Restoring Reciprocity

BY

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M. Prof. Arch.

RESTORING RECIPROCITY

Between Man and Nature through Architecture
as the Mediating Device

Location:

South Berea 609, Corner of Nelson Mandela Boulevard (R21) and Thabo Sehume Street
Fountains, Pretoria, 0002

GPS:

25°45'43.0"S 28°11'37.3"E

Programme:

A Wellness Centre for Urban Diseases

Study Field:

Environmental Potential

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by Gardiol Crous

Submitted in partial fulfilment of the requirements for the degree
Master of Architecture (Professional)
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Edited by: Karlien van Niekerk

Declaration

In accordance with Regulation 4(e) of the General Regulations (G.57) for dissertations and theses, I declare that the thesis, which I hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not been submitted by me for a degree at this or any other tertiary institution.

I further state that no part of my thesis has already, or is currently being submitted for any such degree, diploma or other qualification.

I further declare that the thesis is substantially my own work. Where reference is made to the works of another, the extent to which that work has been used is indicated and fully acknowledged in the text and list of references.

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Gardiol Crous

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My parents, for your endless support, prayers and motivation,

My brother Mauritz, Barend & Wilan for your willing hearts and a helping hand

My fellow dreamer and partner in crime, Lean,

for all the rest.

Abstract

In the quest for achieving a modern civilization, the interconnected relationship between nature and humankind has changed to one of disconnection. This disconnection does not only compromise the natural environment but also underpins most concerns about the health and well-being of people. This is reflected in rising trends in "diseases of affluence" such as allergies, food intolerances, asthma and eczema, which are increasingly affecting urban citizens of all walks of life.

The proposed program is a wellness centre that is centred on the Slow Food initiative, promoting the concept that inner wellness is derived from appropriate eating habits. The program includes permaculture activities, a cooking pavilion and a culinary school, all serving as educational devices. A treatment clinic also forms part of the program to facilitate the healing of urban diseases. The site is located on the periphery of South Berea, functioning as a nexus area between the natural and urban conditions of Pretoria where reciprocity can be effectively restored.

The aim of this dissertation is to explore how architecture can be the mediating device that on the one hand heals the deteriorating natural environment, and on the other heals humans that have been compromised by their environment, to ultimately restore the reciprocal relationship between them as part of the same living system. Regenerative architecture, bioremediation, biophilia and biomimicry will be investigated and adapted at different scales to create a theoretical design framework. This will support and inform the building to function as a social habitat that promotes resilient health in both nature and humans that is not only perceived as the absence of illness, but is expanded to include a state of general well-being, shifting the disconnected condition of "humans versus nature" to one of "humans with nature".

Ekserp

In die mens se soeke na ‘n moderne samelewing, het die noodsaaklike interaktiewe verhouding tussen mens en natuur tot skade gelei. Hierdie gedronge verhouding het verslegtende gevolge vir beide die natuurlike omgewing, asook die algehele welstand en gesondheid van mense ingehou. Onder andere is daar‘n toenemende tendens waargeneem, veral in stedelike gebiede, van siektes soos allergie, sinisitus, voedsel intoleransies, asma en ekseem, wat ‘n direkte verwanskap met klimaat en omgewings veranderinge het.

Die voorgestelde projek is ‘n Gesondheidsentrum gabaseer op die “Slow-food” beweging wat die produksie van voedsel ondersteun wat geen toenemende las op die aarde se hulpbronne, ekosisteme en omgewing plaas nie en terselfde tyd die proses van genesing en algemene welstand vir mense bevorder. Die projek sluit permakulturele aktiwiteite in waarin die gemeenskap kan betrokke raak en ‘n kulinêre skool wat oplossings verskaf vir ‘n leefwyse waaruit beide die mens en natuur bevoordeel kan word deur toepaslike plant, eet en kook gewoontes. ‘n Behandellingskliniek vorm deel van die projek om genesing te fasiliteer vir ernstige siekte toestande wat stedelike inwoners op ‘n daaglikse basis ervaar in die konteks van ‘n moderne samelewing.

Die perseel is geleë in die omgewing van Suid Berea, wat tans funksioneer as ‘n drumpel gebied tussen die natuurlike en stedelike kondisie van Pretoria, waar die wederkerige verhouding tussen mens en natuur weer herstel kan word.

Die doel van die verhandeling is om ondersoek in te stel oor hoe argitektuur as ‘n bemiddelaar geimplementeer kan word, wat enersydse herstel kan bewerkstellig van die natuurlike omgewing en die gesondheidswelstand van die mens en sodoende die voortbestaan van ‘n gesonde en lewensgewende ekosisteem te verseker.

‘n Teoretiese raamwerk met rigting-gewende ontwerp beginsels sal voorgestel word as ‘n ondersteunings en inligting handleiding om die ontwikkeling van die argitektoniese taal ondersteun. Regeneratiewe ontwerp en ontwikkeling, Bio-remediëring, Biophilia en Bio-nabootsing is almal teoretiese beginsel wat verwys na die noodsaaklike interaksie tussen die mens en sy omgewing, om volhoubaarheid en toenemende lewenskwaliteit te bewerkstellig.

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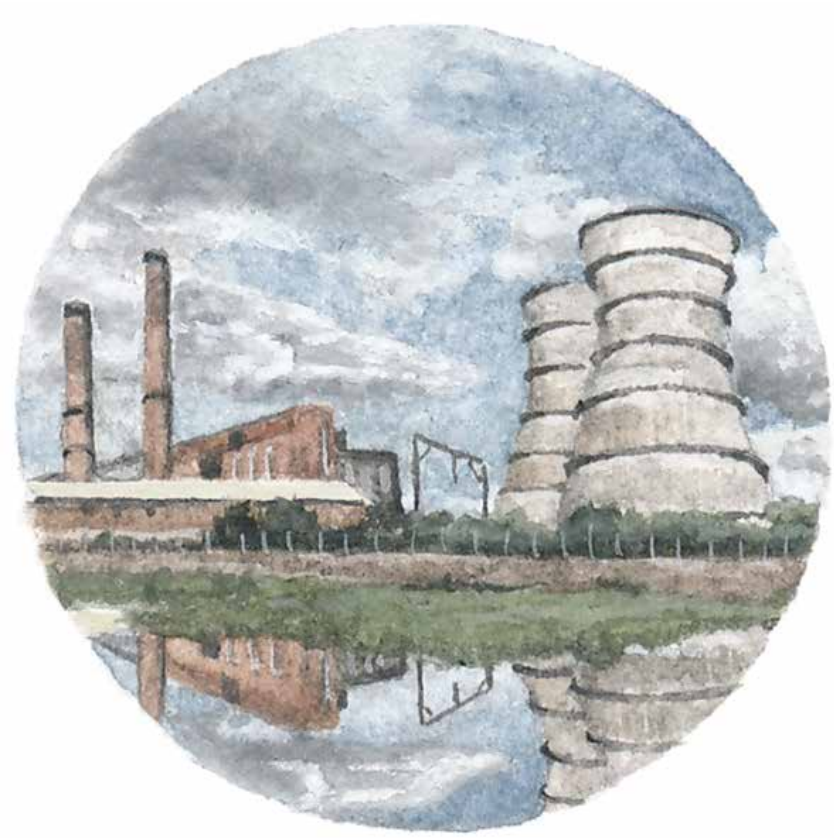


FIGURE 1.1

Day 259, The Athlone Cooling Towers

(Lorraine Loots, 2013)

chapter one

INTRODUCTION

> "*The quality of the air we breathe, the purity of the water we drink, the wholesomeness of the food we eat and the level of radiation we are exposed to is in an endless state of flux and flow. As a consequence, our judgments of "nature" vary continuously. Nature can be perceived as redemptive, but the contemporary reality and perception has regrettably become one of a toxic and hazardous environment, bearing the threat of illnesses.*"

Giovanna Borasi & Mirko Zardini (2012: 21)

1.2 BACKGROUND INFORMATION

Ironically, it is by the hand of human beings in their quest towards achieving a **modern civilization** that the very foundation of human existence has been compromised, and nature, the ideal source of healing, has become that which makes us sick. This is unavoidably evident within the context of Pretoria. According to Borasi and Zardini (2012: 20), pollution and smog, fine dust and biotechnology, genetic manipulation and global warming underpin most concerns about the future of the city and consequently have an impact on **human health and well-being.**

A constantly changing relationship exists between our bodies and the environment, and unfortunately these changes now seem to become worse (Borasi & Zardini, 2012: 15). The immunologist Marc Jackson (2006: 174) claims that it is not surprising that dramatic modifications in modern lives were implicated in rising trends of diseases such as allergies, food intolerances and asthma, previously defined as **"diseases of affluence"**. Our bodies are not biologically suited to cope with the sudden **environmental changes** they have been subjected to in recent decades. Researchers Michael L. Power and Jay Schulkin (Borasi & Zardini, 2012: 35) share this opinion, speaking of a "mismatch between adaptive biological characteristics of our species and the modern environment." There is thus a great urgency to unravel and understand the real crises of which illness is only a symptom. To **'diagnose'** the root of the problem we should investigate the historical connections between the natural environment, the health and wellbeing of its users, and the design of our urban environments (Borasi & Zardini, 2012: 16).

FIGURE 1.2

Image of urban inhabitants compromised by nature

(Borasi & Zardini, 2012)

1.3 PROBLEM STATEMENT

1.3.1 THE GENERAL ISSUE

It becomes necessary to imagine and explore how architecture and urban design can play a different role that, on one hand, repairs the environment and contributes to the responsible use of a region's resources, and on the other gives the architect or designer the chance to fulfill a new therapeutic function (Borasi & Zardini, 2012: 26) A building thus adopts the role of being the **mediator** between humanity compromised by nature's detrimental effects and the natural environment itself, in order to facilitate a healing process and repair a **disconnected relationship.**

All these attempts operate on the optimistic premise that design is capable of delivering individual and **collective wellbeing.** The environment is considered the prime determinant of a population's state of health. In this regard, architecture can play a fundamental role in ensuring **reciprocity**; a relationship between opposites that allows for mutual exchange of benefits. The most significant shift for architecture and urbanism will be from the idea of **'cure'** to the idea of **'care',** not only of our bodies, but also our environments, in order to regenerate a more holistic relationship to place (Mang, 2009: 7).

1.3.2 THE ARCHITECTURAL ISSUE

The divine and ideal relationship between nature and humankind was an interconnected living system, in which all had equal rights and responsibilities (Rios, 2013: 200). The prehistoric architectural expression of this condition was **building in a landscape.**

However, as a consequences of the reductionist paradigm of the early 20th century, underpinning Modern Man's ideals, this relationship was turned on its head, as human needs and desires dictated that humans and their built environments hold sovereignty over nature (Rios, 2013: 201). The architectural result can be defined as **building on a landscape.**

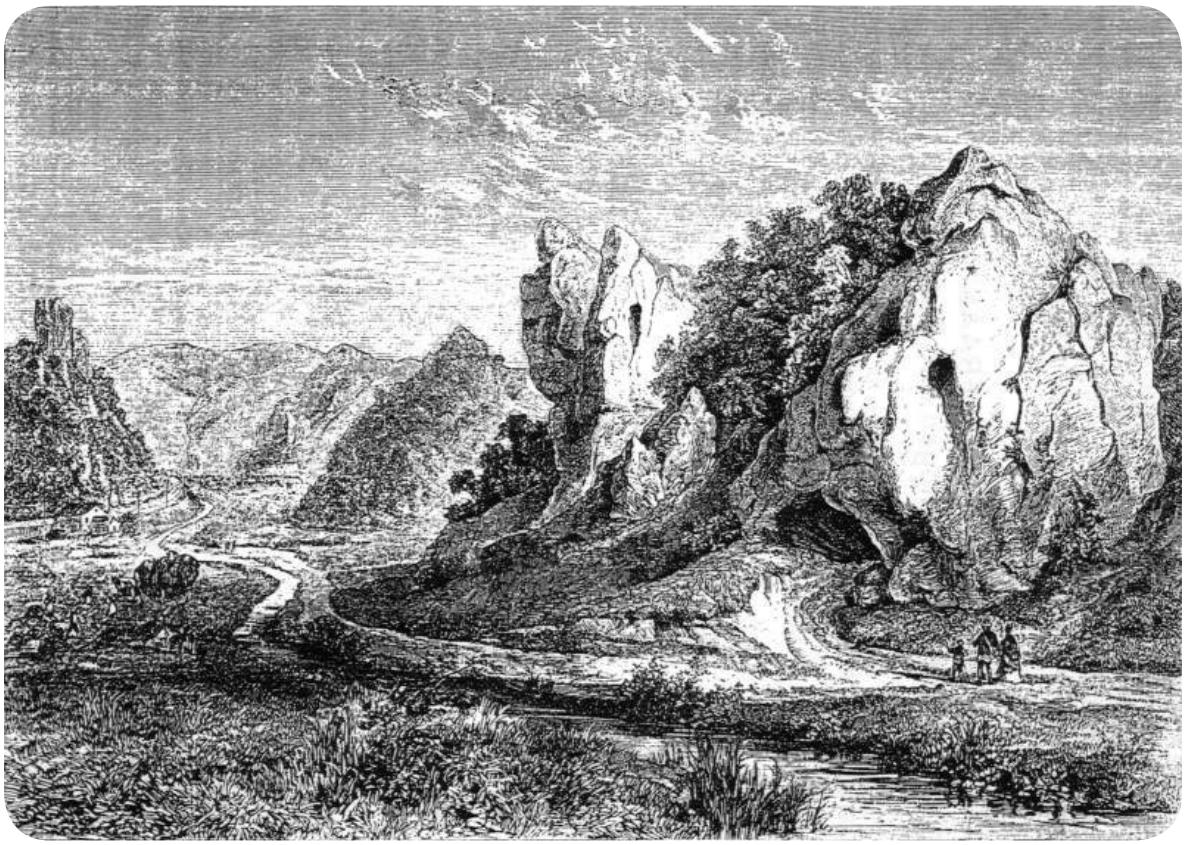


FIGURE 1.3

Building in a landscape: Sketch of Hohle Fels Cave, Germany.

(Ancient Wisdom, 2004)

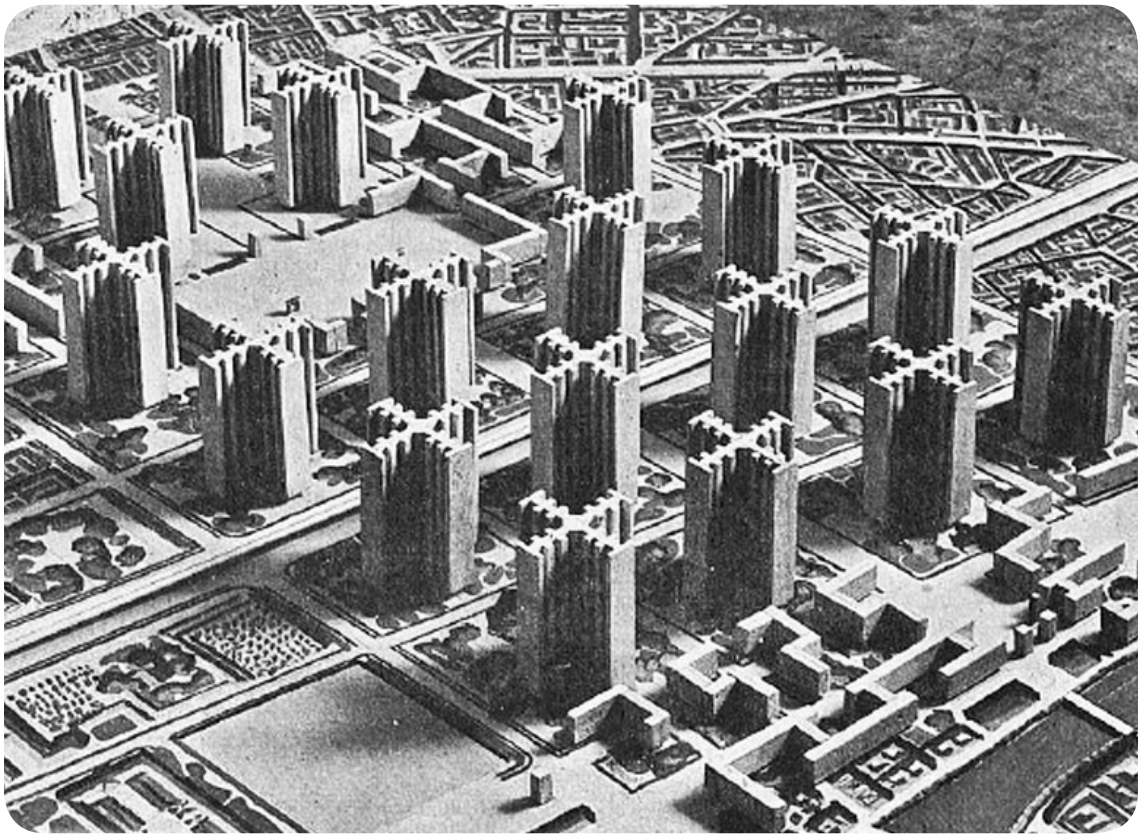


FIGURE 1.4

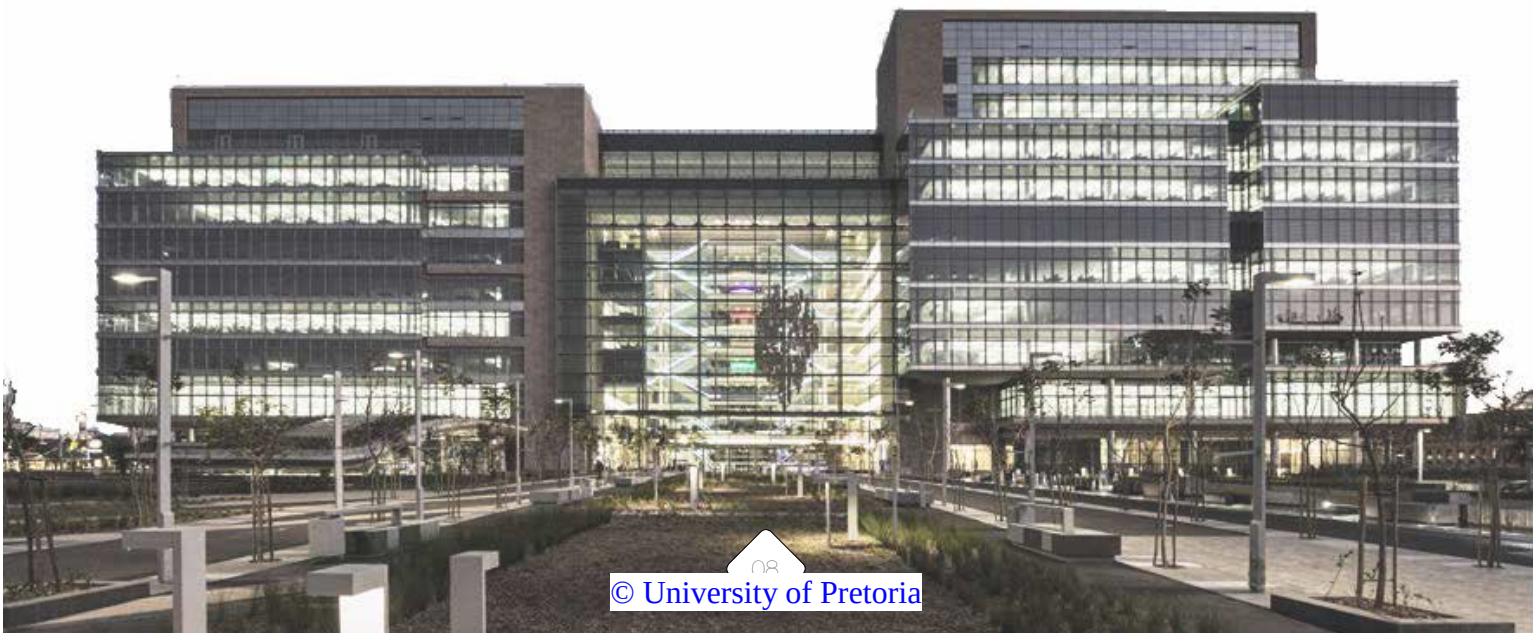
Building on a landscape: Ville Radieuse, Le Corbusier, 1933.
(Editions Parentheses, 2015)

Consequently nature could no longer sustain resource extraction and buildings could no longer sustain man's rapidly growing and changing needs, leading to redundant buildings. Temperature increases have been noted since 1971 (Intergovernmental Panel on Climate Change (IPCC), 2014: 5). The years between 2001 and 2010 were marked as the warmest decade on record, the pinnacle point of global shock due to the effects of man's unsustainable rate of living and consumption. **Global warming and climate change** (IPCC, 2014: 6) have a huge effect on the health and well-being of cities and their inhabitants. Thus, in the same way that humans have disconnected themselves from nature, resulting in an extractive rather than a reciprocal relationship, so too have humans disconnected themselves from their well-being, extracting from their physical and mental reserves rather than building reciprocity between mind, body and spirit, which not only leads to multiple **immune disorders and urban diseases** but also to a general lack of psychological wellbeing.

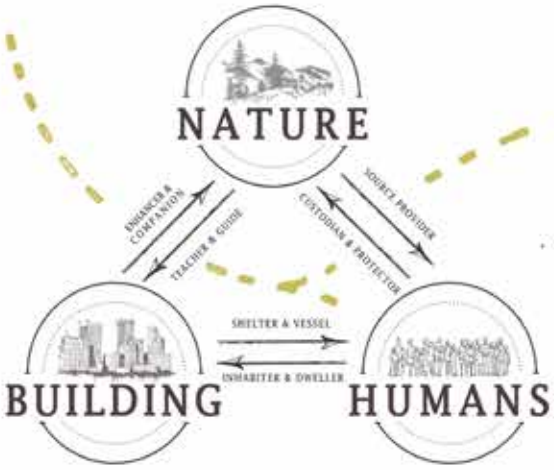
As one of the contributors to this state, the building industry's response was the acceleration of the movement towards sustainability, particularly the green building movement, resulting in **building for a landscape.** Although it largely contributed to technical advantages, it did reduce architecture's possibilities to a set of rules and a checklist to comply with in order to achieve sustainable and 'green' architecture. The result led to homogeneous, standardized typologies (Du Plessis, 2012: 5), creating further separation in an already fragmented relationship between nature and humans.

FIGURE 1.5

Building for a landscape: Standard Bank Rosebank, Johannesburg, Grosskopff Lombart Huybrechts Architects, 2012. (GBCSA, 2013)

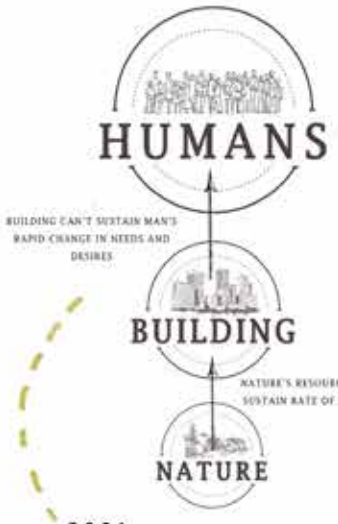


01



building IN a landscape

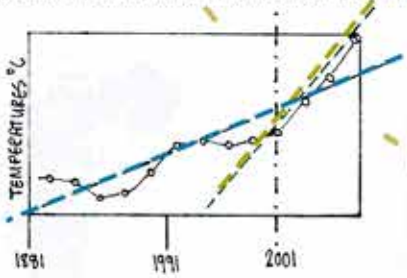
02

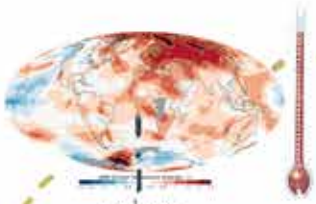


03

building ON a landscape

2001
GLOBAL WARMING TURNING POINT



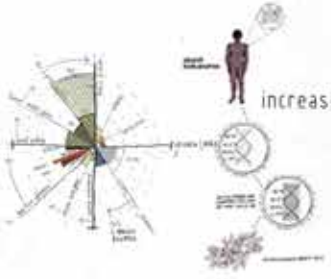


nature

DISCONNECTED CONDITION

humans

04



internal effects
increase in urban illnesess

external effects
compromised living environment

REST

building FOR a landscape

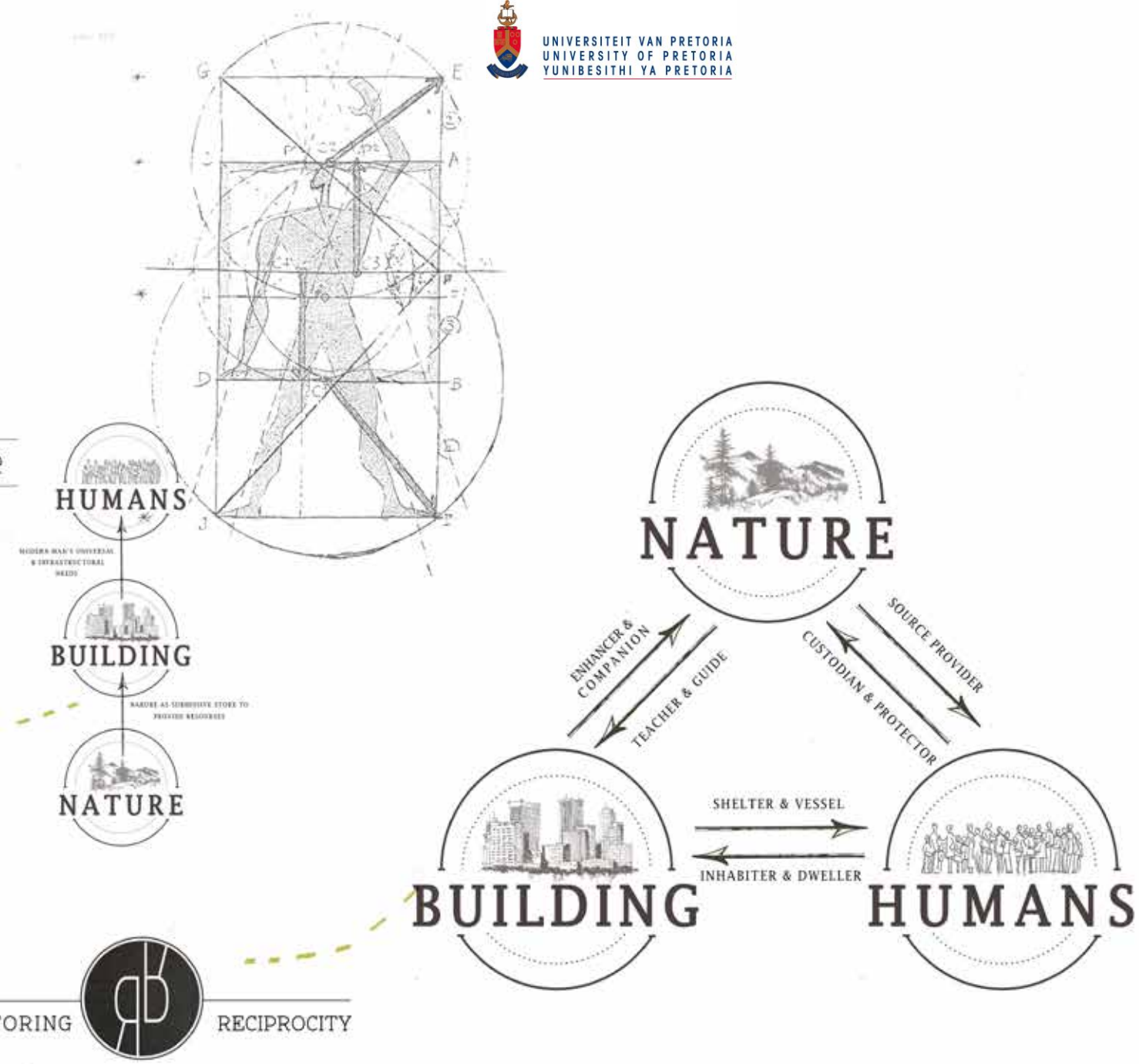


FIGURE 1.6

Diagram illustrating architectural intention as building as a landscape.

(Author, 2016)

It thus becomes necessary to explore new means of how architecture can **restore reciprocity** between nature and humankind on **equal terms,** especially for people whose health is compromised instead of improved by nature. The possibility arises to not only explore building in a landscape, on a landscape or even for a landscape, but to consider designing a **building to function AS a landscape.** By investigating the notion of expressing the physical and intangible qualities of nature within a building, the building would no longer be viewed as the prominent antagonist, but rather as the **mediator** to restore the reciprocity between the compromised landscape and the compromised health and well-being of man.

FIGURE 1.7

The discarded landscape that the West Urban Framework focuses on. (Author, 2016)

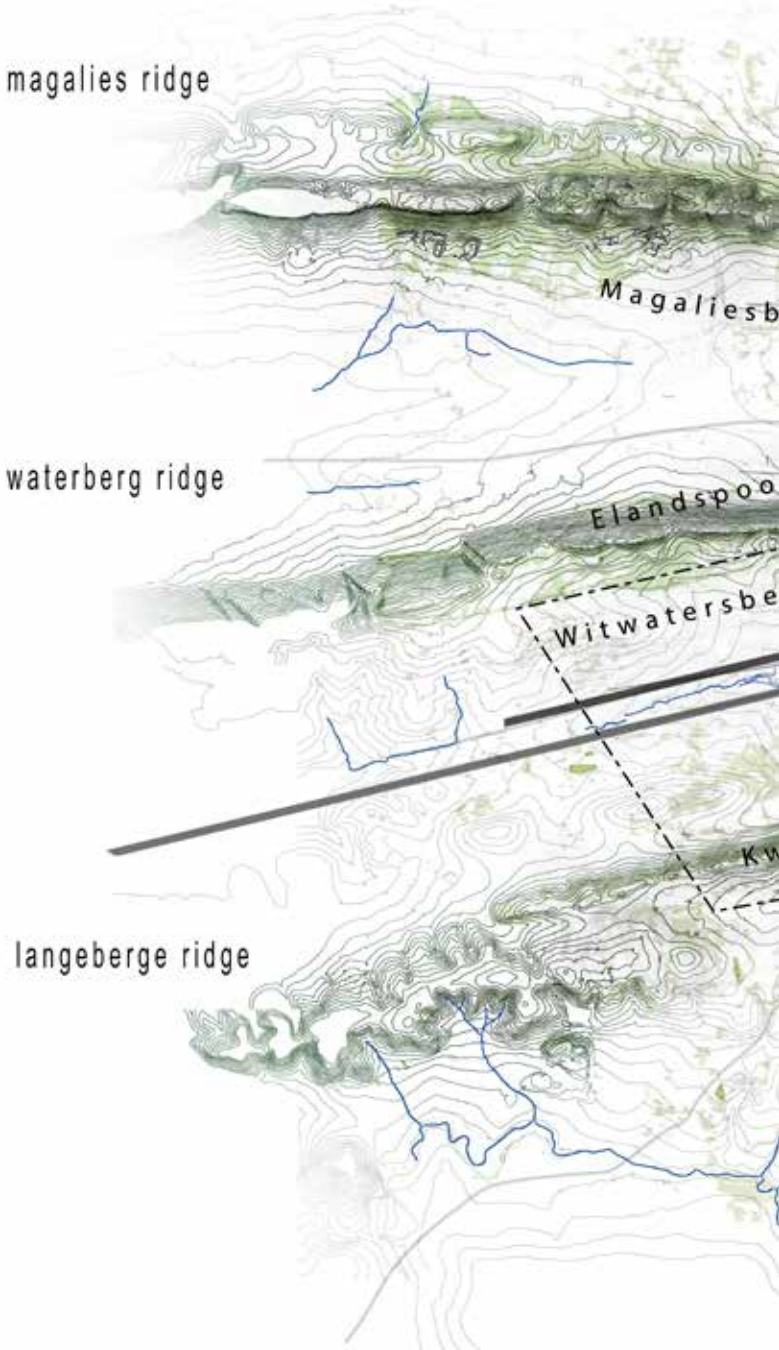
1.3.3 THE URBAN ISSUE

The development of the modernist city, focused on zoning principles, severely influenced territorial management and urban planning choices, contributing to blue and green **ecosystemic dilapidation.** According to Berman (2011:2), the metropolises of Gauteng are particularly exposed to the risks that contribute to climate change, energy scarcity and processes of decay. These present hazards to the health of our cities and their inhabitants by contributing to the rise and creation of urban diseases.

The vision of the Urban Framework is directed towards **The Discarded Landscape of the West** and aims to address the unsustainable and problematic developmental trend towards the east of Pretoria, which has resulted in an **unbalanced city.** The dissertation will tie into the larger vision by attempting to address and restore the ecological conditions predominant in the West. The landscape is therefore viewed as the most prominent medium for urban analysis.

1.4 SITE CHOICE

To find the most appropriate site to achieve **ecological regeneration,** ecological components present within the city of Pretoria were mapped. These include rivers, ridges, hills, nature reserves, green open space and post- industrial brownfield sites (Van der Walt, 1967: 16). The **South Berea Precinct**, forms part of the southern entry gateway into Pretoria. This area was chosen as the most appropriate as it is located on the barrier line of where the West and East seem to be separated, providing an opportunity to ensure a reciprocal relationship between man and nature to be established through design initiatives.



The site is located within 400m walking distance from the Pretoria Gautrain Station, and is positioned in a natural 'basin' that has the potential to contain energy. However, a Mercedes Benz dealership is currently facing the piece of open land that presents huge opportunities to form part of a larger **ecological corridor** if the dealership were to be relocated. The site lies near the periphery of Nelson Mandela Drive, a main transport artery connecting the southern and northern areas of Pretoria. The Apies River, which runs adjacent to the road, can be integrated into the vision for **ecological reclamation.**

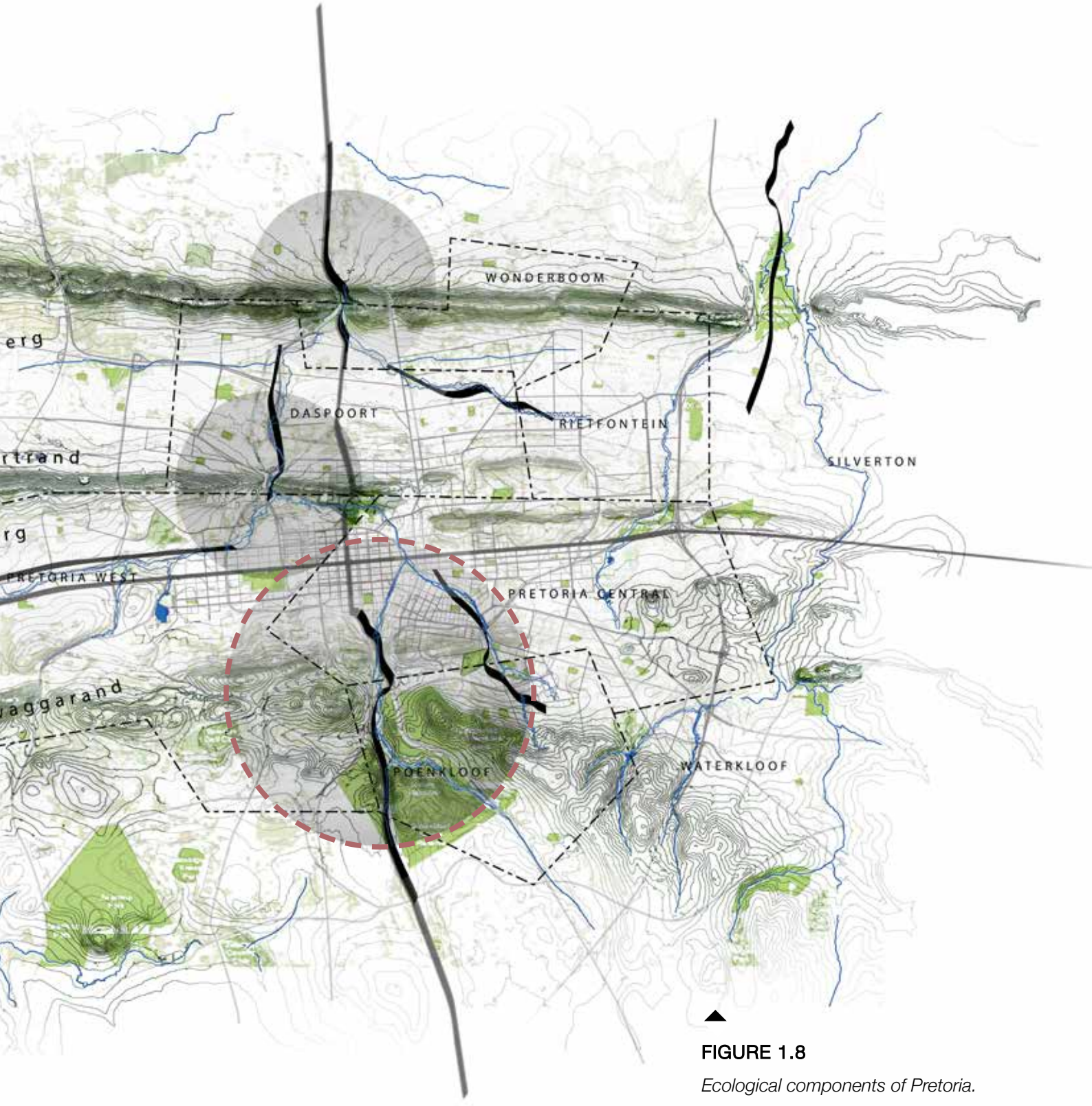


FIGURE 1.8

Ecological components of Pretoria.

(Author, 2016)

FIGURE 1.9

Site of investigation in South Berea. (Author, 2016)

1.5 THE INTENTION OF THE DISSERTATION

The objective of the dissertation is, firstly, to acknowledge that the **qualities of nature** provide an appropriate instrument to generate psychological and physiological well-being of people living in urban environments. Thus the aim is to explore how architectural design can be derived from the **positive qualities of nature**. This would contribute to creating a habitat that promotes **resilient health** in both nature and humans that would not only be perceived as the absence of illness, but can be expanded to include a state of general well-being.

Secondly, the aim is to establish **good health as a social right** of every citizen but specifically for people suffering from illnesses that make them unable to enjoy and experience nature or perhaps, even more importantly, for everyday people who don't have the capital or time to access conventional treatment facilities. Finally, it is to shift the idea that urban diseases such as asthma, allergic rhinitis, food allergies and eczema are not purely conditions that needs to be **managed**, but to seek **ultimate healing** through **alternative means** and therefore shift the disconnected condition of **humans versus nature** to a reciprocal relationship of **humans with nature** (Mang, 2009: 5).

It becomes the task of this dissertation to identify what the positive qualities of natural landscapes are and explore how these can be reinterpreted through spatial and architectural qualities. The notion that a building can encourage an affiliation between man and nature is based on extensive theoretical research, which includes the concepts of **Regenerative Architecture, Bioremediation, Biophilia** and **Biomimicry.** These theories will be investigated and adapted at different scales to create a theoretical design framework.

1.5.1 THE DISSERTATION QUESTION

If the fundamental meaning of a landscape is that it is a spatial structure, an open entirety in which diversity and differences are embedded and where coherence could be generated (McHarg, 1992:31), does it become necessary to explore **how a building can adopt similar meanings**?

How can architecture seek to encapsulate these meanings and become a **healing habitat** in order to restore the reciprocal relationship between nature and humans?

1.5.2 RESEARCH QUESTIONS

What qualities of nature could be adopted into the vocabulary of designing buildings, where the organization and composition of architectural space can be perceived as an **alternative ecosystem?** (Borasi & Zardini, 2012: 251)

How can environmental changes, instead of being perceived as threats and restricting design, unlock the potential regeneration of urban landscapes and establish new, **adaptable and responsive cities** for the future?

To what extent does **Sick Building Syndrome** (SBS) perpetuate illness (Borasi & Zardini, 2012: 253), and how can technical advantages be implemented to ensure healthy built environments from inception, without reducing the architectural potential?

1.5.3 DELIMITATIONS

It is not the aim of the dissertation to propose an alternative therapeutic function for health clinics, but rather to explore how architecture can support **healthy place-making strategies** in order to leave a legacy of tremendous **biological wealth** for the environment as well as city inhabitants.

It is crucial to note that the dissertation does not propose an architecture that imitates nature, nor to seek out to embed nature within architecture, but rather to **critically reflect, rethink, and reinterpret natural qualities within architectural form** and design.

The complex nature of the entire program causes the scheme to become too large to execute thoroughly in a single dissertation: Thus a **central part of the program** that will be identified in the research process will be selected to be resolved up to detail level, whereas the remaining parts will be resolved up to an urban level.

1.5.4 ASSUMPTIONS

It is assumed that the current Mercedes Benz dealership on the site will be **relocated** to a more appropriate location, as there are six other Mercedes Benz dealerships within 10km from the site. Furthermore, the building is of a prefabricated and typological nature, and it is thus assumed that components can easily be dismantled and reused at another location.

1.6 DEFINITIONS

OF TERMS & CONCEPTS

RESTORING RECIPROCITY

The repairing of a relationship between two or more entities that is in a state of disconnection, to allow for **mutual exchange of benefits** to take place for equal gain [Oxford Dictionary of English].

URBAN DISEASES

Diseases previously viewed as "diseases of affluence" that have become more general and in many cases intensified for populations in urban environments, due to increased exposure to pollution, smog, fine dust, biotechnology, genetic manipulation and increasing ambient temperatures (Borasi & Zardini, 2012: 20). These diseases include **allergies, rhinitis, eczema** and **asthma.**

BUILDING IN A LANDSCAPE

The prehistoric **architectural expression of the divine relationship** between humankind, nature and building which embodies a state of harmony where all three entities have equal rights and responsibilities towards one another (Rios, 2013: 200).

BUILDING ON A LANDSCAPE

The architectural result of the consequences of the **reductionist paradigm** of the early 20th century, underpinning **Modern Man's ideals,** where human needs and desires dictate that humans and their built environments hold sovereignty over nature (Rios, 2013: 201).

BUILDING FOR A LANDSCAPE

The architectural notion of the 21st century to reduce the impact of the building industry on our natural environment, defined as the **"green building movement"**. Although it largely contributes to technical advantages, it does reduce architecture's potential, resulting in homogeneous and standardized typologies (Rios, 2013: 206).

BUILDING AS A LANDSCAPE

The notion that investigates how a **building can be constructed to function as a landscape,** adopting attributes and qualities from nature, but without necessarily bringing nature into the design, in order to restore the relationship between the compromised landscape and compromised health and well-being of man.

REGENERATIVE DESIGN

Regenerative design is distinguished from the term 'sustainability' in that it does more than merely meet the minimum requirements of ecological, social and economic responsibility, but seeks to **add more value, significance and life** than that which has been removed (Du Plessis, 2012: 4).

BIOREMEDIATION

The practices of bioremediation are embedded in a **restorative paradigm** where the primary purpose is to return a natural system with its inherent self-organizing capability to its natural state (Batista & Matos, 2013: 116).

BIOPHILIA

As coined by the Harvard biologist Edward O. Wilson, biophilia is "the genetic basis for the human predilection towards the natural world" (Wilson, 1986:15). It includes architectural principles that harness qualities from the natural world to allow for **humans to affiliate themselves with nature.**

BIOMIMETICS

Biomimetics looks to nature as inspiration for human design and development (Kellert & Calabresi, 2008: 35). It finds inspiration in **natural shapes, forms and analogies** and **appropriately imitates** them in order to produce built environments that suggest a clear and visually pleasing connection to nature.

BIOMIMICRY

Biomimicry is the bridge between biology and design that provides the path to measuring the **beneficial services** provided by the local ecosystem to influence the built environment to do at least as well as it does (Benyus, 2002: 7).

FIGURE 2.1

Day 252, Planet Earth

(Lorraine Loots, 2013)

chapter two

THEORETICAL APPROACH

2.1 PREFACE

This chapter frames the argument of the dissertation from a theoretical point of view, and is aimed at discovering and developing the **qualities of landscape** that are to be explored and adopted into the making of architecture. Existing theories related to environmental preferences and restoration within the discipline of architecture will be examined. The diagram below explains the methodology of how these existing theories will be translated into a **design framework** that will serve as design informants at **different scales.** Regenerative design and development will serve as the overarching philosophy in which other theories and models are embedded.

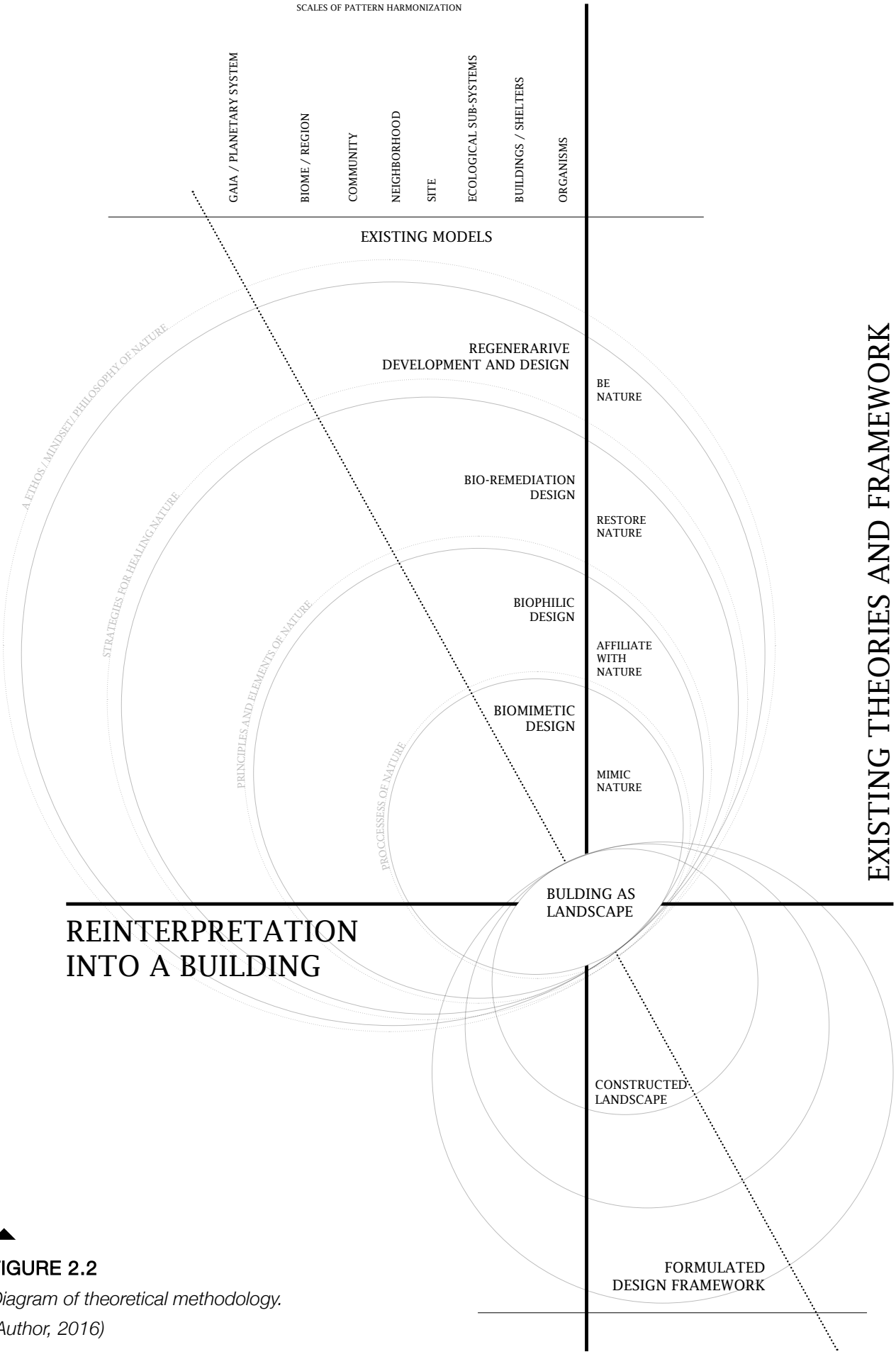


FIGURE 2.2

Diagram of theoretical methodology.

(Author, 2016)

2.2 REGENERATIVE DESIGN & DEVELOPMENT

Worldviews are coherent systems of beliefs that shape how individuals interpret and interact with the world by shaping how they think and, consequently, what they think about. The regenerative-sustainability paradigm suggest that our worldview and mindset need to undergo a major shift from a 'mechanistic' to an'ecological' or **living systems worldview** (Du Plessis, 2012:7).

Regenerative design is a philosophy of architecture that suggests that the role of the human being merges with nature in order to be an integral part of an **interconnected web of life.** Damage to any part of this web ripples back to harm every other part as well. Regenerative practices suggest that human beings are not destined to be merely apologetic destroyers trying their best to minimize the damage they do, but rather to be co-creators that can construct greater states of **systemic health** than would have been the case if no action was taken (Mang & Reed, 2012:26). Ultimately, the purpose of humanity aligns with the purpose of the planetary system itself, having an evolutionary function that looks to continuously improve itself through feedback loops, learning and adaptation to achieve **ever-evolving** levels of diversity, resilience and abundance.

The question remains difficult. How can those working n the built environment – a field that has a disproportionate effect and impact on global resources and systems – best support a smooth and timely transition for a **paradigm shift** to take place? Five aspects that support how regenerative development can be implemented will briefly be discussed (Mang & Reed, 2012:24).

2.2.1 THE ROLE OF HUMANS

It is not enough to seek to mitigate the outcomes of human activity on nature. Human beings need to once again take their place as an irreplaceable part of nature. From this perspective, regenerative development and design proposes the **reconnection of human aspirations and activities with the evolution of natural systems,** and the shifting of human communities and economic activities back into alignment with natural processes. This new role that humans take on doesn't suggest only the preservation or the restoration of an ecosystem. Instead, it is the continual evolution of human culture in association with the evolution of life (Mang & Reed, 2012:26).

2.2.2 A NEW MIND

The first step towards regenerative outcomes is not a change of practices but a change of mind. It requires a new way of thinking about how buildings are planned, designed, constructed and operated. Regenerative development acquires much of its creative thinking from a fundamental shift in focus. Rather than seeing a site and development project as a collection of things, such as slopes, drainages, roads and buildings, a regenerative designer fosters the ability to see everything as **energy systems and webs of interconnected dynamic processes** that are continually structuring and restructuring a site (Mang & Reed, 2012:26).

2.2.3 A NEW ROLE

A shift also takes place within design practices, the processes that are associated with it and, most importantly, the role and responsibilities of the designer. A regenerative practitioner **designs an ecosystem that integrates natural and human living systems** to create and sustain greater health and well-being for both. The participatory and collaborative nature of a regenerative process also requires psychological and cultural literacy, together with the ability to tap into the **latent creativity of communities** by merging broader sets of expertise and insight into the design process (Mang & Reed, 2012:27).

2.2.4 WORKING DEVELOPMENTALLY

Regeneration should be perceived as a developmental process that improves the value of the whole (Mang & Reed, 2012:27). Regenerative design continues to be seen as a **vehicle for reversing the damage** caused by source-to-sink processes, by creating self-renewing resource systems.

2.2.5 THE IMPORTANCE OF PLACE

The definition of place within regenerative thinking is that it is a unique, **multilayered network of living systems** within a geographic region that is a result of complex interactions, through time, natural ecology and cultural activities (Mang, 2009: 16). The responsibility of a regenerative designer is to understand the importance of place during the design and development stages, and to understand what is required to ensure that the ongoing regenerative capacity of the project, and the people who inhabit and manage it, is sustained through time.

Regenerative development can thus be summarized under the following philosophical departure points. **Human beings, together with their artifacts and cultural constructs are an inherent part of ecosystems.** Their actions and endeavors should be rooted in the context to contribute positively to the functioning and evolution of its ecosystems and cycles, enabling the self-healing processes of nature (Du Plessis, 2012:20).

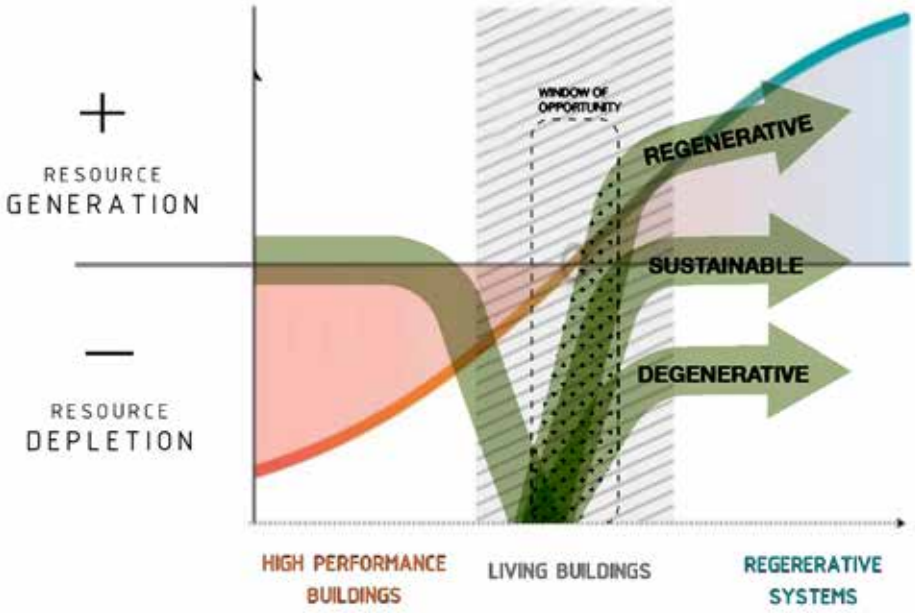


FIGURE 2.3
Diagram of regenerative design and development. (Author, 2016)

2.3 BIOREMEDIATION

We are living in an age of planetary consumption and environmental degradation where the risk of self-inflicted extinction has become a tangible reality. The continued existence of civilization has arrived at a crucial juncture between survival and decay. The practices of bioremediation are embedded in a **restorative paradigm** where the primary purpose is to return natural systems, with their inherent self-organizing capability, to their natural state (Batista & Matos 2013: 116). In the process of remediation, architecture is implemented as a regenerative tool, actively manipulating and reconstructing a contaminated environment. By proposing that **architecture can be a redemptive tool to reconstruct and restore landscapes** affected by extreme cases of man-made ecological decay, inhospitable landscapes can be replaced by a new 'Eden' to aid the diversion of our environmental crisis.

The process of restoring a given landscape involves different stages of intervention. First the traces of contamination from earlier industrial/ human activity should be examined and understood. It should also become clear which components of the landscape, such as soil, water, topography and vegetation, have been contaminated. The practices of bioremediation are thus more relevant on an **urban and site specific scale** than on a building scale. It is however important for structures to be designed to have little impact on subsoil and for architectural elements to cohesively operate within a given site to enable bioremediation and regrowth to take place (Batista & Matos 2013: 117). Finally, the toxic and degraded aspects of a given context such as dust, refuse and contaminated soil should provide new materials for conceptualization, elaboration and use, and rather be seen as avenues of opportunities (Borasi & Zardini, 2012: 25).

A significant example of bioremediation is provided by a theoretical thesis project by Thomas Grove, tilted Engineered Ecologies (President's Medal, 2013). This project proposes the implementation of a geo-engineering research facility amidst the contaminated ruins of the Aral Sea in Kazakhstan, an area that has become a barren, torturous landscape littered with decaying bio-weapon laboratories and nuclear test sites. These ruins and the entire island are to be repurposed into an experimental site for the large-scale testing and investigation of restricted geo-engineering and environmental modification technologies. The architectural intervention serves as a self-contained habitat inserted into the contaminated landscape to function as both a habitable research facility and a regenerative machine, actively manipulating and reconstructing the wasteland into a new resilient landscape.

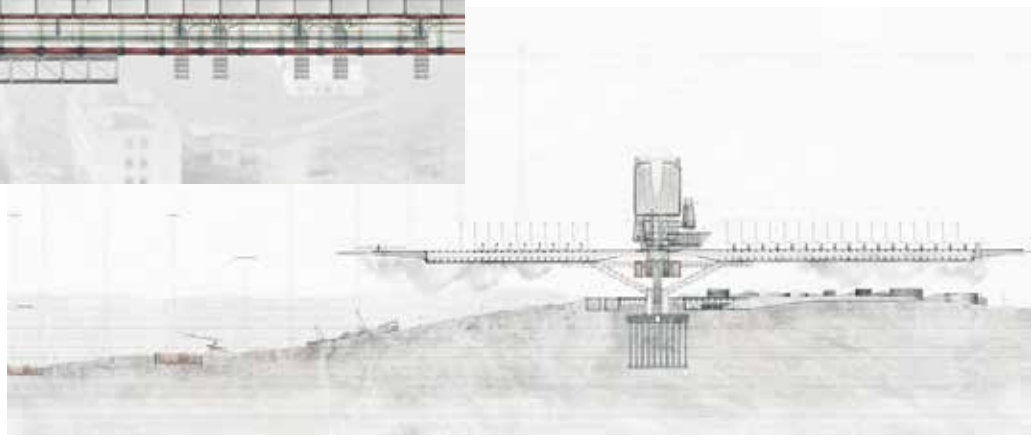


FIGURE 2.4

Engineered Ecologies, Thomas Grove (President's Medal, 2013)
(Adapted by Author, 2016)

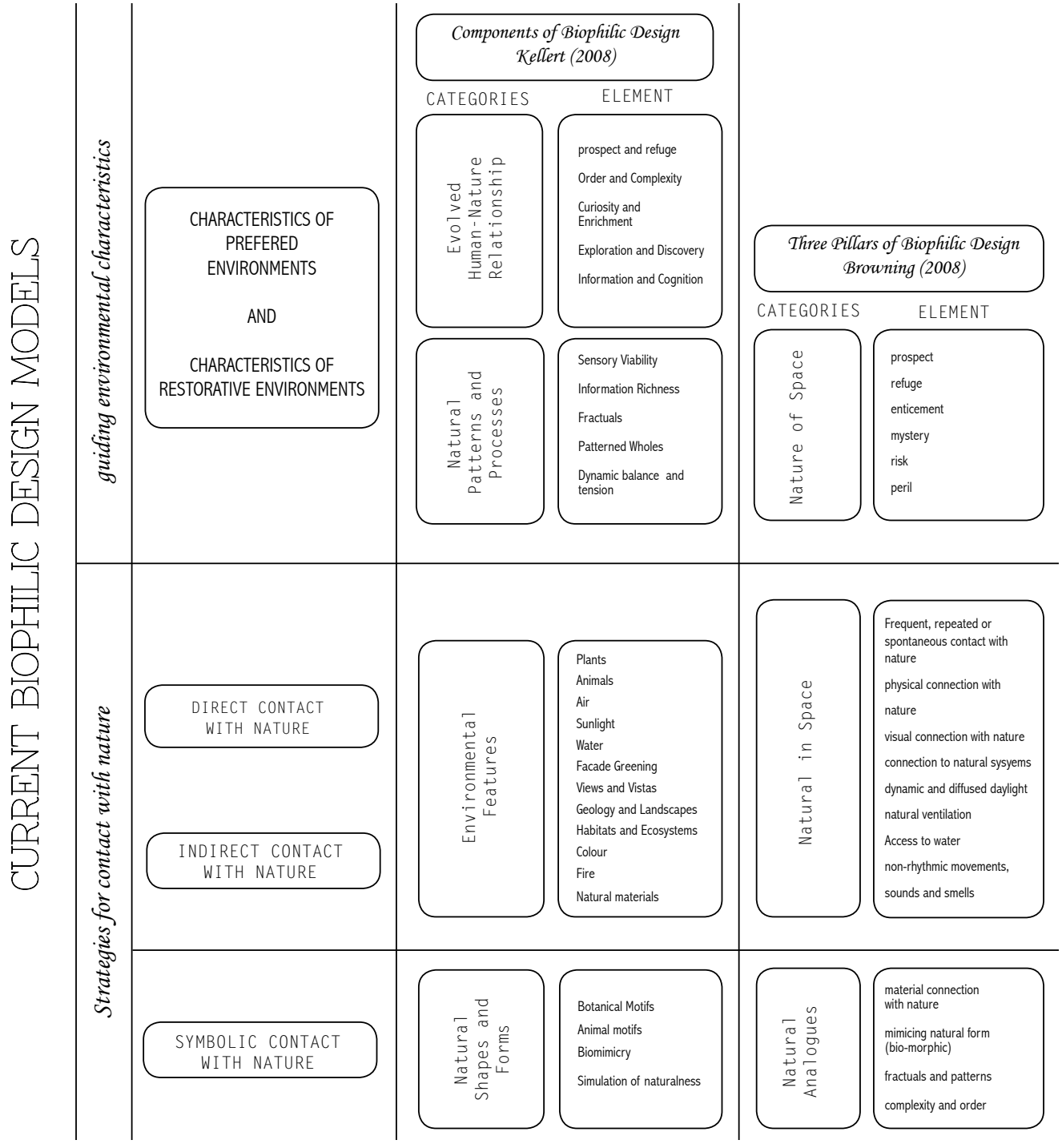
Bioremediation Precedent

Engineered Ecologies, Thomas Grove

FIGURE 2.5

Table of current biophilic models.

(Author, 2016)



2.4 BIOPHILIA & BIOPHILIC DESIGN

According to Wilson (1986: 7-9) the definition of Biophilia is **"an urge to affiliate with other forms of life."** The Biophilia hypothesis suggests that there is an instinctive bond between human beings and other living systems. Human beings are members of all natural systems and therefore we have an inherent longing to be surrounded by life, whether it is plants, animals, botanical qualities or other human beings. Biophilia stresses that although we live in urban conditions that separate us from nature, we need to recognize that our contact with natural states is an important part of our overall health and well-being. Biophilic design is the practice of designing environments that allow human beings to be affiliated with other forms of natural life, that have **tremendous benefits for our psychological health and well-being** (Kellert & Calabrese, 2008: 12) Through design it seeks the interconnection between life, nature and the built environment in order to create architecture that enriches our daily lives.

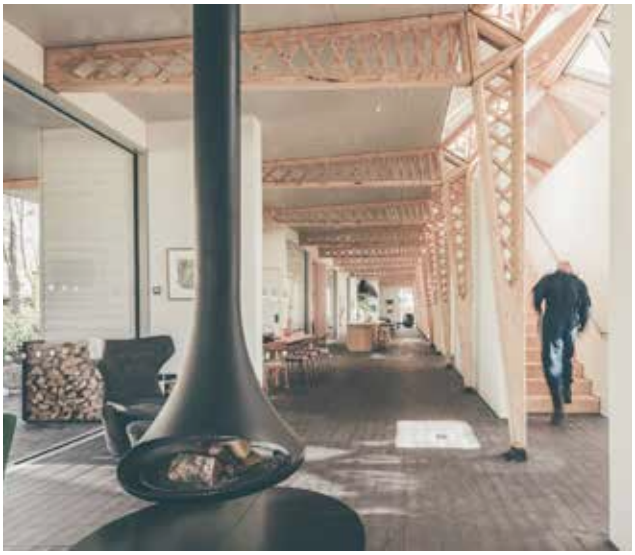
The following table depicts characteristics, elements and strategies of **existing biophilic design models** from multiple sources, which will be synergized to formulate a design framework to inform the design on a building and detail scale.

Strategies for Biophilic Design Wilson (2006, 2008)	*Characteristics of Biophilic Design Heerwagen & Hase(2001)*
STRATEGIES	ELEMENTS AND STRATEGIES
adress both spaciousness and refuge in building design create a sense of complexity, yet order in building design	Enticement: Information richness that encourages exploration, discovered complexity prospect: Visual distance, horizontal imagery, strategic viewing conditions, view corridors refuge: Canopy effects, enclosing surfaces, permitable barriers and surfaces for viewing out sensory variability biomimicry: Fractual Characteristics Sense of Playfulness Biodiversity Water
provide plantings and pleasing natural settings around buildings provide green roofs and living walls Avoid interference with key sightlines blur the transition between interior and exterior spaces incorporate vegetation and interior planting provide high levels of daylighting provide views to nature configure spaces to enhance views of nature provide operable windows decorate with potted plants provide natural materials	Biodiversity: Outdoor and Indoor natural areas with rich vegetation (trees, plants, flowers) and animals Sensory variability: Natural rhythms and processes such as natural ventilation and lighting, Changes and variability in environmental colour, air movement, light, temperatures and texturess over time and spaces. Windows designed and placed to incorporate natural views Water; Glimmer or reflective surfaces, moving suggesting clean aerated water Biomimicry: Use of natural textures
incorporate organic forms provide nature art	Water: Symbolic forms of water Biomimicry: Design derived from nature. use of natural patterns and forms

Biophilic Precedent

Maggie's Cancer Centre, Foster + Partners, Manchester 2016

Maggie's Cancer Centre (Archdaily, 2016) is an example of how affiliation with nature can facilitate psychological health. The centre serves as a place of refuge where people affected by cancer can find emotional and practical support. Inspired by the blueprint for a new type of care set out by Maggie Keswick Jencks, great value is placed upon the power of architecture to help in the process of therapy.



Throughout the centre, there is a focus on natural light with greenery, garden views and landscaped courtyards that punctuate the rectilinear plan. The south end of the building extends to embrace a greenhouse-, a celebration of light and nature- which provides a garden retreat as a space for people to gather, to work with their hands and enjoy the therapeutic qualities of nature and the outdoors. The roof rises in the centre to create a mezzanine level, naturally illuminated by triangular roof lights and supported by lightweight timber lattice beams. The beams act as natural partitions between different internal areas, visually dissolving the architecture into the surrounding gardens.

FIGURE 2.6

Biophilic Precedent: Maggie's Cancer Centre, Foster + Partners, Manchester 2016. (Archdaily, 2016)

2.4.1 THE CHARACTERISTICS OF NATURE

The character of nature is not always tangible, physical or even visual. It is an experience, for it **entices our inherent connection to the natural.** These characteristics can be discussed in two sub-themes; the ***evolved human-nature relationship,*** and human connection to ***natural patterns and processes*** (Kellert, & Calabrese 2008: 16-17). These themes will be elaborated on within the Concept and Design Development chapters.

2.4.2 DIRECT CONTACT WITH NATURE

Multiple aspects can be defined as strategies for architecture to facilitate direct contact between humans and nature, through the implementation of ***environmental features*** (Kellert & Calabrese, 2008: 22). The interpretation of these qualities into architectural elements will be explored in the Concept and Design Development and Technification chapters.

2.4.3 INDIRECT CONTACT WITH NATURE

Strategies to suggest and facilitate indirect contact with the environment are rooted in the context of the surrounding natural, cultural, historical and social conditions, better defined as ***place-based and vernacular relationship*** (Kellert & Calabrese, 2008: 26). These strategies will be elaborated on in the Concept and Design Development chapters.

2.4.4 BIOMIMETICS & SYMBOLIC CONTACT WITH NATURE

Biomimetics looks to nature as inspiration for human design and development. It finds inspiration in ***natural shapes, forms and analogies*** and appropriately imitates them in order to produce built environments that suggest a clear and visually pleasing connection to nature (Kellert & Calabrese 2008: 35). The contact it thus facilitates between nature and humans is of a symbolic and visual nature and will be further explored and delimited in the Concept and Design Development chapters.

An example of Biomimetics is RebildPorten (Archdaily, 2013), located within a northern Denmark nature reserve at Rebild Hills and Rold Forest in Jutland, and is a new visitor's center and exhibition space that creates a new gathering point. "The project's distinctive expression and character are derived directly from Nature's own formal language and elements, which make the building stand out from its surroundings and blend in with nature's scenery at the same time" (Archdaily, 2013). The distinct characteristic of the building- the 'graphic' strength of the timber structure and the visual reference to trees and branches- acts as a matrix for logos, communication elements, media and guiding landscape elements in order to create an appearance and a guiding concept which tie landscape, building and user experience together in one consecutive story.

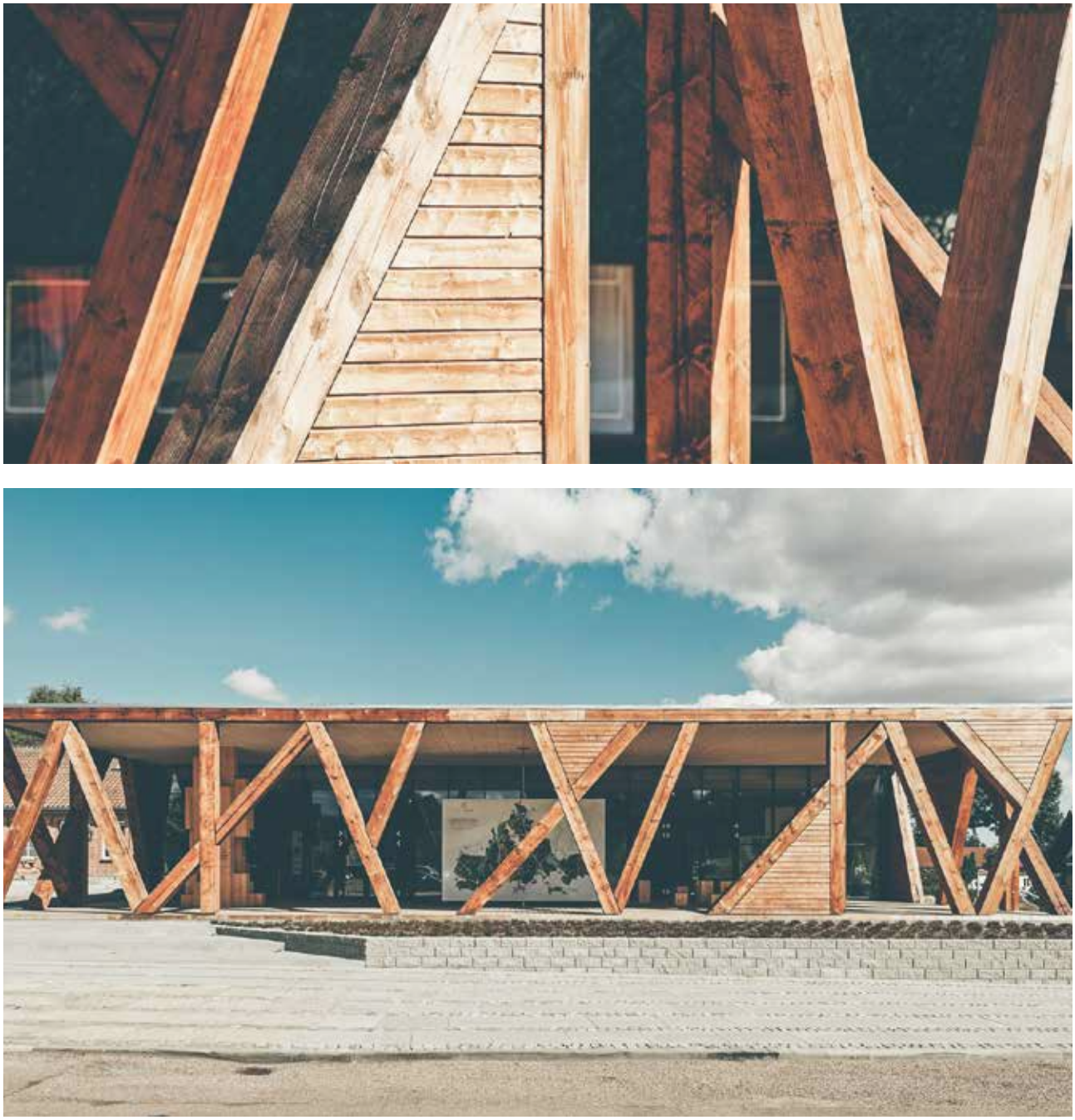


FIGURE 2.7

Biomimetic Precedent: RebildPorten, CEBRA, Denmark 2015. (Archdaily, 2015)

Biomemetic Precedent

RebildPorten, CEBRA, Denmark 2015.

2.5 BIOMIMICRY

Biomimicry is the bridge between biology and design that provides the path to measuring the **beneficial services** provided by the local ecosystem to influence the built environment to do at least as well (Benyus, 2002: 12). These insights are derived from an understanding of how nature works. Biological elders within local ecosystems, whether plants, insects or animals know how to be sustainable and even more importantly have learned how to do it in context. Biomimicry suggests that the best ideas are not ours, but have already been invented in natural living systems.

Within the built environment, biomimicry is in most cases applied to how we **design services and implement materials on a detail level.** Every ecosystem provides ecosystem services and if we **emulate nature's genius,** it can challenge the way we design buildings to meet and even exceed the level of ecosystem services that the local ecosystem in that biome provides. Strategies of how biomimicry (Benyus, 2002: 10) can be approached on a building and detail scale of design will be delimited in the Technical Development chapter.

FIGURE 2.8
Principles of Biomimicry
(Biomimicry Group, 2013)

Natural principle

Design principle

SURFACE TREATMENTS

PASSIVE COOLING

MOVEMENT OF WATER

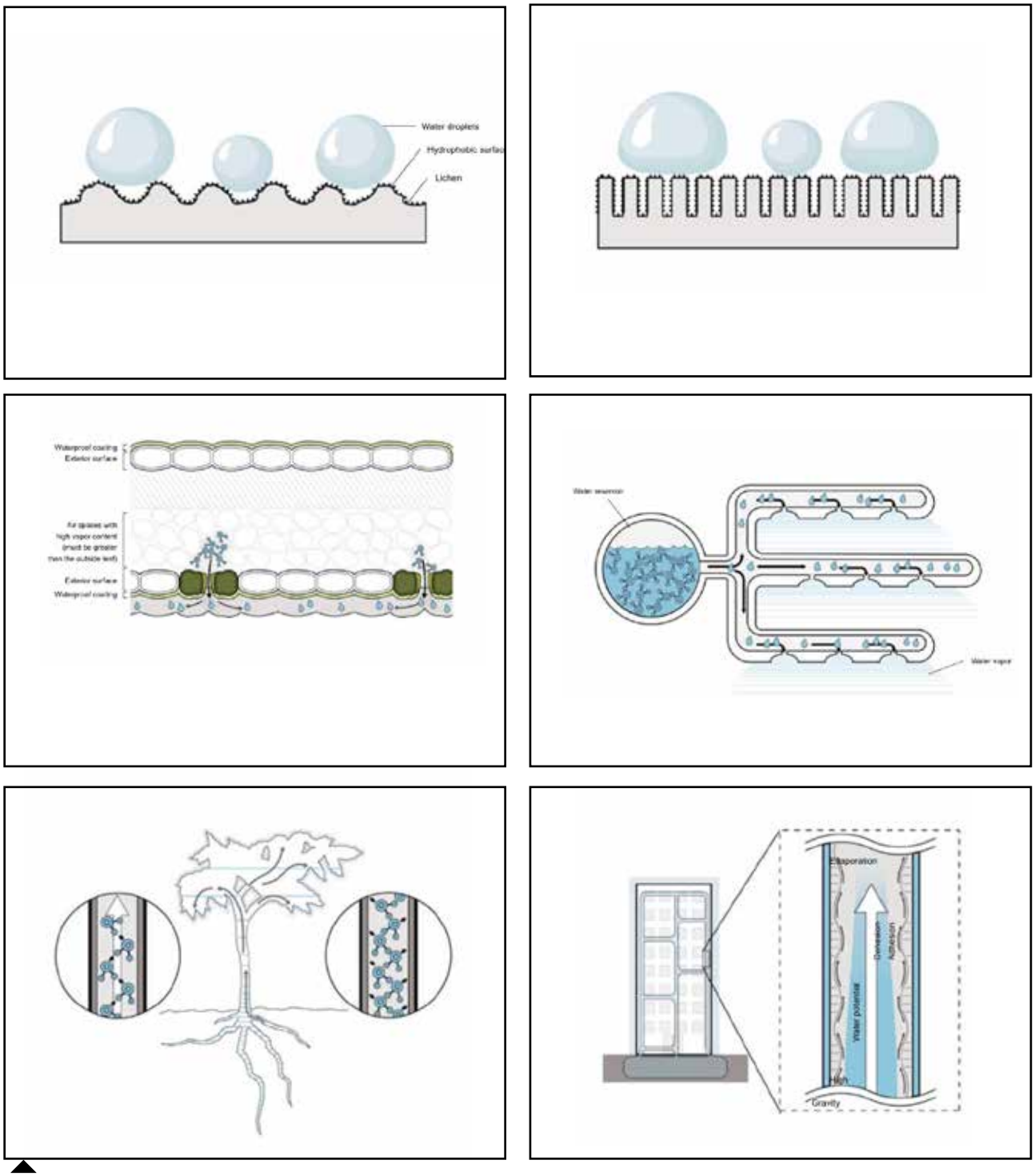
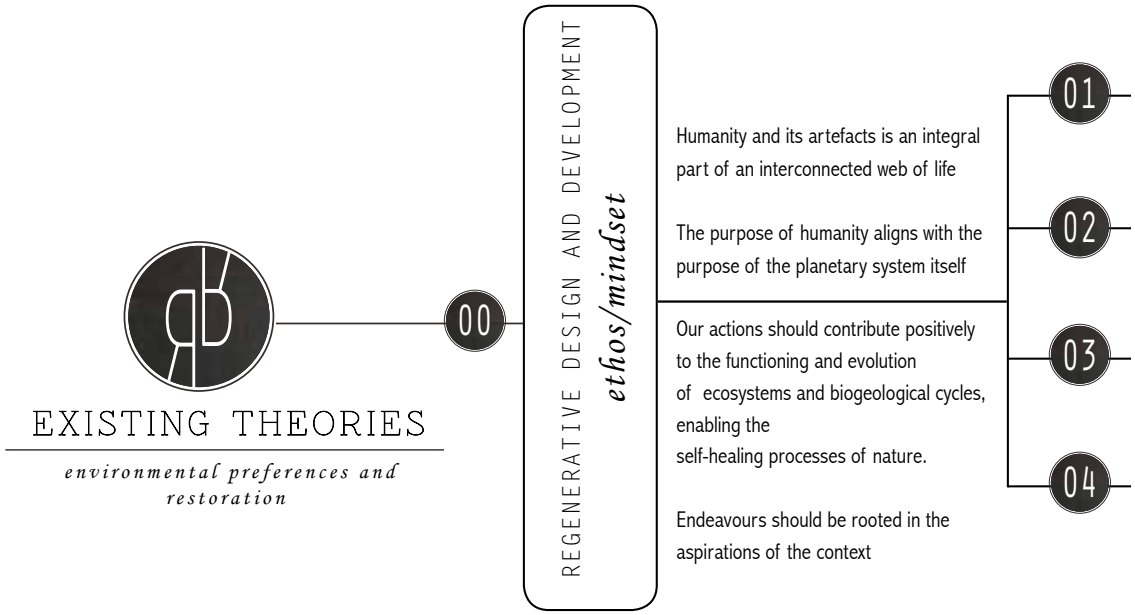


FIGURE 2.9

Services technologies inspired by natural service principles (Biomimicry Group, 2013)

2.6 SUMMARY

THEORETICAL DESIGN FRAMEWORK



Regenerative design and development roots all proceding theories in an **'ecological paradigm'** that seeks to reveal the reciprocal balance that needs to exist between humans and nature as a whole. It is thus an **ethos** that can't necessarily propose formalistic attributes and strategies to achieve this reciprocal relationship, but it does **encapsulate the mind shift** in which true sustainability is embedded. **Bioremediation** then proposes strategies to implement on an **urban and site scale to restore and heal** natural environments of decaying states. **Biophilic design** then proposes **characteristics, strategies and attributes** that can formulate the design on a **building scale,** and also address how it links with aspects on a **site scale.** Finally, **biomimicry** supports interventions and the applications of nature's genius on a **services and detail scale** that will support the overall functioning and management of a building in the truest sustainable manner possible. All these aspects that influence the design on different scales and levels will be translated into form-giving cues in relevant chapters, and **will guide the process of designing a building that seeks to heal nature and humans equally,** and restore the disconnected relationship between them to one of reciprocity. The following diagram is a synergized framework in which the design will be embedded.

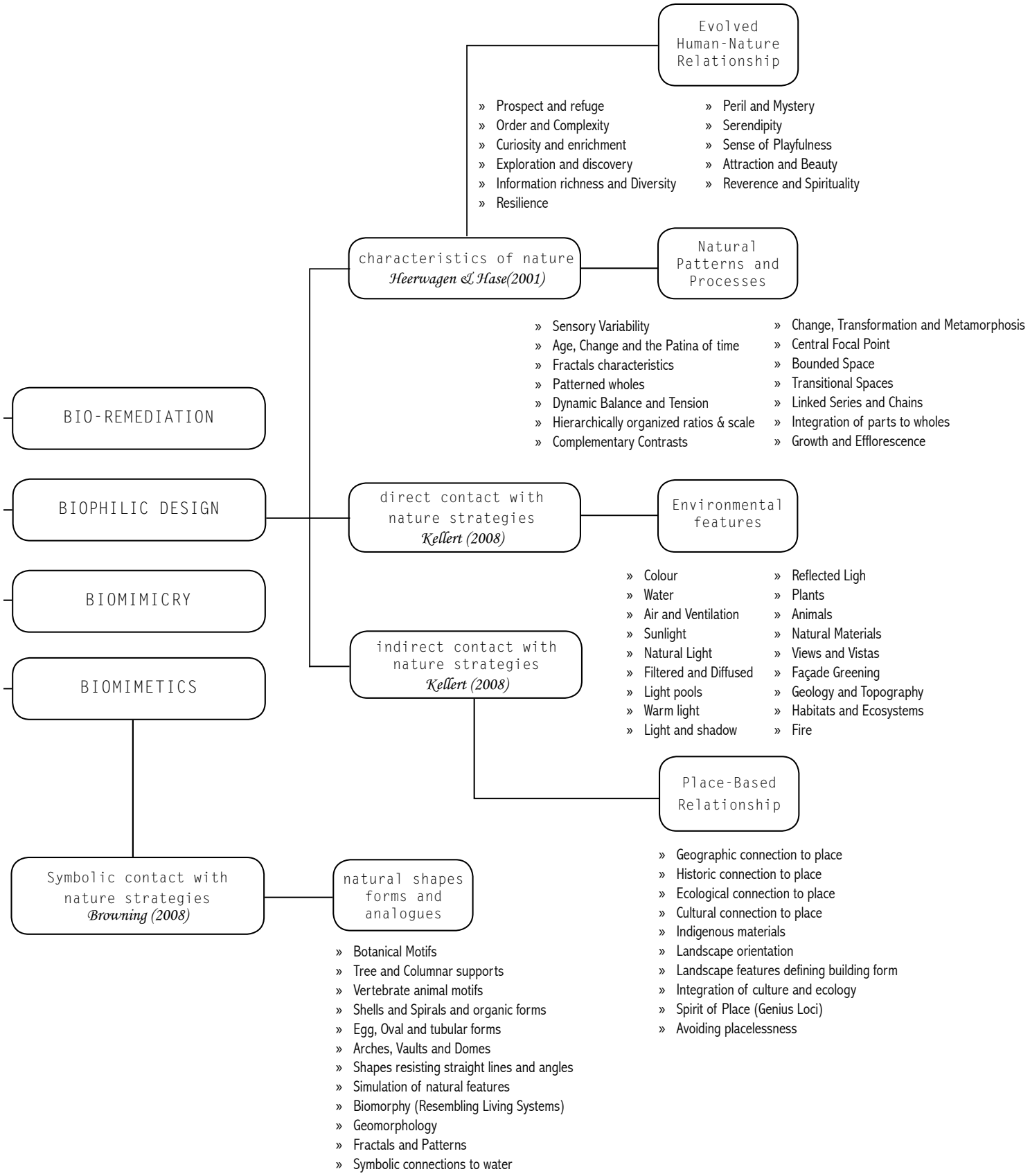


FIGURE 2.10

Theoretical Design Framework.

(Author, 2016)

FIGURE 3.1

Day 130, Fig With Fig Leaf Ice Cream

(Lorraine Loots, 2014)

chapter three

PROGRAM & CLIENT

3.1 PREFACE

The growing rate of urban diseases among city inhabitants including **allergic rhinitis, asthma, eczema** and **food intolerances** has become a serious issue for investigation in recent decades. The topic is raising much speculation among health practitioners that, if the issue is left untouched, it can lead to serious **epidemic consequences** for the living conditions of urban inhabitants.

This chapter will discuss the proposed program, **a Wellness Centre for Urban Diseases** that deals with the **education, research** and **treatment** of the topic in question. First the history of urban diseases will be investigated by means of a timeline (Figure 1) in order to understand the different aspects and contextual influences that amplified it. Multiple conditions that cause the rise of these diseases in cities will also be examined in order to discover how they are interlinked and what the most effective means of intervention would be. The **Slow Food Movement** will be discussed as a core theme to shift the idea of only 'curing' our bodies of symptoms of diseases to that of 'caring' for our bodies, to **promote the internal wellbeing** of humans through food consumption. All these aspects of investigation will give expression to the programmatic intentions and requirements of the Wellness Centre.

GLOBAL WARMING TIMELINE

1870-1910
Second Industrial Revolution. Fertilizers and other chemicals, electricity, and public health further accelerate growth.

1914-1918
World War I: governments learn to mobilize and control industrial societies.

1920-1925
Opening of Texas and Persian Gulf oil fields inaugurates era of cheap energy.

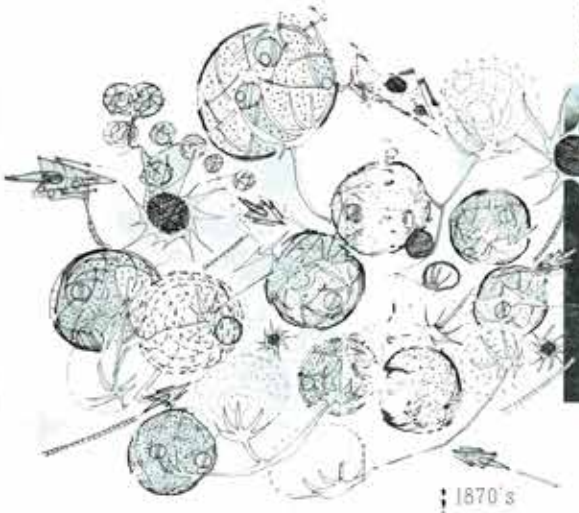
1930's
Global warming trend since late 19th century reported.

1939-1945
World War II: Military grand strategy is largely driven by a struggle to control oil fields.

1960
Mitchell reports downturn of global temperatures since the early 1940s.

1972
Ice cores and other evidence sh... big climate shifts in the past between relatively stable modes ... the space of a thousand years ...

1973
Oil embargo a... first "energy ...



URBAN DISEASES TIMELINE

1870's
Charles Blackley (UK) •Morrill Wyman (USA) produce first maps of pollen count calenders.

1880
Establishing of Health Resorts and Healing Landscapes in the 'Rocky Mountains' for asthma and tuberculosis.

1910's
First Immune Therapy Vaccines.

1910's - 1920's
Ragweed defined as Urban Menace.

Spread from North America to Europe and Africa through wheat shipment.

1920's - 1930's
Allergist and Botanist does detailed local and regional pollen counts and calenders.

Leads to relocations of sufferers to clean air, dry climatic conditions.

early 1930's
Marks start of domesticated flora and gardening movement resulting in increased pollen.

mid 1930's
Eradications of weeds in cities & planting of indigenous species.

Leads to relocations of sufferers to clean air, dry climatic conditions.

late 1930's
Founding of Antihistamines by French Pharmaceutical company Rhone - Poulenc.

1940's
Realization of manmade pollutions commonly trapped between ridges and buildings.

1950's
After WW2 a boom t... domestic use of air-... decrease humidity a...

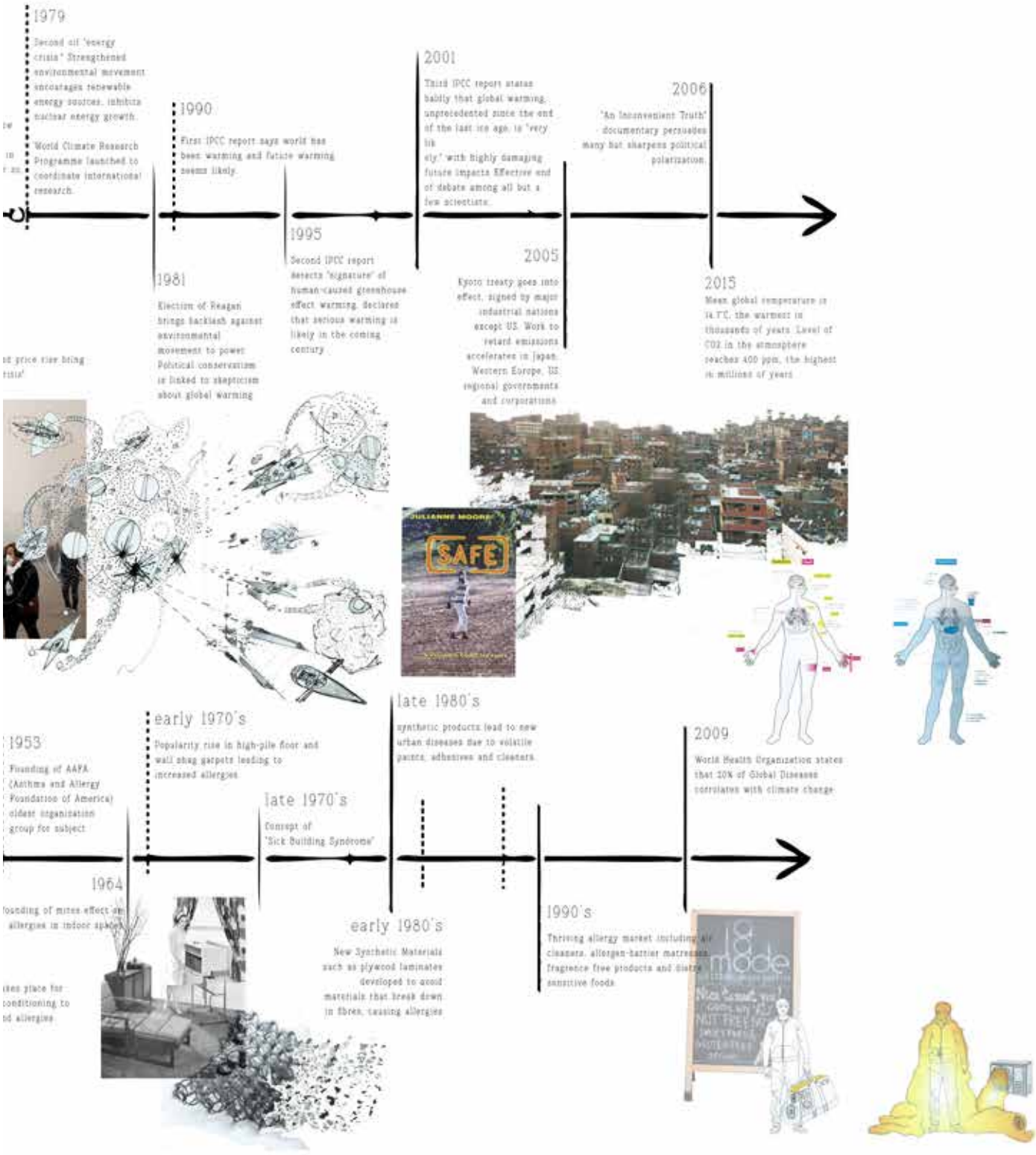


FIGURE 3.2

Image of historic timeline of urban diseases. (Author, 2016)

3.2 A HISTORY OF URBAN DISEASES

Environmental allergies were first recognised during the nineteenth century, when the invention of the microscope together with the production of **pollen maps** by allergists Charles Blackley and Morill Wyman (Borasi & Zardini, 2012: 98) in the 1870s dramatically changed the way landscapes were viewed. Over the next five decades, allergists, botanists and sufferers from allergies extended this information into detailed local and regional knowledge in order to expect and find refuge from them.

At the beginning of the 20th century in reaction to the **rise of new epidemics** and illnesses, the establishment of health resorts and healing landscapes supported the concept of **"climate therapy"**, where allergy and asthma sufferers would withdraw to specific regions in an attempt to escape the symptoms of these illnesses existing in their urban living environments (Borasi & Zardini, 2012: 99). In reality these facilities did not offer a truly effective therapy. The isolation from urban circumstances **minimized the friction** between people and their daily environments, resulting in people being **more sensitized and susceptible to diseases.**

The 1930s marked the start of the **domesticated flora and gardening movement** in urban and suburban environments. Planting practices were focused on the beautification of living conditions and allowing people to connect to the natural environment; however, the result was a **rise in pollen counts** (Borasi & Zardini, 2012: 101) as well as the occurrence of **ragweed, classified as an 'urban menace',** and other harmful moulds and invasive species, increasing the occurrence of allergies. This in turn motivated the development of **antihistamines** by the French pharmaceutical company Khone-Poulenc together with immunotherapy vaccines to alleviate the severely uncomfortable symptoms of allergies.

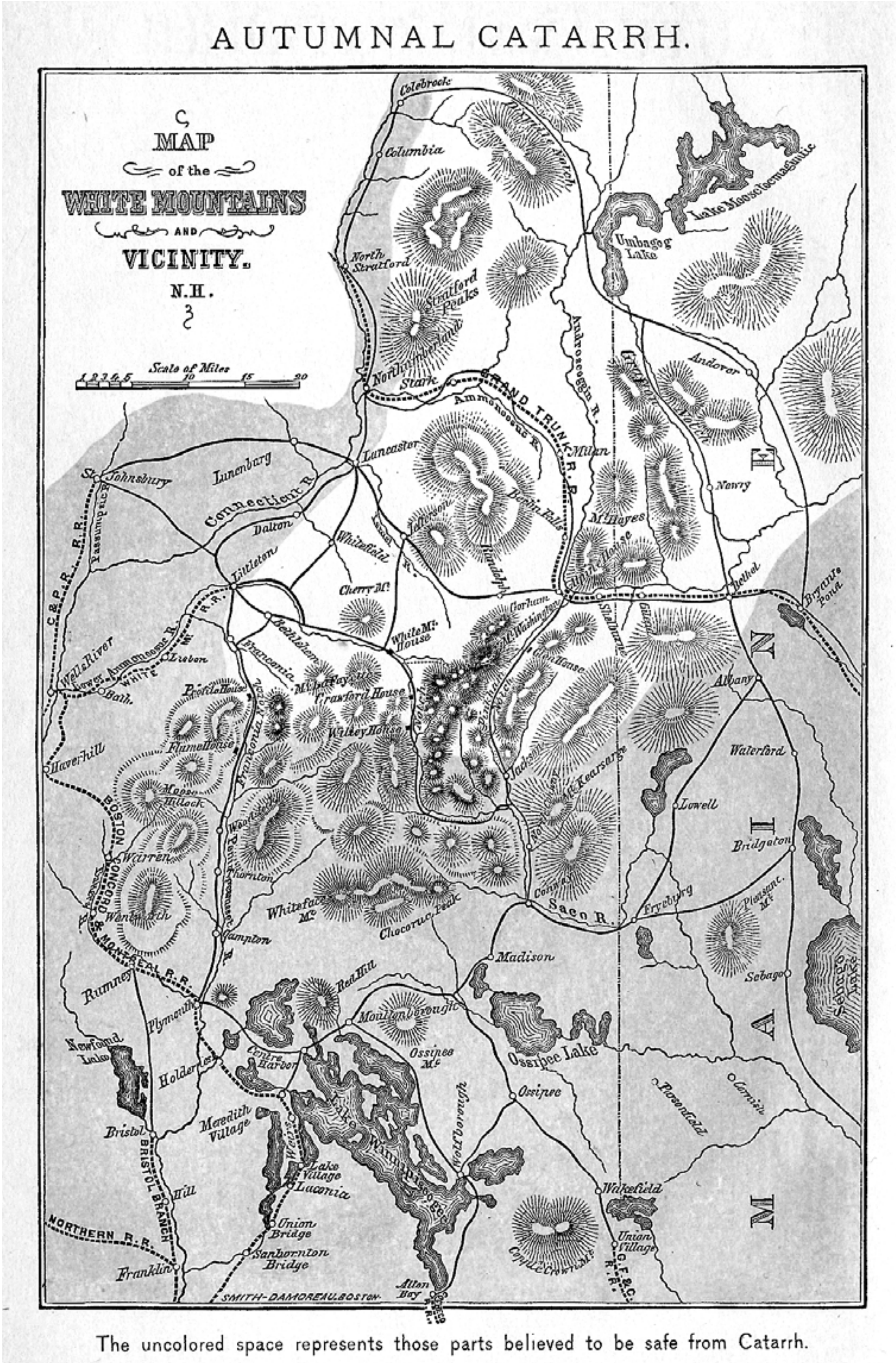


FIGURE 3.3

Images of first pollen maps and data surveys.

(Borasi & Zardini, 2012)

From the 1940s to 1960s, the popularity of wall-to-wall carpeting contributed to the accumulation of dust and material fibres, bringing forth the notion of **sick building syndrome.** Where historically nature and the outdoors were viewed as the threat, **indoor allergens** now became more common due to dust mites and mould growth that contributed to **building-related illnesses** (Borasi & Zardini, 2012: 103). The domestic use of **air-conditioning** became very popular as from the 1950's and was used to improve the circulation of fresh air in buildings and decrease humidity in an attempt to create a **'healthy home'.**

From the 1960s onwards the **rise in global temperatures** became more evident. It might not have been discovered at the time, but this also had a major impact on asthmatics and allergy sufferers in urban settings. It wasn't till the late 1990s that the serious nature of global warming and how it had impacted our health was beginning to be understood
(IPCC, 2014: 6).

In the last decade the lucrative **'allergy market'** proposed multiple new products and approaches to create healthier landscapes and living conditions (Borasi & Zardini, 2012: 97). Many advances have also been made in the pharmaceutical and building industries to deal with the rise in urban diseases. Unfortunately most attempts are focused on treating the symptoms, rather than addressing the root of the problem.

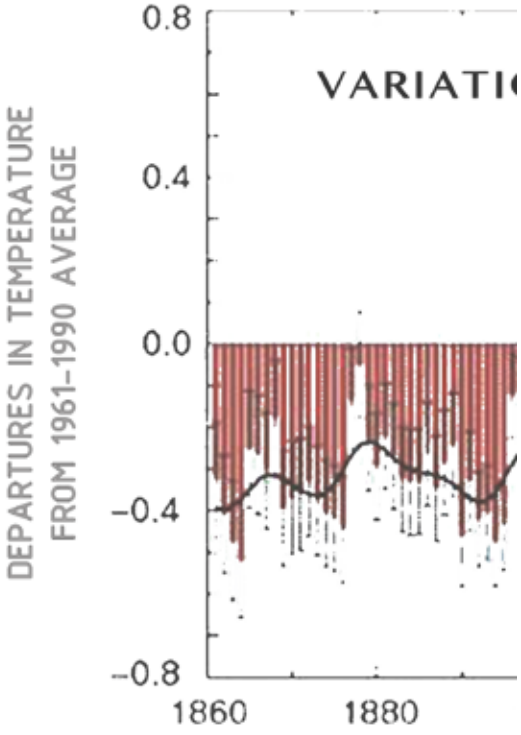
FIGURE 3.4

Image of specialized allergy market products (compilation by Author, 2016)

3.3 CAUSES OF URBAN DISEASES

3.3.1 CLIMATE CHANGE

According to the United nations (UN) World Meteorological Organization, 14 of the 15 hottest years on record have occurred since 2001 (IPCC, 2014: 5). **Temperature change** has a huge impact on the **levels of pollen, irritant particulates and dust** circulating in the air.



Airborne pollen is the most common cause of seasonal allergies (Borasi & Zardini, 2012: 98) and it is due to climate change that more and more urban dwellers are exposed to the risk of allergies and asthma. It is also important to understand that building structures within cities serve as a basin that contains air and reduces ventilation of cooler air, leading to **warmer ambient temperatures.**

3.3.2 POLLUTION

The air in our cities can be perceived as a **toxic landscape** which we inhale every day. Pollution produced by industrial as well as transport activities in and around the city has become a third character in the context of Pretoria as much of the polluted air stays trapped between the two defining ridges of the city (Van der Walt, 1967: 8).

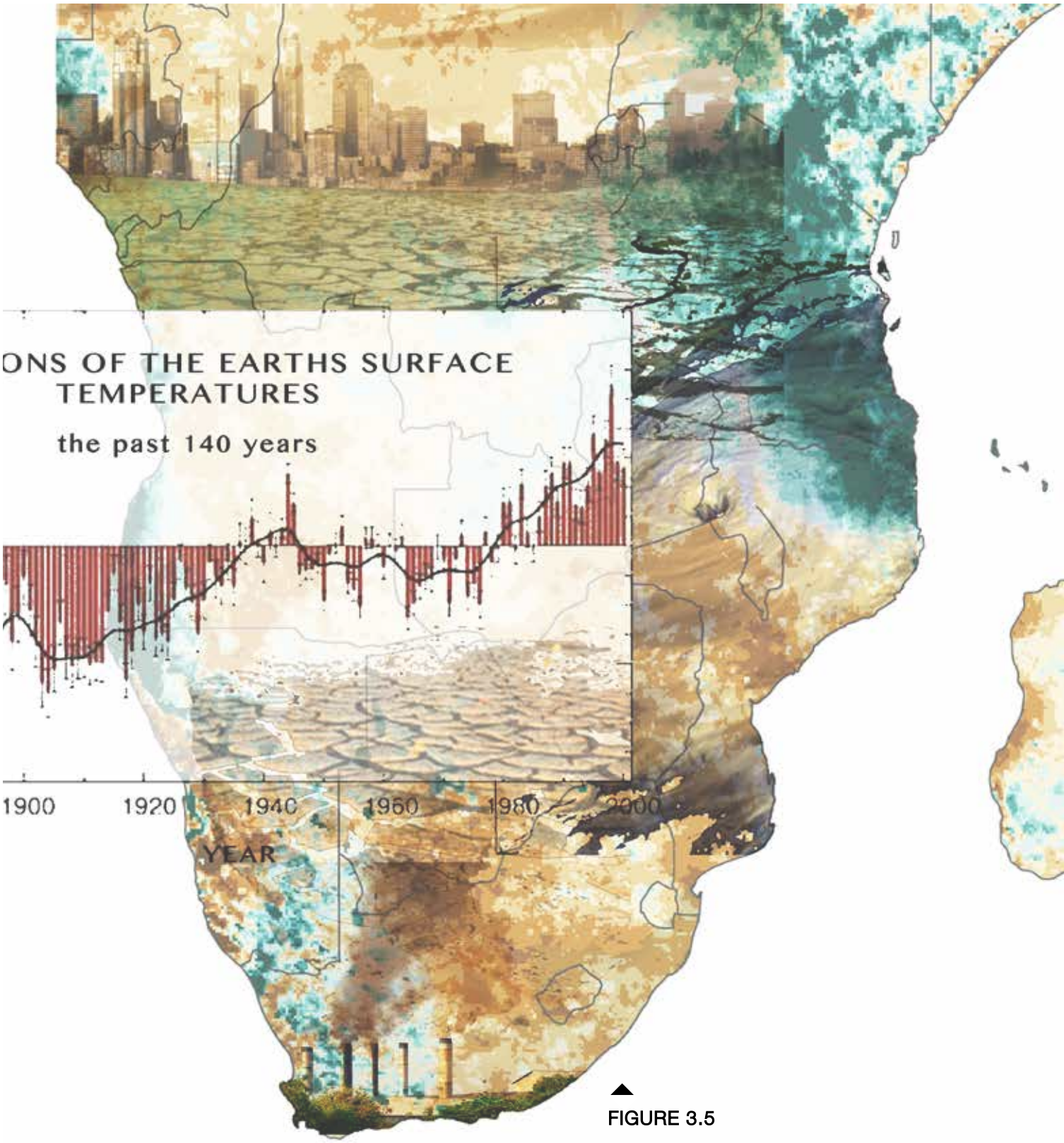


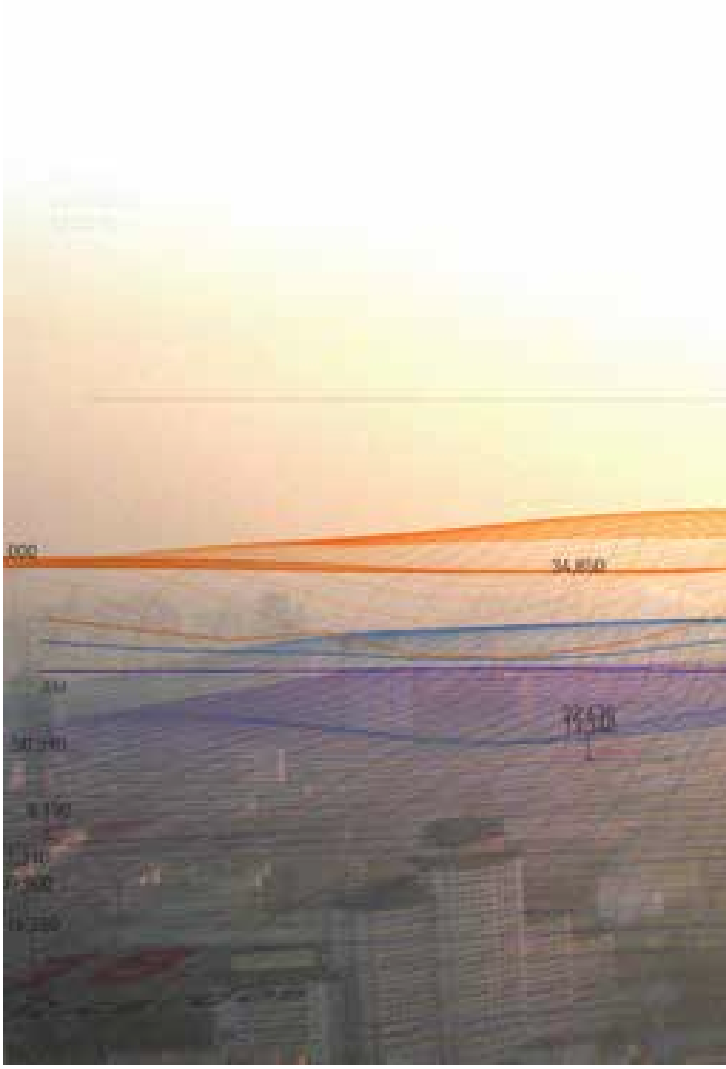
FIGURE 3.5

Image of climate change statistics.

(IPCC, 2014, adapted by Author, 2016)

Pollution Precedent

" In the Air" visualization project, Nerea Calvillo.



The "In the air" visualization project created by Nerea Calvillo (Borasi & Zardini, 2012: 91) is a digital model that analyses the invisible pollution agents in the air of Madrid, in order to produce and demonstrate the quality of the air in a visually legible graphic.

The project identified sulfur dioxide, carbon monoxide, nitrogen oxide, particulate PMo10 and pollen as the key pollutants that have the most detrimentally effect on the health of urban inhabitants (Borasi & Zardini, 2012: 91). The project thus proposes a platform to create individual and collective awareness for practitioners to interpret and use for opportunistic selection and decision-making.

FIGURE 3.6

Precedent: " In the Air" visualization project, Nerea Calvillo.

(Borasi & Zardini, 2008)

3.3.3 STRESS AND PLACELESSNESS

Due to the circumstances presented in an urban lifestyle, people are subjected to **high levels of stress.** They lack a meaningful connection with their natural environment (Du Plessis, 2012: 7), causing them to be naturally and socially isolated and under-stimulated, and leading to a common epidemic in the urban environment described as **Place Deficit Disorder** (Mang, 2009: 7).

3.3.4 INVASIVE SPECIES AND INAPPROPRIATE PLANTING PRACTICES

Pollen generated by the **misapplication of tree species** is considered to be a major aspect that causes the increasing incidence of allergies and asthma in cities worldwide. Any type of vegetation, when **overplanted** can cause allergies, and together with the planting of **invasive species,** it results in the spreading of weeds that are highly allergenic.

Most professional design resources now include guidelines for designing interior and exterior spaces that reduce the negative effects of allergens. Devised by American horticulturalist Thomas Leo Ogren, the **Ogren Plant Allergy Scale (oPALs)** measures the allergy potential of garden and landscaping plants (Borasi & Zardini, 2012: 101). Low-scoring plants include those that depend on insects rather than wind for pollination, as they produce significantly less pollen. Pollen levels can also be reduced by planting only the female variety of a species, as it is the male plant that produces pollen. Traditionally, males have been preferred in urban areas for aesthetic and practical reasons, for they do not produce fruit and thus create less of a mess. Alternative strategies can be considered to deal with the latter issue.

3.3.5 SICK BUILDING SYNDROME

As mentioned, the second half of the 20th century indicated a dramatic increase in allergies due to **inappropriately designed, furnished and finished home interiors** that become more heavily polluted than outdoor urban settings (Borasi & Zardini, 2012: 108).

3.3.6 WHAT WE EAT

The reliance that urban inhabitants have on **fast and processed food** has become a fundamental contributor to the origin and rapid propagation of the latest epidemics and illnesses (Borasi & Zardini, 2012: 260). The use of **genetically modified food and homogenized mass growing processes** has compromised the essential diversity and quality of nutrients in our food, exposing humans to becoming more **susceptible to human-induced disease and immune disorders.**

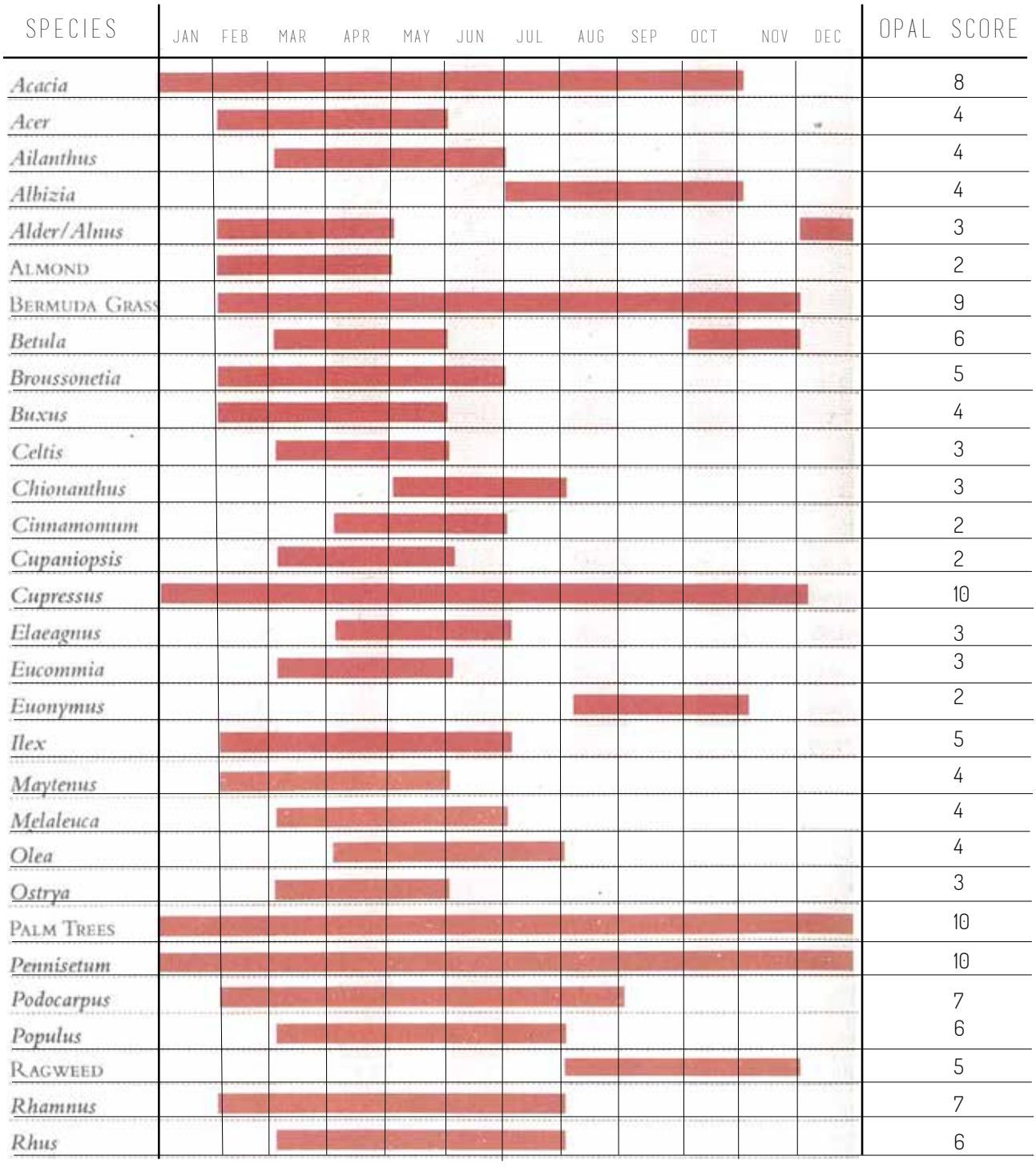


FIGURE 3.7

Diagrams of oPals (Orgen Plant Allergy Scale) scores of common urban planting.

(PolliNation, 2012)

3.3.7 THE CHANGING OF OUR IMMUNE SYSTEMS

The theory of **the hygiene hypothesis** (Okada, 2010: 12) has stirred much speculation and interest in recent years. Its fundamental argument is that infectious agents that have co-evolved with us, in order to protect us against a large spectrum of **immune-related disorders** (Okada, 2010: 16) have been removed from our urban environments in our efforts to have a **clean and germ-free lifestyle.**

The inherent risk in lacking exposure to bacteria is that we reduce the necessary friction between ourselves and our environment, causing our immune system to overreact to harmless proteins such as those found in pollen grains (Okada, 2010: 14).

Another aspect that causes our immune systems to become weaker is the **contamination of the water** supply, **pasteurization** and **sterilization** of milk and other food products, **vaccination** against common childhood infections and the wide use of **antibiotics** (Okada, 2010: 14). The result is a lower infectious burden, but ultimately a higher incidence of urban diseases.

TOXIC FOOD PRACTICES

WATER CONTAMINATION

ANTIBIOTICS

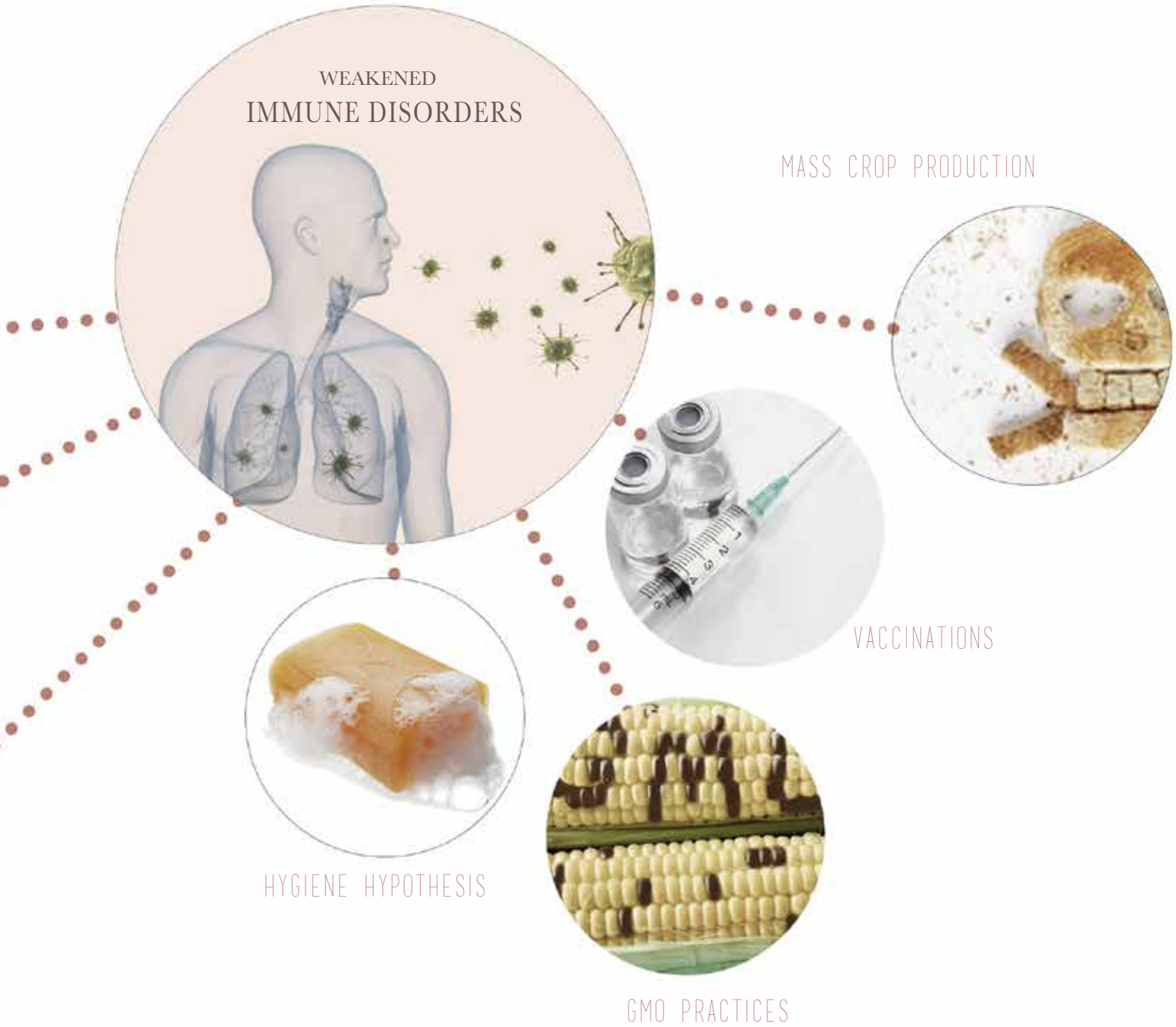


FIGURE 3.8

Causes of changing Immune systems.

(compilation by Author, 2016)

3.4 TYPES OF URBAN DISEASES

It is important to note that many urban diseases can be genetic. Statistics do however indicate that a strong incline has taken place over the **last two decades**. About 50% of children under the age of twelve suffer from allergies. Furthermore statistics show that 20% of adults are showing increased symptoms of urban diseases, whereas it was less than 8% during the 1990s. Even more troublesome is that an estimated **235 million people suffer from asthma** (Berman, 2011: 6), which is now described as an **epidemic phenomenon.**

Most urban illnesses are classified as **aero allergens,** dependent on the quality and content of the air we breathe. These illnesses include **rhinitis, asthma** and other **environmental allergies** such as **hay fever.** These are aggravated by climate and seasonal change (Berman, 2011: 4).

Less common urban diseases include **skin allergies** such as **eczema, hives and atopic dermatitis.** Skin allergies are in most cases genetic, but are most definitely triggered by severe environmental changes and inappropriate eating habits (Borasi & Zardini, 2012: 252).

A more modern urban phenomenon is the occurrence of **food allergies and intolerances** among urban inhabitants, for they are most exposed to **genetically modified** and processed foods that are reduced in quality (Borasi & Zardini, 2012: 260).

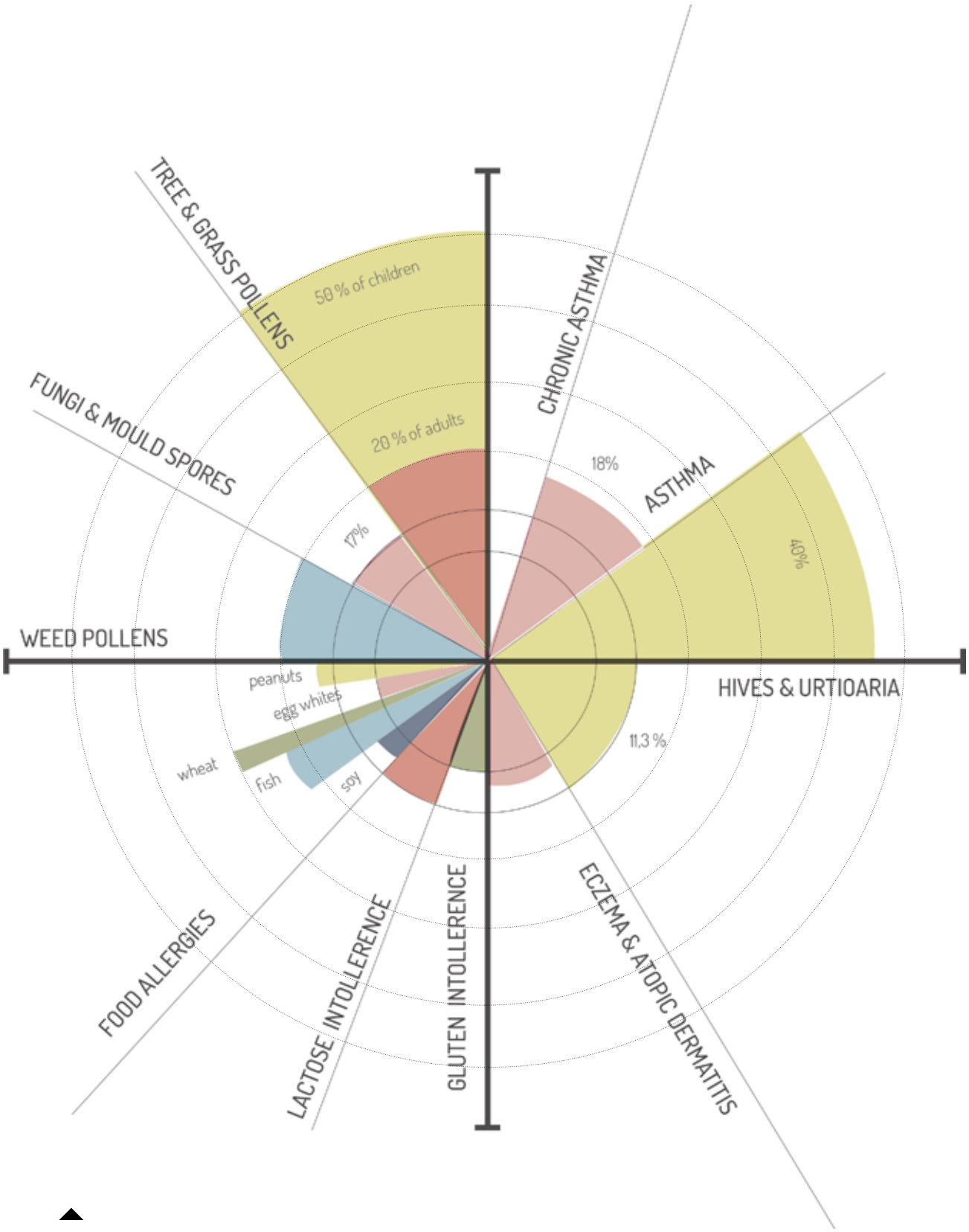


FIGURE 3.9

Statistical diagram of types of urban diseases and their occurrence in our cities.

(Berman, 2011, Adapted by Author, 2016)

FIGURE 3.10

Slow Food Pavilion, Milan, Italy, Hertzog and De Meuron, 2015. (Archdaily, 2015)

Slow Food Precedent

Slow Food Pavilion, Milan, Italy, Hertzog Aand De Meuron, 2015.

3.5 THE SLOW FOOD MOVEMENT

The **Slow Food movement** began in Italy in 1989, and was advocated by Carlo Petrini in an ambitious attempt to counteract the rising trend of fast food consumption predominant in modern environments. Recurrent themes of these efforts can be described as **slow, low** and **local**, in order to place a brake on the rapid changes that city living causes. The contextual nature of these efforts seeks to **find existing flows,** and then honour them by unlocking their potential to allow urban and economic revitalization. The mantra is thus simple: **to grow, eat, shop and hire local** (Borasi & Zardini, 2012: 261).

The Slow Food movement suggests that humans should become **co-producers**, to be active, proactive and informed members of the food chain once again, rather than be only consumers. It is more than just about food: it is about a lifestyle that connects our food consumption to the wider social, ethical, environmental and spiritual elements around us.

Another aspect that is promoted to ensure optimal well-being is to, as far as possible, consume **organic produce** that is less exposed to pesticides, fungicides and fertilizer (Borasi & Zardini, 2012: 261), and is higher in nutrients and self-produced antioxidants that strengthen the immune system. Furthermore, organic produce is **low impact,** especially when cultivated on a **non-industrial scale.**

Finally, the movement motivates **local growing communities** where seasonal planting and sowing can take place on an **educational platform** to aid peoples understanding of the connection between soil, food and their own health and to encourage healthier living with tremendous wealth implications for future generations (Borasi & Zardini, 2012: 261).

The Slow Food Pavilion project aims for visitors to "discover the significance of agricultural and food biodiversity, to explore the variety of the products that are protagonists of biodiversity, and to become aware of the need for adopting new consumption habits" (Archdaily, 2015).

The architectural and curatorial proposal of this project is based on a simple layout that creates an atmosphere of a refectory and market. People can watch visual statements about different consumption habits and their consequences for our planet and our health and be exposed to exponents of sustainable agriculture and local food production to learn about alternative approaches. The sensory use of smell and taste contribute to the richness of the program.

3.6 THE PROGRAMMATIC INTENTIONS

It becomes very clear that there are certain key elements missing in cities, which contribute to the occurance of urban diseases. The first is an **awareness** and **knowledge** regarding the existence, causes, dangers and remedies of these illnesses. The Second it is the **lack of specialized treatment possibilities** that can address these diseases through alternative means. Urban diseases are not properly acknowledged as a problem for urban inhabitants, and thus are treated in general medical terms.

Thirdly, the **concept of wellness** is not fully understood and strived towards, for it should gain more importance in the city and not only be considered as the absence of illness. It becomes evident that there is a lack of spaces in our cities that truly motivate and celebrate wellness for all inhabitants.

Finally, it is crucial that the **inhabitants of the city become aware that they are an interlinked part of nature**, unconsciously seeking connection with it and the qualities it presents. Although all inhabitants are not able to enjoy nature to its fullest because of illness, the program presents major opportunities to explore spaces that provide people with the necessary qualities of nature without improper exposure. However, in no way should the proposed program promote refuge from these illnesses and the management of these diseases in isolation, but it should rather seek to help people to **ultimately thrive beyond it.**

The program for the Wellness Centre thus includes three core components. The first is **Caring for our bodies**, the second is the **Cultivating of our minds** and the third the **Curing of our illnesses.**

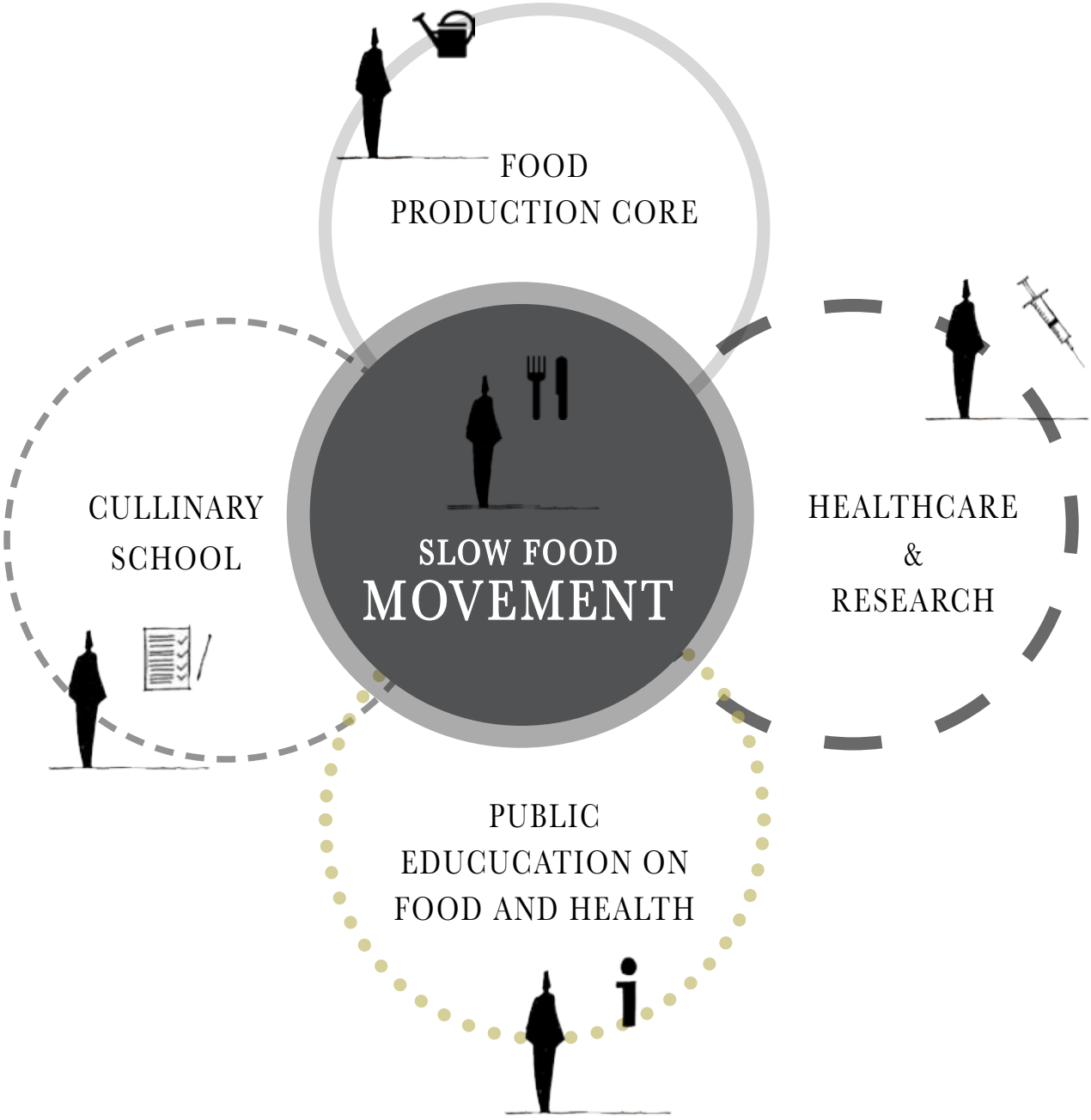


FIGURE 3.11

Diagram of programmatic composition

(Author, 2016)

3.7.1 THE SLOW FOOD PRODUCTION CORE

The Slow Food movement promotes the idea that well-being is achieved through the internalized **Caring for Our Bodies.** Organic food produce will be cultivated on site using **permaculture techniques** in an attempt to restore the soil and simultaneously **reveal and celebrate the health benefits** of simplicity. It will demonstrate visually how the middlemen, commonly present in mass food production can be eliminated to avoid exposure to GMOs and other practices. The **urban food production core** also promotes **job opportunities** for the inhabitants of the surrounding environment, presenting opportunities for multiple NGOs to be involved.

FOOD SPINE
Kitchen (Nut/shellfish seperation)
Cleaning of Food Facility
Cold Stores
Dry Stores
Wash-up Area
Storage
Seedling Preperation Area
Recycling Area
Disposal Area
Preperation Area (Plating) / Serving Counter
Cheff offices
Restaurant Seating Area
Cafeteria and Coffee Shop
Health Shop / Food Store
Entertainment Area
Ablutions
Connection to Food Delivery
TOTAL APPROX AREA

3.7 THE PROGRAMMATIC REQUIREMENTS

DAY VISITOR PUBLIC	STAFF	PATIENTS	DOCTORS & RESEARCHERS	LECTURERS	STUDENTS	APROX. AREA
	X					600 m^2
	X					15 m^2
	X					20 m^2
	X					20 m^2
	X					30 m^2
	X					15 m^2
	X					20 m^2
	X					10 m^2
	X					10 m^2
	X					10 m^2
	X					20 m^2
X	X	X	X	X	X	500 m^2
X	X			X	X	120 m^2
X	X	X				70 m^2
	X					20 m^2
X	X	X	X	X	X	15 m^2
	X					
						1495 m^2

FIGURE 3.12

Accommodation list for the Slow Food Production Core.

(Author, 2016)

3.7.2 THE SPECIALIZED CULINARY SCHOOL

The **culinary school** will directly tie into the food production core, and serve as the **artisan platform** to expose and celebrate the art of cooking organic food. All kitchen's and training studios will be exposed to support the notion of **"theatre food".** The school will also provide **education** on **allergy-free cooking practices** to accommodate people that suffer from food allergies and intolerances.

CULLINARY SCHOOL
Training Kitchens / Studios (150 students)
Administration
Staff Room
Lecturer's Offices (10 lecturers)
Ablutions
Social Areas
Library
Storage
Parking
Urban Agricultural Production Core
Herb Gardens
Fruit & Vegetables
Roof Gardens
TOTAL APPROX AREA

DAY VISITOR PUBLIC	STAFF	PATIENTS	DOCTORS & RESEARCHERS	LECTURERS	STUDENTS	APROX. AREA
				X	X	600 m²
	X			X		50 m²
	X			X		15 m²
				X		40 m²
	X			X	X	25 m²
					X	100 m²
	X	X	X	X	X	250 m²
	X					30 m²
X	X	X	X	X	X	100 Bays
	X				X	
	X				X	
	X					
	X					
						1210 m²

FIGURE 3.13

Accommodation list for Culinary School.

(Author, 2016)

3.7.3 THE CONFERENCE AND EXHIBITION FACILITY

In order to **Cultivate our Minds,** the Wellness Centre will include an **educational platform** that serves as a **public interface**. Here education can be provided on how to deal with urban diseases by presenting new related research and technologies. It includes an **auditorium** for larger conferences as well as an **exhibition space** for expos and smaller events. The facility can also be hired out and used for other functions since it is in close proximity to the Gautrain Station.

CONFERENCE AND HOTDESK FACILITY
Auditorium / Lecture Rooms (300 people)
Projection Room
Stage
Backstage
Exhibit Space / Hotdesk Meeting Rooms
Storage
Outdoor Amphi theatre
Entrance Foyer
Reception
Security Area
Ablutions
Parking (400 people)
Connection to Delivery Area
Connection to Food Spine
TOTAL APPROX AREA

DAY VISITOR PUBLIC	STAFF	PATIENTS	DOCTORS & RESEARCHERS	LECTURERS	STUDENTS	APROX. AREA
X				X	X	300 m^2
	X					25 m^2
			X	X	X	20 m^2
	X					20 m^2
X			X	X	X	500 m^2
	X					50 m^2
X					X	200 m^2
X						100 m^2
	X					
	X					
X	X		X	X	X	25 m^2
						200 bays
	X					
X	X	X	X	X	X	
						1090 m^2

FIGURE 3.14

Accommodation List for the Conference and Exhibition Facility.

(Author, 2016)

3.7.4 THE IMMUNOTHERAPY CLINIC AND RETREAT

To **Cure our Bodies of Illnesses,** the treatment of allergic rhinitis, asthma and skin allergies such as eczema will take place in an **immunotherapy clinic** and other **alternative treatment facilities,** depending on the symptoms presented. The clinic will also have the necessary **laboratories for conducting research** on diseases that predominantly exist in the context of Pretoria, to **produce locally appropriate data** such as pollen counts and other aspects that influence our health.

HEALTHCARE & RESEARCH CENTRE
Reception
Record Storage
Administration Area
Waiting Area
Consultation Rooms
Immuno Therapy Treatment Rooms (60 patients)
Staff Amenities
Supply Storage
Clean and Dirty Utility
Disposal Areas
Testing Laboratories
Children Playing Area
TOTAL APPROX AREA

STAFF	PATIENTS	DOCTORS & RESEARCHERS	LECTURERS	STUDENTS	STAY OVER	APROX. AREA
X	X					15 m²
X		X				50 m²
X		X				50 m²
	X					25 m²
	X	X				100 m²
X	X	X			X	500 m²
X		X				50 m²
X						40 m²
X						15 m²
X						10 m²
	X	X				150 m²
	X					25 m²
						1130 m²

FIGURE 3.15

Accommodation List for the Immunotherapy Clinic and Laboratory.

(Author, 2016)

FIGURE 3.16

Combination of Illustrations by Lorraine Loots

(Lorraine Loots, 2013-2015)

3.8 SUMMARY

It is the changing of our natural environment, the changing of our immune systems to adapt and resist the attacks of the environment and finally the awareness among humans as to what the consequences are of how we treat our bodies as well as our environment that have a direct impact on our health and wellbeing. It is these three key aspects that the Wellness Centre for Urban Diseases will ultimately attempt to expose and address, so that the result may be threefold: to ensure a **healthy environment**, a **healthy body,** and a **restored connection** between human and nature.

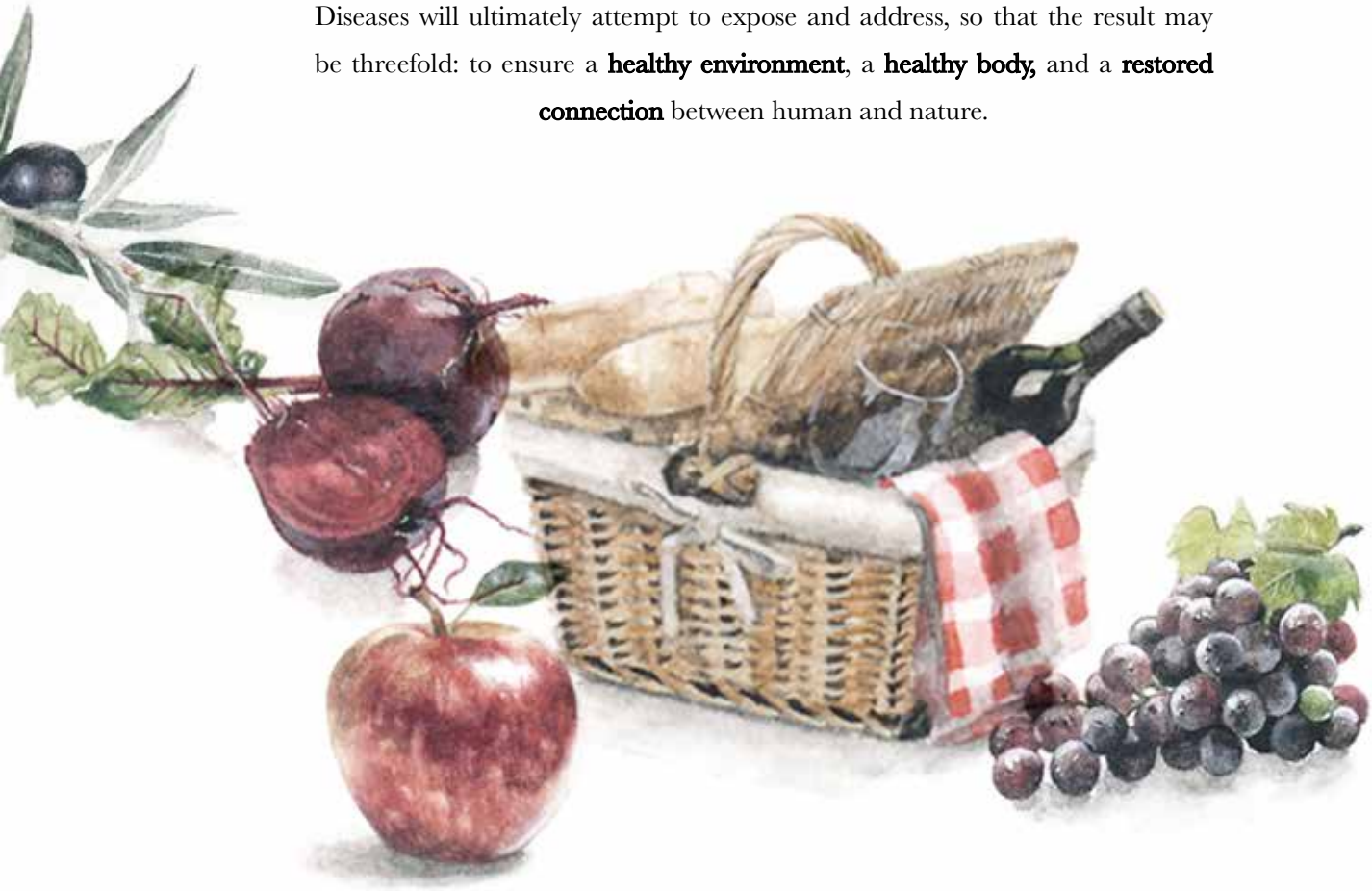


FIGURE 4.1

Day 32, Long Road

(Lorraine Loots, 2013)

chapter four

CONTEXT & SITE

41 PREFACE

The following chapter will investigate the contextual influences on the chosen site that most appropriately support and allow for the **restoration of reciprocity** between humans and nature through building. The dissertation will firstly be positioned within the urban framework that addresses the **discarded landscape of the West,** and deliberate on how it would contribute to the framework. Secondly, an urban analysis of the **South Berea precinct** will be done in terms of the historical, socio-ecological, cultural and ecological context and influences that will inform a Regenerative urban proposal for the **southern gateway into Pretoria.**

A comprehensive site analysis will then be done in order to identify the physical and intangible qualities of the site that will **inform site-appropriate design possibilities.** Most of these qualities will be of an ecological nature in order to promote bio-remediation to take place on site, although other aspects such as movement patterns, access, and social and cultural activities will also be considered.

4.2 THE URBAN FRAMEWORK

If one looks at the historical development of Pretoria it is clear that there has been a strong emphasis on development towards the east, which in time has resulted in an **unbalanced city** (Pretorius, 2011:3) unable to control its own growth, making Tshwane the largest metropolis in the world and with that, one of the most unsustainable. The perception of the west of Pretoria is that it is a landscape fit to be discarded, littered with mental institutions, prisons, old-age homes, homes for the disabled and burial places for the dead. The West has become the backyard of Pretoria, the graveyard of past industrial dreams.

From an internal approach, the area of investigation focused on the western part of Pretoria Central, moving west from Paul Kruger Street and terminating at the western outskirts of Atteridgeville. The northern and southern boundaries are determined by the two ridges that define Pretoria.

Four lenses were used to analyse the latent potential of this area, namely **ecology, heritage, public** and **economy.** After analysing its latent potential, it became clear that the West encapsulate immense cultural diversity and public energy, which can be utilised for the regeneration of their context. Vast tracts of land close to the CBD lie open for potential development. The West is rich in cultural and historical narratives, which can be harnessed in the celebration of this unique and significant environment.

The vision for the West of Pretoria aims to revitalize marginal space, re-instill developmental energy and re-establish the area as an essential part of the city's future, to **ultimately restore developmental balance** to the city at large, and ensure its sustainable continuation. It will enable the people of the West equality in access to the city and enforce their claim to the opportunities it provides.

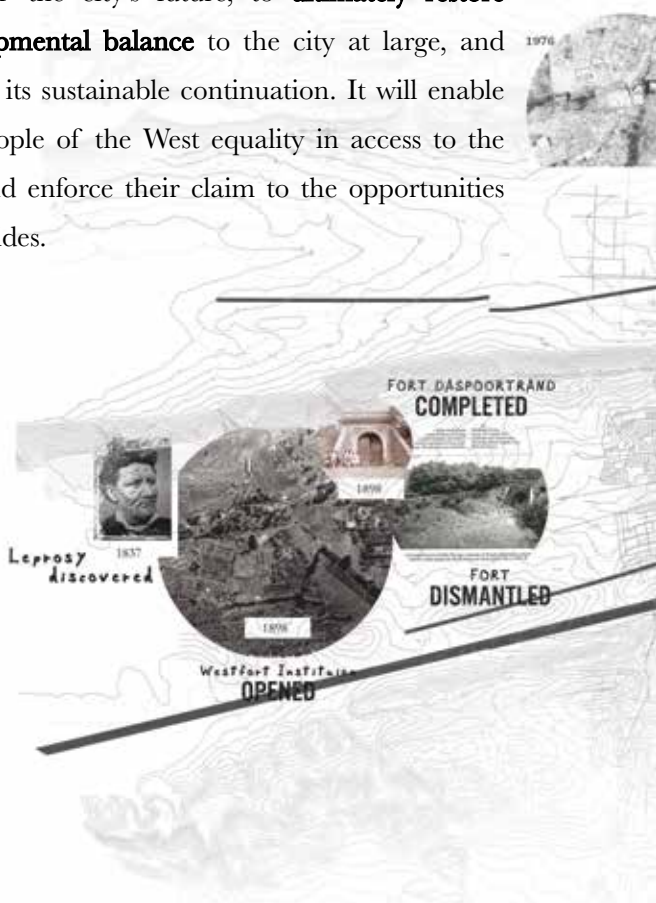


FIGURE 4.2
The discarded landscape of the West timeline (Author, 2016)

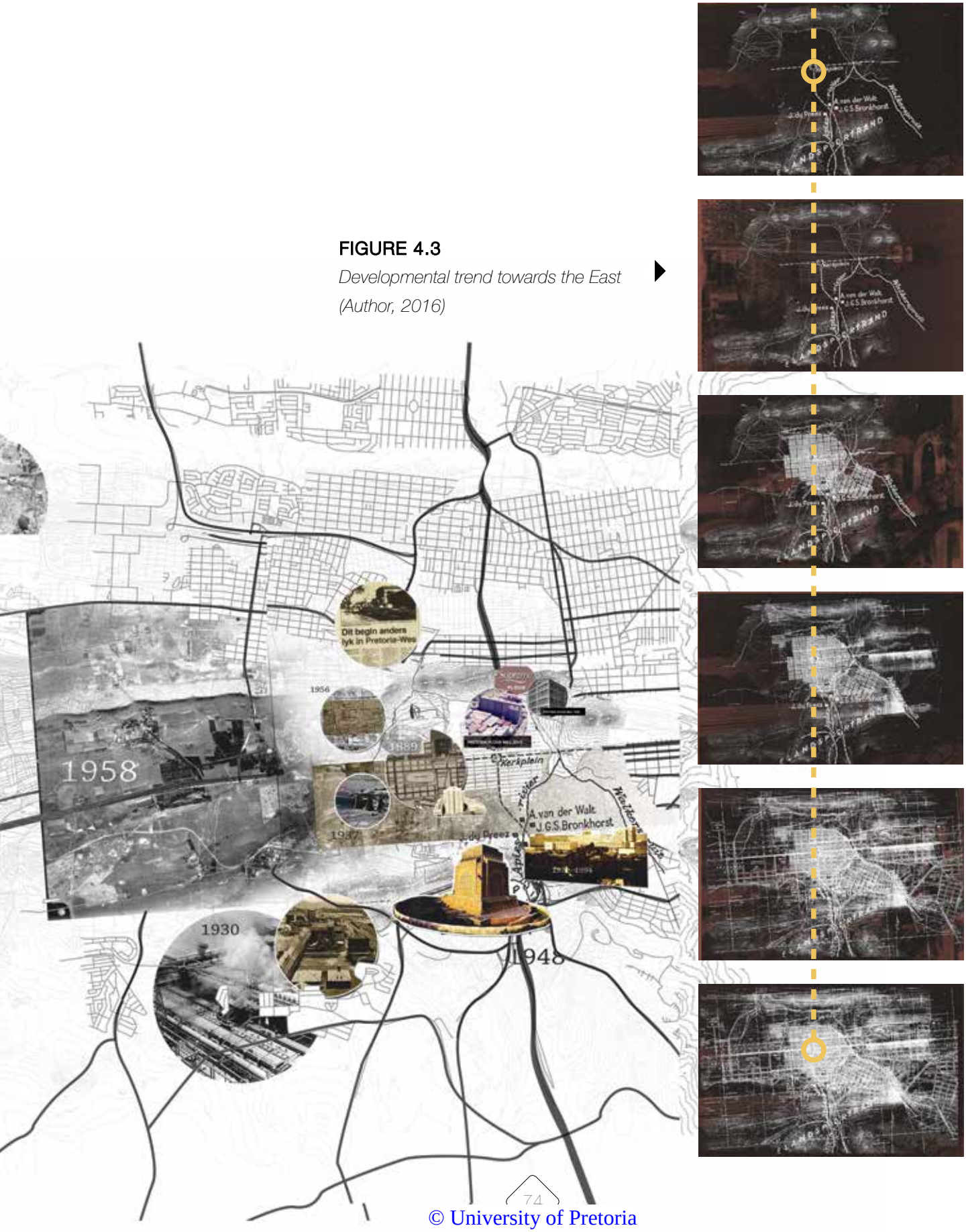
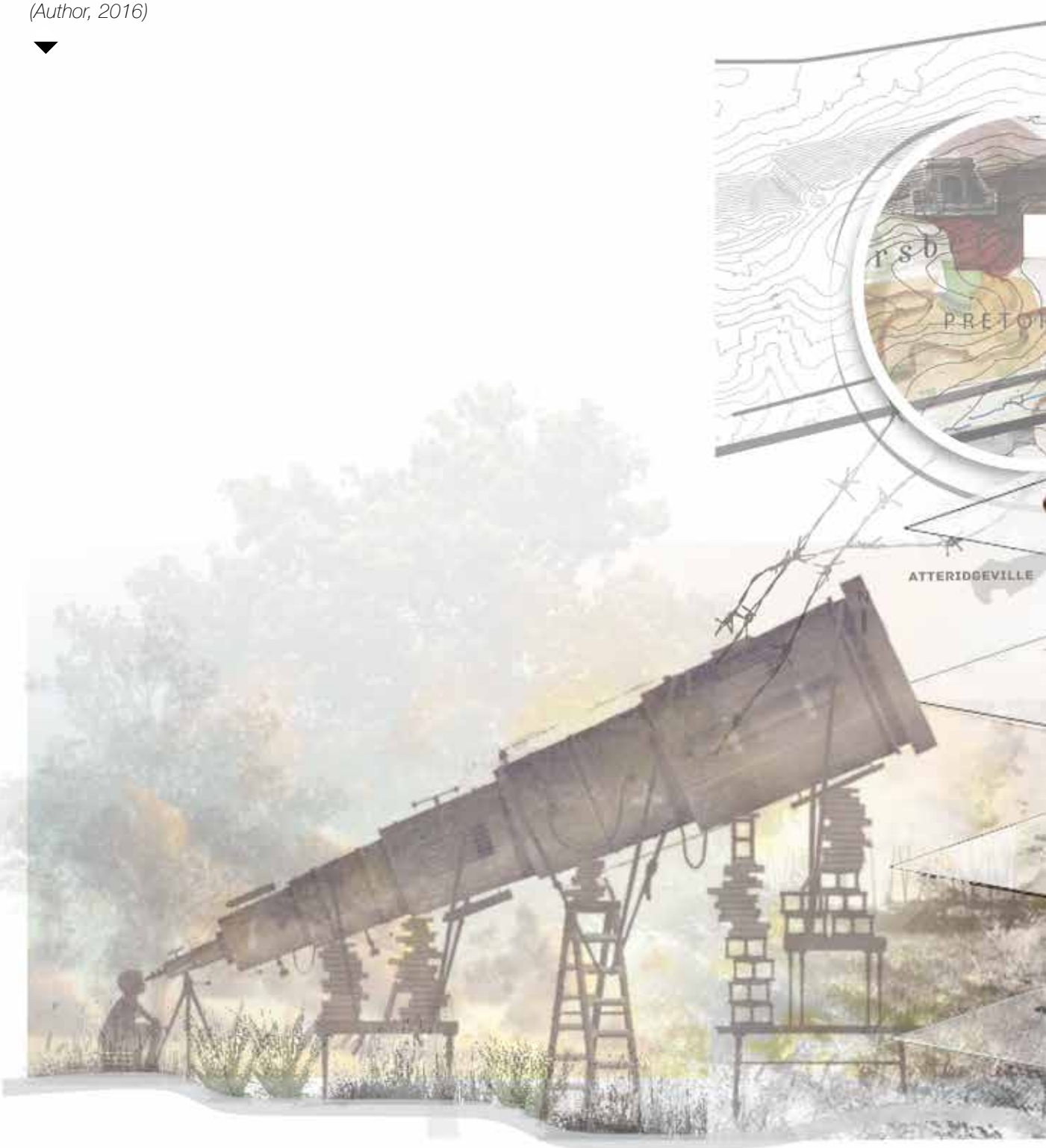


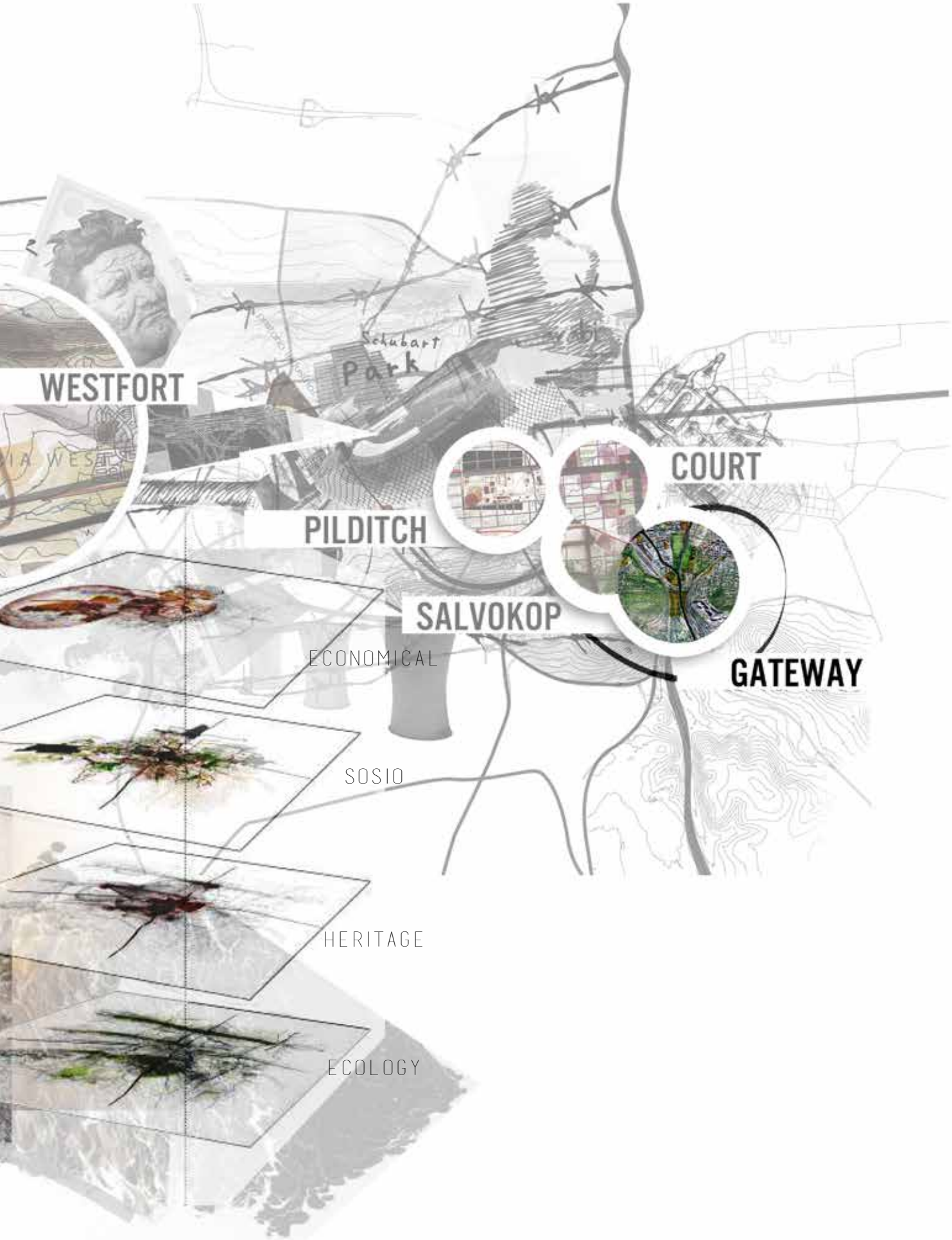
FIGURE 4.3
Developmental trend towards the East
(Author, 2016)

FIGURE 4.4

Urban Framework Approach

(Author, 2016)





Nine broader principles were compiled to be applied, within each site in order to achieve the **vision of depolarizing the West** (Pretorius, 2011:12). These include:

Establish multi-functional uses
Create civic space
Regenerate the immediate context
Celebrate significance
Ensure densification
Strengthening networks
Promote developmental balance
Celebrate everyday rituals
Ensure accessibility

These principles are focused on, firstly, addressing the **natural ecological structure** evident throughout the city. Secondly, it focuses on the **heritage fabric** and its intended development, as well as the intangible active and dormant layers of memory. Finally, it addresses the **public sphere** of the city and the inhabitants' tights and access to the city, as well as the manifestation of the **informal economy** throughout the city (Pretorius, 2011:14).

The dissertation will contribute to the vision for the West by pursuing the **repair of neglected parts of the urban ecosystem** (Corner, 1991:34), which in turn will facilitate urban public health and well-being for all its inhabitants, and subsequently **restore reciprocity** between humans and their natural living environment in the West.

Strengthening networks

Ensure accessibility

Ensure densification

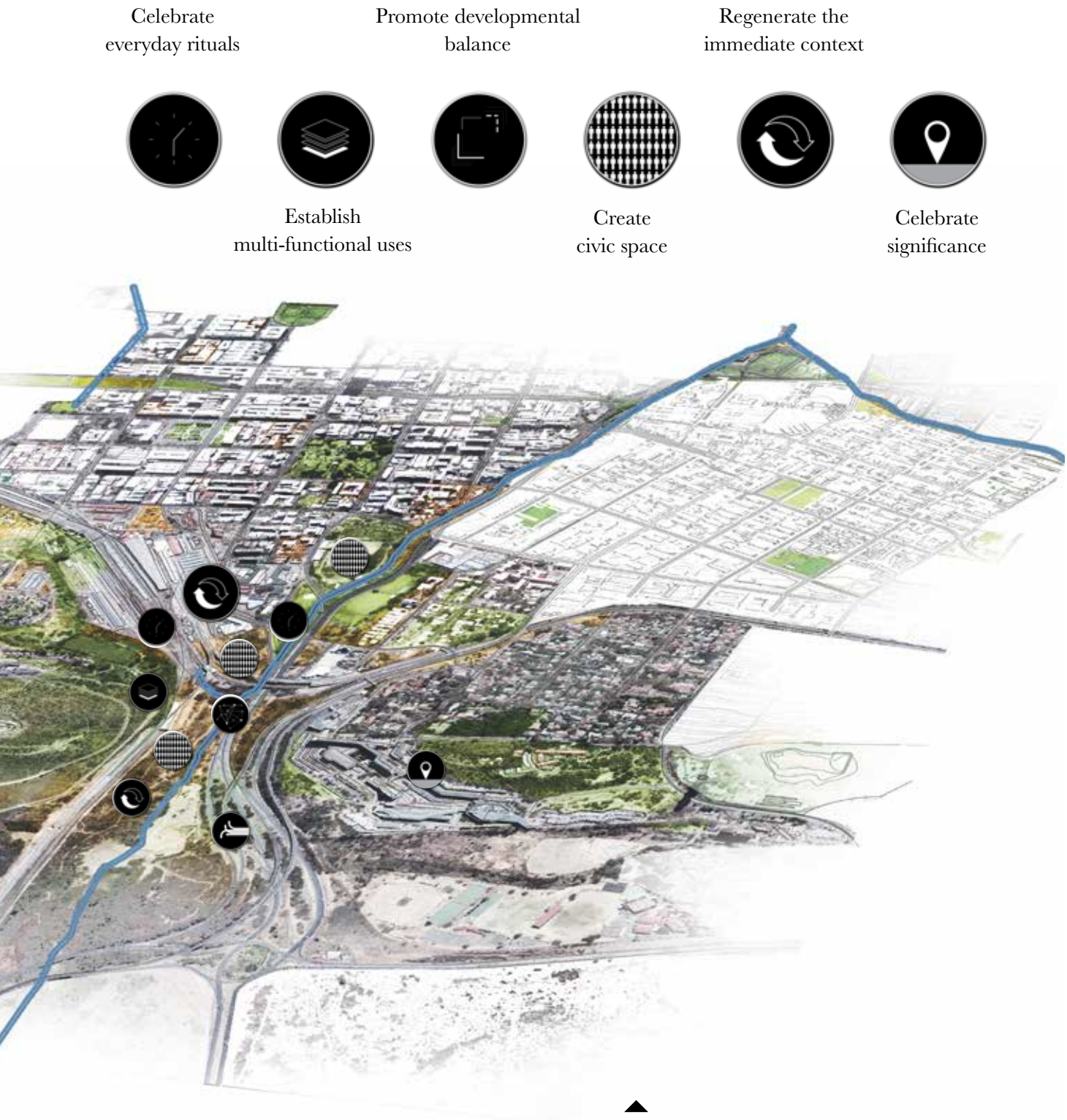


FIGURE 4.5

Illustration of Urban Principles applied to urban foyer (Author, 2016)

FIGURE 4.6

Study area within the context of Pretoria

(Author, 2016)

4.3 URBAN ANALYSIS OF SOUTH BEREA

4.3.1 HISTORICAL CONTEXT

Today, when visitors and inhabitants enter Pretoria through Elandspoort, they are oblivious to the fact that they are tracing the footsteps of stone-age man. Archaeological evidence indicates that, during the pre-colonial era, Elandspoort **served as an access and exit gateway for crossing the valley** to Wonderboompoort (Pelser 1998: 22). A small river, today known as the Apies River, which springs from the strong fountains in the dolomite ridge north of Elandspoort, snakes through the valley and exits north through Wonderboompoort, historically serving as a water source for the hunters and gatherers that resided more permanently along its spine.

However, as one enters Berea today, one is confronted by a vast amount of green open spaces that are inaccessible for public use and neglected in most parts (Pretorius, 2011:18). Even though it is considered to be the southern gateway to the city, this area has been neglected and not fully appropriated for its potential as an 'urban foyer' to the city. The current land uses in Berea are mainly residential, with some retail and office developments on the western side of the river, towards the Pretoria Gautrain station.

FIGURE 4.7
Photos of entrance into Pretoria & site
(Author, 2016)

4.3.2 CULTURAL CONTEXT

The geographical area south of Pretoria was for decades spatially dominated by the **Fort Salvokop and Fort Klapperkop** and the Voortrekker Monument, lying on a west–east axis and projecting a strong spatial and visual dominance of Afrikaner values (Labuschagne,2010: 113). The dominance of the forts and monument from the colonial era motivated the decision to erect **Freedom Park** on the neighbouring Salvokop hill to rectify the spatial imbalance of monuments in the area. It lies on the spatial axis line of the **Voortrekker Monument** and the **Union Buildings.**

Freedom Park nestles unobtrusively around Salvokop's gentle incline. The footpaths linking the various areas synchronize with the surroundings to reduce any possible intrusiveness nature of the Park. Freedom Park with its surrounding natural landscape presents opportunities for pedestrian linkages to be made to the city through the Berea Precinct.

4.3.3 SOCIO - ECONOMIC CONTEXT

South Berea is characterized by a high-density **residential** demographic that has limited **informal and commercial activities.** The residents are predominantly lower-middle class, of a multicultural nature and divided into two distinct groups: a minority older white population relying

on personal vehicular transport, and a younger multiracial pedestrian-orientated population that relies on public transport and is mainly employed in the CBD. Some residents are owners of informal trading stalls along busy streets. The students who attend the educational facilities in Pretoria rely on train, taxi and BRT services for transport. Predominant pedestrian movement during peak hours is evident to and from **Pretoria Station** on a daily basis. **Nelson Mandela Drive** carries heavy vehicular traffic during peak hours to and from the inner city (Myburgh, 2014: 54-55).

Currently, land uses within South Berea are in a transitional phase where the emergence of retail is replacing the previous low-density landuse. According to the 2011 Spatial Development Framework (Pretorius, 2011: 21), South Berea is demarcated for mixed land uses, including office space, retail, residential and institutional facilities: however, few of these intentions have been realised.

FIGURE 4.8

Image of Freedom Park, UNISA and Voortrekker Monument at city entrance. (Labuschagne, 2010, adapted by Author, 2016)

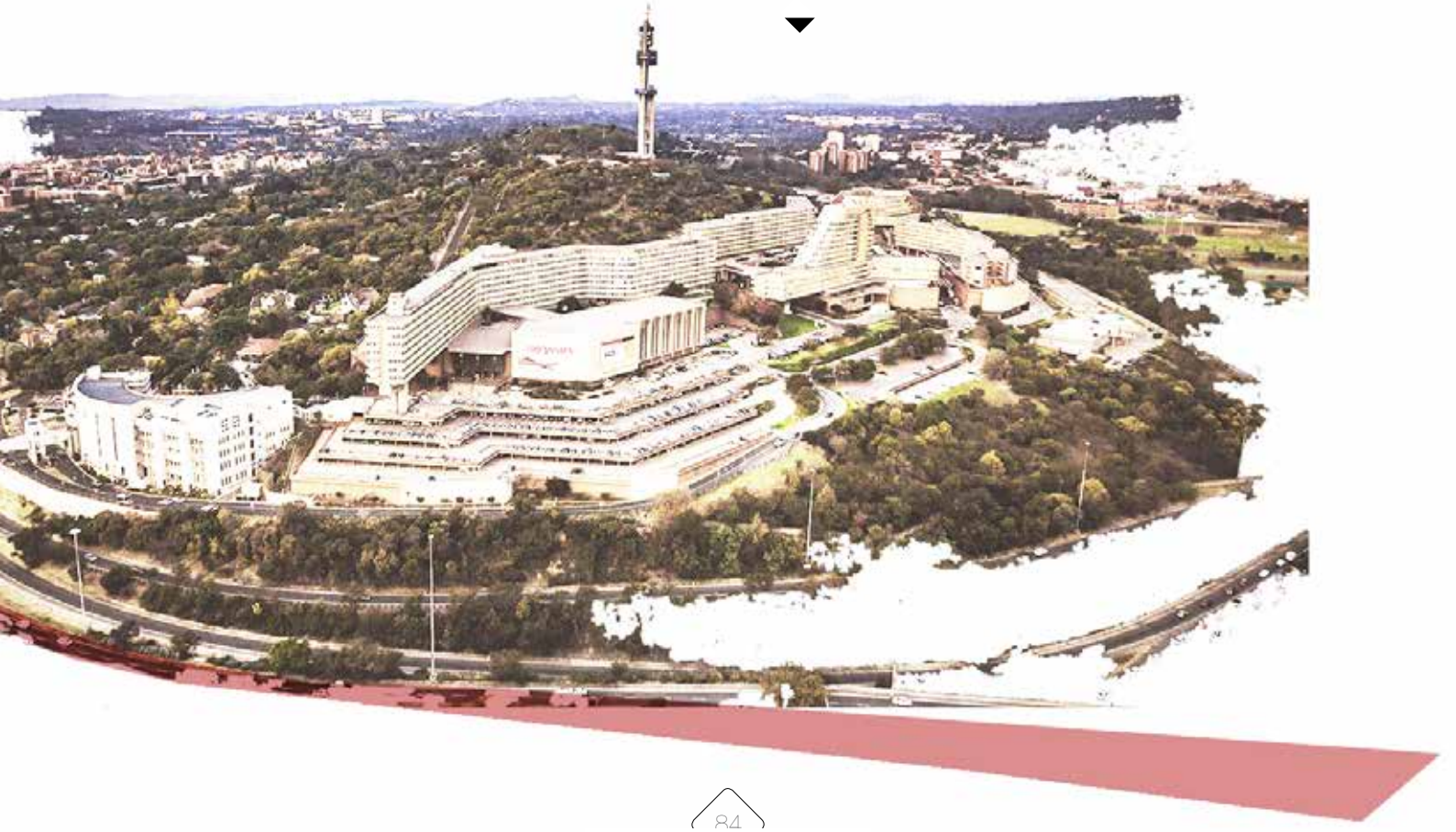





FIGURE 4.9

Photos of entrance into Pretoria & site (Author, 2016)

Hydrology

The predominant water network of Pretoria is the **Apies River** that originates at two fountains located at Fountain's Valley, and which consistently delivers about 26megalitres of water per day (Myburgh, 2014: 32). The route of the Apies River runs through South Berea and has historically determined most of the urban development in the inner city, such as main transport routes and the legibility of the urban structure. However, as the pace of life quickened and the demands of the growing economy increased, the Apies was forgotten to become the city's main drainage ditch. Most developments turned their backs to the river, isolating one of Pretoria's most important form givers.

Being located in such close proximity to the **Apies River** as well as the **slope of the Salvokop hill** (Labuschagne,2010: 116), South Berea has numerous **flood plains and natural basins** that are currently dried up but show evidence of being **natural wetlands,** indicating where flooding could occur during high-rainfall seasons.

Green networks

The chosen site, a deteriorating and unused green space, has been identified as the only access point to the **historical green belt** of the **Fountains Valley** and the rest of the **Groenkloof Nature Reserve** running alongside the Apies River (Van der Walt, 1967: 12).

The site is located in the transition zone of the Rocky Highveld Grassland and Savannah biome. Alien vegetation does exist within the precinct, but will be eradicated and replaced with indigenous vegetation from these biomes.

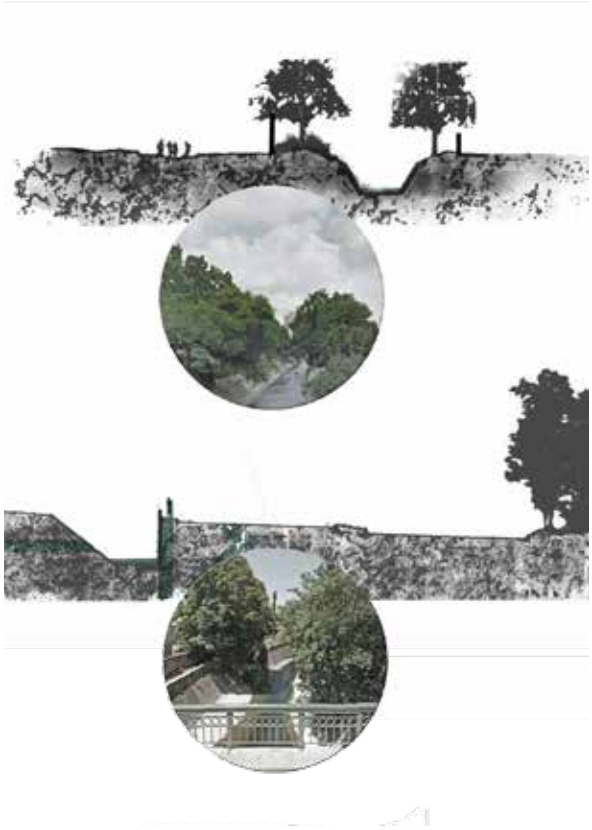


FIGURE 4.10
Sections of Apies River conditions.
(Van der Walt, 1967)

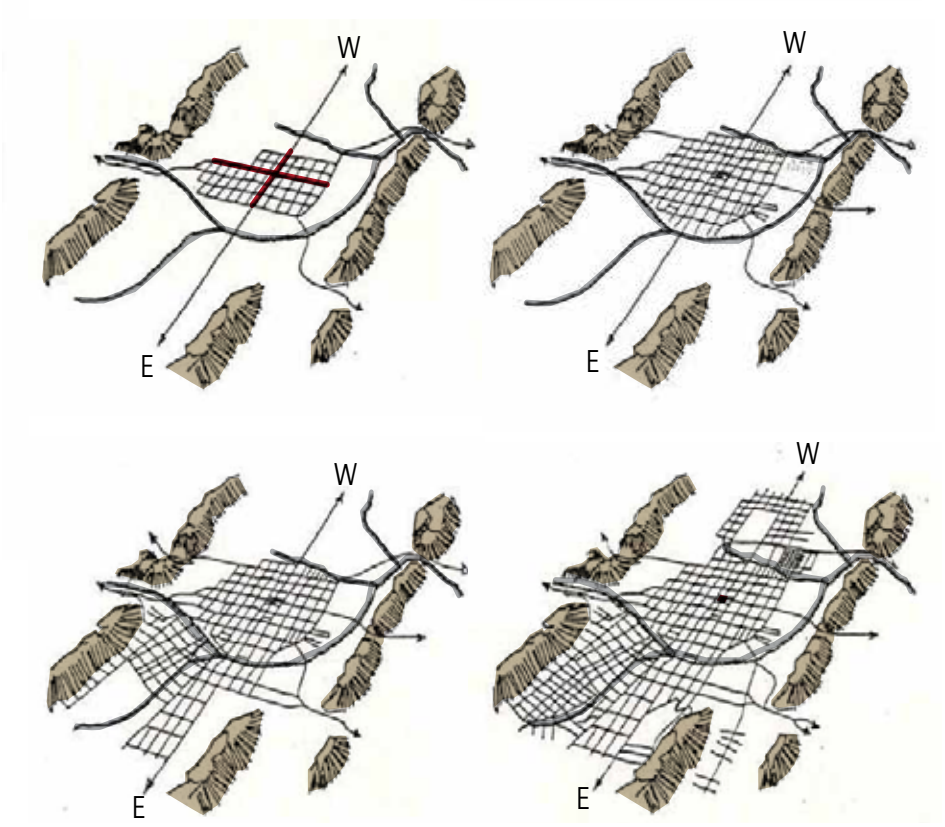


FIGURE 4.11
Topography of Pretoria.
(Labuschagne, 2010)

Topography

The Apies River, which runs in a north-south direction, cuts through three east-west running ridges, namely Salvokop at Elandspoort, the Witwatersberg at Daspoort, and the Magaliesberg at Wonderboompoort. Due to the topography of the ridges the **urban grain** and structure is orientated in an **east-west direction** (Van der Walt, 1967: 6-7).

Unlike the rest of the inner city, the urban patterns of Berea are of a more **organic** and haphazard nature due to ecological influences such as the topography and river, creating a **unique urban grain.**

Geology

The soil in proximity to the river consists of andesitic lava [T3dL] that weathers into a deep red loamy soil. This soil condition is also evident where natural wetlands occur around the contours due to the topography. Shale [T3dS] that weathers into clay also occurs in the precinct of the proposed site and in the riverbeds. This shale rock is usually encountered at a depth of 2m. At this depth the rock is soft, becoming harder with depth, being medium hard at 4m (Van der Walt, 1967: 6-8). This implies suitable conditions for minor and major structures. The impermeable nature of shale, however, creates problems in the operation of French drains in the Pretoria district.

FIGURE 4.12

Contextual mapping & analysis

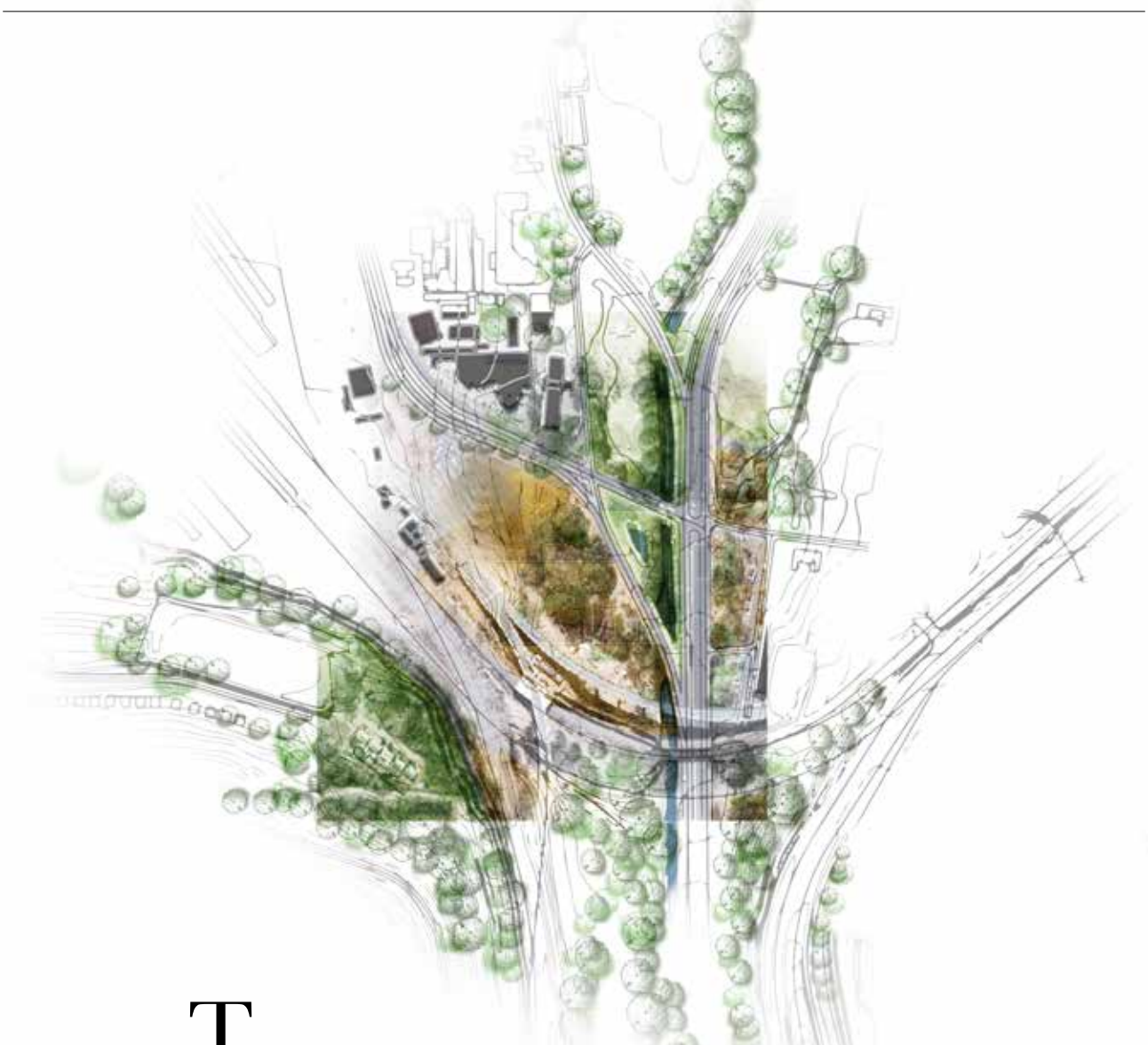
(Author, 2016)

4.4 SITE ANALYSIS

4.4.1 PHYSICAL LOCATION & DESCRIPTION

The chosen site currently functions as the **threshold between the urban and natural fabric of the city.** It displays dynamic edge conditions, with the Gautrain embankment on the southern edge, the Apies River and Nelson Mandela Drive on the eastern edge, an open edge leading to the Gautrain Station to the West, and Thabo Sehume Street on the northern edge leading into the CBD of Pretoria. It thus becomes evident that the site retains major prominence as it becomes a **nexus point** where many **urban, ecological and transport activities converge.** However, it has become an island that is disconnected from the surroundings, with minimal opportunities for access and engagement as it currently houses a Mercedes Benz dealership. The site is within 400m walking distance from the Pretoria Gautrain Station.

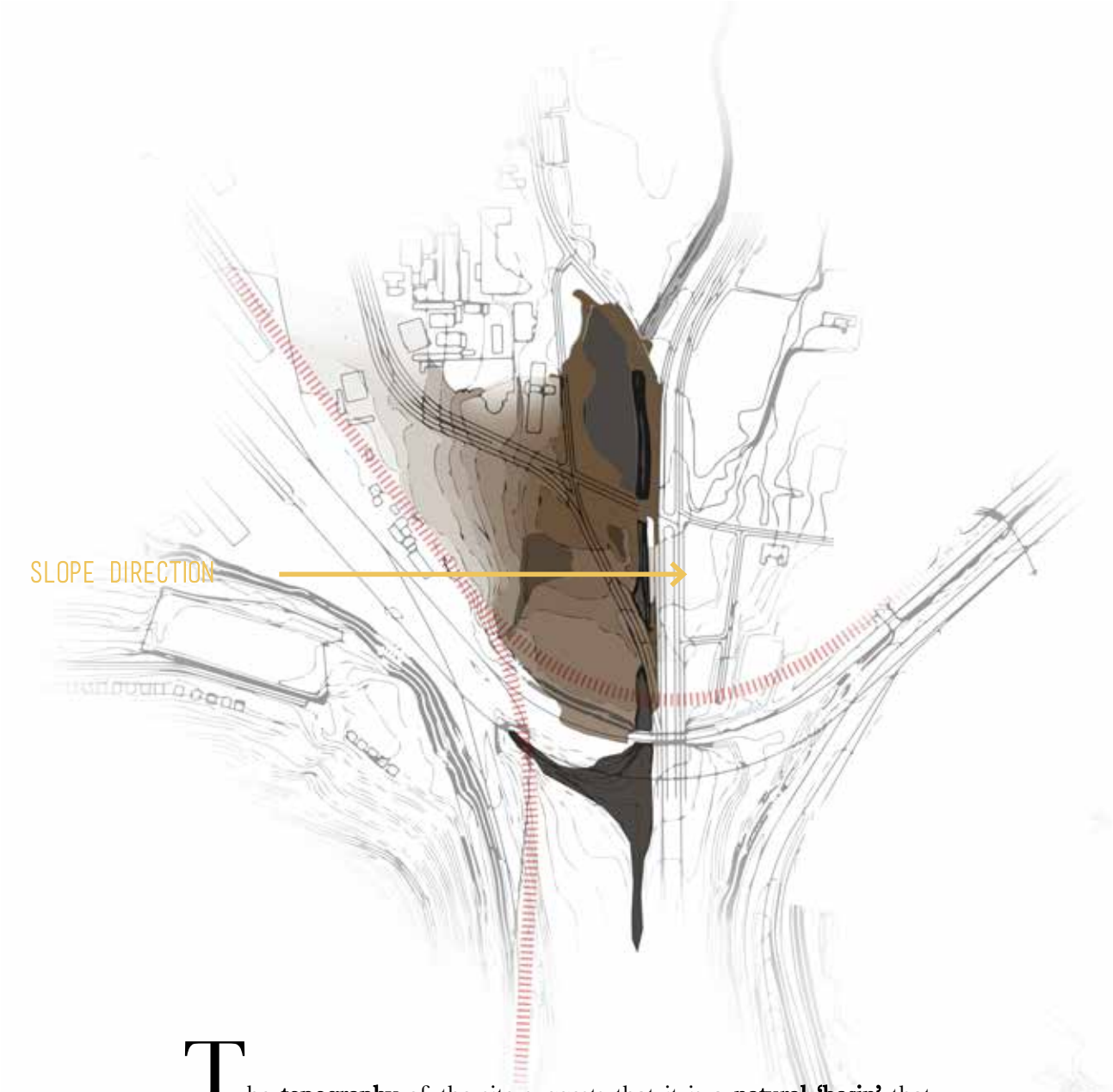
The urban fabric alongside Thabo Seshume Street, across from the chosen site, contains pathways for high levels of pedestrian activity, but is still undefined and illegible due to its lack of character (Myburgh, 2014: 33). **Berea City** is the commercial hub of the area, but serve only the vehicular traffic passing through. As a result, Berea City has become alienated from the **pedestrian-orientated society** in which it is located. Its urban edge is fragmented and the buildings are isolated elements, making reference to neither their natural context nor their man-made context.



The diagram illustrates that the site is of a **brownfield** nature and underutilized. It does however present huge opportunities for becoming part of the larger **ecological corridor.** The Apies River will be integrated into the vision of **ecological reclamation,** together with the establishment of a symbolic man-made wetland dictated by the topography on site.

FIGURE 4.13

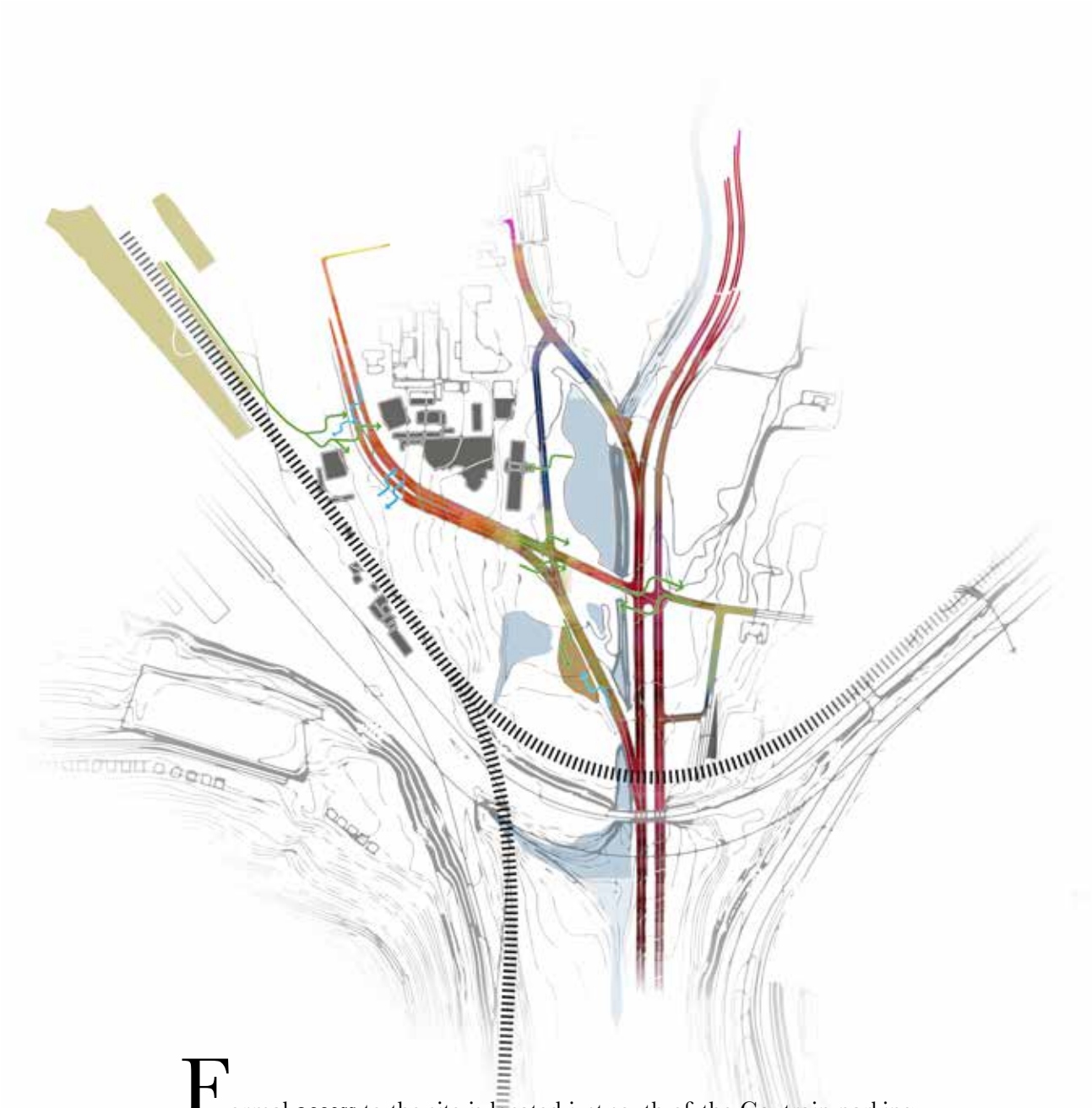
Ecology diagram (Author, 2016)



The **topography** of the site suggests that it is a **natural 'basin'** that provides the opportunity for containing energy. The topography ensures different views of the surroundings, presenting the opportunity to have different levels and vistas.

FIGURE 4.14

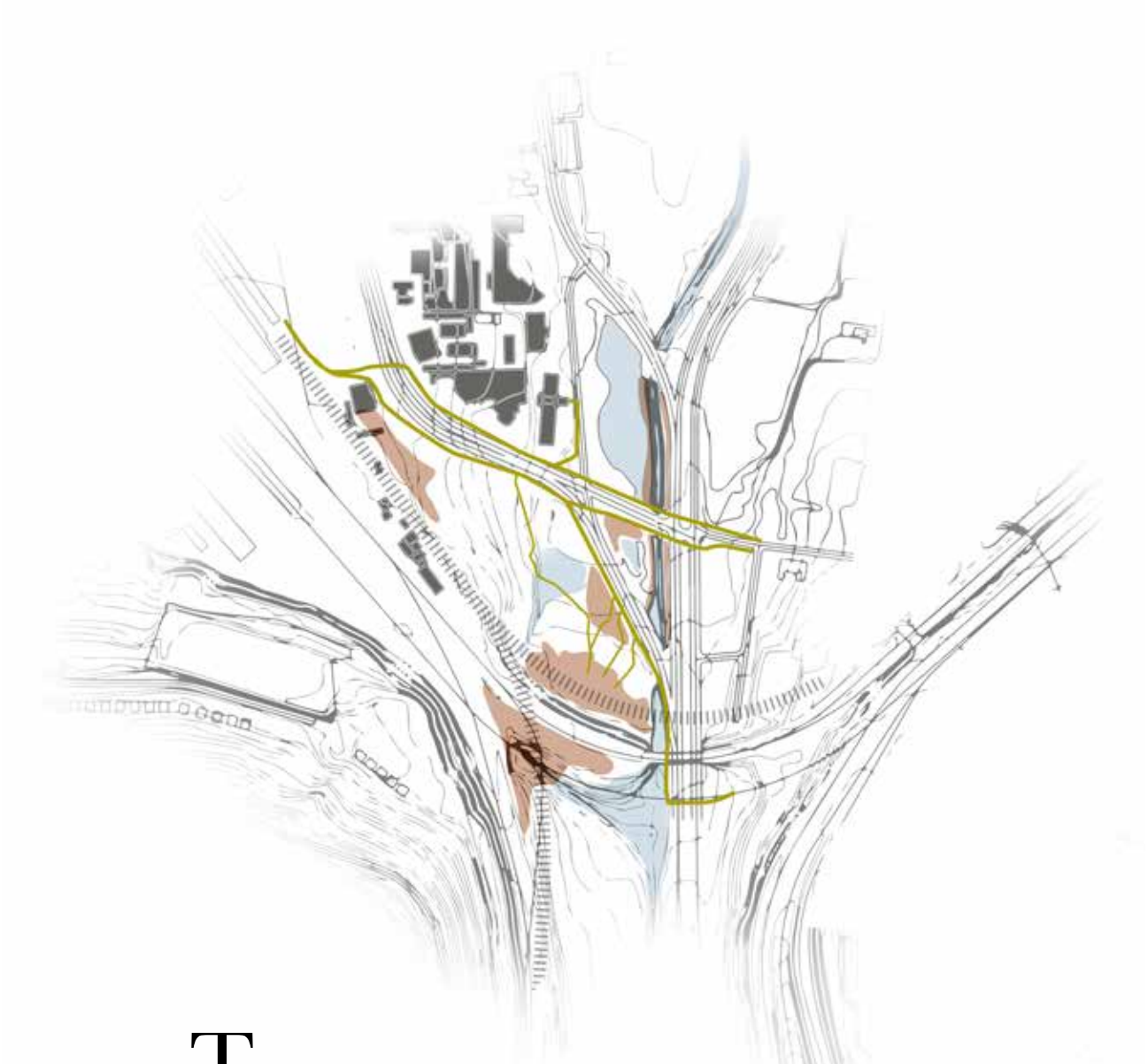
Topography diagram (Author, 2016)



Formal **access** to the site is located just south of the Gautrain parking entrance. There is however an **informal entrance** on the site on the eastern edge, where taxi's pick up and drop off pedestrians living and working close to the precinct. **Informal pedestrian crossings** are indicated with green arrows. The diagram also indicates the **intensity of vehicular movement** around the site.

FIGURE 4.15

Accessibility and movement diagram (vehicular and pedestrian)
(Author, 2016)

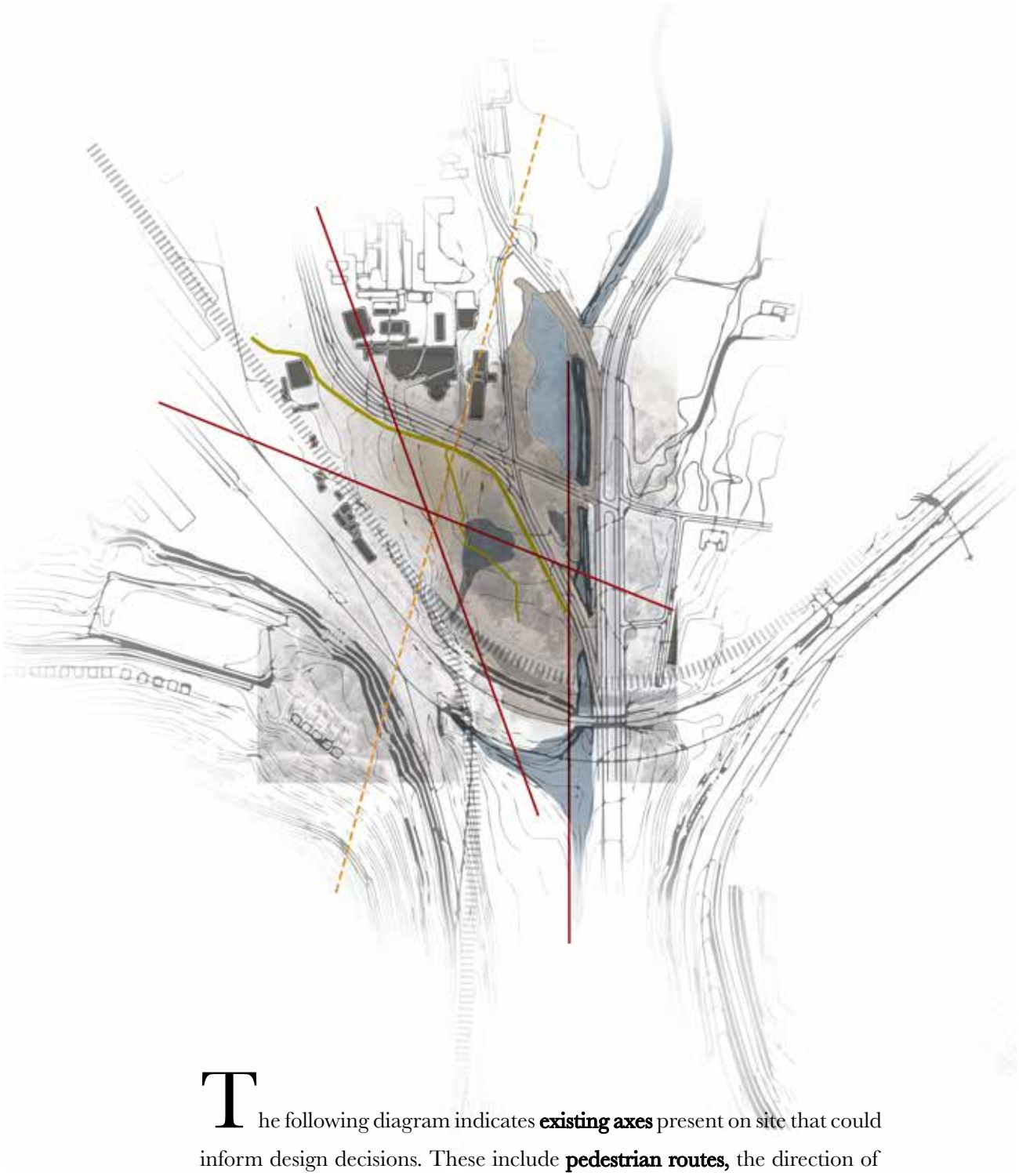


The south-eastern edge of the site accommodates **informal trading and social activity** during the day. It is evident that this might be due to the proximity of the Apies River, used for getting water and bathing, as well as the shade that is provided by the Gautrain bridge crossing Nelson Mandela Drive. This situation proposes immense opportunities for **harnessing existing energies, pedestrian routes** and **activities.**

FIGURE 4.16

Cultural, economical & social activity diagram

(Author, 2016)



The following diagram indicates **existing axes** present on site that could inform design decisions. These include **pedestrian routes,** the direction of the **contours and topography,** and North as the ideal **solar orientation.**

FIGURE 4.17

Axial informants (Author, 2016)

4.5 SUMMARY

When the context on an urban and site scale is understood, it becomes clear that there are very distinct informants to guide the conceptual birth of the project. The design of the Wellness Centre, in the context of Pretoria, has three key outcomes that it needs to achieve to become a **nexus of reciprocity** between nature and humans in the area of South Berea and the rest of the inner city. It should address the **deteriorating and inaccessible state** of the ecology and natural features, so that these can become healed, celebrated and enjoyed. On the other hand it should address the **wellness of the inhabitant of the city** on a psychological and physiological level, in order for them to feel rooted and healthy within their environment, and finally be **reconciled with nature** and become an integral part of it once again.

FIGURE 5.1

Day 180, Venus Fly Trap

(Lorraine Loots, 2013)

chapter five

CONCEPTUAL DEVELOPMENT & PRECEDENTS

5.1 PREFACE

The following chapter aims to translate all the contextual and programmatic informants and intentions in order to embed these within the theoretical framework stipulated in Chapter Two. The theoretical framework not only allows for conceptual interventions to be implemented on **different scales**, but also makes it possible to address the **three core concepts** that the scheme needs to achieve: the **healing of the land**, the **healing of its people**, and the **restoration of a reciprocal relationshi**p between them on equal terms.

Relevant **precedents** will be discussed throughout the chapter to illustrate how certain theories and approaches have been applied. These different approaches on different scales of implementation will generate **various architectural concepts**, but all with one common goal: to **reconcile** man and nature through the process of **healing and celebration.**

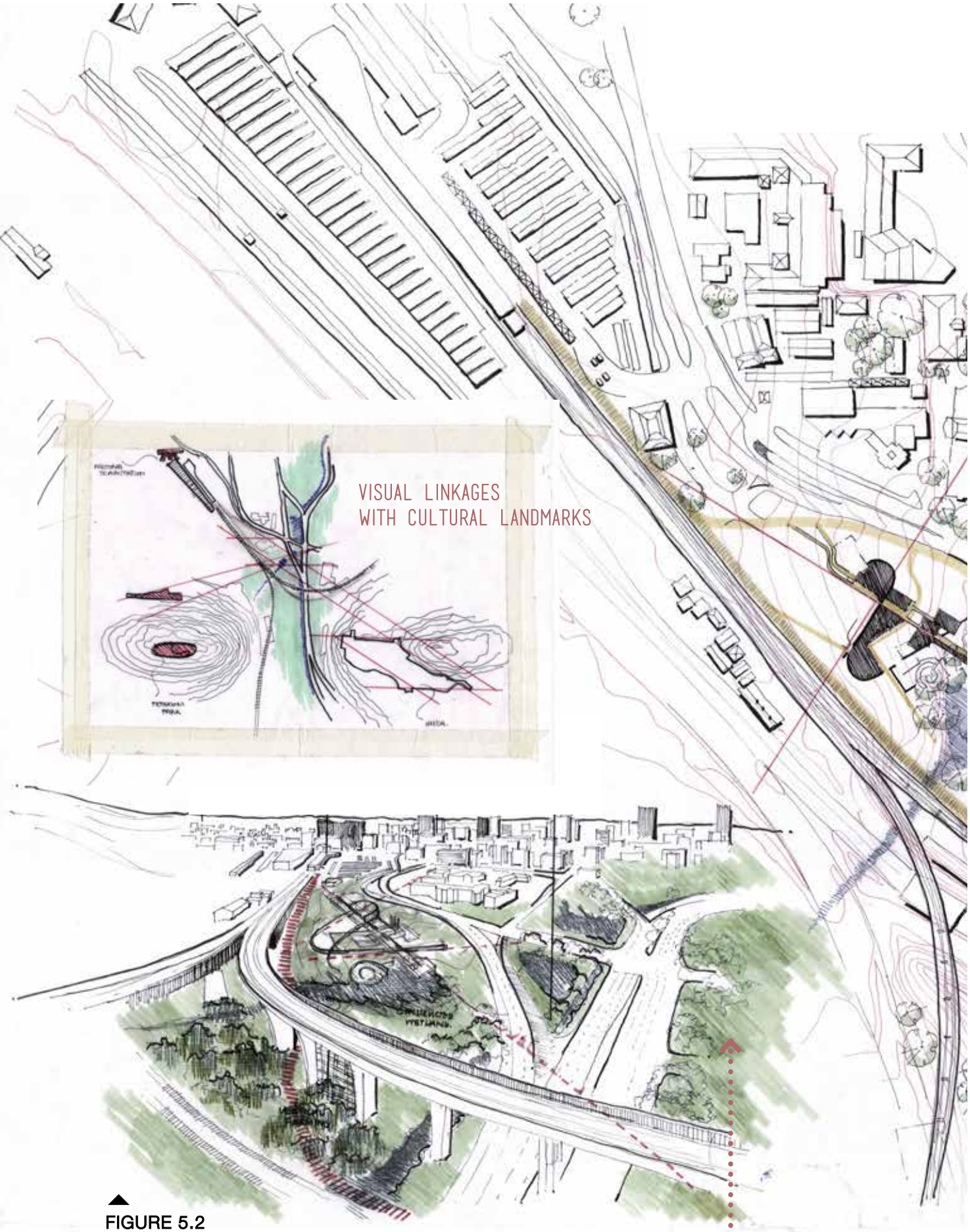


FIGURE 5.2

Urban vision for South Berea as urban foyer

(Author, 2016)

5.2 URBAN PROPOSAL

REGENERATIVE ETHOS

5.2.1 AN URBAN FOYER INTO THE PRETORIA CBD

The most fundamental aspect that the urban proposal will address is to engender the precinct of South Berea with its intended identity as an **"urban foyer"** to the rest of the city. In order to achieve this, the inherent qualities of the area should be **enhanced, celebrated** and made **accessible** to the public.

Multiple open spaces can be found along the spine of Nelson Mandela Drive, such as Berea Park, the UNISA Sunnyside Sport Fields, the Groenkloof Nature Reserve and the Freedom Park Reserve, that could be tied together within an urban vision to enhance South Berea's identity as an **"green urban foyer"** of the city, presenting major opportunities for the renewal of the precinct in terms of **pedestrian-friendly** and **accessible ecological corridors,** in order for it to regain an important place on the mind maps of people living in Pretoria.

By proposing an urban vision that is able to reconnect human aspirations and activities with the evolution of natural systems, effectively leading to co-evolution, it becomes possible to engender the area with a **regenerative mindset** that aspires to merge the inhabitants of South Berea and the people of the city with nature as an integral part of the whole.

Urban Design Precedent

Sagrera Linear Park, Barcelona, Spain, West 8 Urban Designers, 2011

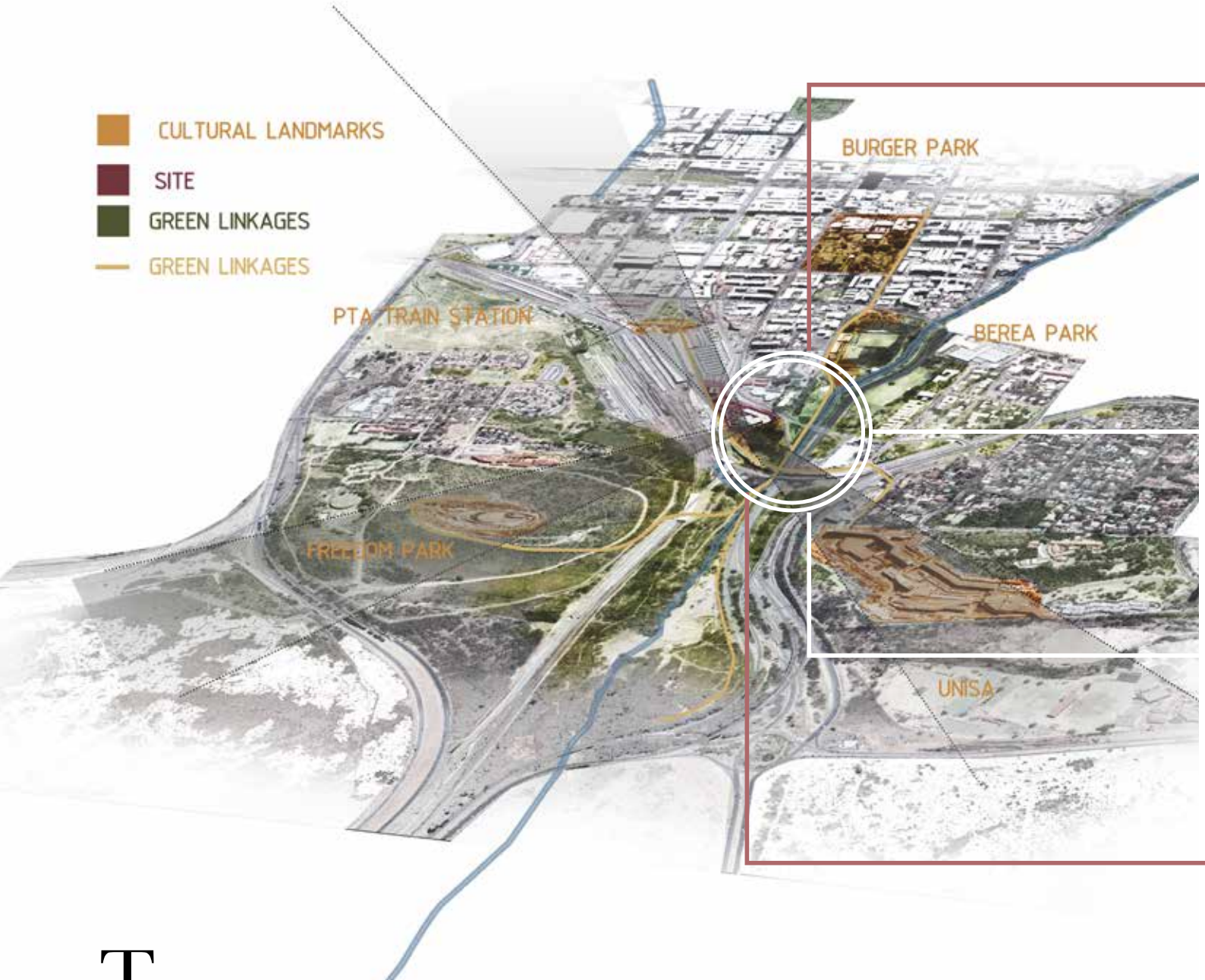
An example of such an initiative within an urban condition is a theoretical urban proposal for Barcelona by West 8 Urban Designers. The Sagrera Linear Park (West 8: 2011) is to become a new green diagonal axis that extends into the very heart of XXI Century Barcelona, aiming to be a protagonist of a new era of a greener and more habitable metropolis which is in direct contact with its natural surroundings. The park not only improves biodiversity in the city but also seeks to be a counterpoint to the urban frenzy and activity present in Barcelona, allowing its users to experience the benefits of a green welcome carpet into the city.

5.2.2 A PUBLIC AND PRODUCTIVE GREEN CORRIDOR

Social, cultural and economic activities in South Berea will be integrated with the ecology of the area by proposing **four essential strategies** for the existing but underutilized green corridor running through the area.

FIGURE 5.3

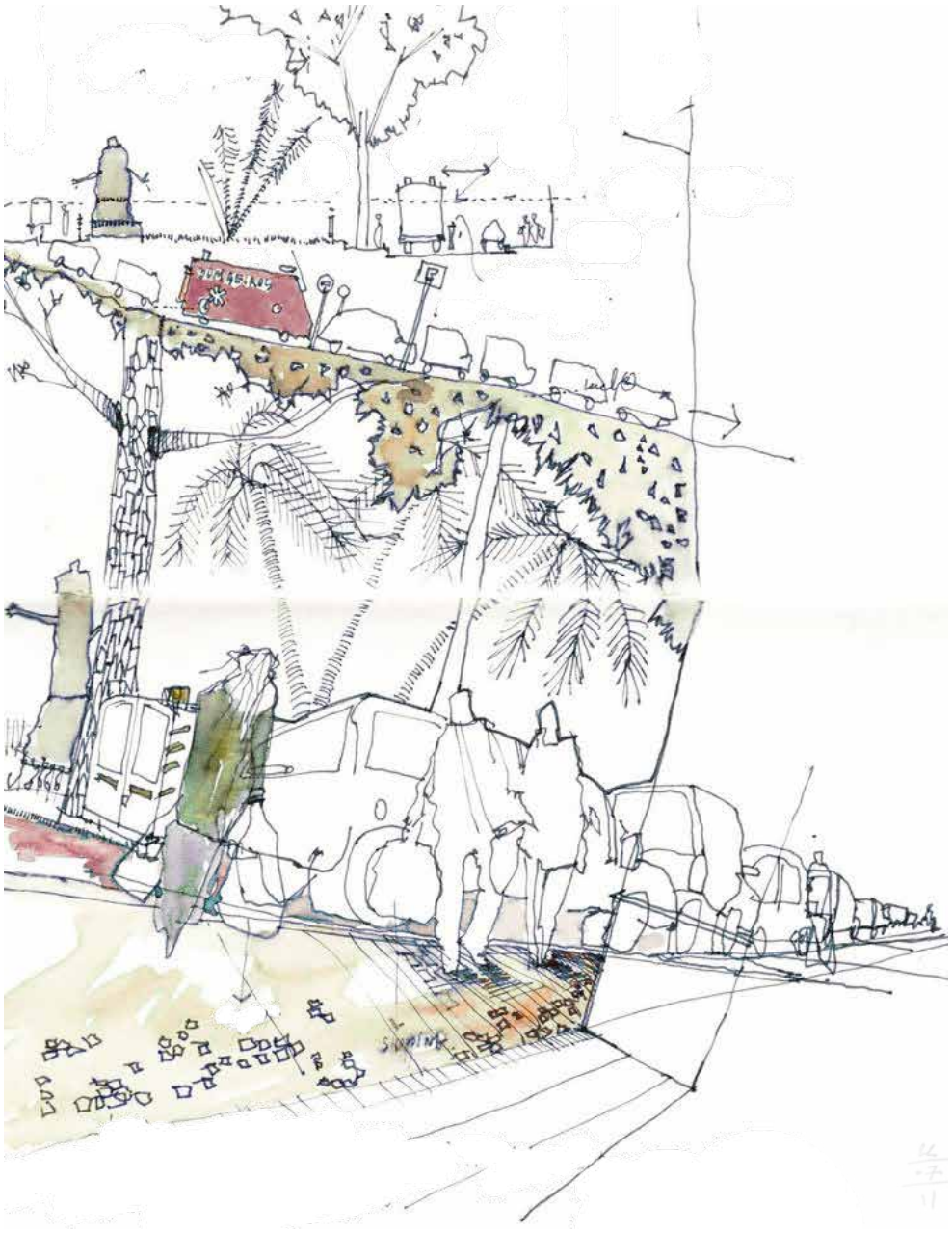
Sagrera Linear Park, Barcelona. Spain
West 8 Urban Designers . 2011
(West8, 2011)



The first is to establish **linkages** between all the detached green spaces along Nelson Mandela Drive through the implementation of pedestrian-friendly walkways and activity routes. These routes should be of a hybrid nature, some allowing for cycling that connects to the nature reserves towards the south, and others connecting to urban activities towards the north. **Culturally** and **historically** significant linkages with Freedom Park, Berea Park and the Pretoria Station can also be made to ensure a richer narrative for the urban open space system of the city. These linkages should be strengthened through the introduction of interactive street furniture at regular intervals, including **seating and lighting** to illuminate walkways at night for security and surveillance. **Surface treatments** should also be considered to improve legibility and to slow down vehicular movement at pedestrian crossings.

FIGURE 5.4

Strategy 1: Linkages and Stitching (Author, 2016)



The second strategy is to establish stronger linkages between the Pretoria Gautrain Station and the rest of the Berea precinct, as a large percentage of Berea residents rely on **public transport.** The Gautrain will also become the main carrier of pedestrians moving to and from the surroundings. This **route** should thus present a character that allows for multiple activities. The route should be wider to accommodate street lighting, tree lanes and street vending and informal market possibilities. **Informative signage** should be provided to improve legibility and inform users of the significance of place, people and nature.

FIGURE 5.5

Strategy 2: Movement and Accessibility (Author, 2016)

After these strategies have been implemented to facilitate the existing human activities, it now becomes necessary to address the **natural condition** of the green belt/spine. The third strategy is thus focused on the **restoration of the brownfield sites** along this spine, achieved by **eradicating invasive species**, ensuring **maintenance** initiatives, and upholding linkages that facilitates public accessibility. Furthermore, the topography along the Apies River also suggests defined flood plains, which can serve as a guide on how **constructed wetlands** can be incorporated along the spine, to ensure a biodiverse and sustainable precinct to enhance the entrance as a natural habitat that people of the city can associate with.

FIGURE 5.6

Strategy 3: Ecological Remediation (Author, 2016)

The final strategy is to introduce **urban agriculture** to the open spaces along the spine, to not only **remediate** the land through **permaculture**, but also unlock **economic potential**, for there is a large component of the female residents of Berea that are unemployed. By initiating urban agriculture in these lost spaces, functional urban green spaces will be provided that could together become a **designed ecosystem** that integrates natural and human living systems, in order to create and sustain greater health and well-being for both. The incorporation of these four strategies in the vision for South Berea as the urban foyer of Pretoria aims to shift the communities in the area, as well as their economic activities, **back into alignment with the natural processes inherent to place,** to mitigate the outcomes of human activity on nature.

FIGURE 5.7

Strategy 4: Urban Agriculture (Author, 2016)

A significant example of how open space can be utilized to create value by cultivating the land in a collective effort is the Value Farm project in Shekou, China (ArchDaily, 2014). The project intersects issues of urban transformation, architecture and urban agriculture, and explores the possibilities of urban farming in the city and how it can be integrated with community building.

Besides creating a green oasis above the urban chaos and reconnecting city inhabitants with nature and the therapeutic hands-on experience of growing crops, urban farming offers a sustainable, secure, accessible food supply. The project considers transforming an entire demolished wet-market block into a terrain for farming. The concept of the historical green rooftop configurations of Hong Kong is translated by means of brick enclosures at different heights allowing for varying soil depths for different crops. Original stair cores are converted into brick platforms and open pavilions, and an irrigation pond that collects water from the site's natural underground source all contribute to serve as a test bed of living, participatory, urban farming event-architecture.

Urban Farming Precedent

Value Farm, Shekou, China, Thomas Chung, 2013

FIGURE 5.8

Value Farm. Shekou, China Thomas Chung, 2013

(ArchDaily, 2014)

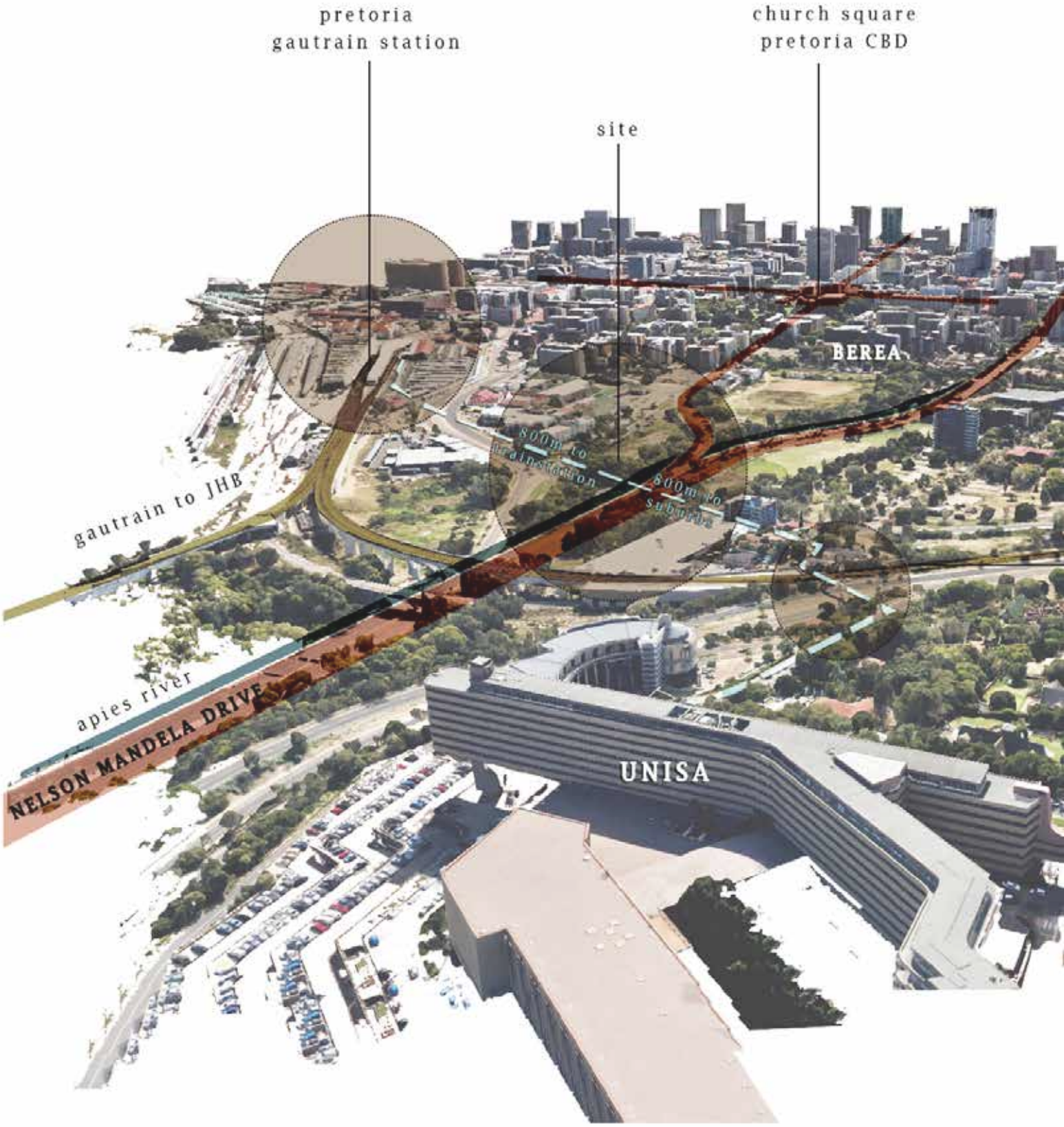
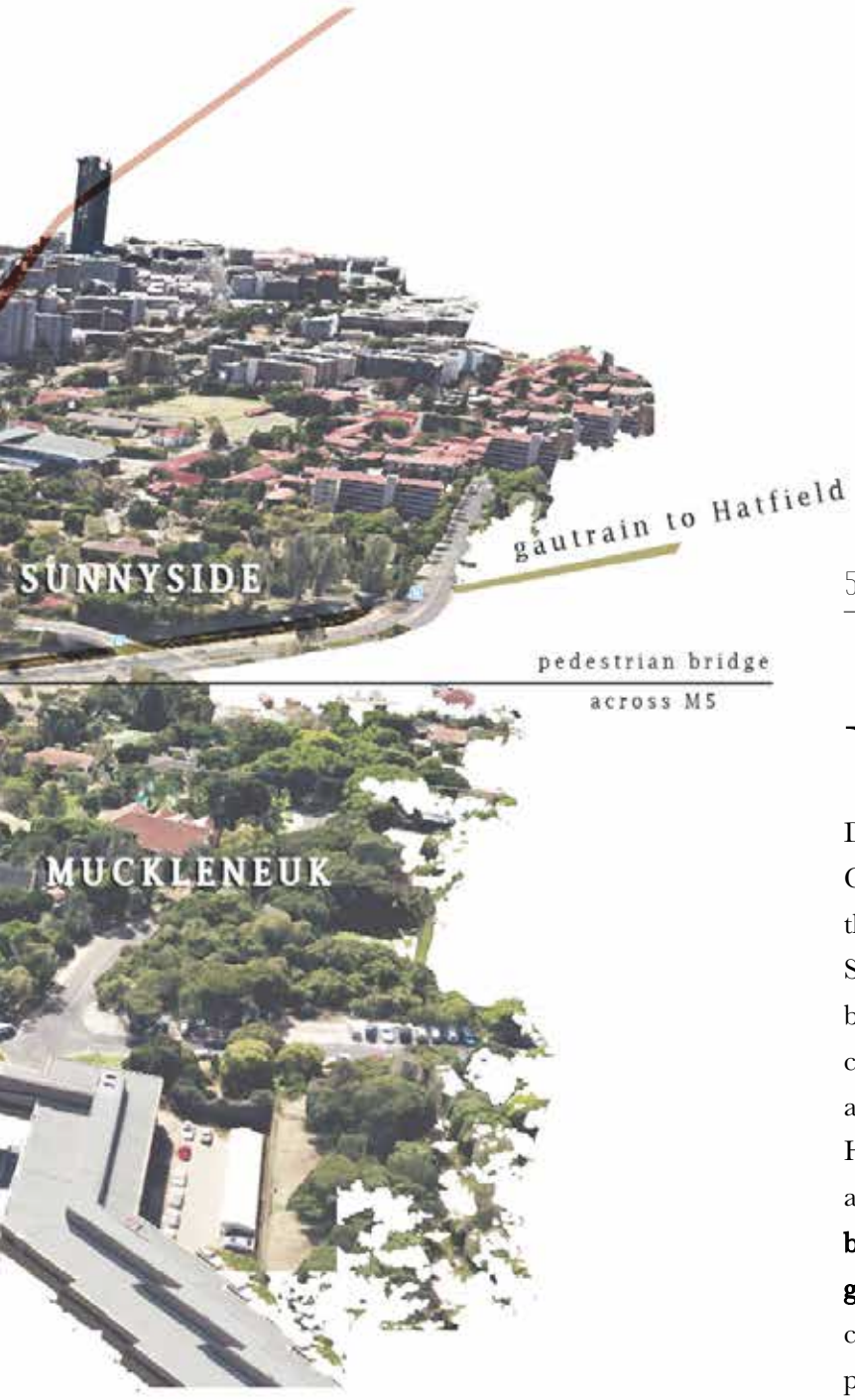


FIGURE 5.9

Established connections between the East and West (Author, 2016)



5.2.3 RESTORING RECIPROCITY BETWEEN THE EAST AND THE WEST

Urban elements such as Nelson Mandela Drive, Elandspoort Road and the train tracks of the Gautrain Station serve as major barriers between the communities of Muckleneuk, Sunnyside and South Berea. In effect, no interaction occurs between these three communities, a fact which contributes to the fracturing of the urban fabric and the loss of a holistic identity for the area. However, all sides have much to offer one another, and by envisioning the **hard existing buffer to be replaced by an accessible and permeable green spine**, the physical disconnection can be changed to one of reciprocal interaction. Thus the proposed dissertation will contribute to the larger urban framework of the discarded landscape of the West, by facilitating the reconnection between the western and eastern suburbs of Pretoria through the common sharing of a green belt that is accessible by the public.

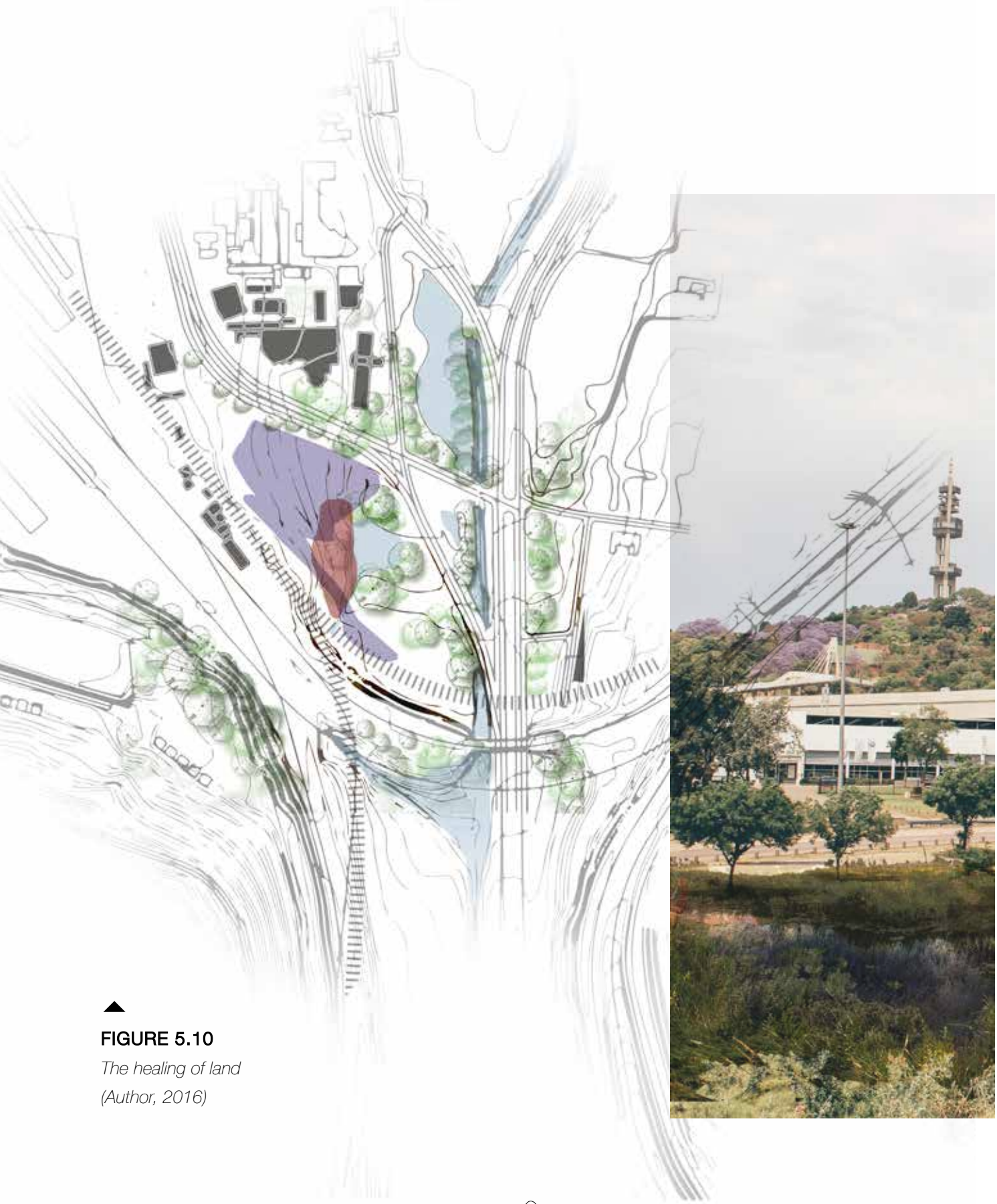


FIGURE 5.10
The healing of land
(Author, 2016)

5.3 HEALING THE LAND

BIOREMEDIATION

The proposed design, located on a brownfield site, will serve as a **device to rehabilitate and remediate the natural ecosystem** in an attempt to not only return the site to its inherent capabilities, but also to **reconstruct the site** through architecture and design initiatives into a new **socio-ecological habitat.**

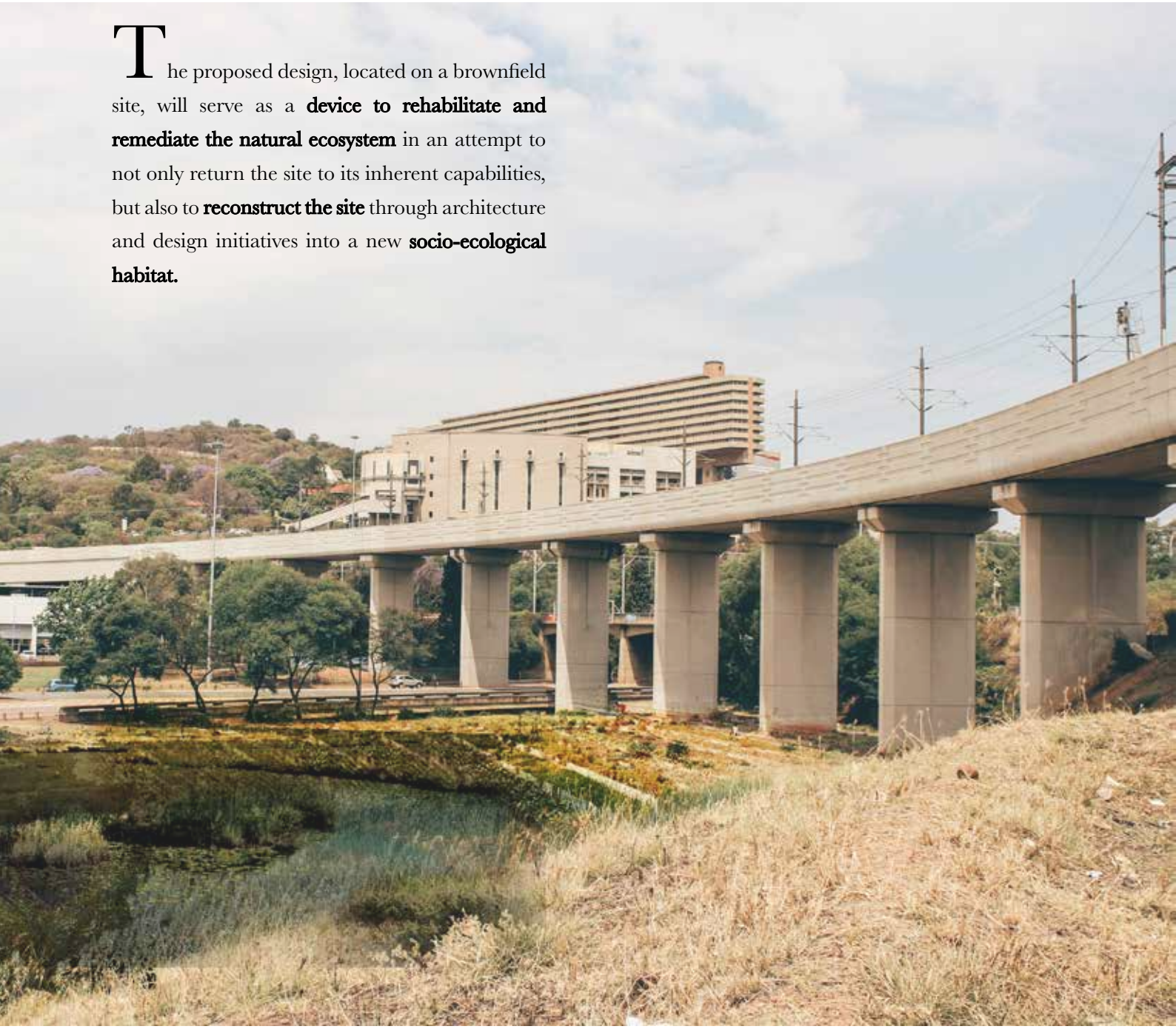


FIGURE 5.11

Sarah Bartmann Centre of Remembrance, Eastern Cape, Chris Wilkinson (Wilkinson Architects ,2011)

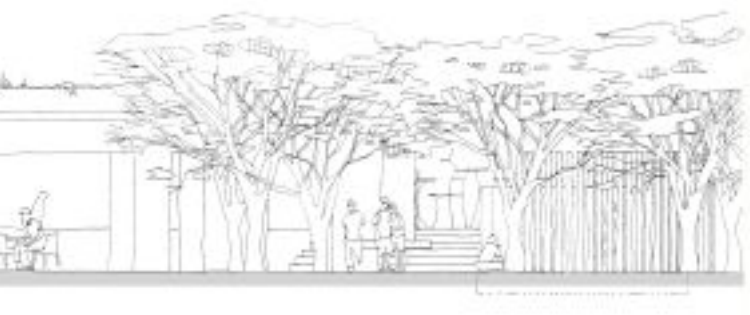
Place-Based and Vernacular Precedent

Sarah Bartmann Centre of Remembrance in the Eastern Cape | Chris Wilkinson

5.4 HEALING THE PEOPLE

BIOPHILIA

The principles, elements and characteristics predominant in nature that are translated into architectural solutions becomes the foundation for establishing a **biophilic building** that will allow for human beings to reconnect with nature (Kellert & Calabrese, 2008: 12). The aim is to consequently **support the healing process to ensure the well-being of all urban inhabitants** affected on different levels by urban diseases. The key conceptual principles that ensures a biophilic outcome are the following:



A local precedent that illustrates an inherent connection to its natural, cultural and historical context is the Sarah Bartmann Centre of Remembrance (Wilkinson Architects: 2011). It honours the life of Sarah Bartmann as well as the heritage of the Khoi-San people. The burial site of Bartmann in Hankey, Eastern Cape, was established as a sacred place, and therefore the design was approached by expressing a circular route or procession that leads from the informal to the sacred, through the means of memory, healing and celebratory spaces. The architectural outcome responds to the landscape, vegetation and climate of the area in a sensitive manner, by proposing subtle references to the Khoi-San people. Different sensory experiences, rather than the imitation of natural features are used as architectural tools.

The defining route through the building that indicates the transitions of experience for the visitor becomes a valid approach to restore reciprocity between two states, an approach that is equally valid in a wellness centre that attempts to educate, heal and celebrate the connection between humans and nature.

In close proximity to the site, Freedom Park (Mashabane, Rose: 2004) represents an example of how nature can be translated into symbolic representations of architecture by considering concepts that arise from indigenous knowledge. The undulating rock walls, boulders and rock gardens establish an architectural language, and the most unique design aspect of Freedom Park in its setting is the relationship that it has with the landscape and the shape of the hill. The project sets out to integrate architectural elements and sculpture with the landscape to create a unique place.

Furthermore, the design encompasses ideas from rural architecture and urban formations from sites across southern Africa, including Mapungubwe, Great Zimbabwe and the mountains in the Free State, that include architectural elements inspired by botanical motifs and organic forms.

FIGURE 5.12
Freedom Park, Pretoria, South Africa, Mashabane Rose Associates, GAPP, MMA, 2004 (Mashabane & Rosel, 2004)

Natural Analogues Precedent

Freedom Park, Pretoria, South Africa, Mashabane Rose Associates, GAPP, MMA, 2004

The Sancaklar Mosque (ArchDaily, 2014), located on the outskirts of Istanbul, illustrates the implementation of various natural features and how these contribute to creating a sense of being immersed in nature.

The architect aimed to address the fundamental issues of designing a mosque by distancing himself from the current architectural discussions based on form, and focusing solely on the essence of religious space and the connection that it seeks with the natural environment. High stonewalls surrounding the building depict a clear boundary between the chaotic outer world and the serene atmosphere within.

As one enters the mosque, the outside world is left behind. The interior is a simple cave-like space with a concrete ceiling shaped like contour lines on a topographic map. The only ornament is the daylight that enters through the slits and fractures that changes according to the time of day. Water pools placed throughout the building facilitate a feeling of serenity and connection with basic natural elements.

Natural Features Precedent

Sancaklar Mosque, Istanbul, Turkey, Emre Arolat Architects, 2015

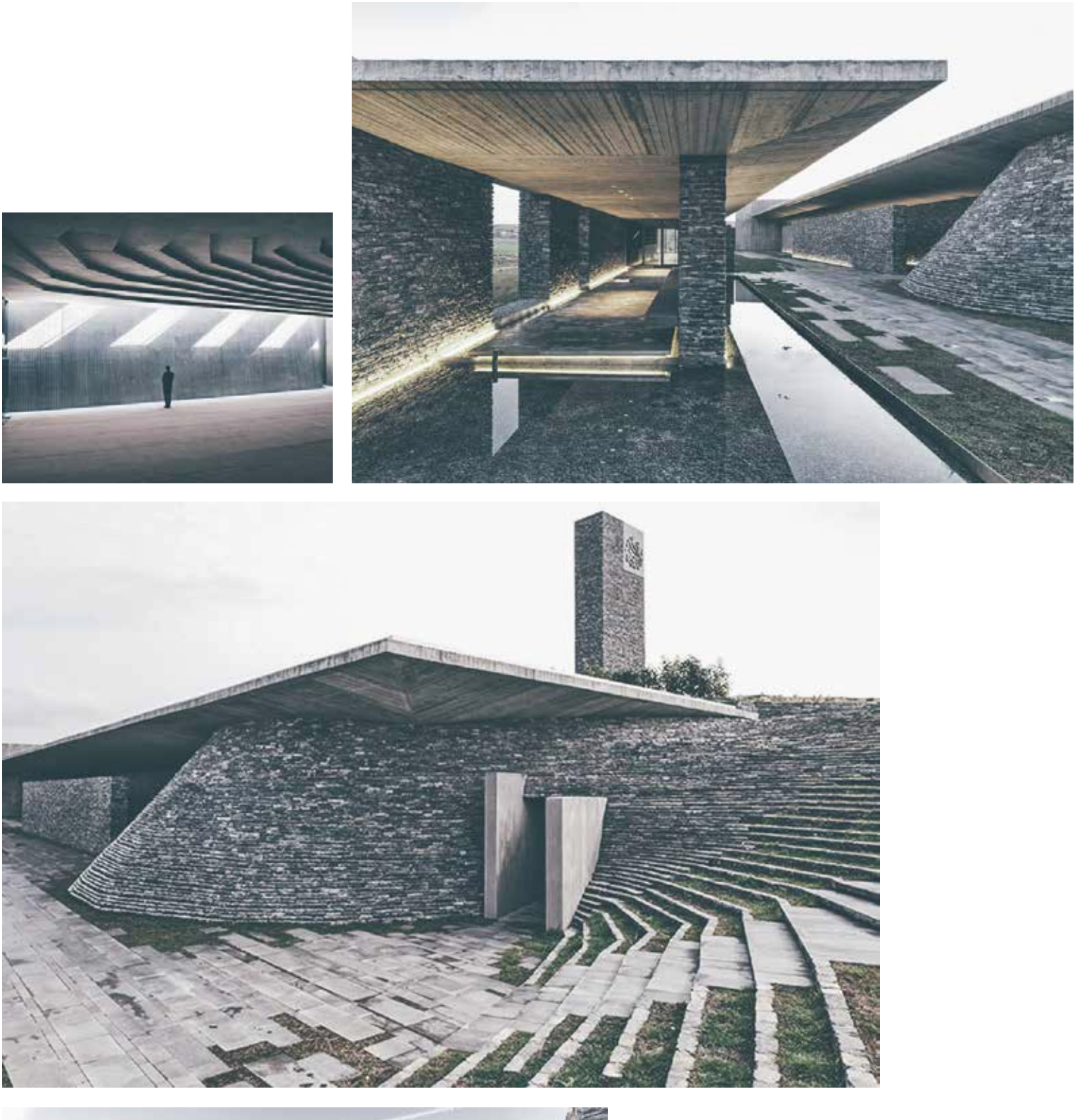


FIGURE 5.13

Sancaklar Mosque, Istanbul, Turkey, Emre Arolat Architects, 2015 (Author, 2016)

5.5 FROM DISCONNECTION TO A NEXUS OF RECIPROCITY

The process of healing for both man and nature will not be fully acknowledged and realised if the conceptual development of the building does not include **moments of reflection, reconciliation and celebration**: therefore it is vital that the architectural concept articulates the transition between two states. As people that suffer from a disconnection with nature, enter the building to start the process of psychological or physiological healing, a **disconnection and separation** from nature should be **visually evident**. However, as they continue through the building, different routes to healing should be revealed. Finally, people should arrive at a **nexus point** where reciprocity between man and nature has been restored. The nexus point should establish a moment of **reverence and calmness,** as man and nature are reconciled once again.

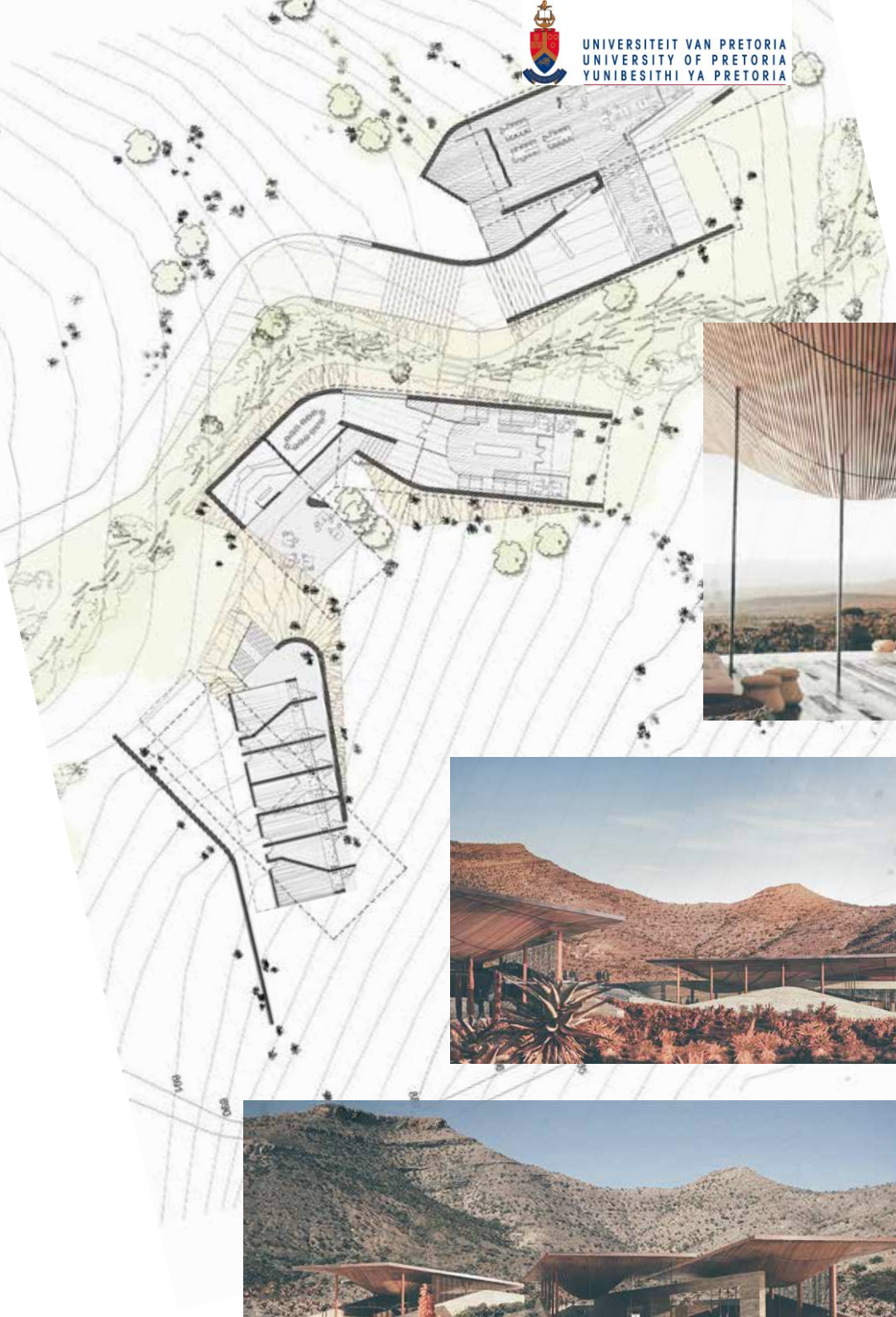
FIGURE 5.14

Karoo Wilderness Centre,
South African Field Arhitecture, 2011
(ArchDaily, 2011)

The Karoo Wilderness Centre (ArchDaily: 2011) is a commendable local example that aims to re-establish the connection between the built and natural worlds as one that is mutually beneficial. The architecture of the centre provides a lasting connection to the landscape, and promotes an understanding of the interdependence of ecosystemic health and human well-being.

The recent phenomenon of human inhabitation in the Karoo has demanded more of the landscape than it can sustain, bringing it to the brink of irreversible depletion. The minimal amount of rainfall in the Karoo has resulted in a scorched condition to which each species of plant and animal has had to adapt.

The structure and form of plant species in the Karoo are characterized primarily by strategies to collect and retain water and provide a shield from the sun. These qualities should be expressed through the architecture of the wellness centre for it to become regionally relevant and support the sustainable continuity of both man and landscape. The building itself thus becomes a nexus of reciprocity, and celebrates the advantages thereof.



Natural Analogues Precedent

Karoo Wilderness Centre, Karoo, South Africa Field Architecture, 2011

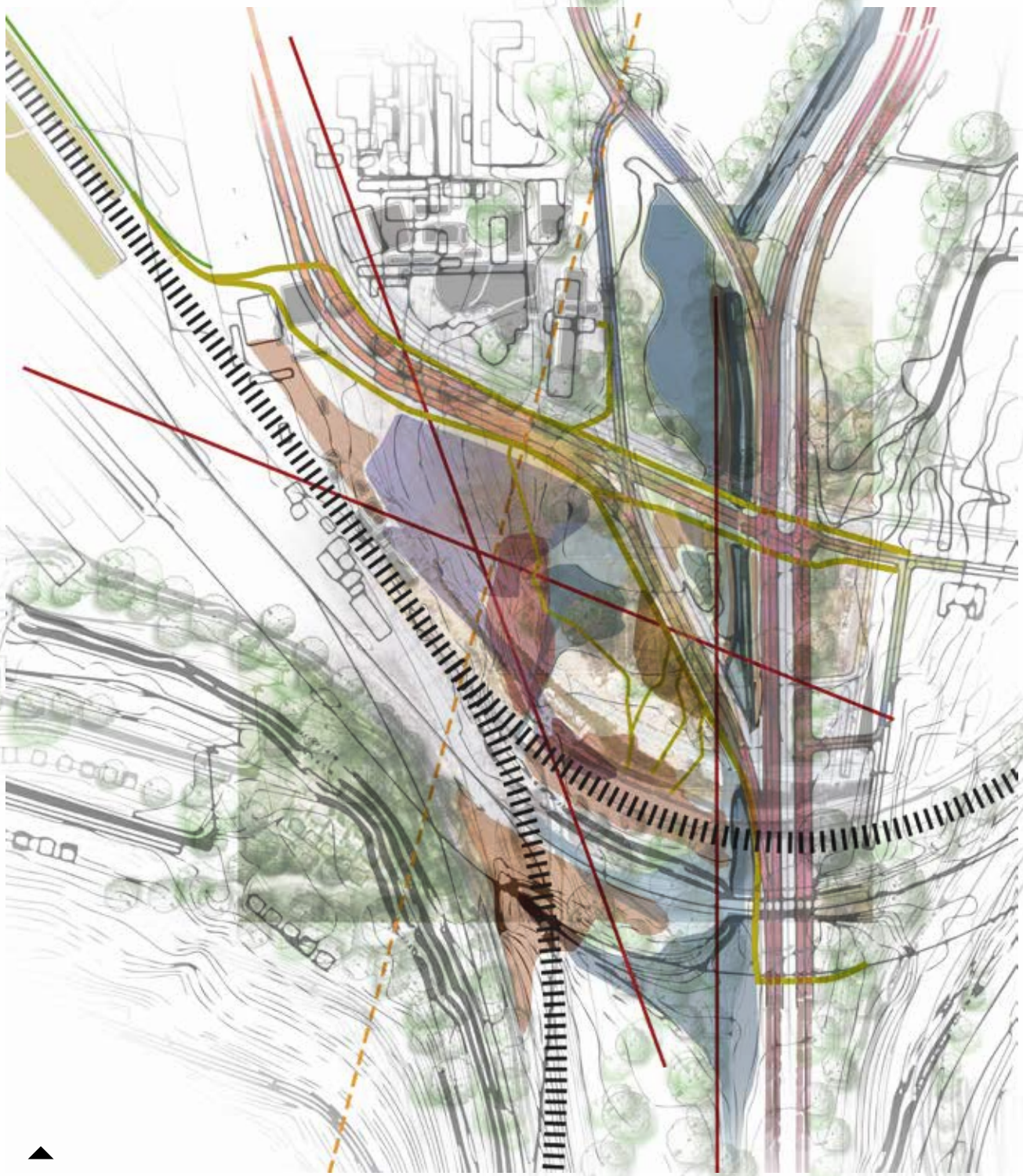


FIGURE 5.15

Consolidation Map of all informants

(Author, 2016)

5.6 SUMMARY

By embedding the conceptual development of the building in the theoretical framework, it becomes clear how many principles of regenerative design, bioremediation and biophilic design are interlinked, guiding the design of the building to become a **holistic healing experience**. The different precedents also illustrates multiple approaches of how healing, reconnection and celebration between man and nauture can be instigated through architectural expressions. The conceptual outcomes that have been discovered, explored and expressed throughout this chapter will be refined and translated into architectural solutions in the following chapters.

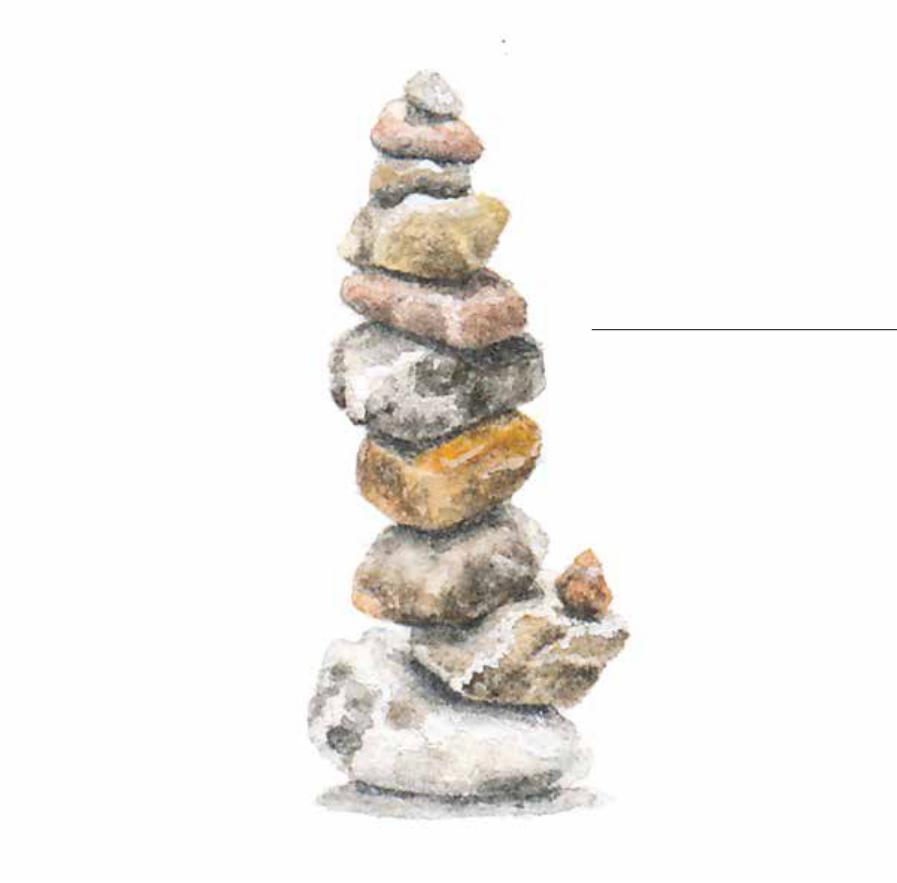


FIGURE 6.1

Day 258, Cairns

(Lorraine Loots, 2013)

chapter six

DESIGN DEVELOPMENT

6.1 PREFACE

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 aimes 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

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

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

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 EVOLOTION

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.

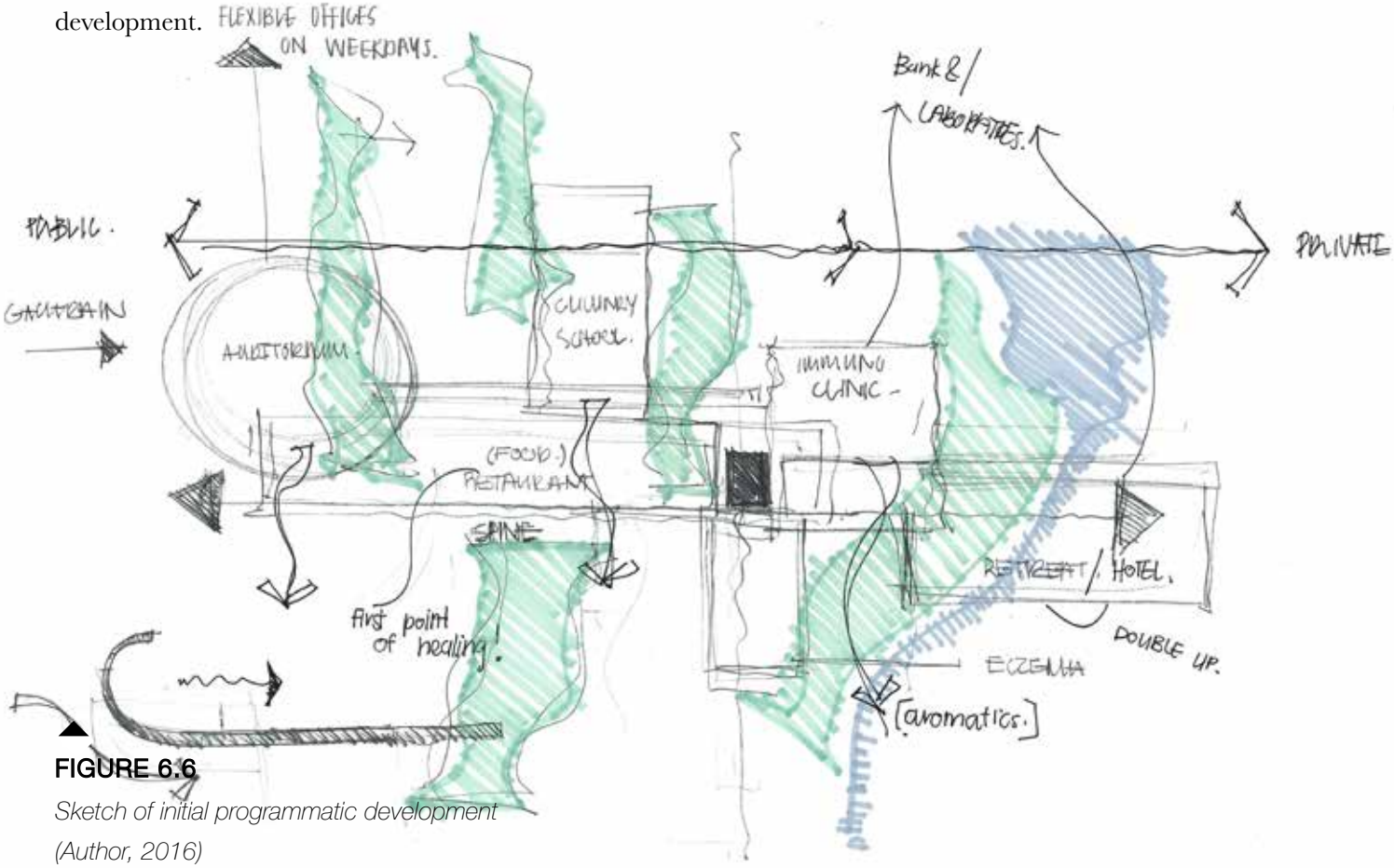


FIGURE 6.6
Sketch of initial programmatic development (Author, 2016)

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.

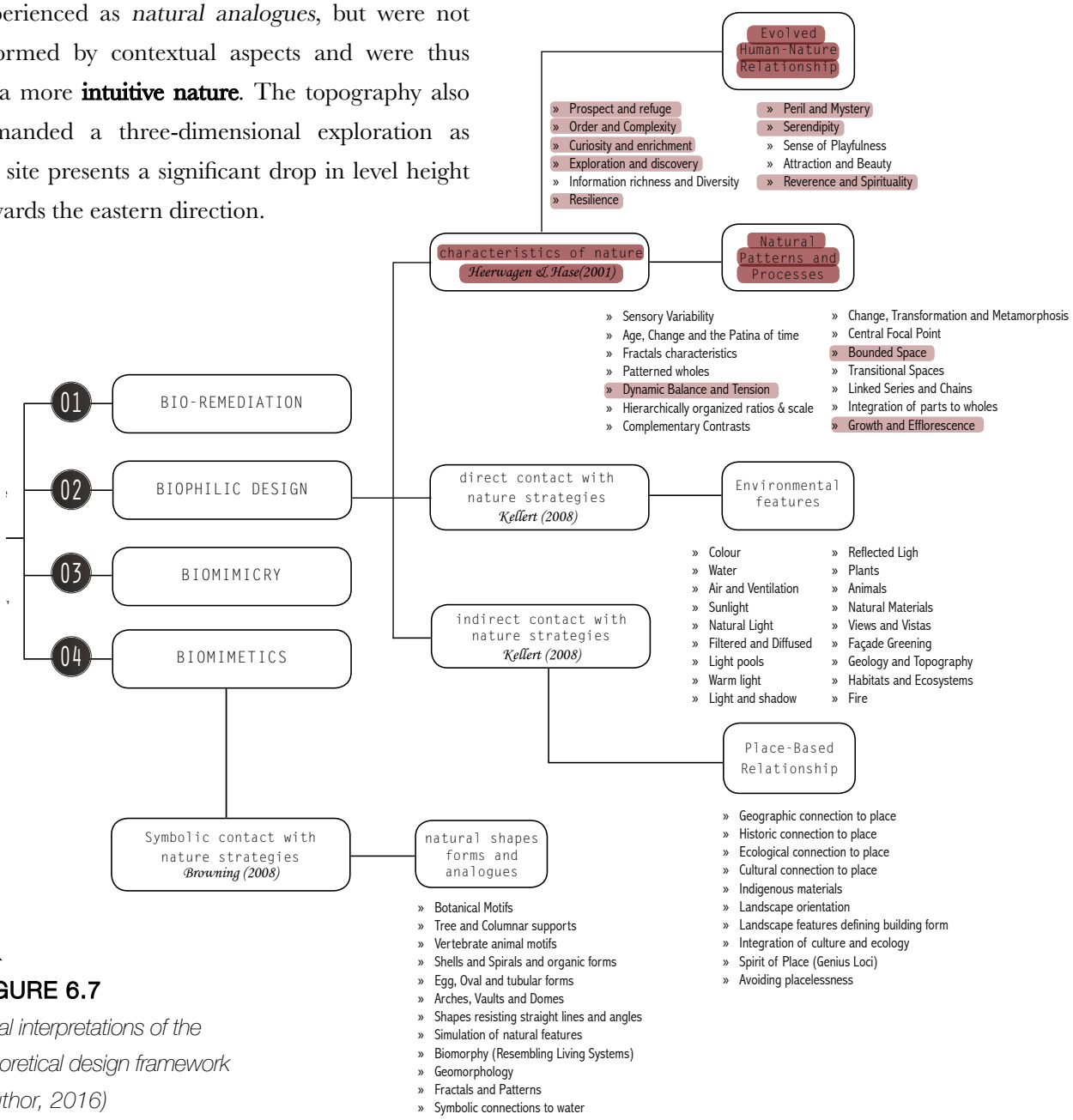


FIGURE 6.7
Initial interpretations of the theoretical design framework (Author, 2016)

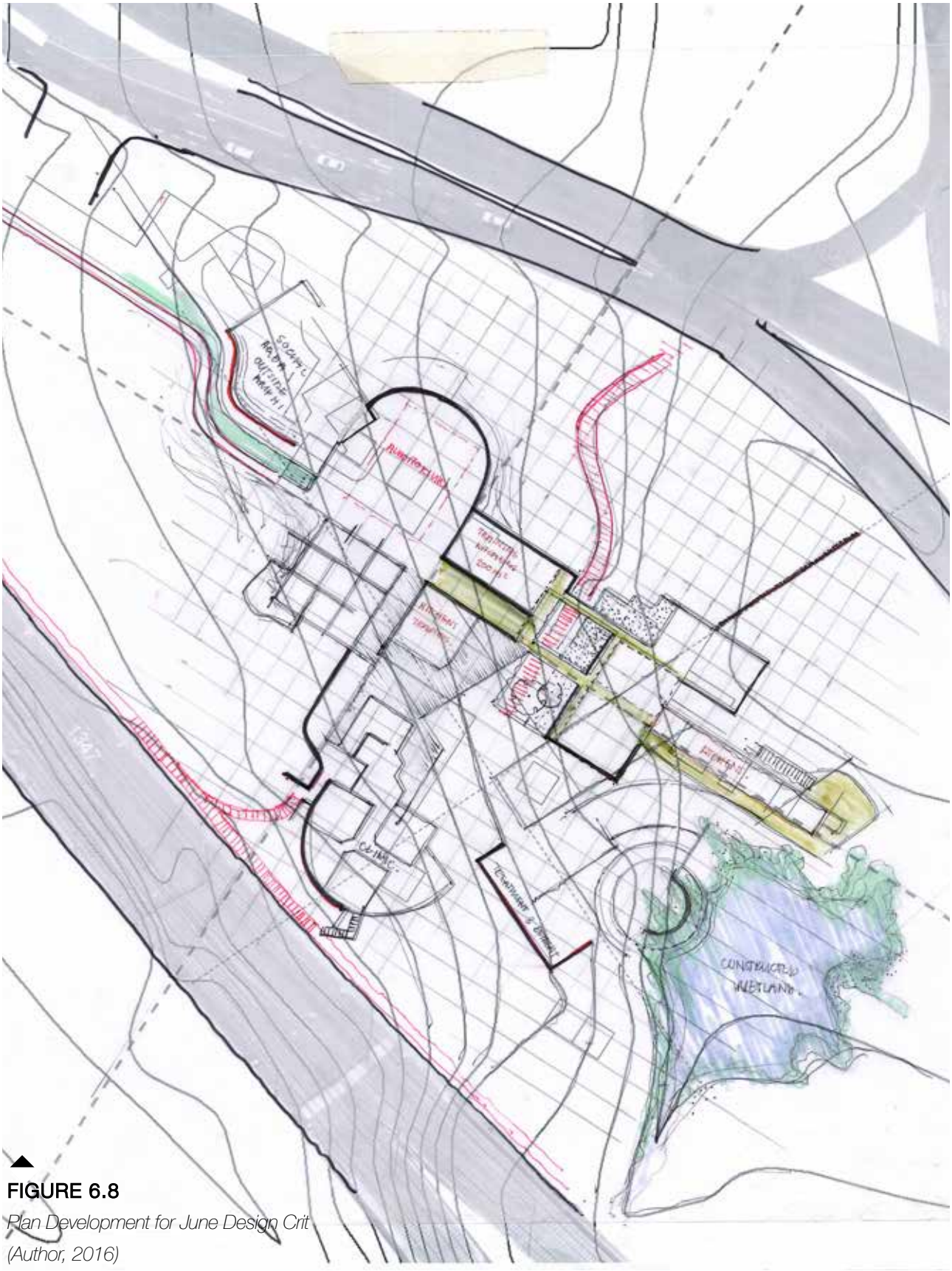


FIGURE 6.8

Plan Development for June Design Crit
(Author, 2016)

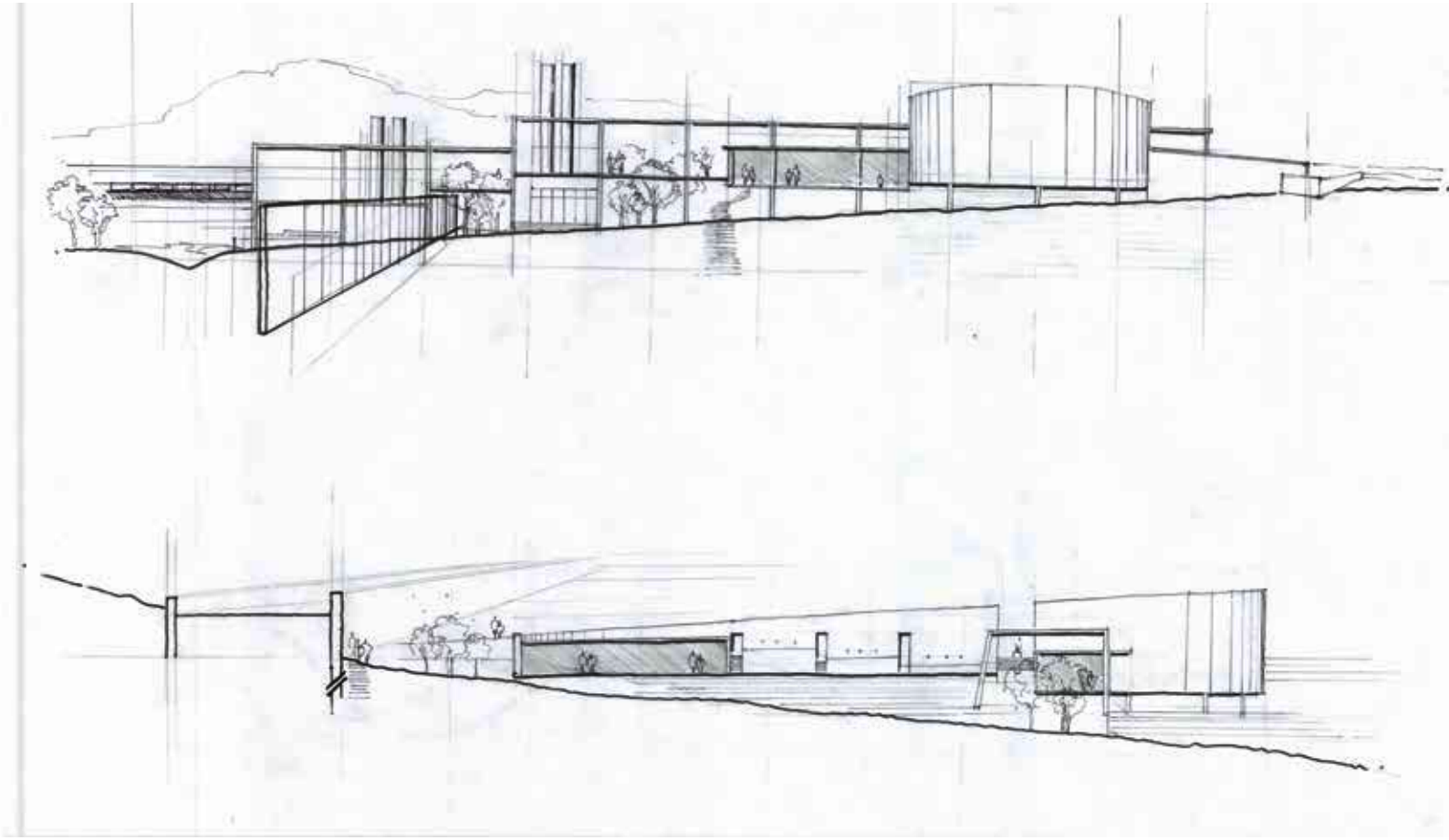


FIGURE 6.9

Section Development for June Design Crit

(Author, 2016)

6.3.3 MID - YEAR DESIGN OUTCOME

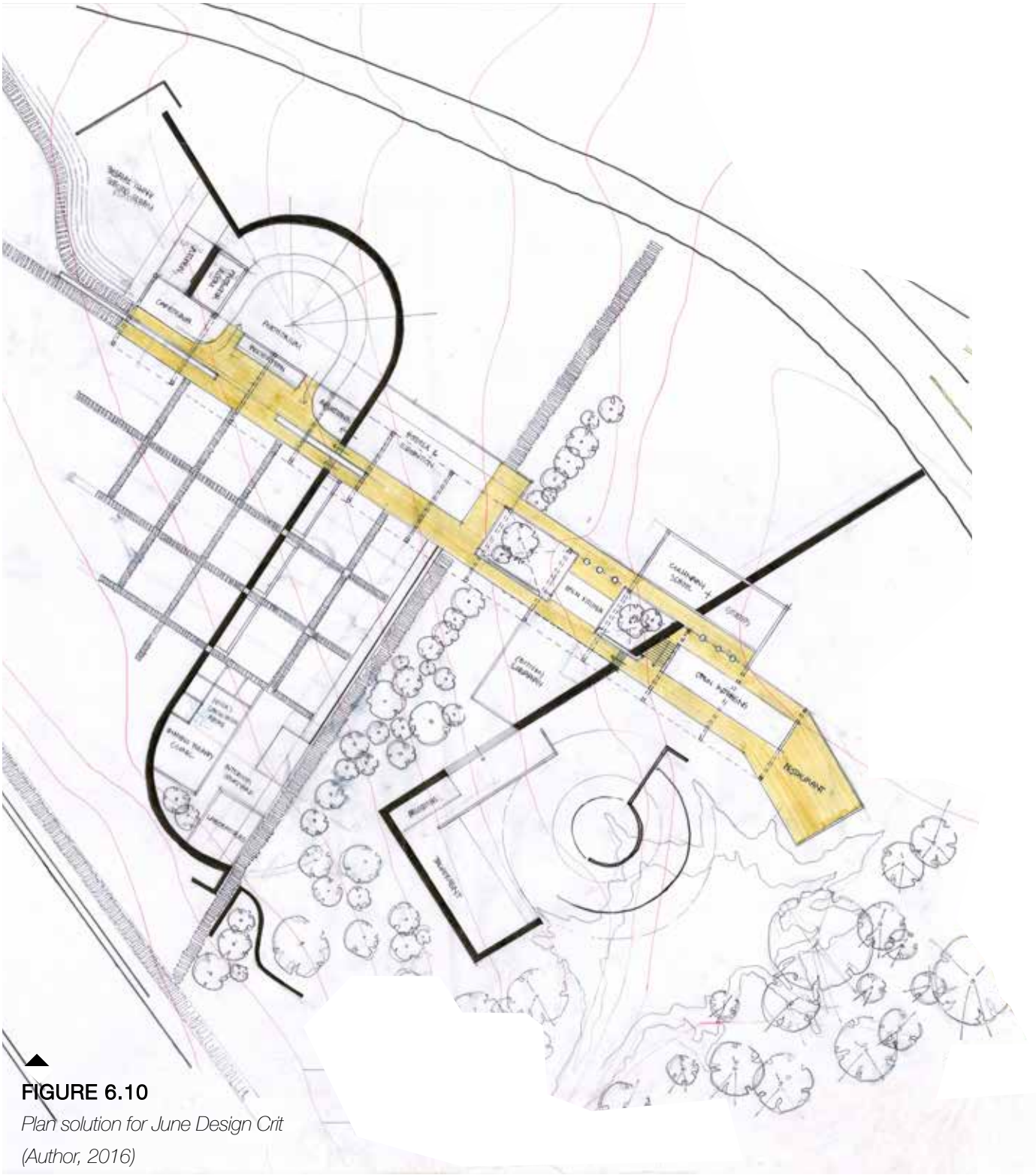


FIGURE 6.10
Plan solution for June Design Crit
(Author, 2016)

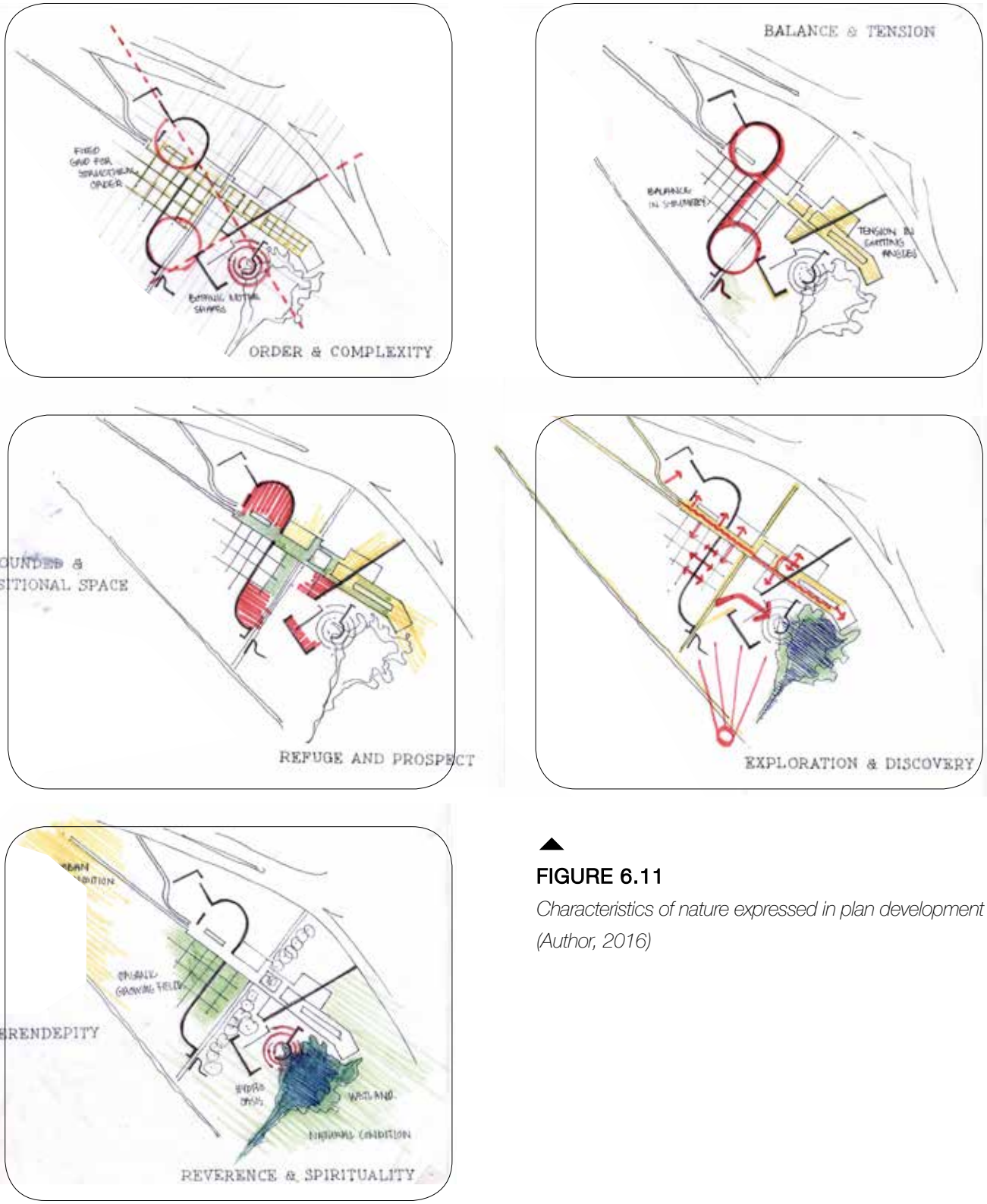


FIGURE 6.11

Characteristics of nature expressed in plan development (Author, 2016)

6.3.4 REFLECTION

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.**

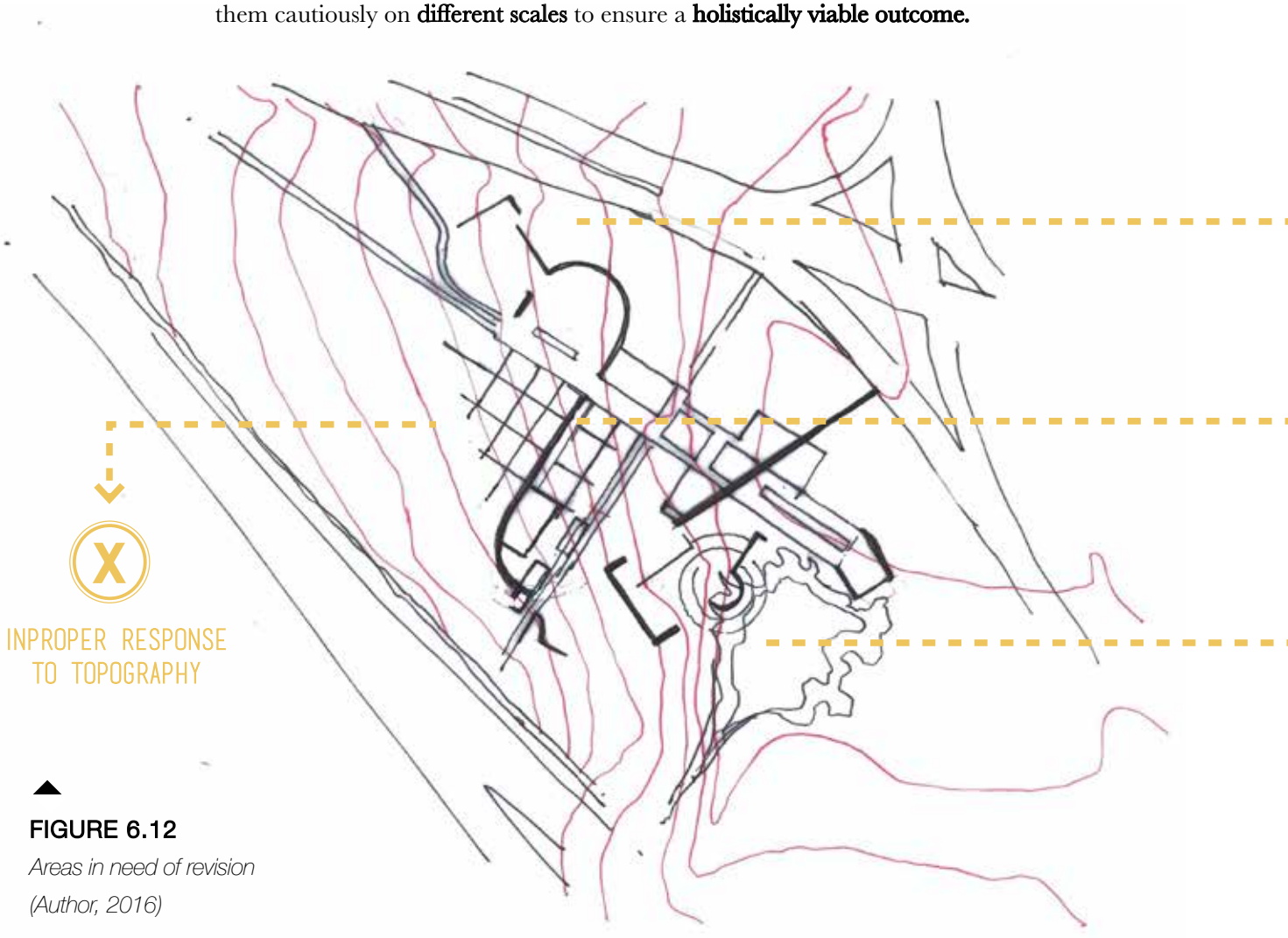


FIGURE 6.12
Areas in need of revision
(Author, 2016)

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:

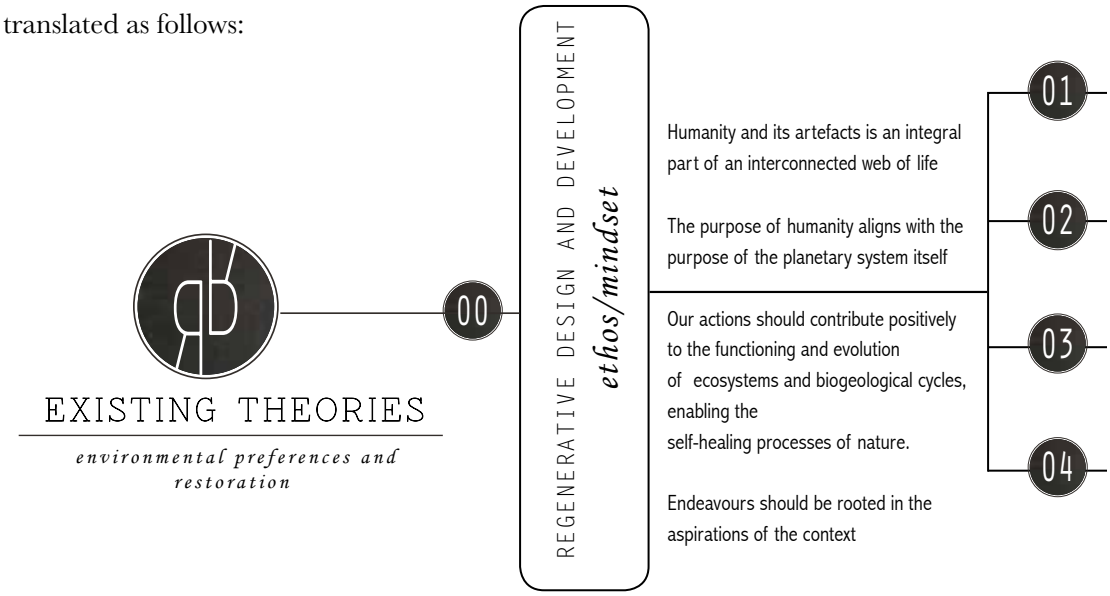
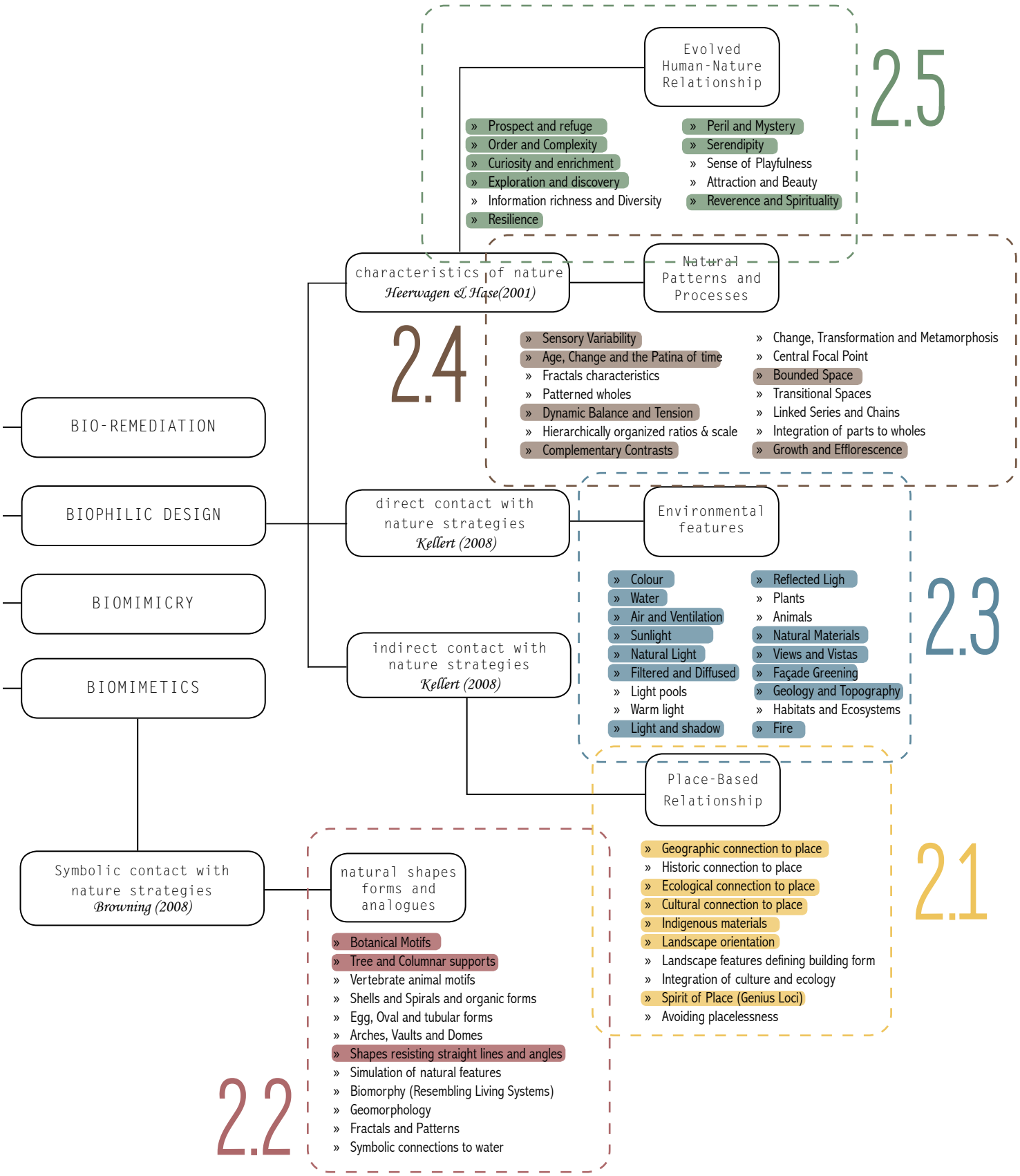
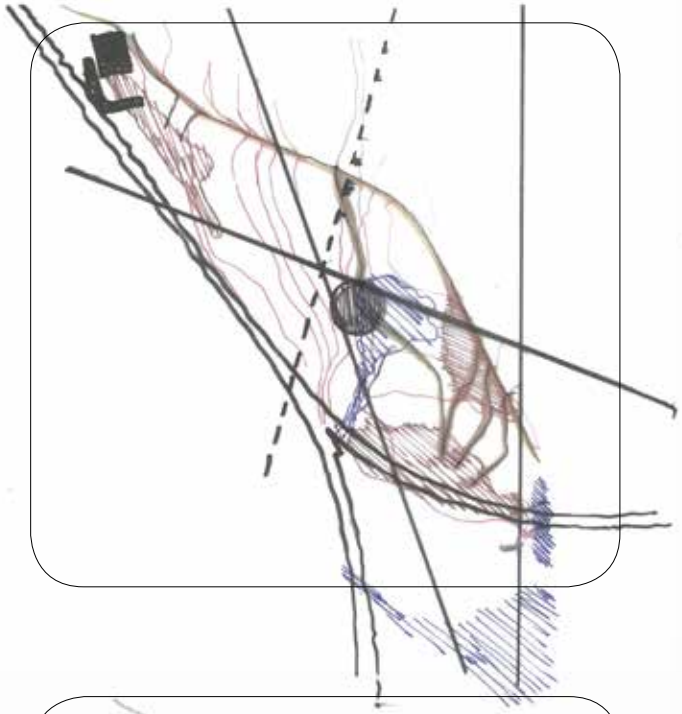
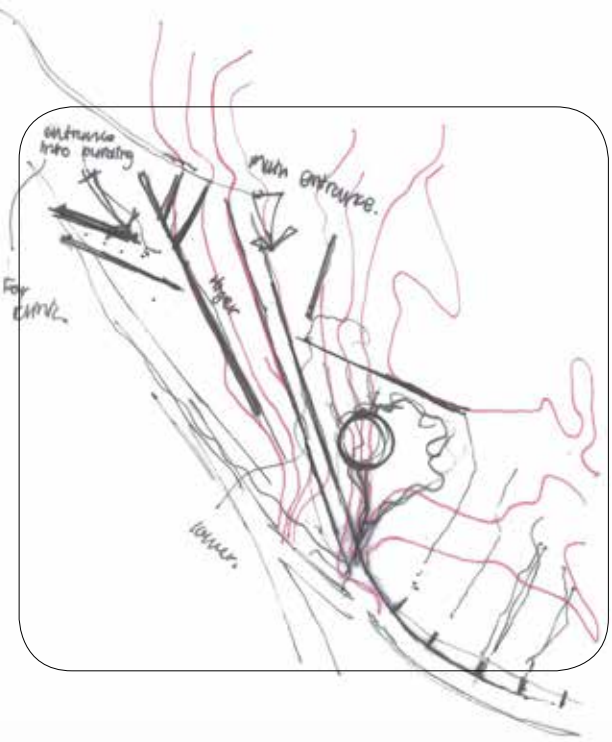


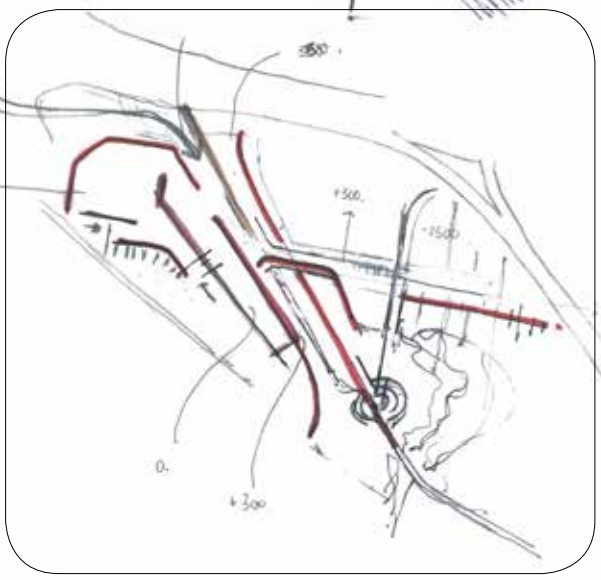
FIGURE 6.17
Revision of theoretical framework application
(Author, 2016)



6.4.1 PLAN DEVELOPMENT







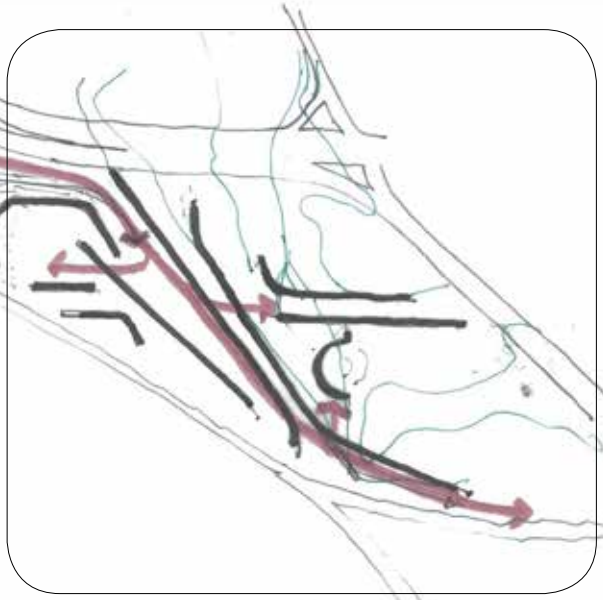
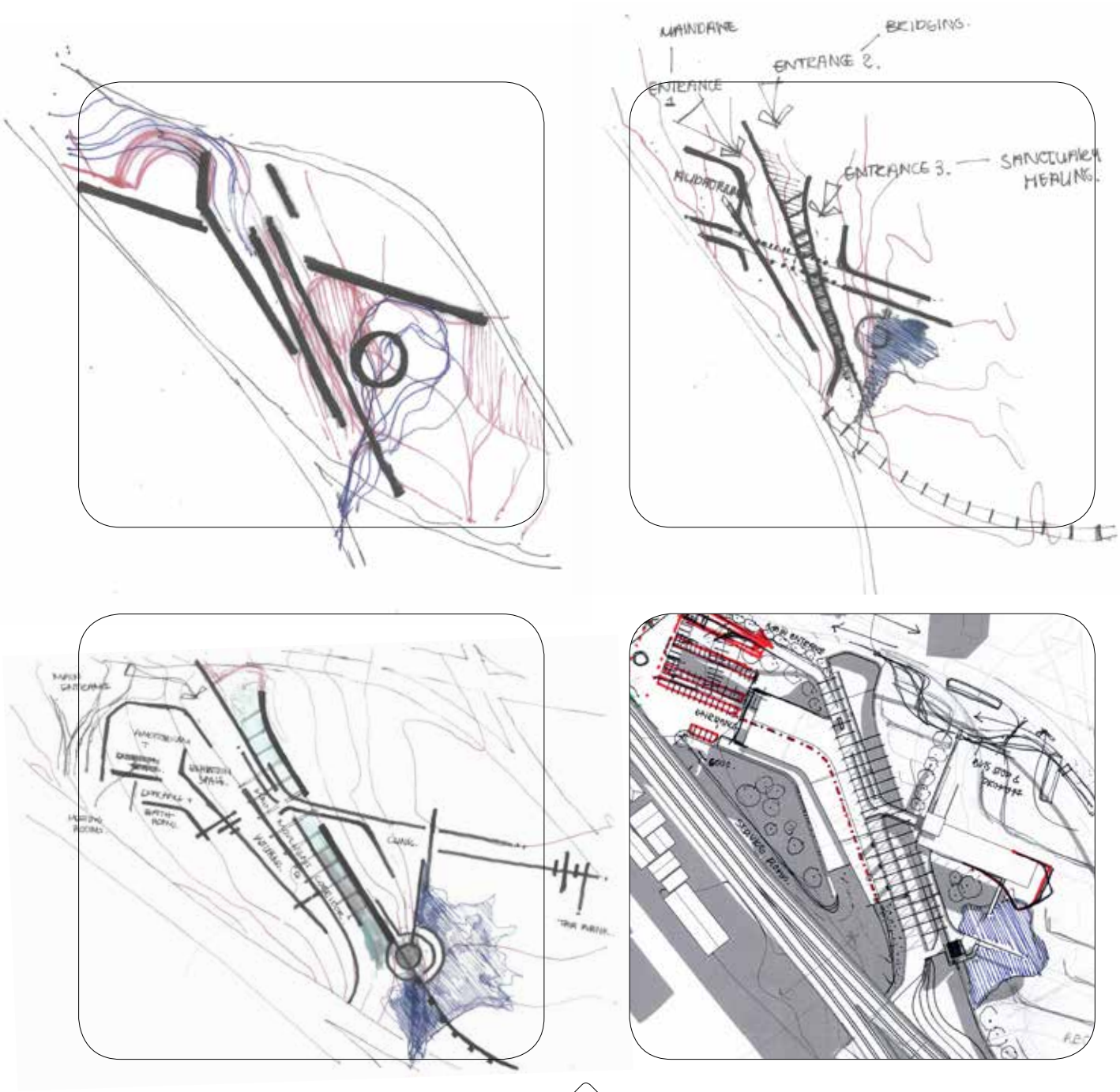
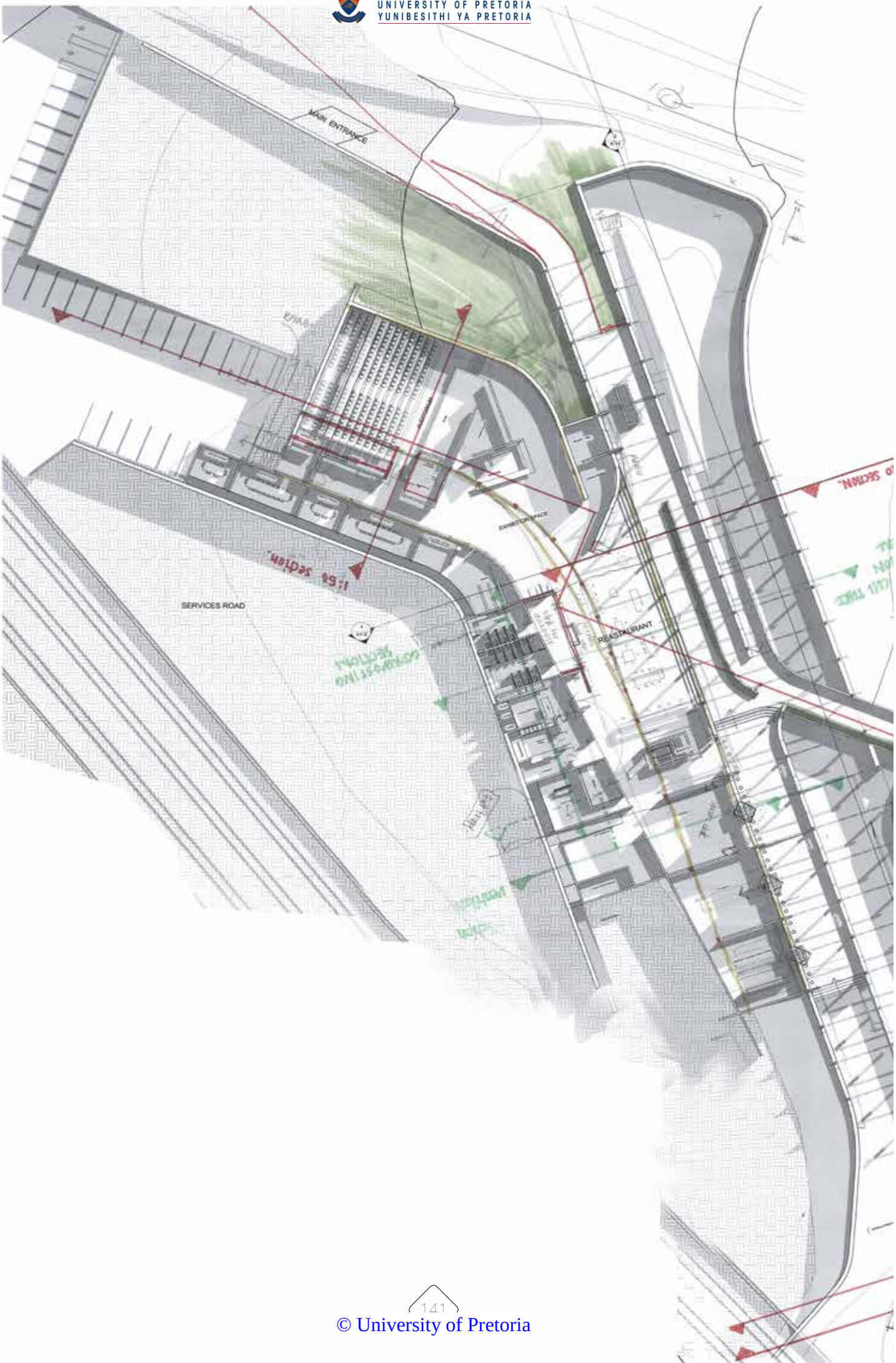


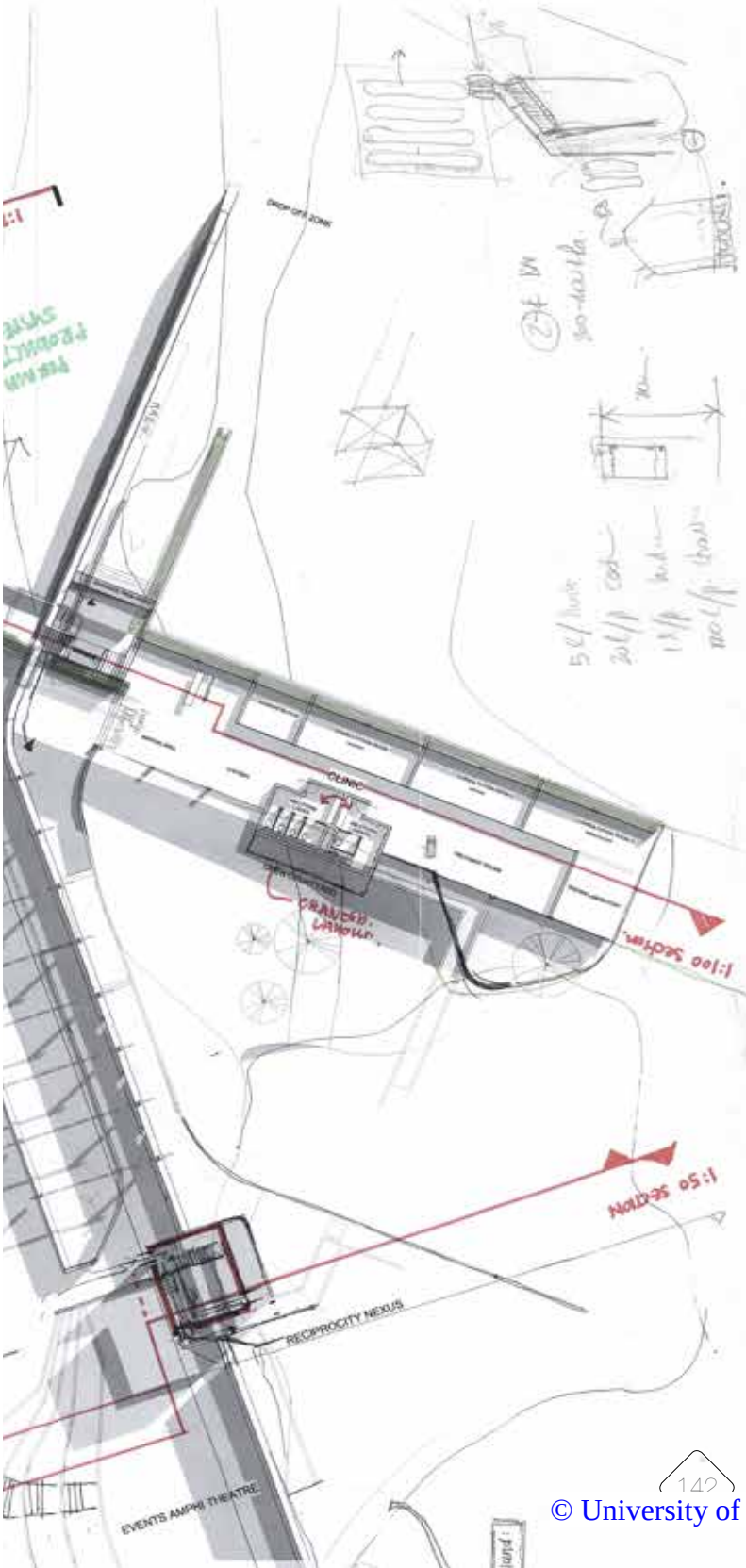
FIGURE 6.14

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)

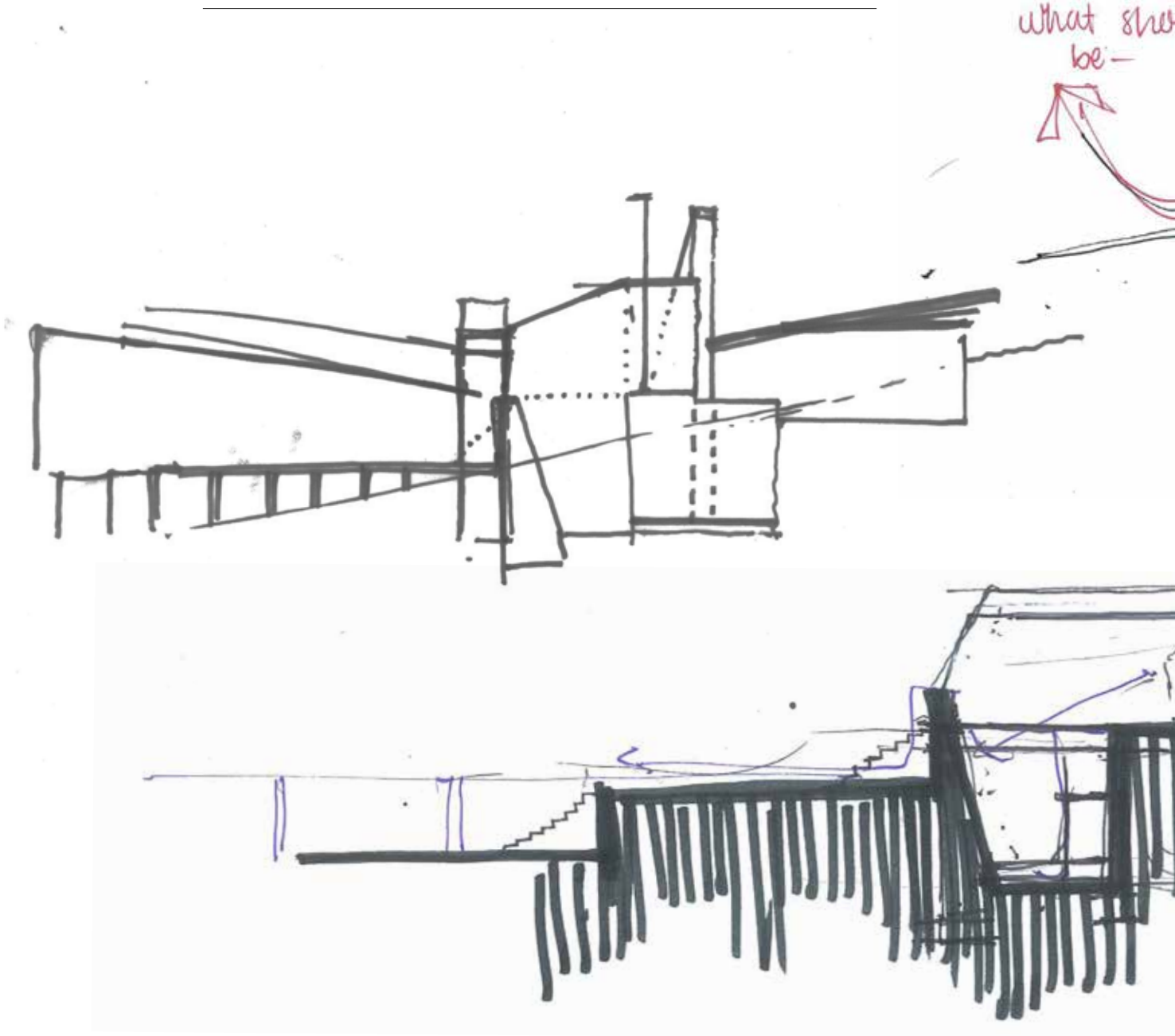
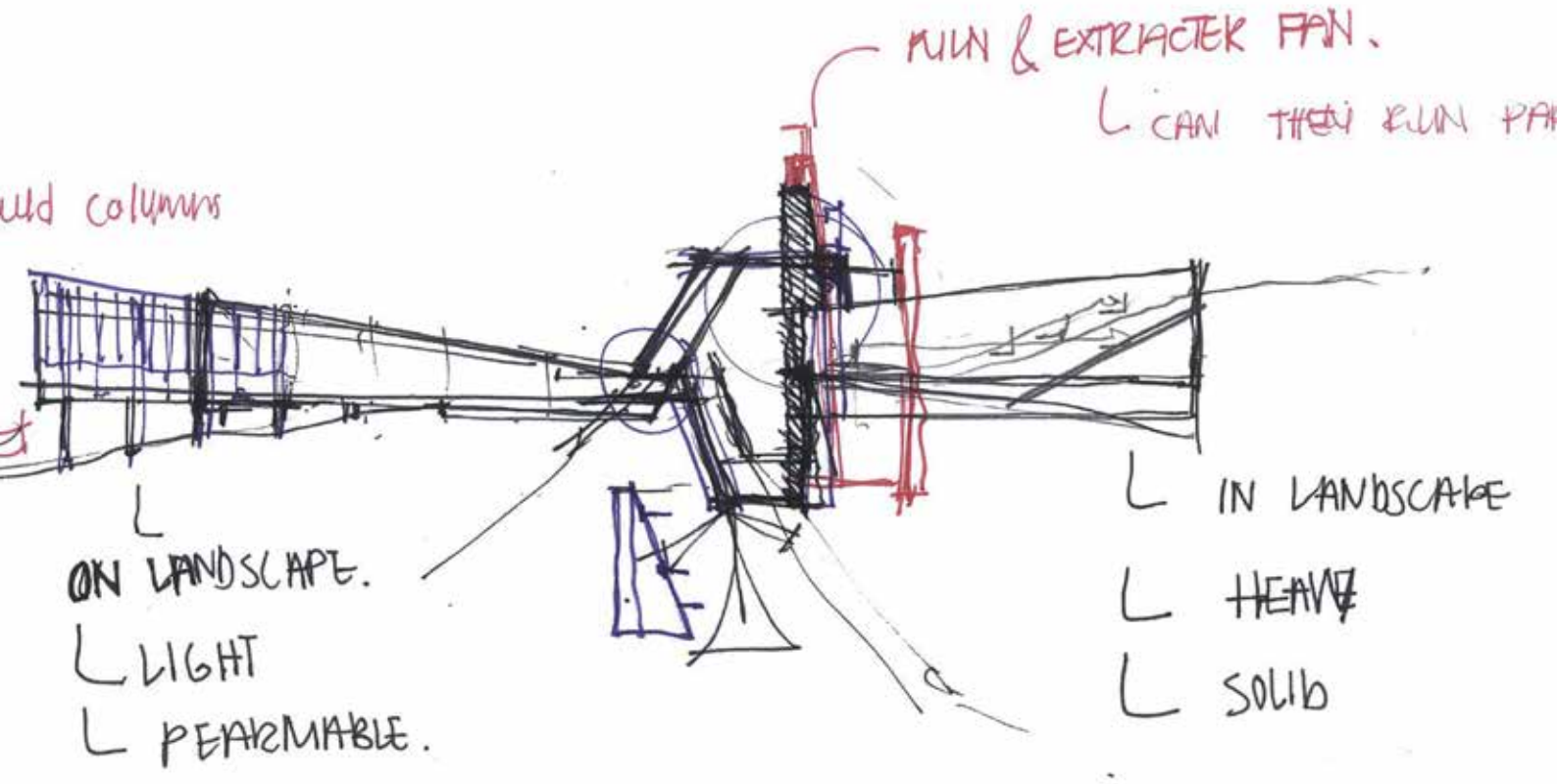
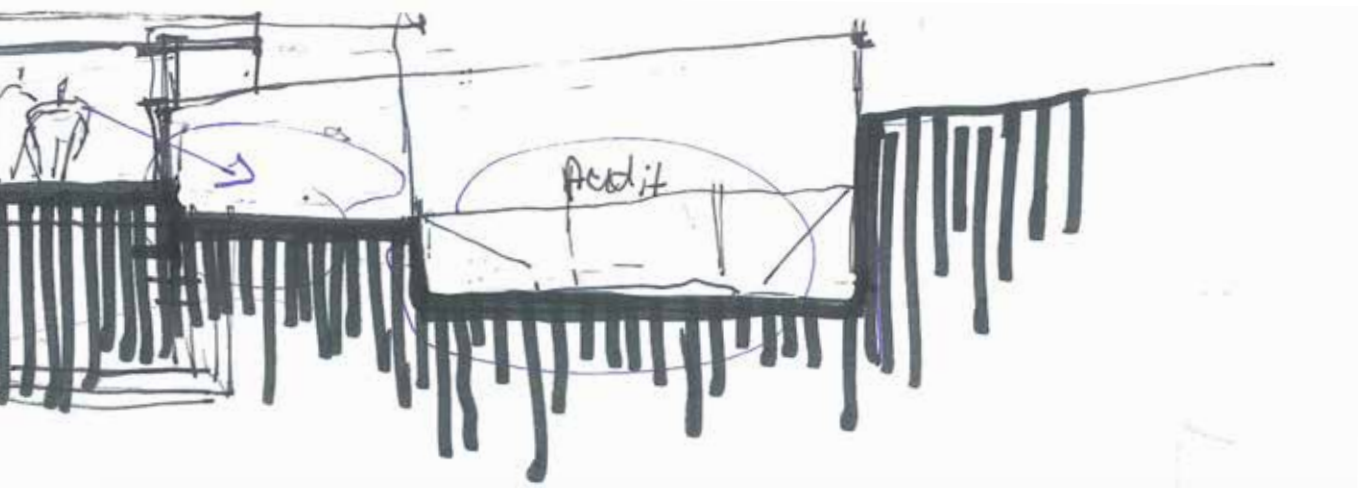


FIGURE 6.16

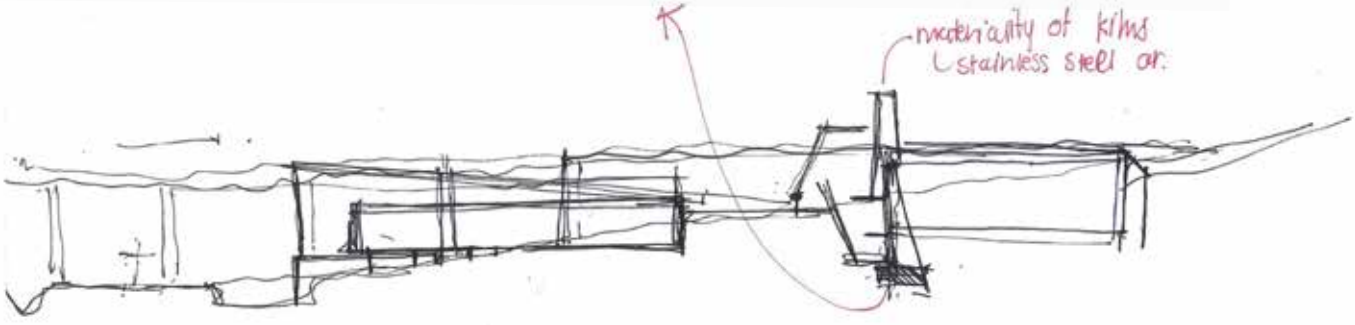
Process sketches of section development

(Author, 2016)



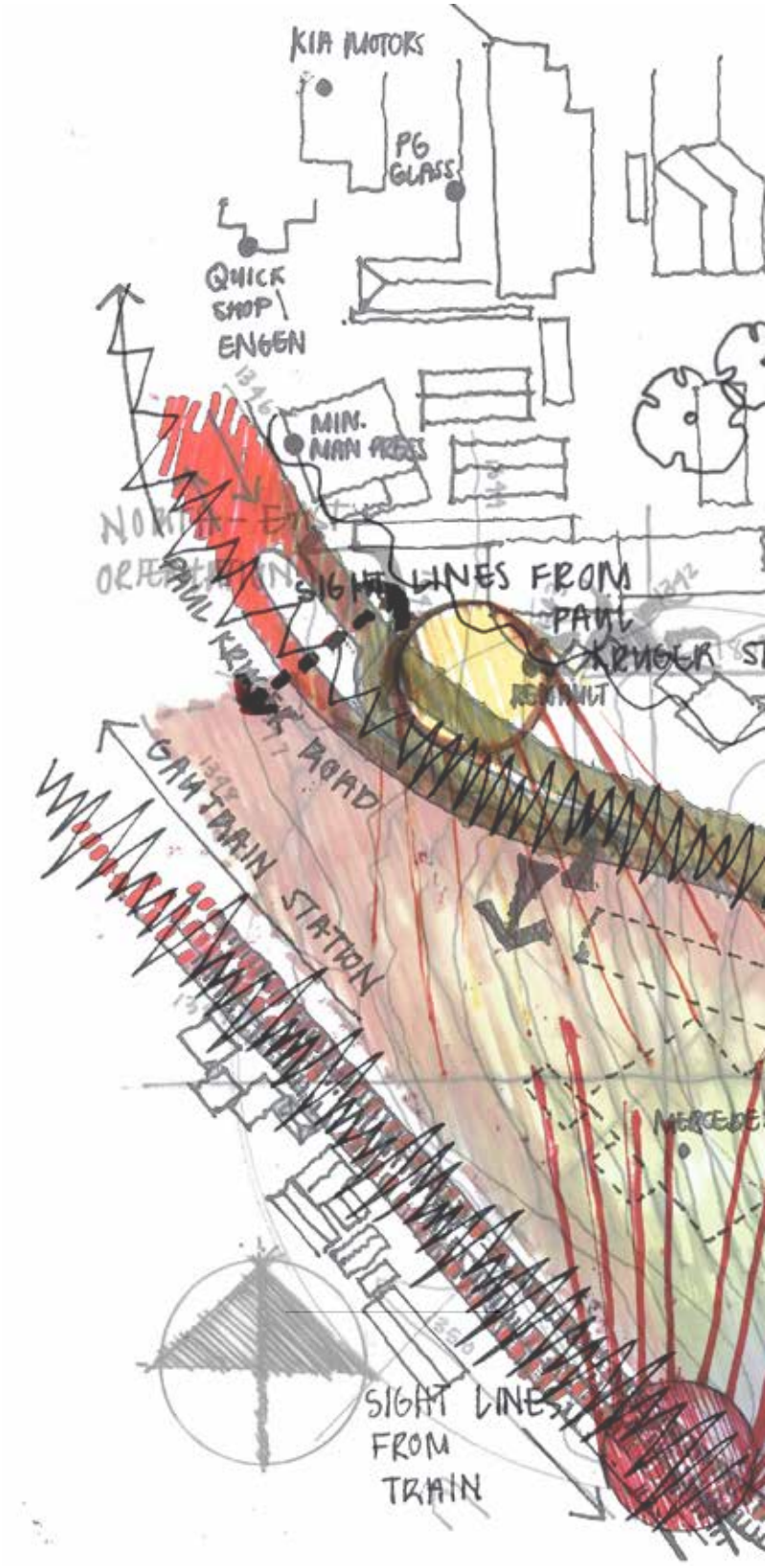


RETAINING! HOW DOES IT LOOK.



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.



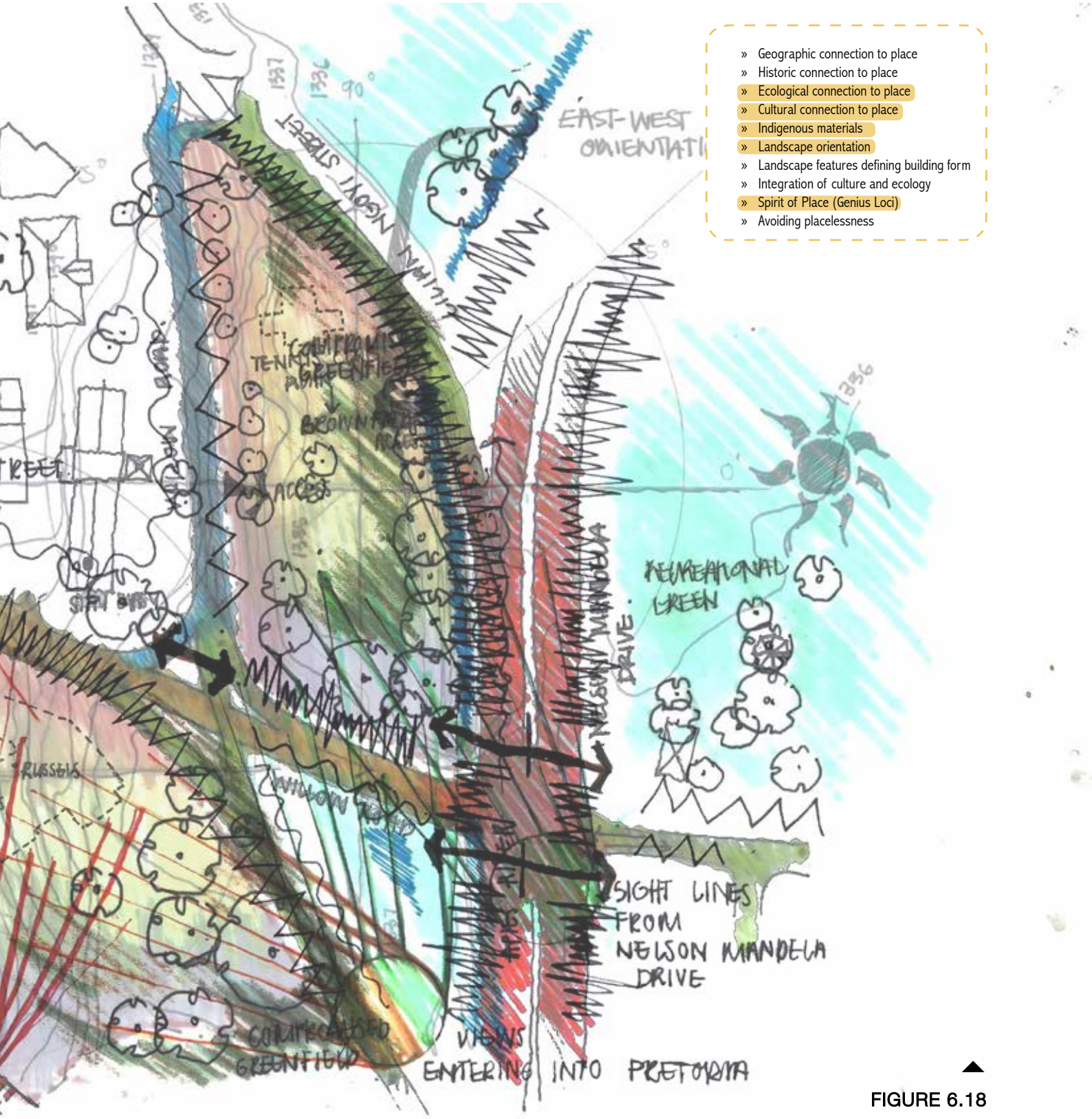


FIGURE 6.18

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

Direct 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.

Planting & 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.**

Natural 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.

Due 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*.

By 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**.

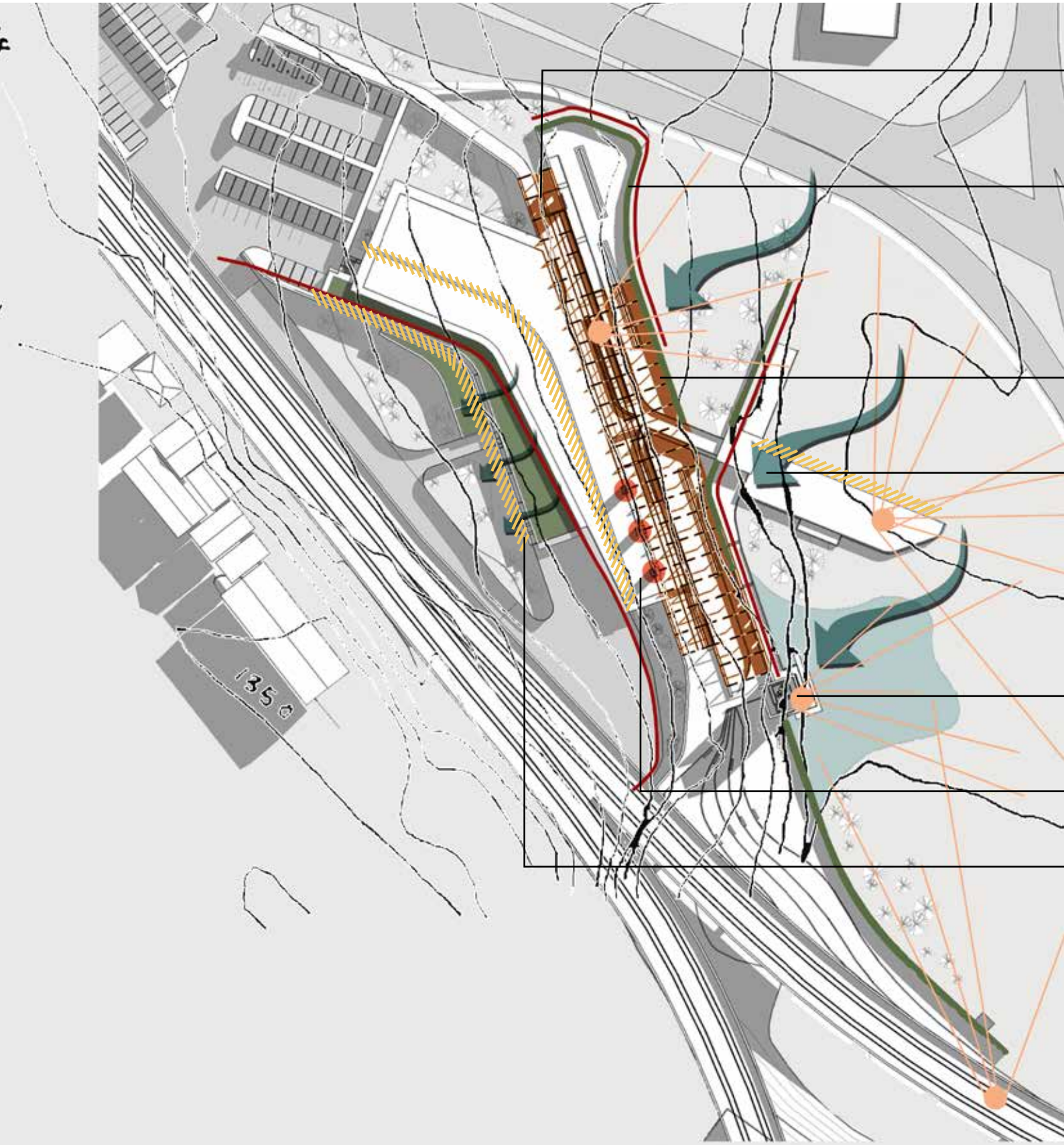
Views and vistas will be implemented towards landmarks such as UNISA and the surrounding hilltops through multiple **indoor and outdoor transitional spaces**, and the **terracing** of the building that takes full advantage of the slope of the site.

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

6.4.6 NATURAL PATTERNS AND PROCESSES

Processes 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



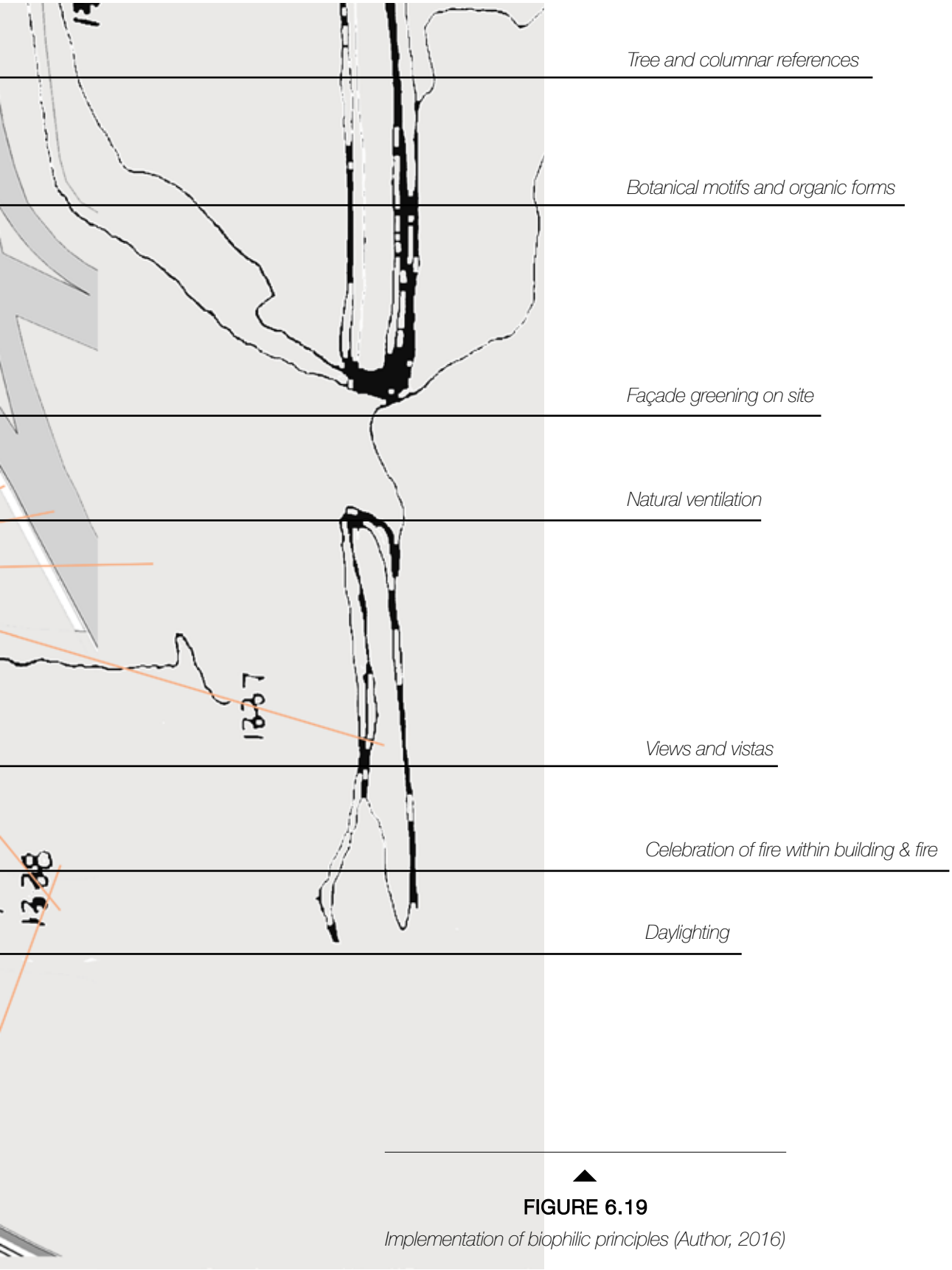


FIGURE 6.19

Implementation of biophilic principles (Author, 2016)

6.4.7 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:

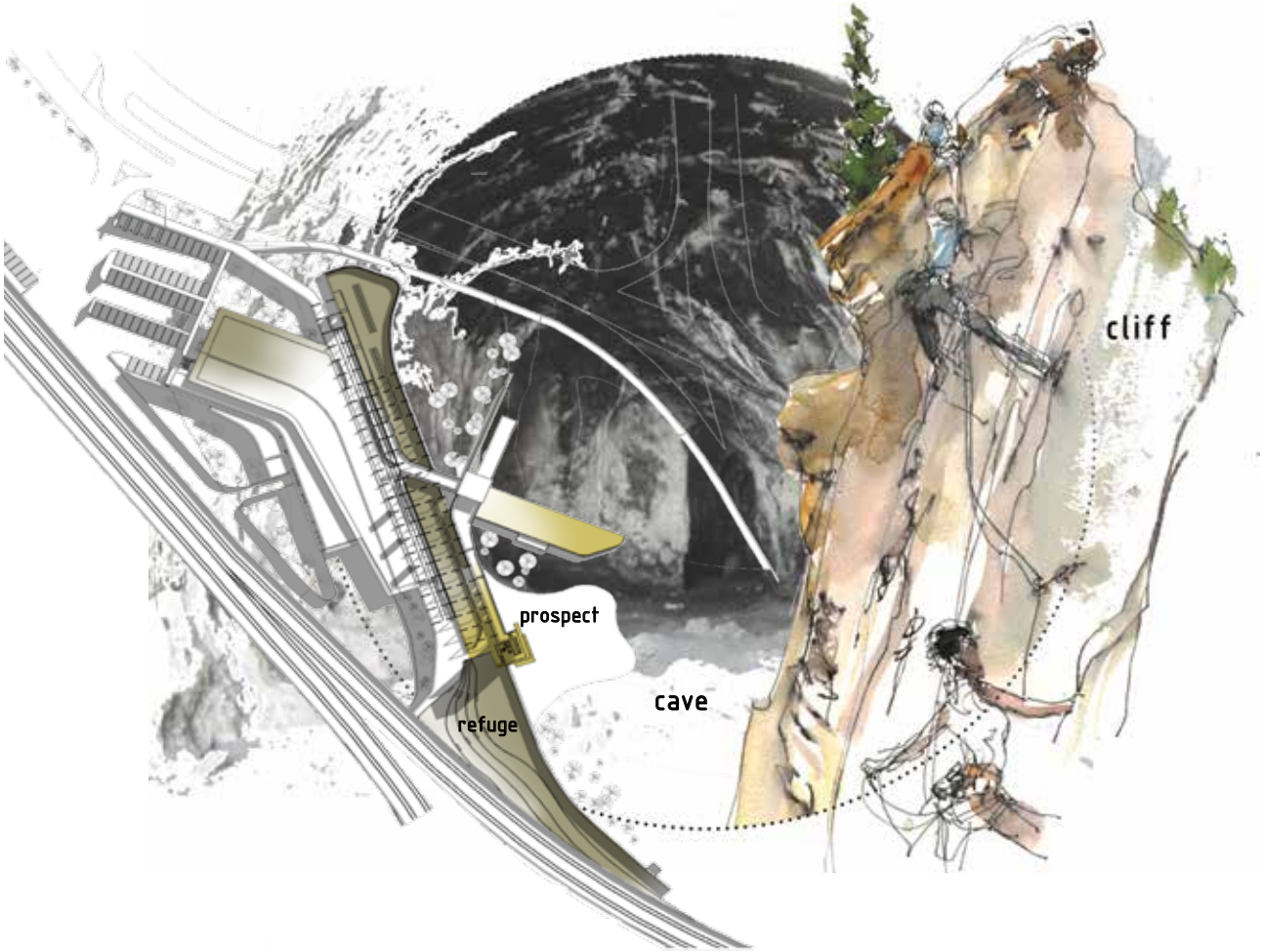


FIGURE 6.20

Prospect and refuge (Author, 2016)

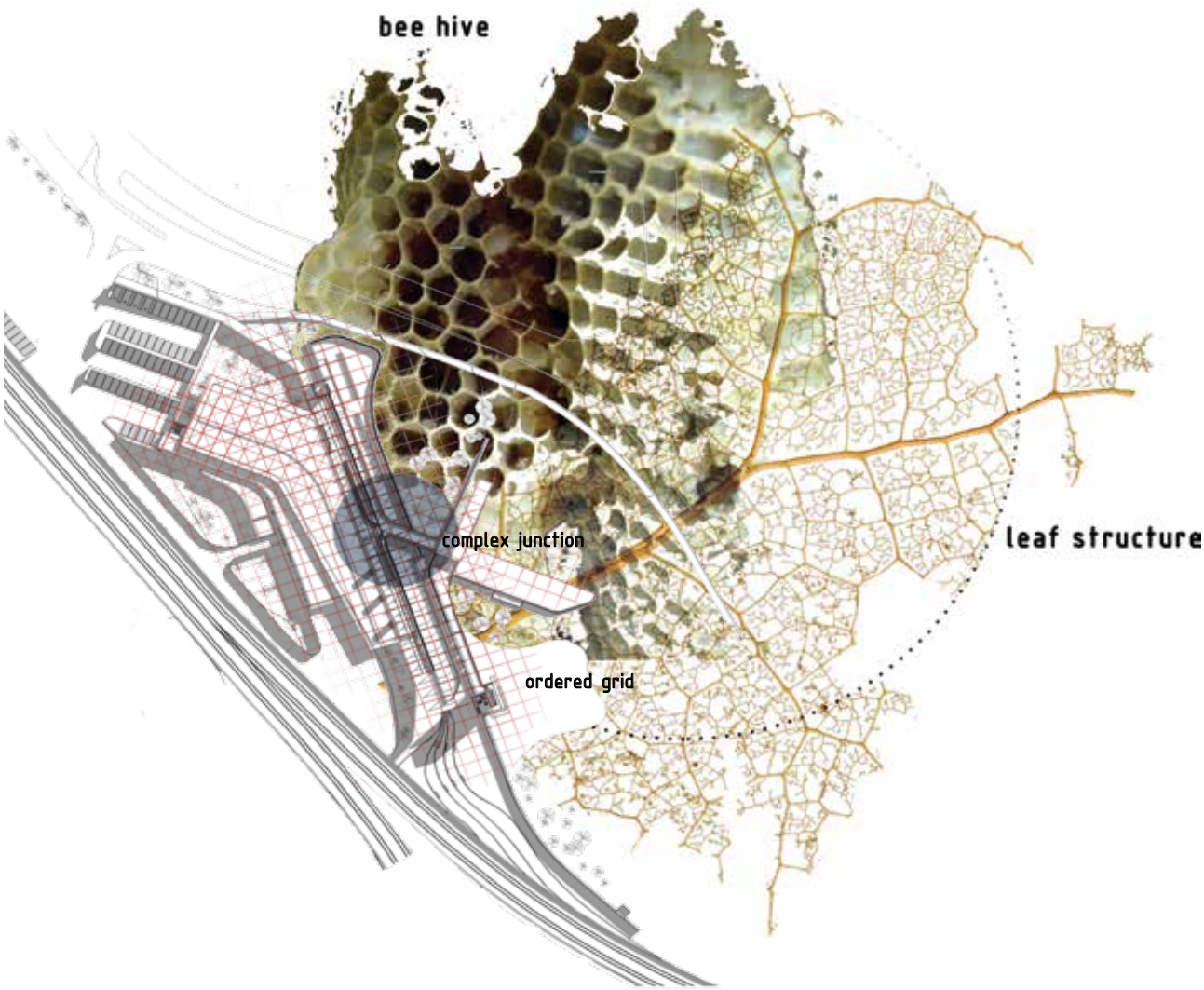


FIGURE 6.21

Order and complexity (Author, 2016)

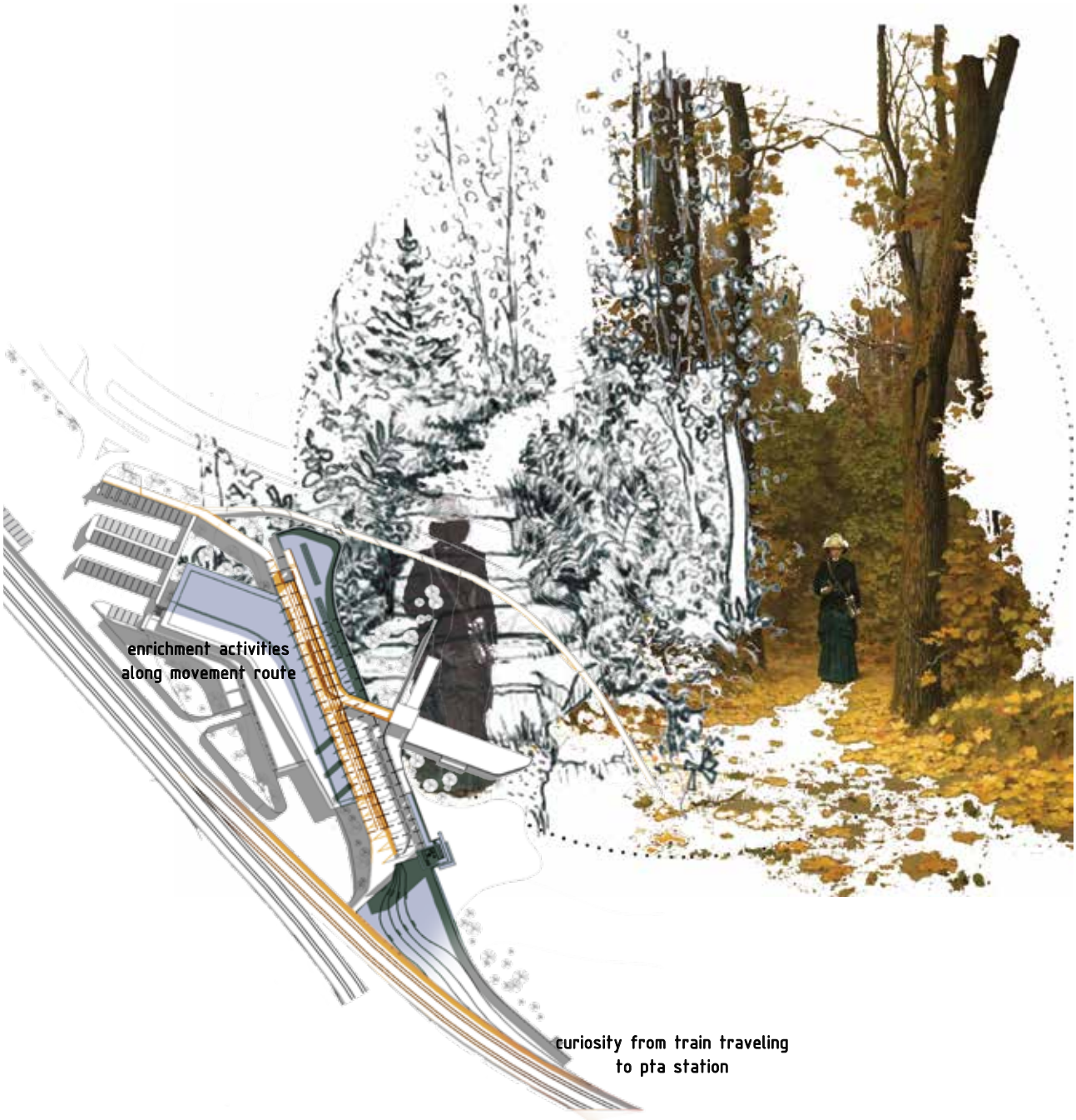


FIGURE 6.22

Curiosity and enrichment (Author, 2016)

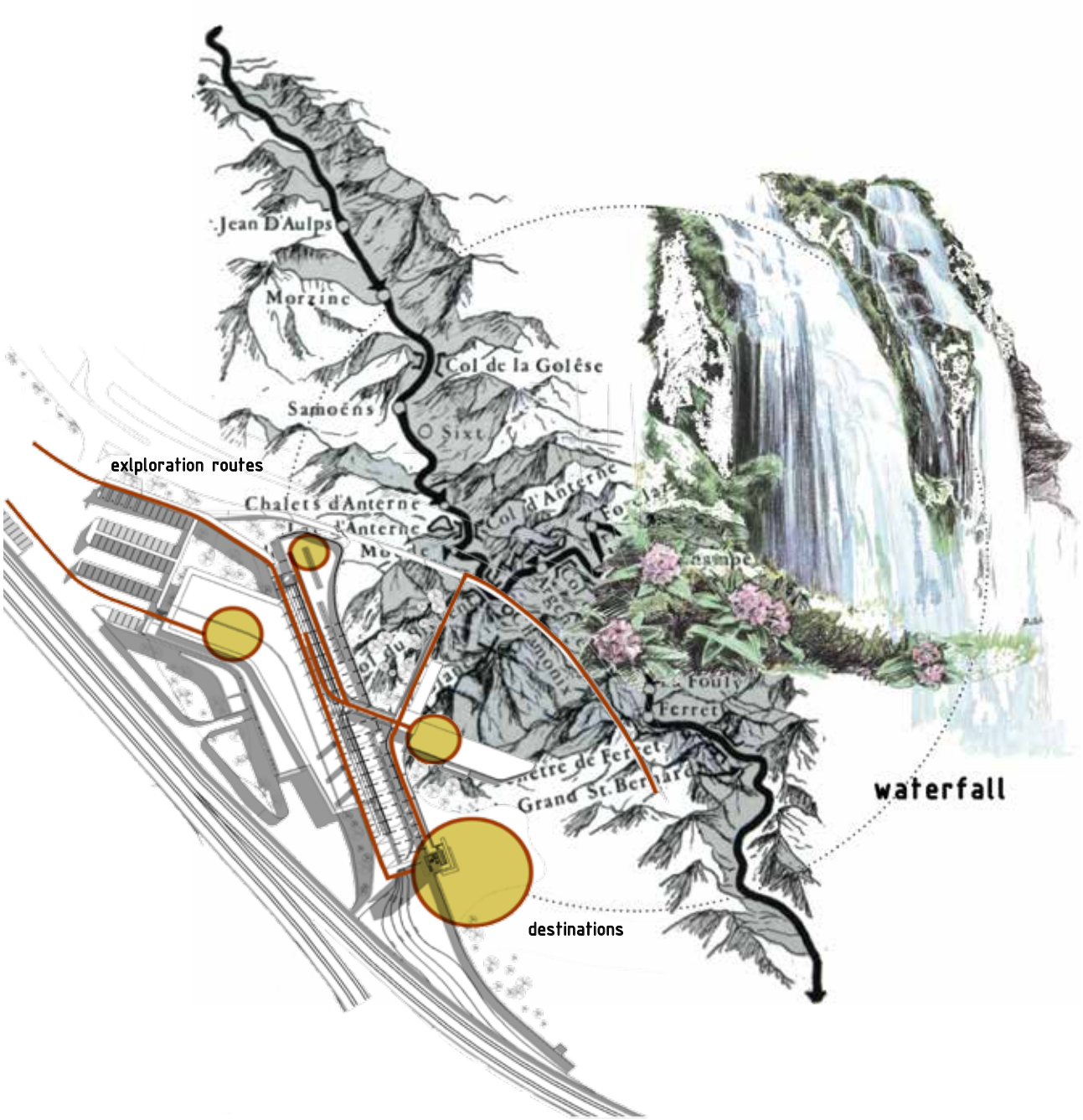


FIGURE 6.23

Exploration and discovery (Author, 2016)

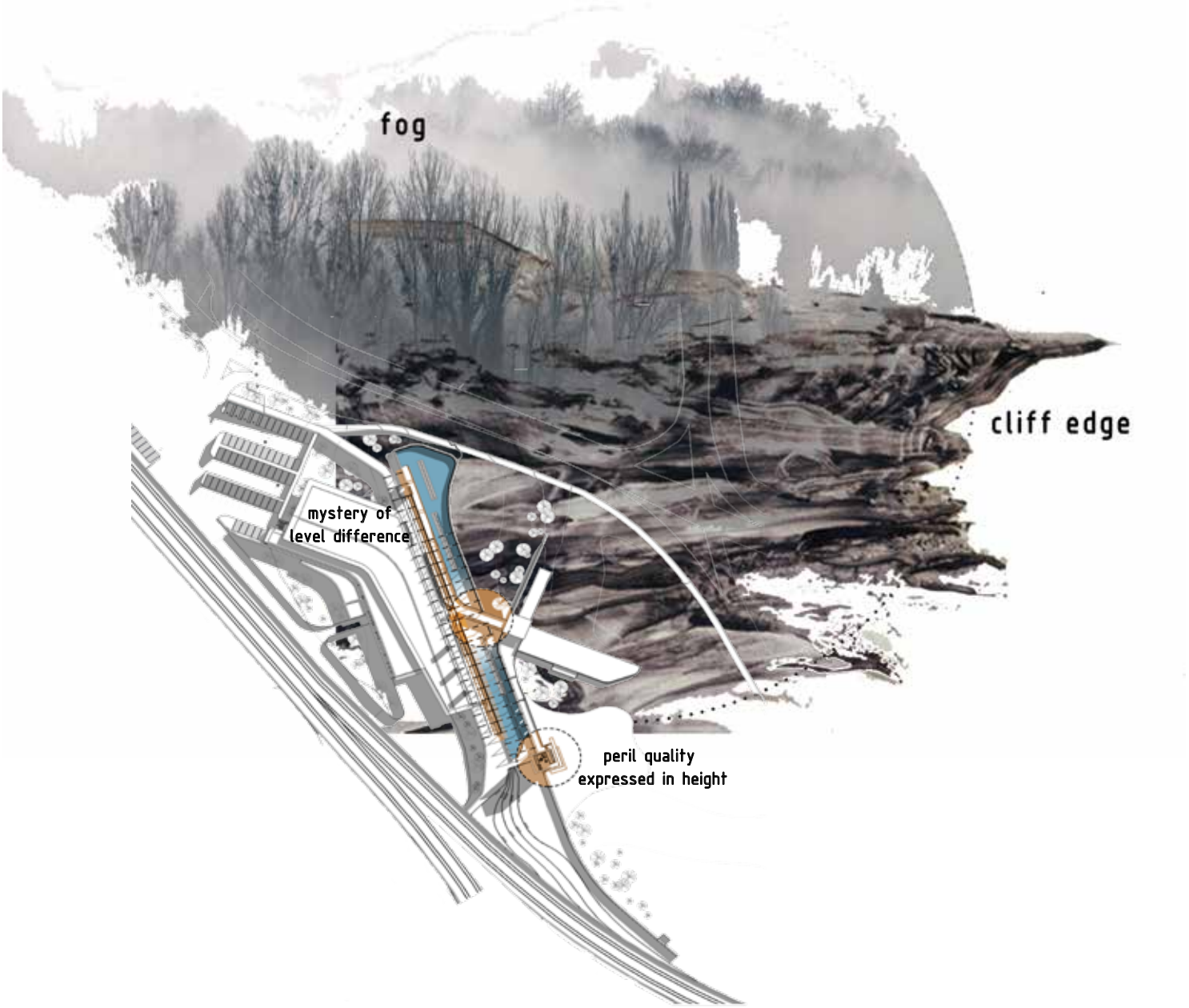


FIGURE 6.24

Peril and mystery (Author, 2016)

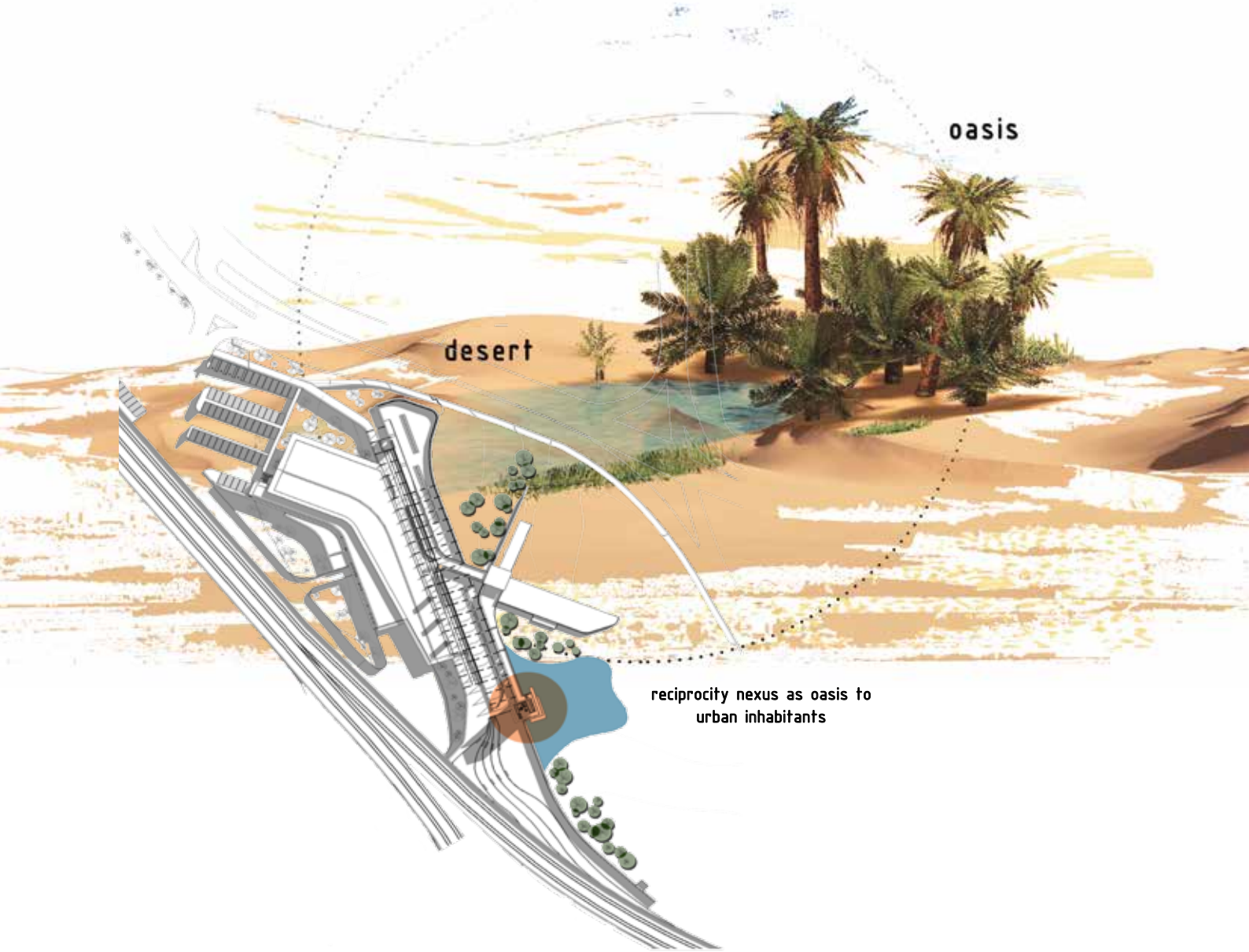


FIGURE 6.25

Serendepity (Author, 2016)

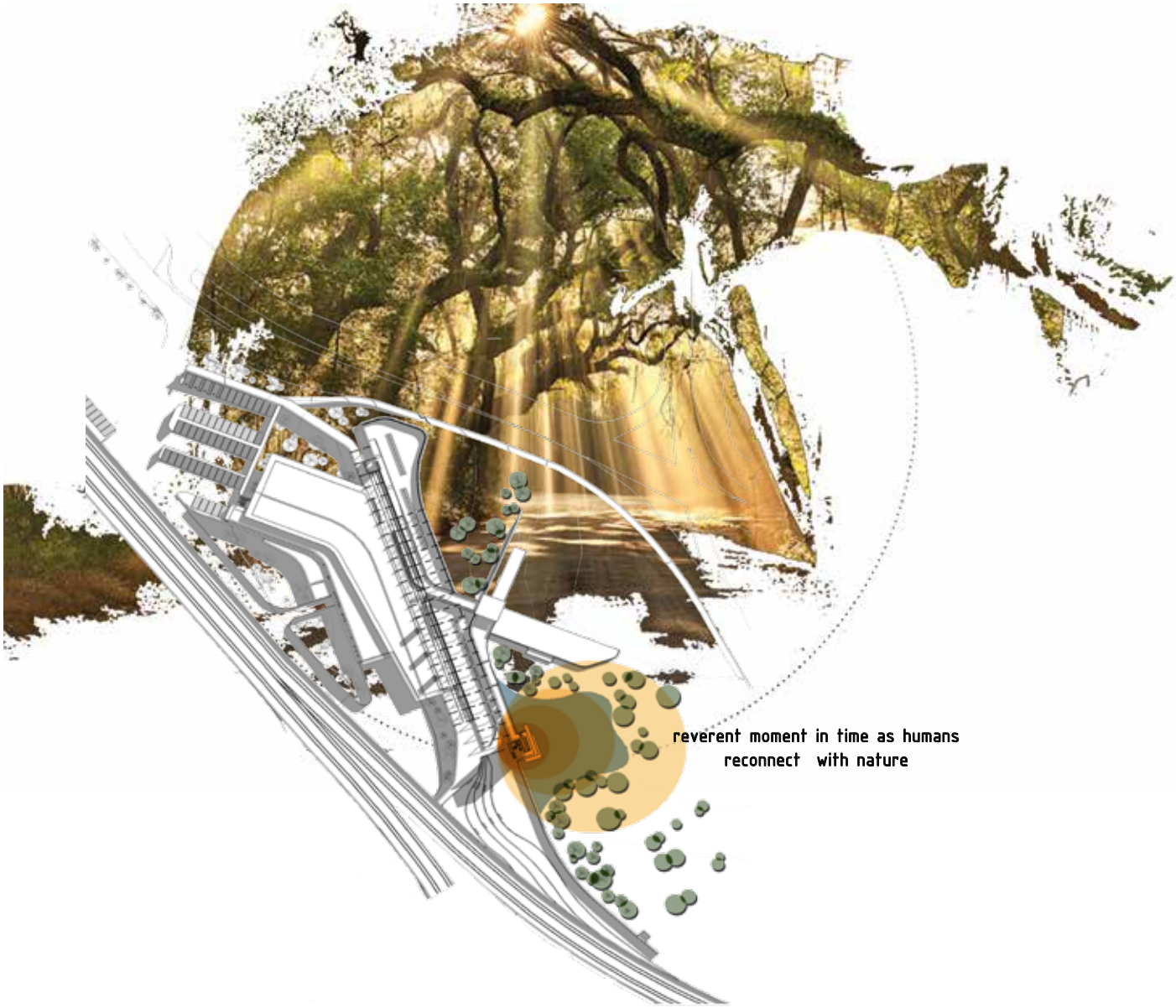


FIGURE 6.26

Reverence and spirituality (Author, 2016)

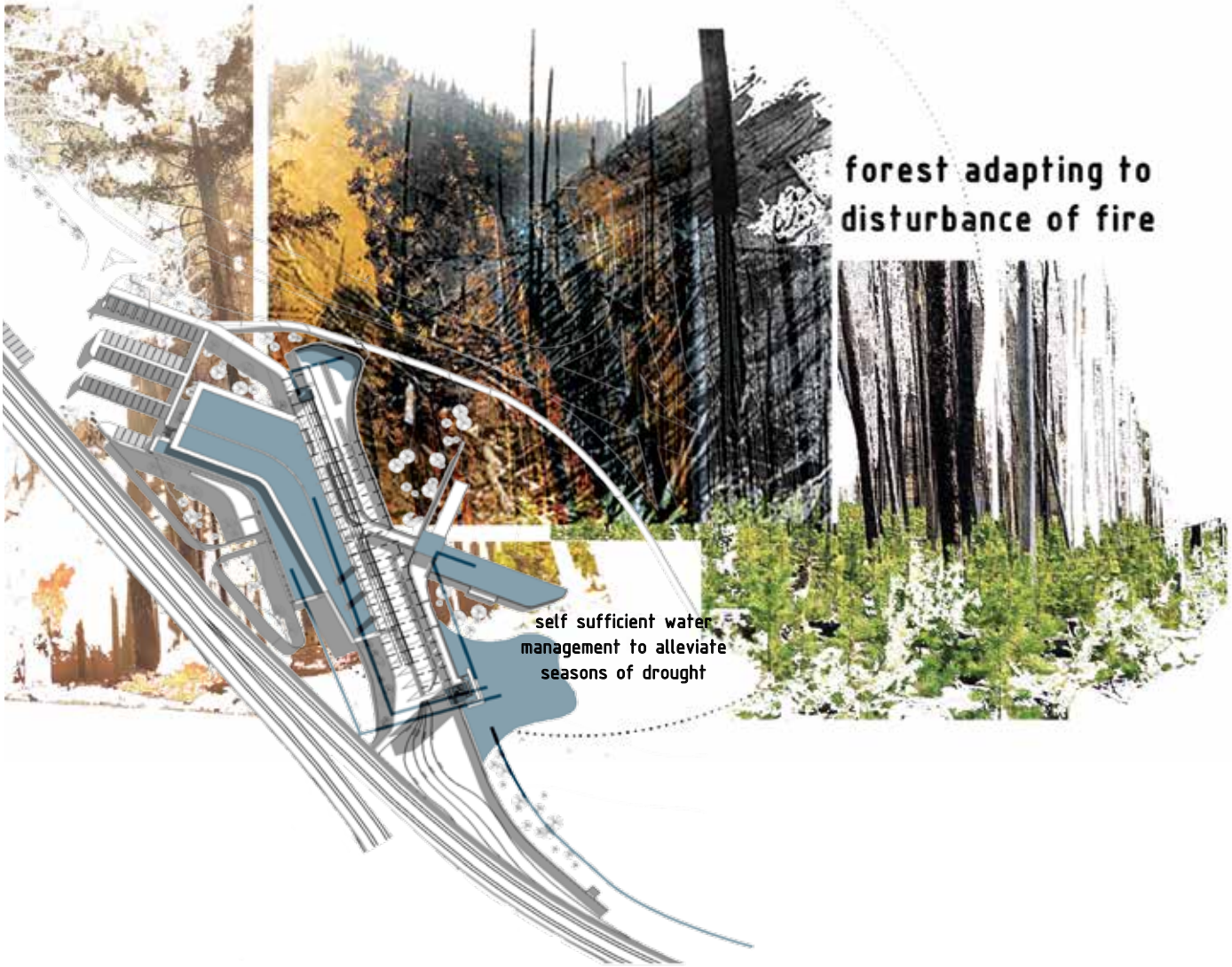


FIGURE 6.27

Resilience (Author, 2016)

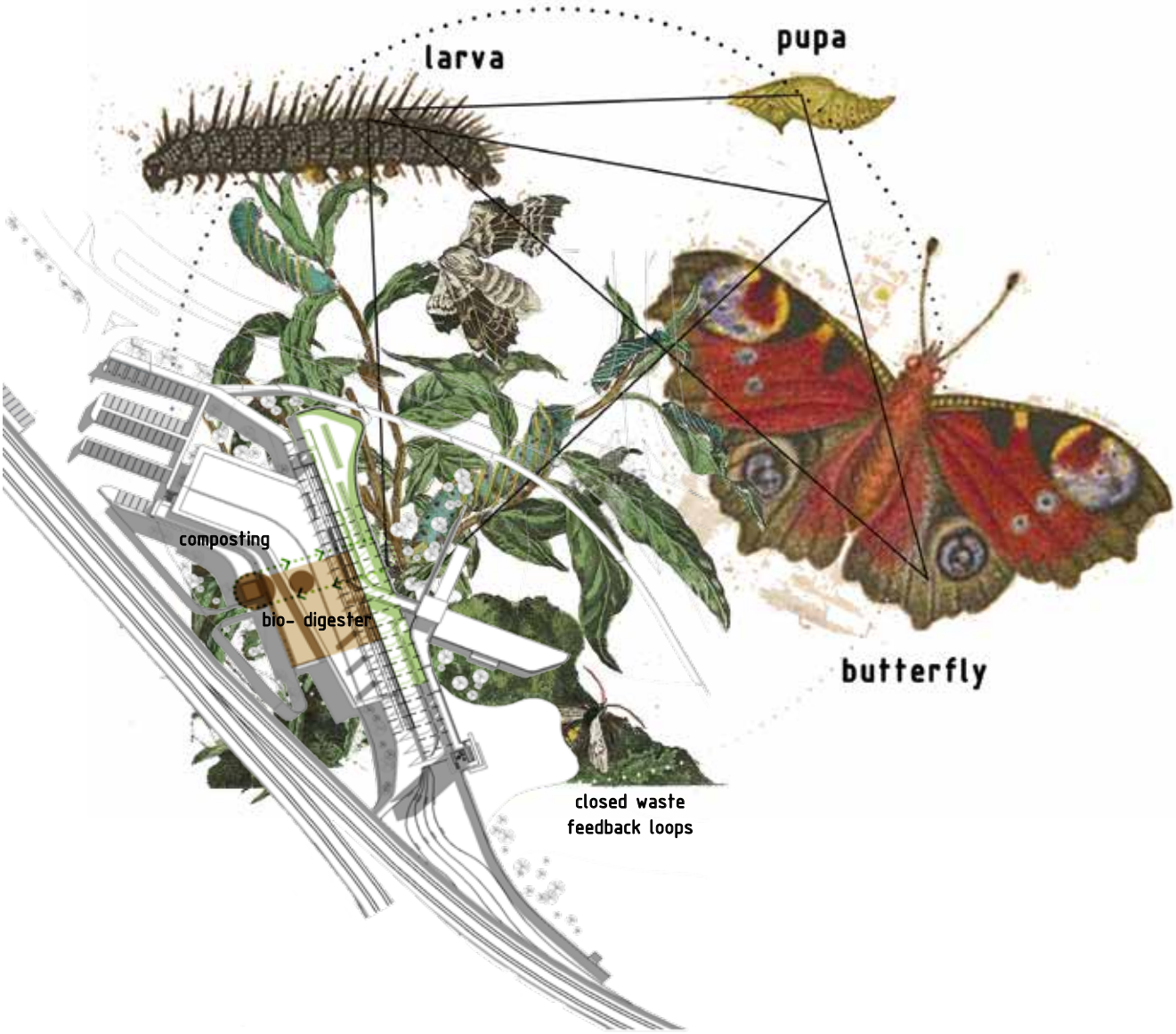


FIGURE 6.28

Growth and efflorescence (Author, 2016)

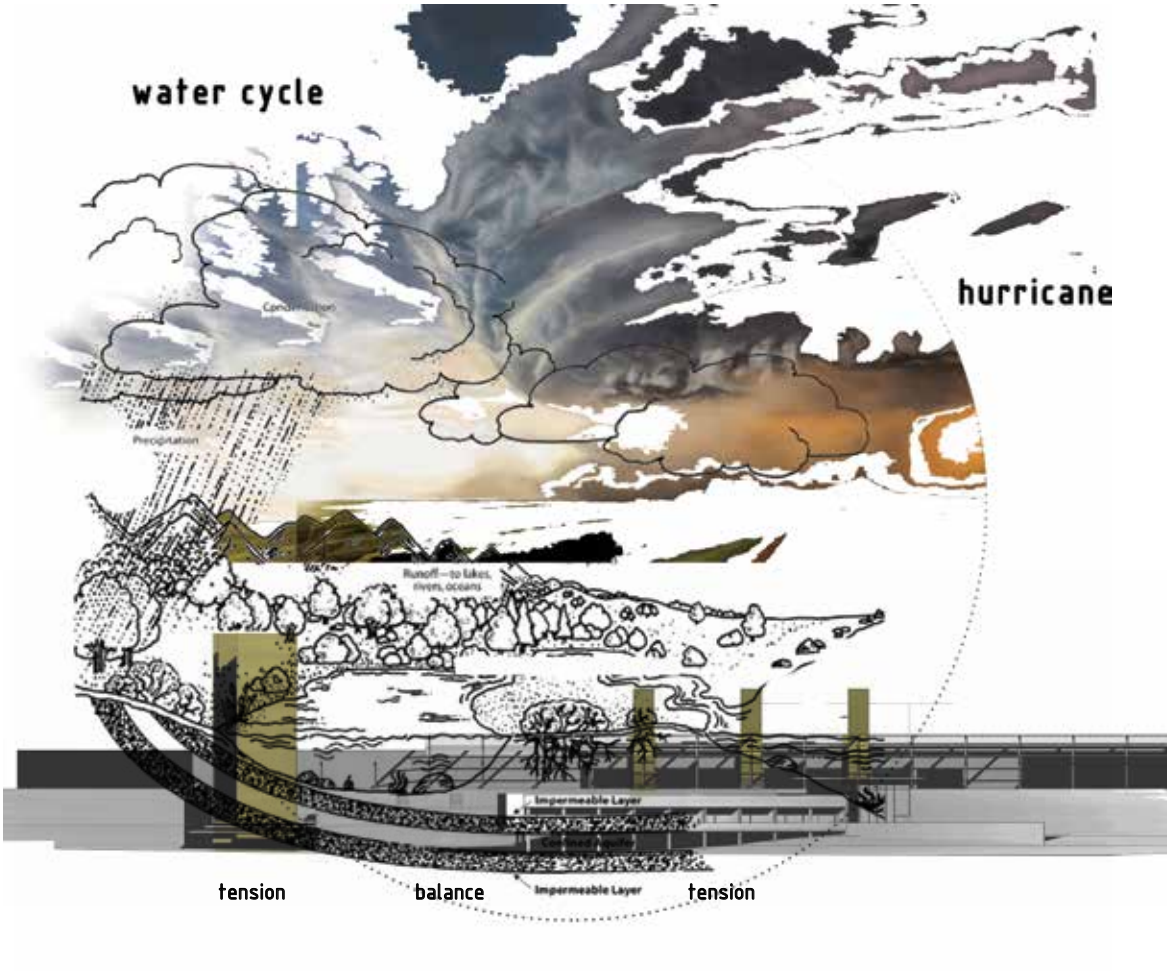


FIGURE 6.29

Dynamic balance and tension (Author, 2016)

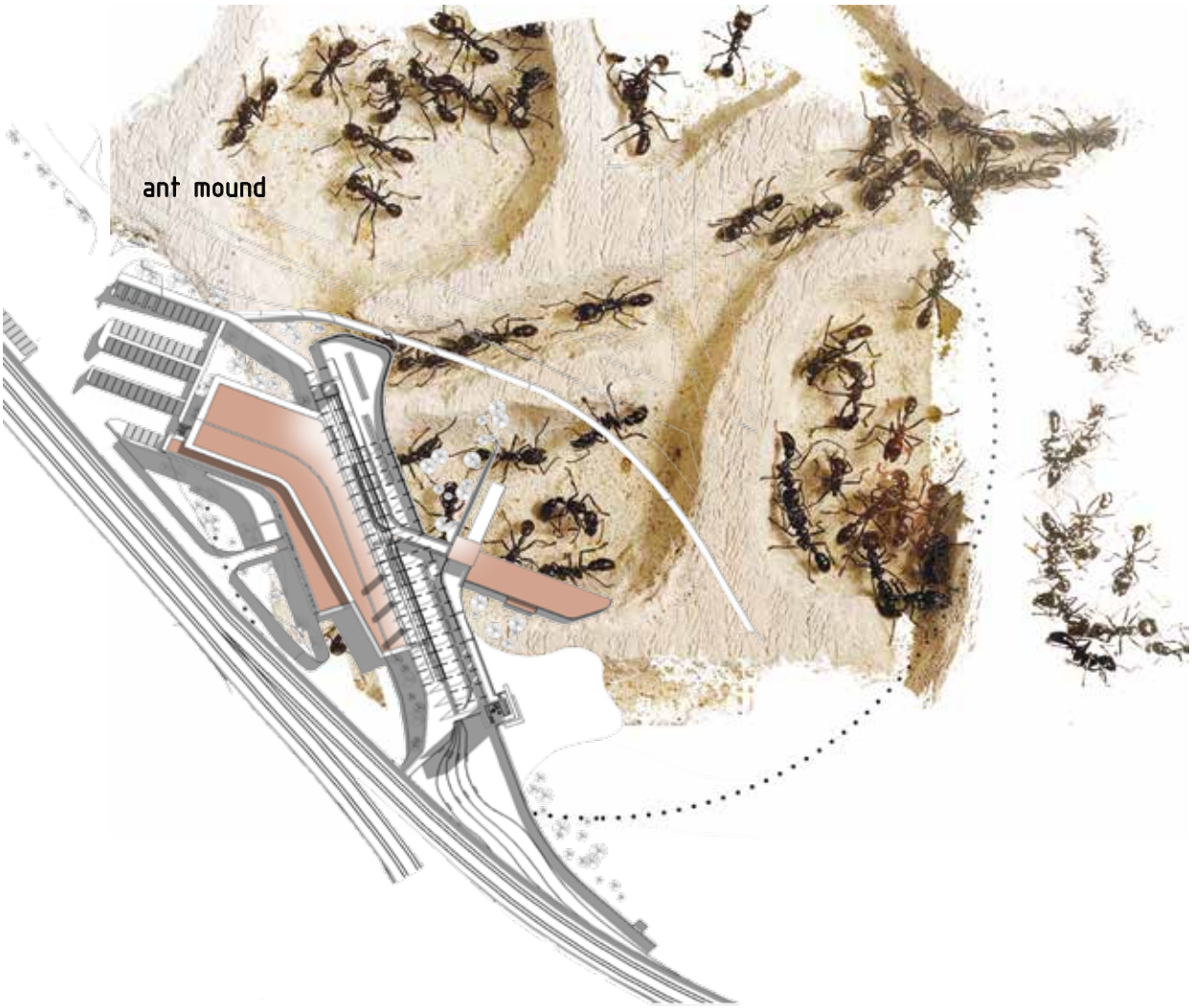


FIGURE 6.30

Bounded space (Author, 2016)

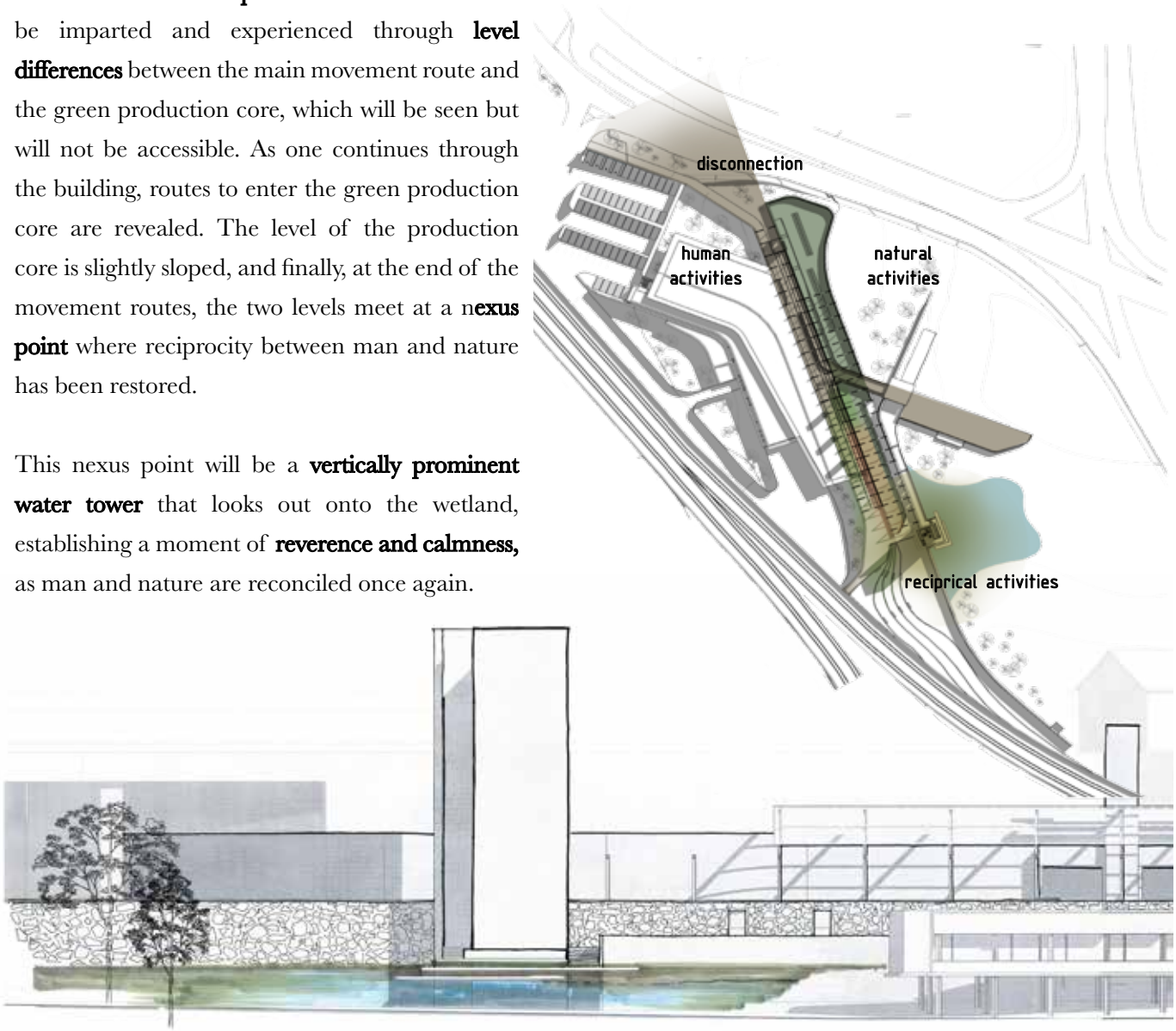
6.5 FROM DISCONNECTION

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 n**exus 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

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.

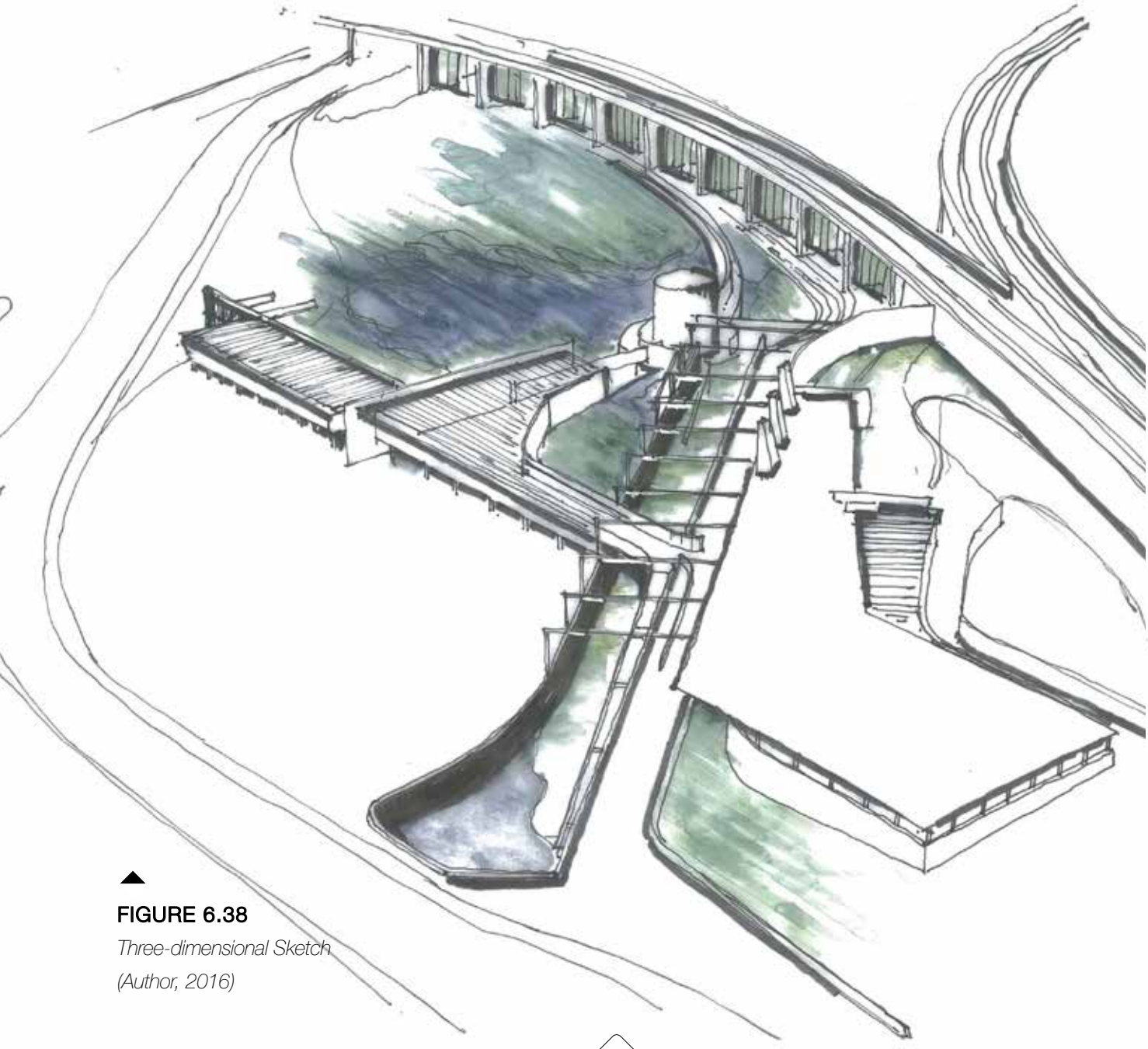
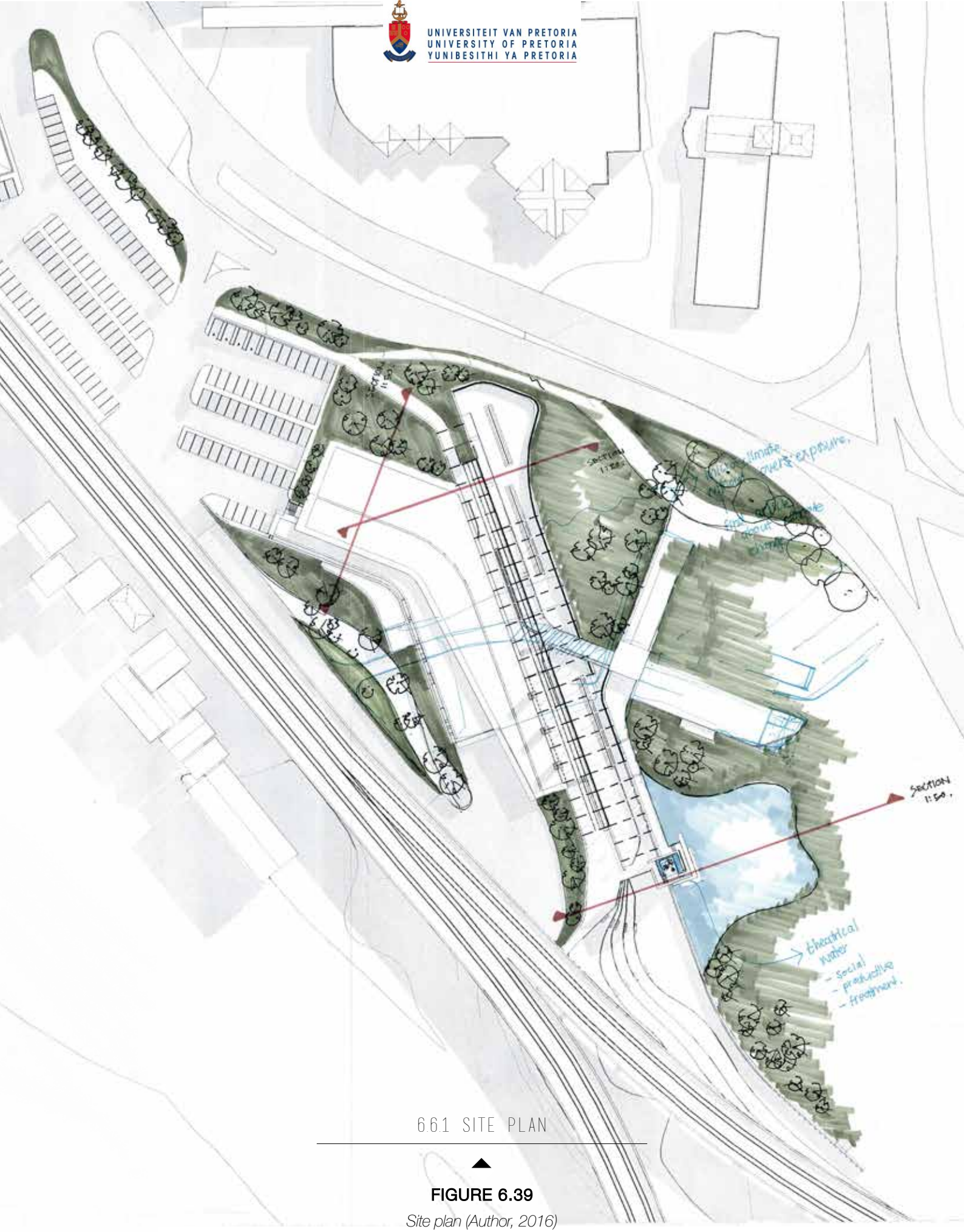


FIGURE 6.38
Three-dimensional Sketch
(Author, 2016)



6.6.1 SITE PLAN

FIGURE 6.39

Site plan (Author, 2016)

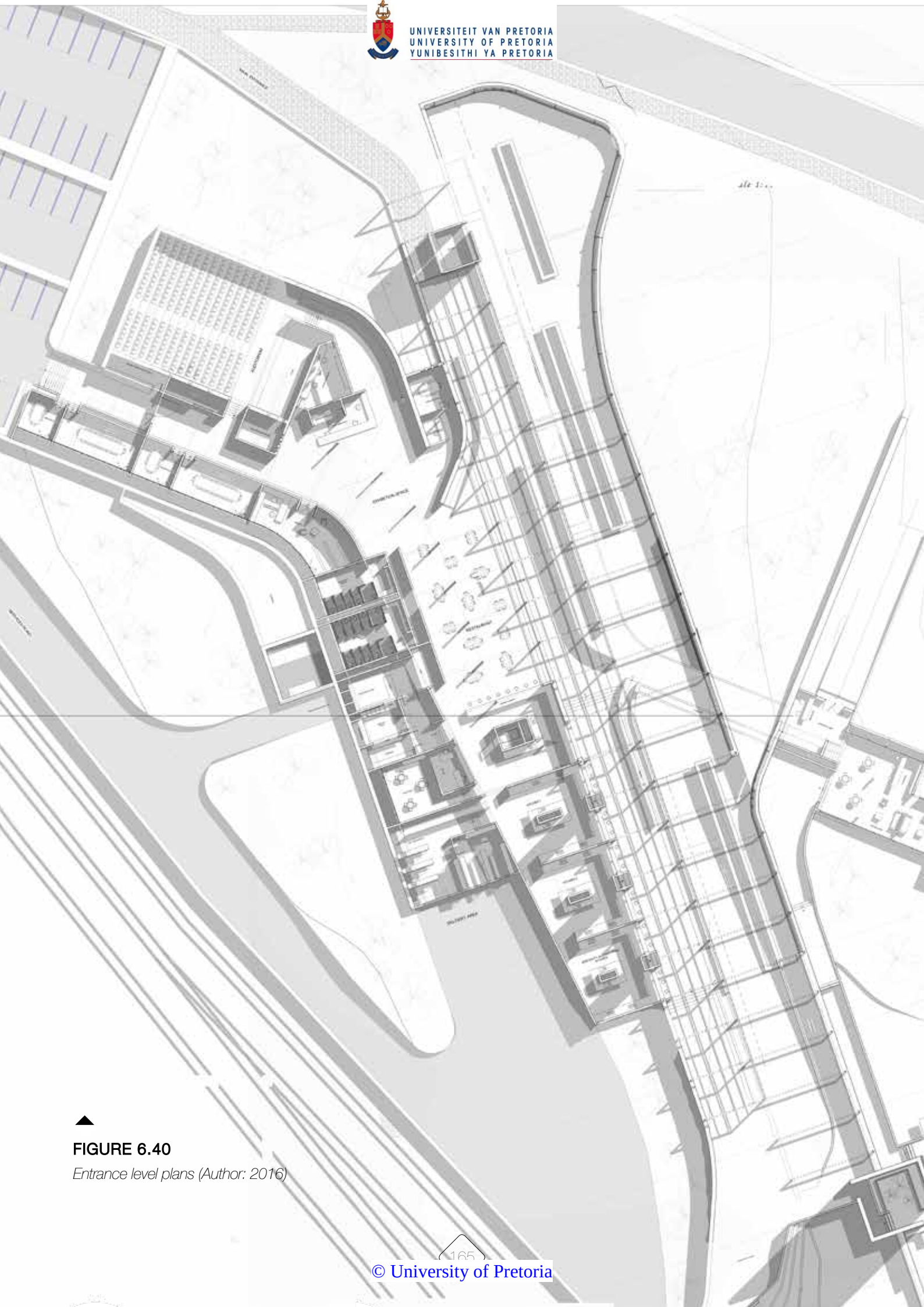


FIGURE 6.40

Entrance level plans (Author: 2016)

6.6.2 GROUNDFLOOR AND SERVICE LEVEL PLANS

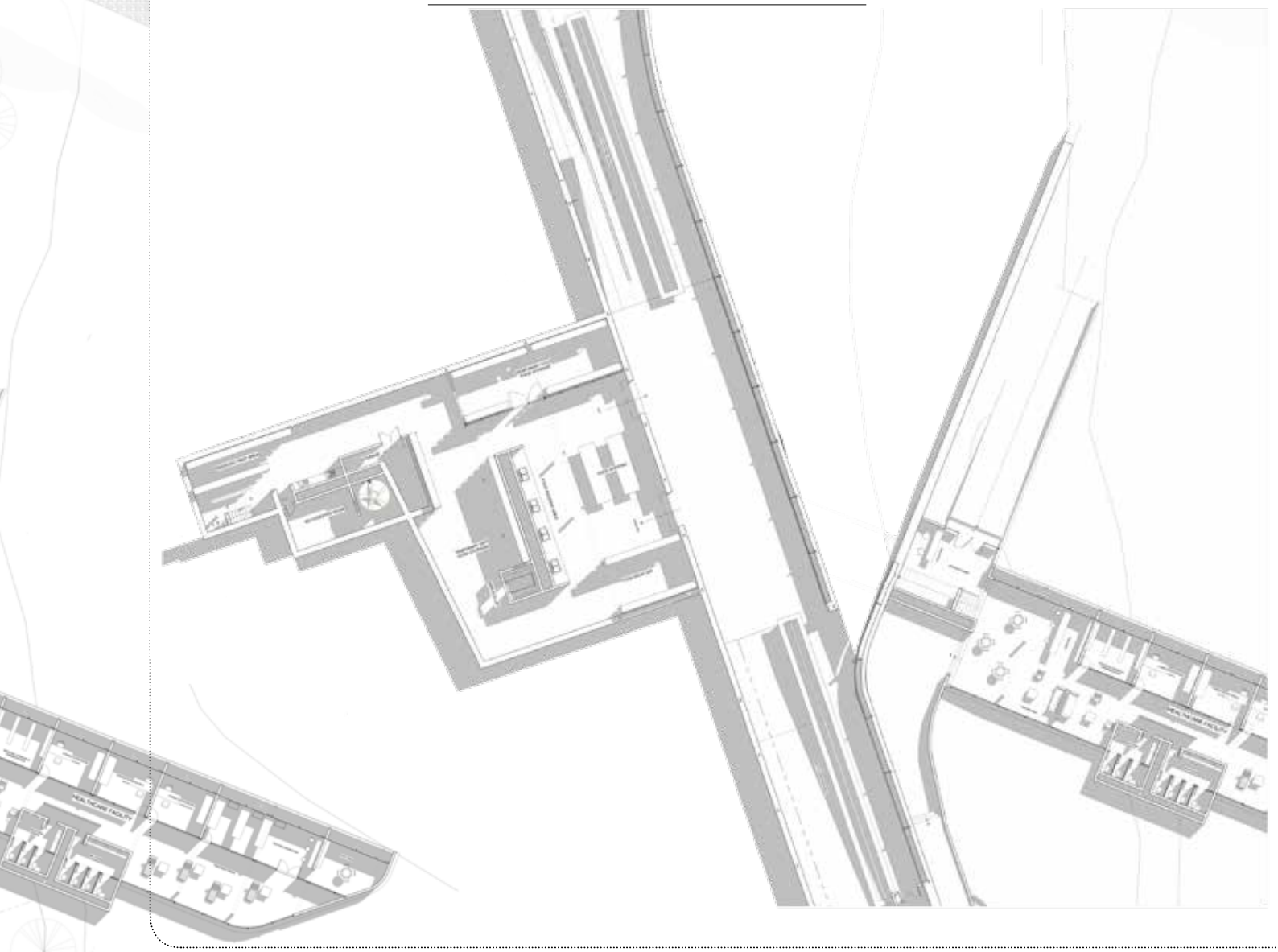
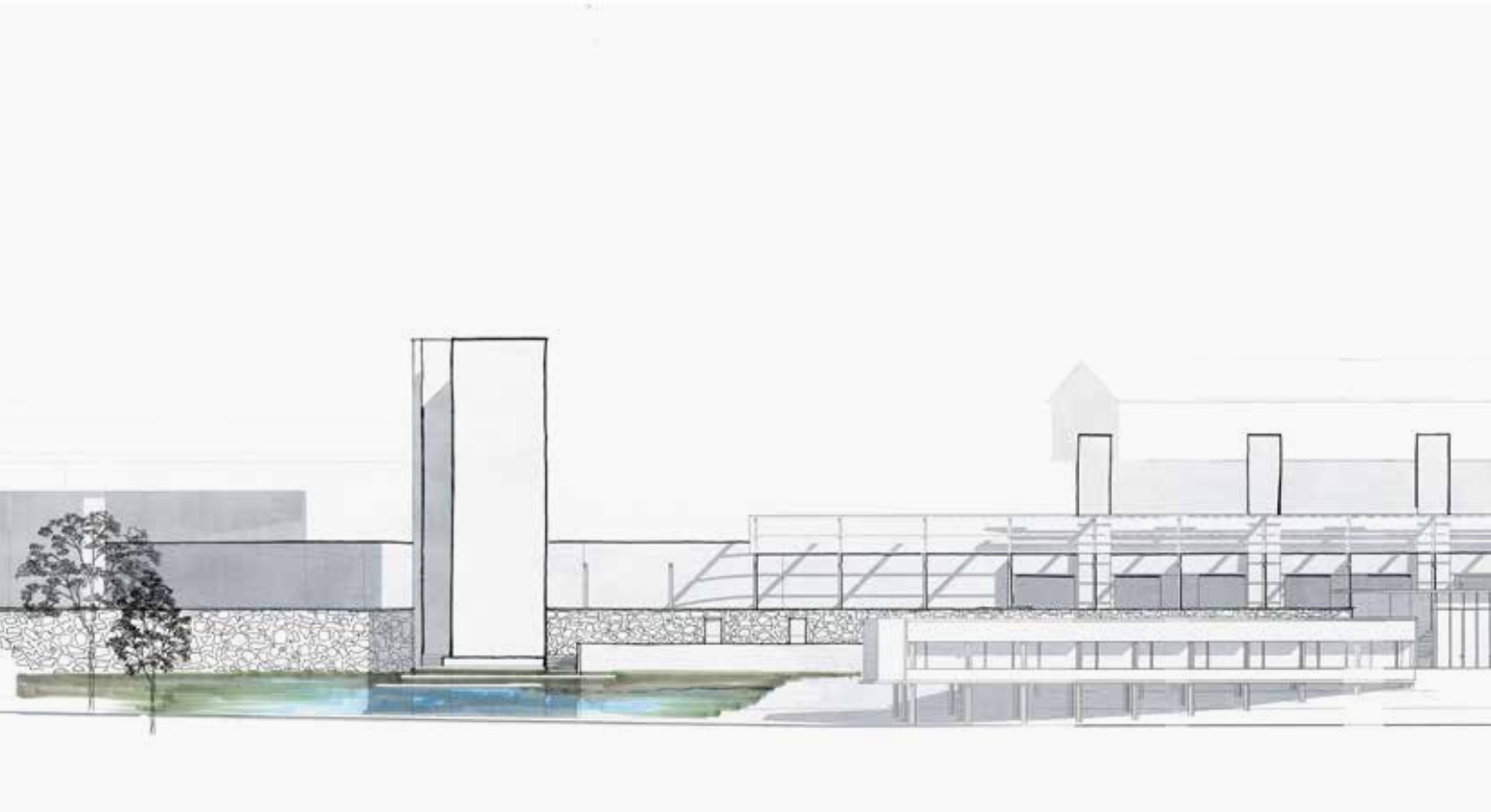
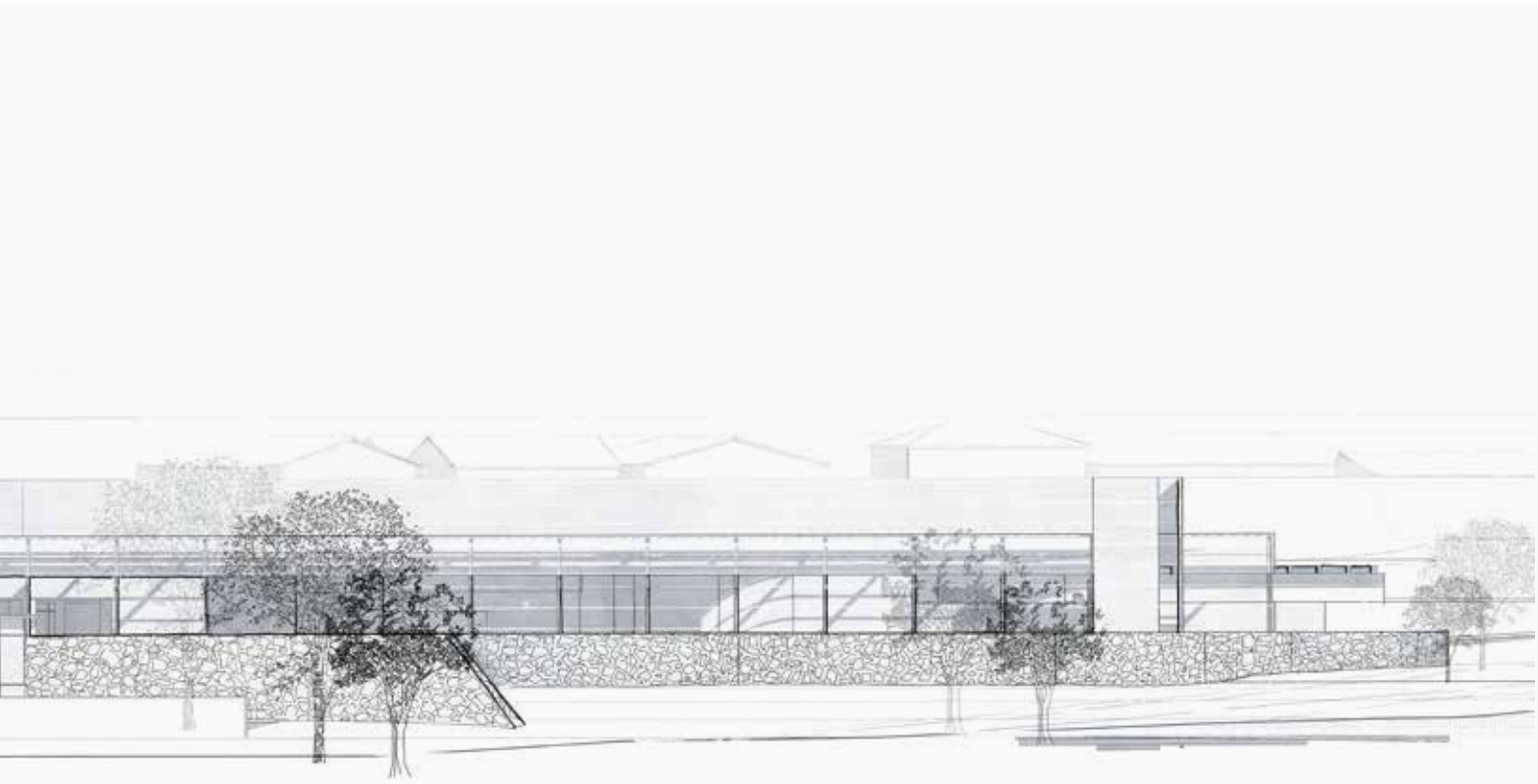


FIGURE 6.41

Service level plans (Author: 2016)

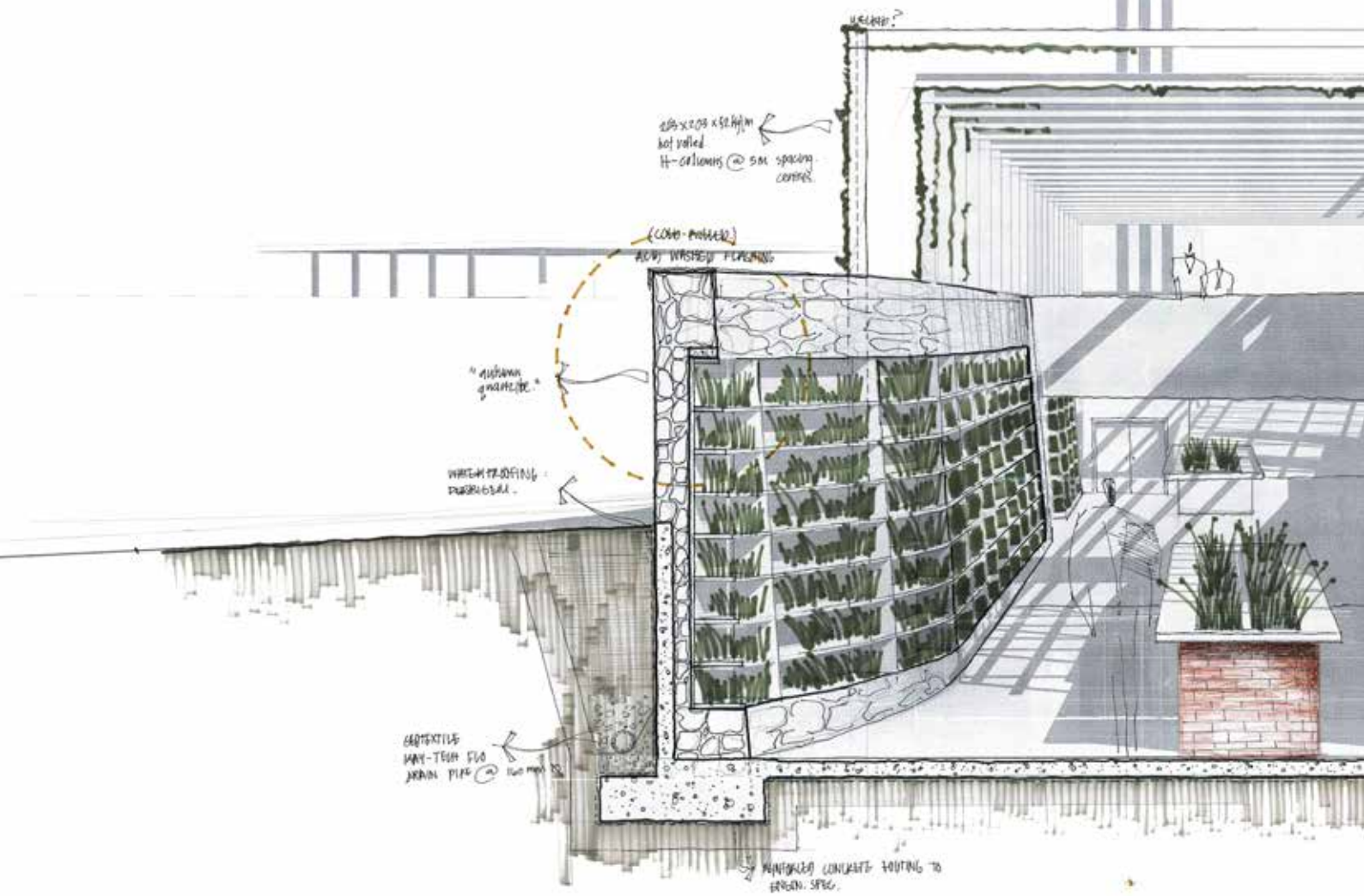


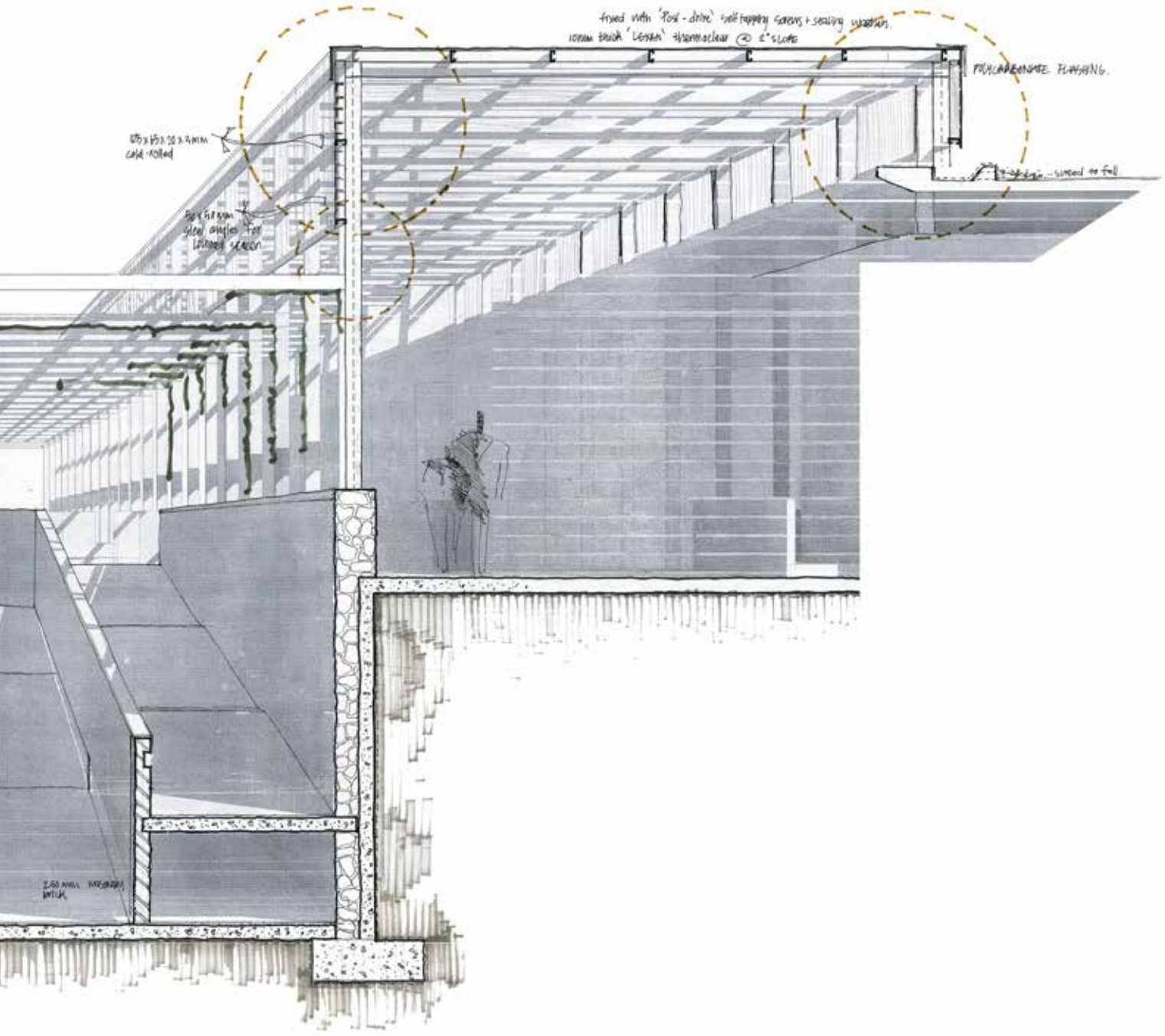


6.6.3 NORTH EAST ELEVATION

FIGURE 6.42

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

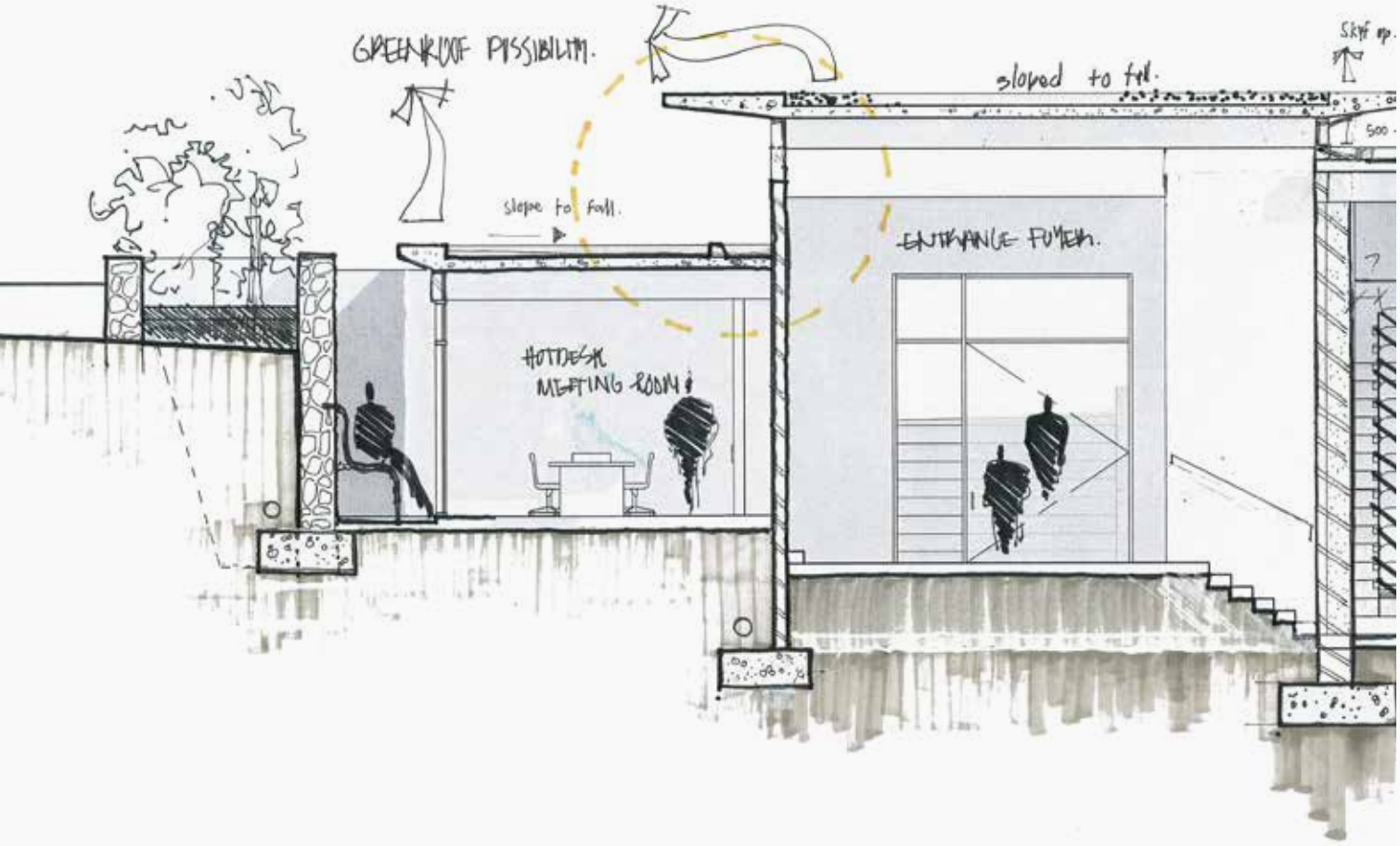




6.6.3 DISCONNECTION SECTION

FIGURE 6.43

Disconnection section (Author, 2016)



6.6.3 EDUCATIONAL SECTION

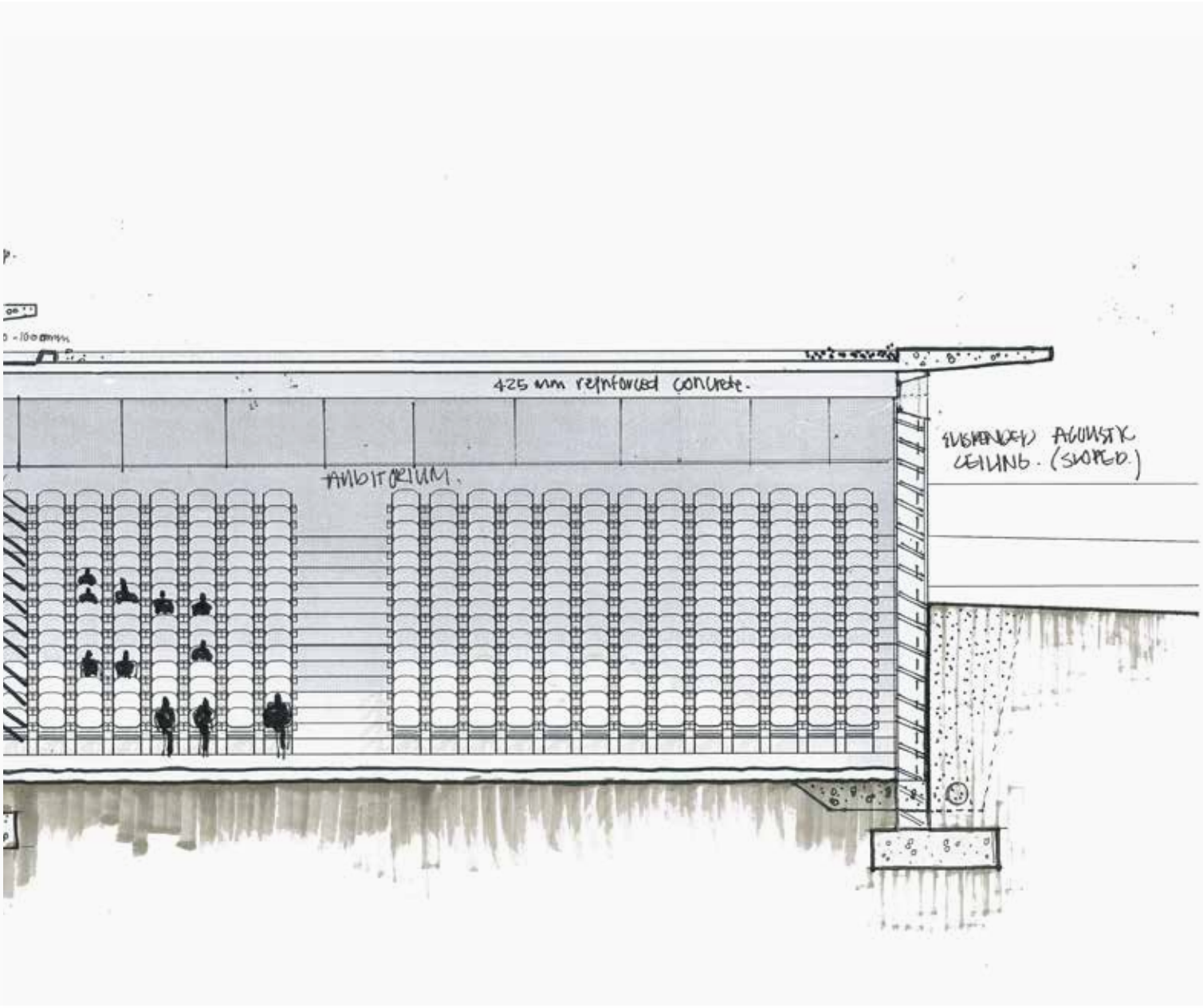
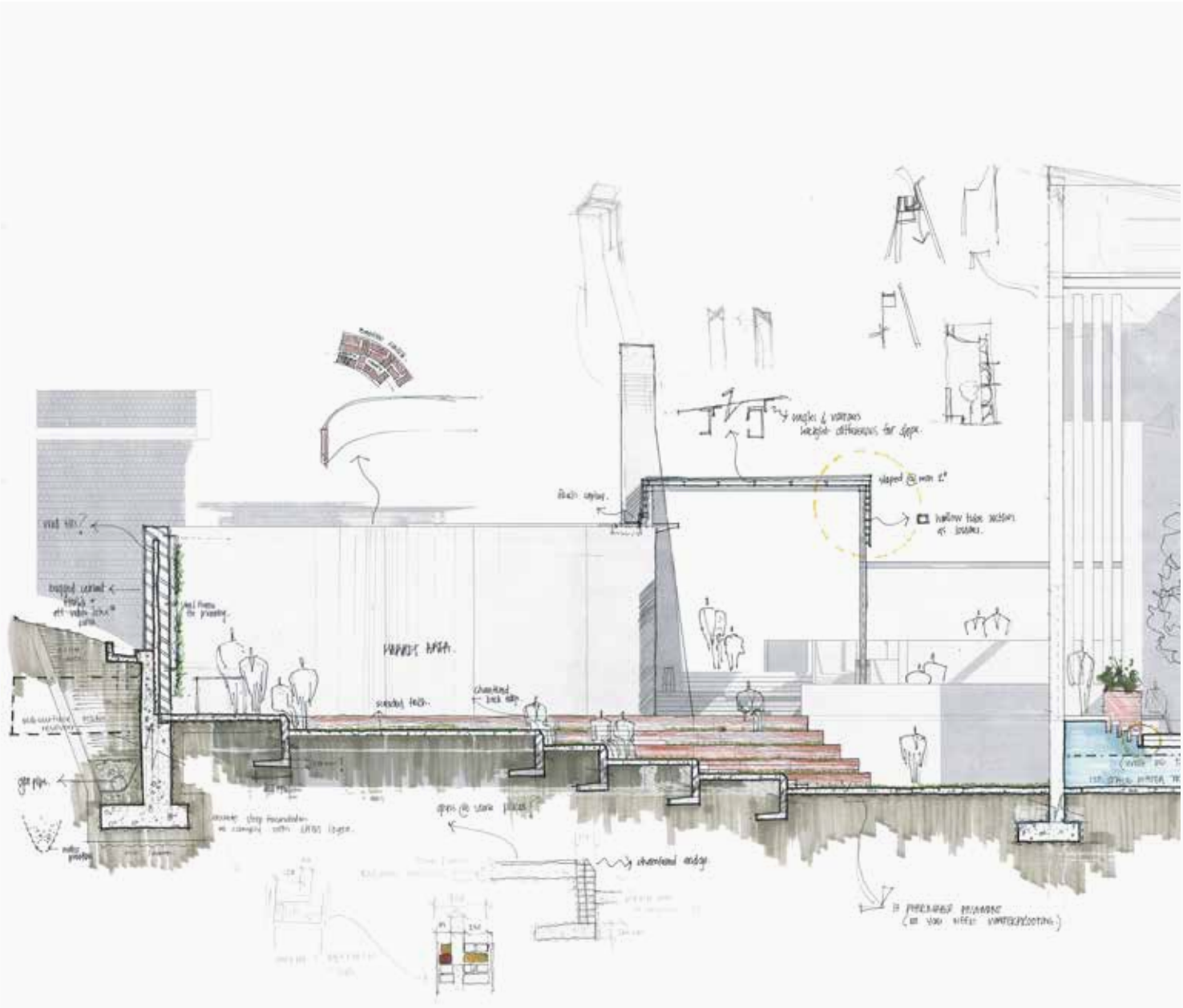


FIGURE 6.44

Educational section (Author, 2016)



6.6.3 RECIPROCITY SECTION

FIGURE 6.45

Reciprocity section (Author, 2016)

FIGURE 7.1

Day 280, Twigs

(Lorraine Loots, 2013)

chapter seven

TECHNIFICATION

7.1 PREFACE

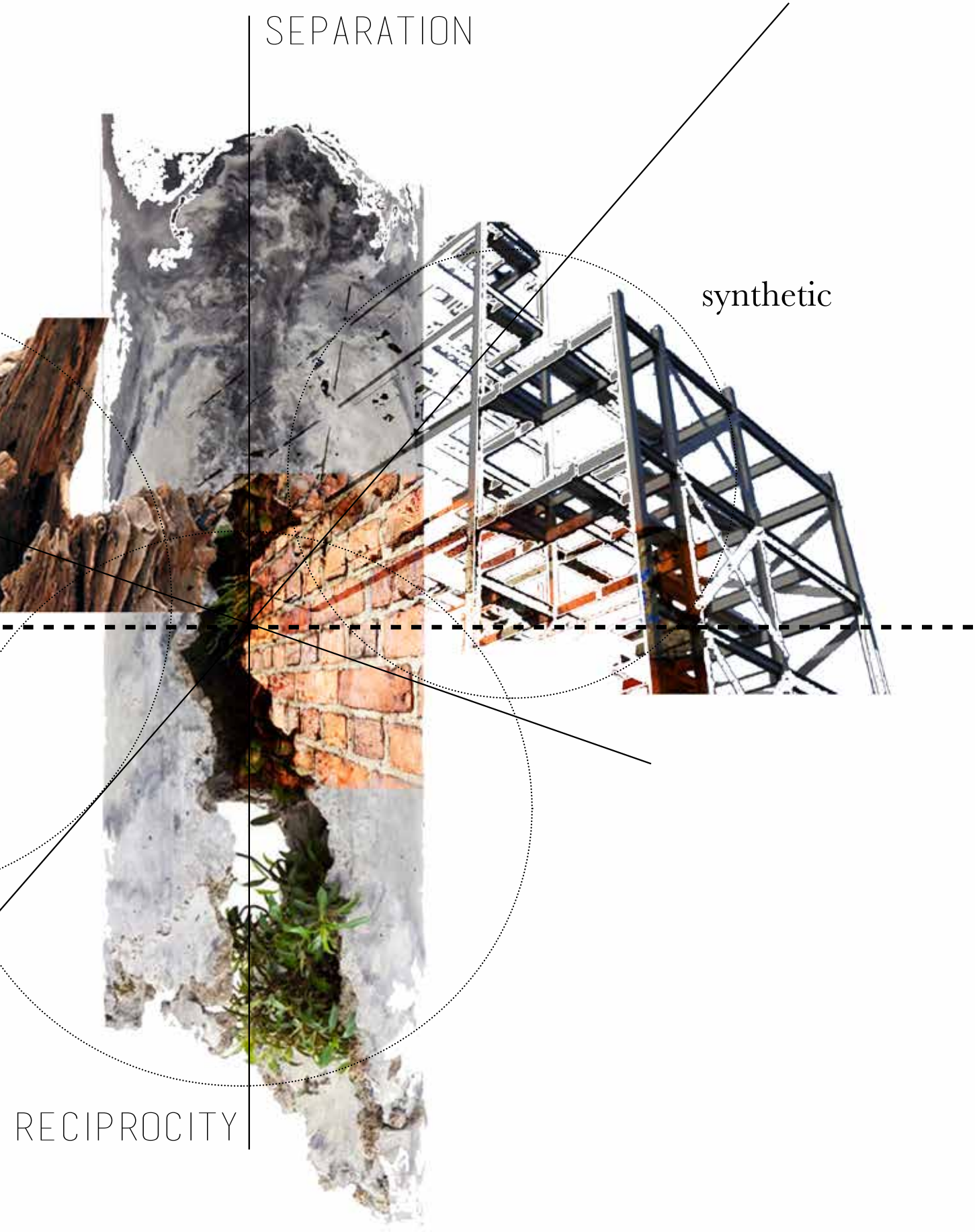
The aim of the final chapter is to develop a continuous reinterpretation of the conceptual and design intentions and translate them into technical resolutions. The **technical concept** that has been informed by the dissertation's fundamental objectives will be discussed to support all tectonic decision-making. **Material selection** and application, the **structural properties** of the building and **system applications** related to **permaculture and services** will be dealt with accordingly. Finally the applications of **passive environmental systems and technologies** will be discussed to ensure that regenerative and sustainable practices are accomplished on every scale.

7.2 TECHNICAL CONCEPT

The technological investigation examines the concept of **transition** from a state of **disconnection** to one of **reconciliation** between the natural and human conditions. It is crucial that the tectonic language not only visually articulates these two states separately, but also introduces a new condition where they are reconciled as a **nexus of reciprocity.**

The **material palette** will be the fundamental device to indicate the transition between states. **Natural** as well as **synthetic** building materials will be implemented and celebrated separately for their unique properties. These materials will then be **reconciled sensitively** with one another at certain nexus points in the building to indicate the advantages and beauty of their **reciprocal condition.**

FIGURE 7.2
Diagram explaining tectonic concept
(Author, 2016)



7.3 MATERIALITY

As mentioned, the material selection is dependent on three categories in order to express the tectonic intentions, namely **natural materials**, **man-made/synthetic materials**, and **hybrid materials** and joining methods. The application and structural properties of these will be elaborated on when the building's structural configuration is dealt with. It is also important to note that the materiality of the building should be an expression of natural processes in order to support biophilia and thus allow for *sensory variability*, *demonstrate the age, change and the patina of time*, and celebrate *complementary contrasts.*

7.3.1 NATURAL MATERIALS

STONE

The **stereotomic** and **retaining** characteristics of natural stone will be utilized to enable direct associations with nature as well as provide inherent mass as a thermal design strategy.

ON-SITE CLAY AND SOIL

On-site soil that will be excavated on site during the construction of the building will be utilized where additional **compaction soil** is needed.

TIMBER

Pine plywood will be used in multiple ways in **interior spaces** in order to express its haptic qualities and affiliation with nature.

VEGETATION

Facade greening and productive green walls will be employed as fundamental tools to establish a **physical link with nature**.

FIGURE 7.3
Natural material palette
(Author, 2016)

7.3.2 SYNTHETIC / MAN-MADE MATERIALS

STEEL

The tectonic qualities of steel as a **tension device** will be implemented to create surface contrast with the stereotomic natural materials. The steel members will be acid-washed and painted to eventually undergo processes of weathering to indicate the *patina of time.*

POLYCARBONATE SHEETING

Wall and roof sheets made of polycarbonate will be applied to **enable light to be diffused** on entering the building while simultaneously **insulating internal spaces** against heat gain. In this way, energy savings will be achieved and the need for additional supporting structures reduced, as the material has a low unit weight with a long life span.

CONCRETE

Concrete is a **low-maintenance and robust materia**l that will be applied in floor slabs, roof and beam structures, foundations and retaining substructures.

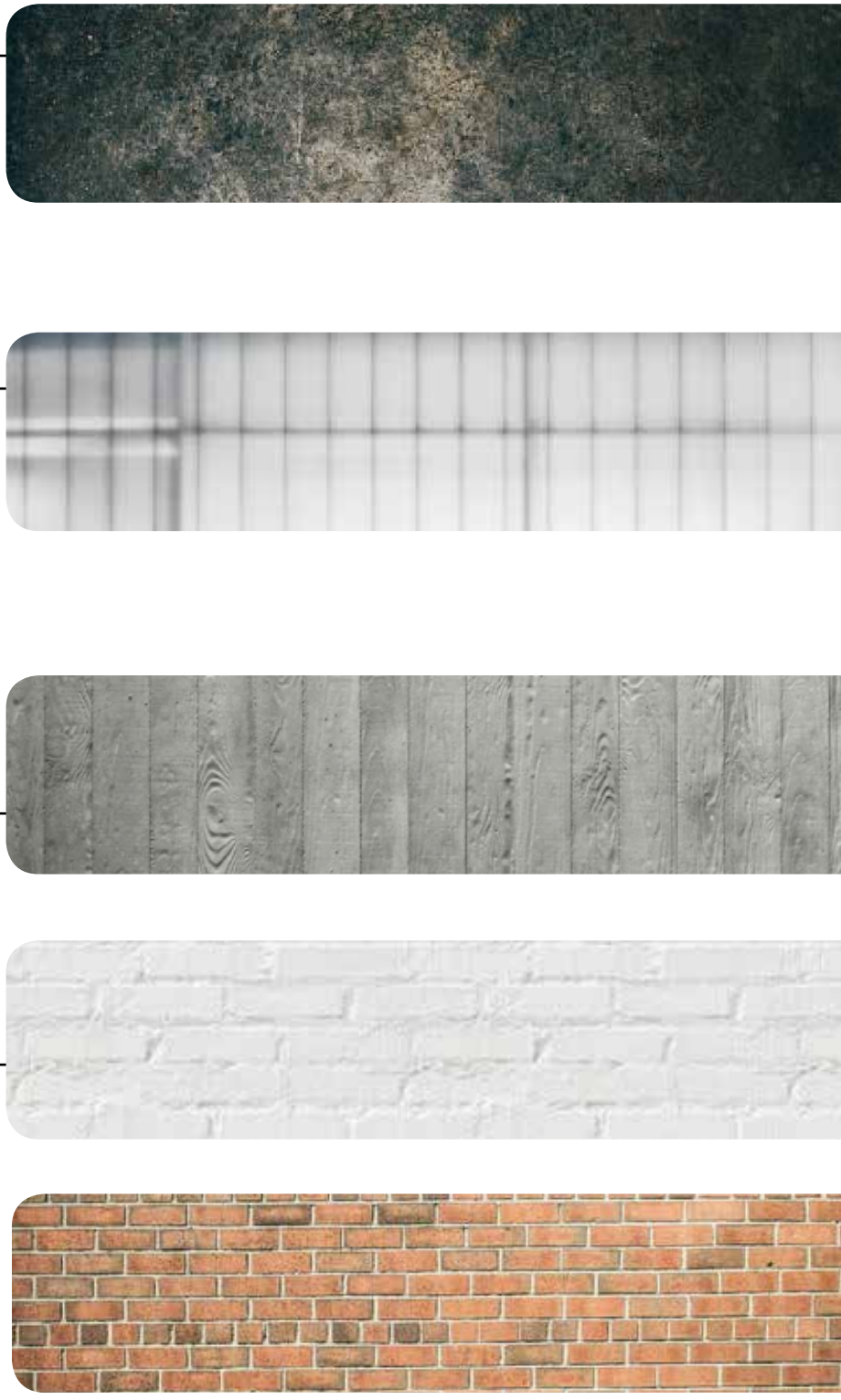
BRICK

Bricks will be implemented for wall structures throughout the building and will be given a **vernacular off-white bagged finish** in order to create a *complementary contrast* with the stonewalls. In some internal spaces the warm natural colour and properties of the brick will be exposed.

FIGURE 7.4

Synthetic/man-made material palette

(Author, 2016)



7.3.3 HYBRID MATERIALS AND RECIPROCAL POSSIBILITIES

PERMEABLE PAVEMENT

Permeable concrete paving will be implemented for **external surfaces**, including parking, roads and pedestrian routes in order to provide a hard surface to support vehicular and pedestrian traffic while simultaneously allowing for vegetation and grasses to grow in between the pavers. It will facilitate the process of **filtering storm water runoff** by trapping suspended solids as well as minimizing the effects of erosion.

BIO-CONCRETE

Bio-concrete supports the natural and enhanced growth of pigmented organisms such as fungi, microalgae and mosses, allowing the development of a beautiful, **living patina**. The material absorbs and reduces atmospheric CO2 regulates internal thermal conductivity, and has notable aesthetic and environmental properties (Brownell, 2013).

Bio-concrete is composed of a structural concrete layer that is made of conventional carbonated concrete together with magnesium phosphate cement and then waterproofed to protect this layer from possible water damage. To the contrary, the **biological layer** has the capacity to capture and retain rainwater by having an intermittent coating layer with a reverse waterproofing purpose that allows water and moisture to gather on it and e**nable biological growth of organisms** (Brownell, 2013).

It is important to note that bio-concrete will only be applied programmatically, where healing of urban diseases has already occurred, and nowhere near the clinic, as biological organisms such as moss and fungi can aggravate allergies for people struggling with environmental allergies and asthma.

FIGURE 7.5
Hybrid material palette
(Author, 2016)

7.4 THE STRUCTURE

7.4.1 THE PRIMARY STRUCTURE

The technical concept and its influences on the material selection reveal the inherent possibilities for how the structure will be constructed. The **primary structure** of the building will consist of the combination of soil, stone, steel, brick and concrete for foundations, floors and roof slabs. The **secondary structure** will consist of the use of steel supporting structures, permeable concrete and brick paving. The **tertiary structure** will become the skin of the building and includes polycarbonate sheeting and vertically growing creepers and vegetation supported by the application of steel mesh and cables. Finally, timber cladding will be applied in some internal spaces for acoustical and aesthetic purposes.

THE SUBSTRUCTURE

The **substructure** walls below natural ground level will be made of **reinforced concrete** and **brickwork** that is waterproofed in combination with a **geotextile Kay-tech Flo-drain pipe** with a 160mm diameter. The geopipes sloping to a minimum of 2 degrees will be connected to underground sumps that feed water into water treatment and storage tanks and chambers.

The specified **stone is 'autumn quartzite'** and is supplied by Bedrock Stone South Africa. The thickness of the stone walls will range between 450mm and 1000mm, and will be loose-packed infill walls further supported by steel columns with lateral bracing within the walls. **Concrete rubble** will also be used as infill to create thicker walls.

The **steel columns** and horizontal beams that support the superstructure as well as the vertical creepers will be 203 x 203 x 52 kg/m hot-rolled H-columns and will be spaced along a 5-10m grid that has been informed by the existing column grid spacing of the Gautrain platform. In order to have a rusted appearance, all steel columns/ beams and supports will be **acid-washed** and then

finished with a **Glisten PC Paint-Over-Rust**, a high performance clear coat sealant, and finally with a clear intumescent paint for fireproofing.

Masonry walls will be applied in various thicknesses ranging between 115mm, 230mm and 425mm, depending on thermal properties and bearing loads. These external and internal walls, as indicated on sections and elevations will be **cement bagged** directly onto/over flush jointed selected stock bricks with a mixture to consist of 1 volume cement to 1 volume washed plaster sand, finished to a reasonably even surface and painted as per paint specification.

All **reinforced concrete floors** will be cast in situ at a thickness of 255mm with an iron-oxide additive and to be diamond-polished in order to provide a durable surface. A strip of brick pavement will be applied at all expansion joints to reduce the risk of cracking and to create aesthetic floor patterns.

The **reinforced concrete roof slabs** will be cast in situ in a custom-made timber shuttering that creates a tapered off-shutter form and finish. The concrete roofs will vary in thickness between 170mm and 425mm (including beams), depending on the internal spans and **green roof** application. Some roofs will also be given a **layer of gravel**, as it presents a fifth elevation viewable from the raised Gautrain platform. Roofs will be supported by **reinforced concrete beams** in accordance with the span and loads respectively.

7.4.2 THE SECONDARY STRUCTURE

125 x 65 x 20 x 3mm cold-rolled lipped channels will be implemented as **secondary supporting purlins** for light-weight fixtures such as th**e polycarbonate sheeting and steel mesh.** 50 x 50mm steel angle slats will be applied as **steel louvered screens**. All **steel supports** will also be **acid-washed** and treated accordingly.

7.4.3 THE TERTIARY STRUCTURE

10 mm thick "Lexan Thermoclear" twin wall **Polycarbonate sheeting** will be applied at a slope of 2 degrees and be fixed to the 125 x 65 x 20 x 3mm cold-rolled lipped channel purlins by means of **"Posi-drive" self tapping screws and sealing washers** as per maunfacturer's specification.

Besides the applications of vertical farming and permaculture, which will be discussed later in the chapter, **planted creepers and climbers,** which are proficient in growing over the provided **steel structures** and **mesh screens**, will exist in a constantly changing state of growth. These plants are diverse in their requirements, colours and effects, and will illustrate different seasonal changes (Mucina & Rutherford 2010: 464). The following creepers will be employed:

FIGURE 7.6
Planting palette (Author, 2016)

JASMINUM POLYANTHUM (Pink Jasmine)

Minimal water requirements
Attracts multiple insects
Semi-deciduous
Requires semi-shade to full sun.

THUNBERGIA ALATA (Yellow Black-Eyed Susan)

Self-seeding creeper
Evergreen
Requires semi-sun

SENECIO TAMOIDES (Canary Creeper)

Semi- deciduous
Requires shade

CLEMATIS BRACHIATA (Traveller's Joy)

Evergreen
Requires full sun

COMBRETUM BRACTEOSUM (Hiccup Nut)

Produces fruit that attracts birds
Evergreen
Requires full sun

TRACHELOSPERMUM JASMINOIDES
(Star Jasmine)

Ever-green climber
Minimal water requirements
Requires shade

7.5 SYSTEMIC IMPLEMENTATIONS OF PERMACULTURE

The implementation of **services and systems** will be directed to serve the **users of the building** and the **natural habitat** in which the building is embedded on equal terms. The implementation of the permaculture activities will serve as an educational and curative device for the health and well-being of its human occupants, while simultaneously remediating the condition of the soil on the site. For **water** and **waste treatment** the design will seek to create **closed feedback loops** within the multiple operations that the building requires. These will be discussed accordingly.

7.5.1 WATER HARVESTING AND TREATMENT

Due to the requirements of permaculture and food production practices, water is an essential element in the functioning of the building. The water harvested and used on site will constantly circulate in a **semi-closed systemic loop** that is linked to the Apies River running adjacent to the site. Wastewater will be treated according to the description that follows, after which it will be channeled for use inside and outside the building.

FIGURE 7.7

Water yield, demand and budget calculations (Author, 2016)

A WATER RESOURCE INFORMATION (YIELD, m^3)

A1 RAIN WATER HARVESTING DATA

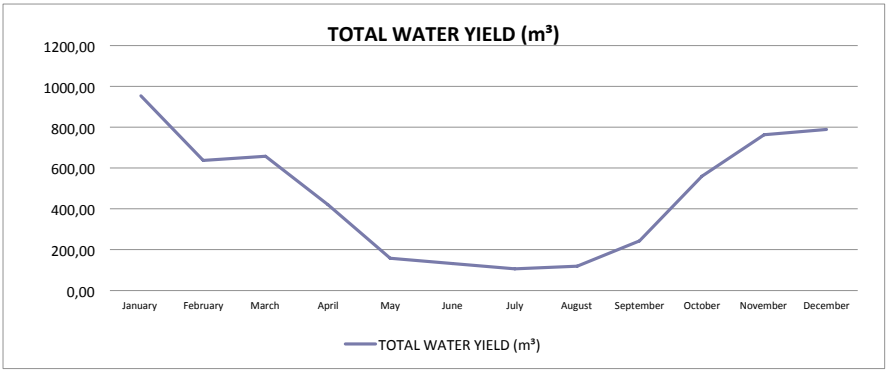
DESCRIPTION	AREA (m^2)	RUNOFF COEFF. (C)
Roof catchment	4637	0,9
Concrete Pavement runoff	11955	0,2
		0
Other		0
TOTAL AREA (A)	16592,00	
WEIGHTED C		0,40

A2 RECYCLED / ALTERNATIVE WATER SOURCE

MONTH	Apies River Connection	ave of 285 litres aquired a day			TOTAL / MONTH (m^3)
	WEEKLY YIELD (m^3)	MONTHLY YIELD (m^3)	WEEKLY YIELD (m^3)	MONTHLY YIELD (m^3)	
January	20	80,00	0	0,00	80,00
February	20	80,00	0	0,00	80,00
March	20	80,00	0	0,00	80,00
April	20	80,00	0	0,00	80,00
May	20	80,00	0	0,00	80,00
June	20	80,00	0	0,00	80,00
July	20	80,00	0	0,00	80,00
August	20	80,00	0	0,00	80,00
September	20	80,00	0	0,00	80,00
October	20	80,00	0	0,00	80,00
November	20	80,00	0	0,00	80,00
December	20	80,00	0	0,00	80,00
ANNUAL AVE.		960,00		0,00	960,00

A3 TOTAL WATER YIELD

MONTH	AVE RAINFALL , P (m)	CATCHMENT YIELD (m^3) (Yield = PxAxC)	ALTERNATIVE WATER SOURCE (m^3)	TOTAL WATER YIELD (m^3)
January	0,13	873,05	80,00	953,05
February	0,09	557,97	80,00	637,97
March	0,09	577,66	80,00	657,66
April	0,05	341,34	80,00	421,34
May	0,01	78,77	80,00	158,77
June	0,01	52,51	80,00	132,51
July	0,00	26,26	80,00	106,26
August	0,01	39,39	80,00	119,39
September	0,03	164,11	80,00	244,11
October	0,07	479,19	80,00	559,19
November	0,10	682,69	80,00	762,69
December	0,11	708,94	80,00	788,94
ANNUAL AVE.	0,70	4581,88	960,00	5541,88



B WATER DEMAND

B1 LANDSCAPE IRRIGATION DEMAND (m^3)

DESCRIPTION:	LAWN (m^2):	2231	AGRI (m^2):	1461	PLANTING (m^2):	431	
MONTH	WEEKLY IRR. (m)	MONTHLY DEMAND (m^3)	WEEKLY IRR. (m)	MONTHLY DEMAND (m^3)	WEEKLY IRR. (m)	MONTHLY DEMAND (m^3)	TOTAL MONTHLY IRR. DEMAND (m^3)
January	0,02	178,48	0,025	146,1	0,005	8,62	333,2
February	0,02	178,48	0,025	146,1	0,005	8,62	333,2
March	0,02	178,48	0,025	146,1	0,002	3,448	328,028
April	0,02	178,48	0,025	146,1	0,002	3,448	328,028
May	0,01	89,24	0,025	146,1	0,002	3,448	238,788
June	0,01	89,24	0,025	146,1	0	0	235,34
July	0,01	89,24	0,025	146,1	0	0	235,34
August	0,02	178,48	0,025	146,1	0	0	324,58
September	0,02	178,48	0,025	146,1	0,005	8,62	333,2
October	0,02	178,48	0,025	146,1	0,005	8,62	333,2
November	0,02	178,48	0,025	146,1	0,005	8,62	333,2
December	0,02	178,48	0,025	146,1	0,005	8,62	333,2
ANNUAL TOTAL		1874,04		1753,2		62,064	3689,304

B2 DOMESTIC DEMAND

MONTH	PERSONS	WATER/ CAPITA/ DAY (l)	DOMESTIC DEMAND (m^3/month)
January	80	4	9,92
February	80	4	8,96
March	80	4	9,92
April	80	4	9,6
May	80	4	9,92
June	80	4	9,6
July	80	4	9,92
August	80	4	9,92
September	80	4	9,6
October	80	4	9,92
November	80	4	9,6
December	80	4	9,92
ANNUAL TOTAL			116,8

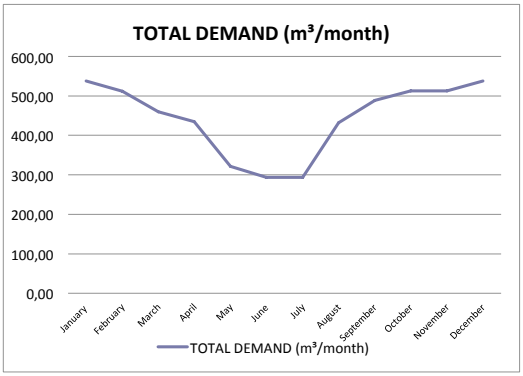
TOTAL WATER LOSS & DEMAND

MONTH	TOTAL DEMAND (m^3/month)
January	537,36
February	512,12
March	459,35
April	434,75
May	321,55
June	293,50
July	293,82
August	431,62
September	488,48
October	513,08
November	512,76
December	537,36
ANNUAL TOTAL	5335,744

B3 EVAPORATION LOSS (For 'open' reservoirs)

AREA OF RESERVOIR (m^2): 1214

MONTH	EVAPORATION RATE (m/week)	EVAPORATION RATE (m/month)	TOTAL LOSS (m^3/month)
January	0,04	0,16	194,24
February	0,035	0,14	169,96
March	0,025	0,1	121,4
April	0,02	0,08	97,12
May	0,015	0,06	72,84
June	0,01	0,04	48,56
July	0,01	0,04	48,56
August	0,02	0,08	97,12
September	0,03	0,12	145,68
October	0,035	0,14	169,96
November	0,035	0,14	169,96
December	0,04	0,16	194,24
ANNUAL TOTAL	0,32	1,26	1529,64



C WATER BUDGET

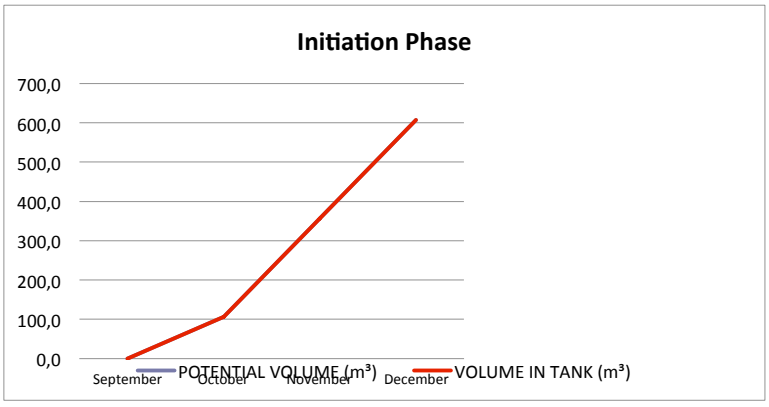
TANK CAPACITY (m^3):	953
MIN VOLUME (m^3):	106

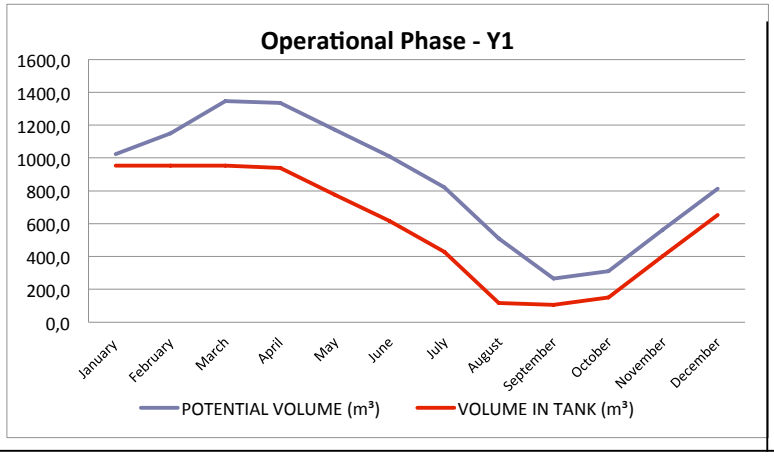
C1 WATER BUDGET INNITIATION PHASE

MONTH	YIELD (m^3/month)	DEMAND (m^3/month)	MONTHLY BALANCE	POTENTIAL VOLUME (m^3)	VOLUME IN TANK (m^3)
September	244,1	488,5	-244,4	0,0	0,0
October	559,2	513,1	46,1	106,0	106,0
November	762,7	512,8	249,9	355,9	355,9
December	788,9	537,4	251,6	607,5	607,5
	2354,9	2051,7	303,3		

C2 WATER BUDGET YEAR 1

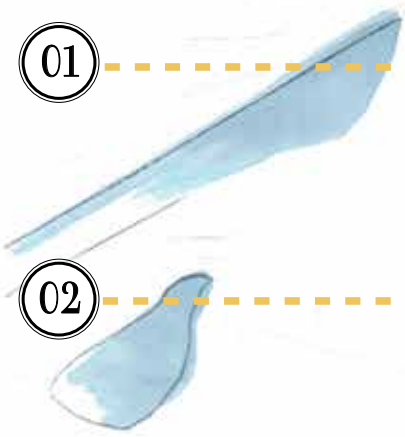
MONTH	YIELD (m^3/month)	DEMAND (m^3/month)	MONTHLY BALANCE	POTENTIAL VOLUME (m^3)	VOLUME IN TANK (m^3)
January	953,1	537,4	415,7	1023,2	953,0
February	638,0	512,1	125,8	1149,0	953,0
March	657,7	459,3	198,3	1347,4	953,0
April	421,3	434,7	-13,4	1334,0	939,6
May	158,8	321,5	-162,8	1171,2	776,8
June	132,5	293,5	-161,0	1010,2	615,8
July	106,3	293,8	-187,6	822,6	428,3
August	119,4	431,6	-312,2	510,4	116,0
September	244,1	488,5	-244,4	266,0	106,0
October	559,2	513,1	46,1	312,1	152,1
November	762,7	512,8	249,9	562,1	402,0
December	788,9	537,4	251,6	813,6	653,6
ANNUAL AVE.	5541,9	5335,7	206,1		





THE ROUTE OF SANITARY AND STORM WATER

01 Water is harvested from roofs as well as external hard surfaces, filtered through a grid to remove floating debris, and then directed towards temporary galvanized steel water tanks, for purposes of further treatment.



02 Wastewater and grey water accumulated from the three kitchens and washing basins are directly taken through a fat trap and then directed towards the temporary galvanized steel water tanks, for purposes of further treatment.

03 Black water is directed towards the municipal sewerage connection and not dealt with in this scheme.

04 The water that has been stored in temporary water tanks is then directed towards multiple treatment chambers beneath the central water tower and taken through an oil trap and sedimentation filter.

05 Water required for irrigation is stored in the retention pond and wetland-based biological system and will retain dissolved minerals that are beneficial for plants.

06 Water used for domestic purposes is treated further in a different treatment chamber to remove harmful pathogens.

07 Water is then pumped up during the night into a storage tank 20m above ground within the water tower, in order to achieve a sufficient water pressure of 2bar.

08 An additional average of 285 litres of water will be acquired a month to support urban agricultural requirements with the site and urban precinct. It will be argued that the rights to a percentage of water will be acquired from the Apies River through a sump and channeling system that will feed water into the retention wetland.

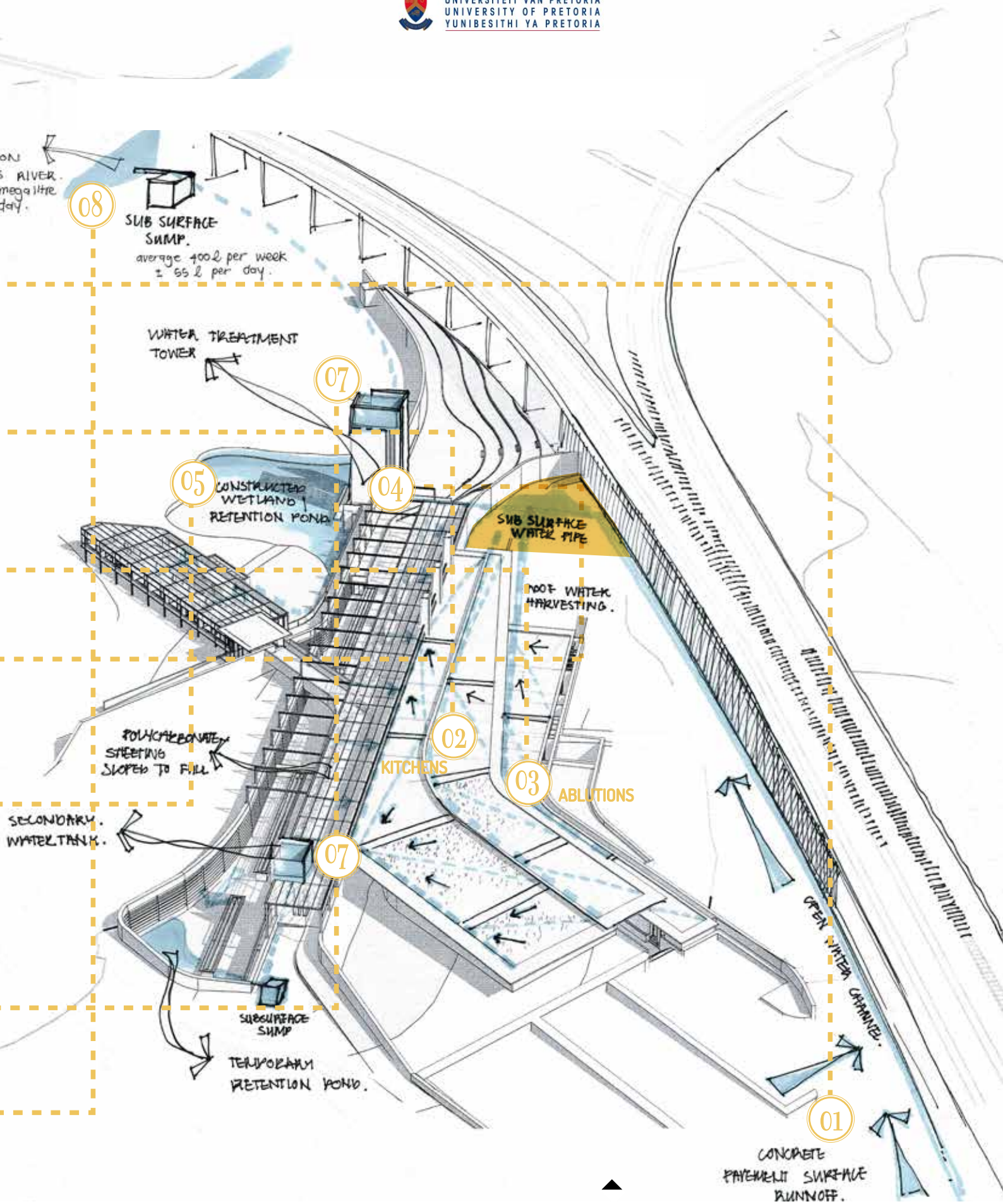


FIGURE 7.8

Diagram illustrating water harvesting, treatment and storage routes (Author, 2016)

7.5.1 WATER HARVESTING AND TREATMENT

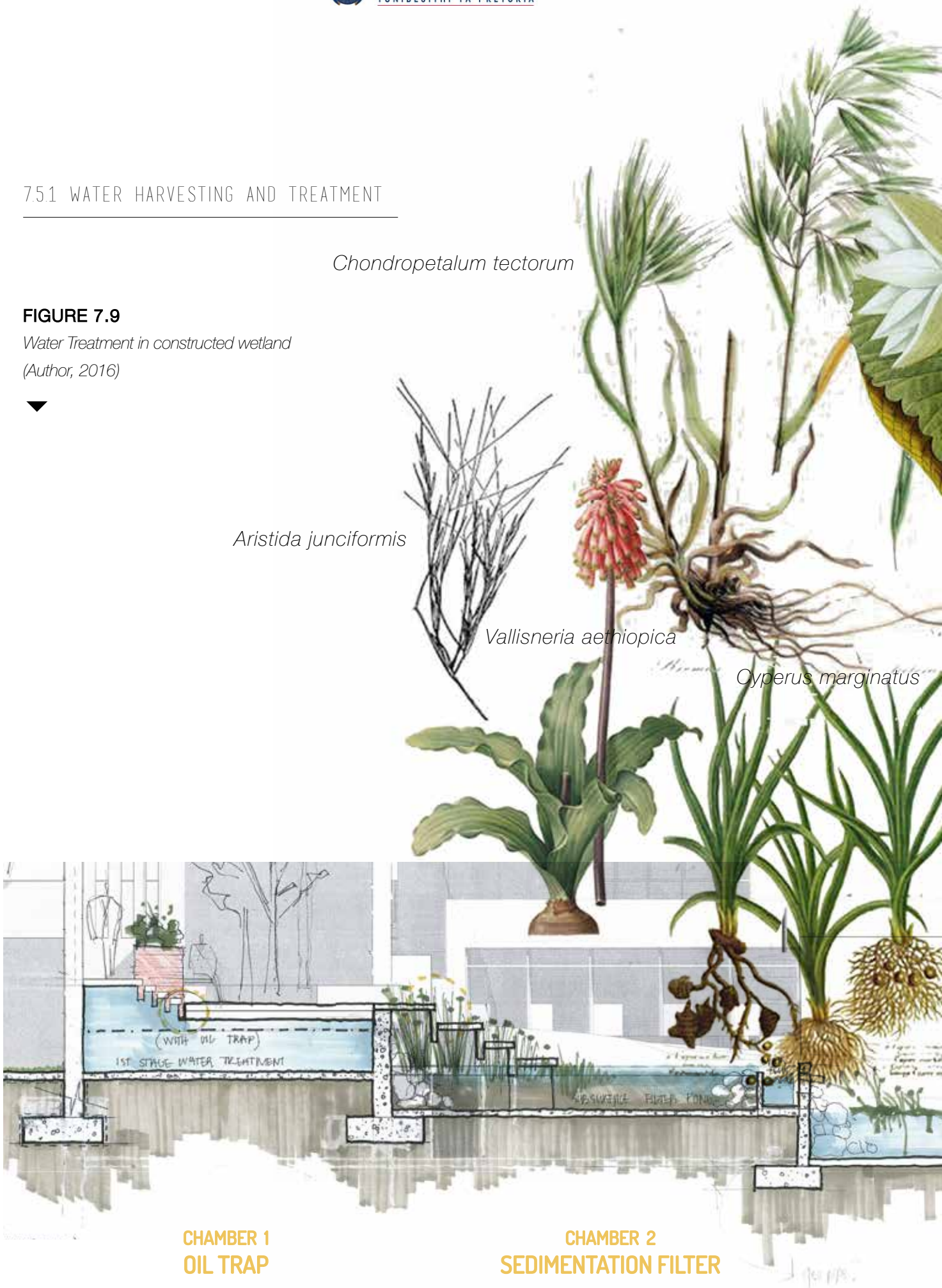


FIGURE 7.9

Water Treatment in constructed wetland

(Author, 2016)

RETENTION POND

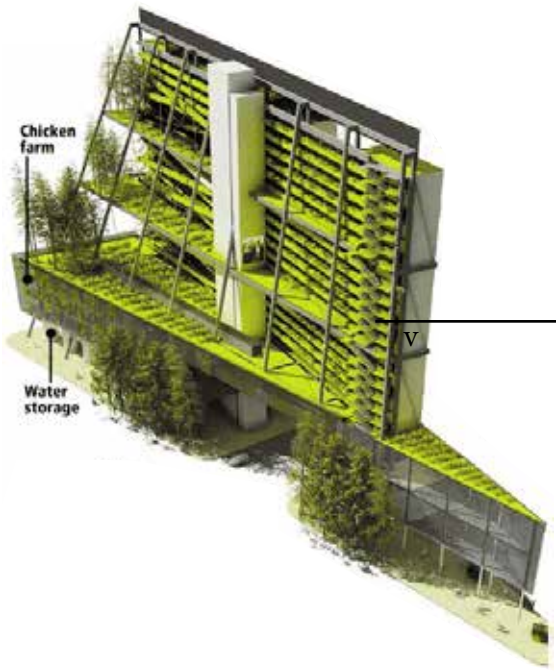
7.5.2 COMPOSTING AND WASTE FEEDBACK LOOPS

Organic waste accumulated on site through permaculture activities and that is of a low embodied energy will be stored in **composting pits** located at the back of house of the building, where it will be treated to produce decomposed organic matter, and be used as **plant fertilizer.**

Organic waste that has higher embodied energies, commonly present in kitchen waste, will feed directly into a **bio-digester**, and will be discussed as part of the technological implementations.

7.5.3 PERMACULTURE PRACTICES AND TECHNOLOGIES

Permaculture entails an ecological design approach that aligns natural systems with human needs and processes (Holmgren, 2002: 8). It is thus not limited to a specific method of natural production, but is rather a **site-specific and locally adaptive approach**. The technical application of permaculture within and around the building will predominantly be **small-scale vertical farming** that ensures controlled planting conditions and production that secures proper water management and input control demands. The approaches and technologies related to vertical farming will be discussed within appropriate diagrams.



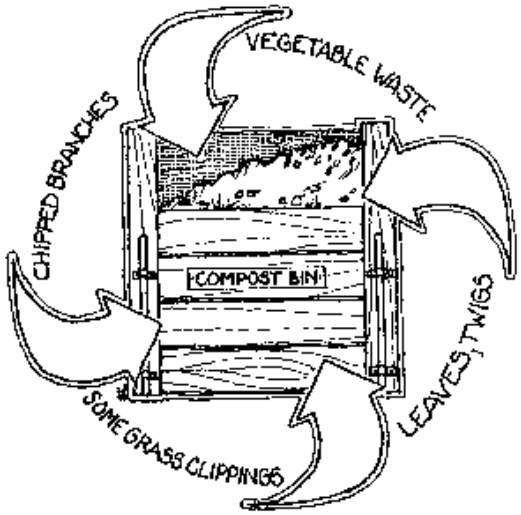
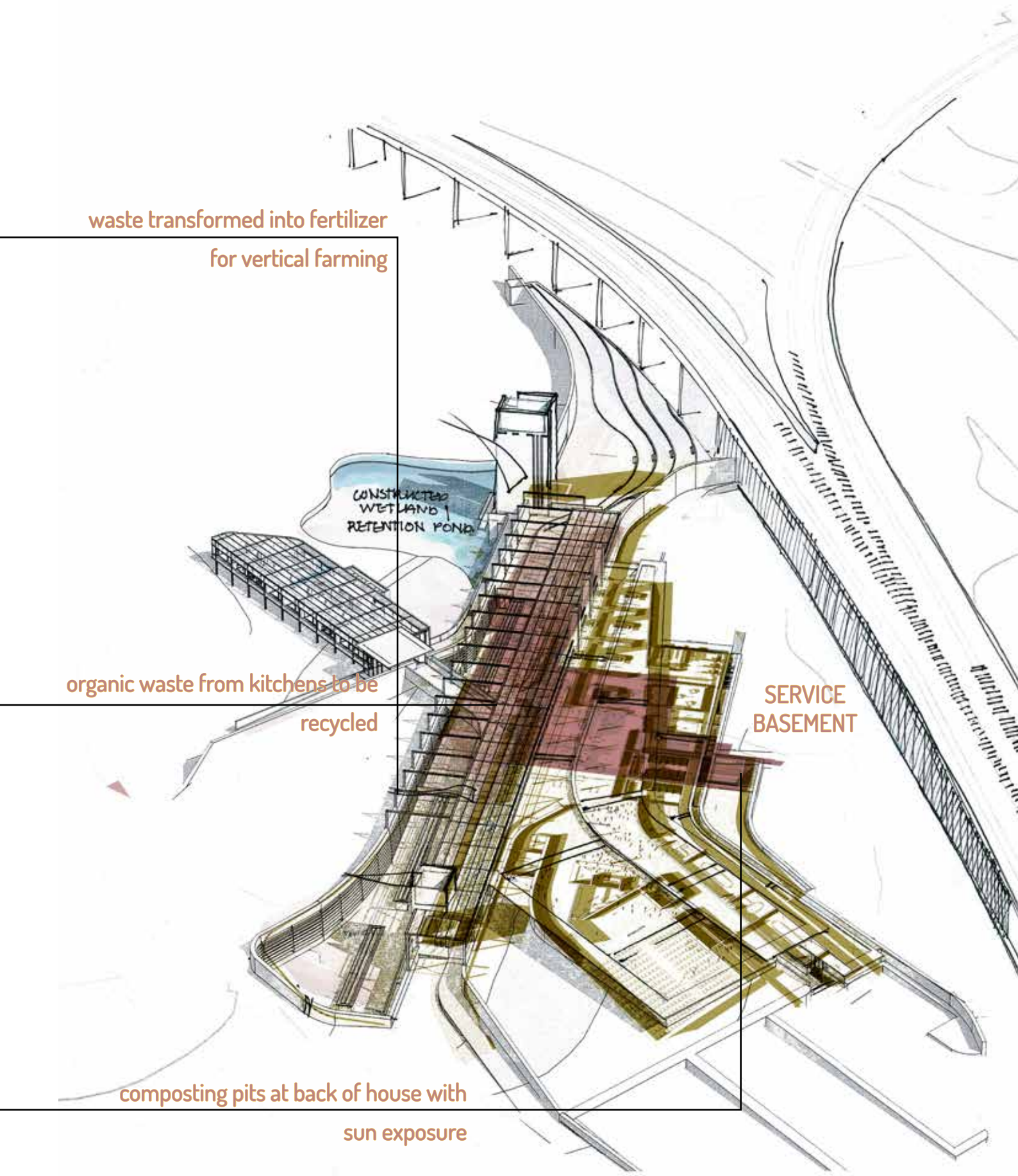


FIGURE 7.10
Waste management strategies (Author, 2016)



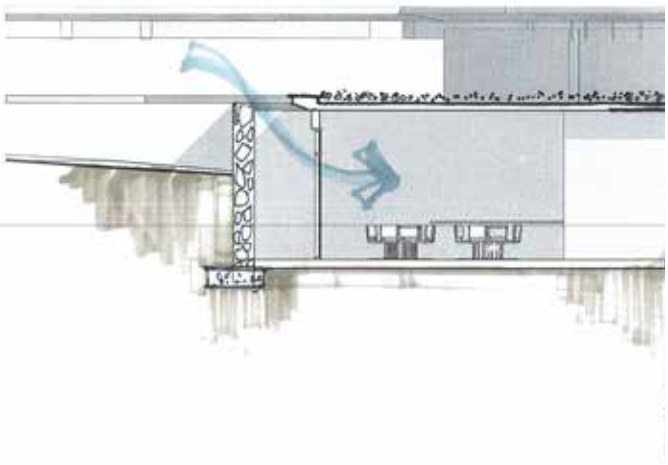
7.6 ENVIRONMENTAL SYSTEMS & SUSTAINABILITY

7.6.1 PASSIVE CLIMATE CONTROL

Stone and thick-skin bagged brick walls that have a **high thermal mass** are used predominantly for northern and western facades to reduce internal heat gain and control internal comfort. The planted facades and vertical farming together with misting and drip irrigation are placed adjacent to the main movement route and also assist to create a cooler, more comfortable temperature due to **evaporative cooling**. This is also achieved by the wetland located on the north-eastern side of the building.

Northern facades are accompanied by **overhead louvers** to reduce unwanted heat gain in the summer, but allow for deep penetration of light and heat in the winter.

The main building axes are perpendicular to the **north-eastern direction** of the **prevailing wind** and can thus make use of the opportunity for **cross ventilation**, as internal spaces are also narrow in nature.

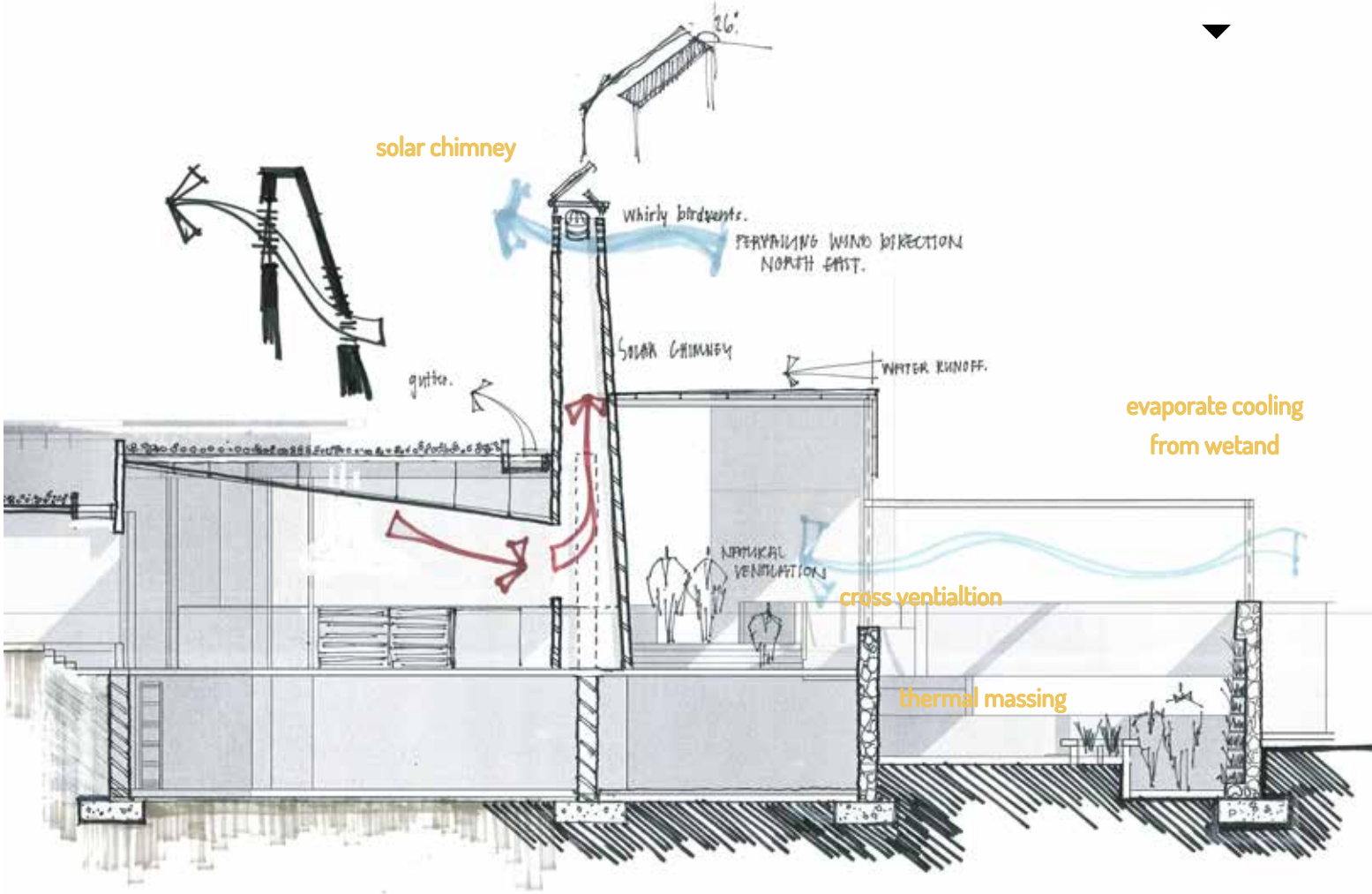


In the kitchens, where cooking and frying activities cause warm air to be trapped, it becomes crucial to provide a **central stack system**. Three central solar chimneys will be integrated to increase ventilation and thermal comfort in the kitchen spaces where latent heat is generated. The kitchens will be provided with a **sloped, suspended ceiling** to direct heated air to the chimney. As the heated air rises, fresh air is drawn into the building with the assistance of **whirlybirds and louvered side-panels**. A **trombe-assisted stack** will also be installed at a 26-degree angle to facilitate the process more effectively.

FIGURE 7.11

Ventilation & cooling strategies

(Author, 2016)



7.6.2 DAYLIGHTING

As mentioned, the building is predominantly angled in two directions namely north and north-east. All northern facades have deep edges and **light shelves.** Southern light will be maximised by taking advantage of the terraced nature of the roof, creating the opportunity for **clerestories** to facilitate natural light entering internal spaces. All the main public spaces such as the hot-desk meeting rooms, ablutions and library are provided with a **narrow open courtyard** to allow for the filtering of light as well as a brief visual connection with nature.

The material properties of polycarbonate sheeting are fully utilized as it **reduces glare** on the north-eastern side of the building by **diffusing the quality of light**. The open steel pergola structure above the production core that will support creeper plants will also create a dynamic casting of light and shadow, mimicking how light would filter through tree branches and leaves.

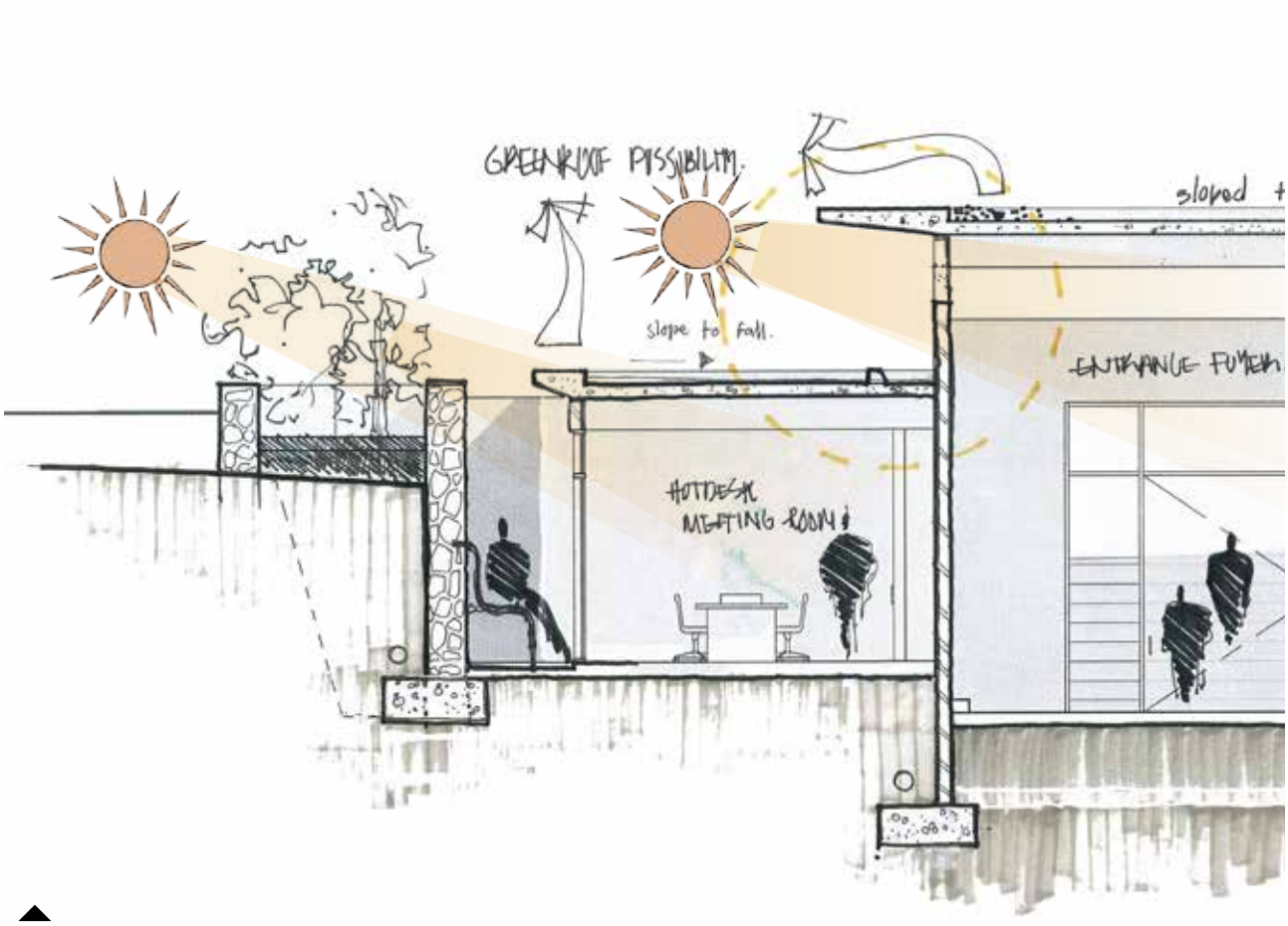
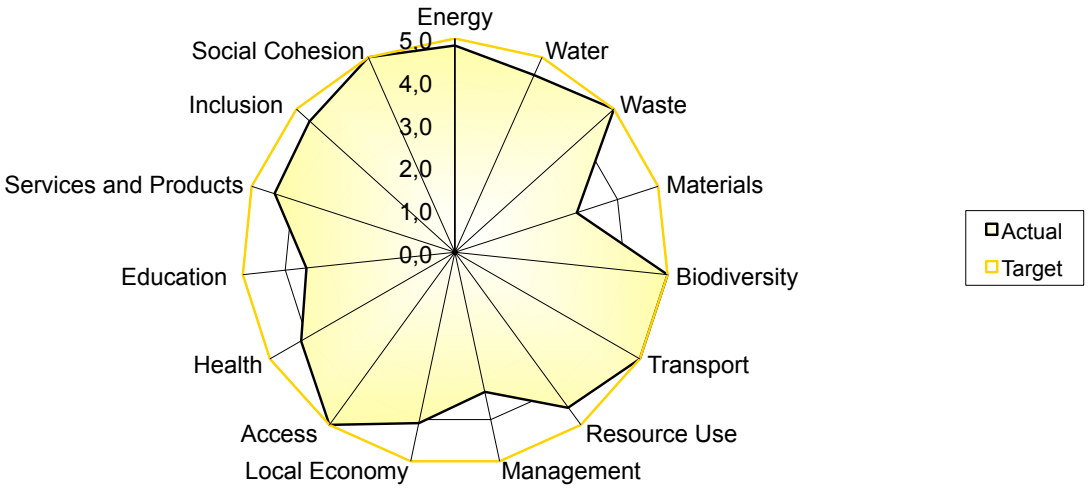


FIGURE 7.12
Diagrams of daylighting strategies (Author, 2016)

SB SBAT REPORT

SB1	Project
	Restoring Reciprocity_A wellness Centre for Urban Diseases
SB2	**Address**
	South Berea 609, Corner of Nelson Mandela Boulevard (R21) and Thabo Sehume Street Fountains,
SB3	**SBAT Graph**



SB4 Environmental, Social and Economic Performance	Score
Environmental	4,5
Economic	4,4
Social	4,3
SBAT Rating	4,4

SB5 EF and HDI Factors	Score
EF Factor	4,5
HDI Factor	4,1

SB6 Targets	Percentage
Environmental	90
Economic	88
Social	87

7.6.3 SBAT RATING

FIGURE 7.13

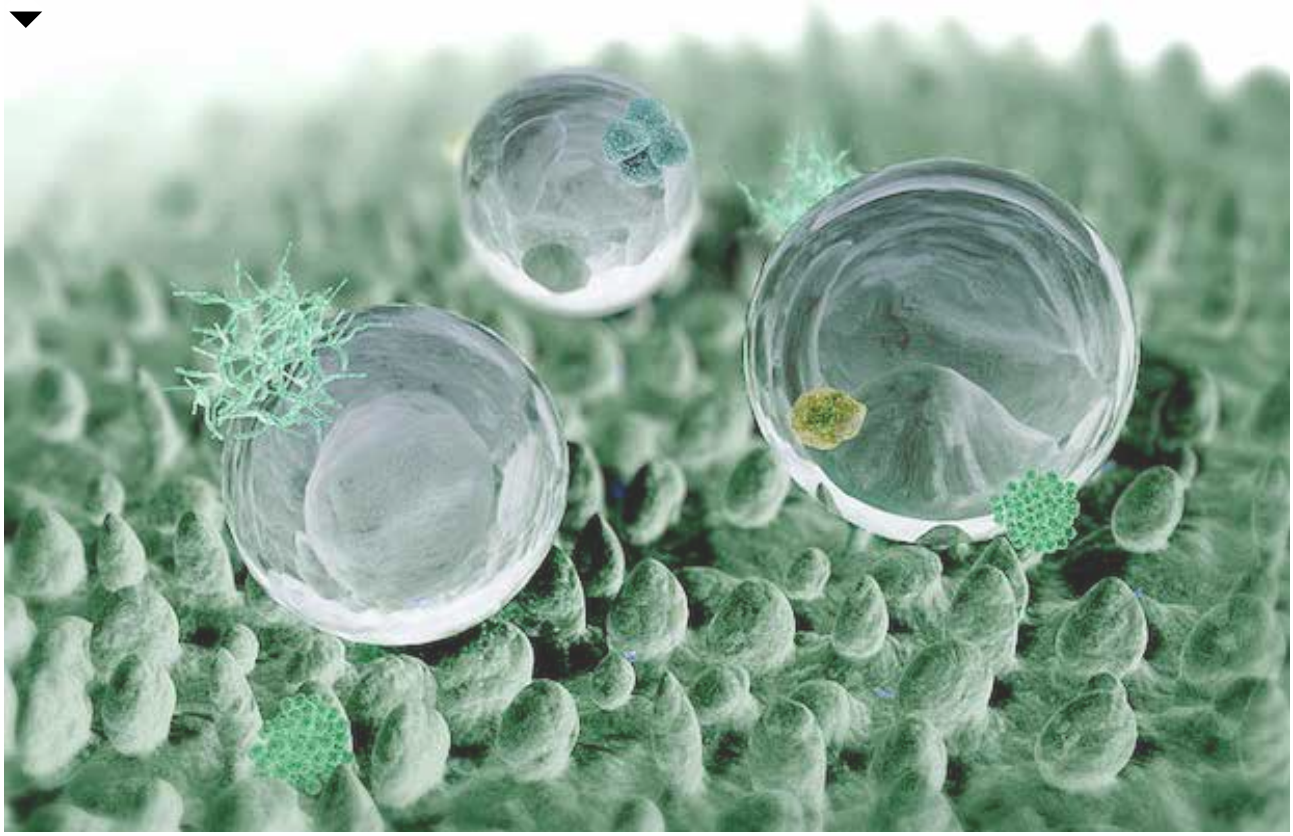
SBAT rating diagram (Author, 2016)

7.7 TECHNOLOGIES

7.7.1 THE IMPLEMENTATION OF BIOMIMICRY TECHNOLOGY

The lotus plant has **self-cleansing capabilities** due to microscopic bumps and hairs on its waxy leaves. It is an excellent example of what biomimicry entails. This phenomenon is known as the 'lotus effect' and has inspired an entire industry of self-cleansing paints, textiles and domestic surfaces (Benyus, 2002: 35). *Lotusan* is an **exterior paint** that was developed by a German company, ISPO. By mimicking the microstructure found on the leaves of a lotus plant, the paint is able to minimize the contact area for water and dirt. This technology is an ideal application for the exterior bagged brick walls to ensure that the white walls are self-cleansing, to not only **reduce building maintenance**, but to also provide an **inherent connection to nature** on the smallest possible scale.

FIGURE 7.14
The lotus effect applied to building paint
(Author, 2016)



7.7.2 BIOGAS DIGESTING OF METHANE GAS

Organic waste that is generated by the operations in the **kitchens and restaurant** will be directed to a **central biodigester**, located in the **service basement** of the building. The biodigester uses anaerobic bacterial processes to convert organic waste products into **methane gas** as well as a by-product of **nutrient sludge.** The sludge can be directed to and treated in the proposed composting pits and be used as fertilizer. The methane gas that is produced will be redirected through a flame trap that is connected to the burner ovens in the kitchens.

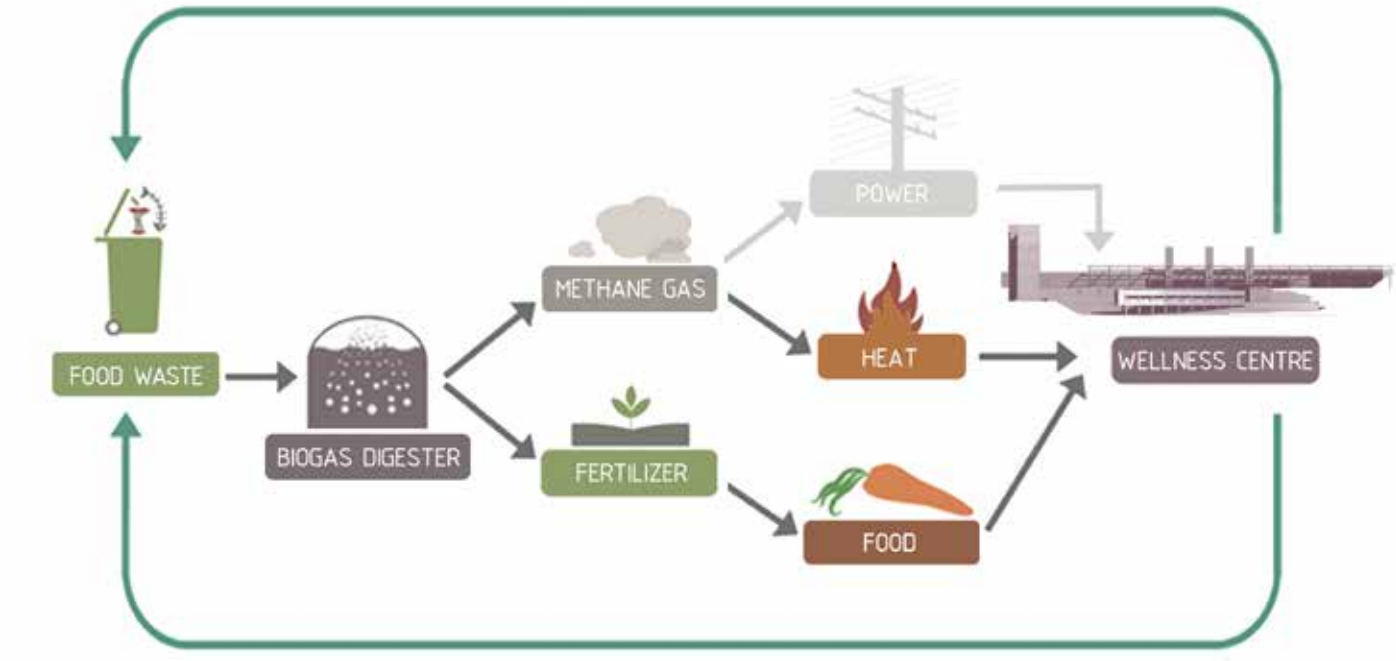


FIGURE 7.15

Diagram illustrating process of biodigester producing methane gas (Author, 2016)

7.9 SUMMARY

The fundamental aspects that this chapter outlines are mainly directed towards **environmental and systemic applications** to support all permaculture, treatment and public activities in and around the building. Biophilic design that enables people to affiliate with nature through architecture was predominantly achieved through **material selection and application**. **Detail resolution** was thus dependent on the properties that the different materials presented, and in some cases the solutions were simplistic whereas in other cases, such as the joining of these different materials, were more innovative.

It can thus be concluded that the technical outcome was predominantly directed to achieve a **sustainable environment** that operates on different **feedback loops** and scales to support **ecological regeneration** and **user awareness** in order to support the **reconciliation and realignment** of human and natural activities.

chapter eight

APPENDICES

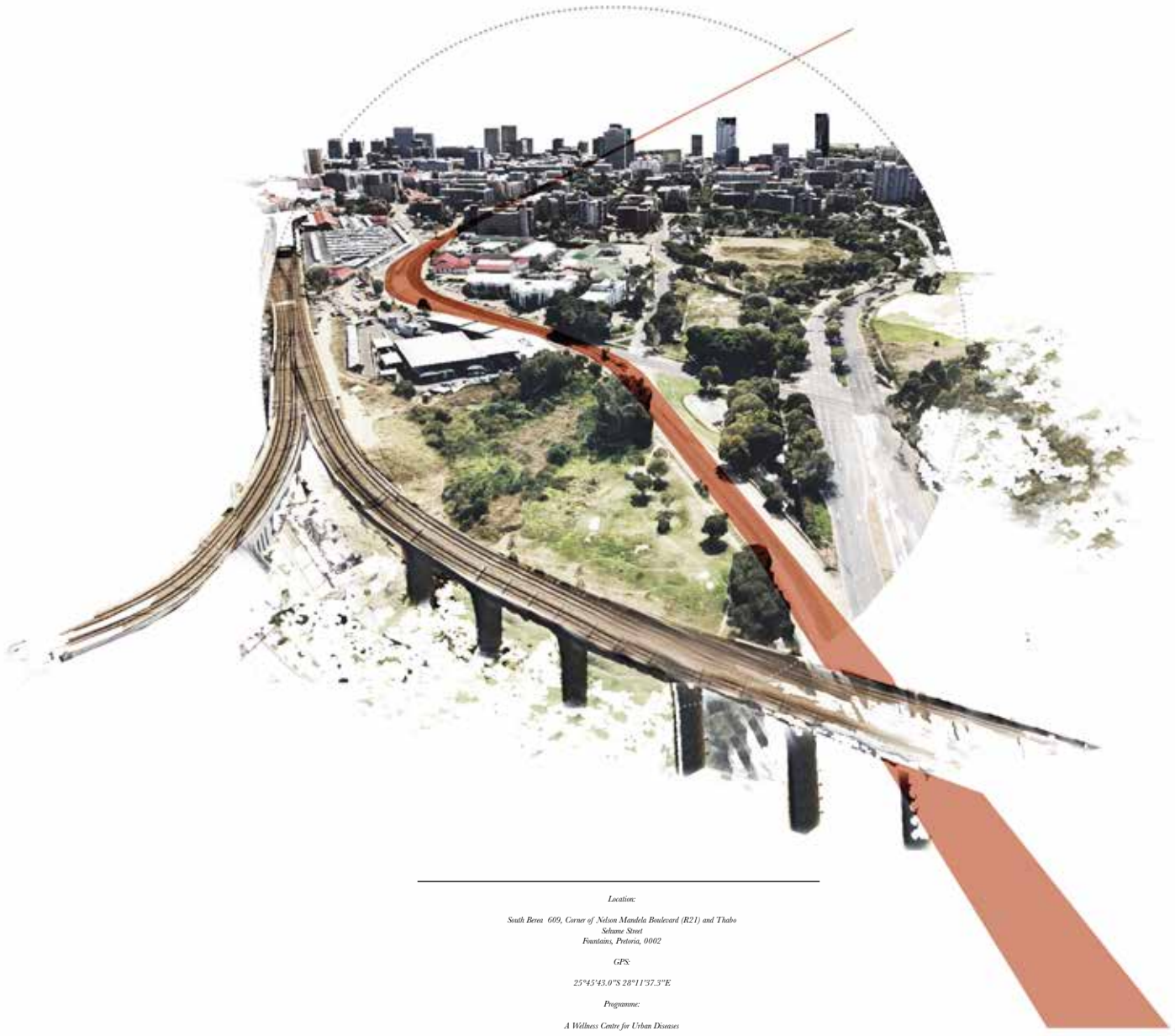
FINAL PRESENTATION

Introduction & Analysis

M.Prof.Arch.

RESTORING RECIPROCITY

Between Man and Nature through Architecture
as the Mediating Device



Location:

South Berea 609, Corner of Nelson Mandela Boulevard (R21) and Thabo Sehume Street
Fountains, Pretoria, 0002

GPS:

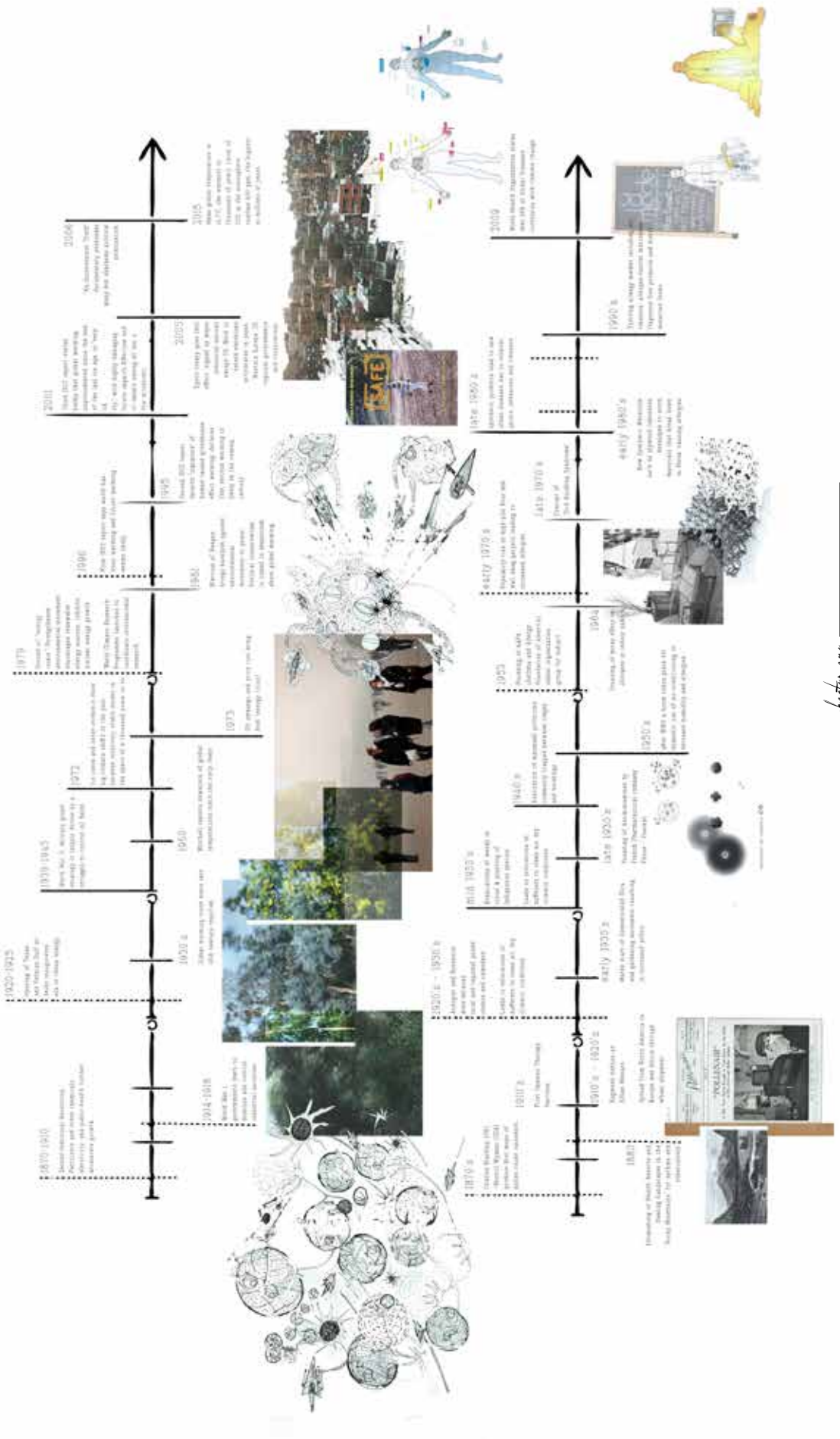
25°45'43.0"S 28°11'37.3"E

Programme:

A Wellness Centre for Urban Diseases

by

Gardiol Crous



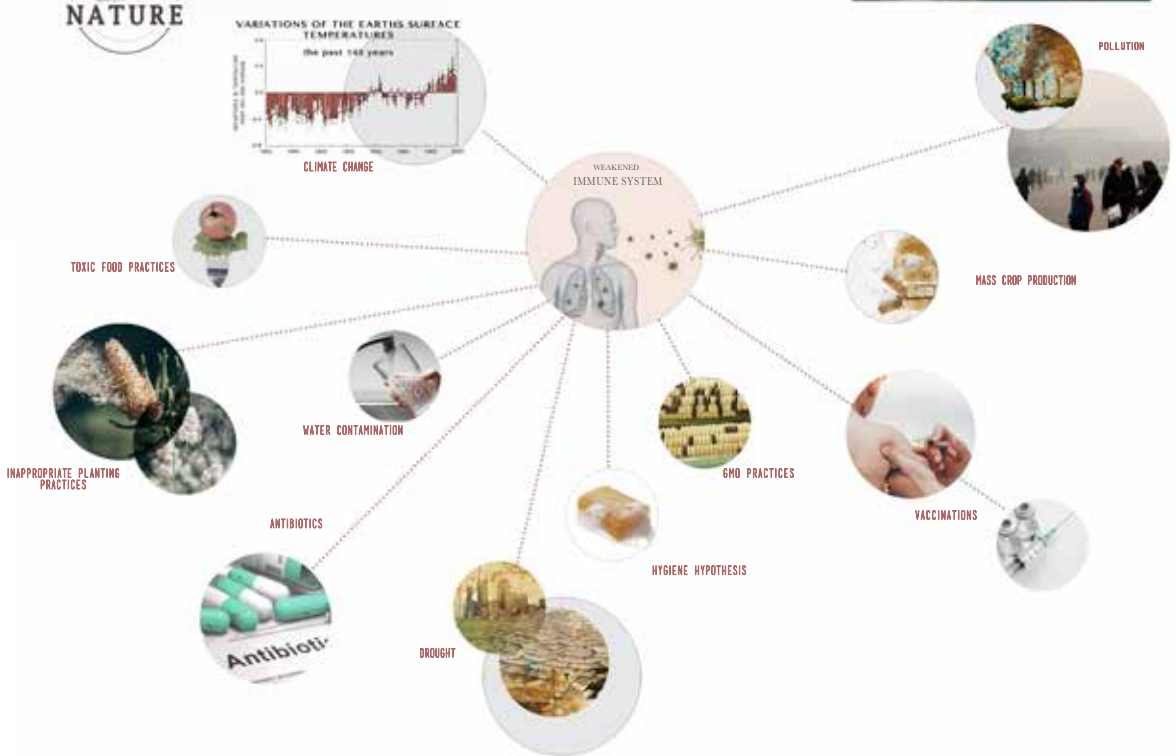
COMPROMISED HEALTH

later ...

OF MAN AND NATURE

chapter one

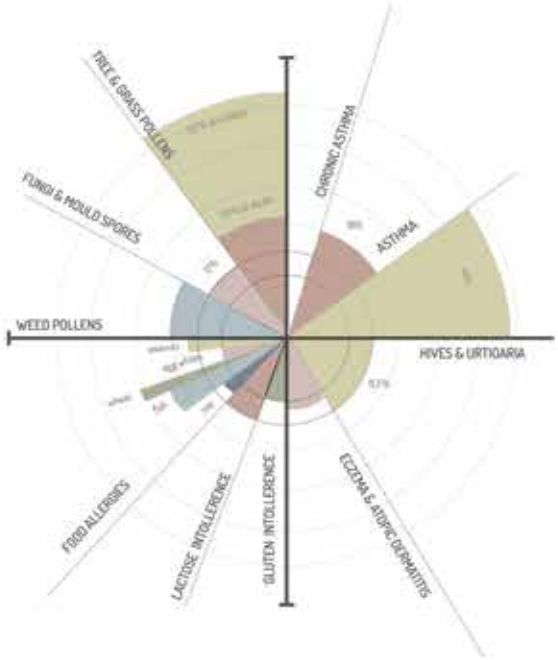
AN ISSUE OF DISCONNECTION

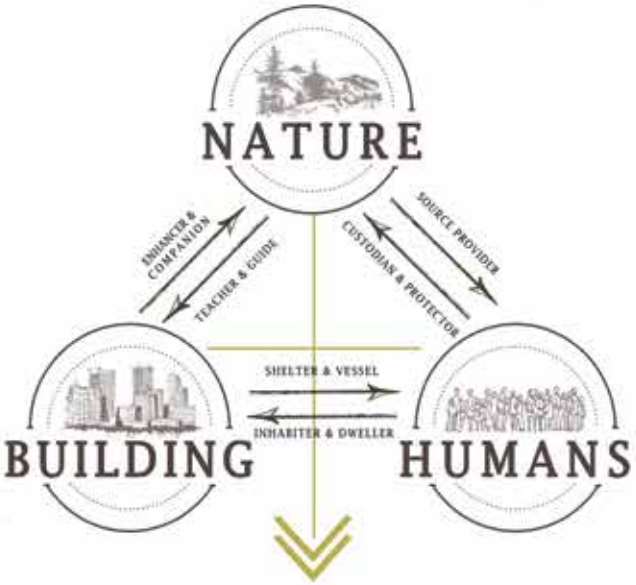


chapter two

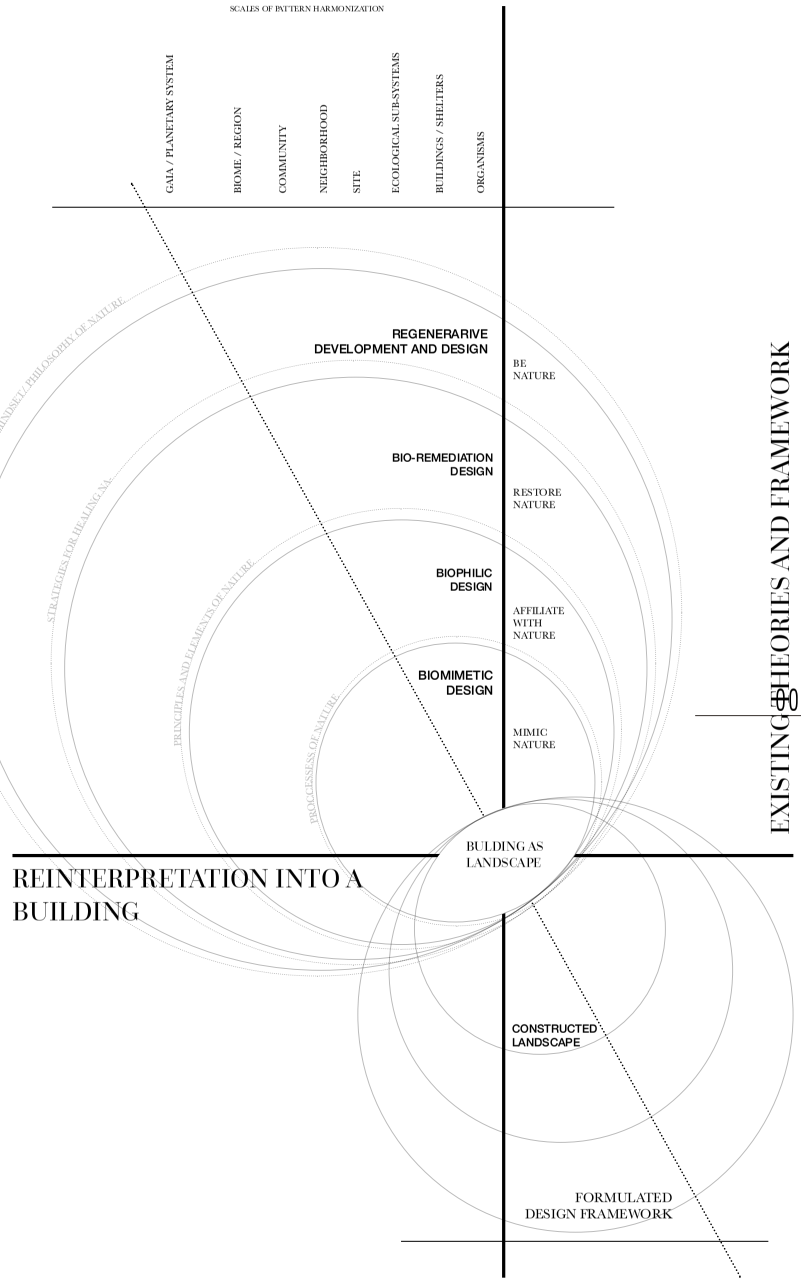
A WELLNESS CENTRE

FOR URBAN DISEASES





THEORETICAL APPROACH



REINTERPRETATION INTO A BUILDING

EXISTING THEORIES AND FRAMEWORK

REGENERATIVE DESIGN AND DEVELOPMENT
ethos/mindset

Humanity and its artefacts is an integral part of an interconnected web of life

The purpose of humanity aligns with the purpose of the planetary system itself

Our actions should contribute positively to the functioning and evolution of ecosystems and biogeological cycles, enabling the self-healing processes of nature.

Endeavours should be rooted in the aspirations of the context

01 BIO-REMEDIATION
02 BIOPHILIC DESIGN
03 BIOMIMETICS
04 BIOMIMICRY

01 Place-Based Relationship

- Geographic connection to place
- Historic connection to place
- Ecological connection to place
- Cultural connection to place
- Indigenous materials
- Landscape orientation
- Landscape features defining building form
- Integration of culture and ecology
- Spirit of Place (Genius Loci)
- Avoiding placelessness

02 Indirect contact with nature strategies *Kellert (2008)*

natural shapes forms and analogues

- Botanical Motifs
- Tree and Columnar supports
- Vertebrate animal motifs
- Shells and Spirals and organic forms
- Egg, Oval and tubular forms
- Arches, Vaults and Domes

03 Symbolic contact with nature strategies *Browning (2008)*

- Shapes resisting straight lines and angles
- Simulation of natural features
- Biomorphy (Resembling Living Systems)
- Geomorphology
- Fractals and Patterns
- Symbolic connections to water

Direct contact with nature strategies *Kellert (2008)*

Environmental features

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

04 Characteristics of nature *Heerwagen & Hase(2001)*

Evolved Human-Nature Relationship

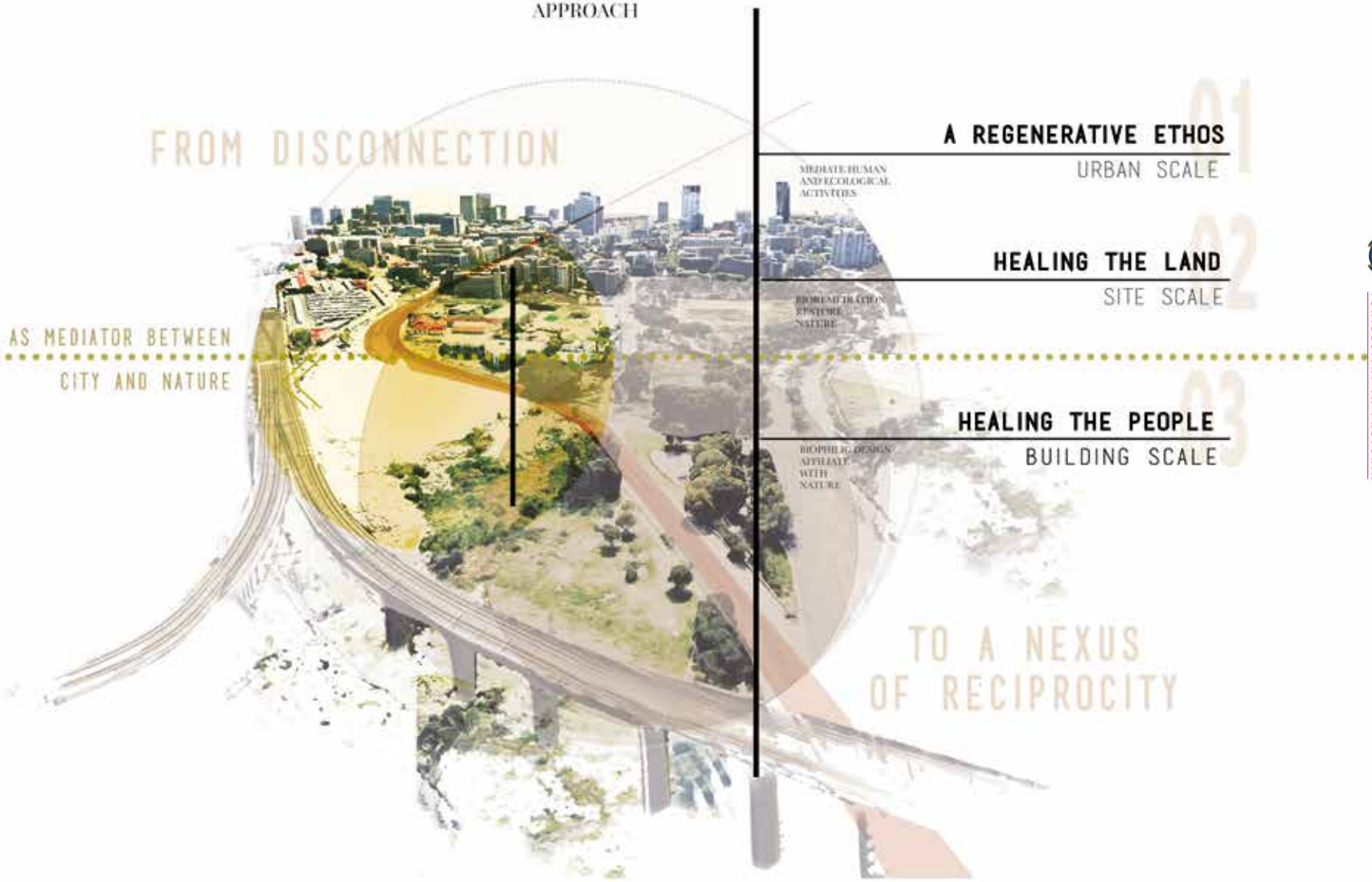
- Prospect and refuge
- Order and Complexity
- Curiosity and enrichment
- Exploration and discovery
- Information richness and Diversity
- Resilience
- Peril and Mystery
- Serendipity
- Sense of Playfulness
- Attraction and Beauty
- Reverence and Spirituality

05 Natural Patterns and Processes

- Sensory Variability
- Age, Change and the Patina of time
- Fractals characteristics
- Patterned wholes
- Dynamic Balance and Tension
- Hierarchically organized ratios & scale
- Complementary Contrasts
- Change, Transformation and Metamorphosis
- Central Focal Point
- Bounded Space
- Transitional Spaces
- Linked Series and Chains
- Integration of parts to wholes
- Growth and Efflorescence

CONCEPTUAL

APPROACH



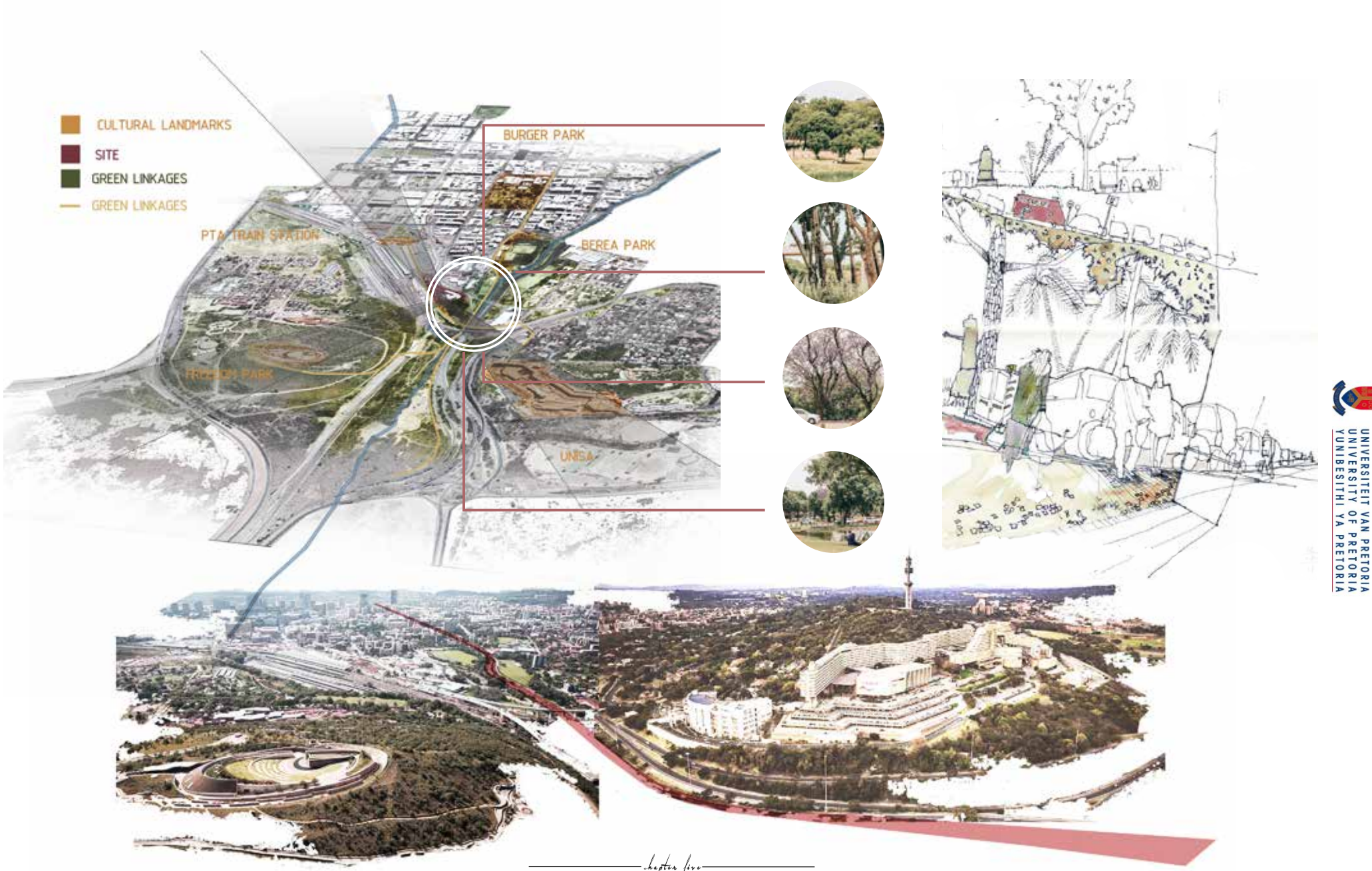
chapter four

The Context of Pretoria

chapter five

Approaching South Berea

ENTRANCE INTO PRETORIA



chapter five

Urban Foyer of Pretoria

chapter five

URBAN & SITE STRATEGIES

HEALING THE LAND

URBAN AGRICULTURE
connecting green spaces as a productive ecological corridor

CONSTRUCTED WETLANDS
along spine within natural flood planes along Apies river

APPROPRIATE PLANTING PRACTICES
of indigenous species with low dPAL scores

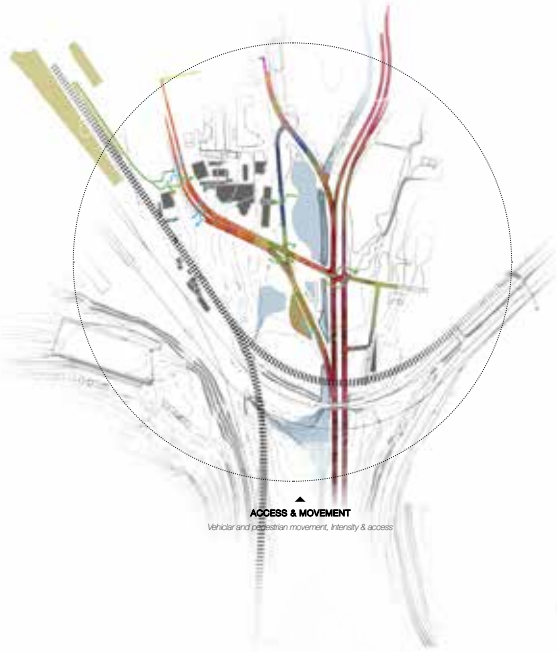
chapter five

SITE ANALYSIS & MAPPING

ECOLOGY
Brownfields, Water networks & Green Corridors

AXIAL INFORMANTS
Countours, Solar Orientation & Pedestrian movement patterns

SOCIAL ACTIVITY
Pedestrian routes, Economical- & Religious activities



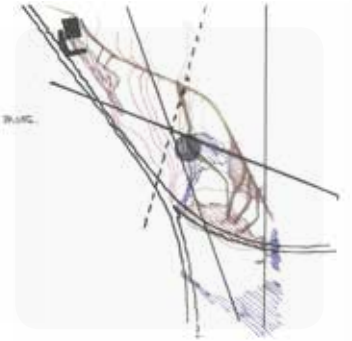
ACCESS & MOVEMENT
Vehicular and pedestrian movement, Intensity & access

TOPOGRAPHY
Fall of the site in the North-East Direction

REMEDIATION & RECIPROCITY
Areas of Contamination & Potential Restoration of Reciprocal Relationship

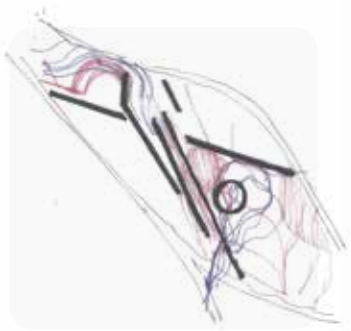
Design Development

PROGRAMMATIC ALLOCATIONS
From urban (thundaray) to natural(secret)

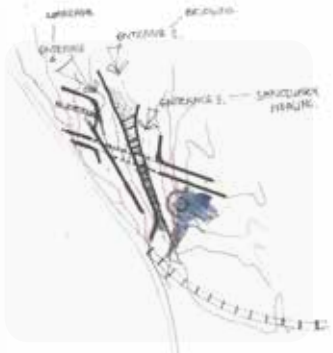


AXIAL RESPONSE & FOCAL AREAS
Contours, Solar Orientation and Movement

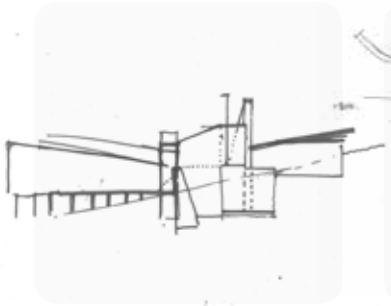
ENTRANCE EXLORATION
Street access and Gautrain pedestrian route



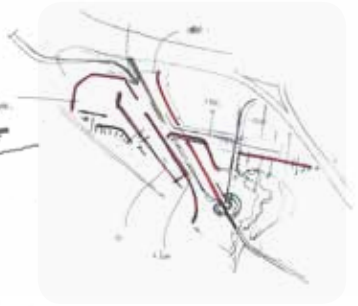
MASSING VERSUS OPEN SPACE EXPLORATION



STRUCTURAL GRID EXPLORATION
5m grid responding to columns of Gautrain



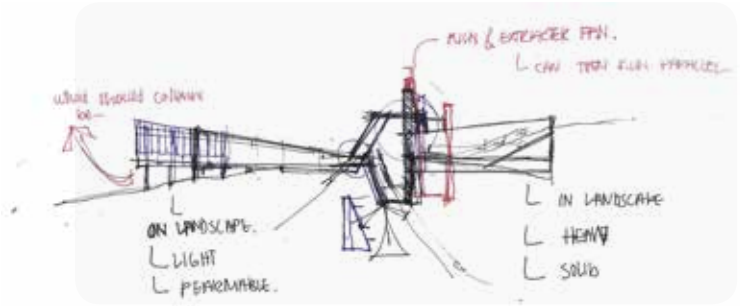
SECTION DIAGRAM
From embedded urban condition to permeable natural condition



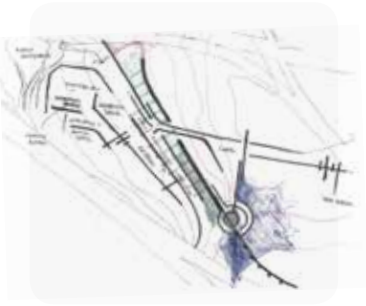
MOVEMENT AND EXPERIENTIAL ROUTES

ROUTES OF HEALING

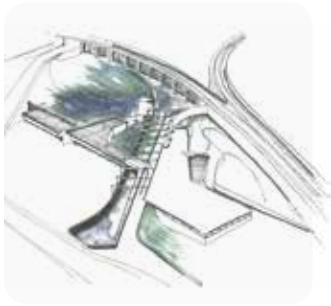
LEVEL & HEIGHT EXPLORATION
Building as an artificial topography



REFINED SECTION DIAGRAM

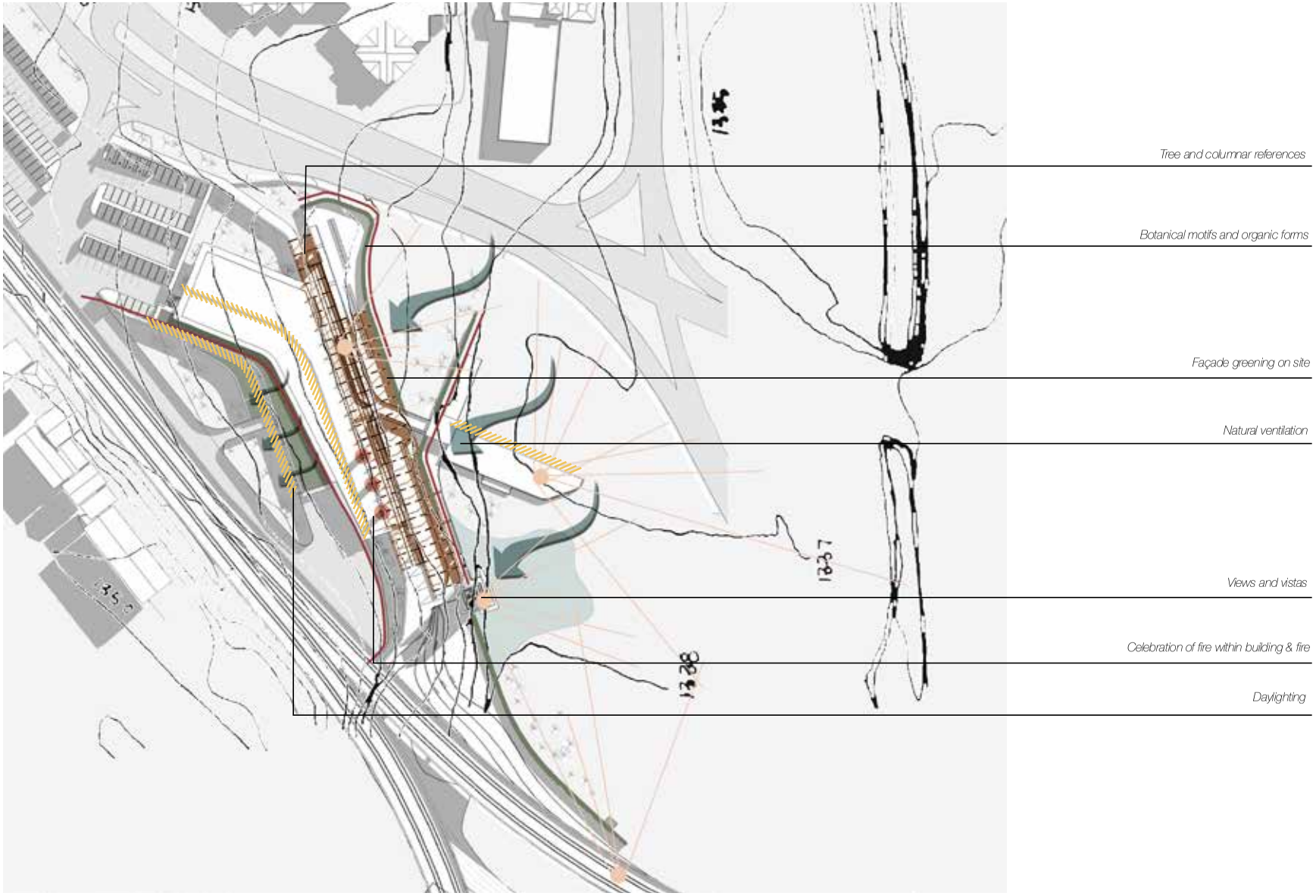


REFINED PLAN DEVELOPMENT



3-DIMENSIONAL EXPLORATION

FINAL PLAN LAYOUT



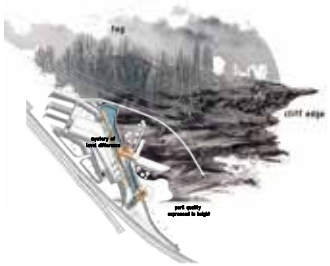
chapter six

Biophilic Design Informants

HEALING THE PEOPLE

Reniterpreting Characteristics of Nature

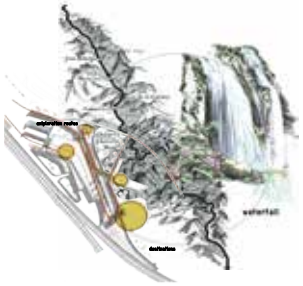
HEALING THE PEOPLE



PERIL & MYSTERY

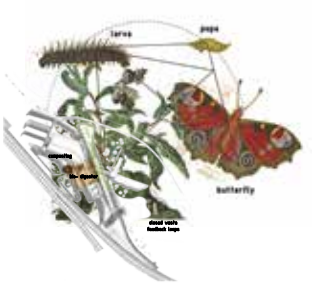
PROSPECT & REFUGE

RESILIENCE

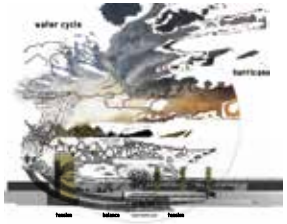


EXPLORATION & DISCOVERY

CURIOSITY & ENRICHMENT

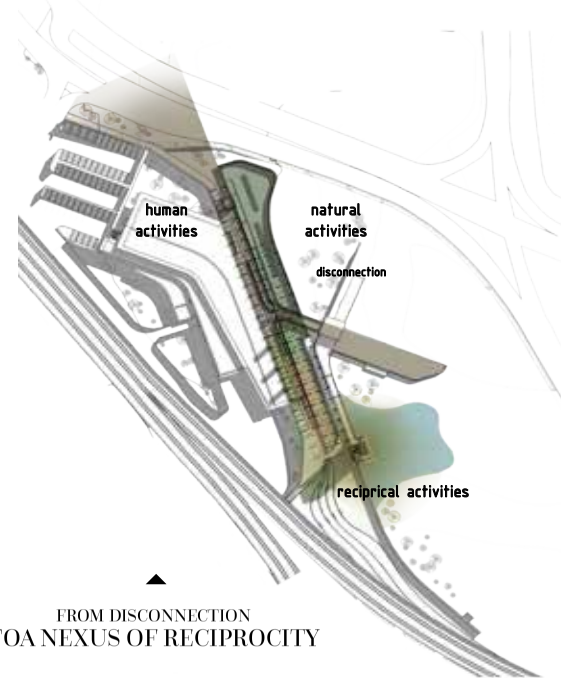


GROWTH & EFFLORESCENCE

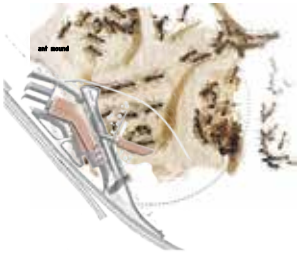


BALANCE & TENSION

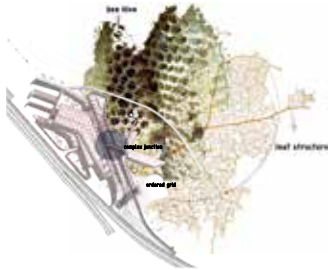
REVERENCE & SPIRITUALITY



FROM DISCONNECTION
TOA NEXUS OF RECIPROCITY



BOUNDED SPACE



ORDER & COMPLEXITY

SERENDEPITY

chapter eight

APPENDICES

FINAL PRESENTATION

Design Outcomes

chapter seven

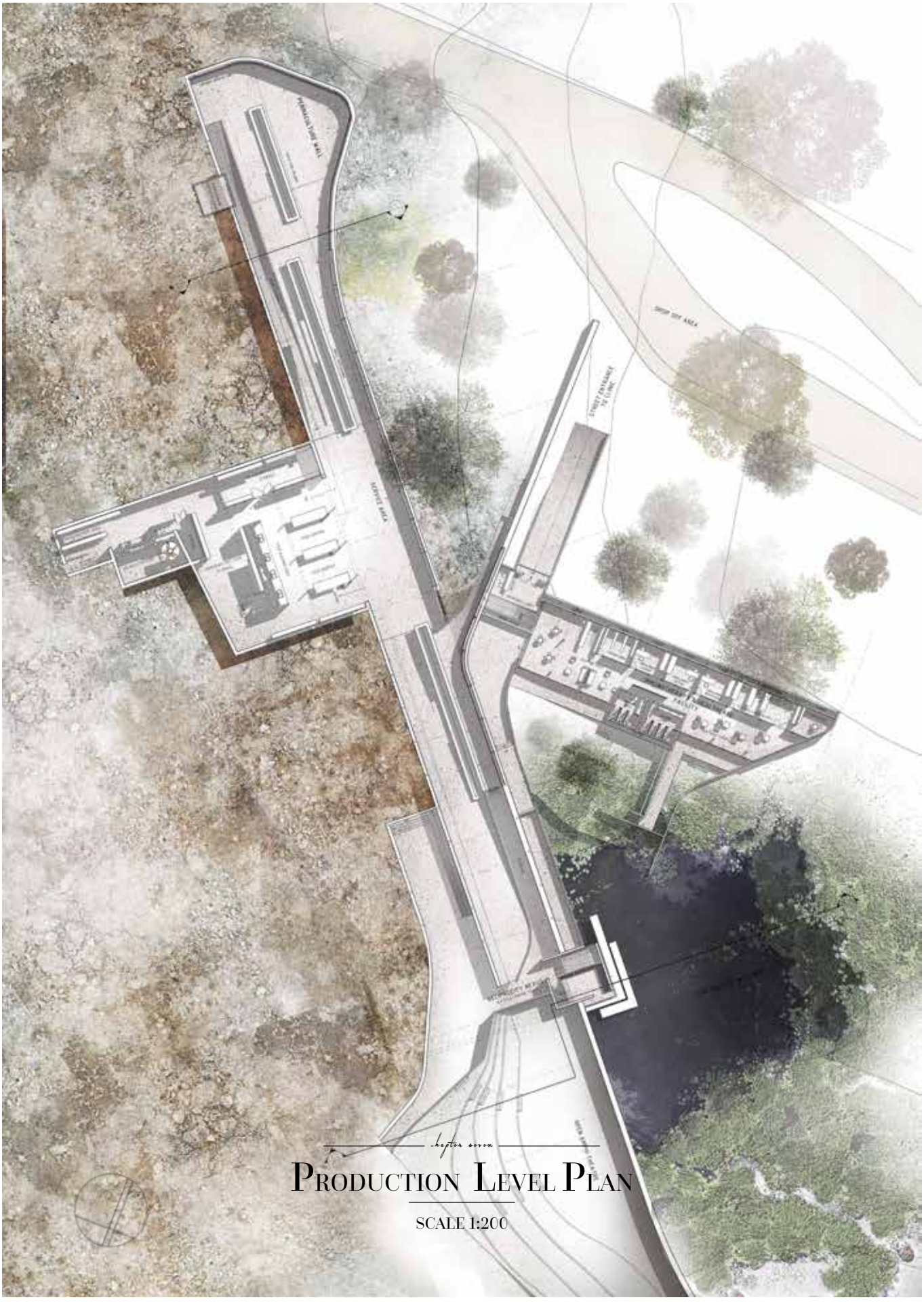
SITE PLAN

SCALE 1:500

chapter seven

Entrance Level Plan

SCALE 1:200



chapter seven

PRODUCTION LEVEL PLAN

SCALE 1:200

chapter eight

NORTH- EAST ELEVATION

SCALE 1:100

chapter nine

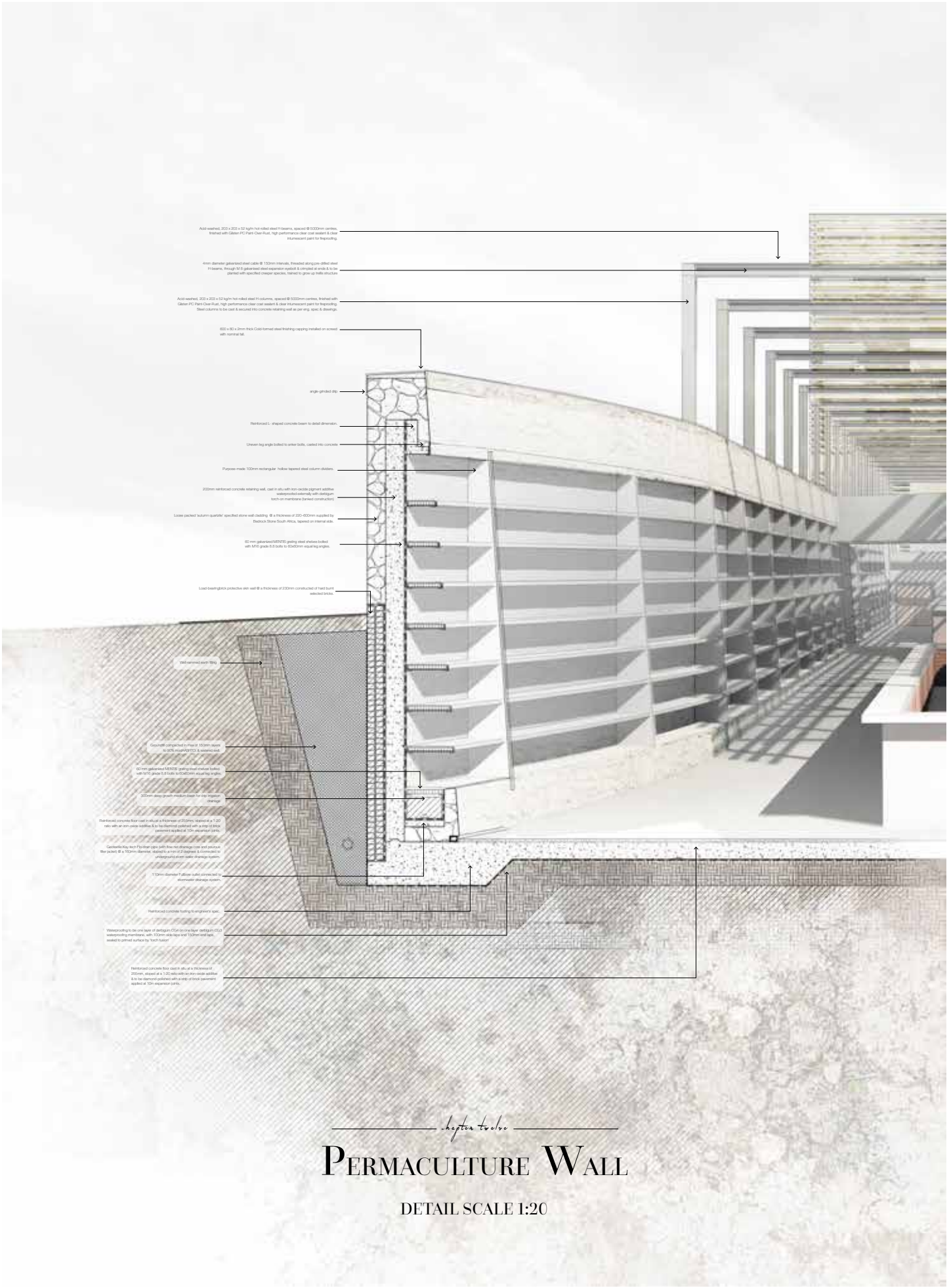
RECIPROCITY SECTION

SCALE 1:50

chapter nine

Disconnection Section

SCALE 1:50



chapter twelve

PERMACULTURE WALL

DETAIL SCALE 1:20

chapter ten

EXTERIOR VIEW

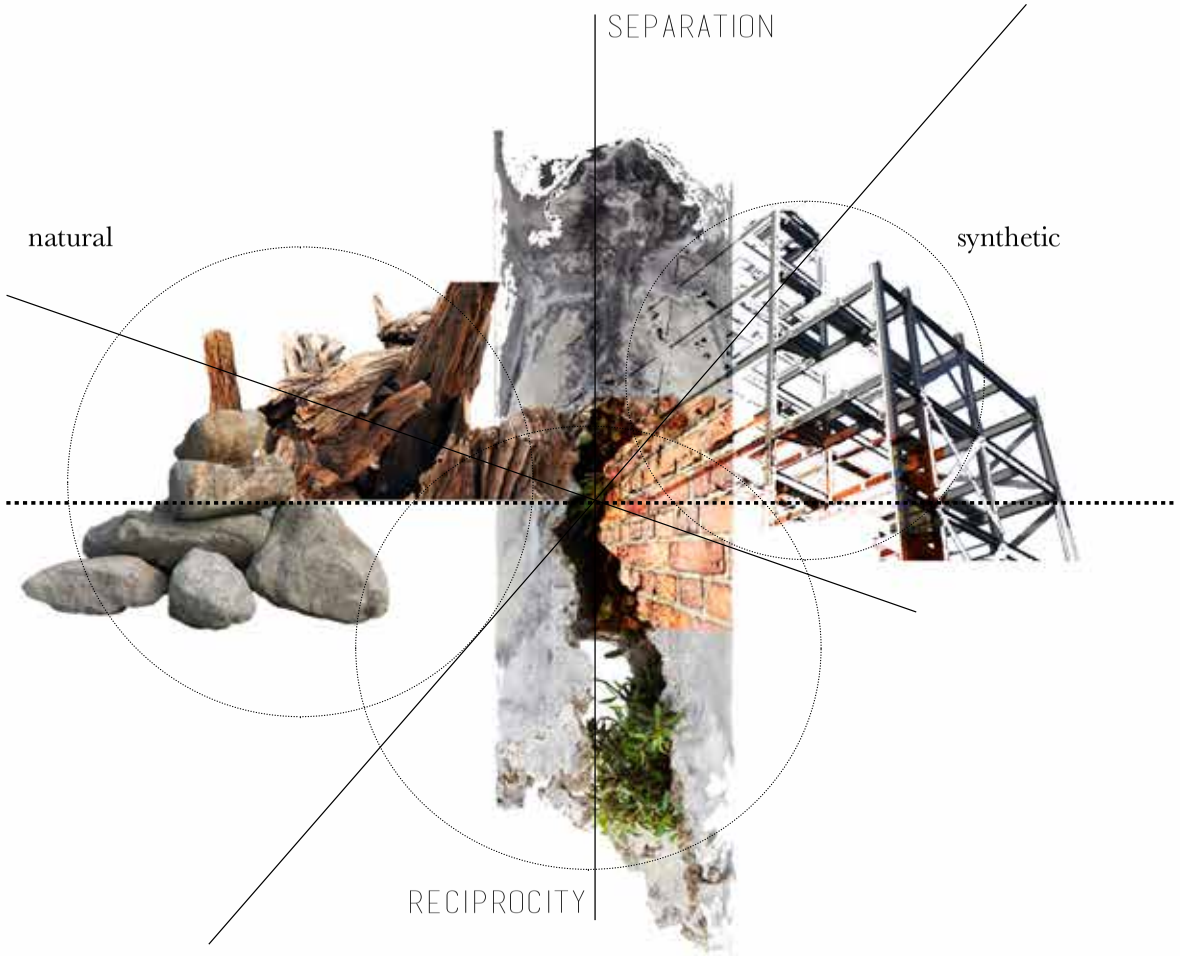
OF BUILDING WITHIN ITS CONTEXT

chapter eight

APPENDICES

FINAL PRESENTATION

Technification Outcomes



chapter eleven

Technical Concept

MATERIALITY

NATURAL

STONE

The **stereotomic** and **retaining** characteristics of natural stone will be utilized to enable direct associations with nature as well as provide inherent mass as a thermal design strategy.

ON-SITE CLAY AND SOIL

On-site soil that will be excavated on site during the construction of the building will be utilized where additional **compaction soil** is needed.

TIMBER

Pine plywood will be used in multiple ways in **interior spaces** in order to express its haptic qualities and affiliation with nature.

VEGETATION

Facade greening and productive green walls will be employed as fundamental tools to establish a **physical link with nature**.

JASMINUM POLYANTHUM (Pink Jasmine)

Minimal water requirements
Attracts multiple insects
Semi-deciduous
Requires semi-shade to full sun.

THUNBERGIA ALATA (Yellow Black-Eyed Susan)

Self-seeding creeper
Evergreen
Requires semi-sun

SENECIO TAMOIDES (Canary Creeper)

Semi- deciduous
Requires shade

CLEMATIS BRACHIATA (Traveller's Joy)

Evergreen
Requires full sun

COMBRETUM BRACTEOSUM (Hiccup Nut)

Produces fruit that attracts birds
Evergreen
Requires full sun

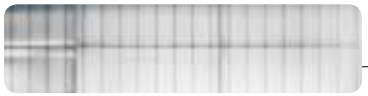
TRACHELOSPERMUM JASMINOIDES (Star Jasmine)

Ever-green climber
Minimal water requirements
Requires shade

SYNTHETIC

STEEL

The tectonic qualities of steel as a **tension device** will be implemented to create surface contrast with the stereotomic natural materials. The steel members will be acid-washed and painted to eventually undergo processes of weathering to indicate the *patina of time*.



POLYCARBONATE SHEETING

Wall and roof sheets made of polycarbonate will be applied to **enable light to be diffused** on entering the building while simultaneously **insulating internal spaces** against heat gain. In this way, energy savings will be achieved and the need for additional supporting structures reduced, as the material has a low unit weight with a long life span.

CONCRETE

Concrete is a **low-maintenance and robust material** that will be applied in floor slabs, roof and beam structures, foundations and retaining substructures.

BRICK

Bricks will be implemented for wall structures throughout the building and will be given a **vernacular off-white bagged finish** in order to create a *complementary contrast* with the stonewalls. In some internal spaces the warm natural colour and properties of the brick will be exposed.

RECIPRICAL

PERMEABLE PAVEMENT

Permeable concrete paving will be implemented for **external surfaces**, including parking, roads and pedestrian routes in order to provide a hard surface to support vehicular and pedestrian traffic while simultaneously allowing for vegetation and grasses to grow in between the pavers. It will facilitate the process of **filtering storm water runoff** by trapping suspended solids as well as minimizing the effects of erosion.

BIO-CONCRETE

Bio-concrete supports the natural and enhanced growth of pigmented organisms such as fungi, microalgae and mosses, allowing the development of a beautiful, **living patina**. The material absorbs and reduces atmospheric CO2 regulates internal thermal conductivity, and has notable aesthetic and environmental properties (Brownell, 2013).

Bio-concrete is composed of a structural concrete layer that is made of conventional carbonated concrete together with magnesium phosphate cement and then waterproofed to protect this layer from possible water damage. To the contrary, the **biological layer** has the capacity to capture and retain rainwater by having an intermittent coating layer with a reverse waterproofing purpose that allows water and moisture to gather on it and **enable biological growth of organisms** (Brownell, 2013).

Water is harvested from roofs as well as external hard surfaces, filtered through a grid to remove floating debris, and then directed towards temporary galvanized steel water tanks, for purposes of further treatment.

Wastewater and grey water accumulated from the three kitchens and washing basins are directly taken through a fat trap and then directed towards the temporary galvanized steel water tanks, for purposes of further treatment.

Black water is directed towards the municipal sewerage connection and not dealt with in this scheme.

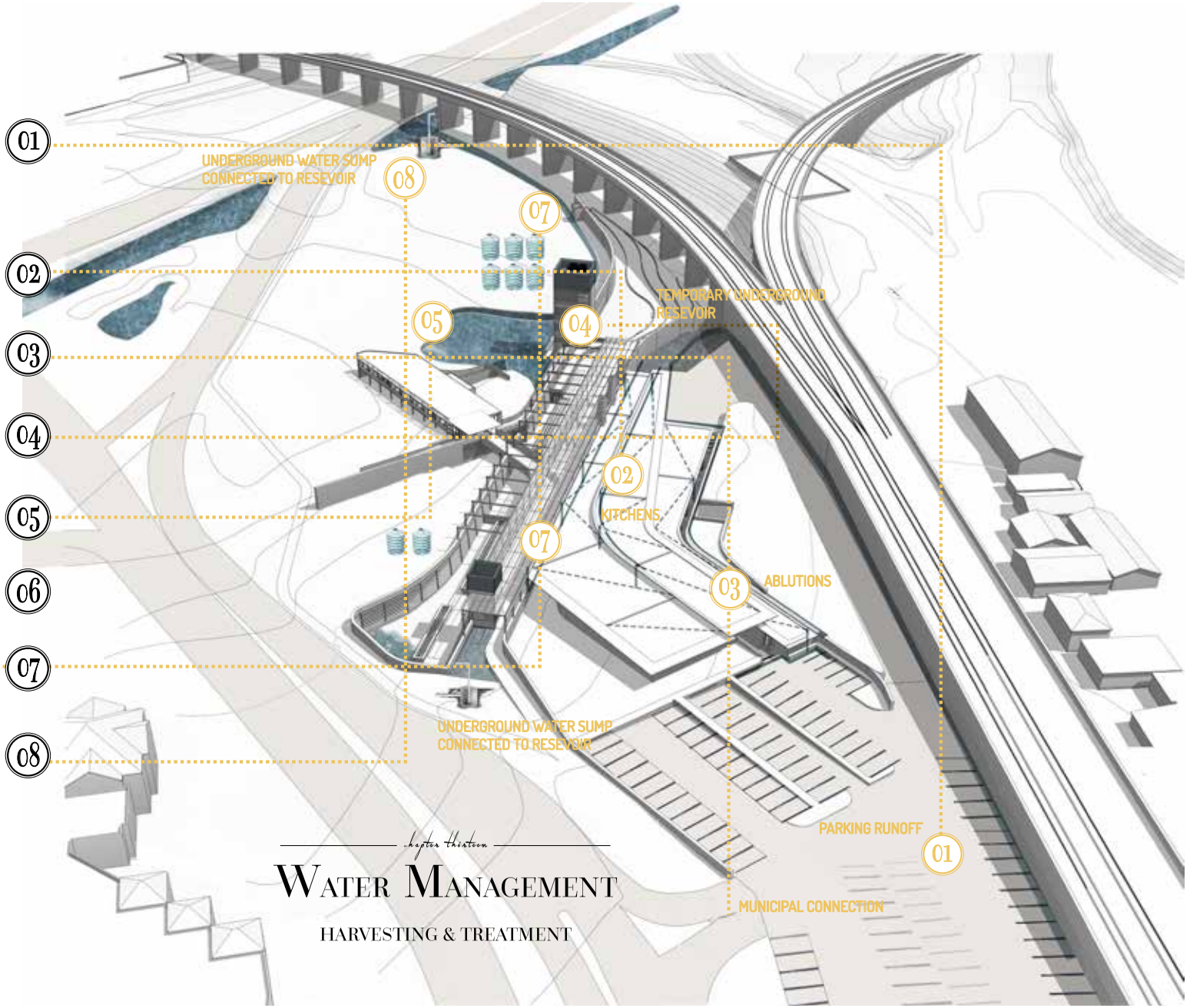
The water that has been stored in temporary water tanks is then directed towards multiple treatment chambers beneath the central water tower and taken through an oil trap and sedimentation filter.

Water required for irrigation is stored in the retention pond and wetland-based biological system and will retain dissolved minerals that are beneficial for plants.

Water used for domestic purposes is treated further in a different treatment chamber to remove harmful pathogens.

Water is then pumped up during the night into a storage tank 20m above ground within the water tower, in order to achieve a sufficient water pressure of 2bar.

An additional average of 285 litres of water will be acquired a month to support urban agricultural requirements with the site and urban precinct. It will be argued that the rights to a percentage of water will be acquired from the Apies River through a sump and channeling system that will feed water into the retention wetland.



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Water Management

HARVESTING & TREATMENT

A WATER RESOURCE INFORMATION (YIELD, m³)

A1 RAIN WATER HARVESTING DATA

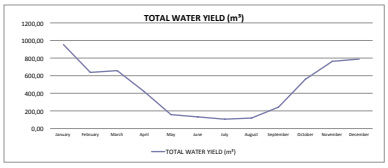
DESCRIPTION	AREA (m²)	RUNOFF COEFF. (C)
Roof catchment	4637	0,9
Concrete Pavement runoff	11905	0,2
		0
Other		0
TOTAL AREA (A)	16592,00	
WEIGHTED C		0,45

A2 RECYCLED / ALTERNATIVE WATER SOURCE

MONTH	Apies River Connection	ave of 285 litres squirrel a day			
	WEEKLY YIELD (m³)	MONTHLY YIELD (m³)	WEEKLY YIELD (m³)	MONTHLY YIELD (m³)	TOTAL / MONTH (m³)
January	20	80,00	0	0,00	80,00
February	20	80,00	0	0,00	80,00
March	20	80,00	0	0,00	80,00
April	20	80,00	0	0,00	80,00
May	20	80,00	0	0,00	80,00
June	20	80,00	0	0,00	80,00
July	20	80,00	0	0,00	80,00
August	20	80,00	0	0,00	80,00
September	20	80,00	0	0,00	80,00
October	20	80,00	0	0,00	80,00
November	20	80,00	0	0,00	80,00
December	20	80,00	0	0,00	80,00
ANNUAL AVE:		960,00		0,00	960,00

A3 TOTAL WATER YIELD

MONTH	AVE RAINFALL : P (m)	CATCHMENT YIELD (m³) (Yield = PxAxC)	ALTERNATIVE WATER SOURCE (m³)	TOTAL WATER YIELD (m³)
January	0,13	873,05	80,00	953,05
February	0,09	557,97	80,00	637,97
March	0,09	577,66	80,00	657,66
April	0,06	341,34	80,00	421,34
May	0,01	78,77	80,00	158,77
June	0,01	52,51	80,00	132,51
July	0,00	26,26	80,00	106,26
August	0,01	39,39	80,00	119,39
September	0,03	164,11	80,00	244,11
October	0,07	479,19	80,00	559,19
November	0,10	682,69	80,00	762,69
December	0,11	708,94	80,00	788,94
ANNUAL AVE:	0,70	4581,88	960,00	5541,88



B WATER DEMAND

B1 LANDSCAPE IRRIGATION DEMAND (m³)

DESCRIPTION:	LAWN (m²):	2231	AGRI (m²):	1461	PLANTING (m²):	431	
MONTH	WEEKLY IRR. (m)	MONTHLY DEMAND (m³)	WEEKLY IRR. (m)	MONTHLY DEMAND (m³)	WEEKLY IRR. (m)	MONTHLY DEMAND (m³)	TOTAL MONTHLY IRR. DEMAND (m³)
January	0,02	178,48	0,025	146,1	0,005	8,62	333,2
February	0,02	178,48	0,025	146,1	0,005	8,62	333,2
March	0,02	178,48	0,025	146,1	0,002	3,448	328,028
April	0,02	178,48	0,025	146,1	0,002	3,448	328,028
May	0,01	89,24	0,025	146,1	0,002	3,448	238,788
June	0,01	89,24	0,025	146,1	0	0	235,34
July	0,01	89,24	0,025	146,1	0	0	235,34
August	0,02	178,48	0,025	146,1	0	0	324,58
September	0,02	178,48	0,025	146,1	0,005	8,62	333,2
October	0,02	178,48	0,025	146,1	0,005	8,62	333,2
November	0,02	178,48	0,025	146,1	0,005	8,62	333,2
December	0,02	178,48	0,025	146,1	0,005	8,62	333,2
ANNUAL TOTAL		1874,04		1753,2		62,064	3689,304

B2 DOMESTIC DEMAND

MONTH	PERSONS	WATER/ CAPITA/ DAY (l)	DOMESTIC DEMAND (m³/month)
January	80	4	9,92
February	80	4	8,96
March	80	4	9,92
April	80	4	9,6
May	80	4	9,92
June	80	4	9,6
July	80	4	9,92
August	80	4	9,92
September	80	4	9,6
October	80	4	9,92
November	80	4	9,6
December	80	4	9,92
ANNUAL TOTAL			116,8

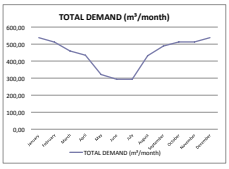
TOTAL WATER LOSS & DEMAND

MONTH	TOTAL DEMAND (m³/month)
January	537,36
February	512,12
March	459,36
April	434,75
May	321,55
June	293,50
July	293,82
August	431,62
September	488,48
October	513,06
November	512,76
December	537,36
ANNUAL TOTAL	5335,744

B3 EVAPORATION LOSS (For 'open' reservoirs)

AREA OF RESERVOIR (m²): 1214

MONTH	EVAPORATION RATE (m/week)	EVAPORATION RATE (m/month)	TOTAL LOSS (m³/month)
January	0,04	0,16	194,24
February	0,035	0,14	169,96
March	0,025	0,1	121,4
April	0,02	0,08	97,12
May	0,015	0,06	72,84
June	0,01	0,04	48,56
July	0,01	0,04	48,56
August	0,02	0,08	97,12
September	0,03	0,12	145,68
October	0,035	0,14	169,96
November	0,035	0,14	169,96
December	0,04	0,16	194,24
ANNUAL TOTAL	0,32	1,26	1529,64



C WATER BUDGET

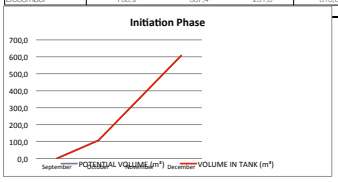
TANK CAPACITY (m³): 953
MIN VOLUME (m³): 106

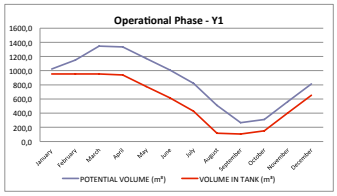
C1 WATER BUDGET — INNITIATION PHASE

MONTH	YIELD (m³/month)	DEMAND (m³/month)	MONTHLY BALANCE	POTENTIAL VOLUME (m³)	VOLUME IN TANK (m³)
September	244,1	488,5	-244,4	0,0	0,0
October	559,2	513,1	46,1	106,0	106,0
November	762,7	512,8	249,9	355,9	355,9
December	788,9	537,4	251,6	607,5	607,5
	2354,9	2051,7	303,3		

C2 WATER BUDGET — YEAR 1

MONTH	YIELD (m³/month)	DEMAND (m³/month)	MONTHLY BALANCE	POTENTIAL VOLUME (m³)	VOLUME IN TANK (m³)
January	953,1	537,4	415,7	1023,2	953,0
February	638,0	512,1	125,8	1149,0	953,0
March	657,7	459,3	198,3	1347,4	953,0
April	421,3	434,7	-13,4	1334,0	939,6
May	158,8	321,5	-162,8	1171,2	776,8
June	132,5	293,5	-161,0	1010,2	615,8
July	106,3	293,8	-187,6	822,6	428,3
August	119,4	431,6	-312,2	510,4	116,0
September	244,1	488,5	-244,4	266,0	106,0
October	559,2	513,1	46,1	312,1	152,1
November	762,7	512,8	249,9	562,1	402,0
December	788,9	537,4	251,6	813,6	653,6





SB SBAT REPORT

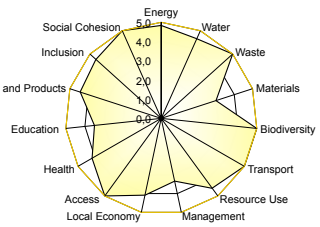
SB1 Project

Restoring Reciprocity A wellness Centre for Urban Diseases

SB2 Address

South Berea 609, Corner of Nelson Mandela Boulevard (R21) and Thabo Sehume Street Fountains, Pret

SB3 SBAT Graph



SB4 Environmental, Social and Economic Performance	Score
Environmental	4,5
Economic	4,4
Social	4,3
SBAT Rating	4,4

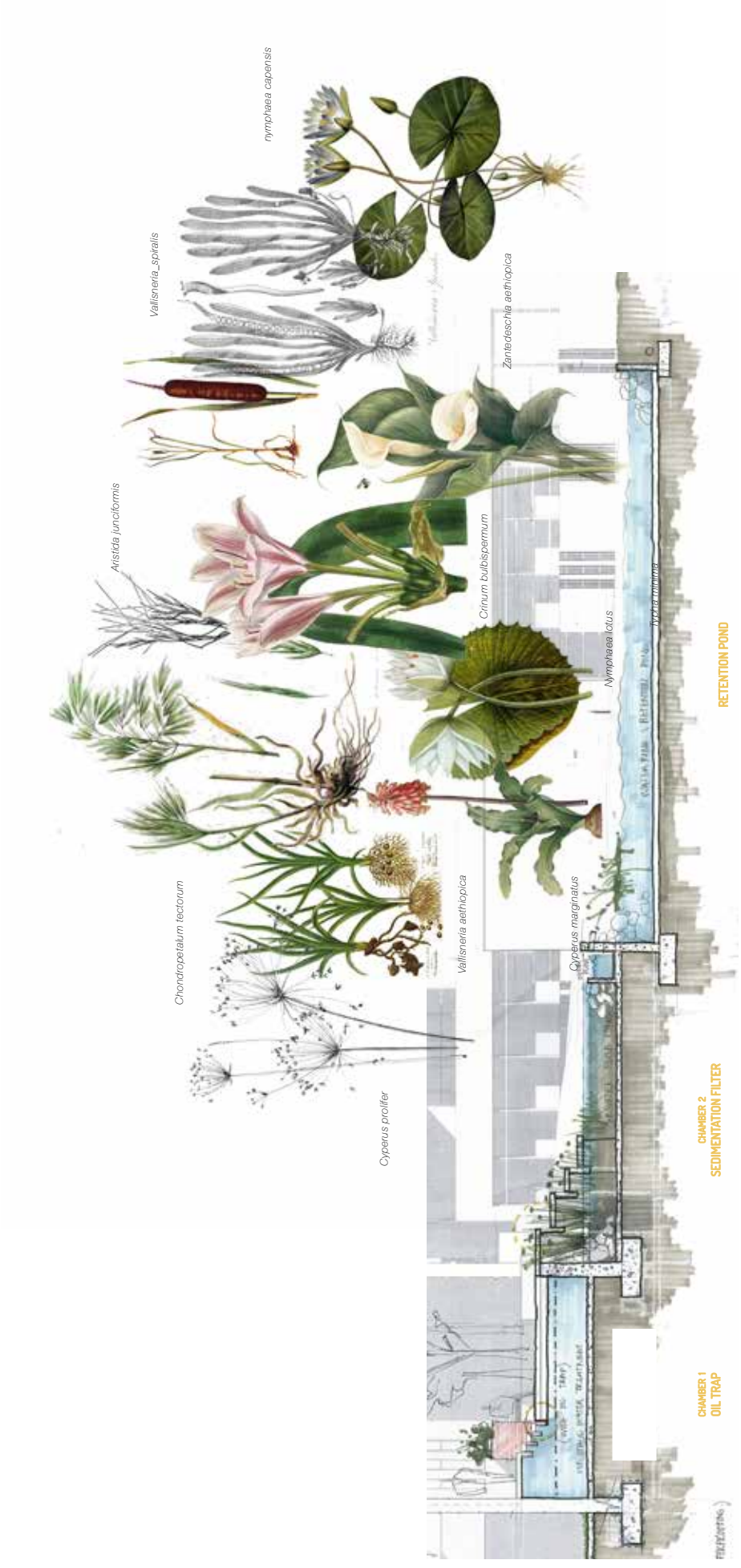
SB5 EF and HDI Factors	Score
EF Factor	4,5
HDI Factor	4,1

SB6 Targets	Percentage
Environmental	90
Economic	88
Social	87

chapter thirteen

SUSTAINABILITY CALCULATIONS

SBAT, WATER DEMAND, YIELD & BUDGET



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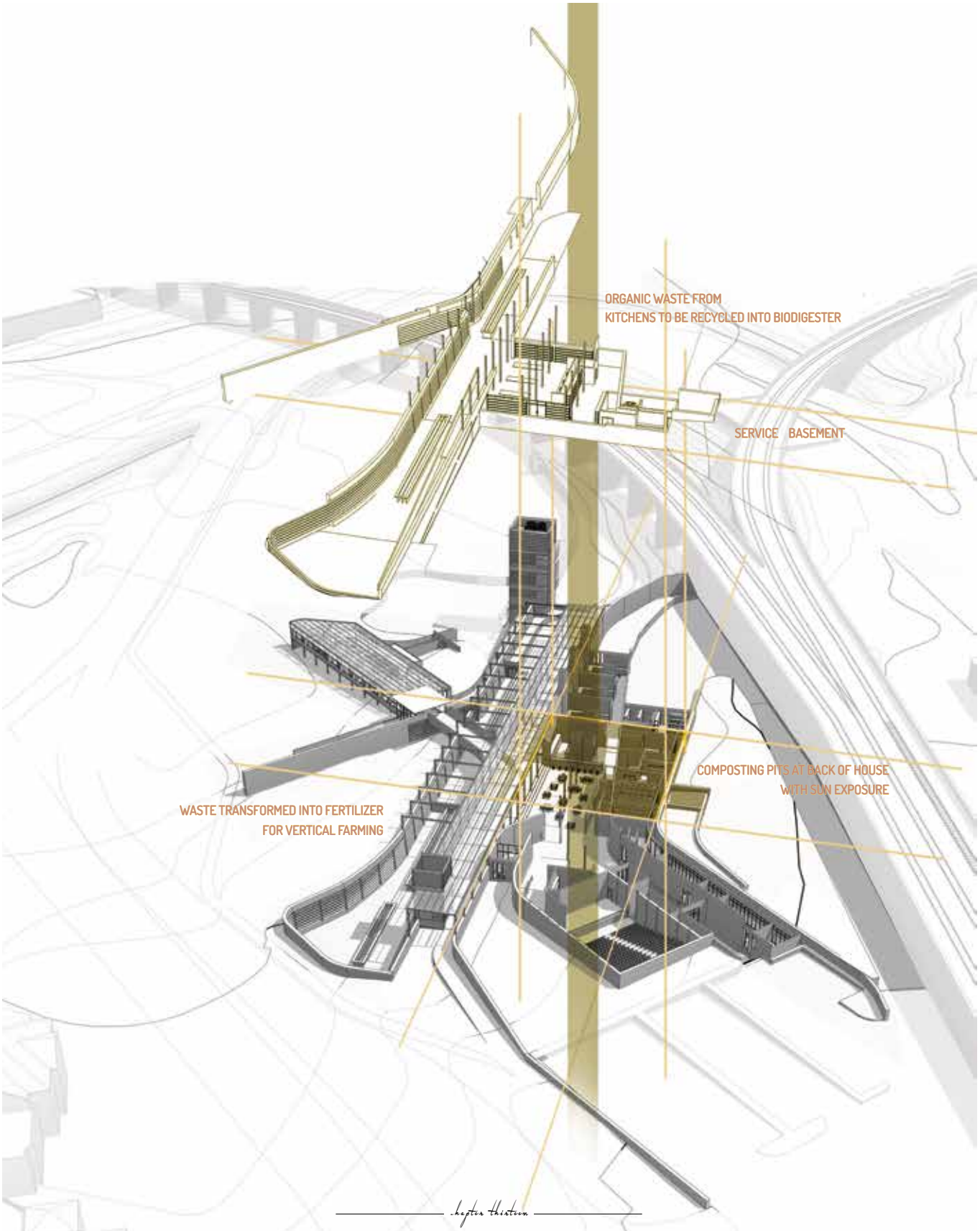
WETLAND

TREATMENT STRATEGY



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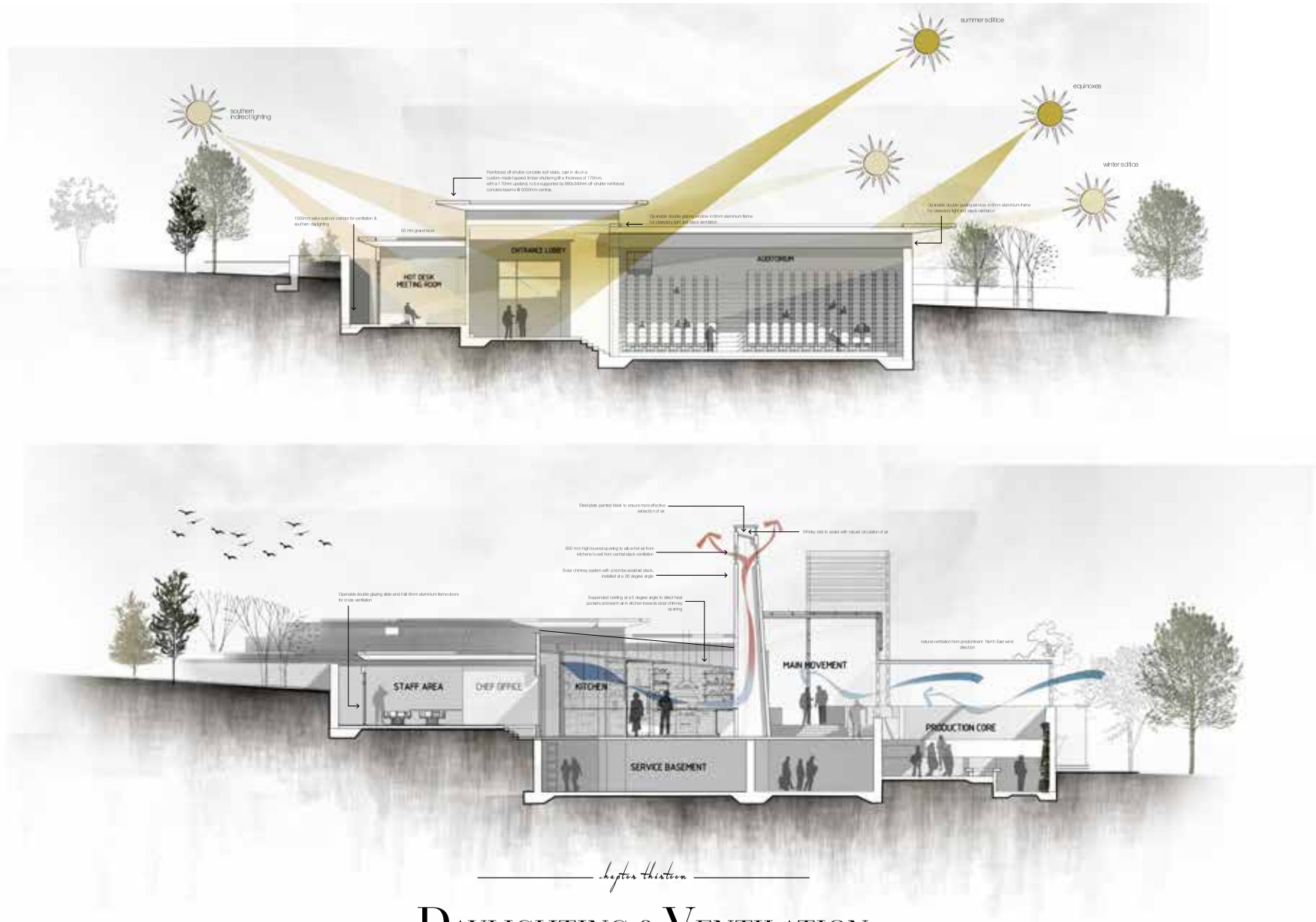
WASTE MANAGEMENT

COMPOSTING & BIO DIGESTING



chapter thirteen

Daylighting & Ventilation

SCALE 1:100

chapter eight

APPENDICES

FINAL PRESENTATION

Model

FIGURE 9.1

Day 154, Cyclist

(Lorraine Loots, 2013)

chapter nine

CONCLUSION

The design presented in this dissertation has attempted to explore how the development of an architectural solution can **adopt and encapsulate the fundamental meanings of a landscape**, as a spatial structure in which diversity and differences are embedded, and where coherence between all living systems can be generated, to finally become a **healing habitat** in order to restore the **reciprocal relationship** between nature and humans.

These meanings and **qualities of nature** were recognized by identifying and implementing the concepts of Regenerative Architecture, Bioremediation, Biophilia and Biomimicry at different scales in the vocabulary of designing a building as an **alternative ecosystem.**

This investigation revealed that the issue of **urban diseases** in our cities cannot purely be solved within medical terms, as this will merely promote the management thereof and avoid addressing the true root of the problem. It did however reveal that architecture could serve as a **healing and educating device** for both humans and nature by rather supporting the concept of achieving **internal wellness.**

The architectural process and design response were developed based on the optimistic premise that a building, together with the program of a wellness centre that **generates psychological and physiological well-being** through **appropriate food practices**, can be the mediating device that on the one hand heals the deteriorating state of the site's inherent ecosystems, and on the other hand heal the urban inhabitants of Pretoria that have been compromised by their environment. Thus by healing both man and nature on **equal terms,** the architectural design of the dissertation plays a fundamental role to once again **reconcile the natural and human living systems** as one and the same.

For you shall go out of the city in joy and be led forth in peace; the mountains and the hills before you shall break forth into singing, and all the trees of the field shall clap their hands. Instead of the thorn the cypress tree shall come and the myrtle tree will grow where there once were weeds.

Isaiah 55:12-13 AMP

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chapter ten

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FIGURE 10.1

Day 121, Thong Sala Pier

(Lorraine Loots, 2013)

10.1 LIST OF FIGURES

Chapter 00 PREFACE

Chapter 01 INTRODUCTION

Chapter 02 THEORETICAL APPROACH

Chapter 03 THE PROGRAMME & CLIENT

Chapter 04 CONTEXT & SITE

Chapter 05 CONCEPTUAL DEVELOPMENT & PRECEDENTS

Chapter 06 DESIGN DEVELOPMENT

Chapter 07 TECHNIFICATION

Chapter 08 CONCLUSION

Chapter 09 BIBLIOGRAPHY

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