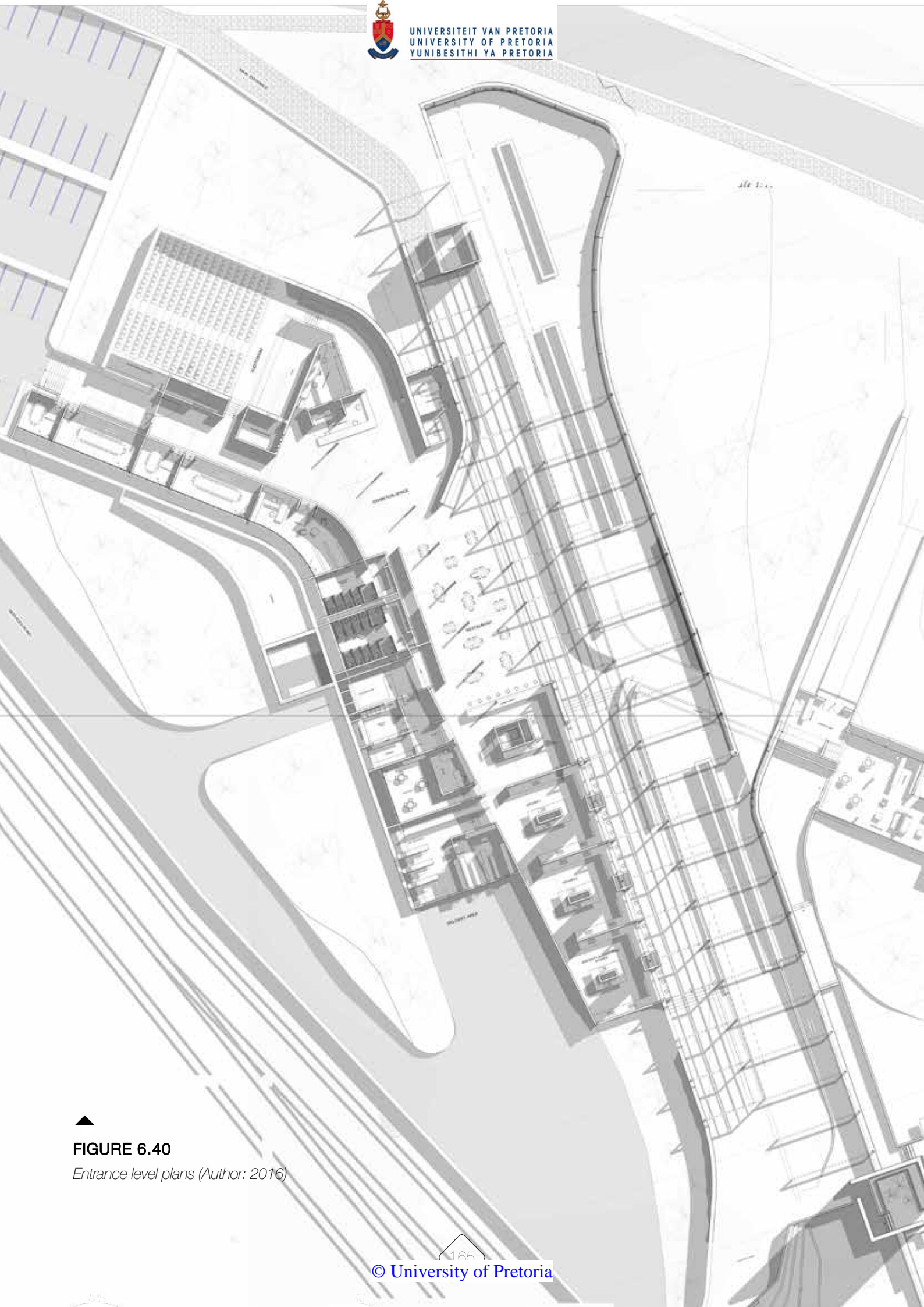


6.6.1 SITE PLAN



**FIGURE 6.39**

Site plan (Author, 2016)

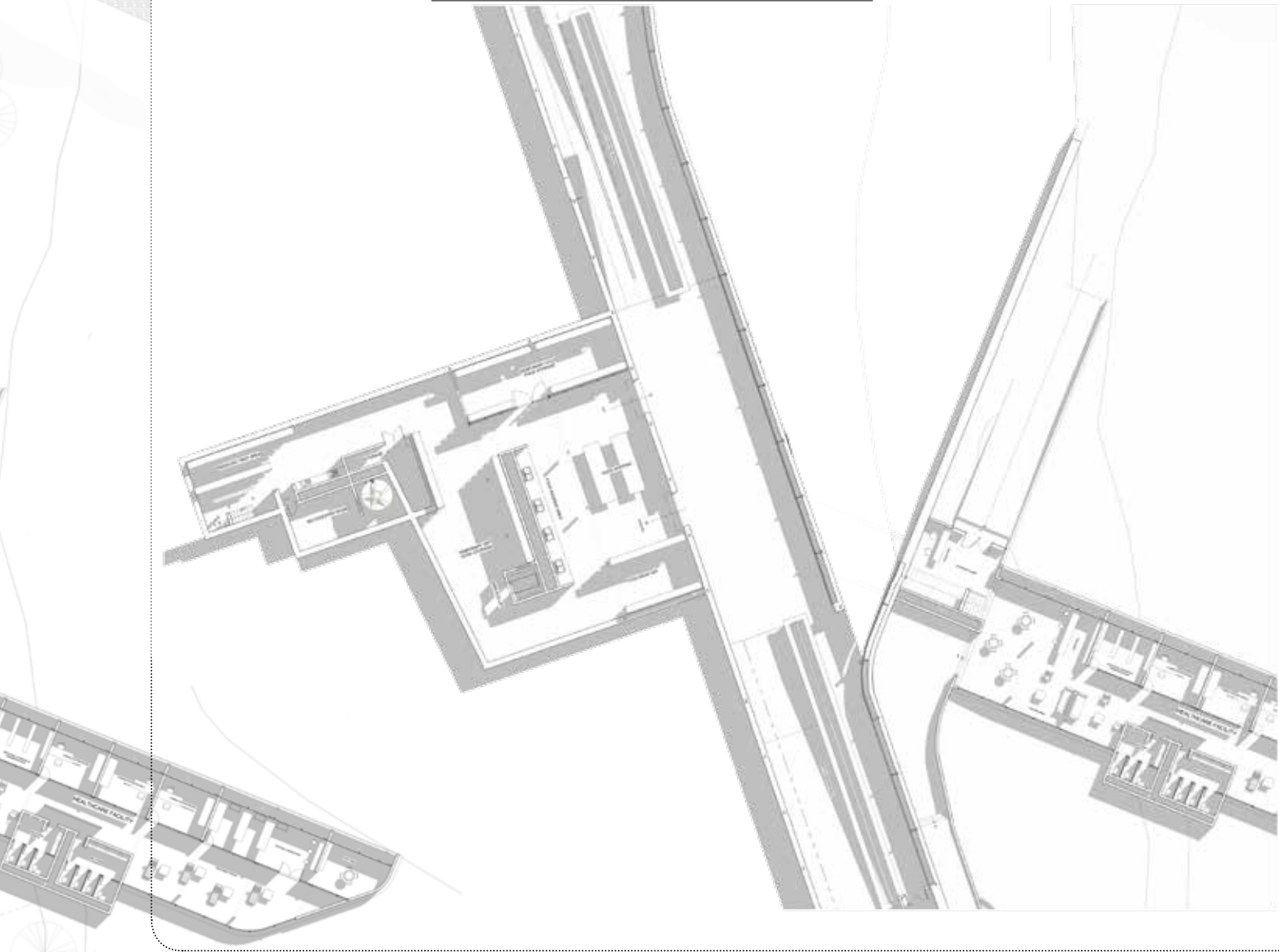


**FIGURE 6.40**

*Entrance level plans (Author: 2016)*

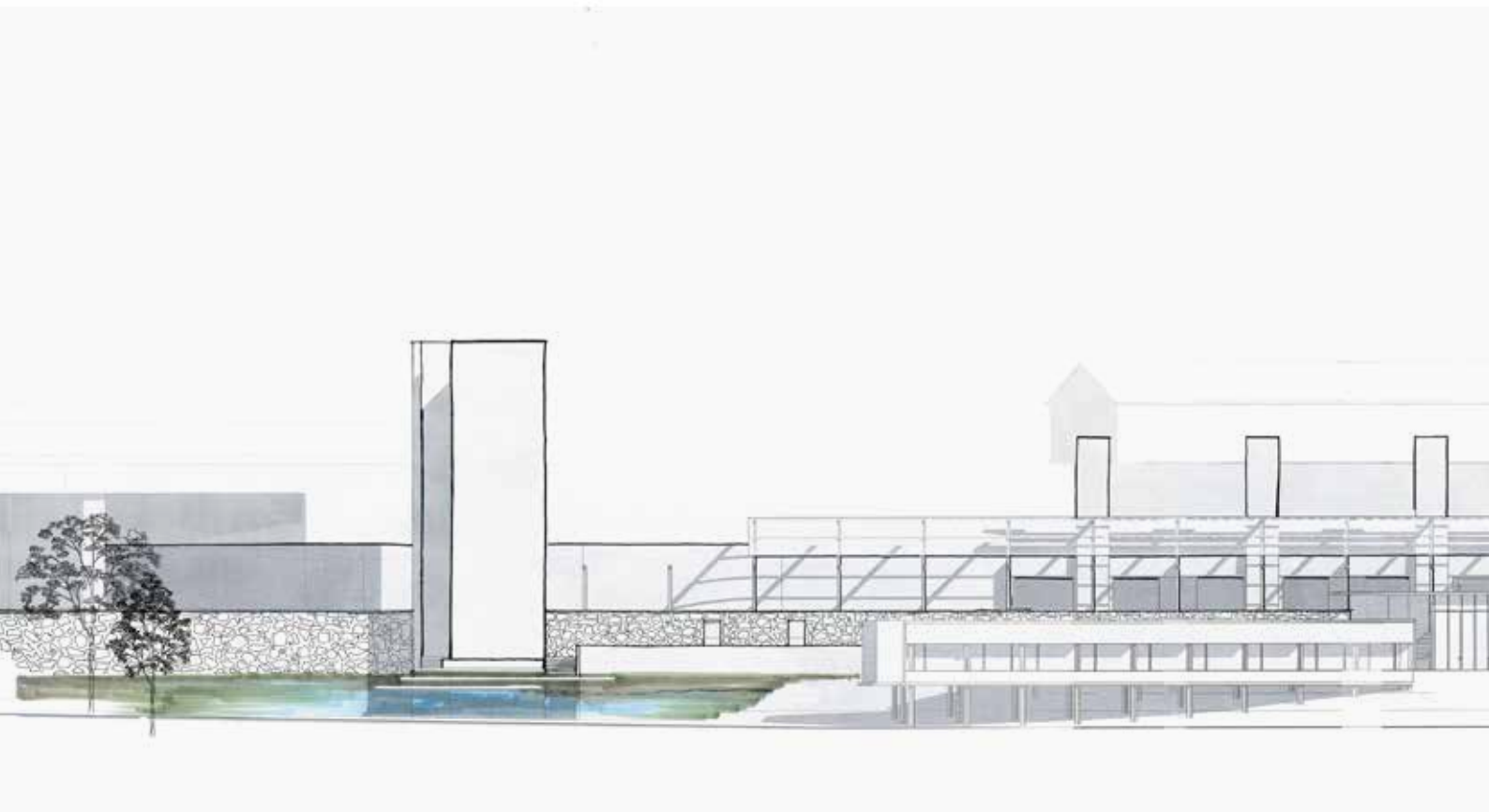


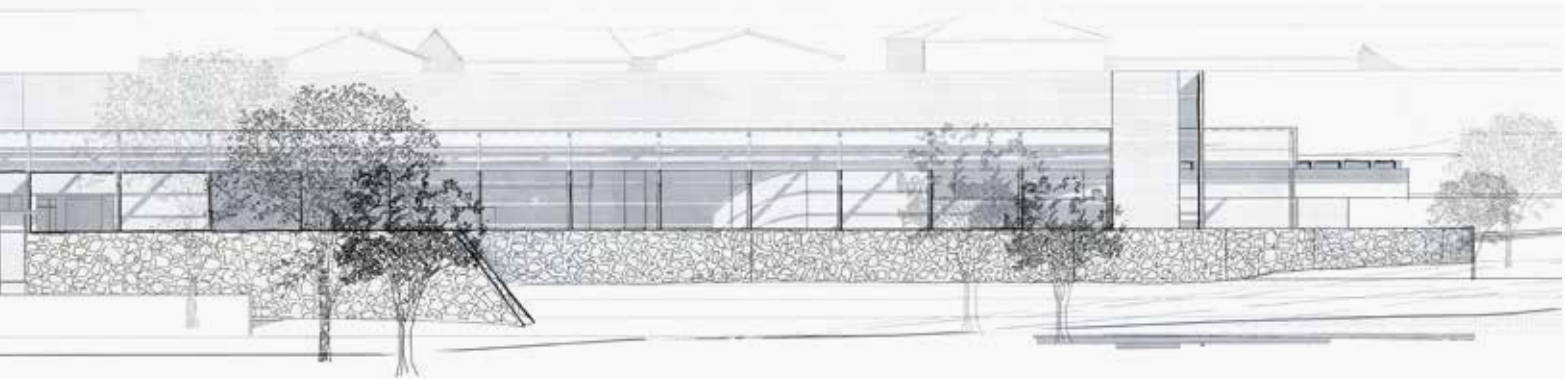
## 6.6.2 GROUND FLOOR AND SERVICE LEVEL PLANS



**FIGURE 6.41**

*Service level plans (Author: 2016)*



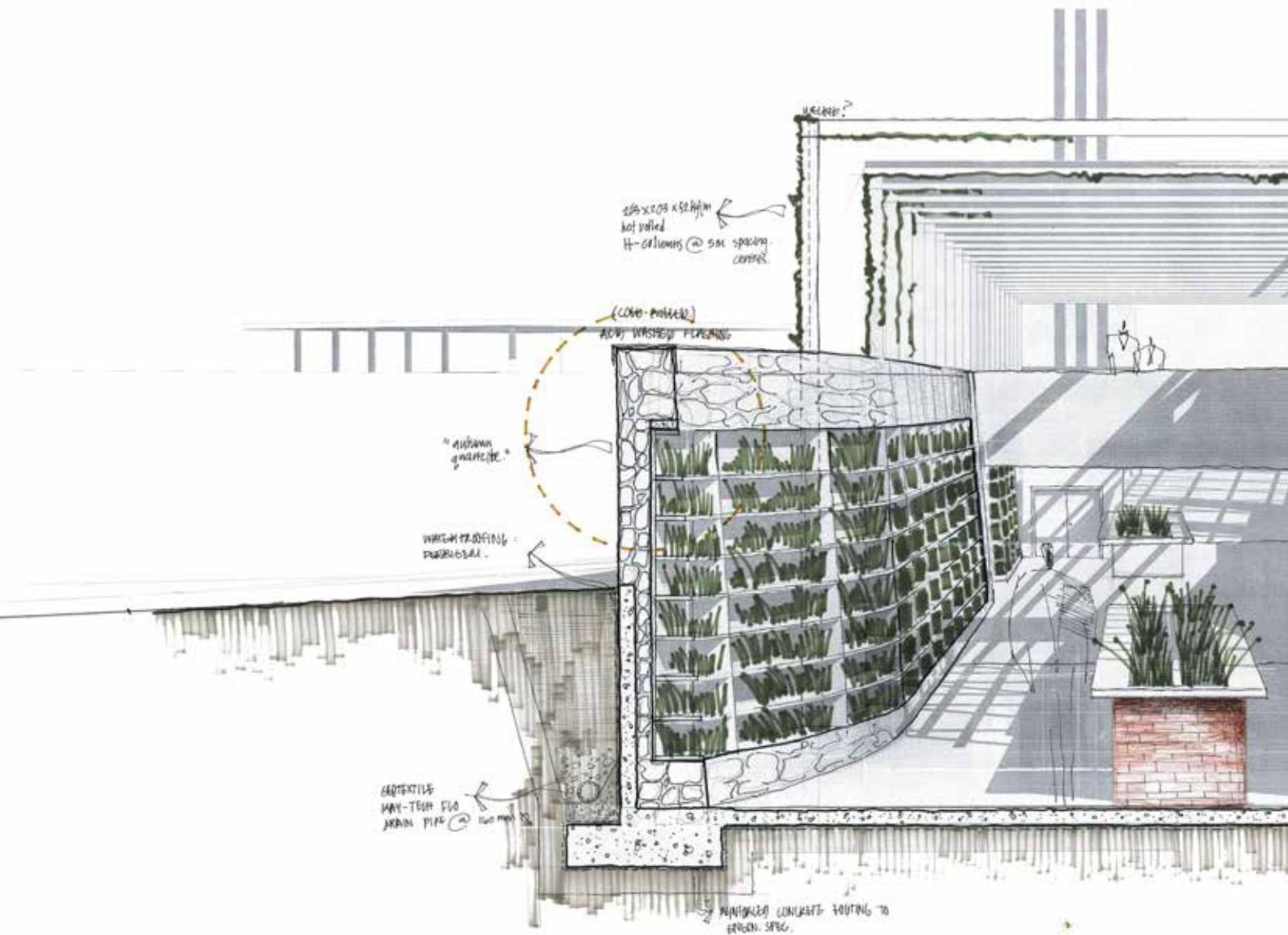


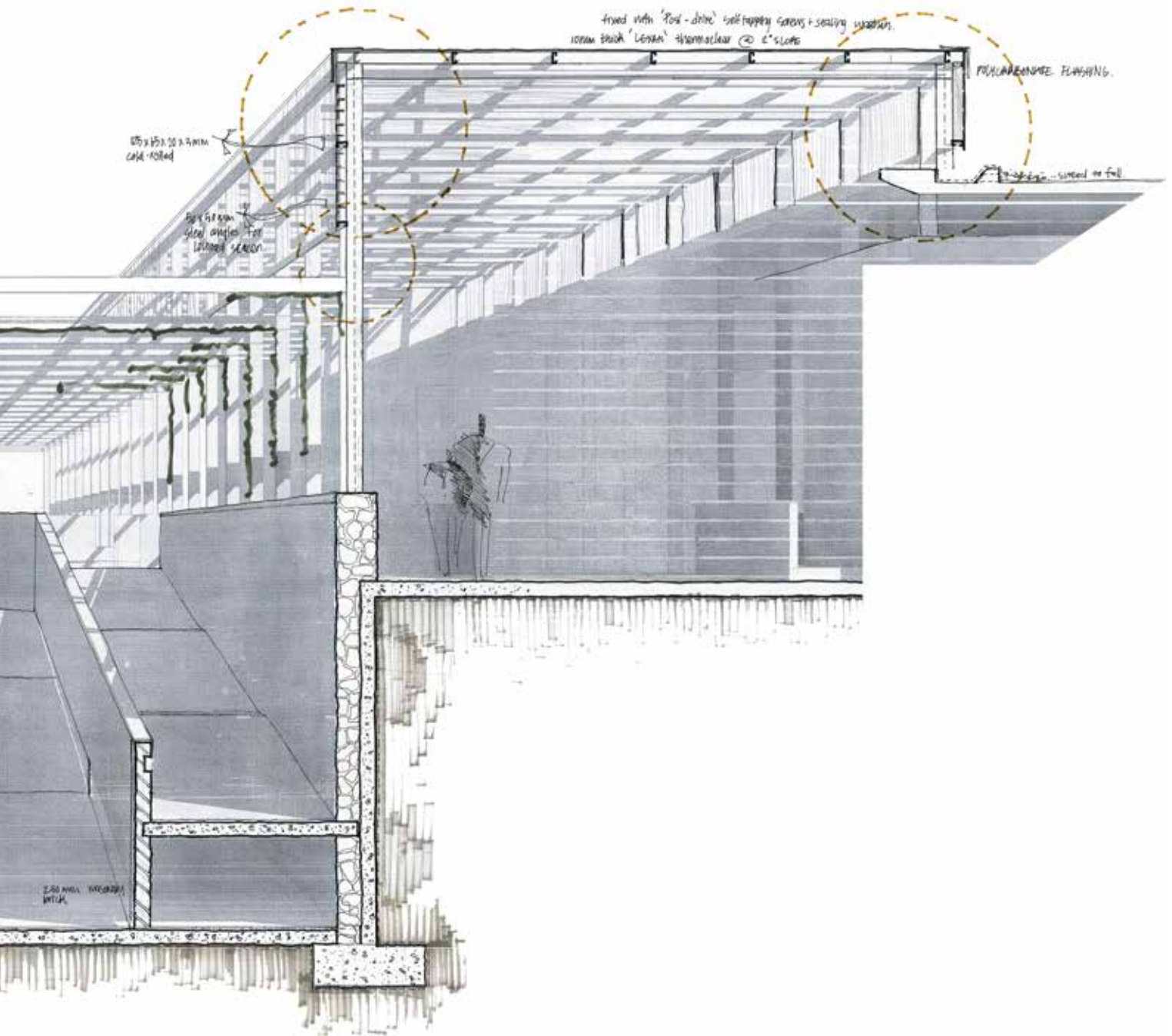
6.6.3 NORTH EAST ELEVATION



**FIGURE 6.42**

*North-eastern elevation on Thabo Sehume Street (Author, 2016)*





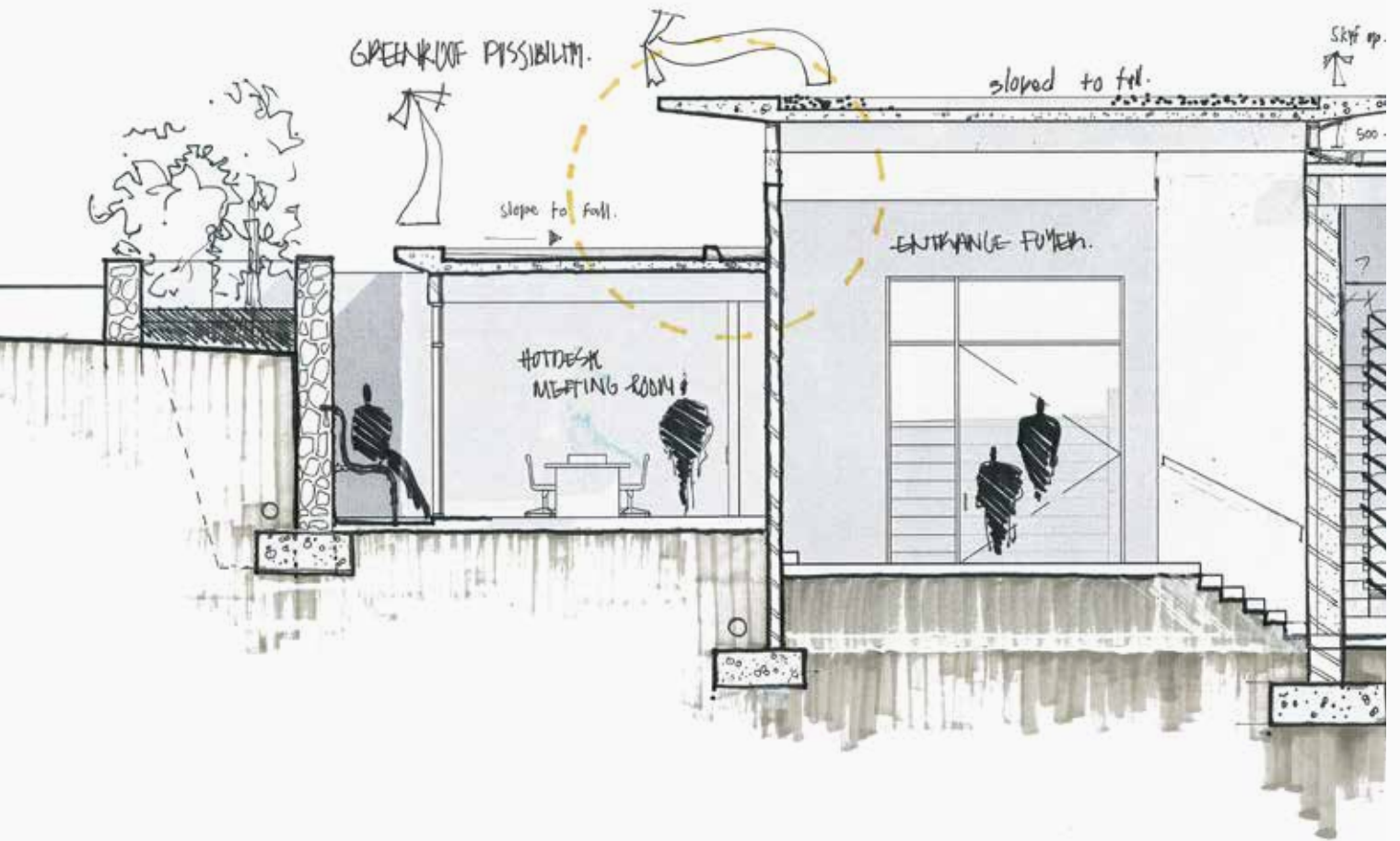
### 6.6.3 DISCONNECTION SECTION



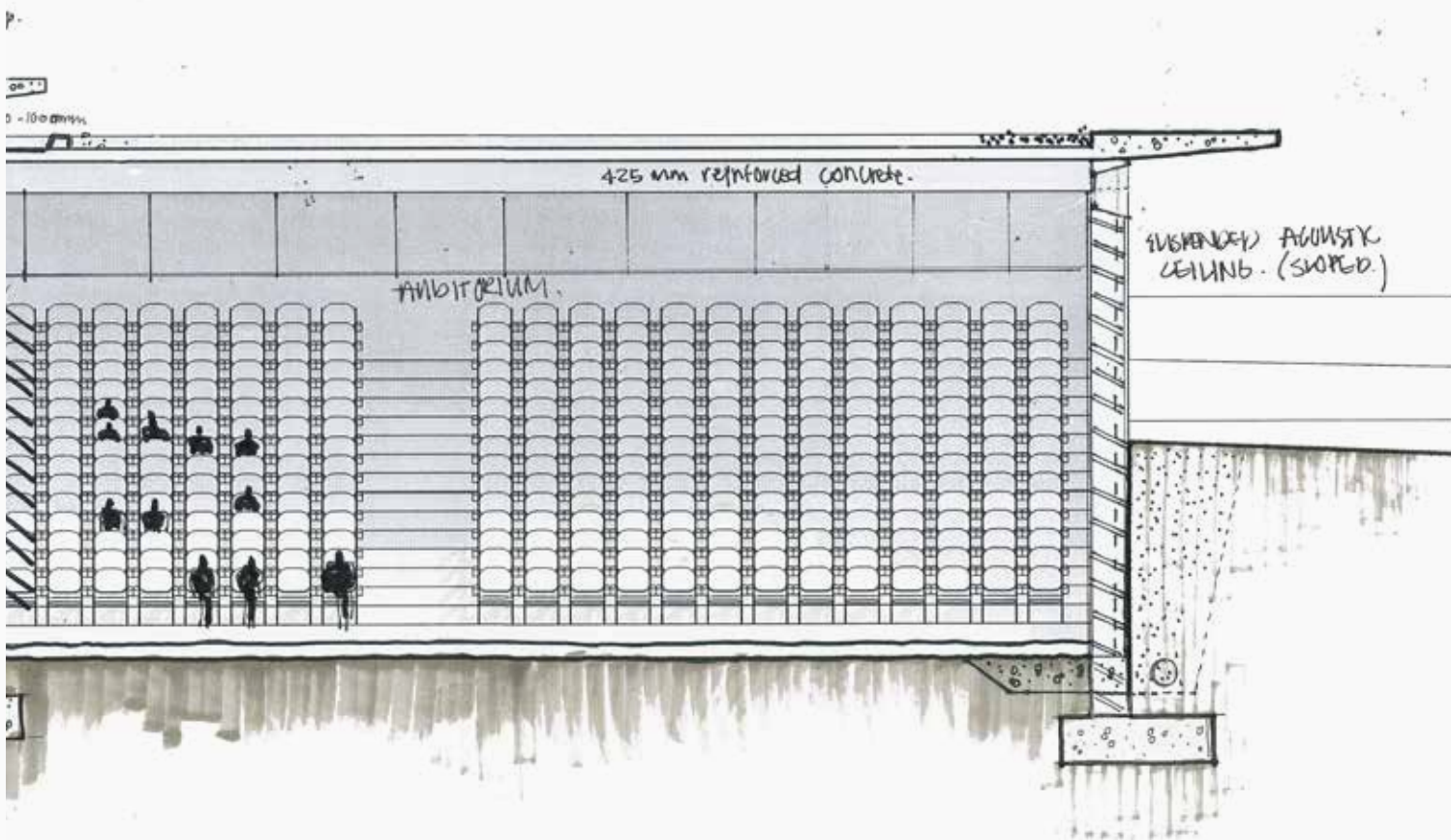
**FIGURE 6.43**

*Disconnection section (Author, 2016)*



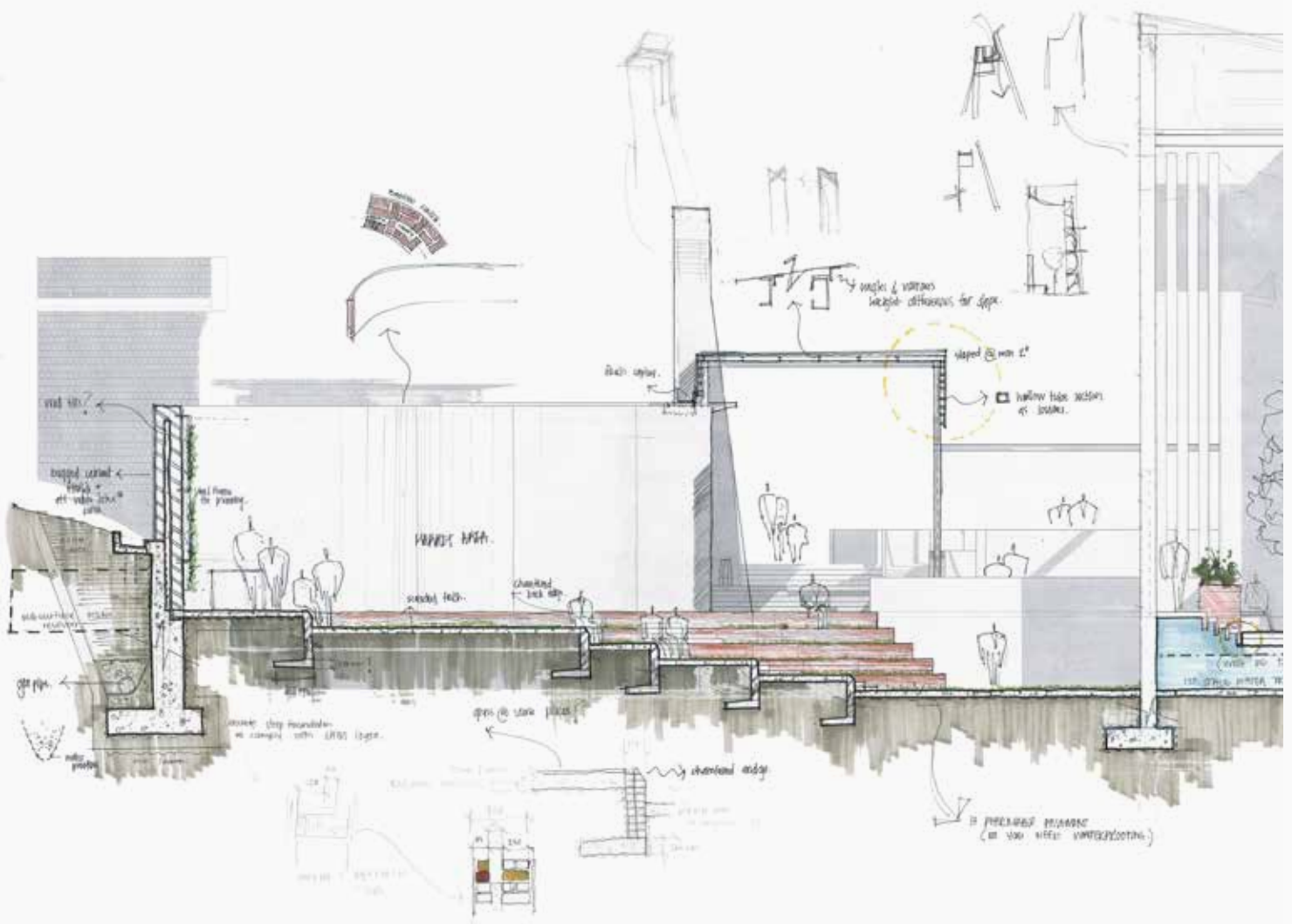


6.6.3 EDUCATIONAL SECTION



**FIGURE 6.44**

*Educational section (Author, 2016)*





### 6.6.3 RECIPROCITY SECTION



**FIGURE 6.45**

*Reciprocity section (Author, 2016)*