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The Prolific Partition

Architecture as catalyst for nature reserve conservation structured in the in-between of Urban and Nature.

Armand Visagie

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The Prolific Partition:

Architecture as catalyst for nature reserve conservation structured in the in-between of Urban and Nature.

by

Armand Visagie

Submitted in fulfilment of part of the requirements for the degree Master of Architecture (Professional) in the Faculty of Engineering, Built Environment and Information Technology.

University of Pretoria

November 2017

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Abstract:

Nature reserves in the City of Tshwane are under threat from ecological and historically significant decay due to the less defined nature of these landscapes. Architecture in form, function and technology can be developed in the in-between of nature and urban to act as conservator for these nature reserves. Utilizing the natural resources of nature to produce products for the urban dweller within a space that conserves the historical protective layers of the site. The space of interaction between nature and urban becomes the conservator, acting as active protector in terms of sustainable production, education and urban dweller interaction with the nature reserve and its continuous history of protection.

Opsomming:

Natuurreservate in die stad Tshwane word bedreig deur ekologiese en historiese betekenisverval weens die minder gedefinieerde aard van hierdie landskappe. Argitektuur in vorm, funksie en tegnologie kan ontwikkel word in die tussen ruimte van natuur en stedelike gebiede om as natuurbewaarder vir hierdie natuurreservate op te tree. Die natuurlike hulpbronne van die natuur kan gebruik word om produkte vir die stedelike inwoner te produseer binne 'n ruimte wat die historiese beskermende lae van die terrein laat voortduur. Die ruimte van interaksie tussen natuur en stedelike word die bewaarder, wat optree as 'n aktiewe beskermer in terme van volhoubare produksie, opvoeding en stedelike inwoner interaksie met die natuurreservaat en sy voortgesette geskiedenis van beskerming.

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Dissertation Summary

Project Title

The Prolific Partition: Architecture as catalyst for nature reserve conservation structured in the in-between of Urban and Nature.

Project Location

Wonderboom Nature Reserve
c/o Lavender and Mansfield Road, Wonderboom, Pretoria, Gauteng.
(dd) -25.695156, 28.187321

Research Fields

Environmental Potential (EP) & Heritage and Cultural Landscapes (HCL).

Function

Nature Reserve Conservation Facility

Keywords

Conservation, Historical Significance, Ecological Decay, Nature Reserves, Ecosystem Services, Hospitable Form.

Theoretical Premise

Investigation of Architecture structured in terms of form, function and technology as conservation catalyst between Urban and Natural environments.

Course Coordinator

Prof. Athur Barker

Study Leader

Prof. Piet Vosloo

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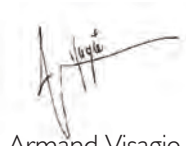
Declaration:

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

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



Armand Visagie

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Net deur Geloof, Gebed, en die Here se Genade.

Dankie Heer vir nog 'n dag, dankie vir die geleentheid dat ek vandag kan stilword en vir U kan kom dankie sê.

Heer, dankie vir die geleentheid om hierdie meesters te kon doen en goed klaarmaak. Dankie dat U saam my was deur elke krit, laat nag en moeilike tyd die jaar.

Alle eer aan U.

Ek sê ook ongelooflik dankie vir 'n wonderlik ma, pa en suster wat U my mee geseën het. Sonder hulle sal ek nie vandag wees waar ek is nie. Beskerm hul waarookal hulle mag gaan en sëen hulle op hul pad.

Heer, ek vra dat hierdie dissertasie 'n verskil sal maak nie net in die kringe van argitektuur nie, maar ook in die denkwyse van elke student, akademikus of persoon wat hom mag lees, dat hul iets insuggewend hierin sal vind en dit hul eie maak.

In U groot, almagtige en heilige naam alleen.

Amen.

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'n Paar Woorde, net om dankie te sê:

Aan my Heemelse Vader:
Sonder U gawes, talente en seënenige sal ek nie die jaar kon klaar maak nie.
Dankie dat U my so baie seën met talente en 'n helder verstand.
Alle eer aan U.

Aan my moeder, Dawn, my pa Francois en my suster Dané:
Dankie dat julle met my saamgeleef het deur die moeilike tye van die jaar, vir my gebid het en hier en daar 'n "jy sal dit maak" gegee het. Ek weet ek raak moeilik wanneer ek stres maar gelukkig het julle verstaan (of probeer).
Sonder julle sal ek nie wees waar ek vandag is nie.
Mag ons altyd 'n close gesin bly. Liefde vir julle.

Aan my honde, Leia, Juliet, Romeo and Lego:
Ek weet julle gaan nie die kan lees nie, maar dankie dat julle oor naweke my stres verlig het.

Aan die Altyd-Besige Pokemanne: Reynders, Bernard and Henri:
Julle was meeste van die tyd die ore waar ek my weeklikse woorde moes opvang.
"Welkom by nog 'n uitsending van radio monument.."

Aan my familie, te veel van julle of te noem:
Dankie vir julle gebede, omgee en altyd die vraag van "hoe gaan dit nog met die M?"
Al kon ek nie altyd antwoord nie weet ek julle het verstaan.

Aan my direkte kolegas: Amy, Jana en Leoné.
Ons gaan okay wees - ons was toe okay.

Aan my studie leier, Prof. Vosloo
dankie Prof. vir die "SPELLING!!" en "Age nee.." komentaar deur die jaar.
Of die "*hoe hoog het jy nou weer jou ontwerp vanaf gegooi*?"

Aan die jaar kodineerder en krit panele:
dankie vir julle insette en komentaar, hierdie dissertasie is julle'sin soveel as myne.

en laaste maar nie die minste nie
aan almal wat ek die jaar mee saamgewerk het,
wat ek leer ken het of net deel was van my dag tot dag:
Dankie, net dankie.

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01_ INTRODUCTION

> "Whatever goal architecture may have set for itself, it can only be meaningful today if it is making a demonstrable contribution towards the improvement of living conditions and circumstances."
> (Mallgrave & Contandriopoulos, 2008:442)

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01_1 Background

Urban protected areas as defined by the International Union for Conservation of Nature (IUCN) can be classified as natural areas that "...offer experiences in nature to the large numbers of people who live near them; and they build urban constituencies for nature conservation" (Trzyna. 2014: xi) The IUCN further states that urban protected areas are distinctive due to the number of ethnically and economically diverse people they attract, their multi-influential governing structures and are subjected to urban scenarios that more remote protected areas never encounter (Trzyna. 2014: xi).

Areas with significant natural, biodiversity features have scientific, cultural, historical, archaeological interests or in need of long term protection for the maintenance of its biodiversity. In the context of South Africa urban environments[1] are classified as nature reserves (South Africa 2003, s 23). Nature reserves in South Africa tend to hold significant resources that very few urban protected natural areas in urban environments around the world have, making them contextually specific. The ecological and historical significance of these sites are unique to the urban context of South Africa and in need a higher level of protection.

Within the urban context of Pretoria, several areas have been classified as nature reserves. These areas hold many similarities in resources[2] and are subjected to a range of parallel challenges that are contextually specific to these urban protected areas. Urbanization, lack of awareness, untapped resource consideration and ecological decay are just some of the challenges faced.

The Wonderboom Nature Reserve (WNR) to the north of Pretoria CBD is no different. The reserve forms part of the Magaliesberg mountain range and is maintained by city of Tshwane, department of nature conservation. The reserve occupies roughly 200ha of mostly a ridge topography and has many cultural ties throughout history (City of Tshwane 2015). WNR is most recognized for its "Wonderboom"[3] and the recreational spaces it provides for urban dwellers of the Pretoria North residential areas. The specific challenges faced by this reserve are the ecological decay and eco-system threat of its southern slope, its disconnected environmental connection to the Magaliesberg mountains and the southern urban context, and its multiple untapped resources that are present on site. Another challenge faced is the management of these resources and the lack of awareness of the significance the reserve holds for the surrounding community.

1. Urban protected areas.
2. Refers to Historical and Ecological resources.
3. Ficus salicifolia

Fig _05 (Left Top): Fort Wonderboom - Historical resource present on site (Author 2017).
Fig_06 (Bottom Left): Natural water channel flowing through Wonderboom nature reserve (Author 2017).
Fig_07 (Bottom Right): Wonderboom nature reserve from western boundry (Author 2017).

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01_2 Problem Statement

Urban protected areas, and in particular nature reserves, in the context of South African cities, are under threat from ecological decay, eco-system depletion and the loss of significance due to the lack of interaction with the urban context. With rapid urban development and the associated lack of interest towards natural enclosed areas due to more thrilling experiences, nature reserves have come under treat from self-decay. This interest lack has forced nature into self-conservation that is not preferred in urban environments. Nature conservation can only be possible by human intervention and interaction (Spear 2017). South African nature reserves furthermore hold cultural and ecological resources that cities can utilize to their advantage in socio-economic development and the conservation funding of these protected areas. With this lack of interest towards nature reserves from urban residents and the cities intervention to address this issues, these natural enclaves are at risk of becoming lost landscapes.

Fig _08 (Above): General Issue Diagram (Author 2017).

Urban Issue

The UN-Habitat World Cities report 2016 show that 54% of the global population resides in urban environments (UN-Habitat 2016; 6). Cities in Africa showed the largest growth in the researched 10-years of UN-Habitat World Cities report. Cities within the Gauteng region of South Africa grew from the 1-5 million brackets to the 5-10 million bracket with the percentage residing in urban areas jumping from 40-60% to 60-80% (UN-Habitat 2016:8). This rise in urbanization and the rate at which urban environments need resources to cater for the growth will put nature reserves at further risk of decay and depletion. If awareness of the significance of these sites and the resources they hold are not escalated or engaged with, these reserves are at risk to be destroyed by neglect or over-exploitation. The concern however is that these reserves will not be protected from urban influences by merely putting up a fence and regulating entry. The urban context needs to interact with the significance of these sites to truly understand the advantages that these enclaves hold.

Fig _09 (Above): Urban Issue Diagram (Author 2017).

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Architectural Issue

Architecture has been used to address many challenges in urban environments such as edge redefining, gapping the void or defining space. These issues are faced by nature reserves but are not new to the discipline. However, the challenge of nature conservation in terms of the specific contextual influences faced, such as those faced by the City of Tshwane's nature reserves have not to date been address by architecture. These sites, due to their context are and were subjected to many diverse types of influences and characteristics that poses an opportunity for architecture to intervene and be developed into a solution for the contextual conservation challenge. Can architecture be placed in the in-between space of nature and urban to successfully address both influences and characteristics? Synthesizing the informants to enhance both environments.

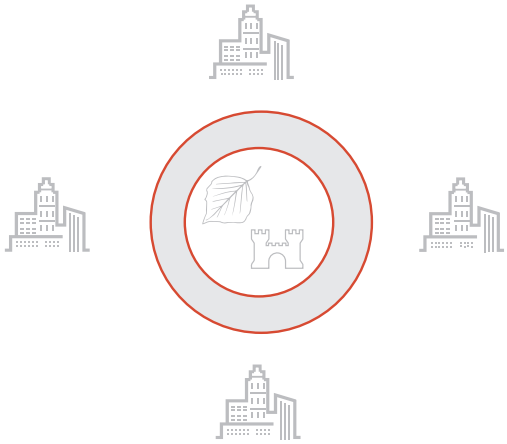

Fig _10 (Above): Architectural Issue Diagram (Author 2017).

Nature Reserve Issue

WNR as protected natural urban environment holds its own specific challenges. The consideration of the protected fauna and flora; the heritage elements of site and the critically endangered eco-systems present the challenge of appropriate locations for development. The sensitivity of the site in the harsh urban environment and how it will react to development pose a further challenge. The issue relates to how to develop the site without destroying the current protected environment, taking into consideration the natural flows of water and the flood lines associated and the endangered species to guide the architecture to the correct location for intervention.

Fig _11 (Above): Nature Reserve Issue Diagram (Author 2017).

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01_3 Research Questions

Main Question

- How can architecture re-define the in-between space of nature reserve and urban to enhance both environments?

- How does architecture structure itself in role and form between nature reserve and urban?

- How can architecture present the site significance in the current paradigm in relationship to the historical narrative of site?

- Can architecture develop the in-between space of nature reserve and urban without destroying nature reserve or deteriorating surrounding urban conditions?

Sub-questions

(*program, context and theory*)

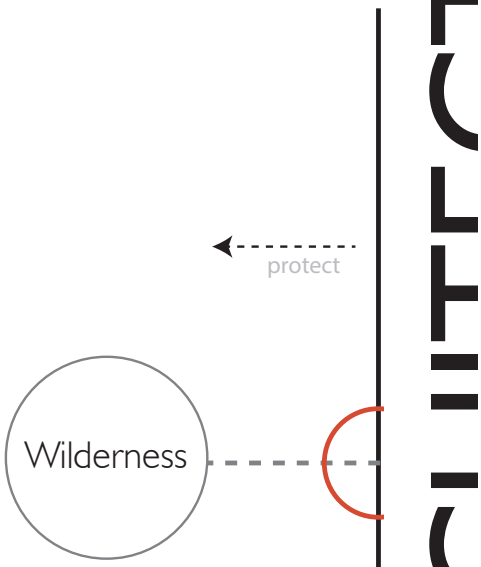
- Can Herman Herzberger's theory of "*musée imaginaire*" in Homework for more Hospitable Form[4] be applied to create an architecture that symbolizes the narrative of protection on site?

- How can nature and urban resources be consolidated into form, function and technology to achieve the enhancement of both environments?

- Can the conservation of the WNR be achieved by architectural intervention at the in-between?

01_4 Research Goal and Objectives

The dissertation will investigate if architecture in form, function and technology can aid as catalyst for nature reserve conservation while activating the edge of the nature reserve and enhancing its connection to the urban context. The objectives will include the countering of the ecological and historical resource decay by means of architectural intervention. The dissertation will study the in-between space of urban and nature as site for intervention due to the protected vegetation of nature reserves. Utilizing the resources[2] of the site and its surrounds as informants to design an architecture that can aid in the challenges as set out by the dissertation. The



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dissertation will furthermore aim to add to the architectural discussion of the relationship between man, nature and architecture while testing if a structuring of informants under form, function and technology can be synthesized to develop an architectural intervention. Other investigations will include the consideration of a consolidated resource structuring approach as protector of resources in natural and urban areas and the notion that architecture is more effective when the program is holistic and diverse.

Main Goal

- Structure an architecture in form, function and technology at the in-between of nature reserve and the surrounding urban environment that can enhance both realms. Nature reserve in conservation and urban surrounds in economic opportunity or development.

- Enrich importance of place significance of nature reserve in urban environment.

- Contribute to architecture in addressing the challenge of contextual conservation with an in-between relationship of nature and urban.

Objectives

- To conserve the ecological and historical significance of the WNR.

- To utilize the resources of site to enhance urban surrounds in attraction of interest.

- To add new facilities to WNR that hold meaning and relevance in the current context and paradigm.

4. Refer to Mallgrave & Contandriopoulos (2008).

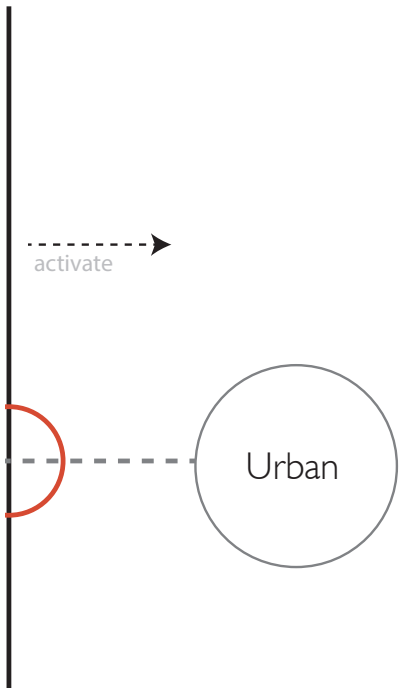

Fig_12 (Center): Diagramatic explenation of reseach questions (Author 2017).

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01_5 Locality

Context

The dissertation context is located within the municipality of the City of Tshwane, Gauteng, South Africa. The area of focus will be to the north of Pretoria CBD where the WNR Reserve is situated as part of the Magaliesberg mountain range. The investigation will focus on the surrounding urban environment of Wonderboom, Wonderboom South, Mayville, Mountain View and Florana as well as the the WNR and the Magaliesberg mountain range.

Site

The proposed site for intervention is situated at the south-western edge of the WNR where the reserve borders Lavender Road. The Apies River is situated to the west of the intended site and the WNR's existing entrance is to the east off Lavender Road.

South Africa

Gauteng

City of Tshwane

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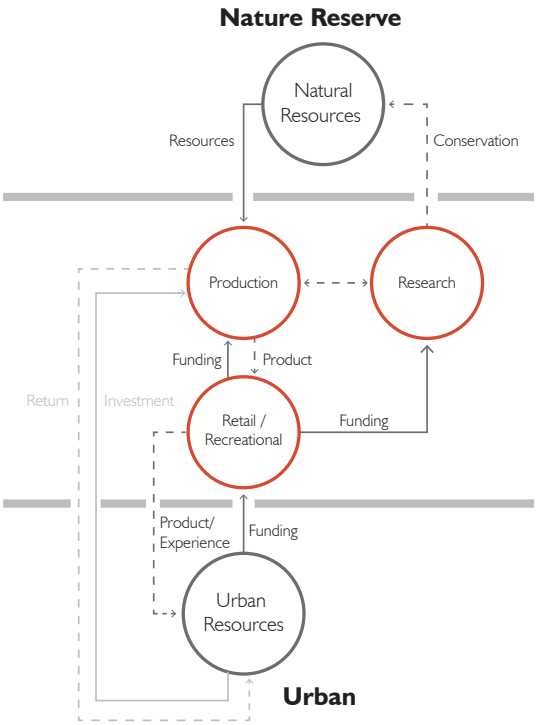
01_6 Program & Client

Program

The proposed program for the architectural intervention is a nature reserve conservation facility that can aid the reserve in revenue generation or other forms of conservation strategies.

Client

The proposed main client will be the City of Tshwane and South African National Parks (SAN Parks) as caretakers of the WNR and possible funders for the project. Other partnerships with private tenants and ecological conservation organizations, such as the Magaliesberg Biosphere & the Magaliesberg Protection Association will also be considered



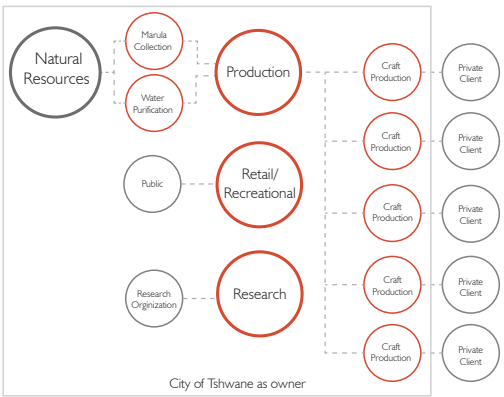


Fig _13 (Left Top): Locality of context for research proposal (Author 2017).
Fig _14 (Left Bottom): Locality of proposed site (Author 2017).
Fig _15 (Left Top): Diagramatic explenation of proposed program (Author 2017).
Fig _16 (Left Bottom): Diagramatic explenation of proposed clients (Author 2017).

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01_7 Research Methodology

Chapter 1: Introduction
Stating the context of the dissertation regarding the challenges and issues related to urban protected areas and WNR. Also, outlining the methodology to explain how this dissertation will go about to address these challenges within the continuum of architecture.

Chapter 2.1 Argument
Setting out the argument in terms of the challenges faced and how these challenges will be approached by means of architecture as contextual conservator. Explaining the nature of the landscape and how this poses an issue. Also, explaining the argument in terms of the continuum of architectural thinking. The argument will further be explained in terms of context, theory, function and precedent and will be considered as informants to the design. These informants together with the conceptual consideration will develop into the architecture.

Chapter 2.2 Informant - Context
Investigation into the urban context surrounding the WNR and the relationship to site. Documenting the urban challenges by means of mapping to identify the challenges that are faced by the site and related sites in the urban context of South Africa. Analysing, investigating and presenting an approach to the existing challenges associated with the urban environment in the form of an urban strategic vision. Presenting the urban strategy in context of the WNR as a conceptual representation of possible implementation.

Chapter 2.3 Informant - Theory
Architectural theories will be utilized in terms of literature reviews as bases for structuring function and form to address the challenges presented by the problem statement. This chapter will explain how architectural theories can be utilized to form the formal and functional considerations of the architecture as response to the dissertations problem statement and additional challenges presented.

Chapter 2.4 Informant – Program
The functional considerations as set out by the architectural theory will detail the extended program and functional requirements in terms of visual diagrams to create a brief for the architectural intervention. This chapter will be an extension of the functional requirements as set out in chapter 2.3.

Chapter 2.5 Informant - Precedent
Chapter 2.5 will investigate and analysing existing precedents in terms of form, design influence and function to formulate a deeper understanding of ways to achieve challenges presented. Precedents presented will give a broad view as introduction to the architecture achieved by the company or architect and focus will only be placed on elements of the buildings that relate to the investigation.

Chapter 3 Concept
All investigations, informants, studies and relationships will be incorporated into a design concept to inform the architectural design. The design concept will inform the design development considering all the informants as stated.

Chapter 4 Design Development
The design development chapter will show the process of developing the argument, informants and conceptual scenario into an architectural response to the challenges presented. Showcasing the designs development from conceptual stage to final design resolution. This chapter will categorize the design development into milestones that represents considerable changes in the design.

Chapter 5 Technology
The technology chapter will develop and demonstrate the design in terms of the technological aspects related to the response. Displaying the rational elements of the architectural design such as the materials, systems and structural elements. This chapter will show the architectural intervention in terms of the technical elements investigated.

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Chapter 6 Conclusion

The dissertation will be concluded in this chapter to summarize the problem statement and how the dissertation addressed these problems. Critically evaluating the outcome in terms of the successfulness of the study and the objectives/goals set out. Stipulating the possible improvements and or other studies that can be considered to improve on the study as presented.

Delimitations

- Due to the size of the WNR the architectural intervention will only be resolved for a segment of the protected area where a part of the reserve boundaries with the urban context.
- The urban masterplan for the WNR and the surrounding context will only be taken to a conceptual stage from where the specific selected site will be developed further.
- The intervention will not consider an in-depth investigation into the specific species of fauna and flora currently on site but will consider environmental and cultural studies previously done in this regard.

Limitations

- The investigation will not extend into the residential or commercial property boundaries due to the ownership and restricted access to these sites.
- The proposed site for intervention will only be on property owned by the City of Tshwane and where areas are shared between commercial owners and the municipality.

Assumptions

- The dissertation will consider the contour maps as provided by the Department of Geography at the University of Pretoria as the correct contours.

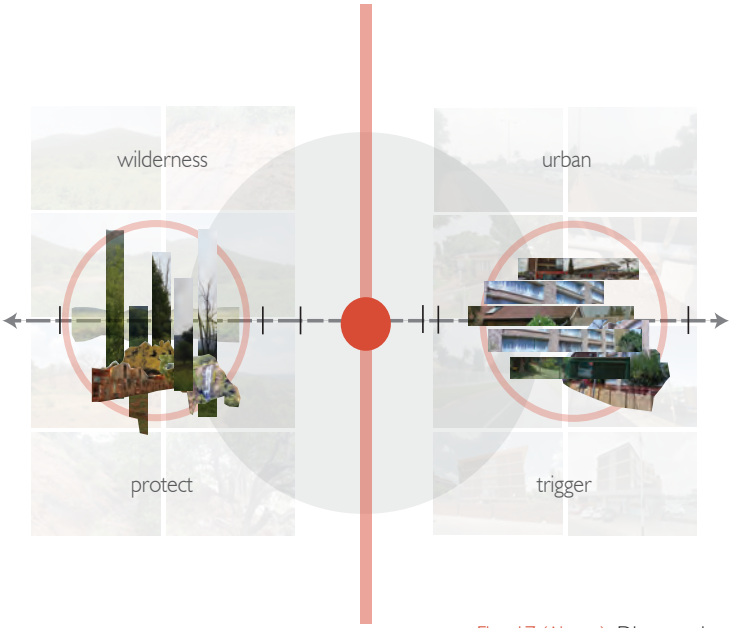

Fig _17 (Above): Diagramatic explenation of intention (Author 2017).

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02_I
ARGUMENT

"When patterns are broken, new world's emerge."
Tuli Kupferbergt

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02_1.1 Introduction

WNR as natural enclave in the north of the City of Tshwane holds multiple resources in need of some or other form of conservation. Historically the site was home to stone and iron age settlers, soldiers in one of the four built Anglo Boer war forts and many visitors to the botanically significant Wonderboom tree (City of Tshwane 2015). Currently the site serves as one of Pretoria's multiple nature reserves, areas protected against urban development, the destruction of protected fauna and flora and as recreational facility for the urban dweller that seeks the natural environment escape.

The introduction of nature conservation in South Africa, that only started late in the 1900s (Blom 2011:2) sparked nature reserve conservation research and funding from municipalities for this research by environmental organizations. This happened through admission fee control and municipal budget allocations as a result of extensive research done by the environmental organizations on nature reserves. In the current City of Tshwane municipality's deteriorating economic circumstances and recent economic downgrade due to high debt and low growth (Moody's Investors Sector 2017:1) the allocations have decreased and are only sufficient for routine maintenance. Conservation of these reserves are at risk of disappearing and with it the historical and ecological significance. The lack of financial allocations for these areas to fund environmental research organizations in conservation strategies have caused these natural environments into enclaves that are neglected in terms of their environmental and historical significance to the surrounding city. These neglected areas are overgrown with invasive species and hold concealed historical artefacts from public visitation. The WNR as part of the collective of nature reserves in the City of Tshwane is in need of ecological and historical conservation.

Conservation and architecture are not a new collaboration as architectural heritage conservation is an everyday matter of the architectural discipline. Thus, the historical conservation of artefacts can be addressed through architectural intervention by use of conservation strategies in architecture. Ecological

Fig _19 (Left): Wonderboom Nature Reserve and surrounds as focus area (Author 2017).

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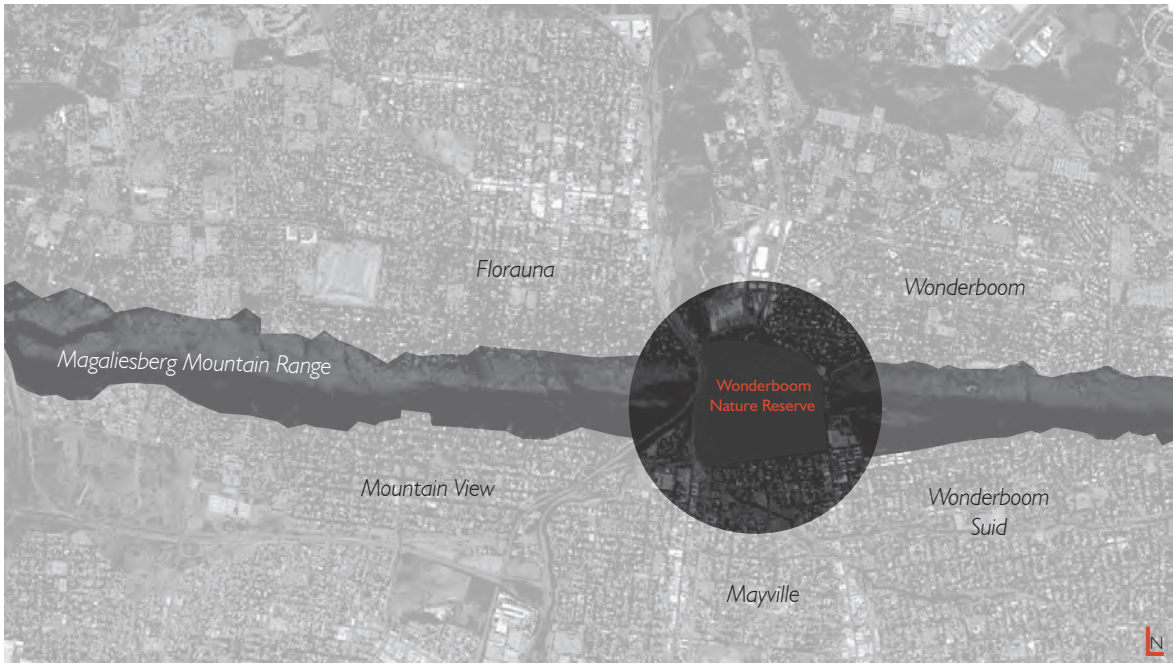
conservation on the other hand, and the idea that built form, space and technologies can contribute to the generation of capital for ecological conservation might be considered as a new collaboration. The conceptual combination of ecology and architecture are new and have only been considered by few architects such as Ken Yeang as described in Eco Architecture the work of Ken Yeang by Sara Hart (2011).

This project's argument will explore the possibility of a positive contribution that Architecture can make towards the conservation of these urban natural protected areas in terms of their ecology and historical artefacts, focusing on the WNR and surrounds (see fig 19).



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02_1.2 An approach to contextual conservation.

Urban protected areas are contextually situated in high density built up urban areas. They are natural areas that offer a break away in the form of an experience within nature, attract large numbers of people who live near them and are built on urban constituencies for nature conservation according to the IUCN (Trzyna2014: xi). The IUCN states that they are distinctive due to the number of ethnically and economically diverse people that they attract, their multi-influential governing structures and are subjected to urban scenarios that more remote protected areas never encounter (Trzyna 2014: xi). Conservation of these natural enclaves and their significance is a distinctive scenario that these areas encounter.

Conservation in the broader sense of understanding consists of the active protection and management of physical objects curated by man. The dictionary (Dictionary.com 2017) defines conservation as the "official supervision of rivers, forests, and other natural resources in order to preserve and protect them through prudent management." Context on the other hand refers to the circumstances that form the environment for the object in which it can be fully understood and related too. It refers to and explains the natural setting where the physical object finds itself. The notion of contextual conservation combines the physical context, its resources, setting and influences as the natural, with the action of conservation in terms of management and preservation as the man-made influence. In the argument these two approaches conceptually meet in the in-between of nature and urban to contextually conserve the natural urban protected area, building on the relationship between man and nature and the partnership that exists between these two approaches within the discipline of art and architecture.

Throughout his existence man has always been in partnership with nature. This partnership is represented in many forms of art, historically and contemporary. Nunzio Paci[5] personally represents this relationship best with his work on the connectedness that exists between man and nature (Designworld 2015) (fig 20 & 21). He approaches his artwork with the notion that nature is so connected with man, that it forms the physical human (Paci 2017). The notion of contextual conservation that is conceptualized as a relationship between nature and man, builds on the Paci's idea of connectedness between man and nature to form architecture.

Within the field of architecture, designers and builders have for many years looked to nature for inspiration. The first depictions of nature as inspiration for art and architecture can be seen in Marc-Antoine Laugier's illustration of 'Essai sur l'Architecture'. Laugier explained: "such is the course of simple nature: by imitating the natural process, art was born" (cited in Hvattum, 2004:31). This imitation that is captured to form art, illustrates the first connection between man and nature. Many designers and architectural theorists throughout history have built on this notion of relationship between man and nature and how architecture as the built form, fits and forms part of the idea.

More recently, two contemporary architectural theorists have published work on this notion. Norman Crowe and William Cronon are two architectural theoretical thinkers in this regard, although viewing the relationship from two different approaches.
Norman Crowe (1995) argues that the built environment is a form of nature and explains the "idea of the man-made" founded its routes in a historical relationship between man and nature. He states that nature is present in all man-made elements and even though we approach the built form from different angles, nature still presents itself (Crowe 1995:3-27). He further states that the relationship between man and nature is historically bonded by the harmony that exists between them and that architecture should continue to build on and not disturb this harmony.

William Cronon (1995) reassesses the environmentalist's agenda. He states in his writings that the idea to protect "pristine nature" is flawed. He argues

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that humans need not be removed from nature to protect it, as we are a part of it and the removal of humans won't keep nature intact. He continues to argue that humans have not yet learned to live responsibly in nature and that this is where the problem lies. "How can we take the positive values we associate with wilderness and bring them closer to home?" (Cronon 1995: 69-90)

Both these theorists regard the relationship between man and nature as a continuous process and that without the interaction none can survive. Building on these theoretical approaches, the notion of contextual conservation finds its roots in the intervention of man in nature to ultimately conserve.

Contextual conservation focuses on the relationship between the two forces of man and nature and how they can aid, in harmony, each other to form an architecture that defines space for management and preservation. Urban protected areas as the focal point between nature and man within urban environments are the ideal locations to implement and test this notion as they are confronted with problematic influences that other more rural natural protected areas are not confronted with.

5. Contemporary Italian artist – Work viewable at http://www.nunziopaci.it/

Fig _20 (Top): Nunzio Paci painting (Designwrld, 2015).
Fig _21 (Bottom): Nunzio Paci representation of man and the connection to nature (Designwrld, 2015).

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02_1.3 The less-defined landscapes of the City of Tshwane.

The City of Tshwane in the northern part of the Gauteng province contains multiple and differing landscapes. The city's array of landscapes includes parks – formal and other, gardens – national government owned and botanical and reserves.
City parks, such as Burgers Park and Springbok Park are considered as formal, generally designed landscapes that represent a certain period in the city's history and were commissioned by the city council. Parks such as Zita Park and Jan Cilliers Park are considered as other (not formal) that are more suburban of nature and are used by suburban residents. These parks are also maintained by City Parks services but were not necessarily designed or commissioned for an occasion, ceremony or commorancy but rather a result of suburban town planning.

Public gardens on the other hand, are used by a larger group of people and are mostly commissioned by national or provincial structures. Within the City of Tshwane, the Union Buildings Gardens are legislative of nature and a result of state office and the landscape associated with it. The city's botanical gardens hold interest for research and specific plant life of the areas. These gardens are more informal in relation to legislative gardens but are more significant in terms of plant life and the study of plant species for the specific climate and in protected plant enclaves.

The distinct purposely designed areas and uses of these landscapes define them. Nature reserves, also part of the diverse landscapes of the City of Tshwane, do not fall into one of the above categories. They are distinctive due to their variation of functions and scales. They also hold historical and ecological significance that are different to the above-mentioned landscapes and typically contain more natural growth and wilderness landscapes. Due to their wilderness[6] condition, they are less defined[7] than parks or gardens. Their less defined nature poses a threat as they are considered to be left to fend for themselves. This self-fending nature of wilderness is optimal in natural areas outside urban environments but due to the external influences of

6. Wild natural growth, not contained or maintained.
7. *Little to no man made interventions to define landscape. Less-defined than other natural areas due to the wilderness nature of the landscape.*

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urban development on inner city natural landscapes, the self-fend option is not viable for urban nature reserves.

The UN world cities report (UN-Habitat 2016; 6) proves that urban development is escalating and it can be seen at nature reserves as the urban development influences on nature reserves are escalating. In recent years the City of Tshwane have made strides to keep the negative urban influences on natural areas at bay by installing fences around nature reserves and natural areas. The actions of the municipality, although little are appreciated but the intervention of fences holds more disadvantages than advantages for nature. With fences nature are not allowed to migrate or source the needed resources from other areas to survive the deterioration form urban influences. The fence is the element that creates the enclave that falls into self-decay. If the edge/fence of nature reserves are approached differently and developed to aid both environments this deterioration will be an issue of the past.

These fences cause a lack of interaction between different natural realms that normally adapt to the urban condition to keep the present ecosystems in balance. The fence also prevents nature from gaining the needed resources, such as migrating fauna and the advantages they bring from other natural enclaves. Due to this disconnectedness, loss of biodiversity becomes evident in nature reserves and they are burdened with destroyed ecosystem balances and an overload of invasive plant species. This imbalance in natural ecosystems, forces nature into forced adaptation without the needed resources from other natural environment or aid from environmental organization management to rehabilitate. The effects are clear, as nature reserves no longer hold preserved vegetation. Dr. Dianne Spear[8] states that the biggest threat to nature is the way we as human beings live our lives. She continues to state that nature that has direct human interaction or influences are limited to appropriate adaptation without human intervention. (Spear 2017). With the lack of intervention by environmental organizations to aid the ecosystems to adapt to urban influences, these natural enclaves are at risk of losing their indigenous vegetation they are known for and becoming destroyed lost landscapes.

Mr Ernst Wohlitz (2017), director of nature conservation at the City of Tshwane explains that nature reserves, according to the city's legislation, is supposed to have a buffer zone that prevents urban development to impact these areas, but with further investigation it was found that these do not exist or that the city considers any infrastructure, that is technically urban development to be a buffer zone. Nature reserves furthermore hold historical cultural artefacts that are sometimes protected by relevant sections within the city's or country's legislation. Where these artefacts are used for tourism and/or recreational functions to fund management and upkeep, the natural environment have proven to be in a better state. Unfortunately, due to the number of historically significant sites within the city, not all are protected by city organizations in this manner. Historically significant sites, such as Fort Klapperkop and Fort Schanskop have proven to be more interactive with the urban environment and the interaction has caused a better relationship between the two. Fort Wonderboom, within the WNR, has not seen this interactive spirit and the degeneration in relation to the other two mentioned can be seen within the reserve.

This natural decline within the WNR presents the opportunity to define this landscape by the resources on site and make this reserve also protected within current management structures, putting conservation in the hands of the reserve and not relying on municipal management to keep the reserve's ecological and historical significance intact.

8. UCT, African Climate and Development Infinitive (ACDI) research fellow:
Designation: Collaborative Adaptation Research in Africa and Asia (CARIAA) and Adaptation at Scale in Semi-Arid Regions (ASSAR). Expertise: Climate Change Adaptation, Invasion Biology, Biodiversity, Conservation, Biogeography.

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02_2
INFORMANT - CONTEXT

"Architecture is not a private affair; even a house must serve a whole family and its friends, and most buildings are used by everybody, people of all walks of life. If a building is to meet the needs of all the people, the architect must look for some common ground of understanding and experience."

John Portman in Architectural Digest

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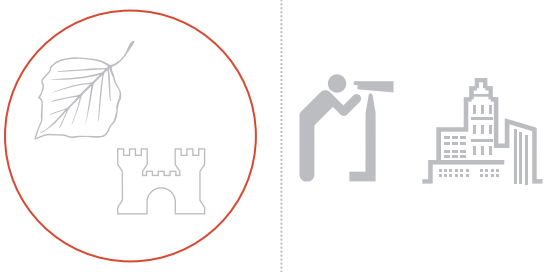
02_2.1 The context – Introduction to the Wonderboom Nature Reserve

The WNR is situated to the north of Pretoria CBD and forms part of the Magaliesberg mountain range. The reserve occupies roughly 200ha of mostly ridge topography and has many cultural ties with the history of the City (City of Tshwane 2015). The WNR is most recognized for its Wonderboom tree and the recreational spaces provided for urban dwellers of the Pretoria North residential areas. The WNR is mostly visited over weekends for a traditional South African family braai or family gathering. It is also home to one of the four Anglo-Boer war forts, the forgotten stone age shelter cave, protected eco-systems, a part of the Apies River and relicts of iron age shelters.

The Magaliesberg mountain range, considered to be among the oldest mountain formations known to man (Magaliesberg 2008), plays a significant role in the historical uses of the site. The mountain stretches approximately 120km from the Bronkhorstspruit Dam in the East to Rustenburg in the West. The mountain acts as destination for enthusiastic mountain climbers and a large part of the mountain forms the backdrop of the Pretoria city centre. The WNR, as part of the mountain, is demarcated in the centre of the mountain range. Cut off by a Kloof formed by the Apies River in the west and a vehicular road to the east, the site is entered from the North, adjacent to a recently completed retail centre.

The kloof to the west not only carries the Apies River in its basin but also a high traffic road and a passenger railway. Both infrastructural additions were based on historical routes running through the kloof to the North of the city. At the cliffs of the kloof, the forgotten stone age cave is hidden behind a man made, non-operational waterfall commemorating the 50th anniversary of South Africa becoming a Union in 1910. It is speculated that the cave was once home to settlers of the stone age (Blom 2012:20-22). According to archaeological records, artefacts dated to 2 million years ago were found at the Wonderboom early stone age site (Van Vollenhoven 2008:13). This research site covers approximately 650 m^2 around the Wonderboom



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area (Blom 2012:20-22). According to Anton van Vollenhoven (2008:13) the natural context of the reserve would have been an ideal hunting and settling area for the early Stone Age civilizations. Tools found by prof. Revel Mason in 1955 proved this as he stated that the kind of tools discovered had many similarities to tools made at Sterkfontein about 1 million years before. Speculating that this part of the mountain was also used for manufacturing of stone age utensils (Carruthers 2000:214-216).

On the southern slope of the mountain lies another ancient archaeological finding. This is estimated to be have been built in the 1600s and are Middle to Late Iron Age rock formations. Several of these line the top part of the Reserve. Carruthers explains that these formations and artefacts found in the area were from a cultural civilization that Van der Ryst & Meyer (1999: 96-98) explains as Late Iron Age, between 1000 and 1800 AD. Unlike the settlers from early Iron Age cultures, Middle to Late Iron Age settlers tended to settle on the top part of mountains. Carruthers explains this change in settling to a higher need for militaristic protection and better security (Carruthers 2000:224). Even though the stone formations could also have been from later Tshwane tribe cattle herders, the Late Iron Age artefacts found in the area make the possibility viable.

The WNR also hosts one of the only four built Anglo-Boer war forts. The forts were commissioned and constructed during the second Anglo-Boer war by the Government of the ZAR as a direct response to the Jameson Raid and the documentation found on a British spy, Captain Robert White, during this time (Van Vollenhoven, 1998: 51). Even though the forts were never tested in battle the history of fortification of the capital as a response to possible threats forms a significant role in the military history of South Africa.

The rich history of shelter and protection present at the WNR makes this site significant in the relationship it has with the urban environment that surrounds it. The theme of nature as context and history as man in relationship with one another is evident on the site. Contradicting this relationship in the historical timeline is the lack of interaction between these two forces today. The reserve, rich in history and significance is deteriorating due to no continuous interaction.

Fig _23 (Left): General Issue Diagram - Problem Statement (Author, 2017).

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02_2.2 An analysis of site.

An investigation into the site and research focus area was conducted between January and March 2017. The process consisted of two students evaluating the site and conditions first hand from a series of visits. Visual and analytical site documentations were gathered and discussed in terms of spatial and problematic influences to present possible architectural solutions. The discussions highlighted the following problematic considerations:

- Firstly, the site was completely isolated. Three main roads to the North, East and West cut off all free flow pedestrian access to the site. A smaller residential boundary on the southern edge made pedestrian access viable but the reserve's fence prevented pedestrian access. Only one entrance of the three visible entrances was accessible on the Northern edge. This entrance was mainly for vehicular traffic and designed with the motorcar in mind. The service entrance on the eastern fence is not accessible due to heavy traffic and placement of the entrance on the top of the hill. The third entrance in the quiet residential area on the southern edge was completely overgrown and rarely if ever used. No traces of a pedestrian entrance were found.
- The recreational activity spots were concentrated to one corner on the north-eastern edge of the site, with staff housing around the focus area of the Wonderboom tree. Signage of the history of the site was present around the tree and a good explanation of the site was obtained. A small hidden path thought thick growth at the base of the hill, just behind the info signage, made a hike possible to the old fort and the cave. Little signage was visible along the route and no focus points for the multiple view points over the city and northern suburbs were present.
- Invasive plant species were visible along the route and tree suffocation by invasive species were observed. Some parts along the route had paved rock paths alongside sheer cliffs that opened the tree canopy for city views. The southern ridges' plant growth was completely different from the north and traces of invasive plants were found here too. At the base of the southern edge, next to a water stream, a herd of Impala had made their home. This was not surprising as no designated pedestrian paths went down the mountain on the southern side.

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- The fort is in ruin and vandals have taken the opportunity to scratch their names next to the names of soldiers of the Anglo-Boer war into the rock to remember the occasion of their hikes. The site is deserted and feels like a destroyed urban playground in the middle of nowhere. The history of place wants to shout out it existence, but the desertedness keeps it at bay. Just west of the fort a few informal dwellers have occupied the old cell phone tower shelter and made it their temporary home. The cell phone tower is no longer in use but the beacon on top of the hill still exists. Just to the north of the fort and cell phone tower, in the dense overgrown hill cover, the historical rock formations present themselves, forgotten and disguised in the greenery of the hill. A further hike down the Northern hill presented the lonely path to the dysfunctional waterfall. At the edge of the fall, access to the cave is now prevented by a palisade fence.
- Around the main entrance on Lavender Road, another problem became evident as no form of drinking water provision was present. After a hike, a single tap in the middle of the grass field was considered as the only source of drinking water. The sense of isolation on the site became more evident and a good understanding of lack of interaction was gathered. It became evident that this lack of public amenities was the main problem that the site faced. After some discussion of the experience by the author and fellow colleagues, it was concluded that, on an urban scale, the site needed an approach that related to the main objective of interaction. Within the main objective of urban interaction, an urban strategic vision was formulated that considers access, edge, connections and facilities as the main issues to address.

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The following section visually demonstrates the investigation done of the context to formulate the urban strategic vision. Firstly, it showcases the mapping, analysis and investigations done of the existing site and surrounds. It builds on this investigation and demonstrates the urban strategic vision in relations to the context and investigations. These conceptual diagrams are taken further to strengthen the choice of site. After the final choice of site is shown, the Urban Strategic Vision is applied to the micro site to formulate a proposed starting point for the intervention.

Where applicable the visual diagrams elaborate on the text to further explain the considerations and actions of the investigation done. This section is mainly image driven and must be seen in conjunction with the contribution article and the informants as stipulated and explained.

Fig _24 (Left): Historical Timeline of Wonderboom Nature Reserve (Author 2017).

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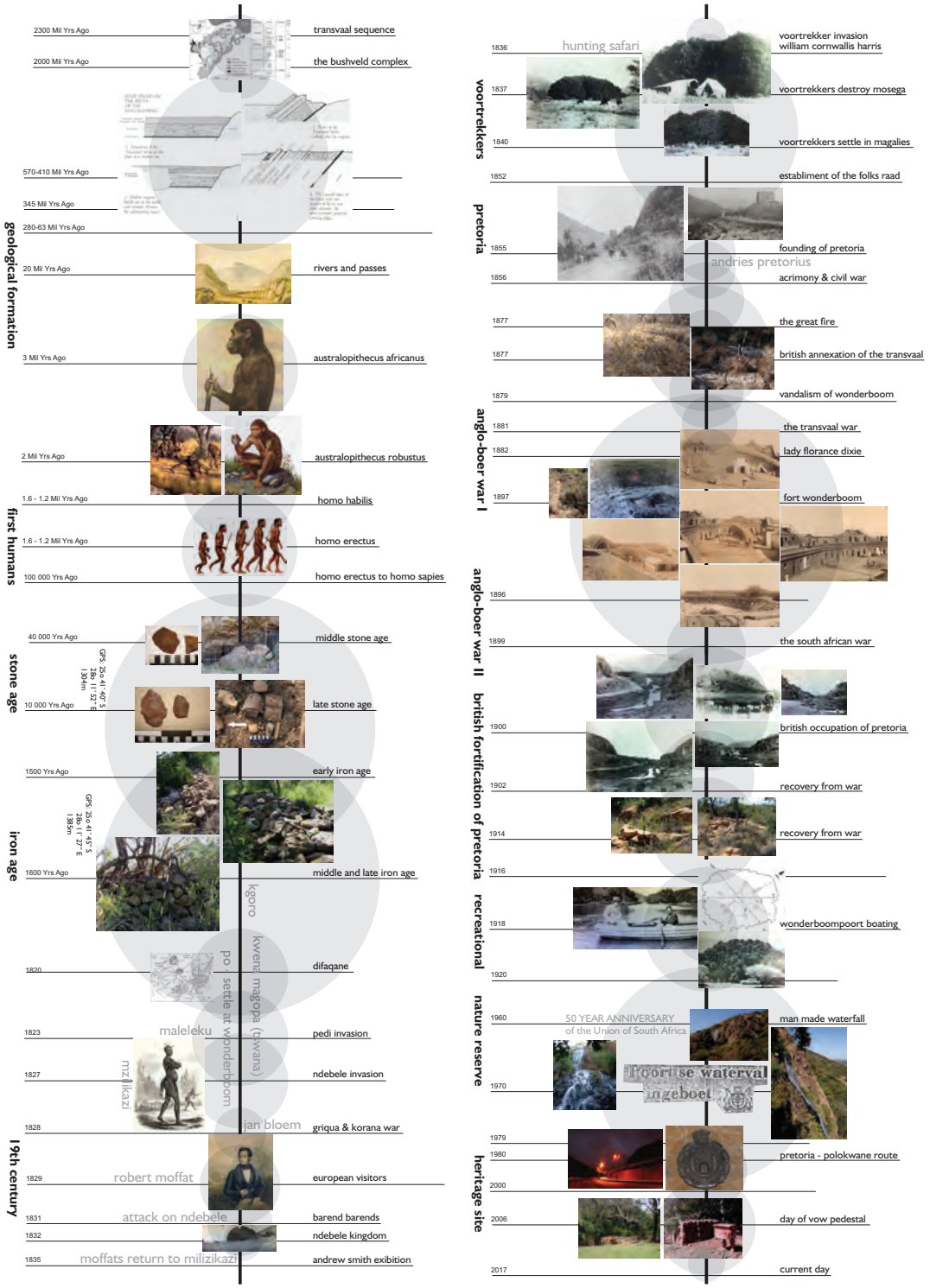

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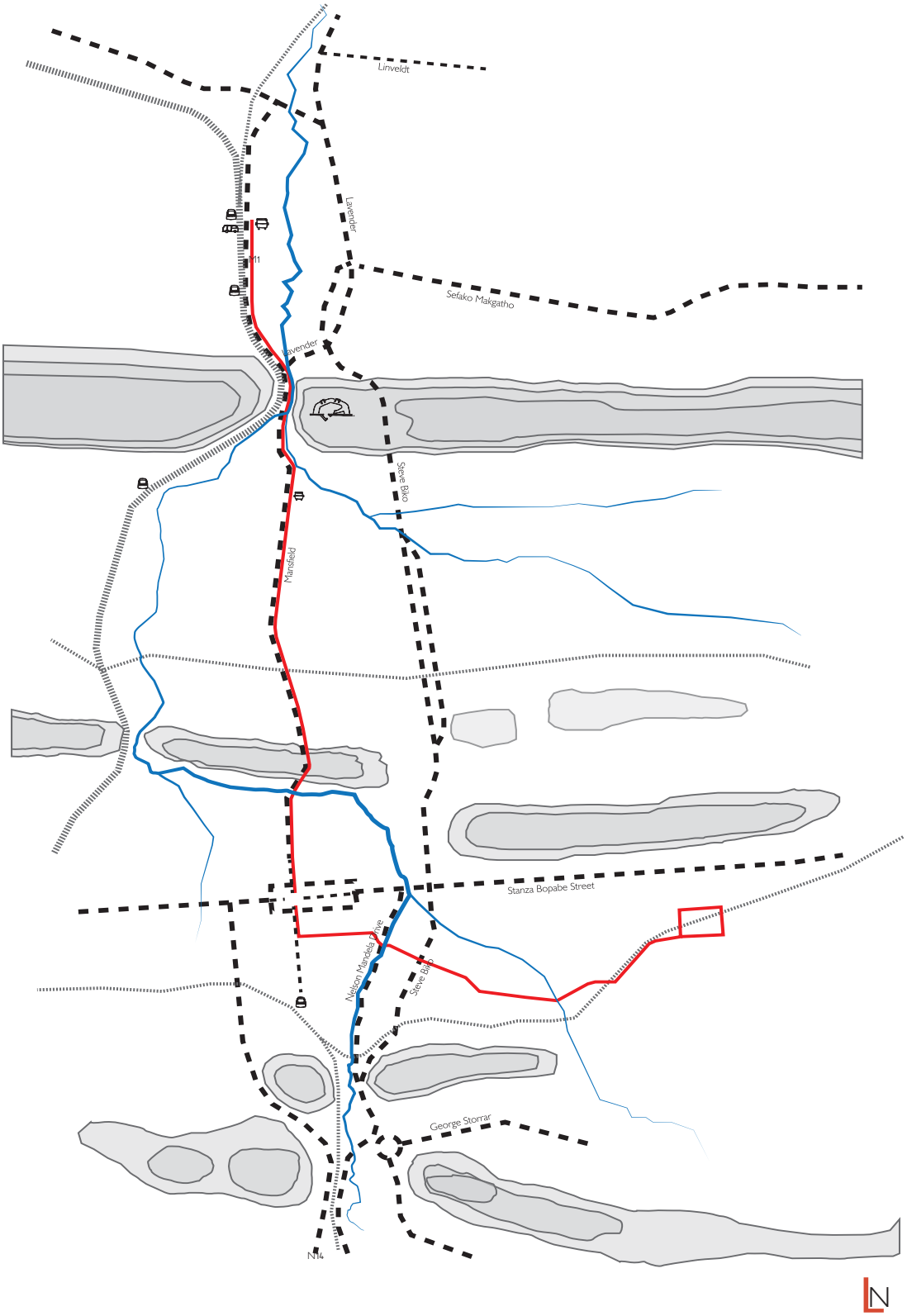

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Fig _25 (Left): Macro Investigation: Ridges and Access Routes (Author 2017).
Fig _26 (Top): Micro Investigation: Site and Access Routes (Author 2017).

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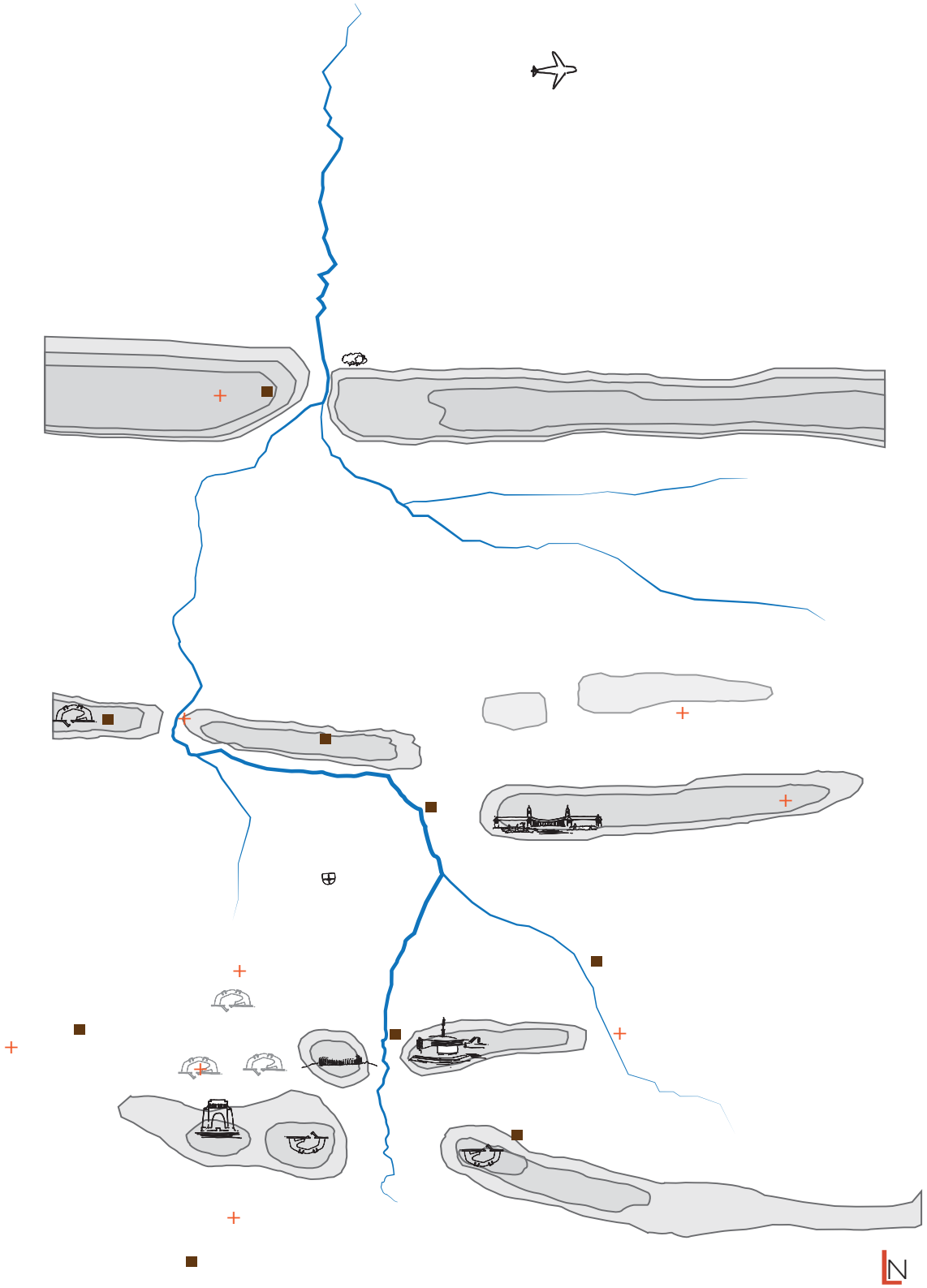

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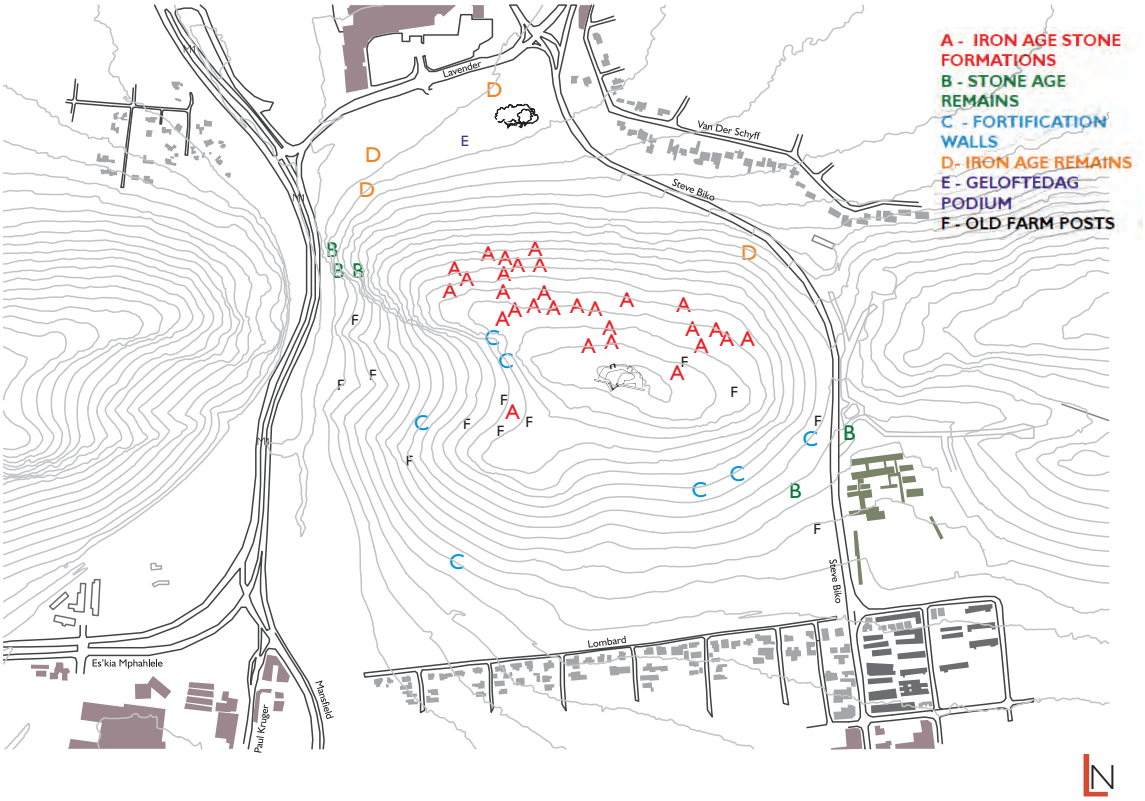

Fig _27 (Left): Macro Investigation: Ridges and Landmarks (Author 2017).
Fig _28 (Top): Micro Investigation: Site and Landmarks (Author 2017).

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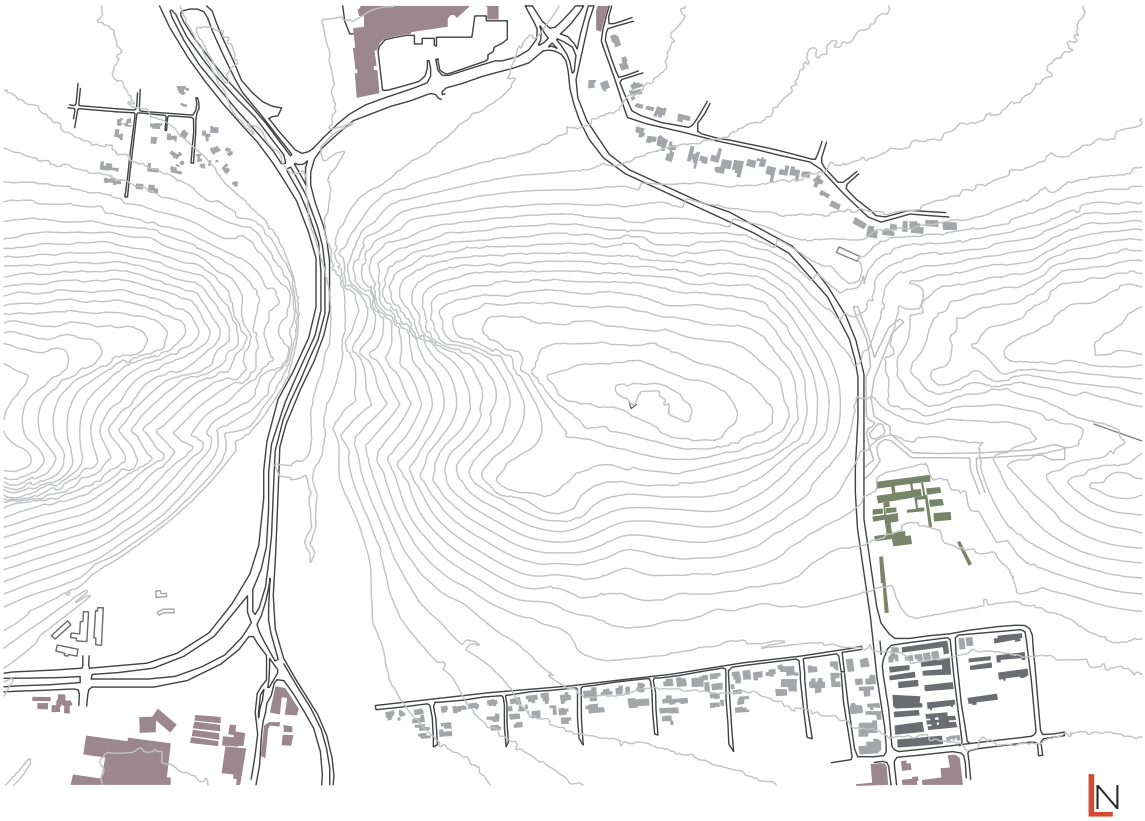

Fig _29 (Left): Macro Investigation: Build in relation to unbuild urban landscape (Author 2017).
Fig _30 (Top): Micro Investigation: Density surrounding site (Author 2017).

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Fig _31 (Left): Macro Investigation: High Density Urban in relation to the Natural Magaliesberg Mountain (Author 2017).
Fig _32 (Top): Micro Investigation: Nature Reserves in relation to the greater Tshwane Region (Author 2017).

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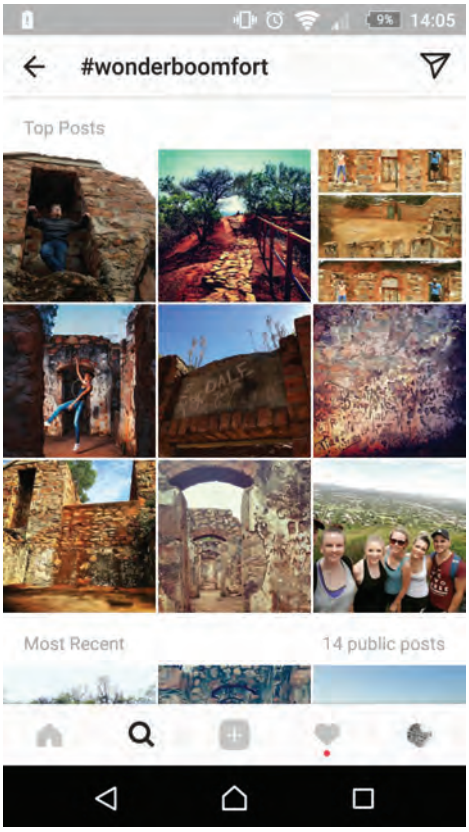
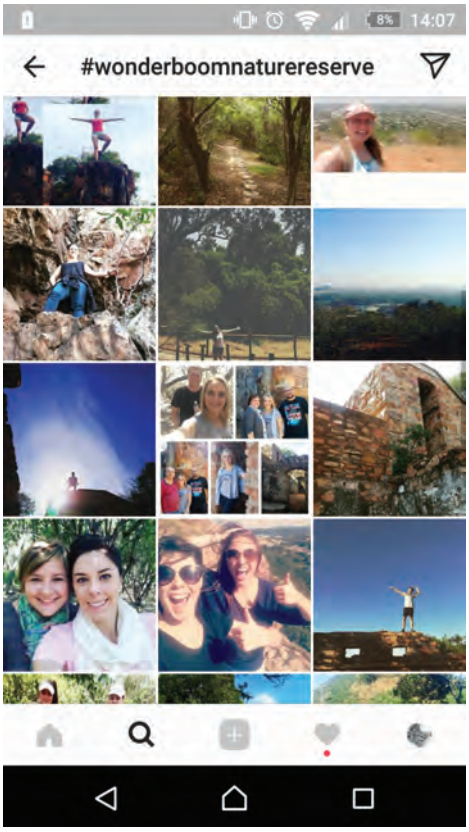
Social media tracking as mean for investigation is a rather new concept. The investigation considers this aspect in terms of visitor review by means of social media's hashtag tracking. This enabled the investigator to a general visitor feedback and the reaction visitors have when visiting the site. Three main platforms (Instagram, Facebook & Google Review) were utilized to gather information on the visitor's experience.

Fig _33 & 34 (Bottom): Instagram Investigation: #WonderboomFort #WonderboomNature Reserve (Krieger & Systroom 2010).
Fig _35 (Top Right): Google Investigation: Search - Wonderboom Nature Reserve (Author 2017).
Fig _36 (Bottom Right): Facebook Investigation: Search - Wonderboom Nature Reserve (Zuckerberg, Moskovitz, Saverin, McCollum & Hughes 2004).





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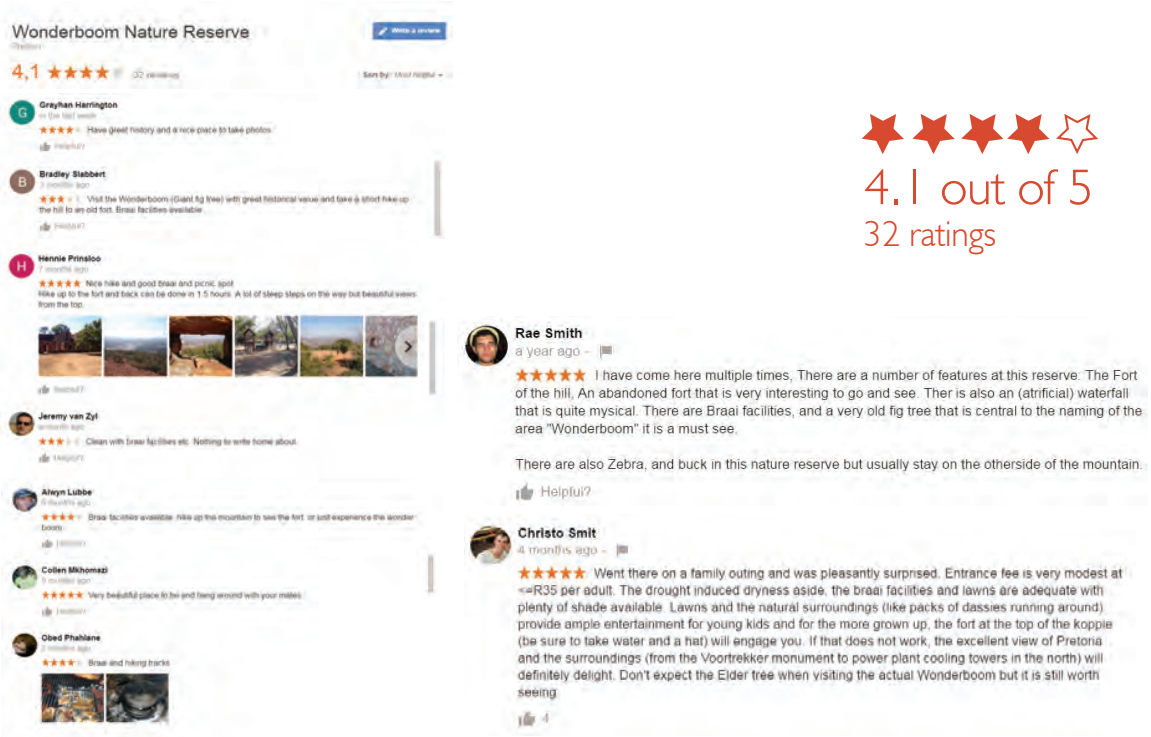
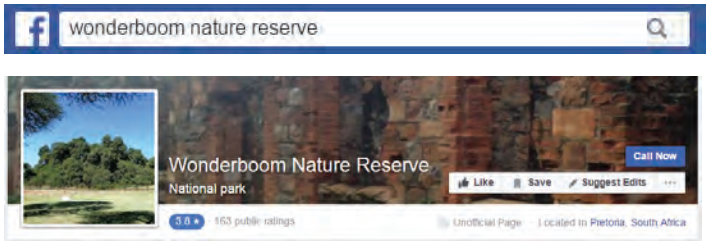
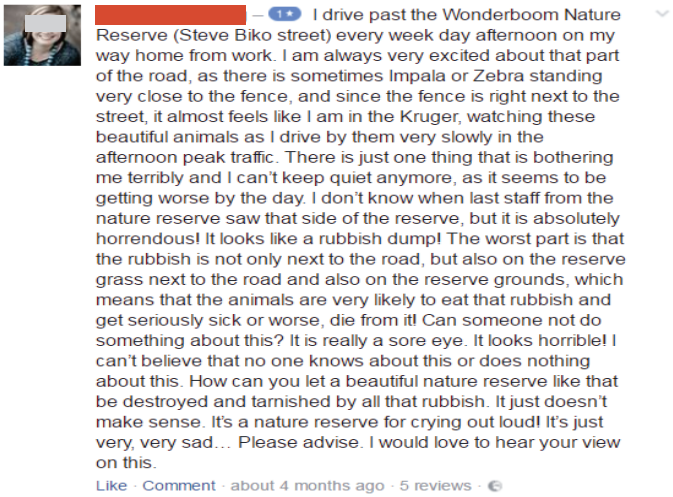
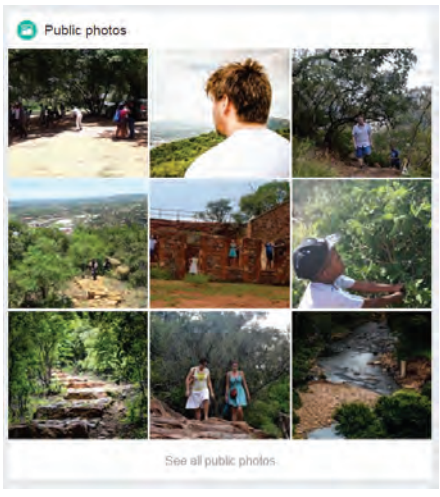


4.1 out of 5
32 ratings



3.8 out of 5
163 ratings


[redacted] – 1 I drive past the Wonderboom Nature Reserve (Steve Biko street) every week day afternoon on my way home from work. I am always very excited about that part of the road, as there is sometimes Impala or Zebra standing very close to the fence, and since the fence is right next to the street, it almost feels like I am in the Kruger, watching these beautiful animals as I drive by them very slowly in the afternoon peak traffic. There is just one thing that is bothering me terribly and I can't keep quiet anymore, as it seems to be getting worse by the day. I don't know when last staff from the nature reserve saw that side of the reserve, but it is absolutely horrendous! It looks like a rubbish dump! The worst part is that the rubbish is not only next to the road, but also on the reserve grass next to the road and also on the reserve grounds, which means that the animals are very likely to eat that rubbish and get seriously sick or worse, die from it! Can someone not do something about this? It is really a sore eye. It looks horrible! I can't believe that no one knows about this or does nothing about this. How can you let a beautiful nature reserve like that be destroyed and tarnished by all that rubbish. It just doesn't make sense. It's a nature reserve for crying out loud! It's just very, very sad… Please advise. I would love to hear your view on this.
Like · Comment · about 4 months ago · 5 reviews ·



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02_2.3 Urban Strategic Vision (USV)

The urban strategic vision is developed from an understanding and deliberation of the analytical investigations done. The vision addresses the less-defined landscape challenges and sets out a hypothesis that can be implemented and tested by means of a general strategic vision approach. The urban strategic vision hypothesis states that architecture is proposed as a frame of reference in the landscape to create and improve awareness of urban wilderness areas to ultimately conserve and emphasize the uniqueness of these places. The implementation and test strategy for the hypothesis considers a general, simplistic approach of balance of development and protection between urban and wilderness that is extended to detail by four sub-categories; Access, Edge, Connections and Facilities (fig 37).

Fig _37 (Right): Urban Strategic Vision Approach (Author, 2017).

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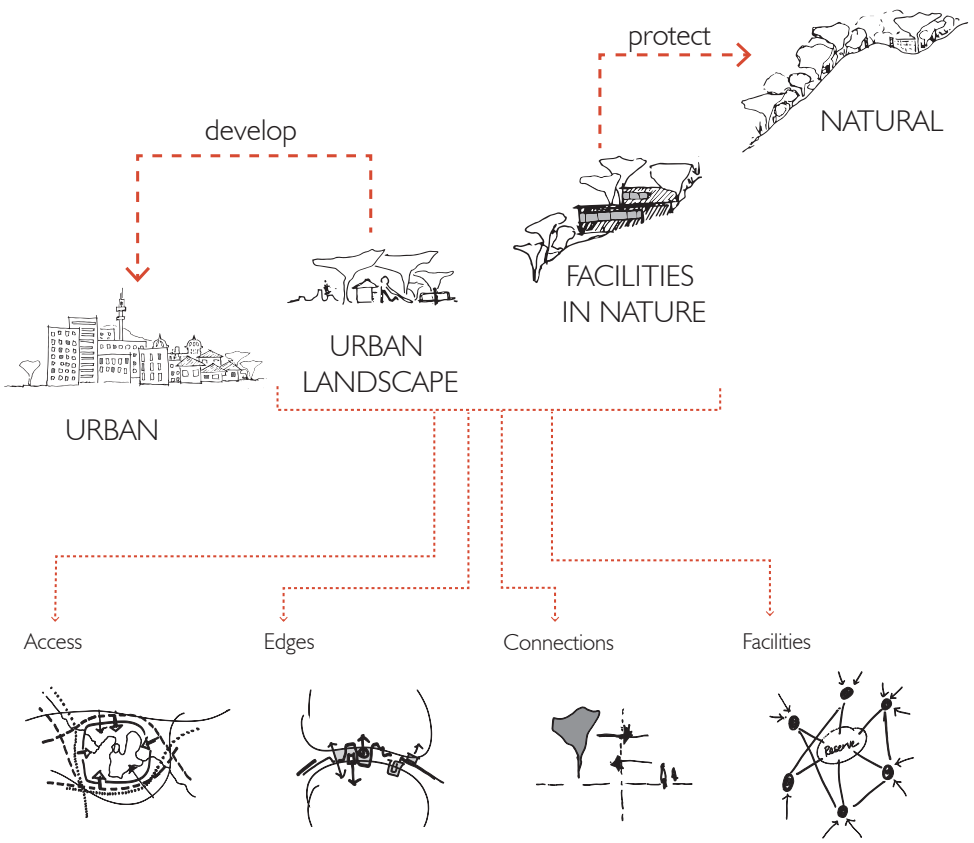

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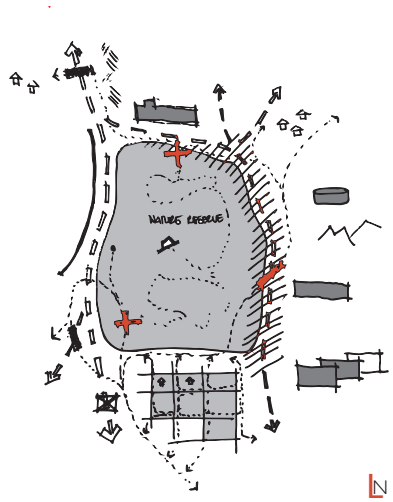
Access, the first strategy sub-category, considers the main approaches to and from the site and how these routes need to be developed for optimal site awareness. Ted Trzyna (2014) co-founder of the IUCN urban specialist group and president of the InterEnvironment Institute at the University in California states that access is a global problematic issue to be addressed when it comes to Urban Protected Areas. He suggests that direct public transport needs encouraging and the supply of well-mapped routes that makes provision for bicycles and pedestrians also needs attention. The access sub-category, as focus subject, initiated from problematic questions raised in the analytical investigation discussion. How do architects improve the existing circulation paths and extend existing access routes to draw more feet into the reserve? In the discussions, more feet into the reserve was an efficient architectural approach to address awareness and enhance interaction between nature and urban. The proposed implementation to address the approach of more feet was set out as a principal implementation strategy to achieve smaller focus aims. The following principles regarding access are proposed within the urban strategic vision:

- Focus on alternative modes of transport for example bus, train, cyclists and mainly pedestrians.
- Slow down routes surrounding the site to facilitate interaction with and visibility of activities along route.
- Increase access points - physical access points, but also visual access for awareness.
- Use architecture as way-finding tool to draw attention as beacons for pedestrians/cyclist in the landscape.

Secondly the urban strategic vision studies the edge conditions. What would the best edge condition for the site be and what must be done to achieve these edge conditions? The analytical investigation discussion suggested that the edges of the nature reserve needed to be addressed as they have become physical barriers keeping interaction to the site to a single point. The edges of the reserve were also considered as a favourable area to intervene between nature and urban as it is situated directly between the two environments. The urban strategic vison sets out the following principles to be implemented



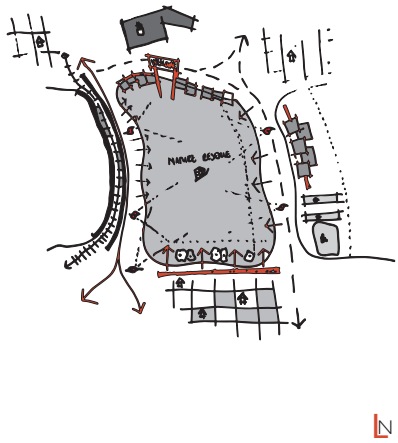


Fig _38 (Top Left): Access conceptually implementated at Wonderboom Nature Reserve (Author 2017).
Fig _39 (Bottom Left): Edges conceptually implementated at Wonderboom Nature Reserve (Author 2017).

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to achieve the goals set out:
- Overall: Improve visual access and awareness of the site.
- Define boundaries/buffer zones and celebrate entrances on high traffic routes.
- 'Lend' natural environments to residential/quiet areas by recessing boundaries into the reserve and facilitating visual access to nature.
- Programs on the site's edges should serve both natural area and urban area and consist of diversified programs.

Thirdly the strategy considers the connections between nature and urban. This subject as sub-category was developed as a result of the edge conditions approach and focuses on the extended relationship between nature and urban. It questions how the urban strategic vision can improve these connections to define the landscape and create points of interaction between nature and urban. "Our connection with the environment is our first level of experience, and one of the most important" (Shankar 2011). The urban strategic vision approaches connections with the following principles:
- Bring people to nature and nature to people.
- Rehabilitate urban green areas as recreational facilities that increase the value of surrounding neighbourhoods.
- Create a network of green spaces that facilitate movement.
- Create new roads to increase passive surveillance of these green areas.
- Adapt building / site interfaces towards the natural areas to increasing passive surveillance.

Lastly the urban strategic vision sets out possible facility provisioning to guide future interventions in their program. These facility considerations are to ultimately complete the strategic vision and prove the hypothesis in its objective to become a frame of reference and protect the landscape. The sub-category facilities, become the bridge between the urban strategic vision and the future possibilities for intervention on the site. It considers questions relating to where and what functional form architecture can start to have to achieve the objective frame of reference in the landscape. Although this sub-category does not physically spell out the programs,

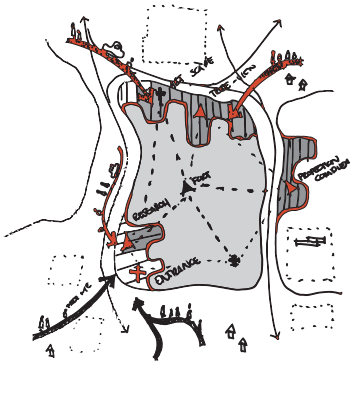

Fig _40 (Top Right): Connections conceptually implementated at Wonderboom Nature Reserve (Author 2017).
Fig _41 (Bottom Right): Facilities conceptually implementated at Wonderboom Nature Reserve (Author 2017).

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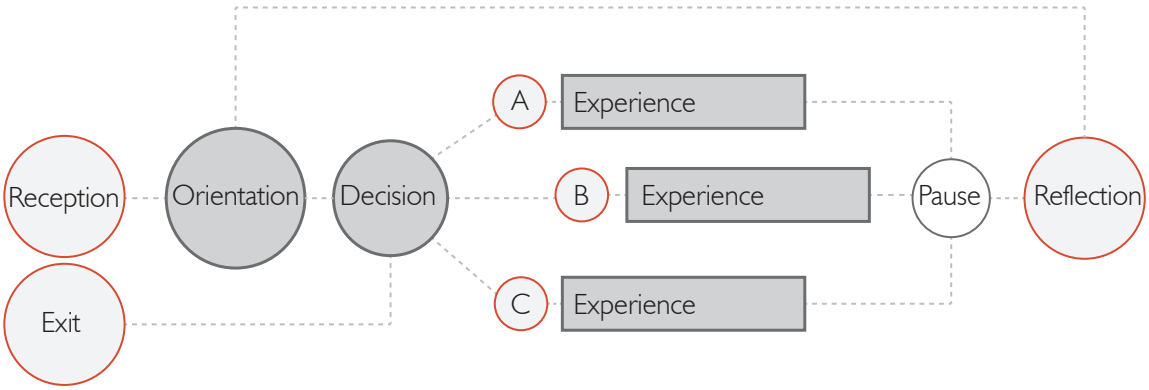
it generally states the starting point that programs need to address. The following principles are proposed under the facilities sub-category:

- Introduce innovative programs that make the site a daily destination (work) as well as weekend destination (recreational) and provide for a variety of users.
- Promote urban natural spaces for what they are worth – easily accessible, important recreational natural space for urban inhabitants (including lower class)
- Facilities and programs should be mixed-use, attracting a variety of stakeholders and users to the site.

The principles as set out under the four sub-categories are practical implementation considerations. With further debate between colleagues on the urban strategic vision it was found that the vision needs to address an additional side to the practical/physical. The sub-conscious or emotional understanding of space was proposed as additional consideration which was based on the idea of an ideal space flow, a unique way in which to address an urban vision regarding the sub-conscious and the understanding of the human decision-making process.

A second layer was developed and added to the urban strategic vision. This layer can be described as the ideal space flow diagram (fig 42). The concept of ideal space flow is formed from the idea that architecture can be developed from understanding the experience gained through space. "Architecture has meaning, and matters to us only when it is experienced, when all other senses are simultaneously engaged in its inhibition, and when it provides the setting in which the acts and rituals of daily life take place" (McCarter & Pallasmaa 2012:5). The urban strategic vision takes this approach to architecture and develops a model as diagrammatic representation of the ideal experience space flow for the context.

The model is developed as the ideal, how the architect intends the user to utilize the space. Predicting the path, the user will take and the spaces needed along that path. Understanding how the user will enter, make a decision and then experience the space of the function provided. After the user has been subjected to the experience or have experienced the space, the user is paused and placed into a space to reflect on the experience gained. This mentally builds an image in the mind that is remem-



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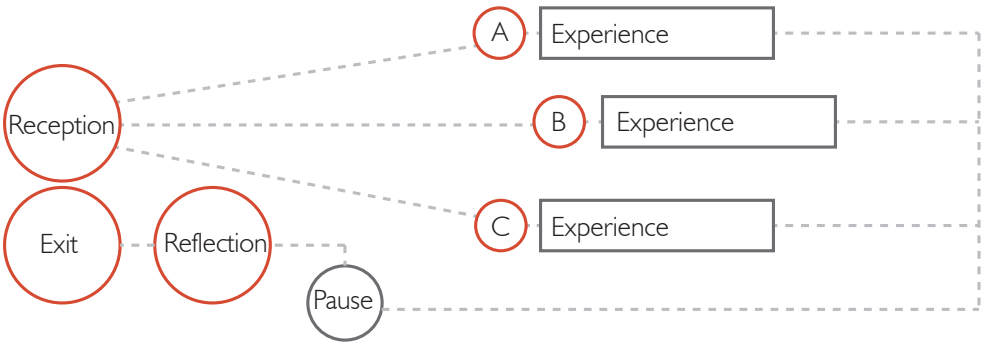

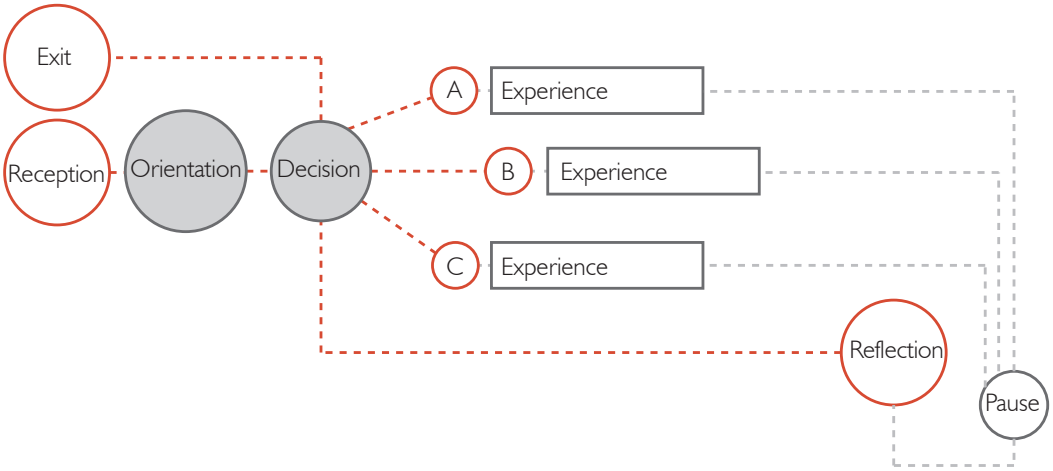

Fig _42,43 & 44 (Left, Top & Bottom): Analysis of current site in terms of Ideal Space Flow diagram (Author 2017).

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bered for a longer period. The objective of the reflection space is to keep the memory of place for longer periods in the user's mind, building a greater interest in place. The user is then placed back into the decision-making space to choose if he wants to encounter another experience or exit the space. The model for the WNR is developed with no specific function in mind but rather on the idea that all programs have an experiential element. This model aids in the objective of creating more interaction with the site and memory of place.
The ideal space flow model as proposed under the urban strategic vision for the WNR area is believed to be the first step in creating an architectural response that considers the notion of ideal space flow under an urban vision.

Considering the practical principles and the second layer of sub-consciousness, a conceptual urban framework (fig 45) was developed to showcase possible precedents and the points at which they can be implemented to achieve the main objective of interaction. The urban strategic vision sets the scene for the investigation of the notion of architecture as contextual conservator.

Fig _45 (Right): Conceptual Urban Strategic Vision Implementation (Author, 2017).

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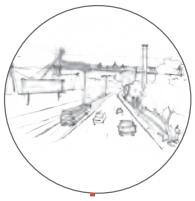

Bridge concept. (Kruger 2017)

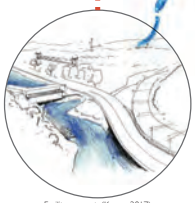
Facilities for children. (Landezine 2016)

Edge defined by buildings. (Landezine 2016)

Cable car to the to
of hill. (Designboom 2015)

River edge treatment. (Landezine 2016)

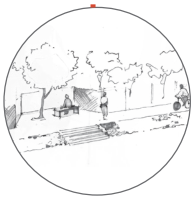
Surface treatments for slow traffic. (Landezine 2016)


Facility concept. (Kruger 2017)

Kirstenbosch Centenary tree canopy walkway. (Harrower 2014)

Nature research facility. (Design Indaba 2014)

Urban Skatepark, Barcelona. (Designboom 2015)


Nature lending to residential area. (Kruger 2017)

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02_2.4 Proposed intervention

Considering the urban strategic vision and the precedent proposals at the possible points for intervention as displayed in the conceptual urban strategic vision (fig 45), six possible sites were identified as strategic points to intervene with a proposed function to achieve interaction. Three of the six sites presented the opportunity for the investigation of architecture as contextual conservator (see fig 47).

The first possibility was a research institute on the south-western edge with an alternative entrance on the southern edge, from the residential suburb. After a site-specific analysis of the site, it was not considered viable due to the current endangered ecosystem that was discovered.
The second identified site is situated just below the mountain peak, on the southern slope. This site has spectacular views to the south, framing the city skyline. An additional entrance from the service road to the site was proposed with the function of a nature reserve distillery utilizing marula fruit, possibly to be imported from SA's northern provinces. The site and function were rejected due to the difficulty to develop a distillery that needed a constant interaction with the road network for access and service purposes.
The third identified site is situated at the foot of the mountain on the northern edge next to the existing entrance on Lavender Road. On this site, the vegetation is disturbed by recreational activities that currently happen in this area. The site holds multiple opportunities to interact with the surrounding urban environment and build connections to nature. The site falls 3 degrees to the West making this part of the reserve the most feasible to construct a large program as the area to slope ratio is low. The proposed program for this site was recreation focused and required to relate to the existing Wonderboom tree to the east and the Apies River to the west. From the three identified sites within the six-conceptual urban vision implementation proposals, the third option showed the most potential to test the notion of architecture as conservator.

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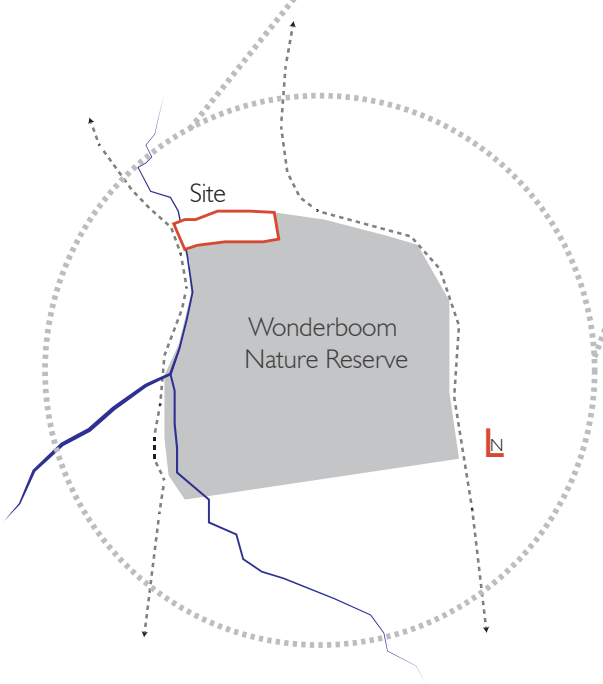

Fig _46 (Top): Proposed site in relationship surrounds and Magiesberg mountain range (Author 2017).
Fig _47 (Left): Proposed site in relationship to surrounding context (Author 2017).

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Fig _48 (Right): Proposed site for architectural intervention (Author 2017).

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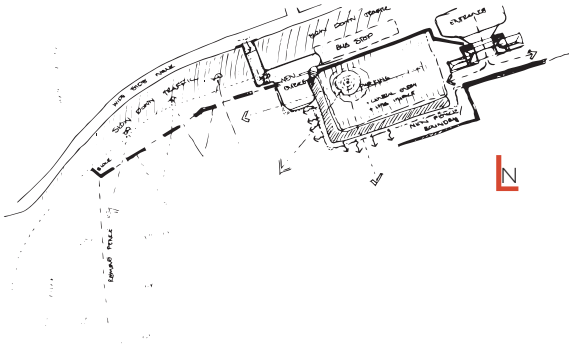
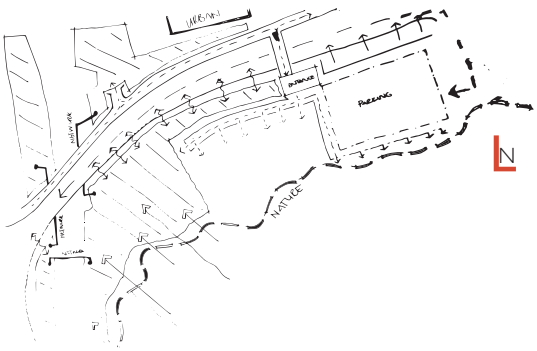
02_2.5 USV Implementation on site

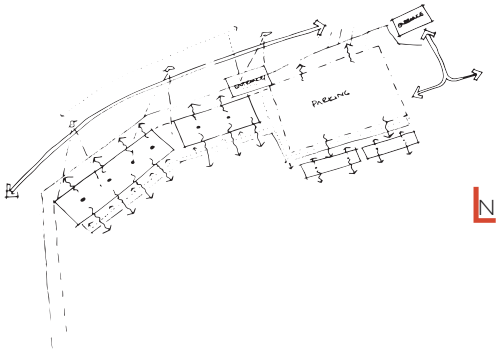
Access



Connections



Edges



Facilities

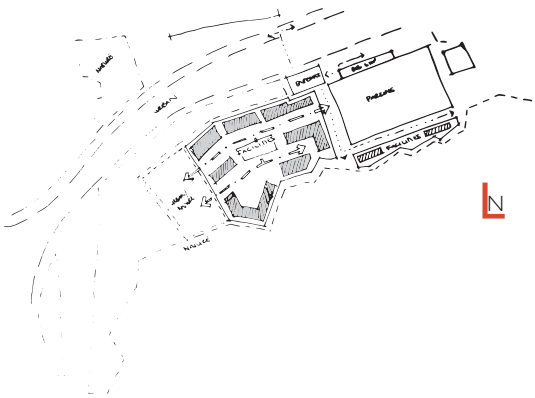


Fig _49 (Top Left): Access conceptually implementated onto selected site (Author 2017).
Fig _50 (Bottom Left): Edges conceptually implementated onto selected site (Author 2017).

Fig _51 (Top Right): Connections conceptually implementated onto selected site (Author 2017).
Fig _52 (Bottom Right): Facilities conceptually implementated onto selected site (Author 2017).

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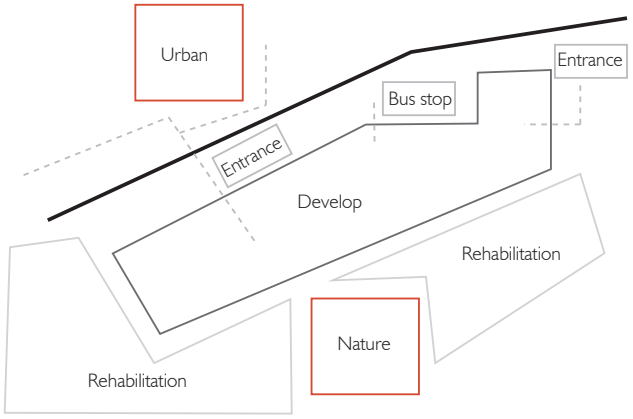

Fig _53 (Top): Synthesis of Urban Stetegic Vision onto site (Author 2017).
Fig _54 (Bottom): Proposed zoning of site from Urban Stretegic Vision (Author 2017).

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02_3
INFORMANT - THEORY

"If you think you can't make the world a better place with your work, at least make sure you don't make it worse."
Herman Hertzberger

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02_3.1 Theoretical Approach

The proposed intervention to test architecture as conservator considers two theories and one research study approach as bases to structure an architecture in function and form. These theories are used to structure the detail function5 and the architectural language6 of the design. Form and function are two of the three fundamental foundations that all architecture is built on. Technology is the third and will be investigated at a later stage in the project. Theory towards function, considers the general notion of ecosystem services theory. This idea looks at the existing ecosystem and the resources it provides to the context in which it functions. Theory towards function also considers the initiative study approach done by "the economics of ecosystems and biodiversity" (TEEB 2010) to strengthen the functional consideration.

Theory towards form uses the architectural theorist and architect, Herman Hertzberger's 1973 theory of Homework for more hospitable form (Hertzberger 1973) to write an architectural language that relates to the existing layers on site. These two approaches are then combined to form the architecture that contextually conserves.

The theoretical approach as explained in this chapter considers two theories to formulate function and form. This section showcases the additional information gathered and the process followed to structure the expanded program and the architectural langue.

The first part explains the extended function and the considerations used to formulate the program. It sets out the detail program and process of the project and showcases possible precedents for each function. The second part takes the historical layers of the site and analyses them into an architectural language of diagram.

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02_3.2 Theory into function

Theory into function focusses on the functional aspects of the proposed intervention project, and the process to formulate a detail program that informs the design and achieve the project objectives. For the proposed project, the main functional objective is to conserve the ecological significance of the site. To address this objective by means of architecture, the first theoretical part considers ecosystem services theory to structure a program that informs the use of space.

The notion of ecosystem services is not new as traces of this idea can be found from the late 19th century in policy adjustments done by the American government (Thompson 2011: 2). The focus on the socio-economic benefits only gained interest when it was sparked in 2000 with the Millennial Ecosystem Assessment call by the then sectary general of the UN, Kofi Annan (Millennium Ecosystem Assessment 2005: ii). The Millennium Ecosystem Assessment (MEA) was initiated in 2001 with the objective to "assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being" (MEA 2005: ii).

The findings in the first part indicate that humans have altered ecosystems in the last 50 years more than any other comparable period and this was due to the rapid growth of demand in for food, fresh water, timber, fibre and fuel (MEA 2005:2). The report further found that action needed to be taken to counter the effects of rapid resource demand on ecosystems being it in policy change or active adaptive management. Part of the study tested possible scenarios to show the estimated effect that certain influences would have on ecosystems and their provisioning of services by the year 2050. The scenarios were used to address certain report related questions, of which one was "What options exist to manage ecosystems sustainably?" (MA 2005:92) The question was answered by proposing interventions and investments in "environmentally sound technology, active adaptive management, [and] proactive actions to address environmental problems before their full consequences are experienced..." (MEA 2005:92)

The project's functional consideration builds on the found disruption in ecosystems services and the proposed interventions made by the MEA to address these disruptions for sustainable ecosystem development. The functional shaping starts off by identifying elements in the WNR and the Magaliesberg mountain context's ecosystem that can provide in urban resource needs, that in future might influence ecosystem depletion. The resources are divided into the four categories of ecosystem services to identify possible intervention points and contributions that ecosystem services can make towards human wellbeing on a socioeconomic level (fig 56). The focus falls on the ecosystem provisioning services category as the natural environment holds the most potential in terms of architectural intervention and the relationship with the urban.
This identified category's resources are sustainably harvested and placed into an alternative, man-made adaptive and continuously managed ecosystem to produce products that reduces the depletion of ecosystem services and start to achieve the objectives as set out by the project.

The functional formulation goes further, by expanding the theoretical input by means of the consideration of an approach implementation as explained in a study called The economics of ecosystems and biodiversity (TEEB 2010). This study's approach considers the natural environment's ecosystem services as sectors to generate economic value. The study's approach showed that the benefits of ecosystem services as economical funder is just as big as other economic sectors of the same nature. The TEEB study considers a three-step process to showcase the capital ecosystem services will be able to generate (TEEB 2010:11-12). This process firstly captures the value of the ecosystem service, demonstrates it in terms of investment potential to ultimately recognize and show the value of ecosystem service. By using these three steps, the project sets out to determine the amount of revenue that will be able to be generated by considering the

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WNR ecosystem service as resource. Aiding the functional consideration in terms of demonstrating the gains that this program, in considering ecosystem services, will be able to contribute to the notion of architecture as contextual conservator.

The projects functional consideration will be a facility that sustainably harvests the natural resources of the WNR and the Magaliesberg mountain's ecosystem services to create an alternative, adaptive, continuously managed ecosystem facility to produce products that can be sold for economic gains (see fig 59). These gains can then be utilised by the nature reserve and nature organizations to fund ecological research and management to keep these enclaves in balance.

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"The benefits people obtain from ecosystems: These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth (Greenfacts 2017)."

Valuing Nature: Economics, Ecosystem Services, and Decision-Making
by Dr. Stephen Polasky, University of Minnesota

1. Link actions to impacts on the provision of services by improving understanding of:
- *the consequences of human actions on ecosystem.*
- *the ultimate impacts on the natural capital that sustains ecosystem services.*

2. Value services to:
- *improve understanding of the contribution of ecosystem services to human well-being.*

3. Provide incentives to:
- *incorporate an understanding of the value of ecosystem services into policy and management frameworks.*
- *provide incentives for the continued provision of valuable ecosystem services.*

- From Theory of Ecosystem Services Seminar 2 (2011)

"The Economics of Ecosystems and Biodiversity (TEEB) is a global initiative focused on "making nature's values visible". Its principal objective is to mainstream the values of biodiversity and ecosystem services into decision-making at all levels. It aims to achieve this goal by following a structured approach to valuation that helps decision-makers recognize the wide range of benefits provided by ecosystems and biodiversity, demonstrate their values in economic terms and, where appropriate, suggest how to capture those values in decision-making (TEEB [sa])"

Advantages in Numbers:

Conserving forests avoids greenhouse gas emissions worth US$ 3.7 trillion (ZAR 35 trillion @ ZAR12.96 to US$)

Halving deforestation rates by 2030 would reduce global greenhouse gas emissions by 1.5 to 2.7 GT CO2 per year, thereby avoiding damages from climate change estimated at more than US$ 3.7 trillion in NPV terms. This figure does not include the many co-benefits of forest ecosystems (Eliasch 2008).

Bee keeping generates US$ 213 million annually in Switzerland (ZAR 2.7 trillion @ ZAR12.96 to US$)

A single bee colony ensured a yearly agricultural production worth (US$ 1,050) in pollinated fruits and berries in the year 2002, compared to just US$ 215 for direct products from beekeeping (e.g. honey, beeswax, pollen) (Fluri and Fricke 2005). On average, Swiss bee colonies ensured a yearly agricultural production worth about US$ 213 million by providing pollination, about five times value of the production of honey (TEEBcase: Valuation of pollination spurs support for bee keepers, Switzerland). The total economic value of insect pollination worldwide is estimated at €153 billion, representing 9.5% of world agricultural output in 2005 (Gallai et al. 2009).

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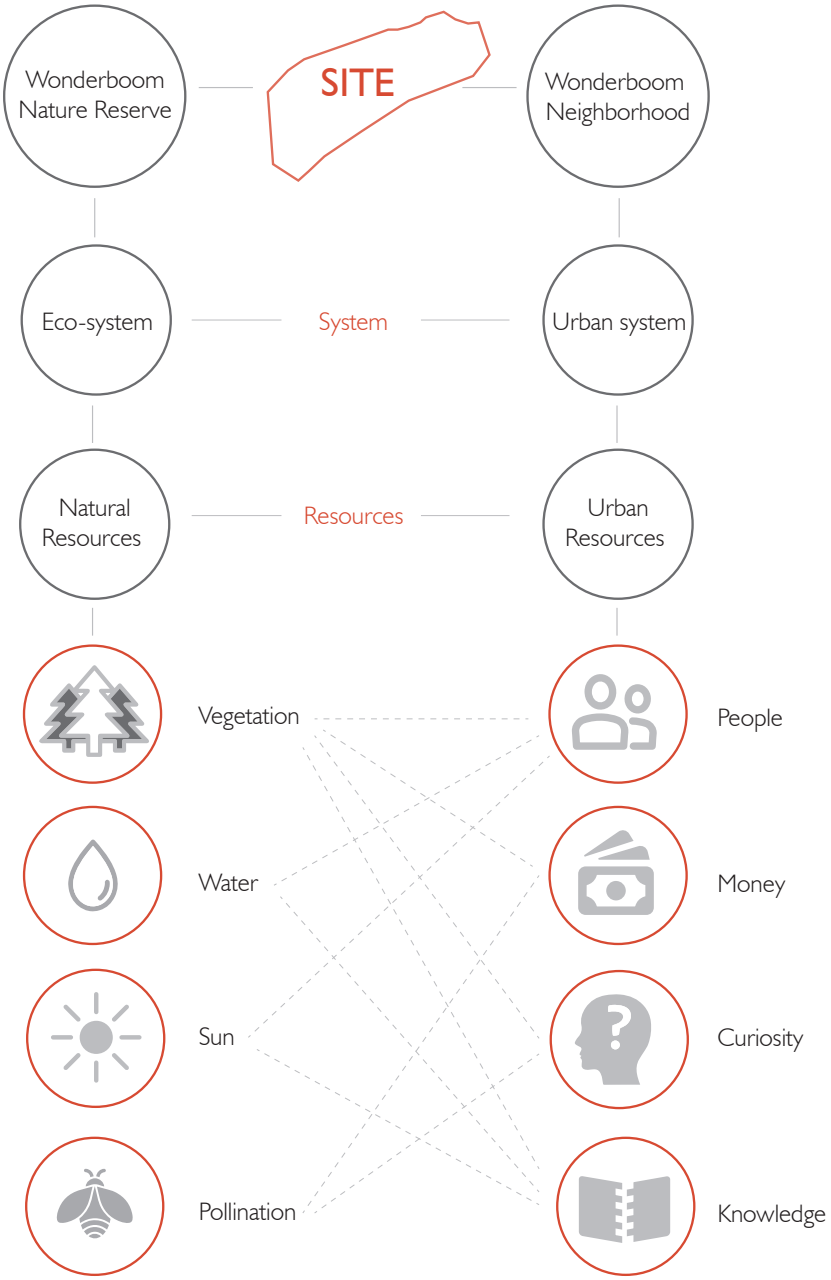

Fig _56 (Top): Ecosystem Services Conseption (Author 2017).

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Recognizing Value

Magalies Berg:
- *Stretch 120 km from Bronkhorstspruit dam to Rustenburg.*
- *Of the oldest mountain ranges in the world.*
- *Quartzite cliffs.*
- *Sanctuary for escape from city life.*
- *Diverse Ecology.*

Demonstrating Value

- *Educating.*
- *Studying (Research).*
- *Utilizing materials.*
- *Tourism.*
- *Experiencing.*

Capturing Value

- *Funds for produce.*
- *Funds for experience.*
- *Conservation.*
- *Documentation.*
- *Recording.*

Fig _57 (Top): The Economics of Ecosystems and Biodiverstity Conception (Author 2017).

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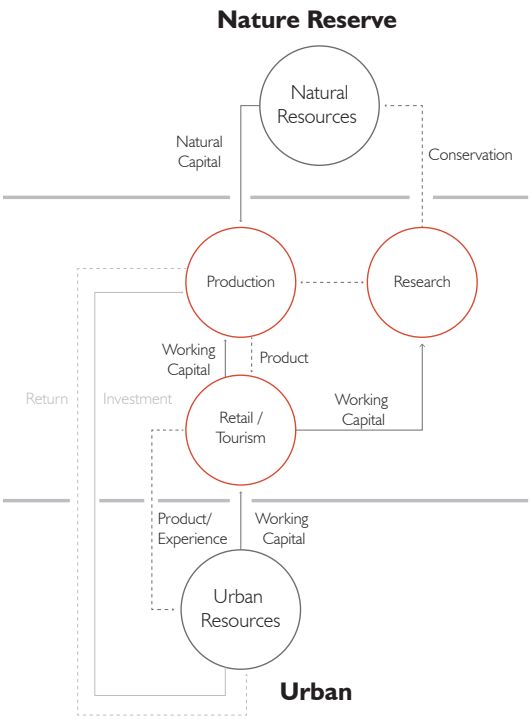

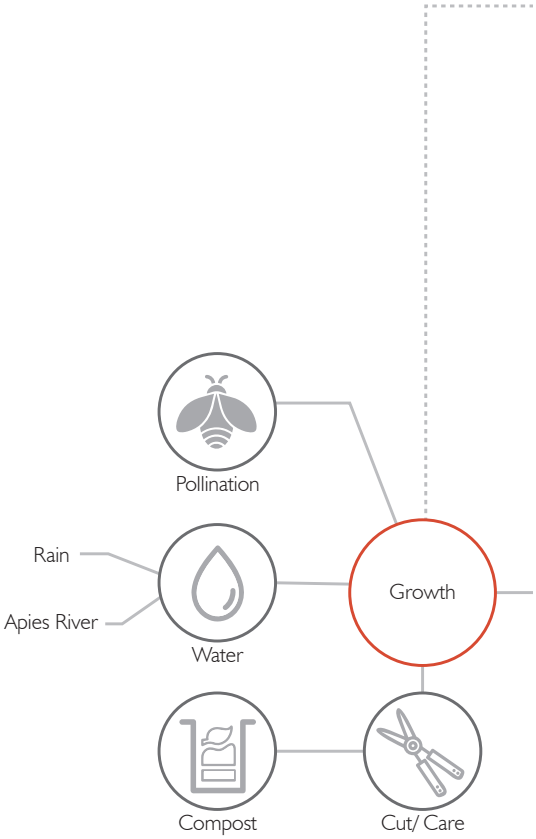

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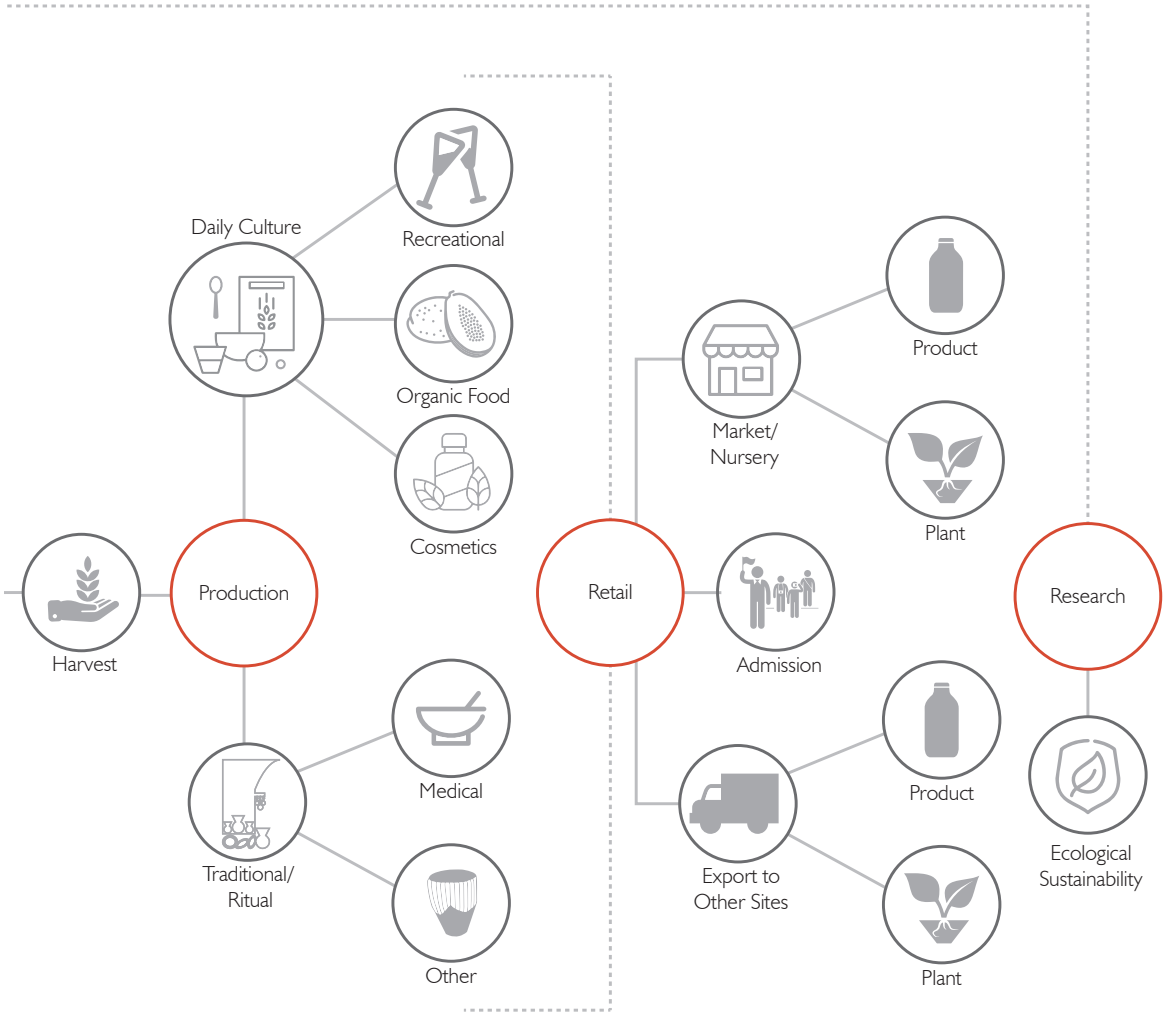

Fig _58 (Far Left): General function diagram (Author 2017).
Fig _59 (Top): Detail function diagram (Author 2017).

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02_3.3 Theory into form

Theory into form sets out to address the formulation of the architectural language for the conservation facility. Its objective is to create an architectural language that retains the historical significance of the site by capturing it in a new form to manifest the historical importance of the site in the visitor's mind. To address this objective, the project considers the architectural theorist, Herman Hertzberger's theory of "Homework for more hospitable form" (in Mallgrave & Contandriopoulos 2008:440-442).

Hertzberger argues that modern forms in architecture evoke animosity and a sense of alienation. He proposes the notion of Hospitable Form. With this notion, he calls for forms with a richer capacity to absorb, carry and convey meanings, forms that people can take possession of through mental associations, archetypical forms with respect to human imagination (Mallgrave & Contandriopoulos 2008:440). The notion of Hospitable Form is built on the identification of the museum of images.

Hertzberger's museum of images is a collection of images that all human minds hold after an encounter with the specific space. They are different from person to person but hold a collective thread. Hertzberger states that if designers relate to the collection of images in addition to the usual considerations, they can create spaces that are not unfamiliar and distanced to the user. He further claims that the more distant the images from one another and separated over time, the more in-depth our collection of these images will become. "By referring each one back to its fundamentally unchangeable ingredients, we then try to discover what the images have in common, and find thus the "cross section of the collection", the unchangeable underlying element of all of the examples, which in its plurality can be an evocative form–starting-point" (cited in Mallgrave & Contandriopoulos 2008:441). The idea of the cross section of the collection of images that relate the user to a place[9] as form starting point comes across as a strong idea to aid the notion of contextual conservation (fig 60).
The project considers this theory in terms of the cross-section of the collection of images of the WNR. It sees the museum of images as the historical artefacts and physical images gained of these artefacts on site. These images are then analysed to form a cross-section of the collection. This cross-section is themed and used as the form stating point to inform the design on a psychological level.
Through the analytical and historical investigation of the WNR's images[10], it was found that the site holds a strong protective cross-section collection. This collection spans over hundreds of years from the stone age to the current canopy of the Wonderboom tree. The protection theme was used as starting point to analyse the images and create an architectural language that portrays a sense of protection. This architectural language informs the design's form and aids in creating a conservation facility. It is proposed that if this theoretical approach is implemented, the users that visit the site will be reminded of the history of the site and the connection between nature and urban. It is intended that the architectural form will remind the user of the new protective layer the site is taking into the future, one of conservation and protection of nature rather than more protection of the urban as was the case until now.

9.Noun - 1. a particular portion of space, whether of definite or indefinite extent. 2.space in general: time and place. (Dictonary.com 2017)
10.The Wonderboom fort; the stone age cave; the stone formations & the tree canopy as found in the WNR.

Fig _60 (Right): Conception of theory - Site to form (Author 2017).

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CONTEXT
(SITE)

museum of imaginary images
"Musée Imaginare"

Cross section of the collection.

In pluraty be an evocative *form-starting-point*.

conserve significance

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SUN CITY

the palace of the lost city

Fig_a. http://www.places.co.za/html/sun_city_resort.html

gholf Nedbank challange

Fig_b. http://suncity.hotel.co.za/

valley of the waves

Fig_c. http://www.sun-city-south-africa.com/activities-and-entertainment/water

cross - section -"Musée Imaginare"
Entertainment & Relaxation

evocative *form-starting-point*
Images of:

Entertaiment & Relaxation

conserve significance

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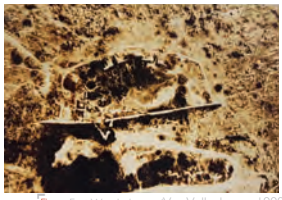
SITE

Wonderboom Fort



Fig_a. Fort Wonderboom (Van Vollenhoven 1999).

Block House

Fig_b. Typical blockhouse (Van Vollenhoven 1999).

Stone Age Cave

Fig_c. Wonderboom Nature Reserve Cave - Interior floor (Author 2017).

Iron Age Rock Walls

Fig_d. Stone formations on nothern hill - Iron Age Artifacts (Author 2017).

Natural Trees

Fig_e. Wonderboom - Enclosed Tree (Author 2017).

conserve historical significance

cross - section -"Musée Imaginare"

Protection

evocative *form-starting-point*
Images of:

Protection

Fig _61 (Left): General example explenation of theory argument (Author 2017).
Fig _62 (Top): Theory argument in terms of site andd historical layers (Author 2017).

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Wonderboom Fort

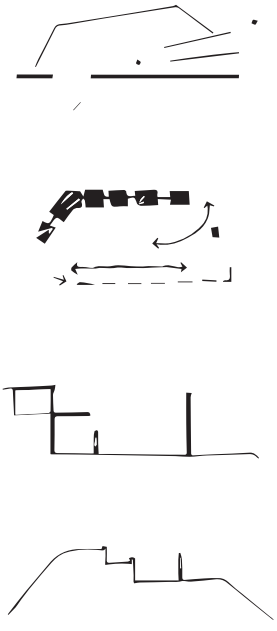
Images

Fig_63a. Fort Wonderboom (Van Vollenhoven 1999).

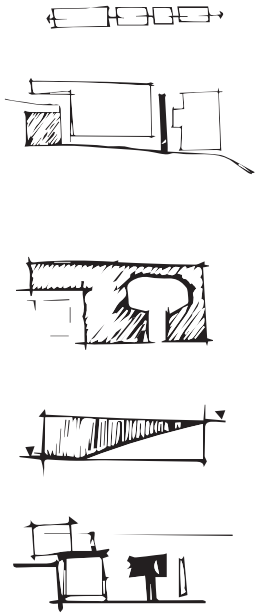
Fig_63b. Fort entrance from interior (Author 2017).

Fig_63c. Fort rooms detreated walls (Author 2017).

Primary Elements



Geometry / Form / Shape



Block House

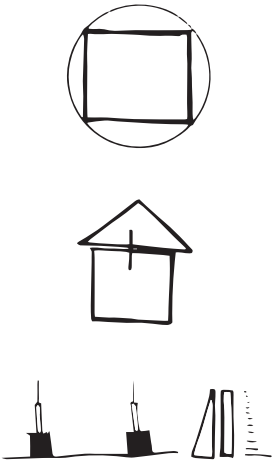
Images

Fig_63d. Typical blockhouse (Van Vollenhoven 1999).

Fig_63e. Blockhouse on Magaliesberg Ridge (Van Vollenhoven 1999).

Primary Elements

Geometry / Form / Shape



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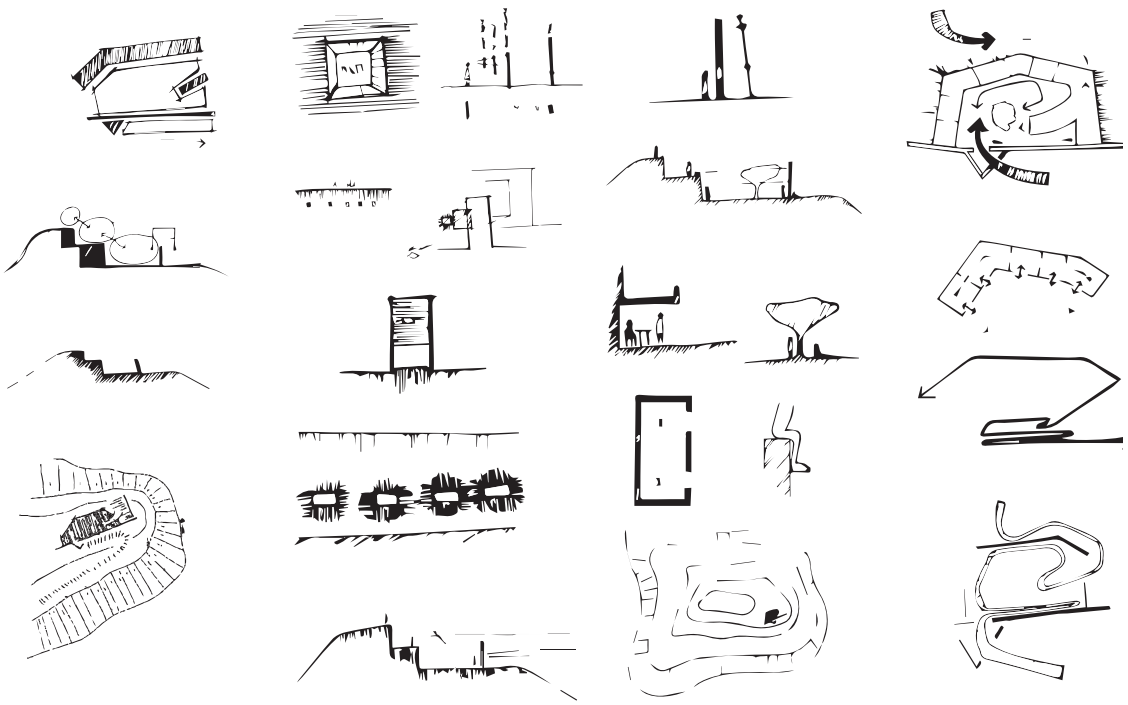
Mass / Void / Tention / Harmony Views / Frames Scale / Porpotion Circulation



Mass / Void / Tention / Harmony Views / Frames Scale / Porpotion Circulation

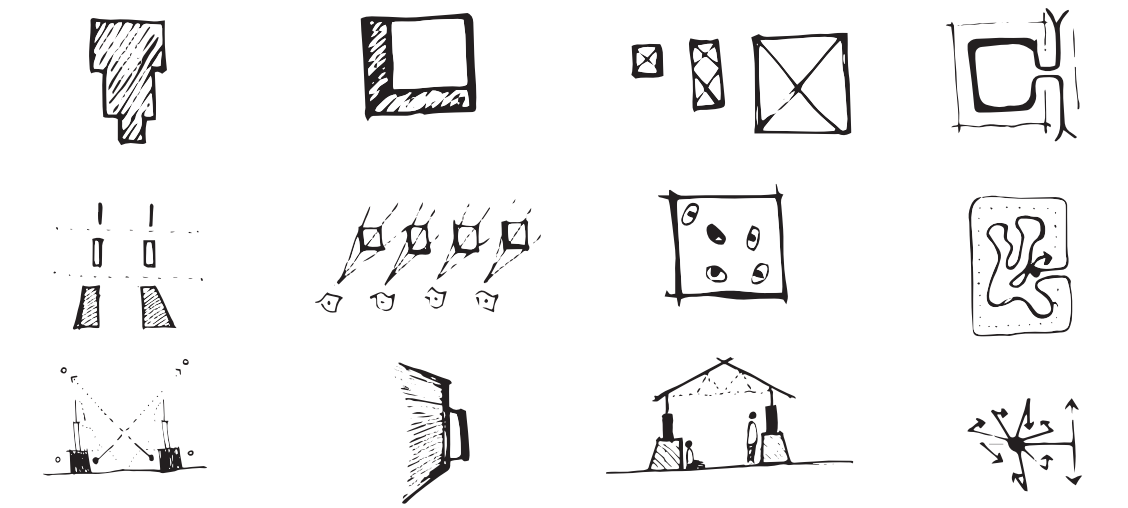


Fig _63 (Spread): Architectural diagram langues of historical layers 1 (Author 2017).

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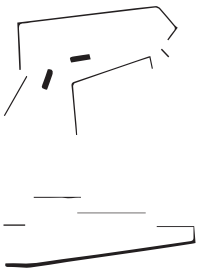
Stone Age Cave

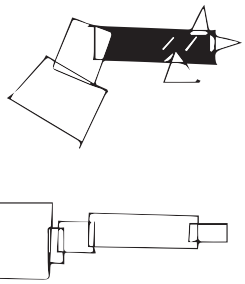
Images

Fig_64a. Wonderboom Nature Reserve Cave - Interior floor (Author 2017).

Primary Elements



Geometry / Form / Shape

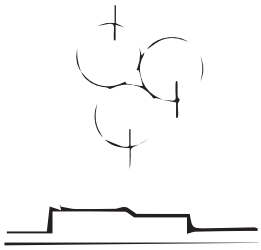


Iron Age Rock Walls

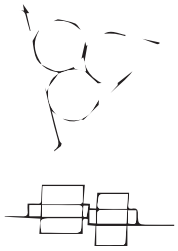
Images

Fig_64b. Stone formations on nothern hill - Iron Age Artifacts (Author 2017).

Primary Elements



Geometry / Form / Shape

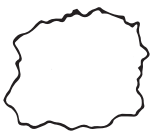


Natural - Trees

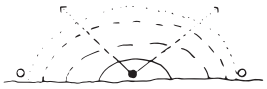
Images

Fig_64c. Wonderboom - Enclosed Tree (Author 2017).

Primary Elements



Geometry / Form / Shape



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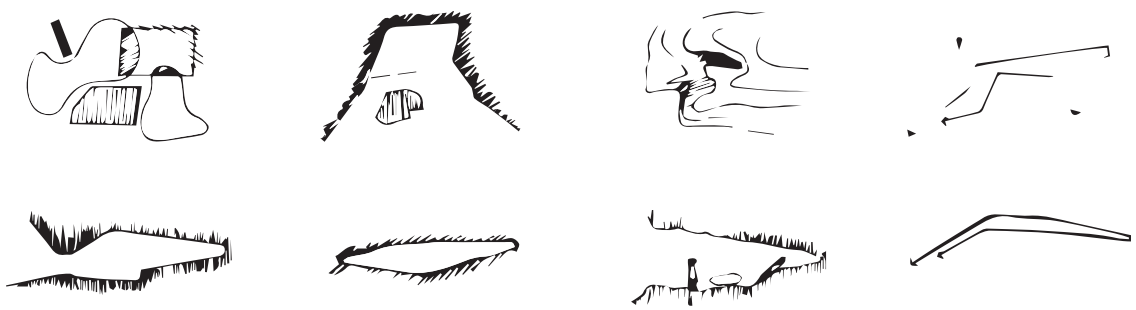
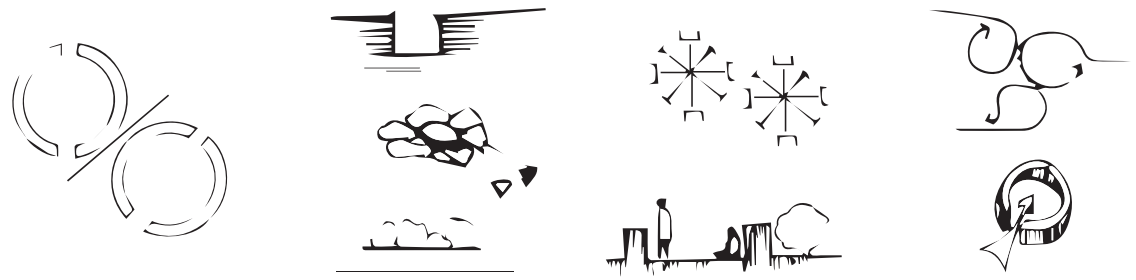
Mass / Void / Tention / Harmony *Views / Frames* *Scale / Porpotion* *Circulation*



Mass / Void / Tention / Harmony *Views / Frames* *Scale / Porpotion* *Circulation*



Mass / Void / Tention / Harmony *Views / Frames* *Scale / Porpotion* *Circulation*

Fig _64 (Spread): Architectural diagram langues of historical layers 2 (Author 2017).

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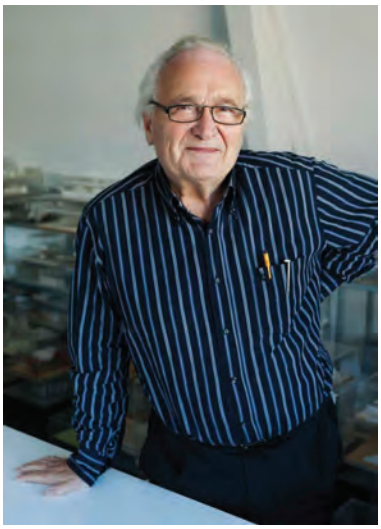
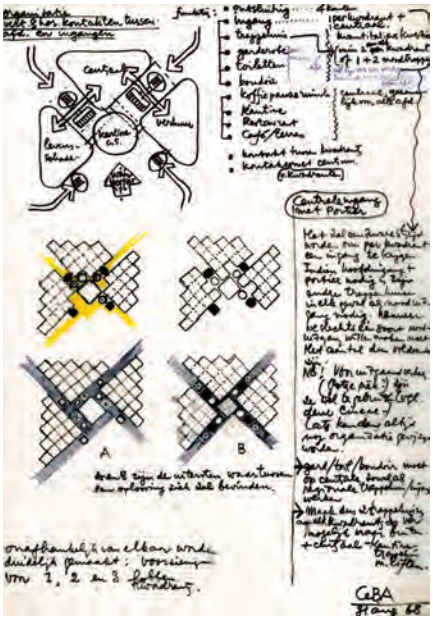
Theory to form - Additional Information

Homework for more Hospitable form - Herman Hertzberger

Theorist Background:
Herman Hertzberger





Born: 1932
Theory: Structuralist philosophy of a building's users influencing its design via a 'spatial framework'.
Major Buildings:
- Centraal Beheer – Office building, Apeldoorn, The Netherlands, 1972
- Montessori School, Delft, The Netherlands, 1966
Short Biography:
1932 born in Amsterdam
1958 graduated in architectural engineering from Delft Polytechnic (today Delft University of Technology)
1965-69 lectured at the Academy of Architecture, Amsterdam
1970-99 extraordinary professor at Delft University of Technology
1982-93 guest lecturer at the University of Geneva, Switzerland
1990-95 dean of the post-doctoral course of architecture, Berlage Institute, Amsterdam; guest lecturer at universities and on architecture courses in Argentina, Australia, Austria, Belgium, Brazil, Croatia, Cyprus, Denmark, France, Germany, Greece, Ireland, Israel, Italy, Japan, Mexico, the Netherlands, Norway, Slovenia, South Korea, Spain, Switzerland, Taiwan, the United Kingdom and the United States.

(Lomholt, 2011)

Fig _65 (Left Top): Herman Hertzberger (E-Architect 2011).
Fig _66 (Left Bottom): Diagram by Hertzberger from notes (BMIAA 2015).

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Homework for more Hospitable form as published in Forum 24:3 (1973)

"9.2 The only escape from the fundamental limitations of our imaginative faculty lies in directing our attention more to the experiences we all have in common, the collective memory, some of it innate (!) some of it transmitted and acquired, which in one way or another must be at the base of our common experimental world.
We don't have knowledge of everybody's personal images and associations with forms, but we assume that they can be seen as individual interpretations of a collective pattern. The relationship between collective pattern and individual interpretations can perhaps be linked with the relationship between language and speech.
(We each use language in our own way; both individuals and groups can express themselves with, and as long as they keep more or less within the framework of recognize declensions and rules, and use recognizable words then the message comes across.) Indeed we assume the underlying "objective" structure of forms – which we can arch-forms - a derivative of which is what we get to see in a given situation.
The whole "musée imaginaire" of forms in situations whatever their time and place can be conceived of as an infinite variety out of which people help themselves, in constantly changing variety, to forms which in the end refer back to the fundamentally unchangeable and underlying reservoir of arch-forms.

9.3 In designing, apart from the usual information, by association we can try to dig up from our memory as many images as possible of situations relating to our problem, and gather these around is. The farther the images are separated from each other in time and place, and the more characteristic they are for the situation at hand, the more our collection of images will gain in depth.
By referring each one back to its fundamentally unchangeable ingredients, we then try to discover what the images have in common, and find thus the "cross section of the collection", the unchangeable underlying element of all of the examples, which in its plurality can be an evocative form–starting-point.
The richer our collection of images, the more precise we can be in indicating the most plural and most evocative solution, and the more objective our solution becomes, in the sense that it will hold a meaningful, and be given a meaning by, a greater variety of people.

9.4 We cannot make anything new but only reevaluate already existing images, in order to make them more suitable for our circumstances. What we need to draw on is the great 'Musée Imaginaire' of images wherein the process of change of signification is displayed as an effort of human imagination, always finding a way to break through the established order, so as to find a more appropriate solution for his situation.
It is only when we view things from the prospective of the enormous collage, that, with the aid of analogies, we can resolve the unknown and, by the process of extrapolation arrive at solutions which can improve our circumstances.
Design cannot do other than converting the underlying and the idea of ever being able to start off with a clean slate is absurd, and moreover, disastrous when, under the pretext of its being necessary to start completely from the beginning, what already exists is destroyed so the naked space can be filled up with impracticable and sterile constructions.
When we do away with what has gone before us, and pay no attention to what more stable groups of people next to us, elsewhere, still possess, and thus make no use of the accumulation of images at our disposal, we nip the possibility of renewal in the bud."

(Mallgrave & Contandriopoulos, 2008:441-443)

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02_4
INFORMANT - PROGRAM

"Our opportunity, as designers, is to learn how to handle the complexity, rather than shy away from it, and to realize that the big art of design is to make complicated things simple."
Tim Parsey

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02_4.1 Eleborated Program

This section picks up on the figure as showcased in the theory to function section (see fig 59). It explains the flow of spaces and relationship between functional requirements. The holistic approach towards function is represented as an in-between fill of natural resources and urban resources.

It furthermore showcases the size requirements of the functions presented and precedents that hold similarities in function.

This section aids the reader in understanding the processes of the conservation facility by means of breaking the program up into smaller considerations.

Fig _68 (Right): Diagram of the program structured in the in-between of nature and urban (Author 2017).

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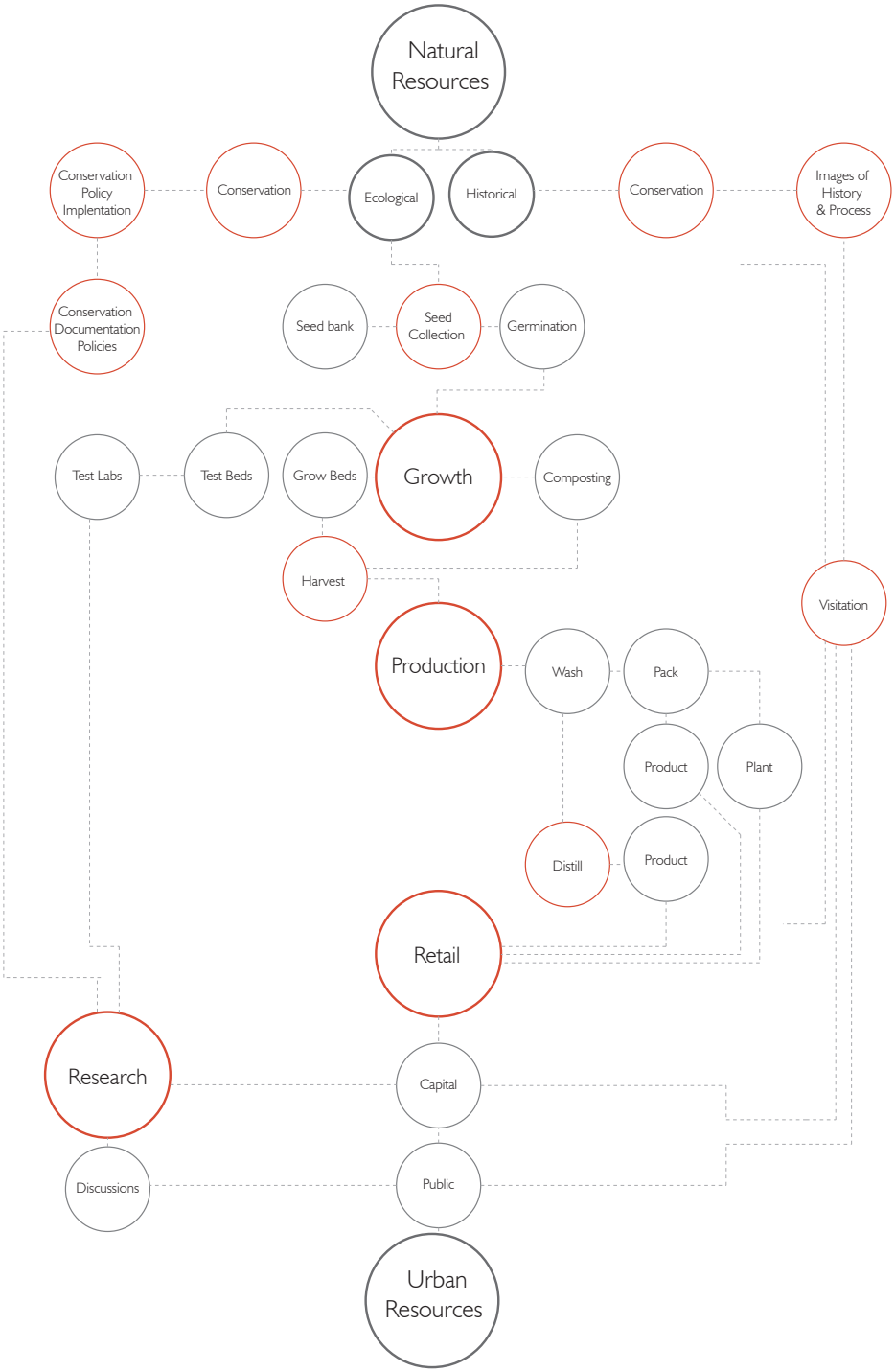

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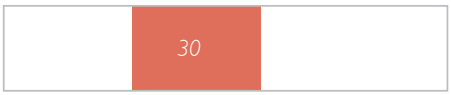
Growth

Sourcing of seeds from nature reserve in a sustainable manner. Germanizing of new seeds and monitoring of growth in grow beds. Aiding services for optimal growth.

Production

Sourcing of natural capital (physical raw materials) that Ecosystem services present. Producing products from raw natural materials for market.



Retail

Selling product to urban communities.

Research

Utilizing working capital gained from retail and tourism to fund sustainable growth and conservation of nature reserve.

Pollination:
Housing beez.
Collecting honey.

150 sqm

Palynopolis - Eriksen Skajaa Architects + Christina Charlotte Tolfsen

Fig_69a. Palynopolis. (ArchDaily 2010)

Recreational:
Distilling.

150 sqm

Distillery Terrace - 1540 Arquitectura

Fig_69e. Distillery Terrace (ArchDaily 201

Admission:
Entry.
Exit.
Admin.

Wasit Natural Reserve Visitor Centre - X Architects

Fig_69i. Wasit Natural Reserve Visitor Centre (ArchDaily 20

Office:
Admin.

Design Strategy & Research Center - THE_SYSTEM LAB

Fig_69m. Design Strategy & Research Center (ArchDaily 20

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Water:
Pump room.

150 sqm

Stortemelk Hydroelectric Plant - Earth World Architects

Fig_69b. Stortemelk Hydroelectric Plant (EWA 2016).

Compost:
Collection point.
Storing.
Distribution.

150 sqm

The Composting Shed at Inverleith Terrace - Groves-Raines Architects

Fig_69c. The Composting Shed (ArchDaily 2010).

Cut and care:
Storage for tools.

150 sqm

Gardening center - Architekti DRNH

Fig_69d. Gardening centre (ArchDaily 2013).

oods:
Wash.
Pack.

150 sqm

Carozzi Production and Research Food Center - GH+A | Guillermo Hevia

Fig_69f. Carozzi Production and Research Food Center (ArchDaily 2014).

Cosmetics:
Mix/ Make.
Pack/Bottle.

150 sqm

Tea Seed Oil Plant - Imagine Architects

Fig_69g. Tea Seed Oil Plant (ArchDaily 2015).

Medical:
Mix/Make.
Pack/Bottle.

150 sqm

Lozy's Pharmaceuticals Factory - GVG Estudio + Vaillo-Irigaray

Fig_69h. Lozy's Pharmaceuticals Factory (ArchDaily 2017).

Market:
Shops.

Boxpark Croydon - BDP

6). Fig_69j. Boxpark Croydon (ArchDaily 2016).

Nursery:
Shop.
Admin.
Display.

"Nursery Fields Forever" Reconnects Early Childhood Education with Nature

Fig_69k. "Nursery Fields Forever" (ArchDaily 2016).

Export:
Distribution.

Cox Communications Distribution Center - el dorado

Fig_69l. Cox Communications Distribution Center (ArchDaily 2016).

Other

Additional programs to aid the sustainability of the conservation facility and aid in the relationship with the urban.

Restaurant.
Interior
Exterior.

Boos Beach Club Restaurant - Metaform architects

7). Fig_69n. Boos Beach Club Restaurant (ArchDaily 2017).

5

Fig _69 (Spread): Precedent considerations for functional spaces (Author 2017).

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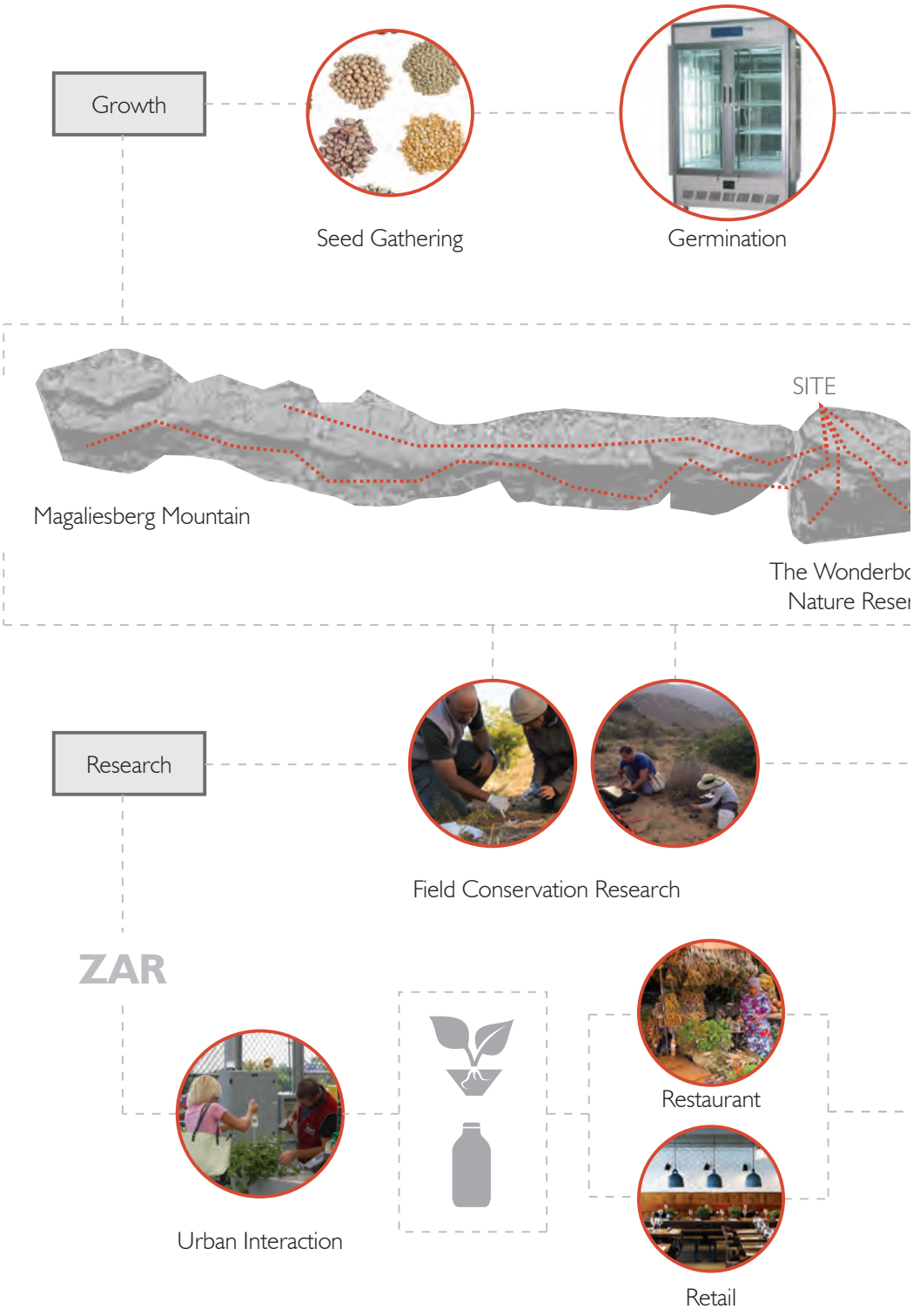

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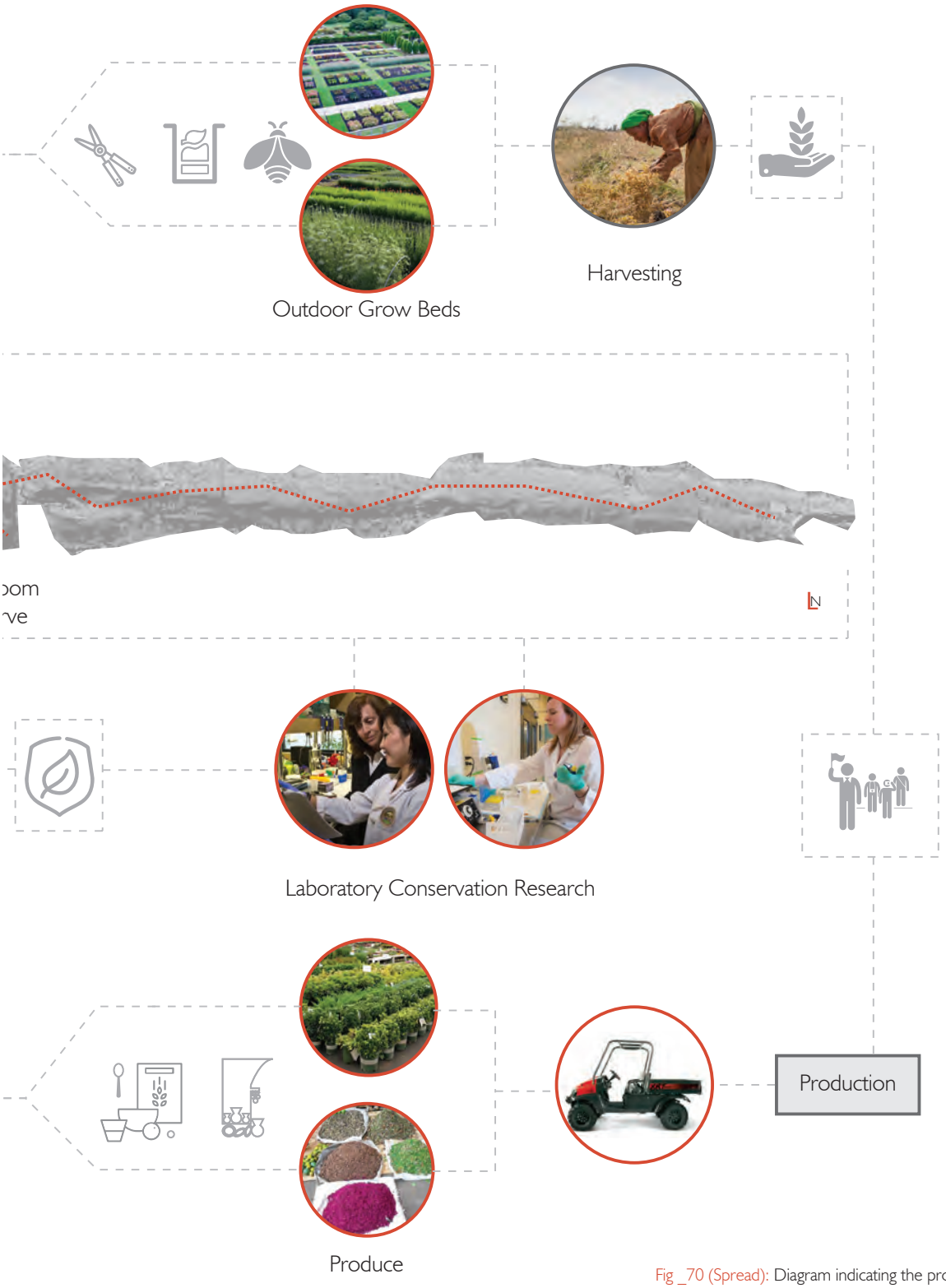

Fig _70 (Spread): Diagram indicating the process of the facility's program (Author 2017).

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02_5
INFORMANT - PRECEDENT

"People ignore design that ignores people."
Frank Chimero

© University of Pretoria

02_5.1 Precedents

Precedents as informant consider existing architectural responses in term of related functional, formal or other interventions. The section elaborates on the precedents mentioned in the contribution article and gives the reader a visual interaction between what was explained and the visual architectural intervention.

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02_5.2a Investigative Precedent

After a thorough analysis of the informants to develop the architecture, an understanding of possible functional and contextual precedent studies was achieved. The investigation focused on examples, local and international, that relate to the functional and contextual typological requirements and to grasp an idea of possible implementation of the argument onto site. These specific typologies mentioned are only a few of a larger number of examples that were investigated to formulate this general explanation of the functional and contextual typologies.

The basis for identifying functional typological precedents related to the similarities in the program's proposed detail. They only consider one or two of the programs that are presented for the project but constitute key considerations to inform the development of the argument into architecture.

The first precedent investigated is Cape Town's well-known V&A Waterfront and forms ties to functionality (fig 74). Watershed, designed by Wolff Architects, takes the retail typology into a different direction. Developing a retail market that caters for many smaller retailers in reaction to the V& A Waterfront mall. The architecture reacts to the ever-changing retail space model and develops the design into a multi-functional retail model that not only sells clothing, accessories or food on small scale, but also workspace. This retail typology, as developed at Watershed co-exists in an environment that is dominated by a large scale commercial retail environment. The precedent is relevant in terms of the surrounding site influences at the WNR that is also dominated by a commercial retail environment and the consideration of this precedents retail typology will be beneficial to the project.

Another precedent is similarity in program is the Wasit Natural Reserve Visitor Centre by X Architects in Sharjah, UAE (fig 73). The visitor centre was completed in 2016 and showcases a way to present nature reserves to the public without harming the sensitive environment. This precedent considers the idea that nature reserves can be utilised for educational purposes while they experience nature in the reserve from behind glass walls. The precedent fails in the interaction between nature and the visitor due to the glass walls but succeeds in presenting the importance of nature to the visiting public.

The Royal Academy for Nature Conservation by Khammash Architects in Jordan frames and captures the natural context it sits in very well (fig 75). The building was completed in 2013 and directly reacts to the natural environment that surrounds it. Built on the edge of an old quarry, the architecture reacts in form and material. The architecture considers the edge of the quarry as the guiding factor in plan and the materiality of the quarry as the informant in section.

Other precedents investigated were: MARIOerMURO, a first place winning proposal for a park in Rome, Italy and B.R.E.A.K., a third-place proposal for Turkey's Bandirma Park, both by TA.R.I. Architects (fig 72). These precedents consider the relationship between urban and nature in terms of architectural intervention; the MARIOerMURO proposal re-evaluates the wall and proposes architecture as the division between the urban city and the inner park, creating a calm environment for city residents to break away to. The third-place proposal, B.R.E.A.K links the history of the site with a new programmatic consideration.

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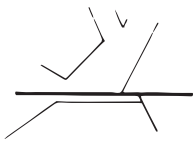
Third-Place Proposal for Turkey's Bandirma Park [Bandirma Regeneration As Knowledge]

Project: B.R.E.A.K.
Architect: TARI Architects
Location: Bandirma, Turkey.
Program: Educational
Year of Proposal: 2017

Information: "*It is a SPATIAL EXPERIENCE, to promote culture and knowledge, where to stay together enforcing the sense of comunity. The system obtained is that of a landscape carved, inclusive and introverted, which retains its essence, sculpted by sharp cuts that make it accessible and permeable to light and visitors. [ ] On the other side, the protected trees form an enchanting woods, with a deep connection to the uncontaminated nature of the site.*"
TA.R.I Architects. 2017. *B.R.E.A.K. BANDIRMA REGENERATION AS KNOWLEDGE.* http://www.tari-architects.com/portfolio-item/b-re-k/ (Accessed 24.06.2017)



Primary Elements *Mass / Void* *Views / Frames*

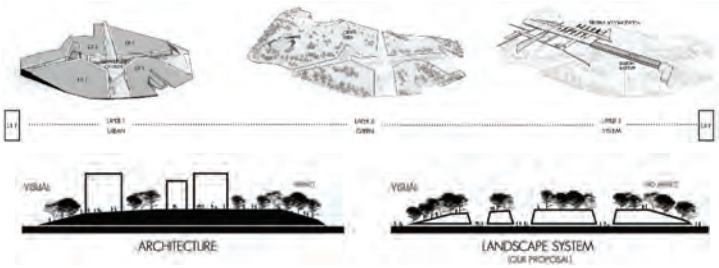


Fig _72 (Poster): Third place proposal for Turkey's Barima Park visuals (TA.R.I. Architects 2017) and analysis (Author 2017).

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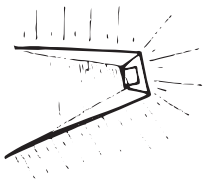
Wasit Natural Reserve Visitor Centre

Project: Wasit Nature Reseve Visitors Centre
Architect: X Architects
Location: Sharjah - UAE
Program: Visitors Centre
Year of Completion: 2016

Information: "*A wetland visitor center is established on site to continue protecting the natural environment, educate people on the richness of the wetland ecosystem and provides information about the birds that frequent the area and other wetlands areas of the emirate. The facility became heaven for bird watchers and researchers.*"
X Architects. 2015. WASIT VISITORS CENTRE. http://www.x-architects.com/x-architects/wasit-visitor-centre/100 (Accessed 24.06.2017)

Views / Frames



Approach

Circulation

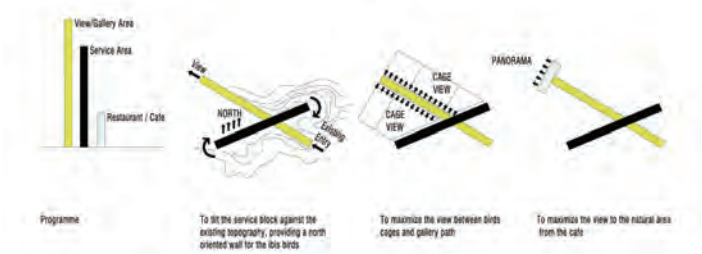


Fig _73 (Poster): Wasit Nature Reserve Visitors Centre visuals (X Architects 2015) and analysis (Author 2017).

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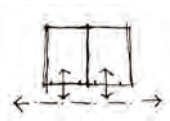
Watershed

Project: Watershed
Architect: Wolff Architects
Location: Cape Town
Program: Retail/ Market
Year of Completion: 2011

Information: "*This design demonstrates how an educational institution can show leadership in the formation of the city that would serve interests beyond those of the proposed business incubator alone. Instead of locating the business incubator in a portion of the existing industrial shed (as required in the brief), we proposed a new street throughout the entire shed that sets up an urban pedestrian network which connects several popular areas around the shed.*"

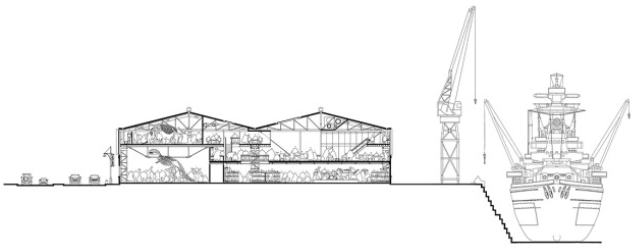
Wolff Architects. 2011. Watershed. http://www.wolff-farchitects.co.za/projects/all/watershed/#top (Accessed 23.06.2017)



Circulation / Order

Retail Spaces

Skin and Fill



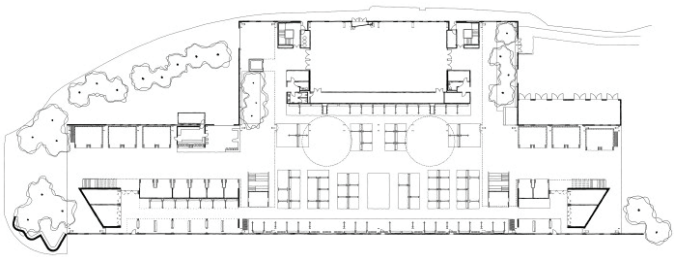


Fig _74 (Poster): Watershed visuals (Wolff Architects) and analysis (Author 2017).

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The Royal Academy of Conservation

Project: The Royal Academy of Conservation
Architect: Khammash Architects
Location: Jabal `Ajlun' Jordan
Program: Educational
Year of Completion: 2013

Information: "*The building design was based on the quarry cliff cut-line that a bulldozer driver once drew in the land some twenty years ago, never knowing that this line will be the base of a building elevation. The building follows the quarry line very accurately creating a linear addition of constructed stone to the bedrock.*"
Khammash Architects. 2011. *ROYAL ACADEMY FOR NATURE CONSERVATION*. http://www.khammash.com/projects/royal-academy-nature-conservation (Accessed 24.06.2017)

Mass / Void

Edge / Frame

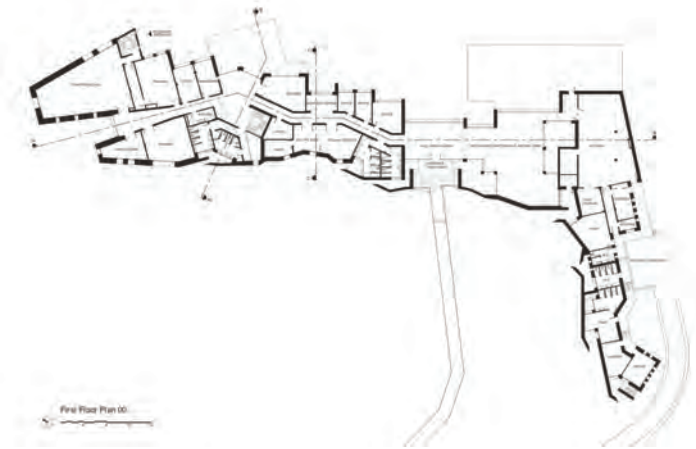

Fig _75 (Poster): The Royal Academy of Conservation visuals (Khammash Architects 2011) and analysis (Author 2017).

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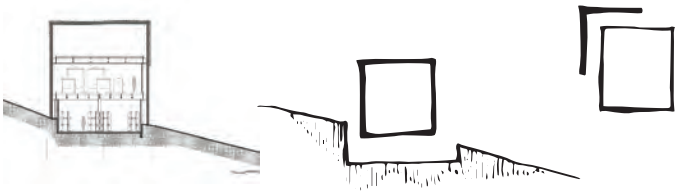
Encuentro Guadalupe Winery

Project: Encuentro Guadalupe Winery
Architect: graciastudio
Location: Jorge Gracia
Program: Winery
Year of Completion: 2011

Information: "*One of the main premises was not to directly intervene in the field, as part of the project's philosophy is to respect nature as much as possible. The availability of steel leads to a clean design form of the structure of the material, which rises from the ground to the skeleton of the room, to avoid contact with the environment.*"
ArchDaily. 2015. *Encuentro Guadalupe Winery / graciastudio*. http://www.archdaily.com/775176/-encuentro-guadalupe-winery-graciastudio (Accessed 24.06.2017)



Form / Landscape

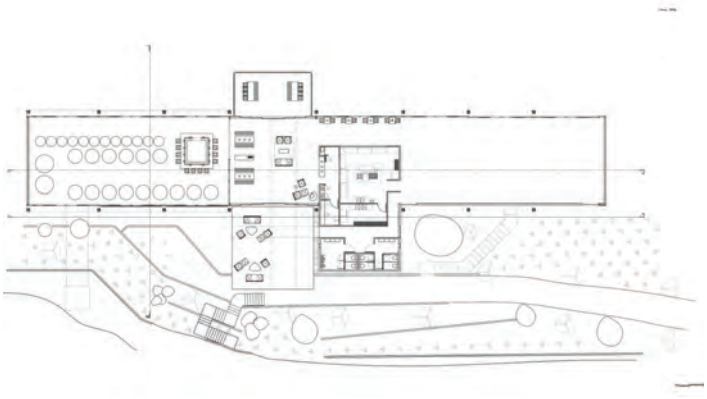


Fig _76 (Poster): Encuentro Guadalupe Winery visuals (ArchDaily 2015) and analysis (Author 2017).

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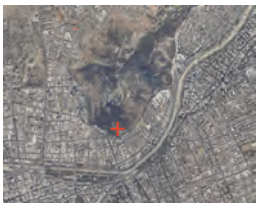
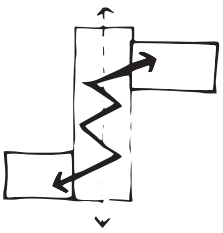
Zoo Nursery

Project: Zoo Nursery
Architect: Carreño Sartori Arquitectos
Location: Camino Carlos Reed, Providencia, Chile.
Program: Nursery
Year of Completion: 2009

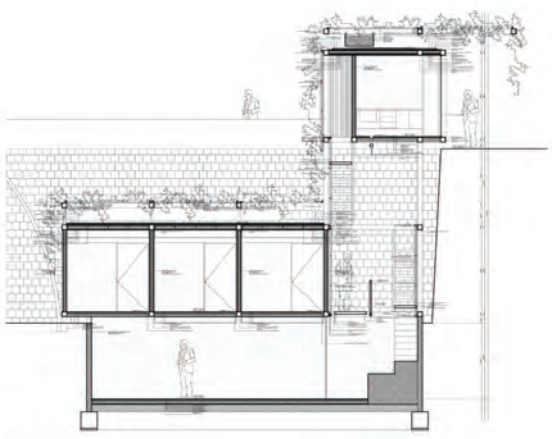
Information: "*One of the main premises was not to directly intervene in the field, as part of the project's philosophy is to respect nature as much as possible. The availability of steel leads to a clean design form of the structure of the material, which rises from the ground to the skeleton of the room, to avoid contact with the environment.*"
ArchDaily. 2015. *Encuentro Guadalupe Winery / graciastudio*. http://www.archdaily.com/775176/-encuentro-guadalupe-winery-graciastudio (Accessed 24.06.2017)



Views



Circulation



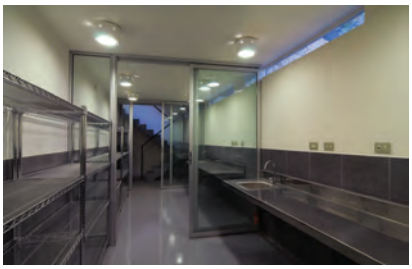


Fig _77 (Poster): Zoo Nursery visuals (ArchDaily 2015) and analysis (Author 2017).

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02_5.2b Visual Precedent

The visual precedents section considers images of the architectural interventions that show similarities in terms of the functional, aesthetical or contextual influence of the projects. No analysis of these precedents was done as they were only used as visual inspiration to understand the responses of similar contextual reaction in architecture. Some of the visual precedents considered were the Cape Point Nature Reserve (fig 78), the Klipbokkop Mountain Reserve (fig 79), the Bokong Nature Reserve (fig 80) and the Mapungubwe Interpretation Centre (fig 81).

Fig _78 (Poster): Cape Nature Reserve photos (Cape Point [sa]), poster (Author 2017).

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Cape Point Nature Reserve

Project: Cape Point Visitors Centre
Architect: [sn]
Location: Cape Point, Cape Town.
Program: Visitors Centre

Information: "*Cape Point is in the Cape of Good Hope nature reserve within Table Mountain National Park, which forms part of the Cape Floral Region, a World Heritage Site. It includes the majestic Table Mountain chain, which stretches from Signal Hill to Cape Point, and the coastlines of the Cape Peninsula. This narrow stretch of land, dotted with beautiful valleys, bays and beaches, contains a mix of extraordinarily diverse and unique fauna and flora.*"
Cape Point. [sn]. About. https://capepoint.co.za/about/ (Accessed 27.06.2017)

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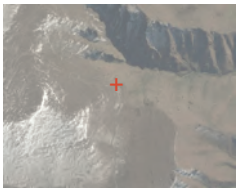
Klipbokkop Mountain Reserve

Project: Klipbokkop Mountain Reserve Conference Facility
Location: Worcester
Program: Conference Centre

Information: "*Situated in the pristine Fynbos Mountains near Cape Town, Klipbokkop Mountain Reserve welcomes you to a unique nature experience. The ambience is enhanced by our commitment to service and quality.*"
Cape Point. [sn]. *About*. https://capepoint.co.za/about/ (Accessed 27.06.2017)

Bokong Nature Reserve

Project: Bookong Nature Reserve Visitors Centre
Architect: [sn]
Location: Lesoto
Program: Visitors Centre



Information: "*At more than 3000 meters above sea level, the reserve is one of the highest nature reserves in Africa. An impressive visitors' centre has been developed on the edge of a 100m cliff. [ ] You may see cattle posts (metebo) which are the ruins of interconnected cattle shelters and kraals for stock that were built from stone.*"
Visit Lesotho [sn]. *What to see, Bokong Nature Reserve*. http://visitlesotho.travel/what-to-see/24-tourist-attractions/180-bokong-nature-reserve (Accessed 27.06.2017)

Fig _79 (Poster): Klipbokkop Mountain Reserve photos (Klipbokkop [sa]), poster (Author 2017).
Fig _80 (Poster): Bokong Nature Reserve photos (Visit Lesotho [sa]), poster (Author 2017).

© University of Pretoria

Mapungubwe Interpretation Centre

Project: Mapungubwe Interpretation Centre
Location: Mapungubwe National Park
Program: Information Centre

Information: "*In this surreal setting Peter Rich has designed a 1,500 sqm visitor's center which includes spaces to tell the stories of the place and house artifacts, along with tourist facilities and SANParks offices. The complex is a collection of stone cladded vaults balancing on the sloped site, against the backdrop of Sandstone formations and mopane woodlands.*"

ArchDaily. 2010. *Mapungubwe Interpretation Centre*. http://www.archdaily.com/57106/mapungubwe-interpretation-centre-peter-rich-architects (Accessed 27.06.2017)

Fig _81 (Poster): Mapungubwe Interpretation Centre photos (ArchDaily 2010), poster (Author 2017).

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02_6
ARGUMENT - STRUCTURE

"Architecture starts when you carefully put two bricks together. There it begins."
Ludwig Mies van der Rohe

© University of Pretoria

02_6.1 Approach

Architecture can be developed in the in-between space between nature and the urban to act as conservator for nature reserves. Utilising the natural resources11 of the site to produce products, retailing these products to urban dwellers for revenue to fund environmental organizations to conserve nature reserves and natural balance. The architecture can further capture the historical protective layers of site in a new form to preserve the significance and echo to the visitor the historical significance of the site. The space of interaction between nature and the urban will become the site for intervention (see fig 84), acting as active protector in terms of sustainable harvesting, production, education of conservation and in building a continuous interaction between urban and nature.

The project addresses the physical, in function and psychological experience of form as two continuous informing agents in creating a synergy to test the notion of architecture as conservator. Combining the interaction between these two spheres conceptually and relating them to the relationship between nature and urban. This consideration fills the current void between urban and nature, giving new definition to the fence in terms of the architecture aiding the natural migration and interacting with the urban environment.

In replacing a segment of the fence in the most probable interaction point between urban and nature, the architecture will not only increase interactive activity between urban and nature but also aid the natural environment in conservation, protecting the ecosystems from over-exploitation of influence from the urban environment and a chance to stop biodiversity deterioration.

By combining the functional considerations that aid conservation in using ecosystems services and TEEB's approach, and the architectural form informants from the adapted use of Hertzberger's theory to create form, it is deemed that the architecture will achieve its objective of contextual conservation. The intervention of man in nature can ultimately conserve, define and capture the elements that make nature reserves protectable and transform these forgotten, yet rich historical sites into places that keep our environments in balance. A balance that is not only important for the healthy continuous existence of nature but also for the existence of man, be it urban or not.

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Architecture can be developed in the in-between of wilderness and urban to act as conservator for nature reserves.

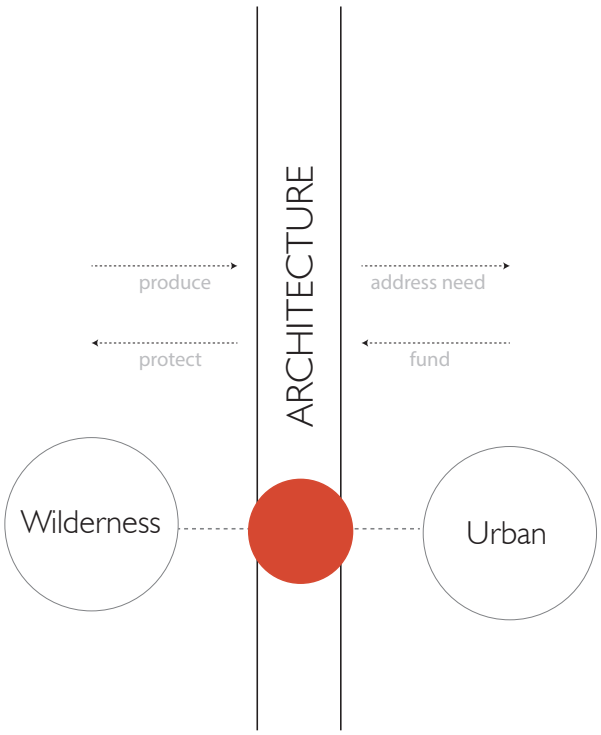

Fig _83 (Above): Argument hypothesis diagram (Author 2017).

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Fig _84 (Right): Argument approach structure diagram (Author 2017).

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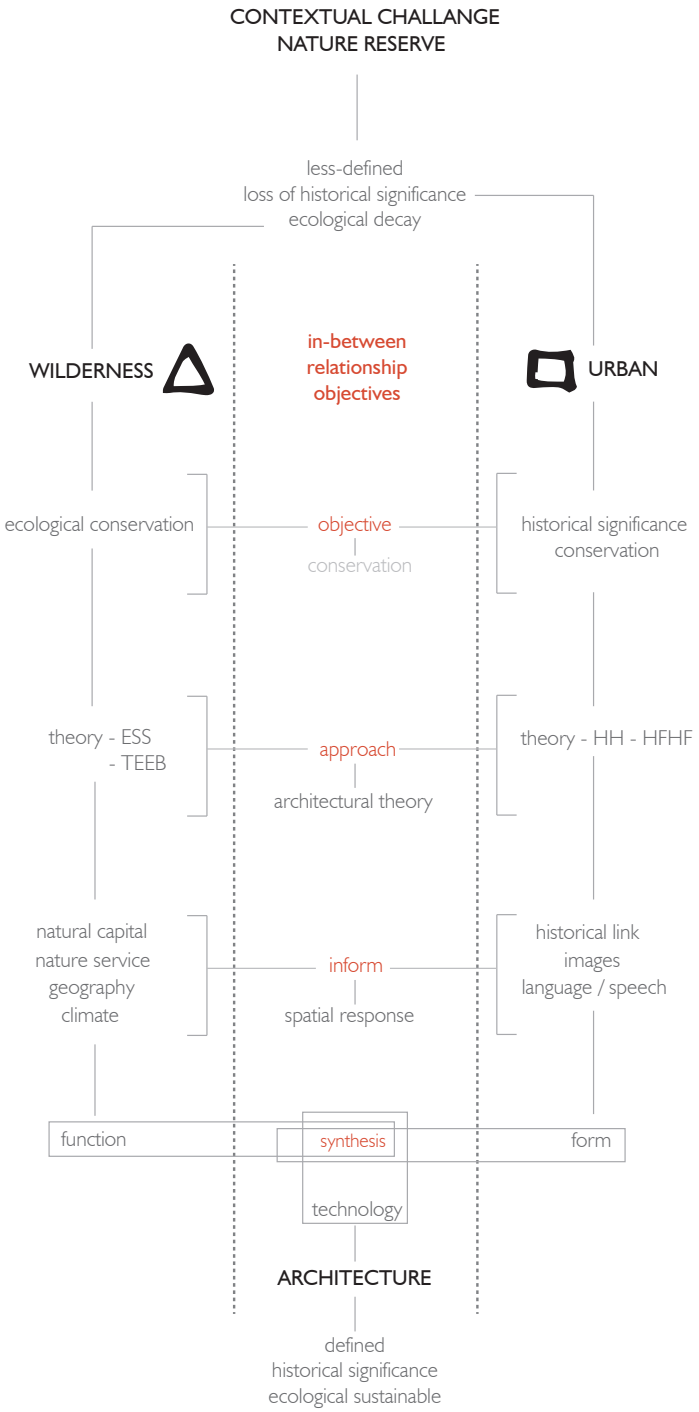
Argument Approach Structure:



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03_
CONCEPTUAL APPROACH

"Architects don't invent anything; they transform reality."
Alvaro Siza Vieira

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03_1 Background

The concept chapter sets out to formulate a conceptual scenario that will inform the response to the problem stated. The chapter will consider the conceptual approach developed from the architectural argument and informants as described and presented in the previous chapter. It will take into account the contribution article (refer to Appendix A) and structured argument to formulate a framework to inform the conceptual scenario and ultimately the design. The implementation of the conceptual scenario will be explained diagrammatically in terms of how the project will go about implementing the conceptual scenario to create an architecture that conserves.

03_2 Conceptual Framework

The conceptual framework is approached by setting out the problem and objectives as stated in chapter 1. It considers the argument approach structure as a basis for the conceptual framework. The consideration of the two realms, nature and urban, in relationship within the in-between, is continued from the argument to structure the framework.

The argument approach structure categorizes three main problems, i.e. loss of historical significance, less-defined8 nature of the landscape and ecological decay as the main challenges faced by the WNR. To address these three challenges the argument assigned theoretical approaches to address these challenges. These approaches structured the form and function of the project and are based on the in-between relationship that exists between these two elements of architecture. The conceptual framework recognizes these two elements and the tension that exists between them as the first step towards formulating a conceptual approach. It investigates the similarities in terms of objectives that form and function set out to achieve the response. This investigation resulted in a strong objective consideration of protection without disturbing the connected relationship that exists between nature and urban. It also illustrated how the functional and formal informants presented an opportunity to continue the historical layers of the site in a new form. The formal consideration wants to protect and educate while the functional consideration wants to harvest and produce. A tension is born. According to Pluto Panoussis (2017), all art and architecture are constructed on a tension between elements and without these tensions art (or architecture) can't be created. He explains this with an example of two lines and where they cross. As soon as the two lines cross a highlighted point is presented. At this point, an interest is sparked and the art is born. Tension creates interest, that formulates art.

The conceptual framework (fig 86) recognizes the tension between the functional and formal informants developed from the challenges faced. This occurs where they meet in the in-between of nature and urban. This area of tension is where the WNR presents the opportunity to create architecture and formulate a relationship that will benefit both realms of nature and urban in forms of conservation, i.e. nature in the conservation of its ecology and urban in the conservation of the heritage and history.

At the meeting point, these two responses interact to form a synergy. The synergy creates an architecture that conserves both realms' interests, while also educating, producing and generating to the benefit of both the natural and urban environment. This synergy in the in-between sets the scene as a conceptual idea, one where the in-between becomes a divider that benefits both nature and urban by using resources from both.

Fig _86 (Right): Conceptual framework diagram (Author 2017).

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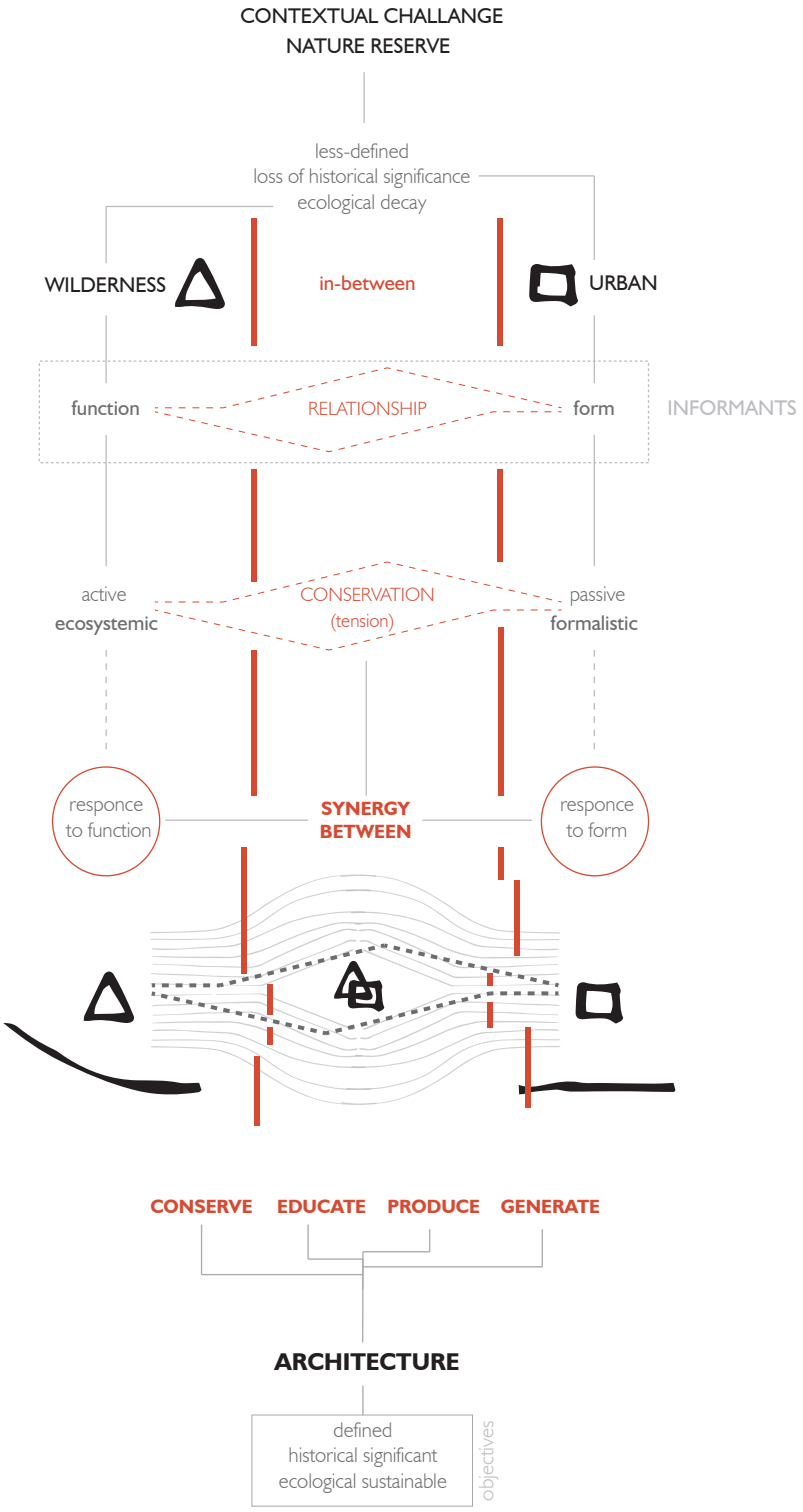

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03_3 Design Concept

Introduction

From the conceptual framework, the idea that a synergy in the in-between, between nature and urban, can achieve the objectives of definition and conservation, the concept investigated architectural elements that relate best to protection and definition. Architectural elements considered were the roof, floor, and wall. The roof provides protection between space and sky. This protection layer is placed above the user and holds a relationship that is vertical. This relationship is distant from the horizontal relationship between nature and urban that is present on site and gives less definition to the in-between space. The floor resulted in the same vertical relationship as the roof but related more to nature and urban as the user was grounded in nature even though divided from it by the floor. The third element, the wall presented the best representation of division and protection while holding a relationship with urban and nature. The wall as an element to define space and protect nature from urban and urban form nature showed the most potential. This idea was taken further to define the wall as divider that uses and produces from both realms; a wall that holds a relationship to both nature and urban without placing one above the other.

The wall as conceptual idea can be used further to connect the two realms in the in-between. Either with openings and divisions or with visual elements such as windows . This opportunity made the conceptual idea stronger in the objective to respond to the challenge in defining while protecting and in becoming the new conservator between nature and urban without dividing the two realms completely. The idea that the wall can be the partition between nature and urban that produces and benefits both were considered. The concept can be stated as the prolific, to produce many offspring, partition, to divide, structured in the in-between to conserve nature and urban significances.

To implement this concept a conceptual scenario was developed to structure the idea in terms of the argument and objectives of the conceptual challenge.

Conceptual Scenario

Urban protected areas are under threat from ecological and historical decay due to little to no awareness of the significance of these sites. The fence as partition between wilderness and urban have forced these two contextual environments into separate ways, creating an in-between space. The separation is currently causing a lack of interaction resulting in the protected area not gaining sustainable economic resources to keep the site from deteriorating. The project conceptually sets out to form a prolific partition between urban and wilderness that conserves the natural in economic resources (program) and preserves the historical in adaptation of historical layers (form). Addressing the challenges by synergizing the two contextual informants and their relationships into a single facility that protects the ecological while preserving the essence of the historical. The architecture becomes the new partition as contextual conservator situated in the in-between.

Fig _87 (Right): Conceptual poster (Author 2017).

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THE PROLIFIC PARTITION

conserve educate produce generate

Urban protected areas are under threat from ecological and historical decay due too little to no awareness of the significance of these sites. The fence as partition between wilderness and urban have forced these two contextual environments into separate ways creating an in-between space. The separation is currently causing a lack of interaction resulting in the protected area not gaining sustainable economic resources to keep the site from deteriorating.

The project conceptually sets out to form a prolific partition between urban and wilderness that conserves the natural in economic resources (program) and preserves the historical in adaptation of historical layers (form). Addressing the challenges by synergizing the two contextual informants and their relationships into a single facility that protects the ecological while preserving the essence of the historical. The architecture becomes the new partition as contextual conservator situated in the in-between.

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03_3 Concept Implementation

Conceptual implementation considers the conceptual scenario and sets out a basis to implement this scenario onto the site and formulate a response to the hypothesis. The implementation consists of a four-phased linear process that creates the synergy within the prolific partition to conserve nature and urban.

The first phase of the implementation process considers the current and is categorized as investigation into the current state of the site (fig 88). It relates to the initial investigation done at the site as explained in the contribution article (see Appendix A) and with the informants. It was found that urban and nature are divided and only a single-entry point is present. The two realms are functioning as two parts and little interaction is present. The partition was evident and no synergy could be achieved with the current situation on site. This phase of the project is explained with the investigation and problem statement. It also formulated the research questions and objectives of the project.

The second phase, division, addresses the need for an interaction point between the two realms to synergize. It is defined by the word possibilities. It sets out to divide the two realms further than was found in phase one by defining space between them. It places objects into the landscape that spark an interest between the two realms and propose possible intervention point within the divide. This phase in the project is presented by the preliminary design stages that are derived from the conceptual scenario. It is a conceptual consideration and only the development showcases these possibilities. The design at this stage is not meant to be built but only considers multiple responses to the conceptual scenario and the possibilities for responses that exist.

The third phase considers the trigger element to start the synergy between nature and urban. At this stage, the context has been developed into a space that has two elements on either side of the in-between space. The trigger element is placed into the in-between space and the process of synergy is activated. This stage has defined spaces and the form and architectural language are present. It also presents the function and relationships between them. This is the stage where a synthesis of all the investigations and possibilities are tested against one another. It continues into the working of the systems and how the architecture will present itself within the context. At the end of this phase, the architectural design as the response to the argument is finished and starting its life cycle as conservation facility.

The fourth and last phase is defined as the synergy phase and as the conservator stage. This is when the architectural design has been completed and the response to the argument has become functional. The result in terms of the argument is tested and the architecture shows its findings in terms of functionality. An indication of success is present at the start of this phase and the project can be concluded even though the result is a continuous process. The synergy between nature and urban to conserve both is the ultimate objective of this phase and ties into the objective of the project. The conclusion will be based on an anticipated result that will be formulated at the end of the trigger phase. This conclusion will be the start of the synergy phase and the architectural response, within its lifetime if ever built, will finally conclude the project in term of synergy.

Fig _88 (Right): Conceptual implementation process diagram (Author 2017).

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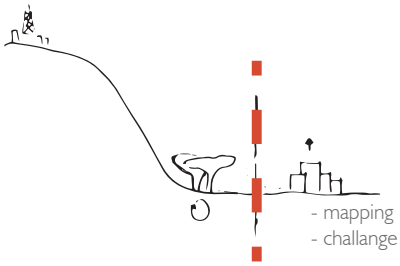
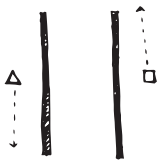
current

INVESTIGATION
- single entry
- divided
- detached
- functioning as two

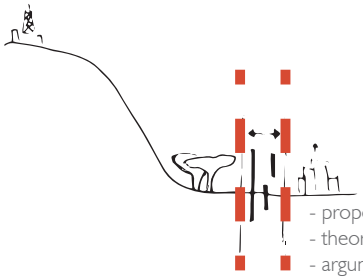


- mapping
- challange identification

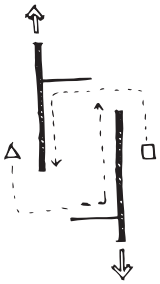


division

POSSIBILITIES
- open divide
- spark interest
- in-between relationship
- proposals

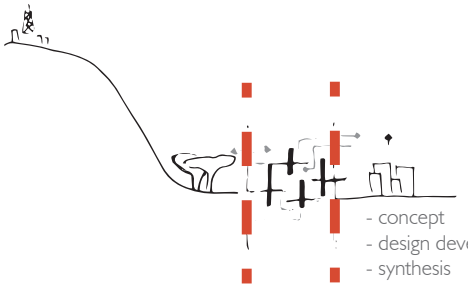


- proposals
- theoretical investigation
- argument
- precedent

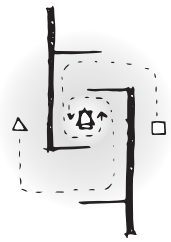


trigger

IMPLEMENTATION
- improve nature
- build form
- continue interest
- start facilities

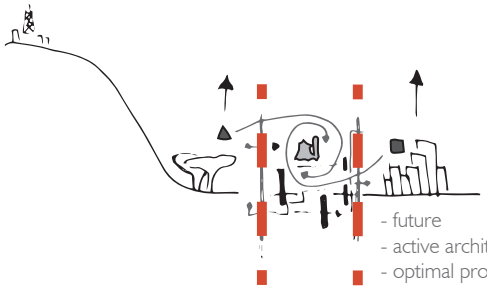


- concept
- design development
- synthesis



synthesis

CONSERVATOR
- user interaction
- sustain interest
- operational facilities
- synergy



- future
- active architecture
- optimal production

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03_4 Alternitive Conceptual Influence

The creation of form is based on the phased approach of the conceptual implementation. It considers the four phases of the conceptual implementation and develops a process to inform the response to the argument where the concept or informants lack. The idea is to generate a conceptual filler for the gaps left by the concept or the formal/functional informants when the design is developed. This consideration makes sure the whole design is developed from the conceptual considerations where concept or informants lack.

The gap is filled by utilizing the four phases as starting points to formulate a formal response. The first phase of current considers the current natural and urban context. It investigates influences from these two realms that can be utilized for informing the design. These elements are identified within the context. The second stage takes these elements and analyses them to understand the relationship to the conceptual scenario and how they can be interpreted to inform the architectural response. The element is then captured and structured into a possible informant that can be utilized This informant must hold a connection to the objectives of the argument and if possible, relate to the objectives of the conceptual scenario. The informant is then subjected to an essence reduction process in the final phase and only this essence as an informant is used where the gap is present. This phase ensures that the informants and conceptual scenario keep the upper hand in formal response.

Fig _89 (Right): Additional conceptual framework diagram (Author 2017).

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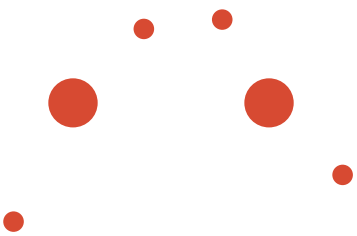
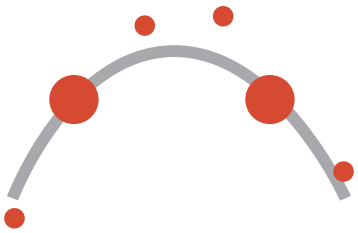
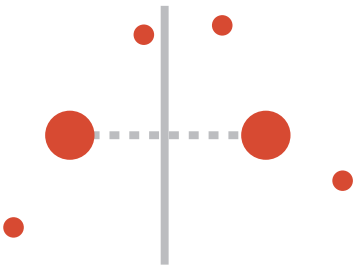


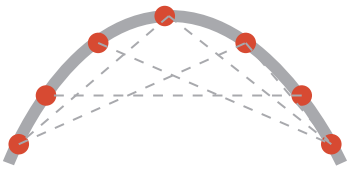
existing



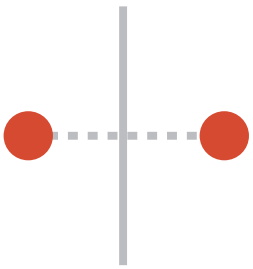
context



dividing



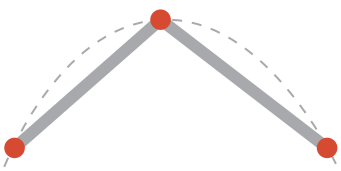
analysis



capturing

structuring

essence



architecture

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04_
DESIGN DEVELOPMENT

"My passion and great enjoyment for architecture, and the reason the older I get the more I enjoy it, is because I believe we - architects - can effect the quality of life of the people."

Richard Rogers

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04_1 Background

The design development chapter describes the design process in terms of iterations. The preliminary iterations (iteration 1 - 3) relate to how the conceptual scenario was utilized to start the design process. These iterations were tested only against the ability to achieve the objective of connectedness between nature and urban within the partition and responding to this tension.

The chapter further shows how the design developed from preliminary to intermediate stages. Further iterations (iteration 4 and 5) considered the design's ability to respond to function and form as added layers of the existing tension between partition and connectedness.

The final iterations (iteration 6 and 7) develop the design further into a facility that responds to the natural and urban realm, address the tensions between connectedness and partition while achieving the integration of form and function. The final design showcases the response to all the informants, the argument and the concept to present an architecture, in the in-between that conserves the WNR and defines its landscape.

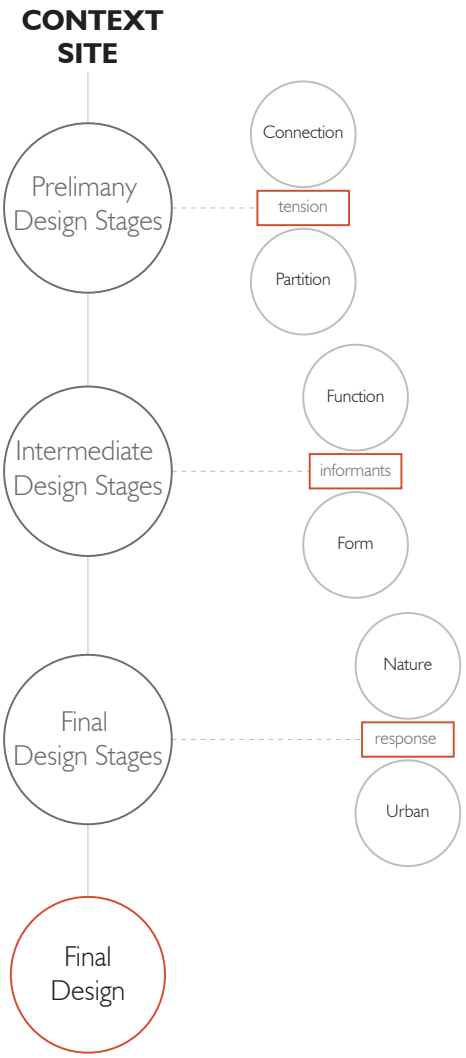

Fig _91 (Right): The design development stages and the investigations per stage (Author 2017).

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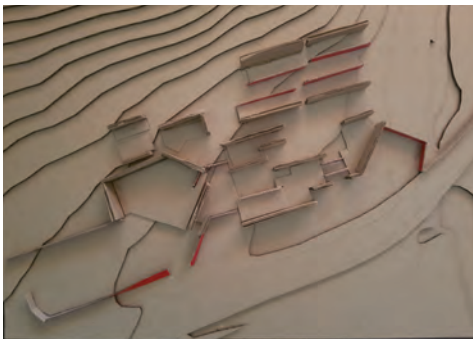
04_2 Design Iteration I

The first design exploration takes the idea of the wall as an element to partition the in-between space of urban and nature to create an architecture that conserves.

The notion that the wall as an element of partition is investigated and a series of walls are plotted onto the site. These walls directly respond to the east-west axis of Lavender Road that runs parallel to the site's northern boundary. This response emphasizes the protective objective of the architecture by keeping the urban connection closed and opening the east and west ends up to the vulnerable natural vegetation of the Magaliesberg mountain.

With the placement of these walls, the in-between space is divided into smaller spaces. These smaller spaces are more defined than the existing in-between and create a clear boundary between nature and urban without cutting the two realms completely off from one another.

The functional considerations of the program are overlaid and connections between the smaller spaces are plotted and displayed as circulation routes. This action presented an initial design plan that was segregated with many small spaces and many circulation routes. Due to the requirements and nature of the program, this plan was discarded and a more consolidated, centralized plan was investigated.



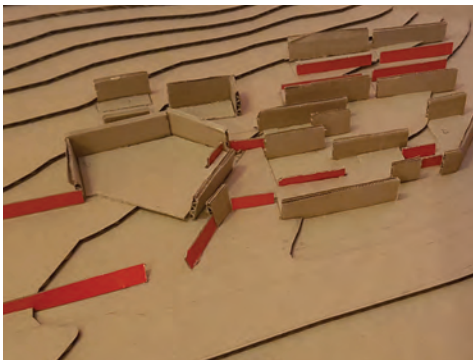


Fig _92 (Top): Plan view of model with walls (Author 2017).
Fig _93 (Center): View from Lavender Street showing the walls and connection to east west axis (Author 2017).
Fig _94 (Bottom): View from West showing the open ends of the walled spaces (Author 2017).

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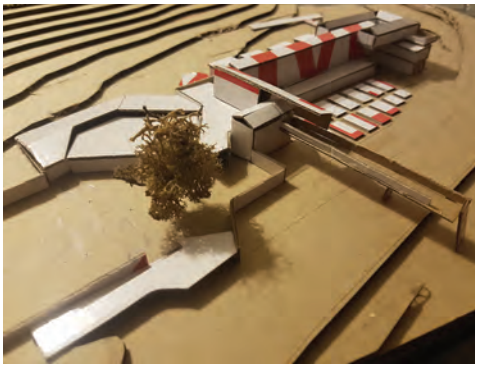
04_3 Design Iteration 2

With the considerations of the first stage, the second stage reorganizes the spaces and place them onto a central circulation axis that keeps the response of the east-west axis of Lavender Road.

This approach focused on the circulation and how the spaces relate to one another. With the consideration of central circulation, the design changed from a segregated plan to a multi-storey facility that was situated on the urban edge. The design also investigated the connection to the existing retail centre and how pedestrians will be able to connect to the facility's market retail space.



The design was discarded due to the lack of connection it had with the natural realm. Although it read as a partition between urban and nature, it completely cut the urban realm off from the natural with no visual or other connection. The idea of the visual east west connection to the Magaliesberg mountain was also lost due to the consolidation of spaces. The design language of a central circulation based design also did not relate to the argument of form and didn't relate to any historical images of the site.

04_4 Design Iteration 3

Design iteration 3 called for a complete rework of the previous two iterations and searched for the middle way between iteration 1 and 2. The idea that the wall can be divided into segments to create a connection between the two realms without disturbing the protective element was investigated. From stage one, the scattered plan, this iteration condenses the scattered "walls" into three main axials orientated partitions. The first partition, the most exposed with a connection to the urban realm. The second, the synergy partition in-between, where the two realms meet and the third, dug into the mountain side, the natural realm partition.

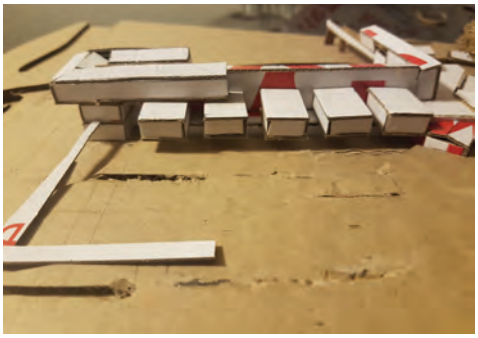


Fig _95 (Top): Plan view of model - Design iteration 2 (Author 2017).
Fig _96 (Center): View from Lavender street - Design iteration 2 (Author 2017).
Fig _97 (Bottom): View from Wonderboom Nature - Design iteration 2 Reserve (Author 2017).

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This design iteration related best to the conceptual scenario of a prolific partition structured in the in-between. It succeeds in the objective of connectedness and partition and showcases the tension. With the successful implementation of the preliminary design process, formal and functional considerations were added to the three partitions.

The first partition with its connection to the urban reacted to the main urban functions of the program. The office spaces and restaurant were placed onto the street edge to connect to the existing retail centre restaurants and the new office development proposed for the Wonderboom Junction. The second partition was programmed with the spaces that related to the two-realm connection. Here the retail market that sells the produce was placed with the in-between of partition one and two becoming an open public place for user interaction. The entrance to the facility was also planned for this central partition. The third partition that related to the natural realm was programmed with the production spaces. The in-between of the second and third partition was planned to become the planting and growing areas.

With the discussion on this design iteration, questions of connectedness and formal control were brought up. The architecture didn't seem to showcase the conceptual idea behind the thinking and there was proposed to investigate the roof as element to bind the three partitions into one architectural response.

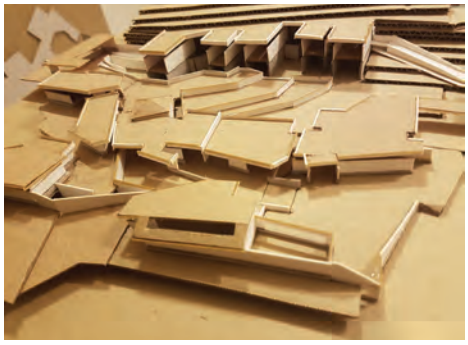

Fig _98 (Top): Design iteration 3 first conception model view (Author 2017).
Fig _99 (Center): Plan view of model - Design iteration 3 (Author 2017).
Fig _100 (Bottom): View from nothern edge - Design iteration 3 (Author 2017).

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04_5 Design Iteration 4 & 5

From the comments on design iteration 3, design iteration 4 (fig 101-103) responded to alter the roof structure for a more formal connection between the three partitions. The central roof structure of the retail and entrance spaces was altered to create a more coherent formal response to the rest of the partitions and the argument.

Design iteration 5 added the wall structure and material considerations that were derived from the historical layers of the site. A 1:200 plan (fig 107, not to scale) was developed to showcase the internal functioning and layout of the response to the argument. Design elevations and sections were also investigated to portray the argument of the museum of images as derived from the historical layers of the site and explained in chapter 3.

After discussions and deliberations, the following comments were made on this design:

- The design does not read as a connection between the urban and natural, more attention should be given to the showcasing of connection within the partition in relation to form.
- Attention should be given to the incorporation to the rest of the Magaliesberg mountain as this consideration was lost in the design process from design stage 1 to stage 4. Integration of the stone age cave and Wonderboom tree can be considered as two points.
- The response to the argument feels very closed-off from the natural and urban realms and attention should be given to the construction of the walls.
- Roofs should be reworked and the placing of the restaurant on the street edge must be reconsidered.

Fig _101 (Top): Model plan view - Design iteration 4 & 5 (Author 2017).
Fig _102 (Center): View from nothern edge - Design iteration 4 & 5 (Author 2017).
Fig _103 (Bottom): Model view - Design iteration 4 & 5 (Author 2017).

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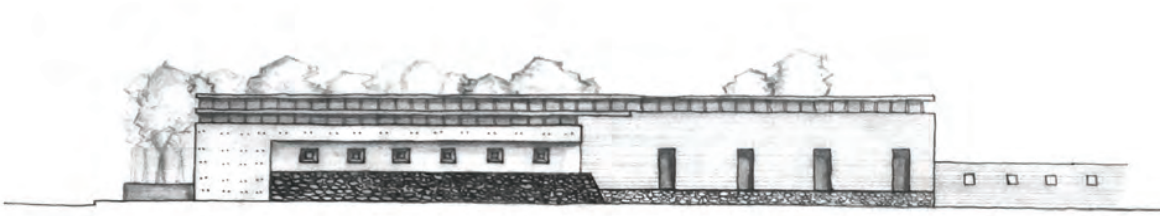

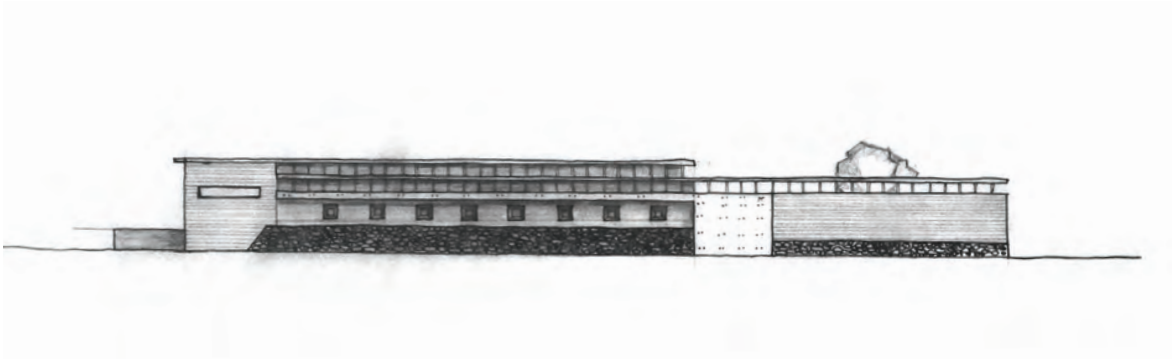

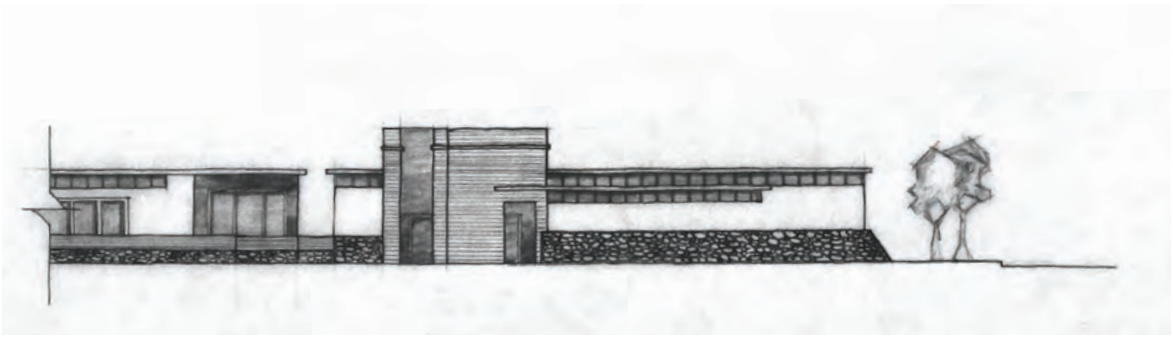

Fig _104 (Top): Office space elevation - Design iteration 4 & 5 (Author 2017).
Fig _105 (Center): Restaurant at street edge elevation - Design iteration 4 & 5 (Author 2017).
Fig _106 (Bottom): Entrance elevation - Design iteration 4 & 5 (Author 2017).

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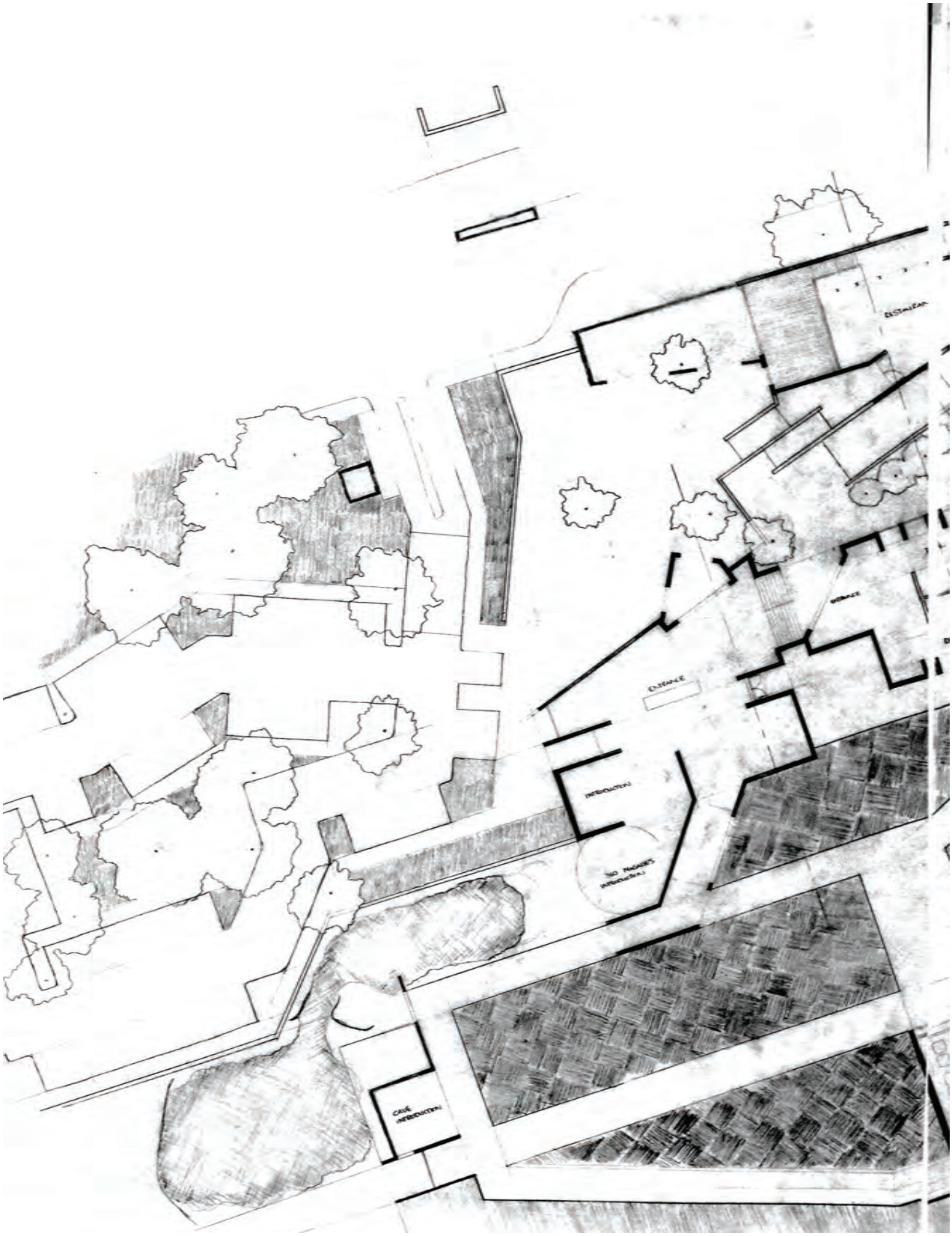

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Fig _107 (Spread): Plan - Design iteration 4 & 5 (Author 2017).

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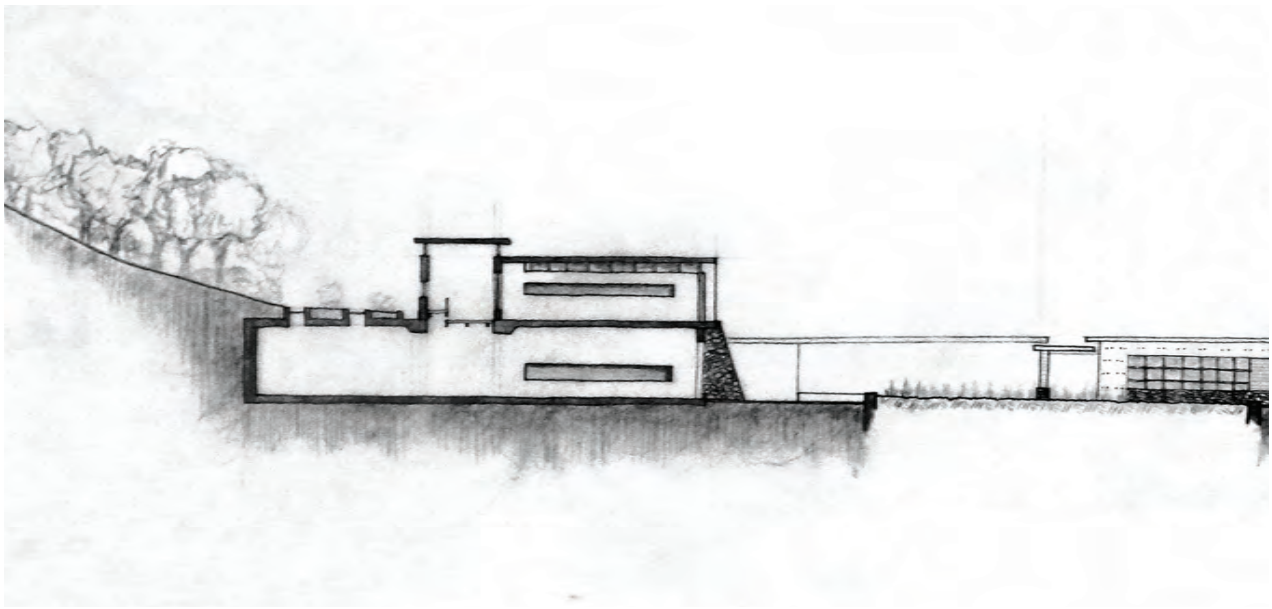

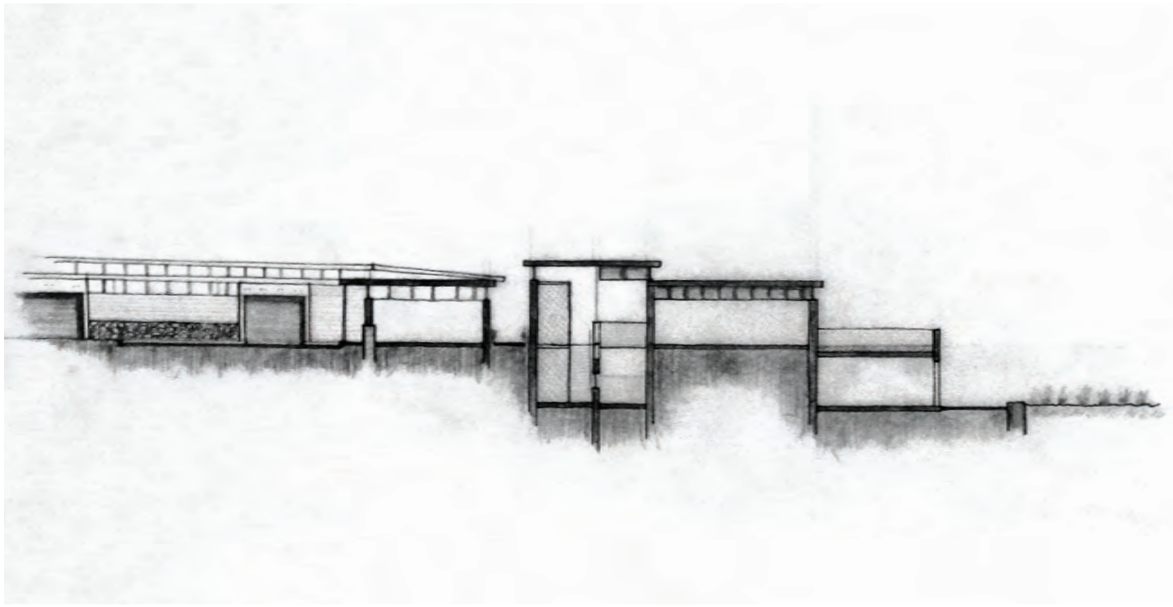

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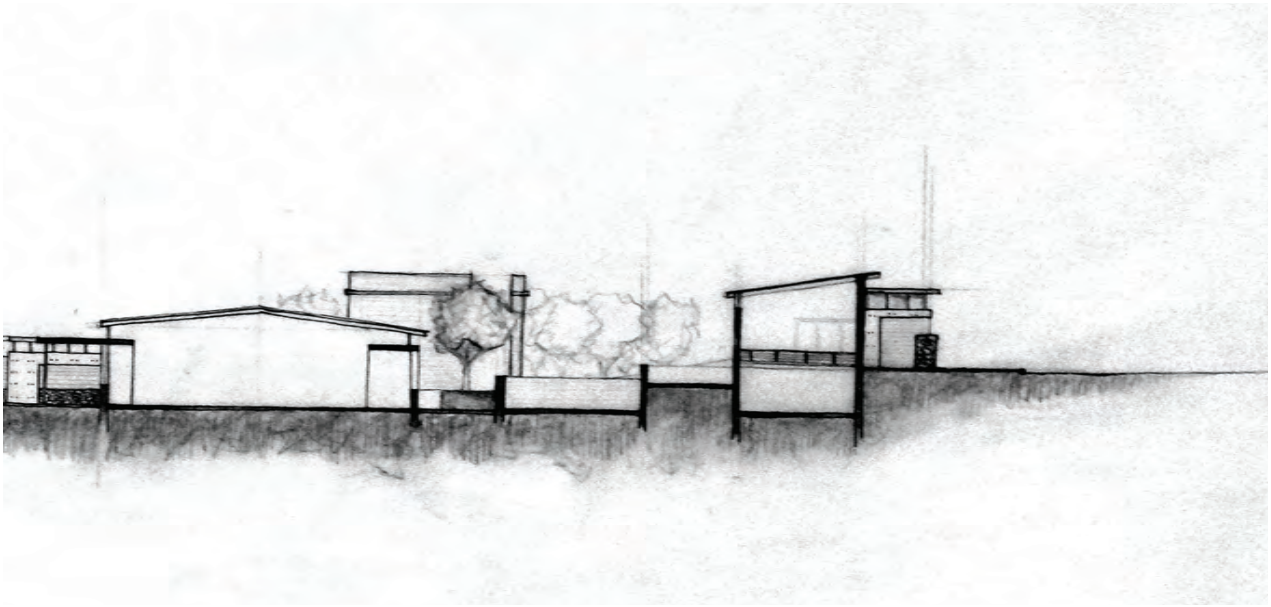

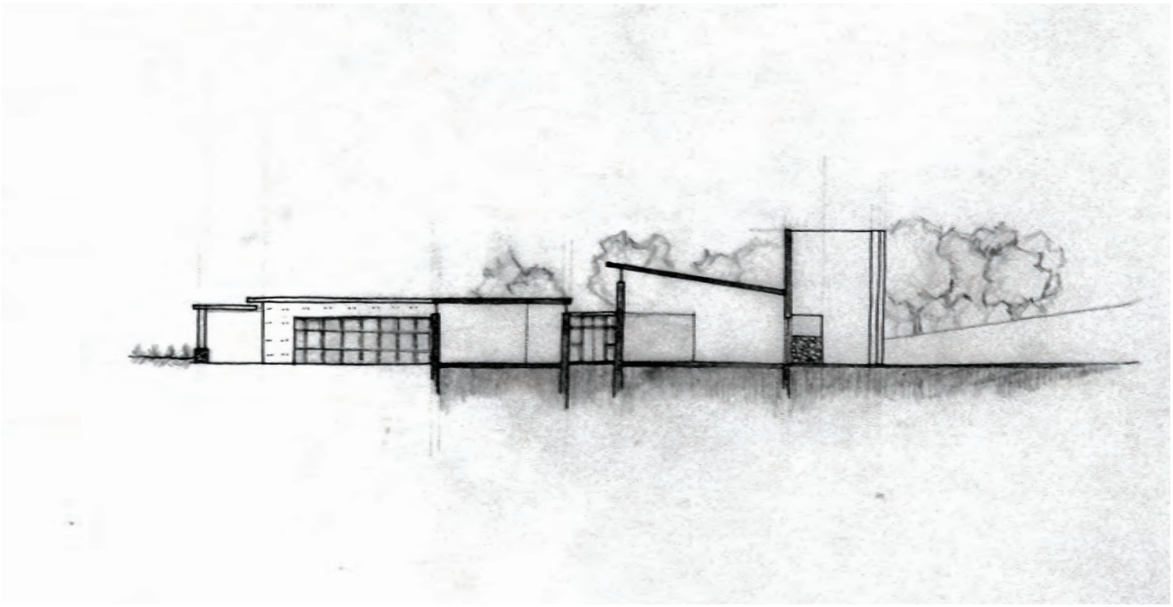

Fig _108 (Spread Top): Section 1 - Design iteration 4 & 5 (Author 2017).
Fig _109 (Left Bottom): Section 2 - Design iteration 4 & 5 (Author 2017).
Fig _110 (Right Bottom): Section 3 - Design iteration 4 & 5 (Author 2017).

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04_6 Design Iteration 6

After consideration of the comments made on the design development of iteration 5, a rework of the site layout was investigated. This rework set out to address the issues raised in the discussions and present an updated design layout that responded better to the argument and the conceptual scenario. With these considerations, attention was given to the moving of the urban partition (restaurant and office space) to the central partition and recessing the whole design with a natural buffer zone between the urban and the in-between. This is the representation of the notion that nature as element can become a partition.

Further development investigated the natural partition (production chambers) and the positioning in relation to the central partition. It was argued that the partition can be completely central due to the argument stating that the architecture is structured in-between and the division between these two partitions can be made stronger. To do so, the natural partition was redeveloped and moved. The positioning of this partition was then investigated and finally placed along the axis of the central partition, combining the three partitions into one long linear response. This response displayed the partition of urban and nature better without disrupting the connection.

An additional layer was added to the formal consideration as the architecture did not read as a strong enough element in the landscape as was set out in the objectives of the urban strategic vision. This layer was developed with the additional conceptual influence process and displayed in form of the roof. The existing Magaliesberg mountain silhouette essence was developed into an additional roof structure that made the response more dominant in the landscape and integrated the functional spaces with both realms. With this addition, the flow from the WNR to the urban environment by means of the in-between was showcased better. The addition of the secondary roof structure also made it possible for ventilation systems to be investigated and created accessible service space.

The formal consideration in terms of wall structure and materials was developed further and the material consideration of the response was finalized.

After the amended plans were discussed a few comments were made in terms of the complexity of the complete layout and the consideration to amend all the small corners and turn into a more, simplified plan. It was recommended to investigate a linear circulation route and cut out some of the bends and turns.

Fig _111 (Right Top): Design iteration 4 & 5 rework 1 - Design iteration 6 (Author 2017).
Fig _112 (Right Bottom): Design iteration 4 & 5 rework 2 - Design iteration 6 (Author 2017).

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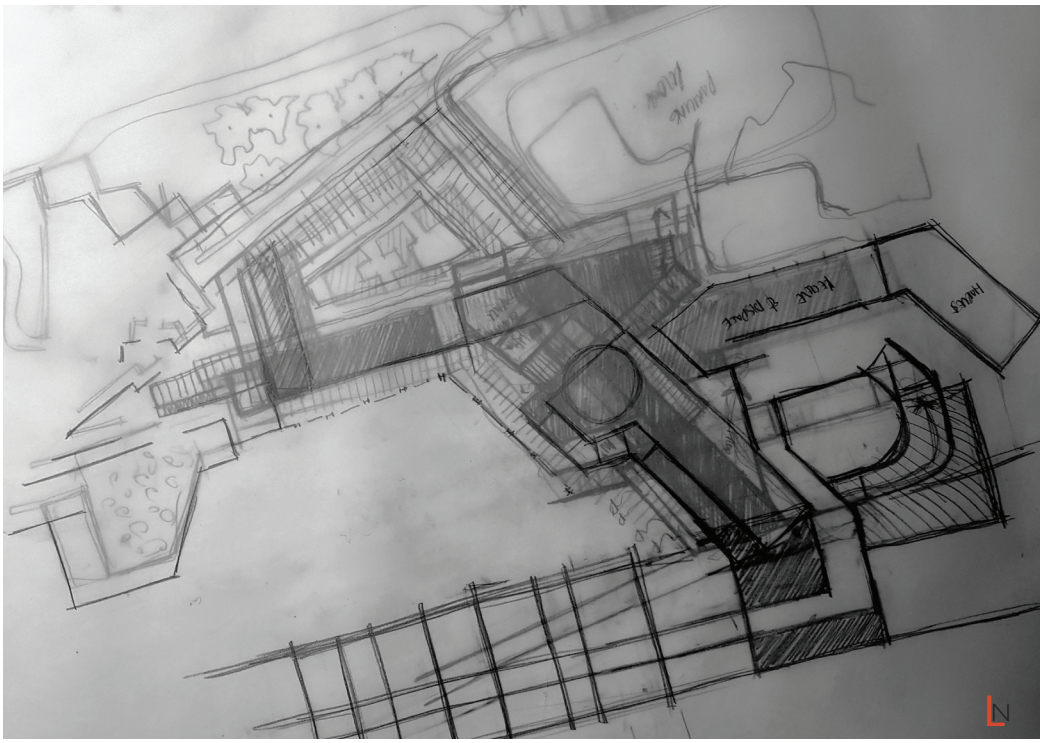

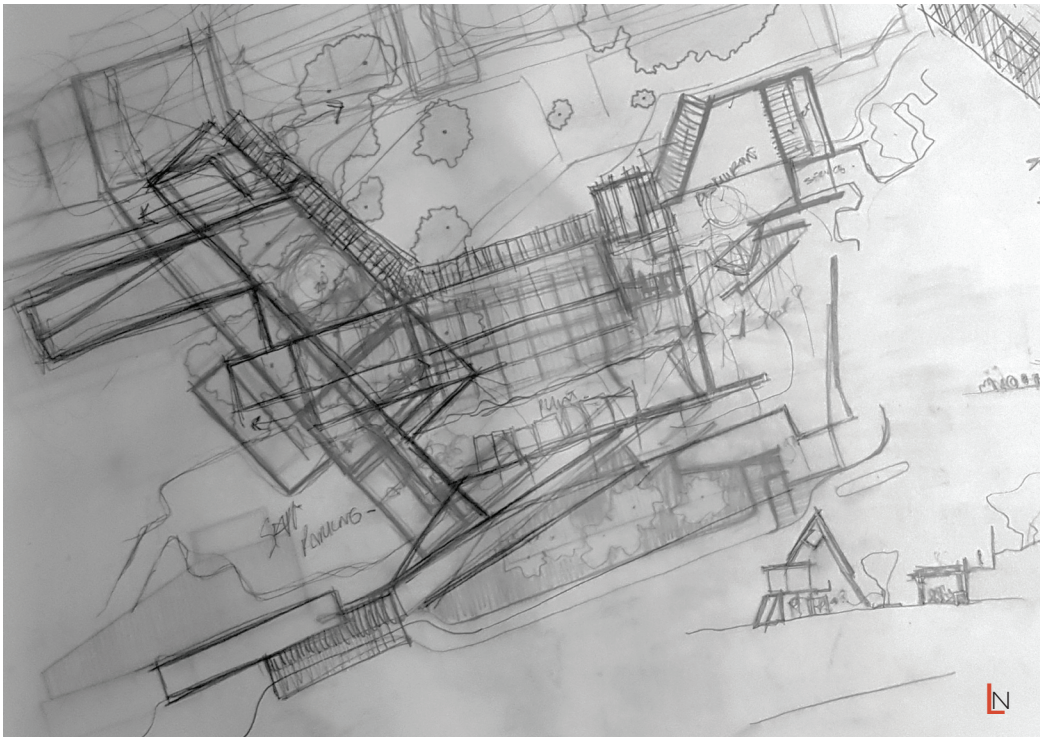

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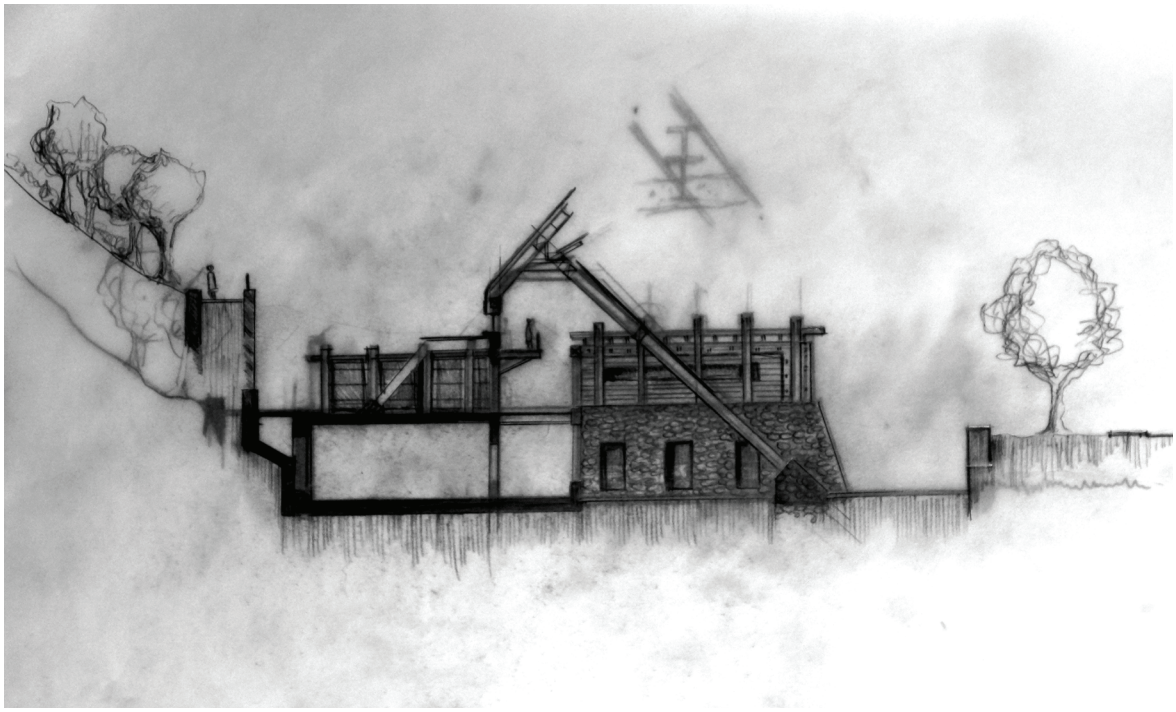

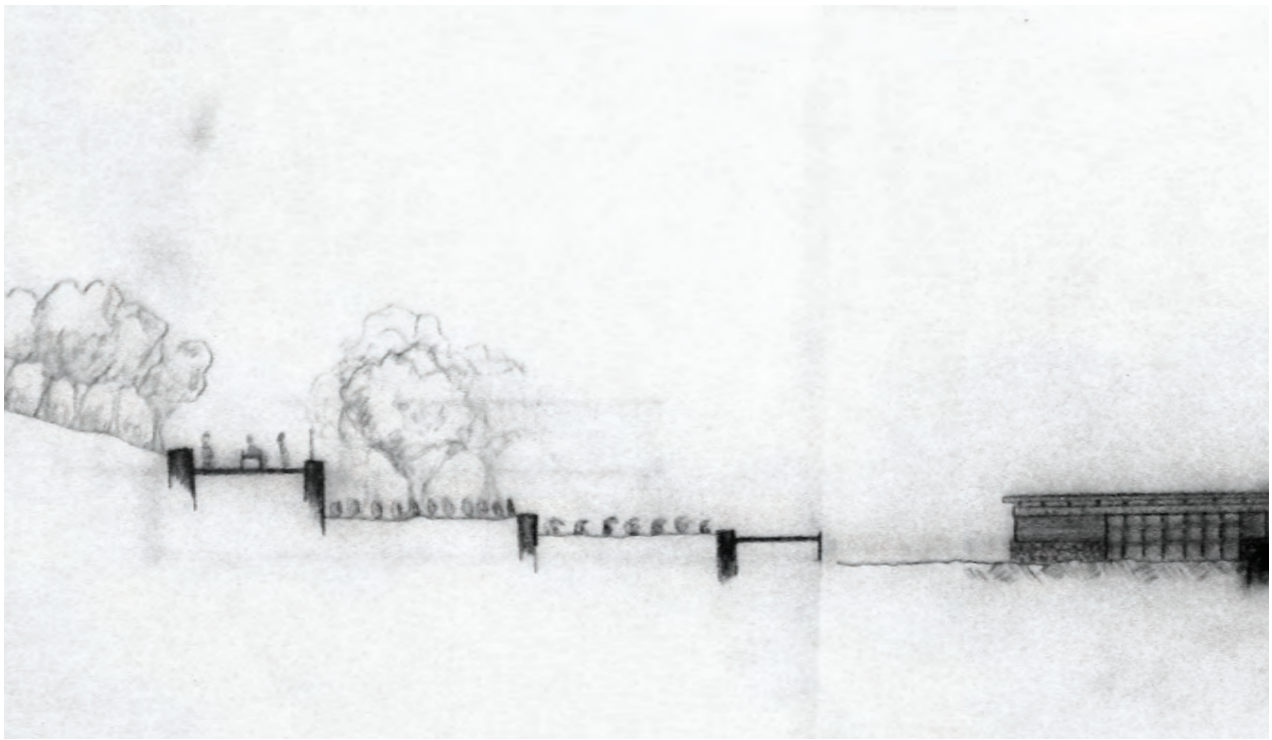

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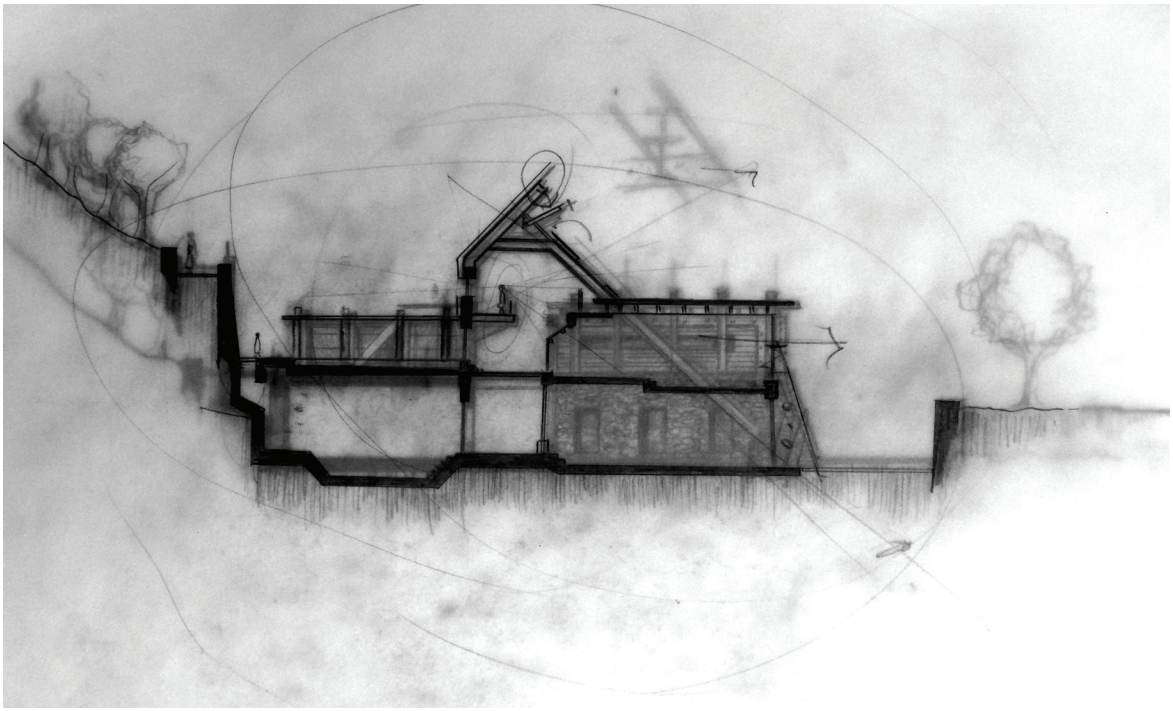

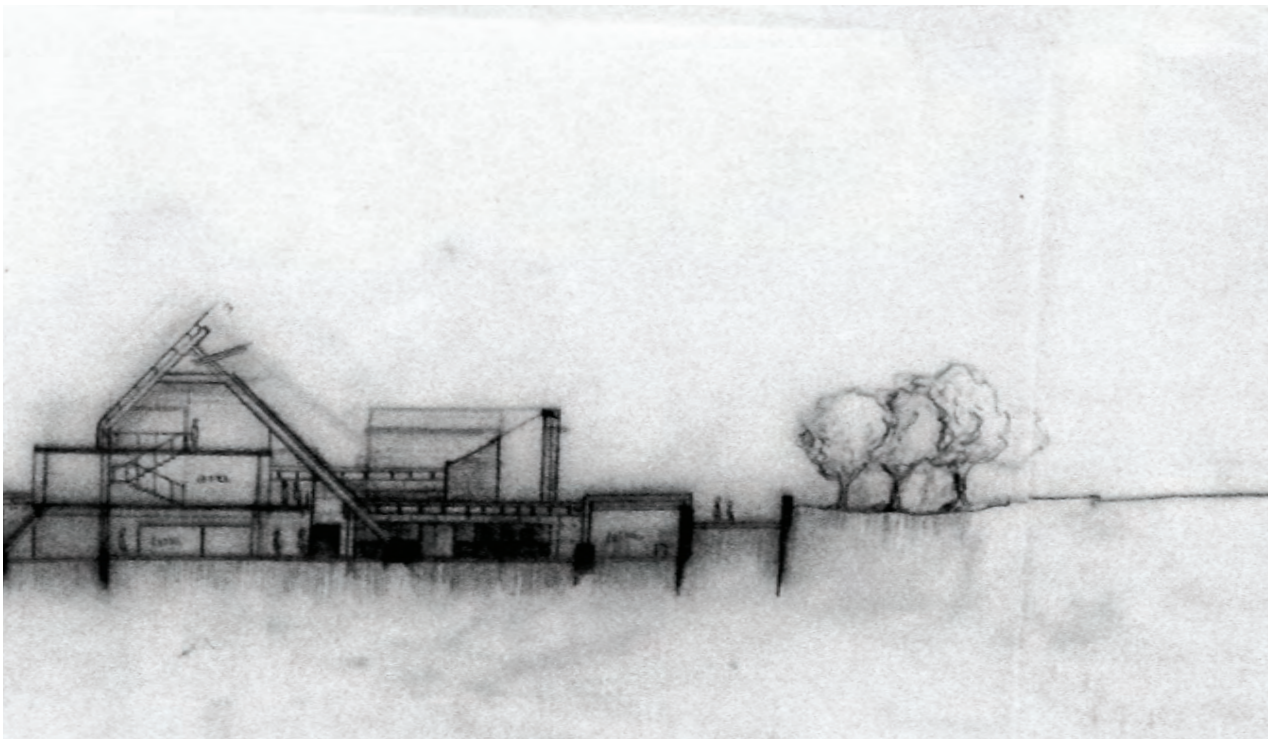

Fig _113 (Left Top): Section 4 - Design iteration 6 (Author 2017).
Fig _114 (Right Top): Section 4 rework - Design iteration 6 (Author 2017).
Fig _115 (Spread Bottom): Section 1 rework - Design iteration 6 (Author 2017).

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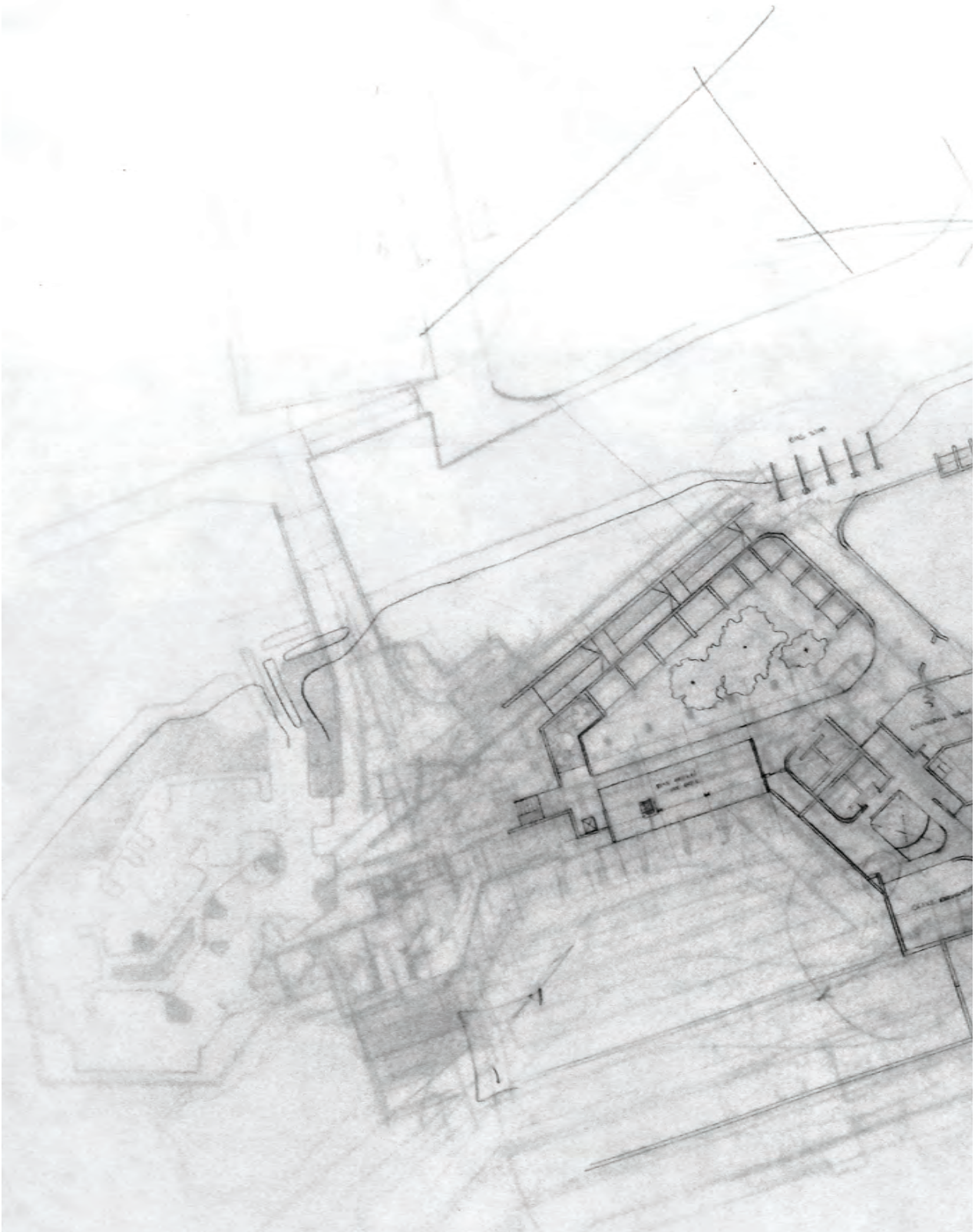

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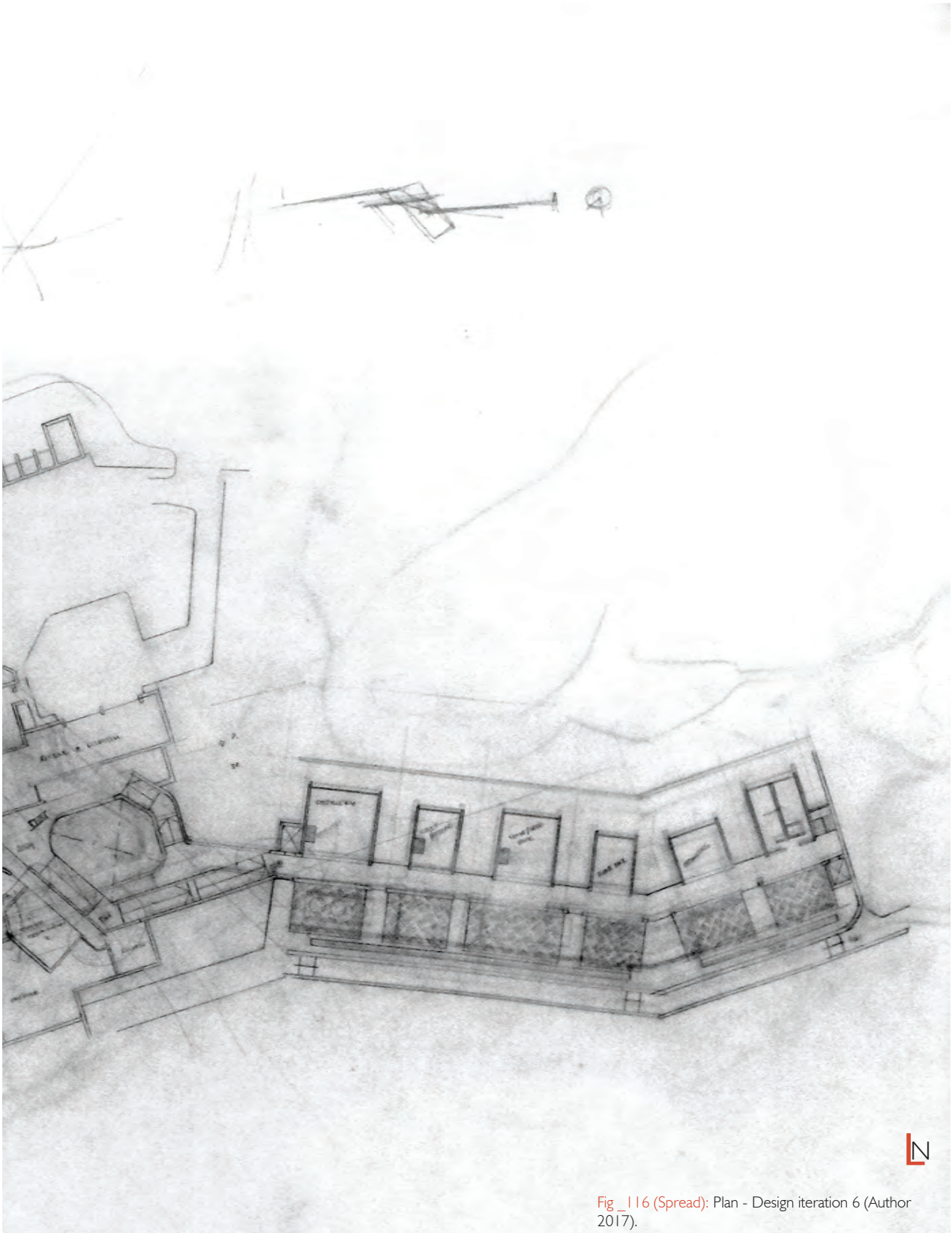

Fig _116 (Spread): Plan - Design iteration 6 (Author 2017).

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04_7 Design Iteration 7

Design iteration 7 focused on the refinement of the plan and the detail layout of the interior space. The development addressed the relationship between the form and the functional requirements of the interior spaces. Each space was designed with the requirements of the program and how these requirements could be placed without disrupting the formal considerations.

The layout was also developed further and all the offset corners were removed to simplify the plan. Ease of access in terms of level changes was investigated and resulted in a change of the production chamber's position on the site . As few as possible level changes were implemented to assure ease of access for all users.

With the plan finalized a detailed model was constructed to illustrate the response to the argument within the context. The construction of the model presented its own challenges and adjustments to the retail market length were made. The model showcased the architecture as a whole and a complete understanding of the response to argument could be gathered. Slight changes in terms of retaining structures were made and the plan design was finalized. The technical investigation could commence.

Fig _117 (Right Top): Detail plan of restaurant and kitchen - Design iteration 7 (Author 2017).
Fig _118 (Right Bottom): Detail Plan of conservation offices - Design iteration 7 (Author 2017).

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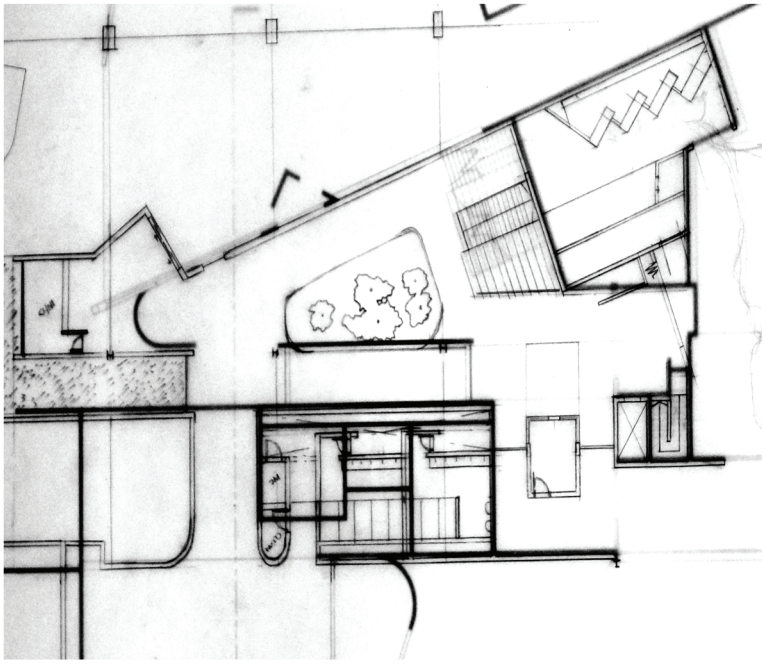

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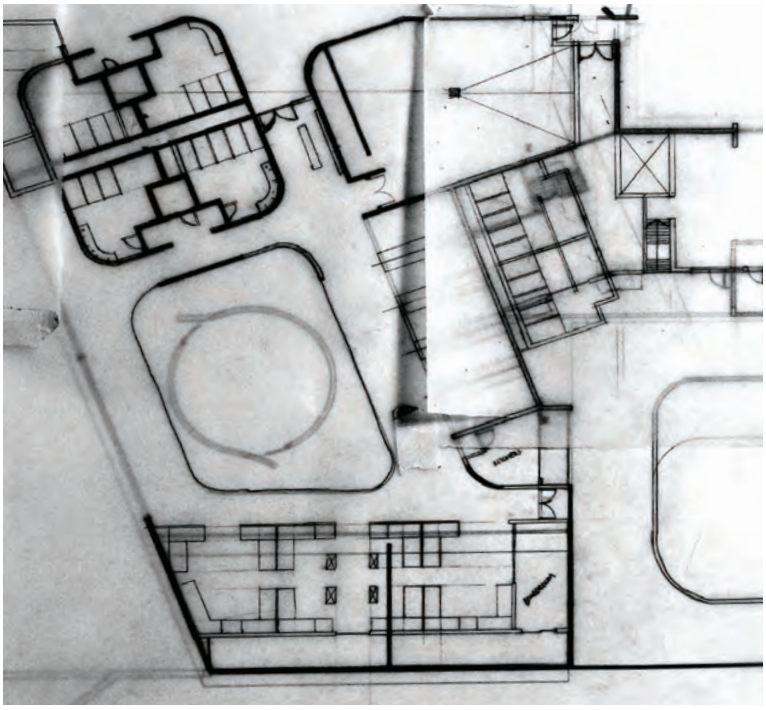

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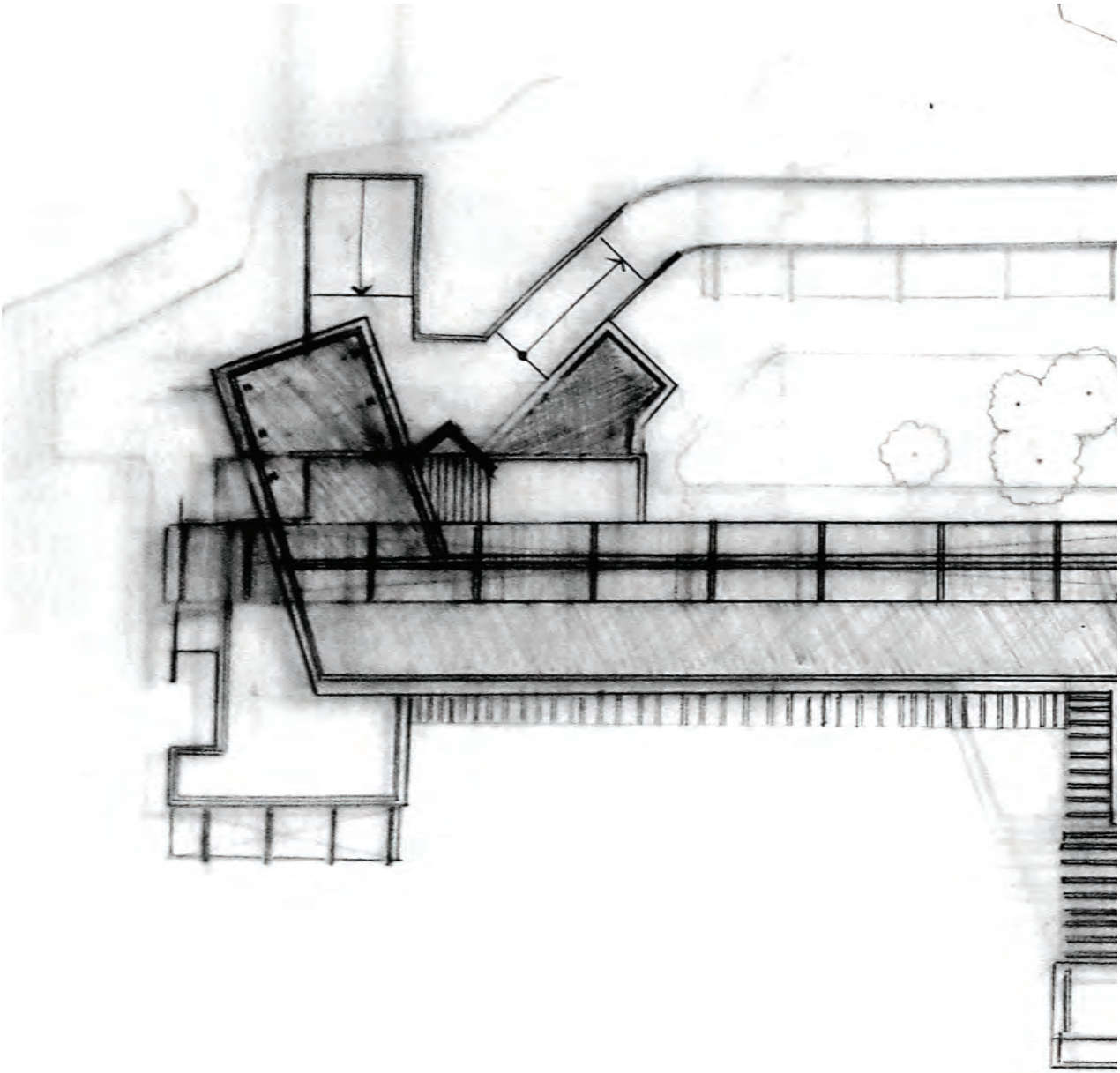

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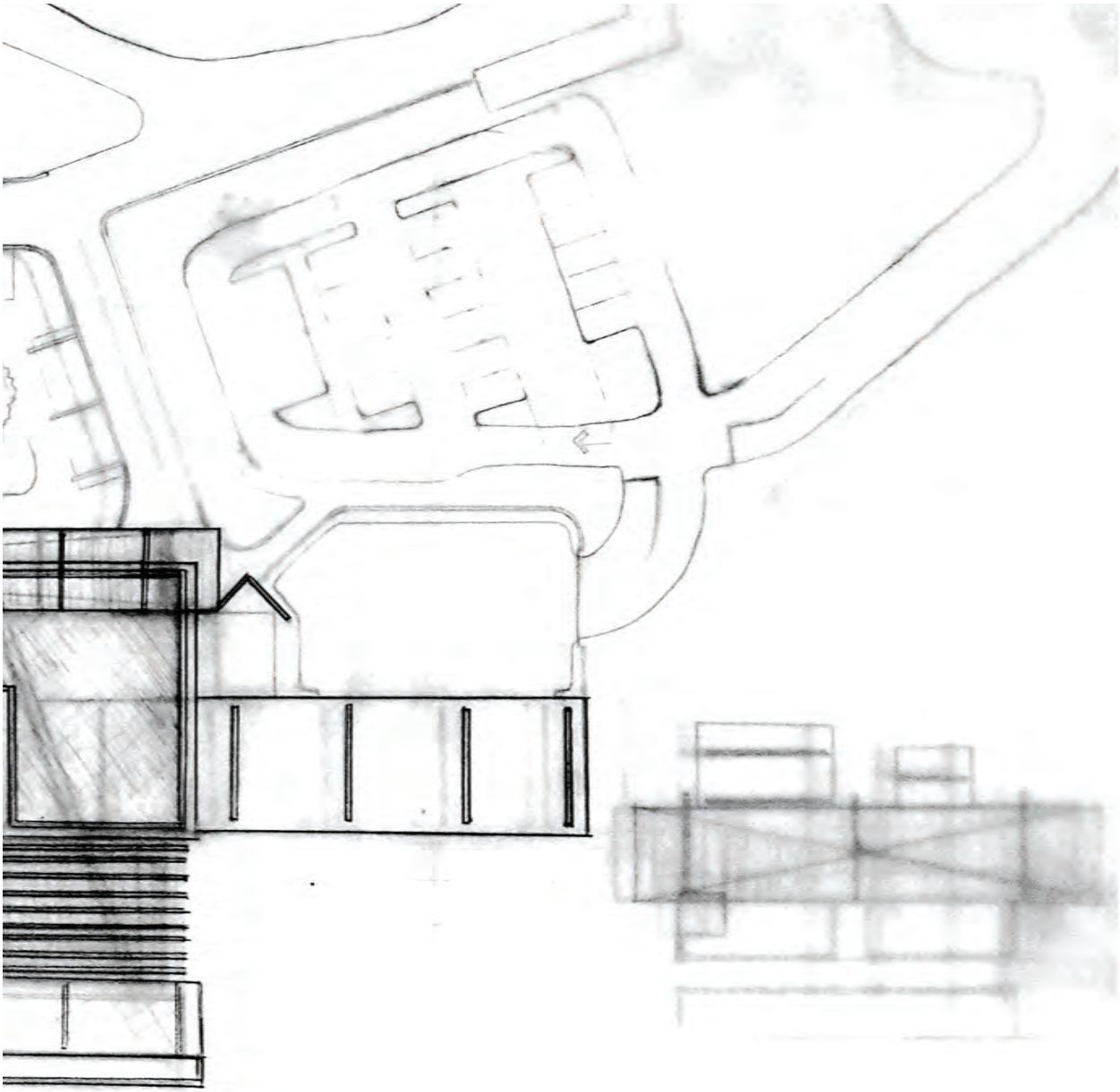

Fig _119 (Spread): Plan - Design iteration 7 (Author 2017).

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Fig _120 (Above): Model process 1 (Author 2017).

Fig _121 (Above): Model process 2 (Author 2017).

Fig _122 (Above): Model process 3 (Author 2017).

Fig _126 (Above): Model process 7 (Author 2017).

Fig _127 (Above): Model process 8 (Author 2017).

Fig _128 (Above): Model process 9 (Author 2017).

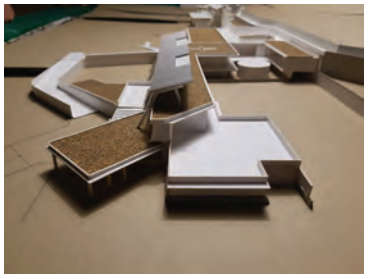

Fig _132 (Above): Model process 13 (Author 2017).

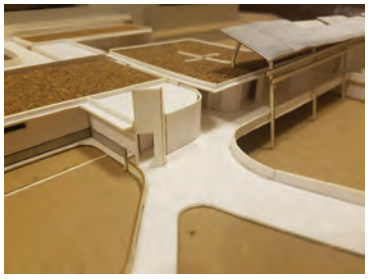

Fig _133 (Above): Model process 14 (Author 2017).

Fig _134 (Above): Model process 15 (Author 2017).

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Fig _123 (Above): Model process 4 (Author 2017).

Fig _124 (Above): Model process 5 (Author 2017).

Fig _125 (Above): Model process 6 (Author 2017).

Fig _129 (Above): Model process 10 (Author 2017).

Fig _130 (Above): Model process 11 (Author 2017).

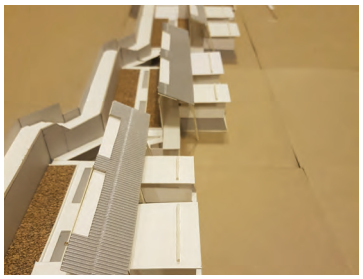

Fig _131 (Above): Model process 12 (Author 2017).

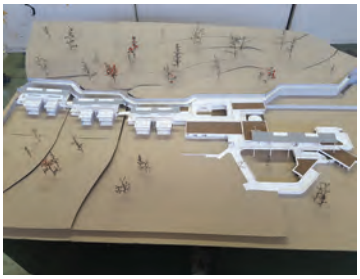

Fig _135 (Above): Model process 16 (Author 2017).

Fig _136 (Above): Model process 17 (Author 2017).

Fig _137 (Above): Model process 18 (Author 2017).

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05_
DESIGN RESOLUTION

"Of course you condition perception through a building but you must be careful not to overdo it, otherwise you asphyxiate the user. It is necessary to find the right balance between the control of the experience of space, and freedom which allows things to happen."

Álvaro Siza

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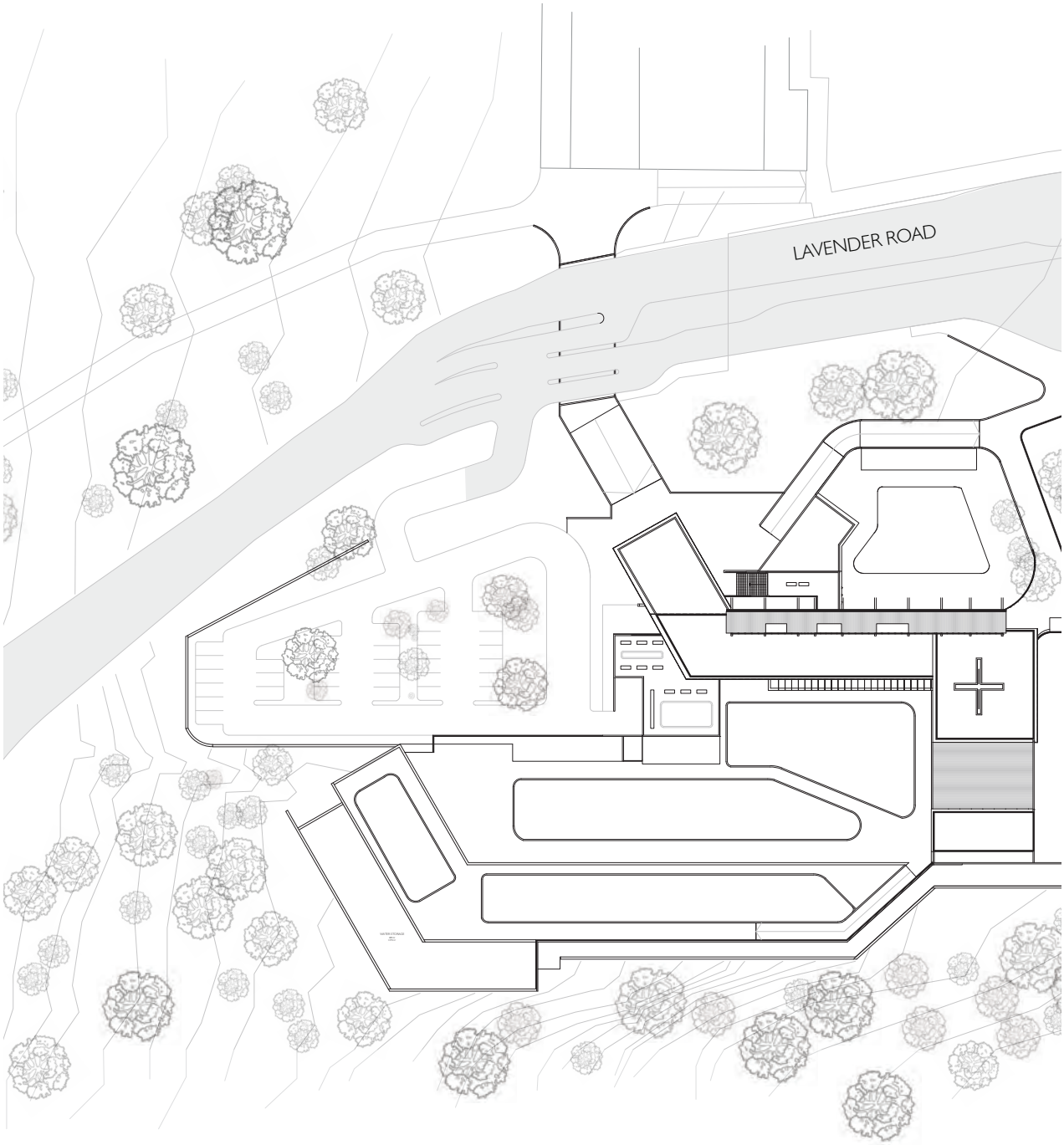

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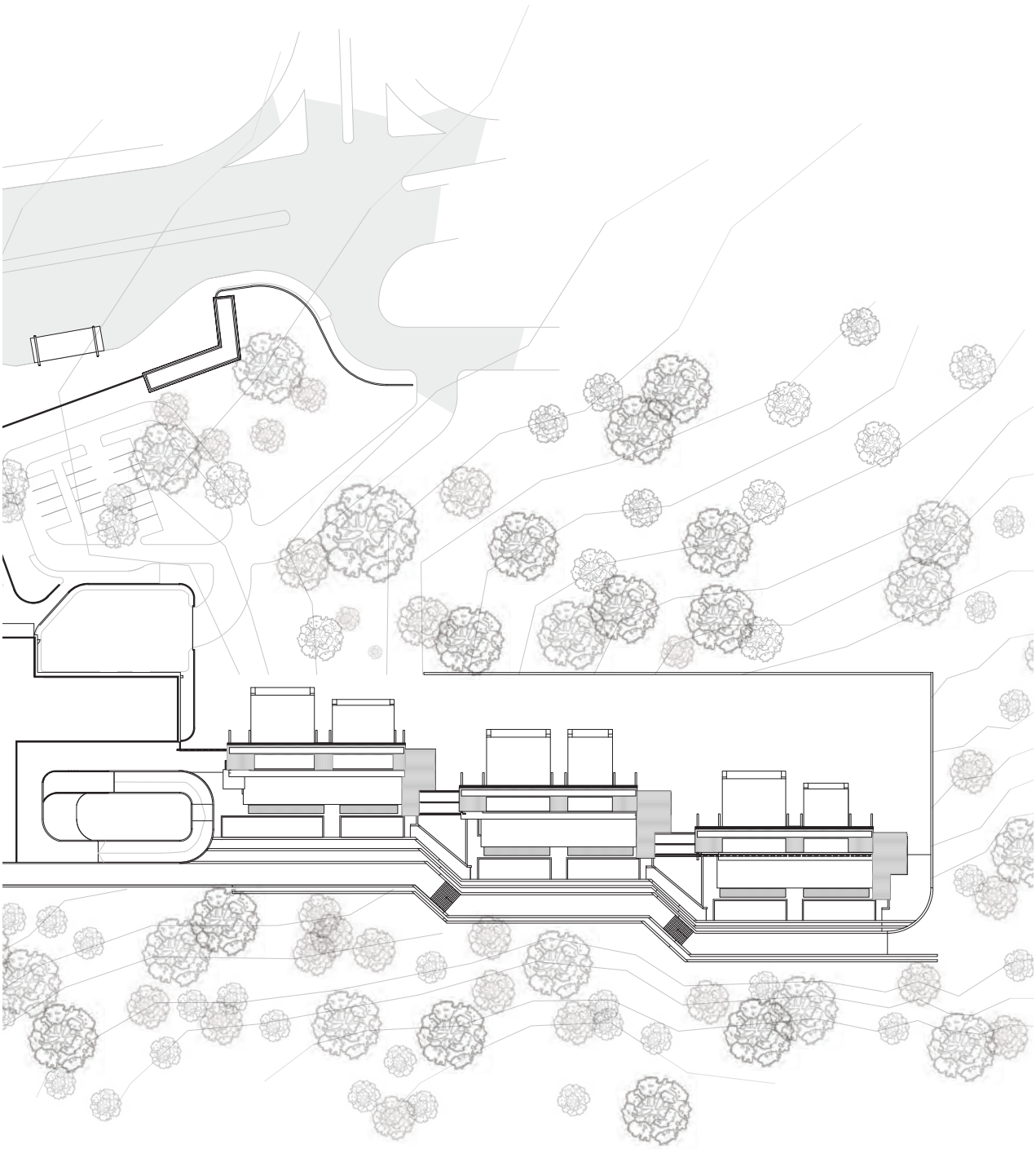

Fig _139 (Spread): Site Plan - Resolution (Author 2017).

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Fig _140 (Above): Approach Render (Author 2017).

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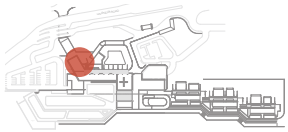
05_1 Approach - Entrance

The conservation facility's visitor enters the site from three different points of approach (fig 104). The first approach from the bus stop on Lavender Road. The visitor has the option of taking two routes to gain access to the facilities public reception courtyard, one down the pedestrian entrance ramp and the other past the rentable office spaces on the first-floor level. The second approach from Wonderboom Junction retail centre allows visitors to safely cross Lavender Road. This approach starts at the retail centre and descends to a crossing corridor that passes underneath Lavender Road. This approach meets up with the bus stop and vehicular entrance approaches. The third, from the visitors parking, approaches from the west and takes the user directly to the public reception courtyard from where they enter the facility's foyer.



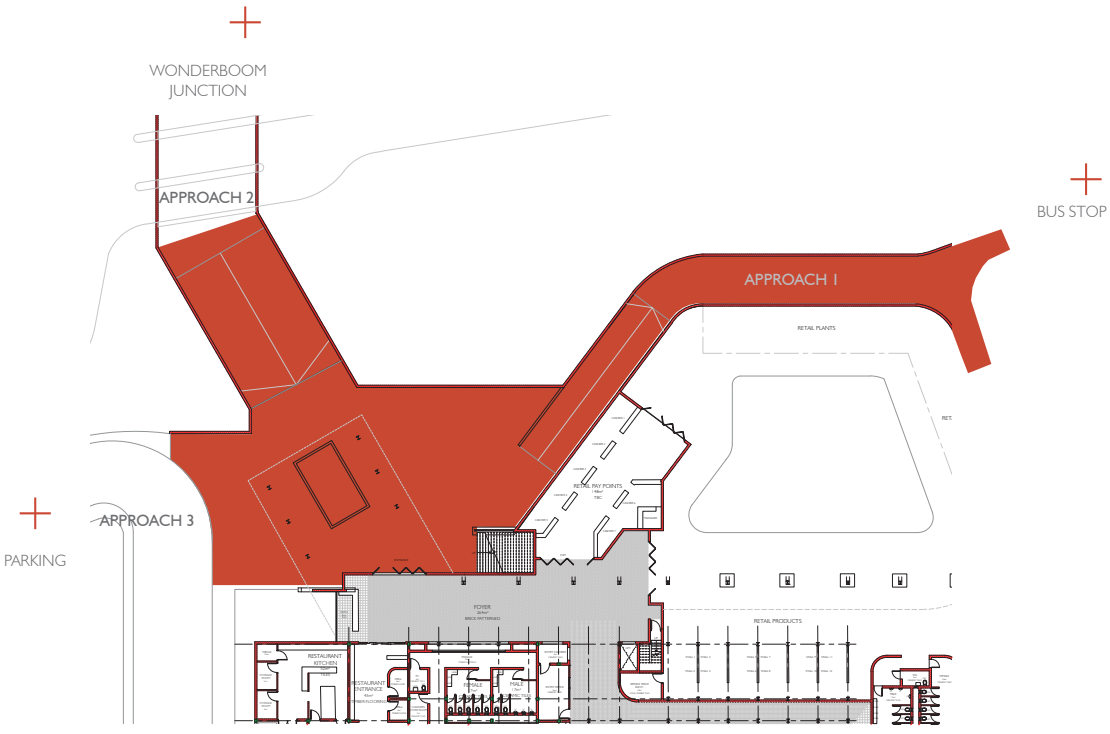


Fig _141 (Above): Call out of approaches and entrance (Author 2017).

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Fig _142 (Above): Entrance Foyer Render (Author 2017).

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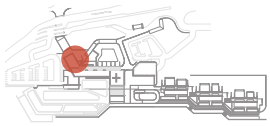
05_2 Facility Foyer

From the public reception courtyard, the visitor enters the facility's foyer (fig 141). This space is partially closed-off to the public and is used as the decision space for the visitor. From the reception foyer, the visitor has an option of three destinations to visit. The first is the facilities restaurant that is situated as separate entity and intends to serve the visitor, the worker, and the passer-by. The second is the tour entry point to the facility where the visitor is asked an admission fee if they wish to visit the conservation facility and experience the process and workings of the facility. This visitor's experience can be viewed as a wanderer or with a guided tour. The third choice is the retail market space. This area can be entered from the foyer or as the end of the facility's tour.



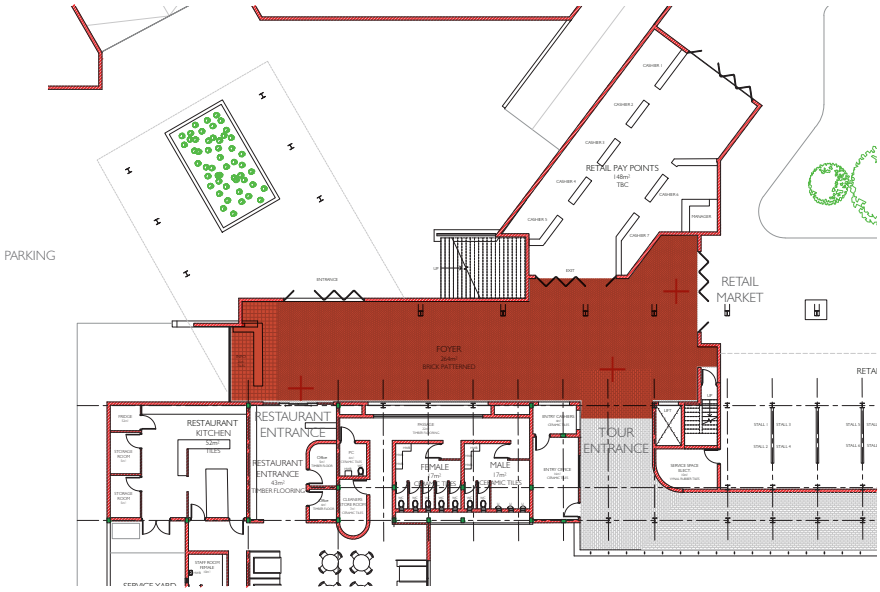


Fig _143 (Above): Call out of facility foyer (Author 2017).

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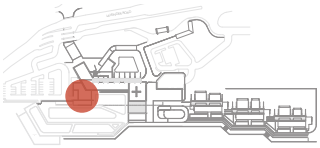
05_3 Restaurant

The restaurant (fig 142) as separate entity to the conservation facility is used to bridge the gap between the retail centre restaurants situated on the southern end of Wonderboom Junction and the conservation facility to the South. The facility's restaurant has the same programmatic intentions as the eateries at Wonderboom Junction but starts to introduce the visitor to the conservation facility in terms of the setting and the relationship between the meals served and the landscape . The restaurants' intention is to focus the visitor's attention on the natural product produced in the surrounding landscape rather than the conventional products that is normally brought in by truck. This idea is presented by means of opening the views up to the facility's grow beds and keeping the visitor always conscious of the natural landscape and where the produce (meals) come from, i.e. nature. This idea is strengthened by using predominately products from the facility on the restaurant's menu and by creating an extension of the natural landscape to the restaurant's menu.



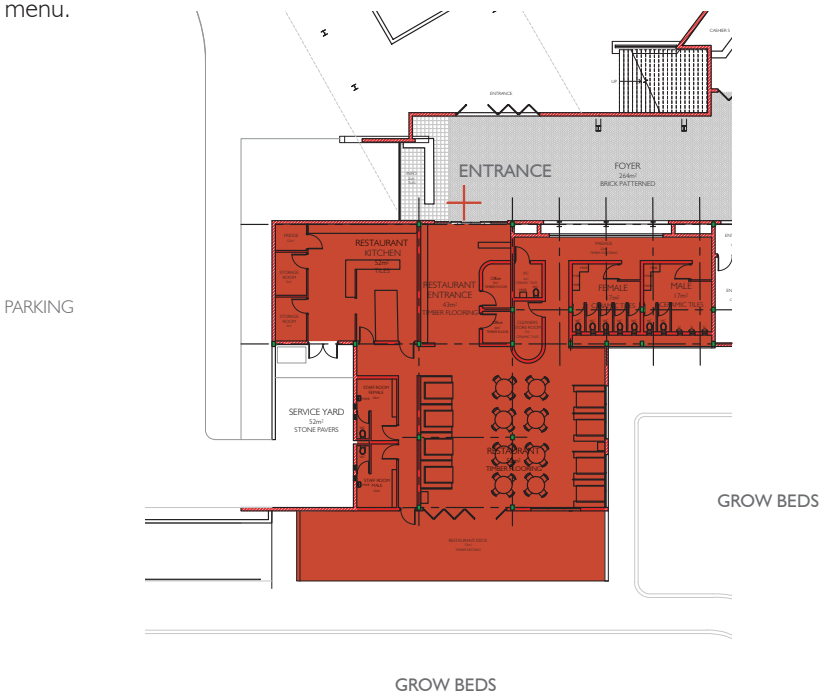


Fig _144 (Above): Call out of Restaurant (Author 2017).

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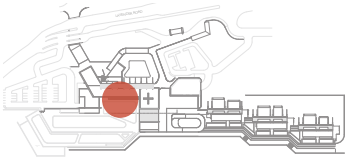
05_4 Facility Tour Entrance

The facility's visitors tour entrance consists of admission fee counters and an access control point to allow visitors who has paid to view the facility to enter. At the entry point, the visitor is immediately introduced to the natural landscape and continues the path into the orientation chamber. The visual connection between the natural landscape and the visitor is only broken when the visitor entry the 360-degree virtual chamber.



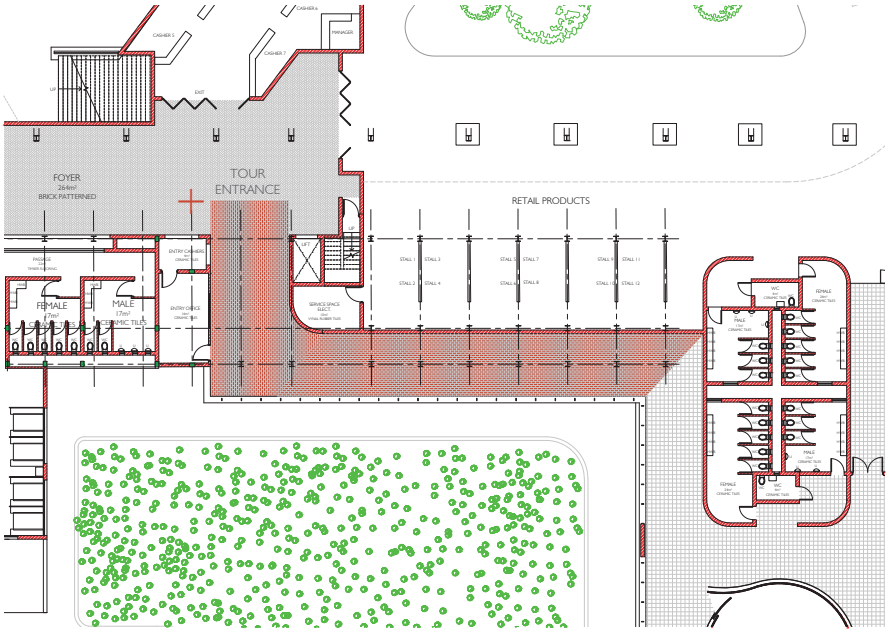


Fig _145 (Above): Facility Tour Entrance (Author 2017).

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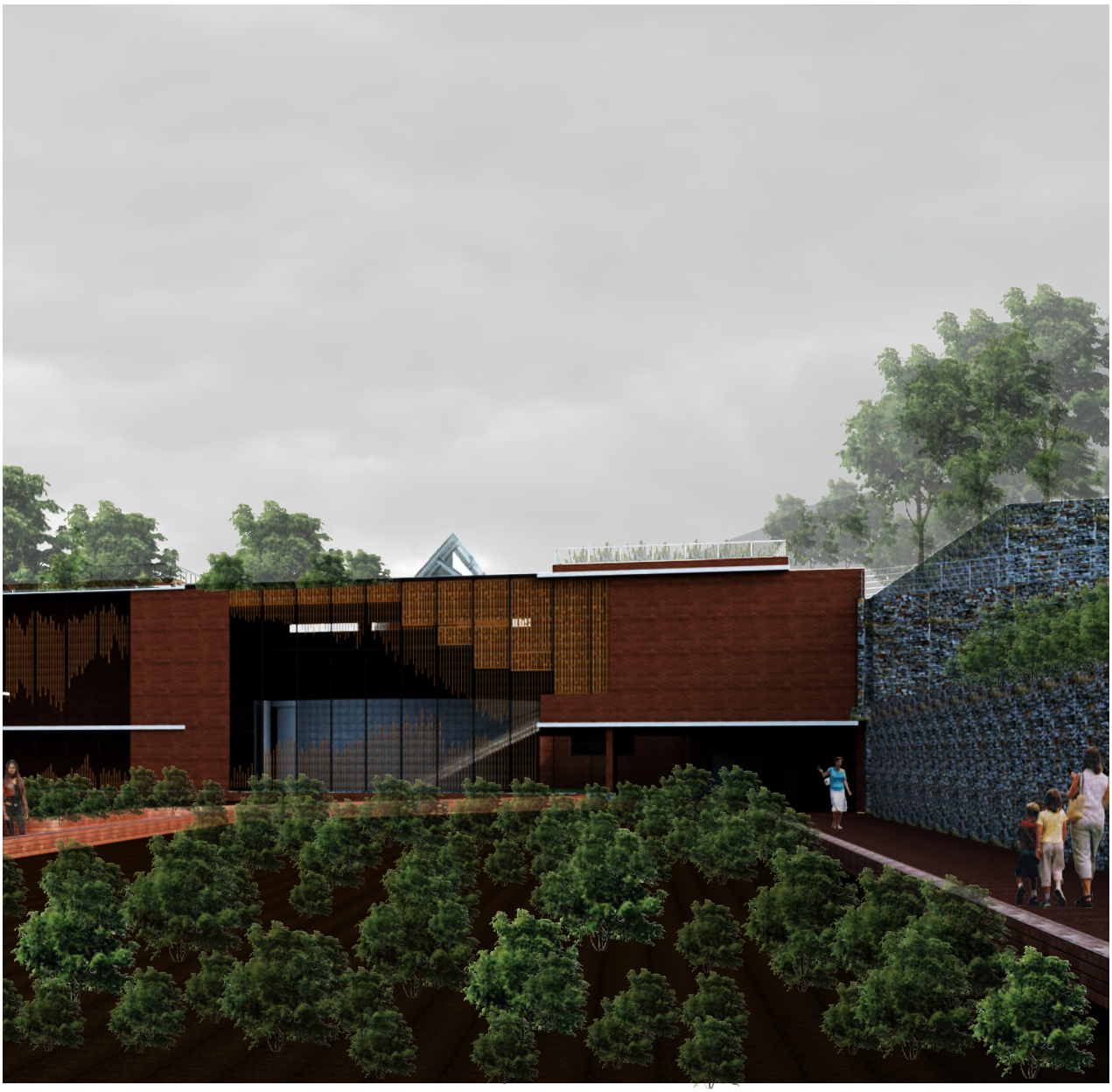

Fig _146 (Spread): Grow Area Courtyard (Author 2017).

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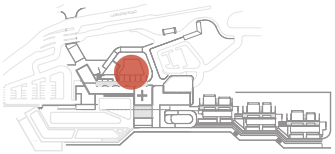
05_5 Retail Market

The retail market can be entered from two different approaches. The first from the reception foyer. This entry point makes it possible for the retail market to cater for the public that visits the facility only to buy products from the facility. The second entry is the last part of the conservation facility's tour route and all visitors are directed through the retail market as the exit point. This concludes their tour with the possibility to purchase the products that they saw being produced. The retail market space caters for two different types of products. The first is the conventional bottled and packed type of products and the second is the plants themselves. The integration of these two product type spaces forms the basis for the ordering of the retail space layout. The central green courtyard can be transformed into hosting events when the facility wants to host a night or specific celebrative market.



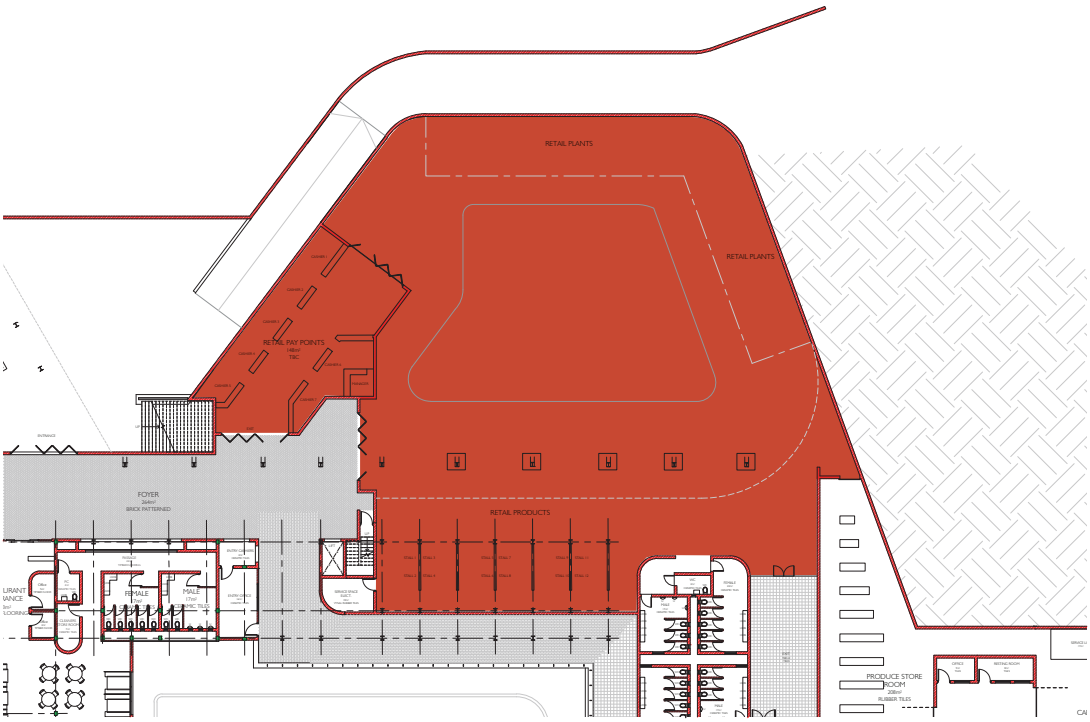


Fig _147 (Above): Call out of Retail Market (Author 2017).

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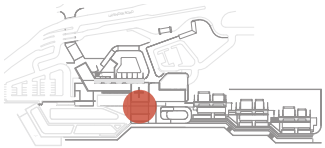
05_6 Facility's Orientation Chamber

The facility's orientation chamber orientates the visitor as the start to the experience of the conservation facility. The idea is to inform the visitor of the surrounding context, how the Magaliesberg mountain formed and how the facility uses the mountain and reserve resources to aid in conservation. This introduction is done by means of a 360-virtual chamber experience in the centre of the space and secondary maps, images and displays surrounding the chamber. The visitor will be able to move freely through the space and experience the information displays at their own pace. After which they can walk through the facility and navigate around by means of maps and signs to understand what the facility is about. All areas of the facility are open to the public visitor to view and experience expect the first floors in the production chambers. For these areas an additional view floor was incorporated making the whole facility visually accessible to the visitor.



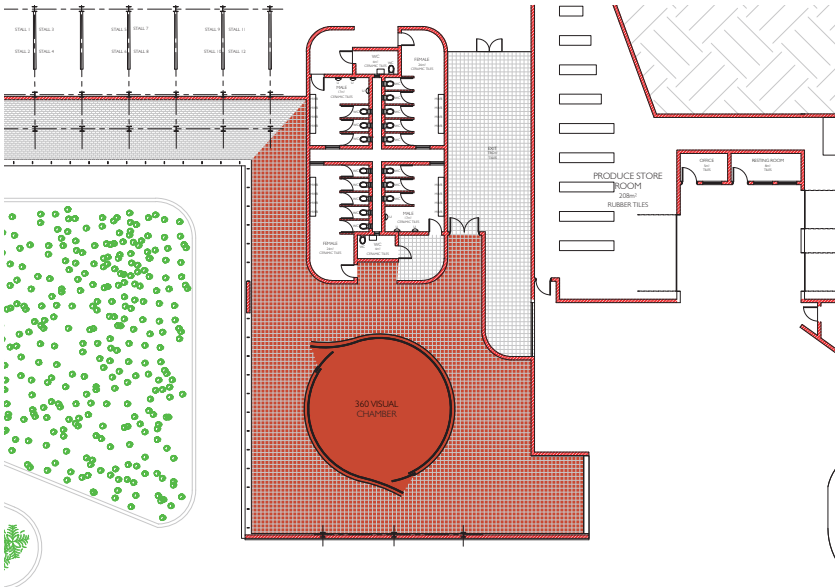


Fig _148 (Above): Call out of Facilities Introduction Chamber (Author 2017).

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05_7 Office Spaces

The conservation facility houses two different office typologies. The first of which is the rentable office workstations. This space makes it possible for entrepreneurs and small business owners to rent a desk space rather than a conventional office. This follows the trend of a shared economy structure. The integration of this typology office structure into the facility allows for new entrepreneurs or small business owners to tap into the infrastructure of the facility and develop innovative ideas for markets. The office workspace is part of the facility's objective in developing the surrounding urban realm into a thriving economy. The second office typology is the research commons that consists of hot desk workstations, a reference corner, a fully fitted test laboratory and meeting spaces. These spaces are to aid conservation researchers and organization to continue and enhance the work they are doing to conserve these nature areas. Funds generated by the facility are invested in these organizations by means of supplying them the infrastructure to aid conservation. The research office space also consists of a public meeting area where the surrounding urban dwellers can interact with the organizations in finding current ways to conserve or develop the natural areas within urban environments.

Fig _149 (Right Top): Call out of Rentable Office Spaces (Author 2017).
Fig _150 (Right Bottom): Call out of Research Office Space (Author 2017).

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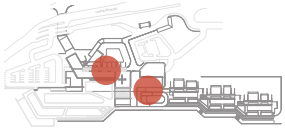

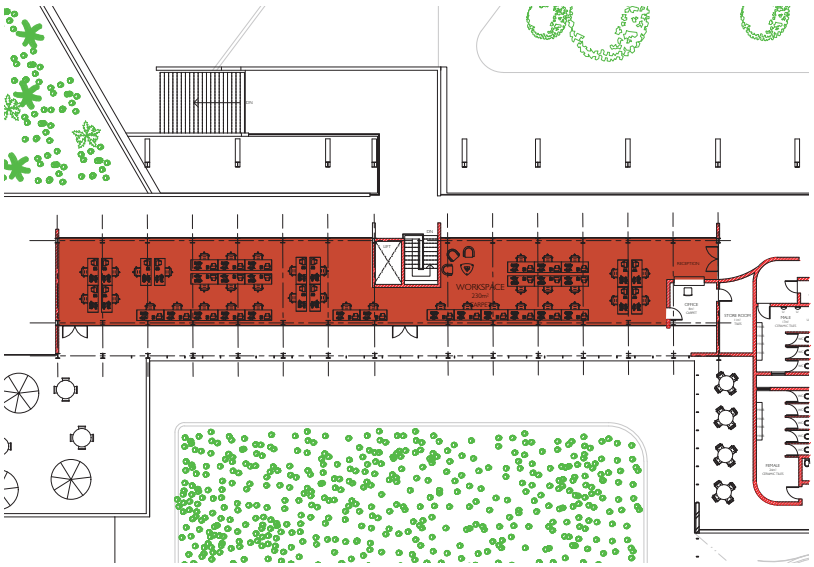

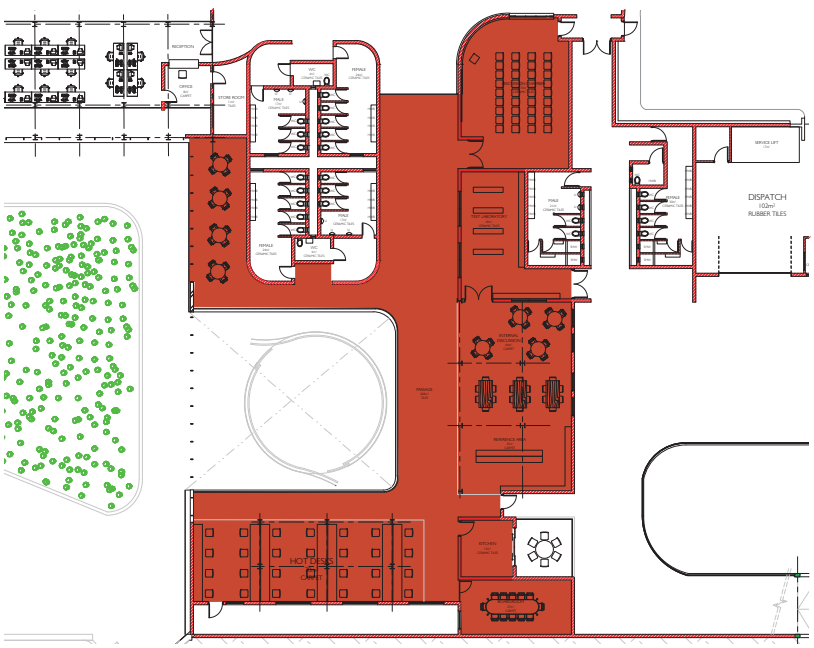

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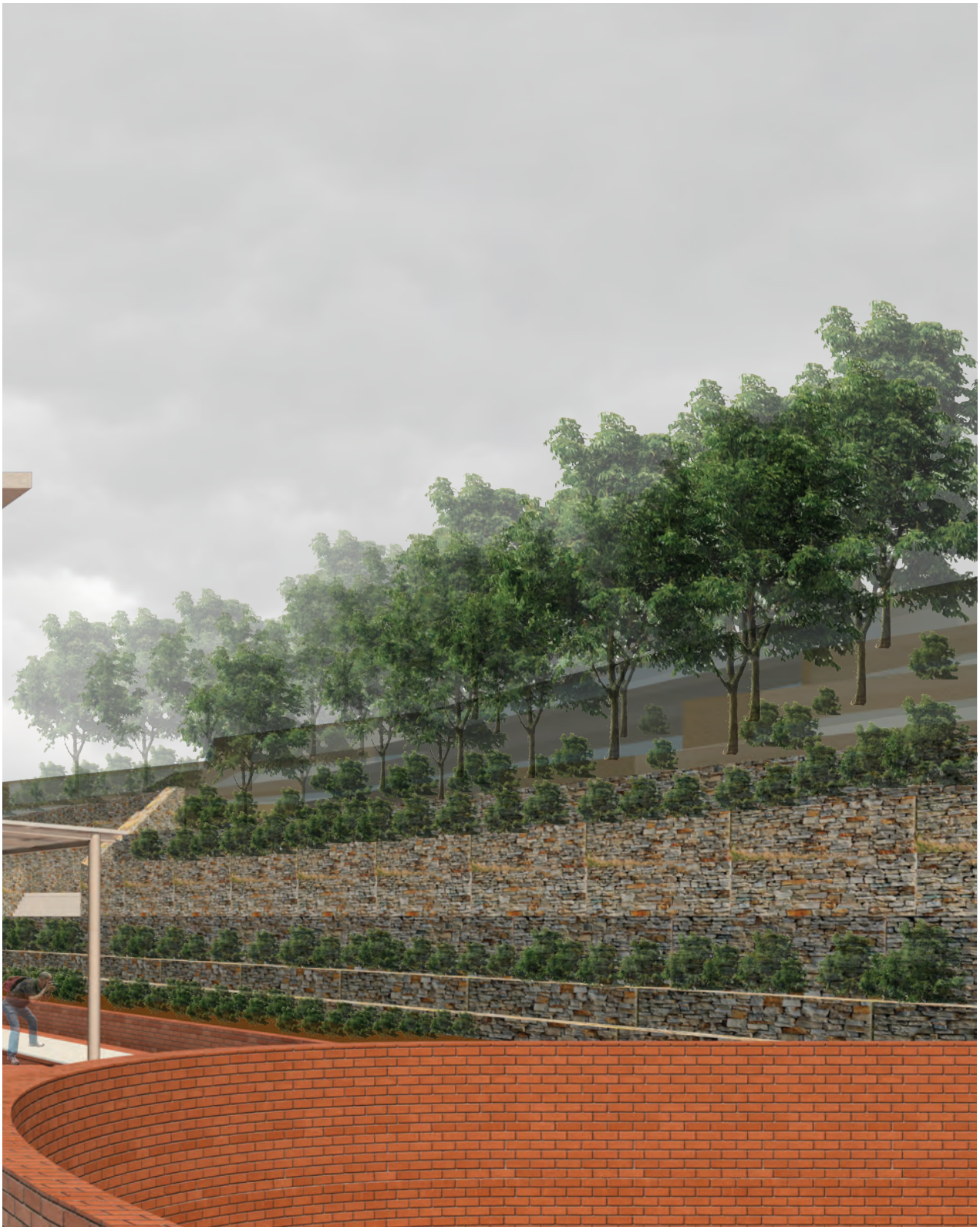

Fig _151 (Spread): Chamber One Entrance (Author 2017).

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05_8 Production Chambers

The production chambers are where all the active functions of the conservation facility occur. Within the chambers, areas are dedicated for the washing and packing of produce; the germination and storage of indigenous seeds; transformation of the harvests into edible products and test laboratories to optimize the growth and harvesting processes. The chambers form the engine that keeps the conservation facility functioning.

The chamber spaces were designed to be altered as the needs arise within the facility. For example, when the facility no longer can produce edible products, the distillery can be refitted with new equipment to enable different processes. These spaces are designed as far possible to be resilient for the conservation facilities existence. Additions and/or expansion can easily be implemented if the need arises. The separation and placement of these spaces on the site make this possible. If the facility can no longer function as was intended, these spaces can also be transformed into other typological public interactive spaces.

Fig _152 (Right Top): Call out of Chamber Ground Floor Level (Author 2017).
Fig _153 (Right Bottom): Call out of Chamber First Floor Level (Author 2017).

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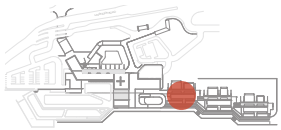

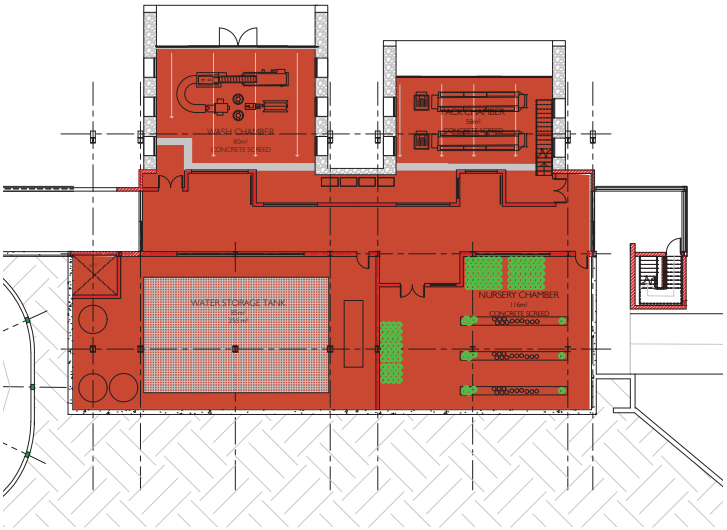

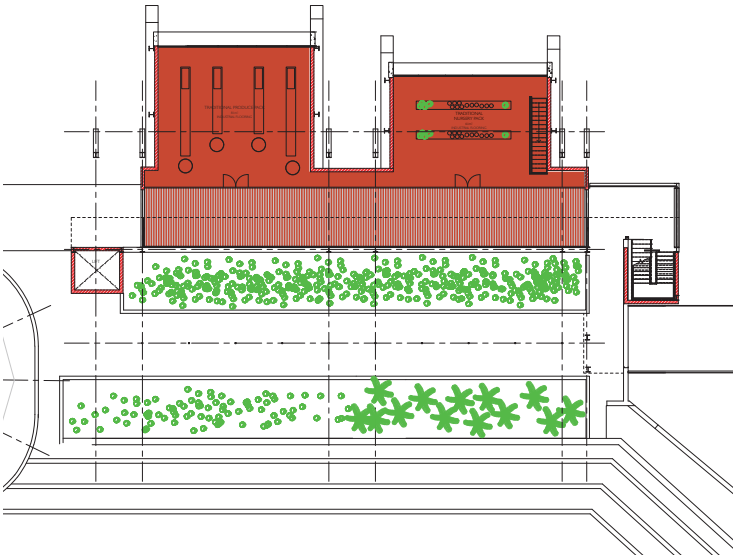

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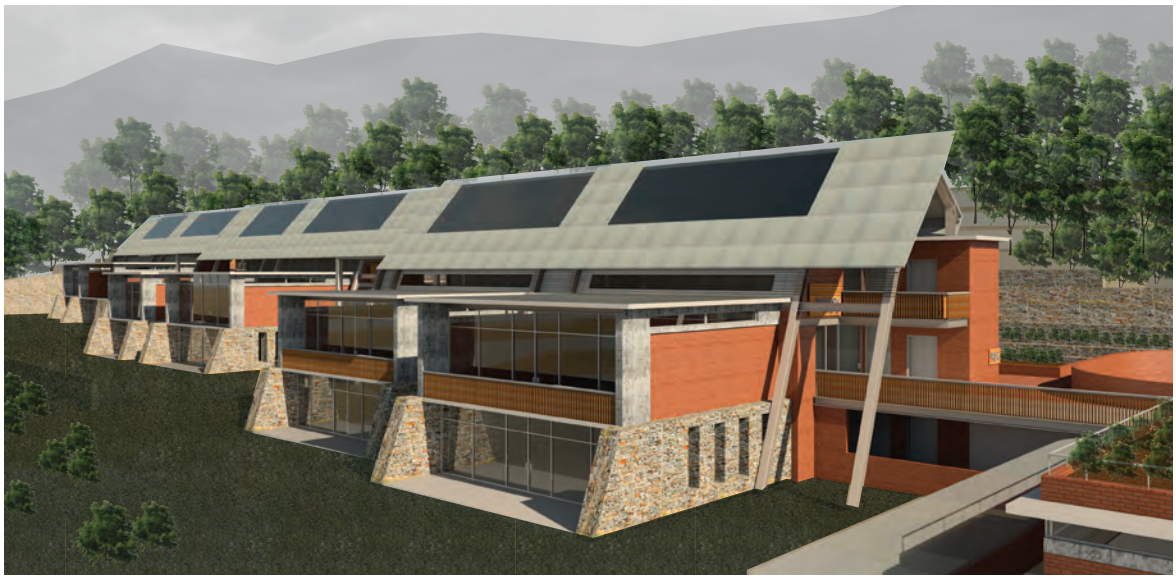

Fig _154 (Above): Chamber Overview (Author 2017).

Fig _155 (Above): Section Elevation of Chambers (Author 2017).

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Fig _156 (Above): Chambers Front View (Author 2017).

Fig _157 (Above): Chamber Interior (Author 2017).

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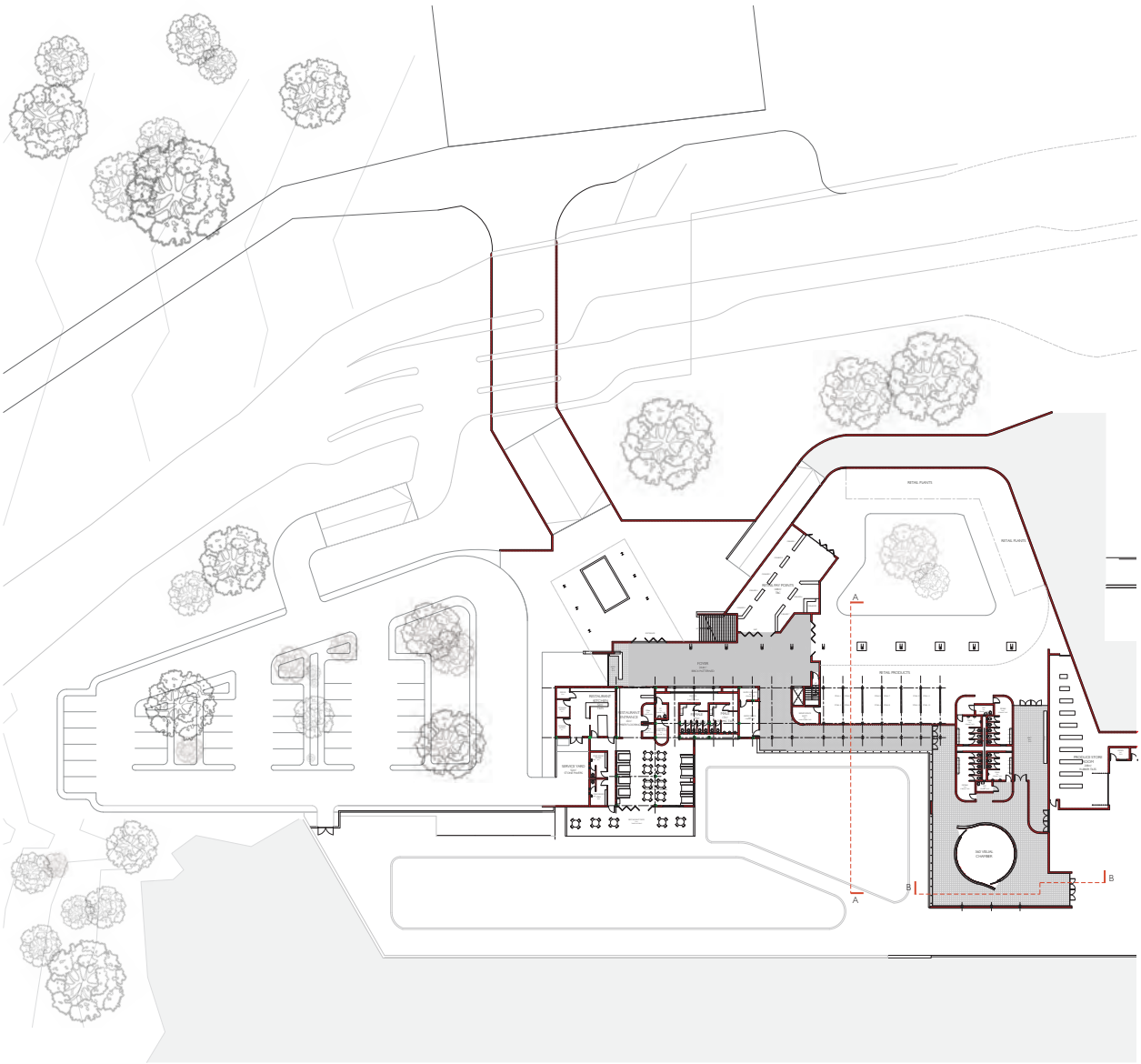

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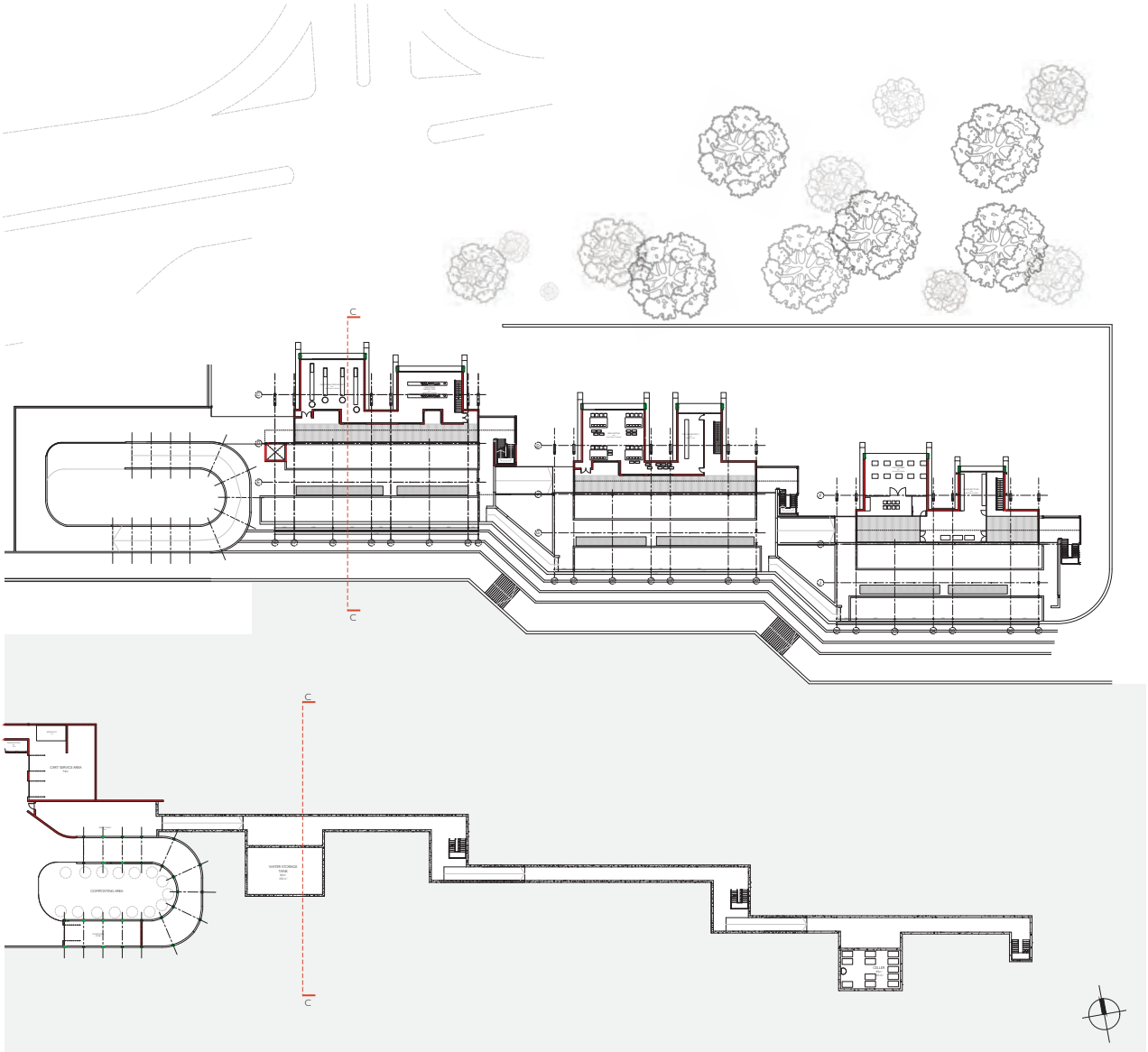

Fig _158 (Top Right): 1238 Floor Plan (Author 2017).
Fig _159 (Spread): 1232 Floor Plan (Author 2017).

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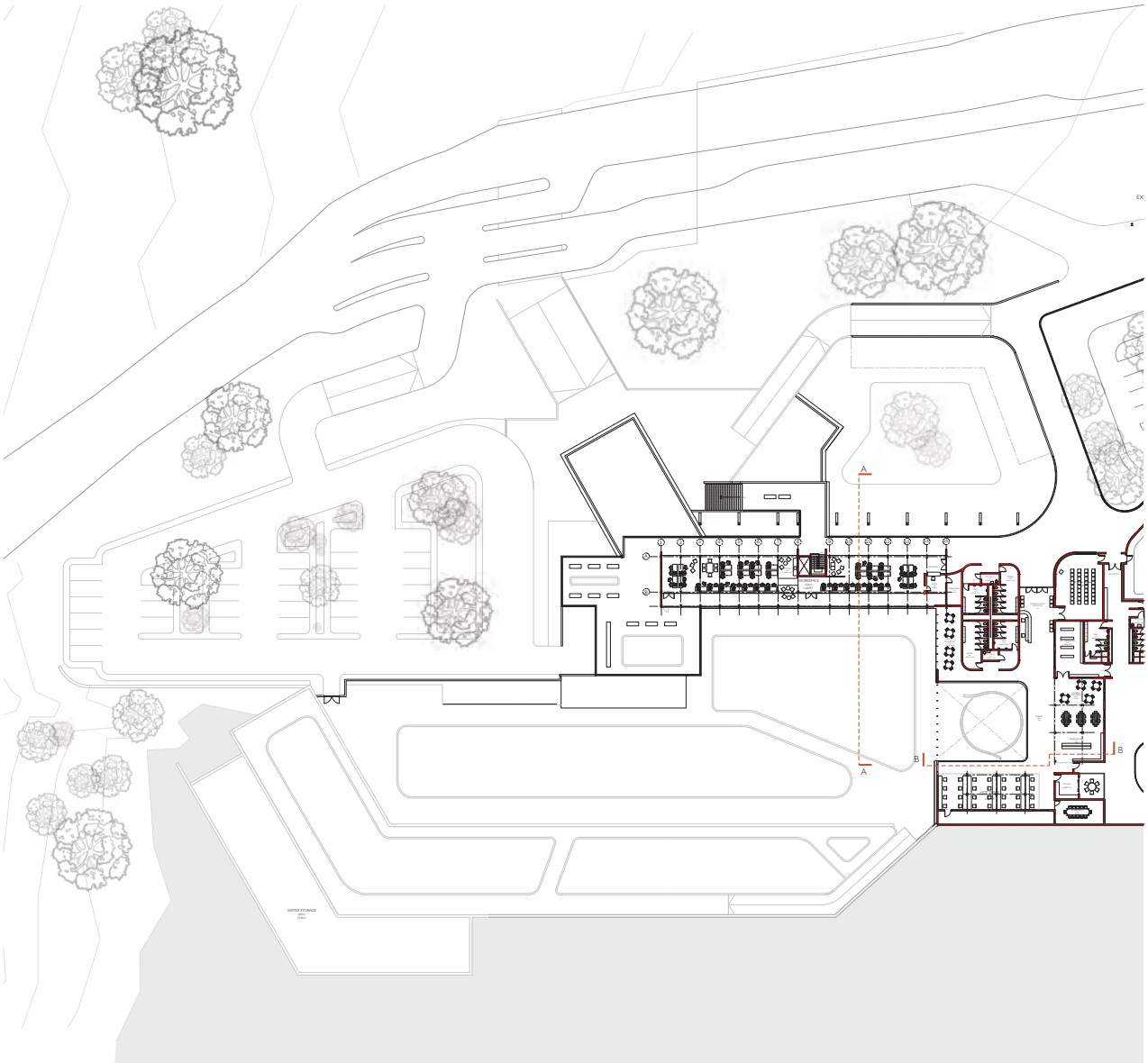

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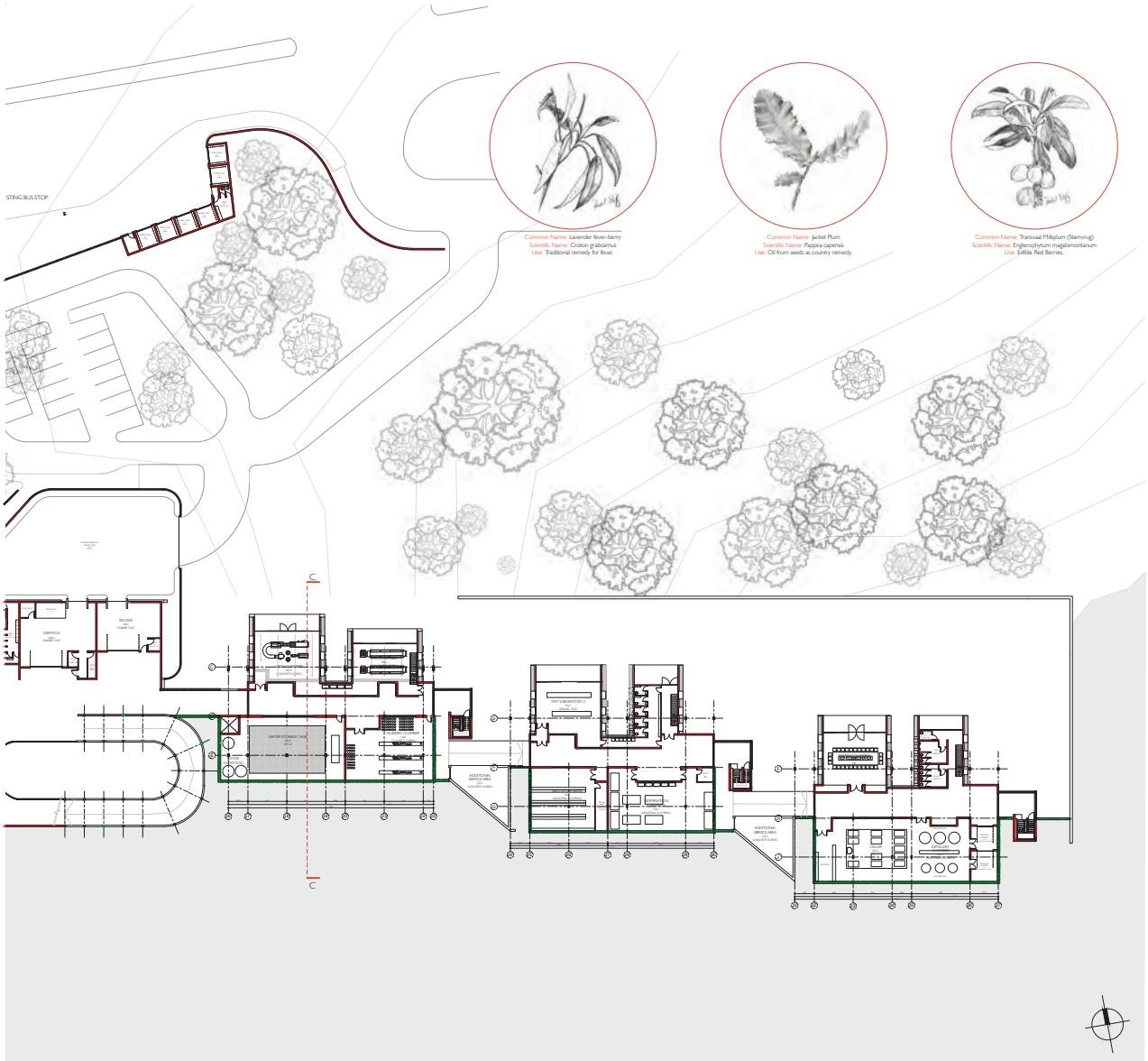

Fig _160 (Spread): 1235 Floor Plan (Author 2017).

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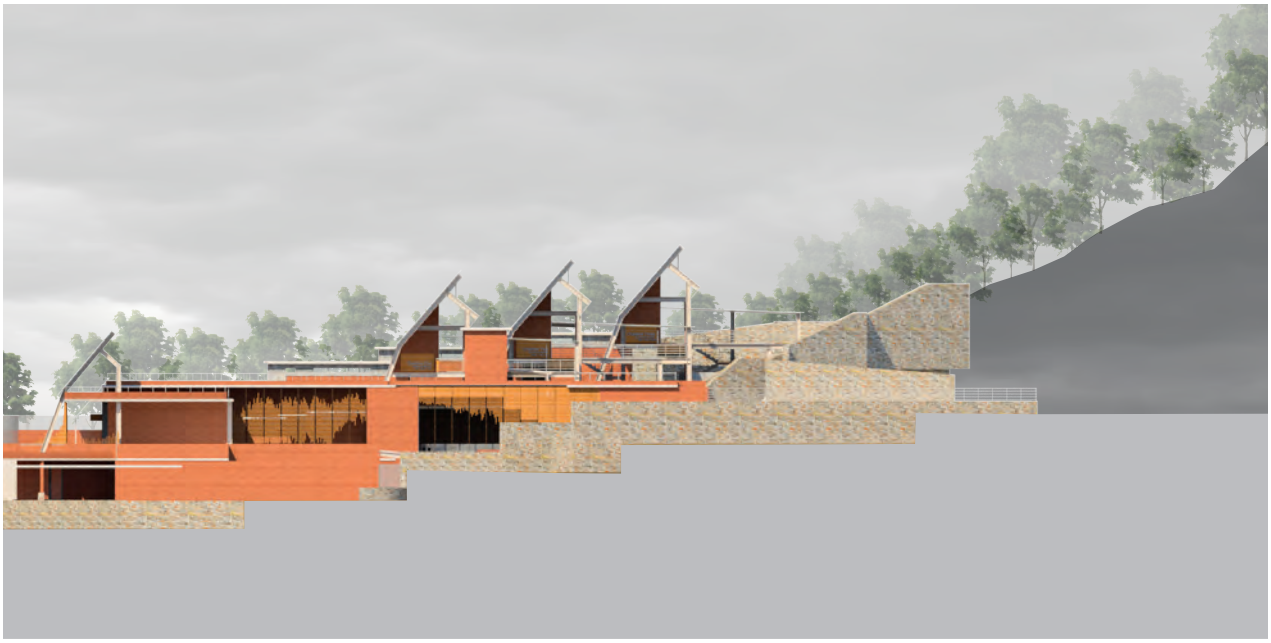

Fig _161 (Spread Top): Noth Elevevation (Author 2017).
Fig _162 (Spread Bottom): West Elevation (Author 2017).

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06_
TECHNOLOGY

"Build, Don't Talk."
Ludwig Mies van der Rohe

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06_1 Background

The project considers the synthesis of form, function and technology to create architecture (fig 164) and in doing so addresses the challenges of significance conservation presented at the WNR. To create this architecture, form, function and technology needed to be investigated. In chapter 2 the functional and formal considerations as derived from theoretical backgrounds were identified and utilized to create the architecture. In this chapter, technology is added to the design and the complete architecture (form, function and technology) is showcased.

06_2 Technology Approach

The technological approach and conception can be seen as a derivative from the functional and formal informants as stated in previous chapters. The architectures technological aspects is approached in terms of a three part sub-categorical investigation to understand the building in the systems, climate and structure. These investigations are concluded into alterations of the design to enhance the systematic, comfortability and structure of the architecture. The three sub-categories are as follows; building infrastucture, building climate and building structure.

Under the sub-category of building infrastructure , the systems and process of the conservation facility are investigated. Calculations on the use and distribution of water and electricity are made and the design is altered to cater for these needs. The working of the internal flows is also investigated and revisions on the design to ease processes are applied. The next sub-category, building climate considers the internal climate and user comfort of the conservation facility. Under this sub-category investigation into solar control, ventilation systems and building climatic modelling are undertaken and the design is altered to reflect these results. The final sub-category, building structure considers the structure of the conservation facility. Investigations into materials, structural grids and constructability are done.

Together, these three sub-categories form the technological approach. This approach is implemented by means of a technical conceptual consideration.

Fig _164 (Right): Conceptual framework diagram (Author 2017).

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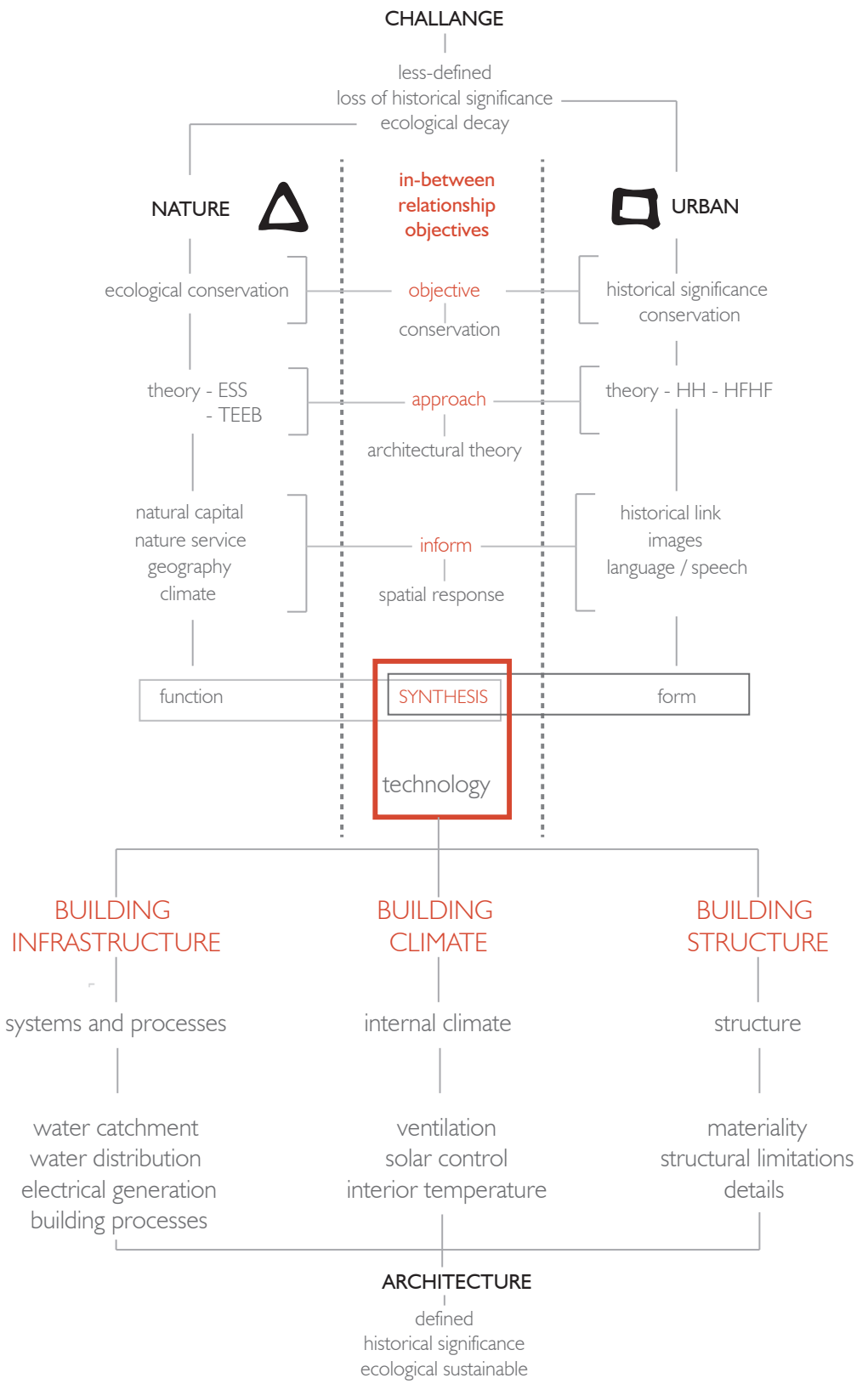

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06_3 Technology Concept

The conceptual consideration for the implementation of technology into the architecture is derived from the projects concept and builds on the same ideas. The prolific partition as explained in chapter 3 aims to intervene in the in-between and form a space that is productive in nature. The same consideration is implemented to form the concept for the implementation of technology where needed.

The three sub-categories as stated in the approach are the elements of technological consideration. Where they meet and share areas in-between programmed spaces presents the opportunity to situate these technologies thus making them function in the in-between . Considering this idea, the concept of intervention or placement of services in the facility is to, as far possible, be implemented in-between programmed spaces. This conceptual approach holds many advantages as no additional spaces need to be developed to house services. Where additional corridors are implemented, these areas will house multiple services for the surrounding and adjoining programmed spaces.

The technology concept is implemented in a similar manner as the projects design concept. The four-phased approached as explained in chapter 3 is altered to fit the requirements of the technology concept (fig 165). The first phase to implement the additions of services needed, is to determine the required services and the available spaces. The following phase identifies the possible in-between spaces

Fig _165 (Right): Conceptual framework diagram (Author 2017).

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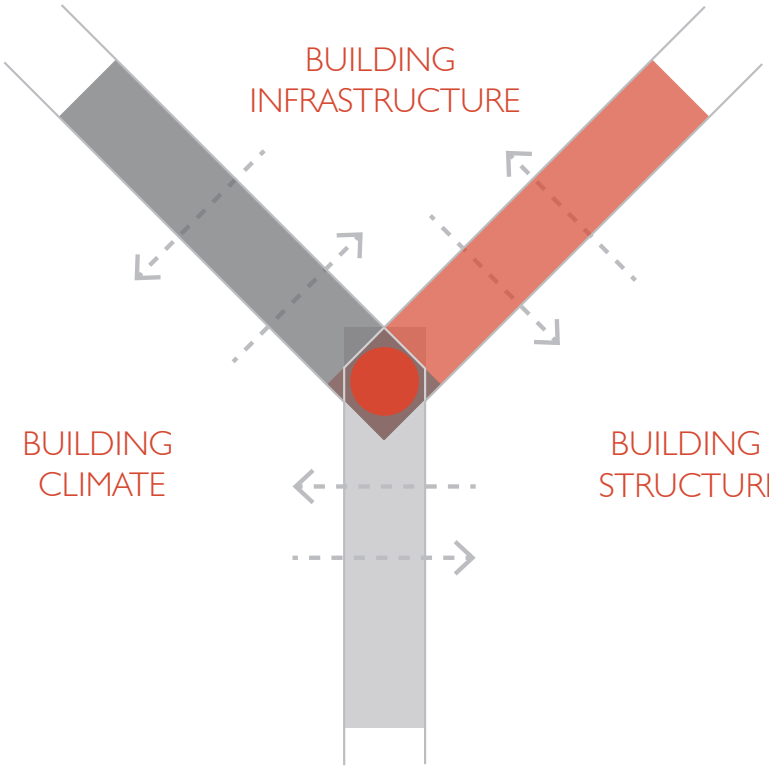

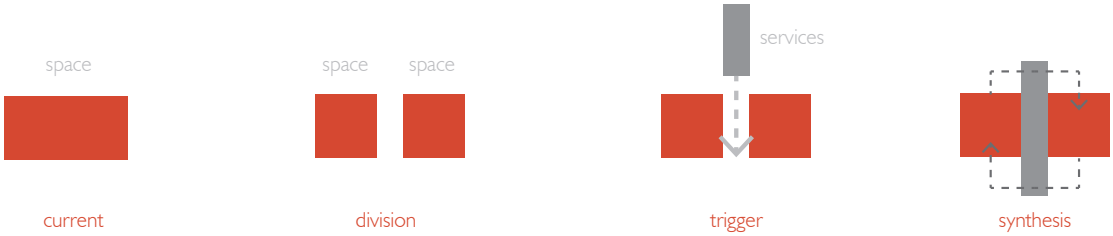

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06_4 Building Infrastructure

The building infrastructure sub-category firstly focusses on the water usage and supply of the conservation facility. The objective of the water usage calculation is to determine if the facility will be able to be independent from municipal water supply for all its needs. The second part of the sub-category focusses on the electricity generation. It is proposed that the facility partially generates its own electricity by means of photo-voltaic panels but still stay connected to the municipal grid for possible emergency needs. The third segment of the building infrastructure sub-category focusses on the building processes and gives a visual interpretation of the working in terms of harvesting processes, the visitors' experience and office spaces.

Water Catchment - Yield

Water usage of the facility is deemed to be high due to its irrigation demand. Rain water harvesting was investigated to see if this can satisfy the water demand without resorting to the municipal water connection.

The first part of the investigation considered the rain water data from the Pretoria area as captured by Wonderboom Airport weather station, less than 2 km away from the site. With adequate yearly rainwater, the investigation identified areas of possible catchment and the annual yield of the facility could then be calculated.

Areas identified were the mountain run-off from south of the facility (fig 169 - area 1), the paved circulation surfaces (fig 170 - area 2) and the sheet metal roofs (fig 171- area 3). With the combined areas and the rainwater data, the annual yield was calculated at 9110m^3/yr. (see page 173)

Water - Demand

With the possible yield calculated, the investigation could then focus on the facility's water demand. The demand consideration was divided into two categories; irrigation demand and sanitary demand. The notion of dividing the two water demand calculations was to evaluate how much of a specific water quality will be needed and to structure the distribution areas accordingly.

The irrigation demand focused on all the grow beds, the test beds and the green roofs where the water that can be used may be of a lower quality. The sanitary demand included potable water and for this the water needed to be taken through a filtration process.

Considering the irrigation and sanitary water and the required filtration for different uses, a basic water distribution network was developed for the site. The water distribution network starts with the catchment pond for all rainwater harvested in the designated areas. The pond is used as a sediment filter. From the pond that is situated on the south-western corner of the facility, the water is directly used for irrigation purposes. The required water for sanitary purposes is pumped from the pond, through a three-part filtration system into a covered secondary water storage area. This storage tank is used to keep the filtered water clean and on demand for sanitary and potable uses. From the indoor storage tank, the water is pressurized and distributed to the areas for the different uses.

Water Budget

The water usage and distribution investigation concludes in the presentation of the water budget. The water budget (fig 178 - 179) showcases the yield and demand in comparison and results in the amount needed per month to keep the facility water self-sufficient. From the water budget the sizes of the catchment pond and the potable water storage network were developed to ensure that enough water was present at any needed time within the conservation facility.

Fig _167 (Right Top): Pretoria Avg Rainwater Yield Graph (Author 2017).
Fig _168 (Right Bottom): Areas considered for water chachment (Author 2017).

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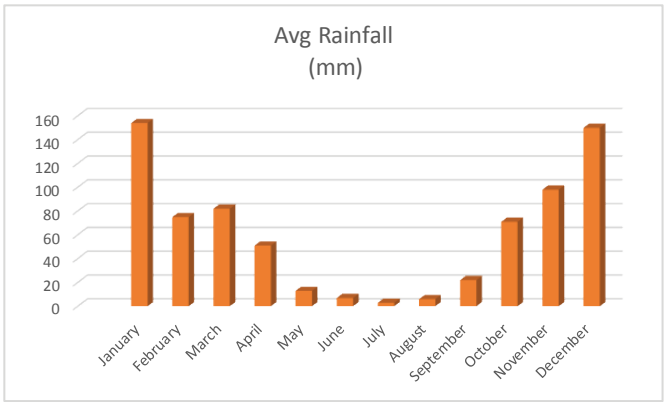
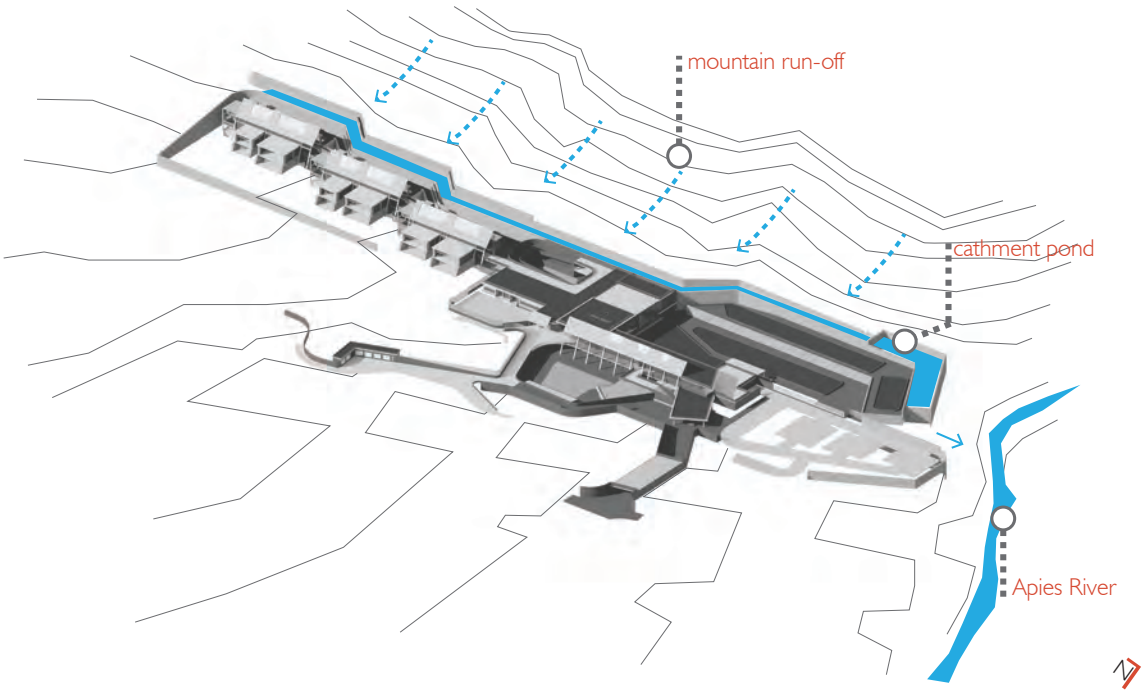
Water Catchment - Yield

Rainfall Data - Pretoria

January	154mm
February	75mm
March	82mm
April	51mm
May	13mm
June	7mm
July	3mm
August	6mm
September	22mm
October	71mm
Novemeber	98mm
December	150mm



Water catchment consideration



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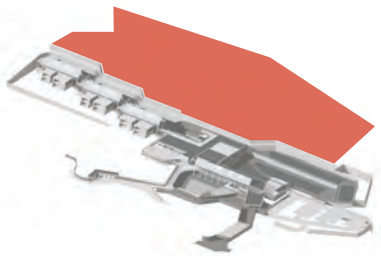
Area of catchment

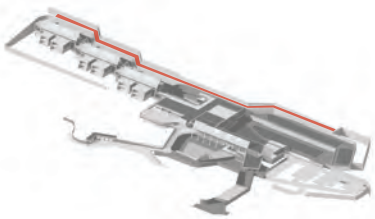
Area 1: Mountain

Total Area of cathment:	24300
Avg Runoff coeficient:	0.35



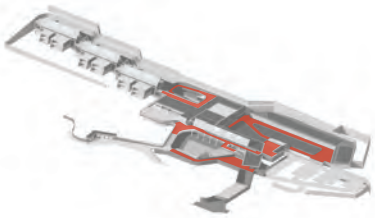
Area 2: Paths

Total Area of cathment:	926
Avg Runoff coeficient:	0.8



Area 3: Other

Total Area of cathment:	4000
Avg Runoff coeficient:	0.8



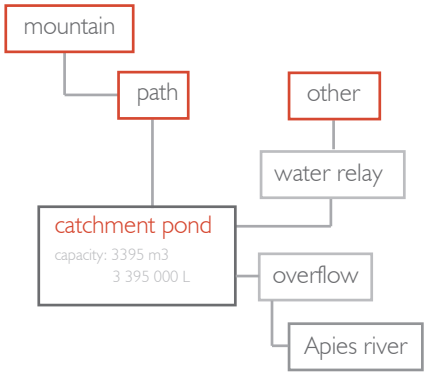


Fig _169 (Top Strip): Area 1 - Location and Yield of mountain run-off area. (Author 2017).
Fig _170 (Middle Strip): Area 2 - Location and Yield of paths (Author 2017).
Fig _171 (Bottom Strip): Area 3 - Location and Yield of other areas (Author 2017).
Fig _172 (Right): Diagram of water catchment and total yield. (Author 2017).

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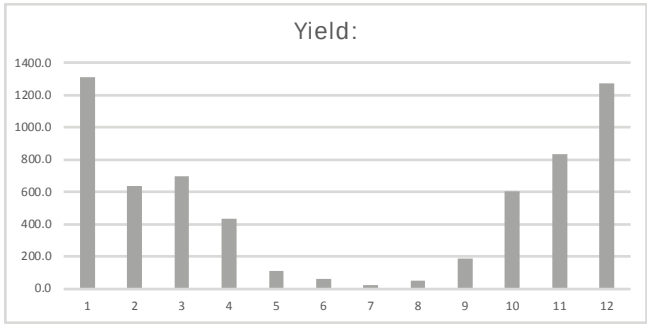
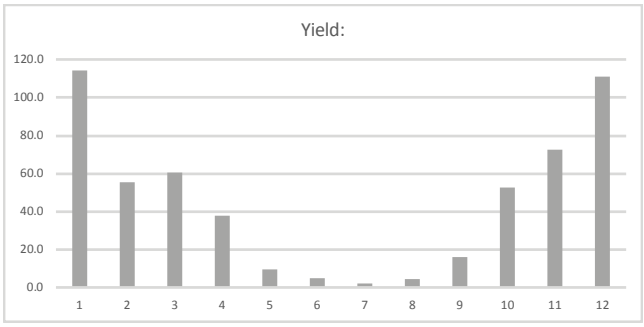
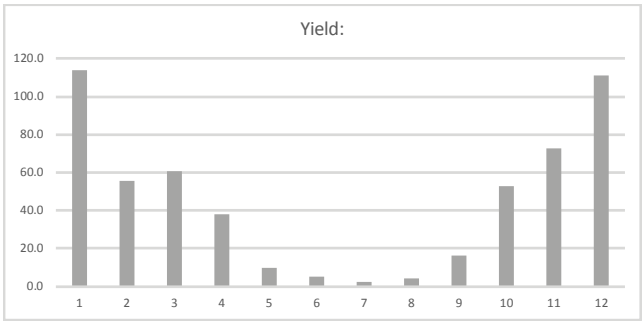
Yield Mountain			
Month	Avg Rainfall (mm)	Conversion:	Yield:
January	154	0.154	1309.8
February	75	0.075	637.9
March	82	0.082	697.4
April	51	0.051	433.8
May	13	0.013	110.6
June	7	0.007	59.5
July	3	0.003	25.5
August	6	0.006	51.0
September	22	0.022	187.1
October	71	0.071	603.9
November	98	0.098	833.5
December	150	0.15	1275.8
Avg Yearly	674		6225.7



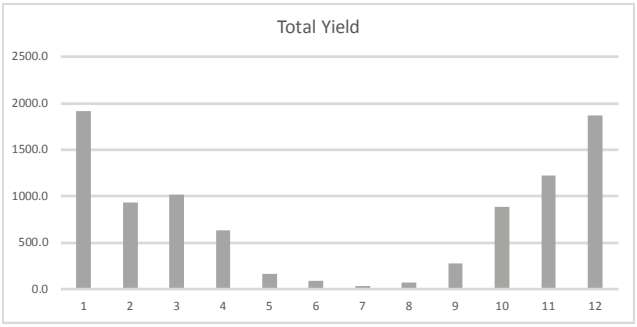
Yield Path			
Month	Avg Rainfall (mm)	Conversion:	Yield:
January	154	0.154	114.1
February	75	0.075	55.6
March	82	0.082	60.7
April	51	0.051	37.8
May	13	0.013	9.6
June	7	0.007	5.2
July	3	0.003	2.2
August	6	0.006	4.4
September	22	0.022	16.3
October	71	0.071	52.6
November	98	0.098	72.6
December	150	0.15	111.1
Avg Yearly	674		542.3



Yield Other			
Month	Avg Rainfall (mm)	Conversion:	Yield:
January	154	0.154	492.8
February	75	0.075	240.0
March	82	0.082	262.4
April	51	0.051	163.2
May	13	0.013	41.6
June	7	0.007	22.4
July	3	0.003	9.6
August	6	0.006	19.2
September	22	0.022	70.4
October	71	0.071	227.2
November	98	0.098	313.6
December	150	0.15	480.0
Avg Yearly	674		2342.4



Yield Total				
Month	Yield Mountain:	Yield Path:	Yield Other:	Total Yield
January	1309.8	114.1	492.8	1916.7
February	637.9	55.6	240.0	933.4
March	697.4	60.7	262.4	1020.6
April	433.8	37.8	163.2	634.7
May	110.6	9.6	41.6	161.8
June	59.5	5.2	22.4	87.1
July	25.5	2.2	9.6	37.3
August	51.0	4.4	19.2	74.7
September	187.1	16.3	70.4	273.8
October	603.9	52.6	227.2	883.7
November	833.5	72.6	313.6	1219.7
December	1275.8	111.1	480.0	1866.9
Total Yield	6225.7	542.3	2342.4	**9110.3**
Avg Yearly	518.8	45.2	195.2	



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Water Distribution - Demand

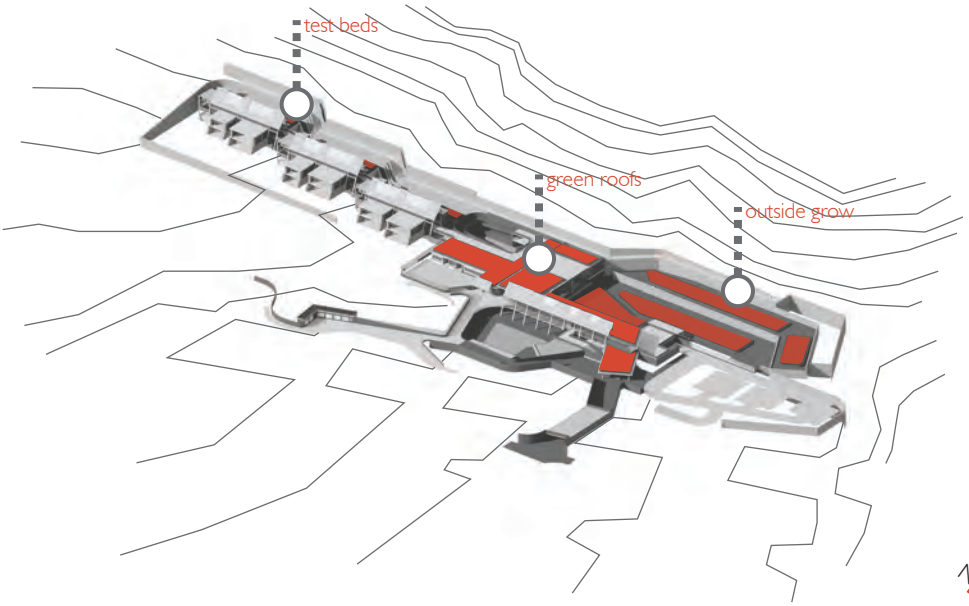

Fig _173 (Top): Irragation demand areas (Author 2017).

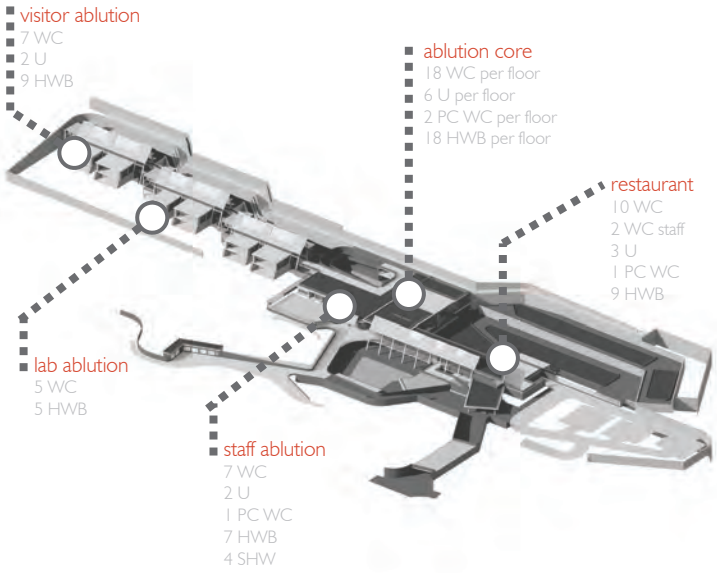

Fig _174 (Top): Sanitary demand (Author 2017).

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Total Irrigation Demand				
Month	Irrigation Green Roof	Irrigation Test Beds	Irrigation Outside Grow Area	Total Irrigation Demand
January	289.728	102.08	358.288	750.096
February	289.728	102.08	358.288	750.096
March	289.728	102.08	358.288	750.096
April	217.296	76.56	268.716	562.572
May	144.864	51.04	179.144	375.048
June	144.864	51.04	179.144	375.048
July	144.864	51.04	179.144	375.048
August	144.864	51.04	179.144	375.048
September	217.296	76.56	268.716	562.572
October	217.296	76.56	268.716	562.572
November	289.728	102.08	358.288	750.096
December	289.728	358.288	358.288	1006.304
Total Yearly	2679.984	1200.448	3314.164	7194.596

Fig _175 (Top): Total irragation demand calculations (Author 2017).

Sanitary Demand					
Month	Person	Amount use (L)	Water / capita / day (L)	Water / capita / month (L)	Domestic Demand (m³/month)
January	500	10	5000	155000	155
February	500	10	5000	140000	140
March	500	10	5000	155000	155
April	500	10	5000	150000	150
May	500	10	5000	155000	155
June	500	10	5000	150000	150
July	500	10	5000	155000	155
August	500	10	5000	155000	155
September	500	10	5000	150000	150
October	500	10	5000	155000	155
November	500	10	5000	150000	150
December	500	10	5000	155000	155
Total				1825000	1825
					155
			Safty Factor		1.5
			Tank Size		2325

Fig _176 (Top): Total sanitary demand calculations (Author 2017).

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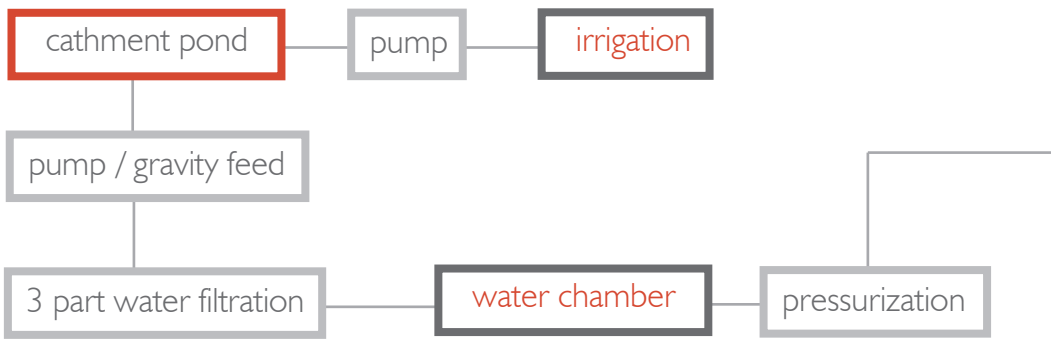
Water Budget

Yield And Demand						
Month	Demand	Yield	Monthly Balance	Vol. water in tank (m^3)	Year 2	Year 3
January	905.096	1916.6532	1011.5572	2203.031	2448.76	2694.49
February	890.096	933.435	43.339	2246.37	2492.1	2737.83
March	905.096	1020.5556	115.4596	2361.8296	2607.56	2853.29
April	712.572	634.7358	-77.8362	2283.9934	2529.72	2775.45
May	530.048	161.7954	-368.2526	1915.7408	2161.47	2407.2
June	525.048	87.1206	-437.9274	1477.8134	1723.54	1969.27
July	375.048	37.3374	-337.7106	1140.1028	1385.83	1631.56
August	530.048	74.6748	-455.3732	439	684.73	930.459
September	712.572	273.8076	-438.7644	0.2356	245.965	491.695
October	717.572	883.6518	166.0798	166.3154	412.045	657.775
November	900.096	1219.6884	319.5924	485.9078	731.637	977.367
December	1161.304	1866.87	705.566	1191.4738	1437.2	1682.93
Total	8865	9110	246	2361.8296	2607.56	2853.29
			Safty Factor	1.5		
			Needed	3542.7444		
			Tank Size	3543	3543	3543
					935	*689*

Fig _178 (Top): Water budget calculations (Author 2017).



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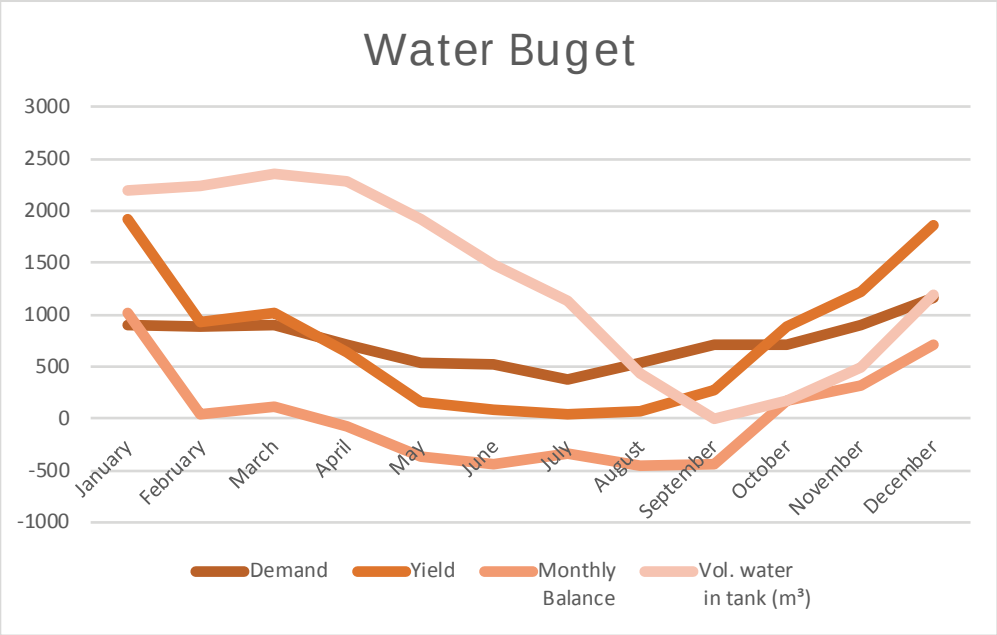

Fig _179 (Top): Water budget graph (Author 2017).

Fig _180 (Top Strip): Water distribution diagram (Author 2017).

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Electricity

The second investigation of building infrastructure focusses on electricity generation. This aspect is approached by means of a grid-tied electricity generation system that incorporates photovoltaic (PV) panels with the electricity grid of the City of Tshwane.

The consideration of a grid tied system is based on several aspects. Firstly, in the event of a fault in power generation from the PV-panels, the facility will still be able to run without any loss of power. The second argument for the grid tied system is to keep the governmental infrastructure economy on electrical generation operational. It is argued that if all building infrastructure is completely removed from municipal grids, the economy of these networks and the funds invested in them will completely be dismantled. The facilities electricity generation network was developed to keep the need for a municipal generation element present. When the municipality does dismantle the electricity infrastructure, the facility will be able to install additional panels to compensate for the loss in power.

Solar Investigation

The investigation into the electricity PV-panel systems started off by considering the solar generated electricity capacity of South Africa, and especially that of the City of Tshwane. The data were used to see if the adequate number of days and sunlight hours would suffice for the generation and installation of PV-panels. The investigation found that the Tshwane area has a solar capacity of 2200 kW/h/m^2 (Solar GIS 2017) based on annual averages from 1994 to 2013 and a daylight hour count on the shortest day (21 June) at a total of 8 hours. These statistics are deemed adequate for efficient solar generation (Solar365, 2017).

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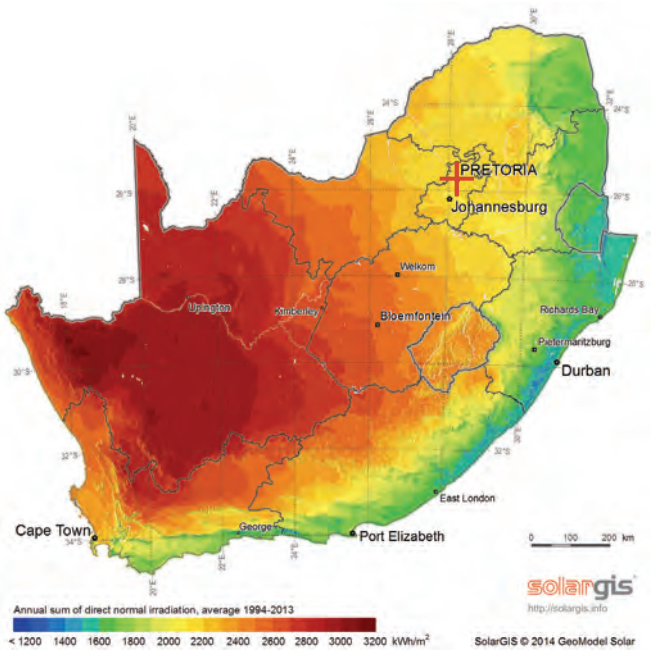

Pretoria:
Annual sum of direct normal radiation (avg1994-2013)

2200 kWh/m2

Hours of sunlight on the shortest day (June 21)

10 hours
2 hour SF

8 hours

Fig _181 (Above): South Africa solar data (Solar365, 2017).

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Electrical Demand

The electricity demand was calculated by means of lights demand and plugs load demand. The lights demand was calculated on the bases of space use and the required lux levels of light for the space. The conservation facility was divided into five different spaces definitions by function and the needed lux, the amount of m^2 and watts needed was considered to calculate the demand. The total power for lights were calculated at 22.19 kWh/m^2/day.

The plug load demand was calculated on the same principles as the light demand but considered the w/m2 of the equipment needed by the function of the space. The plug loads were calculated at 7.5 kWh/m^2/day.

The total demand for the conservation facility was separated to calculate how much generation capacity was needed for each zone of the facility (fig 183). Using this method of distribution made it easier to calculate the number of PV-panels needed per zone to supply the needed electricity.

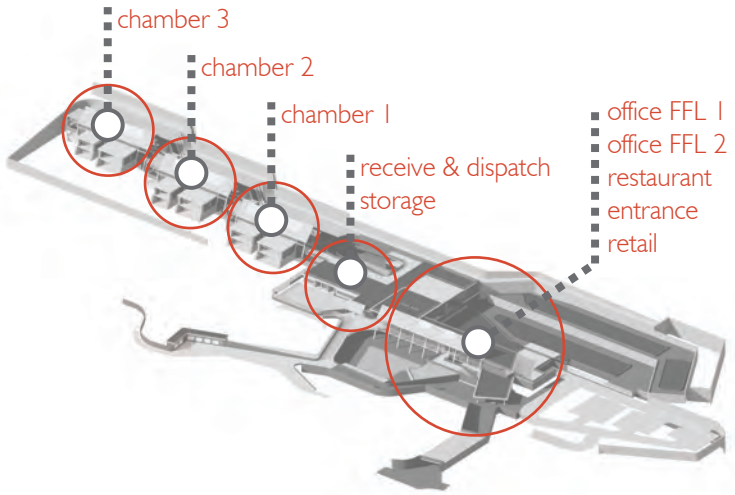

Fig _182 (Above): Zones for electrical demand calculations (Author 2017).

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Lights data:

Space definition:	Lighting Lux Level	Lighting (W/m2)
Office	400	30
Restaurants	200	15
Industrial 1	500	20
Industrial 2	750	50
Laboratorium	800	40

Lights demand:

Demand - Lights					
Area Discription	Area (m2 of space)	Total Use (Watts.m2)	Hours used (hours of day)	Total Use per day (W.m2.day)	kWh/m2
1. Chamber 1	1072	53600	10	536000	5.36
2. Chamber 2	1072	21440	10	214400	2.14
3. Chamber 3	1072	42880	10	428800	4.29
4. R&D and Storage	604	12080	24	289920	0.50
5. Office FFL	1818	54540	8	436320	6.82
6. Office FFL	346	10380	8	83040	1.30
7. Restaurant	537	8055	15	120825	0.54
8. Retail	290	8700	15	130500	0.58
9. Entrance	330	9900	15	148500	0.66
	Total	**221575**		**2388305**	**22.19**

Plug load data:

Space definition:	Plug Loads (W/m2)
Office	10
Restaurants	4
Industrial 1	10
Industrial 2	20
Laboratorium	5

Plug load demand:

Demand - Plugs					
Area Discription	Area (m2)	Total Use (Watts)	Hours used (hours)	Total Use per day (W.m2.day)	kWh/m2
1. Chamber 1	1072	21440	10	214400	2.14
2. Chamber 2	1072	10720	10	107200	1.07
3. Chamber 3	1072	5360	10	53600	0.54
4. R&D and Storage	604	6040	24	144960	0.25
5. Office FFL	1818	18180	8	145440	2.27
6. Office FFL	346	3460	8	27680	0.43
7. Restaurant	537	5370	15	80550	0.36
8. Retail	290	2900	15	43500	0.19
9. Entrance	330	3300	15	49500	0.22
	Total	**76770**		**866830**	**7.5**

Demand per area

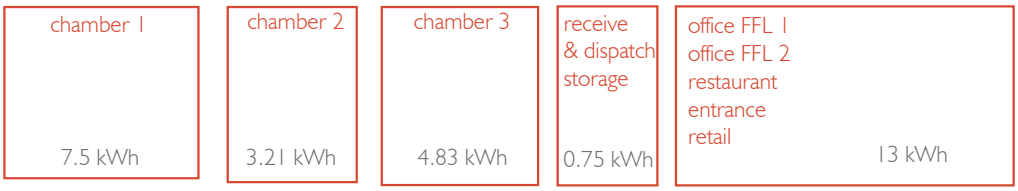

Fig _183 (Page): Electrical demand calculations (Author 2017).

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Electrical Generation

To meet the electricity demand, a detailed calculation on the m^2 of roof space available for solar intervention had to be made. With this calculation, the optimal angle and how the panel will be fitted were taken into consideration. With the m^2 of roof space available an estimate on the generation capacity of these areas could be made to compare with the demand . A product specification of a PV-panel was taken to calculate the kilowatt hours available from the assigned areas.

The PV-panel diagram (fig 185) shows the number of panels dedicated to each assigned roof area (fig 184) and the amount of power that will be generated. The generation capacity is evaluated against the demand and where there is a shortfall the amount of power needed from the municipality is indicated. The additional panel option shown (fig 185 - bottom) is the additional panels needed to fill the gap per dedicated area.

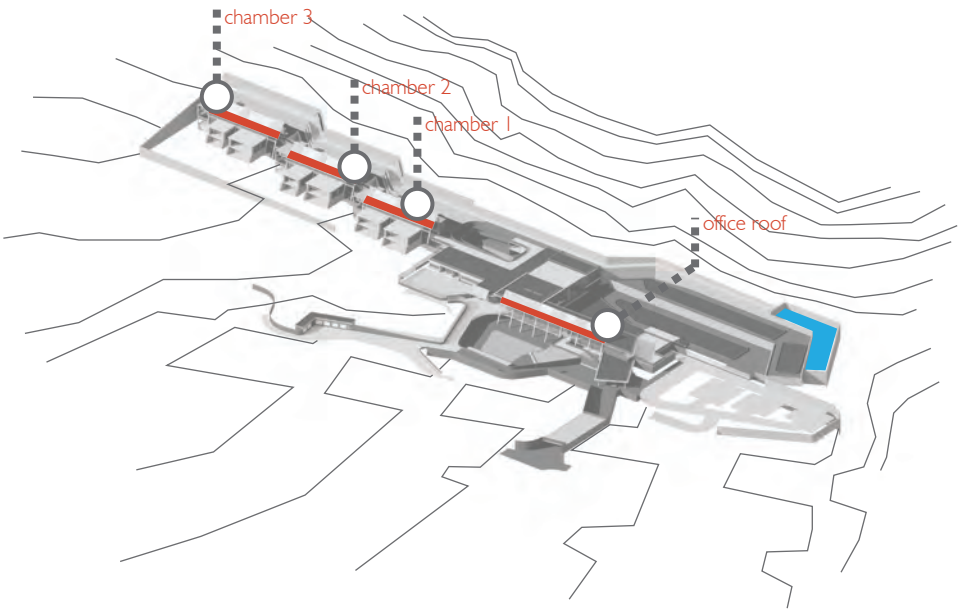

Fig _184 (Above): Dedicated areas for solar power intervetion (Author 2017).
Fig _185 (Right Page): PV-panel diagram showing the generation capacity (Author 2017).

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2200 kwh/m2 @ 30 % efficiency 67 kwh/m2

Areas of PV panels

chamber 1	chamber 2	chamber 3	office roof
33m x 1m = 33m2	33m x 1m = 33m2	33m x 1m = 33m2	50m x 1m = 50m2

Product spesification

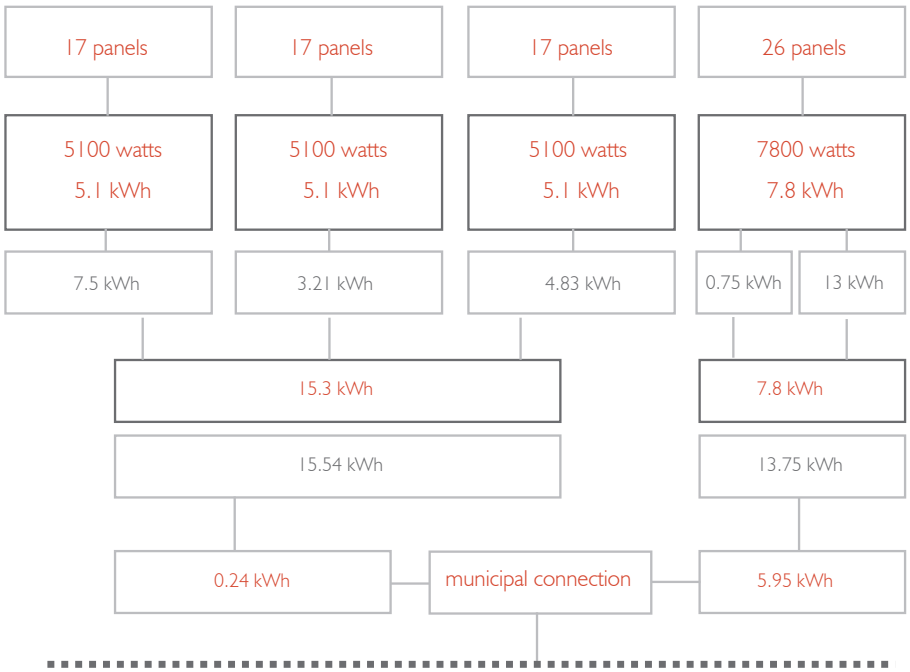
1940 mm

300 w panel
1.9 m2

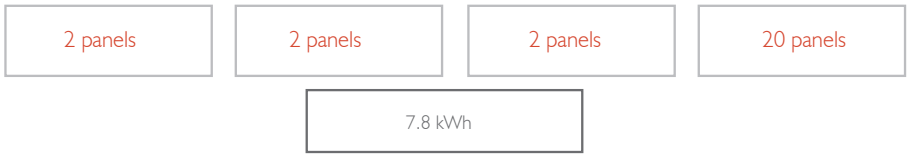
980 mm

https://www.bundupower.co.za/solarpanels-single-sd.php?mod=SP-FG-310W

PV panel generation diagram



Additional panels option



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Building Processes

Harvesting Process

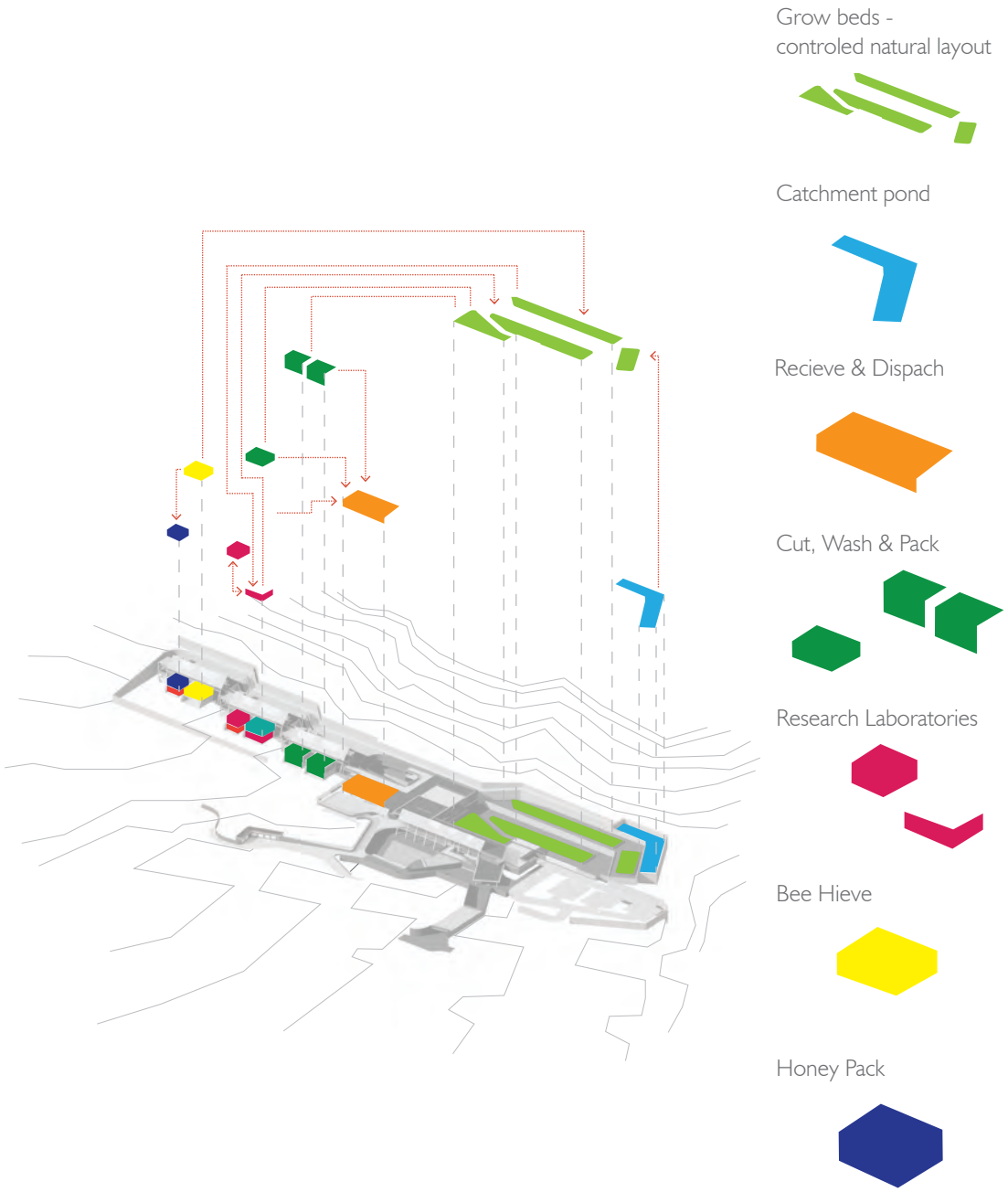

Fig _186 (Spread): Flow and space use of harvesting process (Author 2017).

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Plant

http://www.schneidernursery.com/

http://www.midwestgroundcovers.com/page/Our-Growing-Centers

Water

https://www.clearwater.asn.au/resource-kit/projects-studies/casey-stormwater-harvesting-and-re-use-projects.php

https://www.butelt-landline.co.uk/fire-water-storage/

Export to Other Sites

http://www.cavagna.net/en/portfolio/dispatch-warehouse/

https://www.gizmodo.com.au/2015/04/emirates-flight-catering-food-factory-produces-175000-meals-a-day-and-its-all-fresh/

Harvest

https://farm-software.net/fresh-produce-marketing-software/

http://www.ast-agency.com/media/2017/08/01-08-15-48ad-925c-0ba5c79f672c-packaging-plant-of-taylor-farms-the-largest-producer-of-fresh

Ecological Sustainability

https://www.gmi.oeaw.ac.at/

http://www.apnaasia.com/en/about-us/research-development

Pollination

https://www.honeyflow.com/resources/faqs/where-to-locate-your-flow-hive/p/159

http://mahakobees.com/blog/

Organic Food

http://peacebeefarm.blogspot.co.za/2010/09/bottling-honey.html

https://www.alibaba.com/showroom/product/semi-automatic-nail-polish-filling-machine-with-10-heads/608153_485043221.html

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Visitors Experience

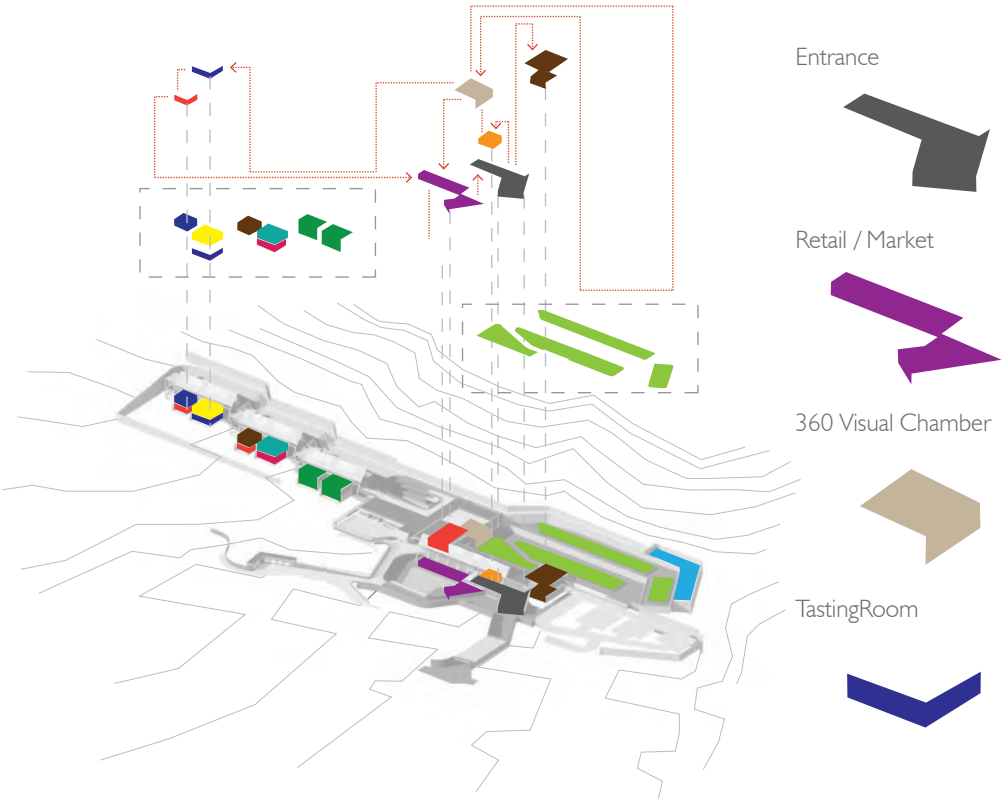

Fig _187 (Spread): Flow and space use of visitor's experience (Author 2017).

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Admission

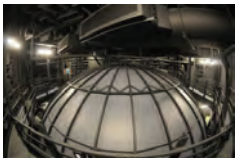
https://www.hasselt.studio.com/en/cms-projects/detail/adelaide-zoo-1288/

http://arquitectura.estudioquaglata.com/tag/henning-larsen-architects/page/3

Product

https://en.wikipedia.org/wiki/Agriculture_in_Ghana

Admission


http://www.atlasobscura.com/places/allosphere

http://www.atlasobscura.com/places/allosphere

Recreational

http://www.distillerytrail.com/blog/jack-daniels-cut-ribbon-refurbished-barrel-house-tasting-room/

http://www.realfoodtraveler.com/2013/06/vodka-the-answer-is-clear/dsc_0025-1183x784/

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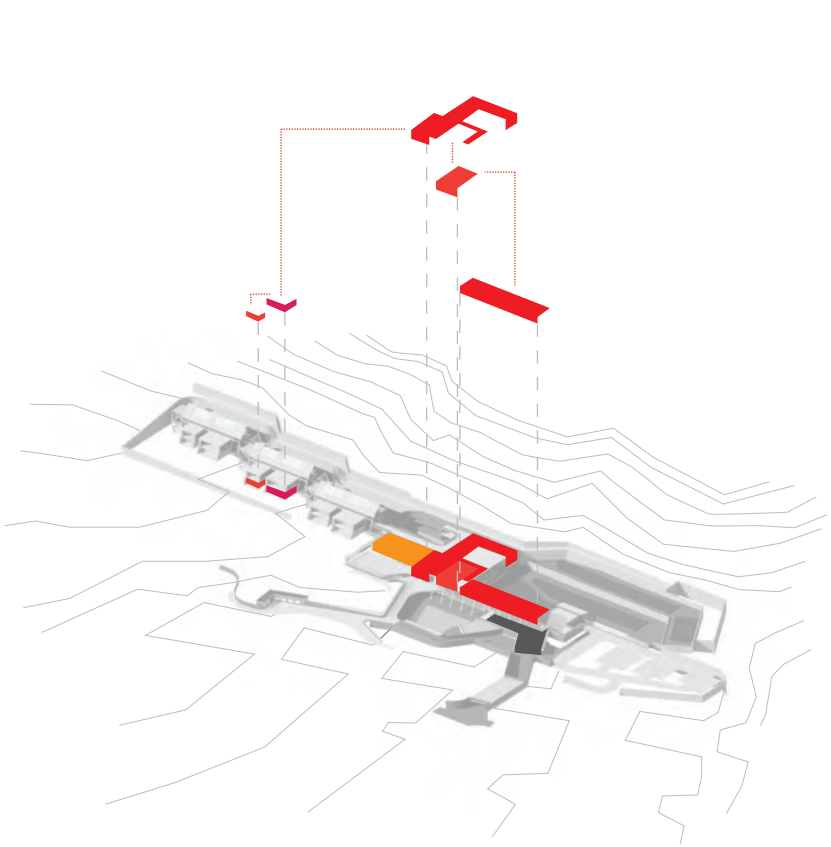
Office Spaces



Reseach Office - Hot desks

Workstation Office

Research LAB Office

Ablution Core

Fig _188 (Spread): Flow and space use of office spaces (Author 2017).

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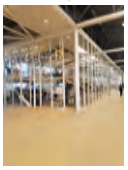
Ecological Sustainability

http://www.architectmagazine.com/technology/wework-takes-on-design-research-and-the-internet-of-things_o

http://www.architectmagazine.com/technology/wework-takes-on-design-research-and-the-internet-of-things_o

Rent Office



Ecological Sustainability

http://newscenter.lbl.gov/2014/10/23/doe-secretary-helps-usher-in-new-era-of-energy-research-at-berkeley-lab/

http://doyouknowbetter.com/2013/11/07/eco-friendly-research-lab-devoted-to-sick-kids/

Ablutions

https://www.pepperfry.com/hardware-electricals-sanitary-ware-water-closets.html

https://www.alibaba.com/product-detail/modern-bathroom-sink-commercial-hand-wash_60483868838.html

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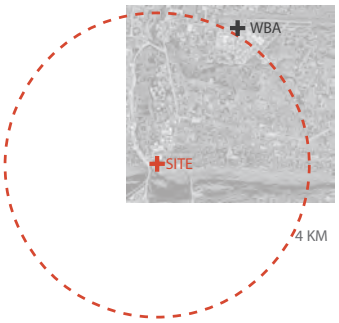
06_5 Building Climate

The building climate sub-category focusses on the internal climate and solar control of the facility. This section investigates the current climatic data of the area and identifies focus points such as key dates and specific times of the year to base investigation on. The approach is based on two distinct periods of climatic change. The summer period considers all the warmer months when temperatures are hot and people as deemed to experience discomfort with heat, the winter period considers the cold months when people will experience a discomfort with a loss in temperature. For the Tshwane climate the summer period is considerably larger than the winter period and due to this more attention was given to keeping the interior spaces cool.

Additional climatic considerations were the wind direction information at three intervals, the humidity of the area in summer and winter and yearly cloud cover. These considerations aided in developing systems to keep the interior spaces as comfortable as possible.

information point : Wonderboom Airport (WBA)

Summer Period : Sept - April (8 months)
Winter Period : May - Aug (4 months)



temperature data

SS Temp Avg.		WS Temp Avg.	
SEPT	9 28	MAY	7 23
OCT	13 29	JUN	3 20
NOV	15 29	JUL	2 20
DEC	16 30	AUG	5 21
JAN	17 30		
FEB	16 30		
MAR	15 28		
APR	12 26		

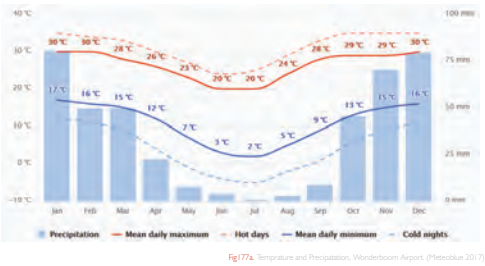


Fig177a. Tempature and Precipatation, Wonderboom Airport (Meteoblue 2017)

Fig _189 (Top): Climate data gathering point (Author 2017).
Fig _190 (Bottom): Tempature data (Author 2017).

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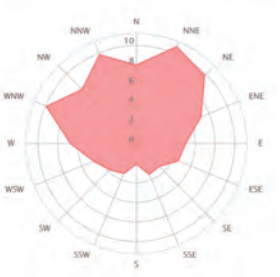
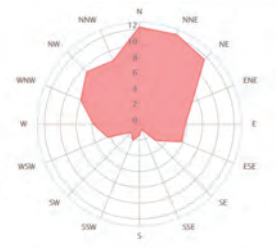
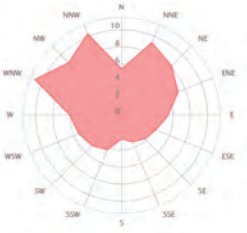
yearly



hotest month



coldest month



Summer Period Info: December

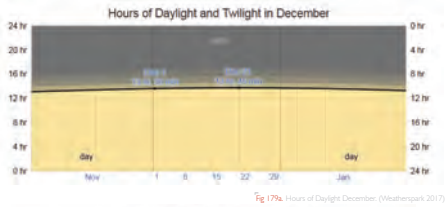


Fig 179a. Hours of Daylight December. (Weatherspark 2017)

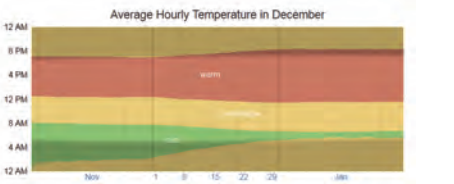


Fig179c. Avg Hourly Tempreture December. (Weatherspark 2017)

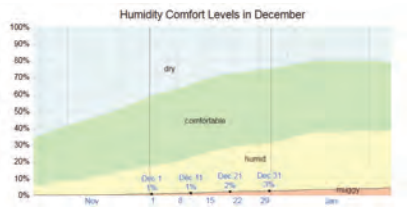


Fig179e. Humidity comfort levels December. (Weatherspark 2017)

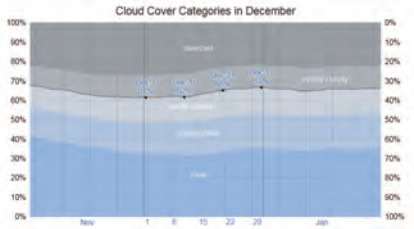


Fig179g. Cloud Cover Categories December. (Weatherspark 2017)

Winter Period Info: June

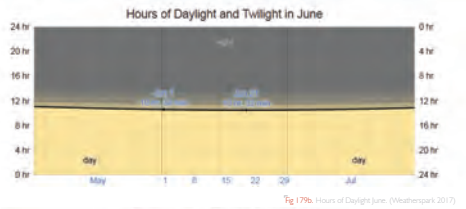


Fig 179b. Hours of Daylight June. (Weatherspark 2017)

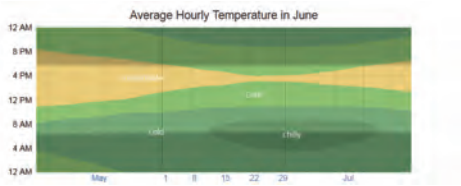


Fig179d. Avg Hourly Tempreture June. (Weatherspark 2017)

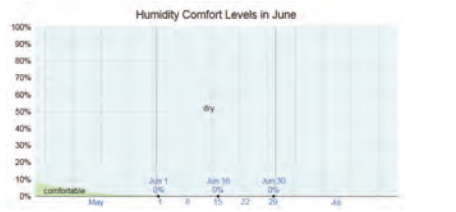


Fig179f. Humidity comfort levels June. (Weatherspark 2017)

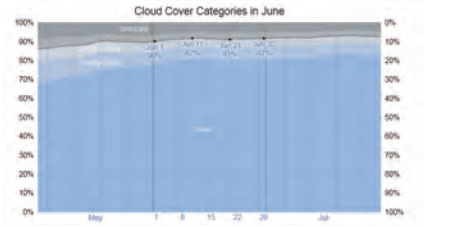


Fig179h. Cloud Cover Categories June. (Weatherspark 2017)

Fig _191 (Top): Wind rose data (Windfinder 2017).
Fig _192 (Bottom): Additional climatic data (Weatherspark 2017).

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Ventilation

The data gathered generated the development of systems to keep the interior climate as comfortable as possible. Ventilation was one of the aspects considered to be developed to aid in cooling of the spaces. The first system developed was to aid the spaces by means of passive ventilation where applicable. The aim was to ventilate and cool the spaces with passive systems as far possible. A system was developed to use the anabatic and katabatic mountain winds combined with the solar heat, earth tubes and tree canopy to passively ventilate the chambers and rental office space. The systems utilize the cool ambient air present under the tree canopy to ventilate the spaces.

Passive System

Air is pulled through the spaces by means of an in roof solar chimney system (fig 195), designed as sucking mechanism to draw all the warm air out of the spaces and create an internal closed air flow ventilation system.

The ventilation system starts with the intake of air through earth tubes. This ensures that the air brought into the space is at a constant temperature throughout the year. At the chambers, where the interior spaces need a higher level of cooling, cool air created from the shade of the trees is utilized and the earth tubes are placed deeper to keep this cool air at this temperature. The air from the earth tubes are vented into the spaces through vents. The air changes temperature due to the activities in the space and rises to the celling. The solar chimney extraction system then removes this warm air (see fig 196 - 197).

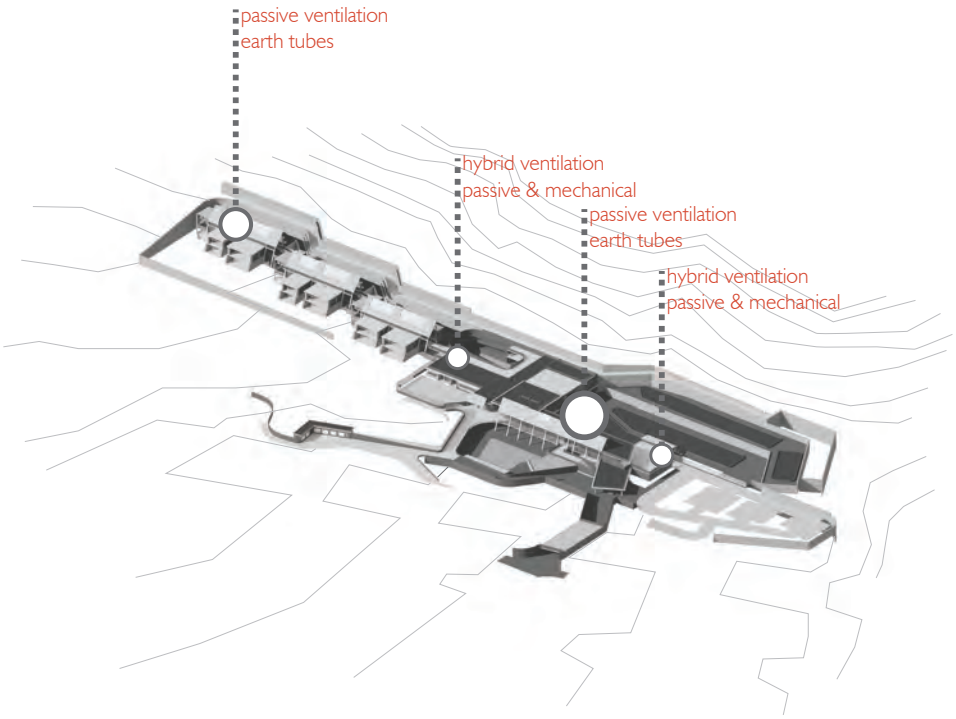

Fig _193 (Above): Ventilation systems (Author 2017).

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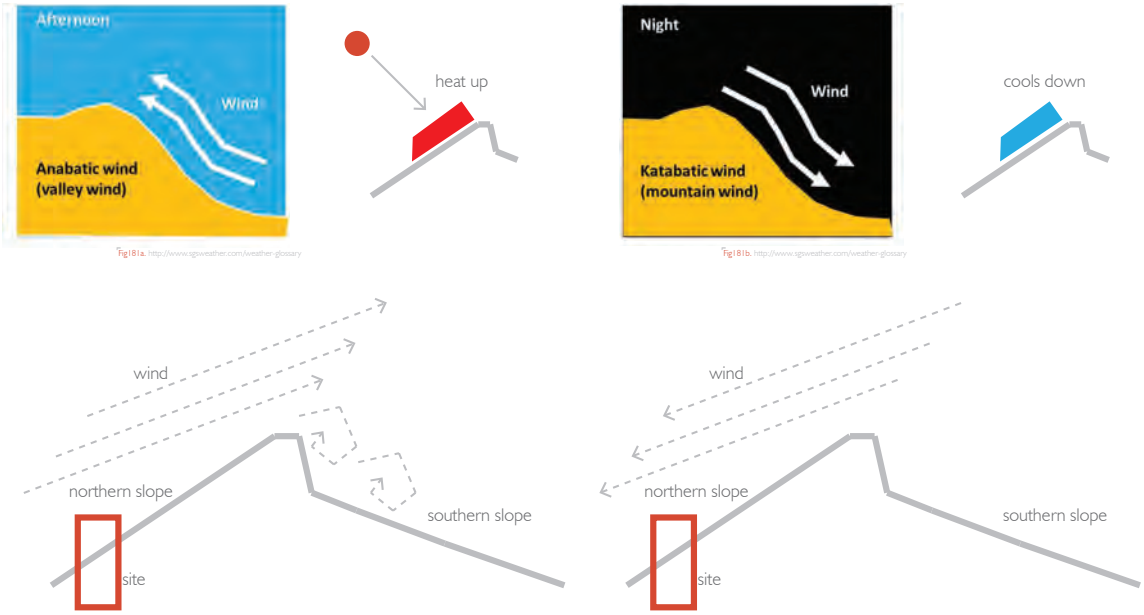

Fig _194 (Above): Anabatic and Katabatic wind systems (Author 2017).

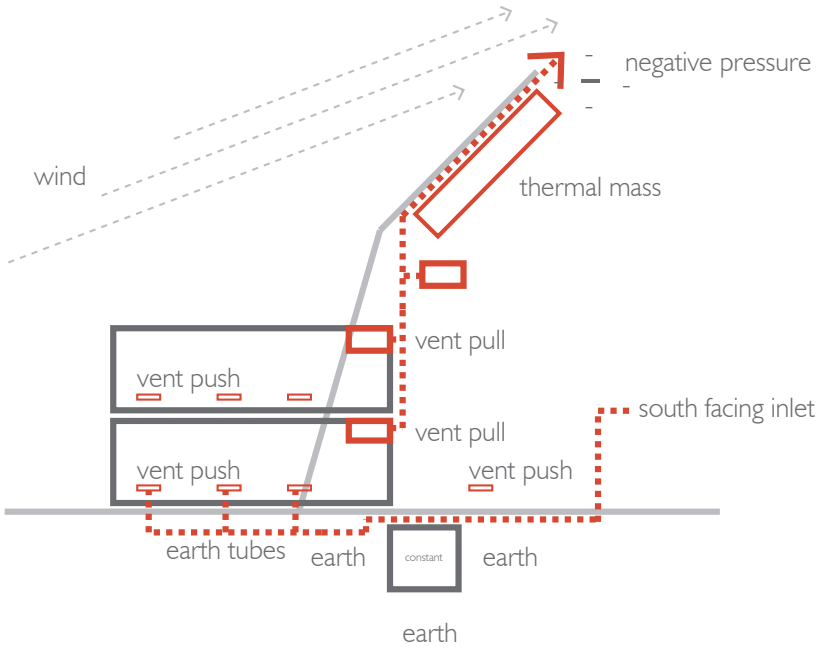

Fig _195 (Above): Passive ventilation systems diagram (Author 2017).

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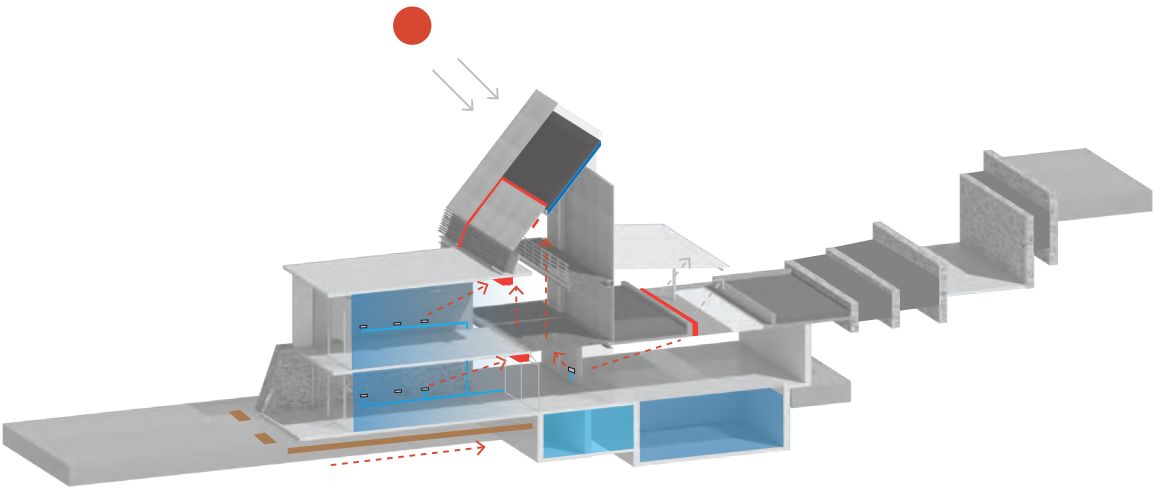

Fig _196 (Above): Passive ventilation systems at chambers (Author 2017).

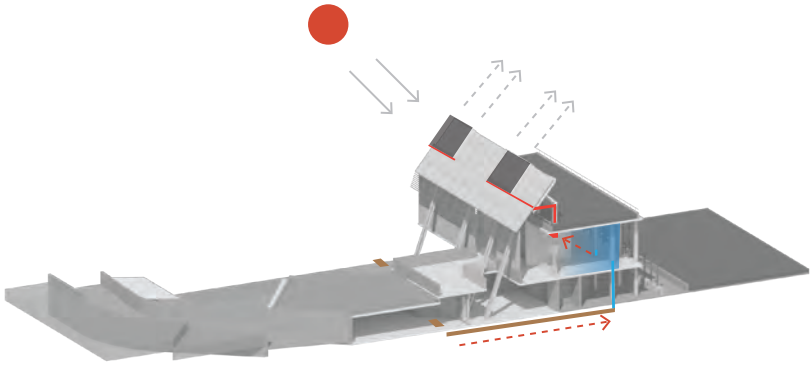

Fig _197 (Above): Passive ventilation systems at offices (Author 2017).

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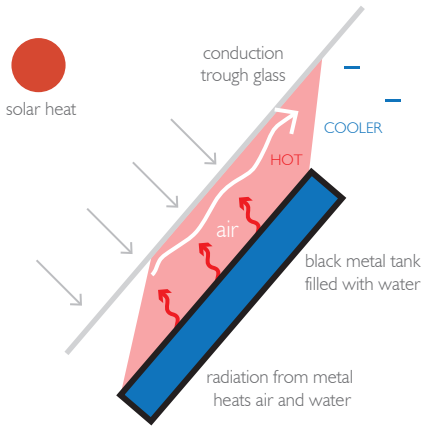
day

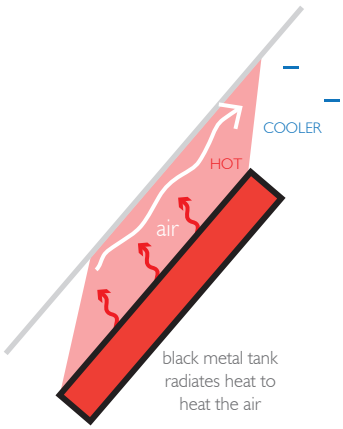


U - Value			
	1	2	3
Type of Material	Glass		
Material tickness (mm)	12	0	0
k - Value	0.96	1	0.12
(http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html)			
R material	**0.01250**	**0.00**	**0.00**
R-inside	0.6		
R-outside	0.12		
R Value	**0.73**		
U Value	**1.37**	W/M2(k)	

Hours of Sunlight ; 8 Hours
Area: 30 m2

U x Ta x A
1.37 x 8 x 30
328.8 Watts (heating power)

night



U - Value			
	1	2	3
Type of Material	Metal	Water	
Material tickness (mm)	20	100	0
k - Value	43	0.85	0.12
(http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html)			
R material	**0.00047**	**0.12**	**0.00**
R-inside	0.6		
R-outside	0.12		
R Value	**0.84**		
U Value	**1.19**	W/M2(k)	

Hours of Sunlight ; 8 Hours
Area: 30 m2

U x Ta x A
1.19 x 8 x 30
285.6 Watts (heating power)

Fig _198 (Above): Passive ventilation systems day and night working and power heating generated (Author 2017).

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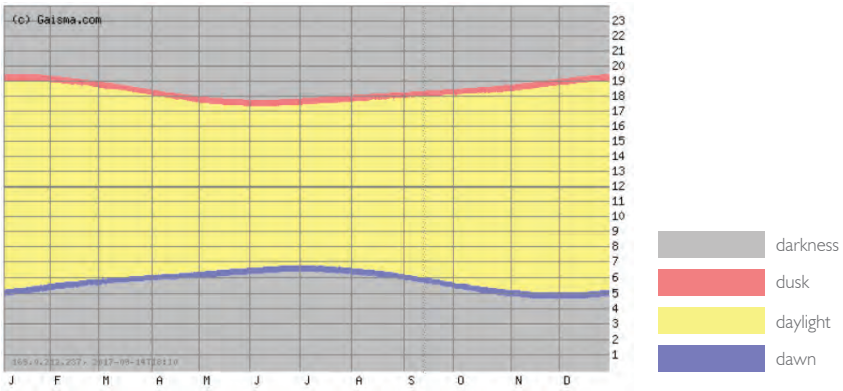
Solar Control

In keeping the interior climate at the optimal comfort level within the climatic data presented, solar control needed to be investigated and shading devices designed to keep unwanted heat and solar glare out. The investigation considered the yearly sun movement pattern in terms of sunrise, sunset and sun path as a starting point. In terms of the solar control investigation two main dates focused the solar control investigation. 21 September (summer equinox) as the summer datum and 21 April (winter equinox) as the winter datum. These two dates indicate when the sun is at the midpoint between the solar cycles (solstices).

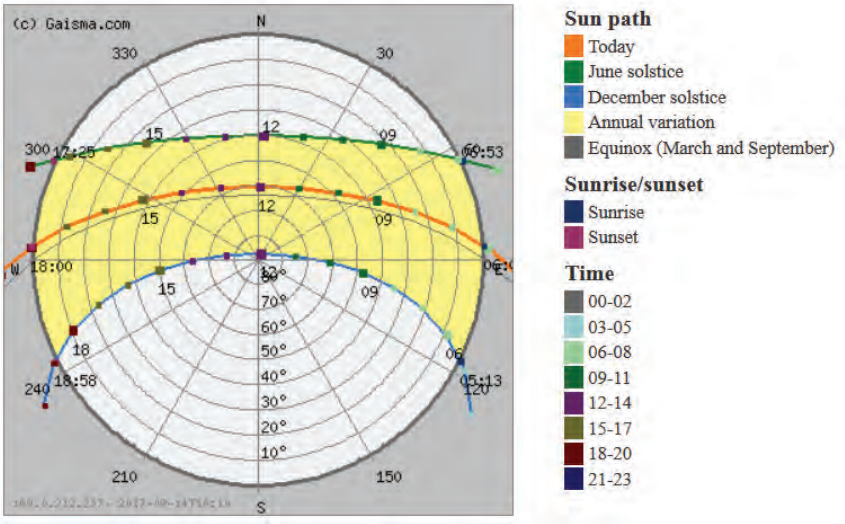
The two dates were divided into bi-hourly intervals to run a solar study on the facility (fig 200). The solar study results showed up areas of concern within the design. These areas concerned time intervals. On 21 September the results showed solar interference between 10:00 and 14:00 and on 21 April between 10:00 and 12:00. Focus was placed on these areas and time intervals to develop solar control shading devices.

Sunrise, sunset dusk and dawn times



https://www.gaisma.com/en/location/pretoria.html

Sunpath diagram



https://www.gaisma.com/en/location/pretoria.html

Fig _199 (Above): Sun data (Gaisma.com 2017).
Fig _200 (Right Page): Solar study (Author 2017).

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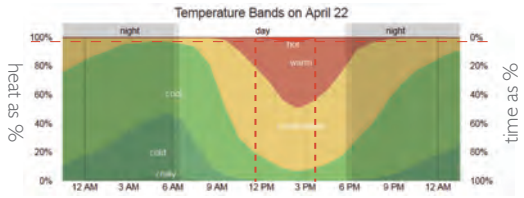
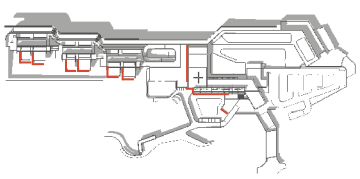
Site

21 April

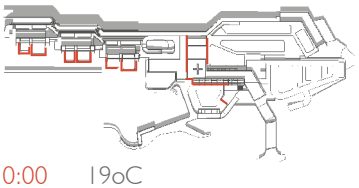
above 29 oC



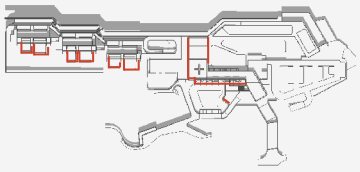
11:30 15:40



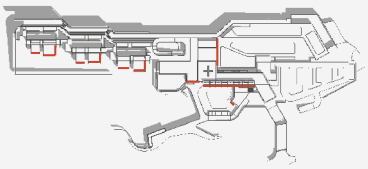
08:00 15oC



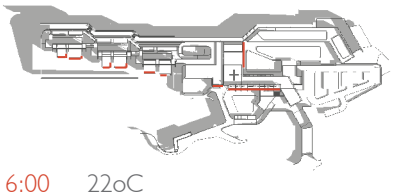
10:00 19oC



12:00 22oC



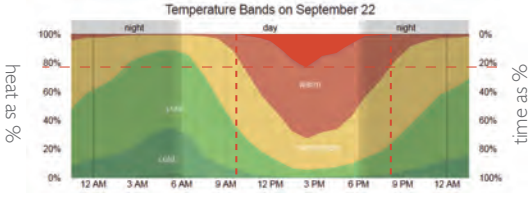
14:00 24oC



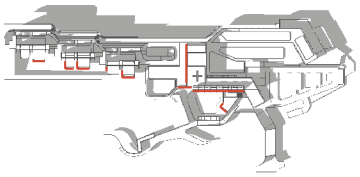
16:00 22oC

21 September

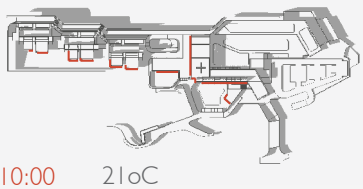
above 29 oC



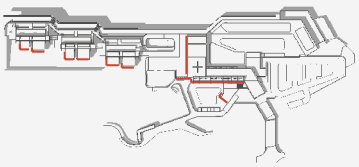
09:40 20:10



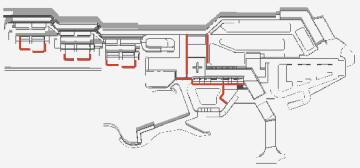
08:00 17oC



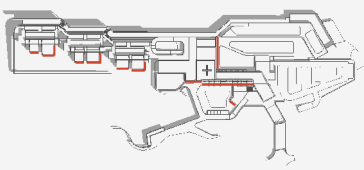
10:00 21oC



12:00 23oC



14:00 26oC



16:00 23oC

https://weatherspark.com/d/148605/4/22/Average-Weather-on-April-22-at-Pretoria-South-Africa#Sections-Temperature

https://weatherspark.com/d/148605/9/22/Average-Weather-on-September-22-at-Pretoria-South-Africa#Sections-Temperature

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Shading Device Design - Office Workstations

The solar study indicated a problem area at the office workstation space on first floor. The solar heat gain and glare onto the desks were problematic due to the functional nature of the space. To deal with this issue, a shading device design approach was taken to develop solar shutters and louvres.

The louvre design was developed to prevent solar infiltration when the sun is at its highest in a daily cycle. The louvres are spaced to keep the sun out of the space between 10:00 and 14:00 during winter and summer periods (fig 201). Using the lowest solar point at midday of 21 June as the angle to determine the louvre spacing. This consideration keeps the work desk computer screens glare free throughout the midday period in summer and winter.

To keep the afternoon sun from penetration the office space, a shutter design was implemented. The shutters were developed to keep the sun out of the space from 14:00 onward when the sun is at a lower angle and the louvres are not required anymore (fig 201). The solar shutters also aid in keeping direct sunlight out of the space in the morning hours to prevent glare. Sunlight protection into the office space is achieved by the southern curtain wall and reflection from the circulation space on the northern edge.

The solar shading devices were tested in the time periods identified in the main solar study as problematic and were found to achieve the desired effect (fig 202).

Fig _201 (Right Top): Louvre and shutter design (Author 2017).
Fig _202 (Right Bottom): Solar study of louvres and shutters (Author 2017).

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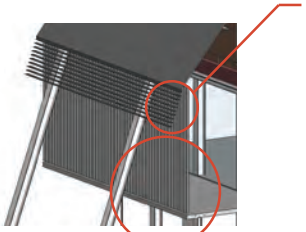
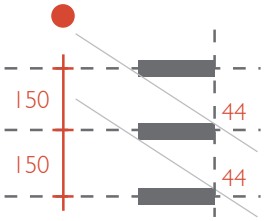
Nothern facade - workstation office

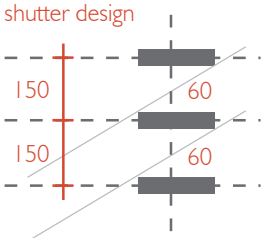


louvre design



natural, 150mm x 60 mm Rinowood laminated beams @ 150mm cc fixed horizontally, screwed to equal angle support frame.

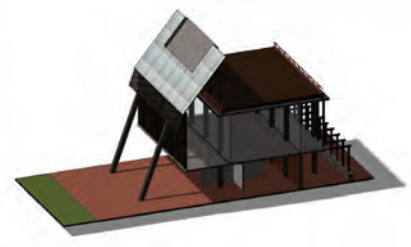
shutter design



natural, 150mm x 60 mm Rinowood laminated beams @ 150mm cc fixed vertically, screwed to equal angle support frame.

plan view

21 April



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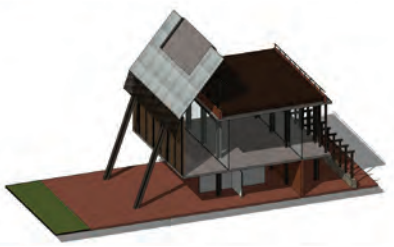
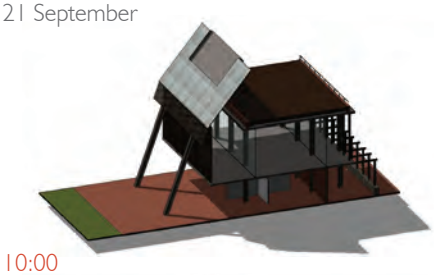
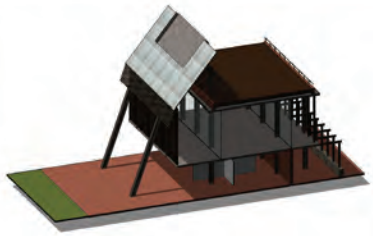


14:00

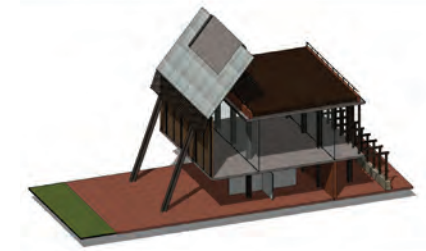
21 September



10:00



12:00



14:00

16:00

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Shading Device Design - Research Offices

Another problematic area with solar gain was presented on the western elevation of the research office and the facility's visitors introduction spaces. To control the solar gain in this area a combination of vertical shutters and perforated shutter screens were implemented. The vertical shutter sections were strategically designed and placed to keep direct sunlight away from any area where a desk might be used or where the interior space surface will absorb the sun's heat.

The ideal intervention on this elevation would have been to completely close it off with shutters but this would have disrupted the views and the architecture's intention to connect with the exterior grow beds. Where the direct sunlight needed to be completely blocked from the space, perforated sun screens were used. These sun screens continue into the roof space to keep direct sunlight out of the double volume without diminishing the light quality of the space.

Fig _203 (Right Top): Louvre design for office west fasade (Author 2017).
Fig _204 (Right Bottom): Solar study of louvres for office west facade (Author 2017).

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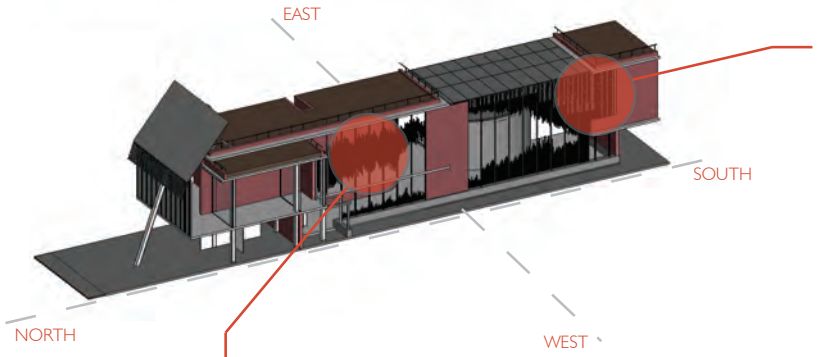
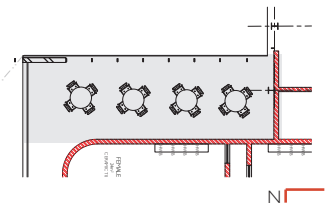
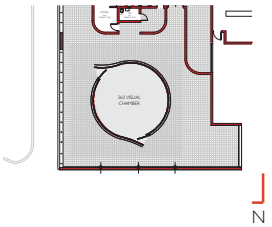
Western facade - reseach group office / interpretation centre

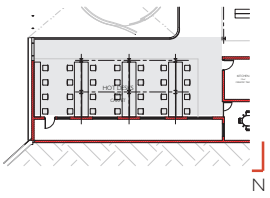


natural pattern cut, 600mm x 30 mm custom made Rinowood laminated sheets fixed to equal angle support frame.

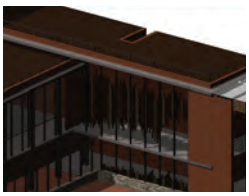
natural, 150mm x 60 mm Rinowood laminated beams @ 150mm cc fixed vertically, screwed to equal angle support frame per detail reference.







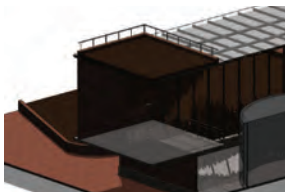
21 September



14:00

16:00

14:00



14:00

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Climatic Modeling

The interior climate of the office workstation space (fig 205 - 206) on the first floor posed a challenge in terms of the large glazing areas to the north and south. The challenge related to interior heat gain and energy needed to keep the climate of this space comfortable. To address this challenge, climatic modelling software (Sefaira 2009) was implemented to test the thermal qualities of the space and the materials used.

The process required of the office space area to be isolated and modelled separately (Revit 2017) to the exact specifications that were intended for the space. A requirement field was set up according to SANS 10400 XA (2011) and SANS 204 (2011) regulations. The intended space model was run in Safaira (2009) to gather results and compare to the requirements as set out. The first attempt (baseline- fig 207) failed the requirements and adjustments were made. These adjustments ranged from adding interior window blinds to adjustments to the structures of the roof and walls. The result (iteration A -fig 208) shows the required construction and range of materials required to meet the requirements as set out. Additional results on the daylight penetration and lux levels of the space are shown in figure 209 and 210.

Fig _205 (Right Top): Area and information of space to be tesed in climatic modelling (Author 2017).
Fig _206 (Right Bottom): Plan view of space to be tested (Author 2017).

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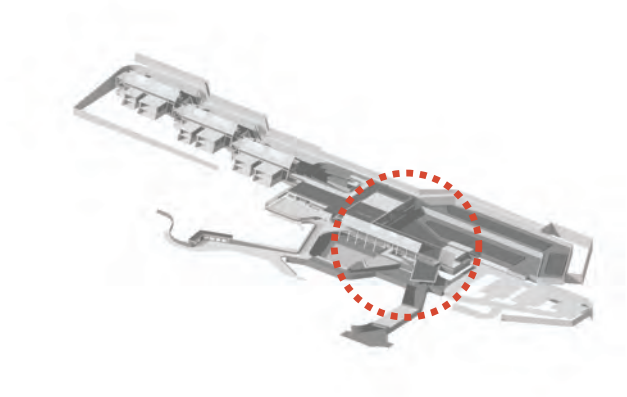
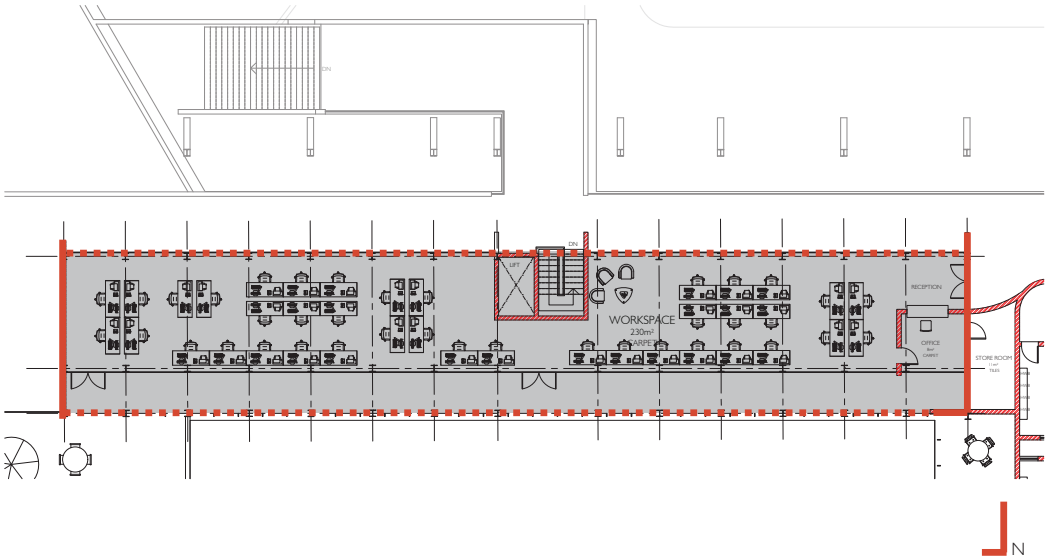


SANS classification: G1 Office
floor area: 533sqm
floor to ceiling height: 3.5m
dimensons: 236 m E to W
42 m N to S
discription: office space for rent structure consiting of glazing on nothern and southern elvevation with masonary walls on eastern and western elevation. roof consists of green roof and floor of cast in-situ concrete slab with suspended service floor.



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Baseline

Roof
U-Value: 0.74 W/m2.K

U - Value					
	1	2	3	4	5
Type of Material	Concrete	Stone	Ground		
Material tickness (mm)	150	50	450	0	0
k - Value	1.5	0.6	1	1	1
(http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html)					
R material	**0.10**	**0.08**	**0.45**	**0.00**	**0.00**
R-inside	0.6				
R-outside	0.12				
R Value	**1.35**				
U Value	**0.74**	W/M2(k)			

Walls
U-Value: 1.06 W/m2.K

U - Value					
	1	2	3	4	5
Type of Material	Masonary	Masonary			
Material tickness (mm)	110	110	0	0	0
k - Value	1	1	1	1	1
(http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html)					
R material	**0.11**	**0.11**	**0.00**	**0.00**	**0.00**
R-inside	0.6				
R-outside	0.12				
R Value	**0.94**				
U Value	**1.06**	W/M2(k)			

Floor
U-Value: 0.30 W/m2.K

U - Value					
	1	2	3	4	5
Type of Material	Concrete	Air	Timber	Carpet	
Material tickness (mm)	150	50	50	10	0
k - Value	1.5	0.024	0.12	0.26	1
(http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html)					
R material	**0.10**	**2.08**	**0.42**	**0.04**	**0.00**
R-inside	0.6				
R-outside	0.12				
R Value	**3.36**				
U Value	**0.30**	W/M2(k)			

Glazing
U-Value: 2.84 W/m2.K
SHGC: 0.60

Crealco Facade 60 Thermal Curtain wall
U-Value: 2.84 W/m2.K
SHGC: 0.60

Fig _207 (Above): Baseline results (Author 2017).

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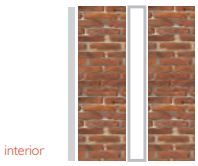
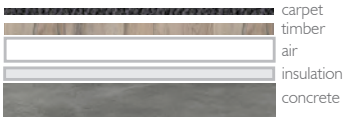
Iteration A

Roof
U-Value: 0.44 W/m2.K

Walls
U-Value: 0.33 W/m2.K



Floor
U-Value: 0.29 W/m2.K



Glazing
U-Value: 2.84 W/m2.K
SHGC: 0.20

U - Value					
	1	2	3	4	5
Type of Material	Concrete	Stone	Insulation	Ground	
Material tickness (mm)	150	50	100	450	0
k - Value	1.5	0.6	0.11	1	1
(http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html)					
R material	**0.10**	**0.08**	**0.91**	**0.45**	**0.00**
R-inside	0.6				
R-outside	0.12				
R Value	**2.26**				
U Value	**0.44**	W/M2(k)			

U - Value					
	1	2	3	4	5
Type of Material	Masonary	Air	Masonary	Plaster	
Material tickness (mm)	110	50	110	10	0
k - Value	1	0.024	1	0.71	1
(http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html)					
R material	**0.11**	**2.08**	**0.11**	**0.01**	**0.00**
R-inside	0.6				
R-outside	0.12				
R Value	**3.04**				
U Value	**0.33**	W/M2(k)			

U - Value					
	1	2	3	4	5
Type of Material	Concrete	Air	Timber	Carpet	Insulation
Material tickness (mm)	150	50	50	10	10
k - Value	1.5	0.024	0.12	0.26	0.11
(http://www.engineeringtoolbox.com/thermal-conductivity-d_429.html)					
R material	**0.10**	**2.08**	**0.42**	**0.04**	**0.09**
R-inside	0.6				
R-outside	0.12				
R Value	**3.45**				
U Value	**0.29**	W/M2(k)			

Metal Technology System 8
U-Value: 1.28 W/m2.K
SHGC: 0.60
internal blinds SHGC: 0.20

Fig _208 (Above): Iteration A results (Author 2017).

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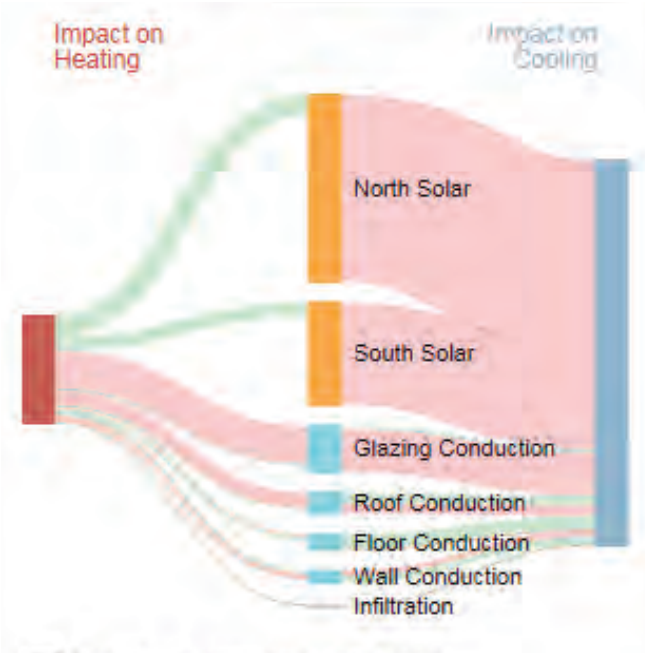
21 September - 12:00

219 kWh/m2 > 190 kWh.m2
Cooling Dominated
Mostly Lit



Gains on north solar is too large to achieve requirements of SANS energy requirements. Decreace needed in heat gains from nother glazing.
South solar impact on cooling can be improved to lower energy demand.

Daylight - Overlit / Underlit

Fig _209 (Above): Aditional Baseline results - Daylight over and under lit areas and Energy use (Author 2017).

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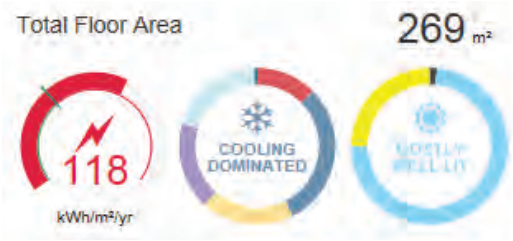
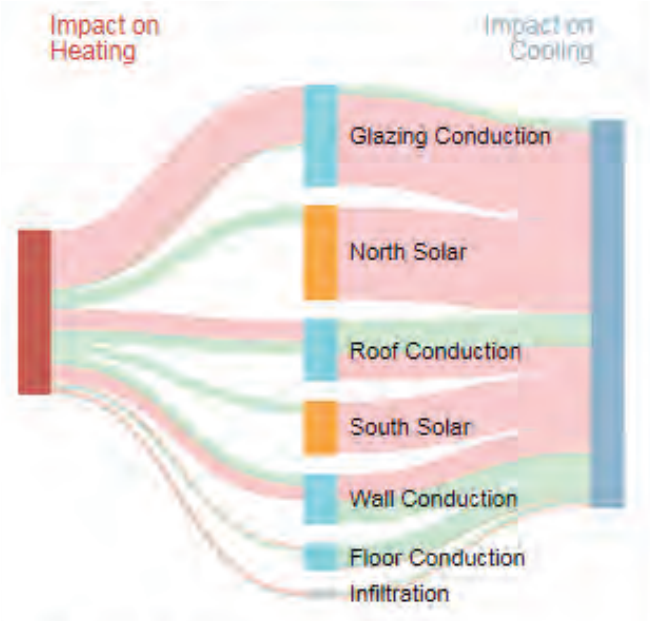


118 kWh/m2 < 190 kWh.m2
Cooling Dominated
Mostly Lit



Balance between conductive elements keeping energy demand below requirements.

Daylight - Above 300 lux

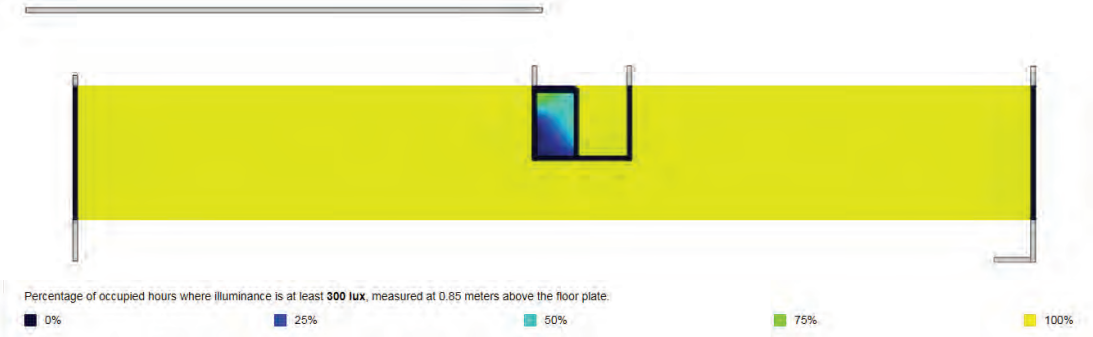


Fig _210 (Above): Aditional Iteration A results - Daylight factor and Energy use (Author 2017).

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06_4 Building Structure

The structure of the conservation facility is investigated in this section. A general approach was taken in terms of investigating and in explaining the structure of the facility. As shown in figure 211, this approach considered the structure in terms of primary, secondary and tertiary elements. The primary elements relate to the structural systems used, the secondary to how this structural system is closed off or filled and the tertiary on how the services are placed into the voids of the structure and/or finished off.

Primary Structure

The primary structure for the conservation facility is a steel frame (portal or other) permanent shuttered concrete construction combination system . This approach was based on the aesthetical quality of steel in making the superstructure seem as light as possible. This creates a contradiction with the spaces directly in contact with the ground, which all have a heavy base. With this contradiction, the in-between becomes highlighted as these segments are exposed as the transition and tie into the relationship consideration of the in-between of the project.

Secondary Structure

The secondary structure considers how the space is created, closed-off or filled in. The system used to create the secondary structure is derived as an extension of the form informant as explained in chapter 2. The "*musée of images*" of the blockhouse structure is re-interpreted and a multi-layer material structure is created. The material used for this multi-layer structure is a stone cladded base with an in-situ cast concrete frame that is filled with a masonry infill. Where needed, the fourth material element of sheet metal is added. This system is used as basis and implemented in different aspects throughout the design.

Tertiary Structure

The tertiary structure refers to all the material elements not included in the primary or secondary structure and completes the structure of the conservation facility. These elements are service or function orientated and differ throughout the conservation facility. The tertiary structure of the office work space is for example the suspended service floor where the tertiary structure for the chambers will be the drainage system pipes that drain the spilled water from washing.

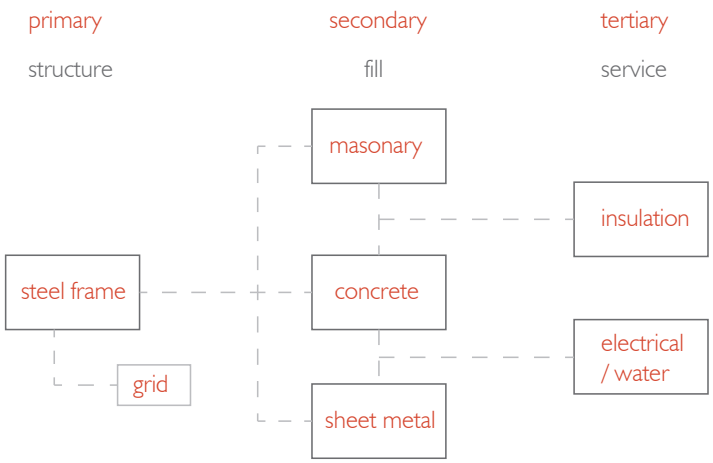

Fig _211 (Above): Structure approach diagram (Author 2017).

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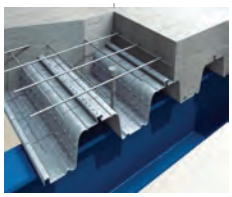
primary
steel frame

I - beam
H - column
permanent shuttering



https://4.imimg.com/data4/LK/RP/MY-4774059/cf80-cutaway-500x500.jpg

secondary
floor slab

concrete cast
in-situ

http://buildipedia.com/knowledgebase/division-03-concrete/03-30-00-cast-in-place-concrete/03-37-00-specialty-placed-concrete/03-37-00-specialty-placed-concrete?print=1&tmpl=component

tertiary
finish

ceramic tiles
service floors
timber flooring

http://www.cbi-europe.it/en/catalogo/sistemi+di+condizionamento+integrati/1/1/index.aspx

primary
reinforced
concrete frame

concrete
cast in-situ
into formwork

http://ronie-mooney-encs.us/design-of-reinforced-concrete-walls.html

secondary
masonary / stone
fill

brick laying
stone packing

http://www.bricklaying-courses.co.uk/bricklaying-books/

tertiary
finish

plaster
sheet metal
paint

https://www.constructionkit.com/kit-additions/

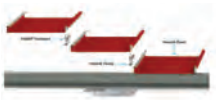
primary
steel frame

colled rolled
square hollow
sections

http://www.austenknapman.co.uk/mild-steel/mild-steel-box-section/

secondary
roof sheeting

aluminum roof
sheeting



http://lcproofblog.co.za/?p=1664

tertiary
ventilation system

thermal mass
metal tank
piping

https://www.coastandcountrywatertanks.com.au/
https://pxhere.com/en/photo/925035

Fig _212 (Above): Structure explained in terms of materials - Primary, secondary and tertiary (Author 2017).

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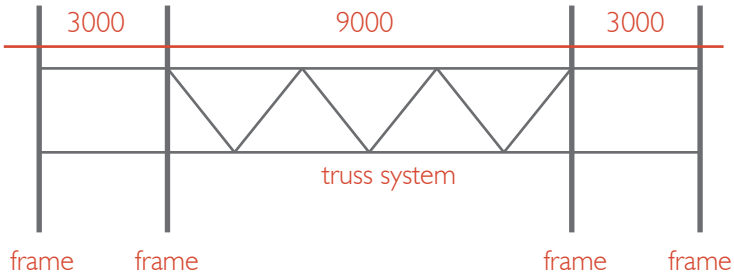
Chamber Structure

Structure diagram



Portal frame structure

Fig _213 (Top): Diagram of structural grid for chamber portal structure (Author 2017).
Fig _214 (Bottom): Portal frame structure for chambers (Author 2017).

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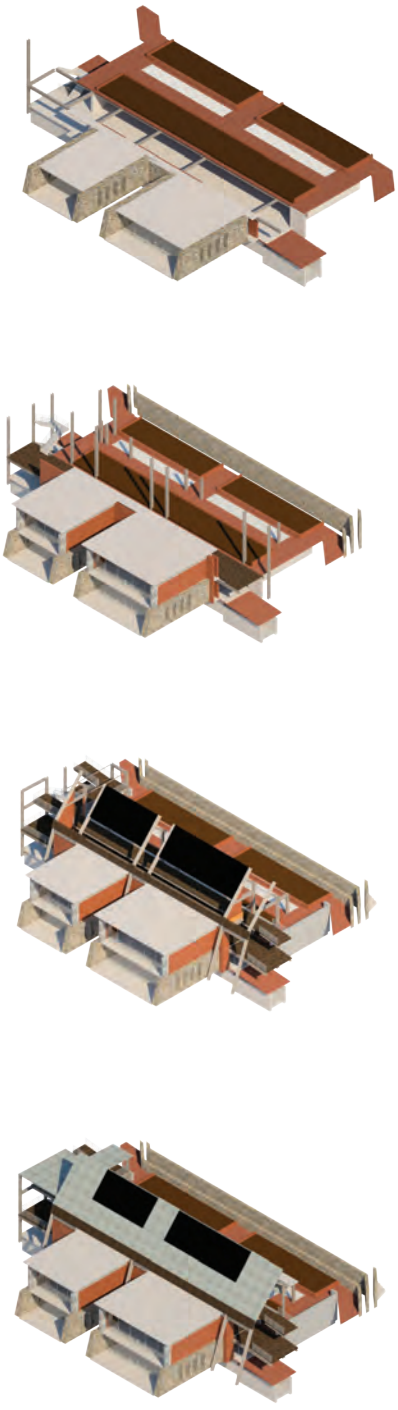

Fig _215 (Above): Typical construction process of chamber (Author 2017).

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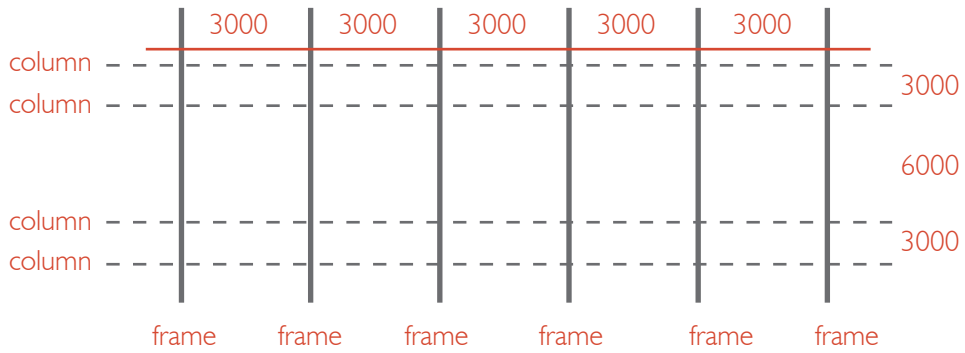
Office Structure

Structure diagram



Portal frame structure

Fig _216 (Top): Diagram of structural grid for office portal structure (Author 2017).
Fig _217 (Bottom): Portal frame structure for office space (Author 2017).

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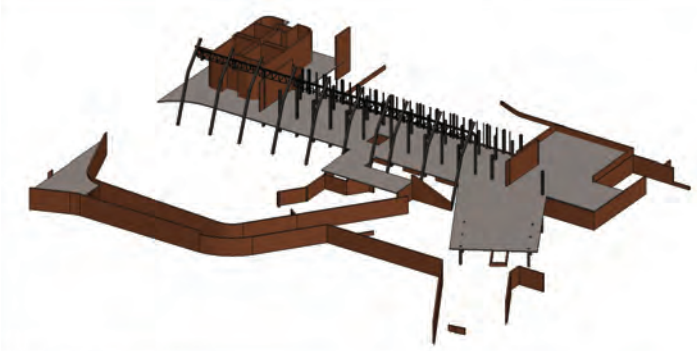

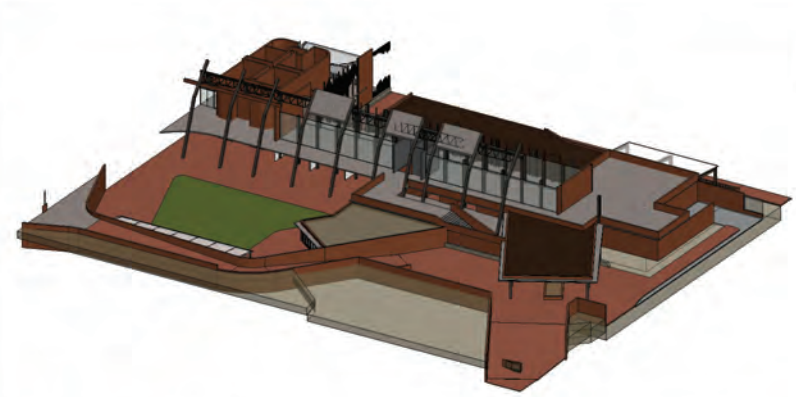

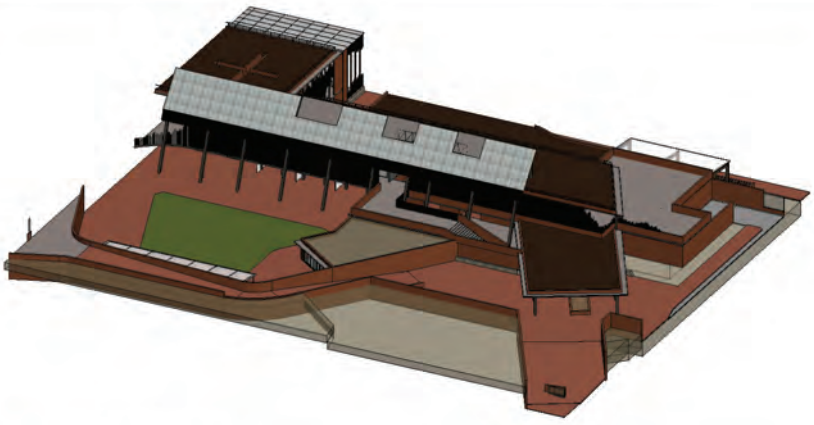

Fig _218 (Above): Typical construction process of office space (Author 2017).

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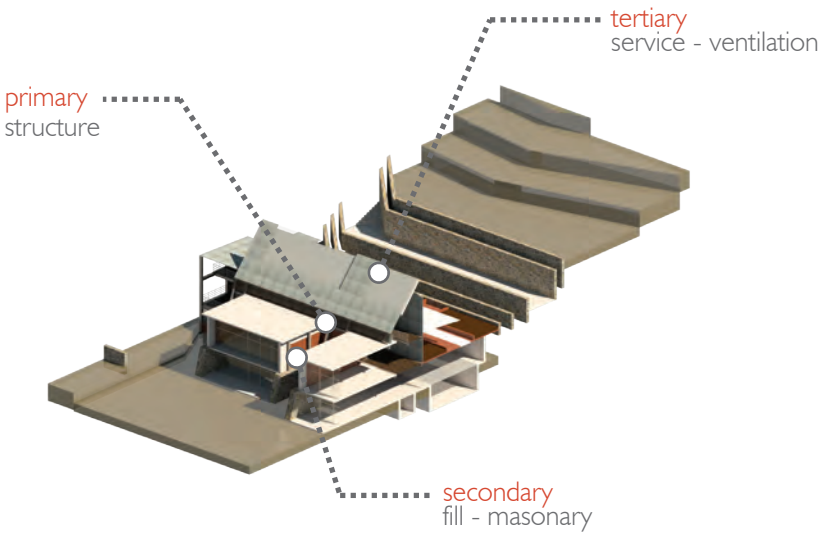

Fig _219 (Top): Section perspective of chamber structure indication the primary, secondary and tertiary structure (Author 2017).
Fig _220 (Right Page): Pull out of design to show the structural elements (Author 2017).

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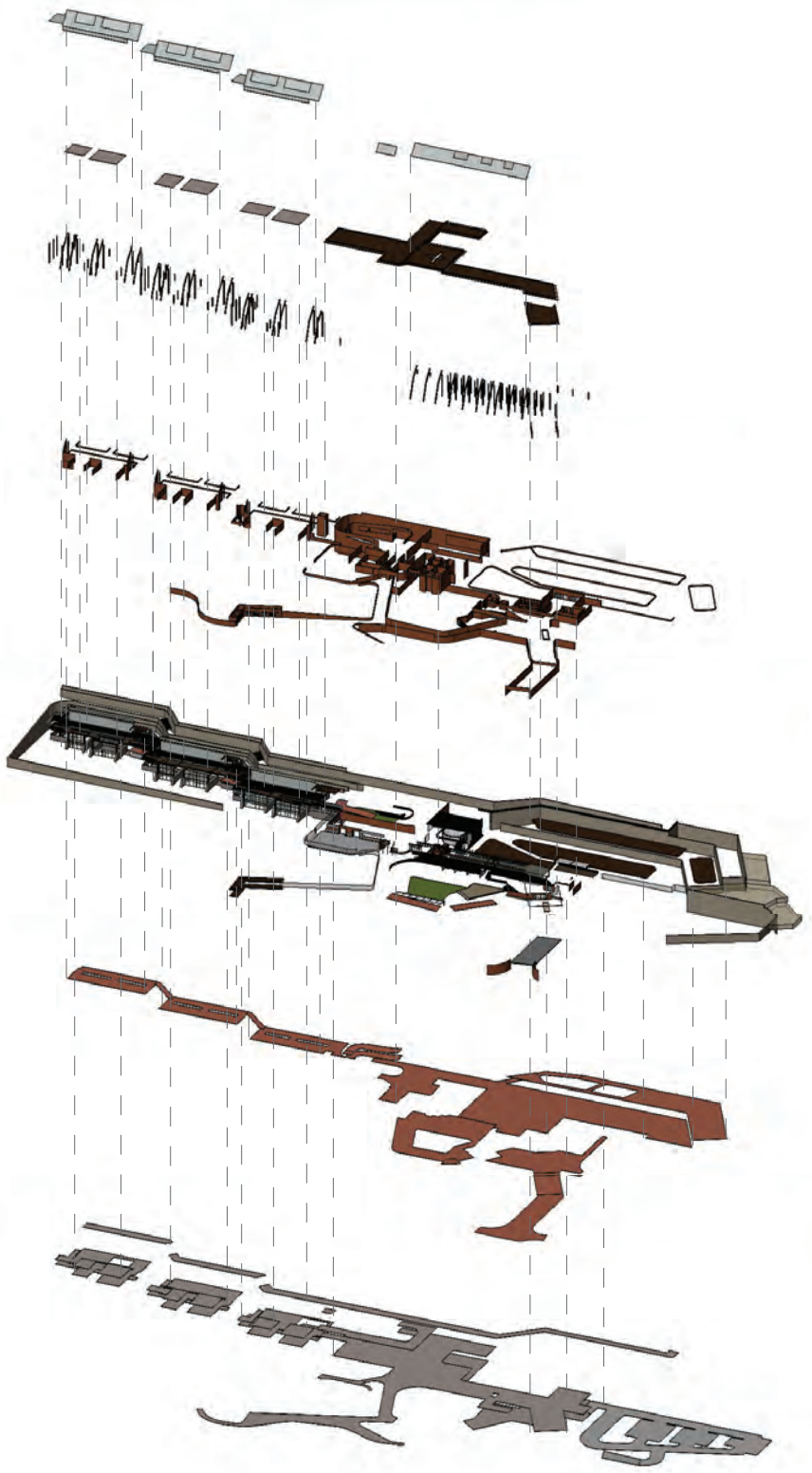

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Materiality

The second aspect of the building structure sub-category considers the material pallet for the conservation facility. The investigation of material is built on the explained structure materials and considers the manufacturer, distance from site and quality of the material to determine the sources of all the materials to be used for the conservation facility. A diagram is developed (fig 222 - 230) to show the manufacturer, the distance the material needs to travel to the site and the material finish.

The criteria for manufacturer and product selection were based on the quality of the product, the finish in terms of the aesthetical requirements and the locality of the manufacturer. Although some materials' original source is distant from the site due to the climates required to produce, the distances from manufacturer or distribution centres to the site are kept to within a +/- 50km radius.

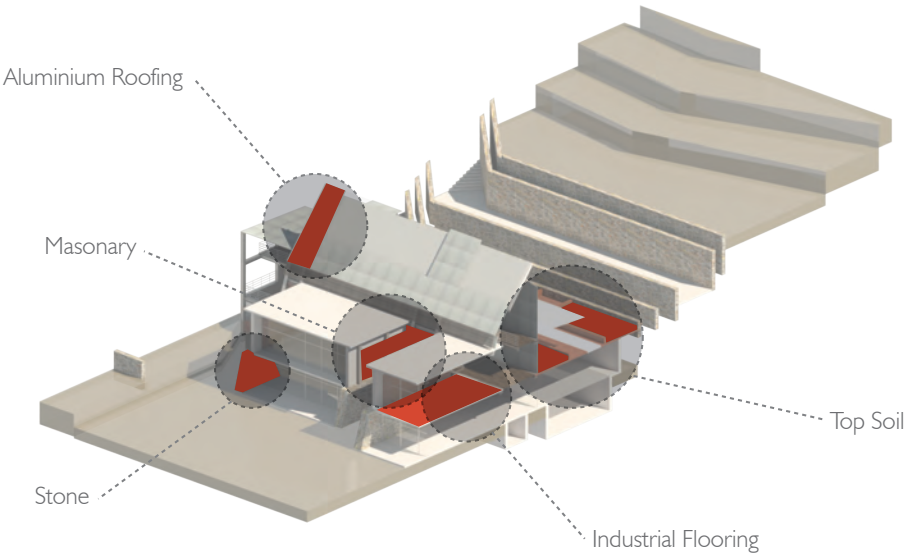

Fig _221 (Above): Section perspective showing the material areas (Author 2017).

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Masonary

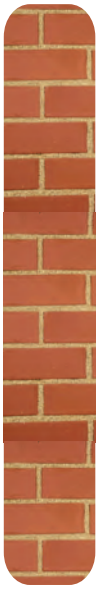
Walls

230 mm facebrick walls - Roan Satin FBX

Company

Corobrik, 2785 Escallonia Street, Montana Commercial Park, Ext 91, Montana, Pretoria, 1000

distance to site 12.2 KM
time to site 19 min



Stone

Wall - clad

Quartzite stone clad

Company

Site - Wonderboom Nature Reserve, M1 Road, Wonderboom, Pretoria, 0182

distance to site 0 KM
time to site 0 min

Fig _222 (Top): Material - Masonary (Author 2017).
Fig _223 (Bottom): Material - Stone (Author 2017).

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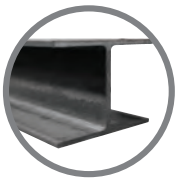
Steel

Structural system - portal frame
305 mm x 305 mm x 118 mm Hot Rolled H-Section (Parrallel Flange)
305 mm x165 mm x 40 mm Hot Rolled I-Section (Taper Flange)



Company
Arcelor Mittal South Africa, Frikkie Meyer Road, Pretoria West, Pretoria, 0183

ArcelorMittal

distance to site 14.3 KM
time to site 14 min

Concrete

Floor & Roof cast - Permanent suttering
150 mm cast in-situ concrete

Company
PPC Hercules Factory, Es'kia Mphahlele Dr, Eloff Estate 320-Jr, Pretoria, 0084

PPC CEMENT

distance to site 6.3 KM
time to site 8 min

Fig _224 (Top): Material - Steel (Author 2017).
Fig _225 (Bottom): Material - Concrete (Author 2017).

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Ceramic Tiles

Floor finish for circulation / ablution

Company

CTM - Pretoria, 519 Michael Brink St, Gezina, Pretoria, 0183

CTM
Big savings. More style.

distance to site 5.2 KM
time to site 8 min

Industrial Flooring

Floor finish for industrial areas

Company

58 Toermalyn St, Klerksoord AH, Akasia, 0200

TTMC EPOXY FLOORING
Your Epoxy Flooring Partner.

distance to site 12.6 KM
time to site 11 min

Fig _226 (Top): Material - Ceramic Tiles (Author 2017).
Fig _227 (Bottom): Material - Industrial Flooring (Author 2017).

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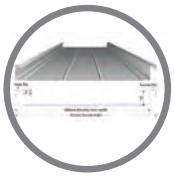
Roofing - Aluminium

Roof Sheeting - Saflok and Newlok (unseamed)



Rain Cloud

Company

Kifaru Trading (Pty) Ltd, 4 Fobian St, Hughes, HUGHES EXT 31, 1459

SAFINTRA
world class roofing systems

distance to site 63.5 KM
time to site 50 min

Top Soil

Green Roof top soil
Plant Beds top soil

Company

Topia Gardens, Cnr Zambezi Road & Mountain Drive,
Montana Park, Pretoria, 0035

Topia Gardens Nursery/Kwekery

distance to site 18.9 KM
time to site 30 min

Fig _228 (Top): Material - Roofing - Aluminium (Author 2017).
Fig _229 (Bottom): Material - Top soil (Author 2017).

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Timber

Shutters and Louvres - all timber applications
Rhino modified wood

Company

Timbermann, Plot 478, Swavelpoort, Pretoria, 0081

distance to site 35.7 KM
time to site 42 min

Carpet

Floor finish for office areas

Company

Top Carpets & Floors Mayville, Cnr Louis Trichardt St & Mortimer ave, Pretoria, 0084

distance to site 2.2 KM
time to site 3 min

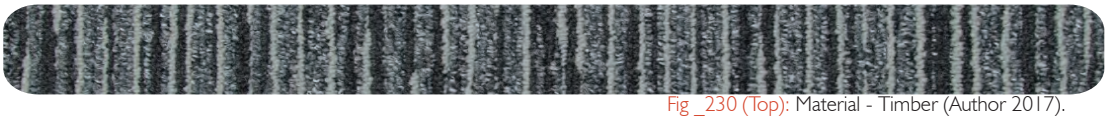

Fig _230 (Top): Material - Timber (Author 2017).
Fig _231 (Bottom): Material - Carpet (Author 2017).

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Section Production Chamber

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Fig _232 (Spread): Section CC - NTS (Author 2017).

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Section Office Space / Retail Market

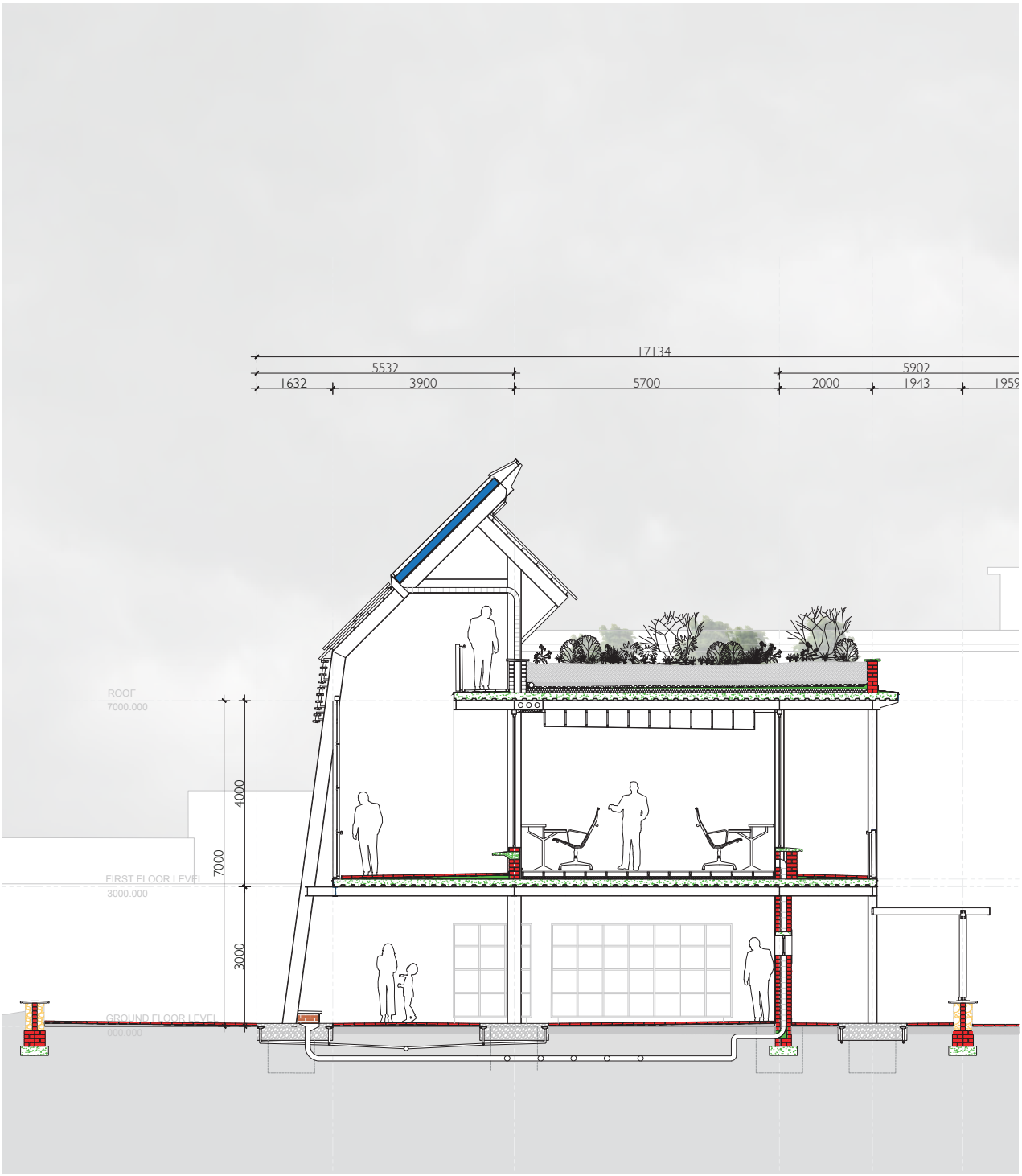

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Fig _233 (Spread): Section AA - NTS (Author 2017).

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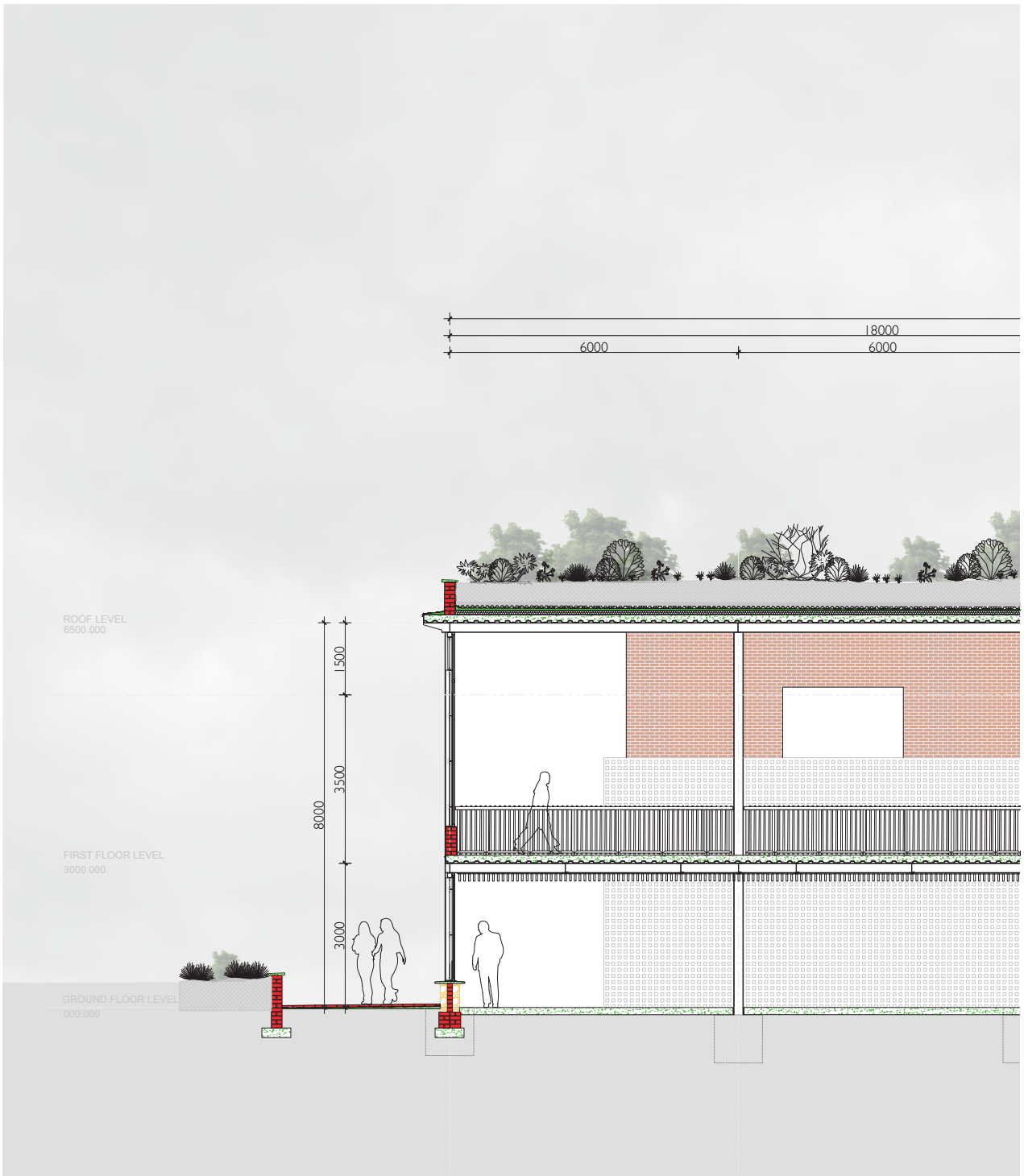
Section Research Office Space / Orientation Chamber



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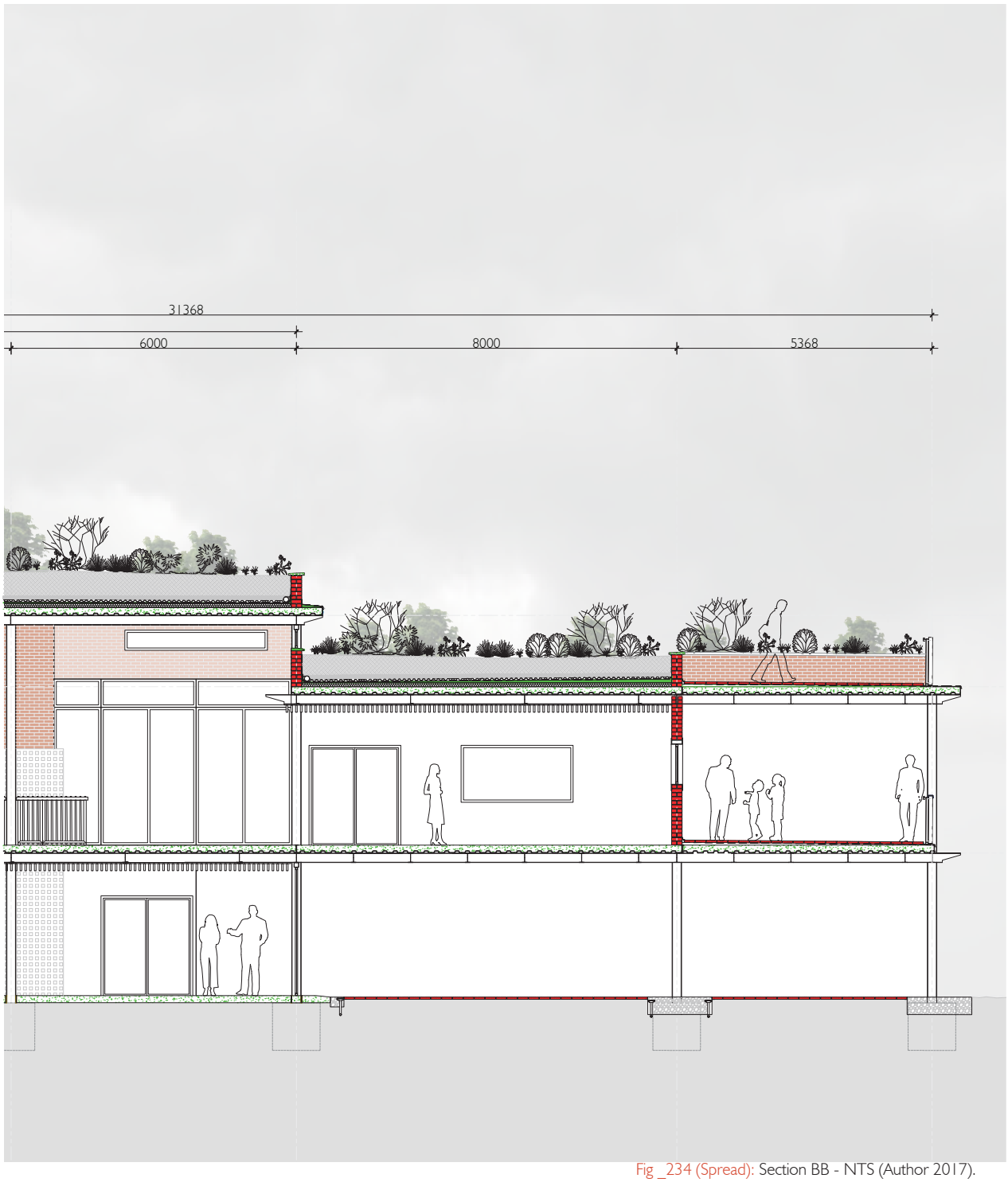

Fig _234 (Spread): Section BB - NTS (Author 2017).

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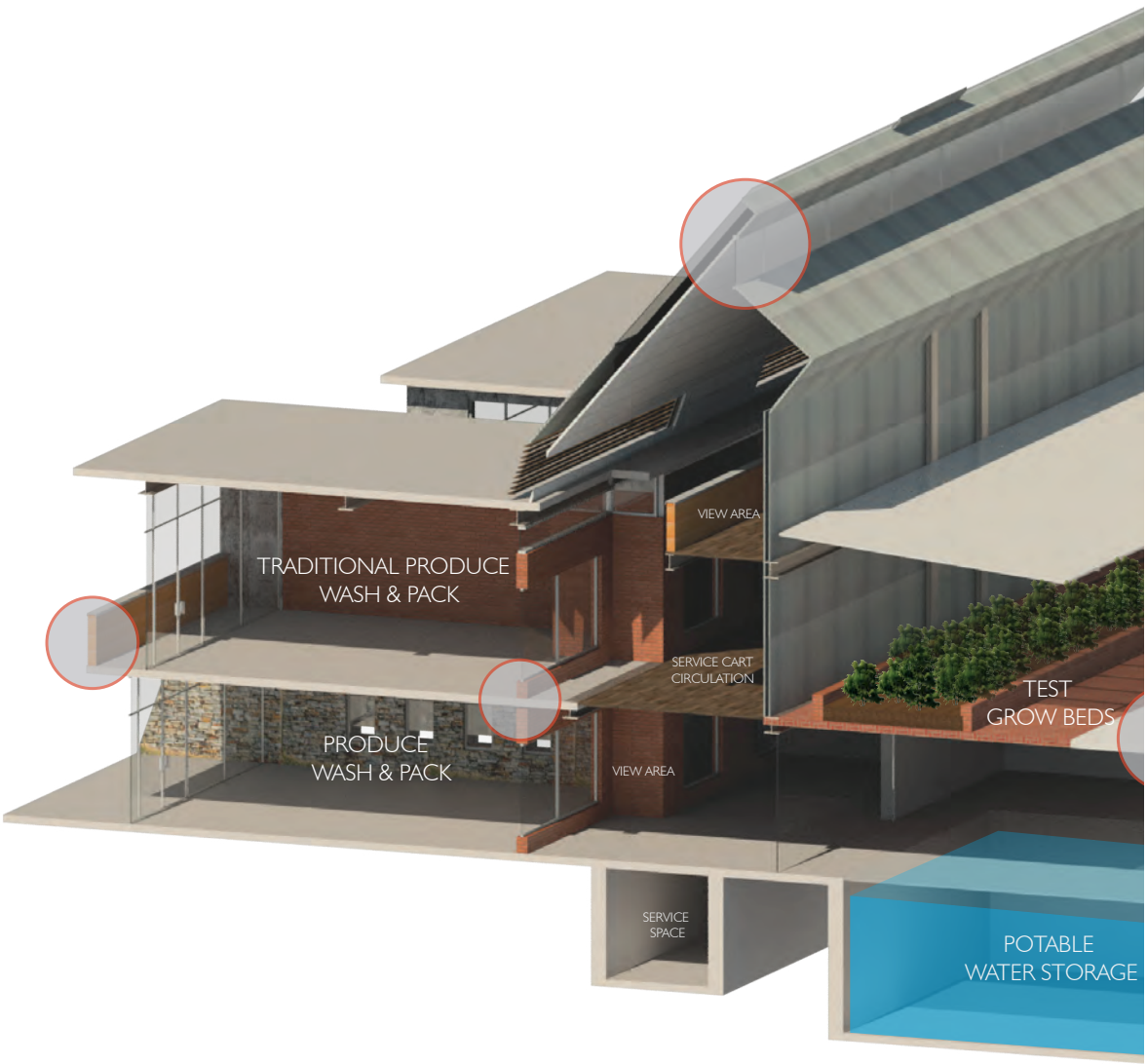

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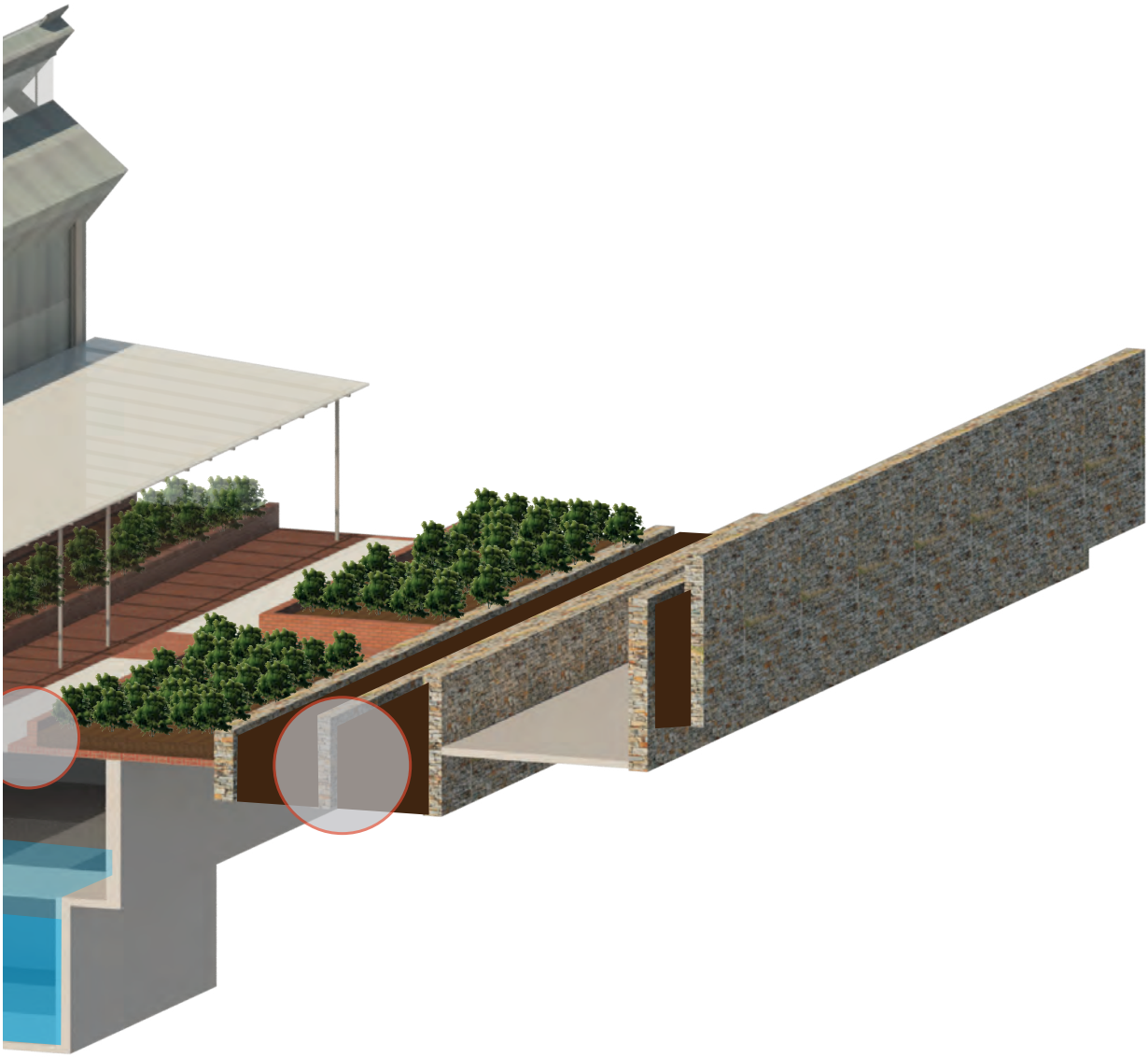

Fig _235 (Spread): 3D Section of Chamber - NTS (Author 2017).

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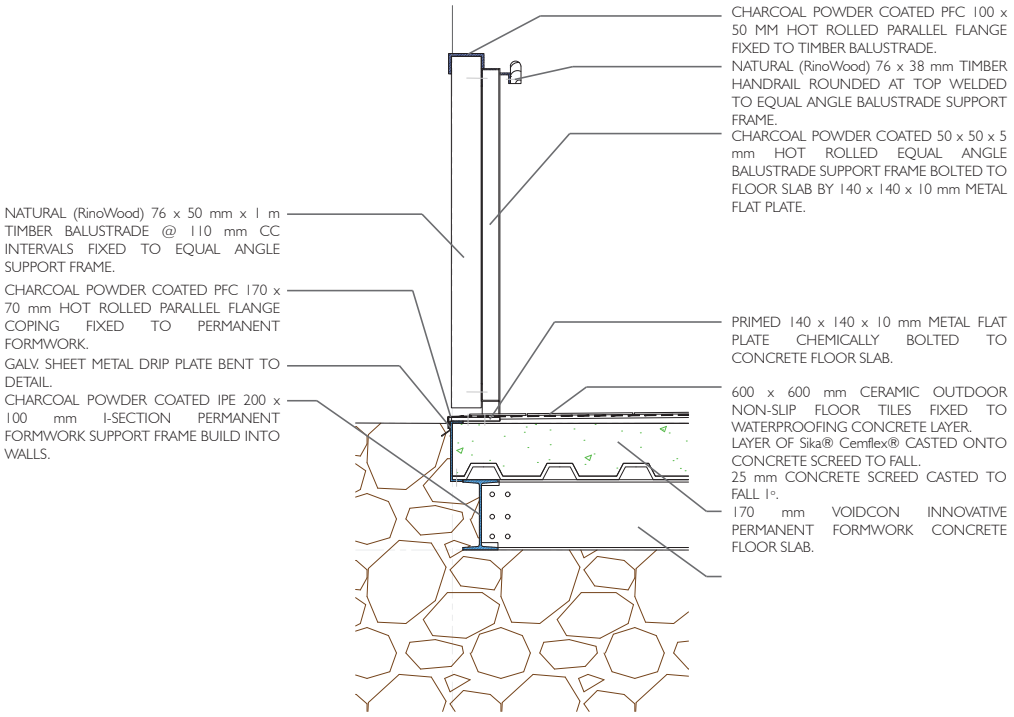

Fig _236 (Above): Detail 1- NTS (Author 2017).

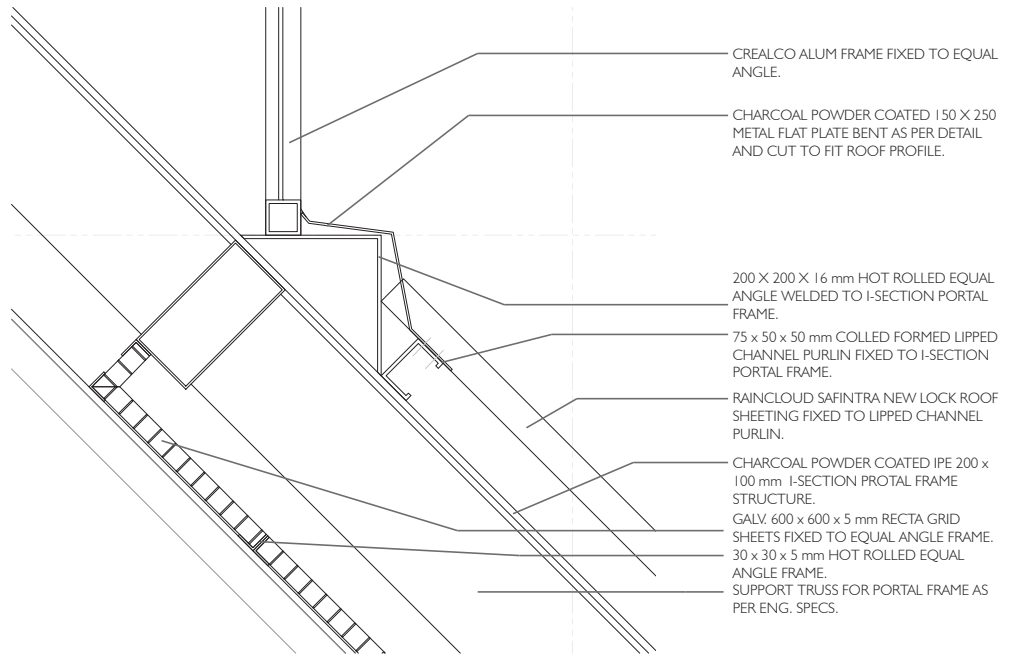

Fig _237 (Above): Detail 2- NTS (Author 2017).

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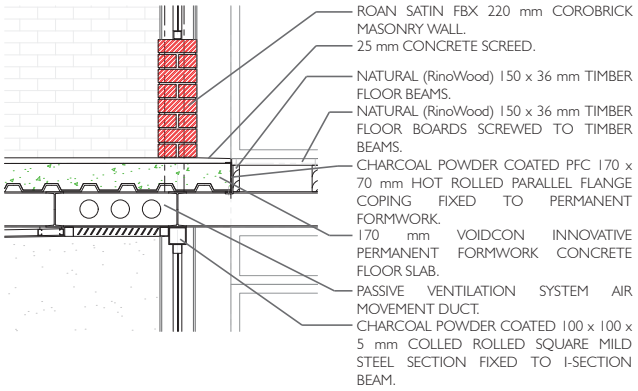

Fig _238 (Above): Detail 3 - NTS (Author 2017).

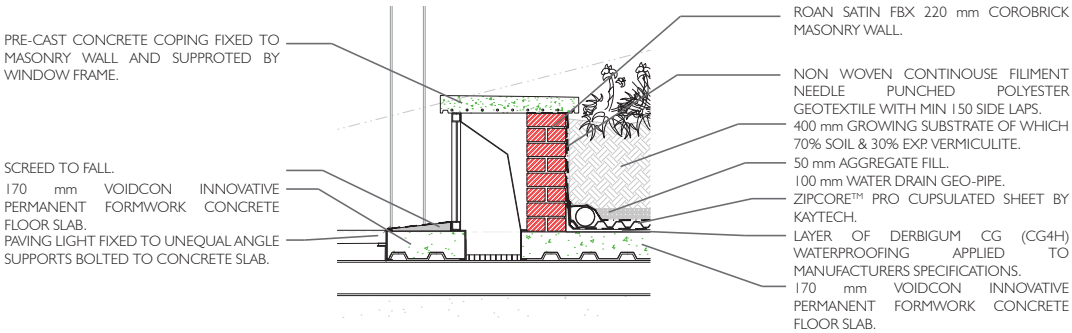

Fig _239 (Above): Detail 4 - NTS (Author 2017).

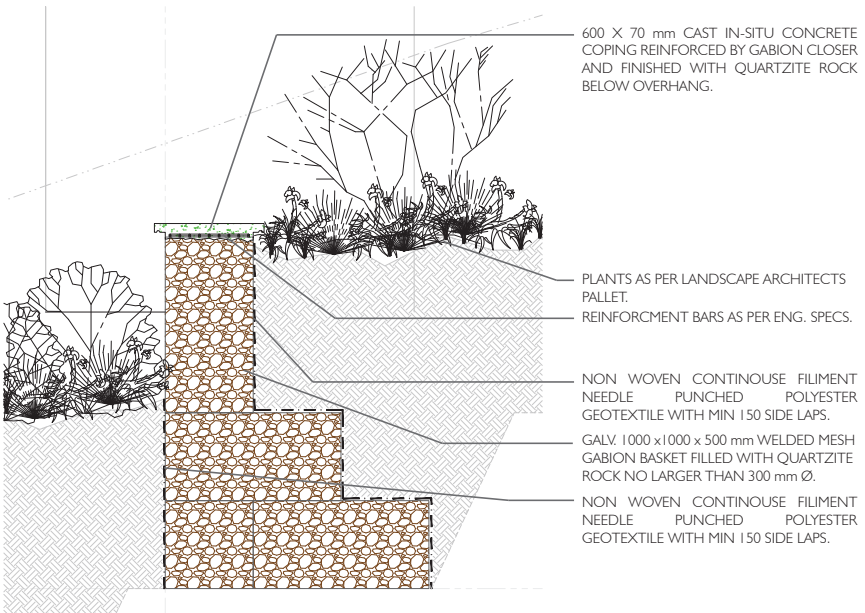

Fig _240 (Above): Detail 5 - NTS (Author 2017).

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Common Name: Bracken
Scientific Name: Pteridium aquilinum
Use: Insect repellent.

Common Name: Mountain Medlar
Scientific Name: Vangueria parvifolium
Use: Edible Berries.

Common Name: Parsley Fern
Scientific Name: Cheilanthes hirta
Use: Roots for lice and fleas.

Fig _241 (Above): Plant Information 1 - 3 (Author 2017).

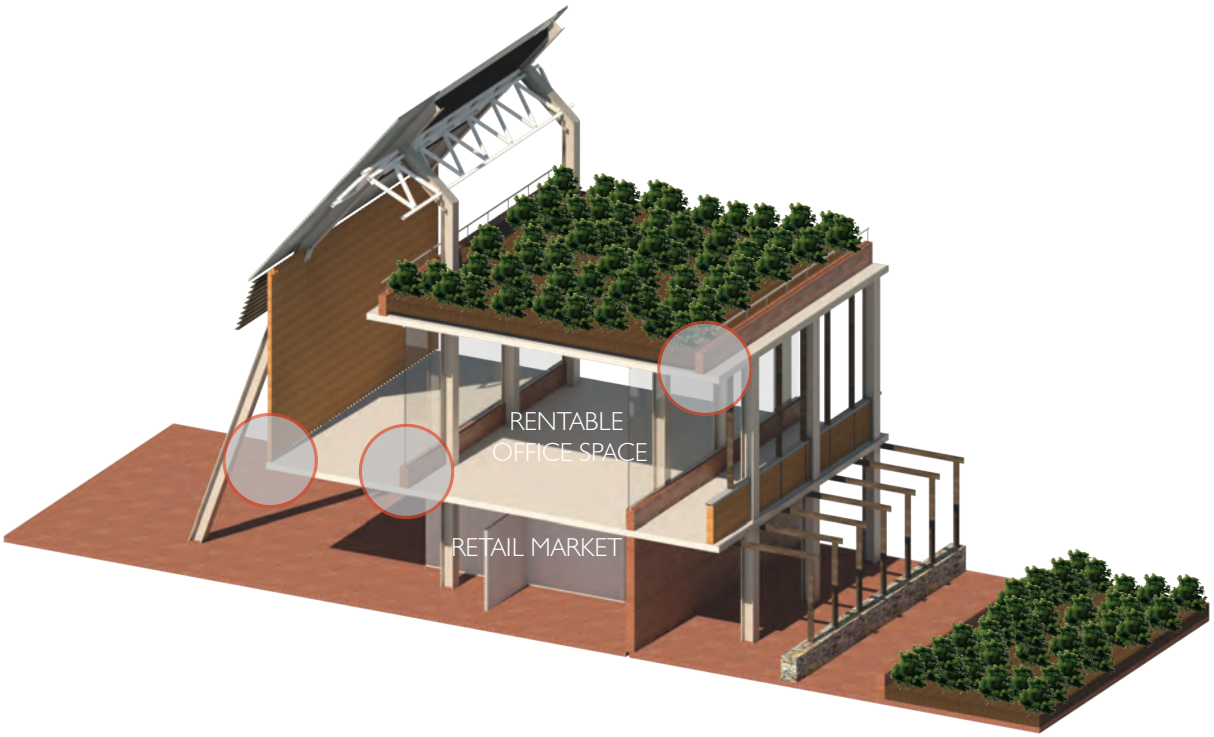

Fig _242 (Above): 3D Section of Rentable Office Space and Retail Market (Author 2017).

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Common Name: Wild Wormwood
Scientific Name: Artemisia afra
Use: Various fevers and influenza.
Relief of toothache, earache and nosebleeds.
Insect repellent.

Common Name: Cats Whiskers
Scientific Name: Ocimum obovatum
Use: Herbal remedies and cooking.

Common Name: Poison Bulb
Scientific Name: Boophone disticha
Use: Remedies for muscular disorders.

Fig _243 (Above): Plant Information 4 - 6 (Author 2017).

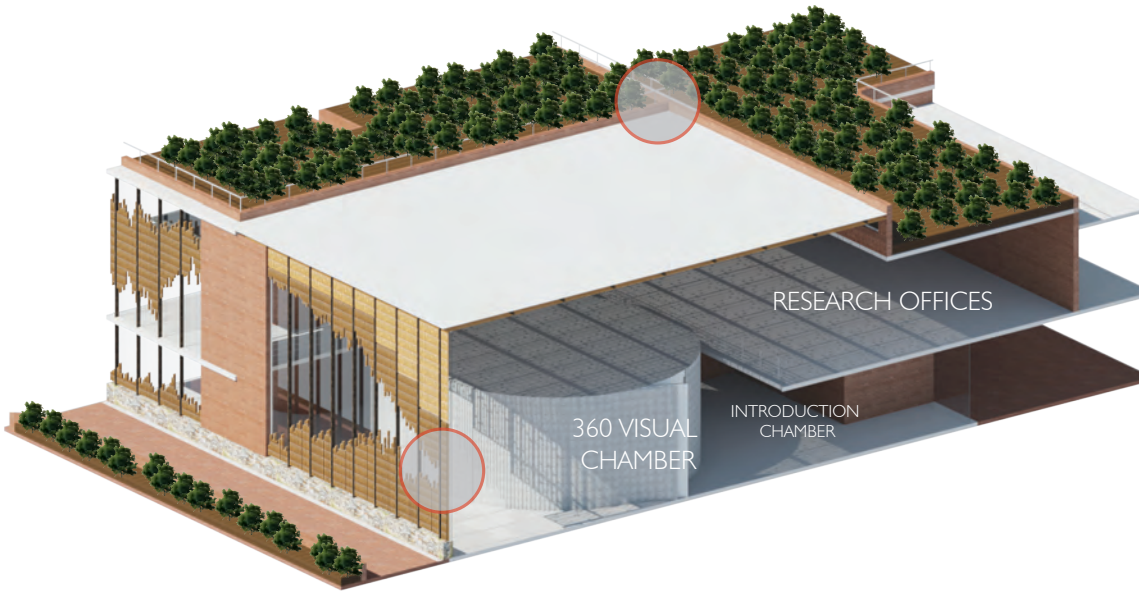

Fig _244 (Above): 3D Section of Research Office Space and Introduction Chamber (Author 2017).

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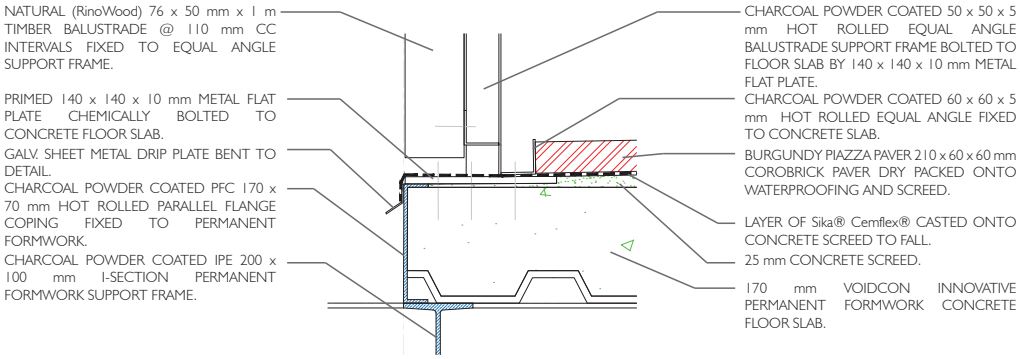

Fig _245 (Above): Detail 6 - NTS (Author 2017).

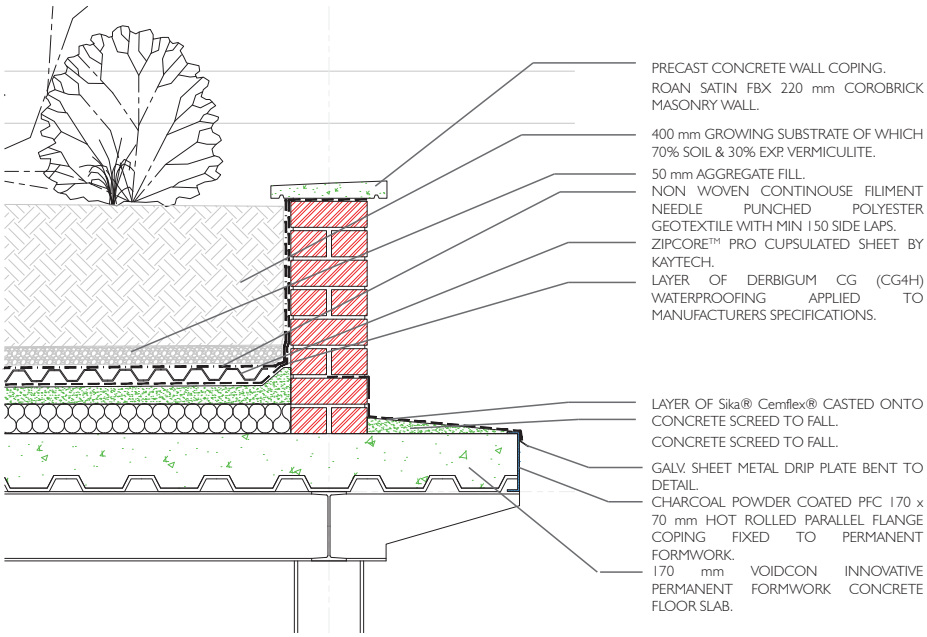

Fig _246 (Above): Detail 7 - NTS (Author 2017).

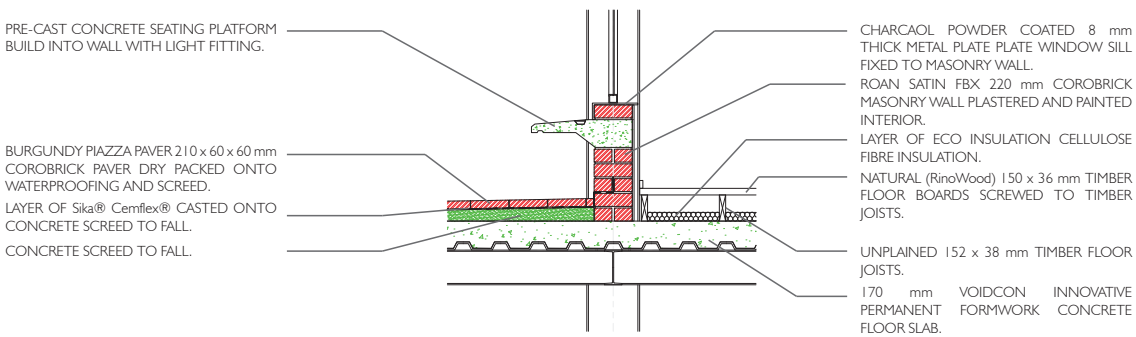

Fig _247 (Above): Detail 8 - NTS (Author 2017).

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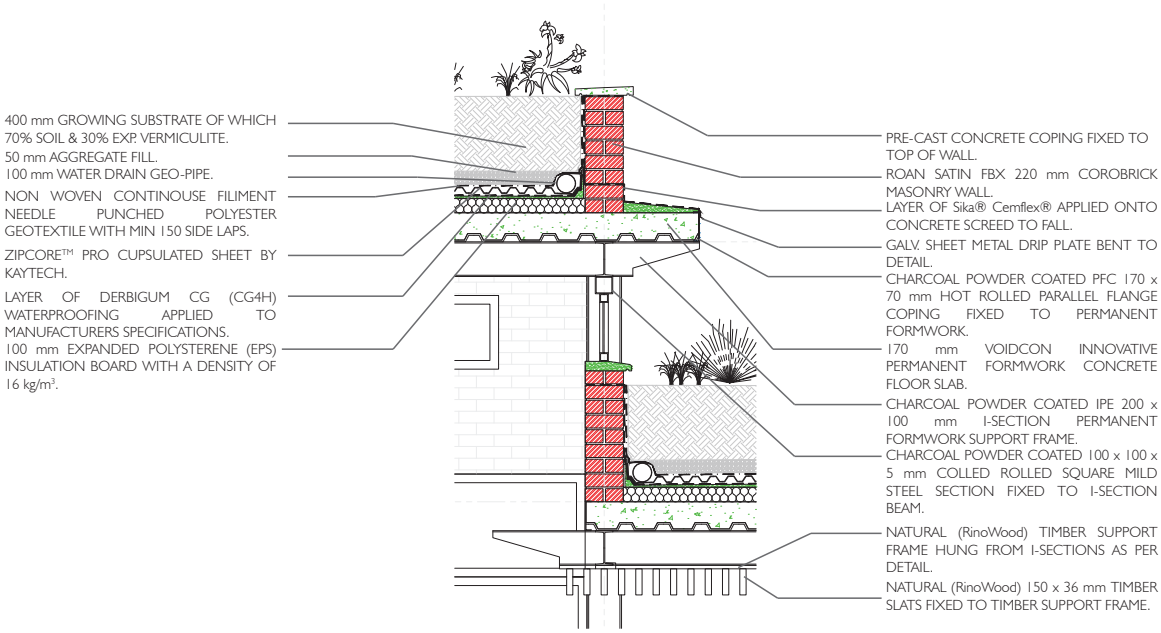

Fig _248 (Above): Detail 9 - NTS (Author 2017).

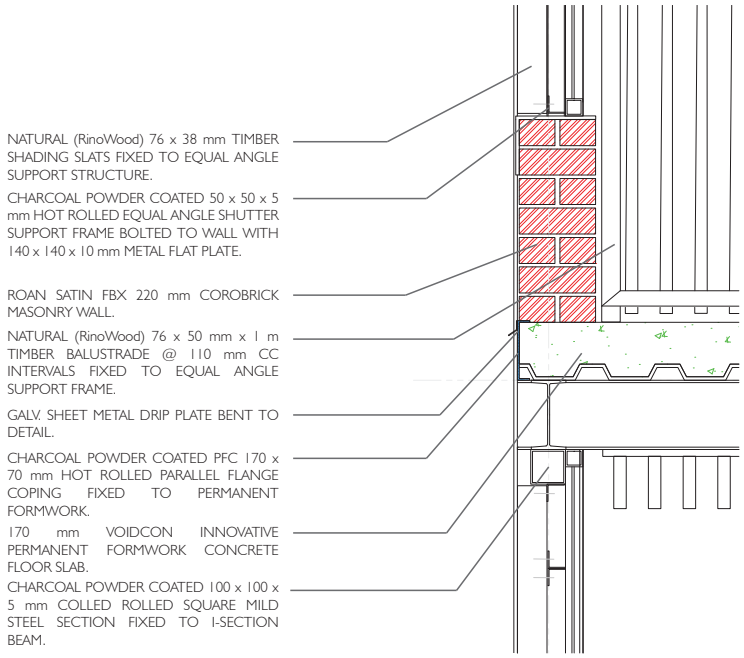

Fig _249 (Above): Detail 10 - NTS (Author 2017).

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07_
CONCLUSIONS

"The longer I live, the more beautiful life becomes. If you foolishly ignore beauty, you will soon find yourself without it. Your life will be impoverished. But if you invest in beauty, it will remain with you all the days of your life."

Frank Lloyd Wright

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The intention of this dissertation is to test if architecture in form, functional and technology can aid in the conservation of nature reserves that are at risk of losing their historical and ecological significance in the urban context of Tshwane. The dissertation set out to analyse, investigate and identify the challenges associated with these natural enclaves and propose an architectural solution to counter the challenges of these less-defined landscapes in terms of the wilderness nature and the loss in significance they are experiencing due too little to no interaction.

The dissertation focused its investigation and architectural intervention on the WNR and tested the argument that resulted in a conservation facility. The conservation facility was developed from the argument that stated that architecture can be utilized in the in-between of nature and urban to act as conservator for nature reserves.

The dissertation identified architecture on the three elements of form, function and technology and developed these elements individually by means of architectural theories or structured approaches. Two of the three elements were assigned theoretical approaches based on the nature of the challenge they were intended to address. Form, in terms of the historical significance conservation considered Herman Herzberger's theory on hospitable form and function in terms of the ecological conservation considering the economics of ecosystems and biodiversity approach. The third, technology, was considered to complete the architecture in making the building functional to achieve its objective in acting as conservator. These three elements combined formed a synergy of architecture that not only produced a space of productive use but also aids the nature reserve in defining the landscape and protecting the significance of site's ecology and history.

The argument in terms of structure was implemented successfully and an architectural intervention was developed to act as conservator. In structuring the architecture under the elements of form, function and technology the dissertation succeeded in its objective to create an architecture that can define and make the WNR more relevant for the surrounding urban environment.

In terms of the general research questions that asked if architecture can redefine the edge, how does the architecture do this and if it is possible for architecture to aid in significance conservation, it can be concluded that architecture can achieve these and the design proves this as a case study. The research question regarding the destruction or deterioration of the nature reserve is subjective and each reader will conclude with their own opinion. The objectives as stated in chapter 1 have been met. An architecture was structured in the in-between, the importance of place significance was achieved by the resolution and a contribution in terms of possibly how architecture can handle the relationship between urban and nature was made.

Further research in terms of the dissertation's investigation can be considered on how Herman Hertzberger's theory can be applied. The approach on how the dissertation was structured can be utilized, altered and applied on other contextual challenges within the South African landscape to see if architecture will be possible to assist in more complex contextual problems.

According to the results and resolution of the design, the investigation to test if architecture can aid in contextual conservation was successful. An in-depth analysis and contextual understanding architecture in terms of form, function and technology will be able to aid in the conservation of nature reserves.

Fig _251 (Left): Nunzio Paci painting 2 (Designwrld, 2015).

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APPENDIX A - CONTRIBUTION ARTICLE

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Armand Visagie

A Architecture as Contextual Conservator.

- Wonderboom Nature Reserve, Pretoria.

Nature reserves in the City of Tshwane is under threat from ecological and historical significance decay due to the less defined nature of these landscapes. Architecture can be developed in the in-between of nature and urban to act as conservator for these nature reserves. Utilizing the natural resources of nature to produce products for the urban dweller within a space that continues the historical protective layers of the site. The space of interaction between nature and urban becomes the conservator, acting as active protector in terms of sustainable production, education and urban dweller interaction with the nature reserve and its continues history of protection.

Fig. 00. Above; Nunzio Paci painting (Designwrld, 2015).

WONDERBOOM NATURE RESERVE as natural enclave in the north of the City of Tshwane hold multiple objects in need of some or other form of conservation. Historically the site was home to stone and iron age settlers, soldiers in one of the four built Anglo Boer war forts and many visitors to the age old Wonderboom tree (City of Tshwane 2015). Currently the site serves as one of Pretoria's multiple nature reserves, areas protected against urban development, the destruction of protected fauna and flora and as recreational facility for the urban dweller that seeks the natural environment escape.

The introduction of nature conservation in South Africa, that only started late in the1900's (Blom 2011:2) sparked nature reserve conservation research and funding from municipalities for this research by environmental organizations. This happened through admission fee control and municipal budget allocations as a result of extensive research done by the environmental organizations on nature reserves. In the current City of Tshwane municipalities deteriorating economic circumstances and recent economic downgrade due to high debt and low growth (Moody's Investors Sector 2017:1) the allocations have decreased and are only sufficient for routine maintenance. Conservation of these reserves are at risk of disappearing and the historical and ecological significance with it. The lack of economic allocations for these areas to fund environmental research organizations in conservation strategies have caused these natural environments into enclaves that are neglected in terms of their environmental and historical significance to the surrounding city. Overgrown with invasive species, threatening the ecosystems and concealing the historical artifacts from public visitation. Wonderboom Nature Reserve as part of the collective of nature reserves in the City of Tshwane is in need of ecological and historical conservation.

Conservation and architecture are not a new collaboration as architectural heritage conservation is an everyday matter of the architectural discipline. Thus, the historical

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conservation of artifacts can be addressed through architectural intervention by use of conservation strategies in architecture. Ecological conservation on the other hand, and the idea that built form, space and technologies can contribute to the generation of capital for ecological conservation might be considered as a new collaboration. The conceptual combination of ecology and architecture are of new and have only been considered by few architects such as Ken Yeang as described in Eco Architecture the work of Ken Yeang by Sara Hart (2011).
This article will explore the possibility of a positive contribution that Architecture can make towards the conservation of these urban natural protected areas in terms of their ecology and historical artifacts, focusing on the Wonderboom Nature Reserve and surrounds (see Fig 1).

An approach to contextual conservation.
Urban protected areas are contextually situated in high density built up urban areas. They are natural areas that offer a break away in the form of an experience within nature, attract large numbers of people who live near them and are built on urban constituencies for nature conservation according to the International Union for Conservation of Nature (IUCN) (Trzyna2014: xi). The IUCN goes further to state that they are distinctive due to the number of ethnically and economically diverse people that they attract, their multi-influential governing structures and are subjected to urban scenarios that more remote protected areas never encounter (Trzyna 2014: xi).
These areas with significant natural' features; have scientific-, cultural-, historical- and archeological interests in need of long term protection for the maintenance of its biodiversity and in the context of South Africa's urban environment are classified as nature reserves (South Africa 2003, s 23). Conservation in the broader sense of understanding consists of the active protection and management of physical objects curated by man. Dictionary.com (2017) defines conservation as the "official supervision of rivers, forests, and other natural resources in order to preserve and protect them through prudent management." Context on the other hand refers to the circumstances that form the environment for the object in which it can be fully understood and related too. It refers to and explains the natural setting where the physical object finds itself. The notion of contextual conservation combines the physical context, its resources, setting

Fig. 01. Below; Research Focus Area (Author, 2017).

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Fig. 02. Left; Nunzio Paci representation of man and the connection to nature (Designwrld, 2015).

and influences as the natural, with the action of conservation in terms of management and preservation as the man-made influence. These two approaches conceptually meet within the in-between of nature and urban to contextually conserve the natural urban protected area, building on the relationship between man and nature and the partnership that exists between these two approaches within the discipline of art and architecture.

Throughout his existence man has always been in partnership with nature. This partnership is represented in many forms of art, historically and contemporary. Nunzio Paci[2] personally represents this relationship best with his work on the connectedness that exists between man and nature (Designworld 2015) (Fig 2). He approaches his artwork with the notion that nature is so connected with man, that it forms the physical human (Paci 2017). The notion of contextual conservation that is conceptualized as a relationship between nature and man, builds on the Paci's idea of connectedness between man and nature to form architecture.

Within the field of architecture, designers and builders have for many years looked to nature for inspiration. The first depictions of nature as inspiration for art and architecture can be seen in Marc-Antoine Laugier's illustration of 'Essai sur l'Architecture'. Laugier explained: "such is the course of simple nature: by imitating the natural process, art was born" (cited in Hvattum, 2004:31). This imitation that is captured to form art, illustrates the first connection between man and nature. Many designers and architectural theorists throughout history have built on this notion of relationship between man and nature and how architecture as the built form, fits and forms part of the idea.

More recently, two contemporary architectural theorists have published work on this notion. Norman Crowe and William Cronon are two architectural theoretical thinkers in this regard although viewing the relationship from two different approaches.

Norman Crowe (1995) argues that the built environment is a form of nature and explains the "idea of the man-made" founded its routes in a historical relationship between man and nature. He states that nature is present in all man-made elements and even though we approach the built form from different angles, nature still presents itself (Crowe 1995:3-27). He continues to state that the relationship between man and nature is historically bonded by the harmony that exists between them and that architecture should continue to build on and not disturb this harmony.

William Cronon (1995) in Uncommon Ground: Rethinking the Human Place in Nature reassesses the environmentalist's agenda. He states in his writings that the idea to protect "pristine nature" is flawed. He argues that humans need not be removed from nature to protect it, as we are a part of it and the removal of humans won't keep nature intact. He continues to argue that humans have not yet learned to live responsibly in nature and that this is where the problem lies. "How can we take the positive values we associate with wilderness and bring them closer to home?" (Cronon 1995: 69-90)

Both these theorists regard the relationship between man and nature as a continuous process and that without the interaction none can survive. Building on these theoretical approaches, the notion of contextual conservation holds its roots in the intervention of man in nature to ultimately conserve.

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Contextual conservation focuses on the relationship between the two forces of man and nature and how they can aid, in harmony, each other to form an architecture that defines space for management and preservation. Urban protected areas as the focal point between nature and man within urban environments are the ideal location to implement and test this notion as they are confronted with problematic influences that other more rural natural protected areas are not confronted with.

The less-defined landscapes of the City of Tshwane

The City of Tshwane in the northern part of the Gauteng province contains multiple landscapes of different sorts. The city's array of landscapes includes parks – formal and other, gardens - legislature and botanical and reserves. City parks, such as Burgers Park and Springbok Park are considered as formal, generally designed landscapes that represent a certain period in the city's history and are commissioned by the city council. Parks such as Zita Park and Jan Cilliers Park are considered as other (not formal) that are more suburban of nature and are used by suburban residential inhabitants. These parks are also maintained by City Parks services but are not necessarily designed or commissioned, rather a result of suburban town planning.

Public gardens on the other hand, relate to a larger group of people and are mostly commissioned by national or provincial structures. Within the City of Tshwane, the Union Buildings Gardens are legislative of nature and a result of state office and the landscape associated with it. The city's botanical gardens hold interest for research and specific plant life of the areas. These gardens are more informal in relation to legislative gardens but holds more weight in terms of plant life and the study of plant species for the specific climate and in protected plant enclaves. The distinct nature and use of these landscapes define their functional nature. Nature reserves, also part of the diverse landscapes of the City of Tshwane, do not fall into one of the above categories. They are distinctive due to their variation of functions and scales. They also hold historical and ecological significance that are different to the above-mentioned landscapes and typically contain more natural growth and wilderness landscapes. Due to their wilderness[3] condition, they are less defined than parks or gardens. Their less defined nature poses a threat as they are considered to be left to fend for themselves. This consideration is optimal in natural areas outside urban environments but due to the high amount of external influences by urban development on inner city natural landscapes, this option is not viable for urban nature reserves.

According to the UN-Habitat World Cities report 2016, 54% of the global population resides in urban environments (UN-Habitat 2016:6). Cities in Africa showed the largest growth in the researched 10-years of UN-Habitat World Cities report. Cities within the Gauteng region of South Africa grew from the 1-5 million population bracket to the 5-10 million population bracket with the percentage residing in urban areas jumping from 40-60% to 60-80% (UN-Habitat 2016:8), proving that urban development influences on nature reserves are escalating. In recent years the City of Tshwane have made strides to keep the negative urban influences on natural areas at bay by installing fences around nature reserves and natural areas. The actions of the municipality, although little are appreciated but the intervention of fences holds more disadvantages than advantages for nature.

These fences cause a lack of interaction between different natural realms that normally adapt to the urban condition to keep the present ecosystems in balance. The fence also prevents nature from gaining the needed resources, such as migrating predators and the advantages they bring from other natural enclaves. Due to this disconnectedness, the threat of self-decay becomes evident in nature reserves and they are burdened with destroyed ecosystem balances and an overload of invasive plant species. This imbalance in natural ecosystems, forces nature into self-conservation without the needed resources from other natural environment or aid from environmental organization management to rehabilitate. The effects are clear, as nature reserves no longer hold preserved vegetations. Dr. Dian Spear states that the biggest threat to nature is the way we live our lives and that nature which has human interaction is limited to

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appropriate adaptation without human intervention. (Spear 2017). With the lack of intervention by environmental organizations to aid the ecosystems to adapt to urban influences, these natural enclaves are at risk of losing their indigenous vegetation they are known for and becoming self-destroyed lost landscapes.
Mr Ernst Wohlitz (2017), director of nature conservation at the City of Tshwane explains that nature reserves, according to the city's legislation, is supposed to have a buffer zone that prevents urban development to impact these areas, but with further investigation it was found that these do not exist or that the city considers any infrastructure, that is technically urban development to be a buffer zone. Nature reserves furthermore hold historical cultural artifacts that are sometimes protected by relevant structures within the city's or countries legislation. Where these artifacts are used for tourism and/or recreational functions to fund management and upkeep, the natural environment have proven to be in a better state. Unfortunately, due to the number of historically significant sites within the city, not all are protected by city organizations in this manner. Historically significant sites, such as Fort Klapperkop and Fort Schanskop have proven to be more interactive with the urban environment and the interaction have caused a better relationship between the two. Fort Wonderboom, within the WNR, has not seen this interactive spirit and the decay in relation to the other two mentioned can be seen within the reserve.
This decay within WNR presents the opportunity to define this landscape by the resources on site and make this reserve also protected within current management structures, putting conservation into the hands of the reserve and not relying on municipal management to keep the reserve ecological and historical significance intact.

The context – Introduction to the Wonderboom Nature Reserve
The Wonderboom Nature Reserve (WNR) is situated to the north of Pretoria CBD and forms part of the Magaliesberg mountain range. The reserve occupies roughly 200ha of ridge and has many cultural ties with the history of the City (City of Tshwane 2015). The WNR is most recognized for its Wonderboom tree and the recreational spaces provided for urban dwellers of the Pretoria North residential areas. The WNR is mostly occupied over weekends for a traditional South African family braai or gathering. It is also home to one of the four Anglo-Boer war forts, the forgotten stone age shelter cave, protected eco-systems, a part of the Apies river and relicts of iron age shelters.
The Magaliesberg mountain range, considered to be among the oldest mountain formations known to man (Magaliesberg 2008), plays a significant role in the historical uses of the site. The mountain stretches approximately 120km from the Bronkhorstspruit Dam in the East to Rustenburg in the West. The mountain acts as destination for enthusiastic mountain climbers and a large part of the mountain forms the backdrop of the Pretoria city centre. The WNR, as part of the mountain, is demarcated in the centre of the mountain range. Cut off by a Kloof formed by the Apies River in the west and a vehicular road to the east, the site is entered from the North, adjacent to a recently completed retail center. The Kloof to the west not only carries the Apies river in its basin but also a high traffic road and a passenger railway. Both infrastructural additions were based on historical routes running through the Kloof to the North of the city. At the cliffs of the Kloof, the forgotten stone age cave is hidden behind a man made, non-operational waterfall commemorating the 50th anniversary of South Africa becoming a union in 1910. It is speculated that the cave was once home to settlers of the stone age (Blom 2012:20-22). According to archaeological records, artifacts dated to 2 million years ago were found at the Wonderboom early stone age site (Van Vollenhoven 2008:13). This research site covers approximately 650 m² around the Wonderboom area (Blom 2012:20-22). According to Anton van Vollenhoven (2008:13) the natural context of the reserve would have been an ideal hunting and settling area for the early Stone Age civilizations. Tools found by prof. Revil Mason in 1955 proved this as he stated that the kind of tools discovered had many similarities to tools made at Sterkfontein about 1 million years before. Speculating that this part of the mountain was also used for manufacturing of stone age utensils (Carruthers 2000:214-216).

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On the southern slope of the mountain lies another ancient archaeological finding. This is estimated to be have been built in the 1600's, and are Middle to Late Iron Age rock formations. Several of these line the top part of the Reserve. Carruthers explains that these formations and artifacts found in the area were from a cultural civilization that Van der Ryst & Meyer (1999: 96-98) explains as Late Iron Age, between 1000 and 1800 AD. Unlike the settlers from early Iron Age cultures, Middle to Late Iron Age settlers tended to settle on the top part of mountains. Carruthers explains this change in settling to a higher need for militaristic protection and better security (Carruthers 2000:224). Even though the stone formations could also have been from later Tshwane tribe cattle herds, the Late Iron Age artifacts found in the area make the possibility viable.
The WNR also hosts one of the only four built Anglo-Boer war forts. The forts were commissioned and constructed during the second Anglo-Boer war by the Government of the ZAR as a direct response to the Jameson Raid and the documentation found on a British spy, Captain Robert White, during this time (Van Vollenhoven, 1998: 51). Even though the forts were never tested in battle the history of fortification of the capital as a response to possible threats forms a significant role in the militaristic history of South Africa.
The rich history of shelter and protection present at the WNR makes this site significant in the relationship it has with the urban environment that surrounds it. The theme of nature as context and history as man in relationship with one another is evident on the site. Contradicting this relationship in the historical timeline is the lack of interaction between these two forces today. The reserve, rich in history and significance is deteriorating due to no continuous interaction.

The problem stated

The WNR is under threat from ecological and historical significance decay. Interaction between nature and urban has deteriorated and the nature reserve is under threat from losing the significance gained over several years and being overrun by urban expansion. The problem of ecological and historical conservation in the context of the WNR presents the following issues:
On the urban scale:

- How can architecture facilitate more urban interaction with nature reserves and how does one approach the surrounding areas that are completely cut off by legislation and physical fences?
- What strategy can architects/urban designers follow to address these enclaves within an urban environment?
- How does the specific South African urban environment relate to these sites and what interaction is truly needed?

The architectural scale begs the issue on the way in which architecture preserves historical significance of site whilst not destroying the ecological significance:

- How does architecture facilitate a function that can prevent ecological decay and at the same time preserve the meaning of site?
- Will intervention of any contextual conservation be the answer to the protection of the site?

Furthermore, the specific issues of nature reserve, ecological decay and eco-system depletion comes to the fore:

- How can architecture address these issues?
- Can architecture structure a means of creating an awareness of nature reserves?

Fig. 03. Below; General Issue Diagram - Problem Statement (Author, 2017).

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The Wonderboom Nature Reserve as site and resource

The WNR, as part of the less-defined landscapes of the City of Tshwane, holds many hidden resources that the everyday urban dweller does not interact with. This lack of interaction sparked interest and further investigation indicates an architectural intervention as a possible solution. An investigation into the reserve and the surrounding areas was conducted as starting point and to establish and document the problematic spatial influences that caused the site to present little interaction. From the analysis, an urban strategy was proposed to counter the interactive lack and present opportunities for architectural intervention. These interventions will be developed, tested and concluded as projects into a document to showcase viable solutions to the less-defined challenges of nature reserves.

An analysis of the site.

Investigation into the site and research focus area was conducted between January and March 2017. The process consisted of two students evaluating the site and conditions first hand from a series of visits. Visual and analytical site documentations were gathered and discussed in terms of spatial and problematic influences to present possible architectural solutions. The discussions highlighted the following problematic considerations:

- Firstly, the site was completely isolated. Three main roads to the North, East and West cut off all free flow pedestrian access to the site. A smaller residential boundary on the southern edge made pedestrian access viable but the reserve's fence prevented pedestrian penetration. Only one entrance of the three visible entrances was accessible on the Northern edge. This entrance was mainly for vehicular traffic and even the manned staff admission fee kiosk was built to the height of a vehicle window. The service entrance on the eastern fence was not accessible due to heavy traffic and placement of the entrance on the top of the hill. The third entrance in the quiet residential area on the southern edge was completely overgrown and rarely if ever used. No traces of a pedestrian entrance for the people on foot was found.
- The recreational activity spots were concentrated to one corner on the north-eastern edge of the site, with staff housing around the focus area of the Wonderboom tree. Signage of the history of the site was present around the tree and a good explanation of the site was obtained. A small hidden path thought thick growth at the base of the hill, just behind the info signage, made a hike possible to the old fort and the cave. Little signage was visible along the route and no focus points for the multiple view points over the city and northern suburbs were present.
- Invasive plant species were visible along the route and tree suffocation by invasive species were present. Some parts along the route had paved rock paths alongside sheer cliffs that opened the tree canopy for city views. The southern ridges' plant growth was completely different from the north and traces of invasive plants were found here too. At the base of the southern edge, next to a water stream, a herd of Impala had made their home. This was not surprising as no designated pedestrian paths went down the mountain on the southern side.
- The fort is in ruin and vandals have taken the opportunity to scratch their names next to the names of soldiers of the Anglo-Boer war into the rock to remember the occasion of their hikes. The site is deserted and feels like a destroyed urban playground in the middle of nowhere. The history of place wants to shout out it existence, but the desertedness keeps it at bay. Just west of the fort a few informal dwellers have occupied the old cellphone tower shelter and made it their temporary home. The cellphone tower is no longer in use but the beacon on top of the hill still exists. Just to the north of the fort and cellphone tower, in the dense overgrown hill cover, the historical rock formations present themselves, forgotten and disguised in the greenery of the hill. A further hike down the Northern hill presented the lonely path to the dysfunctional waterfall. At the edge of the fall, access to the cave is now prevented by a palisade fence.
- Around the main entrance on Lavender Street, another problem became evident as no form of drinking water provision was present. After a hike, a single tap in the middle of the grass field was considered as the only form of rehydration. The sense of isolation on the site became more evident and a good understanding of lack of interaction was gathered. It became evident that this lack of interaction was the main problem that the site faced. After some discussion of the experience by the author, it was concluded that, on an urban scale, the site needed an approach that related to the main objective of interaction. Within the main objective of urban interaction, an urban strategic vision was formulated that considers access, edge, connections and facilities as the main categories to address.

Urban strategic vision

The urban strategic vision is developed from an understanding and deliberation of the analytical investigations done. The vision addresses the less-defined landscape challenges and sets out a hypothesis that can be implemented and tested by means of a general strategic vision approach. The urban strategic vision hypothesis states that architecture is proposed

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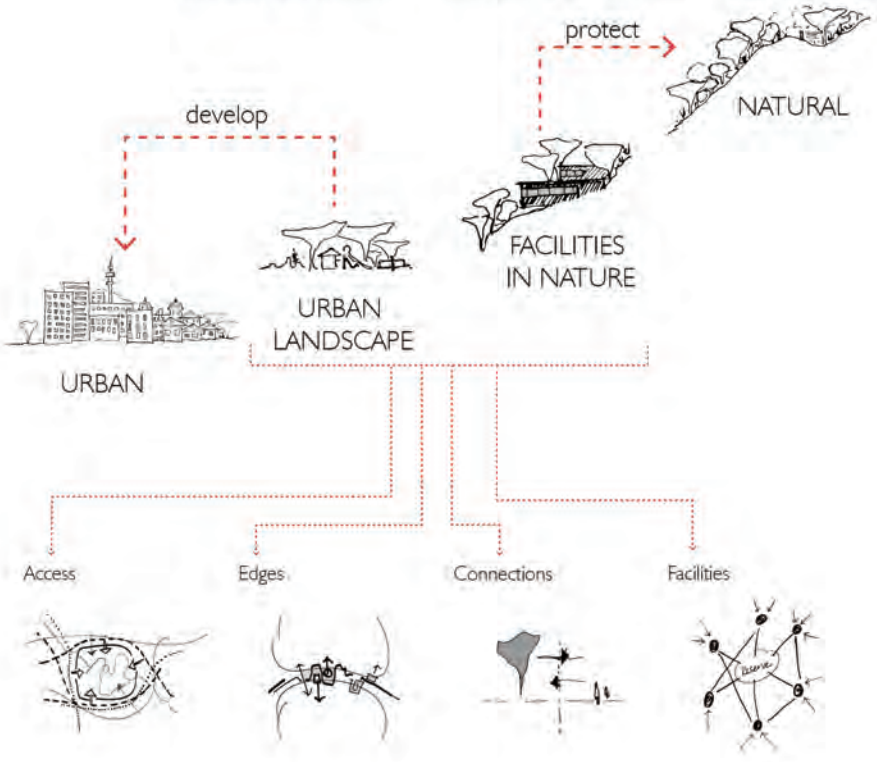
as a frame of reference in the landscape to create and improve awareness of urban wilderness areas to ultimately conserve and emphasize the uniqueness of these places. The implementation and test strategy for the hypothesis considers a general, simplistic approach of balance of development and protection between urban and wilderness that is prolonged to detail by four sub-categories; Access, Edge, Connections and Facilities (fig 4a).

Access, the first strategy sub-category considers the main approaches to and from the site and how these routes need to be developed for optimal site awareness. Ted Trzyna (2014) co-founder of the IUCN urban specialist group and president of the InterEnvironment Institute at the University in California states that access is a global problematic issue to address when it comes to Urban Protected Areas. He goes further to say that direct public transport needs encouraging and the supply of well-mapped routes that makes provision for bicycles and pedestrians also needs attention. The access sub-category, as focus subject, initiated from problematic questions raised in the analytical investigation discussion. How do architects improve the existing circulation paths and extend existing access routes to draw more feet into the reserve? In the discussions, more feet into the reserve was an efficient architectural approach to address awareness and enhance interaction between nature and urban. The proposed implementation to address the approach of more feet was set out as a principal implementation strategy to achieve smaller focus aims. The following principles regarding access are proposed within the urban strategic vision:

- Focus on alternative modes of transport for example bus, train, cyclists and mainly pedestrians.
- Slow down routes surrounding the site to facilitate interaction with and visibility of activities along route.
- Increase access points - physical access points, but also visual access for awareness.
- Use architecture as way-finding tool to draw attention as beacons for pedestrians/ cyclist in the landscape.

Secondly the urban strategic vision studies the edge conditions. What would the best edge condition for the site be and what must be done to achieve these edge conditions? The analytical investigation discussion suggested that the edges of the nature reserve needed to be addressed as they have become physical barriers keeping interaction to the

Fig. 04a. Below; Urban Strategic Vision Approach (Author, 2017).



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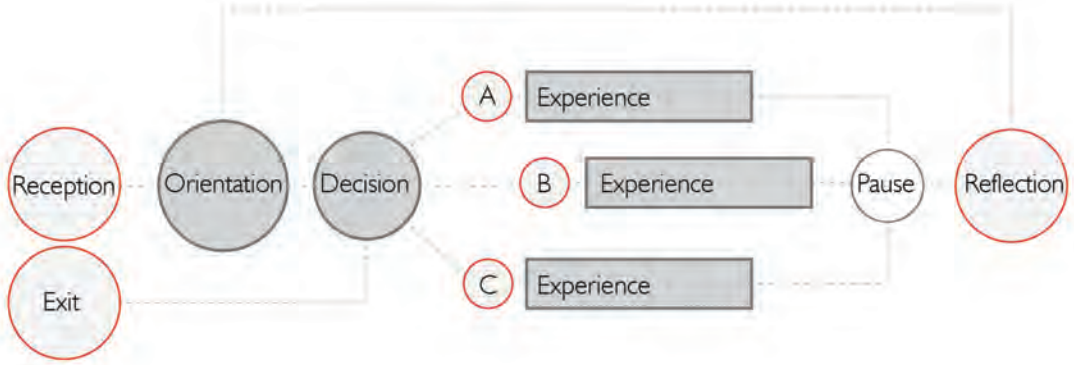
site to a single point. The edges of the reserve were also considered as a favorable area to intervene between nature and urban as it is situated directly between the two environments. The urban strategic vison sets out the following principles to be implemented to achieve the goals set out:
- OVERALL: Improve visual access and awareness of the site.
- Define boundaries/buffer zones and celebrate entrances on high traffic routes.
- 'Lend' natural environments to residential/quiet areas by recessing boundaries into the reserve and facilitating visual access to nature.
- Programs on the site's edges should serve both natural area and urban area and consist of diversified programs.

Thirdly the strategy considers the connections between nature and urban. This subject as sub-category was developed as a result of the edge conditions approach and focuses on the extended relationship between nature and urban. It questions how the urban strategic vision can improve these connections to define the landscape and create points of interaction between nature and urban. "Our connection with the environment is our first level of experience, and one of the most important (Shankar 2011)." The urban strategic vision approaches connections with the following principles:
- Bring people to nature and nature to people.
- Rehabilitate urban green areas as recreational facilities that increase the value of surrounding neighborhoods.
- Create a network of green spaces that facilitate movement.
- Create new roads to increase passive surveillance of these green areas.
- Adapt building / site interfaces towards the natural areas to increasing passive surveillance.

Lastly the urban strategic vision sets out possible facility considerations to guide future interventions in their program. These facility considerations are to ultimately complete the strategic vision and prove the hypothesis in its objective to become a frame of reference and protect the landscape. The sub-category facilities, become the bridge between the urban strategic vision and the future possibilities for intervention on the site. It considers questions relating to where and what functional form architecture can start to have to achieve the objective frame of reference in the landscape. Although this sub-category does not physically

Fig. 04b. Below; Ideal Space Flow Diagram (Author, 2017).



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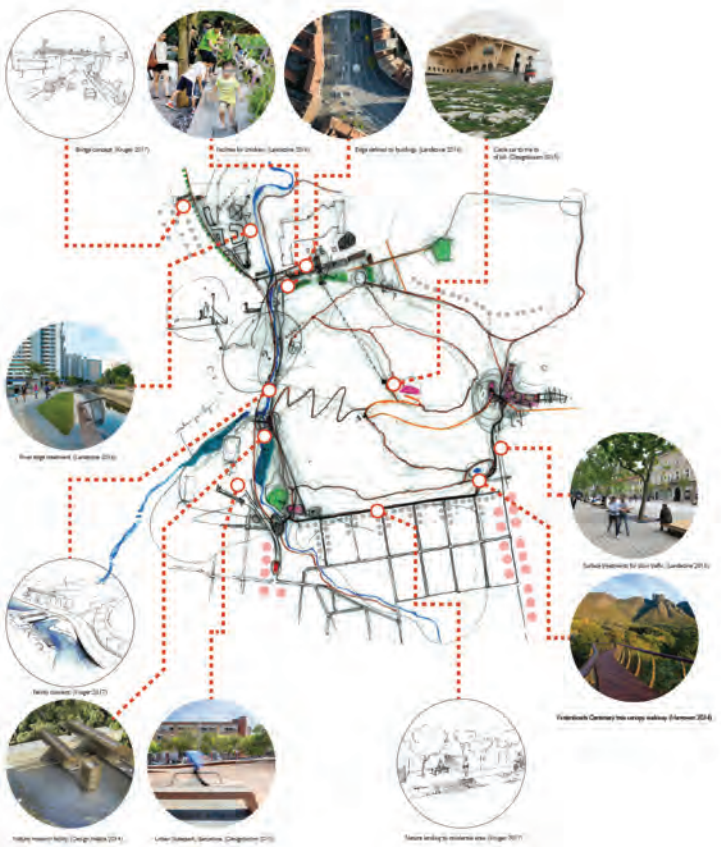

Fig. 05. Right; Conceptual Urban Strategic Vision Implementation (Author, 2017).

spell out the programs, it generally states the starting point that programs need to address. The following principles are proposed under the facilities sub-category:

- Introduce innovative programs that make the site a daily destination [work] as well as weekend destination [recreational] and provide for a variety of users.
- Promote urban natural spaces for what they are worth – easily accessible, important recreational natural space for urban inhabitants (including lower class)
- Facilities and programs should be mixed-use, attracting a variety of stakeholders and users to the site.

The principles as set out under the four sub-categories are practical implementation considerations. With further debate on the urban strategic vision it was found that the vision needs to address an additional side to the practical/physical. The sub-conscious or emotional understanding of space was proposed as additional consideration which was based on the idea of an ideal space flow, a unique way in which to address an urban vision regarding the sub-conscious and the understanding of the human decision-making process.

A second layer was developed and added to the urban strategic vision. This layer can be described as the ideal space flow diagram (fig 4b). The concept of ideal space flow is formed from the idea that architecture can be developed from understanding the experience gained through space. "Architecture has meaning, and matters to us only when it is experienced, when all other senses are simultaneously engaged in its inhibition, and when it provides the setting in which the acts and rituals of daily life take place (McCarter & Pallasmaa 2012:5)."

The urban strategic vision takes this approach to architecture and develops a model as diagrammatic representation of the ideal experience space flow for the context.

The model is developed as the ideal, how the architect intends the user to utilize the space. Predicting the path, the user will take and the spaces needed along that path. Understanding how the user will enter, make a decision and then experience the space of the function provided. After the user has been subjected to the experience or have experienced the space, the user is paused and placed into a space to reflect on the experience gained. This mentally builds an image in the mind that is remembered for a longer period. The objective of the reflection space is to keep the memory of place for longer periods in the user's mind building a greater interest in place. The user is then placed back into the decision space to choose if he wants to encounter another experience or exit the space. The model for WNR is developed with no specific function in mind but rather on the idea that all programs have an experienceable element. This model aids in the objective of creating more interaction with the site and memory of place. The ideal space flow model as proposed under the urban strategic vision for the WNR area is believed to

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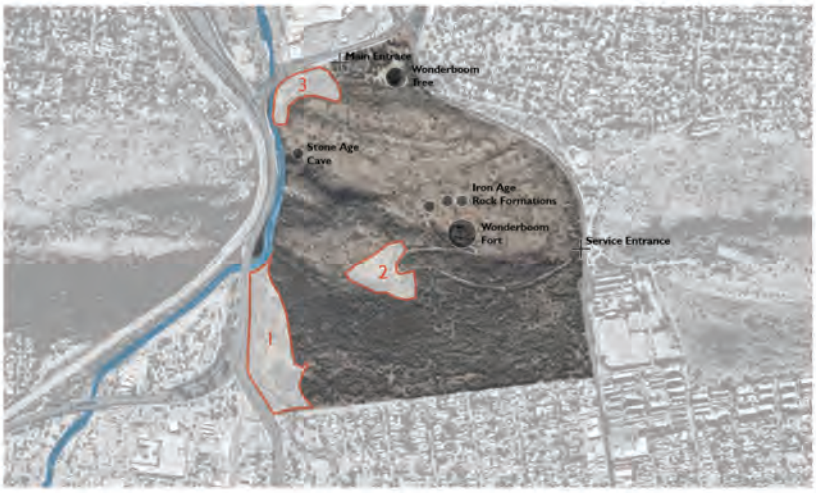

Fig. 06. Above; Proposed intervention sites (Author, 2017).

be the first step in creating an architectural response that considers the notion of ideal space flow under an urban vision.
Considering the practical principles and the second layer of sub-consciousness, a conceptual urban framework (fig 5) was developed to showcase possible precedents and the points at which they can be implemented to achieve the main objective of interaction. The urban strategic vision sets the scene for the investigation of the notion of architecture as contextual conservator.

Proposed interventions
Considering the urban strategic vision and the precedent proposals at the possible points for intervention as displayed in the conceptual urban strategic vision (fig 5), six possible sites were identified as strategic points to intervene with a proposed function to achieve interaction. Three of the six sites presented the opportunity for the investigation of architecture as contextual conservator (see fig 6).
The first possibility was a research institute on the south-western edge with an alternative entrance on the southern edge, from the residential suburb. After site specific analysis of the site, it was not viable due to the current endangered ecosystem treat that was discovered.
The second identified site is situated just below the mountain peak, on the southern slope. This site has spectacular views to the south framing the city skyline. An additional entrance from the service road to the site was proposed with the function of a nature reserve distillery utilizing marula fruit from the north. The site and function were rejected due to the difficulty to develop a distillery that needed a constant interaction with the road network for access and service purposes.
The third identified site is situated at the foot of the mountain on the northern edge next to the existing entrance on Lavender Road. On this site, the vegetation is disturbed by recreational activities that currently happen in this area. The site holds multiple opportunities to interact with the surrounding urban environment and build connections to nature. The site falls 3° to the West making this part of the reserve the most feasible to construct a large program as the area to slope ratio is low. The proposed program for this site was recreation focused and required to relate to the existing Wonderboom tree to the east and the Apies river to the west. From the three identified sites within the six-conceptual urban vision implementation proposals, the third option showed the most potential to test the notion of architecture as conservator.

The Theoretical Approach
The proposed intervention to test architecture as conservator considers two theories and one research study approach as bases to structure an architecture in function and form. These theories are used to structure the detail function[4] and the architectural language[5] of the design. Form and function are two of the three fundamental foundations that all architecture is built on. Technology is the third and will be investigated at a later stage in the project.
Theory towards function, considers the general notion of ecosystem services theory. This idea looks at the existing ecosystem and the resources it provides to the context in which it functions. Theory towards function also considers the initiative study approach done by "the economics of ecosystems and biodiversity (TEEB 2010)" to strengthen the functional consideration.
Theory towards form uses the architectural theorist and architect, Herman Hertzberger,1973 theory of Homework for more hospitable form (Hertzberger 1973), as published in Forum 24:3 (1973) to write an architectural language that relates to the exiting layers on site. These two approaches are then

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combined to form the architecture that contextually conserves.

Theory towards function

Theory towards function focusses on the functional aspects of the proposed intervention project, and the process to formulate a detail program that informs the design and achieve the project objectives. For the proposed project, the main functional objective is to conserve the ecological significance of the site. To address this objective by means of architecture, the first theoretical part considers ecosystem services theory to structure a program that informs the use of space.

The notion of Ecosystem Services is not new as traces of this idea can be found from the late 19th century in policy adjustments done by the American government (Thompson 2011: 2). The focus on the socio-economic benefits only took off with the gaining interest that was sparked in 2000 with the Millennial Ecosystem Assessment call by the then sectary general of the UN, Kofi Annan (Millennium Ecosystem Assessment 2005: ii). The Millennium Ecosystem Assessment (MEA) was initiated in 2001 with the objective to "assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contributions to human well-being (MEA 2005: ii)".

The findings in the first part indicate that humans have altered ecosystems in the last 50 years more than any other comparable period and this was due to the rapid growth of demand in for food, fresh water, timber, fibre and fuel (MEA 2005:2). The report stated further that action needed to be taken to counter the effects of rapid resource demand on ecosystems being it in policy change or active adaptive management. Part of the study tested possible scenarios to show the estimated effect that certain influences would have on ecosystems and their provisioning of services by the year 2050. The scenarios were used to address certain report related questions, of which one was "What options exist to manage ecosystems sustainably? (MA 2005:92)" The question was answered by proposing interventions and investments in "environmentally sound technology, active adaptive management, [and] proactive actions to address environmental problems before their full consequences are experienced... (MEA 2005:92)"

The project's functional consideration builds on the found disruption in ecosystems services and the proposed interventions made by the MEA to address these disruptions for sustainable ecosystem development. The functional shaping starts off by identifying elements in the WNR and the Magaliesberg mountain context's ecosystem that can become urban resource needs, that in future might influence ecosystem depletion. The resources are divided into the four categories of ecosystem services to identify possible intervention points and contributions that ecosystem services can make towards human wellbeing on a socioeconomic level (fig 7). The focus falls on the ecosystem provisioning services category as the natural environment holds the most potential in terms of architectural intervention and the relationship with the urban.

This identified category's resources are sustainably harvested and placed into an alternative, manmade adaptive and continuously managed ecosystem to produce products that reduces the depletion of ecosystem services and start to achieve the objectives as set out by the project.

The functional formulation goes further, by expanding the theoretical input by means of the consideration of an approach implementation as explained in a study called The economics of ecosystems and biodiversity (TEEB 2010). The Economics of Ecosystems and Biodiversity (TEEB)

Fig. 07. Above; Relationship between Ecosystem Services and the constituencies of well-being (MA 2005:2).

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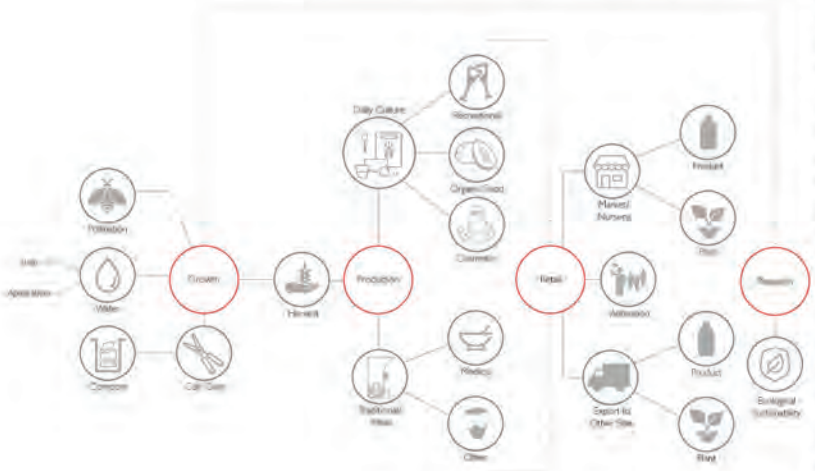
study approach considers the natural environment's ecosystem services as sectors to generate economic value. The study's approach showed that the benefits of ecosystems services as economical funder is just as big as other economic sectors of the same nature. TEEB study considers a three-step process to showcase the capital ecosystem services will be able to generate (TEEB 2010:11-12). This process firstly captures the value of the ecosystem service, demonstrates it in terms of investment potential to ultimately recognize and show the value of ecosystem service. By using these three steps, the project sets out to determine the amount of capital that will be able to be generated by considering WNR ecosystem service as resource. Aiding the functional consideration in terms of demonstrating the gains that this program, in considering ecosystem services, will be able to contribute to the notion of architecture as contextual conservator.
The projects functional consideration will be a facility that sustainably harvests the natural resources of the WNR and the Magaliesberg mountain's ecosystem services to create an alternative, adaptive, continuously managed ecosystem facility to produce products that can be sold for economic gains (see fig 8). These gains can then be utilised by the nature reserve and nature organizations to fund ecological research and management to keep these enclaves in balance.

Theory towards form

Theory towards form sets out to address the formulation of the architectural language for the conservation facility. Its objective is to create an architectural language that retains the historical significance of the site by capturing it in a new form to manifest the historical importance of the site in the visitor's mind. To address this objective, the project considers the architectural theorist, Herman Hertzberger's theory of "Homework for more hospitable form" as published in a special edition of Forum (Amsterdam) in 1973 (Mallgrave & Contandriopoulos 2008:440-442).
Hertzberger argues that modern forms in architecture evokes animosity and a sense of alienation. He reacts to propose the notion of Hospitable Form. With this notion, he calls for forms with a richer capacity to absorb, carry and convey meanings, forms that people can take possession of through mental associations, archetypical forms with respect to human imagination (Mallgrave et al. 2008:440). The notion of Hospitable Form is built on the identification of the museum of images.
The museum of images as stated by Hertzberger is a collection of images that all human minds hold after an encounter with the specific space. They are different from person to person but hold a collective thread. Hertzberger states that if designers relate to the collection of images as addition to the usual considerations they can create spaces that are not unfamiliar and distanced to the user. He further claims that the more distant the images from one another and separated over time, the more in-depth our collection of these images will become. "By referring each one back to its fundamentally unchangeable ingredients, we then try to discover what the images have in common, and find thus the "cross section of the collection", the unchangeable underlying element of all of the examples, which in its plurality can be an evocative form–starting-point (Mallgrave et al. 2008:441)."
The idea of the cross section of the collection of images that relate the user to a place[6] as form starting point comes across as a strong idea to aid the notion of contextual conservation (fig 9).
The project considers this theory in terms of the cross-section of the collection of images of the WNR. It sees the museum of images as the historical artifacts and physical images gained of

Fig. 08. Below; Program Consideration structure for Conservation Facility at WNR (Author, 2017).



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these artifacts on site. These images are then analyzed to form a cross-section of the collection. This cross-section is themed and used as the form stating point to inform the design on a psychological level.
Through the analytical and historical investigation of the WNR's images[7], it was found that the site holds a strong protective cross-section collection. This collection spans over hundreds of years from the stone age to the current canopy of the Wonderboom tree. The protection theme was used as starting point to analyze the images and create an architectural language that portrays a sense of protection. This architectural language informs the design's form and aids in creating a conservation facility. It is proposed that if this theoretical approach is implemented that users that visit the site will be reminded of the history of the site and the connection between nature and urban. It is intended that the architectural form will remind the user of the new protective layer the site is taking into the future, one of conservation and protection of nature rather than more protection of the urban as was the case until now.

Looking elsewhere
After a well-established idea of the informants to develop the architecture, an understanding of possible functional and contextual precedent studies was achieved. The investigation focused on examples, local and international, that relate to the functional and contextual typological requirements and to grasp an idea of possible implementation of the argument onto site. These specific typologies mentioned are only a few of a larger number of projects that were investigated to formulate this general explanation of the functional and contextual typologies as explained. The basis for identifying functional typological precedents related to the similarities in the program's proposed detail. They only consider one or two of the programs that are presented for the project but hold key considerations to inform the development of the argument into architecture.
The first precedent investigated is situated in Cape Town's well-known V&A Waterfront and holds ties to functionality. Watershed, designed by Wolff Architects takes the retail typology into a different direction. Developing a retail market that caters for many smaller retailers in reaction to the V& A Waterfront mall. The architecture

Fig. 09. Above; Conceptual implementation of theory to form for WNR (Author, 2017).

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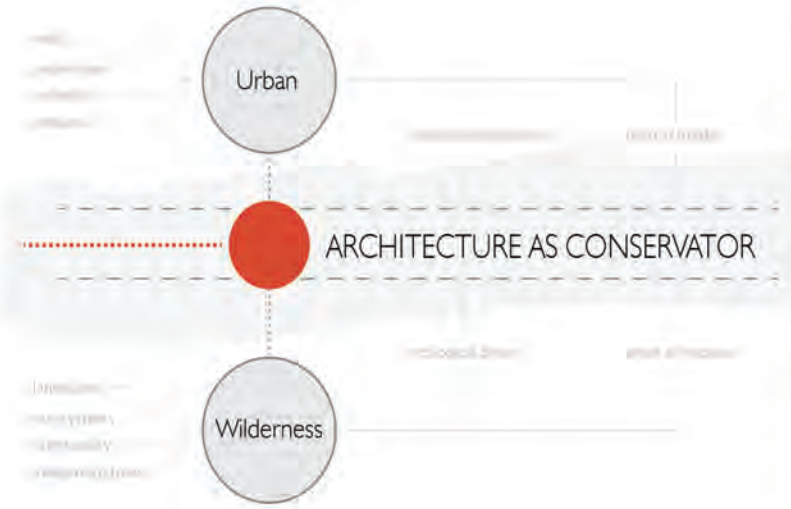

Fig. 09. Above; Conceptual Approach to argument (Author, 2017).

reacts to the ever-changing retail space model and develops the design into a multi-functional retail model that not only sells clothing, accessories or food on small scale, but also workspace. This retail typology, as developed at Watershed co-exists in an environment that is dominated by a large scale commercial retail environment. The precedent is relevant in terms of the surrounding site influences at Wonderboom Nature Reserve that is also dominated by a commercial retail environment and the consideration of this precedents retail typology will be beneficial to the project.

Another precedent is similarity in program is the Wasit Natural Reserve Visitor Centre by X Architects in Sharjah, UAE. The visitor center was completed in 2016 and showcases a way to present nature reserves to the public without harming the sensitive environment. This precedent considers the idea that nature reserves can be utilised for educational purposes in educating the public while they experience nature in the reserve from behind glass walls. The precedent fails in the interaction between nature and the visitor due to the glass walls but succeeds in presenting the importance of nature to the visiting public. The Royal Academy for Nature Conservation by Khammash Architects in Jordan frames and captures the natural context it sits in very well. The building was completed in 2013 and directly reacts to the natural environment that surrounds it. Built on the edge of an old quarry, the architecture reacts in form and material. The architecture considers the edge of the quarry as the guiding factor in plan and the materiality of the quarry as the informant in section.

Other precedents investigated were: MARIOerMURO, a first place winning proposal for a park in Rome, Italy and B.R.E.A.K., a third-place proposal for Turkey's Bandirma Park, both by TA.R.I Architects. These precedents consider the relationship between urban and nature in terms of architectural intervention; the MARIOerMURO proposal re-evaluates the wall and propose architecture as the division between the urban city and the inner park creating a calm environment for city residents to break away. The third-place proposal, B.R.E.A.K links the history of the site with a new programmatic consideration.

Conclusion

Architecture can be developed in the in-between space between nature and the urban to act as conservator for nature reserves. Utilising the natural resources[8] of the site to produce products, retailing these products to urban dwellers for capital to fund environmental organizations to conserve nature reserves and natural balance. The architecture can further remind the visitor of the historical protective layers of the site that relate to the history of protection that is continued. The space of interaction between nature and the urban will become the site for intervention (see fig 10). Acting as active protector in terms of sustainable harvesting, production, education of conservation and in building a continuous interaction between urban and nature. Presenting the current protective theme in function and continuing the historical protective theme in form.

The project addresses the physical, in function and phycological experience of form as two continuous informing agents in creating a synergy to test the notion of architecture as conservator. Combining the interaction between these two spheres conceptually

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and relating them to the relationship between nature and urban. This consideration fills the current void between urban and nature giving new definition to the fence that exists between these two environments.
In replacing the fence, the architecture will not only increase interactive activity between urban and nature but also aid the natural environment in conservation, protecting the ecosystems from over-exploitation and the ecology from decay.
By combining the functional considerations that aid conservation in using ecosystems services an TEEB approach, and the architectural form informants from the adapted use of Hetrzberger's theory to create form, it is deemed that the architecture will achieve its objective of contextual conservation.
The intervention of man in nature can ultimately conserve, define and capture the elements that make nature reserves protectable and transform these forgotten, yet rich historical sites into places that keep our environments in balance. A balance that is not only important for the healthy continuous existence of nature but also for the existence of man, bee it urban or not.

Endnotes

1. Biodiversity.
2. Contemporary Italian artist – Work viewable at http://www.nunziopaci.it/
3. Wild natural growth, not contained or maintained.
4. Program - Use of space.
5. Form.
6. Noun -1. a particular portion of space, whether of definite or indefinite extent. 2.space in general: time and place. (Dictonary.com 2017)
7. The Wonderboom fort; the stone age cave; the stone formations & the tree canopy as found in the WNR.
8. Natural capital of ecosystems/ provisional ecosystem services.

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APPENDIX B - CONTRIBUTION CONFERENCE

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a contribution to architecture:

THE PROLIFIC PARTITION

- Architecture as Contextual Conservator

Prolific
[pruh-lif-ik]
Adjective
2. producing in large quantities or with great frequency; highly productive: "a prolific writer."

Partition
[pahr-tish-uh n, per-]
Noun
1. a division into or distribution in portions or shares.

Dictionary.com. 2017. Definition: Prolific. http://www.dictionary.com/browse/prolific (Accessed 17.05.2017)
Dictionary.com. 2017. Definition: Partition. http://www.dictionary.com/browse/partition?s=t (Accessed 17.05.2017)

INTRO

Research Focus - Locality

Diverse landscapes of Pretoria.

Focus – Wonderboom Nature Reserve

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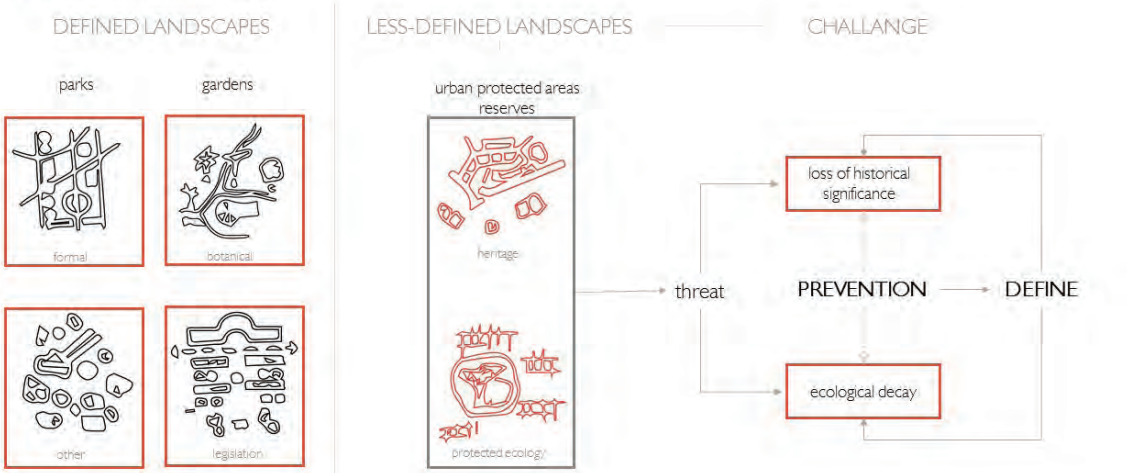
INTRO

Urban Protected Areas - Challenge



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ISSUE

Problem Statement

Problem Statement

General Issue

Urban protected areas, and in particular nature reserves in the context of South African cities are at treat from **ecological decay**, **eco-system depletion** and the **loss of historical significance** due to the lack of interaction with the urban context.

One

Urban Issue

How does the Architecture facilitate more urban interaction with urban protected areas *(wilderness in the city)*?
What strategy can Architects follow to address these enclaves within an urban environment?

Two

Architectural Issue

In what way does Architecture preserve the historical significance of site? *(in form)*
How does Architecture facilitate a function that can prevent ecological decay?

Three

Nature Reserve Issue

Ecological decay and eco-system depletion, how can Architecture address this issue?
Can Architecture structure a means of creating an awareness for urban protected areas *(Nature Reserves)*?

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CONTINUUM

Man and Nature - The Continuous Relationship

Nunzio Paci's

'My whole work deals with the relationship between man and Nature, in particular with animals and plants. (Nunzio 2017)"

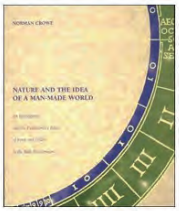
(Designworld 2015)

(Designworld 2015)

Man and Nature - The Architectural Relationship Interest

Norman Crowe – Nature and the idea of a man made world. (1995)

Crowe argues that the build environment is a form of nature and explains the idea of the man-made that holds its routes in a historical relationship between man and nature.



"…the ancient idea that we are responsible for maintaining a harmony between ourselves, what we make, and nature. (Crowe 1995)"

William Cronon– Uncommon Ground: Rethinking the Human Place in Nature. (1995)

Cronon reassesses the environmentalists agenda. He states in his writings that the idea to protect pristine nature (wilderness) is flawed. He argues that humans need not be removed from nature to protect it, as we are a part of it and the removal of humans won't keep nature intact. He continues to argue that humans have not yet learned to live responsibly in nature and that this is where the problem lies.

"How can we take the positive values we associate with wilderness and bring them closer to home? (Cronon 1995, 69-90)"

Cronon, W., 1995, ed., Uncommon Ground: Rethinking the Human Place in Nature, The Trouble with Wilderness. New York: WW. Norton & Co.
Crowe, N., 1995, Nature and the idea of the man-made world. The MIT Press, Cambridge, Massachusetts.
Designworld, 2015, Nunzio Paci's Anatomical Art Explores The Relationship Between Man And Nature. http://designworld.com/nunzio-pacis-anatomical-art/ (Accessed 21.05.2017)
Nunzio, P. 2017, Biography, statement. http://www.nunziopaci.it/bio.html (Accessed 21.05.2017)

CONTINUUM

South African Continuum of Architecture.

South African Architectural Context – as per Prof. Arthur Barker in FutureSpaces (2016)

IDENTITY

ETHICS

How do we act ethically through our responses to the profession, the client, the public, the environment and economics?
(Barker 2016)

LEGACY

SECURITY

MEMORY

How are we dealing with our built and spatial heritage and how do we respond to architectural history?
(Barker 2016)

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GENERATIVE APPROACH – Architecture of influence, informants of context.

Environmental Potential

"The **balance between human development needs and the environment's potential to serve or provide for these needs.** Social consideration, **environmental responsibility and economic equitability** that results in regenerative design and development approaches, sustainable building methods, recycling and reuse of material, **community benefits** and **environmental restoration.** (Pienaar 2017) "

+

Heritage and Cultural Landscapes

"Diachronic and synchronic understanding and analysis of the **ecology of the cultural environment with application in the design of the built environment.** Solutions focus on appropriate building form and space referenced to the legal heritage frameworks and current best practice. **Theory of the relationship between human and landscape and of heritage conservation.** Recording, investigation, interpretation, representation and design response within the built environment regarding places, structures and artefacts of cultural significance and heritage value. (Pienaar 2017) "

Barker, A. 2016, Collection of Articles on Futurespaces: Education: Architectural Showcase for Educational Developments. http://www.futurespaces.co.za/architectural-education/.aspx (Accessed 21.05.2017)
Pienaar, L. 2017, Research in the Department of Architecture research and teaching in the postgraduate programmes are allied to these Research Fields. http://www.up.ac.za/en/architecture/article/2614/research (Accessed 21.05.2017)

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CONTEXT

Investigation – Macro (Zone)

MACRO

- Ridges - Access Routes
- Ridges - Landmarks
- Significance – Time
- Built - Natural Areas
- Magaliesberg - High Density Urban
- Social Media Tracking

Investigation – Middle (Region)

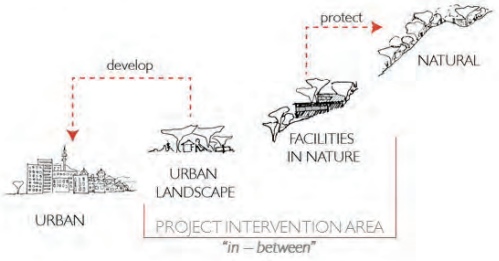
MICRO

- Site - Access Routes
- Site – Landmarks
- Nature Reserves - Density Surrounding Site
- Nature Reserves - Greater Pretoria Region

CONTEXT

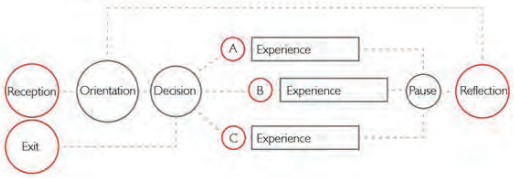
Urban Framework

Approach



1st layer – UF Principles

2nd layer – Space Flow Analysis



Conceptual Urban Framework

Proposed Facilities:

- *Research* — Prolific Partition
- *Educational* — Prolific Partition
- *Recreational* — Medical Meditation
- *Medical* — Medical Meditation

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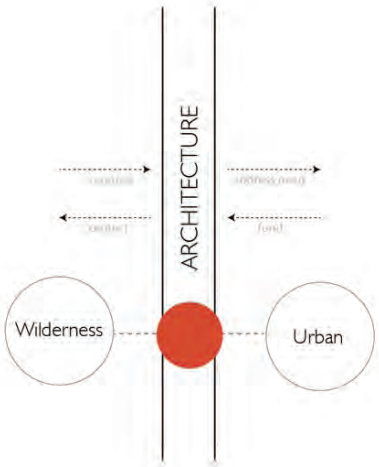
ARGUMENT

Approach – Hypothesis

Architecture can be developed in the in-between of wilderness and urban to act as conservator for nature reserves.

Utilizing the **natural resources** (natural capital of ecosystems/ provisional ecosystem services) **of wilderness** to produce products for the urban dweller within a space that continues the historical layers of the site. The **space of interaction between wilderness and urban** will become the **conservator,** acting as active protector in terms of sustainable production, education and urban dweller interaction with the continues history of site.



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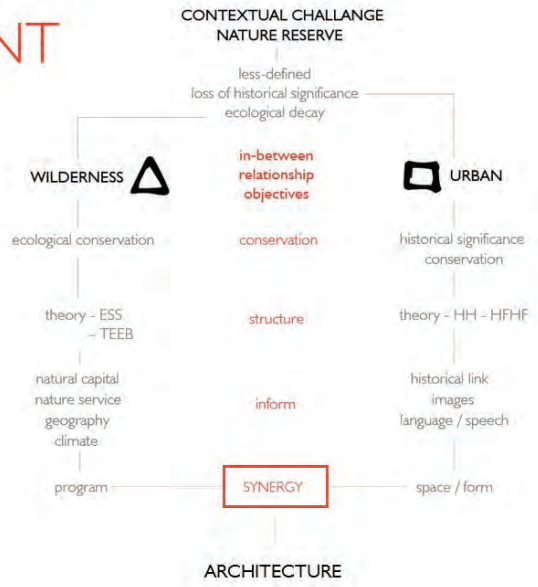
ARGUMENT

Approach – Structure



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THEORY

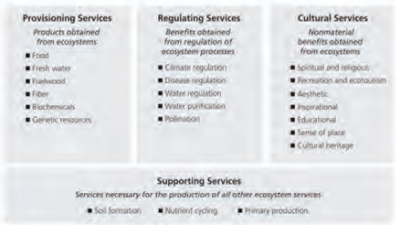
Ecological conservation

WILDERNESS

Theory of Ecosystem Services

By Definition:

"The benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth.(Greenfacts 2017)



MEA categories of ecosystem services

Millennium Ecosystem Assessment (2005)

Valuing Nature: Economics, Ecosystem Services, and Decision-Making

by Dr. Stephen Polasky, University of Minnesota

1. Link actions to impacts on the provision of services by improving understanding of:

- the consequences of human actions on ecosystem.
- the ultimate impacts on the natural capital that sustains ecosystem services.

2. Value services to:

- improve understanding of the contribution of ecosystem services to human well-being.

3. Provide incentives to:

- incorporate an understanding of the value of ecosystem services into policy and management frameworks.
- provide incentives for the continued provision of valuable ecosystem services.

– From Theory of Ecosystem Services Seminar 2 (2011)

Greenfacts. 2017. Ecosystem services Definition. https://www.greenfacts.org/glossary/def/ecosystem-services.htm (Accessed 21.05.2017)
Polasky, S. 2011. Valuing Nature: Economics, Ecosystem Services, and Decision-Making. http://www.nrdc.org/water/pdf/valuing-ecosystem-services-Seminar-2-Theory.pdf (Accessed 21.05.2017)

THEORY

Ecological conservation

WILDERNESS

The Economics of Ecology and Biodiversity (TEEB)

"The Economics of Ecosystems and Biodiversity (TEEB) is a global initiative focused on "making nature's values visible". Its principal objective is to mainstream the values of biodiversity and ecosystem services into decision-making at all levels. It aims to achieve this goal by following a structured approach to valuation that helps decision-makers recognize the wide range of benefits provided by ecosystems and biodiversity, demonstrate their values in economic terms and, where appropriate, suggest how to capture those values in decision-making (TEEB [sa])"

1. Recognizing Value
2. Demonstrating Value
3. Capturing Value

— 3 step process

Greenfacts. 2017. Ecosystem services Definition. https://www.greenfacts.org/glossary/def/ecosystem-services.htm (Accessed 21.05.2017)

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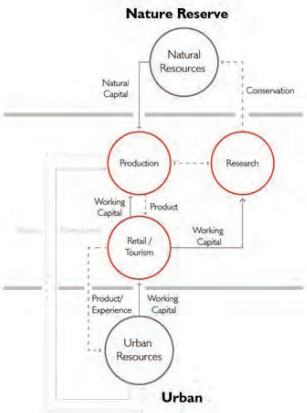
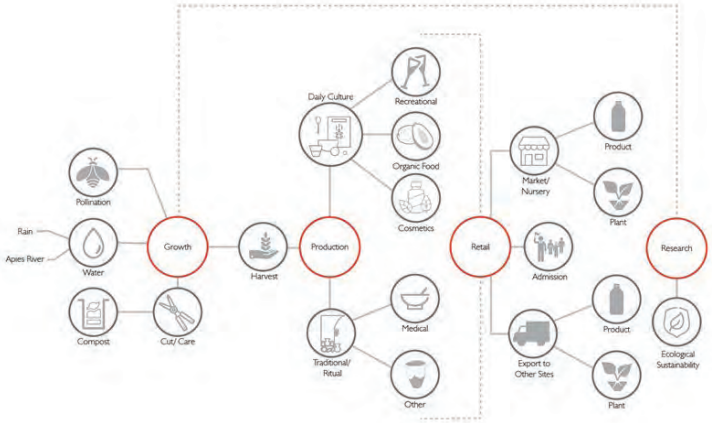
PROGRAM

Conservation Facility Function

WILDERNESS





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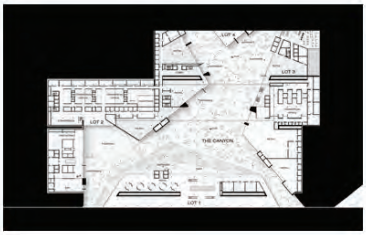
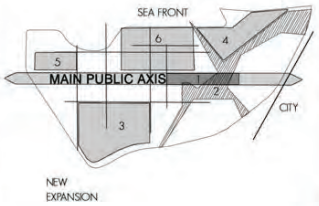
PRECEDENT

Program

Project: Third-Place Proposal for Turkey's Bandirma Park [Bandirma Regeneration As Knowledge]
Architect: TARI Architects
Location: Bandira Park Turkey
Program: Educational / Park





ARCHITECTURE

LANDSCAPE SYSTEM
(OUR PROPOSAL)

ArchDaily. 2017. Third-Place Proposal for Turkey's Bandirma Park Embeds Public Spaces In an Urban Landscape. http://www.archdaily.com/867583/third-place-proposal-for-turkeys-bandirma-park-embeds-public-spaces-in-an-urban-landscape

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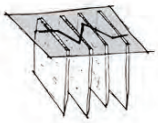
THEORY

URBAN

Conserve Historical Significance
Homework for More Hospitable Form (1973)
by Herman Hertzberger in the Dutch journal Forum.

"9.4 We cannot make anything new, but ***only reevaluate*** *already existing images, in order to make them more* ***suitable for our circumstances****. What we need to draw from on this is the great 'Musée Imaginare' of images wherein the* ***process of change of signification*** *is displayed as an effort of human imagination, always finding a way to break though established order, so as to find a* ***more appropriate solution for his situation****."*

– Herman Hertzberger, from "homework for more hospitable form", in Forum 24/3 (1973), n.p. trans.



CONTEXT → museum of imaginary images *"Musée Imaginare"* → CROSS SECTION OF THE COLLECTION → IN PLURATY BE AN EVOCATIVE FORM-STARTING-POINT

CONSERVE SIGNIFICANCE

The Prolific Partition – Architecture as Contextual Conservator

THEORY - FORM

URBAN

Conserve Historical Significance
Homework for More Hospitable Form (1973)
by Herman Hertzberger in the Dutch journal Forum.

SUN CITY →

THE PALACE OF THE LOST CITY

GHOLF NEDBANK CHALLANGE

VALLEY OF THE WAVES

→ DESTINATION FOR ENTERTAINMENT & RELAXATION

museum of imaginary images

CONSERVE SIGNIFICANCE

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FORM

Conserve Historical Significance

Homework for More Hospitable Form (1973)

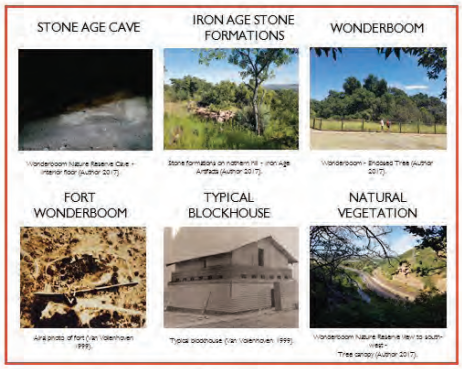
by Herman Hertzberger in the Dutch journal Forum.

URBAN

analysis of protection images

context

WONDERBOOM NATURE RESERVE



cross-section

PROTECTIVE

museum of imaginary images

evocative form-starting-point

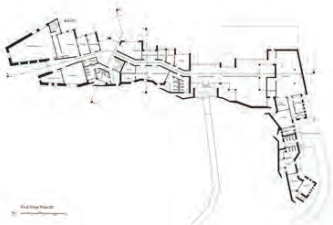
CONSERVE SIGNIFICANCE

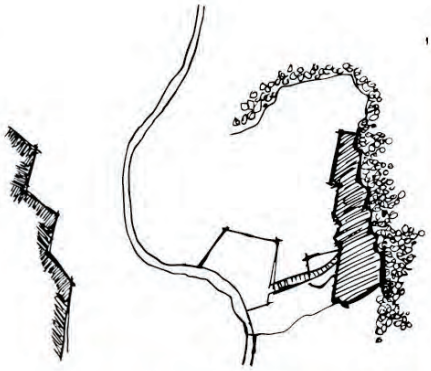
The Prolific Partition – Architecture as Contextual Conservator

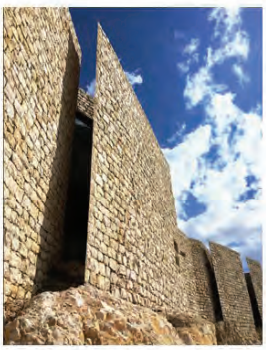
PRECEDENT

Context / Form

Project: The Royal Academy of Conservation
Architect: Khammash Architects
Location: Jabal `Ajlun ‹Jordan
Program: Education







ArchDaily. 2016. Royal Academy for Nature Conservation / Khammash Architects. http://www.archdaily.com/789514/royal-academy-for-nature-conservation-khammash-architects

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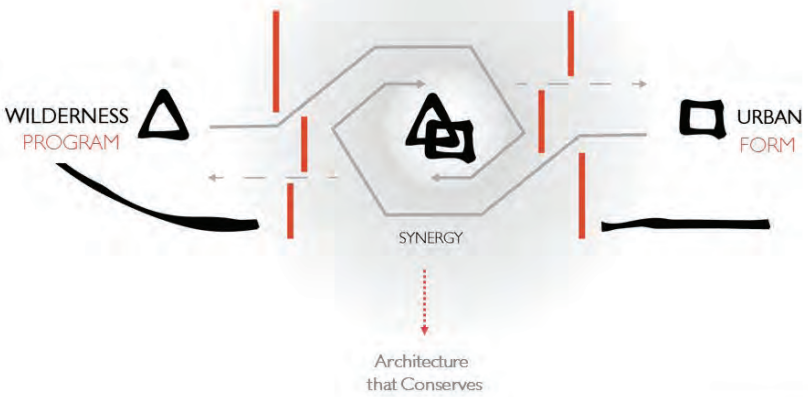
PROGRAM - FORM

Synergy as Architecture



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CONTRIBUTION

Summary - Architecture

Urban Protected Areas Challenge
Problem Statement - General

	1. Urban	2. Architectural	3. Nature Reserve
PROBLEM	Less Defined	Loss of Significance	Ecological Decay
OBJECTIVE	Define Nature Reserve	Conserve Historical Significance	Conserve Ecology
MEANS	Urban Strategy	Theory – HH HFMHF	Theory – ESS; TEEB
DELIVERABLES	Urban Framework	Form	Function
		SYNERGY	

Architecture as Conservator

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CONTRIBUTION

Other - The South African Continuum

Economics and Architecture – Towards a Sustainable Economy

Alternative Domestic Products & Job Creation

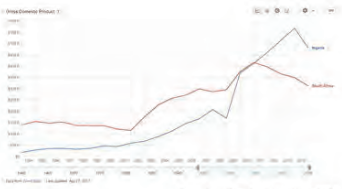
GDP – Gross Domestic Product

"Definition: Gross domestic product is the best way to measure a country's economy. GDP is the total value of everything produced by all the people and companies in the country. It doesn't matterif they are citizens or foreign-owned companies. If they are located within the country's boundaries, the government counts their production as GDP. (Amadeo 2017)"

RSA GDP Growth Rate:

- 2012	2.2 %
- 2013	2.2 %
- 2014	1.5 %
- 2015	1.3 %

- 2016 - 4th quarter – 0.3%



(Google Public Data from: World Bank(2017)

African Cultural Traditions and Architecture – African Need

Indigenous Plant Market

Sustainable supply of traditional medicine.

*"In today's world, where re-examination has been given to cultural globalization, the relationship between **architectures** and **specific regions** is one of many **specific issues**. At this time, the study of architecture from the perspective of geography has significant meaning **for treasuring regional characteristics and protecting the essence of ethnic culture**."*

– From the Abstract of *Born of geographical environment, coloring for regional context: Concept and progress of geo-architecture* by Fang Wang

Amadeo, K. 2017. *What Is GDP? Definition of Gross Domestic Product.* https://www.thebalance.com/what-is-gdp-definition-of-gross-domestic-product-3305638 (Assessed 21.05.2017)
Fang, W. 2017. Born of geographical environment, coloring for regional context: Concept and progress of geo-architecture. *Journal of Geogr. Sci.* 27(5): 631-640

CONCLUSION

Architecture as Contextual Conservator

The project sets out to **aid in an strategic approach towards addressing specific issues** that the urban context within South Africa are confronted with. By **investigation, analysis, theoretical influence, approach structuring and precedent studies** any spatial or urban issue can be addressed.

In the case of Wonderboom Nature Reserve the synergy as structured between function and form of contextual influence to address the contextual issues, such as conservation of urban protected areas must be tested. With the facilitation and capturing of contextual significance and appropriate structuring of function, Architecture can be developed to address specific contextual issues in urban environments (*wilderness or urban*).

Continues contextual conservation within rapid growing urban environments are of absolute importance and architecture should intervene with innovative and current solutions that can aid all environments and parties involved.

(Designwrld 2015)

Designwrld. 2015. *Nunzio Paci's Anatomical Art Explores The Relationship Between Man And Nature.* http://designwrld.com/nunzio-pacis-anatomical-art/ (Accessed 21.05.2017)

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(Designwrld 2015)

End.

Thank you.

Designwrld. 2015. *Nunzio Paci's Anatomical Art Explores The Relationship Between Man And Nature.* http://designwrld.com/nunzio-paci-anatomical-art/ (Accessed 21.05.2017)

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APPENDIX C - FINAL PRESENTATION

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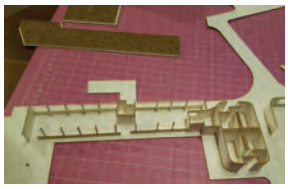

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A Personal Note

The relevance of this intervention and research is questionable due to the nature of the current economic situation confronting the country. The sad reality is, that attention to these challenges are never tabled until it is too late. In completing this dissertation, I contribute to the hope and promises of preserving the natural and historical beauty of South African and especially that of the city of Tshwane's nature reserves. I call on all, student or professional, city dweller or sub-urban resides, male or female, black or white, all - to conserve the historical and natural elements that we are not confronted with daily. It is these elements that our future generations will thank us for.

I don't know why I did this, I just know it was the right thing to do.

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