[RE]CONNECTING ECOLOGY

PETRUS JOHANNES ODENDAAL
14297419

DECLARATION OF WORK

[RE]CONNECTING ECOLOGY
a Centre of knowledge transfer and exposure to ecological systems

By Petrus Johannes Odendaal

Submitted in fulfillment of part of the requirement for the degree of Master in Architecture (Professional)

Department of Architecture
Faculty of Engineering, Built Environment and information Technology.
University of Pretoria

Course Coordinator: Dr. Arthur Barker
Study Leader: Dr. Jan Hugo

Pretoria 2021

Declaration

1. I understand what plagiarism is and am aware of the University's policy in this regard.

2. I declare that this essay is my own original work. Where other people's work has been used (either from a printed source, Internet or any other source), this has been properly acknowledged and referenced in accordance with departmental requirements.

P.Odendaal

SIGNATURE DATE 30/10/2021

In accordance with Regulation 4(e) of the General Regulations (G.57) for dissertations and theses, I declare that this dissertation which I hereby submit for the degree Master of Architecture (Professional) at the University of Pretoria, is my own work and has not been previously by me for a degree at this or any other institution. I futher state that no part of my dissertation has already been, or is currently being, submitted for any such degree, diploma or other qualification.

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

Pieter Odendaal

2021

ACKNOWLEDGMENTS

Thank you to the almighty Lord for giving me the opportunity to take on this task and complete it.

Thank you to my study leader, Dr Jan Hugo, for helping me this year and for all of the knowledge and motivation provided through the year.

Thank you to my father, Dr PJG (Pieter) Odendaal for your unending support and love throughout my academic journey and beyond.

Thank you to my late mother, Lydia Odendaal whom I know would've supported me throughout this endeavour and would have been extremely proud of my achievements.

Thank you to my loving sisters, Yolandi Odendaal & Alize Tredoux, for all your help, love and unending support.

Thank you to all my family members near and far for always taking the time to listen and for giving me your love, support & encouragement .

Thank you to all of my wonderful friends who sat through and engaged with every conversation and supported me through all my groaning when times became tough.

Lastly, thank you to the United students studio republic for all the conversations, late nights and hard work. Without you I would not have completed this year.

PROJECT SUMMARY

PROGRAMME:	CIVIC & ECOLOGICAL CENTRE
SITE DESCRIPTION:	THE ABANDONED STRUCTURE OF DE VILLA BOIS
SITE LOCATION:	WINGATE PARK, PRETORIA, GAUTENG
ADDRESS"	CNR OF DELMAS, DE VILLEBOIS MARIEUL STREET
COORDINATES:	25°50'30"S 28°16'27"E ELEVATION 1,574M
RESEARCH FIELDS:	REGENERATIVE & RESILIENT CITIES, DESIGNED ECOLOGIES
KEYWORDS:	DEEP ECOLOGY, ECOLOGICAL DESIGN, REGENERATIVE DESIGN, SUSTAINABLE
THEORETICAL PREMISE:	THE INTRODUCTION OF AN ECOSYSTEM INTO THE BUILT ENVIRONMENT THROUGH DEEP ECOLOGICAL THINKING.

ABSTRACT

The natural world is an interconnected system made up of ecosystems and an abundance of species diversity that inevitably supports all life on Earth, including humans. Since our origin the humans race has worked in this system to sustain ourselves. This relationship has impacted every aspect of our current societies and our future as a species depend on the health of this system.

Human impact on the natural world has been excessive as our population and our need for resources has grown. Pollution, habitat loss, extinction and climate change is rampant.

A rift has been created, one where humans have severed the relationship with the natural world. Our urban centres do not support natural functions and even within our arts; music, poetry, film and children's books have had terms dealing with the natural world replaced with terms for human made objects.

It is time for change.

A paradigm shift is required, one where humans and nature can once again live with together in a symbiotic relationship - for the benefit of both.

This project proposes a reconnect and an alternative way of thinking, that can alter our current development strategies. Where the needs of **all** organism are considered and the reuse of neglected space is important.

The project will add to the architectural discourse by adding to the discussion around regenerative sustainability and deep ecological thinking.

This is necessary not only for the health and flourishing of our future ecological systems but also for human physical health and mental wellbeing.

TABLE OF CONTENT

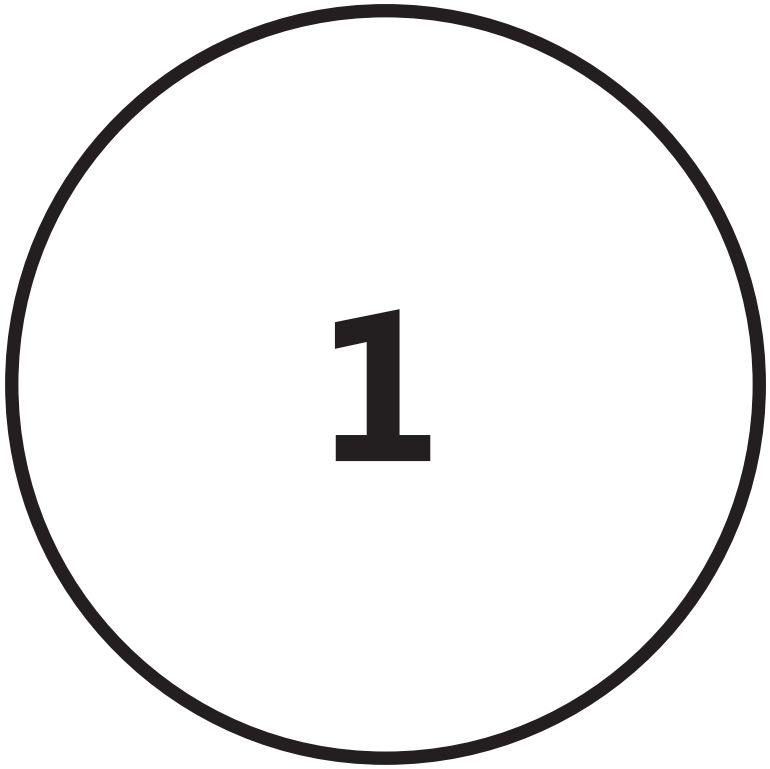
a four part document setting out the problems, research into design, technical synthesis and a reflection

LIST OF FIGURE

Figure.1: DEEP ECOLOGY

"There is a pleasure in the pathless woods,
There is a rapture on the lonely shore,
There is society, where none intrudes,
By the deep Sea, and music in its roar:
I love not Man the less, but Nature more,
From these our interviews, in which I steal
From all I may be, or have been before,
To mingle with the Universe, and feel
What I can ne'er express, yet cannot all conceal."

- Lord Byron, Childe Harold's Pilgrimage



POSITION & SITUATION

SITUATING THE PROBLEM

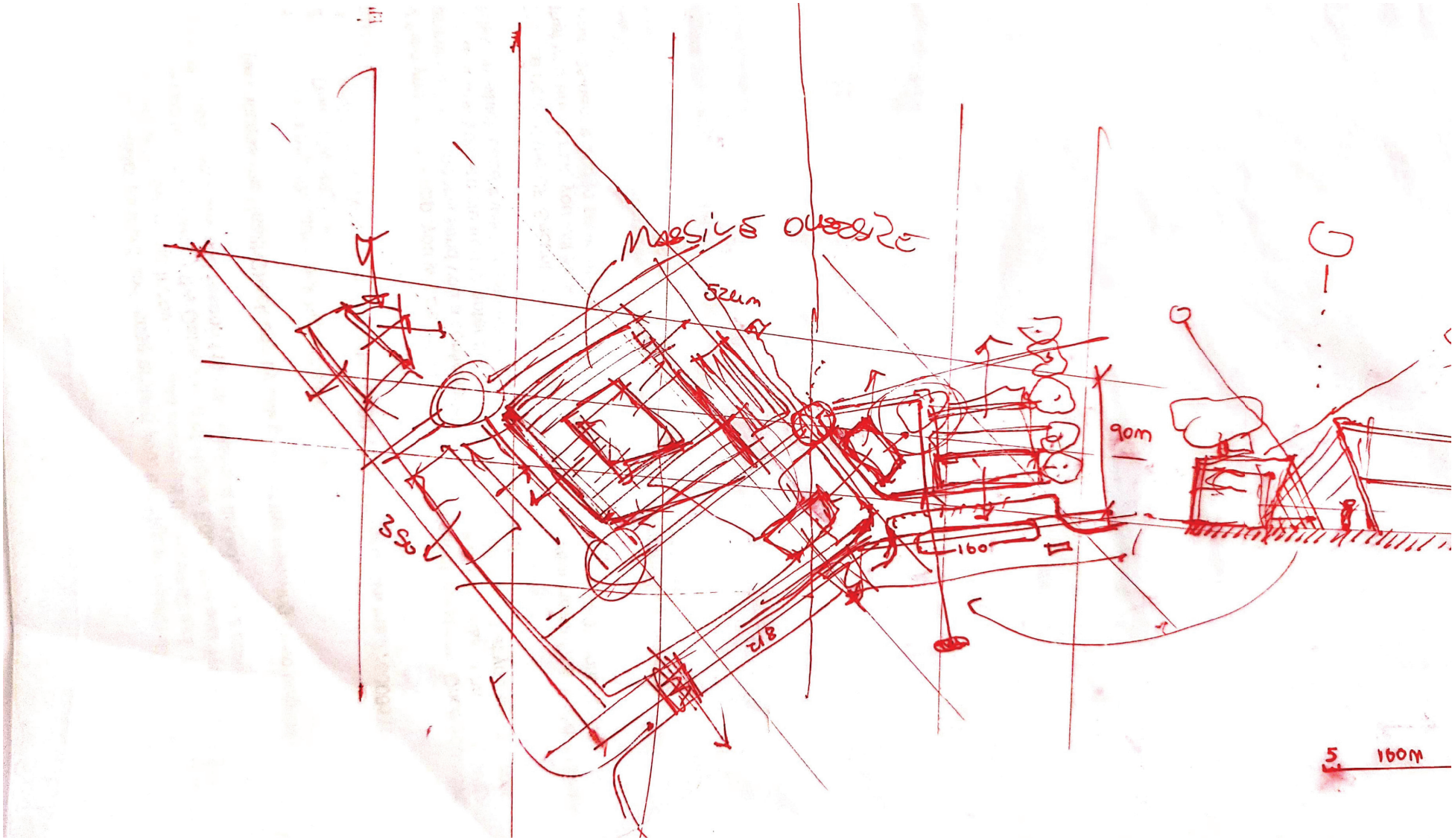


Figure.2: INCEPTION (AUTHOR 2021)

1.1 INTRODUCTION

The natural world is a complex system of entities working in unison and producing no waste. Since its origin the human race has had a fundamental relationship with the natural world; which has shaped the course of our species and our current societies. This relationship impacts every aspect of life human life.

Since the industrial revolution, the human impact on the natural world has been substantial, it has changed land use, caused pollution and is mining away at resources and pushing ecosystems to the brink (Corvalan, Hales & McMichael 2005) in the name of development.

In response, Arne Naess and George Sessions developed the Deep Ecology framework (Naess and Sessions 1985), which is a direct critique on the anthropocentric nature of our current society's development.

They propose a new system of thinking which instead of placing humans as the most important organism on Earth, places humans into an eco-centric model. In other words: placing them firmly within the greater web of life (Capra 1997:7). This is done through a platform with 8 principles, which gives intrinsic value to all organisms, with none being more important than the other. These principles call for humans to ask deeper questions, whilst striving for more meaning in their lives. Naess and Sessions (1985) argue that this will impact all aspects of human society, including the built environment.

In contrast to these ideas, development within our current urban centres face various challenges, namely;v urban sprawl, outdated urban development models and decentralisation (Horn 2009, Bor 1972). These problems are caused by various factors including past policies from apartheid city planning (Reddy 2019) and even more recent failures by the post-apartheid government to rectify issues surrounding the apartheid city. This has caused the periphery of our cities to expand and move ever outwards. As development persists various spaces fall into the cracks of our urban fabric, rendering them abandoned or neglected (Trancik 1986). These spaces have potential to be reused and woven back into the urban fabric. Simultaneously, the reuse of such areas and buildings, allows resources and space to be spared. By rehabilitating these sites, conditions can be made suitable to allow ecosystems to flourish, whilst allowing for the use by humans, within the framework of Deep Ecology.

DE VILLA BOIS & THE GARTSKLOOF SITE

ABANDONED AND IN DECAY

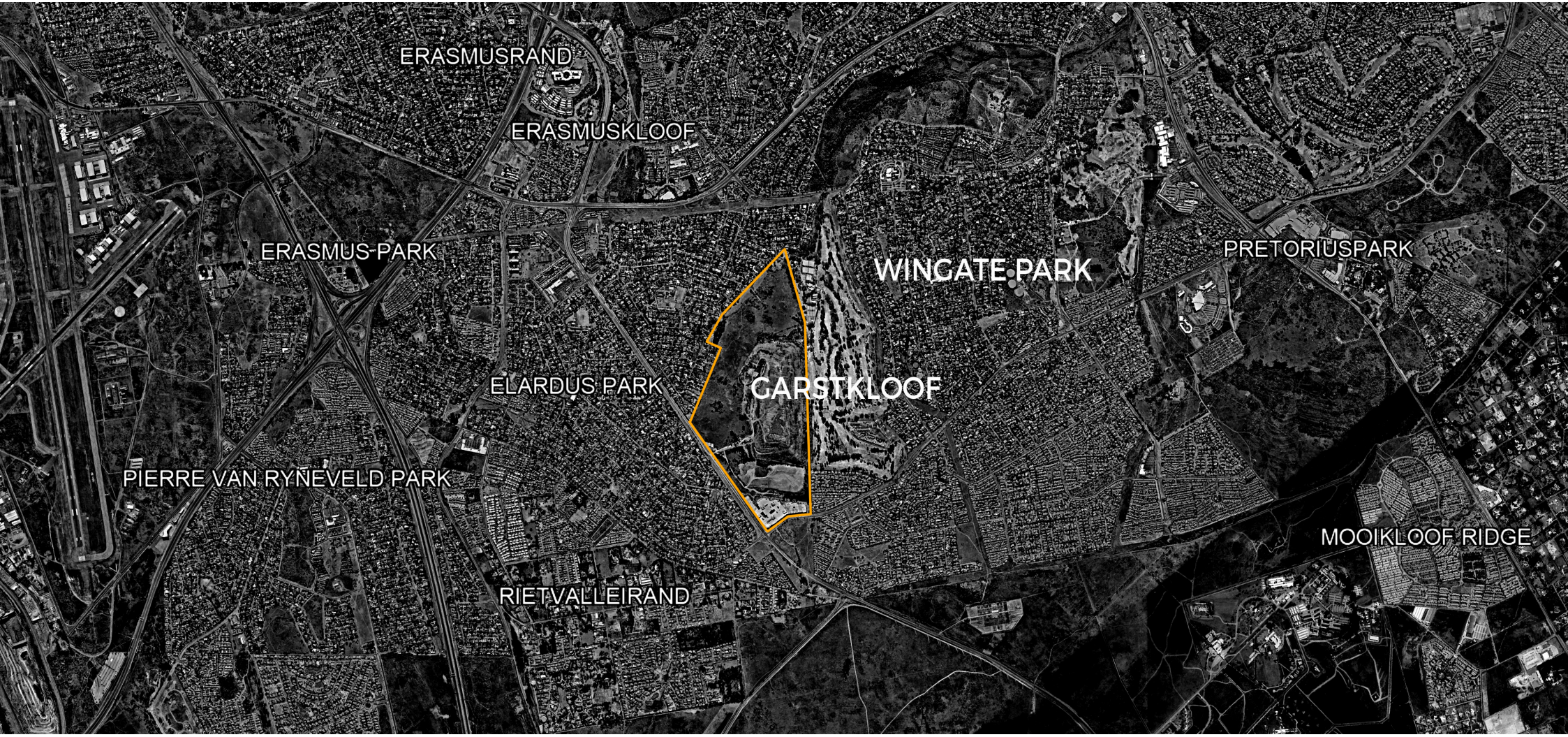


Figure.3: SITE LOCATION (AUTHOR 2021

1.2 SITE INTRODUCTION

The site is an abandoned structure called De Villa Bois (Fig. 4). It has been abandoned from 2010 and left to decay during this time. Its function at this stage is housing equipment for the contracting group that built the structure: GDIrons. It is an eyesore for the neighbouring community, many of whom either lost or know of people that lost substantial amounts of investment capital in this failed development. It is found in the South-Eastern entrance of Pretoria (Fig.3), on the corner of Delmas road and De Villa Bois Marrieul drive in Wingatepark, adjacent to the rehabilitated Garstkloof Landfill.

1.3 THEORETICAL APPROACH

The project follows the ideas of the triple bottom line (Elkington et al 1998) that transformed into the nested approach (Giddings, Hopwood and O'Brien 2002) and the Deep Ecological framework (Naess & Sessions 1985) as the foundational theory that informs the project. This was followed by a literature review from various other ideas and authors that will add and is associated with Deep Ecology.

Figure.4: DE VILLA BOIS (AUTHOR 2021)

1.4 TRIPLE BOTTOM LINE & THE NESTED APPROACH

In 1994 Johan Elkington coined the term triple bottom line (Elkington et al 1998) which at the time introduced a new way of thinking in terms of sustainability. Although the triple bottom line (TBL) was originally designed for corporate business to analyse their impact on social and ecological process, whilst they continue with their business model, various industries across the globe have adopted this paradigm. This idea shifted towards the Nested Model (Giddings, Hopwood and O'Brien 2002) which is a more accurate representation of the connection between societal, economic and environmental spheres (Giddings, Hopwood and O'Brien 2002:191).

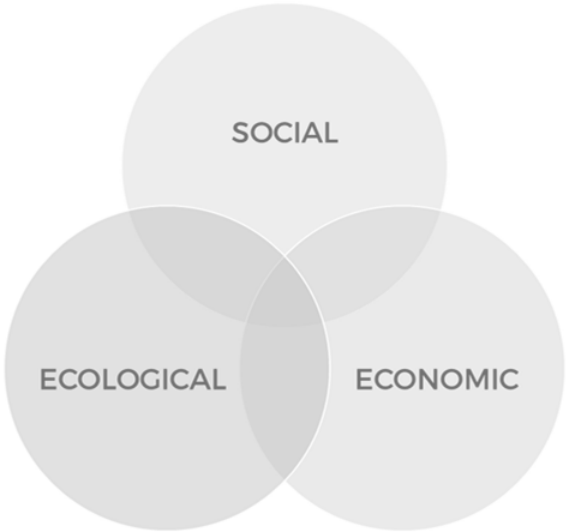


Figure.5: TRIPLE BOTTOM LINE (ELKINGTON 1998)

Human society depends on the environment, in contrast the environment would be able to continue without society (Lovelock 1988).

It states that without the environment there can not be society, and without the society there can be no economy. Acknowledging that there are significant constraints for the economy. Subsequently, the environment does not require the economy or society to continue functioning.

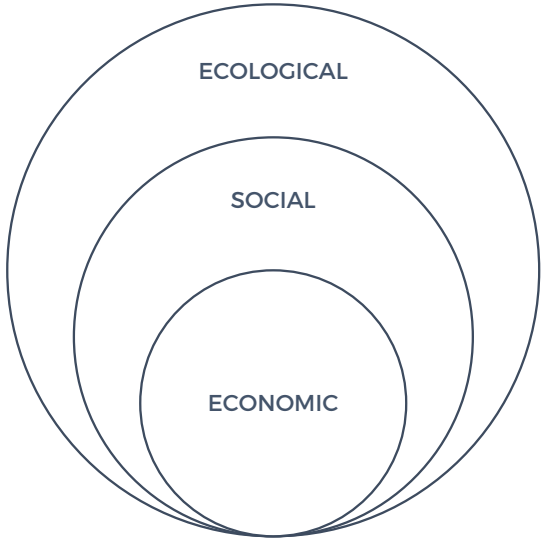


Figure.6: NESTED APPROACH (GIDDINGS ET AL 2002)

1.5 DEEP ECOLOGY

The theoretical framework of the project is built around the radical work of Deep Ecology by Arne Naess and George Sessions (1985). Deep ecology is based on a platform of principles that form the core of its values (Naess & Sessions 1985).

The Deep Ecological platform principles:

1. The health and thriving of human and non-human life on Earth have intrinsic value. These values do not depend on the worth of non-human life for human purposes. This is called biospheric egalitarianism: the view that all living things have value in their own right, irrespective of their usefulness to others

2. Species richness and diversity contribute to these values and are also values in themselves.

3.Humans do not have the right to decrease the richness and diversity of species, except to perform vital needs.

4. The current impact of human life in the non-human world is extreme and it is only becoming worse

5. The improvement of human life and the flourishing of cultures can be achieved with a drastic decline in the human population. The health and well-being of non-human life is dependent on such a decrease.

6. A change in policies and legislation is required. These changes will have an impact on basic economic, technological and ideological spheres. The situation that is born from this will be inherently different from our current circumstances.

7. The ideological change that needs to happen is that of appreciating quality of life, by living with the idea of intrinsic value, rather than the constant need for a higher standard of living.

8. If you pledge to the above-mentioned points, you have a responsibility to directly or indirectly participate, to cause the necessary changes.

(Naess & Sessions 1985)

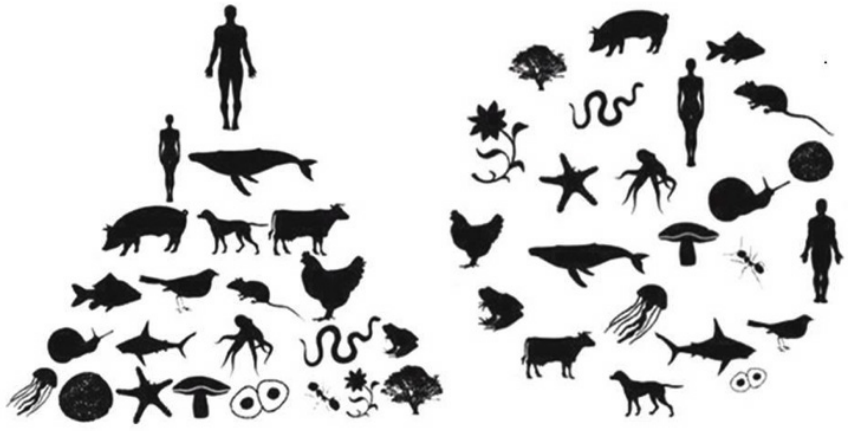


Figure.7: SHALLOW VS DEEP ECOLOGY DIAGRAM

The **first principle** tries to portray a few basic points: Firstly, that all living things, human and non-human, have value and therefore its own right to live, flourish and reproduce. Non-human life does not necessarily mean only living things but also entails lakes, rivers, landscapes, ecosystems, forests, etc. All of which have value in their own right. Then, the value that these species have is not connected in any way to their usefulness, specifically relating to humans. And, lastly, deep ecology is not about anthropocentrism (or human approach), but rather about ecocentrism, which places humans within the interconnected system of life instead of above it (Naess & Sessions 1985).

The **second principle** explains the importance of biodiversity on the planet and introduces the interconnectedness of all systems in the world (Devall & Sessions, 1985:71). It emphasises the relationship as the most important aspect and explains that everything is related. This relationship as well as this "connection" has value (Naess & Sessions 1985).

The **third principle** explains to what extent life can be decreased for human use. The word "vital" is important to consider - What are vital human needs? Some would say Maslow's hierarchy of needs: self-fulfilment, psychological and basic needs (McLeod 2020). The principles delineate the importance of taking into consideration all living things and how they impact the vital needs of human beings. Naess and Sessions seems to have deliberately made this vague as to not exclude things that people find important (Naess & Sessions 1985).

The **fourth principle** is the most talked about part of the deep ecological movement and the area which receives criticism. The rapid growth of the human population inevitably places strain on ecological systems and resources. Deep ecology calls for the decrease in the human population which will lead to a greater quality of life and protection of natural resources. Naess (1985) has stated that if population is allowed to grow it will have a substantial impact on the richness and diversity of species (Sessions 1995:69). One of the main critiques to deep ecology is that it has been called anti-human, or trying to disconnect humans from the natural world (Watson 1983:251). This is however a misinterpretation; in the deep ecological platform it is stated that human interferences on the natural world is excessive but it is cautious not to promote the elimination of humans from the web of life. "Deep ecology does not separate humans – or anything else – from the natural environment" (Capra 1997:7).

The **fifth principle** identifies human interference as the cause of environmental problems. It further explains that improvement of quality of life and flourishing of culture will not be impacted in a negative way with a decrease in human population. Nevertheless, an increase will create problems for the environment (Naess & Sessions 1985).

The **sixth principle** proposes changes in policies and legislation, which is a drawn-out process for the betterment of the environment. The premise is that thought must be given to every aspect of human life. This will lead to a change in worldviews and mindsets regarding our role within the environment (Naess & Sessions 1985).

The **seventh principle** calls for a minimalistic way of living and for greater purpose or happiness, instead of a materialistic lifestyle. It suggests that quality of life must take precedent over the number of things we own (Naess & Sessions 1985).

The deep ecological platform is not without criticism. Richard A. Watson is one of its main opponents, with his largest issue surrounding deep ecology being; he believes that it will fall short in its anti-anthropocentric approach (Watson 1983). He is also of the opinion that humans will only care about the environment if they see its usefulness for humans. This is a valid argument and one that remains important throughout the project, by referring for instance to, ecosystem services. It should however not be the driving point for the protection of ecological systems as only species that benefit humans in some way will reap the benefit of such thinking.

The deep ecological platform influences architects in the way we think about design and development, specifically, in the 1st, 2nd, 3rd, 6th and 7th points. These points speak about the value of the natural world, biodiversity, vital human needs, the need for legislation change and a more minimalistic way of living. All of these can factor into the built environment in some form.

Our species inevitably struggles with the idea of bio-spheric egalitarianism, or seeing the natural world as not benefiting us in any way. It is of paramount importance that this idea be educated and spread throughout our society, to allow for the improvement of ecological system without these needing to “give” anything to human society. This does not mean that ecological services are not important to humans, it rather states that shouldn’t be the sole reason ecology is introduced into human systems.

This is where the Nested approach (Giddings, Hopwood and O'Brien 2002:191) and its trinity of factors: ecological, economic and social are all placed within a relationship with each other understanding the dependence and limitation of each of these factors. Deep Ecology does not see the world as separated objects but rather as a system of phenomena that are fundamentally interconnected and interdependent (Capra 1997:7).

1.6 PROBLEM STATEMENT

GLOBAL ISSUE

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) found in a landmark report, that ecosystem health globally is deteriorating faster than ever (Stokstad 2019). This has caused a drastic decline in fauna and flora (Fig. 8), predominantly due to habitat loss.

The five main drivers of change in nature, stated by the report are: changes in land and sea use, direct misuse of species, climate change, pollution and invasive alien species (Corvalan, Hales & McMichael 2005). Architecture and the built environment may be categorised as part of the first point; changes in land and sea use.

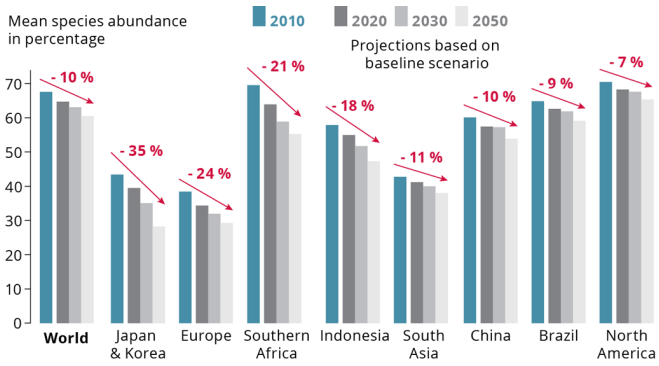


Figure.8: DECLINE IN FAUNA & FLORA GLOBALLY

This predominately occurs when a piece of land is altered and its ecosystem is stripped away, merely to support the human function of the development.

URBAN ISSUE

In our urban system, we promote issues such as sprawl, unsustainable urbanisation and decentralisation. Past policies and various economic approaches are the reason for the current state of our urban centres (Steenkamp 2004). Apartheid city planning divided the people of South Africa, by means of race and allocating areas according to race (Christopher 1999).

The previous planning (Fig. 9) of South African cities has led to urban sprawl that can now be seen happening to the east of Pretoria; developing vast tracts of land that was once agricultural or rural land into urban (Horn 2009). As the city continues to grow, certain spaces that once had functions cease to be in operation and and as a result, areas are left with half-built or abandonded structures and in decay.

These spaces have the potential to be reunited with the urban fabric and reused in a sustainable fashion; with the reintroduction of social, economic and ecological function.

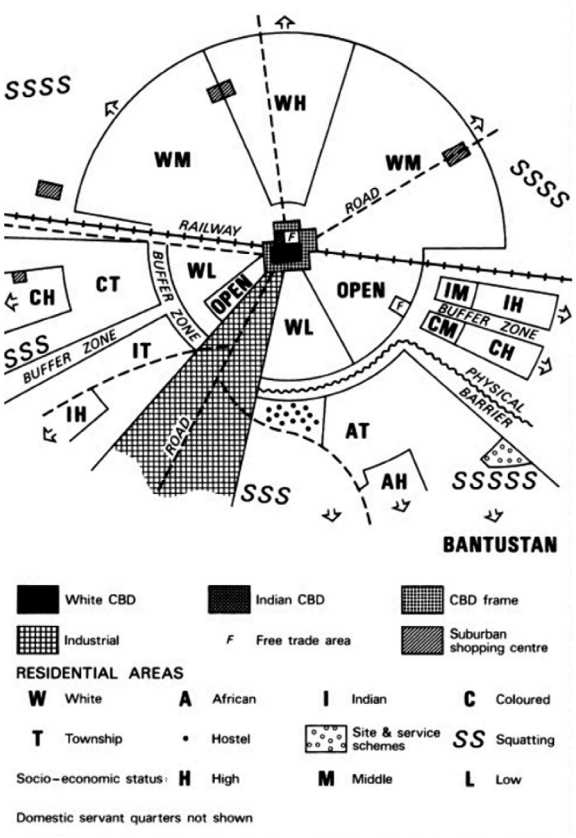


Figure.9: THE APARTHEID CITY (MAHARAJ 2019)

ARCHITECTURAL ISSUE

Within architecture the end of a structure's lifetime is rarely planned for or even thought of. All structures will inevitably need to be adjusted, retrofitted, adapted, strengthened, destroyed or dismantled. This process usually becomes a wasteful endeavour, whereas it has the potential to become a process of recycling and reuse. Designing for disassembly is a good construction practice (Rios, Chong & Grau 2015) and of paramount importance for sustainable building.

In summary; there is a global decline in the number of fauna and flora, and our current development strategies do not aid in the restoration or conservation of important green areas. By developing new areas, we are adding to the problem of habitat destruction and removal of ecosystems. A more sustainable approach needs to be taken for the development of new areas. Abandoned and neglected spaces have the opportunity to be made usable again for both human and non-human life alike.

1.7 RESEARCH QUESTION

How can an ecological system be introduced into a human system at the De Villa Bois structure through the development of an architectural intervention?

1.8 RESEARCH METHODOLOGY

The study will make use of literature, mapping/ site analysis and applied research to address the research question.

Theoretical studies related to deep ecology and the normative position were undertaken. An in-depth analysis of the larger site was conducted to gain an understanding of the area.

Analysis of the current social, economic and ecological functions were conducted and informed on the design. General climatic conditions, vegetation units, circulation, boundaries and edges were important to understand.

Data gathered, together with the influence of the normative stance and the theoretical approach informed decisions surrounding the programmatic response ,general design and pragmatic direction.

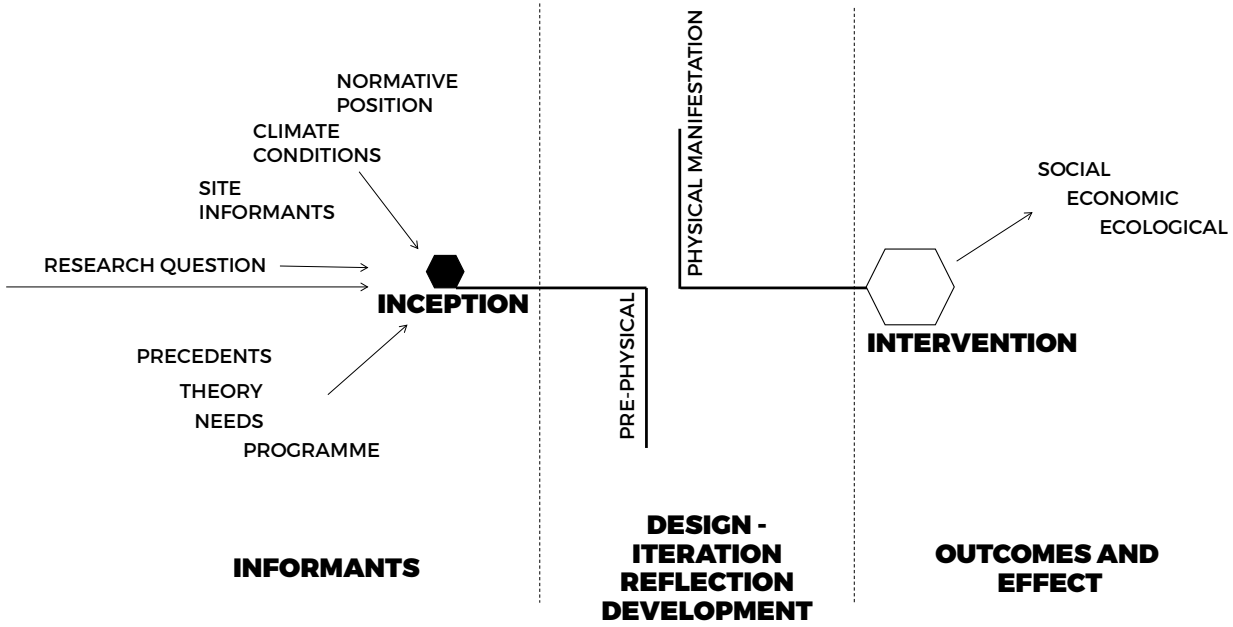


Figure.10: PROCESS

1.9 SITE LOCATION

Figure.11: SOUTH AFRICA

Figure.12: GAUTENG

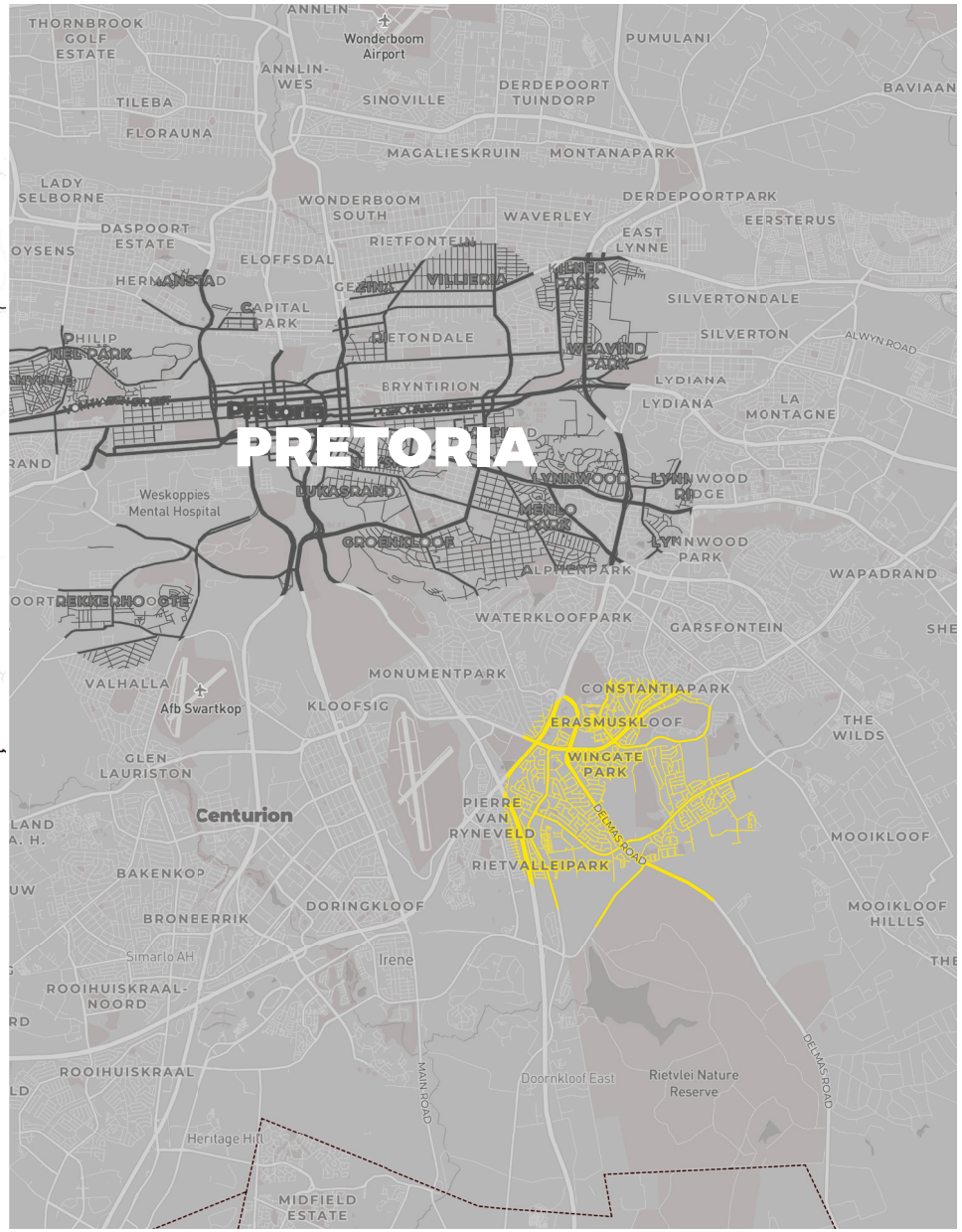


Figure.13: SOUTH EAST PRETORIA (AUTHOR)

1.10 SITE INFO

SOUTH EAST PRETORIA

CLIMATE:

Mean max and min Temperature: Mean Max and Min: 31˚C & -1˚C.

Rainfall: 650mm per annum. Summer thunderstorms brings rain and hail.

VEGETATION UNIT(s)

Gauteng Shale Mountain Bushveld & Rand Highveld Grassland (Mucina and Rutherford 2006). Provides an indication of the general taxa in the area.

GEOLOGY AND SOIL

Shale with quartzite ridge.

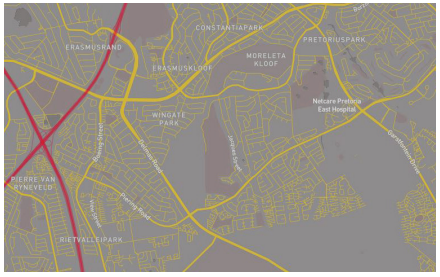


Figure.14:ROAD NETWORK (AUTHOR 2021)

Figure.15: EDUCATION (AUTHOR 2021)

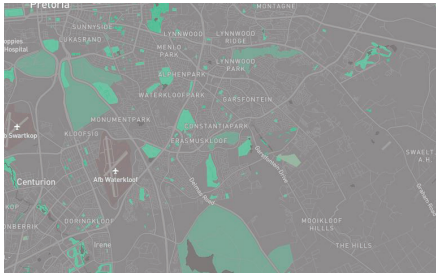


Figure.16: OPEN GREEN SPACE (AUTHOR

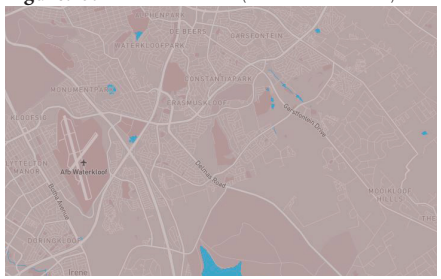


Figure.17: HYDROLOGY (AUTHOR 2021)

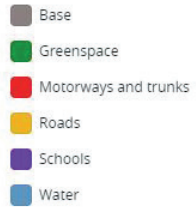
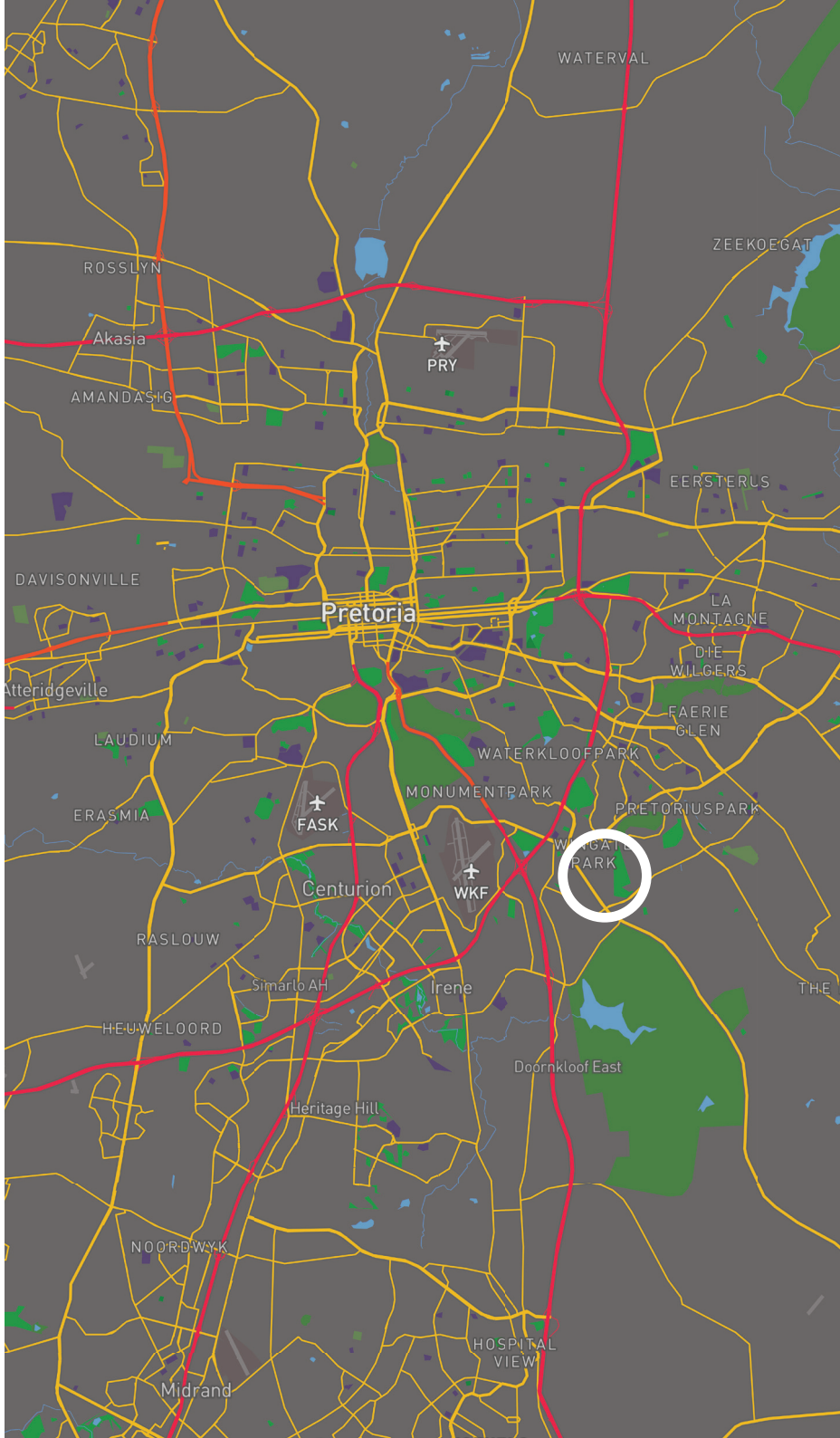


Figure.18:LARGER ANALYSIS



1.11 SITE

The site: De Villa Bois (or the Villa) is a 65% incomplete structure that would have been a GBSCA Greenstar rated mall in the South-East of Pretoria (marked yellow in Fig 19) located in the periphery of the city. It was planned to achieve a 4-star rating. It has been abandoned from 2010 and it is currently inhabited by the contractors GD Irons. The construction of the building halted due an alleged finding by the South African Reserve bank that the investor group is in contravention with regards to the bank act. This is still an ongoing dispute.

As a result, the company has been liquidated and placed under business rescue. Various shareholders, mostly pensioners, lost all of their investments with no guarantee of receiving anything back. Because of this, the structure has become an eyesore to the community and has a general bad reputation, with no change in sight, it has become known as the Sharemax Tombstone.

It is located in the Wingate Park area (Fig. 13) and shares a larger site with (Fig. 19): The Garstkloof nature area (Fig. 22), which the public does not have access to.

Located in a threatened ecosystem (Witwatersberg Pretoria Mountain bushveld) the nature area is home to some red list species of flora and is in good condition and has a high conservation potential. The Garstkloof Landfill (Fig. 20 & 21), is a landfill that has been discontinued and rehabilitated to an impressive state, except for a few invasive species and some rubble that still remains.

The site as a whole has the potential to become a healthy ecosystem, filled with activity for use by humans and non-humans alike, linking it with the Deep Ecological platform (Naess & Sessions 1985).

Furthermore, the larger site has the opportunity to be connected into the larger open green space within this area of the city. This forms part of the The Gauteng Conservation Plan that identifies a set of areas that are required to achieve certain conservation targets (Pfab et al. 2017). It becomes a corridor through which the natural spaces are connected in a strategy knowns as Island Biogeography (which will be elaborated upon in the next chapter).

1.12 SITE INFO - GARSTKLOOF

GARSTKLOOF NATURE AREA

·30HA 'IRREPLACEABLE AREA'

·Not open to the public

·Located in a threatened ecosystems (Witwatersberg Pretoria mountain bushveld)

·Supports red data plants with critically endangered status

·Only entrance at Selmy street

·High conservation potential

GARSTKLOOF LANDFILL SITE

·Currently in the process of being rehabilitated

·Used as a recycling centre

·Possible security risk

·More information needed

·Class 4 ridge

·Invasive species

·Low conservation potential

DE VILLA BOIS TOMBSTONE

·Incomplete structure

·Remnant of a failed investment group

·Currently occupied by GDIrons (contractors)

·Eyesore for community

Figure.19: GARSTKLOOF PARTS EDITED FROM GOOGLE EARTH (AUTHOR 2021)

REHABILITATED GARSTKLOOF LANDFILL

Figure.20: REHABILITATED GARSTKLOOF LANDIFLL (AUTHOR 2021)

GARSTKLOOF NATURE AREA

Figure.22: GARSTKLOOF NATURE AREA (AUTHOR 2021)

REHABILITATED GARSTKLOOF LANDFILL

Figure.21: REHABILITATED GARSTKLOOF LANDIFLL (AUTHOR 2021)

1.13 DE VILLA BOIS

The massive abandoned building is found at the corner of Delmas road and De Villa Bois Marueil drive. Its incomplete column, beam and slab structure decaying in the sun and wind with exposed re-bar and crumbling slabs clear to see in certain areas. There was only primary structural elements erected in the structure, which is not fully completed, no shop fronts or railing were installed.

Total gross floor area in completion: 129,056m²

Various equipment and materials remain on site, some of which were never removed or built. De-constructed cranes stand idle at the back of the structure, unable to complete their task. Massive steel staircase stand outside the structure on the southern side, with no handrails, some treads removed and risers over 300mm, it becomes a frightful experience.

The Southern edge of the structure on De Ville Bois Mareuil street becomes somewhat of a taxi stop, with it transporting people from the local business and residential areas.

A drainage line exists on the eastern boundary of the site, running parallel to Delmas road.

The structure has a few typology of space. Divided into parking area, commercial shop areas and larger open space area which I assume would have become food courts or similar spaces.

Circulation “shafts” exist in the structure to accommodate escalators. Elevators shaft are still evident in some area, some of which can be reused.

The structure impressive as it is, stands mostly empty, some invasive vegetation started propagating in areas where there was a little soil. This gave the entire building a feeling of a ruin, one that is only +-10 years old.

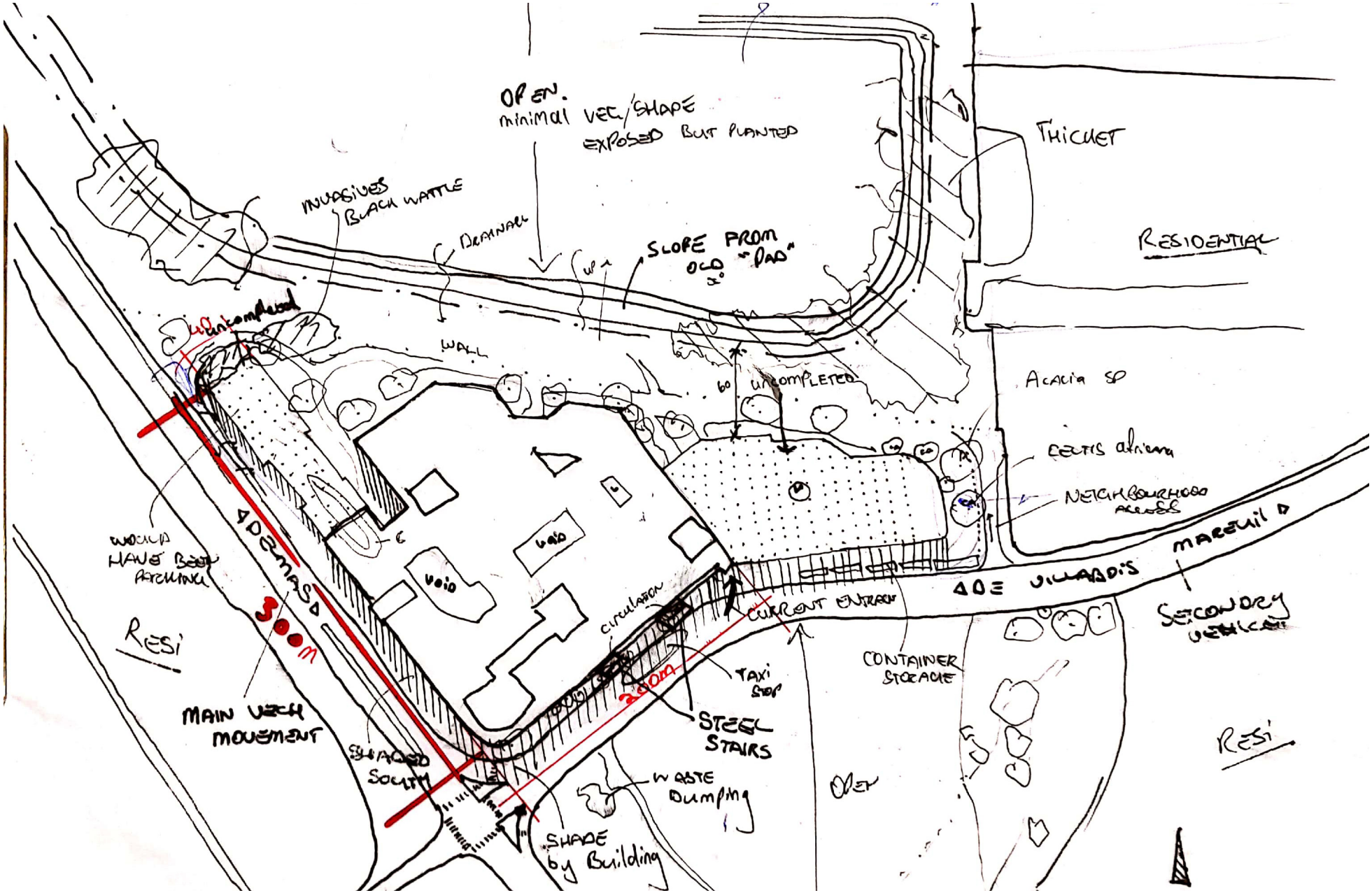


Figure.23: SITE - DE VILLA BOIS (AUTHOR 2021)

1.14 EDGE

Figure 24-28

The Southern edge mostly verges on De Villebois Marueil Drive with a small part of its eastern side verging on a residential estate on Benfleur street.

The building is stepped back from the street edge, with a buffer of about 10-15m.

The North edge runs along a sloped area that was the what once was area for the contractors machinery and equipment (site yard), but has now become overgrown with vegetation ,mostly invasive. A wall with a fence separates these spaces and there is major potential for conservation/ rehabilitation of this area.

The adjacent landfill was rehabilitated to an impressive degree, with most remnants of its prior use seemingly removed (except for larger elements). It too has potential to be connected to the larger combination of green space within the area.

All edges have the opportunity to be improved and adjusted. This is specifically important for the ecological system on the adjacent sites, to allow for the movement and spread of the species across the larger Garstkloof site.

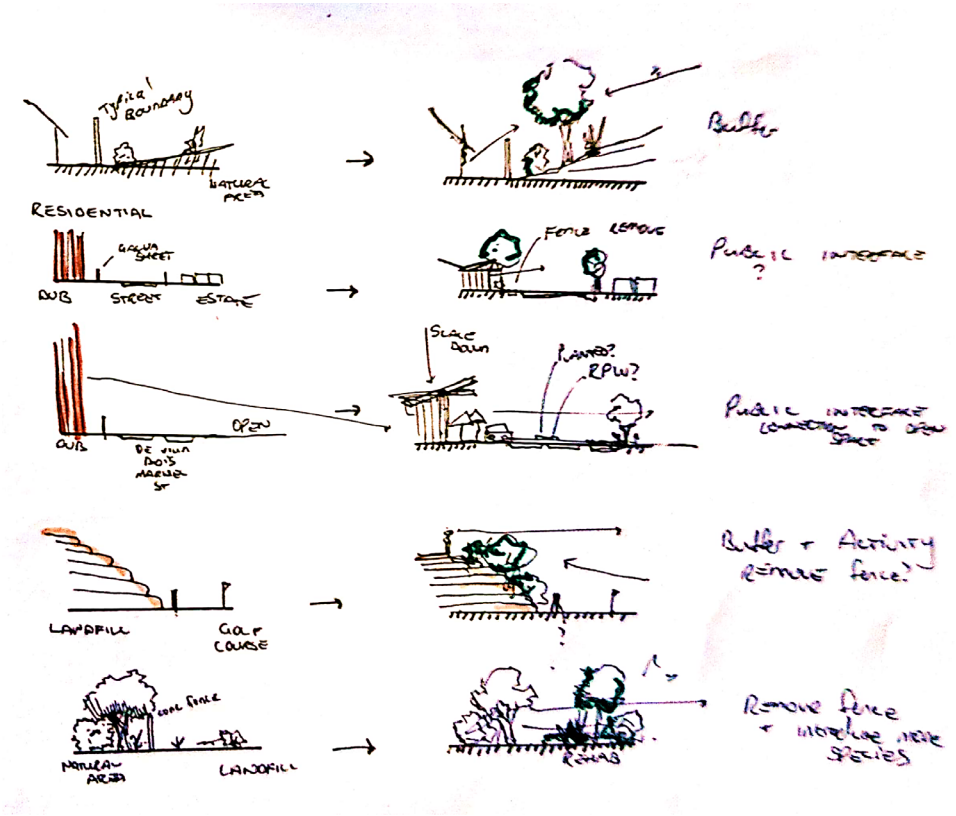
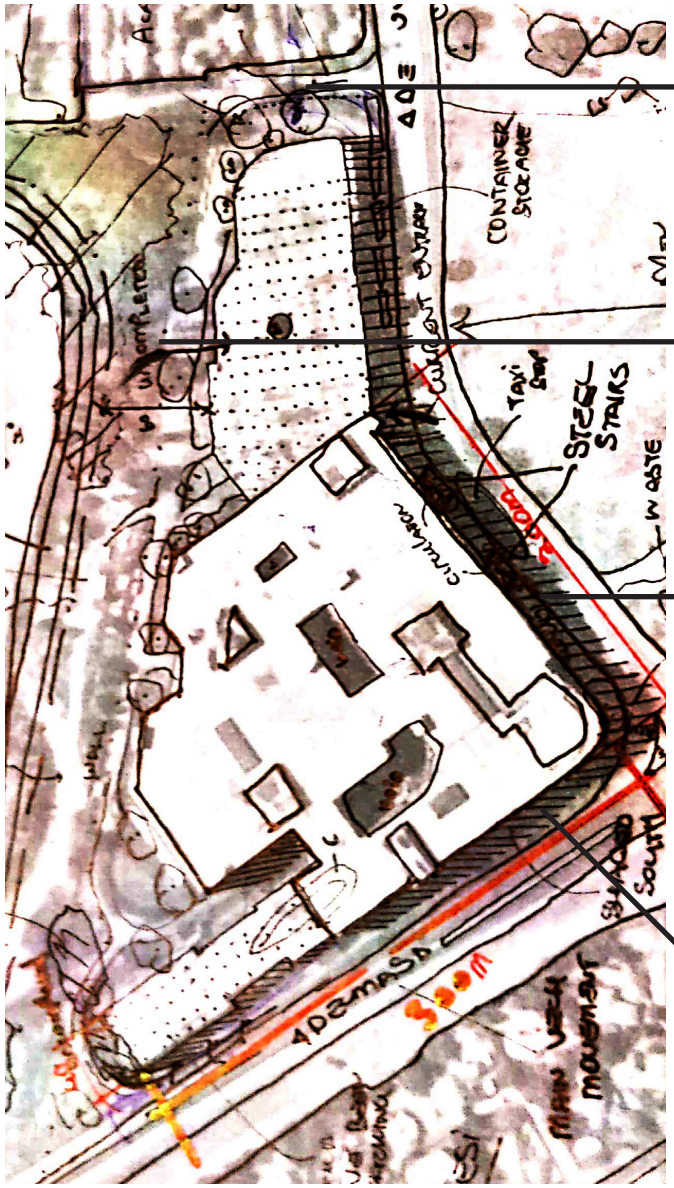


Figure.24: EDGES & APPROACHES



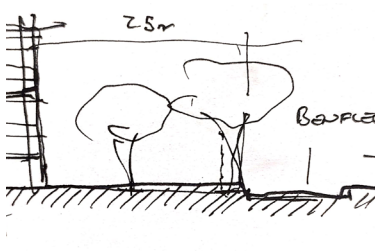


Figure.25: DE VILLA BOIS EAST EDGE (AUTHOR 2021)

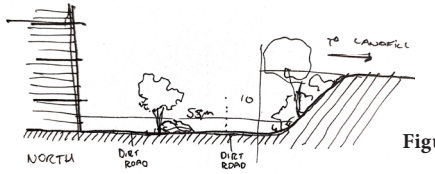


Figure.26: DE VILLA BOIS NORTH EDGE (AUTHOR 2021)

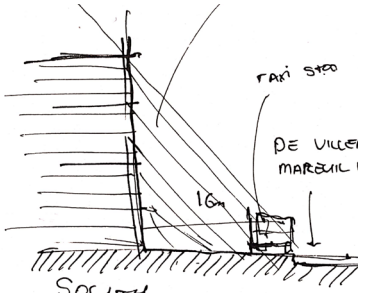


Figure.27: DE VILLA BOIS SOUTH EDGE (AUTHOR 2021)

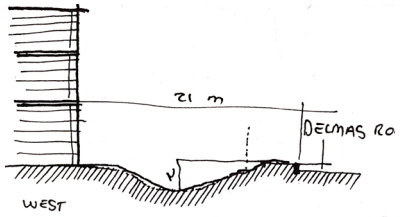


Figure.28: DE VILLA BOIS EAST EDGE (AUTHOR 2021)

Figure.29: DE VILLA BOIS FROM GARSTKLOOF LANDFILL (AUTHOR 2021)

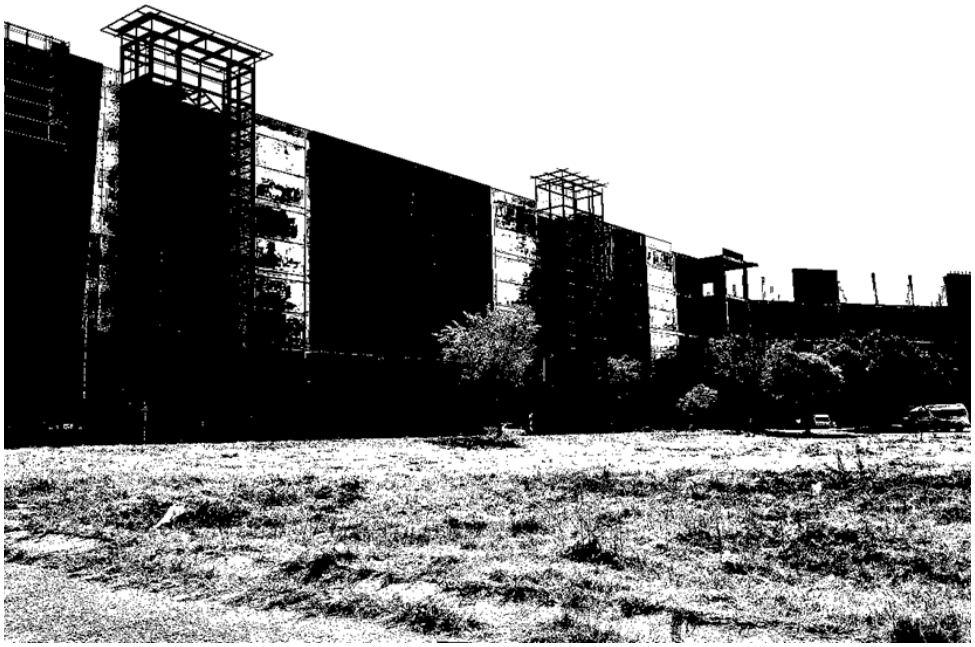


Figure.30: STEEL STAIRS SOUTHERN FACADE (AUTHOR 2021)

Figure.32: CORNER OF DELMAS AND DE VILLA BOIS MAREUIL DRIVE (AUTHOR 2021)

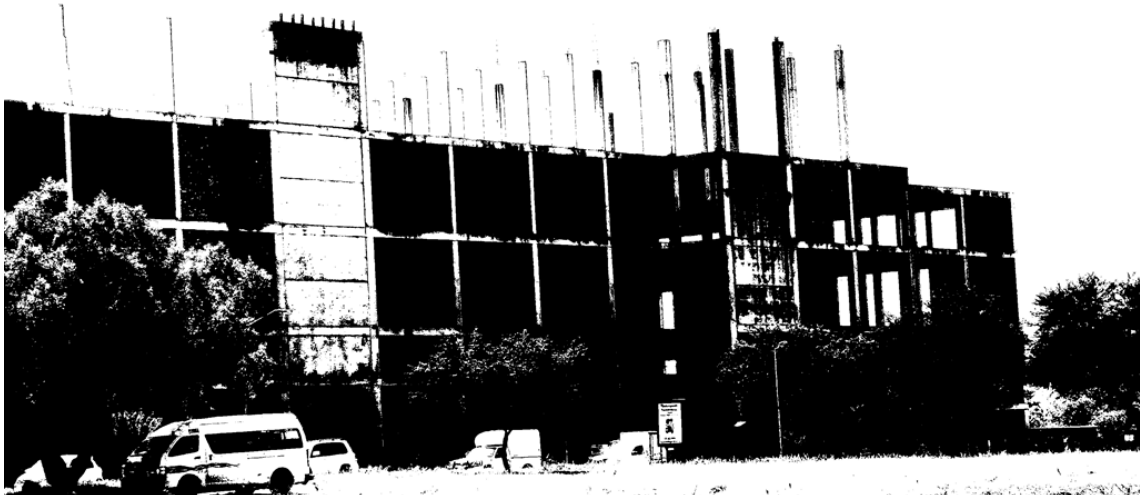


Figure.31: UNFINISHED COLUMNS AND REBAR (AUTHOR 2021)

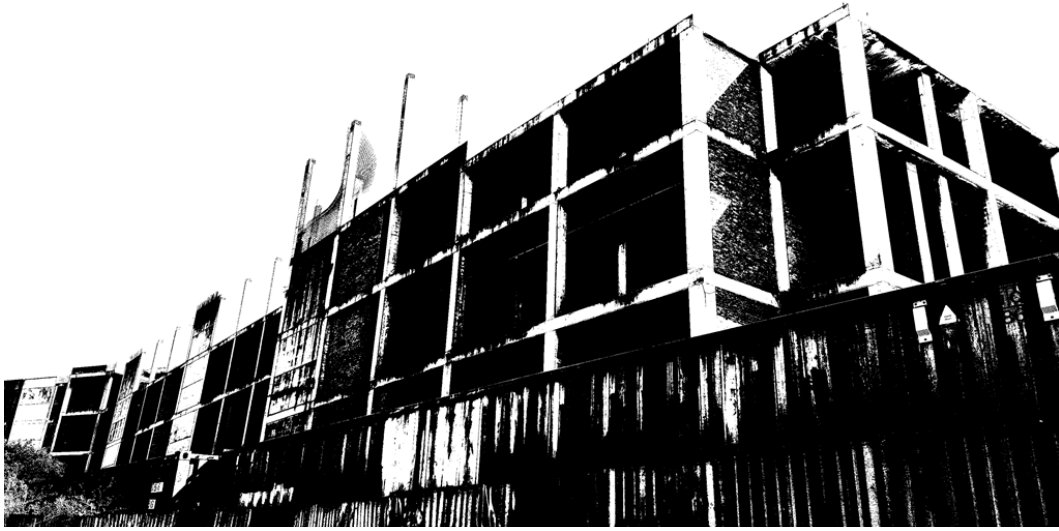


Figure.33: EASTERN CORNER (AUTHOR 2021)

1.15 POSTULATION OF PROGRAMME

From the normative position, the Nested Model (Giddings, Hopwood and O'Brien 2002), it is imperative that social, economic and ecological function be introduced, restored and/or regenerated on site. A Deep Ecology stance will be taken and will inform all of the decisions made for the site. This ecocentric approach will guide the design towards a symbiotic approach where the human system and ecosystem co-exist in a symbiotic relationship.

The current site approach requires the introduction of a system which generates activity for the reuse of the landfill, keeping in line with the theoretical approach of Deep Ecology. Deep Ecology linked with the term "friluftsliv" (meaning: "outdoor life") highlighted the importance of outdoor activity both as an unprompted way of being at home in the world, and also as a way to improve human education and socialisation (Brennan 2013).

This requires the further rehabilitation of the landfill; removal of invasive species and the introduction of local fauna and flora through habitat creation.

From the site analysis and larger analysis, it is clear that there is a general lack of cultural spaces and civic activity within, not only this area, but the larger Pretoria-East.

There is an opportunity in developing a civic precinct through the reuse of the De Villa Bois structure by dismantling or partly dismantling the building.

The programme will then become culturally informed by introducing functions like: a data centre that houses and shares various types of knowledge in various forms, complete with study areas, meeting spaces and online learning. A theatre & art gallery, allowing for exhibitions by various types of artists. The structure will have various temporal spaces for pop up art galleries and perhaps even workshop space for artists and the community.

Together with the introduced civic functions an rehabilitation function and urban agricultural wing can be introduced to make the site "productive"

All of this will be developed within a theoretical approach as the premise for decision making. Creating a narrative where the human and natural world lives within symbiosis on the site and surrounds.

1.16 CONCLUSION

In conclusion, the problems are clear. Species decline globally are caused by human factors. A drastic change in thinking is required. Where humans see ourselves as part of the natural world, rather than above it.

The structure and larger site has opportunity to become a prototype that improves upon the ecological function of the site and further allows for the reuse of the structure by humans, through social and economic means. In following the Deep Ecology platform (Naess & Sessions 1985), there is clear way of approaching the design and development of the structure.

The next chapter will address research into design. Where our relationship with the natural world will be investigated and a reconnection will be proposed, through the development of the De Villa Bois structure.

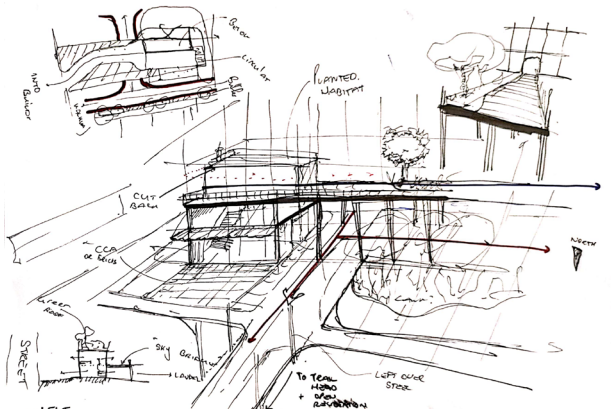


Figure.34: ACTIVITY FACILITATOR (AUTHOR 2021)

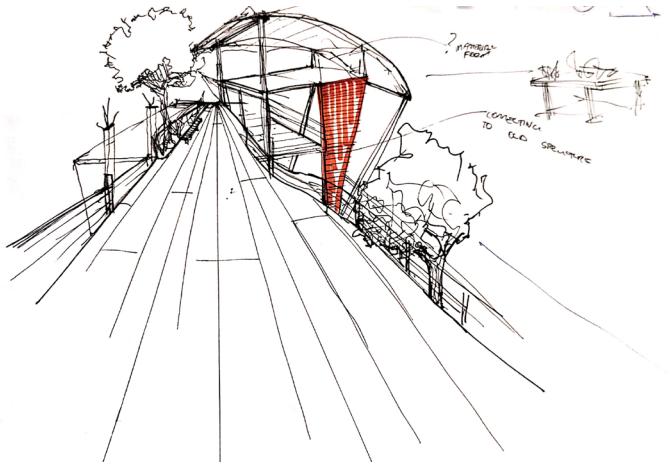


Figure.35: FLYOVER (AUTHOR 2021)

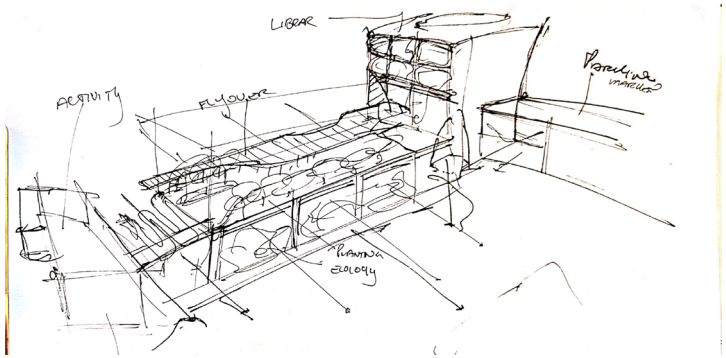
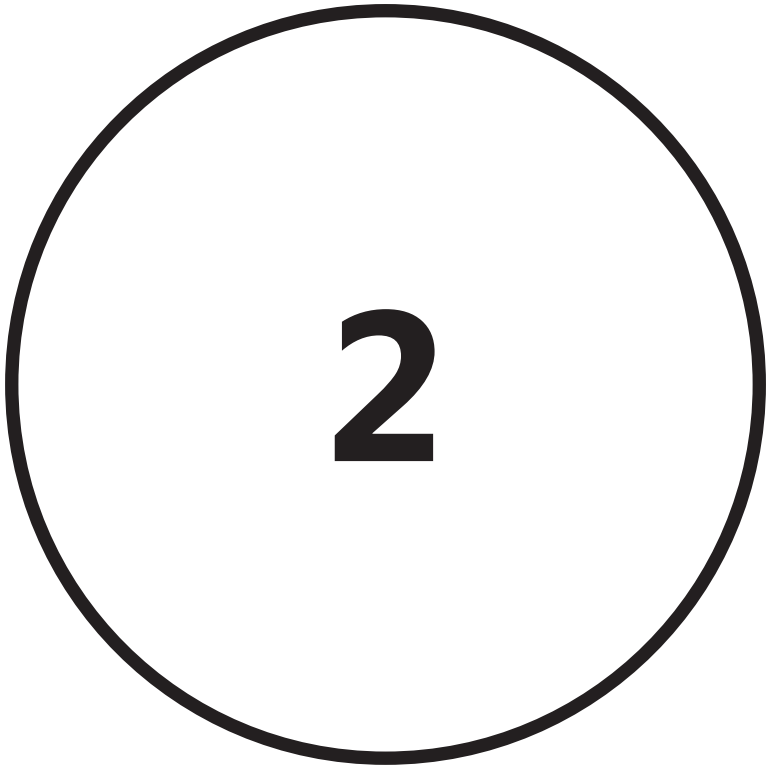


Figure.36: DATA CENTRE (AUTHOR 2021)



DESIGN RESEARCH

THEORETICAL BACKGROUND TO CONCEPTUAL APPROACH

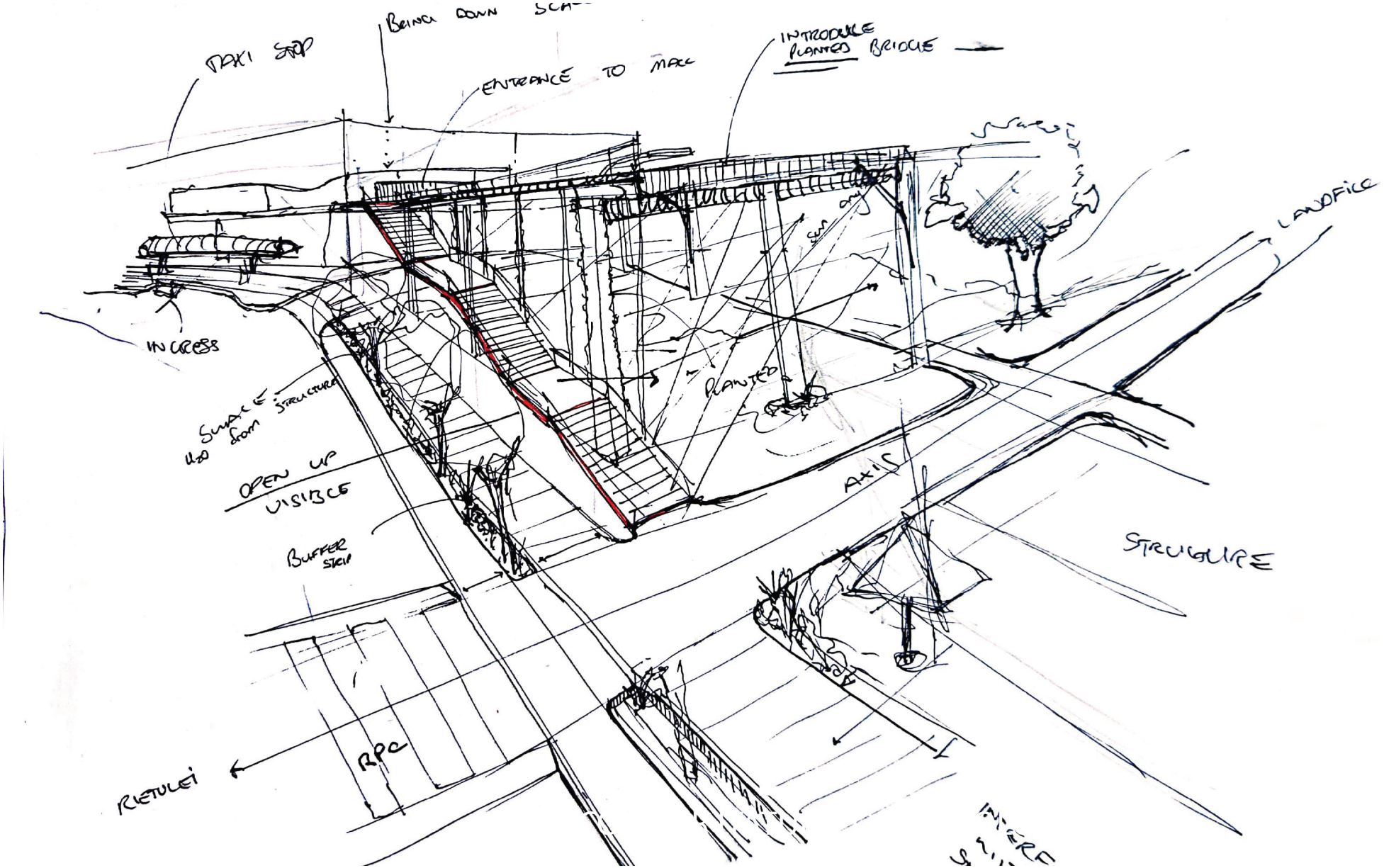


Figure.37: FLYOVER CONCEPTUAL SKETCH (AUTHOR 2021)

2.1 INTRODUCTION

The concept of reconnecting humans with the natural world is not a new idea. Throughout history humans have sought to create this connection, in some of the cases it might not have been directly planned for. For instance, in Egypt the Nile flooded its banks and humans took advantage of this to produce better agriculture. In the modern day the focus falls more on conservation of existing natural systems rather than restoration of ecosystems (Urbanska 2000). It is much easier to safeguard the natural areas you have, than to create new ones, but by doing so there will be a slow decline in natural spaces.

The built environment needs to accommodate ecosystems if we are to protect and conserve this natural resource. These two systems working together in a symbiotic relationship can be how ecosystems are reintroduced into the urban fabric, in an eco-centric approach towards design and development The question is then: can an ecosystem be introduced to a complex human system (building) and still allow the ecosystem to flourish and the building to complete its function?

2.2 HUMANS & NATURE

History has shown that since the beginning of mankind, humans have had a profound relationship with nature. Starting out as primitive nomadic hunter-gathers, which lived by foraging the needed resources from the natural world (Ember 2020). Populations were small and compact, requiring only a small amount of resource to sustain these groups. A drastic change came about when humans developed into an agricultural species, historians note this as the true dawn of Civilisation. Settlements and cities were born out of the domestication of plants and animals (Milner 2019), from there the human race evolved to have massive centres of settlement. These settlement and cities include those found in Mesopotamia of 7500BCE, Alexandria in the Hellenistic era 323BC, ancient Rome 476AD and Constantinople 1453 AD. Jumping into more recent time sees us within the industrial revolution which came with an increased in the living standards of most of today's modern humans (Mailler 2021). Human population and our cities have grown considerably, in 2016 54% of human population lived in urban areas and this number is expected to increase (Ritchie and Roser 2019) (Fig. 38)) but at what cost to the environment do these developments remain ?

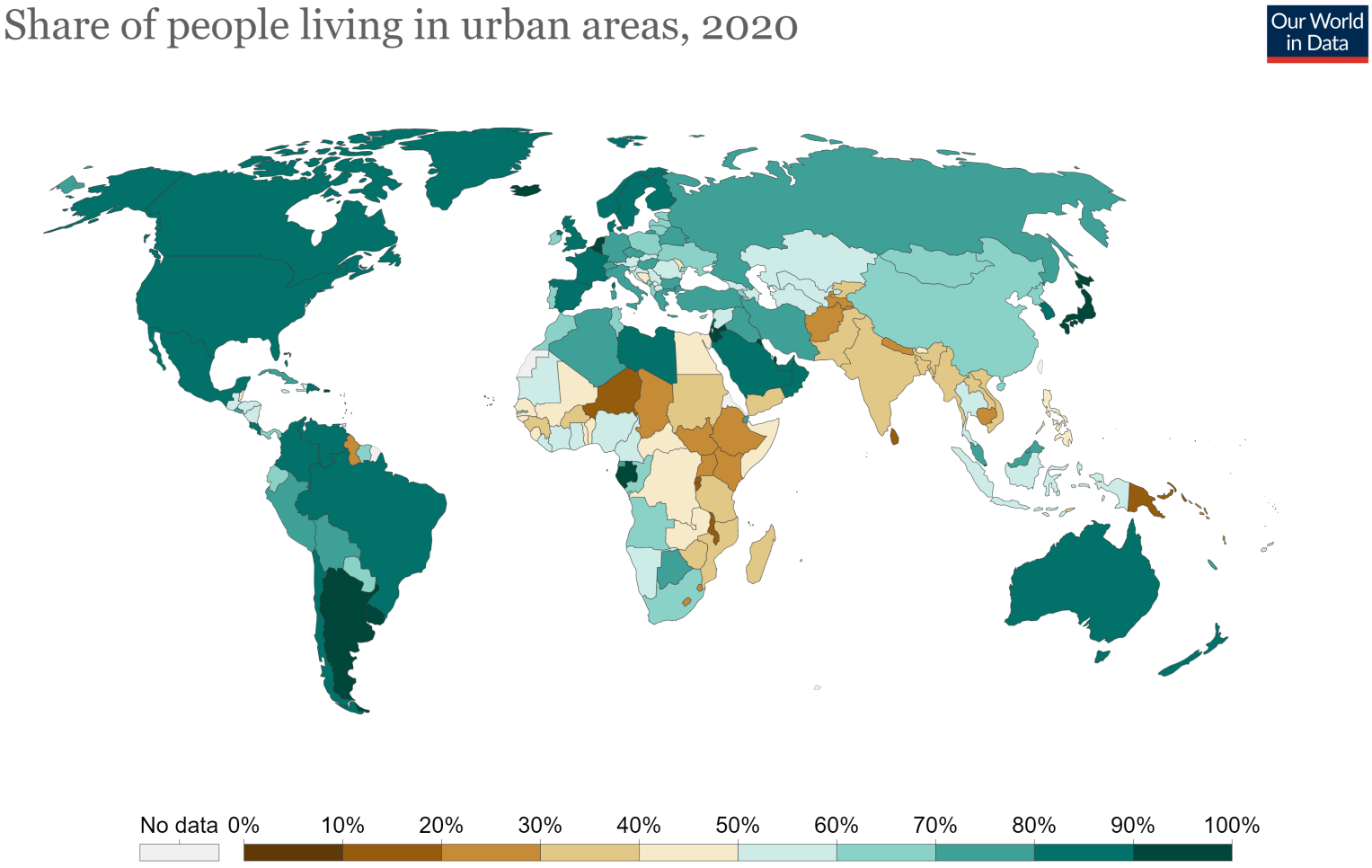


Figure.38: HUMAN POPULATION IN URBAN AREAS 2020

2.3 IMPACT OF THE INDUSTRIAL REVOLUTION ON THE ENVIRONMENT

With Human ingenuity came ecological destruction. Since the industrial revolution there has been a clear move away from sustainable development (Moghadam 2015) with the idea of bigger is better and an addiction to more, placing enormous strain on the environment (Patnaik 2018). Industrial activities from within this time period have affected the Earth's climate and environment in various aspects extending from a regional scale to a global scale, ranging from soil pollution, drastic changes in land use and vegetation across the last century (Mackereth 1966, Bradbury & van Metre 1997, Kim & Rejmánková 2001) .

In our modern sprawling mega-cities ecological systems barely exist apart from the introduced exotic street trees and areas of land we identified to protect. Our neighbourhoods, places that once were open veld, thriving with indigenous wildlife and floral species, now contain a fraction of the indigenous floral biomass and even less of the general fauna (reduced to mostly birds, or at least this is what the research is dominated by) that once dwelled here (Reichard and White 2001).

Modern cities have been shaped by a worldview in which the natural world is seen as disconnected from human beings and their habitat and rather seen as an element to be controlled (Peres, Barker & du Plessis 2015:1).

Previous urban planning led to the draconian ideas of building and developing open green spaces with no regard to ecological spaces, rather than the redeveloping of the existing urban fabric (Bor 1972:218).

"Instead of having to insert slowly and often painfully piece by piece new structure and roads into an existing urban fabric, we can build large areas comprehensively with all the necessary roads, buildings and open spaces within any major physical, social or economic disruption" - (Bor 1972:218)

Urban planning has come a long way since ideas such as this but ecological design within urban areas still lack in truly incorporating ecology into our developed centres. Changing how we approach projects is necessary if meaningful change is to be made.

2.4 THE DISCONNECT FROM NATURE

Society as we know it has gone through a separation period from nature, ranging from the non-use of natural reference in educative books for children, fiction writing, songs, poetry and film since the 1950s, with an increase in the number of terms used for human-made object (Kesebir & Kesebir et al 2017), to the ways our cities and neighbourhoods were/are designed (Bor 1972:218).

The disconnect has reason to cause concern, with studies showing what benefit natural green spaces have on human mental and physical well-being (Grima et al. 2020, Hes & Du Plessis 2014).

To reiterate, with the current misuse of resources and the destruction of natural systems, there has been a clear decline in the number of fauna and flora globally (Stokstad 2019). This has been caused by human factors (Corvalan, Hales & McMichael 2005).

This separation is problematic and a reconnect is of paramount importance, not only so that our species can have some sort of response to the current state of environmental degradation, but also for restoring human psychological and physical wellbeing (Hes & Du Plessis 2014:45).

Figure.39: DE VILLA BOIS EXPOSED REBAR AND INCOMPLETE COLUMNS (AUTHOR 2021)

2.5 PARADIGM SHIFT

A paradigm shift is required if we as humans are to live within this world, in harmony, and part of the natural cycle.

Returning to the image of the primitive hut by Laugier (Fig. 40). This figure, in a way points to a return to the natural world and the moving away from ornament and the "status quo" of the time, using architecture as the mediator between man and nature. In the same breath modern day humans should critically analyse our current situation and understand that a new approach (not only within the built environment but all walks of life) is required.

The Deep ecological platform from Arne Naess and George Session (1985) becomes a foundational idea from which this paradigm shift can be approached, various other facets form part of this approach, such as work from: The biophilia Hypothesis (Kellert 2005), Island Biogeography (Davis & Glick 1978), New Sustainability (Gibbons 2020) and the works of van der Ryn & Cowan (2007).

Figure.40: LAUGIERS PRIMITVE HUT (LAUGIER 1753)

2.6 THE APPROACH -THE ECOLOGICAL PARADIGM

The approach should then be: an interconnected movement where humans are seen as a part of the natural world, and therefore human needs and ecological needs are one and the same. Using the Deep ecological platform (Naess & Sessions 1985) as the foundational theory, various ideas can be added to it. Sustainability is not a singular approach but rather a network or system of approaches (Fig. 41).

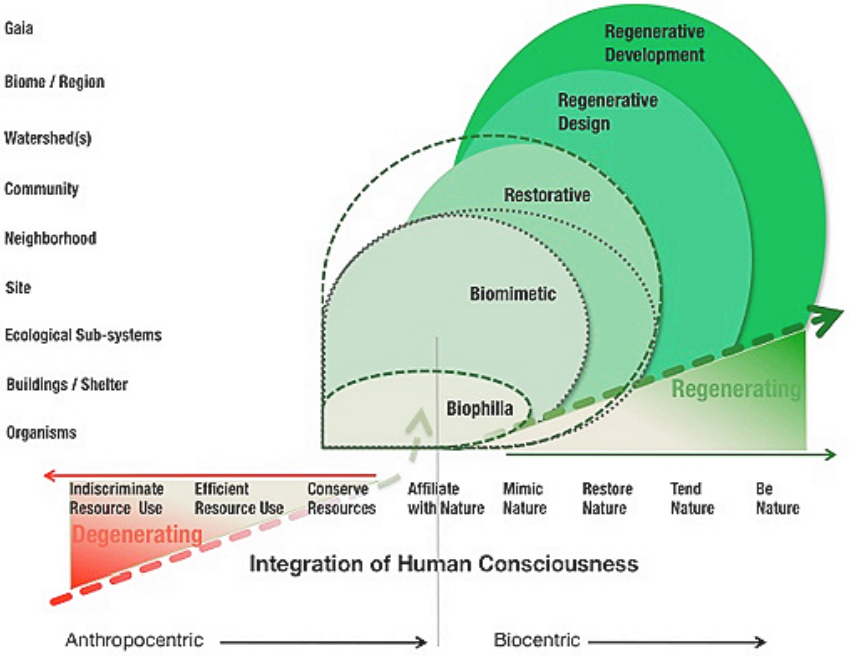


Figure.41: DE-GENERATIVE TO REGENERATIVE (Mang & Reed 2012).

Various strategies surrounding ecological sustainability were developed in the late 1990s, ordered around various theoretical and scientific ideas surrounding ideas of ecology (Mang & Reed 2012).

These differ in general scope but are all planned to have a net-positive impact. Moving away from a degenerative approach to a regenerative approach by integrating and adapting human consciousness or paradigm.

2.7 REGENERATIVE SUSTAINABILITY

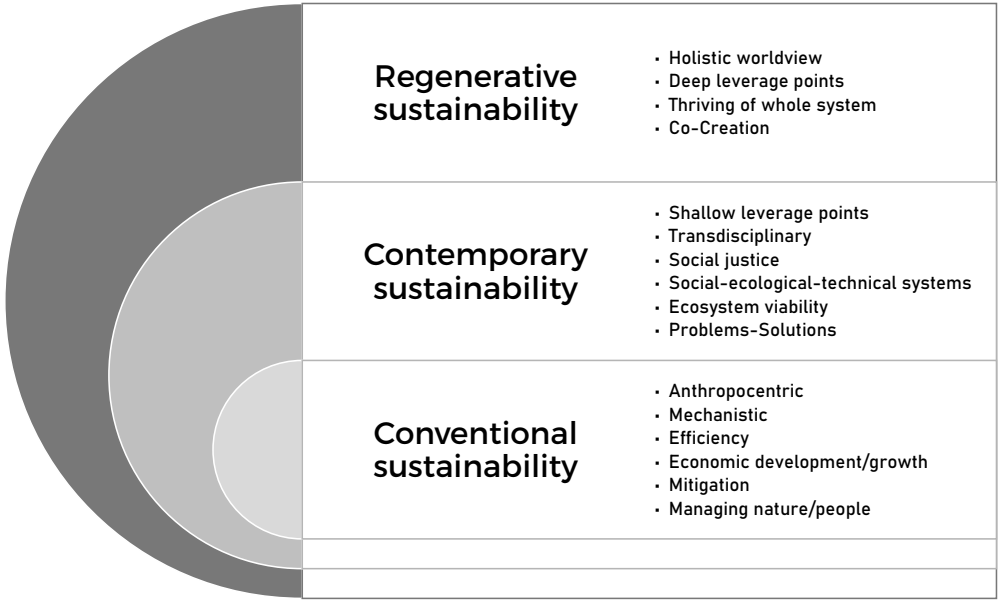
Regenerative sustainability is the new wave in the larger movement of sustainability. It represents a large shift in wordview an much like Deep Ecology sees humans and the rest of life as a holistic system (Gibbons 2020).

This movement is a radical change from our current thinking and would require major transformation for it to truly be effective but it is a goal to work towards.

The nature of these changes include to transcend our current approaches of contemporary

sustainability (Fig. 42), which focuses on symptoms of problems rather than the roots of unsuitability, or a "shallow leverage" (du Plessis 2012).

Regenerative sustainability adopts a holistic worldview which gives humans the ability to integrate and transform our current paradigm (Gibbons 2020). By causing changes within our current paradigm it leads to transformation within the deepest leverage point of systems (Meadows 1999) and this change is ultimately necessary for sustainability (Hes & Du Plessis 2014).



2.8 THE BIOPHILIA HYPOTHESIS

The Biophilia Hypothesis assert that human happiness and a fulfilling existence is inherently dependant on our relationship with the natural world, it further argues that the natural world is as essential to mankind's history as our social behaviour is in a term Edward O. Wilson termed; biophilia (1993). Stephen Kellert developed the term The Biophilia hypothesis with Wilson, which states that; during the development of our species, we have adapted to use the natural world to aid us in evolution. This created a need for us to be closely connected with the natural world and other living things (Kellert 2005). Wilson (1993) further elaborates that our brains developed before cities existed and therefore this connection is still relevant to humans.

"As such, social scientists should be concerned about what will happen to the human psyche when such a deep defining part of human evolutionary experience is diminished or erased" - (Gullone 2000:293)

This approach is appropriate because it provides an informant that is interconnected with the way humans have evolved within the natural world.

Figure.42: REGENERATIVE SUSTAINABILITY ADAPTED FROM (Gibbons 2020) BY AUTHOR 2021

Furthermore, It states why the reconnection between the inside and the outside of human life (and space) is of paramount importance to our mental and physical well-being (Hes & Du Plessis 2014:46).

This becomes an effective departure point that can be utilised and use as an approach to reconnect humans with nature. This approach proposes more than only placing natural elements within spaces designed for people but also includes not as obvious ways of exposure to these elements, such as dappled shade from structure (Hes & Du Plessis 2014:47).

In Designing for Hope, Dominique Hes & Chrisna Du Plessis (2014) unpack Kellert's work of Biophilic design and its six dimensions:

1. Environmental features.
2. Natural shapes and forms.
3. Natural patterns and processes.
4. Light and space.
5. Place-based relationships.
6. Evolved human nature relationship.

These six dimensions give insight into how different aspects of the Biophilia hypothesis can be used to inform design.

2.9 MAKE NATURE VISIBLE

Adding to these biophilic aspects, in Ecological design by Sim van der Ryn and Stuart Cohan (2007) the authors propose various principles that informs ecological design processes. One of which is by making nature visible, which is directly linked to the concepts of Biophillia.

Van der Ryn (2007). argues that we live within a de-natured world and that we have fallen into the trap of dumb design (van Der Ryn 2007). Everyday systems such as; how we receive our water, food, electricity, climate and how plants grow are hidden away in our buildings. Not allowing us to see the extent of our impact through these systems and/or learn anything from them (van der Ryn 2007). He goes on to say that it is no surprise that our buildings are teaching us only disconnect.

"De-natured environments ignore our need and our potential for learning. Making natural cycles and processes visible brings the designed environment back to life. Effective design helps inaform us of our place within nature." - (Van Der Ryn 2007:185)

Therefore, it becomes important to keep humans connected with the natural world and its cycles on a diurnal basis. This connection can be approached through the introduction of

biodiversity within a development and further, exposing these natural systems to the human occupants of such a development. By exposing natural systems to humans on a daily basis, people can reconnect with a broad range of life and natural cycles (Van der Ryn & Cowan 2007).

There should be a change to how we approach our buildings in regards to the exposure of systems. Buildings have the opportunity to be able to inform people of everyday cycles they live in (van Der Ryn 2007:187). Through allowing for natural systems within buildings, like: sunlight, natural ventilation, vegetation growth and storm water that is fed into artificial wetlands instead of storm water drains one can create an environment within a human system that exposes these systems to the public.

2.10 CONCEPTUAL APPROACH

Following on the work from the ecological paradigm, the discussed theory (the theory to still be discussed) and the normative position, a conceptual approach was developed with these as informants.

The conceptual approach calls for the symbiosis of the natural world and human beings and the co-evolution of this relationship, cementing it as part of who we are as humans. Finally, to expose this relationship between humans and the natural world through the development of an interface. A convergence area where a human system and a ecological system co-exist.

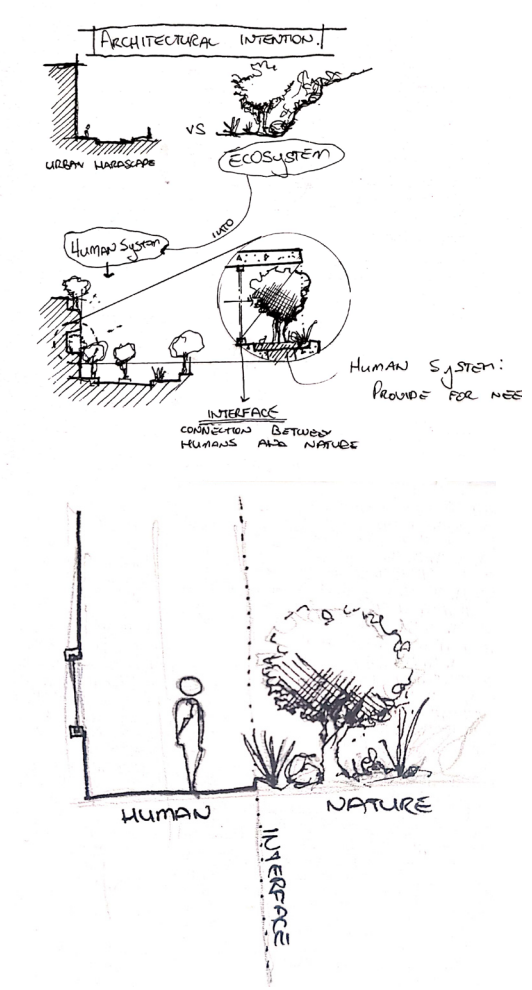


Figure.43: CONCEPTUAL APPROACH (AUTHOR 2021)

2.11 LARGER SITE APPROACH - ISLAND BIOGEOGRAPHY

Island Biogeography states that the various habitats found in urban areas should not be seen as separated entities but rather as connected, (Davis & Glick 1978). Seeing these areas as islands of green space within a larger contrasting matrix of the urban hard-scape (roads, houses, shopping malls, parks, etc). Planning for such spaces to be interconnected makes them more resilient and robust to change and further allows for more diversity in them (Handel 2017:1).

"Considering our urban habitats as islands in a sea of constructed problems may focus the protocols of urban work in a different way, from restoration work repairing or enlarging most rural habitat preserves." -(Handel 2017:2).

The development of the larger framework proposes to connect the Rietvlei Nature reserve with the Garstkloof site, Moreletaspruit and even as far as even Wolwespruit and other neighbouring open green space (Fig. 44) to create condition where all these spaces benefit.

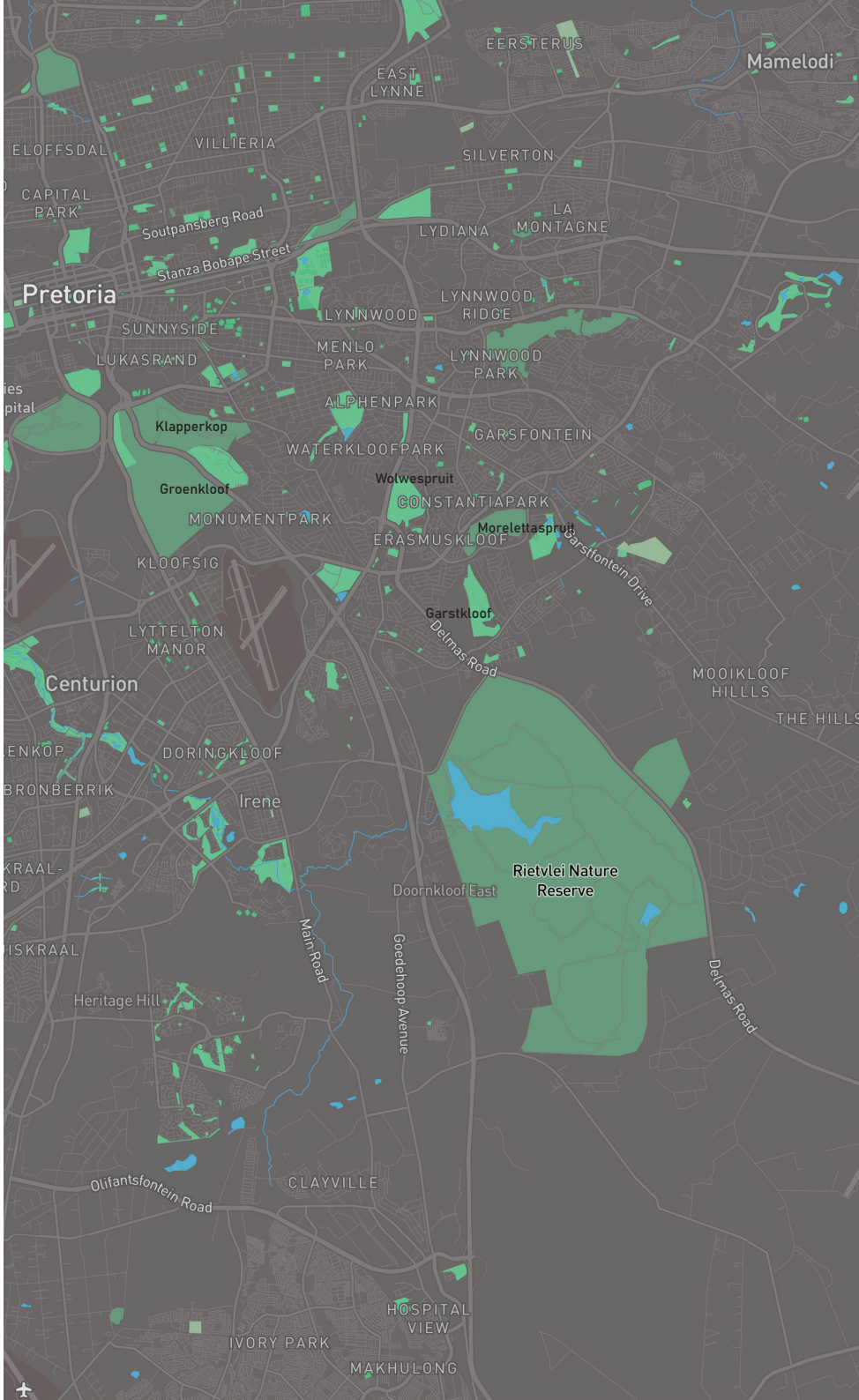


Figure.44: ISLAND BIOGEOGRAPHY PRETORIA EDITED FROM MAPBOX BY AUTHOR 2021

2.12 MASTERPLAN

The masterplan development calls for extension of the ideas surrounding island biogeography, and calls for the regeneration and improvement of the larger Garstkloof site to sustain a better ecosystem. This requires the further rehabilitation of the Garstkloof Landfill and the removal of boundaries separating it from the Garstkloof Nature area, to allow for the free movement of species between these spaces.

In doing so this will improve the adaptive capacity (Angelerand & Allen 2016) of the system and create a more diverse "island" of biodiversity. This in turn makes it more resilient and robust to change (Curtin & Parker 2014).

The De Villa Bois structure will be adapted and adjusted to allow for the use by humans and non-humans. This area will be where the largest concentration of human function that will exist on the larger Garstkloof site. The project focus falls on this area.

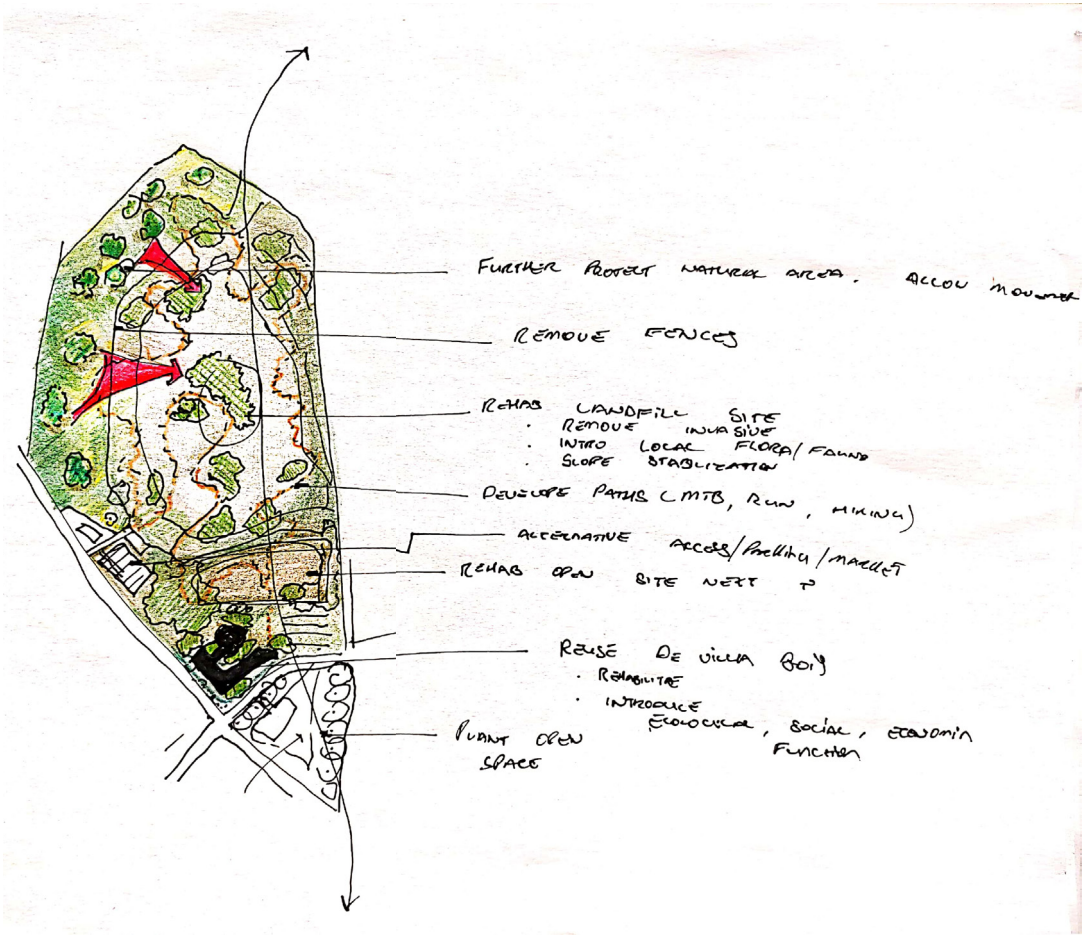


Figure.45: MASTERPLAN (AUTHOR 2021)

2.13 SITE APPROACH

Taking into account the theoretical backing, it is important to then understand the context surrounding the structure: a neglected, abandoned building, unused and left to decay. This provides an opportunity to reuse this building (Fig 46), providing space and function for both human and non-human needs, again implementing the introduction of ecological, social and economic functions. The function of the structure will then allow for this reuse whilst providing a space for a cultural and civic precinct through the rest of the structure, as a result of the larger site analysis conducted.

This programme will then include an activity facilitator for the reuse of the landfill, a main circulation route that becomes the transitions between nodes, a transport interchange, a theatre and art gallery and finally a data centre that will be housed in the western corner of the site. The data centre will not be a typical centre for masses of electronic equipment but rather a space of knowledge and data transfer through various media. The programme of this structure will attempt to incorporate the ecological principles set out by the dissertation theory of deep ecology, the normative position of the nested approach,

The Biophilia hypothesis (Wilson 1993, Kellert 2005) and exposing natural systems as explained by Sym van der Ryn and Stuart Cowan (2010). This calls for the introduction of ecological function through the De villa Bois structure.

The data centre will be unpacked in the next chapter, The programmatic intentions for the site is to become an interface for the connection between man and nature.

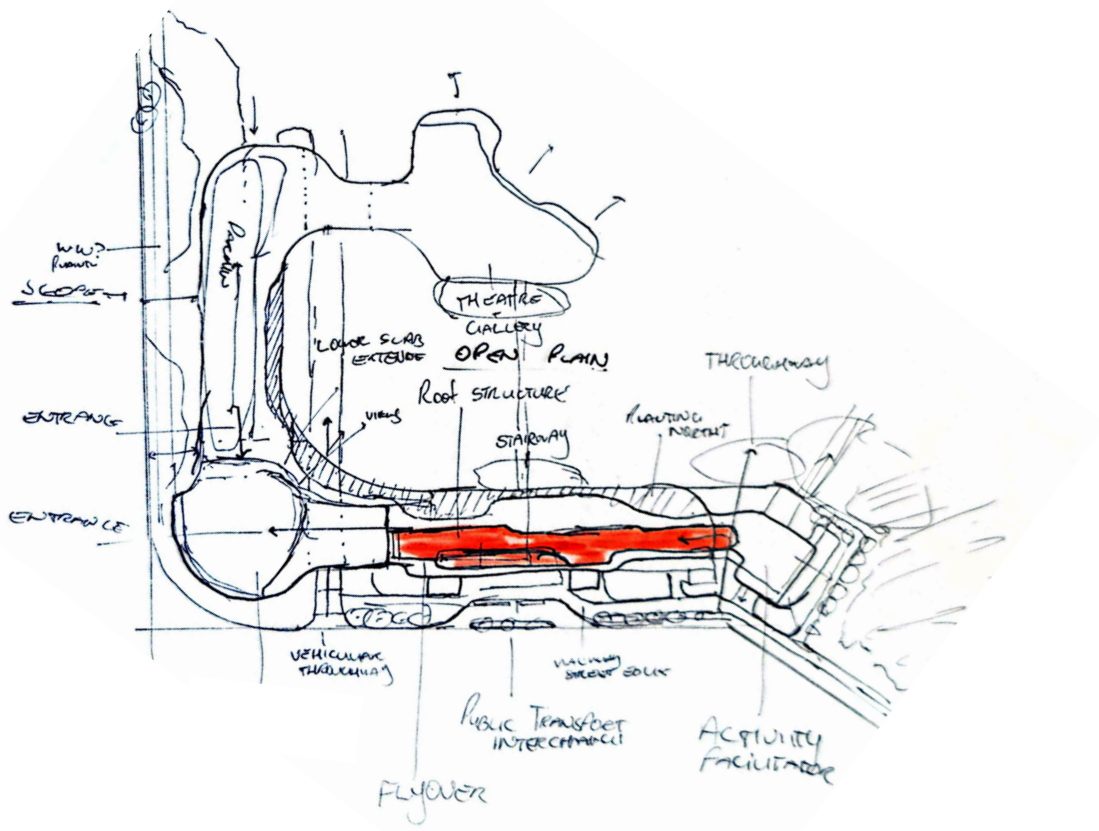


Figure.46: SITE APPROACH (AUTHOR 2021)

2.14 DECONSTRUCTION

For the introduction and rehabilitation of the Garstkloof area, a substantial decrease in size is proposed for the De Villla Bois structure to allow for the implementation of an ecological system within the building footprint. This will also affect the reputation of the structure in making it less imposing and taking away from its original form by creating something new in its place.

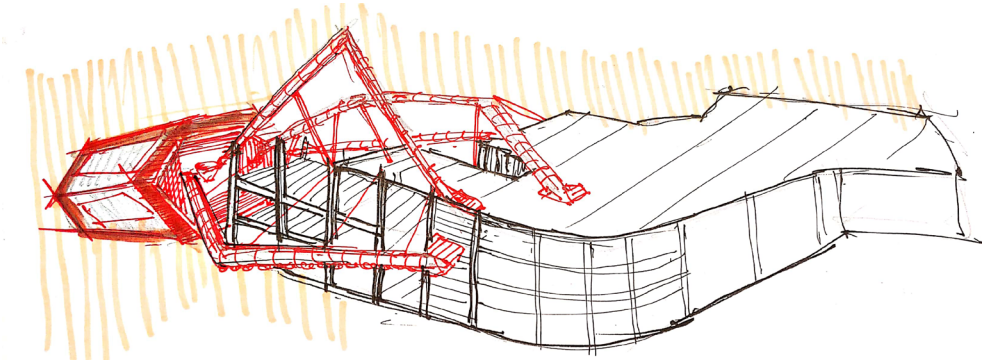


Figure.47: DECONSTRUCTION CONCEPT (AUTHOR 2021)

The decrease in size of the structure will be done by systematically removing considerable amounts of materials in the process or deconstruction (partial deconstruction).

Deconstruction is a well-defined field of engineering leaning on construction management, structural design, construction and industrial ecology (Thomsen, Schultmann & Kohler 2011). The first phase of deconstruction is the careful planning and extremely controlled deconstruction process producing various materials. The second phase is the repeated reused of de-constructed materials and components in other (or the same) building , at the highest level, to avoid "down cycling" and moving material to landfill (Thomsen, Schultmann & Kohler 2011).

This process is more sustainable and environmentally friendly (Rios, Chong & Grau 2015) than preparing the building for demolition (Thomsen, Schultmann & Kohler 2011). Retrofitting the entire structure is also detrimental in the long term as such a large building is not required and a waste of space, that will furthermore, have substantial upkeep costs.

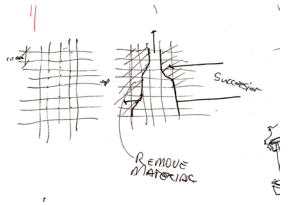


Figure.48: DECONSTRUCTION PLANNING (AUTHOR 2021)

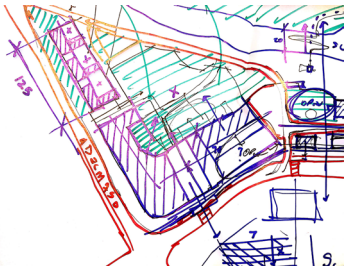


Figure.49: DECONSTRUCTION

"Initially the end of the life cycle was mainly seen as a waste (landfill) and maybe a recycling (down-cycling) problem. But 'waste' is increasingly considered as another form of resource. The 'cradle-to-cradle' perspective means the end of the life cycle is just the beginning of a new life cycle." - (Thomsen, Schultmann & Kohler 2011:328)

The most abundant material from the De Villa Bois structure is: concrete from the existing superstructure. Concrete can be reused within the "new" structure in various ways either within the new development as recycled concrete

aggregate or sold to other construction sites as building rubble in a system of resource sharing. The concrete aggregate can be used to create a plethora of items: kerbs, street furniture, pavers, walls, sculptures, planters, channels, etc.

The deconstruction approach (Fig. 50,51) leaned on keeping elements on the street edge at the corner of Delmas and De Ville Bois Mareuil somewhat intact. Material would be removed (Fig. 53) from the central areas of the structure and from upper floors. This will create large open space to the interior of the development, that can be rehabilitated and made suitable for ecological conditions

It is possible to create high quality concrete that can be used as structural element (Fig. 53) using high quality recycled concrete aggregate (Kearsley & Mostert 2011).

All measures must be taken to ensure that none of the material be taken to landfill, to avoid what occurred on the neighbouring landfill site.

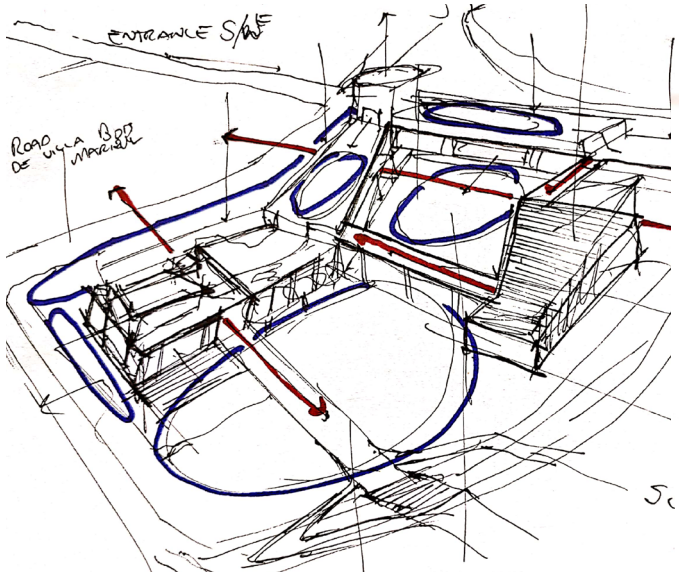


Figure.50: DECONSTRUCTION CONCEPTUAL APPROACH (AUTHOR 2021

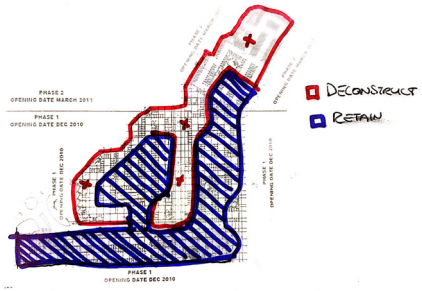


Figure.51: DECONSTRUCTION VS REMAIN (AUTHOR 2021)B

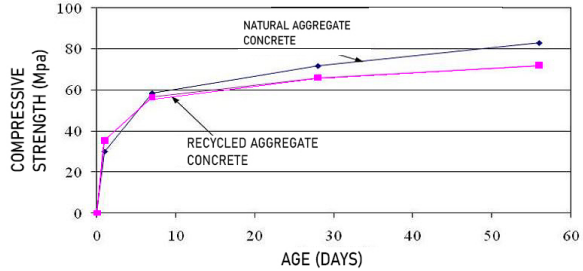


Figure.52: RECYCLED CONCRETE AGGREGATE VS NATURAL AGGREGATE EDITED FROM (Kearsley & Mostert 2011)

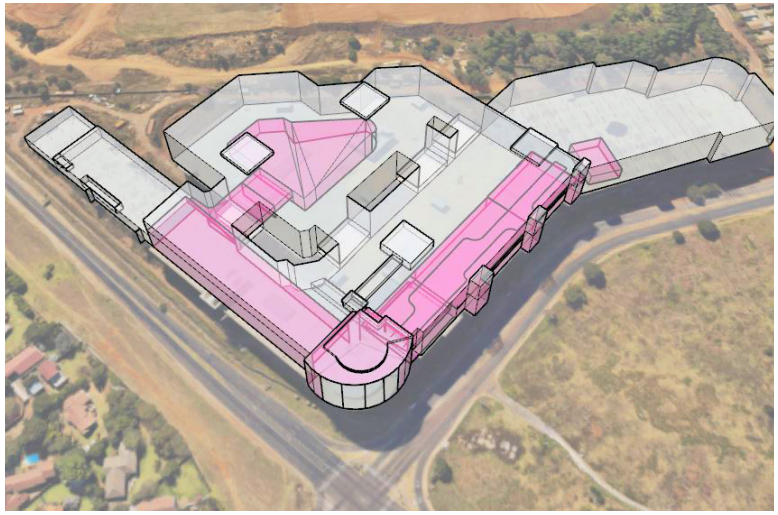


Figure.53:REMAINING VS DE-CONSTRUCTED (AUTHOR 2021)

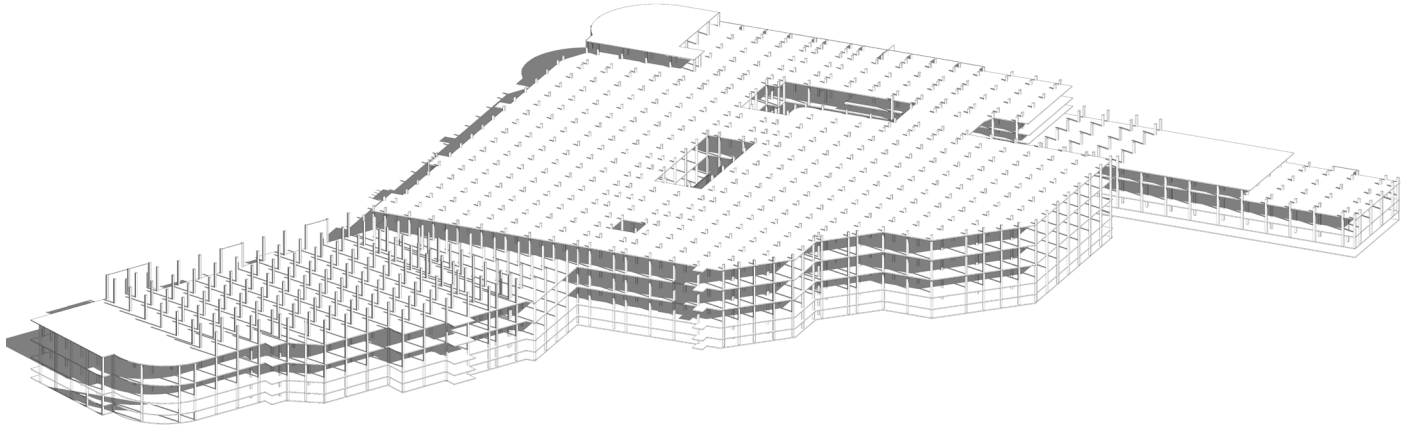


Figure.54: NORTHEN FACADE PRE-DECONSTRUCTION (AUTHOR 2021)

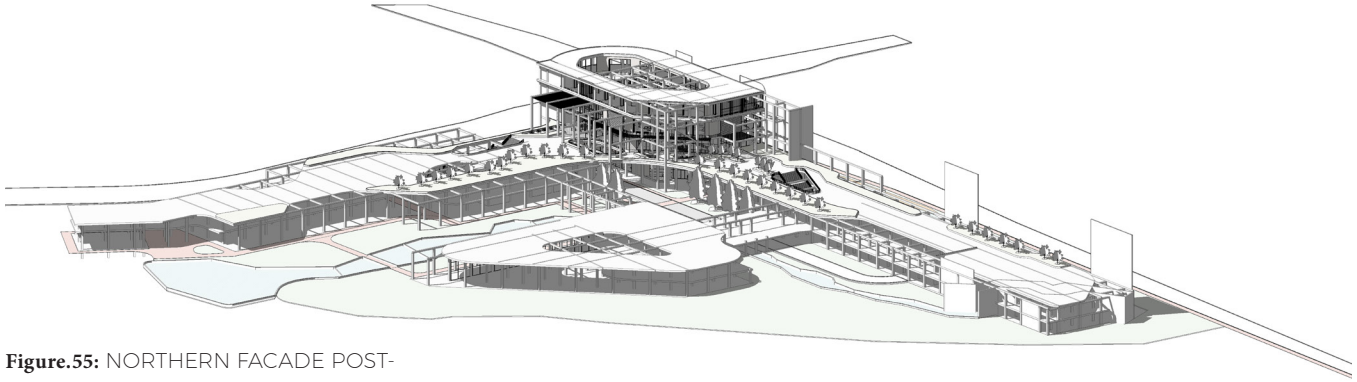


Figure.55: NORTHERN FACADE POST-DECONSTRUCTION (AUTHOR 2021)

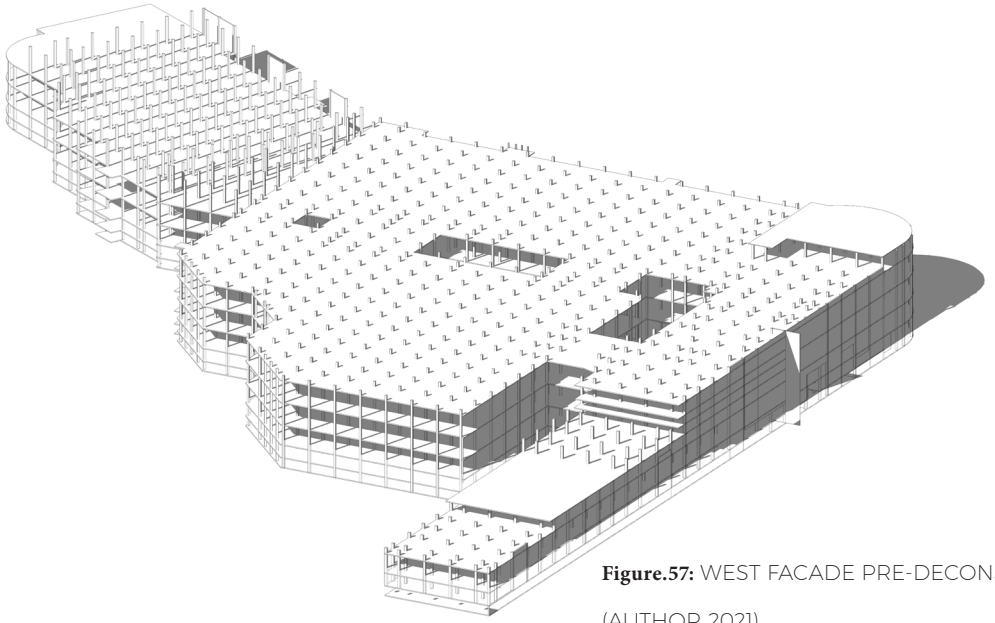


Figure.57: WEST FACADE PRE-DECONSTRUCTION (AUTHOR 2021)

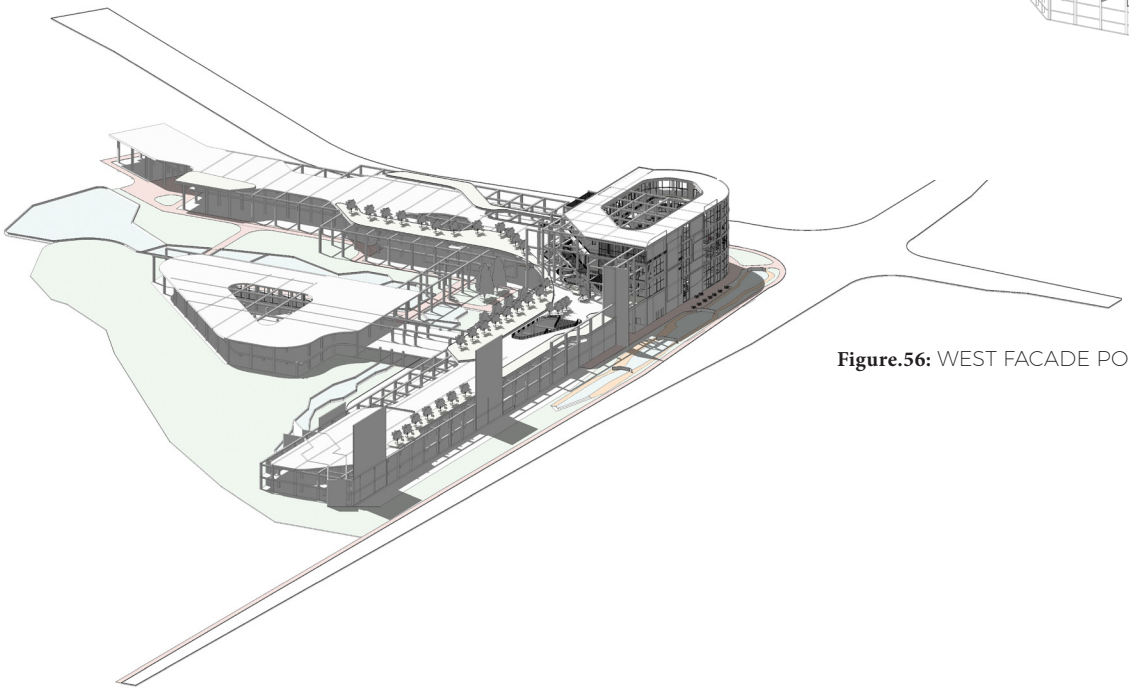


Figure.56: WEST FACADE POST DECONSTRUCTION (AUTHOR 2021)

2. 15 PRECEDENTS

SEATTLE CENTRAL LIBRARY- OMA/LMN

Location: Seattle, Washington, USA

Opened 2004

Functional precedent

The Seattle central library designed by Rem Koolhaas and Joshua Prince-Ramus is the flagship of the Seattle Public Library System. The design for the library was a move away from designing a library for only the book. Rather an approach was taken to design a space for all types of media and information. Every space of the building was curated and tailored to the specific needs of that specific space. Sections of themes within the library was not limited to specific floors but rather allowed to be more organic as it moves through the building.

This informed the design by not constricting functions to strict floor but rather allowing the programmes to move organically through the building

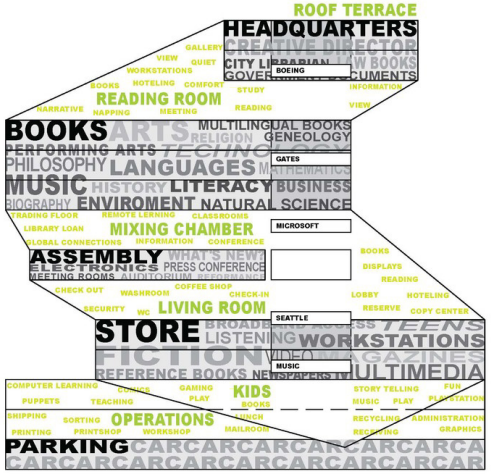


Figure.58: SEATTLE CENTRAL LIBRARY ORGANISATION (OMA/LMN 2004)

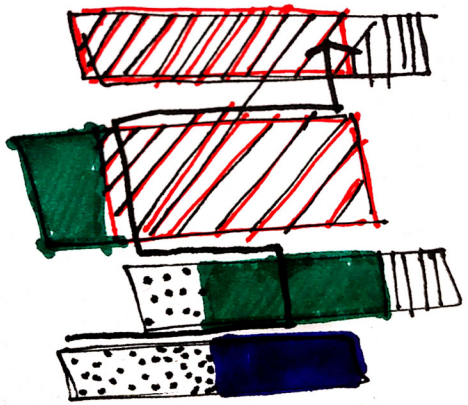


Figure.59: FLUID ORGANISATION (AUTHOR 2021)

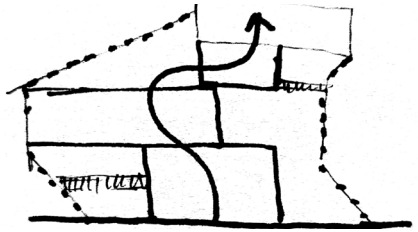


Figure.60: MOVEMENT THROUGH STRUCTURE (AUTHOR 2021)

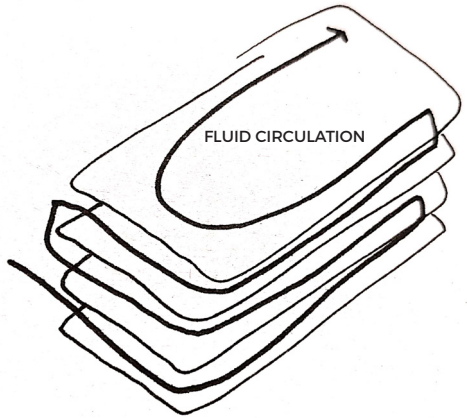


Figure.61: FLOORS NOT LIMITING MOVEMENT (AUTHOR 2021)

ZEITZ MOCCA – HEATHERWICK STUDIOS

Location: Cape Town, South Africa

Opened 2017

Construction precedent

The Zeits Mocca is a museum containing contemporary art from Africa. It is constructed in what was Cape Town's grain silos and at a time the tallest building in South Africa. The silos were decommissioned and the structure was left neglected. The architects had the challenge of working with the enormous silos that the building was constructed with.

The strategy and method they used to "cut" the concrete silos became important (Refer to fig 2). How spaces were then created through the deconstruction is why this precedent is of relevance to the dissertation.

Figure.62: ZEITZ MOCCA ATRIUM (HEATHERWICK STUDIOS 2018)

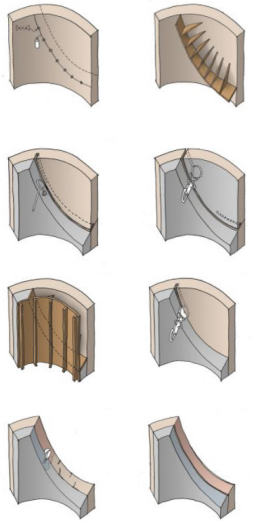


Figure.63: PROCESS OF CONCRETE "CUT" (HEATHERWICK STUDIOS 2018)

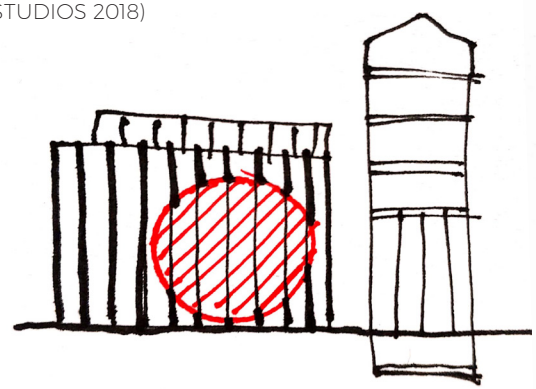


Figure.64: ZEITZ MOCCA CAVITY (AUTHOR 2021)

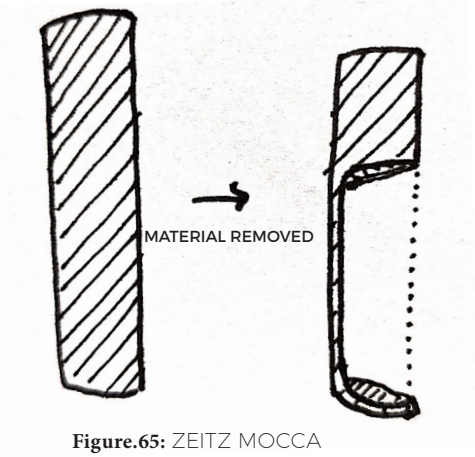


Figure.65: ZEITZ MOCCA COLUMN CUT (AUTHOR 2021)

HIGHLINE – FIELD OPERATIONS

Location: Manhattan, New York, USA

2009

Functional precedent

The Highline is a 2km long "strolling garden in the sky". It is constructed on an old rail structure that has been abandoned and left to decay. With the structure being reclaimed, ecology was introduced into an extremely compact urban area, this caused social and economic function to improve in the areas that the Highline passed.

Various strategies were used in the reuse of the structure, creating different spaces cityscape.

This precedent is of relevance for the design of the "flyover" space or the main circulation route between nodes. Specifically how a very linear element can be approached to be interesting and exciting throughout.

Figure.66: HIGHLINE ELEVATED PLATFORM (FIELD OPERATIONS 2009)

Figure.67: HIGHLINE SPACES (FIELD OPERATION 2009)

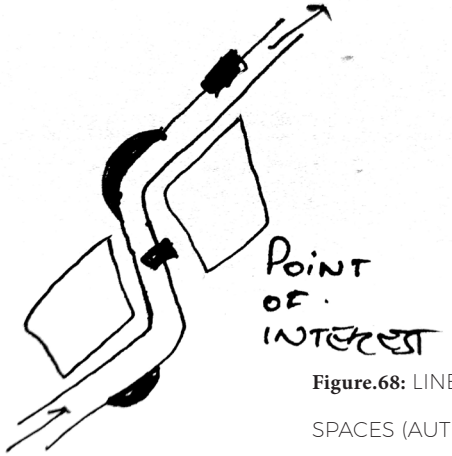


Figure.68: LINEAR ORGANISATION OF SPACES (AUTHOR 2021)

FUTURE AFRICA EARTHWORLD ARCH

Location: Pretoria, South Africa

Opened 2019

Ecological inclusion

The Future Africa precinct is a good example of how ecological systems, together with the use of net zero material can be implemented into design and development.

The artificial wetland/waterbody increases biodiversity whilst improving the micro-climate for the space.

Figure.69: FUTURE AFRICA DEVELOPMENT (EARTHWORLD ARCHITECTS 2019)

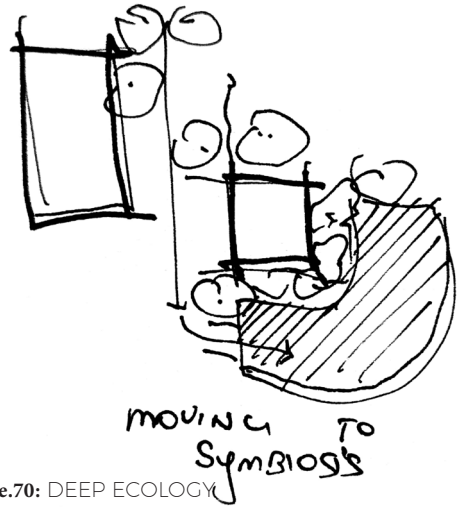


Figure.70: DEEP ECOLOGY(

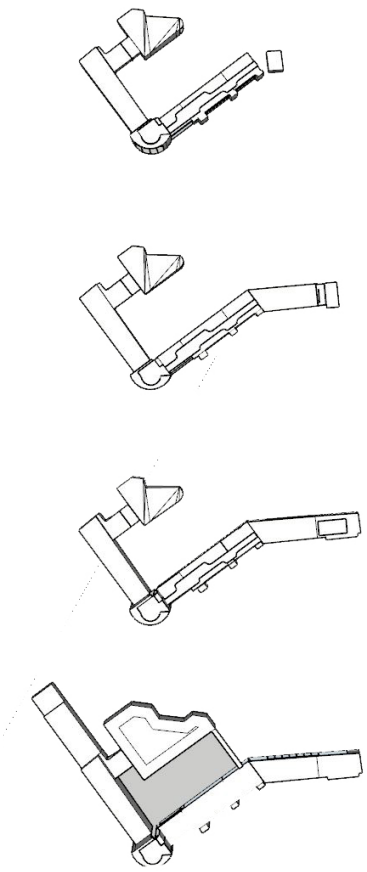


Figure.71: ITERATIONS OF DECREASING SCALE (AUTHOR 2021)

2.16 DESIGN PROCESS & EXPLORATION

The design development was a result of the site analysis conducted and development of the larger site approach of island biogeography that connects the Rietvlei Nature reserve with the Garstkloof Landfill, Moreletaspruit and beyond.

With this idea De Villa Bois was identified as the convergence point of this natural system and a human system. The strategy then progressed to how the structure can be deconstructed and allow for the introduction of an ecological system into the site. The iterations (Fig. 71) that follow show how the original structures scale and size is decreased by stripping away material. This indicates the systematic deconstruction for the project. The decrease of the size and the scale of the original De Villa Bois structure, that will change the entire genius loci of the site.

This process was informed by the identification of nodes where programme would be introduced within the disassembled structure.

A few nodes of activity are introduced being: Urban agriculture/rehabilitation on the extreme eastern boundary, Activity Facilitator on the eastern edge, Data centre on the Western corner, Taxi stop between the Data centre and activity facilitator, Theatre/gallery on the Northern edge, and Cube agricultural facility on the North Western Edge between nodes movement or circulation paths are introduced, with the main route called the Flyover. With the structures size, distance between nodes of activity was substantial, planning was made to decrease the distance but it remains vast.

The development of the structure is ordered in a linear organisation (Ching 2015) (Fig. 72), linking the end nodes (Data Centre and the activity facilitator, art/theatre gallery and cube agriculture) via the flyover which becomes the main circulation route throughout the development. Further, offsetting the taxi stop from the main circulation route and allowing access onto the flyover.

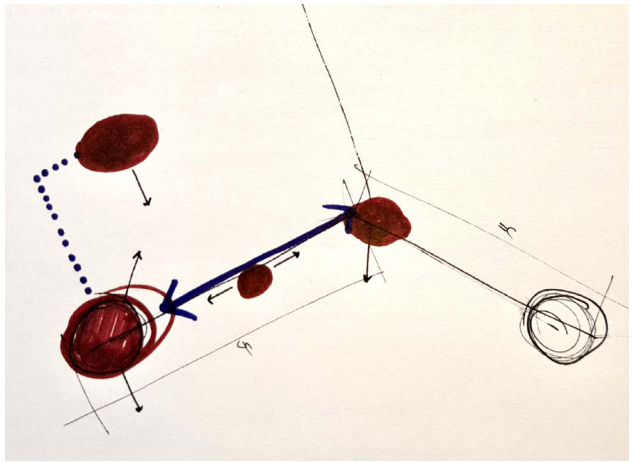


Figure.72: LINEAR ORGANISATION (AUTHOR 2021)

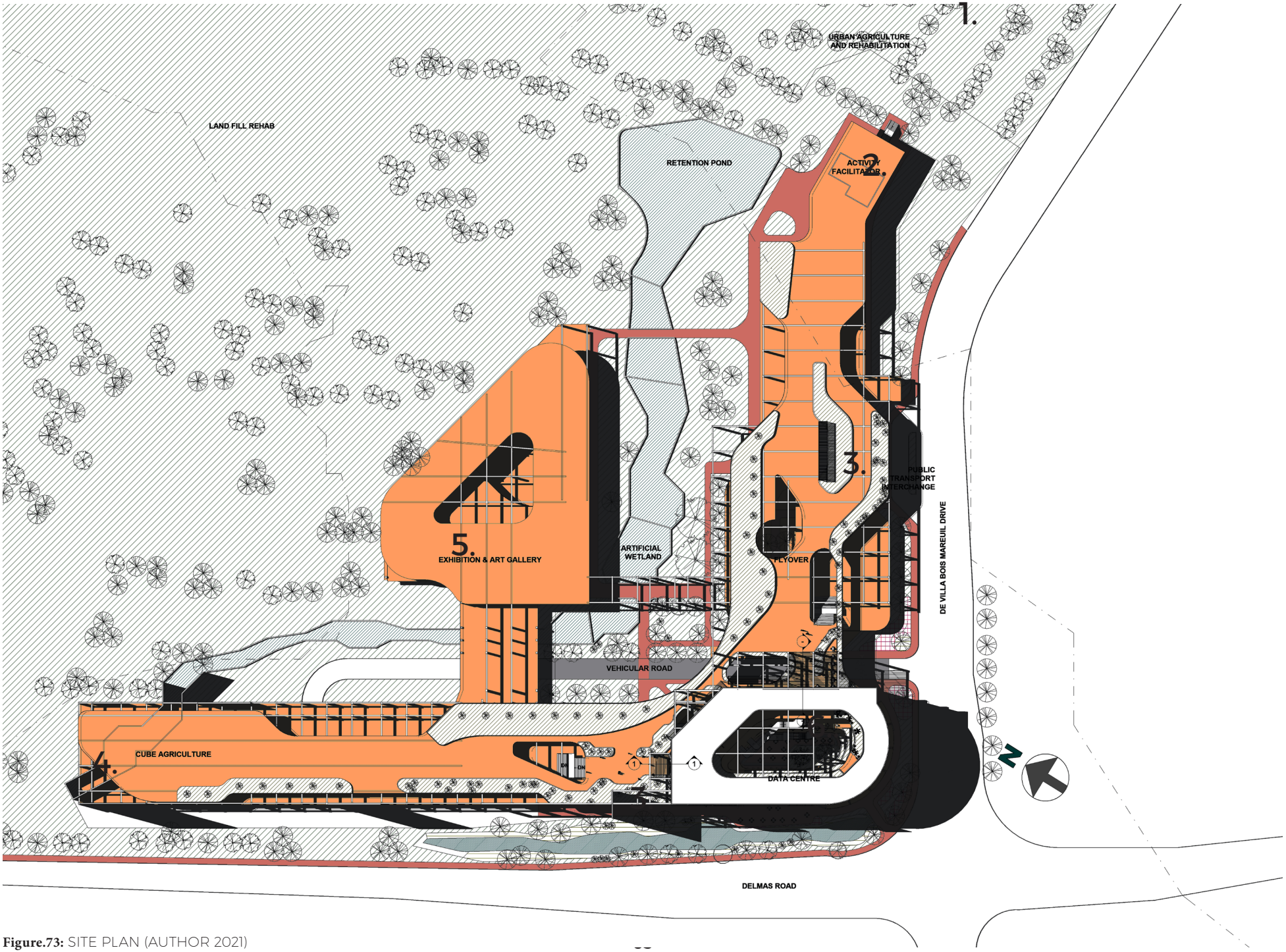


Figure.73: SITE PLAN (AUTHOR 2021)

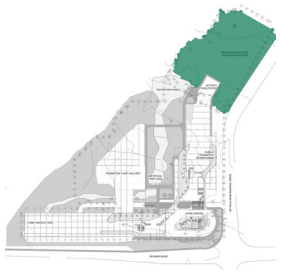


Figure.74: REHABILITATION/ AGRICULTURE (AUTHOR 2021)

The nodes (Fig. 73):

1. Urban Agriculture/Rehabilitation – The area to the extreme west of the site will be rehabilitated with indigenous trees, some that bear edible fruit. This will create a large area of local flora within the area and verging on the street edge, open to the public. Masses of trees in this area creates a habitat buffer between the landfill site and the street that can sustain multiple habitats and protects the vulnerable edge of this "island" (Lövei, Magura, Tóthmérész and Ködöböcz 2006)

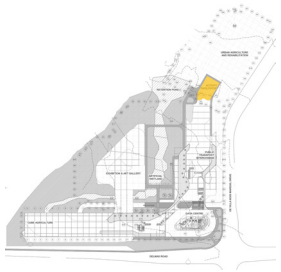


Figure.75: ACTIVITY FACILITATOR (AUTHOR 2021)

2. Activity facilitator – The function of this structure will enable the sustainable reuse of the rehabilitated landfill site. In other word this structure will be the point at which humans will "enter" into the landfill for reuse through various activities (Hiking, biking, running, birding, etc.). Introduction of an ecological system into this area will require the rehabilitation of the disassembled structure (as in all other areas of the larger structure) and further, the creation of habitats.

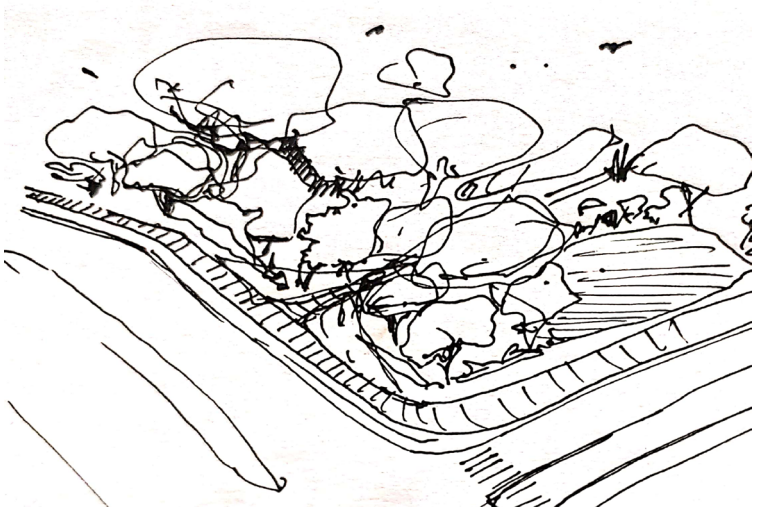


Figure.76: REHABILITATION/AGRICULTURE CONCEPT (AUTHOR 2021)

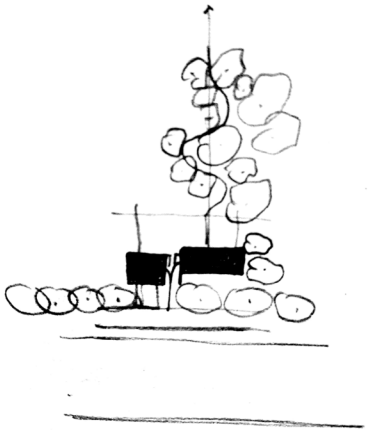


Figure.77: ACTIVITY FACILITATOR PLANNING (AUTHOR 2021)

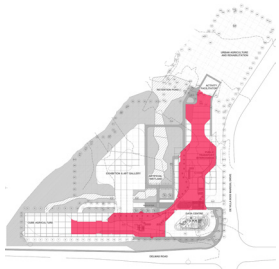


Figure.78: FLYOVER (AUTHOR 2021)

3. Flyover – The function of this structure will be the main circulation between nodes. The walkway on the flyover will allow for movement and waiting or contemplative spaces, activity areas, all with views to the rehabilitated landfill and the rest of the De Villa Bois development. The spaces was informed by how the Highline by Field Operations functions.

This area will be populated with various plant species in planted areas on the slab. Species for this area will need to be selected carefully, with non-aggresive root systems and able to grow in limited soil. Finally, this structure will pass over the taxi stop/public transport node with allowance for a stair onto the flyover and flow into the Data centre structure.

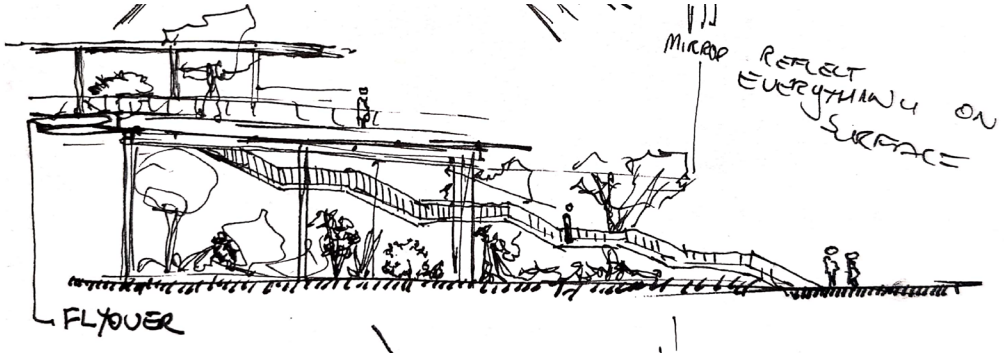


Figure.79: FLYOVER CONCEPT (AUTHOR 2021)

4.Cube Agriculture – CubeAgri farms are indoor urban farms that produce food at a rapid pace (within 6 days in some cases).

The inclusion of this programme indicates that neglected and abandoned building can be used for varying purposes and be productive in some capacity. This system provides the plant with the suitable growing conditions for the entire year within a controlled environment. Its automated growing system uses 95% less water (that will partly be harvested from the site) and no pesticide or herbicides.

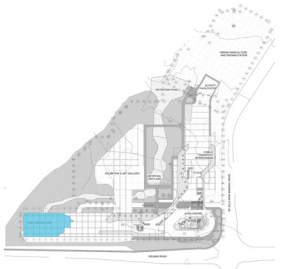


Figure.80: CUBE AGRICULTURE (AUTHOR 2021)

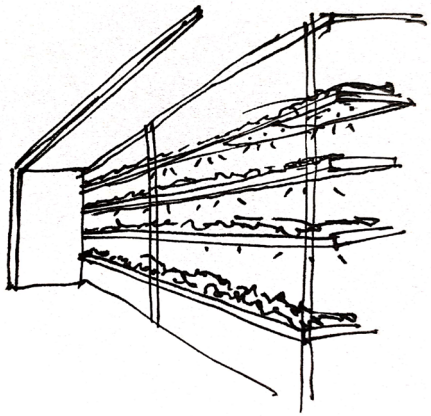


Figure.81: CUBE AGRICULTURE GROWING AREAS (AUTHOR 2021)

Figure.82: ART/THEATRE GALLERY (AUTHOR 2021)

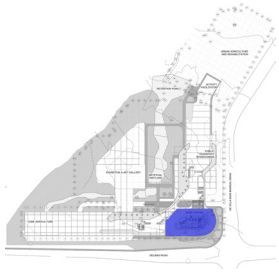


Figure.83: DATA CENTRE (AUTHOR 2021)

5. Art/Theatre Gallery – This space will be a multifunctional open space, providing room for various exhibition, showings or recreational activity. This will add to the cultural value of the site and provide this area of Pretoria with cultural stimulus.

6. Data Centre – The data centre will become the main point of focus for this dissertation and the area that will be designed in full. This area becomes the main visual connection of the site and most traffic will travel past it on Delmas road. Deep ecological principles (Naess & Sessions 1985) will be implemented here (and throughout the development).

It functions in following the example of the Seattle Central Library that incorporate various types of media in the structure, with an organic means of organising section/themes of information throughout the structure. This part of the De Villa Bois structure will remain at its original size.

The approach requires the building to be split open to allow for circulation and visual connection between floors, natural light, to allow for the introduction of ecology into the Data centre, making nature visible.

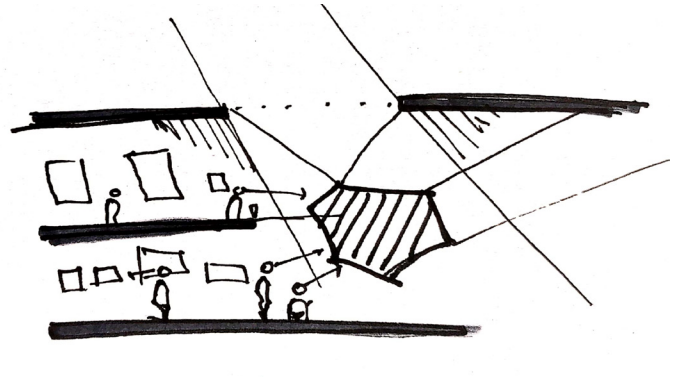


Figure.84: ART/THEATRE GALLERY CONCEPT (AUTHOR 2021)

The Data centre will partly spill out onto the flyover in two directions, this will also be town entrances that allows access into the structure, The other entrances will be on ground level, either on the street edge or spilling out onto the larger central area.

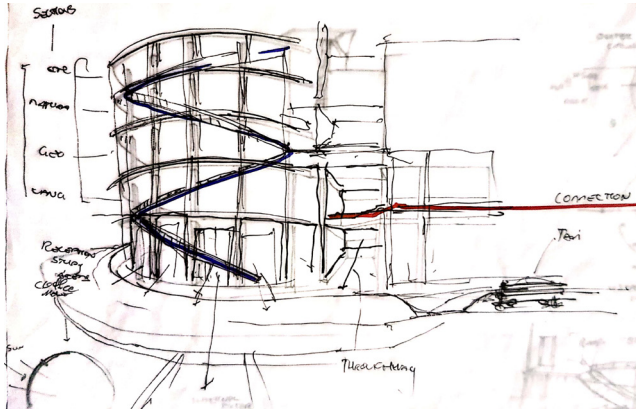


Figure.85: DATA CENTRE PLANNING (AUTHOR 2021)

2. 17 CONCLUSION

In conclusion, the problems our species face are clear. With our cities not supporting ecological functions and our very environment causing detachment from the natural world, change is required.

With a change in mindset and worldview a reconnect can be proposed. One where the natural world and human life is redesigned to co-exist and flourish, benefiting both . The theory discussed gives an indication on how this change in mindset and a reconnect can be approached and implemented in our current society and the built environment.

The foundational theory the project is informed by is Deep Ecology, other associated theoretical ideas are added to it and adjusted for the varying scales of the site. Island Biogeography will be employed for the larger site approach, with large scale rehabilitation of the landfill site and the De Villa bois site, which will be partially de-constructed.

The creation of habitat through the (re) introduction of fauna and flora, throughout the site, will inform upon the Biophilia hypothesis and exposing natural systems to occupants. In this way an area of convergence and interface is created, where a human system and an ecosystem live in symbiosis, which finally causes a reconnection.

The next chapter will take the project from an abstraction of theories and informants, to a functioning structure and system.

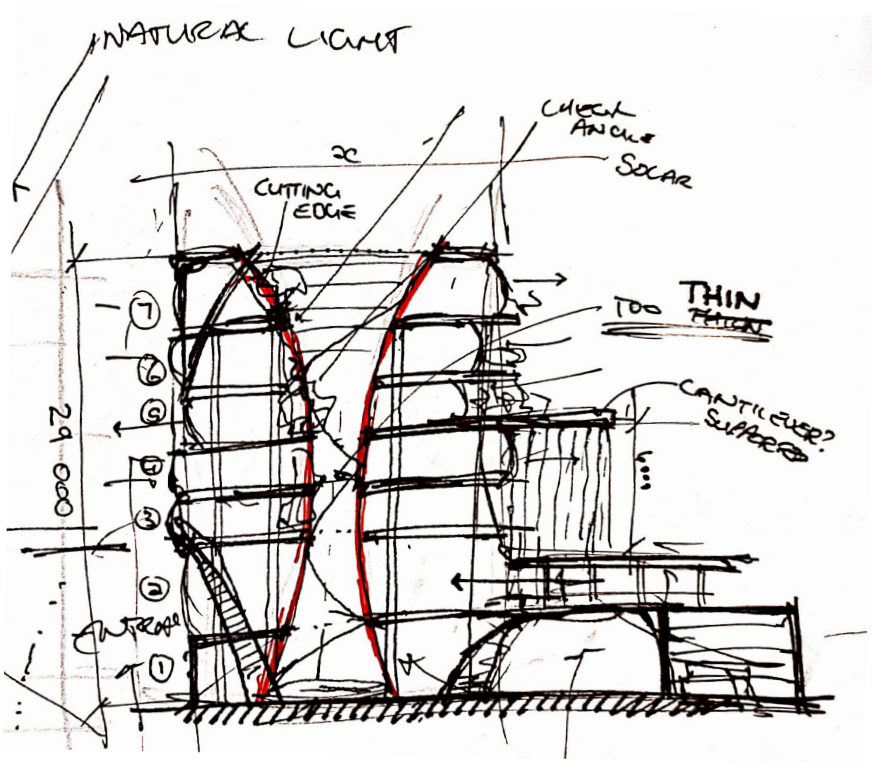
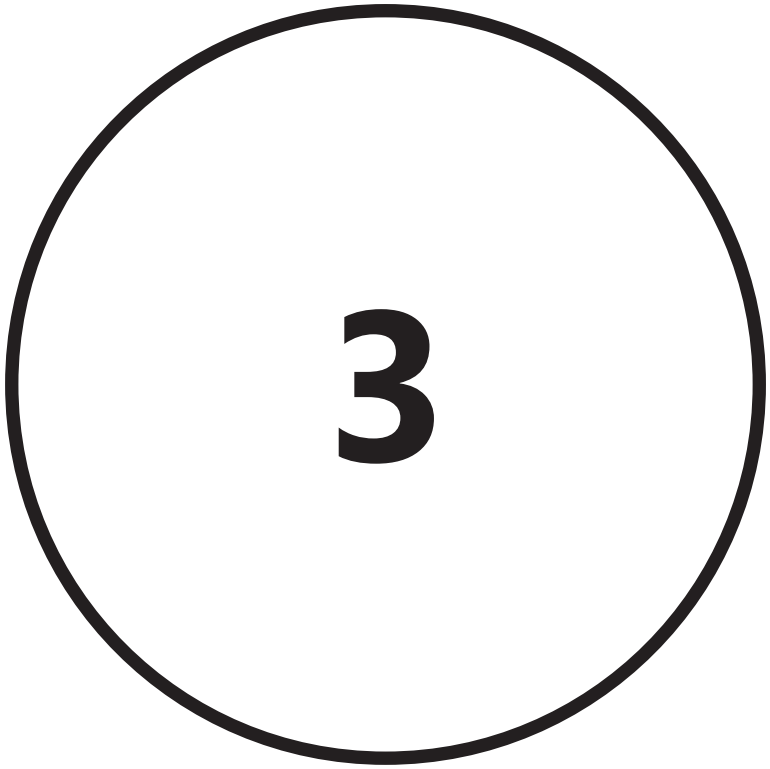


FIGURE.86:DATA CENTRE CONCEPTUAL SECTION (AUTHOR 2021)



SYNTHESIS

POETIC TO SCIENTIFIC

Figure.87: FIRST FLOOR EAST ENTRANCE (AUTHOR 2021)

3.1 INTRODUCTION

This third chapter will convey the design decision made to take the project from poetic abstraction to a physical manifestation. The technological intention will be addressed, followed by the specific brief for the structure, the data centre, which will become the main point of focus for the project.

The Data centre is the main civic structure on the site, which houses and shares various forms of data and knowledge to the public, through knowledge sharing activities. Whilst allowing for a ecological system to be introduced in and around it.

From there the benefits of merging a human system and an ecosystem will be touched on briefly, followed by explanation of the structural system and other systems within the building. Finally, the design will be unpacked and explained.

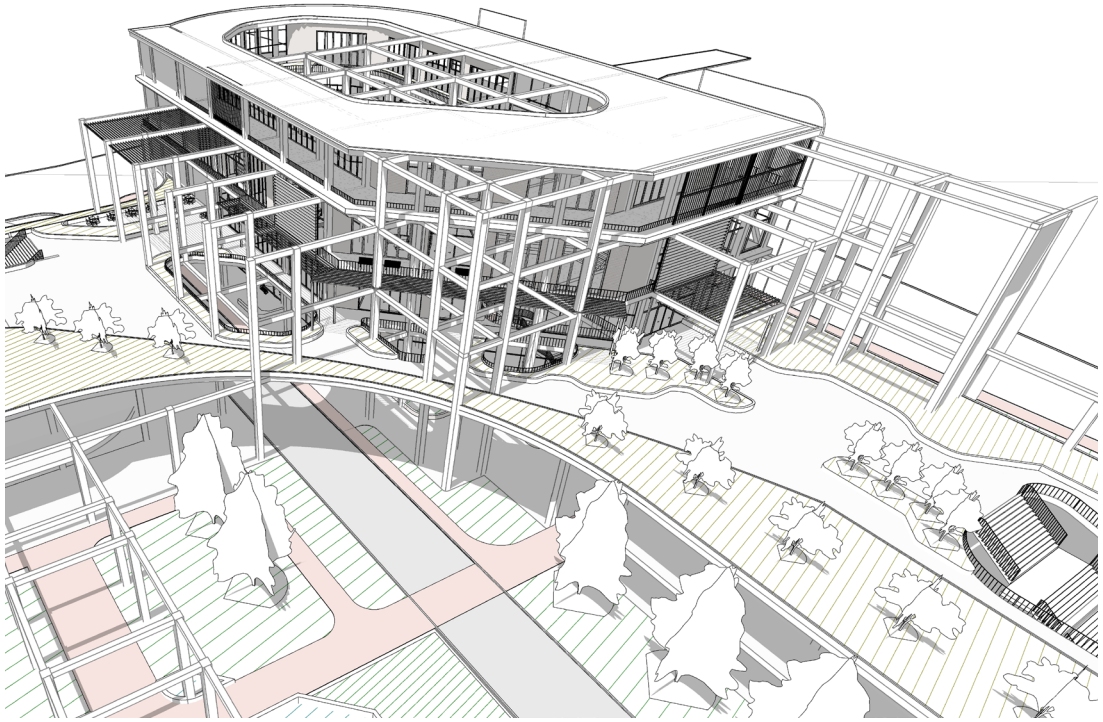


Figure.88: NORTH FACADE- DATA CENTRE (AUTHOR 2021)

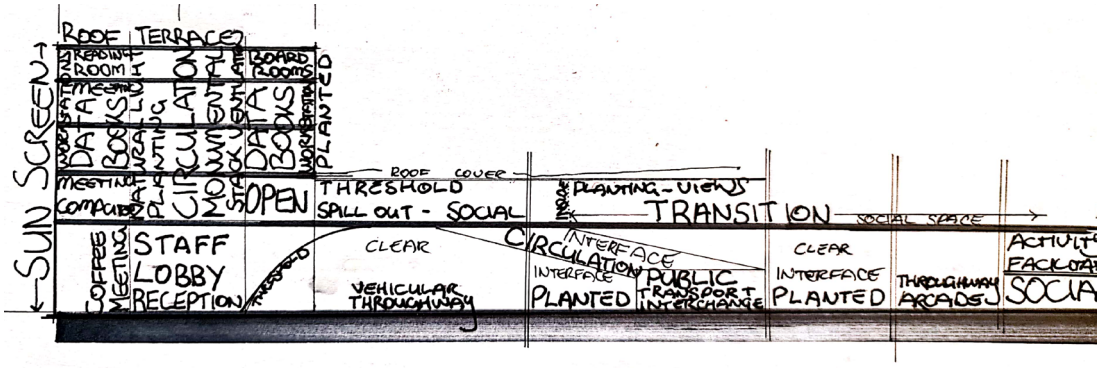


Figure.89: ORGANISING PROGRAMME (AUTHOR 2021)

3.2 TECHNOLOGICAL INTENTIONS

The technological approach and intentions attempt to reconnect the natural world and mankind. Designing these two systems, an ecosystem and human system (building)to work in symbiosis and further, as the co-evolution of man and nature.

The approach is rooted within the theory discussed within the previous chapter of the project.

Through the implementation of these theories one can create an interface where these two systems work in symbiosis. It becomes important to explicitly expose these different systems to the inhabitants of the structure. The benefit of this symbiotic relationship will be clear in how it affects spaces. For instance the structure (human) providing habitat for the introduction of planting (nature) which in turn improves the micro-climate of the space.

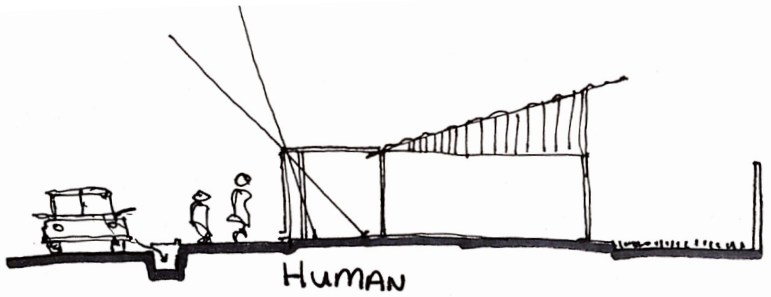


Figure.90: HUMAN SYSTEM (AUTHOR 2021)

Figure.91: NATURAL SYSTEM (AUTHOR 2021)

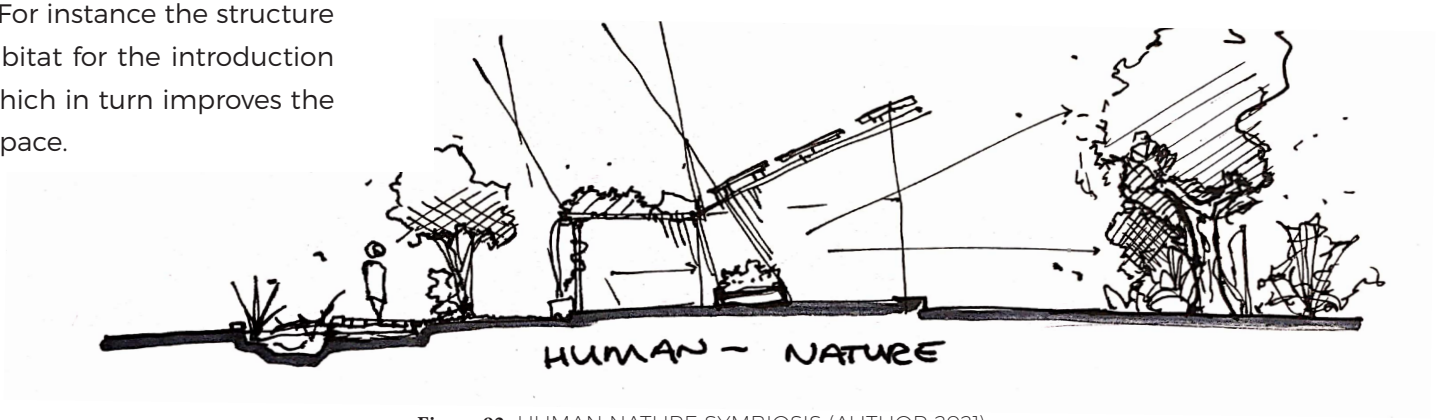


Figure.92: HUMAN NATURE SYMBIOSIS (AUTHOR 2021)

3.3 BRIEF FOR DATA CENTRE

The data centre will become the main area of focus for the study and the main area of design. The programme of this structure will attempt to incorporate the ecological principles set out by the dissertation theory of deep ecology, the normative position of the nested approach, the Biophilia hypothesis (Wilson 1993 & Kellert 2005), regenerative sustainability (Gibbons 2020) and exposing natural systems as explained by Sym van der Ryn and Stuart Cowan (2010)

The brief for this area is as follows: The centre should become an area of knowledge and data transfer, and provide various spaces for this function, like the Seatlle central library, such as lecture rooms, seminar space and online learning workspace, together with the introduction of an ecological system. It should also allow for the incorporation of some economic functions into the structure. Finally, a system of conservation that provides a capacity to safeguard species for future generations. The programme will include:

SOCIAL - Learning and seminar like space for the transfer of knowledge between individuals and/or various size groups. These spaces will include amphitheatre seminar space for presenting to larger groups, lecture rooms which can accommodate various fields of information with various sizes of "classes", group workshop areas and individual work unit for online learning.

ECONOMIC - Commercial/rentable for economic stimulant for the structure, whilst providing space for occupants to meet. This will include a restaurant like space, event space, hot seats for office use and other rentable space.

ECOLOGICAL - An active-collection-genetic-seed-bank. This programme will deal with the processing, sorting and storage of red data list species for storage in the short term (1-20 years). This will cause the structure to have an active role in conservation of indigenous species. Species will be harvested by professionals in areas where it is appropriate to harvest them and subsequently transferred to the site. From here the seeds must be registered, cleaned and dried, packaged, documented and stored on site. The storage of seeds becomes an important point as the duration at which seeds are stored is directly dependant on the temperature that can be achieved and maintained. For instance, the Svalbard Global Seed Bank is meant to be for apocalyptic scenarios, where mass extinction takes place (Qvenild 2008). The temperature must remain at -18° as seeds can be stored for

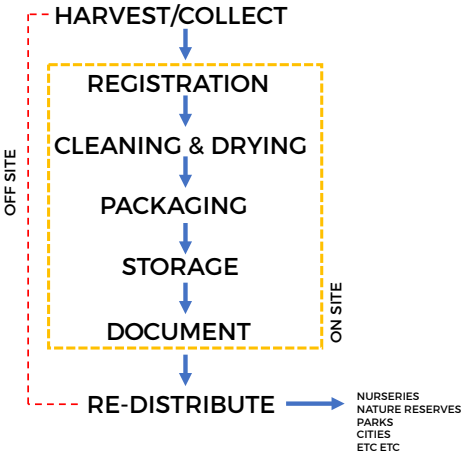


Figure.93: GENETIC BANK PROGRAMME PROCESS (AUTHOR 2021)

an extremely long time at this temperature (Kameswara Rao 2006). As this genetic bank is an active collection and seeds will be stored at the longest for 20 years, the temperature can be a lot higher. "The temperature of 0–10˚C and relative humidity (RH) of 25–30% and seed moisture 68% are adequate for medium-term storage module" (Kameswara Rao 2006). As genetic materials become needed (opening of a new nature reserve, preservation, conservation etc.) seeds can be withdrawn and distributed to the intended site.

All of these programmes will have direct or indirect contact with an ecological system that will be introduced into the structure, either through interior and exterior planting or the living wall that acts as the building skin that provides habitat for various species. The benefit of being exposed to such living/green elements is documented and will be explained.

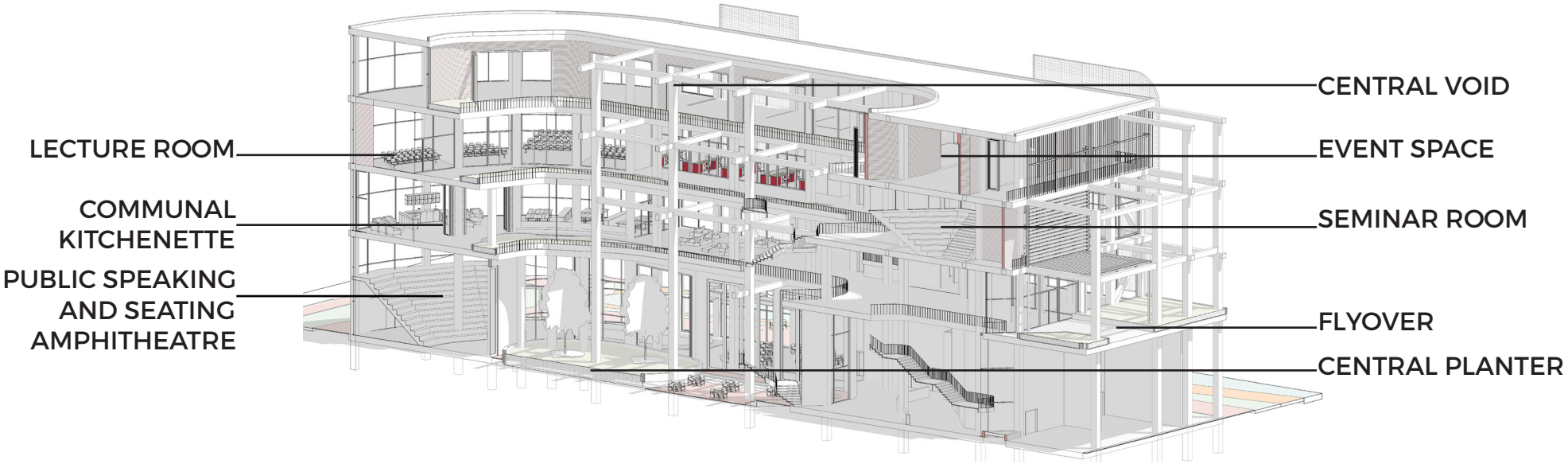


Figure.94: STRIP SECTION DATA CENTRE (AUTHOR 2021)

3.4 BENEFITS OF AN INTERFACE WITH ECOLOGY

In designing an interface between man and nature, various factors exist that can be benefit the inhabitants of a structure.

3.4.1 THE EXPOSURE TO NATURE

Various benefits exist for humans to be exposed to natural elements. All of which are connected to our complex set of senses; with sight being the most prevalent of them all but again, not the only one.

The viewing of natural elements is shown to provide a wide range of benefits for human health (Velarde, Fry and Tveit 2007).

These include reduced anxiety and stress (Ulric 1979), lower heart rate (Laumann, Gärling & Stormark 2001) and increased attention (Tennessen & Cimprich 1995), all of which can be beneficial to any environment but more so to spaces where learning and sharing is important.

Other types of exposure to nature include the other senses such as sound, taste, smell and touch but also non-sensory pathways such as the effects of microbiota on the production of serotonin, melatonin and various other neuroactive molecules (Rook, Raison & Lowry 2012).

By designing spaces with our exposure to the natural world in mind, numerous health benefits can be achieved, that specifically aids in the knowledge and data sharing function of the structure.

3.4.2 ECOSYSTEM SERVICES

The benefit that humans gain from nature is known as ecosystem services (Wohlitz et al 2016).

This becomes an extremely important aspect of the introduction of an ecological system and the benefits are substantial.

It should be noted that in accordance to the Deep Ecological platform rule #1 - a species worth is not attributed to the benefit it has for humans (Naess & Sessions 1985). This value is not mutually-exclusive (meaning the benefit for both human and non-human occur simultaneously), the specific species has intrinsic value but the added benefit of value to humans in some shape or form. This still means that species shouldn't merely be introduced because they

provide a service to humans, but rather because they in themselves have value.

Various forms of services can be provided by a natural system through ecosystem services:

1. Regulating air quality and improving micro-climate can be achieved by the introduction of vegetation into space.
2. Ecosystems become carbon sequestrators and have the ability to store greenhouse gasses
3. Waste water treatment through the use of wetlands, which also prevents floods.
4. Erosion prevention through the use of vegetation on troublesome slopes further contributing to soil fertility
5. Pollination
6. Biological control of pests
7. Habitat and Supporting services
8. Creating habitat for various species
9. Maintaining genetic diversity
10. Provisioning services
11. Food for consumption by humans and non-humans
12. Raw materials that can be used in construction or as organic material

(Wohlitz et al 2016)

All of these services speak of the benefit in having an ecosystem in symbiosis with a human system (or the structure).

The benefit that these services provide to various other species, including humans can not be understated. By exposing these services and benefits to the inhabitants of the structure, people can experience the value that these species have within themselves and the benefit they provided to individuals and the larger development.

Figure.95: ECOSYSTEM SERVICES https://www.earthwiseaware.org/what-are-ecosystem-services/

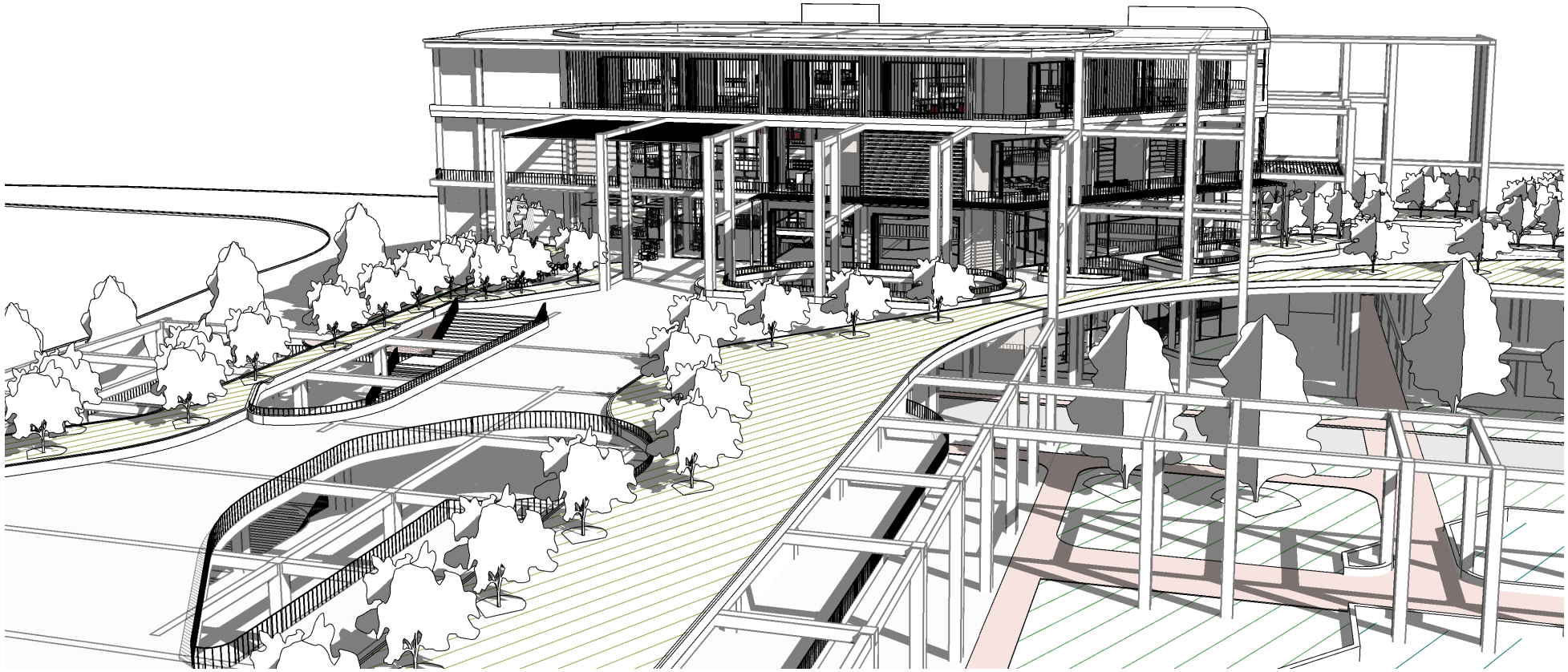


Figure.96:FLYOVER AND DATA CENTRE EAST FACADE (AUTHOR 2021)

3.5 UNPACKING THE DESIGN

For the Data Centre a void is cut through a series of coffer slabs in the centre of the structure. (Refer to Fig).

The function of this cut is twofold: it allows for the exposure to natural cycles as van der Ryn (2007) proposes. The building will experience weather events, wind drafts and importantly light ingress into the structure reaching to the ground floor, illuminating the building, making nature visible (van der Ryn 2007).

This also allows for the introduction of planting habitat on all floors facing the Northern aspect, For the Southern aspect of the interior some shade loving species can be introduced. This informs and implements the Biophilia hypothesis (Kellert 2005 & Wilson 1993).

This central void allows for the main circulation route to be housed within it, a large stairway will move up the floors within it. The central stairway is supported by columns and beams that remain within the central void.

As the building has 4 floors, standards require that the structure have elevators. This also allows for universal access throughout the structure, two elevators are placed at opposite ends of the structure for ease of access.

Two fire escapes are also required and they are placed in existing fire escape shafts adjacent to the elevators at appropriate distances.

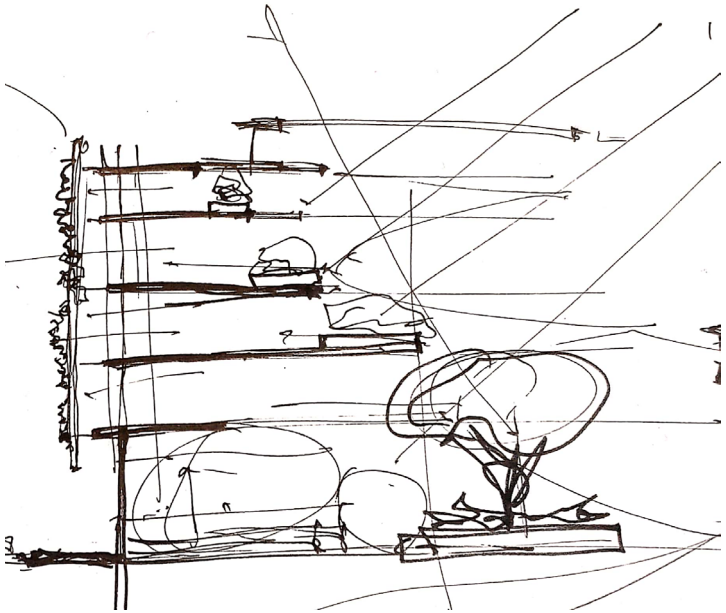


Figure.97: EARLY VOID CONCEPT (AUTHOR 2021)

3.6 GROUND FLOOR

The ground floor becomes the main meeting space and is also considered more public in nature. A public speaking platform, café (and kitchen), a children's play area, seating inside and outside and parts of the genetic seed bank are housed on this floor. Large central pivot industrial doors span the floor to soffit and when opened the space feels as if it is bleeding into the central courtyard space.

Within the central courtyard, seating is provided around a planter that houses a variety of vegetation, two of which will be flowering feature trees. *Dombeya rotundifolia* - Wild pear and *Bolusanthus speciousus* - Tree wisteria (vanwykshout). These species will bloom together (D. rotundifolia White July-Oct and B. speciousus Purple Sept-Nov) in a spectacular show of colours. Sufficient space is provide for these specimens. These trees symbolise the coexistences of man and nature. Together with this various birds and insects, species will be attracted to the vegetation in the planter.

Large spillout spaces exist outside the building with masses of vegetation that are evident around walkways and an artificial wetland that supports various other species and decreases visibility to the street.

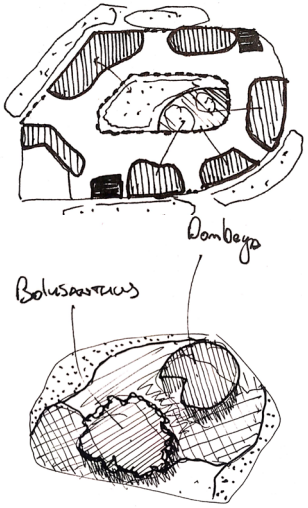


Figure.99: GROUND FLOOR COURYARD AND SPACIAL ORGANISATION (AUTHOR 2021)

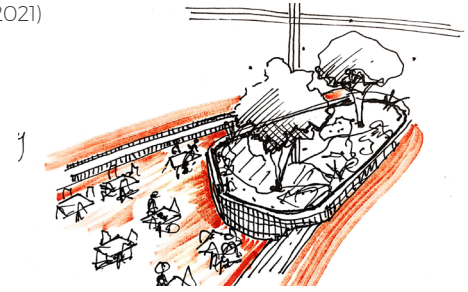


Figure.101:CENTRAL COURTYARD (AUTHOR 2021

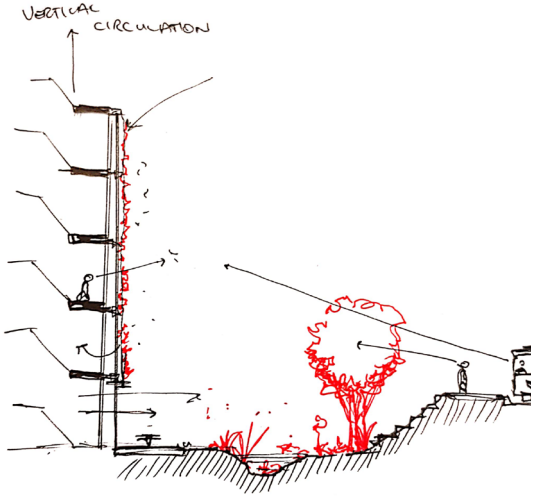


Figure.100: VIEW FROM STREET (AUTHOR 2021)

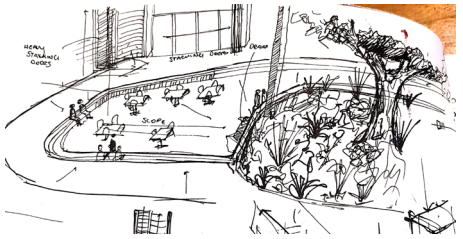


Figure.102: CENTRAL COURTYARD AND PLANTER (AUTHOR 2021)

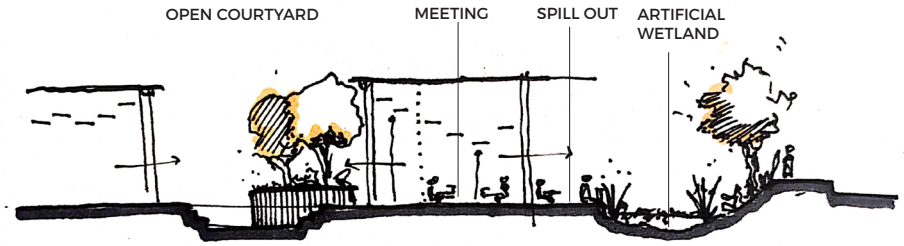


Figure.98: GROUND FLOOR CONCEPTUAL SECTION (AUTHOR 2021)

Figure.103: GROUND FLOOR NORTH ENTRANCE (AUTHOR 2021)

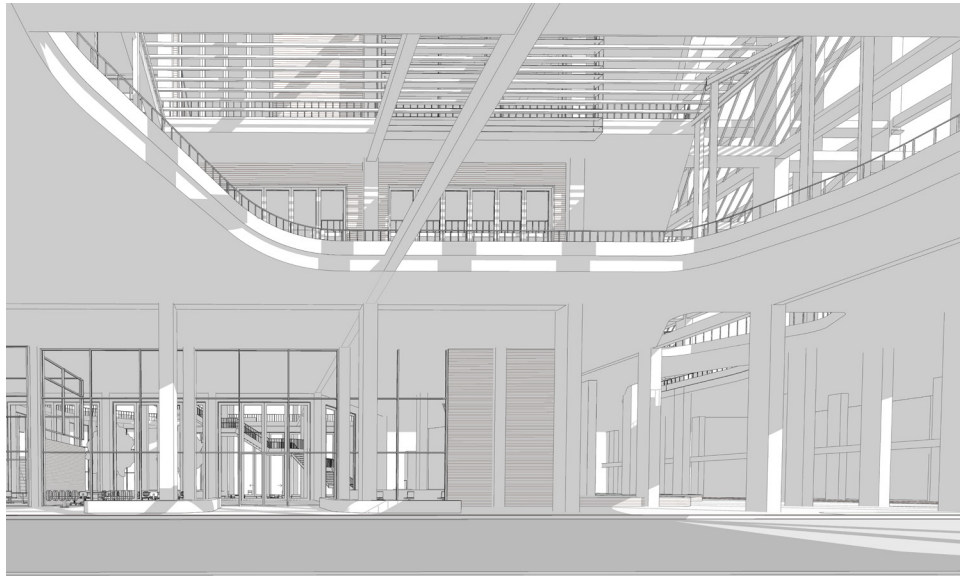


Figure.104: GROUND FLOOR APPROACH EAST ENTRANCE (AUTHOR 2021)

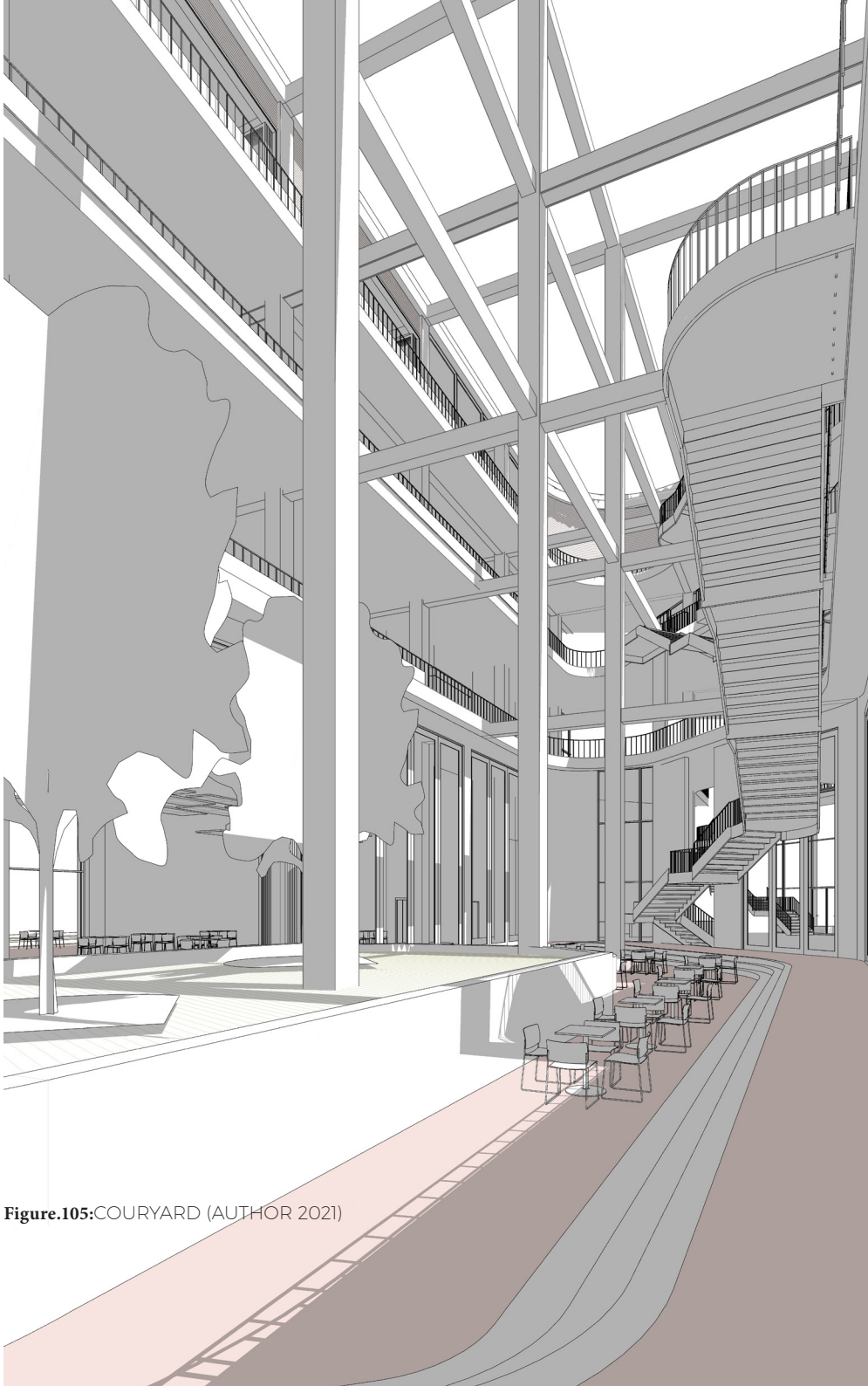


Figure.105:COURYARD (AUTHOR 2021)

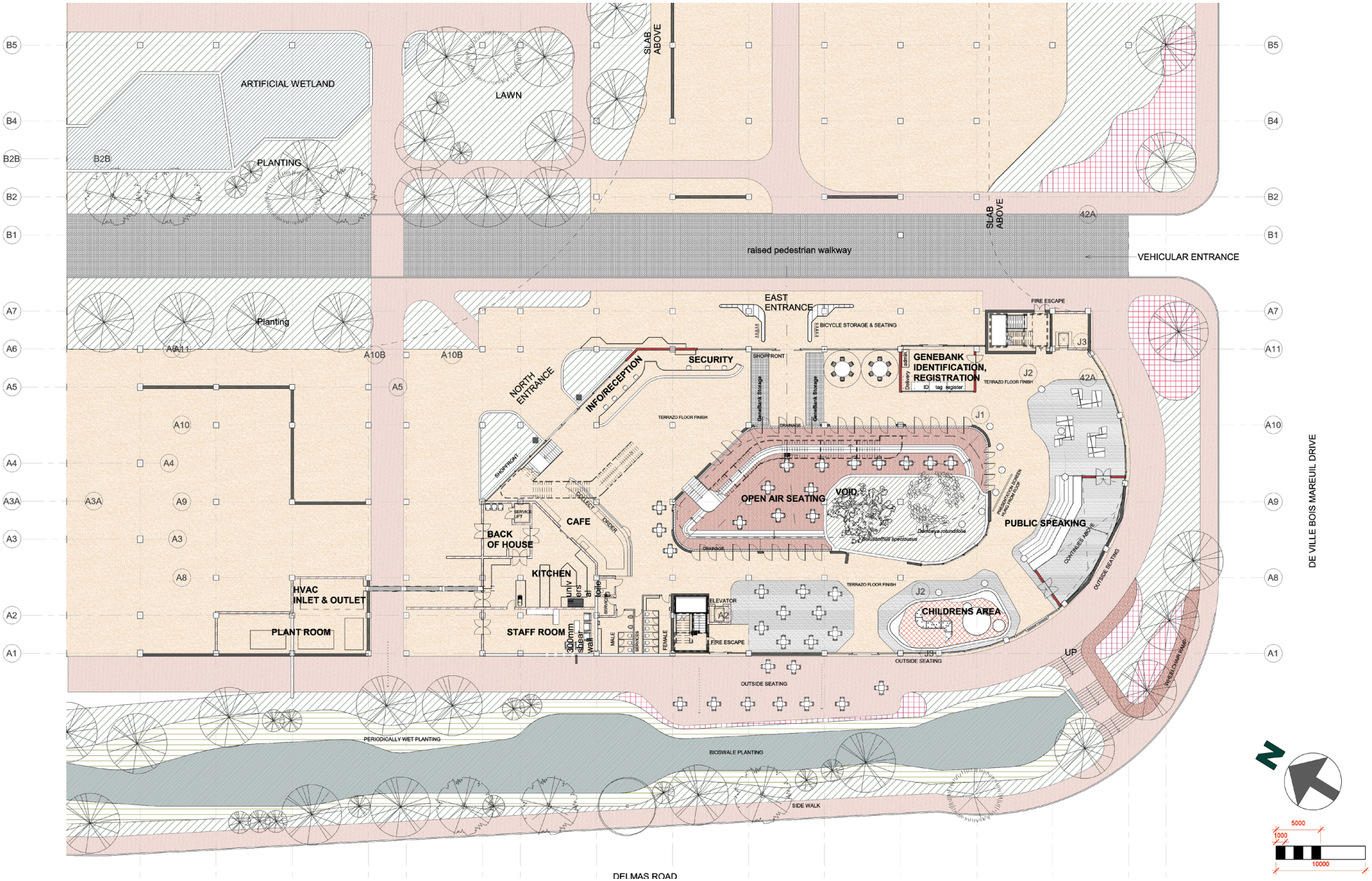


Figure.106: GROUND FLOOR PLAN

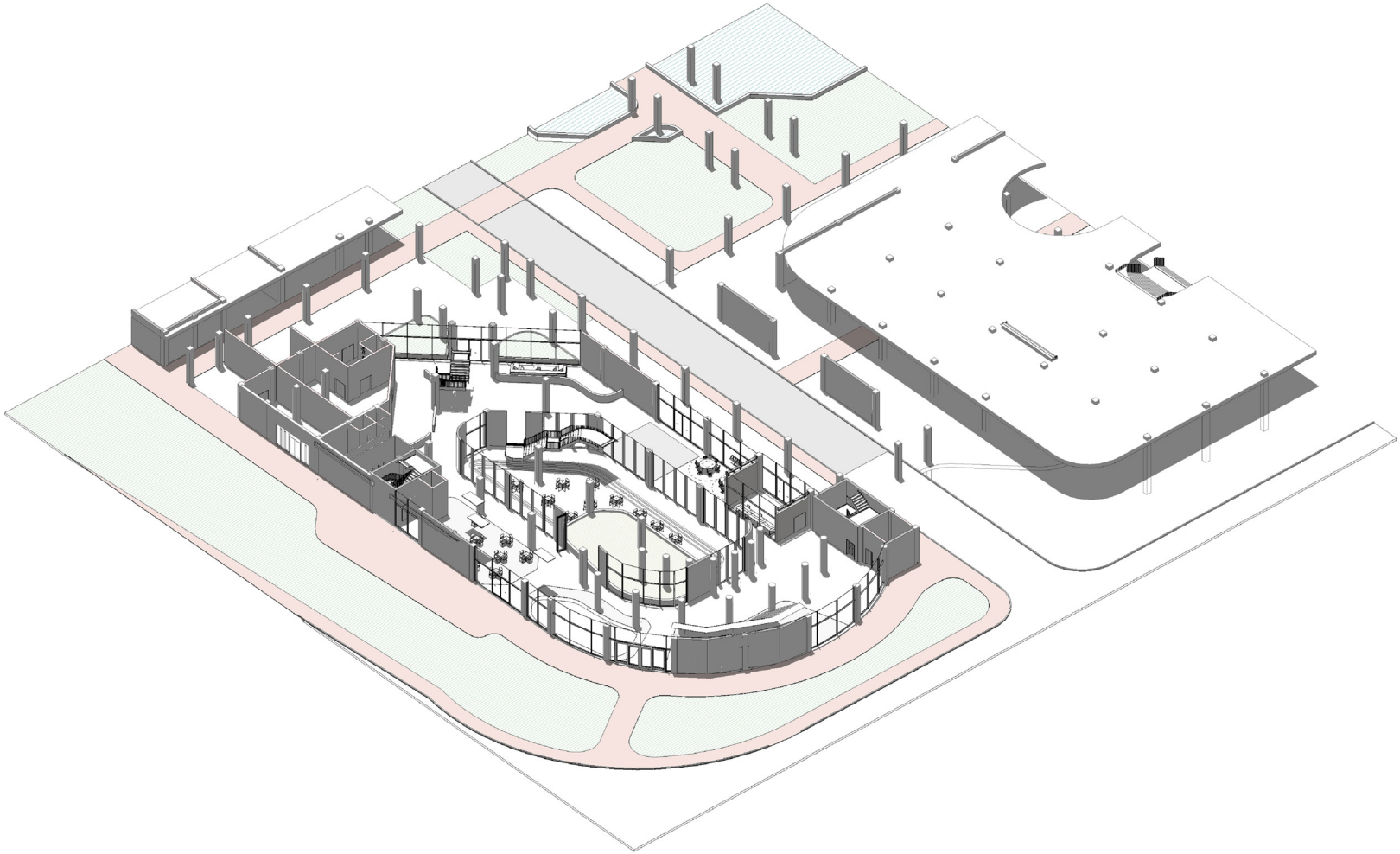


Figure.107: GROUND FLOOR AXONOMETRIC `

3.7 FIRST FLOOR

The first floor becomes the “main entrance” way, and connects to the outside transition space the flyover. This part of the structure carries people from node to node and into the data centre.

The flyover becomes a main connection point to habitat, housing various plant species and pergola structures. This creates comfortable spaces that attract masses of birds and various insects, making it “alive”.

This space spills into the data centre, where the bulk of the commercial space of the structure exist, providing space economic stimulus, and a space for social interaction whilst exposing the inhabitants to the ecological system, inside and outside.

The threshold leading into this space has an enormously scaled shade structure extending out of the third floor, covering this entrance. Next to the shade structure the living wall wraps around the building covering it in louvres and plants.

Once inside the structure, past the commercial space, group working spaces sit at the southern side of the building, together with kitchenette areas for occupants to prepare meals or take breaks.

The design development of the void was completely enclosed with shop-fronts, these were moved back to create “outside” space between the various programme areas and the central void within the structure. This makes ventilation within the structure more effective and more efficient as spaces that are being ventilated are more compact.

Moving the shop-fronts back allows for the introduction of large planting at the areas that have a north aspect. Another wing of the Genetic seed bank is found on this floor.

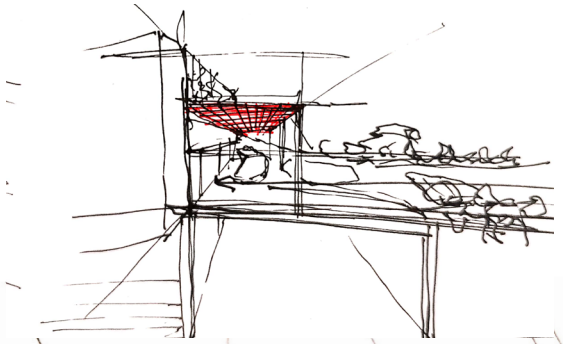


Figure.108: CONCEPT FIRST FLOOR ENTRANCE (AUTHOR 2021)

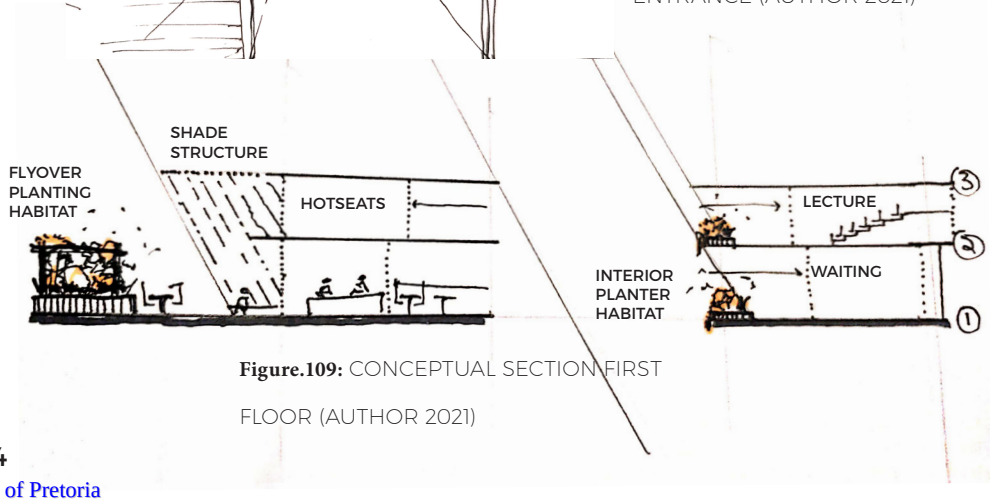


Figure.109: CONCEPTUAL SECTION FIRST FLOOR (AUTHOR 2021)

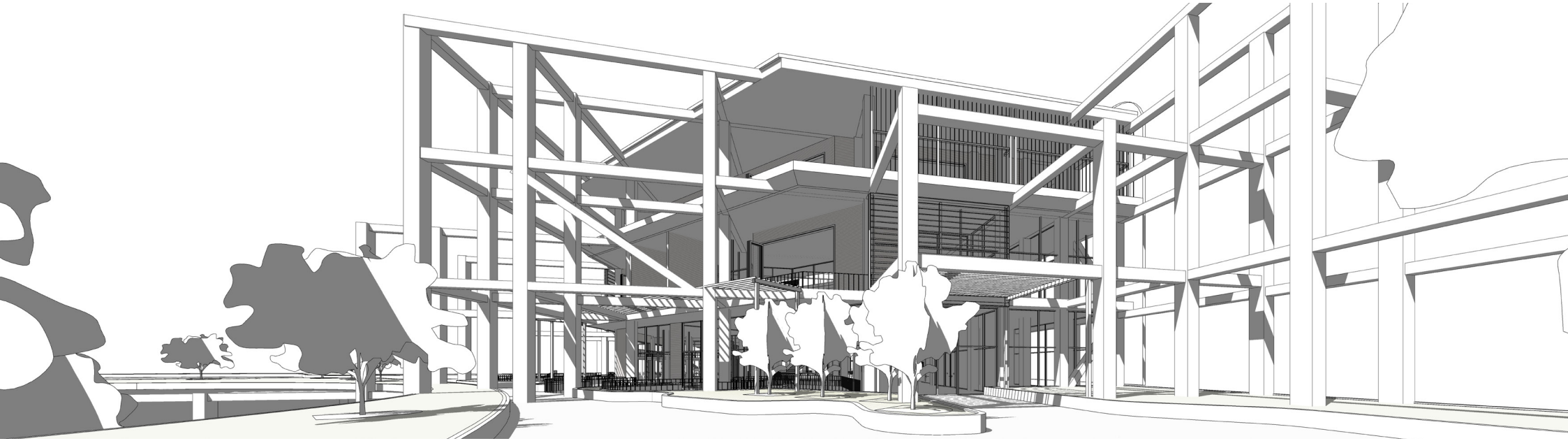


Figure.110: FLYOVER NORTH FACADE (AUTHOR 2021)

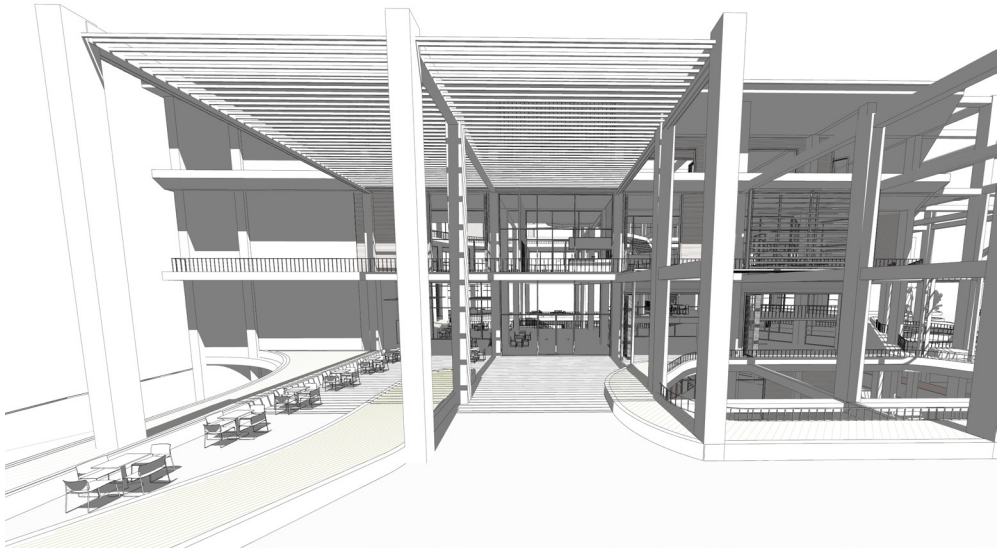


Figure.111: EAST ENTRANCE FIRST FLOOR (AUTHOR 2021)

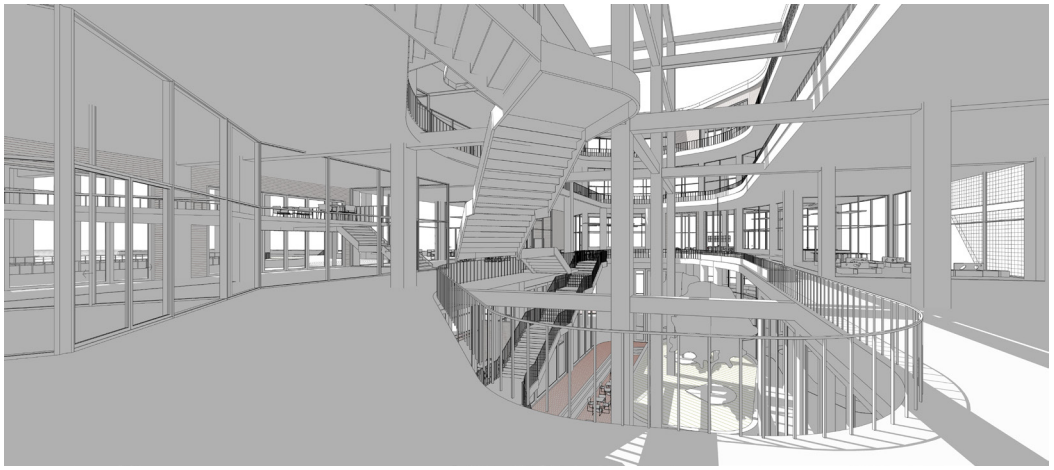


Figure.112: CIRCULATION IN VOID FIRST FLOOR (AUTHOR 2021)

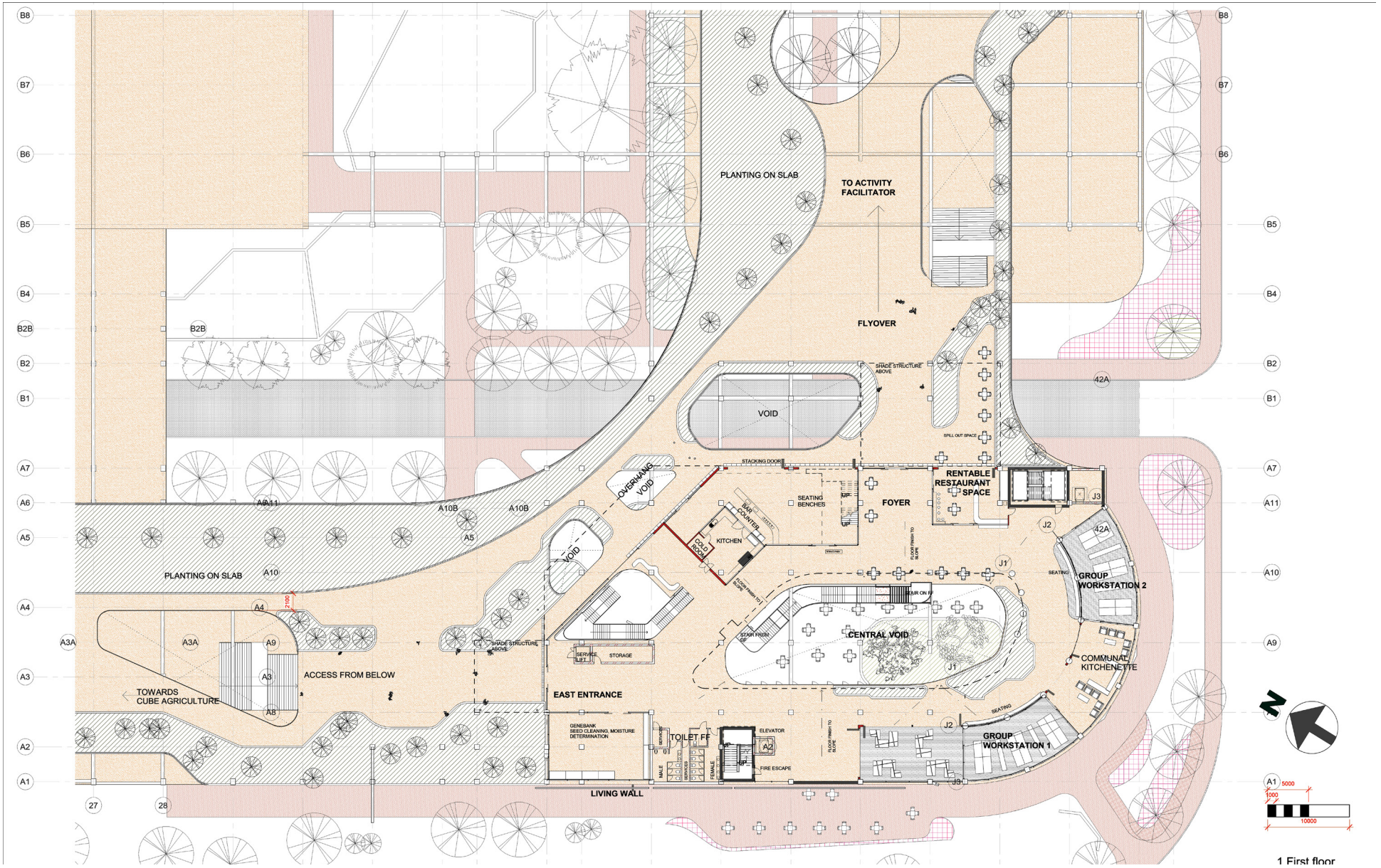


Figure.113: FIRST FLOOR PLAN (AUTHOR 2021)

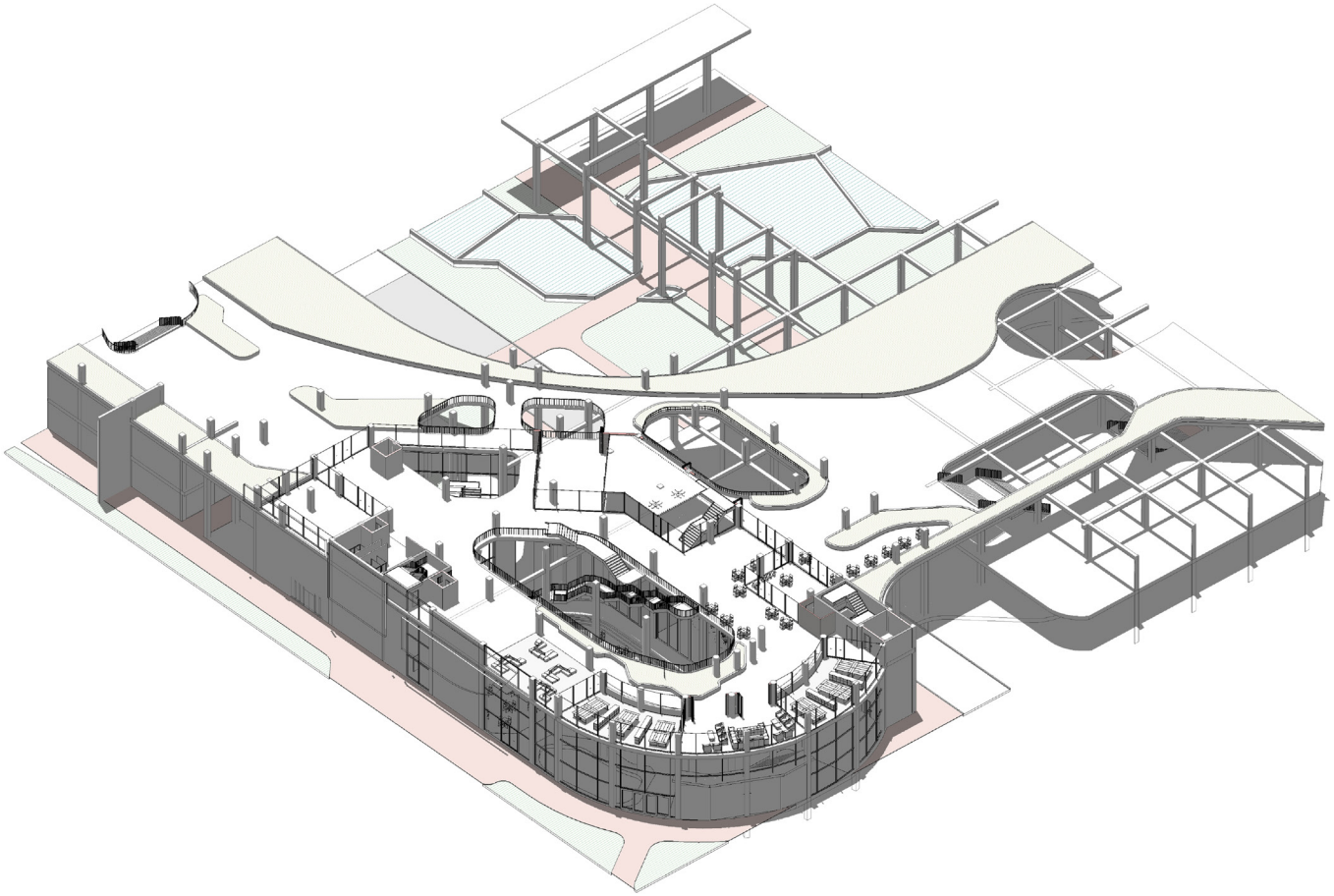


Figure.114: FIRST FLOOR AXONOMETRIC (AUTHOR 2021)

3.8 THE SECOND FLOOR

The second floor is only accessible by the stairs and elevators within the building. On this floor it becomes a more subdued atmosphere, with individual speakers addressing larger groups in the seminar room or lecture rooms.

This floor also houses hotseats for office use and boardrooms that can be rented and used. A series of work units also exist on the floor and this will become spaces for individuals to participate in online learning within closed private spaces.

Finally, the final genetic bank wing is found on this floor, where seeds are packaged and made ready for storage, the final steps . The genetic bank and the hotseats share a kitchenette between them for the staff of both facilities.

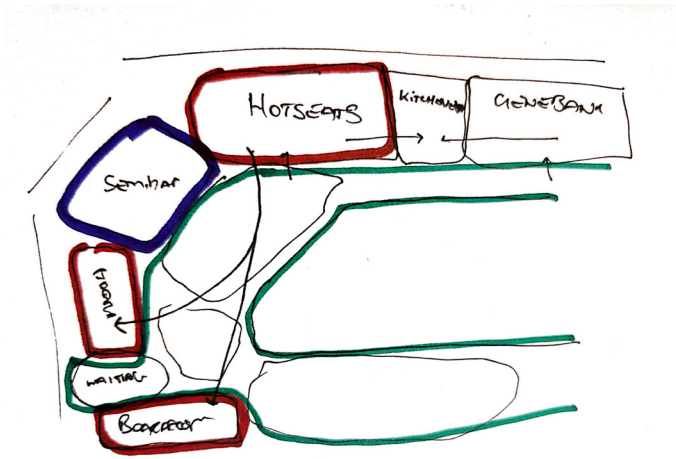


Figure.115: SECOND FLOOR ORGANIZATION (AUTHOR 2021)

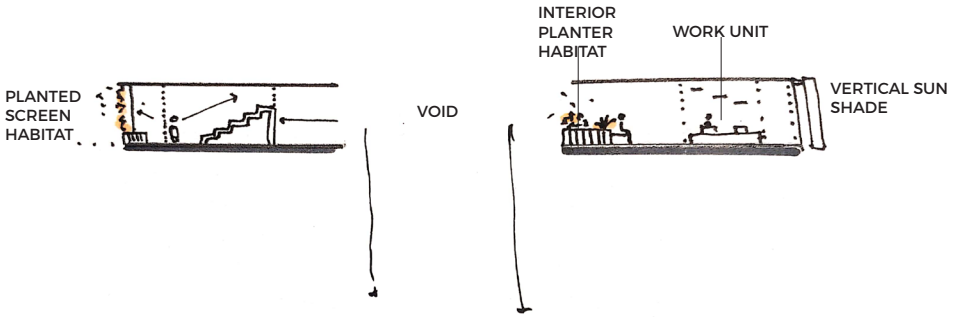


Figure.116: CONCEPTUAL SECTION SECOND FLOOR (AUTHOR 2021)

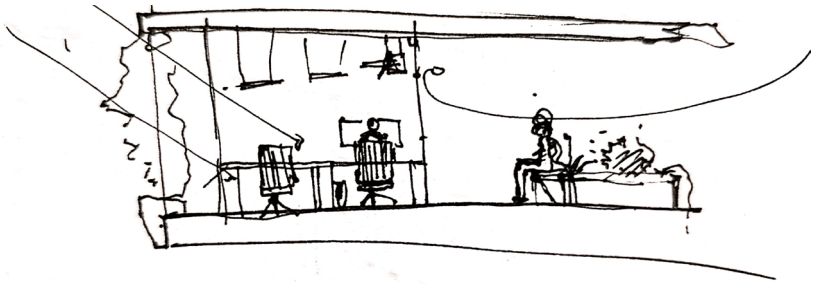


Figure.117: INTERFACE AND CLIMATE (AUTHOR 2021)

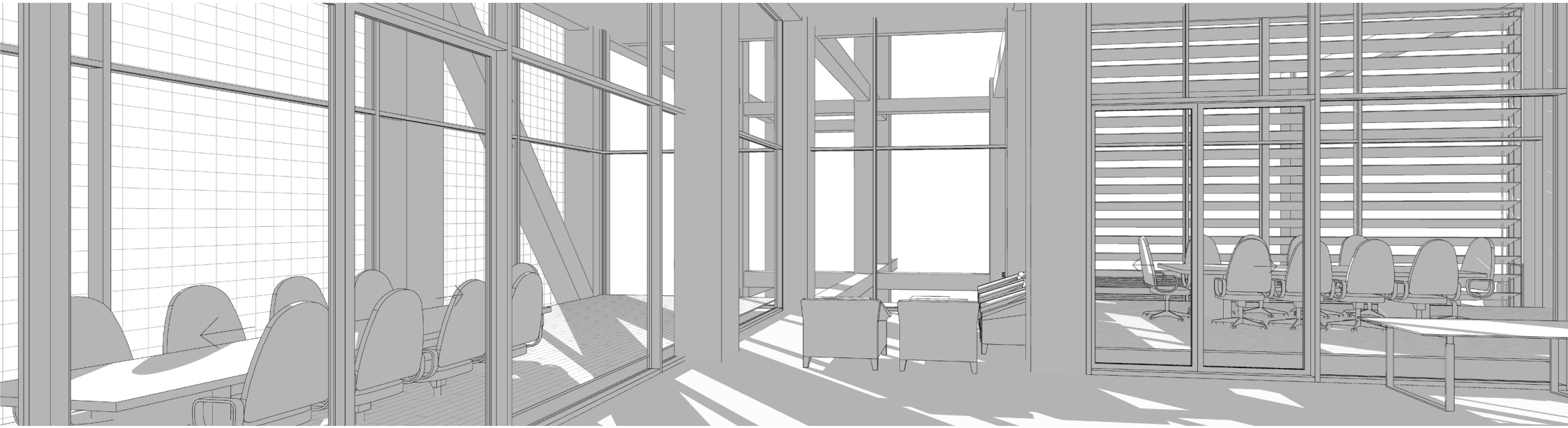


Figure.118: BOARD ROOMS AND SHADING DEVICE (AUTHOR 2021)

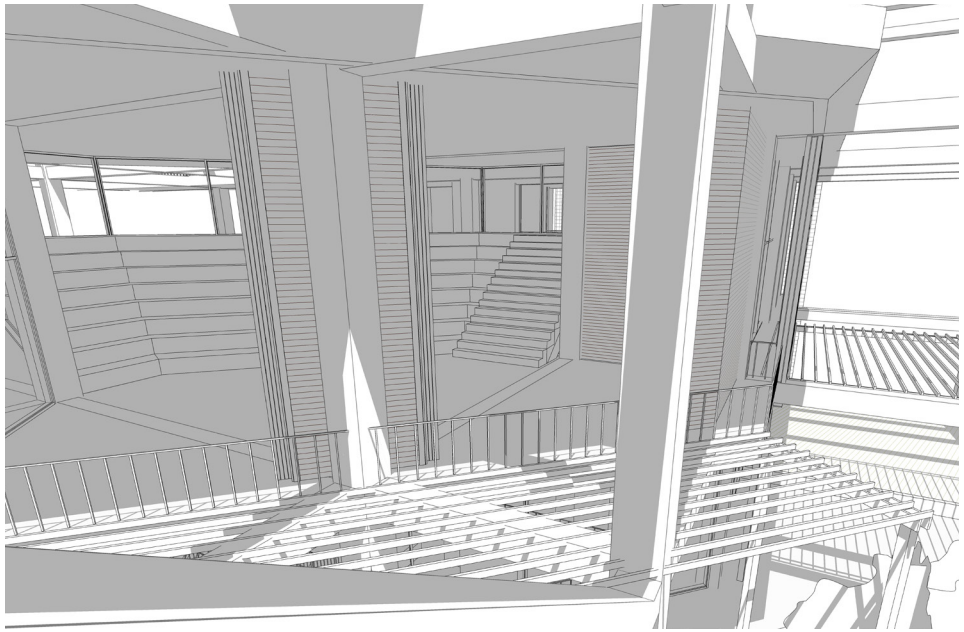
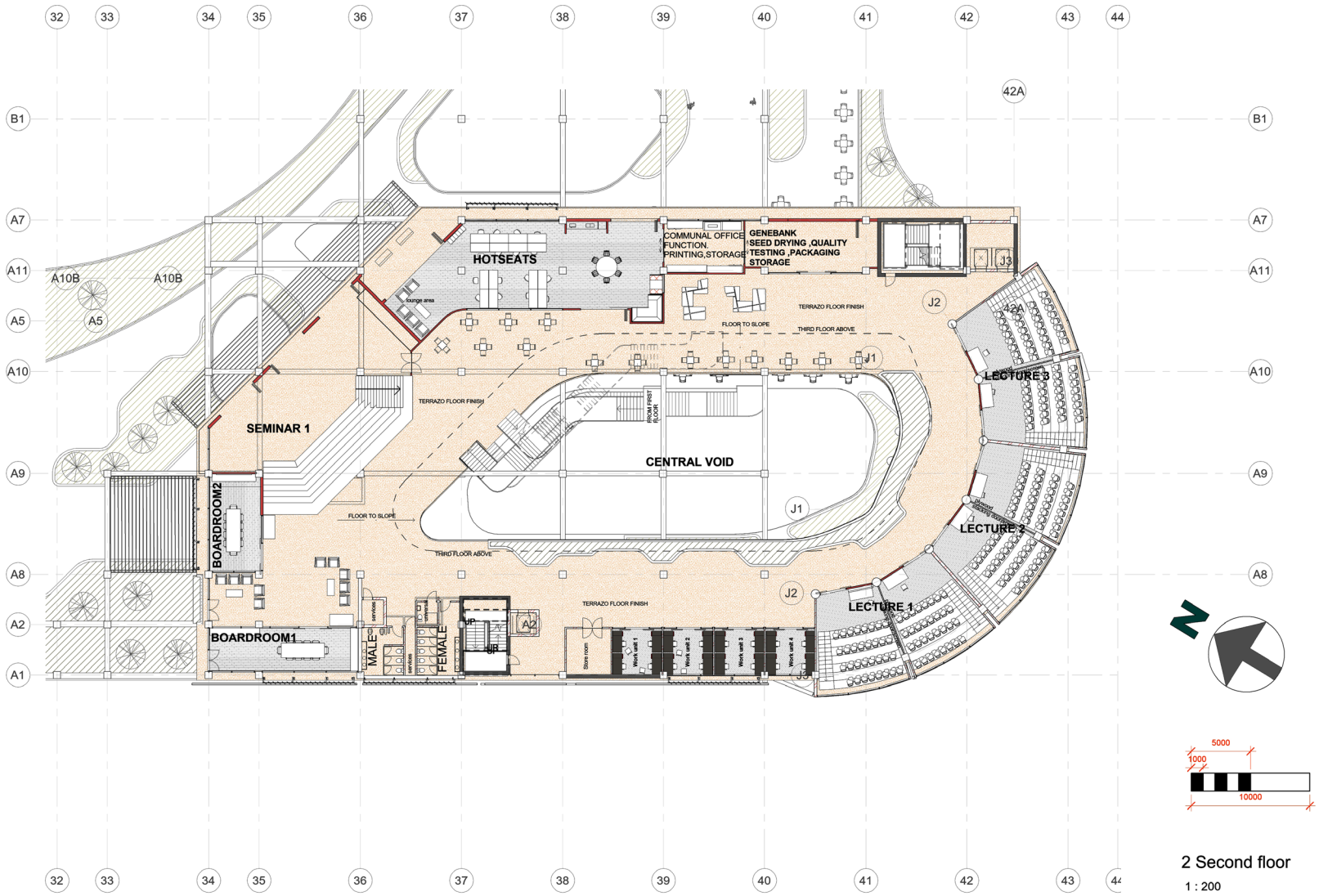


Figure.120: SEMINAR ROOM SECOND FLOOR (AUTHOR 2021)



2 Second floor
1 : 200

Figure.121:SECOND FLOOR PLAN (AUTHOR 2021)

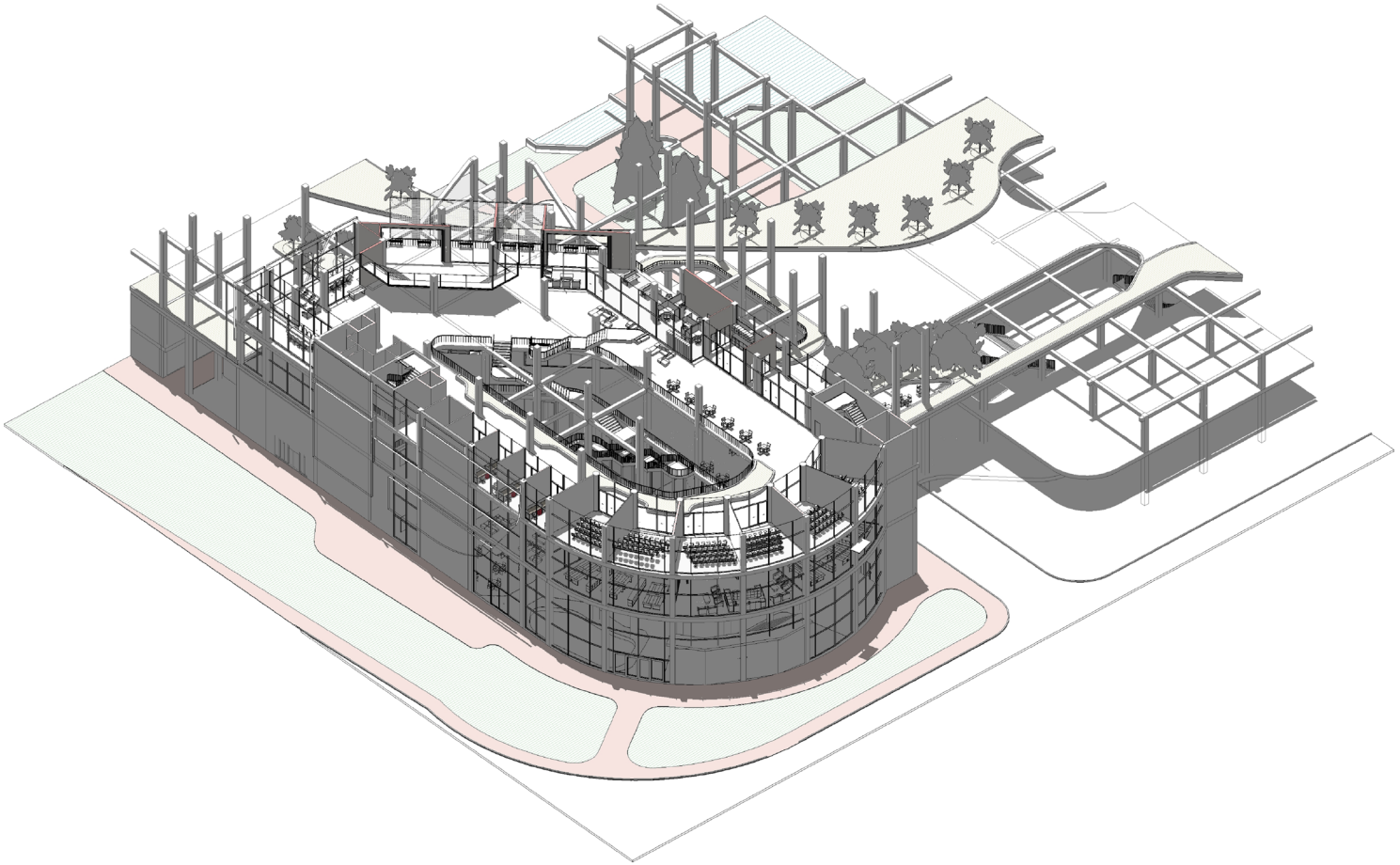


Figure.122:AXONOMETRIC SECOND FLOOR (AUTHOR 2021)

3.9 THE THIRD FLOOR

The third floor is a somewhat open space designed to act as a breakaway from the rest of the Centre. It also acts as an event space in case such a space is required within the precinct. This space becomes the highest area in the development. With views of the street, development and rehabilitated landfill area.

This floor will have substantial exposure to the living wall, within its facade accommodating various species of plants that will attract various species of insects and birds.

As the functions on this floor is minimal in normal working days there is an opportunity to linger in this space and be exposed to biophilia.

Informal seating and meeting space is provided for people who wish to move out of the busy floors below.

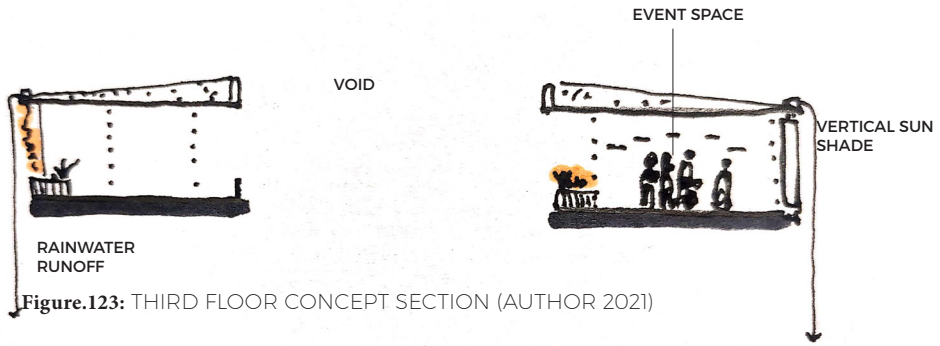


Figure.123: THIRD FLOOR CONCEPT SECTION (AUTHOR 2021)

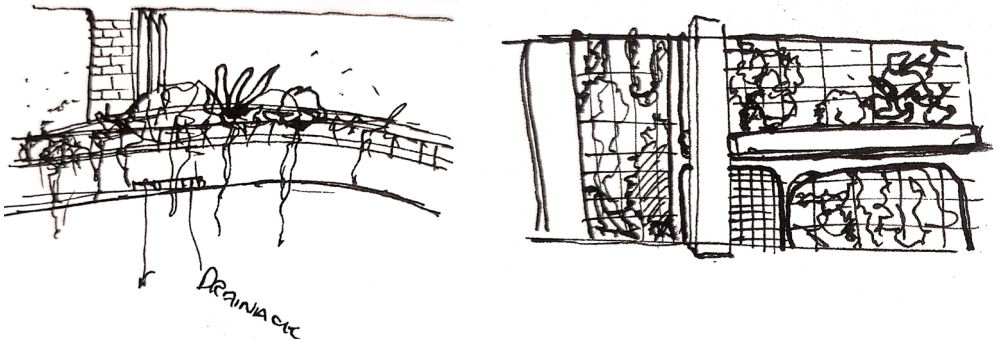


Figure.124: SPECIES INTRODCUTION (AUTHOR 2021)

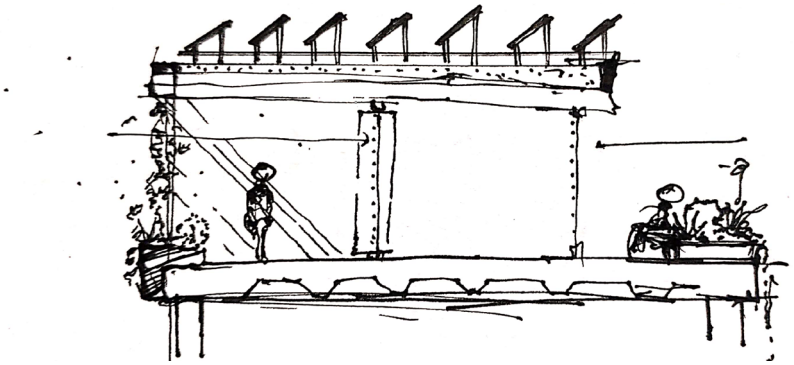


Figure.125:THIRD FLOOR INTERFACE (AUTHOR 2021)

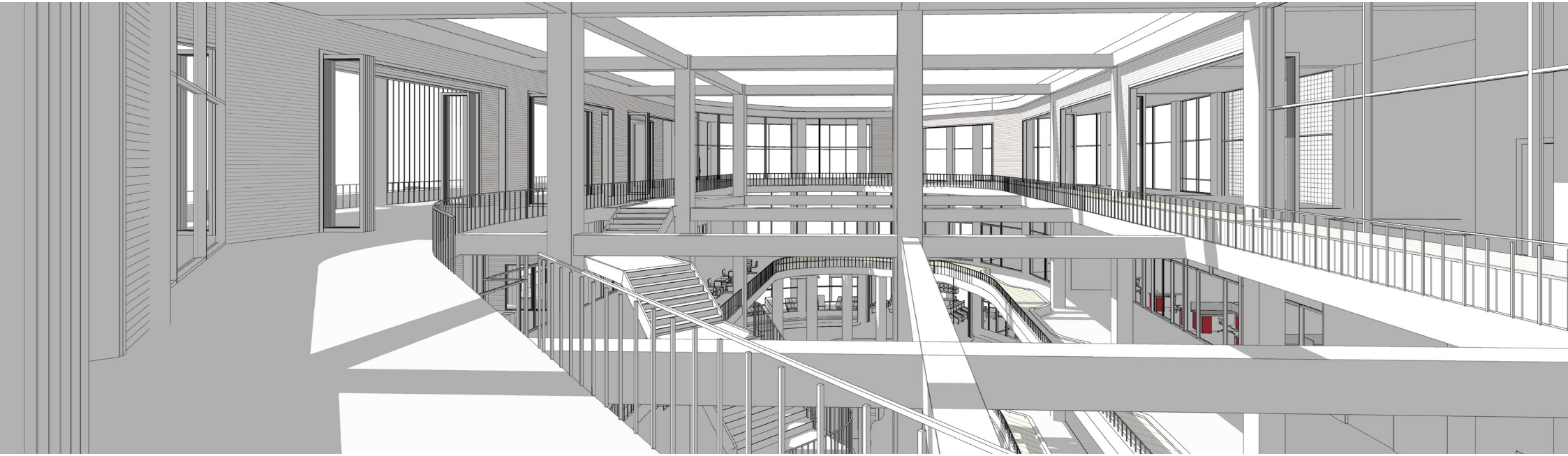


Figure.126:THIRD FLOOR CENTRAL VOID VIEW (AUTHOR 2021)

Figure.127: EXPOSED COLUMN AND BEAM STUCTURE (AUTHOR 2021)

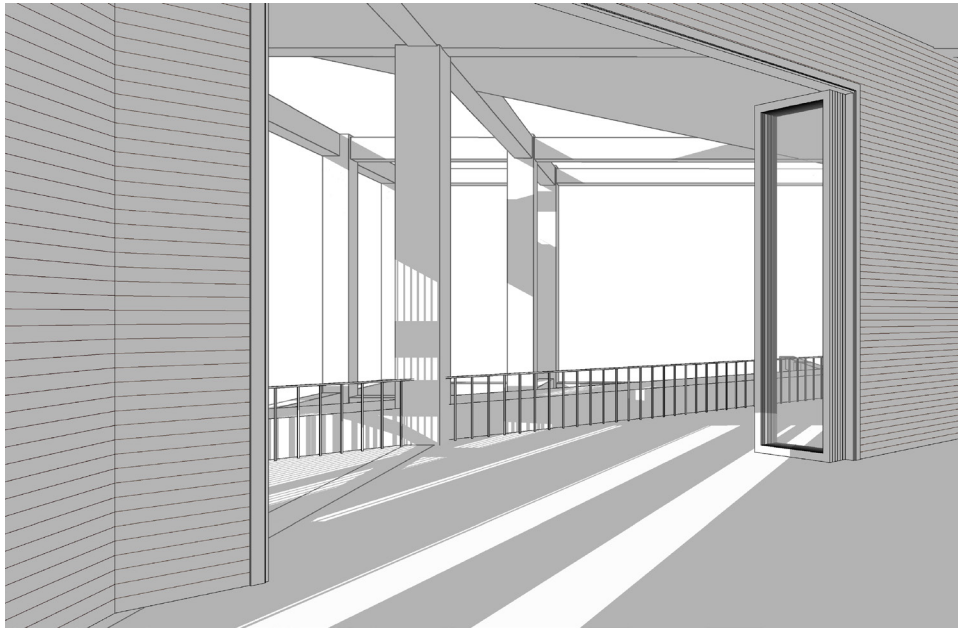


Figure.128:THIRD FLOOR STRUCTURE AND OPENING (AUTHOR 2021)

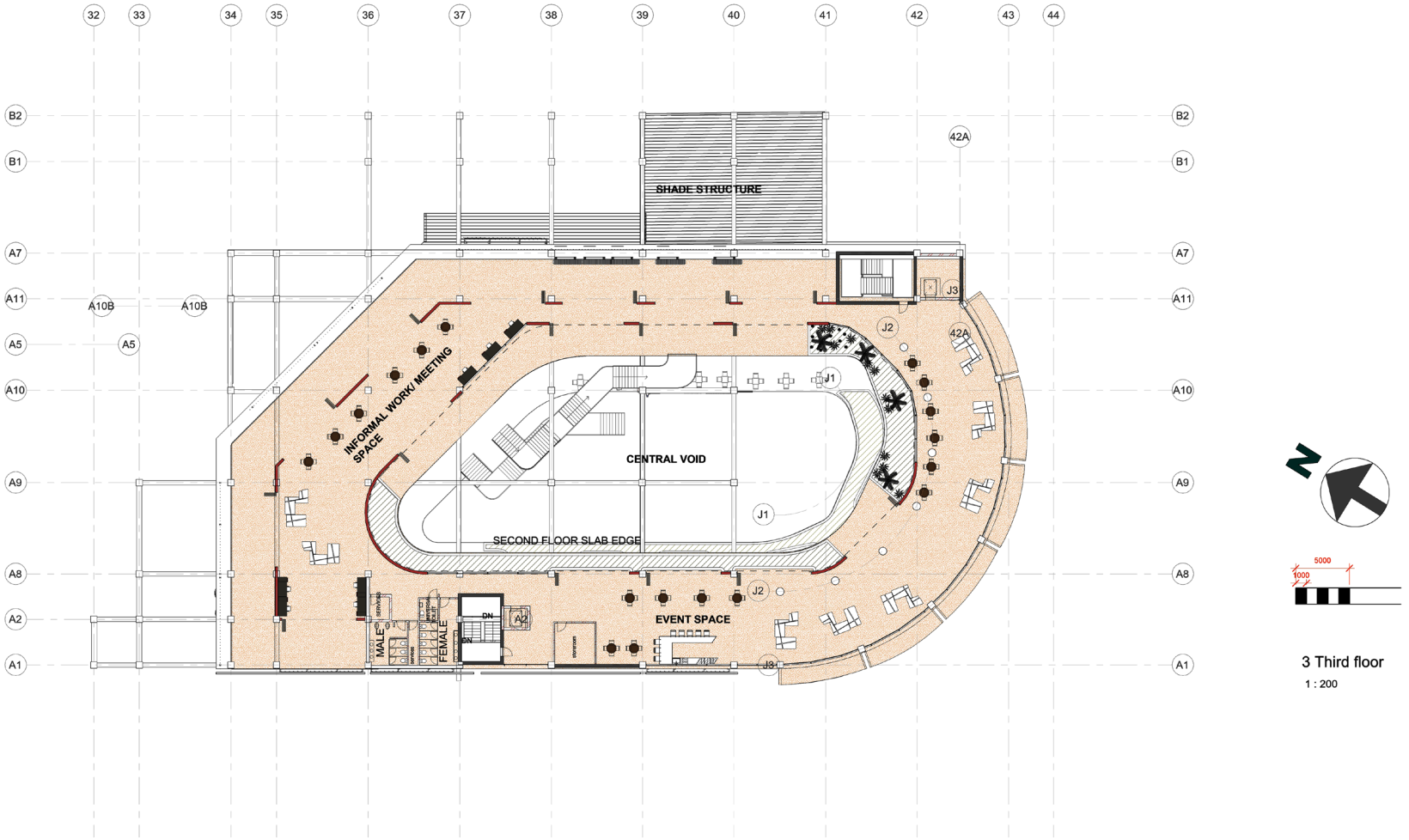


Figure.129:THIRD FLOOR PLAN (AUTHOR 2021)

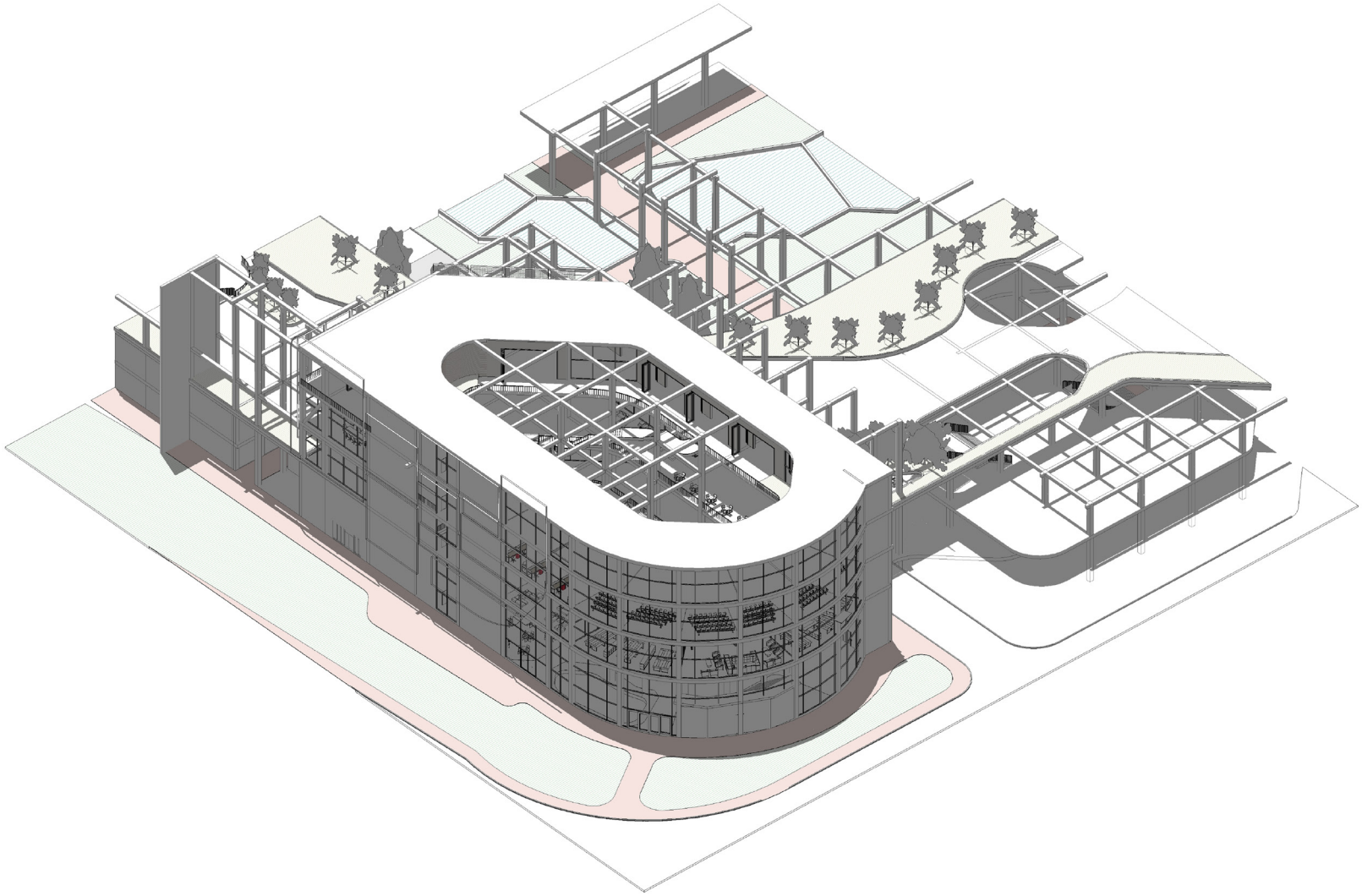


Figure.130: AXONOMETRIC THIRD FLOOR (AUTHOR 2021)

The structure in its entirety become a space of sharing, from an individual level of Online learning to larger groups working together with seminar speakers spreading knowledge. Within this, the structure showcases a system where a human system (the building) and an ecosystem works together in co-evolution or symbiosis for the benefit of both. The GeneticBank allows the structure to have a direct impact on ecological system within its immediate area and beyond, contributing to the genetic conservation of areas within Gauteng.

By introducing an ecological system in such a way, the idea of deep ecological thinking becomes a more tangible idea, where people are exposed to this system by means of an interface with it. This system will cause the introduced species to have intrinsic value (Naess & Sessions 1985) and cause the inhabitants to experience this.

Seeing how these systems change with the seasons becomes an exposure to phenology (the study of cyclic and seasonal natural phenomena, especially in relation to climate and plant and animal life). The structure becomes almost a living educator, where the different systems are exposed (van der Ryn 2007) and informs people of the workings of the combined systems of man and nature.

These systems will be explained shortly.

The structures design is attributed to the theory discussed: Deep Ecology (Naess & Sessions 1985), the Biophilia hypothesis (Kellert 2005 & Wilson 1993), Regenerative sustainability (Gibbons 2020), Island Biogeography and making nature visible (van der Ryn 2007).

By following these approaches it introduces a ecosystem into the building; one which humans are a part of. As explained, various benefits exist for both humans and non-humans by following this approach such as: ecosystem services, habitat creation, improved mental wellbeing of humans, biodiversity, improved micro climates and so on.

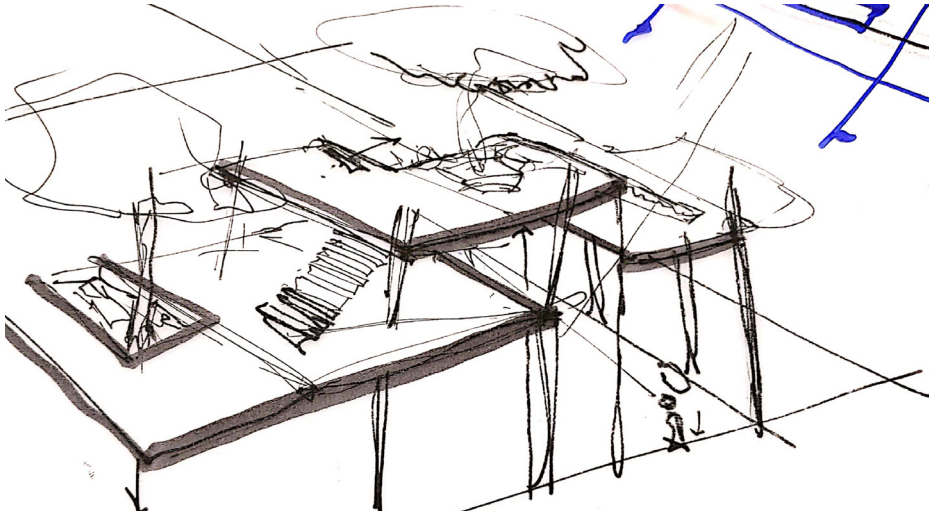


Figure.131: INITIALL CONCEPT SKETCH FOR DATA CENTRE (AUTHOR 2021)

Figure.132: NORTHERN ENTRANCE APPROACH ON FLYOVER (AUTHOR 2021)

Figure.133: SECTION PERSPECTIVE WEST-EAST (AUTHOR 2021)

Figure.134: SECTION PERSPECTIVE NORTH-SOUTH (AUTHOR 2021)

3.10 STRUCTURAL SYSTEM

The primary structural system consists of the existing column, beam and slab frame of the structure, which will be cut into whilst ensuring that the building remains structurally sound.

Consultation with an engineer set the parameter to which the project kept to ensure the structure remain structurally strong. This process gave insight into overhang lengths (35% of Slab span) and strategies to withstand deflection forces (Keeping columns in ordered groups) .

The secondary structural system will add in space creating elements such as walls, shop-fronts. These elements if shop front will be new materials. Elements such as brick or concrete walls, can be recycled from the site.

The tertiary system becomes the building skin and ceiling and wall panels. The building skin will be expanded upon shortly. The ceiling panels aid in reducing the scale of the structure, whilst providing room for some services

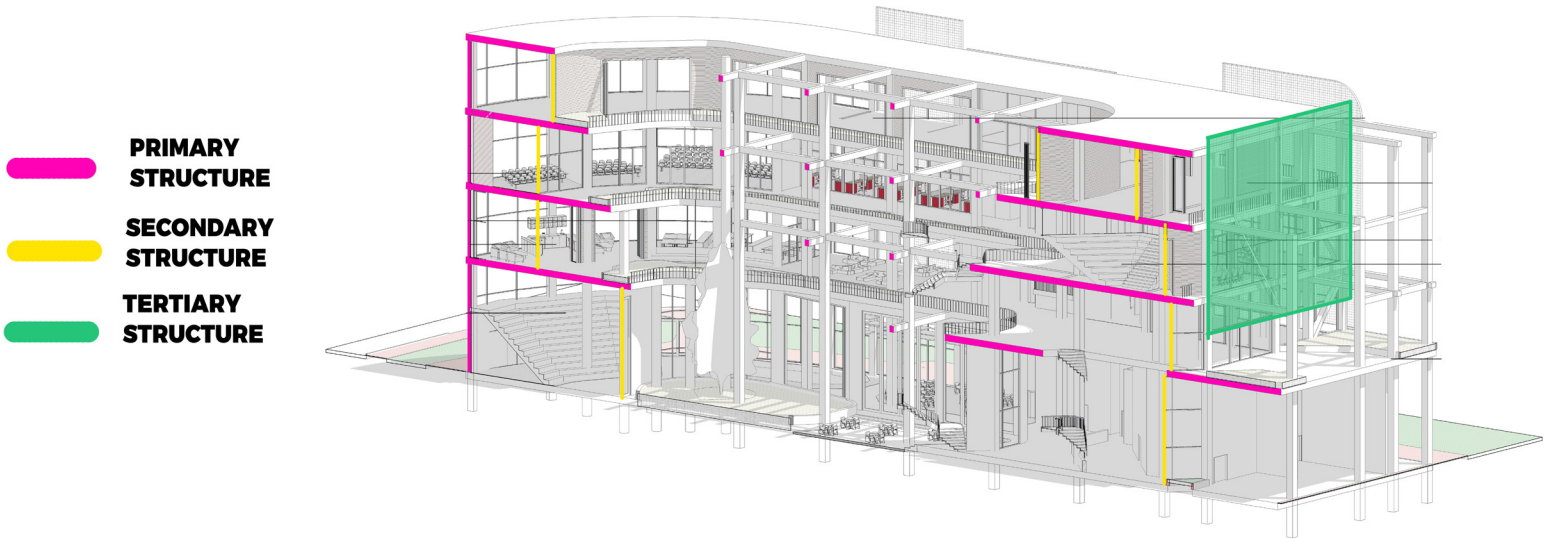


Figure.135: STRUCTURAL SYSTEM (AUTHOR 2021)

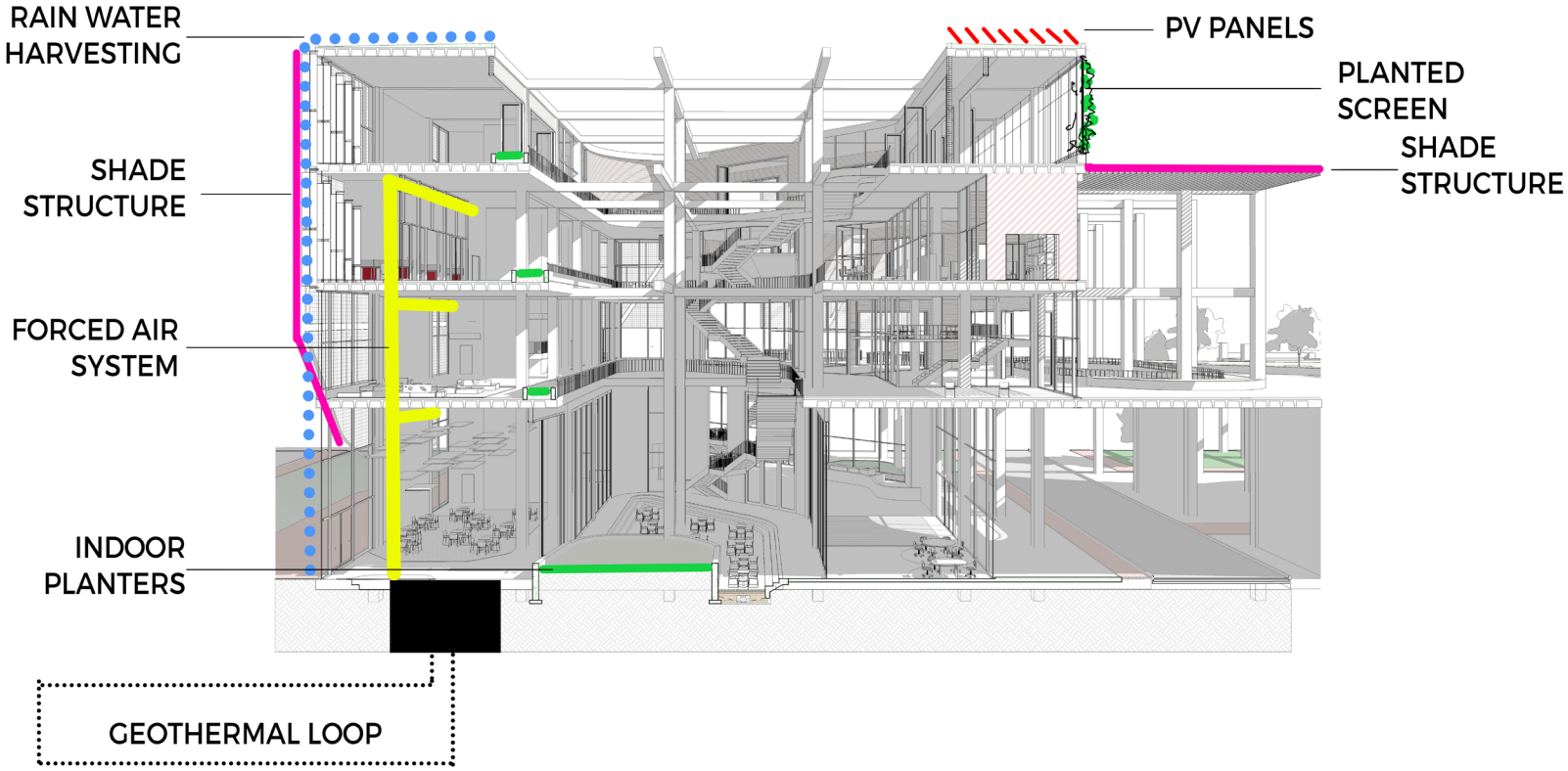


Figure.136:SYSTEM APPROACH (AUTHOR 2021)

3.11 SYSTEM STRATEGY

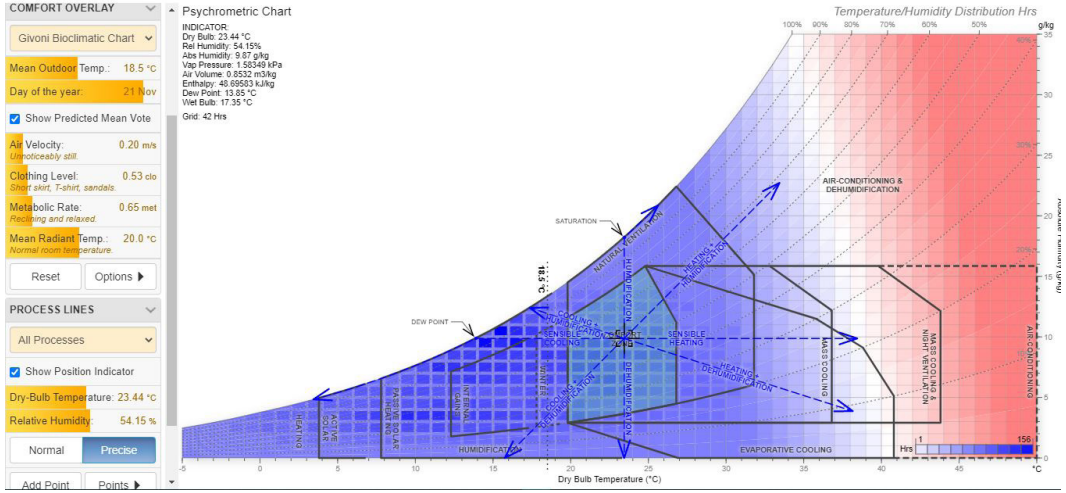
The systems within the structure stem from the theories of sustainability, the reuse of space , deep ecological thinking and the theory discussed. Most of the systems work in conjunction with each other, for instance; rainwater harvested from the roof will water the planters on the façade after it has passed through an artificial wetland.

The photovoltaic panels supplements power throughout the structure. Through this method fewer resources are used creating a more efficient and sustainable system, which in turn has a positive impact on the economic and ecological stance of the site.

Various systems will be working within the structure, most of which will deal with heating and cooling. These systems include:

3.11.1 PHOTOVOLTAIC (PV)

A PV array for the production of electricity, which will power the other systems in the building and various other part of the structure such as lights, computers etc. The PV panels will also have the added benefit of shading the roof, restricting heat ingress.



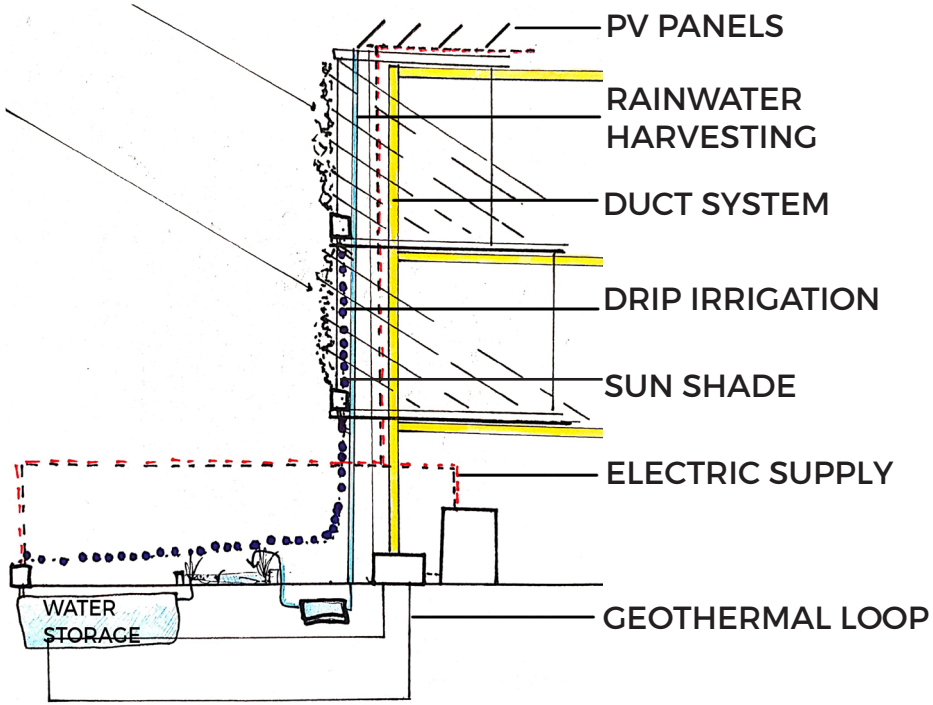


Figure.137: PSYCHOMETRIC CHART (ANDREWMARSH.COM) TOP

Figure.138: INTEGRATED SYSTEMS (AUTHOR 2021) BOTTOM

3.11.2 RAINWATER HARVESTING AND GREY WATER HARVESTING

A substantial harvesting system will also be relied upon. Rainwater from the roof will be directed into the artificial wetland where it will be filtered and stored for other uses (depending on the amount it can be used for irrigation and used to for flushing and cleaning of the site). Grey water will be harvested from wash hand basins within the structure and also directed towards the artificial wetland system and stored for later use.

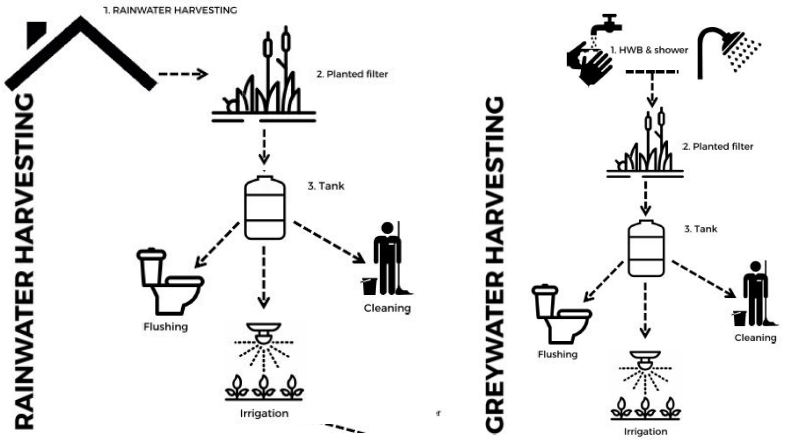


Figure.139: WATER HARVESTING STRATEGIES

(AUTHOR 2021)

3.11.3 GEOTHERMAL HEATING & COOLING.

This method of heating and cooling uses the constant temperature found in the soil which fluctuates between 16.5˚C and 21˚C at a depth of 2 meters. This in turn heats or cools a liquid that gets transferred to a heat exchanger and which subsequently heats or cools air that is moved to conventional forced air system to heat or cool the building.

Depending on the time of the year this method can be efficient but in extreme heat or cold it will need to be supplemented by an air conditionings system to aid with heating or cooling of the structure. The site has sufficient space to have a horizontal geothermal loop (the pipe system which houses the liquid within the soil) next to the structure. Fresh air for the air-conditioning system will be acquired in and around heavily planted area, where the air is cooler, instead of heated air from hardscaped surfaces. This becomes important for this air is used within the HVAC and receiving dirty or heated air from outside is counter-intuitive to the systems approach.

At night the structure will be night cooled, all hot air will be purged from the structure, allowing the building to be cooler during the day.

3.11.4 LIVING WALL SHADING SYSTEM

This system will also be incorporated into the structure. The system will exist out of two parts: one part (human-made) will be horizontal and vertical fins on the Northern and eastern/ western façades respectively. These fins are able to move mechanically as light and temperature requirements change, allowing for more or less sunlight into the structure. The other part (natural) will be a system of planted façade modules, existing out of either mesh screens or iron rod bars for plants to grow on (depending on species requirement). Plants species will be chosen for their sun/shade requirement and placed on the corresponding aspect of the building. Evergreen and deciduous plants will be mixed, this will allow the structure to receive more sunlight in winter months when the deciduous plants have lost their leaves. Various factors can inform plant selection: sun and water requirements, flowering time and colour, does it attract a certain butterfly or bird etc.

The geothermal heating & cooling and the sun shade will work in symbiosis to cool and heat the structure and will be exposed showing the interface of the human-nature relationship working together (van Der Ryn 2007). This system will be supplemented by a standard air conditioning system that will only be used in the most extreme cases.

Together these systems in combination will work to make the building efficient and more sustainable while using less energy,

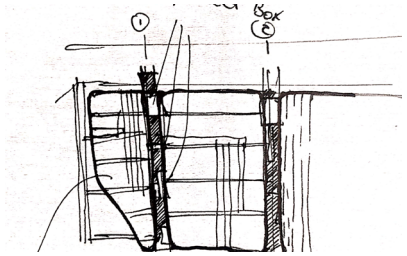


Figure.140: INITIAL IDEA LIVING WALL (AUTHOR 2021)

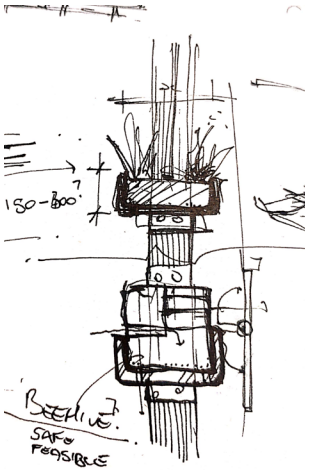


Figure.142: INITIAL DETAIL PLANTERS (AUHTOR 2021)

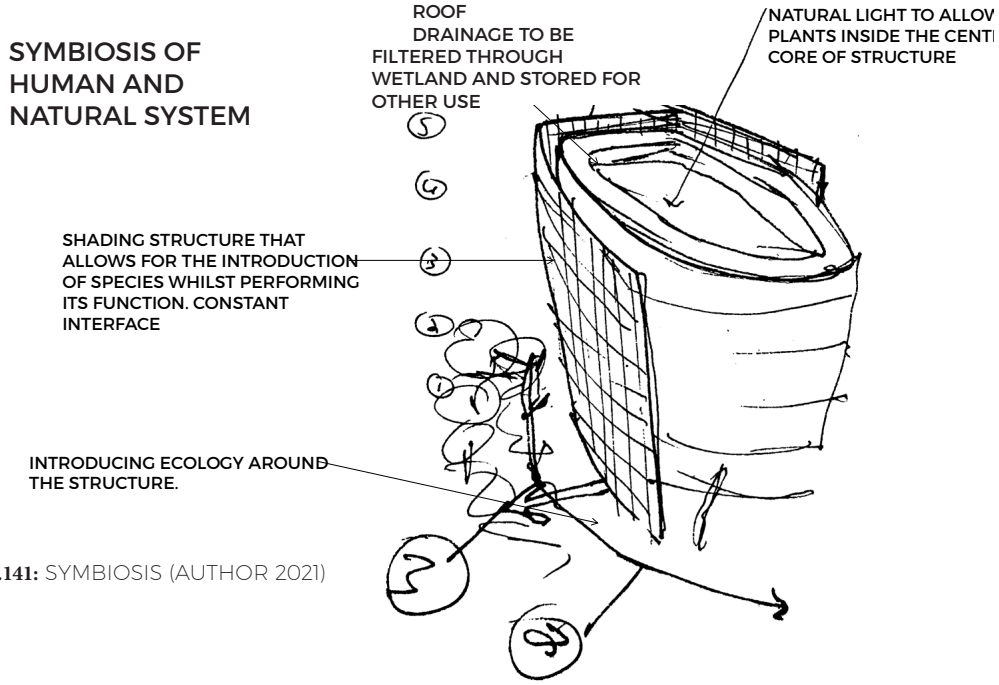


Figure.141: SYMBIOSIS (AUTHOR 2021)

3.15.1 PLANTING PALETTE - TREES

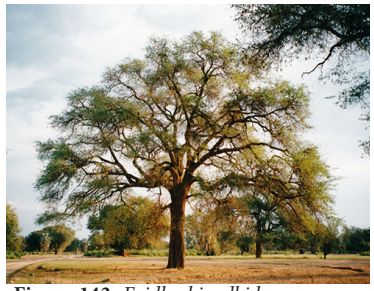


Figure.143: *Faidherbia albida*


Figure.144: *Heteropyxsis natalensis*


Figure.145: *Kigelia africana*


Figure.146: *Kiggelaria africana*


Figure.147: *Bolusanthus speciousus*


Figure.148: *Acacia tortilis*


Figure.149: *Ficus ingens*


Figure.150: *Crotum gratissimusa*


Figure.151: *Olea europea subsp africana*


Figure.152: *Combretum krausii*


Figure.153: *Acacia burkei*


Figure.154: *Diospyros whyteana*


Figure.155: *Dais continifolia*


Figure.159: *Dombreya rotundifolia*


Figure.156: *Harpephyllum caffrum*


Figure.157: *Galpinia transvaalica*


Figure.158: *Combretum erythrophyllum*

Figure.160: *Erythruna lysistemon*

Figure.161: *Acacia karoo*

Figure.162: *Burkea africana*

Figure.163: *Cussonia paniculatem*

Figure.164: *Peltoforum africanum*

Figure.165: *Schotia bracypetala*

Figure.166: *Acacia xanthaphloea*

Figure.167: *Acacia sieberiana*

Figure.168: *Englerophytum magalismontanum*

3.15.2 PLANTING PALETTE

Figure.169: *Aloe ferox*

Figure.170: *Aloe arborescens*

Figure.171: *Melins repens*

Figure.172: *Aloe marlothii*

Figure.173: *Xerophyta retinervis*

Figure.174: *Melins nerviglumis*

Figure.175: *Aloe pretoriensis*

Figure.176: *Aristida congesta*

Figure.177: *Themda triandra*

Figure.178: *Grewia occidentalis*

Figure.179: *Ancylobrotrys capensis*

Figure.180: *Chlorophytum bowkeri*

Figure.181: *Crocosmia aurea*

Figure.182: *Dieters grandiflora*

Figure.183: *Ertheria rigida*

Figure.184: *Felicia sp*

Figure.185: *Jasminum sp*

Figure.186: *Budleja saligna*

3.15.3 SPECIES SELECTION

Part 3.15.1 & 3.15.2 give an indication of the type of species that can be introduced into the development (there are various other species not shown). Most of these plants fall within the relevant vegetation units: Gauteng shale mountain bush veld & Rand Highveld grassland. Other species that do not fall within these units are chosen mostly for aesthetic reason and they are easily sourced.

The mixture of these two vegetation units provides a large mix of species available for selection, ranging from smaller ground cover from the grassland unit to large Acacia trees from bush veld unit.

Choosing species from these units has various benefits: Most of the species will have the same requirements regarding; Water and geological condition. Further, these species will attract indigenous fauna to the area, species from all spheres, insects, birds, reptiles and hopefully mammals.

Some feature trees: Erythrina lysistemon & Dombeya rotundifolia. These species bloom in the same time and create an impressive sight with their white and red flowers.

Figure.187: *Bauhinia galpinii*

Figure.188: *Hypoestes aristata*

Figure.189: *Combretum microphyllum*

3.15.4 FEATURE TREES

Figure.190: *Erythrina lysistemon*

Figure.191: *Dombeya rotundifolia*

3.16 GREEN STAR AND RATING

The De Villa Bois structure received a 4-star Green star rating prior to completion. It scored well in parts such as; management, transport, water, material use, emissions and energy. Most of these aspects can be improved upon.

Some of the points scored are irrelevant now, as the structure was never completed and some aspects were never built, however, there are still parts that are of relevance.

MANAGEMENT

The management of the structure becomes important. There is a need to be more environmentally adept and understanding. This is required from construction management phase to the full occupation of the building by staff and the public to ensure the systems in place work efficiently. The energy and water use within the structure (and the larger development) will be monitored by staff. Together with this the health of the ecosystem must be monitored and managed by relevant parties, to ensure it function as it should and supports biodiversity. Any fault or system that is not functioning as it should will be addressed immediately.

INDOOR ENVIRONMENTAL QUALITY

Indoor environmental quality is approached largely by the creation of the central void in the structure. This void allows for natural ventilation and the ingress of natural light within the structure. Overhangs on façades that receive direct sunlight are designed adequately (allowing for sun ingress in wintertime but shading spaces in the summer)

Within this the Geothermal heating and cooling system keeps the enclosed spaces of the structure heated or cooled in the respective over-heated and under-heated period of the year

ENERGY

All energy demands will be supplemented by PV panels. Other strategies include the use of Automatic lights that switch off if people are not using a certain space, the same goes for the ventilation system.

Through the reducing of scale of the building ,it allows for a smaller and more efficient HVAC systems which uses less energy, combined with the the Geothermal heating and cooling system it creates an efficient system for ventilation.

TRANSPORT

The development reuses existing parking bays within the structure. Priority parking is given to electrical vehicles and disabled persons.

Bicycle storage is also provided in the data centre as well as other parts of the development.

A new public transport interchange is also proposed which will connect to a larger system of public transport, encouraging people to use public transport.

WATER

Rain water and grey water will be harvested from the various parts of the development and used for irrigation and flushing throughout the development. This water will be filtered through an artificial wetland system and stored in underground tanks for later use.

MATERIALS

Some of the existing material used within the structure was created in a specific way: in terms of the concrete 30% of the cement used in the project will be replaced by industrial waste products, reducing the embodied energy of the concrete. In terms of the steel 60% of the steel reinforcing will have a recycled content of greater than 90%. As the structures scale is reduced and by reusing concrete as recycled concrete aggregate this will once again be more recycled material within the concrete reducing its embodied energy.

Space that use timber floor will make use of rubber cradle acoustic systems. The rubber crumb cradles are created from recycled tyre rubber and can be installed quickly and avoid the need for levelling screed with extensive drying times. InstaCradles facilitate easy levelling of uneven sub-floors. These floor are also acoustically appropriate for these spaces .

LAND USE & ECOLOGY

The land use of the development is drastically altered with the deconstruction of the structure and the conversion from what would have been a mall to an ecological focused civic centre with various functions. The deconstruction allows for the introduction of vast amounts of flora (and hopefully attract various fauna in the process) that will improve the ecology of not only the De Villa Bois structure but the entire Garstkloof site and beyond. The improved of the Garstkloof nature area and landfill will further improve ecology and biodiversity for the site.

INNOVATION

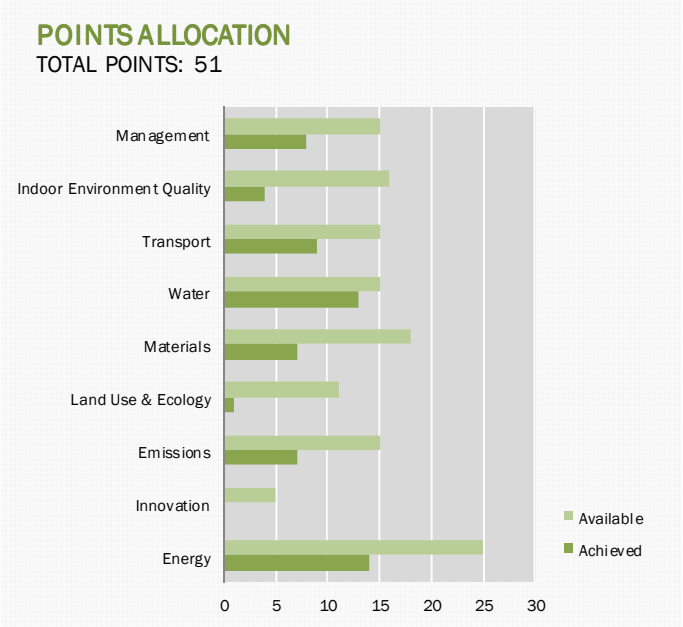
The living wall becomes an innovation worth including in the report. This system will aid in the heating/cooling of the structure but also benefit ecology by the introduction of species. The introduction of an ecosystem into a human system will also fall under innovation.

ADDITIONAL CATEGORY: SOCIO-ECONOMIC

As the structure was never complete and left abandoned for over 10years, no social or economic function existed on site. By developing the site and allow for commercial and further changing the perspective of the site from an eyesore to something positive impacts on the socio-economic stance. The site also provides much needed civic space for an area in Pretoria that lacks it.

In conclusion, the previous rating was a 4-star rating with a score of 51 points. The "new" structure had a rough estimated point value of 70.5, which is sufficient for a 5-star rating (points between 60-74). With most of the points coming from innovation, improvement of land use and ecology and indoor environmental quality.

The management of the structure will remain important long after construction is completed.



GREEN BUILDING COUNCIL OF SOUTH AFRICA

Figure.192: GREENSTAR RATING (GBCSA)

3.17 SBAT RATING

The sustainable building assessment tool gave a indication for environmental, economic and social performance. To my surprise, the project scored the least for environmental performance, which I believe to be a lack of rating tools from the SBAT in terms of the ecology.

The project also scored poor in energy as a in depth energy usage was not completed , as this was not within the project scope.

Generally however the building/development performed well.

SB4 Environmental, Social and Economic Performance	Score
Environmental	4,2
Economic	4,5
Social	4,5
SBAT Rating	4,4

SB5 EF and HDI Factors	Score
EF Factor	4,3
HDI Factor	4,2

SB6 Targets	Percentage
Environmental	83
Economic	91
Social	90

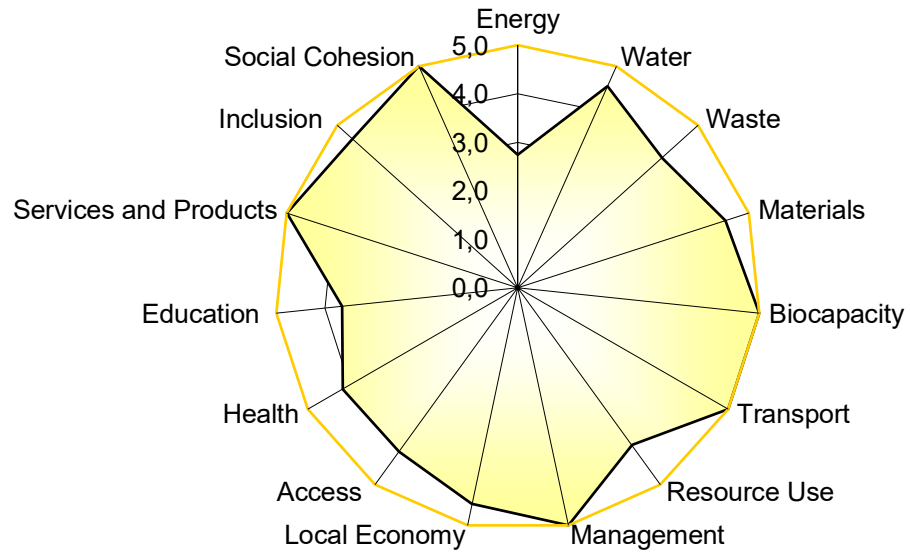


Figure.193: SBAT RATING CREATED FROM SBAT EXCEL SHEET

3.18 CONCLUSION

By designing the structure in such a way to accommodate for the ecological system, habitat is increased for species, whilst providing the human occupants of the structure with various benefits, ranging from increase attention spans (Tennessen & Cimprich 1995) to improved micro climate (Wohlitz et al 2016).

The social, ecological and economic potential of the development is improved upon through the introduction of an ecosystem and the introduction of commercial areas and meeting space.

Introducing an ecological system in such a way can become a prototype for new development being planned or older existing structure being reused.

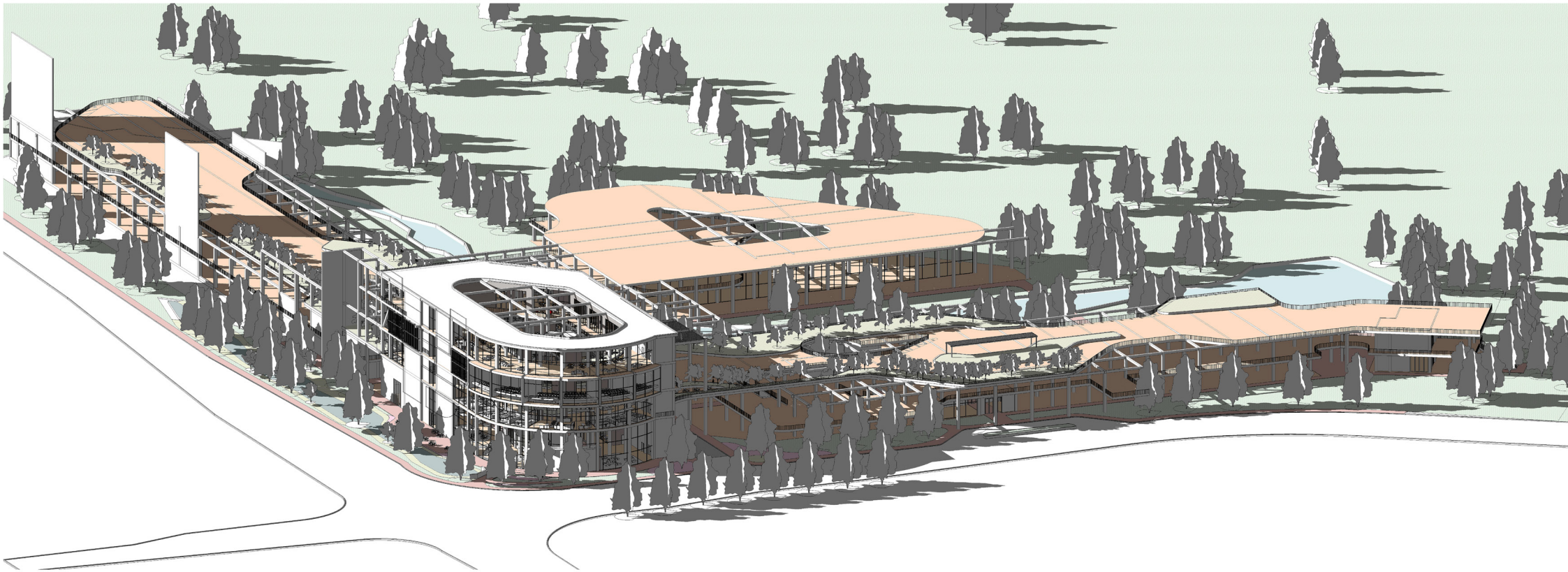
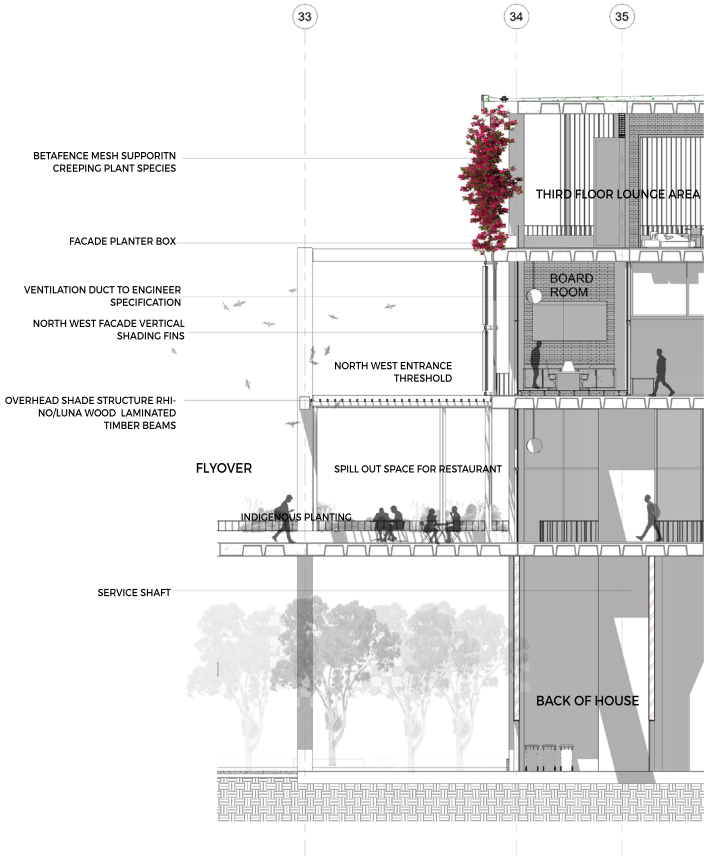


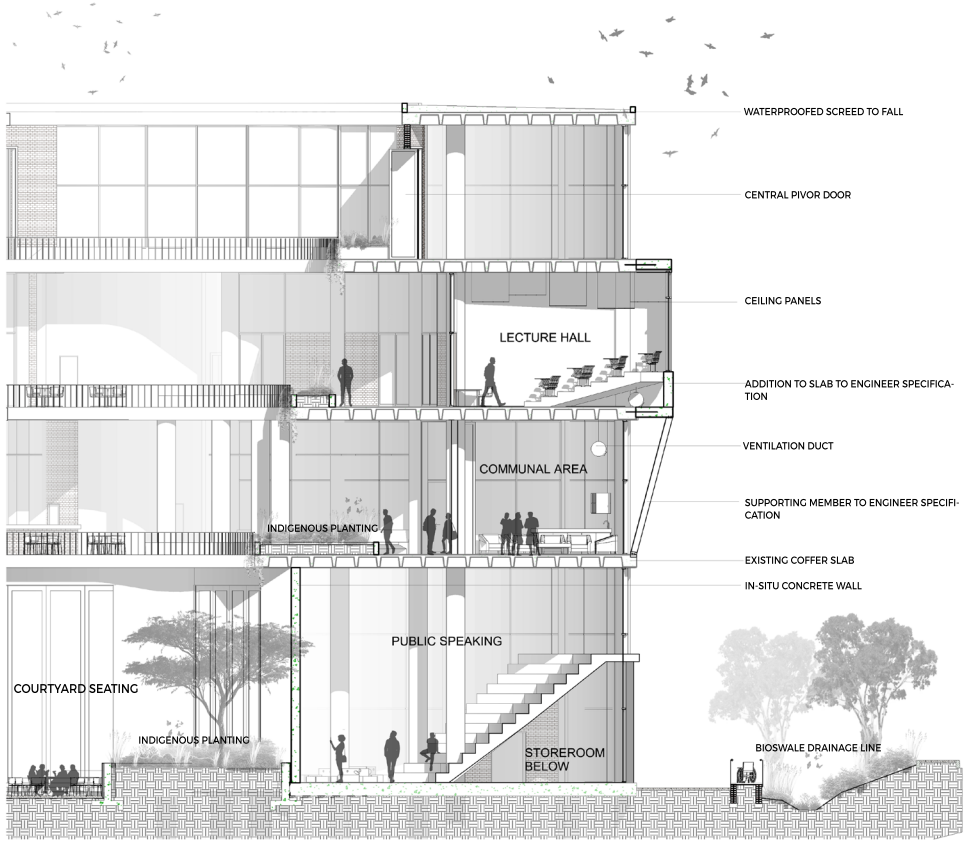
Figure.194: AXONOMETRIC (AUTHOR 2021)

Figure.195: SECTION EAST-WEST 1:50 on A0 (AUTHOR 2021)



North strip section

1 : 100



South strip section

1 : 100

Figure.196: STRIP SECTION 1:100 on A1 (AUTHOR 2021)

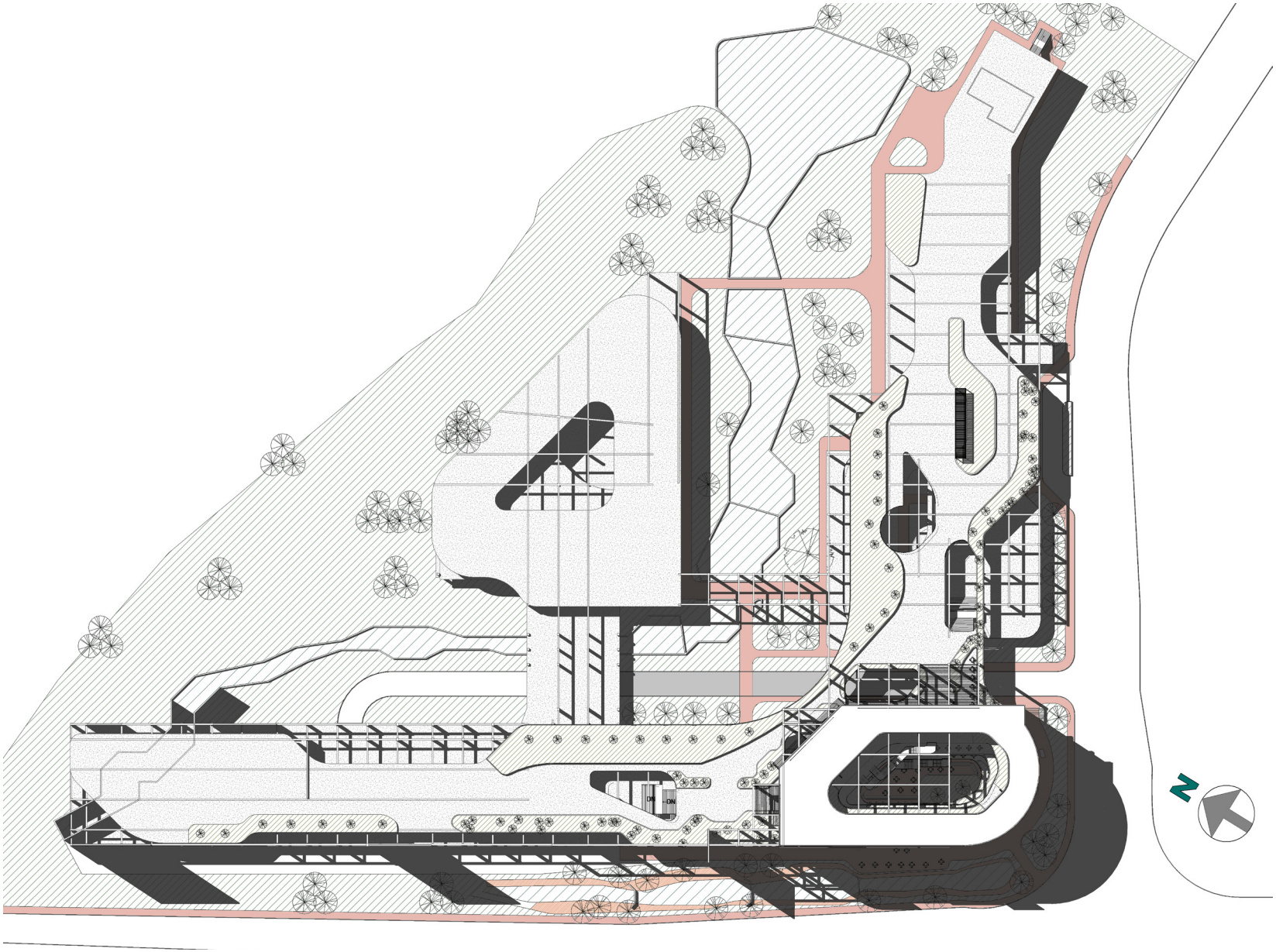


Figure.197: SITE PLAN (AUTHOR 2021)

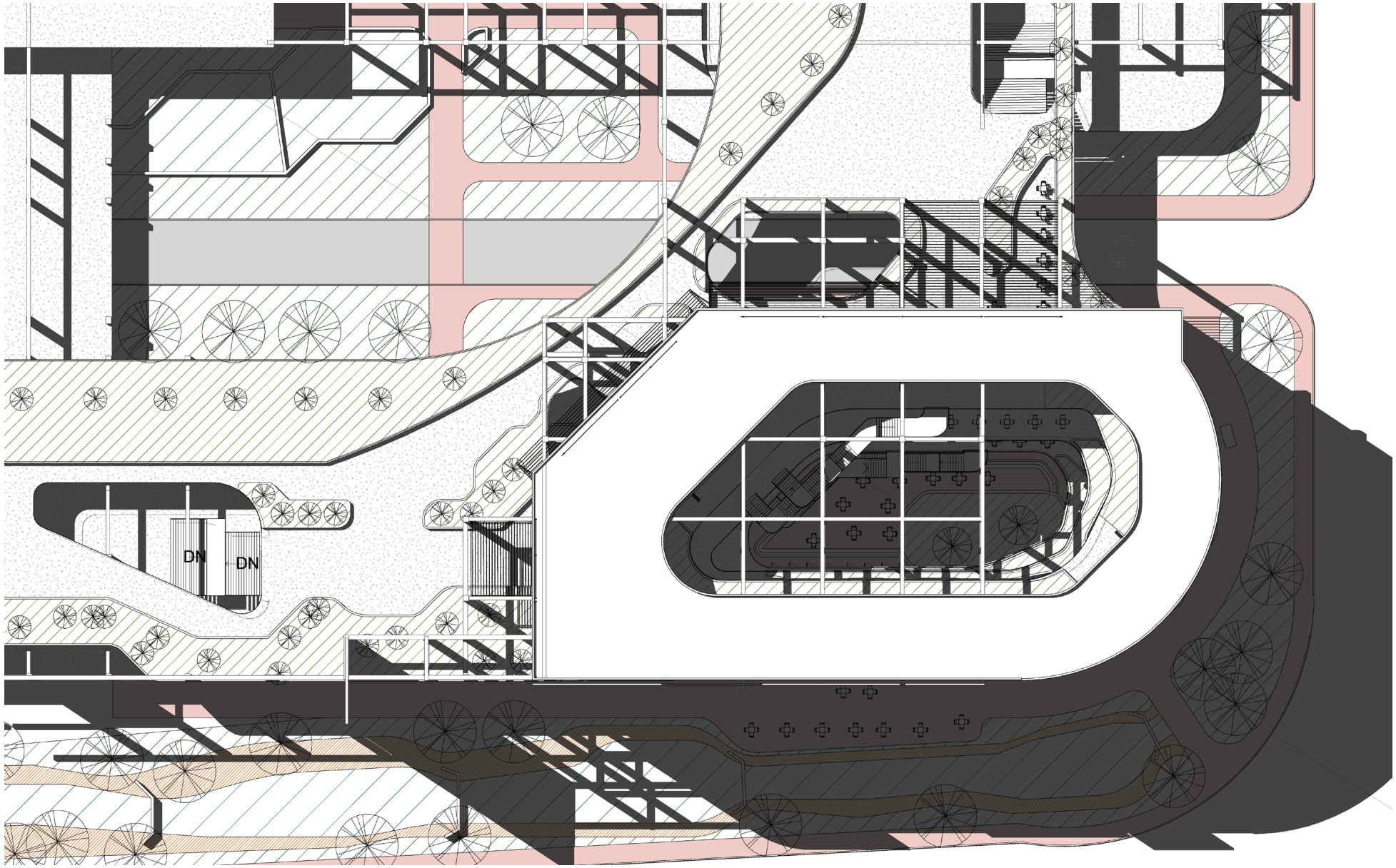


Figure.198: SITE PLAN DATA CENTRE (AUTHOR 2021)

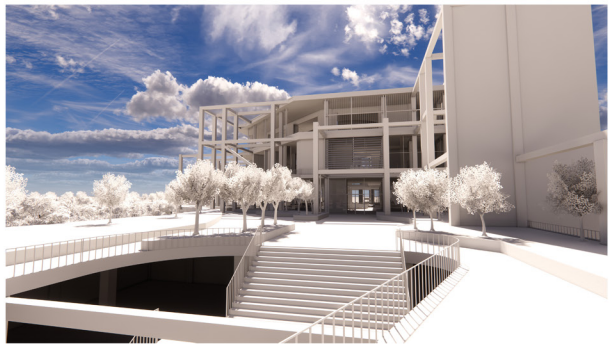
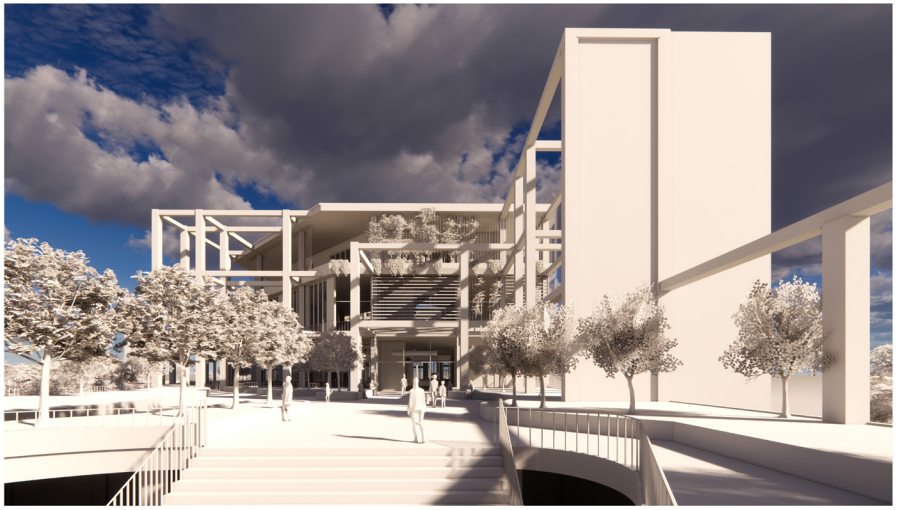
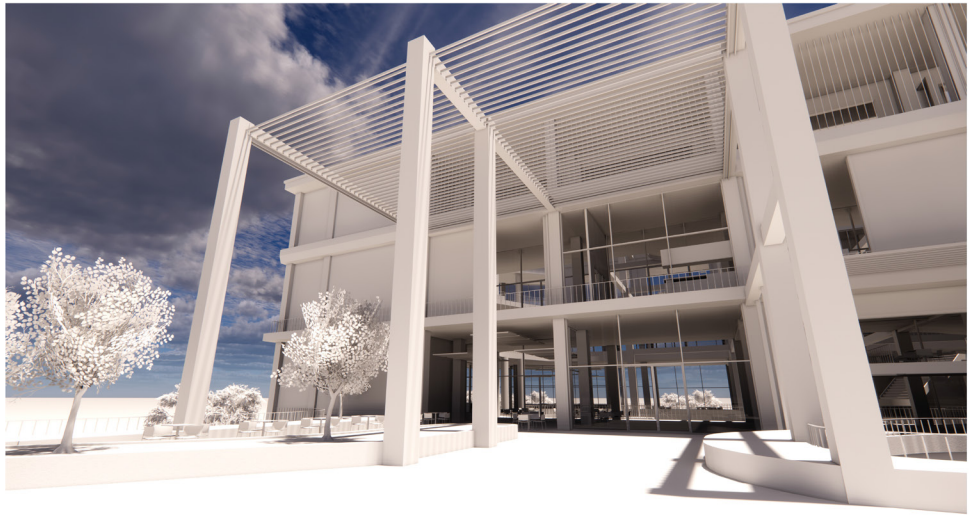
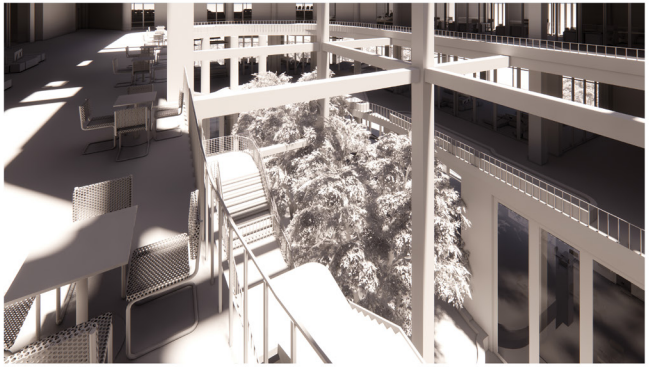


Figure.199: RENDERS (AUTHOR 2021)







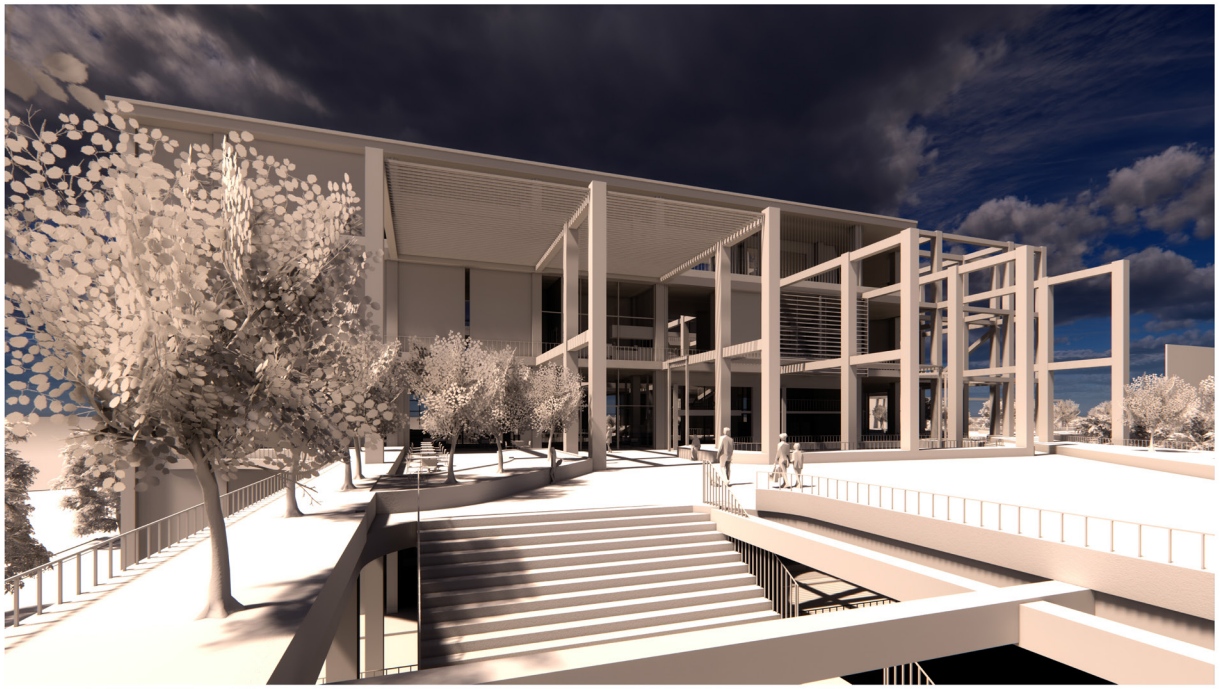


Figure.200: RENDERS CONTINUED (AUTHOR 2021)

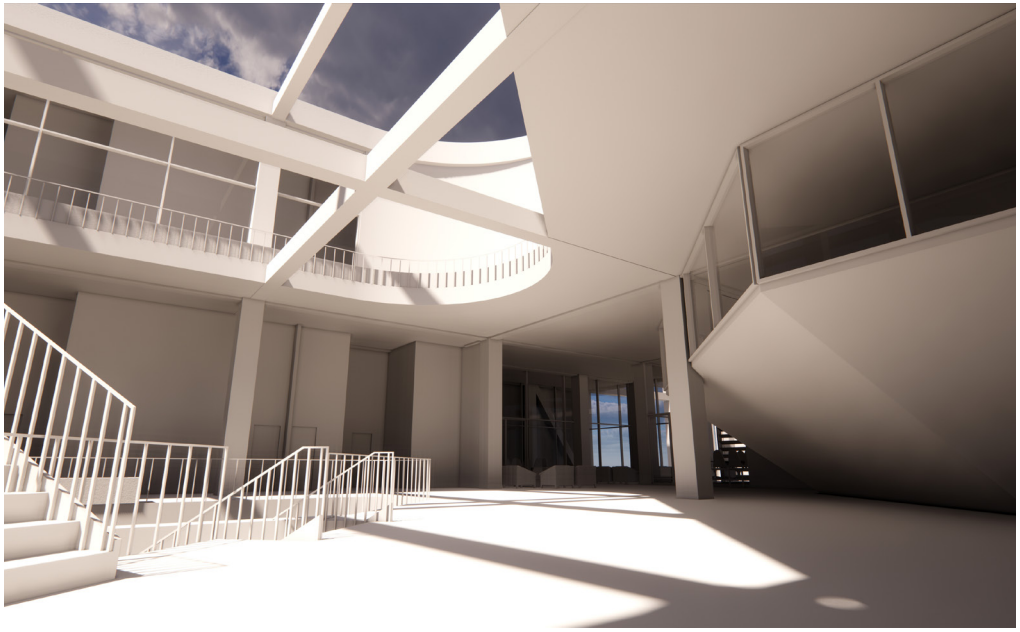


Figure.201: RENDERS CONTINUED (AUTHOR 2021)

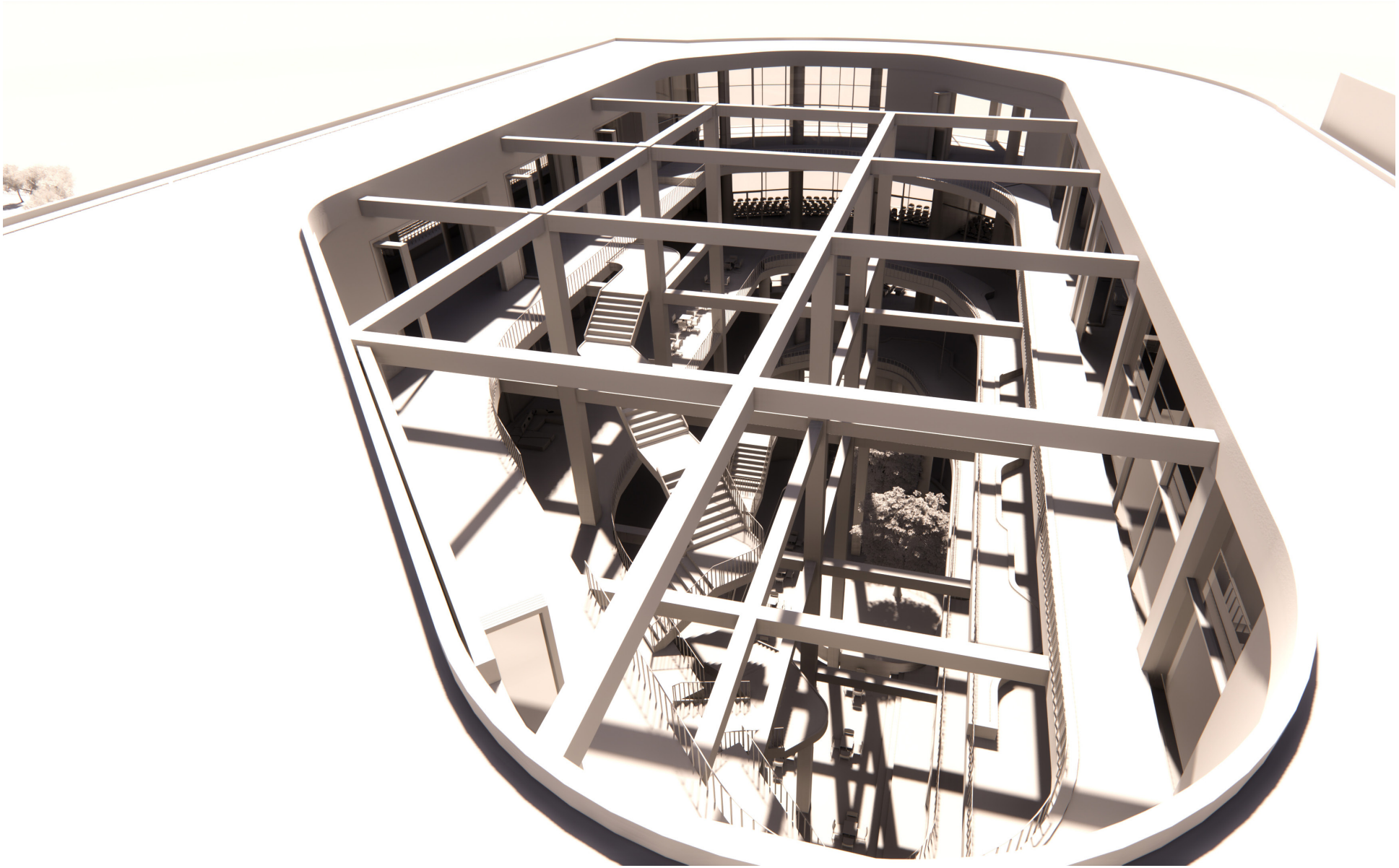
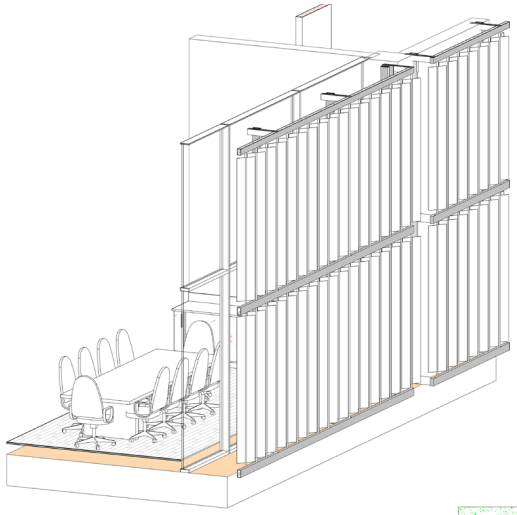
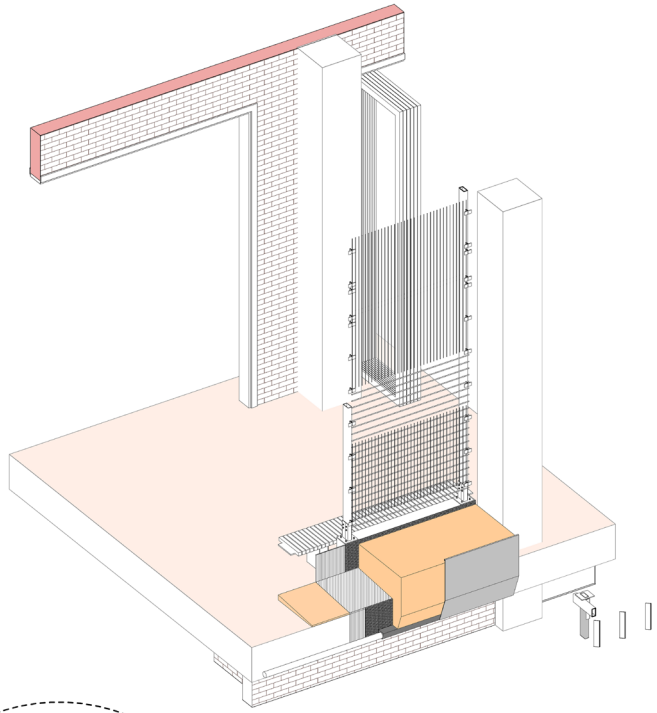
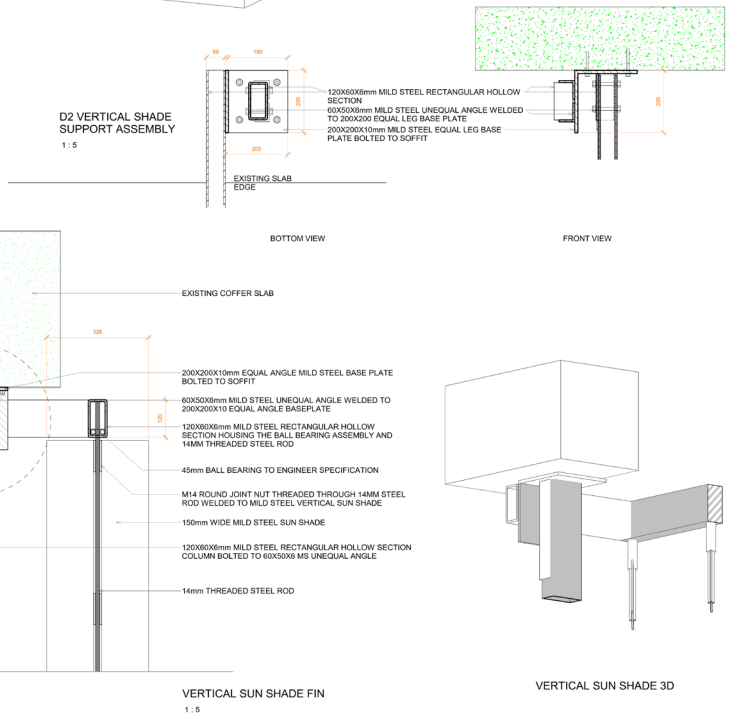
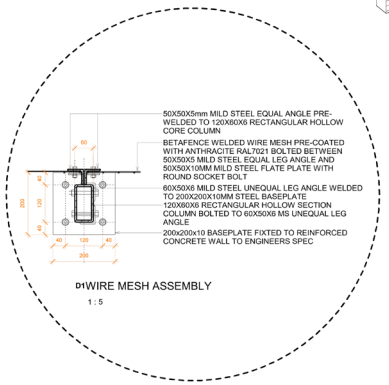


Figure.202: RENDERS CONTINUED (AUTHOR 2021)









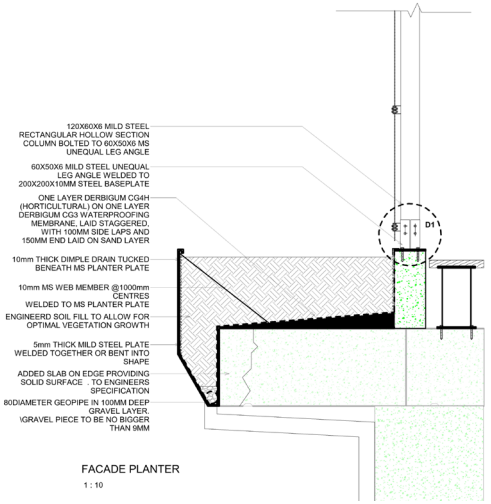
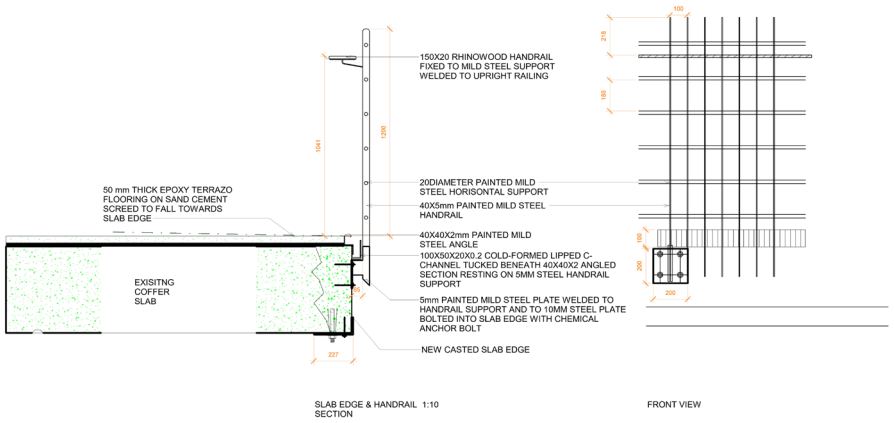
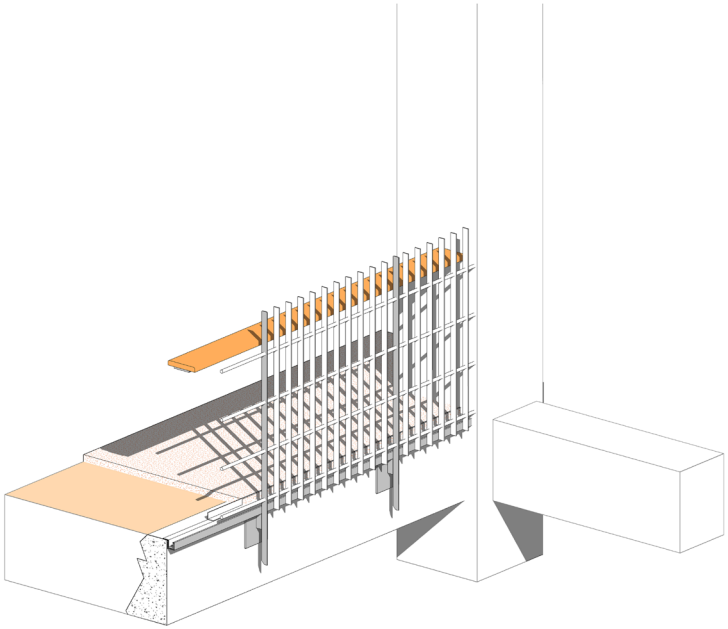


Figure.203: DETAILS (AUTHOR 2021)





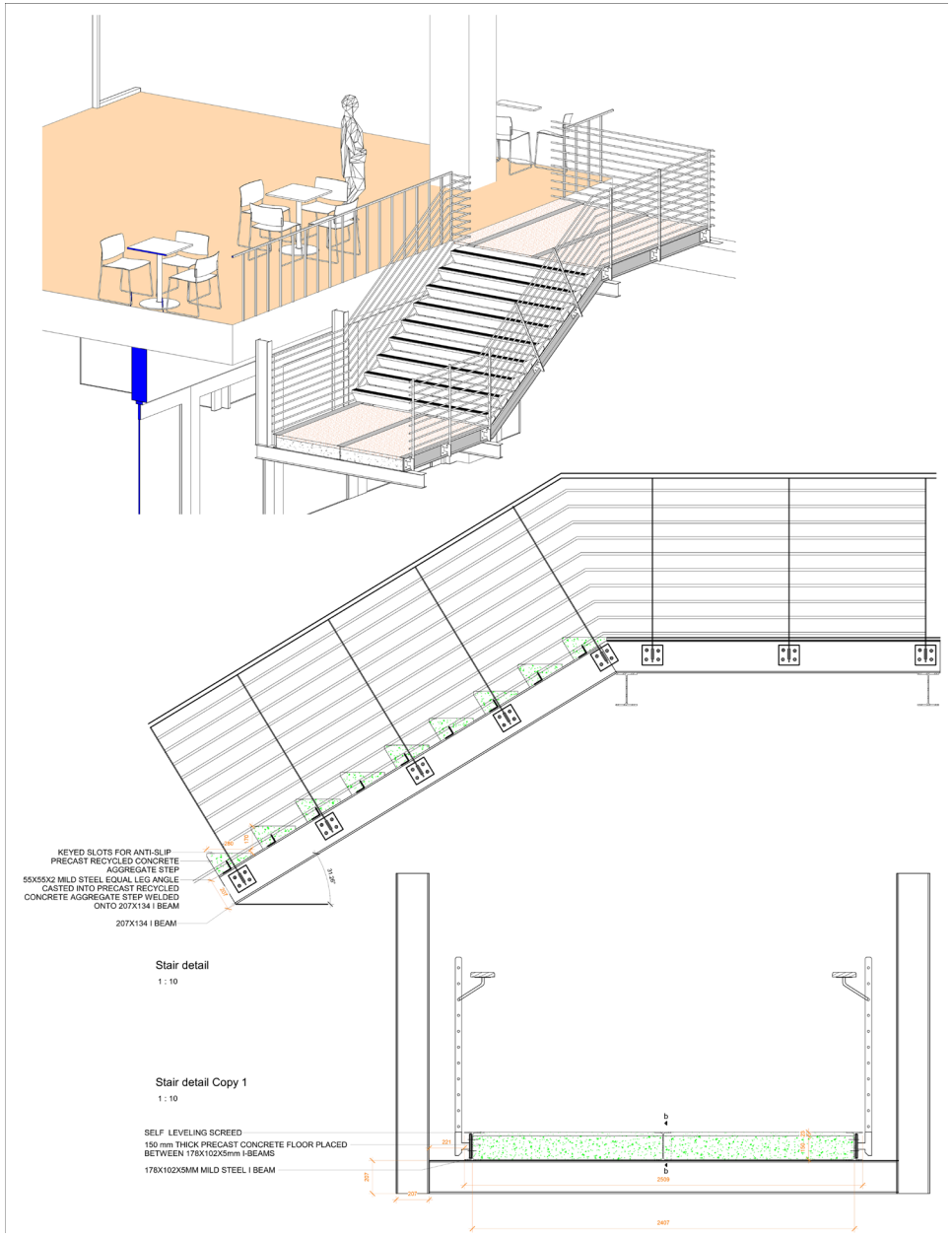
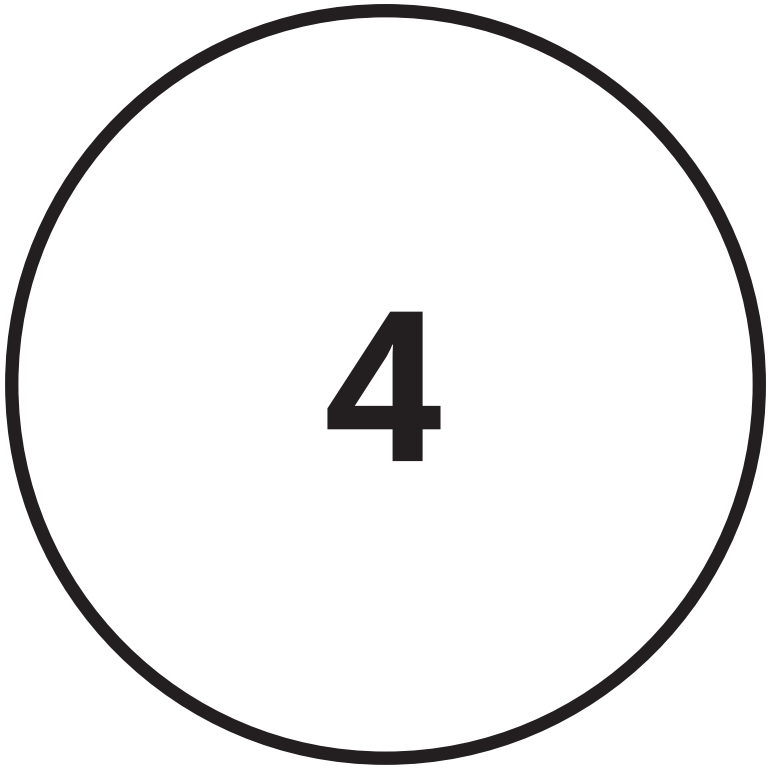


Figure.204: DETAILS (AUTHOR 2021)



REFLECTION

A SUMMARY

Figure.205: DATA CENTRE NORTH FACADE(AUTHOR 2021)

4.1 INTRODUCTION

The fourth and final chapter reflects on the dissertation with a brief summary. Unpacking what the intentions were, why it is important, the site, and how it was approached. This chapter concludes by discussing the architectural contribution to the discourse.

4.2 APPROACH

The dissertation and project proposes an architectural intervention within the abandoned De Villa Bois structure, where humans and nature are reconnected, live in symbiosis and co-evolution through the development of an interface. This interface allows for interaction and exposure of the ecological system to the human occupants of the space, whilst providing various co-benefits.

These co-benefits include; ecosystem services, with the capacity to improve and benefit various aspects of a space (Wohlitz et al 2016), reduced blood pressure (Laumann, Gärling & Stormark 2001), increased attention span (Tennessen & Cimprich 1995) and an increase in biodiversity of the site, etc.

This interface between of the human-nature relationship will exist as a series of systems placed within the structure these systems (natural and man made) will be exposed to the public. One such system is the “living wall”, which acts as a sun shade, working with other systems to cool and heat the structure at the appropriate times. The living wall will constitute various species of plants, attracting insects and birds and providing more habitat and shelter as they grow.

These systems and the benefit they provide are developed from the deep ecological framework from Arne Naese and George Sessions (1985) and the Biophilia hypothesis by of Edward Wilson (1993). Deep Ecology states that all organism have intrinsic value, or value irrespective of their use to humans, as such they are just as important as the human species.

The Biophilia Hypothesis assert that human happiness and a fulfilling existence is inherently dependent on our relationship with the natural world, as such the natural world and inclusion of it within our human systems are of paramount importance.

The project proposes to implement these theories into the structure to allow for the reconnection of the human-nature relationship by exposing various ecological systems to the occupants.

4.3 REASONING

The importance of the introduction of an ecosystem into human development cannot be understated. Globally there is a dramatic decline in the number of fauna and flora, on a scale never seen before (Stokstad 2019). The reason for the decline is directly caused by human impact on the natural world which includes: changes in land use, pollution, direct misuse of species, climate change, and invasive alien species (Corvalan, Hales & McMichael 2005).

The sad fact is that these problems are only expected to increase (European environment agency 2015) as humans continue to develop into natural areas and strip away at habitat.

The built environment and architecture in general find ourselves in the sphere of changing land use to other function, where once it was a functioning ecosystem, it is now a building. It is therefore important to adapt our approach to design, by taking into account the needs of an ecosystem and planning for it appropriately, to allow a natural system to thrive within a human environment.

Furthermore, rethinking our approach to development will highlight the need to reuse abandoned and decaying spaces. This should be much more important than breaking new ground.

In such a way one can protect existing natural spaces whilst improving abandoned ones.

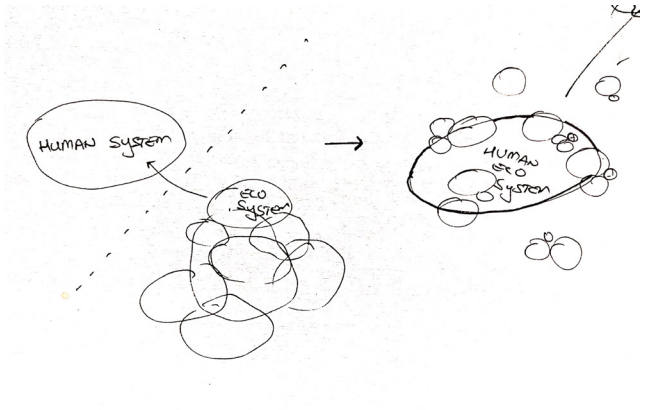


Figure.206: CONCEPTUAL APPROACH (AUTHOR 2021)

4.4 SITE

The abandoned De Villa Bois structure is found in the South East of Pretoria. In Wingate Park, in the larger Garstkloof area, on the corner of Delmas Road and De Villa Bois Marieuil drive.

Its history has caused it to have a bad reputation within the community, as a result of the failed investment group, losing its assets and the subsequent discontinuation of construction.

This meant the loss of substantial amounts of capital for the community who invested in the project. Furthermore, the building, an eyesore, remains dormant with no change in sight

The approach for the site included the larger Garstkloof site as part of a intervention to connect green space within the area in a approach known as Island Biogeography. This states that green areas within an area should be seen as connected entities and not separate spaces (Davis & Glick 1978). By planning for these spaces in such a way makes them more robust to change and improves upon diversity (Handel 2017).

The rehabilitation of the greater Garstkloof site will cause an improvement for the biodiversity and ecological health of the site and the larger Garstkloof site.

4.5 ARCHITECTURAL CONTRIBUTION

The architectural contribution that this project/ dissertation suggests is a new approach towards design. One where human needs and ecosystem needs are not seen as separate but rather as equally important and both having intrinsic value.

By integrating the natural world with our human systems, ecosystems can thrive whilst human function can still continue with both providing a benefit and a service to each other, in symbiosis and co-evolution. This means the health and flourishing of ecosystem can continue, together with human development.

This approach and theory can be implemented in any space, be it an abandoned/existing structure or a new development.

By following this approach one can improve biodiversity within an area, creating a system where species thrive and become more resilient and robust, whilst allowing humans to interface and exchange with that system, as humans have done for millennia.

In doing so there can be a change in approach to how humans see the ecological world, not as a separated from humans in any way, but rather

as but rather as a interconnected web of life (Capra 1997), that humans are a part of.

The project had various limitations, that made it difficult to firstly develop the design but also to implement the discussed theory.

The built environment and architecture are rarely taught to understand the workings of an ecosystem. This is somewhat out of our scope of work except if you are perhaps a landscape architect. The profession in general should have knowledge on how to approach such systems. In this way the natural world and human can integrate better than we are doing now. When architects are at the forefront of development it is imperative that we understand these systems and design for them.

Other obstacles exist, if our modus operandi was the betterment of the natural world, our hands are tied by what the client "wants". Causing the professional to give up on certain points or approaches.

This must change. A change in mindset and worldview is required for everyone (not just architects). Implementation of legislative changes from SACAP and our respective city councils could act as a guideline and "force" clients, developers and architects to make better choices and have better approaches.

In this way the developer and/or client has no say in the matter and it can guide better strategy and action that in turn protect, conserve and regenerate natural systems.

4.6 AIMS ACHIEVED

Research question;

"How can an ecological system be introduced into a human system at the De Villa Bois structure through the development of an architectural intervention?"

Through the implementation of the various theories, the specific site/programme chosen and the design developed, the method is clear. I do however worry that the intervention in regards to ecological introduction might be seen as "green washing", which is not the case.

The ecosystem introduction should be seen as an integral part of this symbiotic system (human-nature). This system works with the human programme in certain instance but also is allowed to functions and flourish on its own.

A deeper change in thinking is required on a societal level to reconnect humans with nature, with interventions and approaches like Deep Ecology, regenerative sustainability and the others discussed, this can be achieved.

4.7 REFLECTION

My normative position changed and adapted throughout this year with the further reading and new found theory that I investigated. I believe this position and theory will continue to guide my life within architecture and beyond (it will most probably evolve and adapted as time goes on).

The masters year of 2021 was one of mixed emotions or two halves.

With project inception the project was progressing, although I had to change site almost 3 times.

The proposal crit caused me to solidify De Villa bois as the site for my masters project. This came with various unforeseen challenges; The building is currently in a legal dispute and information/ plans and so was difficult to acquire as it is under non-disclosure. I got very lucky in how I finally obtained building plans (this was only after the mid year crit).

My mid-year crit was disastrous and hands down the worst crit of my academic career within this department and probably my lowest point in the masters year.

This was the point in the year where I moved into studio and started working extremely hard (spending an enormous amount of time in studio. If lock-down regulations allowed for it). This effort paid off and a few months later the tech crit happened and it went (a lot) better than the mid-year.

From there it has been a non-stop “graft” in studio to get things done and I can attribute my relative success to this space.

This space filled with like-minded individuals, all on their own path to the end of the year and all willing to take 10minutes to speak to you (project related or not). The studio culture, in my opinion, saved my year.

I will admit that it has been a very tough year, I have never had so many setbacks on a project but I assume every masters student that has come through this department feels that way.

I have learned a lot about myself in this year; patterns I fall into, strategies I use to work better and become more productive, the list goes on. This new find knowledge and work ethic will stay with me, probably for the rest of my life.

The masters year was a difficult task but I am proud of myself (although I still believe that I could’ve done more) and what I have achieved.

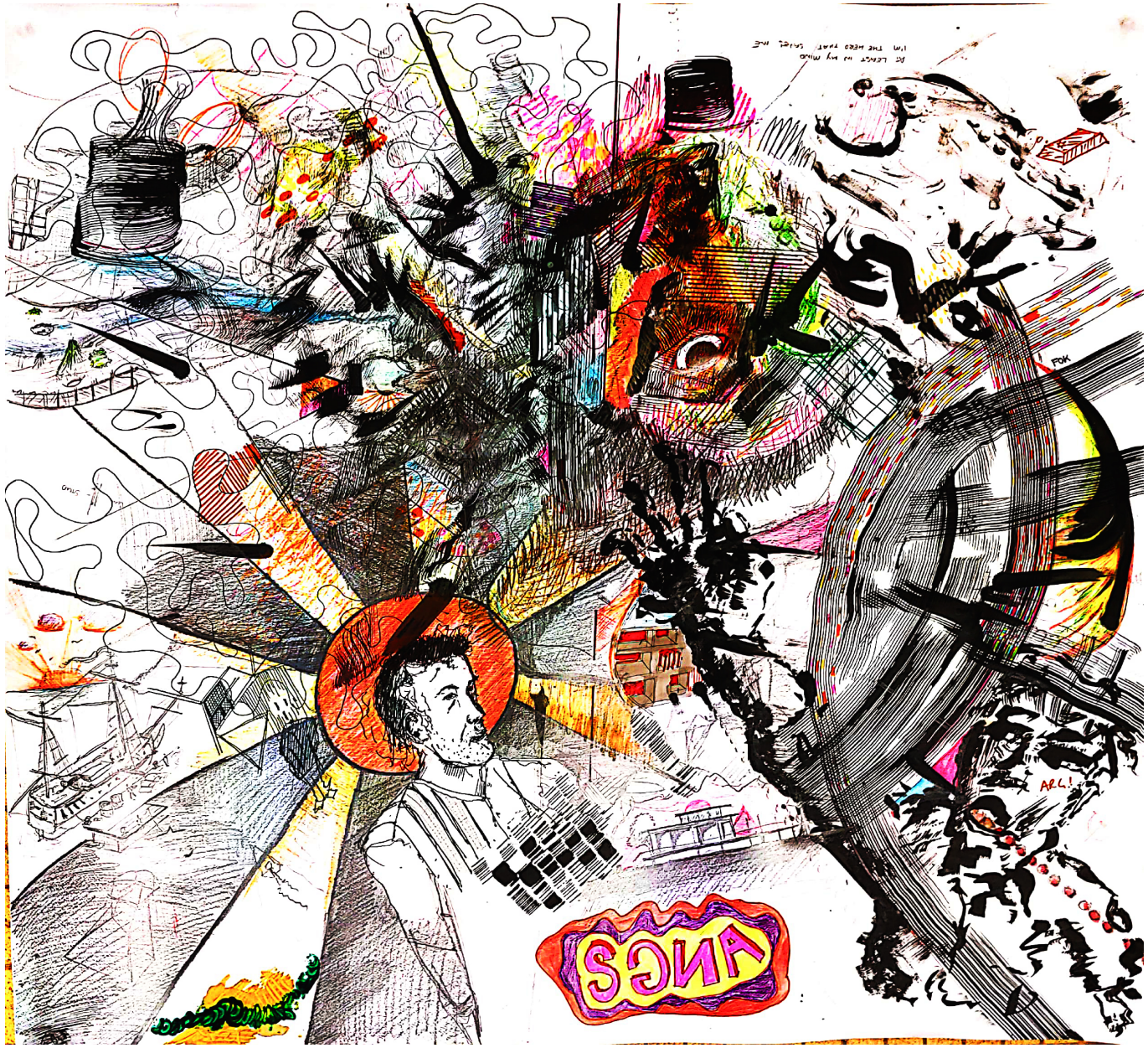


Figure.207: UNNAMED (MASTER CLASS 2021)

Figure.208: DEEP ECOLOGY

Figure.209: LOWVELD, EASTERN TRANSVAAL (PIERNEEF 1928)

BIBLIOGRAPHY

1. Angeler, D. G., and Allen, C. R. 2016. *Quantifying resilience*. J. Appl. Ecol. 53, 617–624. doi: 10.1111/1365-2664.12649
2. Bradbury JP, van Metre PC. *A land-use and water quality history of White Rock Lake reservoir,* Dallas, Texas, based on paleolimnological analyses. J Paleolimnol. 1997;17:227–37.
3. Bor, W., 1972. *The making of cities*. 1st ed. New York: Barnes & Noble Books, p.218.
4. Brennan, A., 2013. *Deep Ecology.* International Encyclopedia of Ethics, pp.1-7.
5. Byron, G., 1814. *Childe Harold's pilgrimage.* Amarillo, Tex.: [Jones Press].
6. Capra, F., 1997. *The web of life.* London: Flamingo.
7. Carol R. Ember. 2020. H*unter-Gatherers in C. R. Ember, ed. Explaining Human Culture.* Human Relations Area Files, http://hraf.yale.edu/ehc/summ aries/hunter-gatherers, accessed [18 Oct 2021].
8. Cartwright, J., 2019. *Ecological islands: conserving biodiversity hotspots in a changing climate.* Frontiers in Ecology and the Environment, 17(6), pp.331-340.
9. Ching, F., 2015. *Architecture Form Space & order.* 4th ed. United states of America: Wiley.
10. Christopher, A.J. 1999. *Towards the post-apartheid City.* L'Espace géographique, 28(4):300–308.
11. Corner, J., 1999. *Recovering landscape*. New York: Princeton Architectural Press.
12. Corner, J. and Hirsch, A., 2014. *The Landscape Imagination.* The Collected Essays Of James Corner, 1990-2010. New York: Princeton Architectural Press.
13. Corvalan, C., Hales, S. and McMichael, A., 2005. *Ecosystems and Human well-being.* France: WHO Library Cataloguing-in-Publication.
14. Curtin, C. and parker, J., 2014. F*oundations of Resilience Thinking.* Conservation Biology, 28(4), pp.912-923.
15. Davis, A. and Glick, T., 1978. U*rban Ecosystems and Island Biogeography.* Environmental Conservation, 5(4), pp.299-304.
16. DeKay, M., 2011. *Integral Sustainable Design* : Transformative Perspectives. 1st ed. London: Earthscan.
17. Devall, Bill, and George Sessions. 1985. *Deep Ecology: Living As If Nature Mattered.* Salt Lake City, Utah: Gibbs Smith.
18. du Plessis, C., 2012. T*owards a regenerative paradigm for the built environment*. Building Research & Information, 40(1), pp.7-22.
19. du Plessis, C., 2006. *Thinking about the day after tomorrow – new perspectives on sustainable building.*

Pretoria: CSIR.

20. Elkington, J., 1998. *Accounting for the triple bottom line.* Measuring Business Excellence, 2(3), pp.18-22.

21. Handel, S., 2017. I*sland Life: Urban Habitats as Theaters for the Evolution of Biodiversity*. Ecological Restoration, 35(3), pp.203-204.

22. Hes, D. and Du Plessis, C., 2014. *Designing for hope: Pathways to regenerative sustainability.* 1st ed. London: Routledge.

23. Horn, A., 2009. *The Life & Death of Urban Growth Management in the Gauteng Province*. Masters. University of Pretoria.

24. Gauteng Department of agriculture and rural development, 2019. Ridges Guideline. Pretoria: GDARD.

25. Gibbons, L., 2020. *Regenerative—The New Sustainable?* Sustainability, 12(13), p.5483.

26. Giddings, B., Hopwood, B. and O'Brien, G., 2002. E*nvironment, economy and society: fitting them together into sustainable development.* Sustainable Development, 10(4), pp.187-196.

27. Grima, N., Corcoran, W., Hill-James, C., Langton, B., Sommer, H. and Fisher, B., 2020. T*he importance of urban natural areas and urban ecosystem services during the COVID-19 pandemic*. PLOS ONE, 15(12).

28. Gullone, E., 2000. *The Biophilia Hypothesis and Life in the 21st* Century: *Increasing Mental Health or Increasing Pathology*?. Journal of Happiness Studies, 1(3), p.294.

29. Kameswara Rao, N., 2006. *Manual of seed handling in genebanks.* 8th ed. Rome: International Board for Plant Genet Resources.

30. Kearsley, E. and Mostert, H., 2011. *The use of recycled building materials as aggregate in concrete.*

31. Kellert, S.R., Heerwagen, J. and Mado, M. (2011). *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life.* New York: John Wiley and Sons.

32. Kellert, S. And Wilson, E., 1993. *The Biophilia hypothesis.* Washington: Island press.

33. Kesebir, S. and Kesebir, P., 2017. *A Growing Disconnection From Nature Is Evident in Cultural Products.* Perspectives on Psychological Science, 12(2), pp.258-269.

34. Kim JG, Rejmánková E. *The paleoecological record of human disturbance in wetlands of the Lake Tahoe Basin*. J Paleolimnol. 2001;25:437–54.

35. Laumann, K., Gärling, T. And Stormark, K., 2001. *Rating scale measures of restorative components of environments.* Journal of Environmental Psychology, 21(1), pp.31-44.

36. Lovelock J. 1988. *The Ages of Gaia: a Biography of our Living Earth*. Oxford University Press: Oxford.

37. Lövei, G., Magura, T., Tóthmérész, B. and Ködöböcz, V., 2006. T*he influence of matrix and edges on species richness patterns of ground beetles (Coleoptera: Carabidae) in habitat islands.* Global Ecology and Biogeography, 15(3), pp.283-289.

38. Mackereth FJH. S*ome chemical observations on post-glacial lake sediments.* Philos Trans R Soc Lond Ser B Biol Sci. 1966;250(765):165–213

39. Mang, P. and Reed, B., 2012. *Regenerative Development and Design.* Encyclopedia Sustainability Science & Technology, Chapter 303,.

40. Marzluff, J., 2005. *Island biogeography for an urbanizing world: how extinction and colonization may determine biological diversity in human-dominated landscapes.* Urban Ecosystems, 8(2), pp.157-177.

41. McLeod, D., 2020. *Maslow's Hierarchy of Needs.* [online] Simplypsychology.org. Available at: <https://www.simplypsychology.org/maslow.html> [Accessed 11 June 2021].

42. Meadows, D., 1999. *Leverage points.* Hartland Four Corners, VT: Sustainability Institute.

43. Miller, K., 2021. 19 *Biggest Pros and Cons of Industrial Revolution.* [Blog] FutureofWorking.com, Available at: <https://futureofworking.com/8-biggest-pros-and-cons-of-industrial-revolution/> [Accessed 2 November 2021].

44. Miller, G. and Spoolman, S., 2011. *Living in the environment.* 17th ed. Belmont, CA: Brooks/Cole.

45. Milner, G., 2019. E*arly agriculture's toll on human health.* Proceedings of the National Academy of Sciences, 116(28), pp.13721-13723.

46. Moghadam, D., 2015. *A Brief Discussion on Human/Nature Relationship*. International Journal of Humanities and Social Science, Vol. 5(No. 6).

47. Mucina, L. and Rutherford, M., 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. 1st ed. Pretoria: South African National Biodiversity Institute.

48. Naess, A., 1984. *A Defence of the Deep Ecology Movement.* Environmental Ethics, 6(3), pp.265-270.

49. Naess, A. and Sessions, G., 1985. *Foundation For Deep Ecology.* [online] Deepecology.org. Available at: <http://www.deepecology.org/index.htm> [Accessed 13 May 2021].

50. Patnaik, R., 2018. I*mpact of Industrialization on Environment and Sustainable Solutions – Reflections from a South Indian Region.* IOP Conference Series: Earth and Environmental Science, 120.

51. Peres, M., Barker, D. and du Plessis, P., 2015. *Architecture for Life: exploring regenerative and resilience thinking.* Architecture SA, 71(1).

52. Pfab, M., Compaan, P., Whittington-Jones, C., Engelbrecht, I., Dumalisile, L., Mills, L., West, S., Muller, P., Masterson, G., Nevhutalu, L., Holness,

S. and Hoare, D., 2017. *The Gauteng Conservation Plan: Planning for biodiversity in a rapidly urbanising province*. Bothalia, 47(2).

53. Qvenild, M., 2008. *Svalbard Global Seed Vault: a 'Noah's Ark' for the world's seeds*. Development in Practice, [online] 18(1), pp.110-116. Available at: <https://www.jstor.org/stable/27751880?seq=1#metadata_info_tab_contents>.

54. Reddy, P., 2019. *The Apartheid Legacy and Legislative Framework Re-examined – The Case of eThekweni Municipality*. Urban Regeneration in South Africa, [online] 11(2), p.85. Available at: <https://journals.co.za/content/journal/10520/EJC-18121befd1> [Accessed 11 March 2020].

55. Reichard, S.H. and White, P. 2001 *Horticulture as a pathway of invasive plant introductions in the United States*. BioScience 51, 103–113.

56. Ritchie, H. and Roser, M., 2019. *Urbanization.* [online] Our World in Data. Available at: <https://ourworldindata.org/urbanization#citation> [Accessed 20 October 2021].

57. Rios, F., Chong, W. and Grau, D., 2015. *Design for Disassembly and Deconstruction - Challenges and Opportunities.* Procedia Engineering, 118, pp.1296-1304.

58. Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin, F., Lambin, E., Lenton, T., Scheffer, M., Folke, C., Schellnhuber, H., Nykvist, B., de Wit, C., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R., Fabry, V., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P. and Foley, J., 2009. P*lanetary Boundaries: Exploring the Safe Operating Space for Humanity*. Ecology and Society, 14(2).

59. Rook, G., Raison, C. And Lowry, C., 2012. C*an we vaccinate against depression?* Drug Discovery Today, 17(9-10), pp.451-458.

60. Sessions, George. *Deep Ecology for the 21st Century.* Shambhala Publications, Inc., 1995.

61. Steenkamp, C., 2004. *Urban regeneration in a south african context.* Masters - Dissertation. Potchefstroom.

62. Stokstad, E., 2019. *Landmark analysis documents the alarming global decline of nature.* Science.

63. Tennessen, C. And Cimprich, B., 1995. V*iews to nature: Effects on attention.* Journal of Environmental Psychology, 15(1), pp.77-85.

64. Thomsen, A., Schultmann, F. and Kohler, N., 2011. *Deconstruction, demolition and destruction*. Building Research & Information, 39(4), pp.327-332.

65. Trancik, R., 1986. *Finding lost space*. New York: John Wiley & Sons.

66. Ulrich, R., 1979. *Visual landscapes and psychological well-being*. Landscape Research, 4(1), pp.17-23

67. Van der Ryn, S. And Cowan, S., 2007. *Ecological Design*. 10th ed. Washington: Island Press.

68. Velarde, M., Fry, G. And Tveit, M., 2007. H*ealth effects of viewing landscapes – Landscape types in environmental psychology.* Urban Forestry & Urban Greening, 6(4), pp.199-212.

69. Watson, Richard. *A Critique of Anti-Anthropocentric Biocentrism.* Environmental Ethics 5:3 (1983): 245-256.

70. Wilson, E. O. (1984). Bi*ophilia: The human bond with other species.* Cambridge: Harvard University Press.

71. Wohlitz, E., 2016. B*ring nature back to the city*. 1st ed. Pretoria: BRIZA.

72. Yeang, K., 1995. *Designing with nature*. New York: McGraw-Hill.

APPENDIX
ETHICS CLEARANCE

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering, Built Environment and Information Technology
Fakulteit Ingenieurswese, Bou-omgewing en Inligtingtegnologie / Lefapha la Boetšenere, Tikologo ya Kago le Theknolotši ya Tshedimošo

9 June 2021

Reference number: EBIT/79/2021

Ms A van Aswegen
Department: Architecture
University of Pretoria
Pretoria
0083

Dear Ms A van Aswegen

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Conditional approval is granted.

This means that the research project entitled "Masters Professional Mini-Dissertation in Architecture, Landscape Architecture and Interior Architecture (Group / Blanket)" is approved under the strict conditions indicated below. If these conditions are not met, approval is withdrawn automatically.

Conditions for approval
This application is approved based on the summaries provided.
Applications from each student (including application forms and all necessary supporting documents such as questionnaire/interview questions, permission letters, informed consent form, etc) will need to be checked internally by the course coordinator/ supervisor. A checklist will need to be signed off after the checking.
All of the above will need to be archived in the department and at the end of the course a flash disc / CD clearly marked with the course code and the protocol number of this application will be required to be provided to EBIT REC administrator.
No data to be collected without first obtaining permission letters. The permission letter from the organisation(s) must be signed by an authorized person and the name of the organisation(s) cannot be disclosed without consent.
Where students want to collect demographic the necessary motivation is in place.

This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Code of Ethics for Scholarly Activities of the University of Pretoria, or the Policy and Procedures for Responsible Research of the University of Pretoria. These documents are available on the website of the EBIT Ethics Committee.

If action is taken beyond the approved application, approval is withdrawn automatically.

According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of the EBIT Research Ethics Office.

The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof K.-Y. Chan
Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

Masters (Professional) Programmes in Architecture, Landscape architecture and Interior Architecture

Students Research Ethics Application Summary

* To be completed by the student. Keep this summary within 2 pages limit.

1. Details of the student:	
1.1 Student Surname	Odendaal
1.2 Student Initials	PJ
1.3 Student Number	14297419
2. Details of the Research Project:	
2.1 Research title [re]connecting ecology	
2.2 Main objective(s) pertaining to field work The main objectives of the field work will be to conduct a site analysis with rigorous mapping and further, observations of activities that is currently happening on site	
2.3 Research question(s) pertaining to field work How can architecture integrate an ecological system into a human system	
3. Data collection method:	
3.1 Will there be *people* involved in your research? ☐ No, there will be no people involved in my research. ☒ Yes, there will be people involved in my research but *only* as informants and *not* subjects.	
3.2 If "Yes" to 3.1, describe the nature of these people (Who are they? Note that no minors are to be involved.) Persons that use the site in various capacities and people who are neighbours of the site	
3.3 If "Yes" to 3.1, how will you collect information from these people? ☐ Primary data using Questionnaire ☒ Primary data using Interviews ☐ Other, please specify	
3.4 If "Yes" to 3.1, are there *two or more* people from the same company/organisation that you have identified as your informants? ☒ No ☐ Yes, and I have obtained permission letter(s) from the company/organisation.	
3.5 If "Yes" to 3.1, what is the nature of the primary data that you will collect from these people? ☐ Personal data such as gender, income, education level, health status. I have provided a motivation letter for asking these questions. ☒ Opinions (e.g. ranking of factors, agreement to statements) that are not related to any company/organisation. ☐ Company related information (e.g. financial performance, operational data). I have obtained permission letter(s). ☒ Project related information. I have obtained permission letter(s). ☐ Other, please describe: Click or tap here to enter text.	
3.6 Will you be using secondary data? ☐ No ☒ Yes, and the secondary data is publically available ☐ Yes, however the secondary data is NOT publically available and I have obtained permission letter(s).	

UNIVERSITY OF PRETORIA
FACULTY OF ENGINEERING, BUILT ENVIRONMENT & INFORMATION TECHNOLOGY
DEPARTMENT OF ARCHITECTURE

CPD 810 / DPD 801/2/3 / DIT 801/2/3

Student researcher declaration

(To be signed by each student and kept on record by the supervisor)

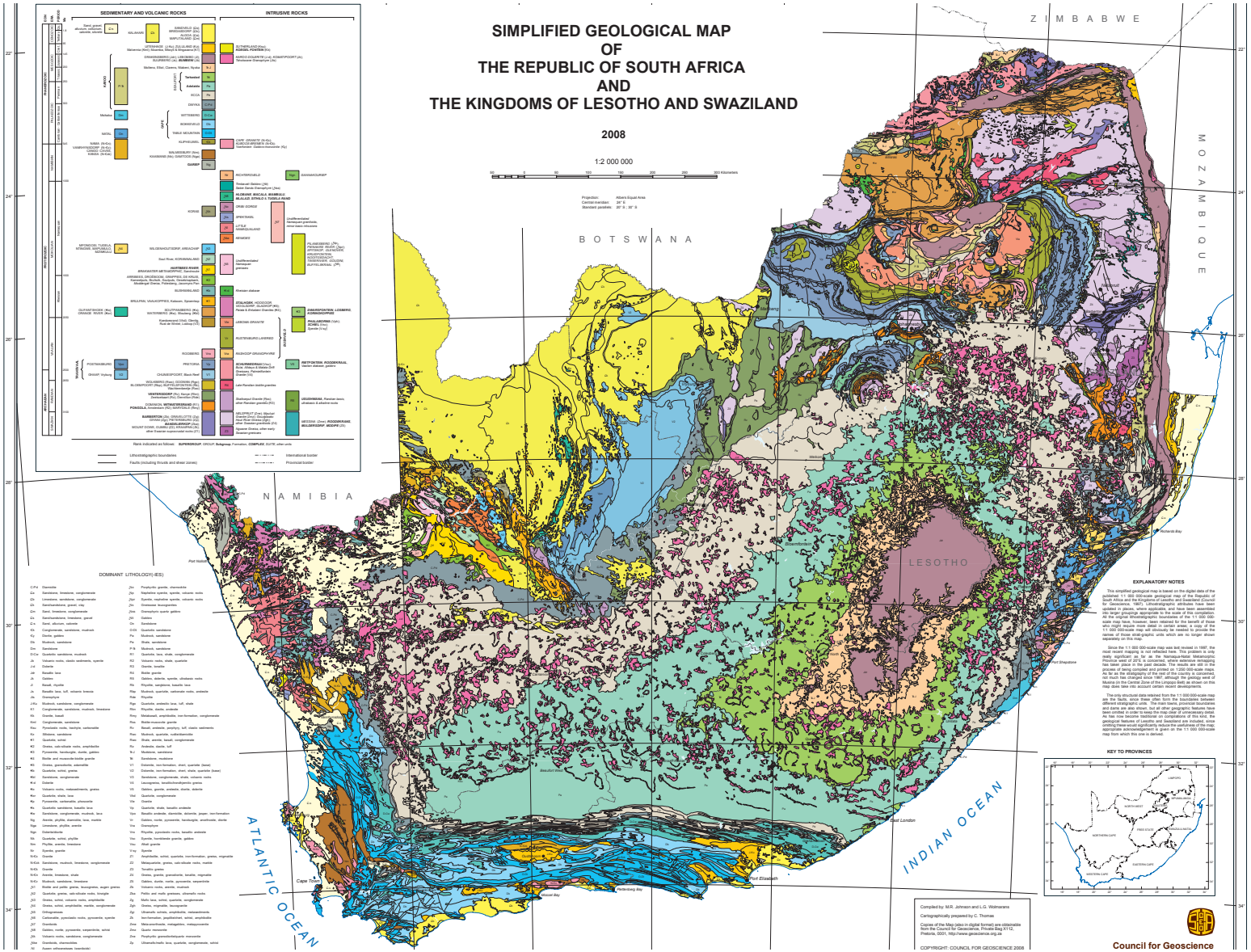
1. Title of research project: **[re]connecting ecology**

2. I Petrus Johannes Odendaal student number 14297419 hereby declare that:

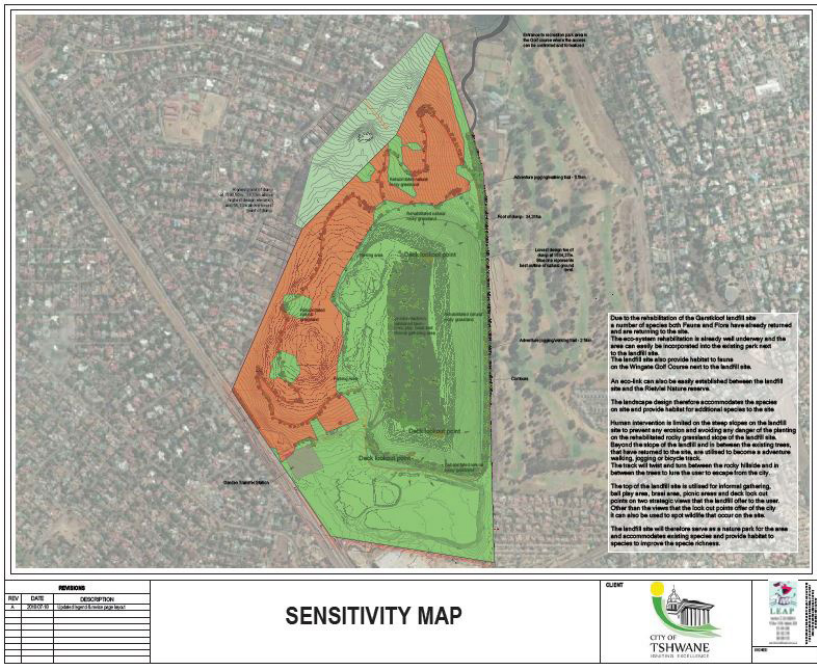
1) I am acquainted with the Code of Ethics for Research and will apply the principles contained in the Codes in all my research activities;
2) I will conduct the study as specified in the application and principally responsible for all matters related to the research;
3) I will communicate all changes to the application/or any other documents before any such is executed in my research with my supervisor;
4) I will explain the objectives and implications of the research to informants;
5) I will indicate to informants that their participation in the research is voluntary and that they can withdraw from the research at any stage;
6) I will obtain written informed consent from each informant;
7) I will not to ask informants any questions requesting personal information (e.g., questions on name, ID number, etc.) or questions beyond the theme of the abovementioned project;
8) I will treat all responses of informants confidentially;
9) I will not engage in any form of research fraud (e.g., falsifying or distorting data);
10) I will obtain written permission letters from organisation(s) that may be contacted as for data related to the abovementioned project; and
11) I will not engage in research that presents conflict of interest or financial benefit, whether for the researcher, company or organisation, that could materially affect the outcome of the investigation or jeopardise the name of the University of Pretoria.

Student signature: _____ Date: 12 Apr. 21

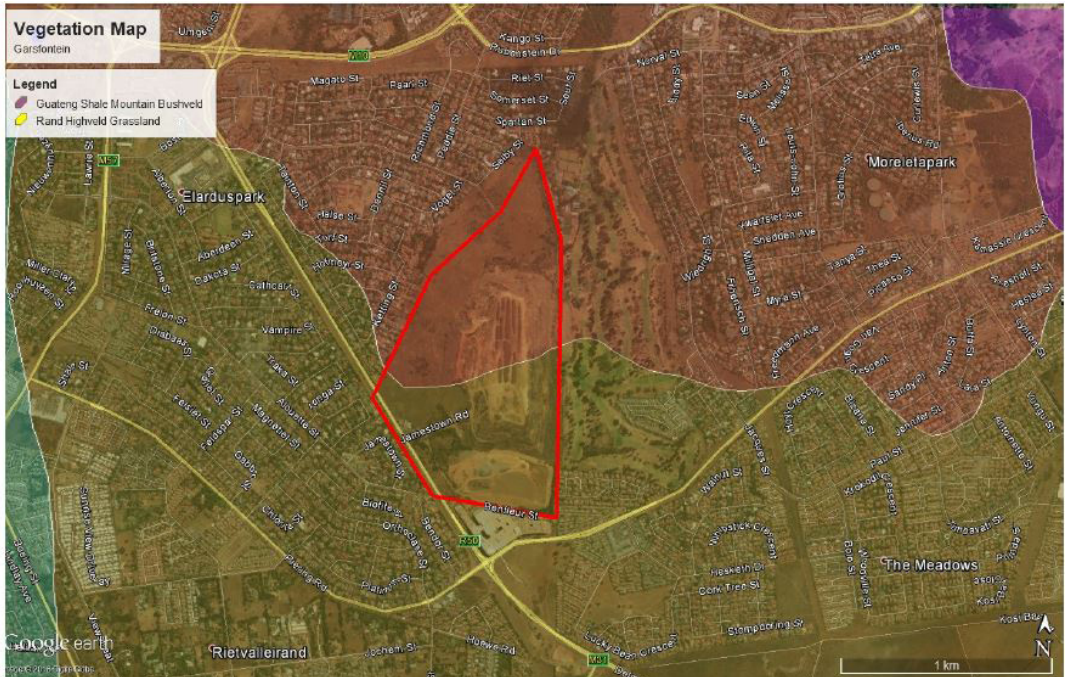
GEOLOGICAL MAP OF SOUTH AFRICA



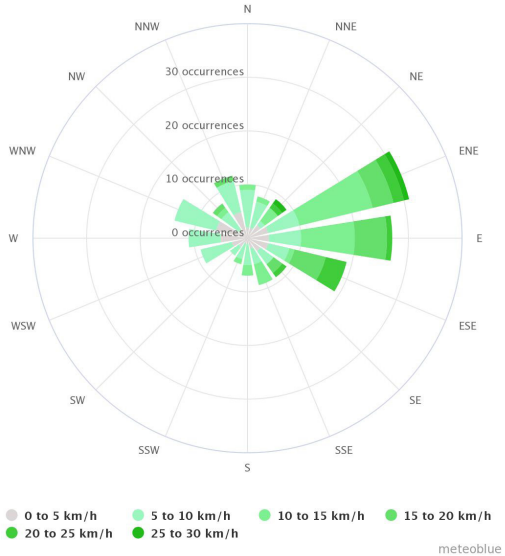
REHABILITATION PLAN GARSTKLOOF

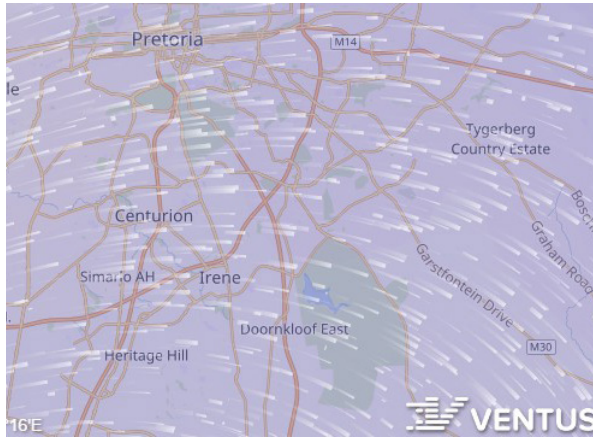


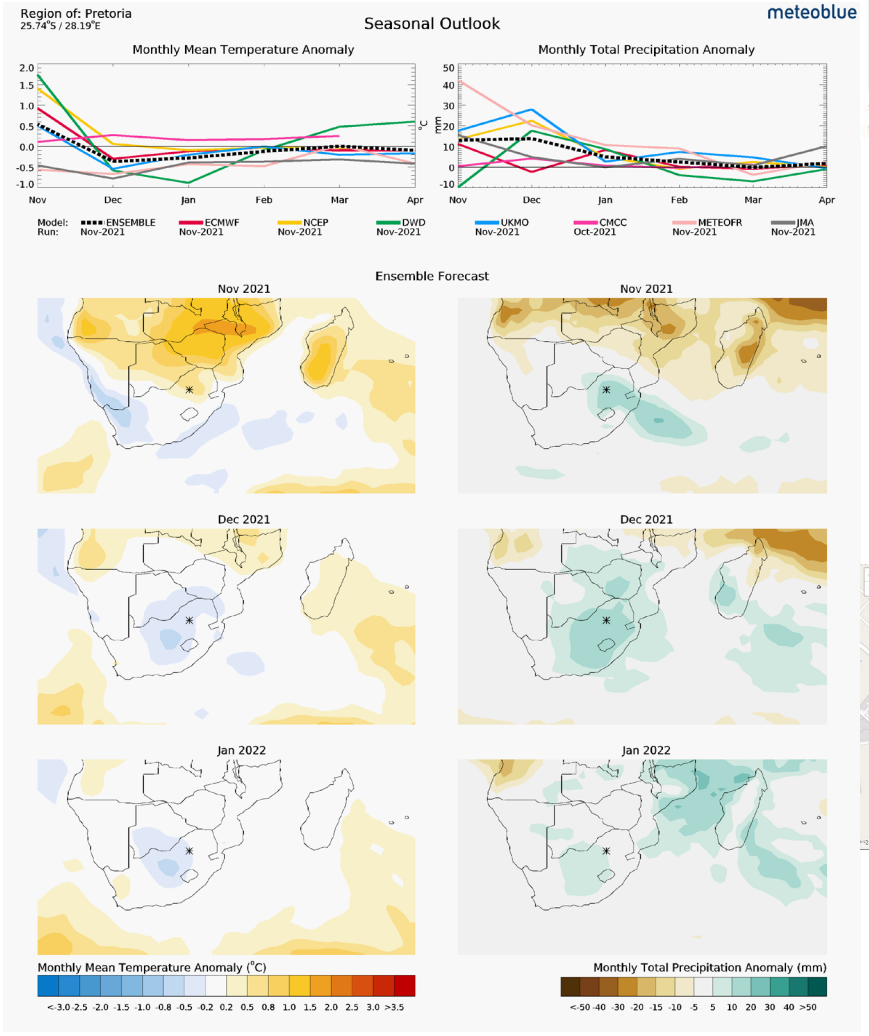
VEGETATION MAP



METEOROLOGICAL DATA

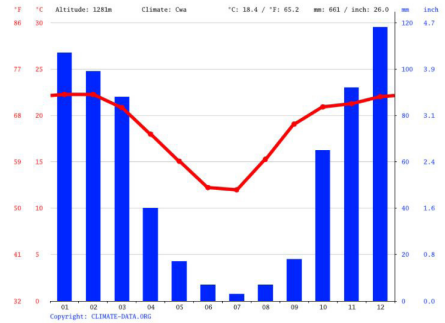


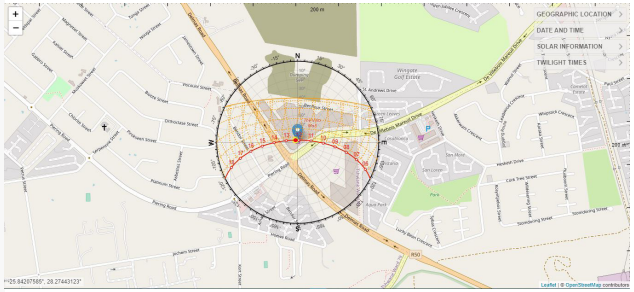


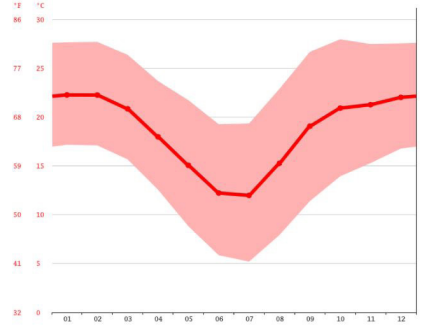


	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature °C (°F)	22.3 °C (72.1) °F	22.3 °C (72.1) °F	20.8 °C (69.5) °F	18 °C (64.4) °F	15.1 °C (59.1) °F	12.2 °C (54) °F	12 °C (53.6) °F	15.3 °C (59.5) °F	19.1 °C (66.3) °F	20.9 °C (69.6) °F	21.3 °C (70.3) °F	22 °C (71.6) °F
Min. Temperature °C (°F)	17.2 °C (62.9) °F	17.1 °C (62.8) °F	15.7 °C (60.2) °F	12.6 °C (54.6) °F	8.6 °C (47.9) °F	5.9 °C (42.5) °F	5.2 °C (41.4) °F	7.9 °C (46.3) °F	11.4 °C (52.5) °F	13.9 °C (57.1) °F	15.3 °C (59.5) °F	16.8 °C (62.2) °F
Max. Temperature °C (°F)	27.7 °C (81.8) °F	27.7 °C (81.8) °F	26.4 °C (79.5) °F	23.7 °C (74.6) °F	21.7 °C (71.1) °F	19.3 °C (66.7) °F	19.3 °C (66.9) °F	22.9 °C (73.2) °F	26.7 °C (80) °F	28 °C (82.3) °F	27.5 °C (81.5) °F	27.5 °C (81.6) °F
Precipitation / Rainfall mm (in)	107 (4.2)	99 (3.9)	88 (3.5)	40 (1.6)	17 (0.7)	7 (0.3)	3 (0.1)	7 (0.3)	18 (0.7)	65 (2.6)	92 (3.6)	118 (4.6)
Humidity(%)	62%	59%	59%	58%	49%	47%	42%	36%	34%	43%	53%	61%
Rainy days (d)	11	9	8	5	2	1	1	1	2	6	9	11
avg. Sun hours (hours)	9.5	9.5	9.0	8.5	9.0	8.9	9.1	9.5	9.8	9.9	9.8	9.8

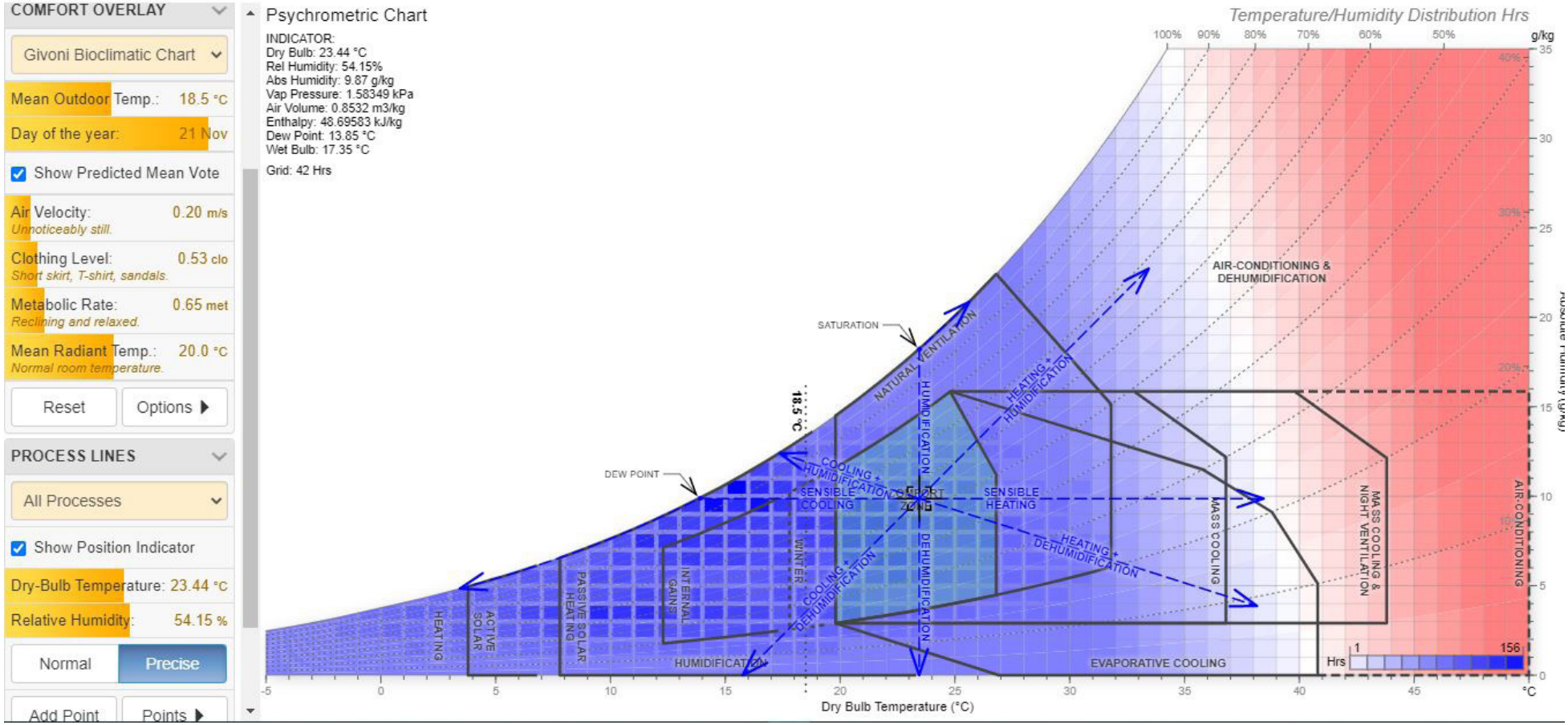
The variation in the precipitation between the driest and wettest months is 115 mm | 5 inch. The variation in annual temperature is around 10.3 °C | 18.5 °F.



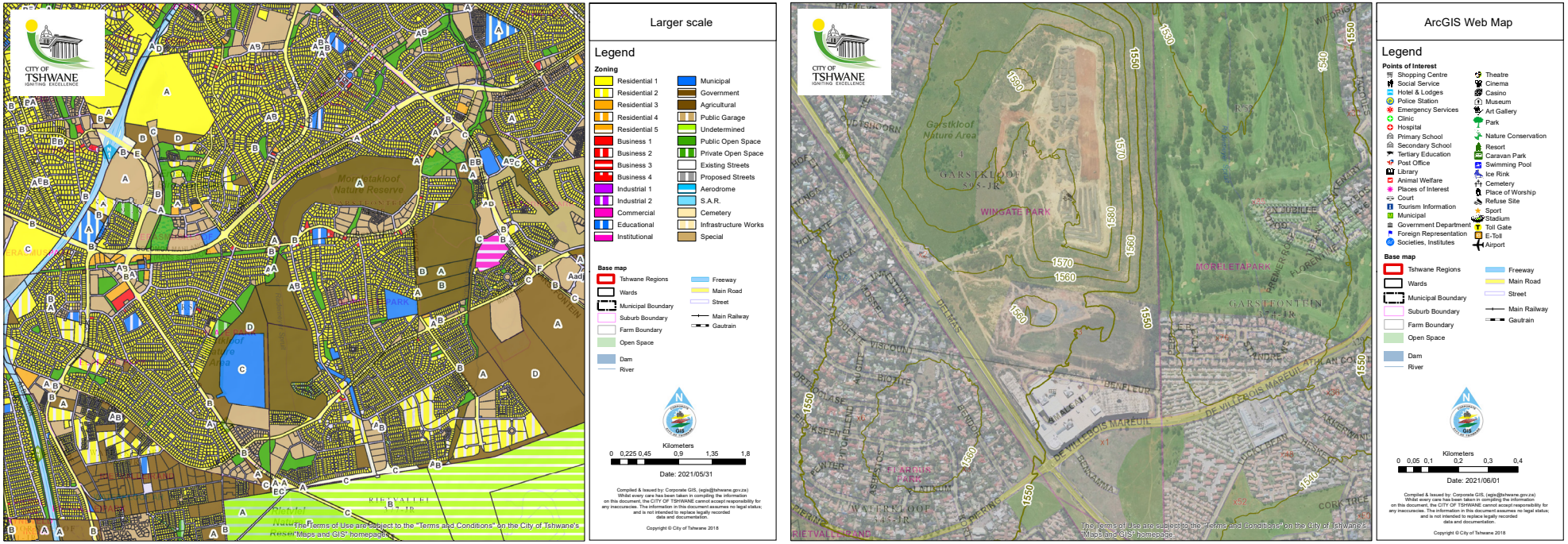




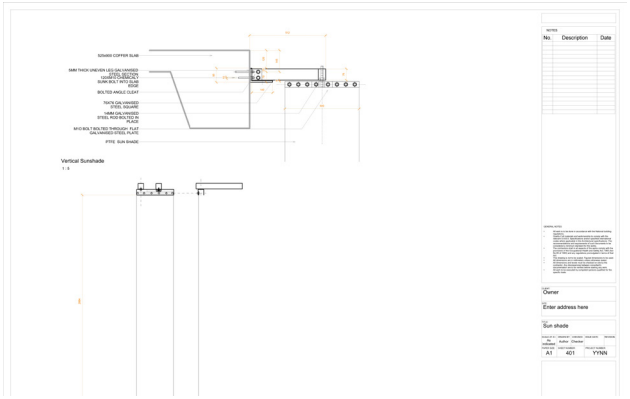
PSHYCOMETRIC CHART

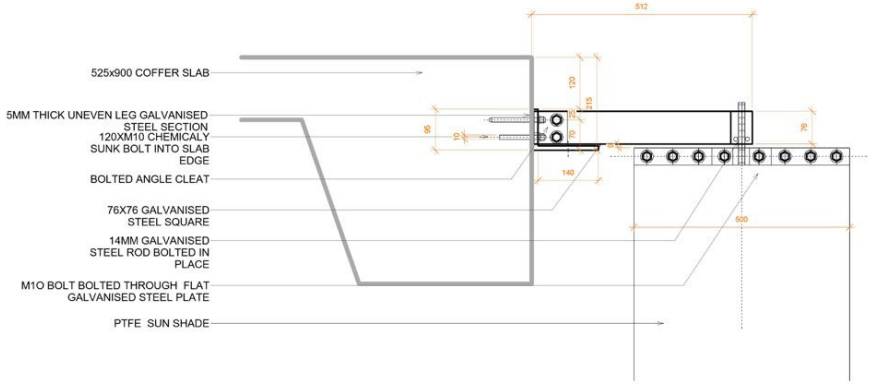


ZONING DIAGRAMS



DETAILS AND SECTION





Vertical Sunshade

STAIR DETAIL AND RENDER