



THE BUILDING AS ECO-URBAN FILTER

by Cosette-Mari Minnaar

THE BUILDING AS ECO-URBAN FILTER

RECONNECTING MAN TO EARTH

by Cosette-Mari Minnaar

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Research Field
Environmental Potential

Editor
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Declaration

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

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

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

Cosette Minnaar
2020

Thanks

I want to thank my parents, Linda and Jan, for being my foundation throughout this tough year.
They were constant green tea servants, toasted sarmie makers, and shoulders to cry on.
They are always my biggest supporters, my biggest fans and they celebrate every small win as if it was their own.
Love you so very much lots.

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Thank you for every all-nighter in studio and every pin borrowed.
I will never forget the sunset and sunrise from the rooftop of the Boukunde building.

Cosette Minnaar
2020





FIGURE 1. Sunset Render of ramp and Southern Entrance (Author, 2021)

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To whom it may concern

This letter serves to confirm that I, Karien Redelinghuyts, edited the dissertation "The Building as Eco-Urban Filter" by Cosette-Mari Minnaar. I am a registered language practitioner with the South African Translators' Institute (SATI) and have a PhD in Linguistics.

I hereby acknowledge that the dissertation has undergone a proper and professional edit for grammar, spelling and punctuation. The onus rests on the student to work through the proposed changes after the edit and accept or reject these changes.

Yours sincerely



Karien Redelinghuyts

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Student researcher declaration

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

1. Title of research project: The Building as eco-social filter. (Working Title)

2. I Cosette-Mari Minnaar, student number 15040217 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: 3/3/2020

Keywords

Biomimetic design, ecosystem services, human well-being, filter, Regenerate, Eurhythm, social sustainability, Phenomenology

Abstract

The study explores the possibility that a transition zone can become a ‘filter’ that surrounds an urban core. As a filter, the transition zone can regulate and rehabilitate ecosystem services to support human well-being.

The main research question focusses on how eco-systemic development can act as a filter while supporting human well-being. The two sub-questions concern (a) how architecture can become a buffer between urban and suburban areas in Pretoria, and (b) how architecture can aid in ecosystem rehabilitation to regenerate urban and human well-being. Through the research done in this study, it is evident that transitional zones around city centres are commonly derelict and unsafe.

Human well-being is under pressure as a result of the increasing degradation of ecosystem services, which is brought about by human misuse and urban densification. As cities and human populations grow, urban cores expand. This expansion results in constant re-zoning as well as the demolition and degradation of existing spaces (Preston, 1966:240). Basic human well-being is dependent on successful ecosystem services and the biodiversity of urban environments (Bolund & Hunhammar, 1999:299).

This study aims to identify, reintroduce and rehabilitate ecosystem services on an urban edge to facilitate the health and well-being of the community living there. The study addresses three main themes, namely:

(1) urban zoning and development, (2) human well-being, and (3) ecosystem-service rehabilitation and reintroduction.

By analysing the themes of urban development, well-being as well as social sustainability and ecosystem services, different theories and principles are identified to provide lenses through which the dissertation will be approached. The main lens is that of Vitruvius and the principles he sets out in *Ten books on architecture*, which relates all design decisions back to nature.

Other theories, such as Ernest Burgess’ concentric circle model and the circular economy theory, and the guidelines of the Living Building Institute led to the selection of the site, the development of the urban framework and the design of the intervention.

By combining these theories with a programmatic intervention, which was derived from the site and themes, the end result aims to revive the community, the well-being of its members and to reinforce the existing development while ensuring ongoing rehabilitation of the ecosystem services.

This intervention aspires to become a catalyst according to which all transition zones in urban environments can be transformed from eye sores and barriers to filters and activators.

Title

The Building as Eco-Urban Filter

Programme

Community Skills Development and Art Therapy Center

Research Field

Environmental Potential

Client

The City of Tshwane

Main Research Question

How can eco-systemic development act as a filter, while supporting human wellbeing?

Macro Study Area

The bigger Gauteng region with specific focus on City of Tshwane.

The focus is on the various City Centres that exist in the Gauteng region, specifically the major business nodes that are existing and planned to develop according to the Tshwane 2055 city plan.

Meso Study Area

The Menlyn Maine Business development and surrounding residential and retail blocks.

Micro Study Area

The Plot including Thrashers Skate Park and 19th Hole Put Put.

25°47'19.50"S 28°17'03.57"E

Complete address of the site

Thrashers Skate Park

241 Serene Street, Garsfontein

Pretoria 0081

Main function of the existing site:

Thrashers Skate Park is a skateboarding facility including a hockey and trick bike course, a small skate merchandise store, a tattoo parlour and a small restaurant.

The skate park was built in 1996 and was the first official skateboarding facility in South Africa.

The park is used for events and family days as well as competitions and skateboarding lessons.

The building has been adapted once where facilities were added, and the roof has also since been changed to be accessible.



FIGURE 2. Render of shaded outside area. (Author, 2021)

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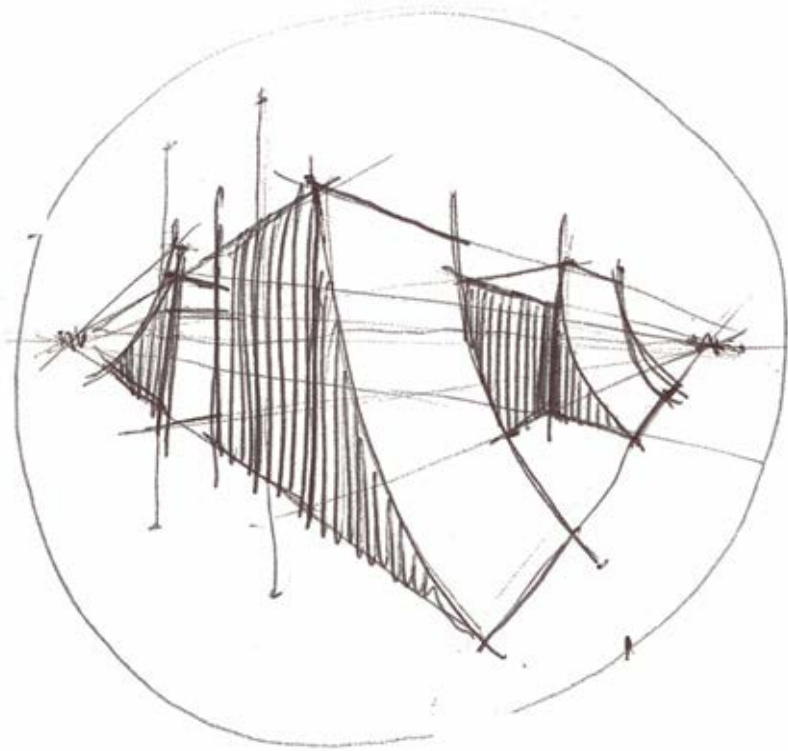


FIGURE 3. Design Form Exploration (Author, 2020)



Chapter 1

Introduction

The Background and Context

The Apartheid City
Appropriation of Space
Urban and Spatial Transformation
Tshwane 2055 plans

General Issue
Urban Issue
Local Issue
Architectural Issue

Research Methodology/Strategy

Research Paradigm
Research Delimitations and Assumptions
Research Collection and Analysis methods

Dissertation Rationale
Overview of Structure

The Apartheid City

It is no secret that South African historical spatial planning has had a long-lasting effect on the social problems of cities. It is believed that the state of South African cities reflects the position of the nation itself.

Therefore, any future urban planning in South Africa should consider the effect of development on socio-cultural aspects and the built environment. The remnants of apartheid city planning can be seen throughout South Africa and, in this case, Gauteng (Williams, 2000:167).

All city business centres currently have adjacent townships that have formed and grown over years. These townships are due to work-to-home proximity – a problem that arose because of apartheid city planning.

Figure 1 (Maritz et al, 2016:127) – Conference, Cole & De Blij 2007)

Another problem that South African cities face is the issue of public transport. This issue has caused townships to develop closer to city centres and in industrial areas in cities.

These problems, together with the continuous population growth that has stemmed from constant urban expansion, have caused people to abandon large spaces around city centres, leaving these areas derelict and unattractive to residents and developers.

Appropriation of Space

According to psychologist Kaj Noschis (1978), the appropriation of space entails “the totality of actions to which we proceed in order to enter into possession of our surroundings, in the sense of their transformation for a certain use”, with private property being an example. This appropriation occurs only if individuals desire to perform these actions and if there is a sense of well-being in their surrounding environment (Nosch, 1978:451).

When one considers the current urban problems in South Africa, it becomes apparent that the appropriation of space plays a big role – especially in the city. The best example of this situation is seen in cases where individuals who cannot afford to travel long distances to and from work are motivated to claim space in city centres to construct houses for themselves. These individuals also commonly re-appropriate abandoned buildings or sites waiting on construction.

Very frequently, this appropriation occurs on city centre edges where expansion is planned and buildings are abandoned or demolished. Bigger issues, such as ownership, which will not be discussed in this dissertation, stem from the right to appropriate urban space.

‘That is, it should be produced in such a way as to enable the “full and complete use” of urban space by inhabitants in their everyday lives. It therefore includes the “right to live in, play in, work in, represent, characterize and occupy urban space... The conception of urban space as private property, as a commodity to be valorised (or used to valorise other commodities) by the capitalist production process, is specifically what the right to appropriation stands against” (Purcell, as quoted by Gorgens et al, 2012:4)

Urban and Spatial Transformation

Spatial transformation can be defined as clear and defined urban restructuring. This transformation is commonly due to cities facing new spatial and socio-economic needs and population growth. These are truly relevant issues that confront South Africa.

The National Development Plan aims to achieve spatial transformation by accomplishing spatial justice, equality, efficiency, resilience and sustainability – much like the Tshwane 2055 development plan.

Three guidelines were mentioned at the seventh Planning Africa Conference in 2016 to determine if the city had undergone spatial transformation, namely:

- (1) social and racial integration,
- (2) the change in overall city structure and urban fabric, and
- (3) local texture change referring to the experience and quality on a household scale (Maritz et al, 2016:127).

Tshwane 2055 plans

This dissertation assumes that the aims of the Tshwane 2055 Vision will be realised and that all of Tshwane's residents will benefit from living in an inclusive, resilient and liveable city by 2055.

In order to realise these aims, Boogertman + Partners Architects, in collaboration with other significant role players, selected six main development nodes across Tshwane. These nodes are the Pretoria Central Business District (CBD), Hatfield, Brooklyn, Menlyn, Centurion and Irene as seen in figure 6.

This study will use these nodes as a point of departure for a contextual analysis and will analyse the urban transformation in these spaces (Myeza, 2013:99).

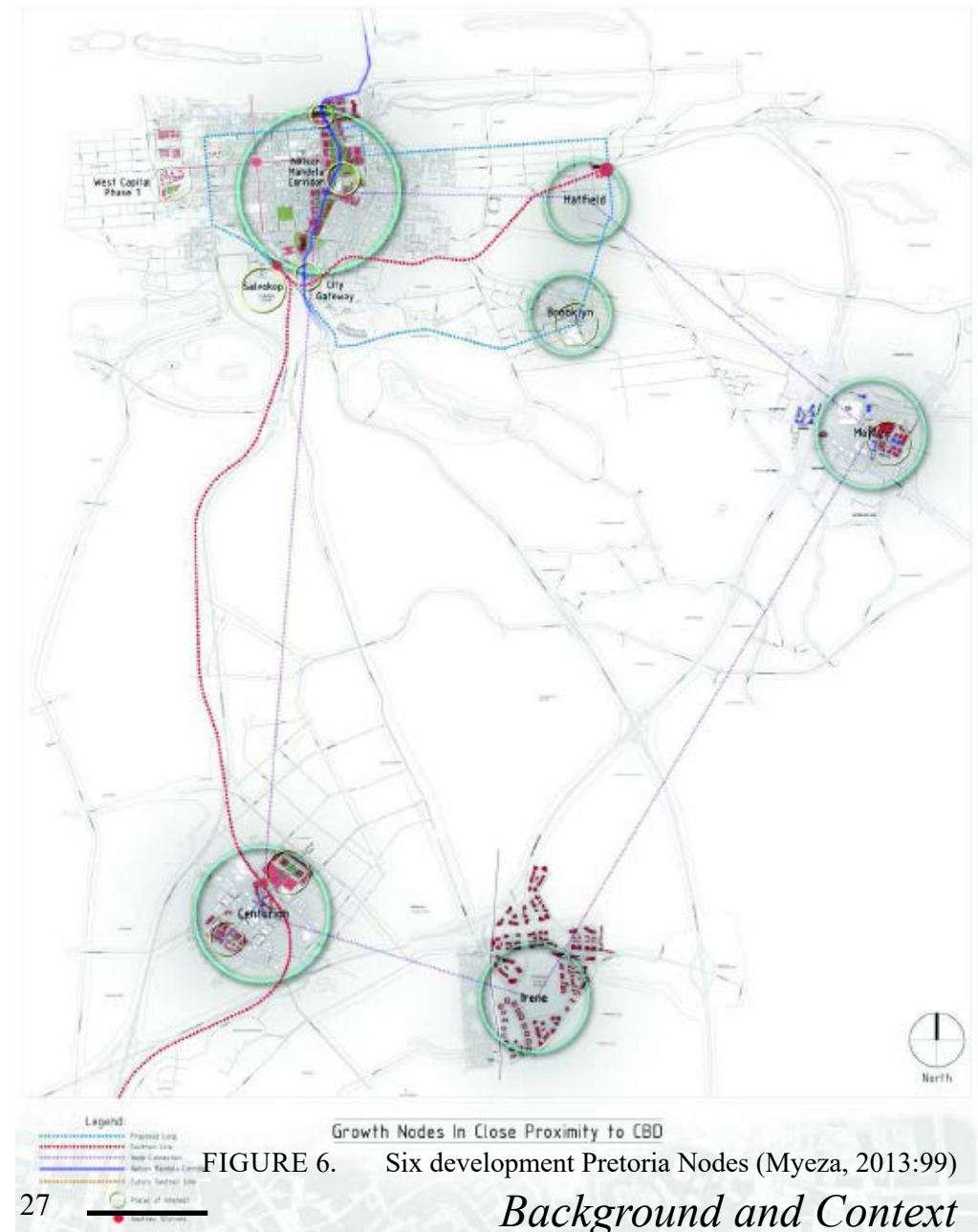


FIGURE 6. Six development Pretoria Nodes (Myeza, 2013:99)

Background and Context

General Issue

The focus of the study concerns the global issue of urban and eco-degradation as a result of constant urban expansion. Globally, all cities face the challenge of an ongoing population growth that results in poverty, homelessness and increased unemployment.

There are advantages to both densification and urban sprawl; however, urban densification often means that cities require ecosystem services from outside their boundaries. Urban sprawl, on the other hand, occupies more land but easily creates and produces more ecosystem services within cities (Bolund & Hunhammar, 1999:299). This is brought about by the fact that urban sprawl facilitates private garden spaces and public park spaces, while densification often requires green space elimination at a faster rate than green space reintroduction.

Studies show that the average city requires an ecosystem that is 500 to 1 000 times as big as the city itself. The problem is not whether the ecosystem is spread over a large area or is found outside the city edges – the problem is that both urban sprawl and urban densification commonly induce ecosystem degradation. This induction, in turn, results in a decrease in city inhabitants' well-being (Bolund & Hunhammar, 1999:299).

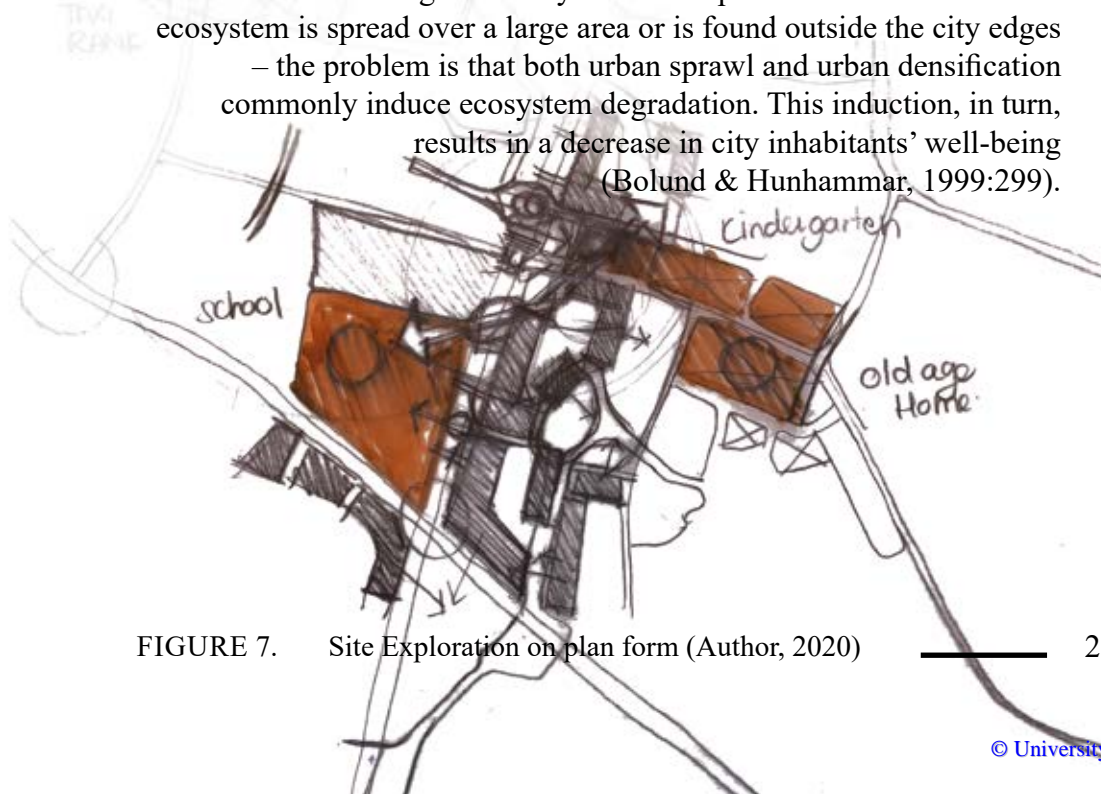


FIGURE 7. Site Exploration on plan form (Author, 2020)

Urban Issue

The urban, and commonly local, issues that stem from the global topics mentioned mostly concern zoning, re-zoning and a lack of public open space in denser urban areas. Another urban issue, which is the focus of the dissertation, is the development of new business nodes across cities. These nodes increase issues that are already prevalent in city centres. There is a constant development of city business centres to counter the ever-growing unemployment number. This development means that certain areas, commonly former residential areas, have to be re-zoned to accommodate the expansion. According to Preston (1966:240), these re-zoned areas are called transitional zones as they border on urban environments that are next in line for development.

These zones are abandoned for long periods as inhabitants do not want to live in developing city centres. Another reason is that even though existing plots are already re-zoned or due for development, the building process has not started yet. These buildings often become spaces for criminal activity, which contributes to the abandonment of the larger area.

Urban environments often produce large numbers of traffic and pollution, causing inhabitants to move farther away from city centres. The research discussed in the dissertation explores methods of identifying these transitional zones before they become derelict and abandoned (Preston, 1966:238). These methods prevent the overall decline of areas through the implementation of interventions that revive and restore these areas. These studies also provide possible zoning suggestions to regenerate the sites and their surrounds.

This dissertation aims to develop these zones so that they become threshold filters to and from the city. These zones then become community centre points and function as anchors to ensure that these areas stay active and safe. Zones such as these are subsequently designed to add value to both the urban and suburban environments, providing indefinite future relevance.

Local Issue

The local issues that challenge Pretoria stem from the above-mentioned global and urban issues. Pretoria and Johannesburg are fast-developing business centres for South Africa, with 12 business nodes planned across the province by 2055 (Myeza, 2013:99). This plan means that more areas will be classified as transitional zones, resulting in more abandoned and derelict sites. To counter the problems discussed, one should start developing a model for these sites and buildings today to ensure their present and future relevance.

This dissertation will consider sites that are facing these problems due to new city centre developments, primarily because of the effect that they will have on existing low development residential areas.

Issues linked to transitional zones have already been identified in existing city centres. They can, however, be overlooked when dealing with new business node developments. Developments often do not anticipate these issues and therefore do not make provision for them.

There is an opportunity to learn from existing spaces, like those of cities, and to implement precautions in areas where similar issues are overlooked.

Architectural Issue

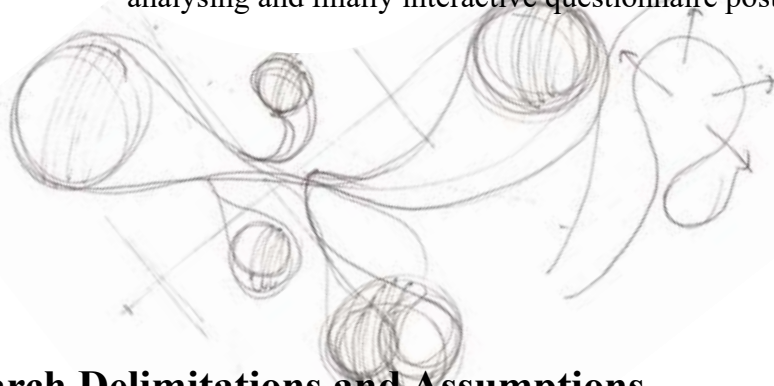
The main architectural issue found is that urban design does not always take both urban and suburban areas into account. Architecture, in this case, should be a system that can easily adapt to change. Architectural implementation should add value to existing sites as well as their ever-changing environments. When implemented in transitional zones, interventions should reinforce both urban areas and suburban areas. In so doing, these interventions will become the threshold through which individuals move when shuttling to and from 'work' and their 'lives'. Unfortunately, due to local transportation issues, many inhabitants prefer to live closer to their workplaces, as opposed to city centres. Transitional zones, when treated correctly, can thus become eco-systemic filter zones as well as zonal ones. The implication is that sites will become hierarchical thresholds between urban and suburban zones, and will transform into multi-purpose public sites. Factors such as affordability and public transport are other major local issues that need to be considered when these zones are developed.

One of the biggest global issues with which we are faced is sustainability. Sustainability is thus the most important driver in the dissertation. Urban environments produce pollution and waste due to industrial buildings, factories, vehicular traffic and other factors. Air and waste consequently need to be filtered before entering suburban environments to ensure and increase human well-being. If transitional zones become filters, it will restore ecosystem well-being which, in turn, increases human well-being. The main sustainable aim in this study is to create a net-positive environment where not only the natural environment thrives but its users too. The intervention should not only add value to the community but should also have a positive output in terms of energy, water and other natural features, and inspire its users to do so individually.

FIGURE 8. Site Flow from adjacent sites on plan (Author, 2020)

Research Paradigm

This paper is approached from an interpretive standpoint to ensure that the scientific and human sides of the argument are considered (Harris et al, 2015). Three methods of data collection were used to ensure the equal inclusion of both aspects in the research. The three main methods were literature reviews, mapping and analysing and finally interactive questionnaire posters.



Research Delimitations and Assumptions

This study assumes that the Menlyn Maine development will become a business node based on the city of Tshwane's plan for 2055. One can consequently assume that public transport will be the chosen method of movement in Pretoria, which will decrease the number of private vehicles on the road and increase foot traffic. This study also assumes Menlyn Maine will develop outward as there is planned re-zoning of the residential areas into high-density mixed-use zones.

This study focusses mainly on the development of a new business city node and deals with the problems that go hand-in-hand with re-zoning in suburban areas. The dissertation by no means aims to solve historical town planning or current ownership issues – it rather strives to become a catalyst for future city developments. These developments will be more mindful of human and ecosystem well-being and existing user's on-site.

Research Collection and Analysis methods

Case studies and literature investigating the phenomenon of transition zones were consulted to fully understand why and how these zones develop. The information found in the case studies was applied and tested on the relevant areas of investigation. This step was done to ascertain whether the South African urban development system correlates with international development systems, such as Burgess' (1966:237) concentric circle method.

The area studied was analysed according to Murphy and Vance's (1966:238) field-mapping procedure to determine the location of the transition zone. This mathematical analysis was done concomitantly with Burgess' (1966:237) concentric circle analysis.

As a first step, past and present maps regarding the change in open space were considered in terms of residential, urban and industrial zoning. Maps from 1996 to 2010 and 2019 were used and overlaid (Tshwane GIS, 13 March 2020).

This process established the amount and rate at which the area had grown over the last 24 years. The development and loss of public open spaces were also considered to determine whether these spaces were used for densification in an urban fabric. In addition, other area maps regarding the change in densification of urban nodes in Pretoria were analysed and considered to ensure that the possible solutions can support different urban environments across South Africa.

As a second step, different business nodes in Gauteng were explored through the concentric circle model to establish how South African cities develop. These areas included Hatfield CBD, Pretoria Central CBD, Johannesburg CBD, Sandton CBD and the new Menlyn Maine development (Myeza, 2013:99).

FIGURE 9. Flowing Nodes on site (Author, 2020)

Research Collection and Analysis methods

After the development pattern of the area was analysed, the study applied Murphy and Vance's (1966:238) mathematical analysis. This application was done by inspecting every block around the area and calculating land-use proportions, as well as different patterns of zoning.

This process showed which land use was the most prominent in the area and, in turn, indicated whether the area was becoming a transitional zone on an urban periphery (Preston, 1966:238).

Multiple case studies were compared to thoroughly understand the expanse of ecosystem services and functions, some of which are obvious and others obscure. This comparison helped to identify all ecosystem services that are present in the area. It is apparent that human needs differ regionally and, to ascertain which ecosystem services are most in demand, site investigations are essential.

This consideration is important to determine which ecosystem services should be reintroduced to an area and to establish which services are lacking.

Case studies investigating the connection between human well-being and ecosystem services were consulted to understand the importance of these services to the human user. Furthermore, literature on social sustainability and spaces that enhance well-being was reviewed.

These studies led to the understanding of possible solutions to reintroduce ecosystem services in order to revive human well-being.

To determine whether these interventions would be feasible in the selected area, a series of interactive posters were created to introduce a communal study. The interactive poster questionnaires were circulated in the immediate area (Menlyn Maine, Pretoria) where answers to questions about the site and its value were gathered.

To include a range of participants, a method of interactive collaboration was used. The survey was open for two weeks and was completed by 18 participants. The participants were a mixture of skateboarders that had been using the facility for years as well as children, parents and people who passed by. The study entailed participants to answer using a green sticker. All questions were yes-no questions or comparative questions where participants could place their stickers on their answers. Some questions included different categories of answers to cover a wide variety of information and opinions.

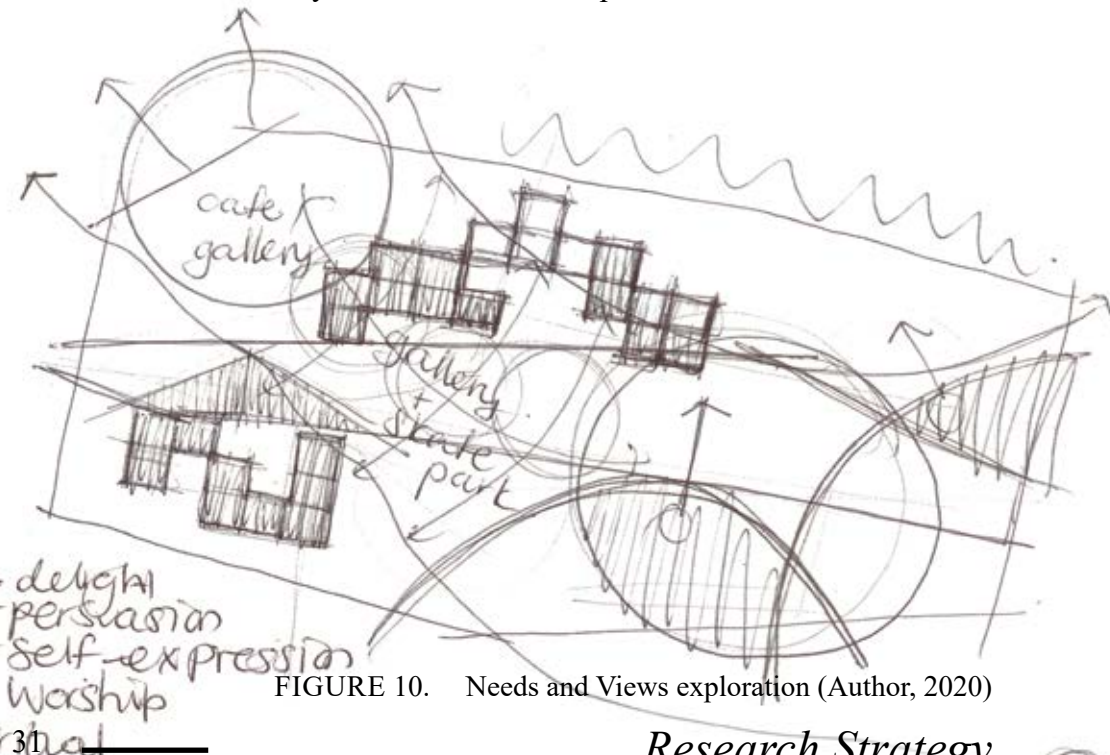


FIGURE 10. Needs and Views exploration (Author, 2020)

Dissertation Rationale

The rationale behind the structure is derived from the concept of a filter.

Once all the relevant information is gathered, the research should be filtered to remove unnecessary data, and to selectively absorb important and relevant components.

The components of information will then be applied on-site together with Vitruvius' principles to provide the final design.

Overview of Structure

The dissertation will be structured around the three main themes of the design. The main themes of the study are

(1) urban zoning and development, (2) human well-being, and (3) ecosystem-service rehabilitation and reintroduction.

The overall research theme involves the well-being of humans as well as the well-being of nature. The theme underlying this theme is sports and recreation. The component of sports and recreation is linked to an existing on-site programme and considers how sports can increase human well-being. The other main theme entails sustainability and biodiversity degradation, and considers how biomimetic architecture can aid in the rehabilitation of ecosystem functions and services.

A sub-theme of sustainability involves the requirements that have to be met for a building to be classified as 'green' and why these requirements are not thorough enough.

Here the study will look at net-positive design as opposed to net-zero design, where the building outcome adds to the grid rather than just being 'off-the-grid'.

The third main theme concerns urban zoning and urban development.

A sub-theme to urban development will be that of transitional spaces and architecture.

As a last step, these themes will be combined and superimposed so as to become an urban-eco filter. The filter does not only focus on the passing through of elements but also the process of 'catching' elements on-site. Here the definition of so-called filters becomes important. Filters are devices that are used to remove impurities but also create layers that selectively absorb specific components.

Chapter 2

Theory

Urban Development

History and Spatial Appropriation
Ernest Burgess Concentric Circle Model
Transitional zones
Open Space and Green Space in the city
Transitional zone as Filter

Human well-being

Social Sustainability
The Theory of Phenomenology

Ecosystem Service degradation

Sustainability and Net-Positive
Circular Economy Theory
Biomimetic Architecture
The Living Buildings Institute

Synthesis

Urban Development

History and Spatial Appropriation

Urban development is one of the biggest factors influencing human well-being – especially in developing countries like South Africa.

South Africa has a long history of problematic city planning and development, and these problems have had a lasting effect on human well-being. Historically, the city of Pretoria was divided into racial-specific areas where predominantly white areas surrounded city centres and economic nodes (Williams, 2000:167). In the last few years, citizens have moved into these city centres, often illegally, as they cannot afford transportation fees to and from work on top of the expensive living costs of suburban areas (Nosch, 1978:451). This situation has seen retail and transportation spaces move across the city where they become scattered and unorganised (Williams, 2000:167).

Ernest Burgess Concentric Circle Model

According to research by Ernest Burgess (1966:237), most cities develop in concentric circles from the business centre outward. Every concentric circle represents a different zone and periphery thereof. By analysing American and European cities, Burgess (1966:237) found that most cities only develop in three directions as they approach a barrier element like a river, a main transportation route or educational facility. As cities grow and more business nodes develop, these concentric circles of development start to overlap, which creates issues at intersections called transition zones (Preston, 1966:240).

This paper focusses on the transitional zone that forms between urban and suburban areas.

In South Africa, many citizens have moved farther away from city business centres to escape traffic, pollution, crime and other factors. Cities, like Pretoria, have simultaneously expanded, resulting in multiple business districts across the region (Myeza, 2013:99).

This situation has led to the abandonment of some areas as sites were re-zoned in preparation for urban expansion. These zones, commonly encircling the business nodes, indicate a shift from urban to suburban use, which signifies the development of transitional zones.

Transitional zones

Burgess (1966:237) states that transitional zones are zones of deterioration encircling urban areas. This is due to urban researchers not being able to develop a precise definition and understanding of these zones. This situation could be due to the fact that every transitional zone is dependent on the context and country in which it occurs as well as the relevant problems of that area.

Even though transitional zones are an anomaly, Preston (1966:237) explores several commonalities between different transitional zones to help identify them. His field observations unveiled that these transitional zones commonly consist of public, wholesale, retail, office and transportation spaces. These zones expand outward in a lateral direction and fade when they collide with large areas of homogenous land use, for example, heavy industrial and residential land use. Residential communities are most apparent at the outer edge of these so-called transitional zones (Preston, 1966:240).

The biggest problem that these areas face is their increased vacancy. The issue of vacancy occurs because of the underdevelopment of these areas, unattractive land for competitive development, the obvious division between residential areas and city centres as well as land-use proportions that indicate the unimportance of these plots (Preston, 1966:241).

These factors led to the conclusion that there is a need for a specific set of rules regarding peripheral zones. Urban planners should identify specific zoning requirements and uses for these zones as well as demarcated start and end points to minimise expansive and unnecessary development into residential areas (Preston, 1966).

Open Space and Green Space in the city

Another issue with increased development involves the re-zoning of open space (commonly public green spaces) that negatively influence the well-being of the public since many residents depend on these spaces as their only green space. According to a report by the United Nations, 80% of South Africa's population will be living in an urban environment in 2050 (COGTA, 2014:12).

Open space thus becomes scarce as densification of city centres is the most feasible option. The development of city centres results in an increase of pollution rates due to bigger industrialised areas, an increase in traffic and a loss of green space (Bolund & Hunhammar, 1999:299).

This development affects environmental and human well-being, and simple sustainable measures are not sufficiently countering this ongoing cycle.

Transitional zone as Filter

Transitional zones offer a place in the existing urban fabric where green spaces and well-being spaces can be reintroduced, and the ecosystem can be rehabilitated. These zones can act as barriers between urban and suburban areas and function as filters to regulate what enters suburban neighbourhoods in terms of pollution, traffic and development. If ecosystem services are increased and negative influences regulated, the well-being of cities' inhabitants will be increased.

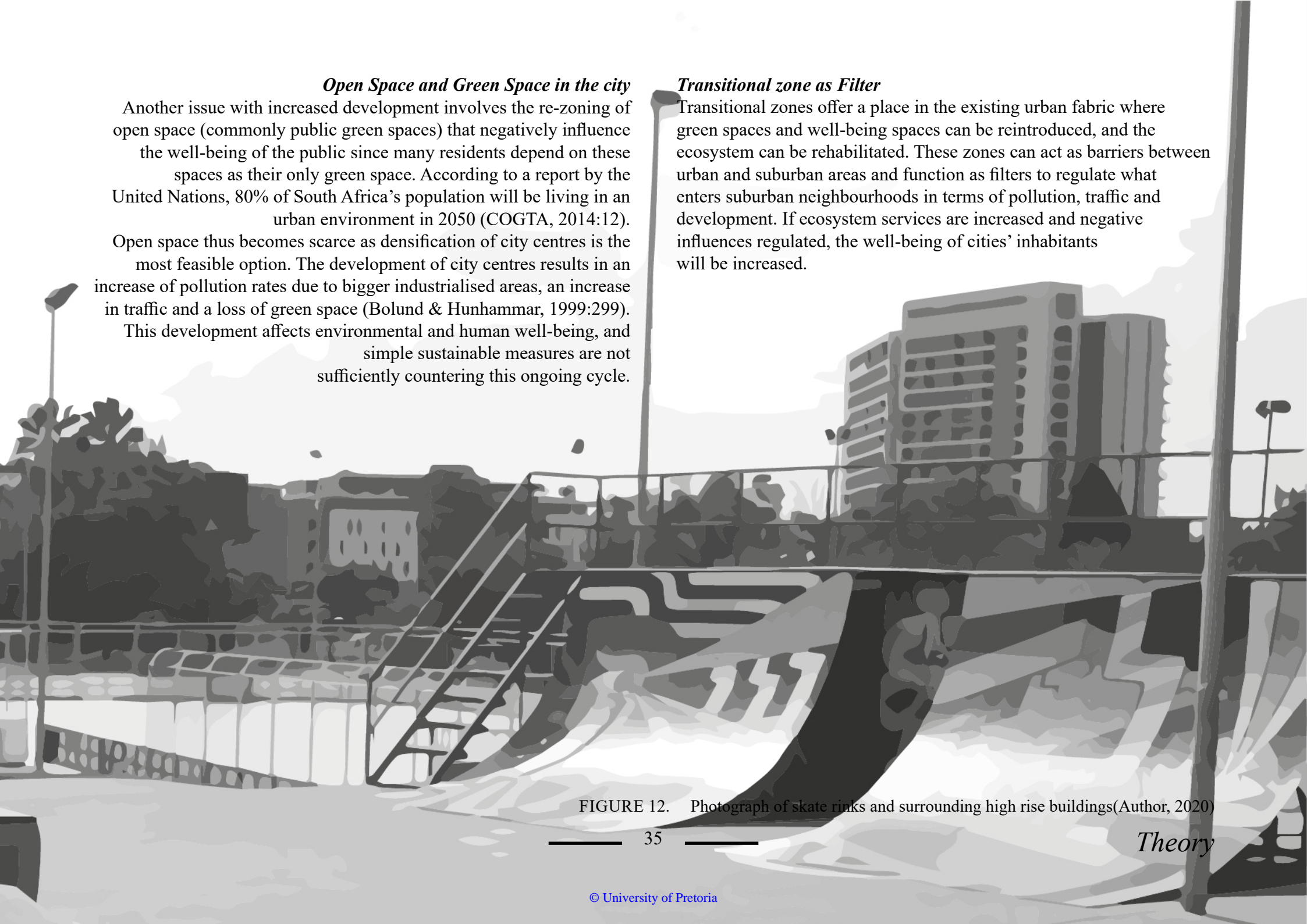


FIGURE 12. Photograph of skate rinks and surrounding high rise buildings(Author, 2020)

Human well-being

We often neglect the well-being of cities and their inhabitants, and focus solely on densifying cities to have space for those inhabitants.

There is also a lack of understanding of the massive scope that underpins human well-being and everything that contributes to the concept. Human well-being should be considered in its entirety, including the mental, physical, social and spiritual aspects thereof (Taylor & Hochuli, 2015:749).

Taylor and Hochuli (2015:749) argue that human well-being is predominantly reliant on three spaces, especially in an urban setting. These are walkable, green and community spaces. These spaces act as social spaces where one interacts with others and nature while being active and escaping from everyday constraints.

Ultimately, these spaces act as mental, physical, social and spiritual well-being enhancers. Urban development also commonly neglects the public in considerations that concern work and live spaces.

In-between zones become important when creating an easy transition between urban and suburban areas. By considering what Taylor and Hochuli (2015:749) believe and comparing it with the average urban environment, one can see that green, walkable and community spaces have often been neglected in the past, which has resulted in a decrease in human well-being.

Social Sustainability

Social sustainability becomes important at this point. It is the creation of successful and sustainable spaces that provide for people's needs while simultaneously promoting their well-being in the spaces where they work and live (Woodcraft, 2017:135). These spaces should provide for their users' needs – a provision that does not necessarily happen in other environments. In so doing, these spaces become break-away spaces. This can be taken a step further in cases where work and live spaces find harmony through social sustainability. Another important consideration involves the inclusion of physical, mental and spiritual health in the decision making of urban development, which means that well-being is the main driver. To fully ensure that all aspects of human well-being are being tended to, the development should be rooted in the well-being of nature.

The Theory of Phenomenology

To ensure that attention is paid to inhabitants' mental, spiritual and social health, it is important that buildings relate to users on a personal level. The theory of phenomenology enables architecture to tap into the human senses, creating a space of experience. Seamon (2000:157) simplifies phenomenology as “the interpretive study of human experience” (Seamon, 2000:157).

Phenomenology and architecture frequently involve the creation of an understanding or an awareness of something. Phenomenology can thus be used as a tool to create an awareness of ecosystem-service decline. It can also increase users' understanding of the ecosystem and how it influences their well-being. Pallasmaa (2007:41) describes architecture as an extension of nature and notes that architecture should trigger human senses in the same way that nature does. If these senses are used are at a constant level of interconnection, a sense of healing is instilled in users. Pallasmaa (2007:41) proposes that architecture should include a multi-sensory experience to increase users' sense of being in the world while creating an awareness of the environment.



FIGURE 14. Photograph of roof leading into skate rink (Author, 2020)

Ecosystem Service degradation

On the authority of the Millennium Ecosystem Assessment (2005), it was found that 60% of the world's ecosystem services are degraded and used unsustainably (Haines-Young & Potschin, 2010:111).

This means that people, unfortunately, break the link between themselves and nature. This disconnect occurs primarily because people lack knowledge about ecosystem services, do not understand how they are connected to these services or do not grasp the effect of these services on their well-being.

An ecosystem service is identified as the benefits humans gain from nature without paying a price.

Haines-Young and Potschin (2010:111-113) divide ecosystem services into provisioning, regulating, cultural and supporting services (Haines-Young & Potschin, 2010:111-113).

This division downplays the importance of the entire process. According to de Groot, Wilson and Boumans (2002:394) these resources should be split into functions and services.

Ecosystem functions provide services in terms of regulation, habitat, production and information functions.

Services are brought about, in turn, that generate value for ecological, socio-cultural and economic purposes (De Groot et al, 2002:394).

Here, one can add that these services provide value through provision, regulation, culture and support, explaining the system as a whole, rather than as an outcome, as Haines-Young and Potschin (2010:113) suggest.

To further understand the importance of ecosystem functions and services, one must be able to recognise them as well as their benefits in everyday life. In *Creating Better Cities: How Biodiversity and Ecosystem Functioning Enhance Urban Residents' Wellbeing*, Taylor and Hochuli (2014:755) state that an ecosystem should be healthy and void of any pollution to provide an entire range of services, such as pollination, storm protection, noise regulation and food production (Taylor & Hochuli, 2014:755).

De Groot, Wilson and Boumans (2002:394) classify these services according to the type of value they provide in their function, their process and components, and lastly the service itself. For example, food production needs components such as solar energy and rich soil that ultimately provide a continuous cycle of food, materials and fertilizer. This service also links to the production of medicinal products with an entirely new cycle (De Groot et al, 2002:396).

Ecosystem services often degrade due to the re-zoning of land. Previously green biodiverse spaces on the periphery of the city now become developed land. This development, unfortunately, results in a decrease in services, which ultimately influences human well-being. Ecosystem services should be provided in socially sustainable spaces as they are the main providers of human needs. Munzel, Meyer-Waarden and Galan (2018) take this concept a step further by linking it to urban development, where more than half of the world's population is situated (Ledent 2003; Munzel, Meyer-Waarden and Galan, 2018).

Urban plans should specifically include ecosystem services in their developments through non-natural methods, such as architecture. Architecture can be used to rehabilitate or reintroduce these services after they were demolished in the first place.

Sustainability and Net-Positive

Unfortunately, one commonly associates the concept of sustainable design with solar power, energy and water saving. These interventions are needed indeed but the most important factor is often overlooked – the rehabilitation of the environment. The Living Building Institute expands on this notion by incorporating net-positivity with the concept of the building becoming an ecosystem (Living Building Institute, 24 August 2020).

The important concept of net-positivity entails that a building or site produces more than what it requires. This process results in a positive re-production that improves the system rather than just avoiding it with a net-zero approach (Cole, 2015).

Circular Economy Theory

Another model that should be introduced by urban development is the circular economy theory. This model aims to reduce the amount of waste produced in a normal business, industrial and economic cycle.

Any waste produced should become a possible source in another cycle – eventually creating one large inclusive system in the urban environment (A Circular Economy is what we need to move towards, 7 September 2020). A possible architectural solution to this issue would be biomimetic architecture, which is when the building itself produces ecosystem services. The building thus becomes a part of the environmental system rather than a negative imposition.

Biomimetic Architecture

By defining bio-mimesis, one finds that it is an architecture that imitates life (Croxford et al, 2017:695). More in-depth definitions define biomimetic as “the abstraction of good design from nature” (Bogatyrev et al, 2006:471-482) and “an emerging discipline that emulates nature’s designs and processes to create a healthier, more sustainable planet” (Benyus, 1998:392).

Biomimetic architecture, therefore, provides the possibility to replace and rehabilitate ecosystem services and functions using man-made structures. The biologist and leading researcher in the field, Janine Benyus, voices her concern for the way in which this construct has been used in the past. Most previous attempts were unsuccessful as these constructions only mimicked natural form. Benyus (2008) explains that biomimetic design cannot function without mimicking the form, process and ecosystem in which these services function.

The Living Buildings Institute

The Living Building Institute (2020) requires buildings, and their entire pre-and post-construction life, to function like a flower. The institute not only demand energy- and water-saving elements but also for architectural products to add to their environments through material use, movement, beauty, human health and happiness, place and equity. This approach involves both human and natural needs throughout the entire lifespan of a project (The Living Building Institute, 24 August 2020).

By introducing this concept, the built environment will function like a biodiverse ecosystem, solving the problems of ecosystem and well-being degradation.

Synthesis

The researched discussed clearly shows a connection between urban development, ecosystem degradation and the decline of human well-being. It is evident that most cities develop through concentric circles, which result in the formation of transition zones on the urban-centre periphery. As cities expand to support their population growth, more city centres are established – a situation that results in multiple transition zones. As was pointed out, this phenomenon might lead to a decline in human well-being and it could have other negative influences on the environment (Preston, 1966).

Multiple business node developments also contain benefits. Business developments have a positive influence on the overall economic value of cities and on employment numbers, but the well-being of users is just as important. If the urban environment enhances human well-being while enhancing economic well-being, the overall city system will function in a resilient manner (A Circular Economy is what we need to move towards, 7 September 2020). The problem of isolated urban development arises at this point. Urban developers often neglect human well-being and surrounding zones, and refrain from including both urban and suburban needs into the expansion.

Another factor to consider is the reintroduction of public and green spaces on the periphery of urban cores to regulate further densification. To prevent the situation where these open spaces are developed in the future, they need to serve a specific purpose in the overall city system. They should provide amenities and facilities that can and should not be developed as they are an integral part of the city's well-being and value.

By developing these spaces, urban densification will be regulated and filtered before it reaches suburban city zones. Urban development has the opportunity to add value to cities in multiple ways – especially through social sustainability.

Social sustainability focusses on the implementation of energy-saving techniques and basic sustainable interventions, as well as the rehabilitation and reintroduction of ecosystem services into public spaces. If these spaces are focussed on the urban periphery, both urban and suburban areas will have access to socially sustainable spaces and their benefits (Woodcraft, 2017:133-144).

As is identified in the research, the basis of human needs is located in ecosystem services. Ecosystem services require biodiversity, green spaces and open spaces. If this is not possible, these ecosystem services should be imitated through man-made structures. These ecosystem services are essential to counter the negative influences of densification as they provide for basic human needs – needs that are often removed by urban expansion.

Human well-being is also dependant on basic needs or, in other words, on basic ecosystem services (Taylor & Hochuli, 2014). Urban developers, designers and the public often misinterpret the meanings of ecosystem services and sustainability – a misinterpretation that results in sustainable interventions that are insufficient.

To ensure human well-being does not suffer further decline, it is important that basic resources are not merely protected – their processes also need to be rehabilitated. We should not only rehabilitate ecosystems; we should also reintroduce them by means of man-made structures and interventions to ensure future resilience and net-positivity, rather than net-zero. Most research on biomimetic architecture does not include all aspects of the ecosystem: the available research mostly only mimics form. Therefore, the ecosystem in its entirety should be fully mimicked and properly understood (Benyus, 2008).

Transition zones offer the best opportunity for the reintroduction of ecosystem services and socially sustainable spaces. These zones, placed on the periphery of city centres, should act as filters and regenerators by capturing the necessary and eliminating the unnecessary. These spaces become buffer zones that regulate pollution, traffic and development that influences suburban areas. These spaces can also become community centre points for neighbourhood well-being. In conclusion, to design and live sustainably is not enough.

The creation of socially sustainable resilient spaces, however, might regenerate and rehabilitate both human and ecosystem well-being. Without human intervention, these services will diminish. Our economic development is depleting our resources but our economy would be void without these resources.

Therefore, we cannot view urban development as purely scientific or solely humane – it is a combination of both, working in unison.



FIGURE 16. The three links of the argument (Author, 2020)

Chapter 3

The Site

Macro Site Selection

Meso Site Selection

Mapping

Ernest Burgess Concentric Circle Model

Murphy and Vance Analysis Maps

Urban Vision

Micro Site Selection

4 theories

Site Analysis

Questionnaires

Climate Study

Macro Site

When considering the theory consulted, the macro-site selection was based on the city where the most development was planned. Tshwane has a long history with planning issues due to the apartheid era. However, existing city centres are being regenerated to counter issues related to safety and abandonment. These issues stem from apartheid-era planning, insufficient housing for 'inner city living', as well as common transitional zone problems.

To solve these problems, existing buildings are repurposed to accommodate ever-growing population needs, and more high-rise residential buildings are being built (Myeza, 2013:99).

According to the Tshwane 2055 Vision, Gauteng will experience major densification and development, with six new business developments that are planned for Pretoria as shown in figure 6 on page 27 (Myeza, 2013:99).

Issues commonly associated with business and industrial city centres will now prevail in areas across the city where they are not necessarily anticipated.

These issues will now prevail in suburban areas across the city. The Menlyn Maine development was chosen as it is located within a predominantly residential area. The new development has since caused unanticipated urban issues to arise.

Fortunately, these problems are still evolving, which provides the opportunity for intervention and prevention.

It is, however, easy to prepare for problems associated with ecosystem degradation, pollution, re-zoning, noise, safety and many more in city centres. Owing to the development of business nodes in predominantly residential areas, it is expected that these issues will spill over into these neighbourhoods. This possibility should thus be addressed in the development plans. Often, the mentioned issues cannot be solved in existing urban areas but they can nevertheless inform the designs and plans for new urban areas. There is an opportunity to use this existing knowledge and prevent further degradation across the city.

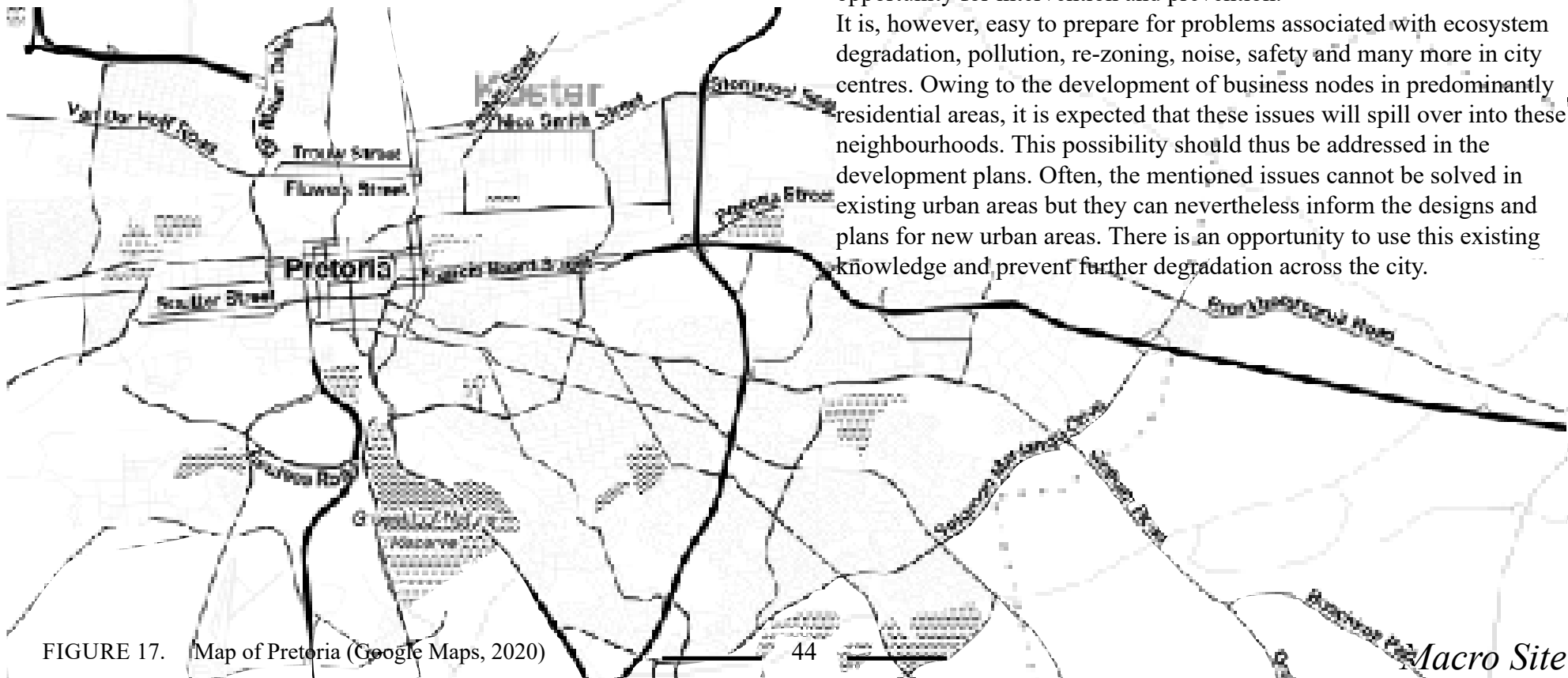
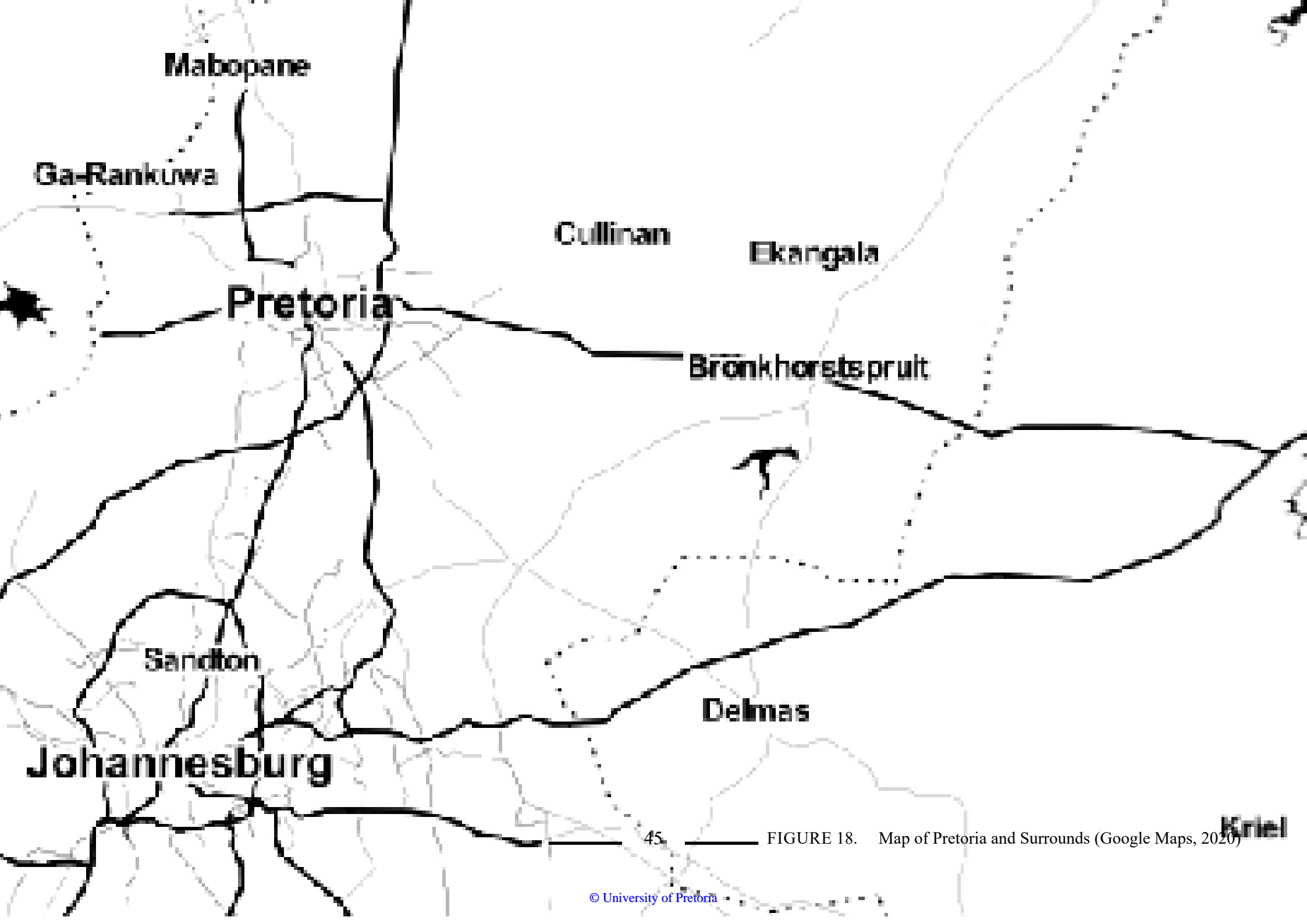


FIGURE 17. Map of Pretoria (Google Maps, 2020)



Mabopane

Ga-Rankuwa

Pretoria

Cullinan

Ekangala

Bronkhorstpruit

Sandton

Johannesburg

Delmas

Kriel

FIGURE 18. Map of Pretoria and Surrounds (Google Maps, 2020)

Miso Site

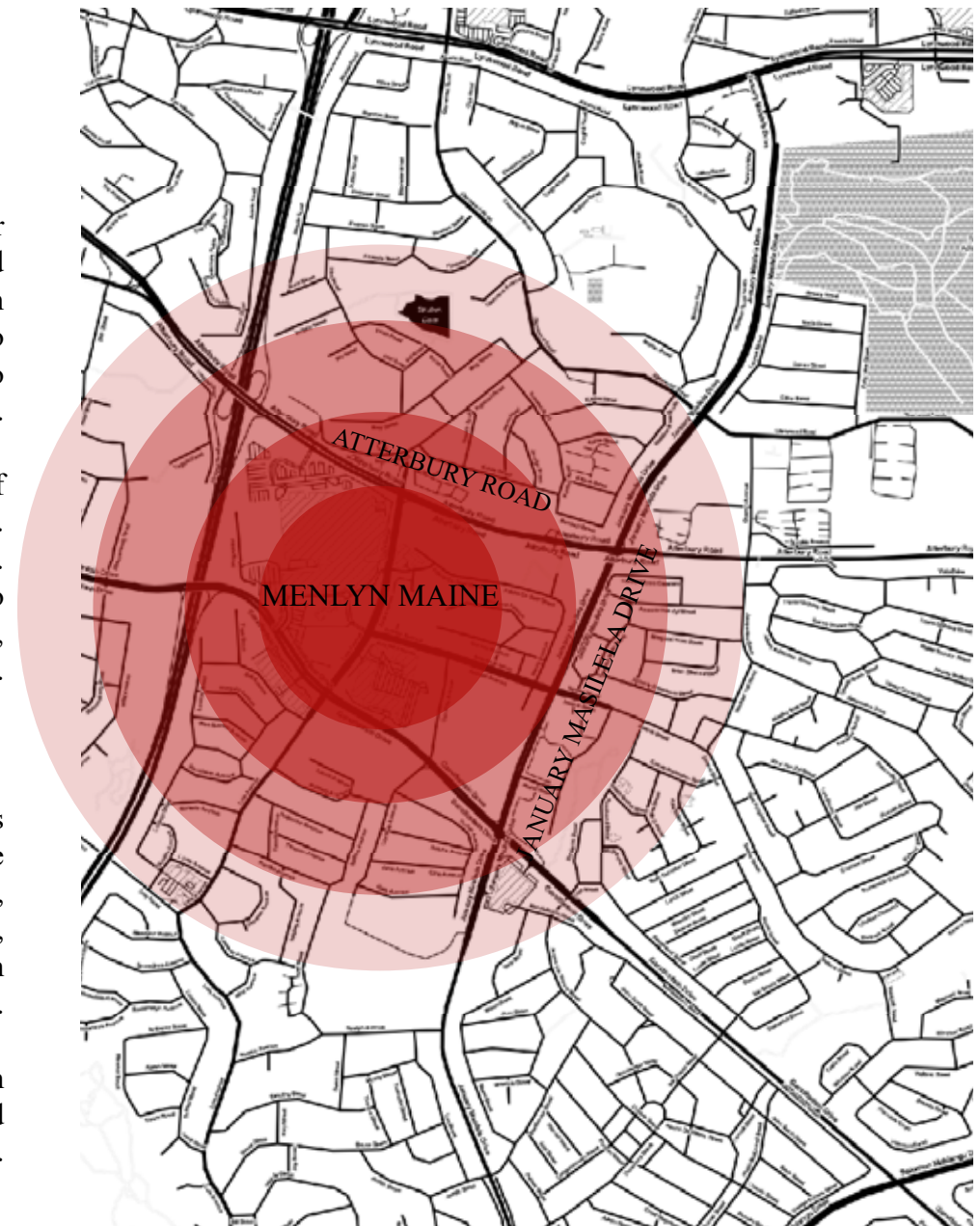
The Miso site is along the streets of January Masilela, expanding between Garsfontein and Atterbury Road, and Serene Street, between Lois Avenue and Winifred Yell Street.

The Miso site was chosen in an area where urban issues are in their beginning stage. These issues can therefore be addressed and solved before they influence the surrounding areas further. This consideration helps to inform other new urban developments, enabling them to anticipate these issues and allowing them to provide for solutions in their planning.

The miso-site selection is primarily based on the expected nodes of development according to the Tshwane 2055 Vision (Myeza, 2013:99). The 2055 vision strives for resilience and a successful just Tshwane. Much like the 2055 Vision, the National Development Plan aims to accomplish spatial transformation by achieving spatial justice, equality, efficiency, resilience and sustainability (Maritz et al, 2016:127).

At the seventh Planning Africa Conference in 2016, different guidelines were set out to measure whether the city had undergone spatial transformation, namely: (1) social and racial integration, (2) a change in overall city structure and urban fabric, and (3) local texture change, which refers to experience and quality on a household scale (Maritz et al, 2016:127).

To establish the most suitable business node, the study will focus on different methods that can be used to identify an area that has developed according to these three guidelines (Maritz et al, 2016:127).



Site maps from 1990 and 2018 were superimposed to identify the largest areas of change and densification. Figure 20, indicating the industrial and urban development as well as the change in residential zoning, were analysed. These maps show that as business zoning appears and expands across an area, residential areas slowly disperse and disappear. Industrial and business zoning also starts appearing throughout densely residential neighbourhoods, forcing a divide in communities (Tshwane GIS, 13 March 2020).

The 1990 and 2018 maps were overlaid (figure 21) to identify areas that were residential areas before they were demolished and rebuilt into business, urban or industrial areas. This map indicates the pattern of development from the new Menlyn Maine business node outward into the residential neighbourhoods (Tshwane GIS, 13 March 2020).

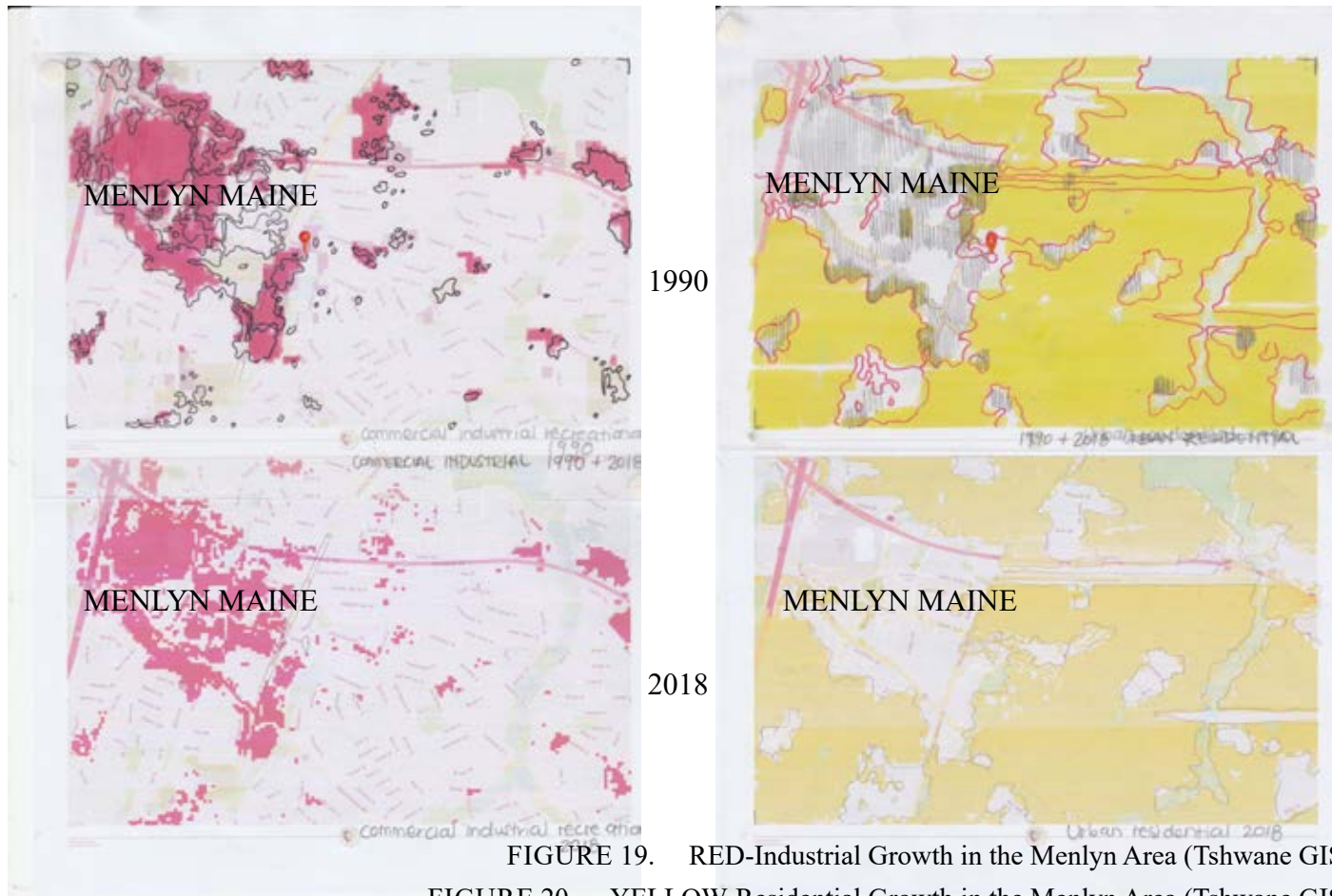


FIGURE 19. RED-Industrial Growth in the Menlyn Area (Tshwane GIS & Author, 2020)

FIGURE 20. YELLOW-Residential Growth in the Menlyn Area (Tshwane GIS & Author, 2020)

This step led to the conclusion that Menlyn Maine and the surrounding area show the most successful development.

The following points can be noted about the area:

- (1) The area has densified immensely in terms of zoning and built-up space.
- (2) According to future developments, the new Gautrain and A Re Yeng transport nodes will be implemented, which will increase the number of public transport nodes.
- (3) Its urban fabric has changed drastically from a highly residential area to a highly business area.
- (4) There is an increase in foot traffic and vehicular movement.
- (5) The area provides an entirely new experience than before, including a casino and an entertainment arena.
- (6) The area has a new nightlife, which increases safety.
- (7) There is an increased diversity of users, particularly in terms of their ages.

The Menlyn Maine area was thoroughly investigated to fully understand its future.

The investigations included:

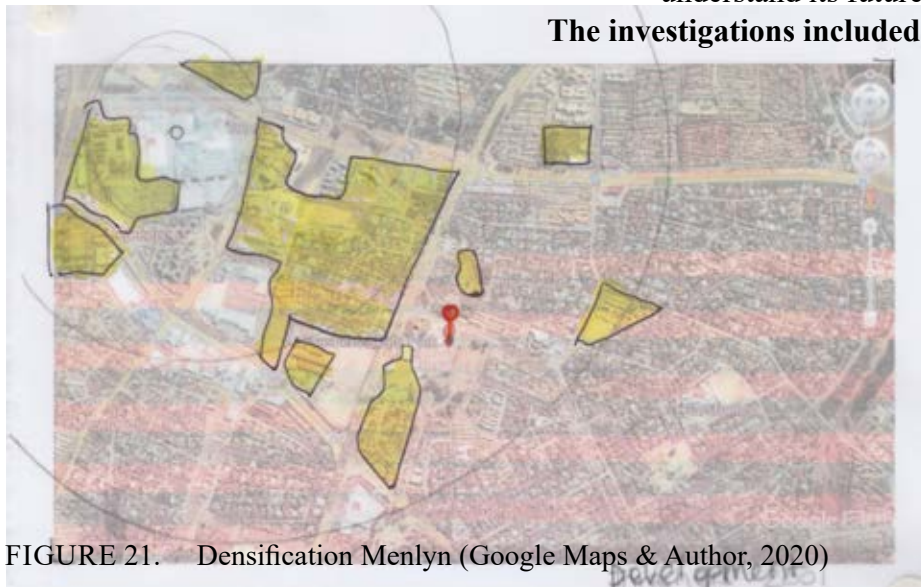


FIGURE 21. Densification Menlyn (Google Maps & Author, 2020)

- An existing zoning analysis

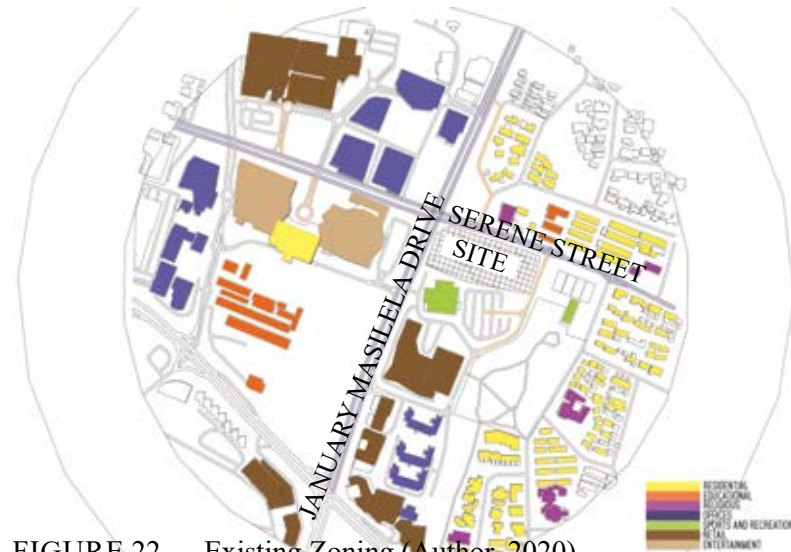


FIGURE 22. Existing Zoning (Author, 2020)

- An existing major green space analysis

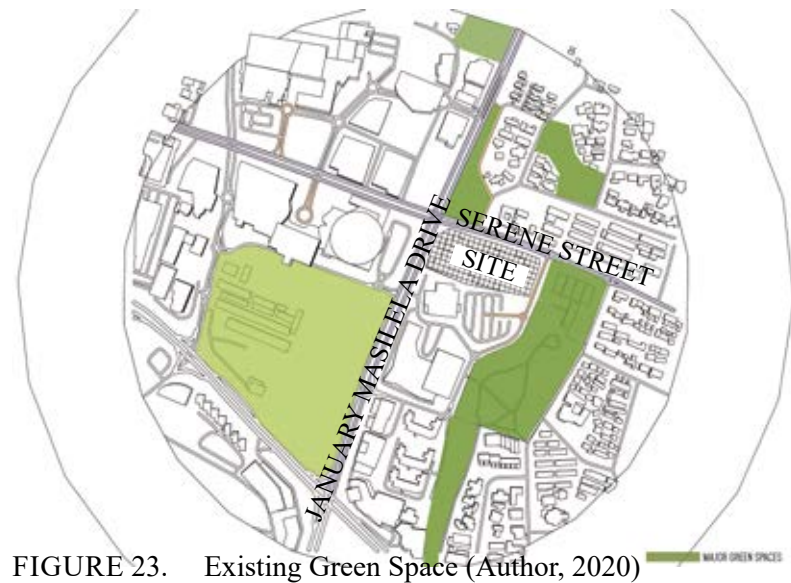


FIGURE 23. Existing Green Space (Author, 2020)

Main transport routes

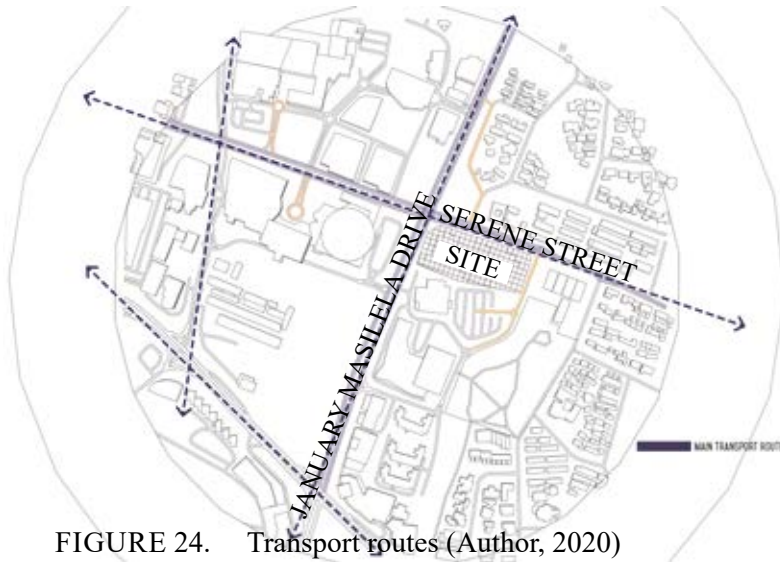


FIGURE 24. Transport routes (Author, 2020)

Main bus routes and bus stops

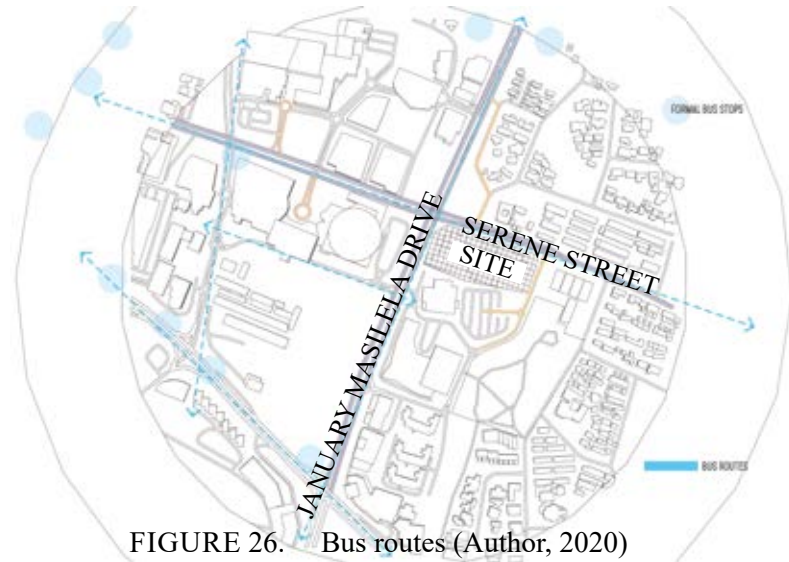


FIGURE 26. Bus routes (Author, 2020)

Main taxi routes and taxi stops

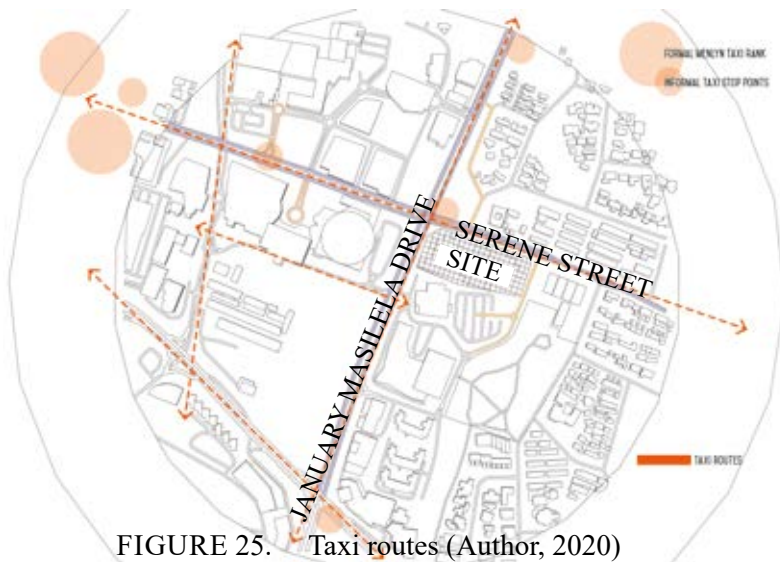


FIGURE 25. Taxi routes (Author, 2020)

Pedestrian movement density analysis

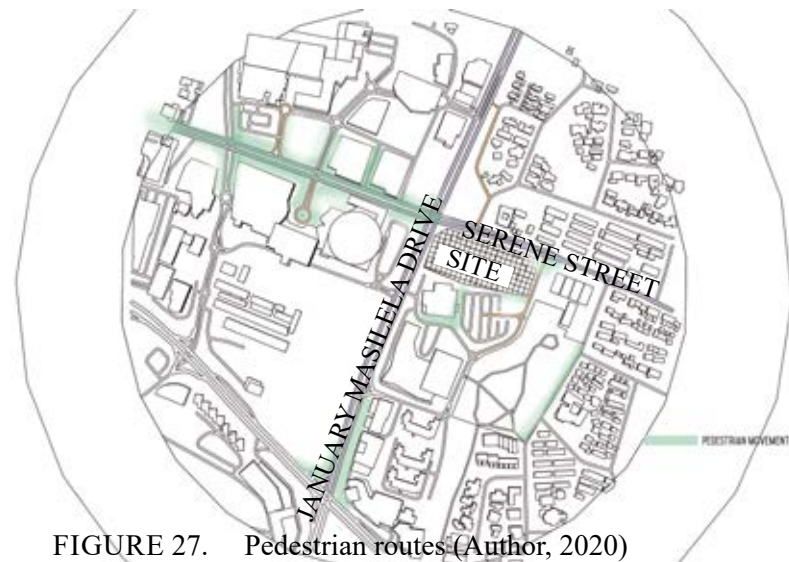


FIGURE 27. Pedestrian routes (Author, 2020)

These maps, shown in figure 9 concluded that the main development has only manifested in the western and southern parts of the precinct, mainly to the west on January Masilela Drive.

To the east, little to no development has taken place and the main zoning still consists of residential use. Owing to this lack of development, there are only a few or no public transport nodes to the south-east of the precinct, with only informal transport stops to the east of January Masilela Drive.

This situation also results in pedestrian density to maximise mostly the western part of Serene Drive and the southern parts of January Masilela Drive.

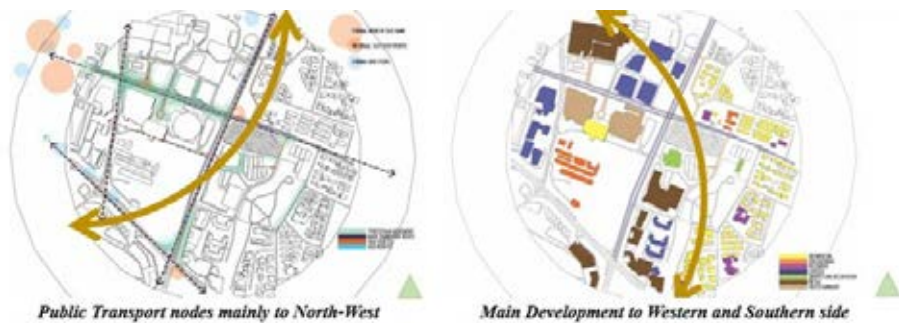


FIGURE 28. Major Issues Identified through the mapping (Author, 2020)



The biggest issue identified through these maps is the slow reduction of green space as the development expands to the east. The loss of green space is mainly due to the demolition of residential plots. These small spaces provided for ecosystem biodiversity and biodiversity corridors between larger open spaces. The loss of green space has affected not only the well-being of the ecosystem but also the well-being of the residents in the precinct.

Although the recent development of Menlyn Maine has had a positive effect on the area, the existing community is under threat of being moved as the residential zoning decreases. Smaller businesses are also struggling to compete with new retail spaces. Lastly, there is an existing community of elderly residents and families who enjoy the benefits of the developed business node, but they feel threatened by the new development that might potentially take over their entire neighbourhood. Owing to the new development, the possibility is looming that the adjacent residential community will turn into a transitional zone.

The negative effects that Menlyn Maine has had on a smaller neighbourhood scale are as follow:

- (1) A major scale and zoning jump from urban to residential use
- (2) No sidewalks or shade to the eastern side of January Masilela Drive
- (3) Pollution and waste generated by the businesses and increased traffic
- (4) No basic maintenance for smaller businesses

The development also influences the ecosystem services in the area.

Degrading ecosystem services include:

- Noise and sound protection
- Climate regulation (shaded and cooler zones)
- Biodiversity in fauna and flora
- Habitat spaces for different species
- CO2 reduction
- Water and air treatment and filtration
- Food and medicinal resources
- Cultural and artistic spaces
- Recreational spaces
- Spiritual health

This situation has resulted in some spaces becoming derelict and unsafe. These spaces face the possibility of vacancy and other problems associated with transitional zones.

If Menlyn Maine is to expand to the eastern direction, these issues will be pushed further into the residential neighbourhoods, creating more problems. For these reasons, an intervention is needed that anticipates and prevents problems. As stated before, many of these issues exist in city centres but new development plans often neglect to account for them.

Therefore, this area provides the opportunity to experiment with the filter solution for transitional zones.

Not only does the new architectural implementation need to reinforce the old and new developments but it should also account for the following:

- The reintroduction of ecosystem services
- Past and present architectural styles
- Historical and future zoning
- New citizens enjoying the new amenities
- Older residents that have been in the community for more than 40 years
- Small business owners
- New business owners
- A younger demographic of people who are lured by entertainment options
- An older demographic in the surrounding old-age homes
- Families that live in the area
- Children that attend nearby schools
- Employees in all the surrounding businesses
- All those using the public transport amenities
- People passing through

In order to propose a solution of resilience and regeneration, the future development of the area needs to be considered. To establish this future pattern, the concentric circle method proposed by Burgess (1966:237) is investigated. This method indicates the economic development of city business centres through the use of concentric circles. Burgess (1966) developed this method by analysing various city development patterns. The inner circle represents the business centre of the city and the second circle represents the transitional zone that moves from business or retail use to residential use (Preston, 1966).

Ernest Burgess Concentric Circle Model

This method as illustrated in figure 30 was applied and adjusted to five existing city centres across Gauteng to ensure that a thorough investigation of South African city development patterns was done. These nodes are Menlyn Main, Pretoria CBD, Hatfield CBD, Johannesburg CBD and Sandton.

The most interesting conclusion is that the majority of the nodes investigated developed in a three-point direction, rather than circularly outward. This finding is either due to heavy industrial areas or national roads that prevented development, or residential zones that had existed before the business node developed and grew in the city.

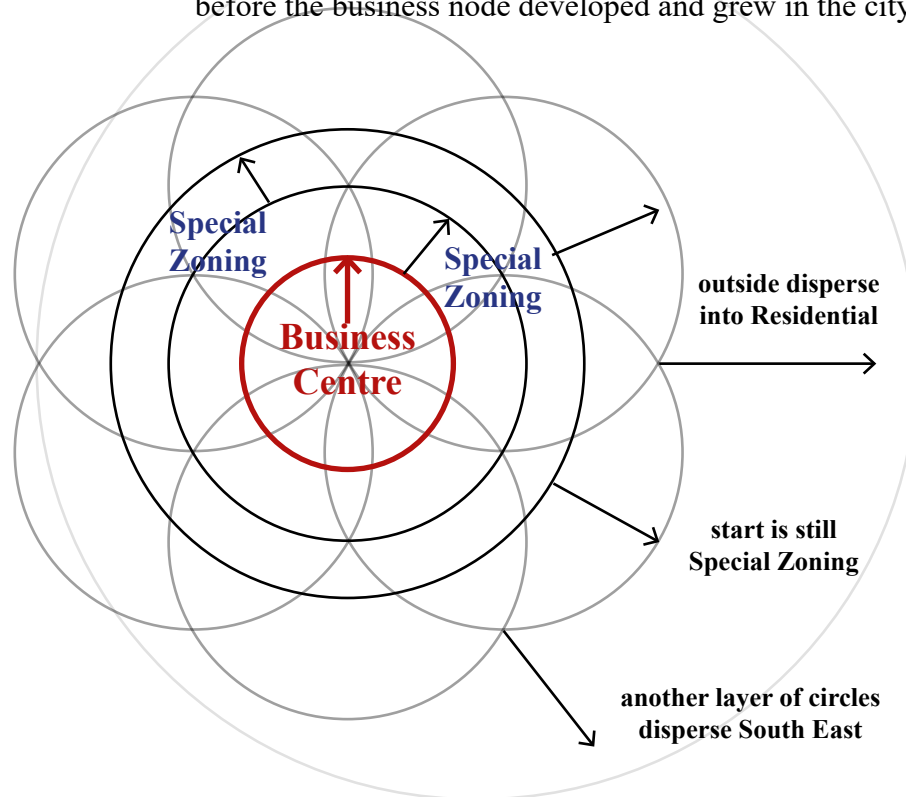


FIGURE 29. Concentric Circle Method (Author, 2020)

Figure 31- Pretoria CBD

The concentric circle development of Pretoria's inner city takes place towards the east, and fades into a suburban and residential area. Educational facilities like the University of Pretoria prevents any further expansion to the south-east.

To the west, any expansion is prevented by undeveloped land and a heavy industrial zone. There is a surge in densification between the Pretoria CBD and Hatfield area, which is fast becoming a new business node, where residential areas 3, 4 and 5 are developing.

This development means that high-rise residential areas are more in demand closer to the city centre.

FIGURE 30. Pretoria CBD concentric circles (Tshwane GIS & Author, 2020)

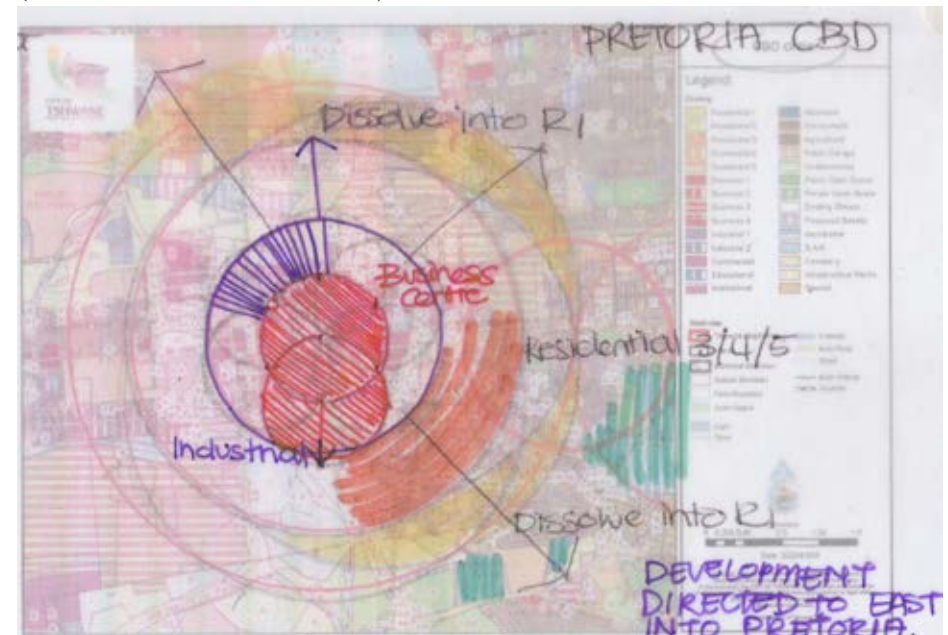


Figure 32- Hatfield CBD

The University of Pretoria and N4 highway prevent any development of Hatfield to the south-east, and residential zoned areas are being re-zoned for special and business interventions.

Hatfield is slowly colliding with the inner city of Pretoria where high-rise residential units are densifying the city.

The most prevalent concentric circles are expanding towards the north and north-east.

FIGURE 31. Hatfield concentric circles (Tshwane GIS & Author, 2020)



Figure 33- Johannesburg CBD

An interesting phenomenon is seen in Johannesburg as the development takes place linearly, following the existing mining belt of the area.

This development is also evident in the zone pattern, which is the industrial belt surrounded by businesses that move into low-density residential use.

The only concentric circle development is seen to the south-west of the city with a more apparent linear development.

FIGURE 32. Johannesburg concentric circles (Tshwane GIS & Author, 2020)

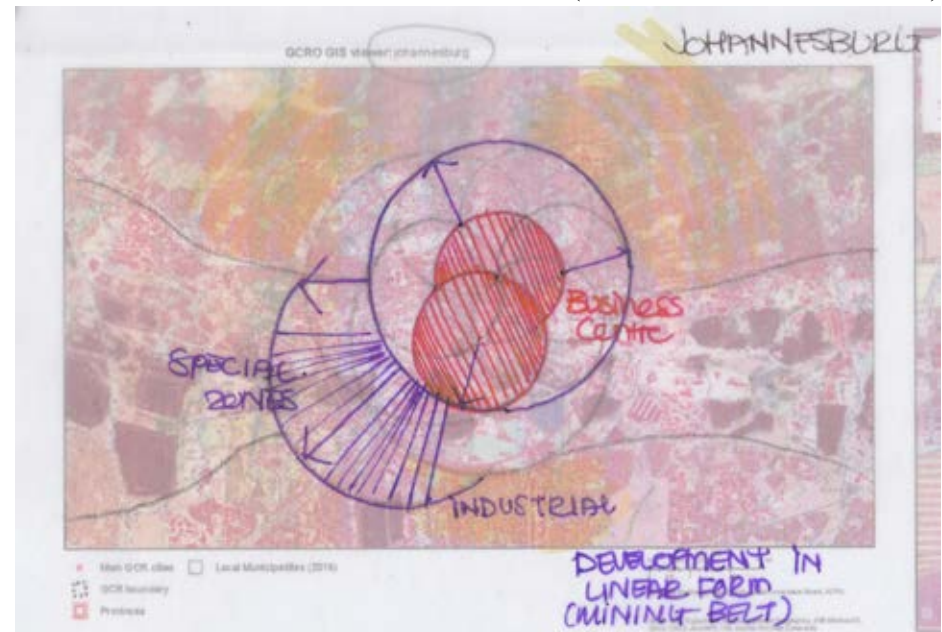


Figure 34- Sandton CBD

Sandton is a perfect example of three-direction development rather than perfect concentric circles. The city centre expands towards the north and north-east with mostly special and industrial amenities.

These zones disperse into a highly residential-focused area that surrounds the entire district.

Through historical development analysis maps, it is obvious that business areas are slowly seeping into residential communities.

FIGURE 33. Sandton concentric circles (Tshwane GIS & Author, 2020)



Figure 35- Menlyn Main

As can be seen in the image, the concentric circle model is most apparent in the Menlyn Maine area. The development slowly moves into the surrounding residential areas on the north, east and south of the business centre.

To the west, the national highway prevents development but it seems it has jumped the road and moved over to the other side.

The central circle indicates where the new business centre is situated. The business centre moves into special zoning, including retail and public zoning throughout the second and third circles.

Where the third circle meets the residential areas, it slowly disperses and becomes small singular special zones on the periphery of the residential zone.

This study supports the phenomenon of a transitional zone developing around the new Menlyn Maine development.

Smaller businesses are spreading outward, leading to open and vacant plots surrounding them. As residents move farther away from the urban environment, communities are affected, abandoned plots become derelict and the overall value of the area decreases.

To determine the extent to which the new development is influencing existing zoning and the zoning pattern, Murphy and Vance's (1966:238) mathematical method is used. This method will indicate whether a transitional zone is developing.

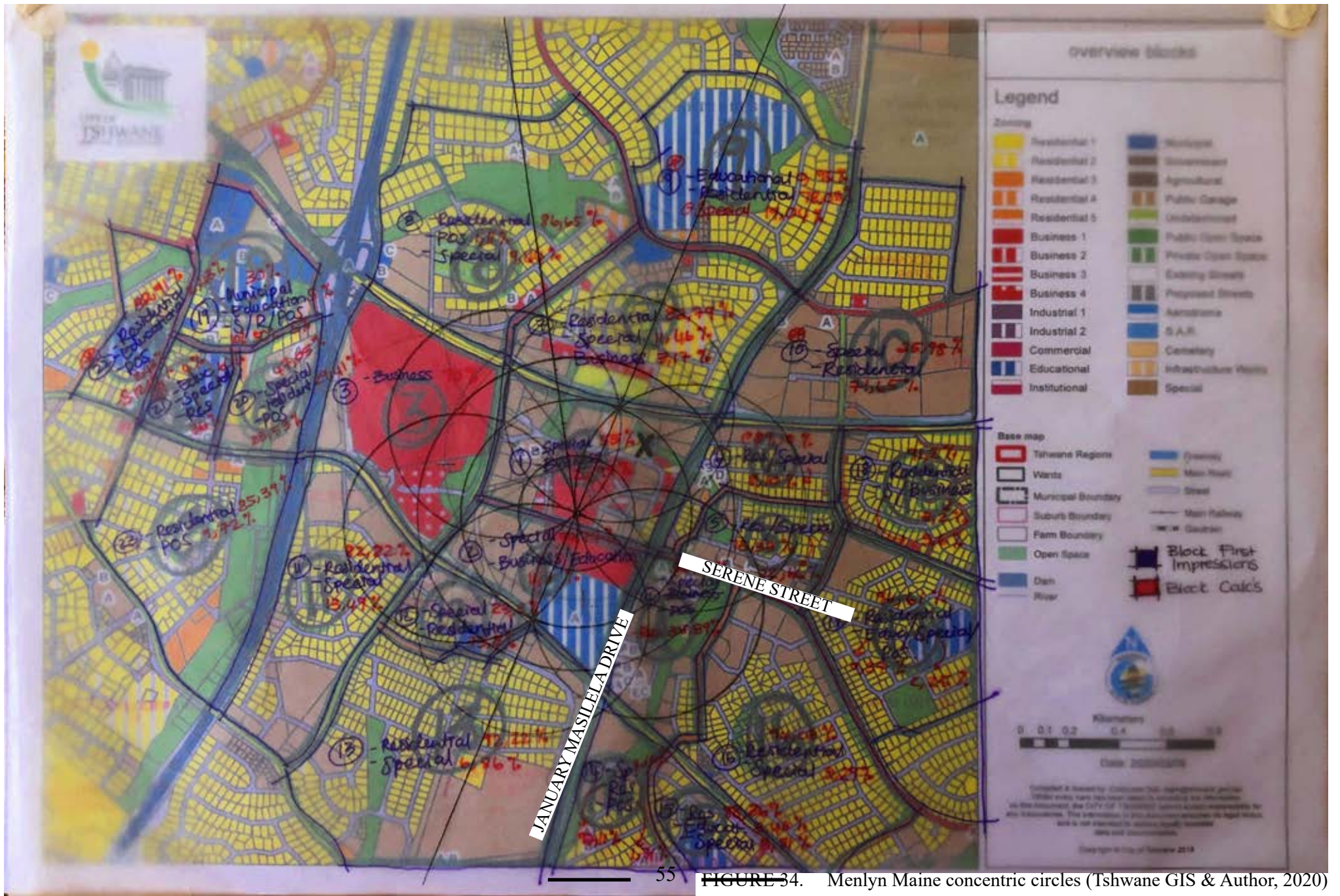


FIGURE 34. Menlyn Maine concentric circles (Tshwane GIS & Author, 2020)

Murphy and Vance Zone Proportioning



FIGURE 35. Murphy and Vance Mapping Method to determine zoning proportions (Tshwane GIS & Author, 2020)

The method of zone proportioning by Murphy and Vance was applied to the Menlyn Main area to calculate the zones most prevalent in the area and their positioning (Preston, 1966).

Shown through figure 36 23 blocks were studied. The most common zones are residential zones at 72.75%, followed by special zones at 21.56%, business zones at 10%, public open space zones at 5.21% and educational zones at 3.9%. Their positions moved from clustered business and special zones to mostly special zones to residential zones.

Small business plots can be found farther into the residential area but they are most commonly grouped together. The public open spaces and educational facilities are positioned closer to the residential areas except for one high school that was previously adjacent to residential plots; it is currently surrounded by business and special zones.

According to the transitional zone research discussed in Chapter 2, transitional zones are highly public-, retail- and special-zoning based.

They originate from urban centres and disperse into residential areas (Preston, 1966). The zoning proportions and patterns seen in the Menlyn area indicate that this transition zone is developing and expanding. The new transition zone is accompanied by various issues, ranging from vacancy to safety, and these issues should be anticipated.

Transition zones also indicate future areas of development as these zones can evolve into urban zones. Densification influences public space and green space directly as they pose expansion opportunities.

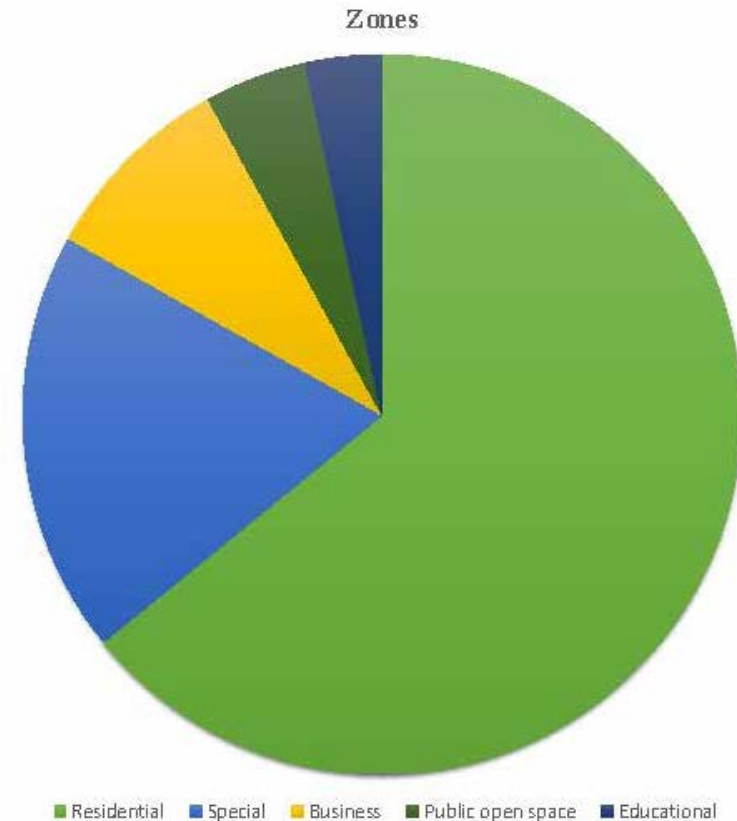


FIGURE 36. Zoning Proportions data showing percentages (Author, 2020)

With a figure of 5.21%, it is evident that there is only a small percentage of public open space left in the area. This situation occurs because residential plots are demolished for high-rise, built-up space, which eliminates small ecosystems (Bolund & Hunhammar, 1999:299).

In figure 38 existing green spaces and biodiversity corridors are mapped across the Menlyn area to comprehend their larger purpose in Pretoria's overall ecosystem.

Through this map, it is apparent that concentric circles result in a slow decrease of green space, which disjoins the biodiversity corridor that stretches from north to south.

It also acts as the midpoint ecosystem connection between the Faerie Glen Nature Reserve and the Pretoria Country Club golf course.



FIGURE 37. Biodiversity corridors around site (Tshwane GIS & Author, 2020)

As is seen in Chapter 2, ecosystem services are not mere processes in nature – they are systems that produce specific products that are used by humans every day.

These services provide ecological, social, cultural and economic benefits, and improve human well-being by providing consumable products, regulating ecosystems, and supporting cultural and personal needs (De Groot et al, 2002:394).

All these services function in a cyclical system that connects and adds to other systems. The system of pollination, for example, connects to the system of medicinal plant production, which adds to edible plants, and so on (Taylor & Hochuli, 2015:749).

Other services, like noise regulation, can be achieved either through natural or man-made interventions but the origin of the service is found in nature.

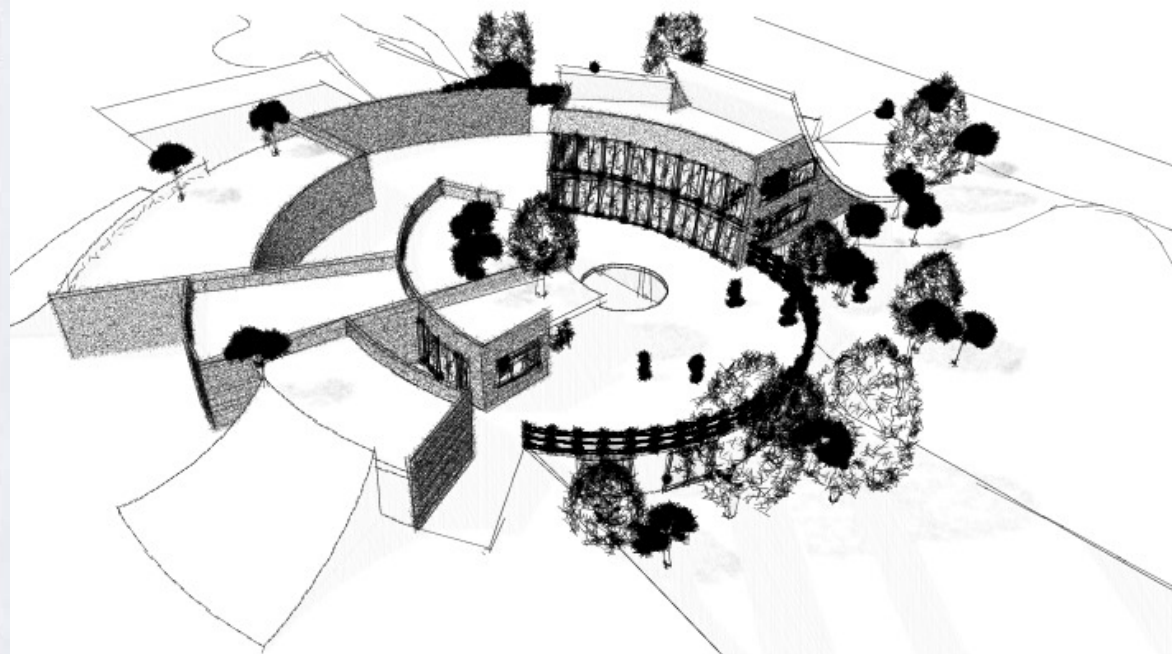


FIGURE 38. Proposed intervention from above (Author, 2020)



SITE LOCATION:
*The site is situated in the
 TRANSITION ZONE
 Which is the zone of
 deterioration. This zone
 requires **REGENERATION**
 and **RESTORATION**, to
 prevent the degradation of
 human well-being.
 And in this case
**PREVENTATIVE
 MEASURES***

SITE LOCATION:
*The site location in the
 Transition zone is based on
 the **EXISTING GREEN
 BELT (BIODIVERSITY
 CORRIDOR)** to regenerate
 the ecosystem services in the
 corridor thus preventing the
 degradation of human
 well-being.
 The site selection is also
 based on the position
 between
**URBAN VS.
 RESIDENTIAL***

FIGURE 39. The site location within the concentric circles (Author, 2021)

Urban Vision

The Urban Vision stretches along Serene Street, between Lois Avenue and Winifred Yell Street focussing on the intersection between Serene Street and January Masilela Drive.

My Urban Vision aims to revive the surrounding residential neighbourhood so that it connects to the new, existing development. The new Menlyn Maine development introduces a mass of new and different elements into the area that should be captured and distributed into the adjacent areas. By reintroducing ecosystem services in the area, most problems will be addressed through natural interventions or interventions that mimic natural methods. In so doing, any further damage to the site will be prevented that might occur through architectural development.

Based on the analysis done on the area, the transient walks and the interviews, five main issues were identified:

- 1) Ecosystem-service degradation
- 2) Local business degradation
- 3) Age-specific amenities
- 4) An increase in foot traffic
- 5) Vehicular traffic increase

Several benefits were also identified:

- 1) Economic growth
- 2) Increased safety
- 3) Closer entertainment amenities
- 4) Increased nightlife
- 5) Younger inhabitants

The Urban Vision strives to solve the above-mentioned issues by connecting them to the indicated benefits by means of the new architectural intervention that acts as a filter, and by reintroducing ecosystem services on-site to regenerate the overall ecosystem of the city.

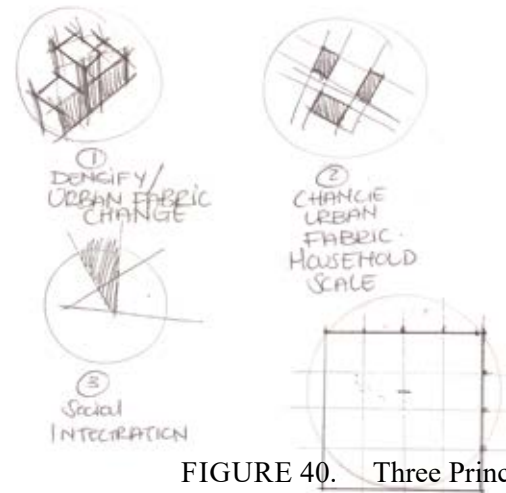


FIGURE 40. Three Principles for urban design (Author, 2020)

Three main principles are considered in the Urban Vision. These are:

- 1) Social Integration
- 2) Urban-Fabric Change
- 3) Urban-Fabric Change on Household Scale (Maritz et al, 2016:127)

The Urban Vision looks at filtering the entire precinct onto a main axis, namely Serene Street.

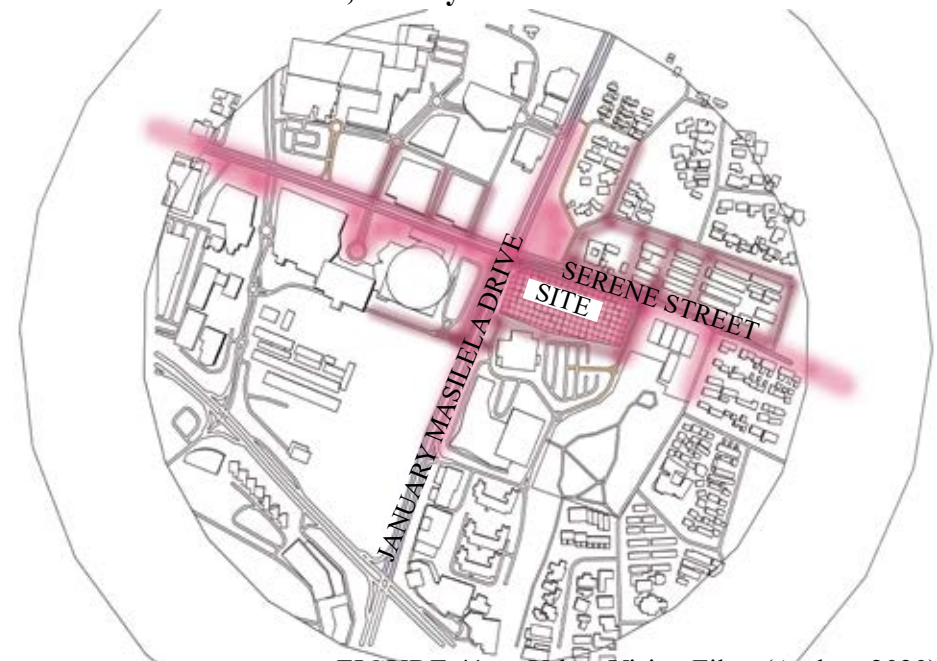


FIGURE 41. Urban Vision Filter (Author, 2020)

This provides the opportunity to use Serene Street to connect the existing green spaces in the area, which means Serene Street will act as the main biodiversity corridor.



FIGURE 42. Urban Vision Green space filter (Author, 2020)

The Urban Vision looks at three different well-being nodes in the area, namely: physical well-being, social well-being and spiritual well-being.

These three well-being types are mapped throughout the area, as shown in figure 44 and then linked through the main axis route. This process ensures that these nodes function as a well-being filter through the entire precinct.



FIGURE 43. Urban Vision Connecting well-being nodes (Author, 2020)

Lastly, the different types of zoning are mapped and filtered to create a balance between the north and the south as well as the east and the west. In so doing, the division and expansion of the great divide across January Masilela Drive will be prevented.



FIGURE 44. Bleeding zones into site (Author, 2020)



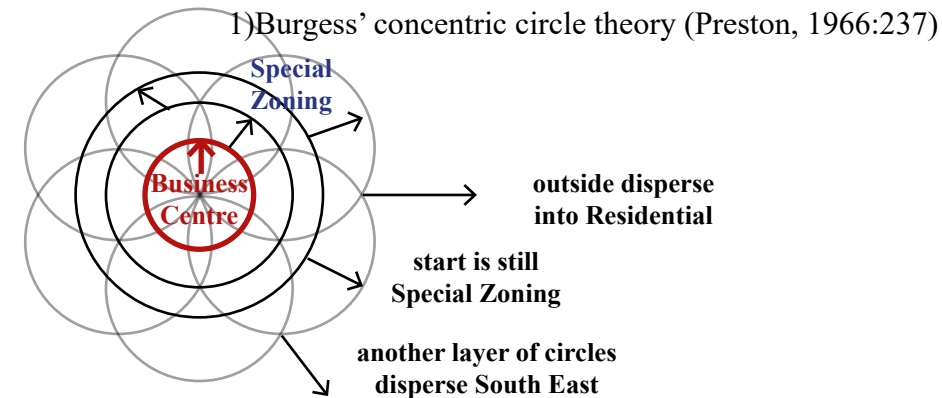
FIGURE 45. Overlaid all filters of the Urban Vision (Author, 2020)

Urban Vision

Micro Site

The Plot including Thrashers Skate Park and 19th Hole Put Put
 25°47'19.50"S 28°17'03.57"E
 Thrashers Skate Park
 241 Serene Street
 Garsfontein
 Pretoria 0081

Four tools or theories were used to influence the micro-site selection. These are:



2) Murphy and Vance's transitional zone mapping (Preston, 1966:238)

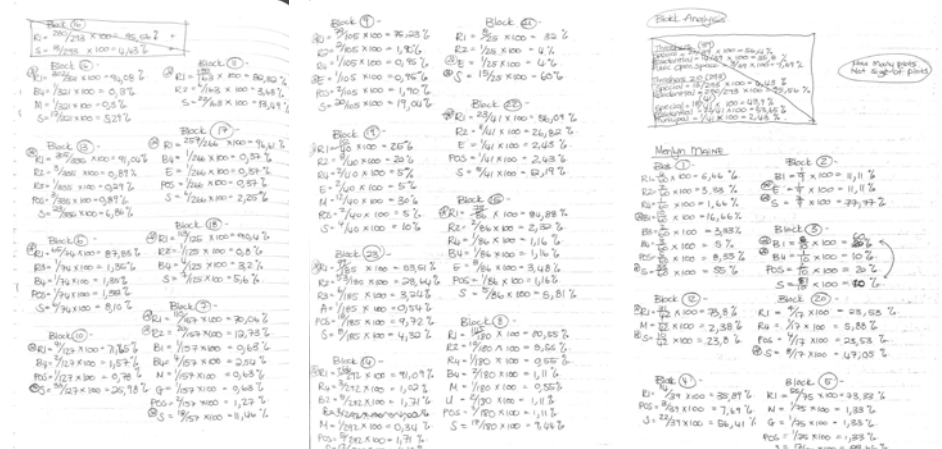


FIGURE 46. Concentric circle method unpacked (Author, 2020)
 FIGURE 47. Zoning proportion calculations (Author, 2020)

3) Vitruvius' principles based on order and hierarchy as well as health and wellness

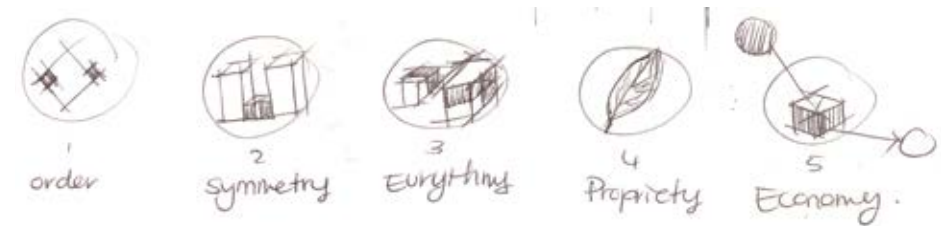


FIGURE 48. 5 Vitruvian Principles (Author, 2020)

4) Dissertation themes (well-being, urban development and ecosystem rehabilitation)

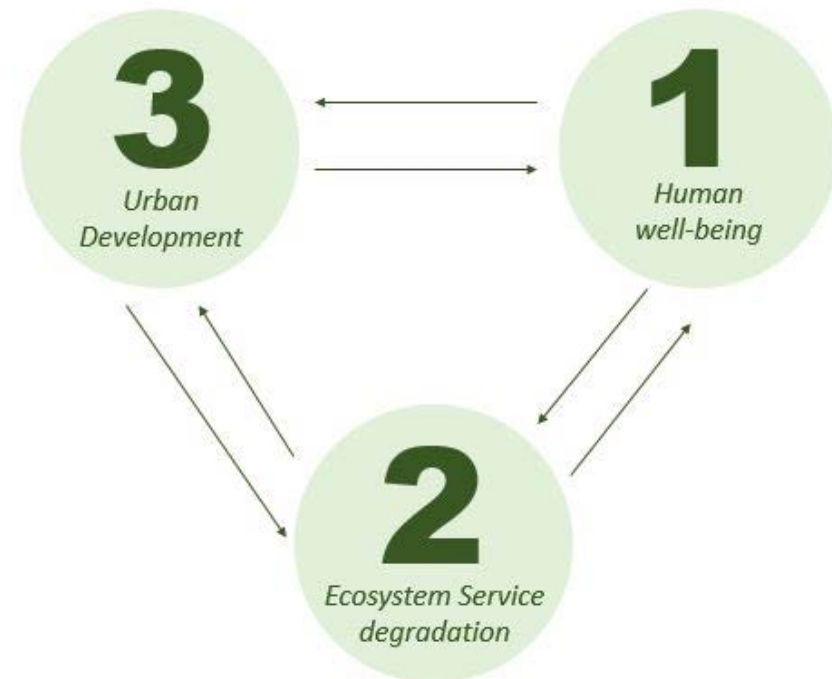


FIGURE 49. Three main theoretical links (Author, 2020)
 Micro Site

Thrashers Skate Park, 19th Hole Putt-Putt, Tuks Wrestling, CrossFit, dance studios, the tennis club and the Virgin Active gymnasium are adjacent to the new Menlyn Maine development. This site thus consists mainly of sports and recreational activities that provide for physical, mental and social well-being. There are four churches in the immediate vicinity, providing spiritual well-being on a religious level. The site also borders Jimmy Ave's Public Park, which provides an opportunity for ecosystem rehabilitation. Furthermore, the site provides possibilities for accessibility because of the main roads that connect on the corner and there are educational facilities in the area, which include a high school and primary school.



FIGURE 50. Thrashers skate park entrance (Author, 2020)

A thorough site analysis is done to identify whether the area's ecosystem services are degrading. The site visit indicates that certain aspects are completely degraded and derelict, like sidewalks, noise regulating foliage, diversity in fauna and flora, as well as air- and water-quality regulation. Ecosystem-service degradation has a direct correlation with human well-being decline; thus, if a space experiences ecosystem loss, the social sustainability of the neighbourhood will diminish at the same time (Taylor & Hochuli, 2014:749).



FIGURE 51. Degraded ecosystem services on the site borders (Author, 2020)

Other negative effects seen on-site occur because of a lack of formal municipal maintenance. Some areas are completely unused, creating safety issues, and some of the local tenants' leases expired in 2016.

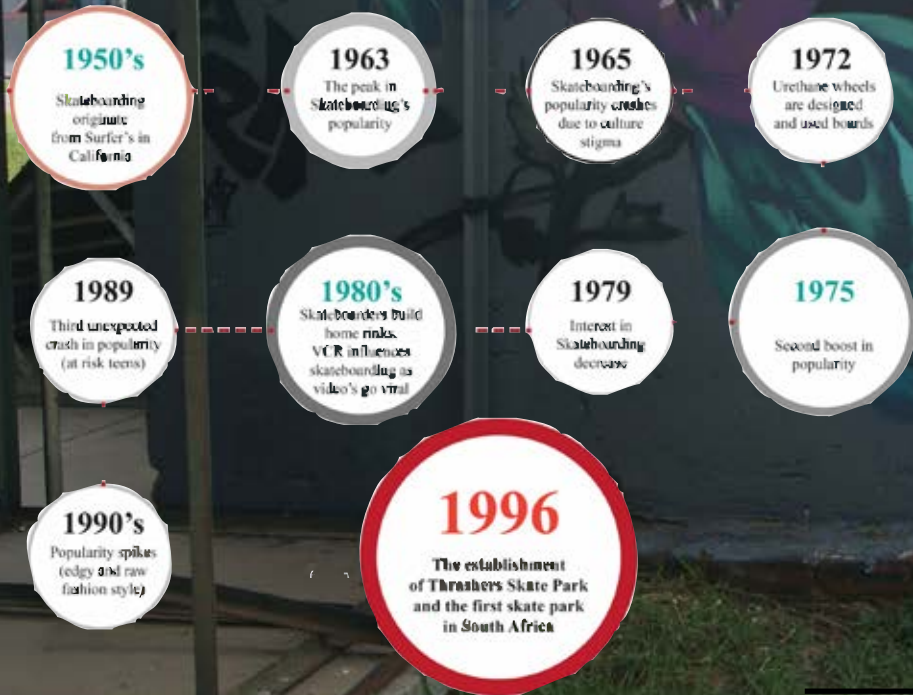


FIGURE 52. Degradation on site and plumbing issues (Author, 2020)

Micro Site

As mentioned before, the site has become the community centre point,
and a place of self-expression and freedom.
These positives are seen through the art on-site.

- FIGURE 53. Large face of woman painted on bathroom wall (Author, 2020)
- FIGURE 54. Monster Graffiti on bathroom walls (Author, 2020)
- FIGURE 55. Graffiti on the outside of the facility (Author, 2020)
- FIGURE 56. Angel Graffiti on the outside of the facility (Author, 2020)
- FIGURE 57. Old wooden shed on premises (Author, 2020)
- FIGURE 58. Timeline of Skateboarding (Author, 2020 & Cave, 2015)





The site has also become a place of mental, spiritual, physical and social well-being. In 1996, Thrashers Skate Park was the first skate park to be established in South Africa. This means that the facility was the first of its kind in the area, as well as in the country, establishing historical importance to skaters and the youth of South Africa. It has since grown to accommodate all ages through skateboarding classes, events for children and the elderly, and serves as a weekend picnic spot for locals. The site is a social-sustainability hub.

Social sustainability ensures that spaces provide for the needs of the people using those spaces (Woodcraft, 2017:135). According to Taylor and Hochuli (2015:749), sufficient walkable, community and green open spaces will ensure that a variety of needs are tended to. When considering human needs and well-being, one should make sure that all aspects are covered, including mental, physical, social and spiritual well-being. This is done through systems that function in the image of ecosystems where all facets feed into each other and connect to create a larger overarching system.

Biomimetic architecture aims to imitate ecosystems and services by means of man-made structures to facilitate and rehabilitate existing ecosystems (Benyus, 1998:392). In so doing, one will lighten the load of human consumption, which will result in more sustainable use of resources.

The current problem with biomimetic design is the misinterpretation of its meaning (Benyus, 2008:40). By researching the requirements of the Living Building Institute, it is also clear that most 'green' requirements are lacking and are limited to energy-saving considerations. Unfortunately, this is insufficient when trying to create a fully sustainable intervention that caters to the needs of both the environment and the users connected to that space (Living Building Institute, 24 August 2020).



When considering the most at-risk locations for total ecosystem degradation, focus is usually placed on urban environments as more than half of the world's population live in urban neighbourhoods (Ledent, 2003:322-328; Munzel et al, 2018:14-27).

According to the Millennium Ecosystem Assessment, 60% of the world's ecosystem services were already degraded in 2005 – a finding that reiterates the need for massive intervention to not only prevent further degradation but to reverse it as well (Haines-Young & Potschin, 2010:111-113).

Biomimetic architecture and social sustainability are a must for urban development to ensure resilience. One intervention will not be sufficient to ensure urban resilience; thus, this paper considers a zone in the urban environment to implement a possible solution – the transition zone.

As is seen in Chapter 2, transition zones are the most attractive area to implement these biomimetic interventions. These zones will regulate unnecessary urban expansion and sprawl into residential communities, and can act as filters for and regenerators of ecosystem services.

To ensure that all needs are tended to correctly, interviews and field research were conducted (please see Appendix B). The interviewees granted permission to use the information obtained but required to stay anonymous as they were not comfortable in partaking in the study.

The information gathered, with permission, indicated that the new entertainment development and casino at Menlyn Main were a nuisance to surrounding old-age homes. The development also attracted unwanted traffic, noise and a large number of people moving through the residential area.

The interviewees mentioned some positives such as the area's increased safety at night due to the night-time activities, and some local businesses gained customers. Other amenities suffered due to their function becoming void in an urban environment, like the existing skate park, gymnasium and putt-putt course. For additional information, interactive poster questionnaires were created to encourage participation in the data-collection process.

These can be seen in Appendix C.

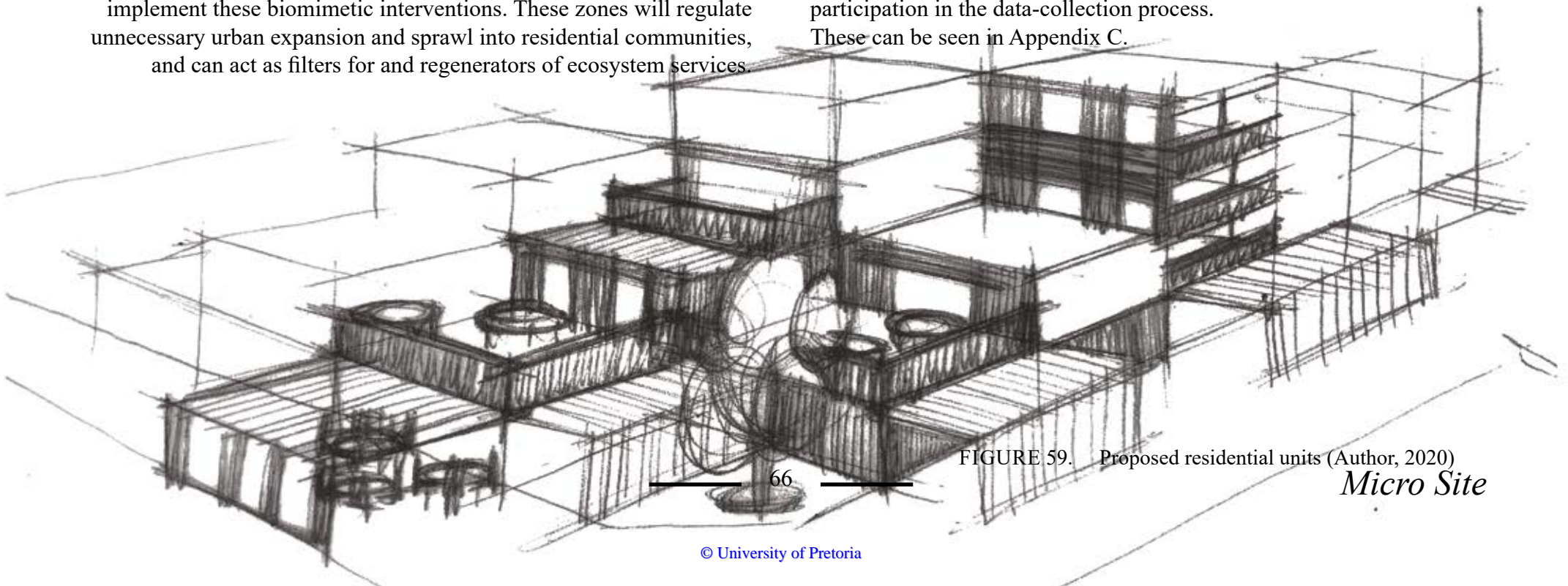


FIGURE 59. Proposed residential units (Author, 2020)

Micro Site

Thrashers Skate Park was used as the centre point of data collection as it was built in 1996 together with the residential area. The skate park has a dedicated community, some of whom have been using the facilities in the area for over 20 years.

Based on seven interactive posters that were placed at the park and the answers of 18 respondents, the following conclusions were made:

In the past two years, 61.1% of users started using the facility while 11.1% started in the past five years, 5.5% started in the last ten years, and 11.1% started in the last 15 years. 11.1% used the facility for more than 20 years.

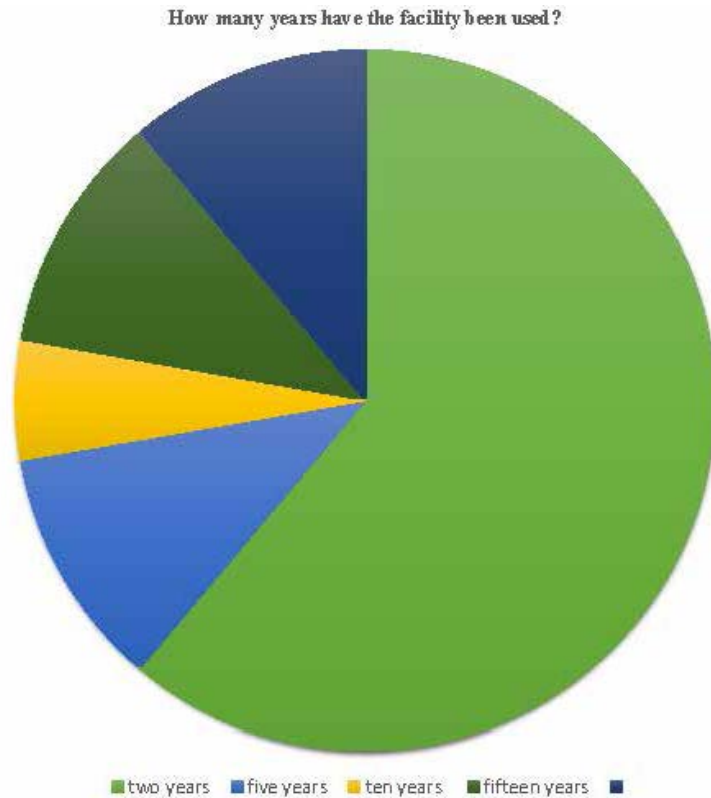


FIGURE 60. Facility use data (Author, 2020)

72.2% of users connected the area with the words 'home' and 'community', while the remaining 27.8% of respondents associate it with 'hobby', 'play', 'work' and 'relax'.

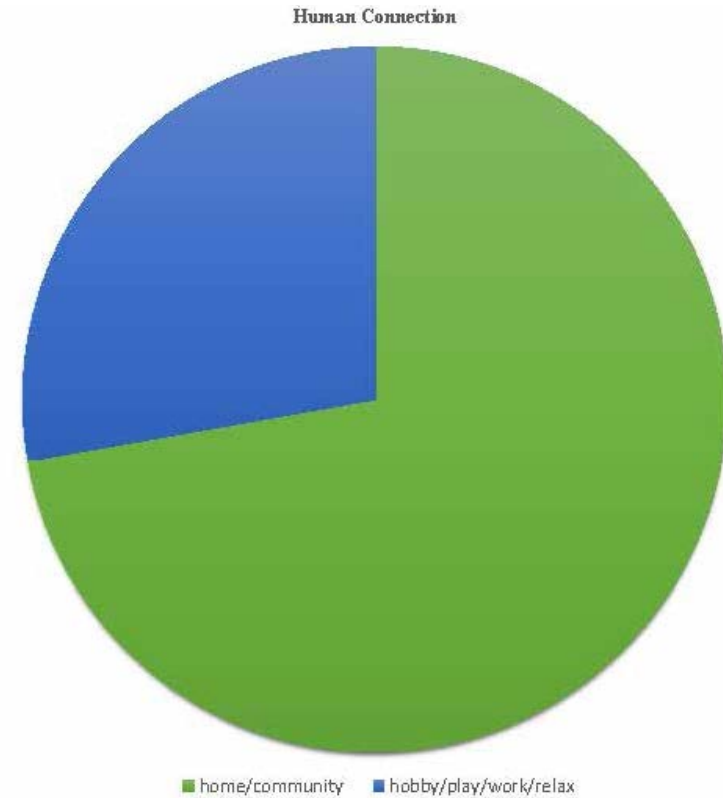


FIGURE 61. Human Connection data (Author, 2020)

Micro Site

33.3% of the users travel more than ten kilometres to use the space whereas only 27.7% live closer than five kilometres.

This finding indicates that the area has a strong sense of community, and that the existing spiritual and social well-being of the area needs to be protected.

When asked whether the new Menlyn Maine development has had a positive influence on the area, 88% of users agreed as it created a safer environment.

To establish whether users preferred the area to densify more, a comparative poster was created. Four pictures were given consisting of a skate park, a plaza, residential blocks and business blocks.

When respondents were asked what would be their ideal future for the skate park and its surrounds, 91.3% said it should remain a skate park.

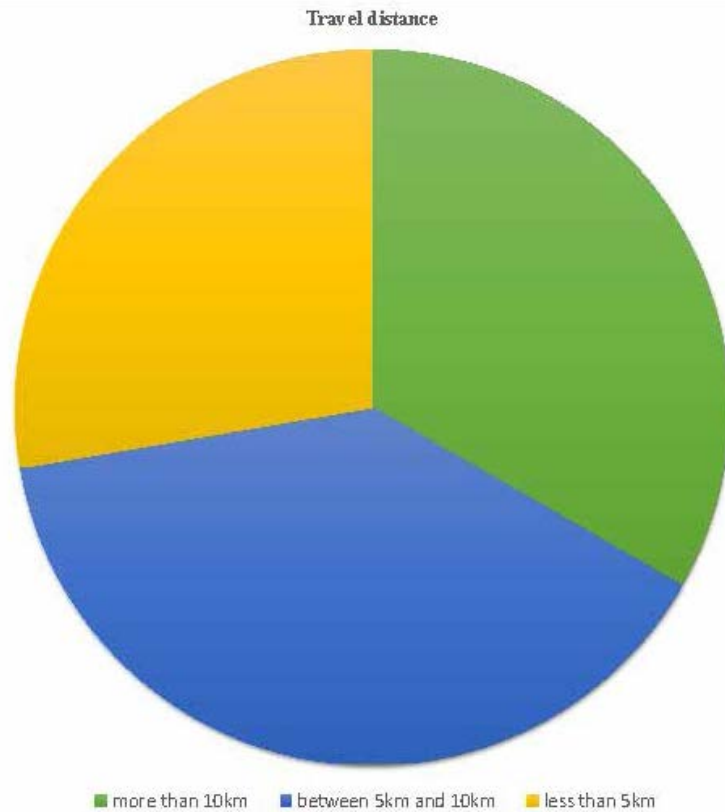


FIGURE 62. User travel distance data (Author, 2020)

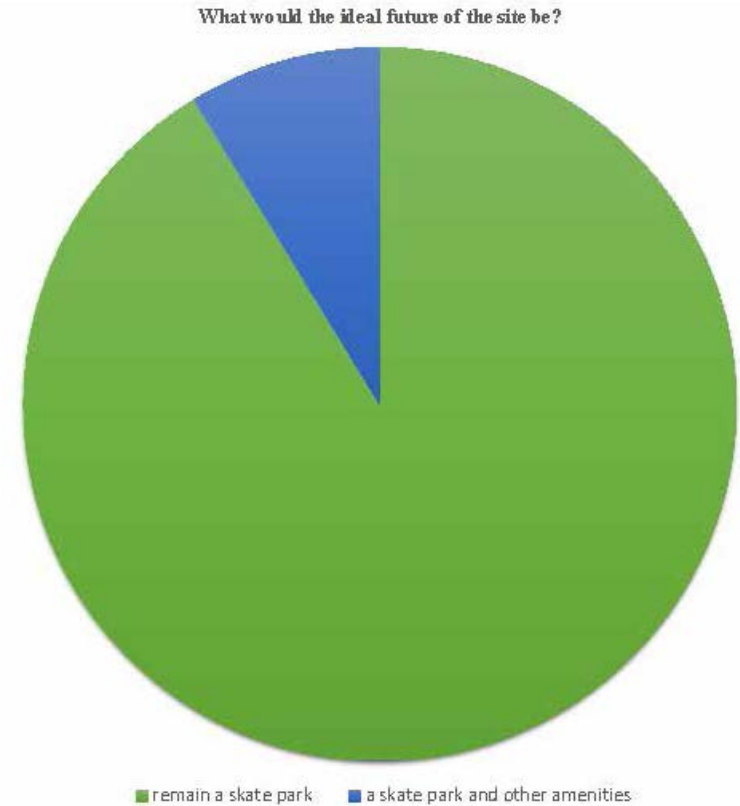


FIGURE 63. User ideal future data (Author, 2020)

Micro Site

When the question was expanded to ask what amenities they would add, 64.7% of respondents said a sports and recreational facility with high-rise residential units.

These findings show that even though the existing functions are preferred, the area can still be developed to add value to the community and their needs.

If the site was to change, what amenities would suit the community best?

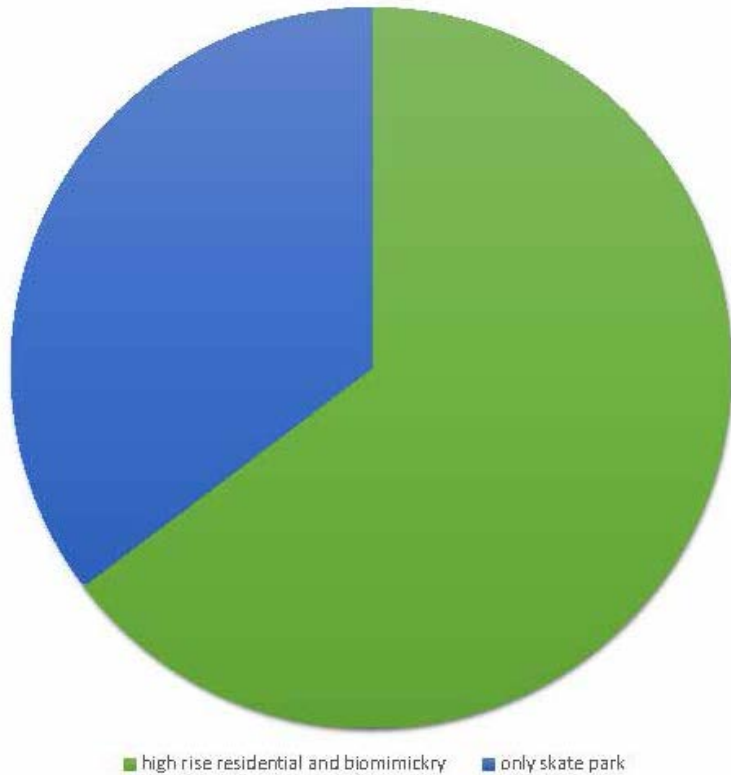


FIGURE 64. Community amenities data (Author, 2020)

The last question was what users liked and preferred in terms of natural resources to establish their ecosystem-service needs. The options were trees and shading, water, edible plants and medicinal plants. 33.3% prefer water and 28.5% prefer trees. 28.5% said that they preferred edible and medicinal plants. Only one participant preferred all options.

What natural resources do you prefer?

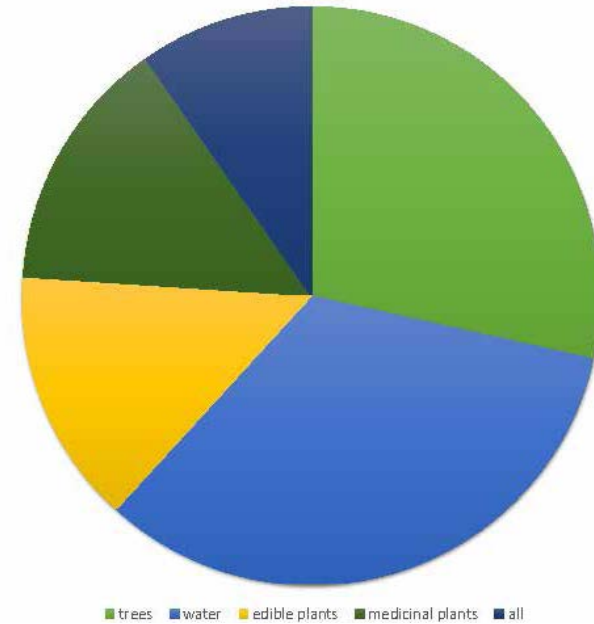


FIGURE 65. Preferred resources data (Author, 2020)

Through the site analysis, it was obvious that the area lacked shaded spaces that provide rest and tranquillity to inhabitants. The study concluded that the Menlyn Maine development had a positive effect on the area but that its frequent users preferred its existing amenities. Social sustainability has declined due to the development as the existing spaces were not and are not considered during the development process. This oversight has influenced the well-being of the neighbourhood as well as the overall biodiversity of the area.

Climate Study

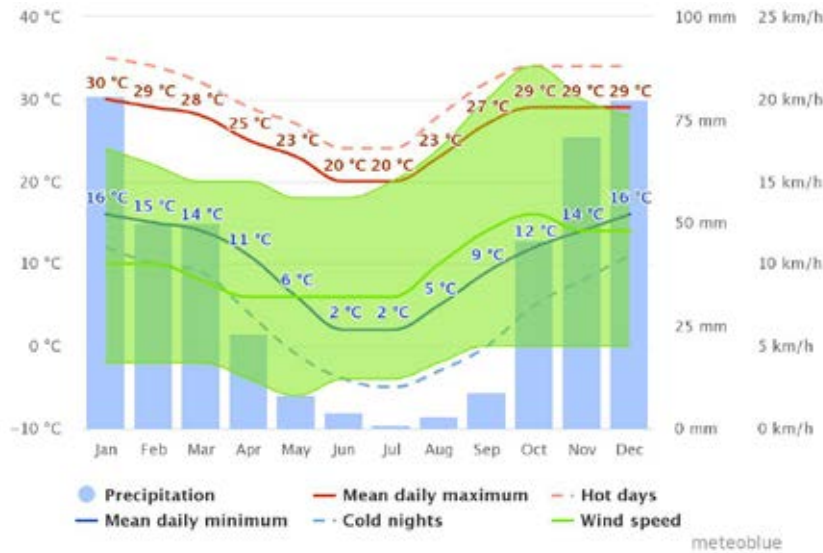


FIGURE 66. Average Temperature data (Meteoblue, 2020)

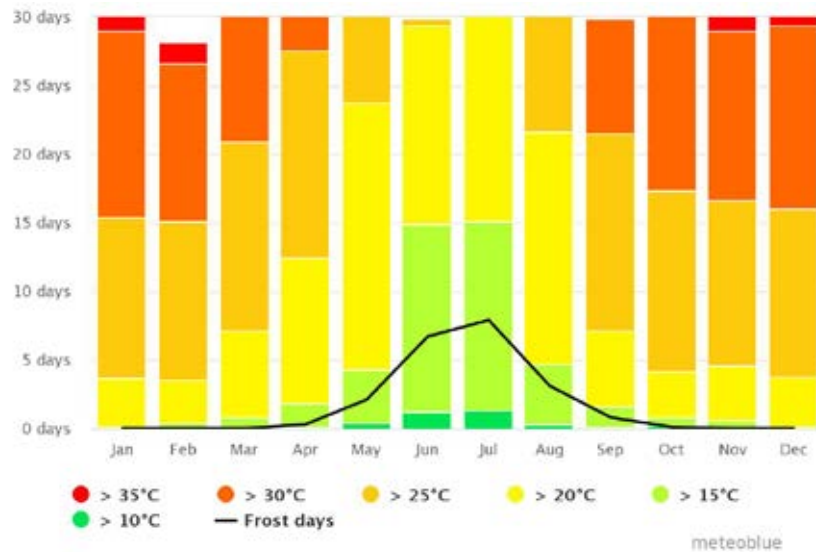


FIGURE 67. Maximum Temperature data (Meteoblue, 2020)

A climate study is done to identify the most important considerations to factor in when designing the proposed intervention. These factors will also determine the most important ecosystem services that need to be implemented on site for optimal human and ecosystem well-being. Pretoria is a temperate climate which has many climatic influences on a site. The average temperature and maximum temperature graphs as well as the graph showing sunny, cloudy and precipitation days (figures 67-69) indicate a large amount of sunny days throughout the year. The average temperature graph shows that these sunny days can stretch to 30° C. These factors require the use of shading devices, natural shading sources, as well as planning the building orientation and space placement to create optimal comfort throughout the year. This also provides the opportunity for heat collection and energy production through the use of photovoltaic panels and bioenergy algae panels. These factors also influence material use, as the materials should be able to withstand high temperatures and the possibility of creating a slow temperature release throughout the day (Meteoblue, 2020).

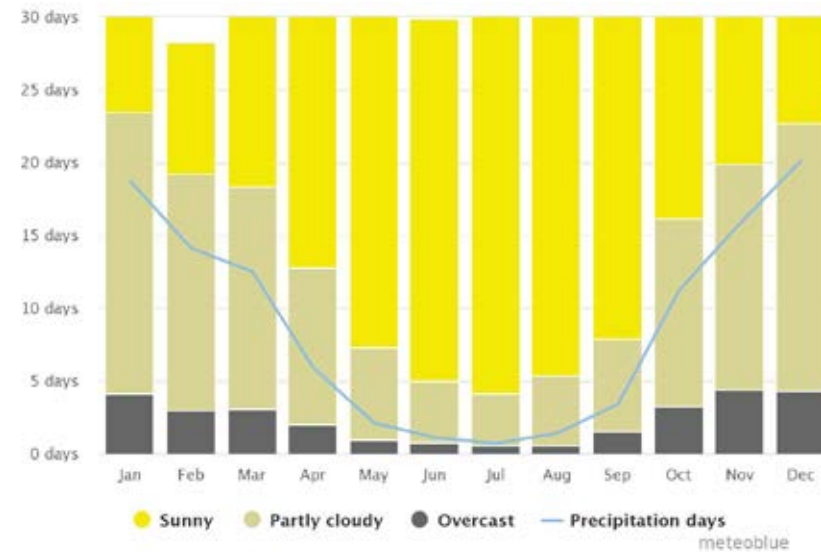


FIGURE 68. Sunny days data (Meteoblue, 2020)

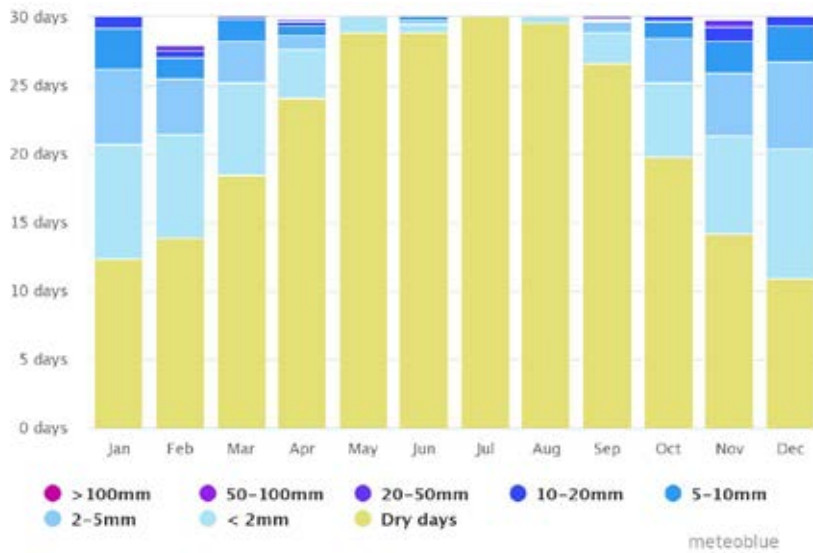


FIGURE 69. Precipitation data (Meteoblue, 2020)

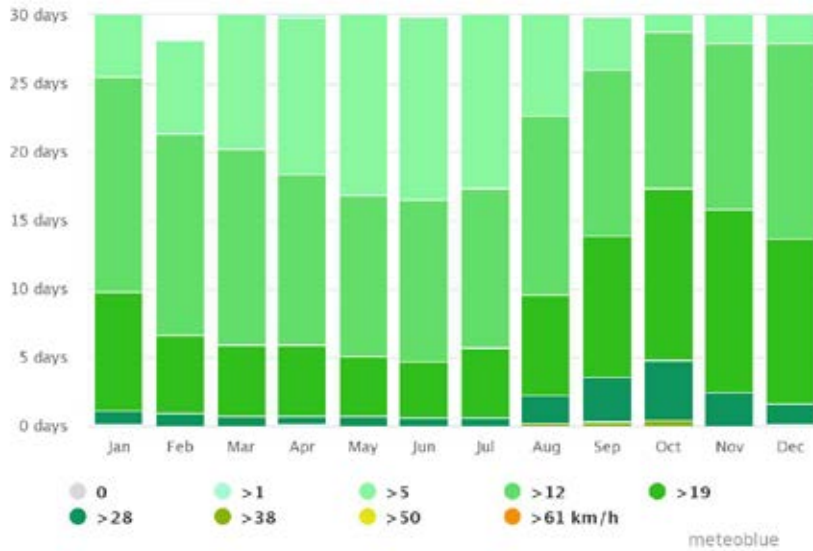


FIGURE 70. Average wind speed data (Meteoblue, 2020)

The Precipitation graph indicates an excessive amount of dry days throughout the year in Pretoria (2020) with the summer months (October- March) producing between 5-20mm and even sometimes up to 50mm of rain illustrated through figure 70. This provides the opportunity for rain water harvesting for use in the dry months from May to August. This will reduce the overall water use costs of the proposed intervention.

The wind rose of Pretoria specifies the prevailing wind direction as North-East with speeds up to 28 km/h. From August to January the wind speeds are between 12 and 19 km/h most days of the month providing the opportunity to maximise and harvest the wind as power for possible energy use (Meteoblue, 2020).

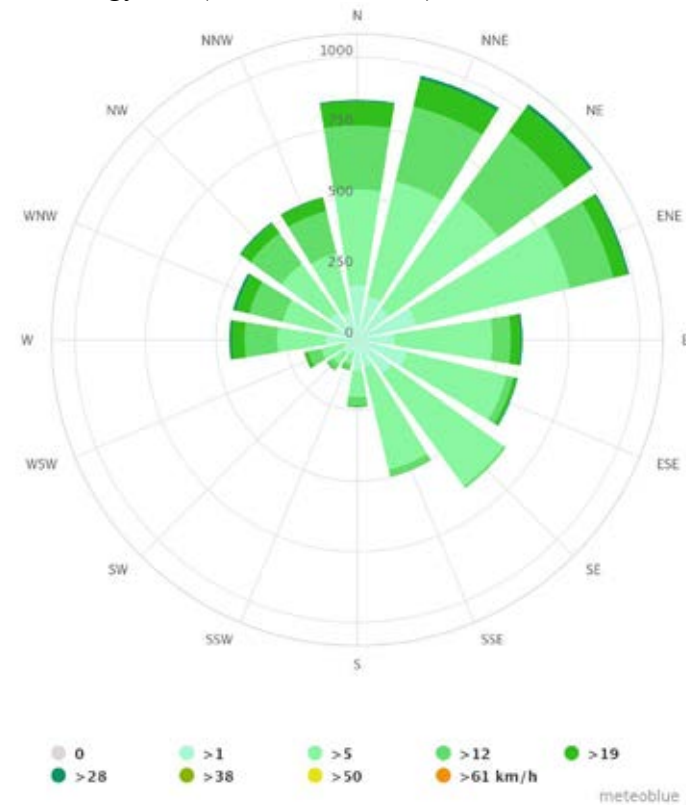


FIGURE 71. Pretoria prevailing winds data (Meteoblue, 2020)

Chapter 4

The Client

The Client

City of Tshwane

The Program

Arts and culture

Art Therapy and Art Gallery

Creation Spaces, Studios, Seminar rooms

Youth and Skills Development programmes

Ecosystem Services and Systems

Space Planning and Spatial Relationships

Program Precedents

UK Pavilion, Shanghai China, 2010, Heatherwick Studios

Duke Student Wellness Center, Durham, United States 2017, Duda|Paine Architects

Chongqing Tiandi Art Museum, Yuzhong, China 2017, Shenzhen Huahui Design Co. Ltd

Accommodation Schedule

The Client

The client was decided on the basis of the existing majority landowner of the site and its surrounds. The site – Thrashers Skate Park, 19th Hole Putt-Putt and Tuks Wrestling, as well as an open piece of land north of the site – is municipal land. The site also borders Jimmy Aves Park, which is a public park in the city of Tshwane.

All these considerations led to the conclusion that the most appropriate client would be the city of Tshwane, and the decision was made to fit the intervention and project within their parks, sports and recreation facilities. The Jimmy Aves Park forms part of a larger park system that stretches from Irene and Centurion to Pretoria CBD.

These parks include:

- Burger's Park (a public park)
- Springbok Park (a public park)
- National Zoological Gardens (a nature reserve and biodiversity park)
- Jan Cilliers Park (a public park)
- Venning Park/Rose Park (a public park)
- Magnolia Dell (a public park)
- National Botanical Gardens (a nature reserve and biodiversity park)

Other parks include:

- Austin Roberts Bird Sanctuary (a nature reserve and biodiversity park)
 - LC de Villiers (wetlands and agricultural land with sporting facilities)
 - Struben Dam Bird Sanctuary (a nature reserve and biodiversity park)
 - Faerie Glen Nature Reserve (a nature reserve and biodiversity park with hiking facilities)
 - Waterkloof Park (a nature reserve and biodiversity park with hiking facilities)
 - Zeta Park (a public park with children's amenities)
 - Moraleta Kloof Nature Reserve (a nature reserve and biodiversity park)
- (City of Tshwane, 26 August 2020)

The city of Tshwane provides many different functions in terms of parks and recreation, and sports and recreation. To ensure that this intervention serves a purpose in the greater city of Tshwane, it should provide a function that is lacking in the chain of parks. To determine the specific function, all sports and recreational facilities should be considered.

The City of Tshwane sports and recreational facilities aim to achieve the following:

- The best sports facilities and services for all people to enhance their quality of life
- The development and conservation of arts and culture as well as the city's heritage
- Community library and information services to enhance the education of all Tshwane residents

The City of Tshwane community library and information services aim to provide the following facilities:

- Skills and youth development programmes
- Art galleries and museums
- Creation spaces (welding, woodworking, sculpting, etc.)
- Activity, auditorium and seminar spaces
- Electronic information networks
- School project assistance
- Study facilities
- Community information
- Books, CDs and videos, magazines and newspapers
- Internet and computer services
- Holiday programmes

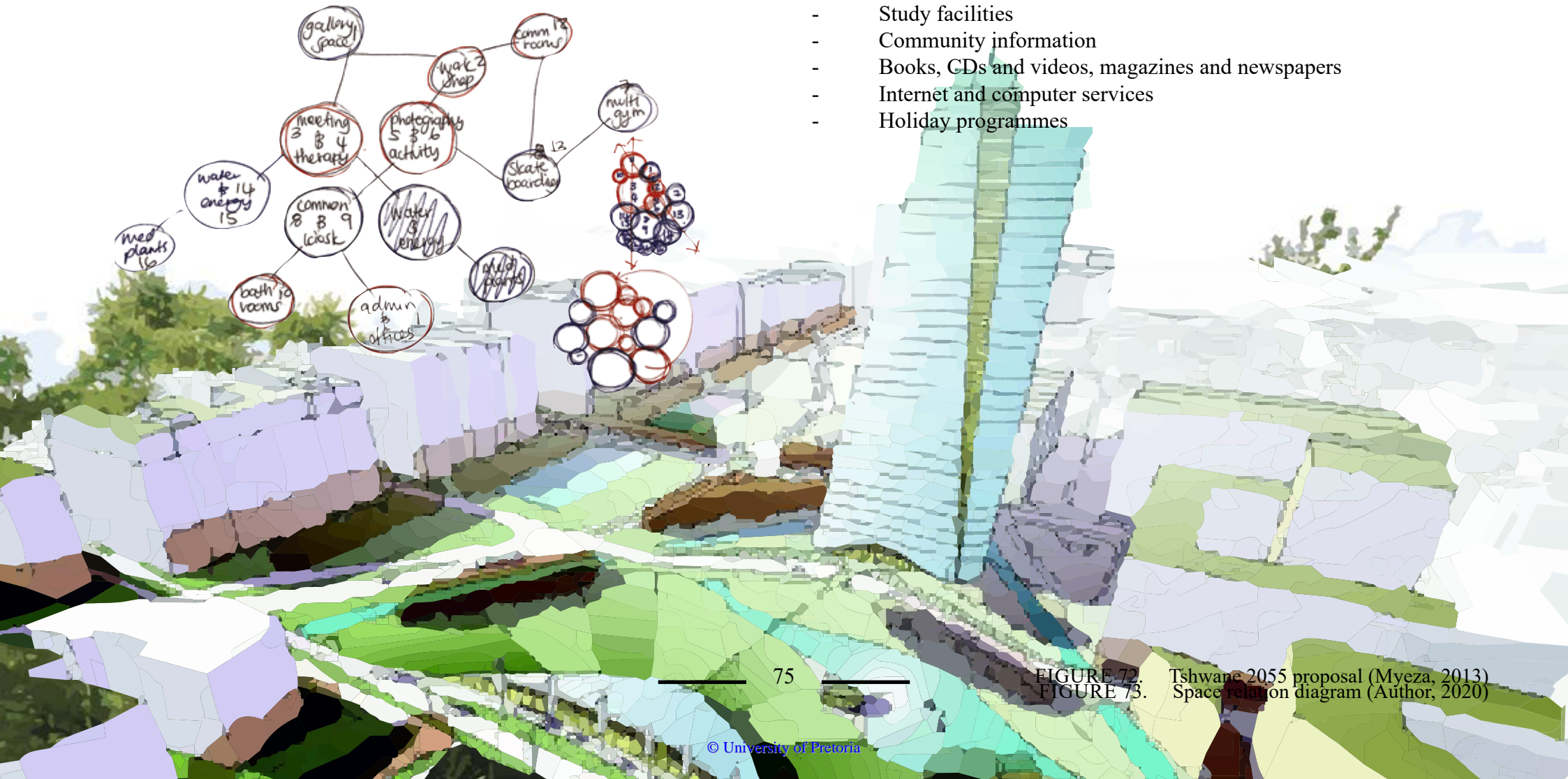


FIGURE 72. Tshwane 2055 proposal (Myeza, 2013)
 FIGURE 73. Space relation diagram (Author, 2020)

The Program

The programme is derived from the existing functions of the city of Tshwane's sports, parks and recreational facilities. As mentioned, this intervention should serve as a cog in the larger park system; therefore, the most needed and missing functions should form the programme.

First, the existing site programmes should be considered, as well as those surrounding the study area.

These are:

- The skate park (skating, rollerblading, hockey, trick-bike, picnic and café facilities)
- Wrestling facilities
- Putt-putt and picnic facilities
- Old-age homes and family housing
- Retail spaces
- Transportation spaces
- Entertainment amenities
- Hotel and apartments
- The public park
- The dance studio
- The gymnasium
- Offices

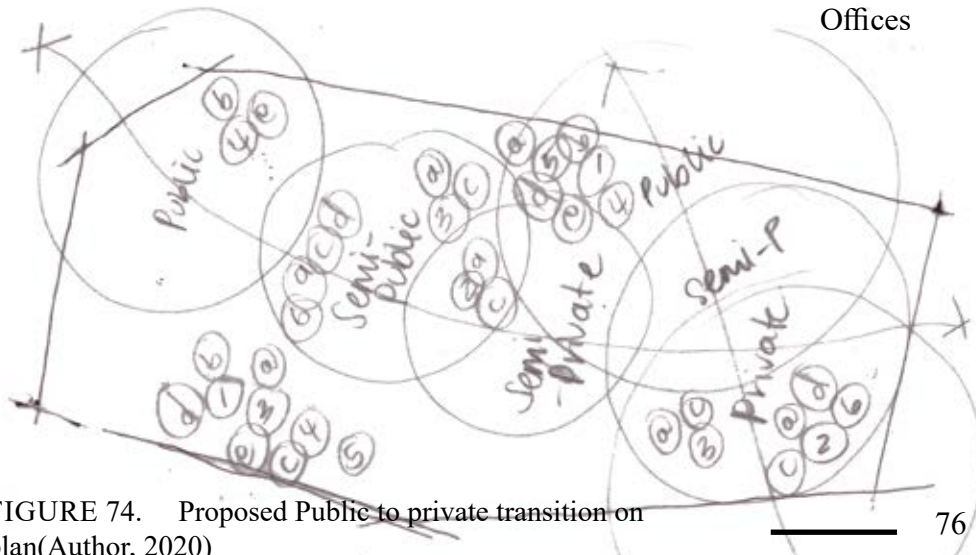


FIGURE 74. Proposed Public to private transition on plan (Author, 2020)

The new Menlyn Maine development is a very public development that serves the main function of retail and entertainment to the precinct. The development creates a large divide between west and east since January Masilela Drive consists primarily of residential zoning and small semi-public spaces. The site offers the opportunity to transition smoothly from public to private space by introducing private functions in a public manner.

This new function should also connect to the surrounding green spaces and parks.

The existing parks in the area all serve the functions of:

- Hiking
- Trail running
- Cycling
- Walks
- Bird sanctuaries
- Fauna and flora conservation

The site is situated in an area that is primarily based on health, fitness, movement and different forms of self-expression. To connect existing facilities to the new intervention, it is necessary to consider a programme from the list of functions for sports and recreation that reintroduces opportunities of health, well-being and self-expression.

There are many different forms of health, including environmental, mental, physical, social, emotional and spiritual health. All these forms of well-being should be considered and addressed when spaces are designed so as to ensure that full social sustainability is achieved.

Social sustainability creates ideal spaces for both users and nature, and provides spaces that encourage users to be their full selves.

There are many different forms of self-expression, like personal, social, spiritual, educational and political expression. These forms link to the various forms of well-being – a connection that indicates that these two functions go together.



FIGURE 75. Different forms of well-being (Author, 2020)

The most appropriate functions (derived from the city of Tshwane’s sports and recreation facilities) that would provide these opportunities are:

- The development and conservation of arts and culture
- Art galleries and museums
- Creation spaces (welding, woodwork, sculpting, etc.)
- Activity, auditorium and seminar spaces
- Skills and youth development programmes

(City of Tshwane, 26 August 2020)

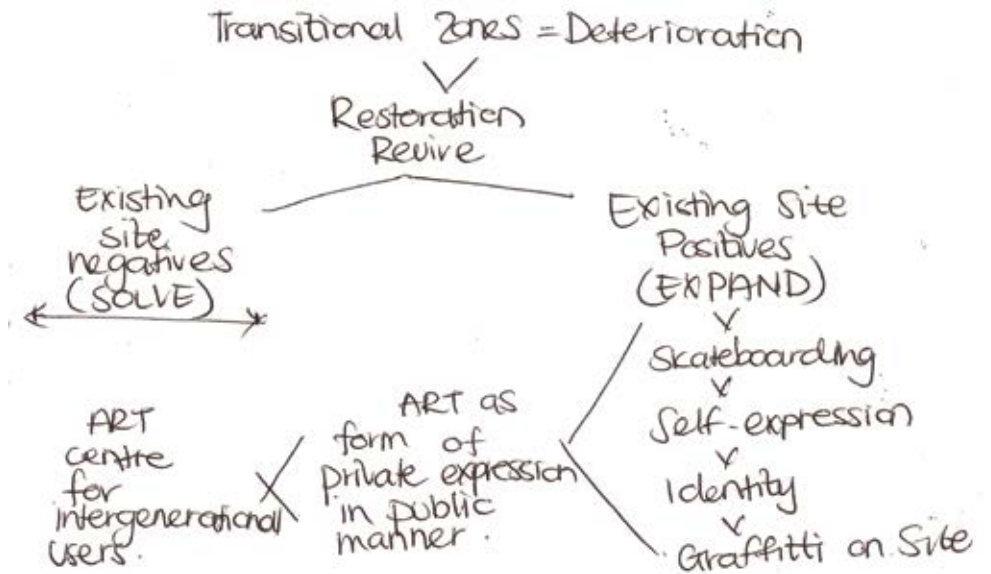


FIGURE 76. From problem to program unpacked daigram(Author, 2020)

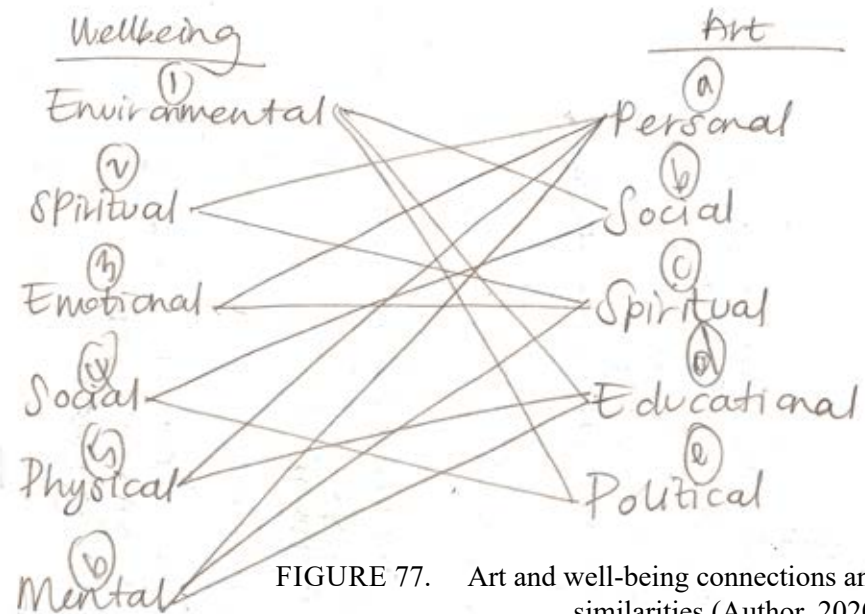


FIGURE 77. Art and well-being connections and similarities (Author, 2020)

The Program

Arts and culture

There is a clear dialogue of self-expression on-site when existing functions are considered. Self-expression is primarily unveiled through forms of graffiti and public art which goes hand-in-hand with the culture of skateboarding. Graffiti is a popular method of self-expression and art in the skateboarding community. To understand why, it is important to acknowledge the timeline of skateboarding (Cave, 2015).



In the 1990s, skateboarding became more than just a means of transportation and a physical activity. The rawness and edge of skateboarding were starting to become observable in fashion and style as well as culture. Skateboarders became very identifiable through what they wore, how they spoke and where they spent their time (Cave, 2015). To reintroduce the existing art and culture of skateboarding and graffiti, the main function of art therapy is introduced.

FIGURE 78. Graffiti on existing wooden shed on site (Author, 2020)

Art Therapy and Art Gallery

Art therapy is a means to connect art to well-being in a way that is accessible to all ages. This connection offers users of the space the opportunity to produce art freely and to enhance their well-being while exhibiting these works for the public to view. Therefore, art therapy and art gallery, specifically regarding art produced on-site, are introduced (Functions of Art, 7 September 2020).



Creation Spaces, Studios, Seminar rooms

To accommodate therapy meetings, it is necessary to place art exhibitions, the production of art as well as different activity spaces, studios and meeting rooms on-site.

FIGURE 79. Author in front of graffiti on the existing bathroom walls (Author, 2020)

The Program

Youth and Skills Development programmes

Unfortunately, most people misunderstand skateboarding culture as it originated in poorer communities who used it as an affordable means of transport. Skateboarders also primarily used urban spaces as playgrounds, often damaging these spaces and their furniture in the process, which fuelled their bad reputation (Kidder, 2012).

People who skateboard are commonly associated with at-risk teens, but the nature of skateboarding creates the perfect opportunity for its use as a form of movement therapy (Inspired2Become, 13 March 2020).

The new intervention should accommodate skateboarding and create spaces that encourage it. In so doing, safe spaces will be generated for people who use skateboarding as a form of self-expression – whether it be through movement, graffiti, style, skating or the culture itself.

Art therapy and skateboarding will be combined to help teach life lessons and new skills (Indigo Youth Movement, 13 March 2020).

Activity rooms and creation spaces will provide skills training for all ages.

Ecosystem Services and Systems

As stated in Chapter 2, ecosystem services are products and functions that are produced by nature for the benefit of humanity (Haines-Young & Potschin, 2010:111-113).

These services range from provisioning, regulating, and cultural and supporting services to habitat production and information services.

For this dissertation, the services produced through regulation, habitat, production and information will be focussed on (De Groot et al, 2002), *which are as follow:*

- 1) **Regulation:**
 - **CO2 cycles and air quality**
 - **Water supply and quality**
 - **Waste treatment**
 - **UV-B protection through O3**
 - **Climate regulation**
 - **Drinking water**
 - **Pollution control and detoxification**
 - **Noise pollution**
- 2) **Habitat:**
 - **Maintenance of biodiversity**
- 3) **Production:**
 - **Food and medicinal resources**
 - **Conversion of solar energy into edible plants**
 - **Attractive landscape, sports facilities and the use of nature in art and architecture**
- 4) **Information:**
 - **Aesthetic information**
 - **Recreation**
 - **Cultural and artistic quality**
 - **Spiritual quality**

In addition to these services, the sustainable building certification provided by the Living Building Institute will be taken into account to inform the programme and its design (Living Building Institute, 24 August 2020). The requirements of this qualification will be discussed further in Chapter 6 of the dissertation.

Space Planning and Spatial Relationships

All of the required spaces were considered in relation to the other spaces to determine which spaces should be placed where and why.

To link the programme and the placement of spaces to the main concept of a filter, the spaces are arranged from private to semi-private, semi-public and lastly public. This arrangement provides a staggered approach from the very public urban core into the private residential community.

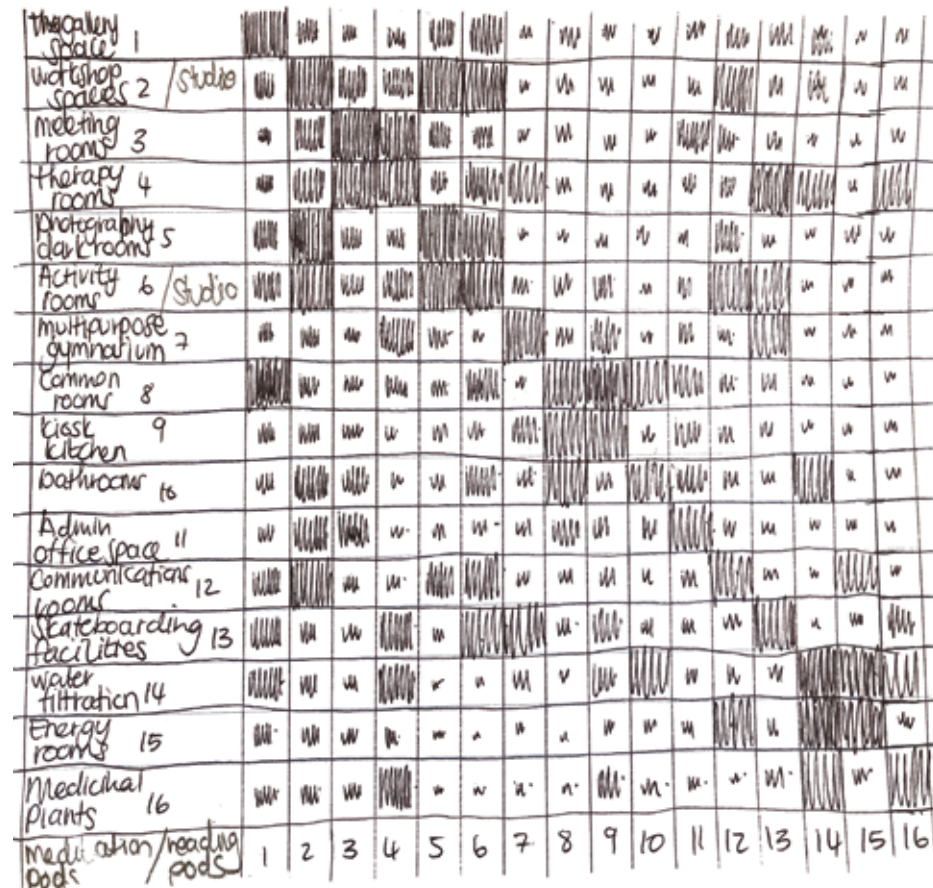


FIGURE 80. Space planning block diagram (Author, 2020)

Program Precedents

UK Pavilion, Shanghai China, 2010, Heatherwick Studios

The UK pavilion was an expo piece that illustrated the United Kingdom's history of botanical research. The piece provided a space for users to experience the complexity of the architecture and educated them in the process. The architecture used phenomenology to engage all human senses and, in so doing, involved users on multiple levels.

The piece also became alive by moving with the elements of nature through light-emitting acrylic rods. By creating movement in the architecture itself, it related not only to users but to nature too and, in so doing, strengthened the celebration of seeds.

The piece also achieved its goal through the landscape in which it was placed. The landscape is folded like a crumpled piece of paper, which framed the piece and created a second texture. This space also provided for public seating and resting space that created the opportunity for users to view the piece from different perspectives (Heatherwick Studio, 21 October 2020).

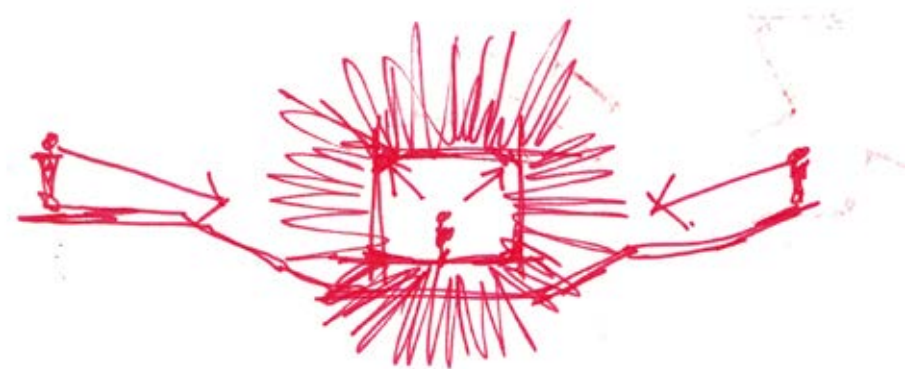


FIGURE 81. UK pavilion precedent diagram (Author, 2020)

The Program

Duke Student Wellness Center, Durham, United States 2017
Duda|Paine Architects

Duda|Paine Architects is responsible for the intervention at Duke University's student wellness centre, which provides a new perspective on well-being by incorporating wellness and health in everyday life. The wellness centre allows natural light into its spaces to increase the mental and physical health of students studying at the university.

There are meditation and contemplative gardens that include nature in their design. These gardens reinforce students' connection to nature, increasing their health and well-being even more. To increase social interaction, the building uses large stairways and inner building circulation to celebrate social wellness. The circulation is placed in certain ways to provide for public and private spaces even in a public setting (Duke Student Wellness Center, 21 October 2020).

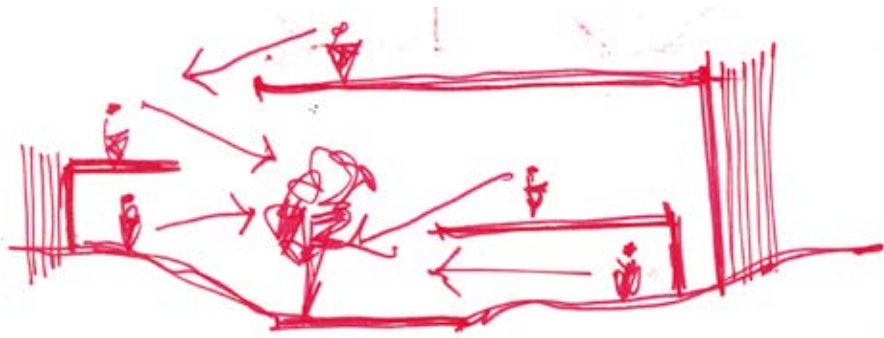


FIGURE 82. Duke precedent diagram (Author, 2020)

Chongqing Tiandi Art Museum, Yuzhong, China 2017
Shenzhen Huahui Design Co. Ltd

Chongqing Tiandi Art Museum is situated between a commercial area and a residential community. It aims to create a link with its complex environment and to celebrate its landscape. The intervention complements users' experience of art by creating an interior to exterior experience. The building becomes a narration of the landscape and an extension of the topography. All these elements enhance the observation and understanding of the art exhibited throughout the building.

The scenery and the surrounding landscape become part of the art exhibition through viewpoints and pavilions, which are created to encourage users to pause and reflect. The spaces are intentionally designed to frame views and art pieces to lead users around the building subconsciously (Chongqing Tiandi Art Museum, 21 October 2020).

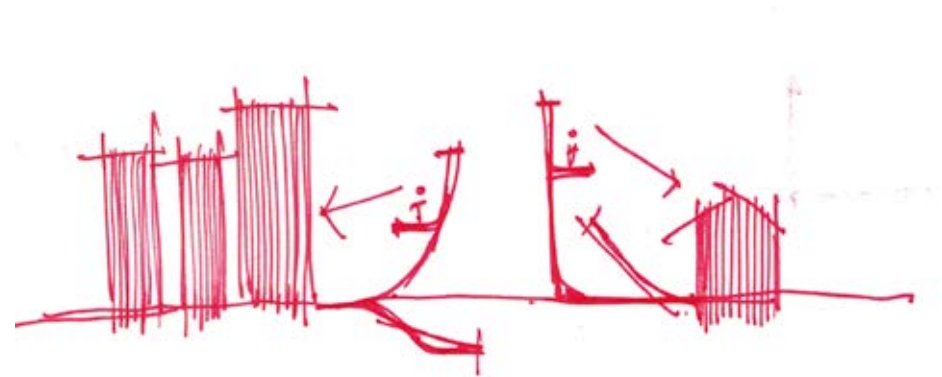


FIGURE 83. Tiandi precedent diagram (Author, 2020)
The Program Precedents

Accommodation Schedule

Space	Spatial Quality	Description of Requirements	Aprox. Size	Amount	Total m2	Lux Req
Ground Floor			m2		m2	
Movement and Skate Ramp- Accessible entrance (Incl. public seating, planter boxes, social space)	External space Space of enjoyment Accommodate skating and parkour	Material that is durable and can withstand skateboarding and other forms of urban sport. Should be accessible to all, and provide seating where necessary. Should provide access to street edge and public transport. Shaded by natural elements for comfortability. Should provide for runoff and water catchment.	670,3	1	670,3	20
Shaded Public Space (Incl. shaded public seating, greenery and skateboarding space)	External space space of tranquility (quiet) soft light cool temperature (cut into landscape)	Material that is durable and can withstand skateboarding and other forms of urban sport. Should be accessible to all, and provide seating where necessary. Should provide access to all spaces and a view of the surrounding environment. Shaded by natural and synthetic elements for comfortability. Should provide for runoff and water catchment.	1145	1	1145	20
Movement Therapy Gymnasium (With view to water for tranquility and privacy)	Soft light internal space	Should provide privacy for comfortability but also view to outside. Should have ample natural light but not be in full view to public. Should be naturally cool for comfortability.	155	1	155	200
Photography and Communications Room (Internet access, printers, dark room)	Quiet Space Space of concentration and work	Should be dark and cool as well as private. Should provide for internet connectivity, electricity as well as any appliance for photography development.	86	1	86	5
Therapy Offices (Private spaces, view of outside shaded seating, individual offices and therapy space)	Dappled light from trees North Eastern light Tranquil quiet space space to reflect	Should have natural light and natural ventilation, but be private and hidden slightly from public view. Enough view of natural elements like trees and water. Overlook adjacent park.	53	4	212	300
Plant room (Solar batteries, biofuel and biogas plant)	Functional Space	Should be accessible, safe and space for all needed equipment as well as fittings.	100	1	100	5
First Floor			m2		m2	
Art Exhibition Hall (Seating, Presentation spaces, Space for installations, Open adaptable floor plan, social space)	Interior Space Soft light through Biopanel Space overlooking outside public distorted view of urban environment	Should be fully accessible to all users. Have ample natural light and natural ventilation. Shading from the west to avoid heat. Dappled and soft filtered light through biopanel. Adaptability for easy change of space. Access to electricity and any other needs for exhibiting installations etc.	165	1	165	100
Outdoor Public Space (Incl. public seating, planter boxes, social space)	Shaded by Buildings, Shading devices Space for fun and interaction overlooking street edge	Material that is durable and can withstand skateboarding and other forms of urban sport. Should be accessible to all, and provide seating where necessary. Should provide access to street edge and public transport. Shaded by natural elements for comfortability. Should provide for runoff and water catchment.	1045+33	2	1078	20
Activity and Studio Space (Seating, Presentation space, Lecture space, creation space, social space)	Interior Space Soft light through Biopanel Space overlooking outside public distorted view of urban environment Soft Southern natural light Sound from skateboarders on ramp	Should be fully accessible to all users. Have ample natural light and natural ventilation. Shading from the west and east to avoid heat. Dappled and soft filtered light through biopanel. Natural light from South. Space for lectures and classes. Access to plugs for laptops and presentations. Adaptability for easy change of space. Access to electricity and any other needs for art creation, sculpting etc. View to adjacent park.	232+256	2	488	200
Kitchen	functional space hygienic space	Hygienic clean surfaces and space for all appliances. Connection to water and all grey water to be filtered and reused for green roof watering.	63	1	63	150
Bathrooms (male and female)	functional space Hygienic space Privacy from outside view	Hygienic clean surfaces and space for all needs. Connection to water and all grey water to be filtered and reused for green roof watering.	62	1	62	100
Disabled WC	functional space Hygienic space Privacy from outside view	Hygienic clean surfaces and space for all needs. Connection to water and all grey water to be filtered and reused for green roof watering.	7	1	7	100
Storage room for extra tables etc.	functional space	Should be accessible, safe and space for all needed equipment as well as fittings.	5,6	1	5,6	100

Offices (Serve as 'reception' area) and staff offices	Overlook Public Space View of activity and creation Shaded by shading devices light from North and South	Should have natural light and natural ventilation, but be private. Enough view of natural elements like trees. Overlook public spaces. Shaded from west and east to prevent heat and over exposure. Be accessible to all users, but be safe.	32	2	32	300
Lounge area (space for lunch, lounging)	Overlook Public Space View of activity and creation Shaded by shading devices light from North and South	Should provide for rest space and be accessible to all users. Dappled and filtered light for optimal comfortability and use. Ample seating and shade through natural elements.	27	1	27	75
Second Floor			m2		m2	
Accessible Roof Gardens (medicinal plant growth e.g. lavender to promote calmness, shaded seating and social spaces, lounge space)	Shaded by Buildings, Shading devices, Natural shading dappled light through trees View over intervention and Urban environment Space for plant growth	Should provide for rest spaces. Dappled and filtered light for optimal comfortability and use. Ample seating and shade through natural elements as well as synthetic shading. Be able to accommodate medicinal and edible plant growth in future.	546	1	546	
Third Floor			m2		m2	
Creation Space (Seating, Presentation spaces, Open adaptable floor plan, social space)	Interior Space Soft light through Biopanel Space overlooking outside public distorted view of urban environment Soft Southern natural light	Have ample natural light and natural ventilation. Shading from the west and east to avoid heat. Dappled and soft filtered light through biopanel. Natural light from South. Space for lectures and classes. Access to plugs for laptops and presentations. Adaptability for easy change of space. Access to electricity and any other needs for art creation, sculpting etc. View to adjacent park.	67	1	67	200
Fourth Floor			m2		m2	
Accessible Roof Gardens (shaded seating and social spaces, lounge space)	Shaded by Buildings, Shading devices, Natural shading dappled light through trees View over intervention and Urban environment Space for plant growth	Should provide for rest spaces. Dappled and filtered light for optimal comfortability and use. Ample seating and shade through natural elements as well as synthetic shading. Be able to accommodate medicinal and edible plant growth in future. View of entire intervention and surrounds as well as urban environment and adjacent park.	63+53	2	116	
Miscellaneous			m2		m2	
Garden space around building (optional edible food and medicinal food growth)	Space for education, therapy	Space for play, public enjoyment and seating. Shaded by trees and space for possible edible plant and medicinal plant growth.				
					5024,9	m2

FIGURE 84. Accommodation Schedule (Author, 2020)

Chapter 5

The Concept

Design Normative Position

The Concept

Filter

Well-being

Living Building's Challenge

Ecosystem Services

Reintroducing Well-being

Existing Programmes

Programme Concept

The Concept Precedents

XiXian New Area Chongwen Jing River Eco-Restaurant and Hotel, Xi'an, China 2019, PMA, Plasma Studio

Termalija Family Wellness, Slovenia 2018, Enota Architects

Yifang Art Center, Yubei District, China 2020, YIHE Landscape Architecture

Design Normative Position

I dream of a world where architecture serves the need of its users whilst adding value to the environment where it is situated.

Architecture should mimic the simplistic beauty of nature, but encompass the complex functions that nature provides.

Architecture should provide for human needs much like nature does.

The building should also provide for its own needs in terms of energy, water and air.

The building, its users and nature should function in harmony, complementing and reinforcing one another to increase the well-being of all.

Cosette-Mari Minnaar

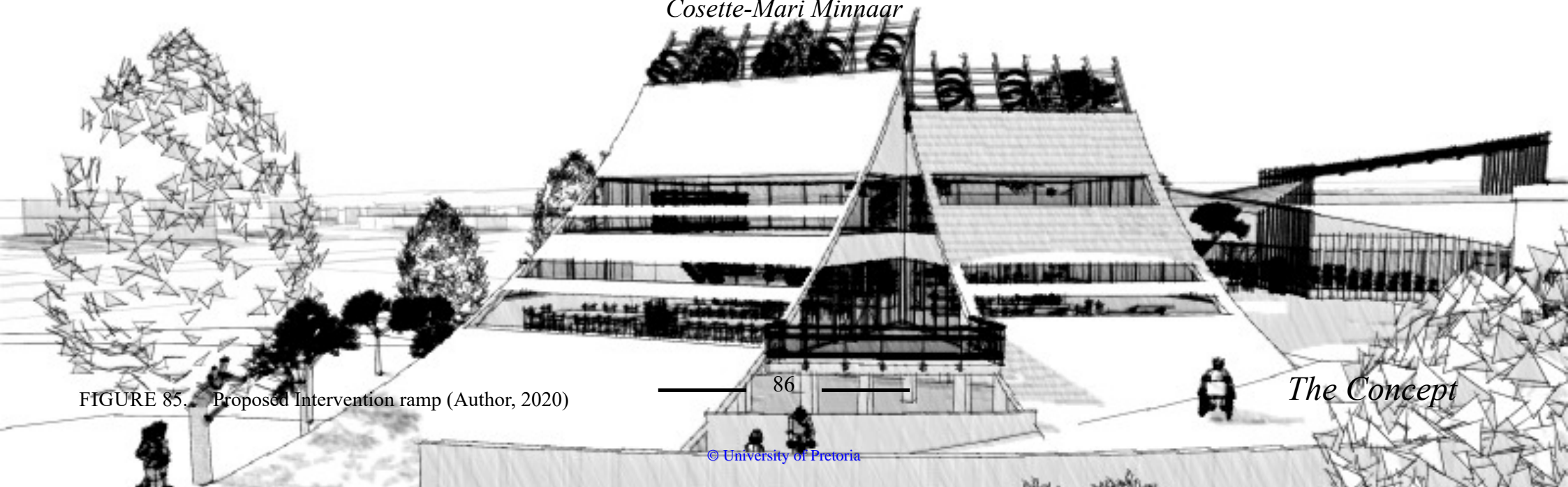


FIGURE 85. Proposed Intervention ramp (Author, 2020)

The Concept

Filter

The new Menlyn Maine development has created a massive divide between the urban and suburban neighbourhoods of the area studied. There is a distinct jump in zoning from the western to the eastern side of January Masilela Drive, which created the problems discussed in Chapter 3.

These problems are negatively affecting the residential communities, their well-being and the eco-systemic well-being of their neighbourhood. These problems are the result of an urban development that neglected to consider urban and suburban growth – it only had economic growth in mind. The problems discussed go hand-in-hand with those of a transitional zone.

The new development has introduced some benefits to the area and these should be filtered into the eastern side of the precinct to ensure that all residents benefit from the business node. In so doing, the existing community and residents will be assured that no further development could take over their space. Many residential plots have already been demolished and any further development would force residents to move, which would result in a list of different problems.

Filter

At this point, the concept of a filter came to life.

The URBAN and SOCIAL FILTER

filters traffic and large amounts of people from the busy urban environment to the quiet residential community by changing the programme and scale of the proposed intervention.

The proposed intervention becomes more intimate and creates a community identity rather than the impersonal large scale business and retail.

The SCALE FILTER

Decreases the building scale from urban multi storey to single storey residential.

The ECO FILTER

Uses ecosystem services to filter temperature from the hot urban environment to the cool residential environment through implementing soft landscaping and greenery on a roof scale. The air is filtrated through the decrease in CO2 entering the suburban environment from January Masilela Drive. The filtration and buffer of biodiversity in the biodiversity corridor transitions from a highly biodiverse public park (Jimmy Aves) to a sudden urban space.

The PROGRAMMATIC filter

transitions from public urban and business and retail, to semi public studio space, gallery and skills development space, to semi private therapy space to private residential.

The DESIGN filter

place spaces to filter and channel users to public spaces in the proposed intervention. The spaces move from public to private along movement routes. A smooth transition from landscape to building is designed to provide a soft buffer between the hard urban environment and the soft natural park

The TECHNICAL filter

uses materials to transition from concrete to brick to steel (from stereotomic to techtonic) to create a seamless earth to sky buffer.

Well-being

The filter will regulate and enhance the well-being of residents as well as the natural environment in the study area as the development has resulted in a massive decrease in green space.

Well-being will be regenerated through the use of natural elements and natural services, more specifically ecosystem services.

The existing ecosystem services on-site will be mimicked and reintroduced through the intervention to ensure that whatever was taken from the community is revived. This aim will be achieved through the regulations set out by the Living Building Institute.

Living Building's Challenge

The Living Building Institute (2020) states that any development or intervention should function as a flower. A flower is the simplest and purest representation of nature as it uses all resources – such as the sun, water, heat and nutrients – and provides beauty, functionality and enjoyment to all who use it.

“IMAGINE a building designed and constructed to function as elegantly and efficiently as a flower: a building informed by its bioregion’s characteristics, that generates all of its own energy with renewable resources, captures and treats all of its water, and that operates efficiently and for maximum beauty.”

*- The Living Building’s Institute
(Living Building’s Institute, 24 August 2020)*

The Living Building Institute challenges designers to think of every design and construction as something that could have a positive effect on the greater community of humans and nature, and which has the potential to change the cultural impact of human communities. It is a holistic challenge that incorporates different disciplines and their ways of thinking to create a set of criteria according to which every intervention should function (Living Building Institute, 24 August 2020).

The Living Building Challenge is composed of 20 Imperatives grouped into seven petals. Some Imperatives are not required for all Typologies.

		TYPOLOGY			
		New Building	Existing Building	Interior	Landscape + Infrastructure
PLACE	01 Ecology of Place	Orange	Orange	White	White
	02 Urban Agriculture	Orange	Orange	White	White
	03 Habitat Exchange	Orange	Orange	White	White
WATER	04 Human Scaled Living	Orange	Orange	White	White
	05 Responsible Water Use	Orange	Orange	White	White
ENERGY	06 Net Positive Water	Orange	Orange	White	White
	07 Energy + Carbon Reduction	Orange	Orange	White	White
HEALTH + HAPPINESS	08 Net Positive Energy	Orange	Orange	White	White
	09 Healthy Interior Environment	Orange	Orange	White	White
	10 Healthy Interior Performance	Orange	Orange	White	White
MATERIALS	11 Access to Nature	Orange	Orange	White	White
	12 Responsible Materials	Orange	Orange	White	White
	13 Red List	Orange	Orange	White	White
	14 Responsible Sourcing	Orange	Orange	White	White
EQUITY	15 Living Economy Sourcing	Orange	Orange	White	White
	16 Net Positive Waste	Orange	Orange	White	White
	17 Universal Access	Orange	Orange	White	White
BEAUTY	18 Inclusion	Orange	Orange	White	White
	19 Beauty + Biophilia	Orange	Orange	White	White
	20 Education + Inspiration	Orange	Orange	White	White

FIGURE 86. Certification (Living Building Institute, 2020)

Five different certifications are offered by the Living Building Institute, namely:

- The zero-carbon certification
- The zero-energy certification
- The core green building certification
- The petal certification
- The living certification

To qualify for full-living certification, all 20 imperatives should be achieved; however, this intervention aims to qualify for the petal certification (Living Building Institute, 24 August 2020). The petal certification requires the intervention to achieve all core imperatives, in addition to the imperatives of the water, energy or materials petals. **This intervention aims to complete all core imperatives including:**

- 01- Ecology of place
- 02- Human-scaled living
- 03- Responsible water use
- 04- Energy and carbon reduction
- 05- Healthy interior environment
- 06- Responsible materials
- 07- Universal access
- 08- Inclusion
- 09- Beauty and biophilia
- 10- Education and inspiration

The intervention also aims to complete the imperatives listed under energy, namely:

- Energy and carbon reduction
- Net-positive carbon

The flower concept that extends from the Living Building Challenge will also be incorporated. A flower has many different parts, but they all function as a whole. A flower provides for all its needs but to the benefit of the larger environment. Flowers are delicately constructed yet strong. A flower has a stem that supports the entire structure like a column, using the ground as a foundation. A flower also has a central element that produces pollen and contains necessary regulatory systems with petals extending therefrom (Living Building Institute, 24 August 2020).

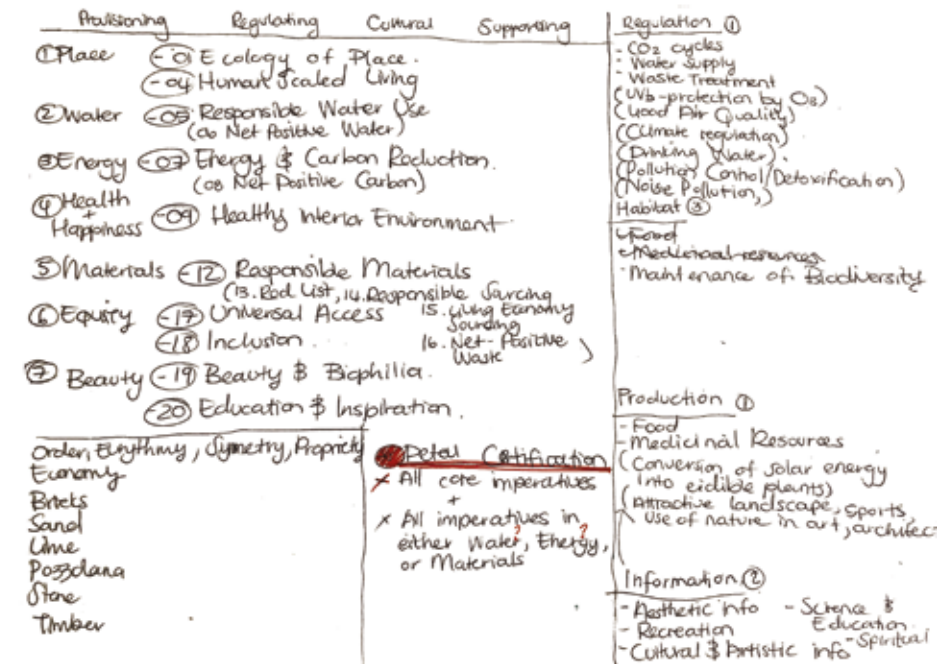


FIGURE 87. Ecosystem Services (Author, 2020)

Ecosystem Services

On-site ecosystems should be reintroduced in a way that is understandable, educational and visible to users. Users should experience ecosystem services to ensure that they fully understand the extent to which they depend on these services. Therefore, the idea is explored that the intervention should be visible to the public and should expose the landscape. To establish which ecosystem services should be reintroduced, it is necessary to identify the degraded ecosystem services on-site.

Ecosystem services that exist on-site – some of which are degraded:

- Trees and some shade
- Spaces of rest
- Space to move
- Physical well-being
- Spiritual well-being
- Self-expression (culture)

Ecosystem services needed on-site:

- More shaded spaces
- Sidewalks and street interaction
- Waste management
- Natural light
- Air ventilation
- Temperature regulation
- Habitat space
- Biodiversity
- Attraction and beauty

The intervention should not only reintroduce nature but also grow with it. It will invite users into the earth while revealing the benefits people gain from it. The intervention will grow towards the sky, linking users to all natural elements and reconnecting all the elements to users.

Ecology of Place

– Reintroduce community and create a safe space for all.

Human Scaled Living

– Slowly filter the building size from Menlyn Maine to residential.

Responsible water use

– Rain water harvesting for dry months and grey water for irrigation.

Energy + Carbon reduction

– Use hot summer sun for photovoltaic panels and solar energy collection. Use wind for wind turbine power collection. Use bioreactor panels to reduce CO2 from the busy street and urban environment and filter the air as well as generate biofuel and biogas.

Healthy interior environment

– Ensure enough natural light and shading from harsh sun. Use the wind direction for natural ventilation. Air is filtered through the bioreactor panels, and all spaces connect to the outside for visual well-being.

Responsible Materials

– Use materials that increase ecosystem services like concrete for insulation and natural heating in winter. Brickwork for curved walls which is easy to construct and affordable. To reduce the building material footprint, all existing concrete on site from the existing skate rinks and hockey rink will be recycled.

Universal Access

- All spaces will be accessible for all.

Inclusion

– The intervention will provide public spaces as well as community skills development programmes.

Beauty and Biophilia

– The proposed intervention will create a habitat for natural elements and reintroduce green spaces through roof gardens.

Education and Inspiration

– The programme provides skills development programs.

Reintroducing Well-being

The well-being of nature and the well-being of humanity should be seen as equal and contingent on one another; however, the reality is, unfortunately, that humans' well-being dominate.

Human dominance has resulted in a disconnect between people and nature, but the situation can be remedied by reconnecting people with the earth through the reintroduction of natural elements by means of man-made interventions.

To fully revive the well-being of users and the community, the intervention should relate to each user on a sensory level. Here, the theory of phenomenology becomes important as it reconnects architecture and people in an experiential manner (Seamon, 2000:157-178).

To create awareness of ecosystem-service degradation as well as the importance of ecosystem services to every human, the theory of phenomenology will be implemented as it is frequently used as a tool to facilitate understanding. Architecture should also create the same emotional and sensorial effect on users – much like nature does (Pallasmaa, 2007:41).

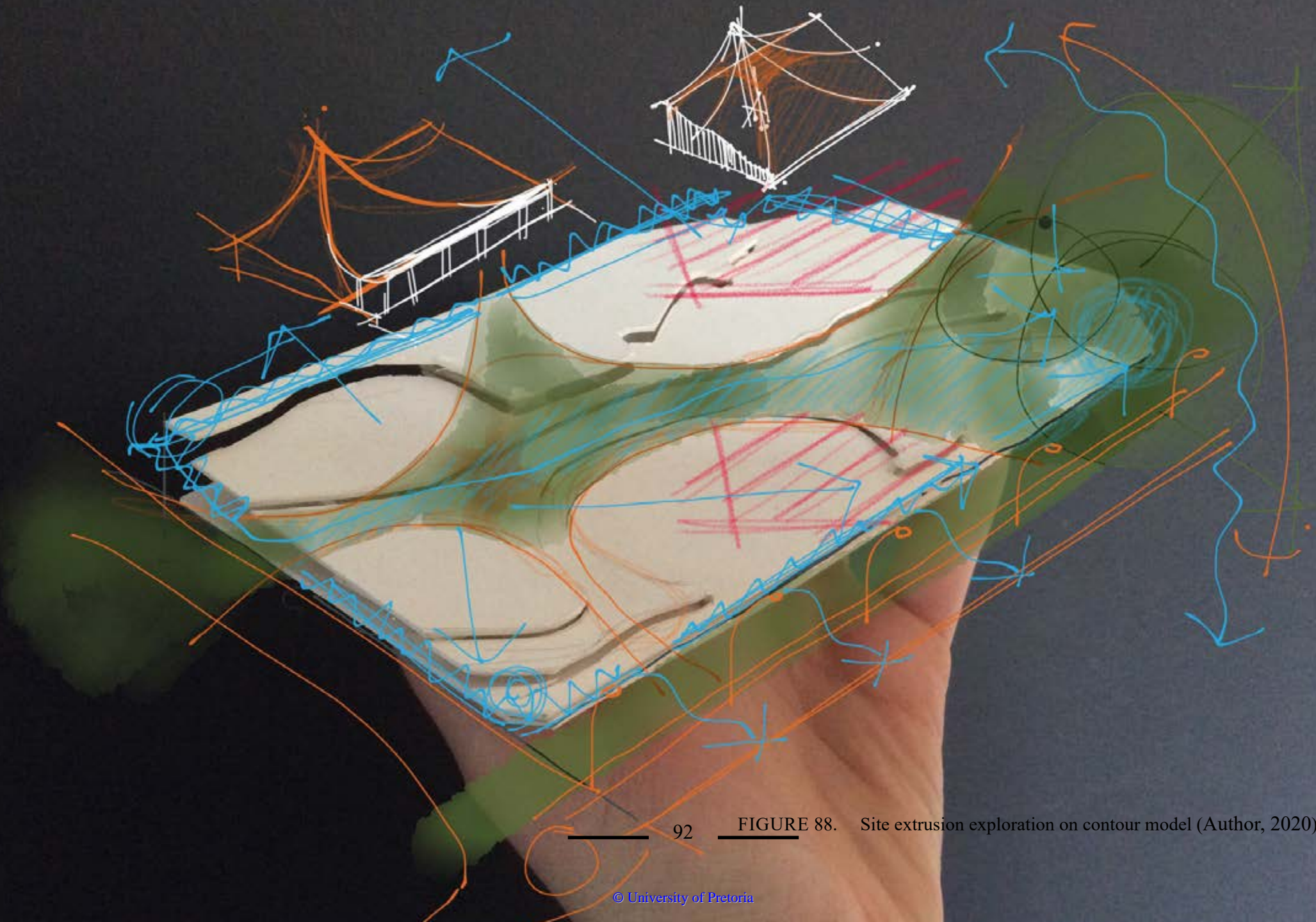
Existing Programmes

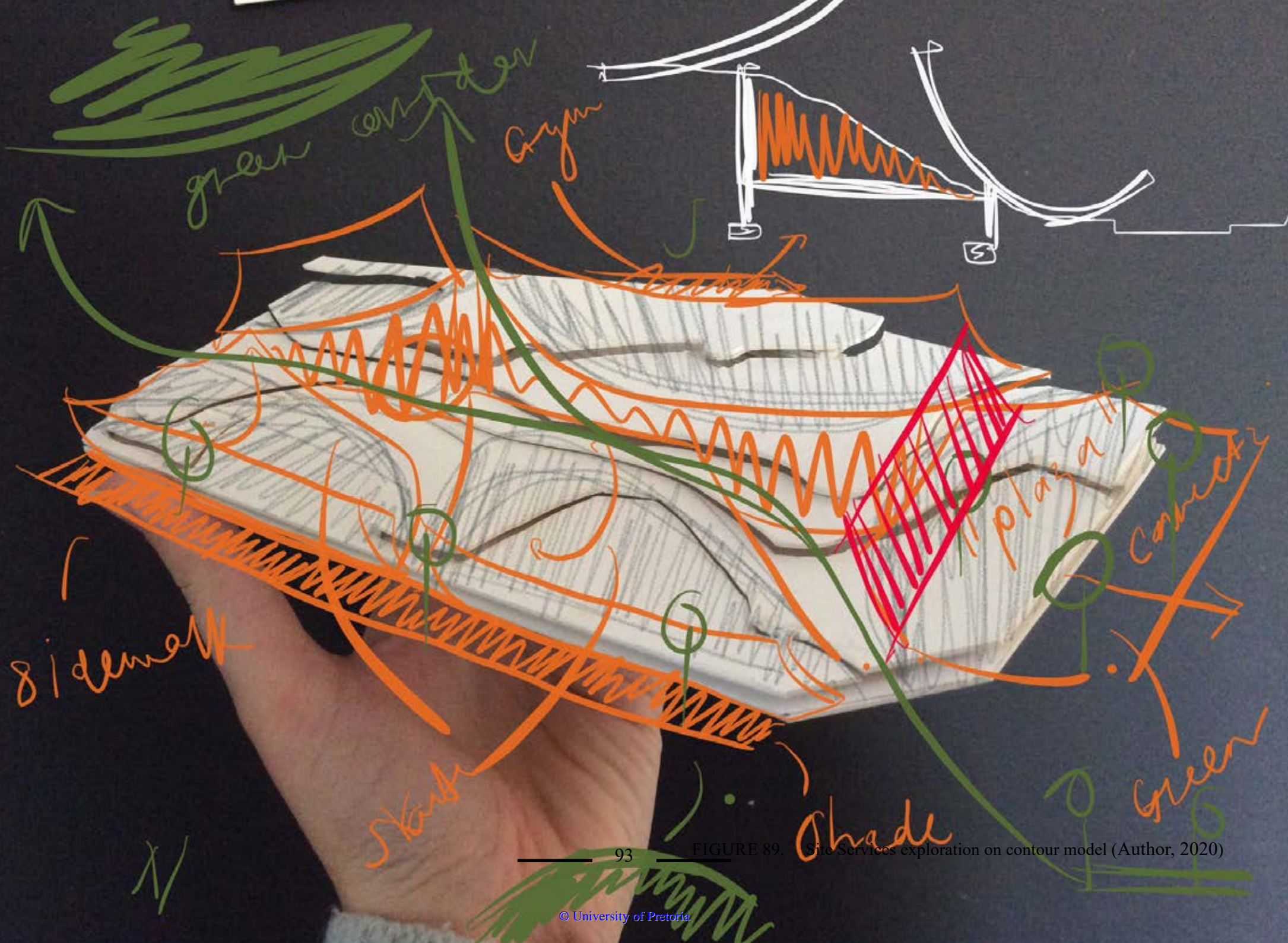
Lastly, the design acknowledges existing functions by creating an urban playground through the building itself. The building mimics the movements of the human body and the skateboard to relate to the existing programme of the skate park. The shapes start to create ramps in the landscape that can be used by the public, children and the skateboarding community. These shapes also become the circulation paths of the building providing entrance ramps for full inclusivity. An element of play, which was evident in the putt-putt site, is also reintroduced through the ramps, the landscape and the multi-purpose gymnasium. These elements link to the existing wrestling club by reintroducing the gymnasium and activity spaces.

Programme Concept

The programme strives to be a private one that operates in a public manner. This aim will be achieved if the building offers public access and a fully public lower-floor level, but with private functions like art therapy, creation spaces and well-being spaces.

The main purpose of the intervention is based on self-expression through art. Art is a form of private self-expression but it is normally exhibited in a public manner – and that is the aim of the intervention. In so doing, a bridge is created between the public nature of the urban development and the privacy of the residential neighbourhood.





Concept Precedents

XiXian New Area Chongwen Jing River Eco-Restaurant and Hotel, Xi'an, China 2019

PMA, Plasma Studio

XiXian New Area Chongwen Jing River Eco-Restaurant and Hotel is situated in an eco-park where the surrounding nature is of utmost importance. The main concept of the design entails the continuous flow from natural to man-made. The building morphs into contours that connect the programme and architecture to nature and people. The architecture and the landscape are uniformly transformed to emphasise that both are equally important. The building finds its identity through the articulation in the landscape rather. The boundaries between people and nature become blurred to create a new environment, but the intervention still respects the elements. The building extrudes from the landscape to ensure that enough natural light is captured. In other places, slopes create a playground for younger users (XiXian New Area Chongwen Jing River Eco-Restaurant and Hotel, 21 October 2020).



FIGURE 90. XiXian diagram (Author, 2020)

Termalija Family Wellness, Slovenia 2018

Enota Architects

The Termalija family-wellness intervention forms part of a series of buildings that uniquely respond to user needs and the environment. With every space added, the building improves its response to the surrounding site, creating a stronger connection with the landscape. Some spaces are submerged into the earth while others require above-ground space. This design provides new experiences with each space, continuously surprising users. The indoor spaces also strive to be as open as the exterior spaces so that they can be used in the colder months.

These spaces enhance the well-being of users in that each space caters to the specific function that it houses. Even though the design is unique to the area, it still aims to morph with the adjacent rural buildings to continue the narrative of the area's heritage (Termalija Family Wellness, 21 October 2020).



FIGURE 91. Termalija diagram (Author, 2020)
The Concept Precedents

Yifang Art Center, Yubei District, China 2020
YIHE Landscape Architecture

Yifang Art Center uses an existing concrete structure and repurposes it so that it becomes a new community centre. Each space has a focal point that creates an identity for that space. The building uses a series of walls that define exhibition areas, but these also provide for a flow of movement throughout the building. The design is inspired by traditional Chinese gardens that create meditation and tranquil spaces. This is brought about through the manipulation of shadow, light and movement. These elements constantly change to create the impression that the building morphs throughout the day. Spaces are hidden and revealed to users, providing a feeling of surprise that enhances the overall sensory experience of art and architecture (Yifang Art Center, 21 October 2020).

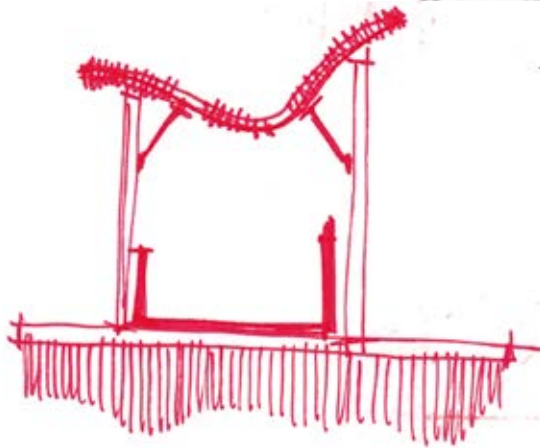


FIGURE 92. Yifang diagram (Author, 2020)

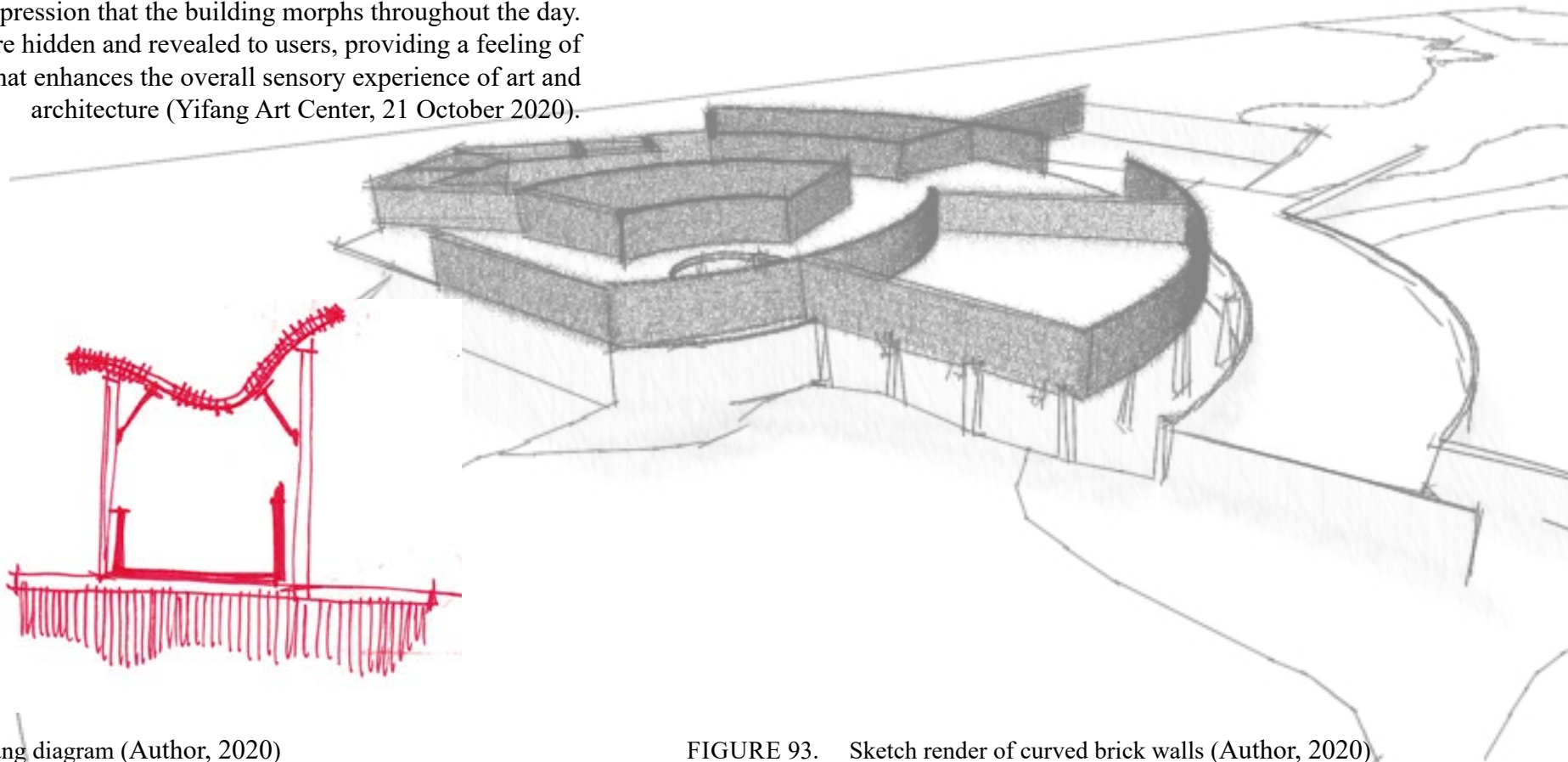


FIGURE 93. Sketch render of curved brick walls (Author, 2020)

Chapter 6

Design Development

Design Development

Vitruvian Principles

Vitruvian Man Ratio

Grid

Contours

Master Plan

Restrictions

Organic development

Plan development

Growth from site

3 Principles

Sectional Development

Material Concept

Roof Development

Daylighting, Over lit, Daylight factor and Illuminance Studies

Dry Bulb Comfortability

SBAT

Shading

Design Development

The development of the design stemmed from the conceptual framework of the well-being of humans and of nature through the reintroduction of ecosystem services.

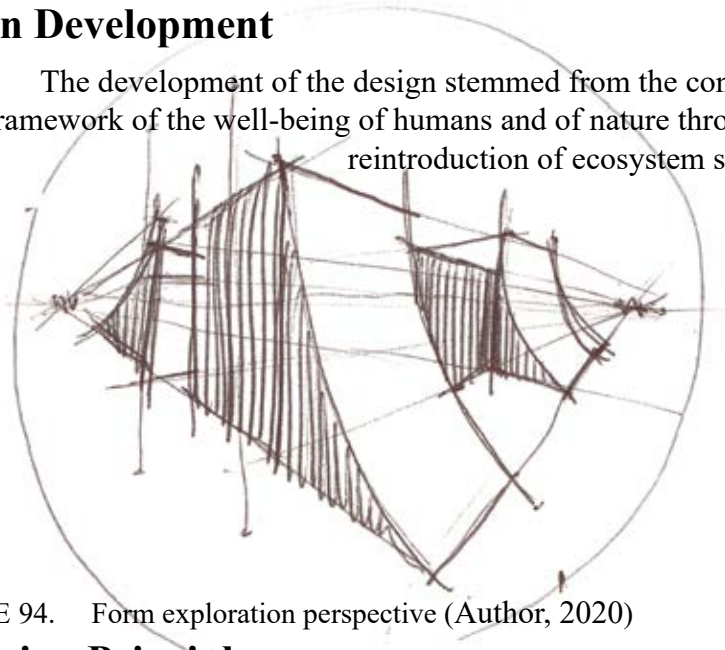


FIGURE 94. Form exploration perspective (Author, 2020)

Vitruvian Principles

The design evolution started with the Vitruvian principles of eurhythmy and propriety. The use of these principles guaranteed that all design decisions would be made using natural elements as a guideline.

Eurhythmy means that all members of the design work in harmony and symmetry. All elements should be based on the principles of other elements in the design. This basis creates unity in the design and ensures that the intervention functions as a whole.

Propriety means that all decisions are based on approved principles. In the case of this intervention, the approved principles represent ecosystem services. All design decisions are based on nature and their functions for humans (Vitruvius, 1914).

Vitruvian Man Ratio

The Vitruvian man-ratio plays a role in ensuring that all spaces facilitate optimal human movement since the programme includes movement therapy and well-being. The Vitruvian man-ratio was multiplied with the average heights of South African women and men to make sure that the grid is based on local users (South African Government, 22 May 2020).

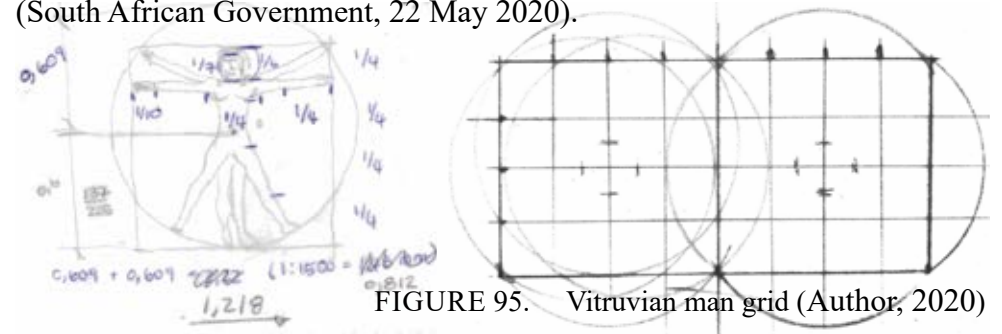


FIGURE 95. Vitruvian man grid (Author, 2020)

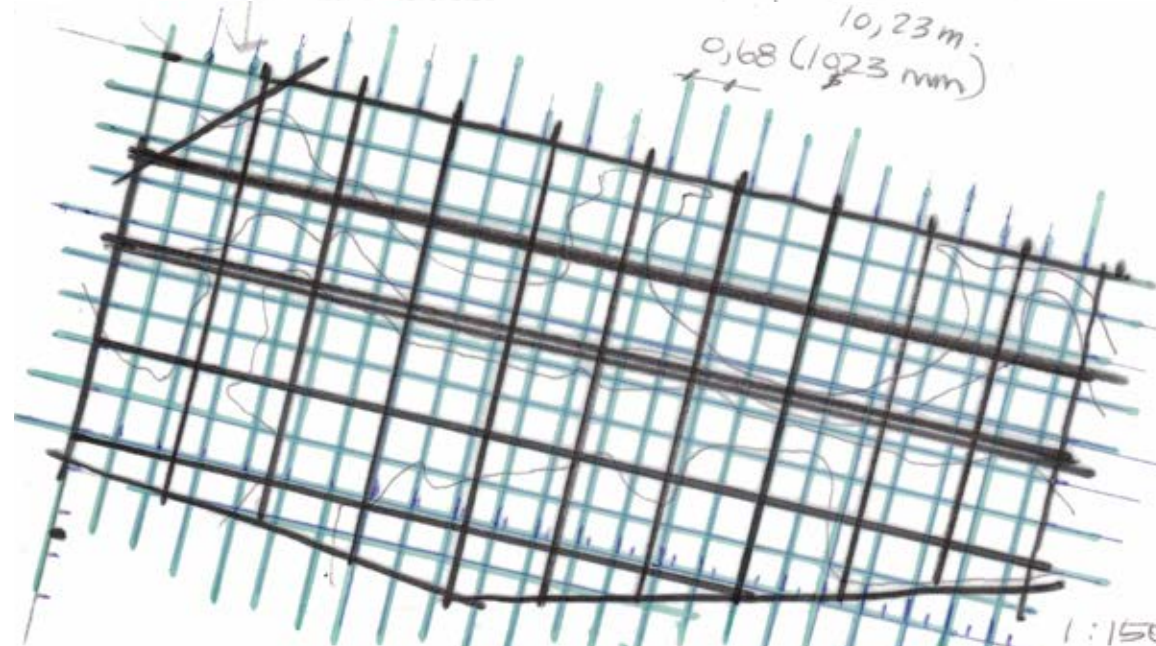
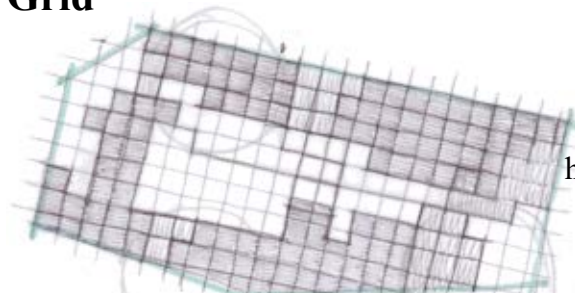


FIGURE 96. Grid exploration on site (Author, 2020)

Grid



This step inspired the grid system, which loosely indicated the heights and widths of spaces on-site, together with the curved forms and the contours.

FIGURE 97. Grid and plan exploration on site (Author, 2020)

Contours and Views

As the intervention is primarily based on-site, the landscape and its elements – its contours – played a big role in the placement of spaces and services. The site falls towards the north and north-west by four meters.

This step provided the opportunity to use the fall as a safety benefit to the intervention. The intervention can protrude from the landscape towards the street edge, creating a physical barrier into the building.

The contours were also manipulated with previous construction, creating interesting curves in the landscape. The use of these contours will create a link with the existing programmes on-site.

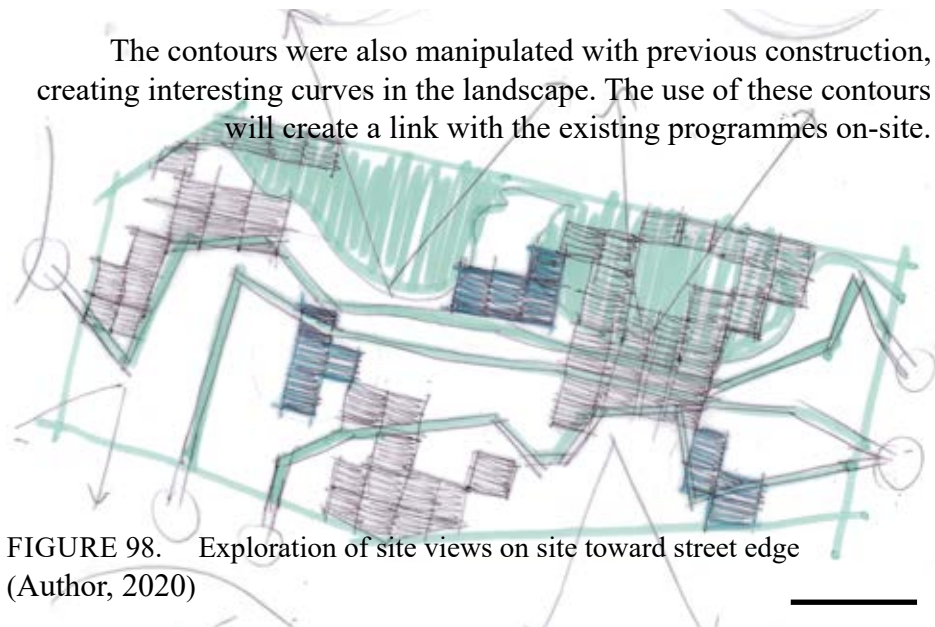


FIGURE 98. Exploration of site views on site toward street edge (Author, 2020)

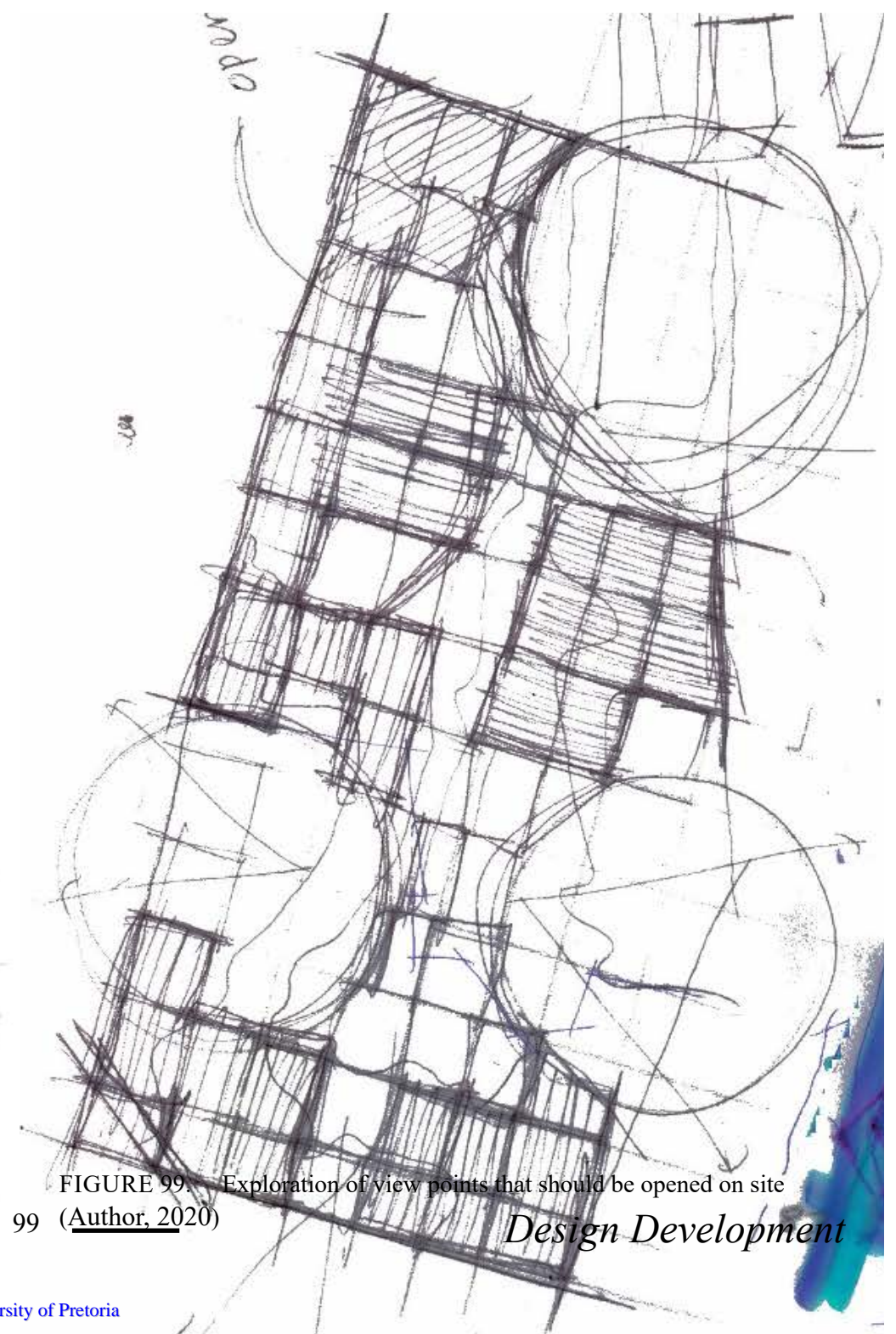


FIGURE 99. Exploration of view points that should be opened on site (Author, 2020)

Design Development

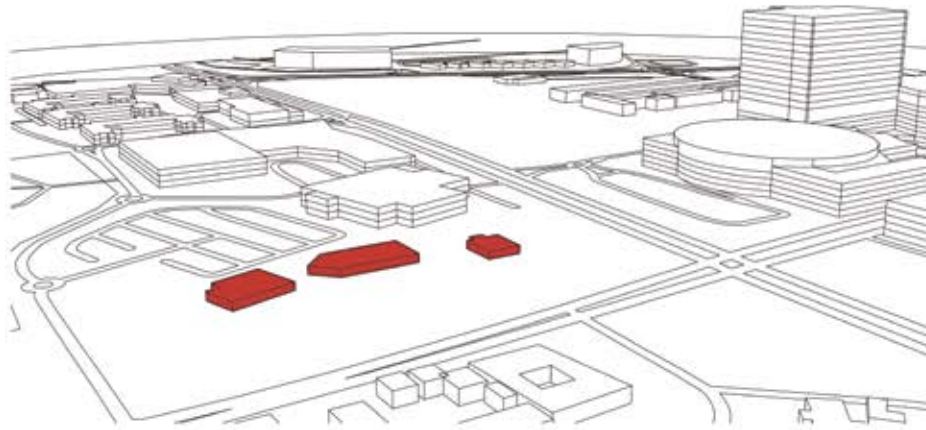


FIGURE 100. Existing Structures on the site (Author, 2020)

The existing spaces include a skate park, wrestling facilities and a put-put course, but the structures are unmaintained and mostly unused. The most important existing factors like the culture, the social and community importance as well as the skateboarding element will be retained. The structures will be demolished.

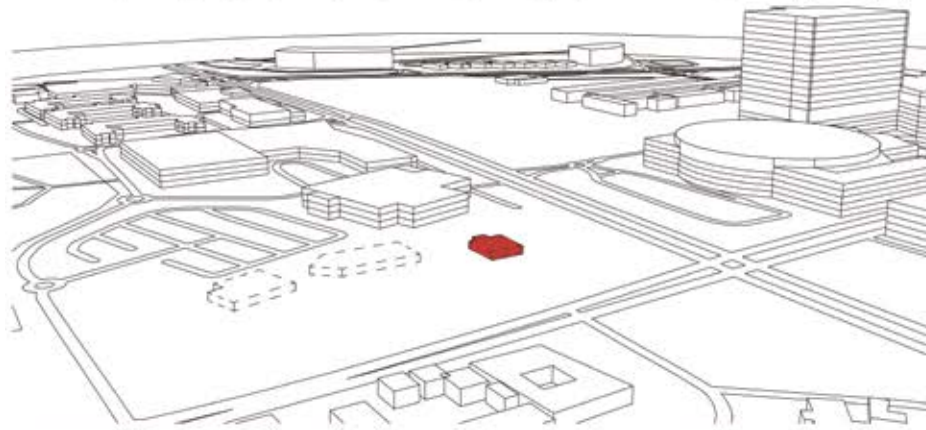


FIGURE 101. Demolished and Phased Approach of larger site development (Author, 2020)

The new proposed intervention will take place in phases. For the first phase the skateboard rinks and Thrashers skate park, as well as the wrestling building will be demolished. The second phase will look at the demolition of the put-put course and building. This will provide space for further development in the arts, culture and public space program as can be seen in figure 102.



FIGURE 102. New proposed intervention on Eastern corner of site (Author, 2020)

The new proposed intervention will be placed where the skate park and wrestling facilities are. This intervention will bleed into the landscape and surrounds.

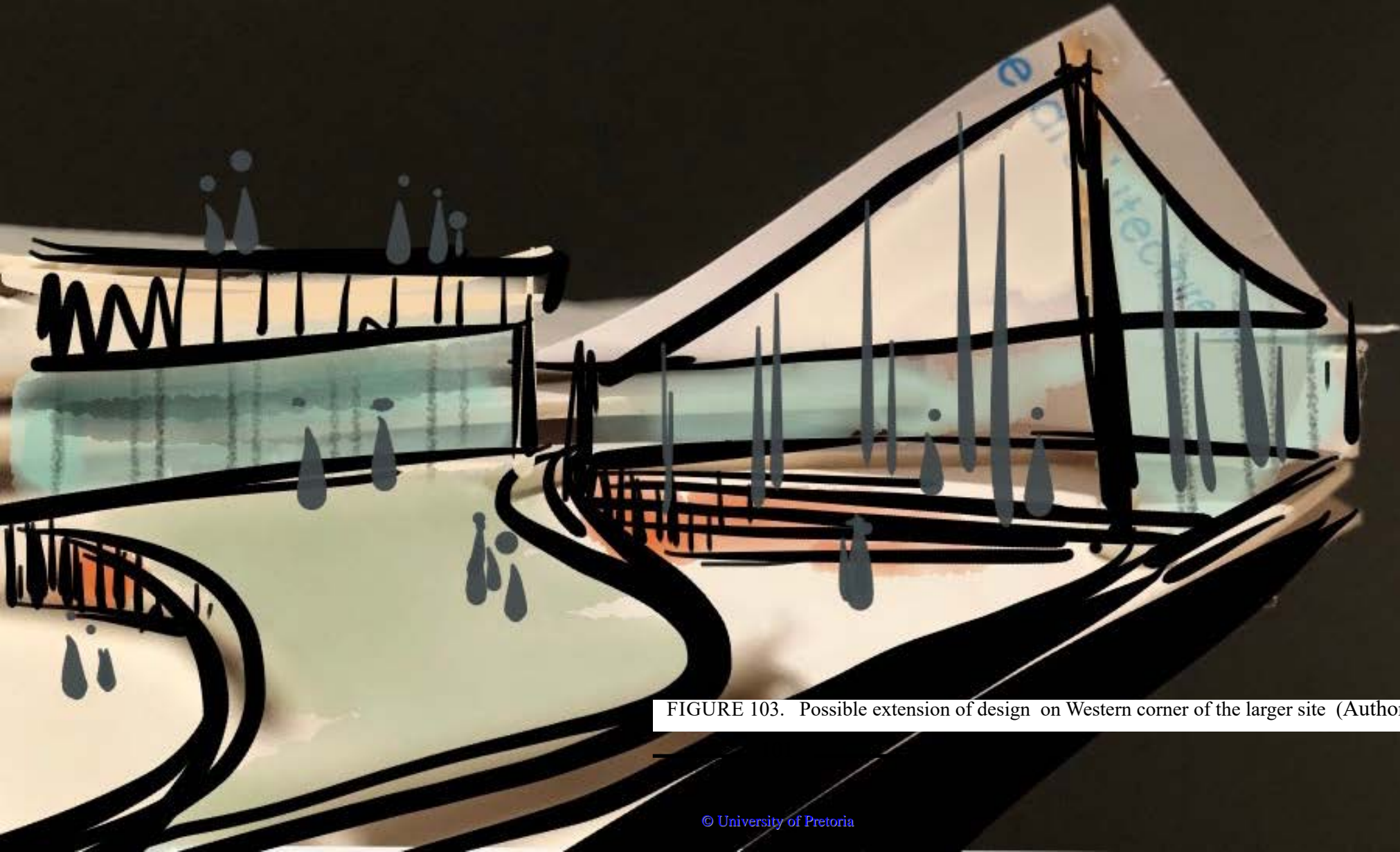
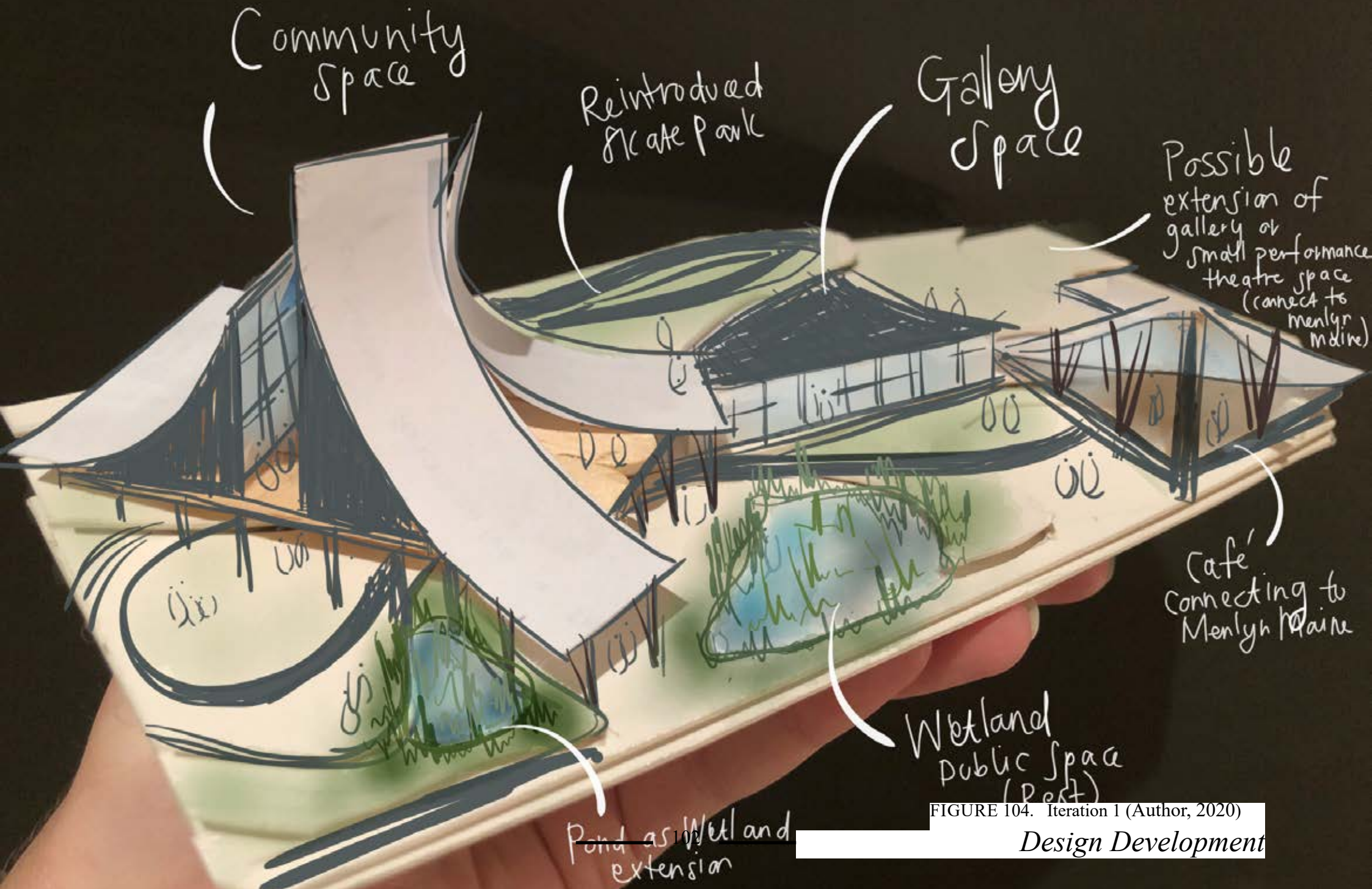


FIGURE 103. Possible extension of design on Western corner of the larger site (Author, 2020)



Community Space

Reintroduced Skate Park

Gallery Space

Possible extension of gallery or small performance theatre space (connect to menlyn mdine)

Cafe' connecting to Menlyn Main

Wetland Public Space (Pest)

Pond as Wetland extension

FIGURE 104. Iteration 1 (Author, 2020)

Design Development

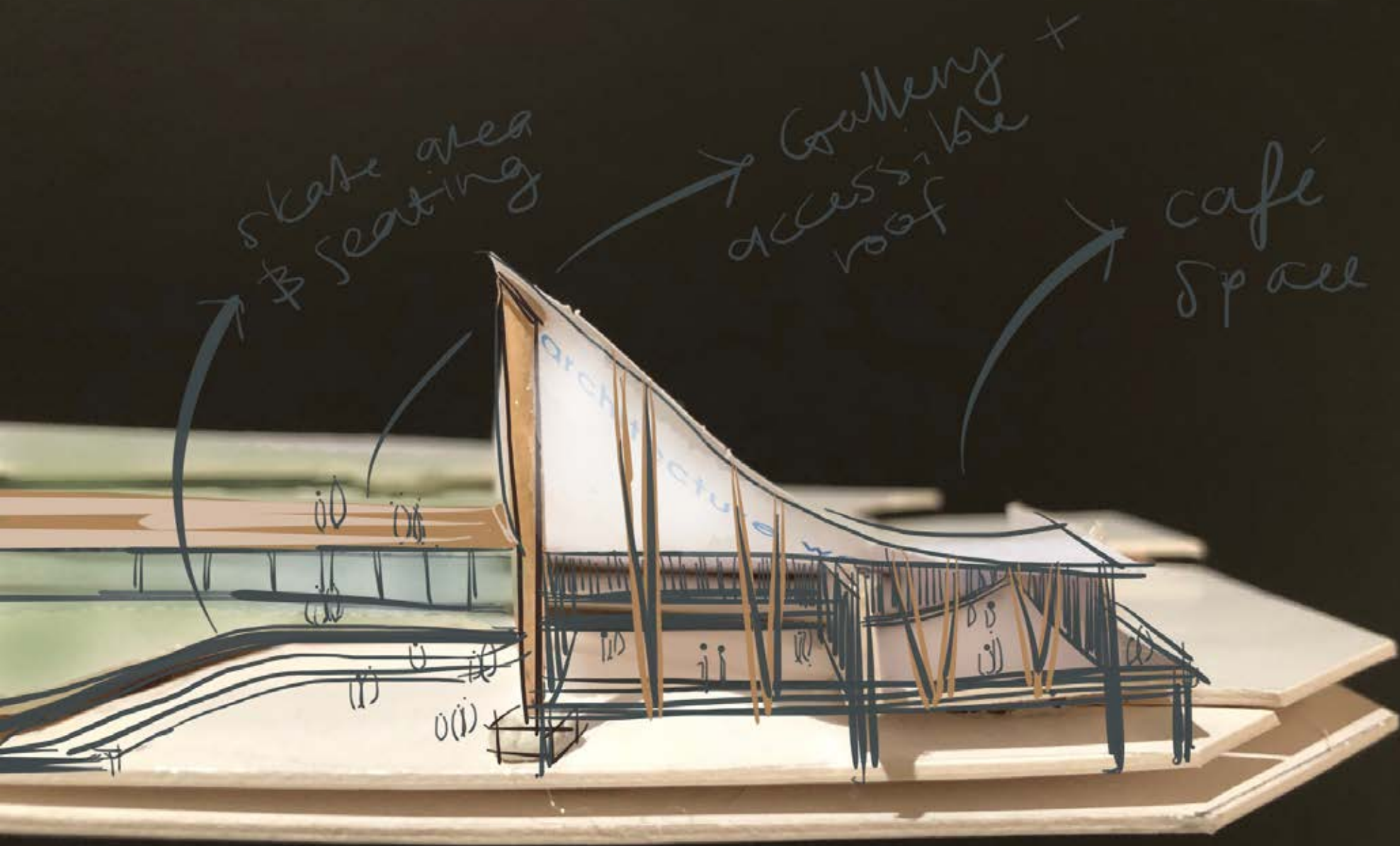


FIGURE 105. Iteration 1 (Author, 2020)

Restrictions

The restrictions on-site include:

- *The street edges and street corner*
- *The gymnasium parking*
- *The surrounding older-aged community*
- *The adjacent church*

Noise is the main concern to be considered. Through the interviews, it became evident that the existing programmes on-site produce too much noise for the retirement facilities and churches in the area. Thus, all spaces that might produce too much noise should be placed at the southern end of the site.

The intervention should accommodate people passing by with public resting spaces and sidewalks along the street edges and corner. Shaded spaces and greenery should be added to introduce ecosystem services for everyone – not only the users on-site.

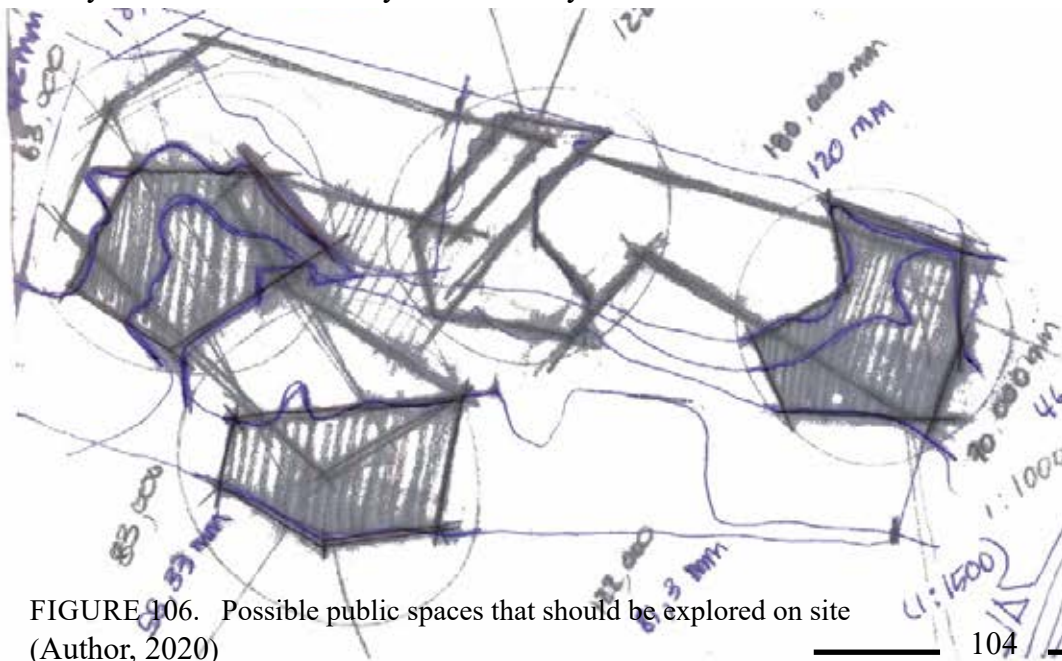


FIGURE 106. Possible public spaces that should be explored on site (Author, 2020)



FIGURE 107. Open spaces that should be explored on the street edge (Author, 2020)

Design Development

Organic development

Natural elements play a large role in the design process; thus, the intervention should complement the landscape and integrate it into the design. Curved forms are introduced to integrate the contours into the design as well as the idea of flow and movement. The programme, which is based on well-being, as well as the existing sporting functions, influenced the design organically.

Organic shapes imitate movement, ensuring that the site becomes an experience rather than merely a building. The vertical organic shapes are inspired by the existing function of skateboarding and skate ramps.

Not only does the movement enhance the experience of the intervention – it becomes a playground. This process enables the intervention to accommodate a myriad of users, which serves to diversify the community, especially age-wise.



FIGURE 108. Form development on contour model (Author, 2020)

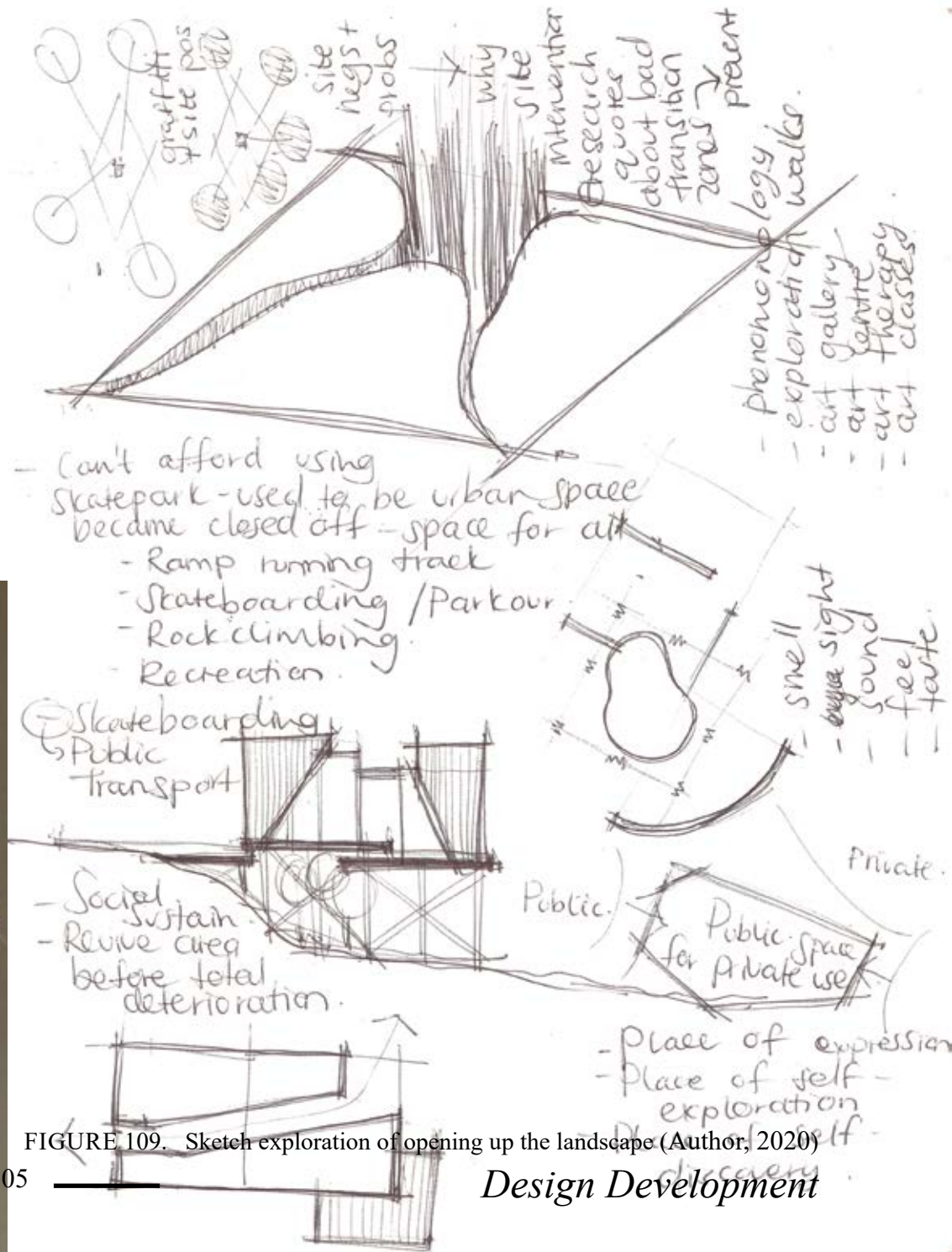


FIGURE 109. Sketch exploration of opening up the landscape (Author, 2020)

Design Development

Organic development

By creating an experience, the principle of phenomenology is tangibly introduced into the design. This will facilitate the idea of including users in the process of ecosystem services.

The movement that is created on-site also links the residential area and the business district on a human scale, thereby reducing the scale difference that exists from west to east. This aim is also achieved by creating curved roofs that heighten the intervention without designing a multi-level building.

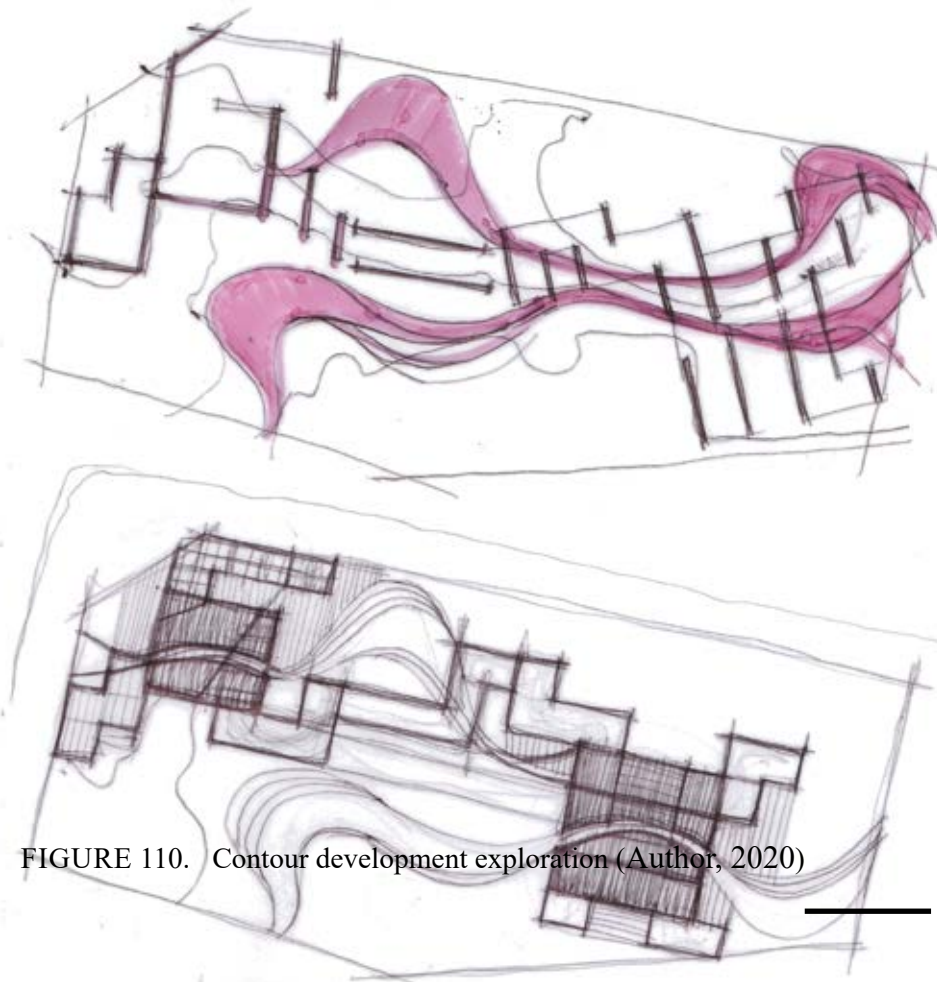


FIGURE 110. Contour development exploration (Author, 2020)

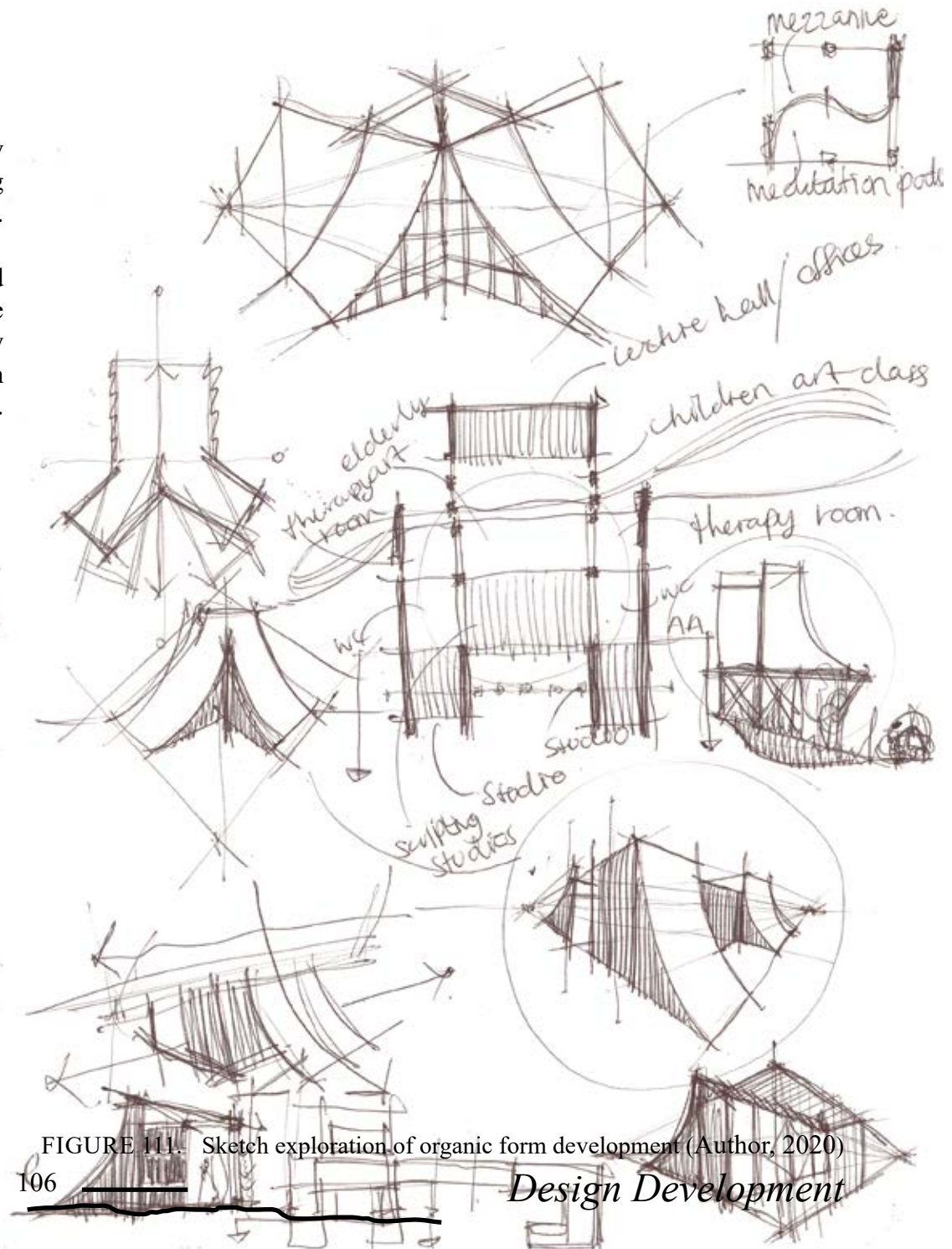


FIGURE 111. Sketch exploration of organic form development (Author, 2020)

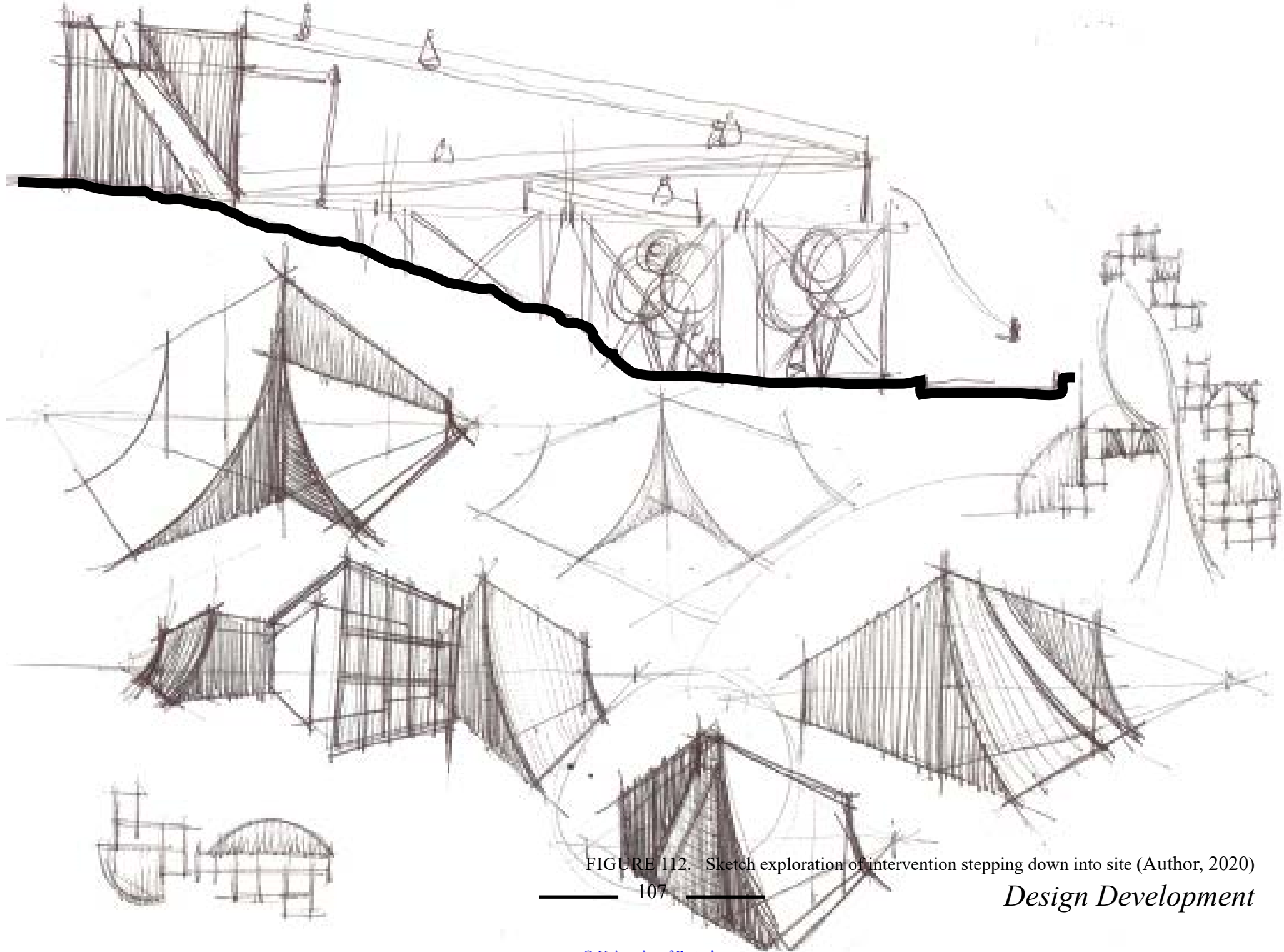


FIGURE 112. Sketch exploration of intervention stepping down into site (Author, 2020)

Plan development

This aspect of the intervention emphasised the floor plan in that every space is directly connected to the outside.

The ground-floor level is built into the site. It exposes the landscape and its elements to users in a tangible way. In so doing, users can learn about the different benefits that the ecosystem provide for them.

The floor consists of therapy spaces, photography and dark rooms, communication and computer rooms, a water-filtration pond and a movement-therapy gymnasium. The movement-therapy gymnasium is specifically geared towards well-being – it should not be confused with the gymnasium that is adjacent to the intervention.

By excavating the site towards the street edge and eastern edge, the intervention ensures that therapy spaces receive enough natural light, and create a sense of tranquillity, in the case where these therapy rooms connect to the water pool.

These spaces also open to the outside, increasing well-being.

The upper level consists of studios, meeting and activity rooms, as well as bathrooms and a kitchen. These spaces also connect to the outside and joint courtyard spaces, which ensures enough natural light and ventilation. These are furthermore open-plan spaces that are customisable to users.

This design provides users with the opportunity to self-explore from the space arrangement to the actual activity product, like art. The curved walls also eliminate the feeling of rigidity that might influence the freedom of art therapy.

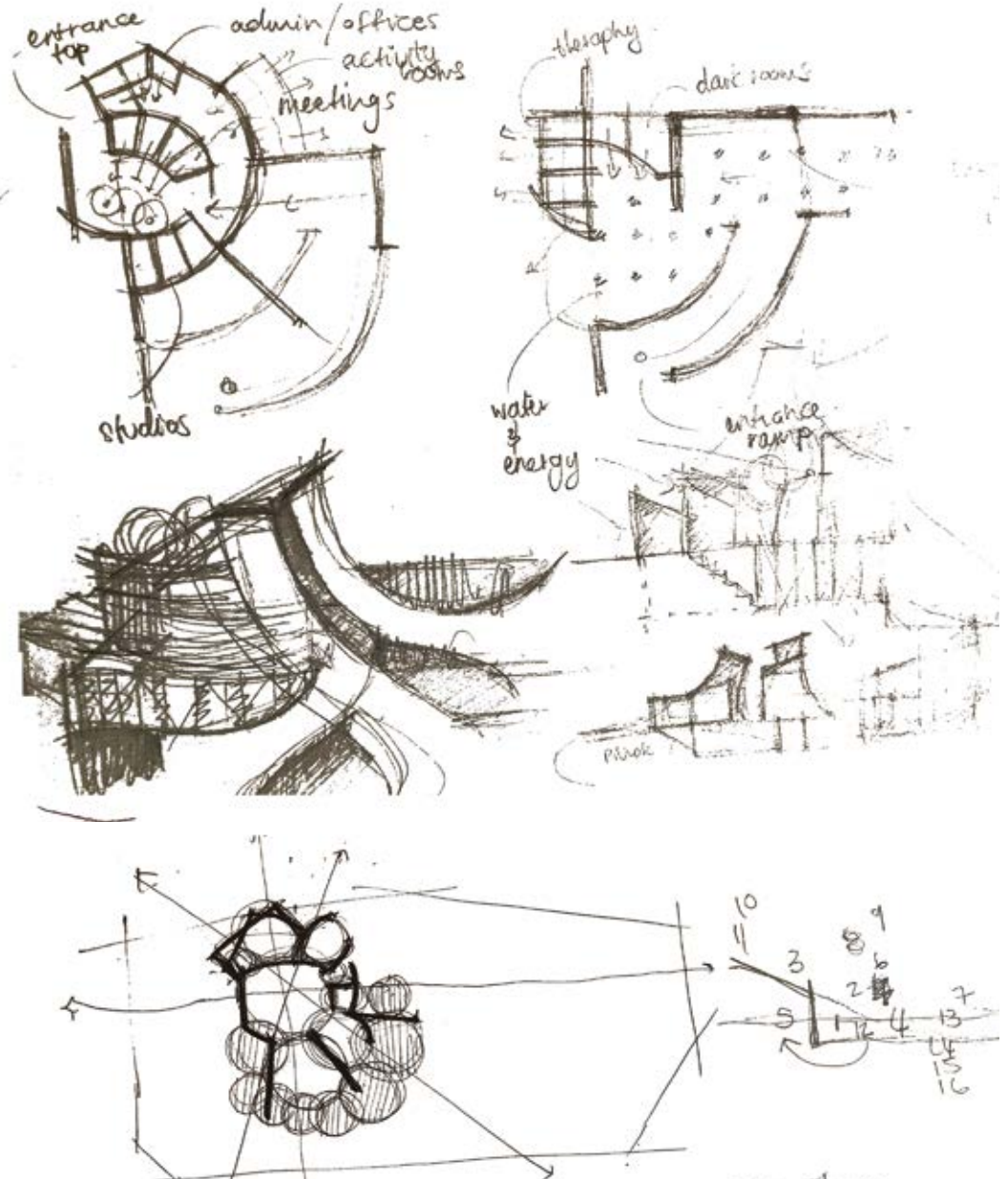


FIGURE 113. Sketch exploration of the plan layout on site (Author, 2020)

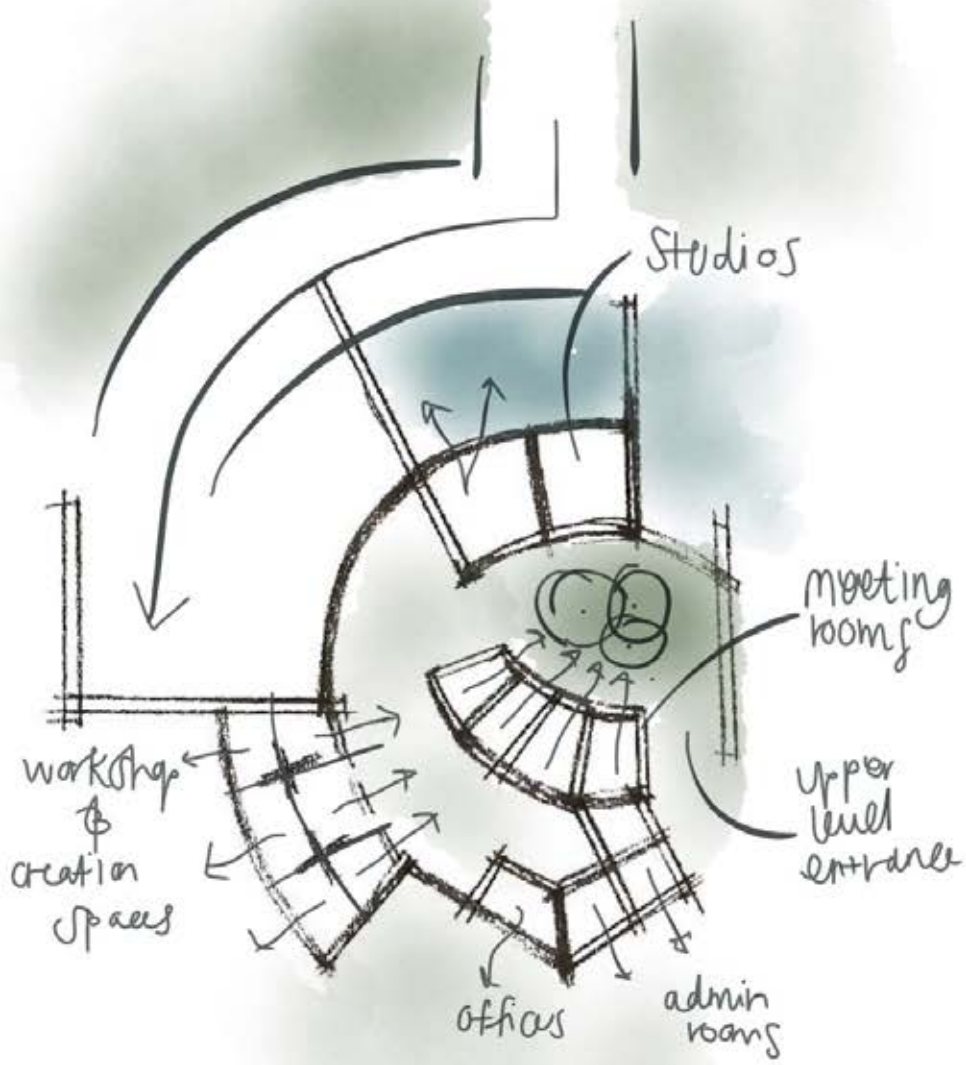
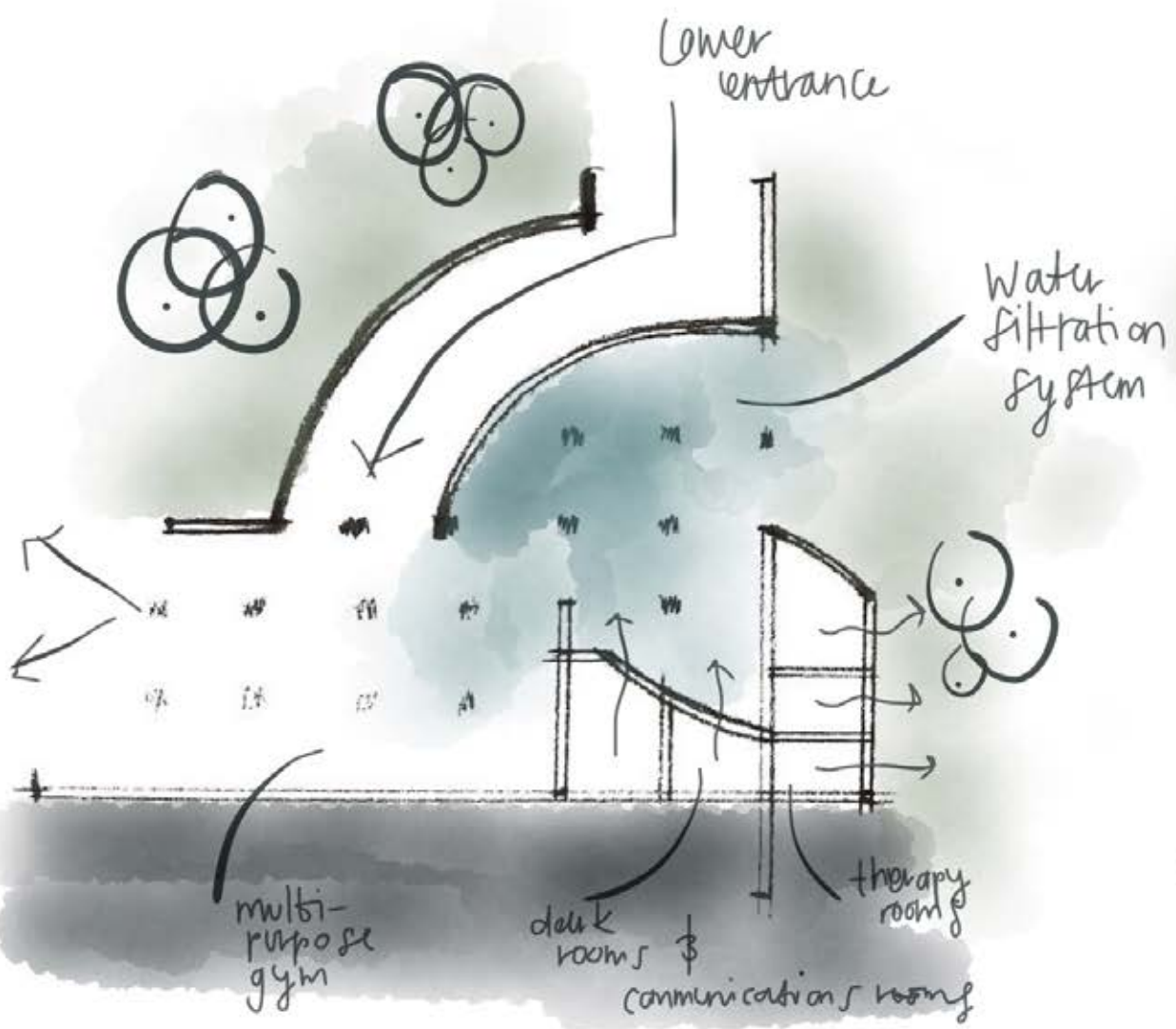


FIGURE 114. A sketched iteration of the plan development and organic growth (Author, 2020)



FIGURE 115. Formal plan development exploration (Author, 2020)

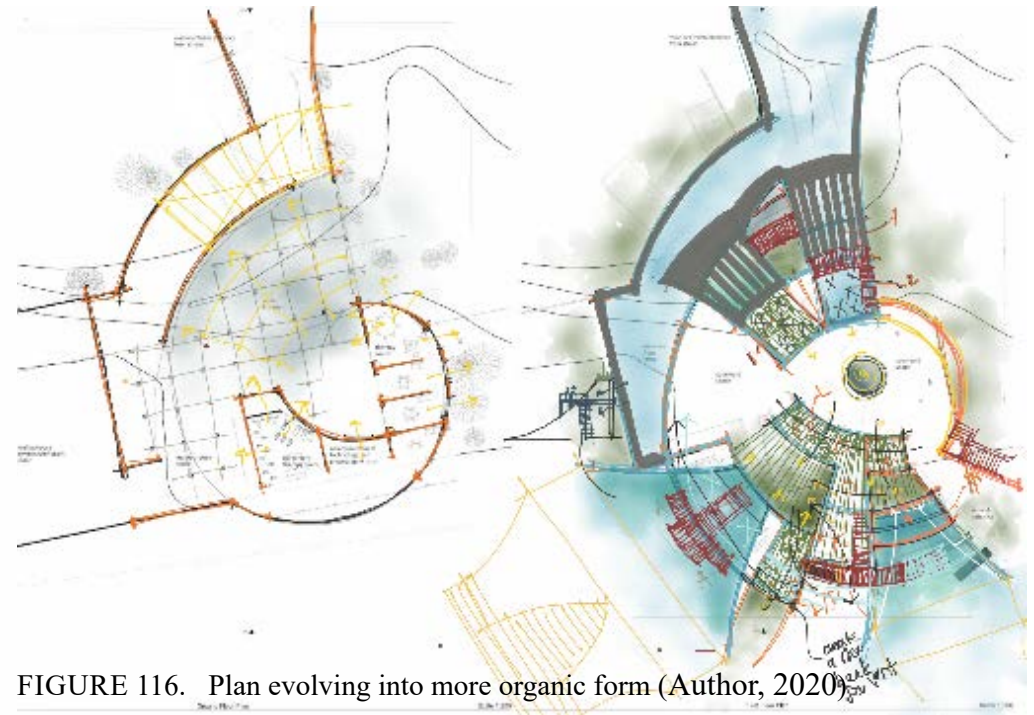


FIGURE 116. Plan evolving into more organic form (Author, 2020)

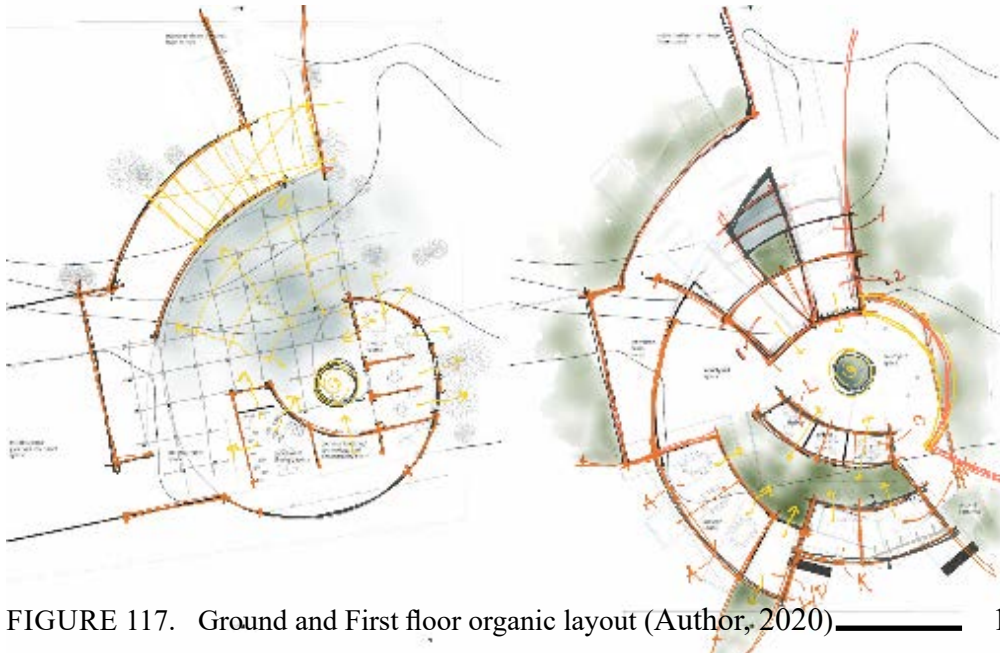


FIGURE 117. Ground and First floor organic layout (Author, 2020)

The floor plans developed organically to further connect with the fluidity and constant movement of nature.

The ground floor, housing the therapy offices, electronics spaces and movement gymnasium incorporates more curved walls and organic spaces. This creates the atmosphere that the user is free to move and be themselves- rather than the feeling of rigidity.

The phenomenology and atmosphere of a space has a significant impact on the mental state of users, thus the therapy spaces should create a complete sense of being free.

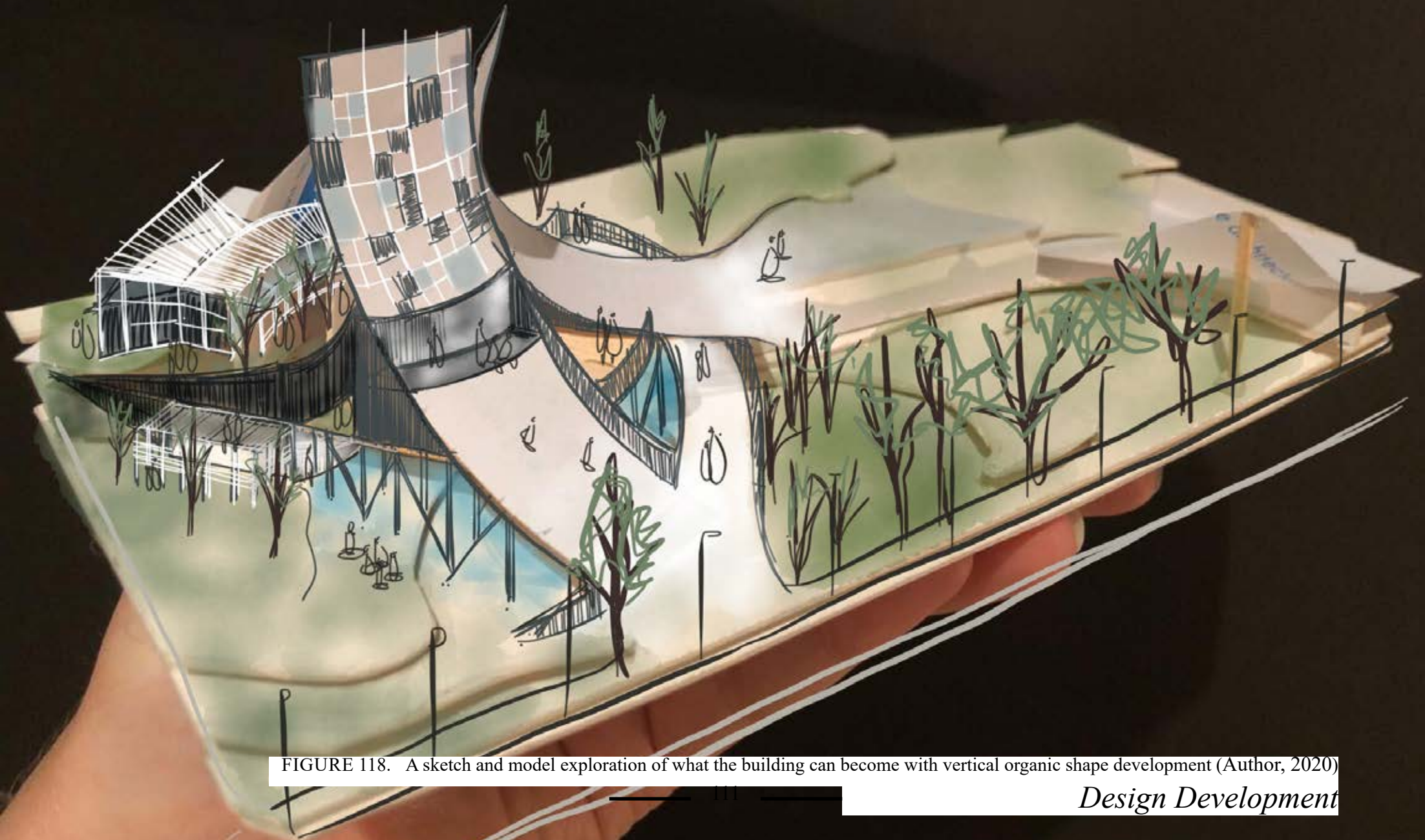


FIGURE 118. A sketch and model exploration of what the building can become with vertical organic shape development (Author, 2020)

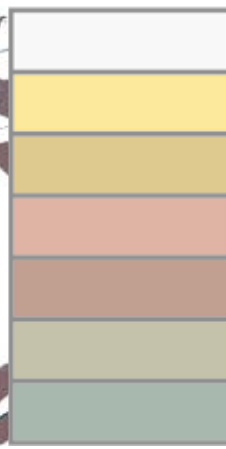
Design Development



FIGURE 119. A diagrammatic breakdown of spaces (Author, 2021) _____ 112 _____



FIGURE 120. Diagrammatic Space Breakdown Ground floor (Author, 2021)

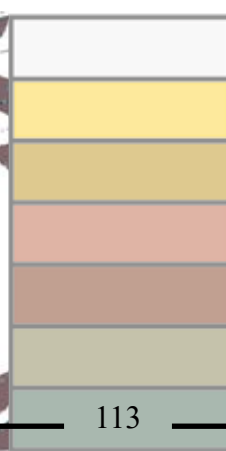


- Bathrooms and Kitchen (Services)
- Office spaces (Therapy offices, Offices, Lounge)
- Studio Spaces and Activity spaces (Lecture rooms)
- Art Gallery and Exhibition Space)
- Photovoltaic Panelling
- Space for wind turbines
- Accessible Green roofs



FIGURE 121. Diagrammatic Space Breakdown First floor (Author, 2021)

FIGURE 122. Diagrammatic Space Breakdown Roof (Author, 2021)



Growth from site

The curved roofs form the physical skate ramps on-site, which integrates playfulness with the actual intervention. This design also makes the building appear like an extension of the landscape. The building grows from the site, both physically and eco-systemically. The intervention thus incorporates the movements of both people and nature in order to reconnect the earth to humans to the sky.

3 Principles

Three principles arose that informed my technical design. These are:

- (1) Humans and nature are one and the same but they are unfortunately disconnected.
- (2) Natural elements should be used to bridge the gap between humans and nature.
- (3) Natural elements should be reintroduced through architecture.

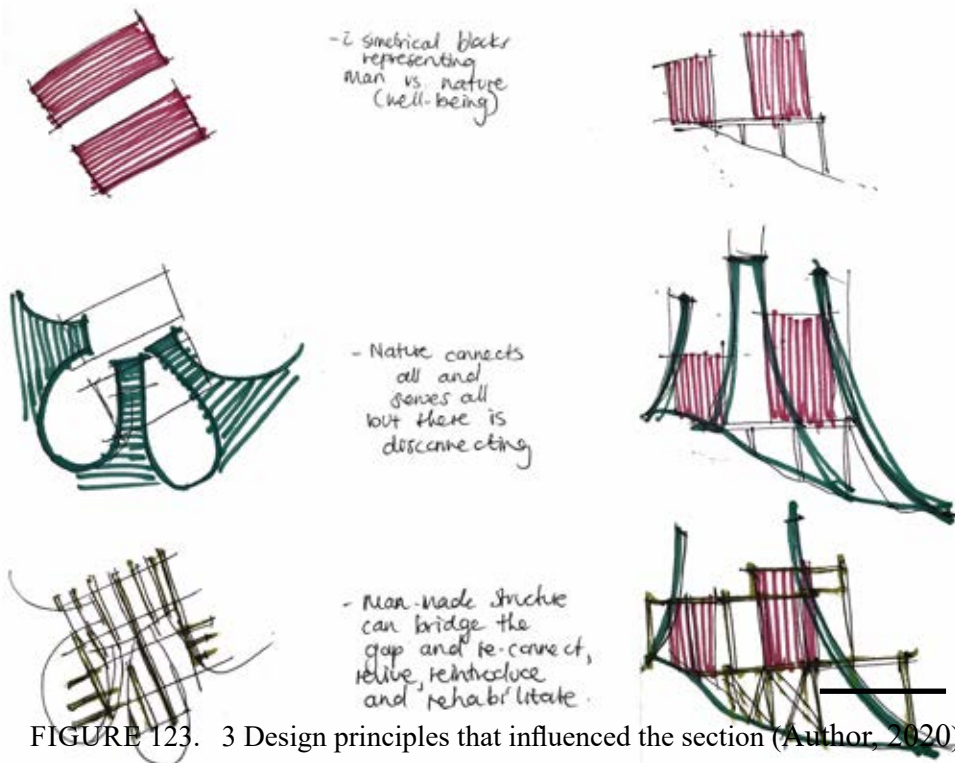


FIGURE 123. 3 Design principles that influenced the section (Author, 2020)

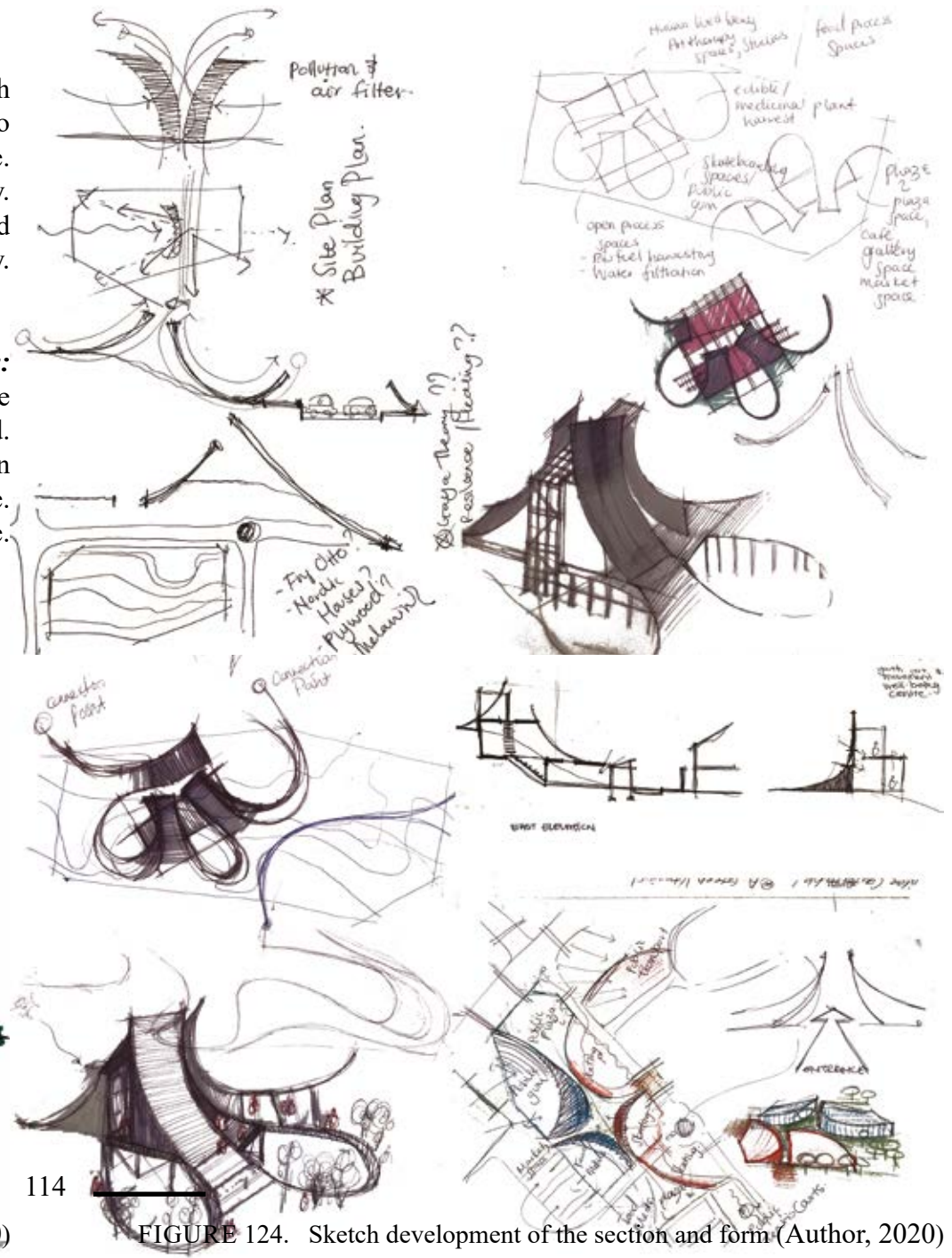


FIGURE 124. Sketch development of the section and form (Author, 2020)

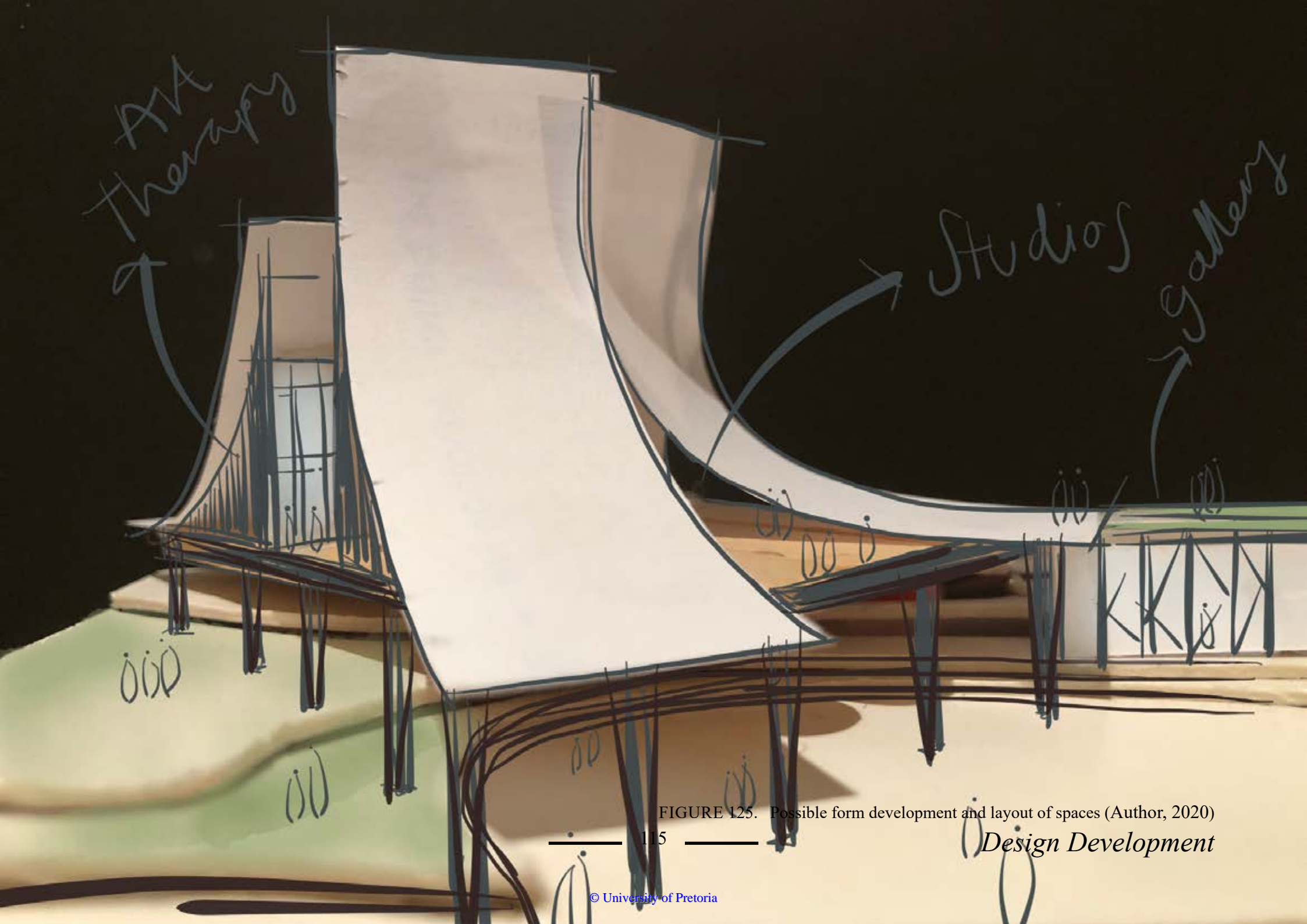
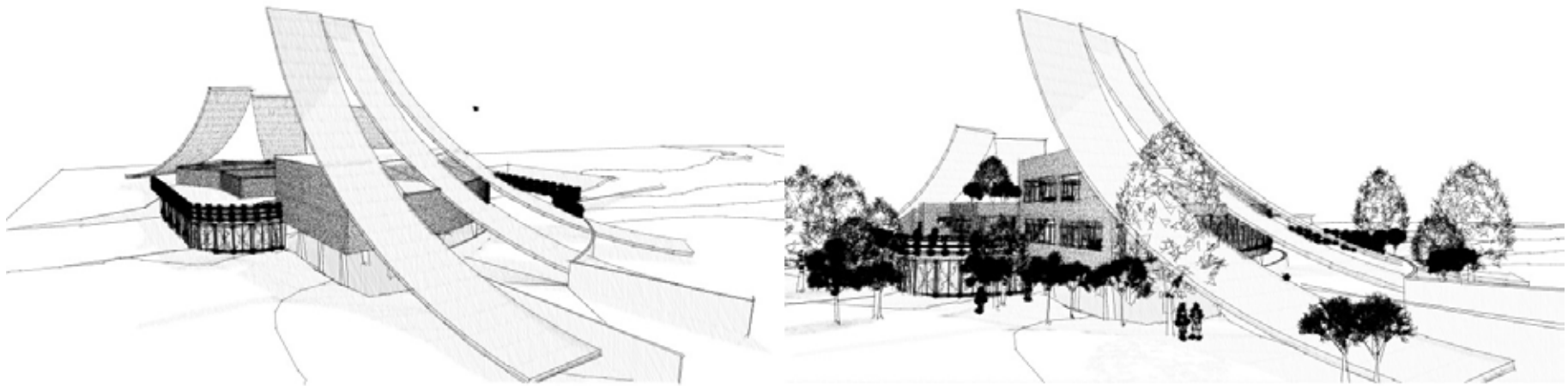


FIGURE 125. Possible form development and layout of spaces (Author, 2020)



Design Development

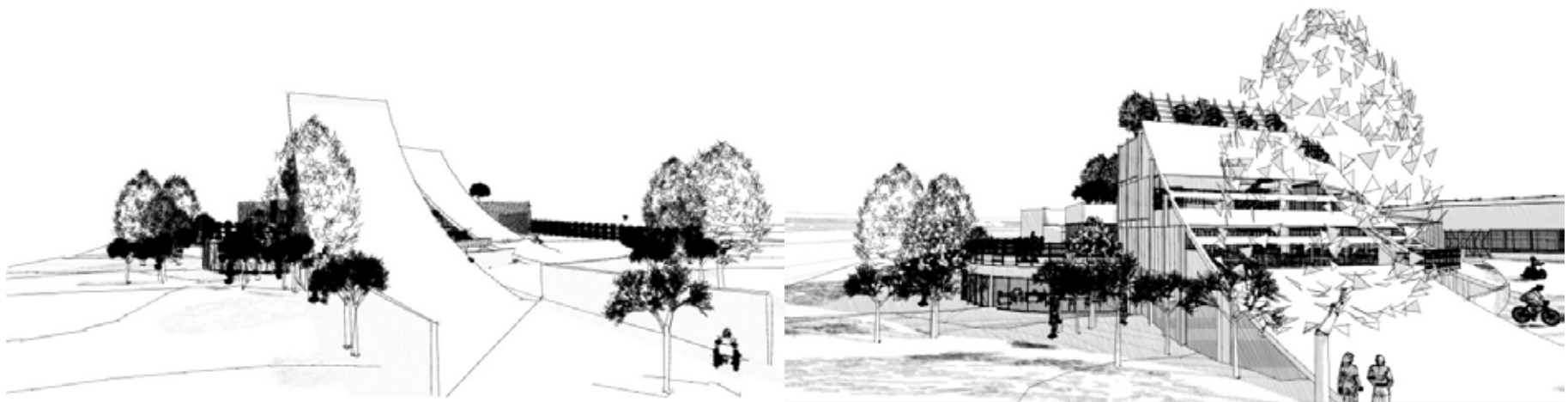


FIGURE 126 Design Evolution perspective (Author, 2020)

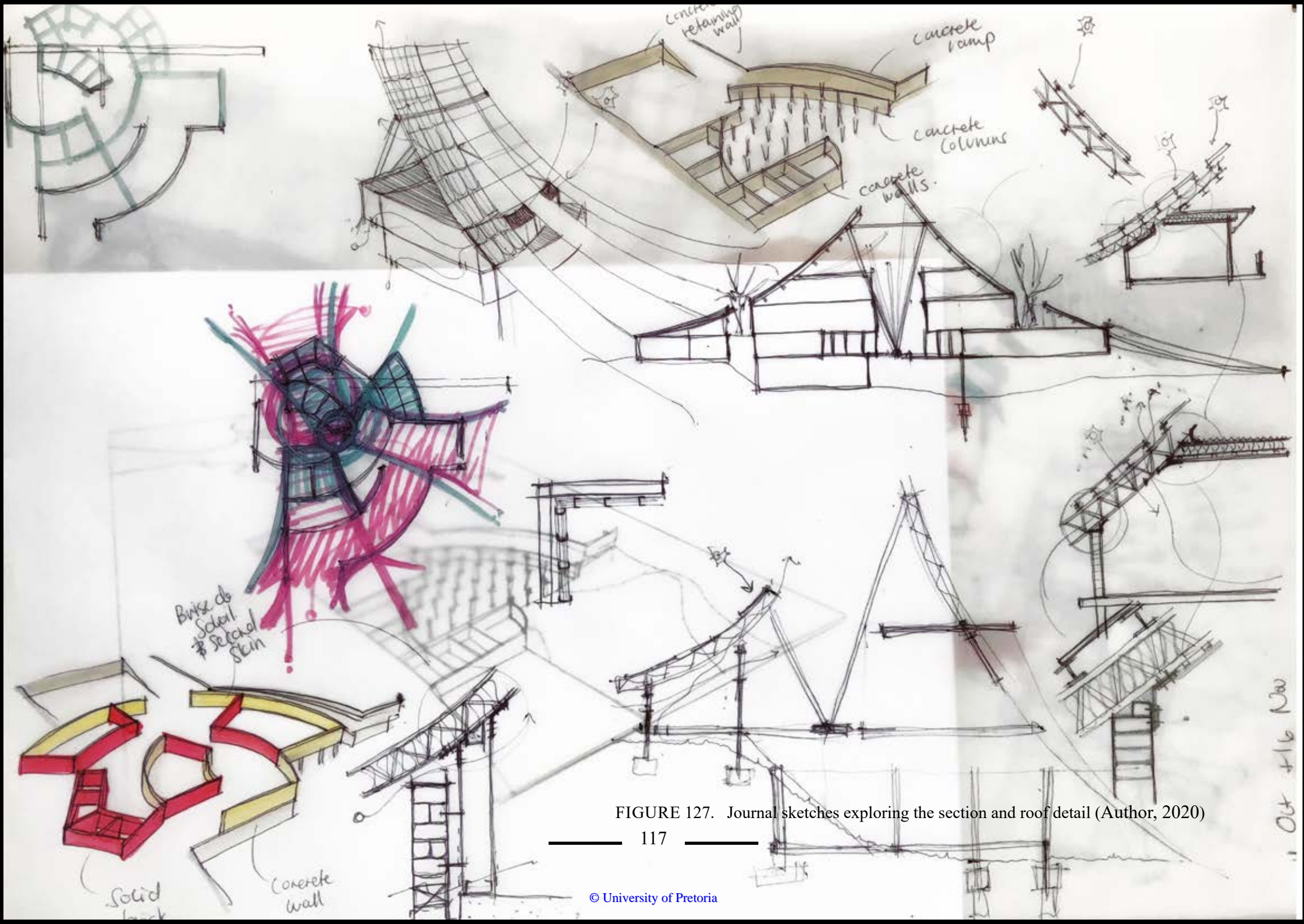


FIGURE 127. Journal sketches exploring the section and roof detail (Author, 2020)

1 Oct +16 Nov

Sectional Development

The sectional development follows the anatomy of a flower in the following ways:

- The earth is the foundation wherefrom all the needs of the intervention are drawn.
- The stem is imitated through columns that support the entire structure.
- The bud becomes the main building, which houses all the important functions.
- The petals extend into the sky, catching important elements like the sun and rain.

All these elements enable the flower to function as a complete individual that is specific to the region. It also creates beauty for those who behold it.



FIGURE 128. Section development of main studio building (Author, 2020)

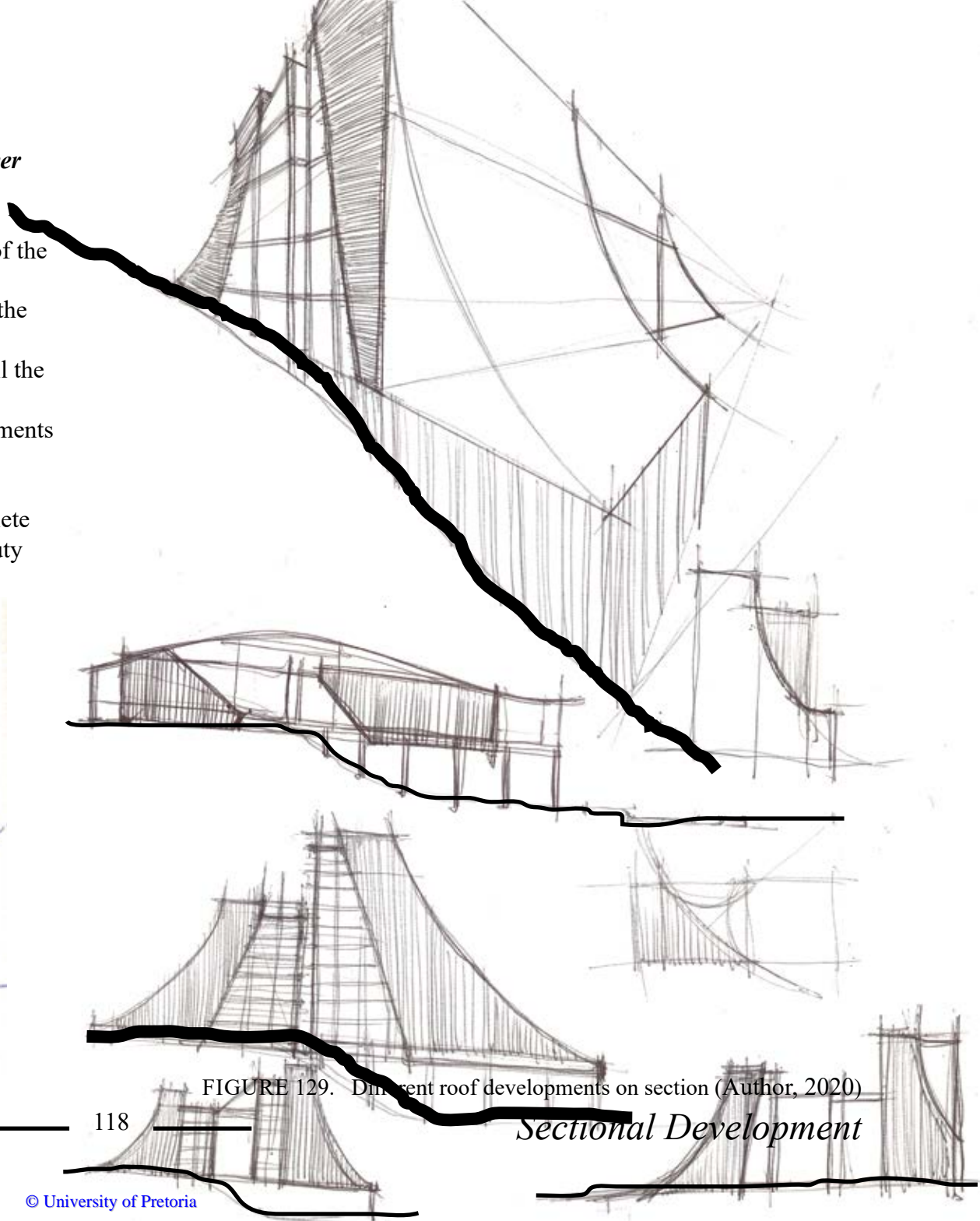


FIGURE 129. Different roof developments on section (Author, 2020)

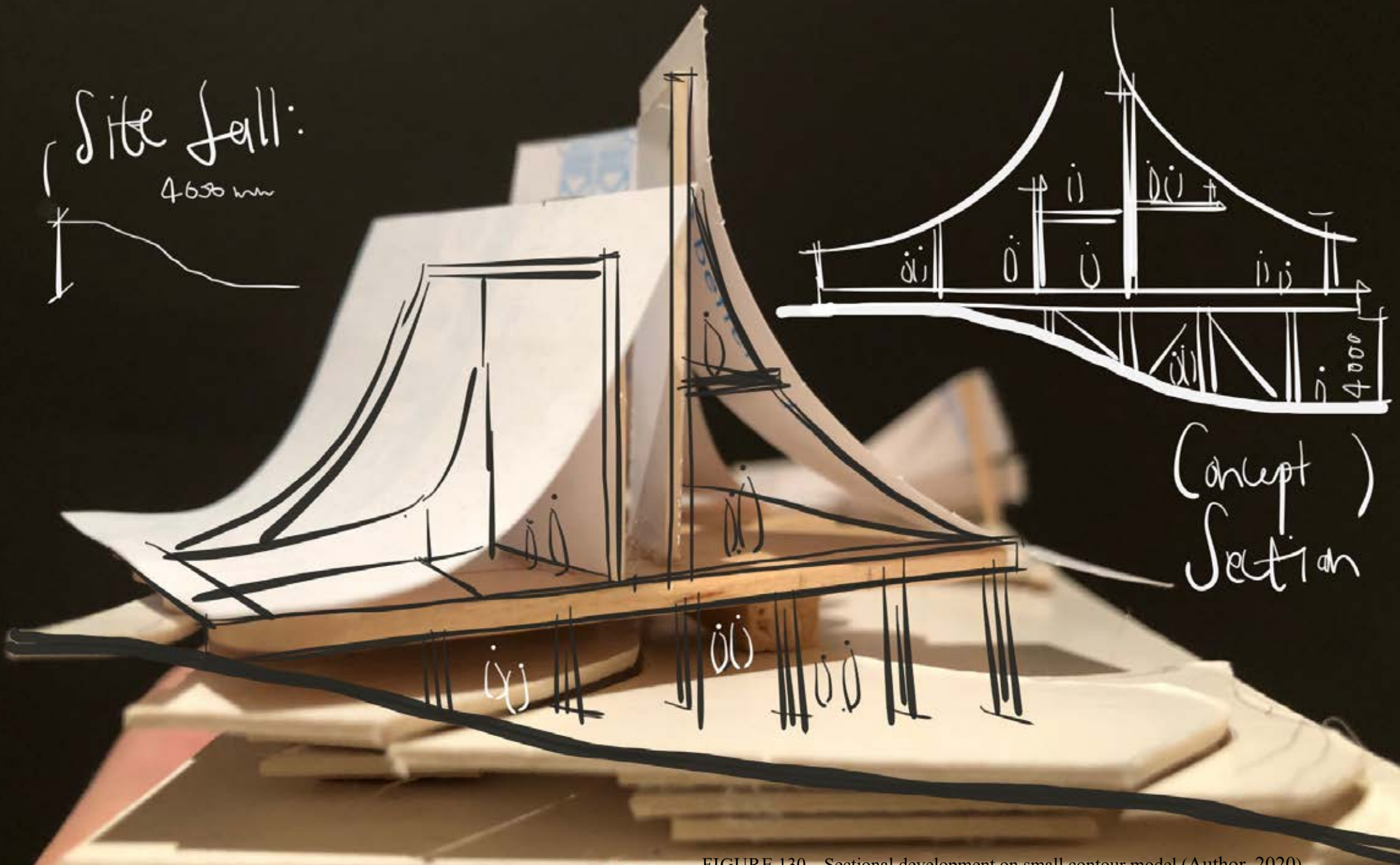
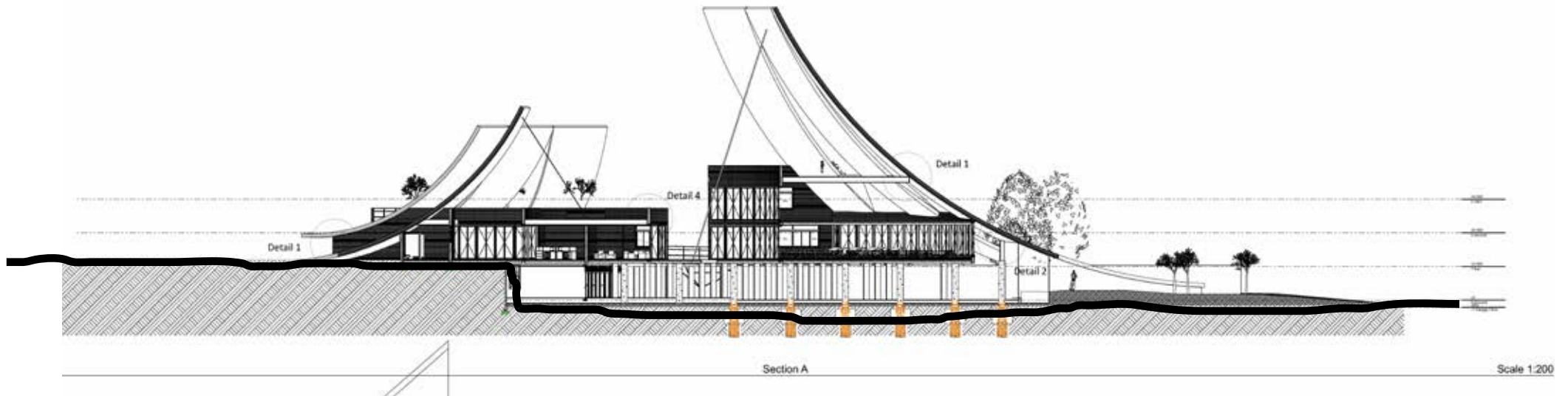


FIGURE 130. Sectional development on small contour model (Author, 2020)



ARCHICAD EDUCATION VERSION

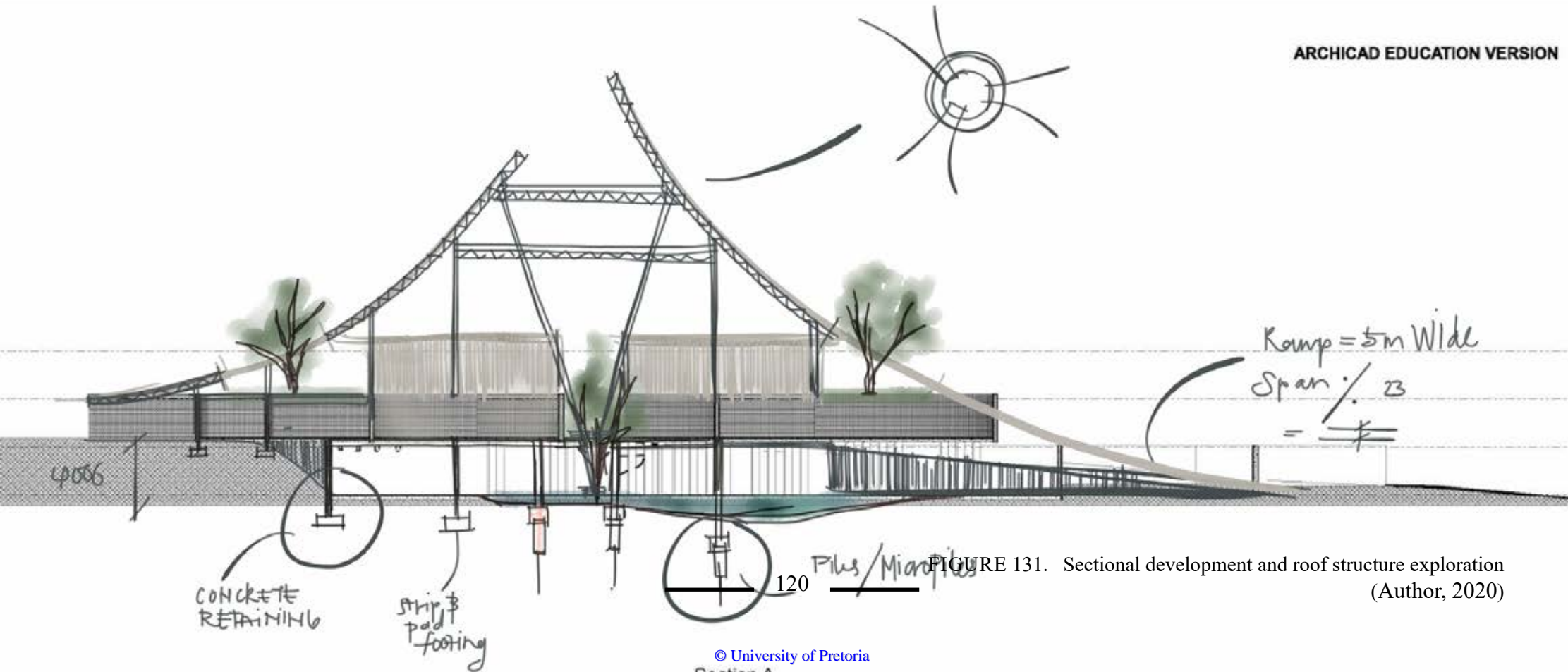


FIGURE 131. Sectional development and roof structure exploration (Author, 2020)

A steel roof truss detail exploration led to the decision that steel will not provide a seamless transition from concrete ramp to curved roof, thus concrete will be used for the roof and will create a continuation from ramp to roof.

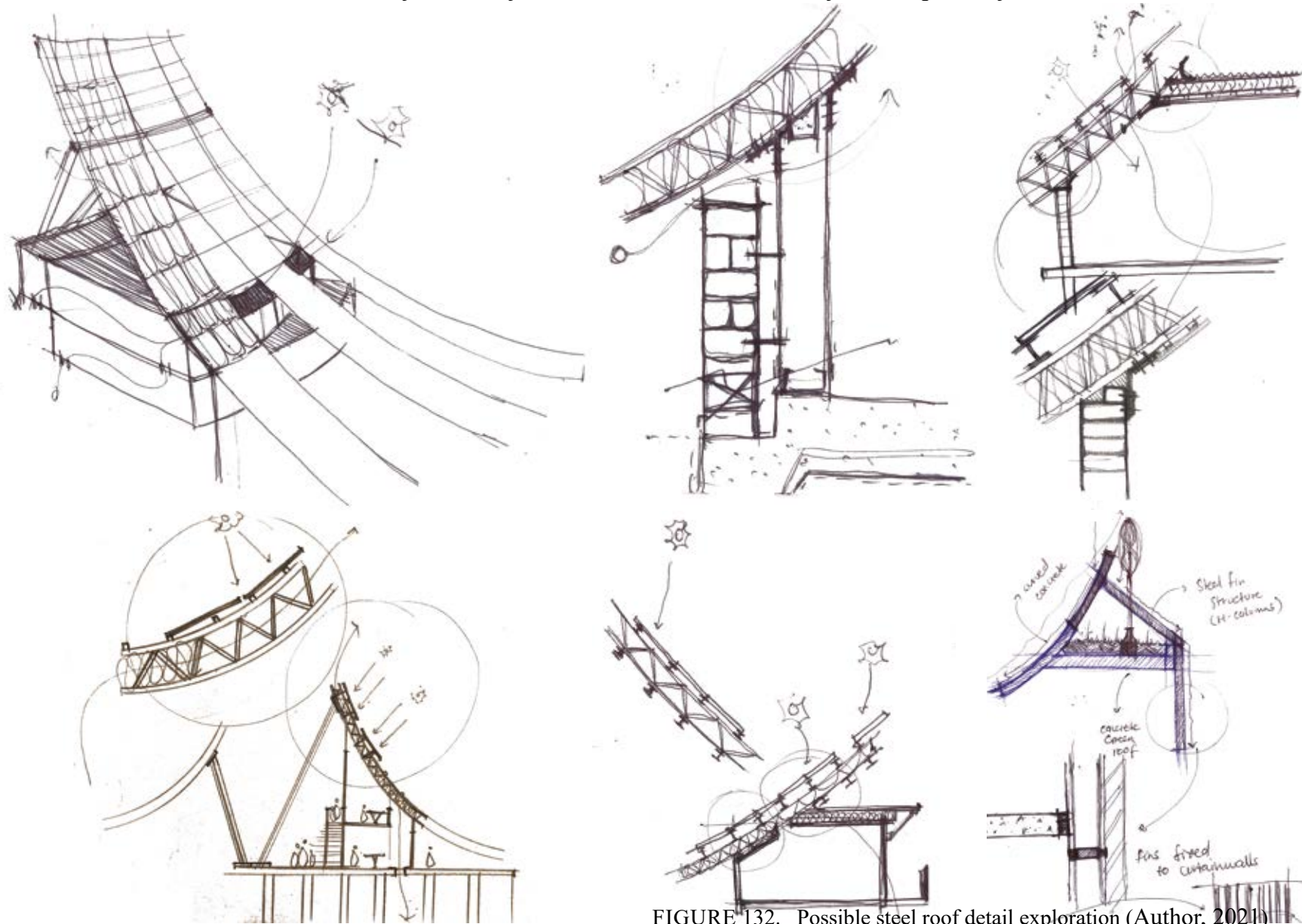


FIGURE 132. Possible steel roof detail exploration (Author, 2021)

Sectional Development

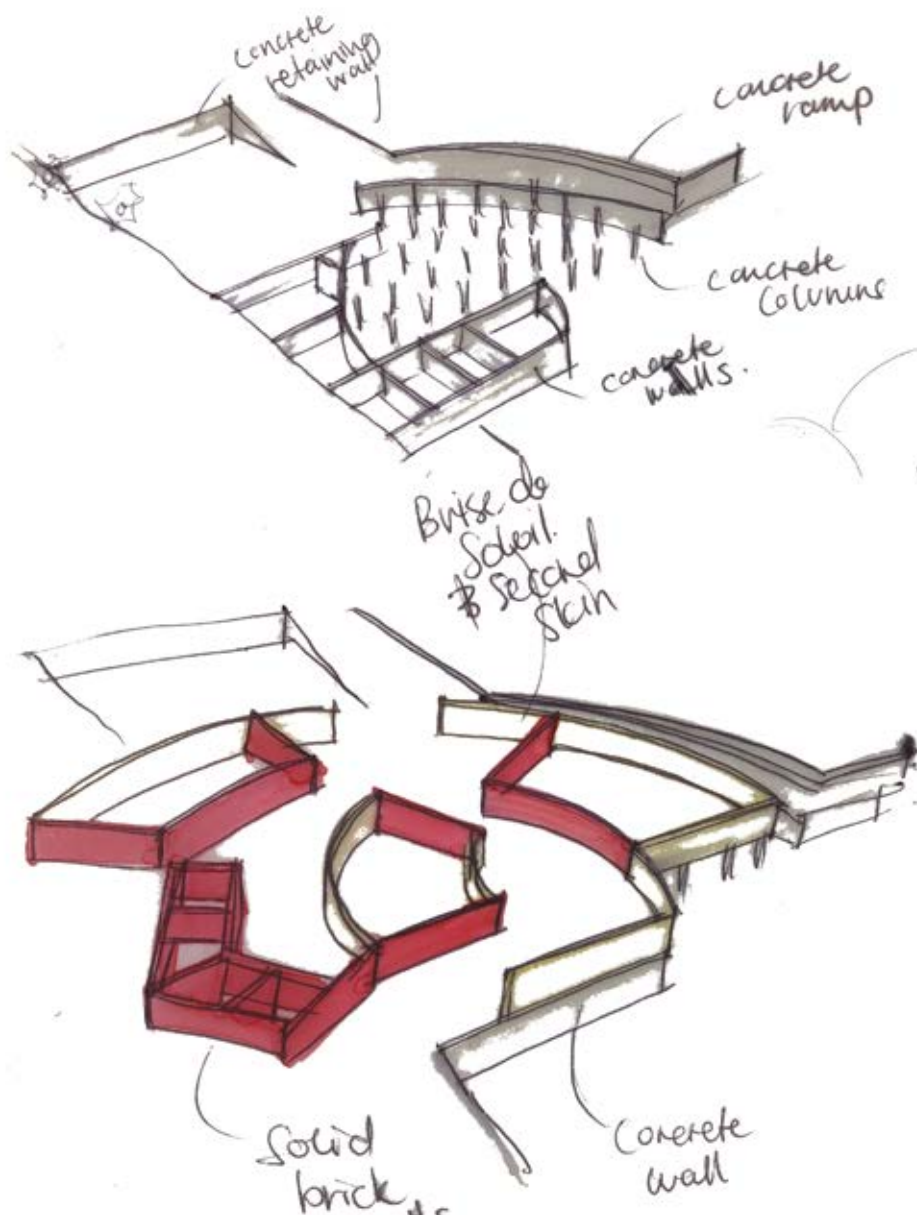


FIGURE 133. Sketched perspective of ground and first floor plans with material exploration (Author, 2021)

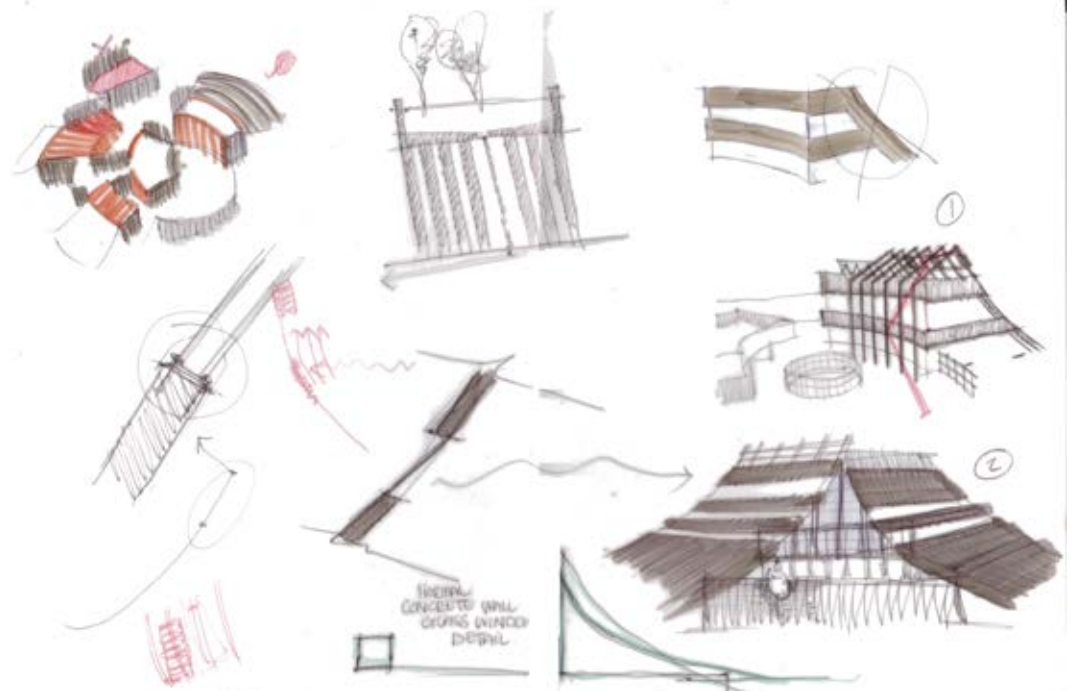


FIGURE 134. Detail facade development sketches (Author, 2021)

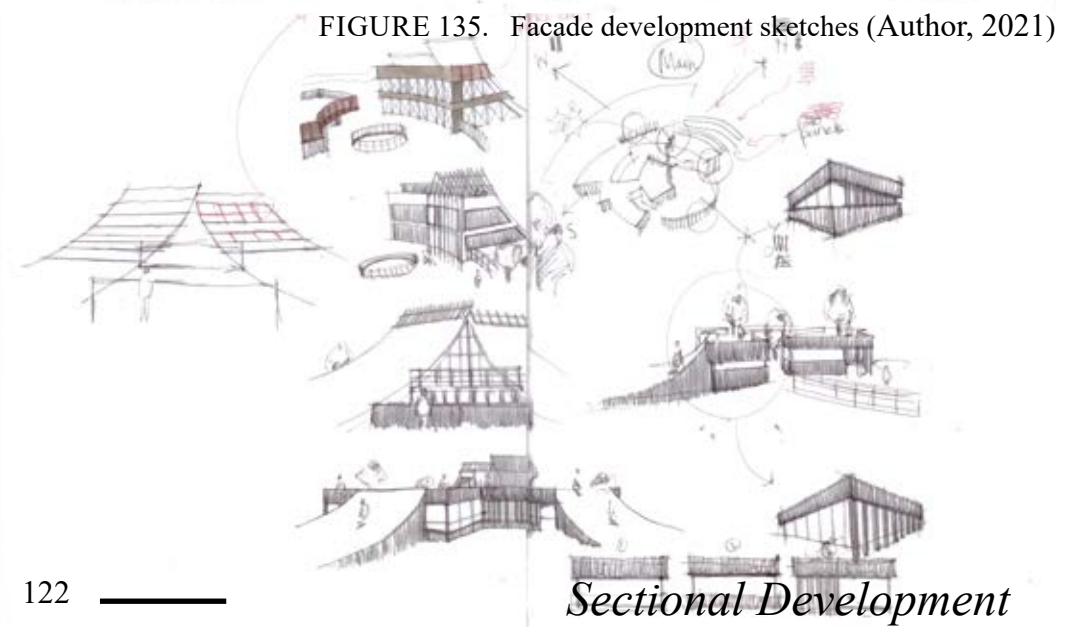


FIGURE 135. Facade development sketches (Author, 2021)



FIGURE 136. Render of public space in centre of proposed intervention (Author, 2021)

Material development

The material development coincides with the materials and beauty petals of the Living Building Institute's requirements, and it is an extension of the idea of connecting users to nature.

Tectonic to stereotomic materials should be used to enhance the sensory experience of the site and to enable a constant texture change.

These materials link the earth to humans to the sky.

To connect the materiality of the intervention with the solidity of the earth, a stereotomic heavy material like concrete is used (existing concrete to be recycled from site).

The intervention thus cuts into the earth so as to open up the site to users. The sunken ground floor consists of concrete retaining walls, skateboarding and movement ramps, and columns in the water pond.

To connect the materiality of the intervention with people, a heavyweight material is used in a lightweight manner.

The first floor connects to users with comprehensible material, like brickwork. A curved brick structure with concrete shading is incorporated to flow with the contours of the building and the movement of users.

The concrete shading also contributes to the overall phenomenology on site through the patterns created by shade which introduces movement through light. It also reveals that a seemingly heavyweight material can be used in a lightweight manner.

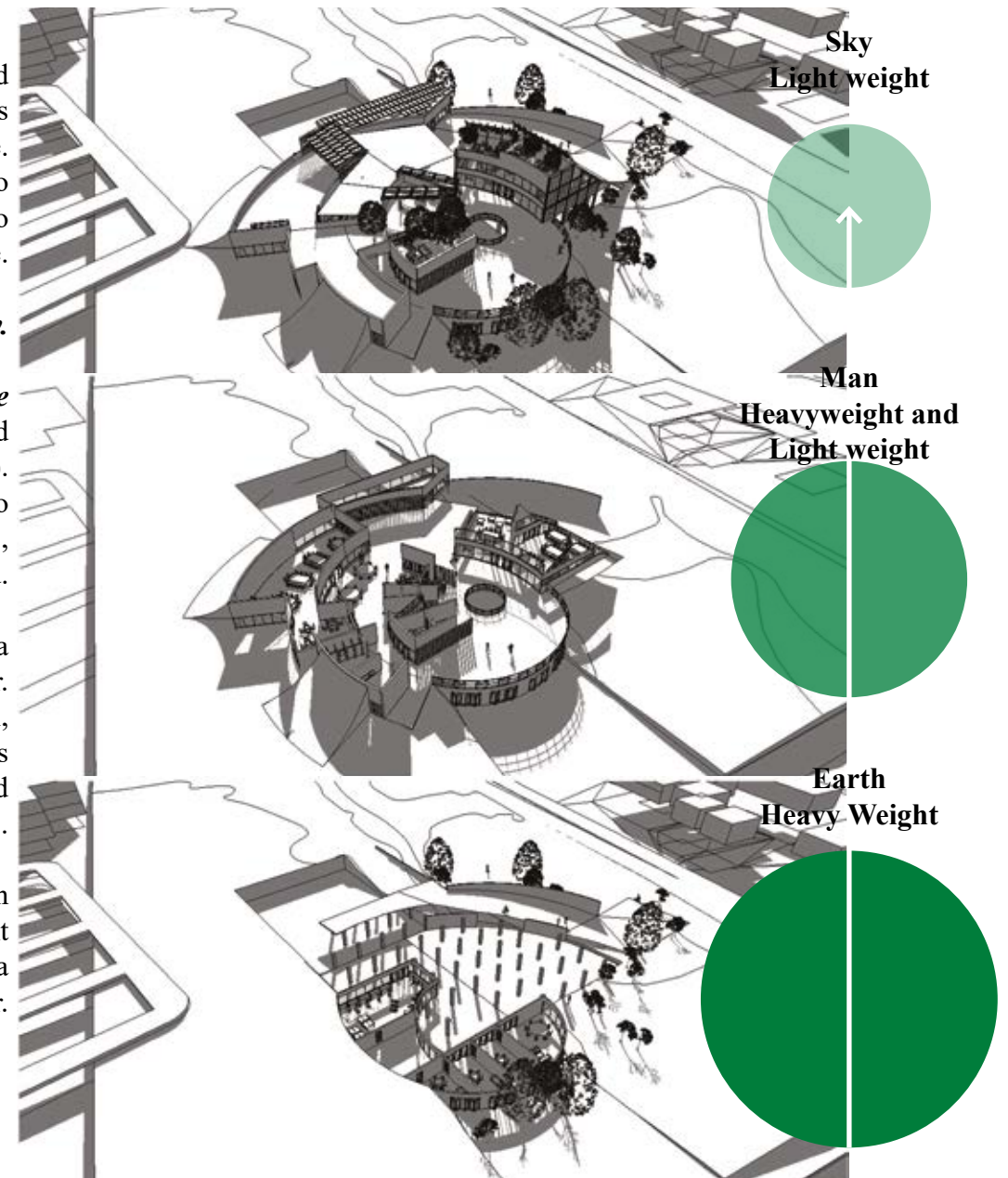


FIGURE 137. Material development exploration diagrams (Author, 2021)

Sectional Development

Roof development

To connect the materiality of the intervention with the sky, a lightweight steel structure is placed over the intervention creating a second layer of shade. This connection is also manifested literally with the structure extending into the sky, and with the system that sees the roof acting as a vessel for air filtration, regulation and power generation.

What becomes important are the connection details between the three different materials, and how these can facilitate the link between the different systems. The materials should be connected in the most appropriate way to ensure that they do not contrast with the conceptual aim or interfere with the different systems on-site.

The roof, like flower petals, is an element that attracts interest. It also protects the production spaces and functions of the intervention. In this intervention, the roof acts as a vessel for air filtration, airflow regulation, energy generation and it functions as a water catchment system.

The roof not only acts as a shelter and functional element but also becomes the public playground space on the ground floor as well as the main access ramp. The roof essentially becomes the element that ties the entire intervention together.

The decision was made to construct the roof from concrete to ensure a continuous flow from ramp to roof. A steel structure will be added over roof gardens for shading.

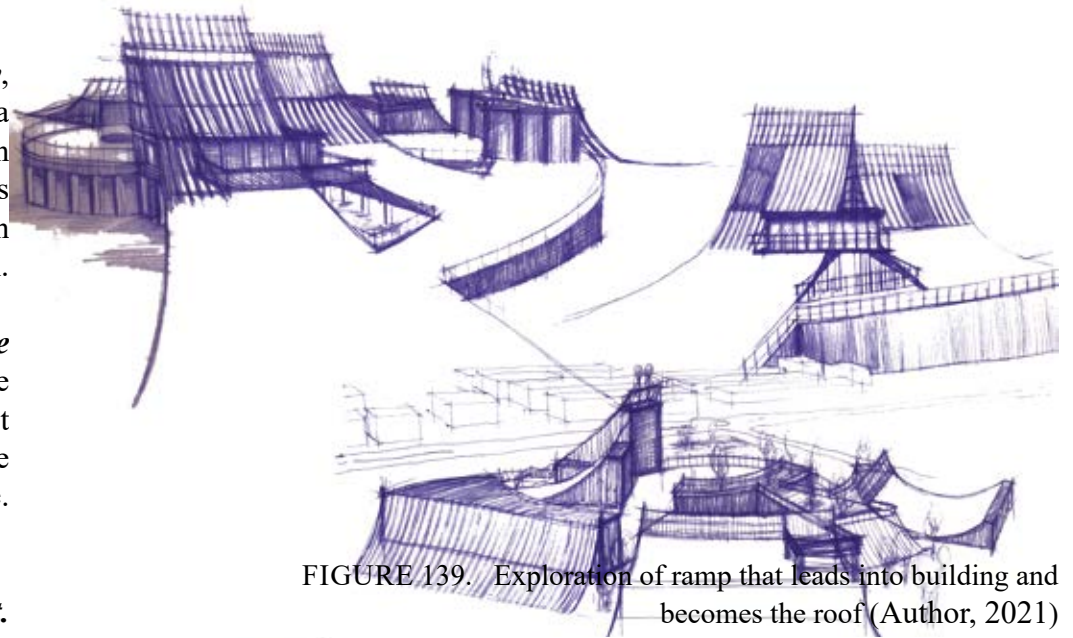


FIGURE 139. Exploration of ramp that leads into building and becomes the roof (Author, 2021)

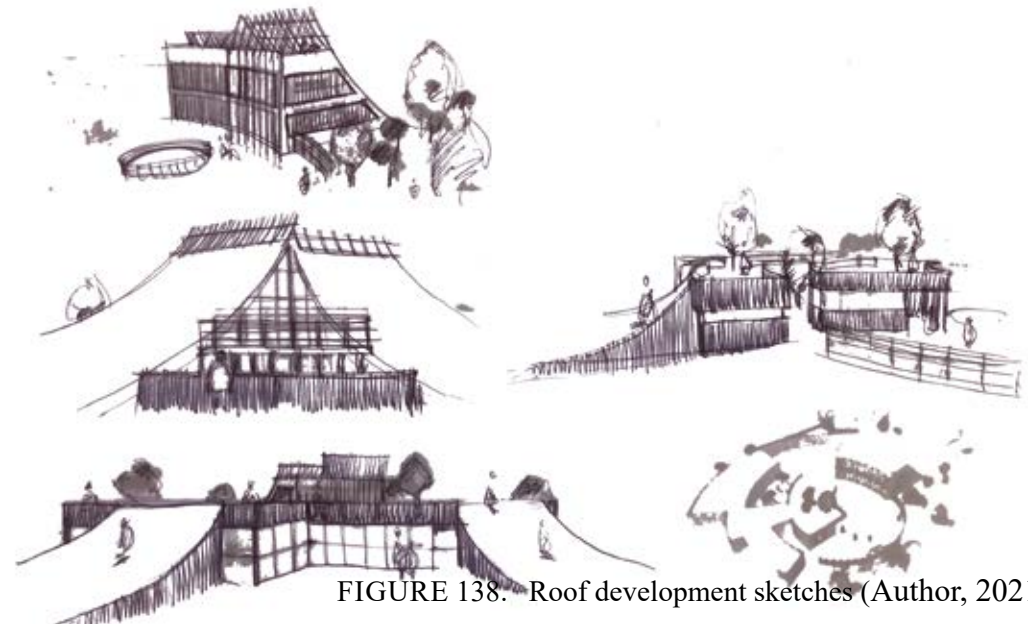


FIGURE 138. Roof development sketches (Author, 2021)

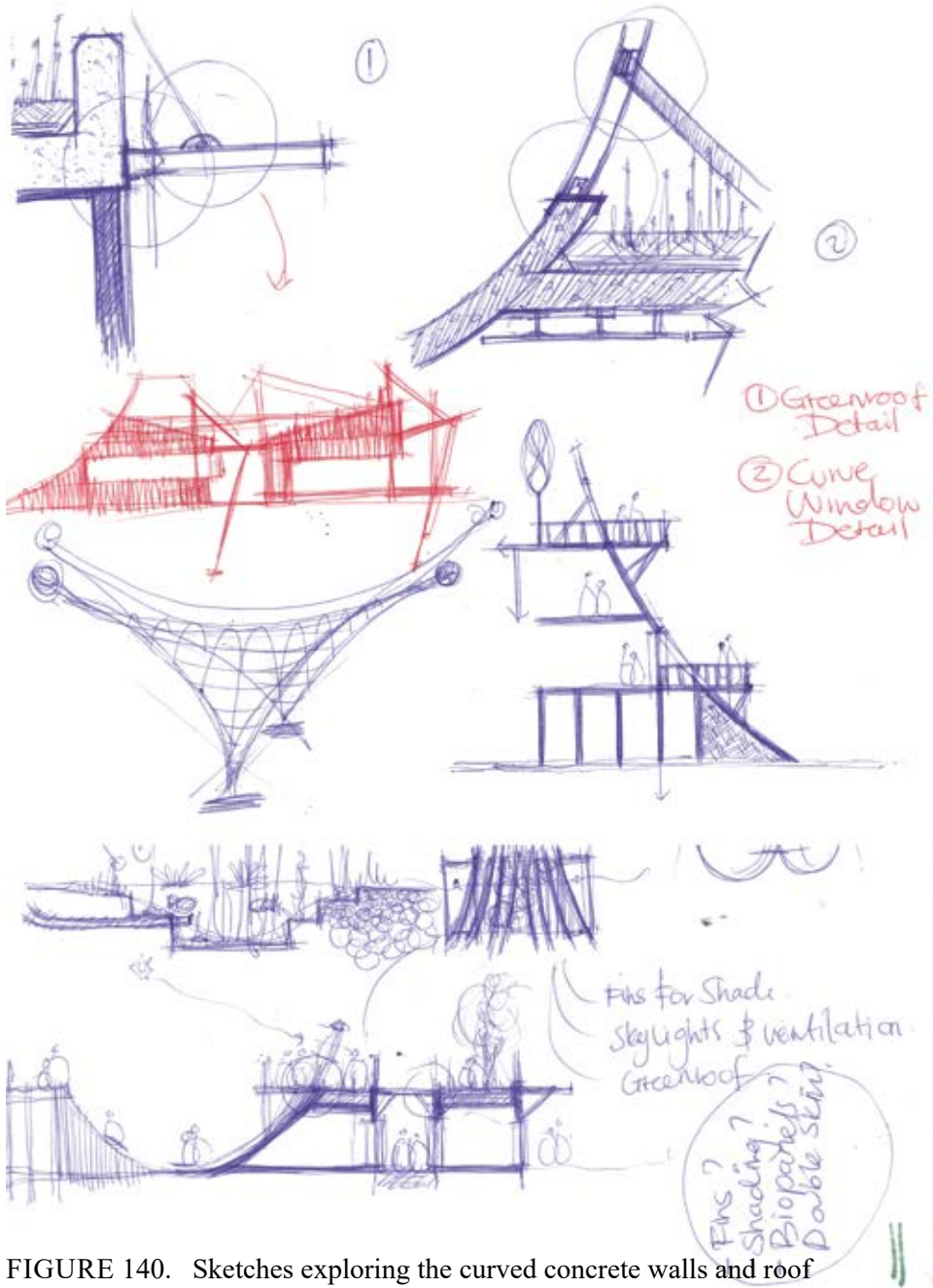


FIGURE 140. Sketches exploring the curved concrete walls and roof (Author, 2021)

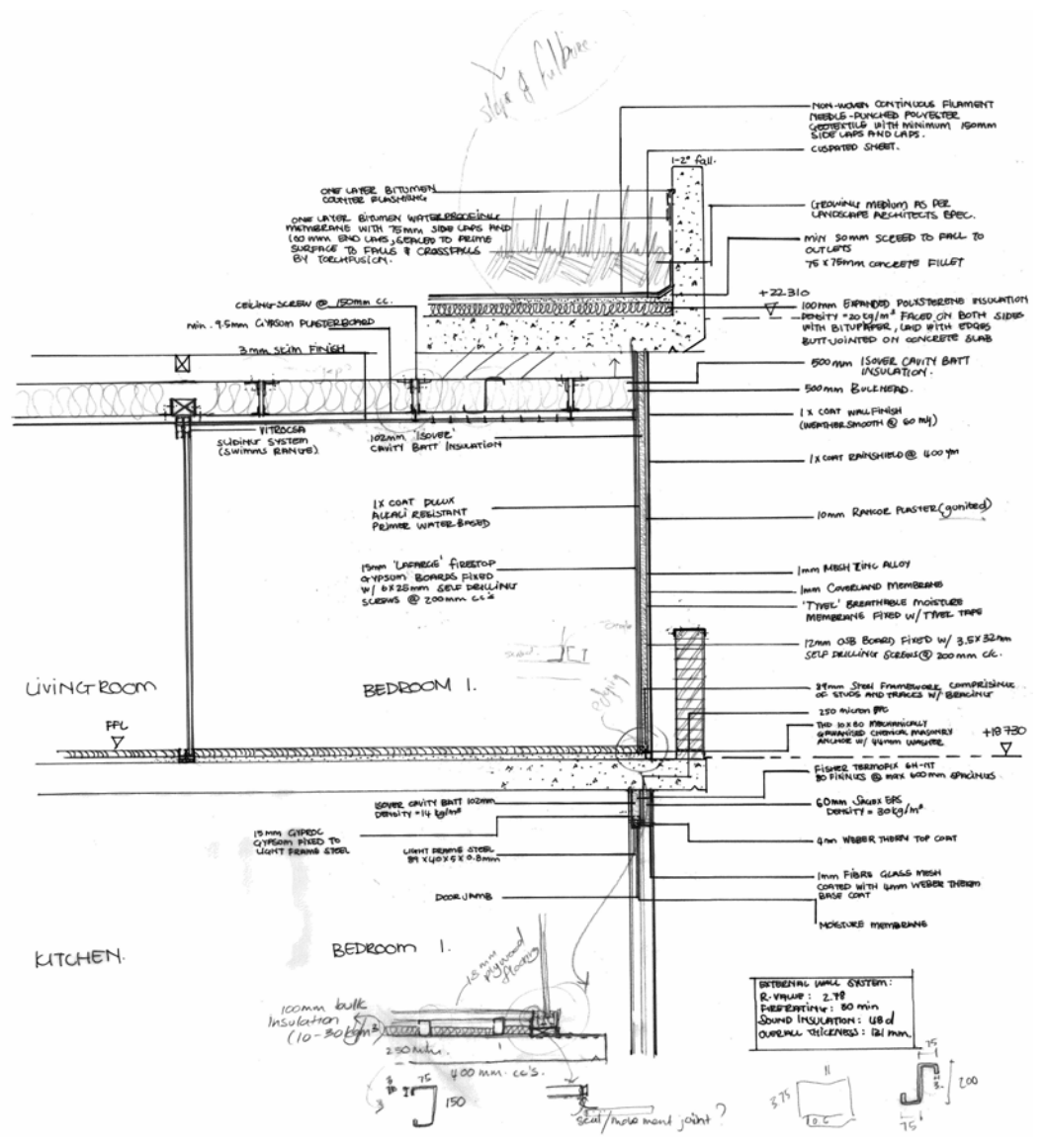


FIGURE 141. Sketch of green roof perimeter detail (Author, 2020)

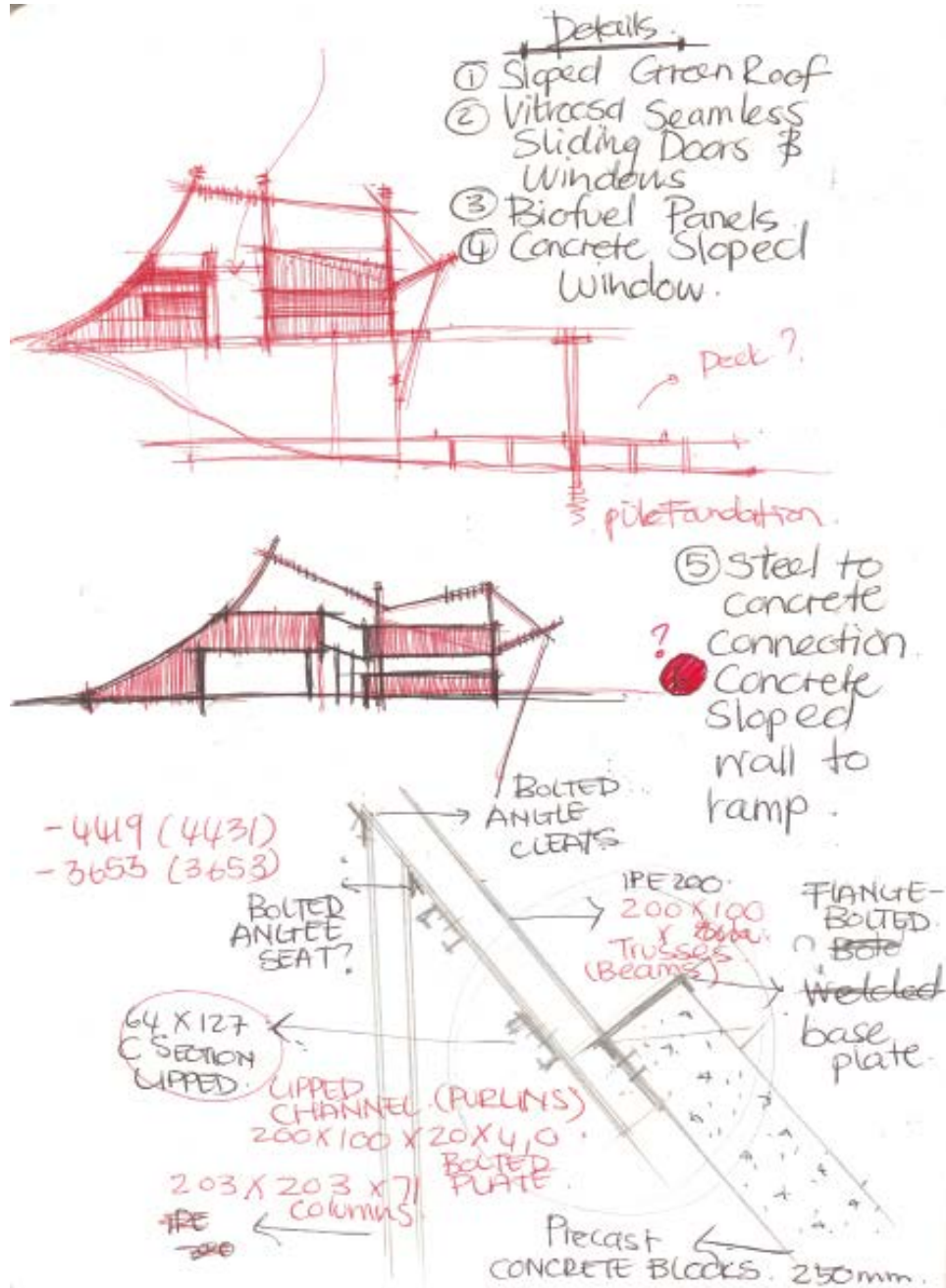


FIGURE 142. Steel shading detail exploration sketch (Author, 2021)

The slanted windows on the Northern facade of the studios ensure that the studio has a view of the adjacent street edge for safety and constant interior-external connection. The slanted window also prevents dust and water collection and provides a smooth slanted surface for optimal water collection.

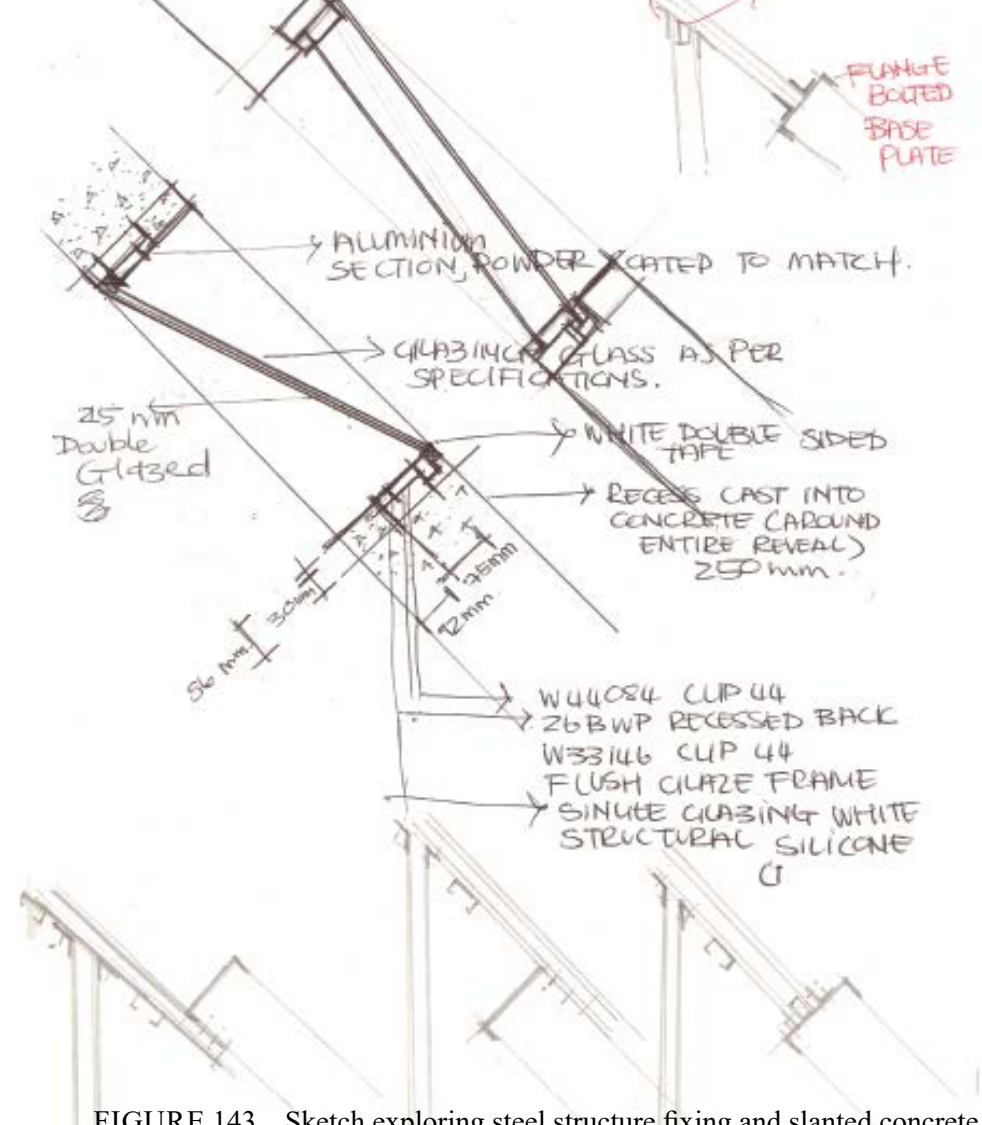


FIGURE 143. Sketch exploring steel structure fixing and slanted concrete window detail (Author, 2021)

Daylighting, Over lit, Daylight factor and Illuminance Studies



Annual Daylighting (illuminance)

FIGURE 144. Illuminance study (Sefaira, 2021)

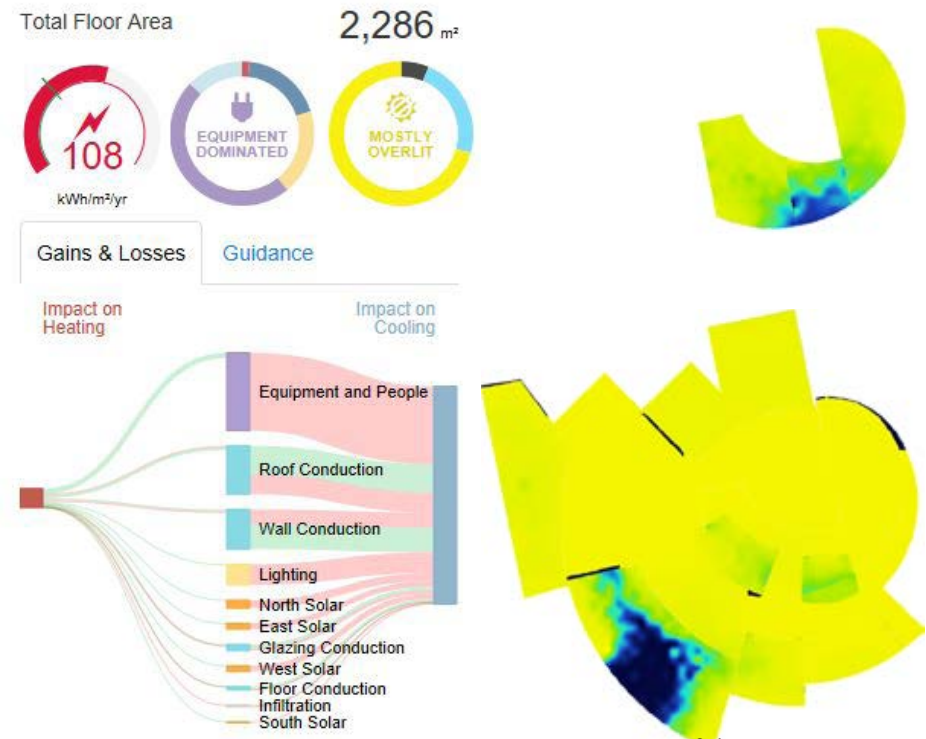
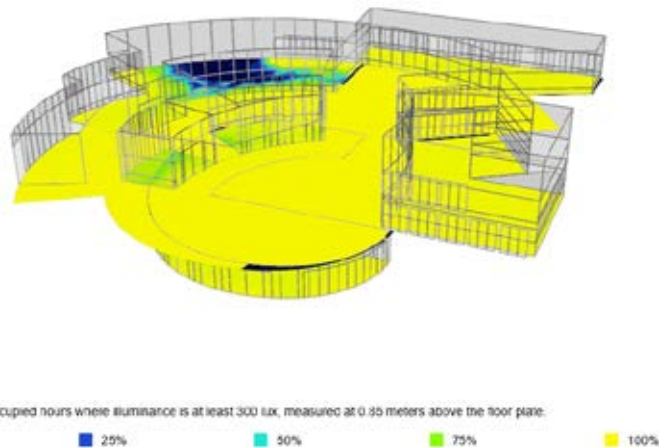
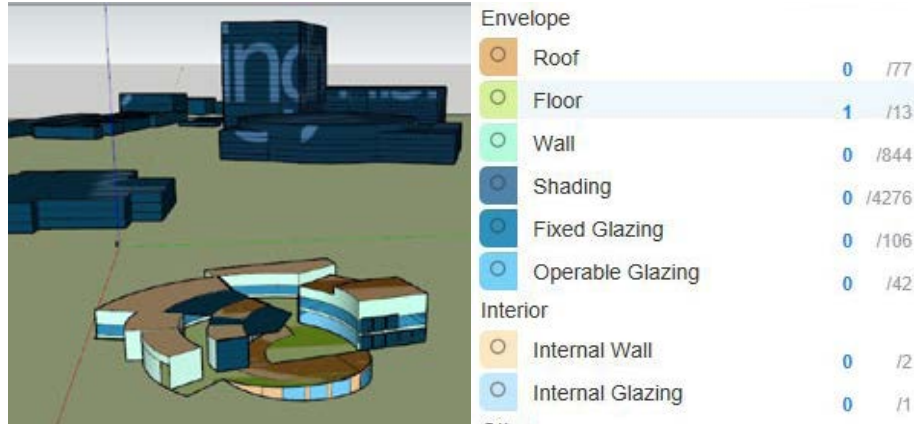


FIGURE 145. Illuminance study floor plans and data (Sefaira, 2021)
The proposed intervention provides enough illuminance ranging between 75%-100% where the daylighting is at least 300 lux for the yearly occupied hours.

The south western studio and lecture space shows a very low illuminance percentage indicating that the space needs more daylight. The recommended lux for a space of education is 200 lux so this space needs to be adjusted accordingly. The ground floor also shows a low lux but this is good as the photography spaces only require a lux of 5 (Sefaira, 2021).

Daylighting, Over lit, Daylight factor and Illuminance Studies



Over lit and Under lit

FIGURE 146. Over lit and Under lit study (Sefaira, 2021)

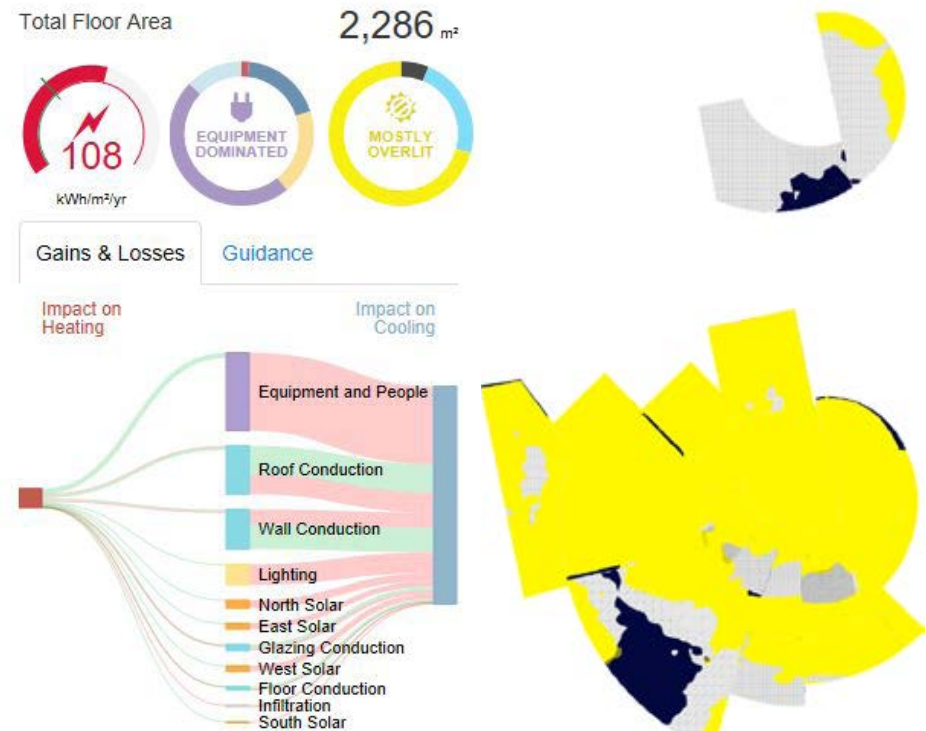
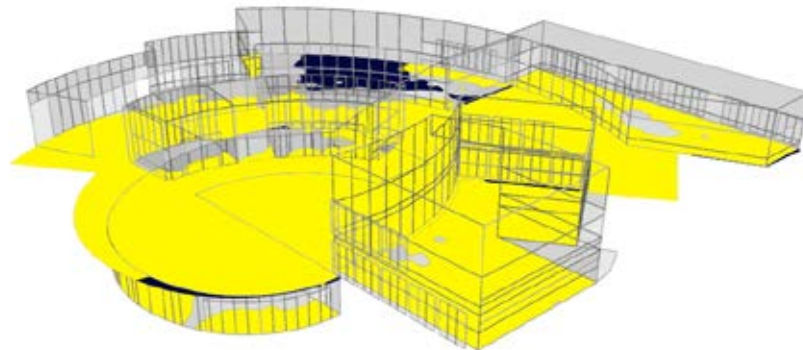
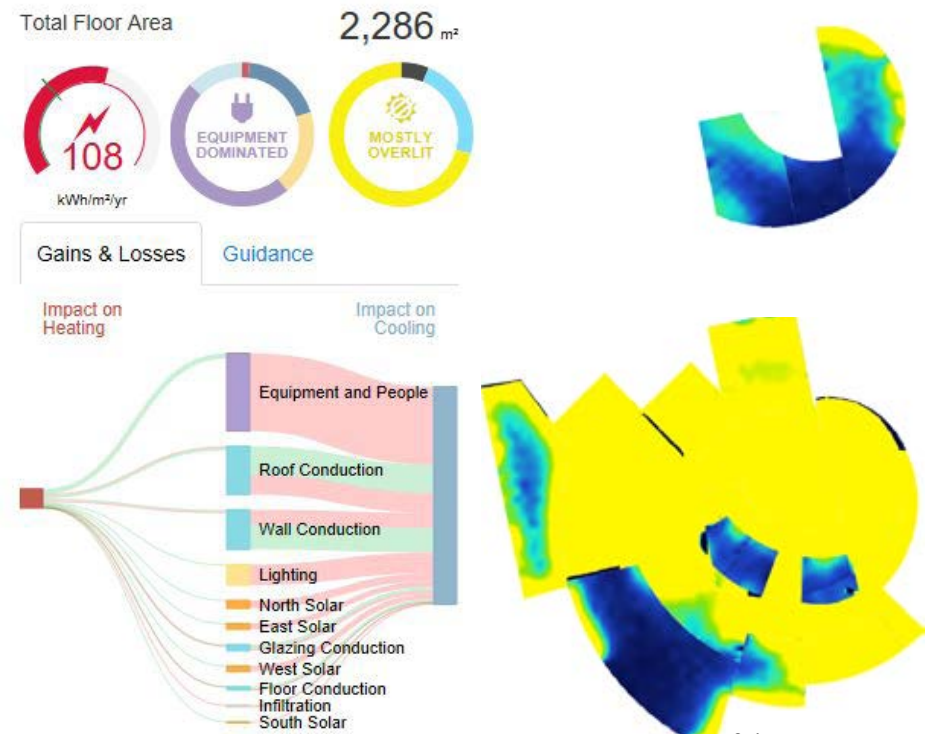


FIGURE 147. Over lit and Under lit floor plans and data (Sefaira, 2021) The over and under lit study shows that most of the proposed intervention is overlit. This will produce an uncomfortable amount of glare and heat, especially in the summer months, and should thus be shaded to lower the over lit factor especially in the northern studio space. The south western studio and lecture space is again under lit due to the lack of illuminance and should thus be opened up to more natural light through roof lights or more glazing to the south.

The sDA (spatial daylight autonomy) is 94% which is 20-40% higher than the recommended 60-80%. The ASE is 71% which is also too high (Sefaira, 2021).

Daylighting, Over lit, Daylight factor and Illuminance Studies



Daylight Factor

FIGURE 148. Daylight factor study (Sefaira, 2021)

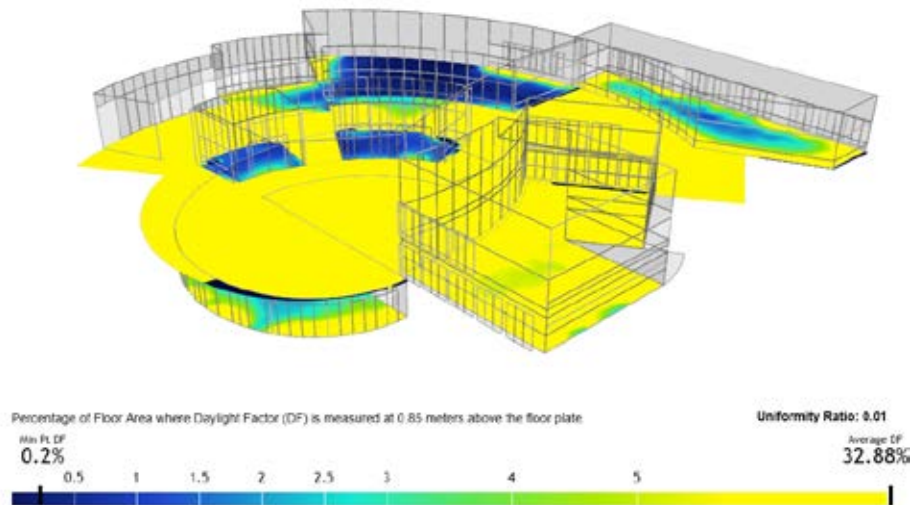
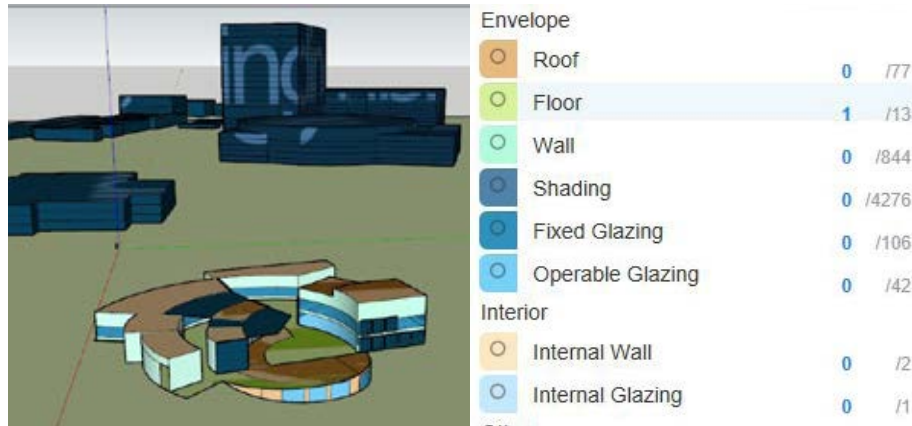


FIGURE 149. Daylight factor study floor plans and data (Sefaira, 2021)
The average Daylight Factor is 32.88% and the minimum is 0.2%. This is primarily in the south western studio and lecture space as well as the offices.

The northern studio spaces require shading to better control the daylight factor fluctuations to ensure optimal comfortability in a learning environment.

The outside spaces should be controlled through natural shading (trees) to increase thermal comfort and decrease heat and glare (Sefaira, 2021).

Daylighting, Over lit, Daylight factor and Illuminance Studies



Direct Sunlight

FIGURE 150. Direct sunlight study (Sefaira, 2021)

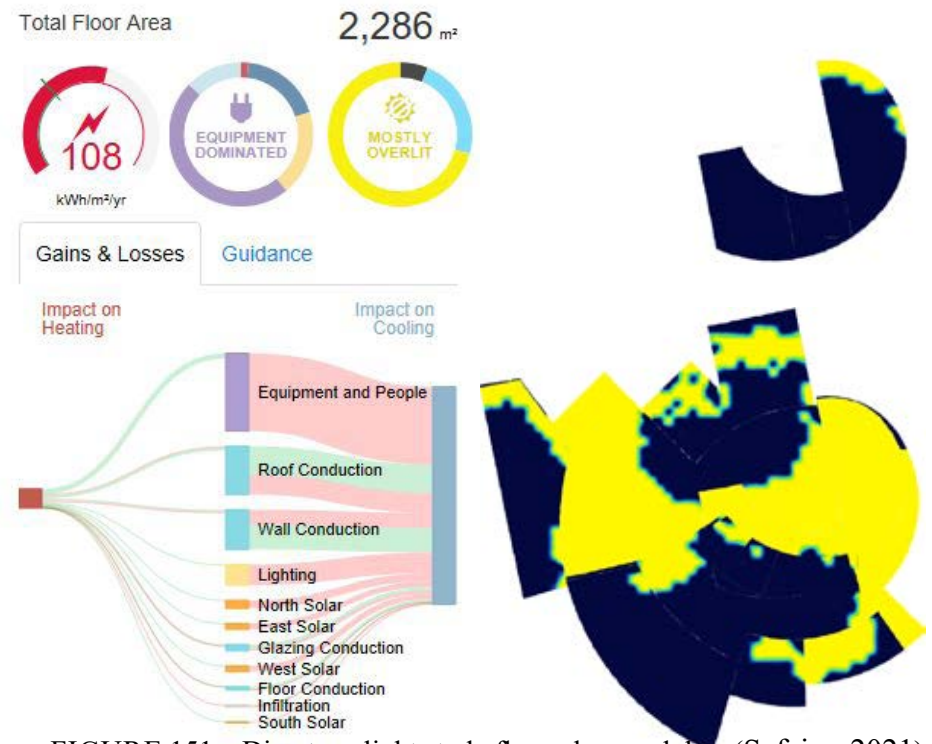
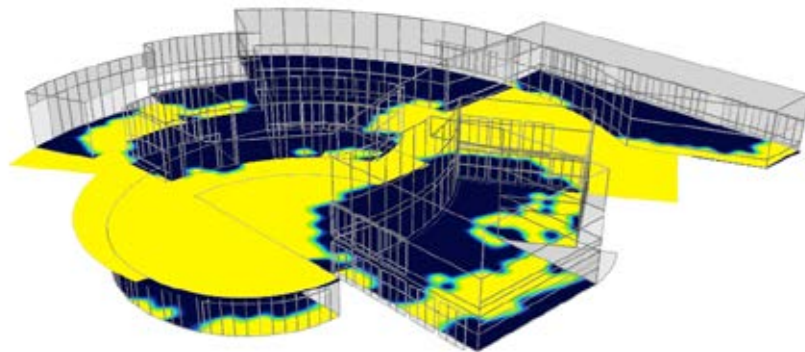


FIGURE 151. Direct sunlight study floor plans and data (Sefaira, 2021) The direct sunlight analysis show that most outside spaces receive the required amount of 3 hours direct sunlight per day throughout the year. This can be controlled through natural elements like trees and shading.

The internal spaces show that little to no direct sunlight enter the spaces. This can be rectified with larger windows with shading that provide filtered light for a better internal environment (Sefaira, 2021).

Dry Bulb Temperature and Comfortability

DRY BULB TEMPERATURE RESULTS - ZONE BREAKDOWN						
Floor	Zone	Zone Type	Floor Area	Heating Setpoint	Cooling Setpoint	Pass/Fail
			m2	°C	°C	
2	C09	Core	66	18,5	26	pass
2	C08	Core	35	18,5	26	pass
2	C07	Core	68	18,5	26	pass
2	C06	Core	28	18,5	26	pass
2	C05	Core	27	18,5	26	pass
2	C04	Core	26	18,5	26	pass
2	C03	Core	8	18,5	26	pass
2	C02	Core	246	18,5	26	pass
2	C01	Core	186	18,5	26	pass
Comfort						
Total Unmet Hours	Av. % Comfortable - Dry Bulb	% Building Passing - Dry Bulb				
hrs	%	% area				
2600	70	30				

FIGURE 152. Dry Bulb comfort data table (Author & Sefaira, 2021)

The dry bulb temperature and comfortability shows that most spaces are 70% comfortable, but only 30% of the zones pass.

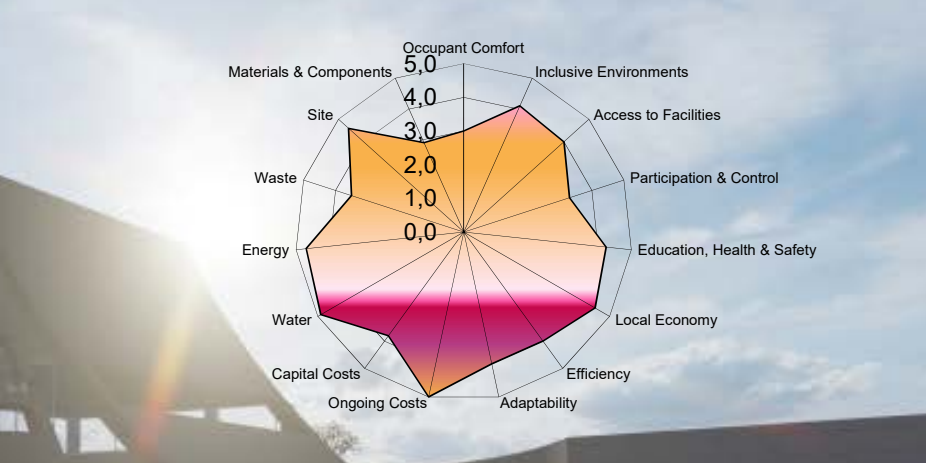
This is due to the lower level being built into the landscape. To ensure that those spaces are comfortable, natural ventilation will be implemented through the placement of operational windows and doors. All therapy offices open to the outside as well as the ground level public space which creates cross ventilation (Sefaira, 2020).

The therapy and movement gymnasium also opens to outside on both ends to provide cross ventilation. The configuration of the spaces, as well as the design of the ground floor height will create a wind tunnel (much like an underground parking lot) which creates a constant flow of air.

The same principles are implemented on the first floor where all spaces have cross ventilation of natural air.

SUSTAINABLE BUILDING ASSESSMENT TOOL (SBAT- P) V1

PROJECT	ASSESSMENT
Project title: The Eco-Urban Therapy Center	Date: January 2020- January 2021
Location: Pretoria, South Africa	Undertaken by: Cosette Minnaar
Building type: Multi-Use therapy center	Company / organisation: The University of Pretoria
Internal area (m2): 1470 m2	Telephone 823472964
	Email: cosette.minnaar@gmail.com



Environmental	4,1
Economic	4,3
Social	3,7
Overall	4,0

FIGURE 153. SBAT rating data and diagram (Author, 2021)

FIGURE 154. Render of proposed intervention and concrete ramp (Author, 2021)

Shadow Study



FIGURE 155. December 21 9 am shadow study diagram (Author, 2021)

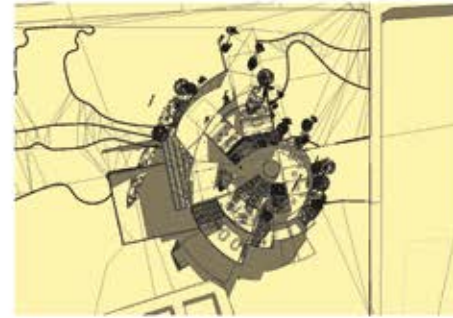


FIGURE 158. June 21 9 am shadow study diagram (Author, 2021)



FIGURE 156. December 21 12 pm shadow study diagram (Author, 2021)



FIGURE 159. June 21 12 pm shadow study diagram (Author, 2021)



FIGURE 157. December 21 3 pm shadow study diagram (Author, 2021)



FIGURE 160. June 21 3 pm shadow study diagram (Author, 2021)

Shading

FIGURE 161. Concrete shading (Author, 2021)



Concrete vertical shading on the western and eastern facades.

Shading

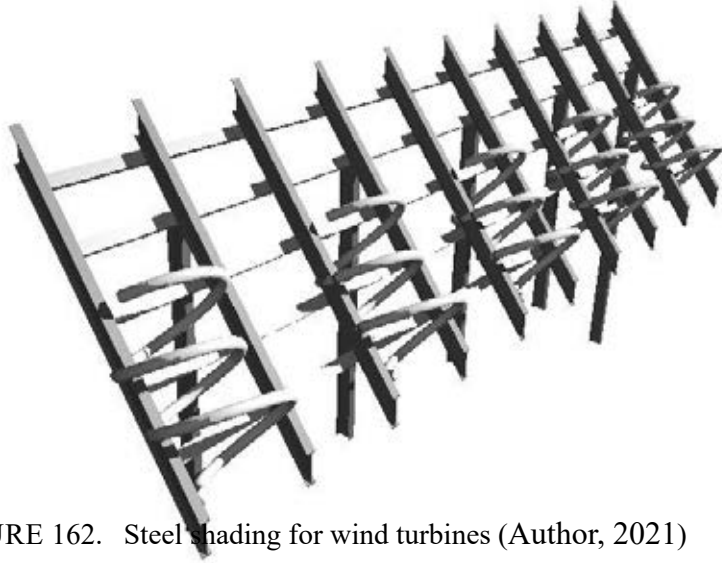


FIGURE 162. Steel shading for wind turbines (Author, 2021)

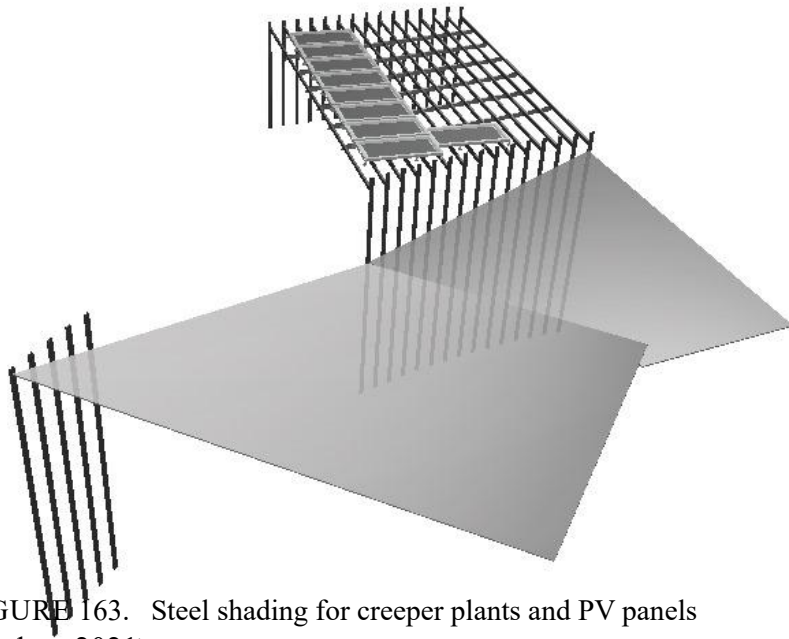


FIGURE 163. Steel shading for creeper plants and PV panels (Author, 2021)

Steel frames that provide shade, space for creeper plants to grow and provide natural shade on roof gardens. These structures also provide space for photovoltaic panels and wind turbines.

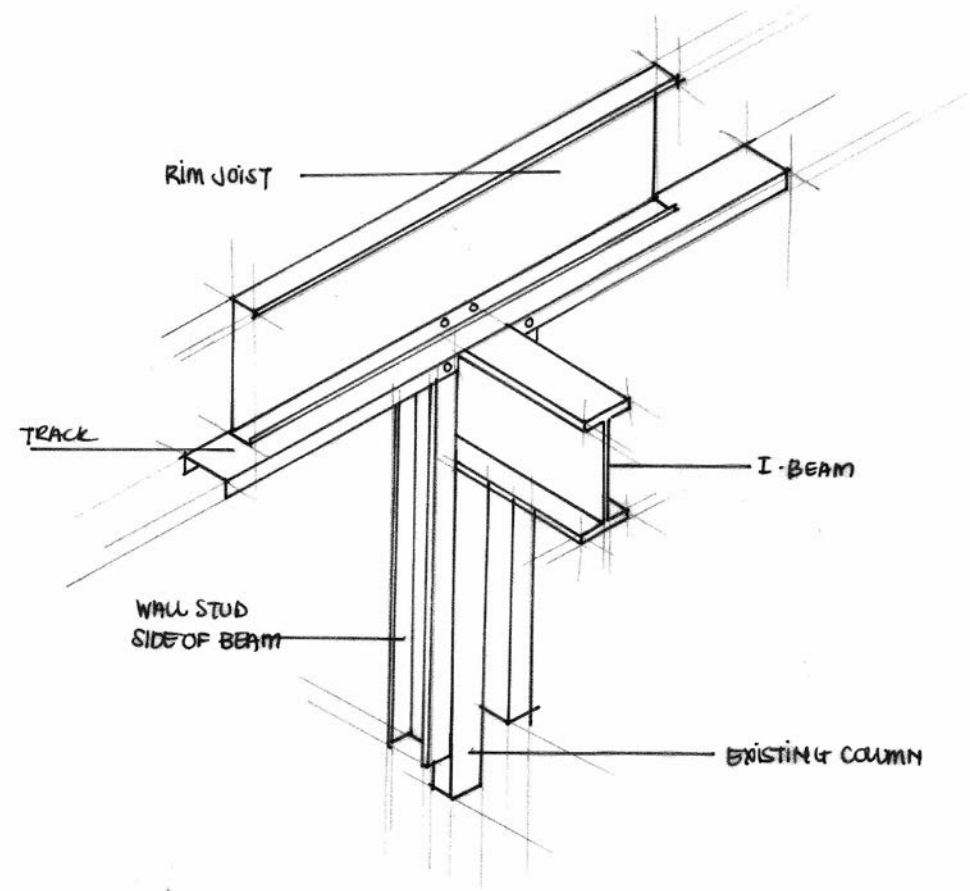


FIGURE 164. Steel connection detail development (Author, 2020)

Shading

Biophilic algae panels provide further shade on western and eastern facades to reduce temperature, reduce CO2 and provide soft filtered light.



FIGURE 165. Biopanel shading perspective (Author, 2021)

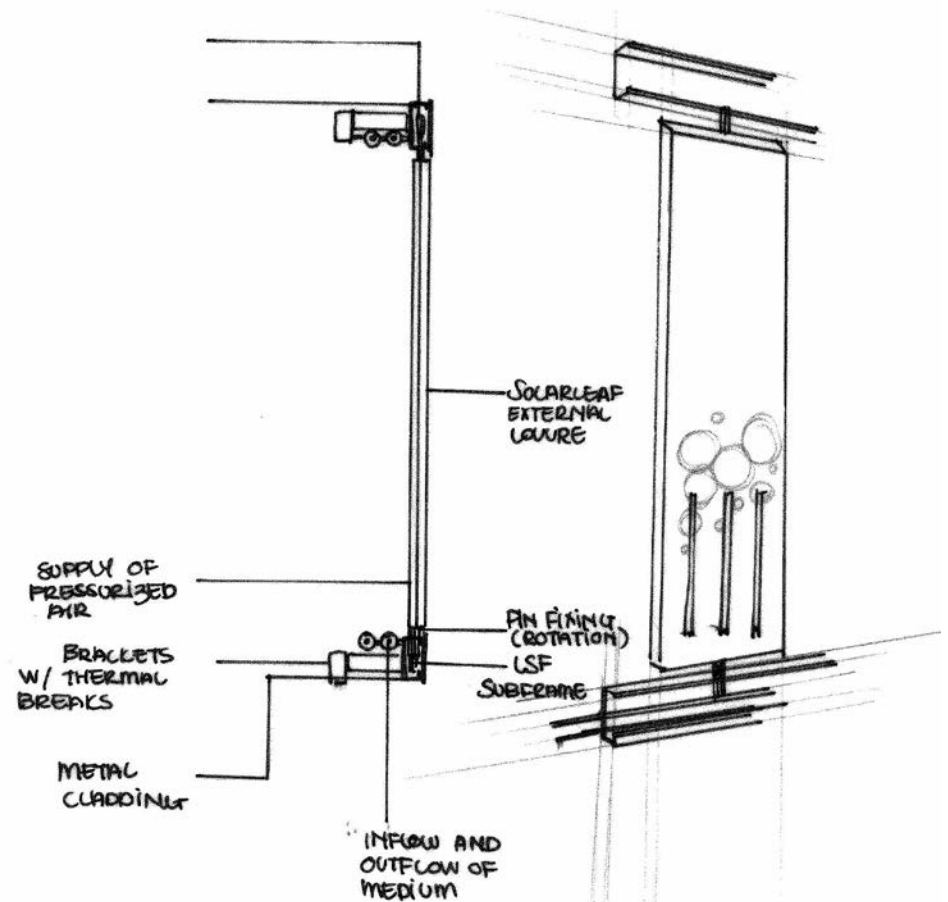


FIGURE 166. Biopanel shading detail sketch (Author, 2021)

Chapter 7

Technology

Technology Normative Position

Technical Argument

Technical Intentions

Technological Precedents

BIT Sports Center, Haidian Qu, China 2019, Atelier Alter Architects

Cloaked in bricks, Tehran, Iran 2015, Admun Design and Construction Studio

Seun City Walk, Seoul, South Korea Unbuilt, Avoid Obvious Architects

Techné

Systems development

Movement and Traffic

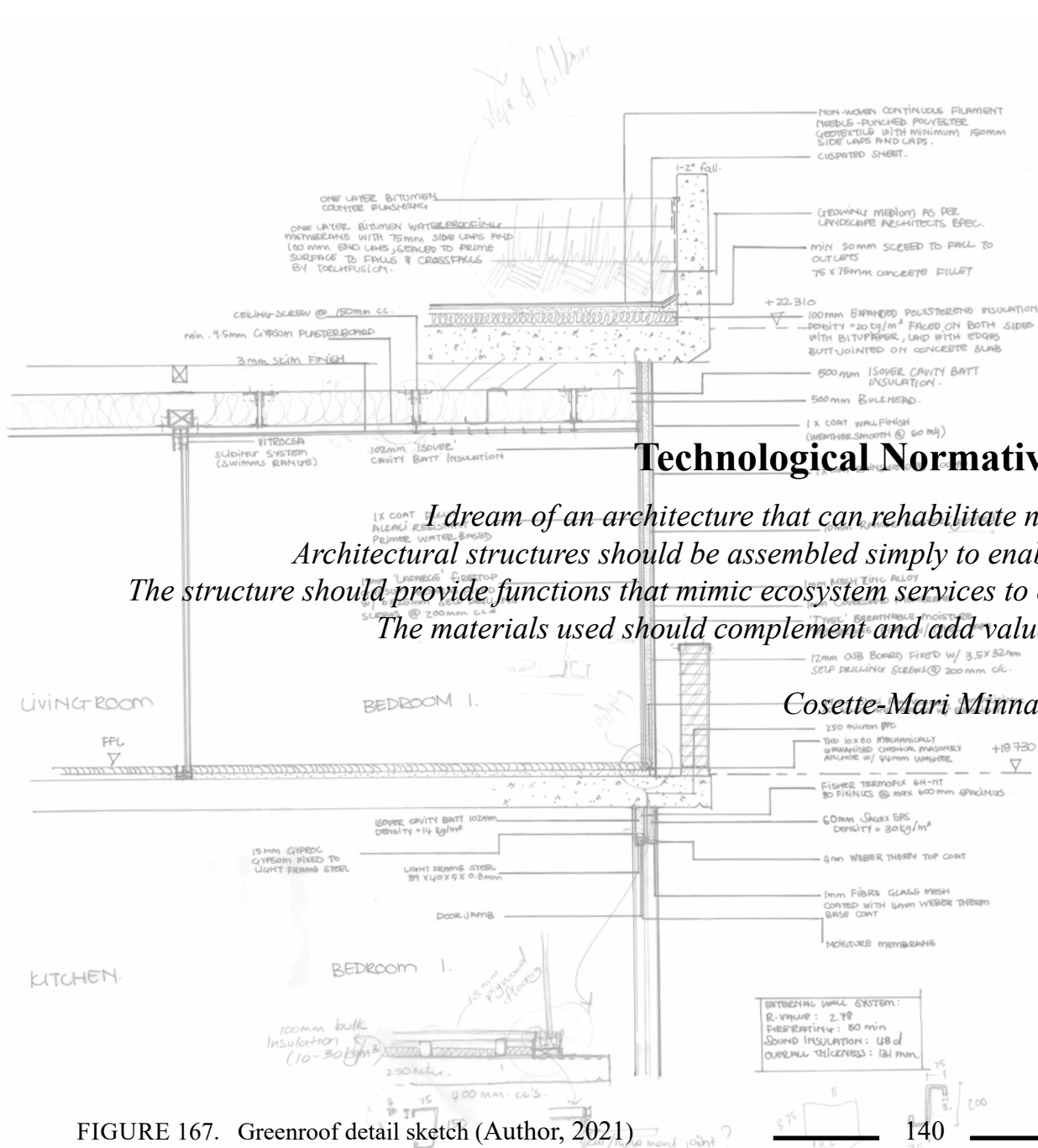
Air Temperature, Flow and Quality Regulation

Climate

Energy Calculations

Water and Water filtration

FINAL DOCUMENTATION



Technological Normative Position

I dream of an architecture that can rehabilitate natural and ecosystem services.

Architectural structures should be assembled simply to enable easy construction and deconstruction.

The structure should provide functions that mimic ecosystem services to enable the building to fully embody its place in nature.

The materials used should complement and add value to the context of the intervention.

Cosette-Mari Minnaar

FIGURE 167. Greenroof detail sketch (Author, 2021)

Technical Argument

The technical argument aims to solve the issue of ecosystem degradation. The technical concept of the building as an ecosystem entails the reintroduction of important natural functions on-site.

This approach will solve issues regarding the re-zoning of cities in that buildings will become well-being hubs on top of their initial purpose.

Technical Intentions

Architectural technology should aim to mimic and reintroduce natural systems while using materials that complement the context and the users of the intervention.

The construction and technology of the design are just as important as the conceptual design. To introduce the education and inspiration petals for the Living Building Institute certification, the structure should ensure that users not only understand the systems of nature, but also the systems of architecture.

Users should see that the construction, and the purity of the materials used, are fully emerged in the system of the site. In so doing, architecture can educate users on ecosystem services and it is hoped that this awareness will encourage humans to live in a way that is more considerate of nature.

Thus, the materials with which the building will be constructed should be used in their most pure form. They should be used in many ways to show users their versatility, and they should provide many functions.

The connections between these materials should be visible to users in a simple and understandable way.

Technical Intentions

Lastly, the construction of the intervention should be sustainable. The Living Building Institute requires materials to be safe and beneficial for all species throughout time. The intention is to create a non-toxic environment that is ecologically restorative.

The materials used should be sourced locally and should be sustainable; they must not be on the Living Building Institute's red list. Material waste has to be limited and should be disposed of responsibly. Construction should be carried out without unnecessarily disrupting surrounding programmes or damaging the site and its surrounds. If possible, the surrounding community should be supported by including them in the construction process.

The systems on-site aim to create ideal living spaces to all users. These should promote health and well-being. The indoor air quality should be optimal for users and greenery, and there should be ample natural light and ventilation, as well as a direct link to nature.

The intervention should also be constructed in a way that allows for universal access and inclusivity, which are achieved through the use of ramps and the inclusion of public spaces.

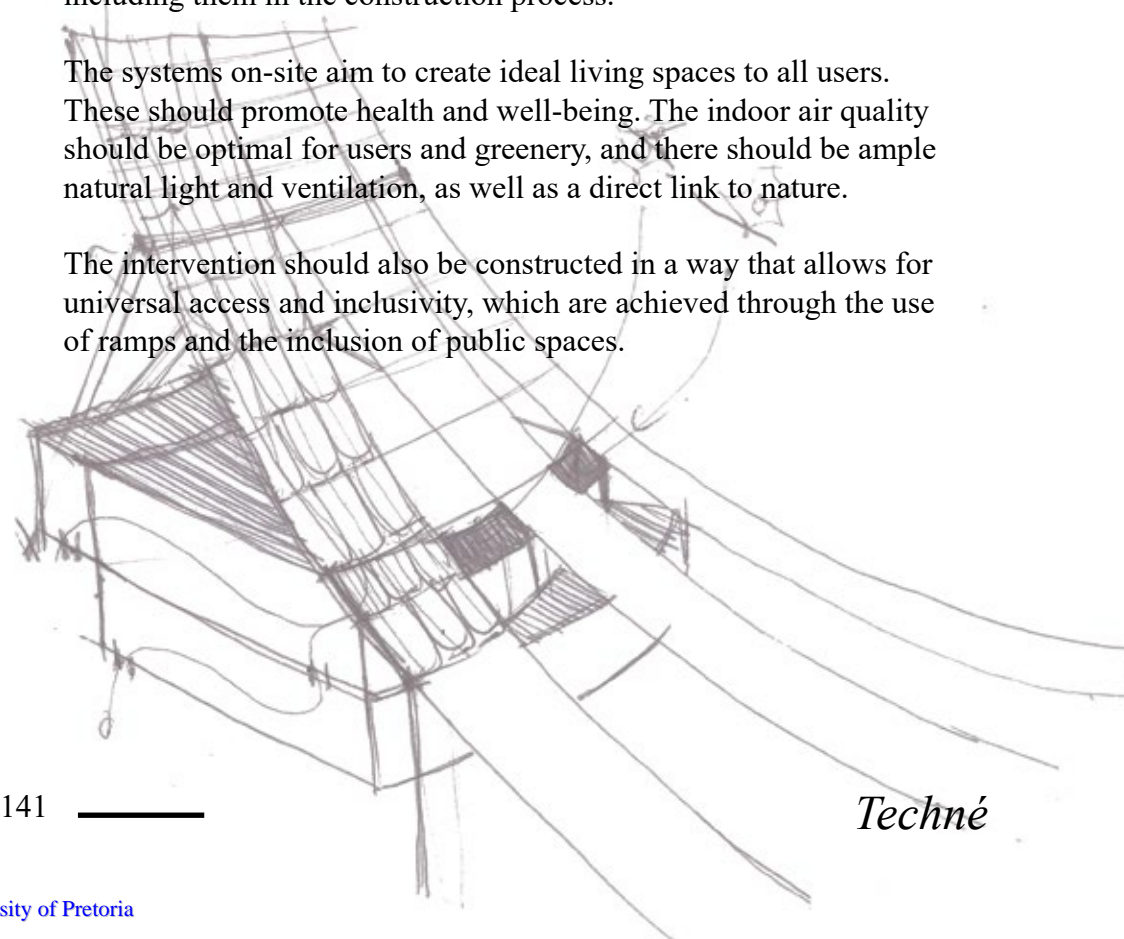


FIGURE 168. Roof panel exploration (Author, 2021)

Technological Precedents

BIT Sports Center, Haidian Qu, China 2019

Atelier Alter Architects

The BIT sports centre tries to integrate the arts with other forms of learning. The intervention accomplishes this integration by combining architecture with science and experience. The structure imitates the landscape using a curved roof system, which is related to the mountains in its vicinity. The roof engulfs the space to provide for a free flow of movement without unnecessary disruption. This effect is achieved through a triangular roof-space frame structure.

The structure makes an architectural statement but relates experientially to users at the same time.

Interior spaces are kept simple to accommodate a series of programmes.

The spaces seem simple from the outside, through the creation of a soft flow, but their complexities can be found in the structure and construction of the intervention. The roof structure also allows for water collection, can withstand wind pressure and it complements other natural systems. The architecture educates through inspiration (BIT Sports Center, 21 October 2020).

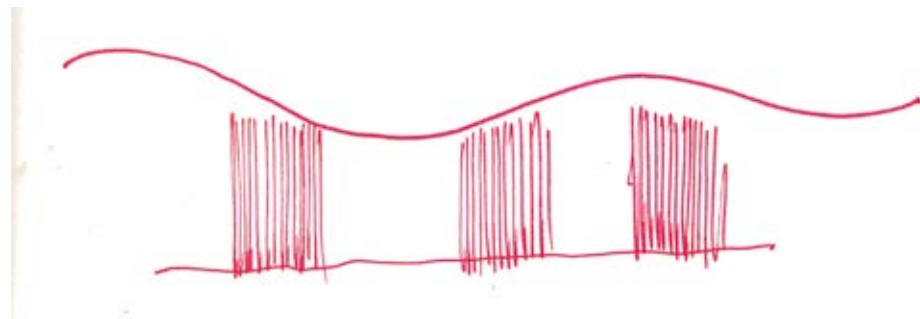


FIGURE 169. BIT diagram (Author, 2021)

Cloaked in bricks, Tehran, Iran 2015

Admun Design and Construction Studio

The Cloaked in Bricks housing development aims to increase human comfort, to provide for people's needs, and to prioritise the human experience. Unfortunately, vertical growth was the most profitable option but the architects of the development did not want to jeopardise a key characteristic of Iranian-culture privacy. Windows rarely face outward but, in this case, exterior balconies were the only feasible option. Brick was the obvious choice of building material so as to ensure that the building complements the vernacular surrounds.

The façade becomes a textured brick brise soleil shading structure that not only ensures privacy but also enables airflow and allows for views. By rotating the bricks, the façade allows for different opening shapes and sizes, and it creates the impression that the wall is alive from both the inside and outside – even by using a singular material.

The wall openings consider the sun angles and views to create the ideal experience for residents. To simplify the construction method, bricks were punched, which eliminated the use of mortar (Cloaked in Bricks, 21 October 2020).

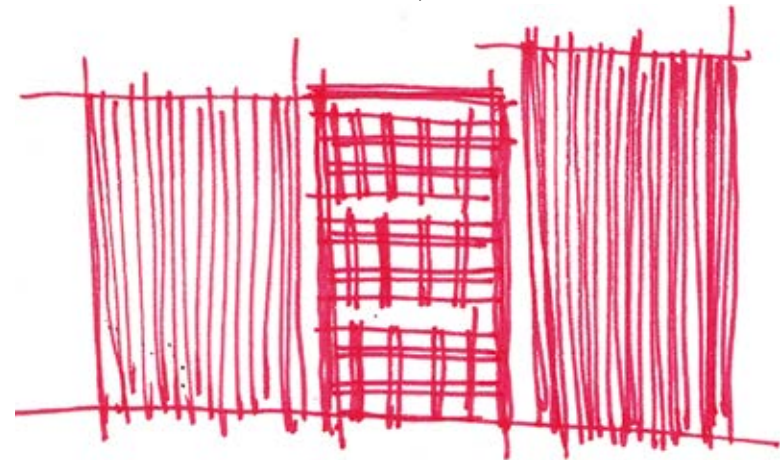


FIGURE 170. Cloaked in Bricks diagram (Author, 2021)

Seun City Walk, Seoul, South Korea Unbuilt
Avoid Obvious Architects

The Seunsangga city walk aims to connect work and play to create an ideal environment for human well-being. The different programmes provide the opportunity for user collaboration, which enhances social well-being and creativity. The inspiration for this intervention comes from weaving materials and the act of weaving the landscape with the structure. The construction changes with and adapts to each space to enhance the architectural experience. The landscape morphs into a deck that becomes the building itself, creating a continuous flow in the structure. The column and deck structures are clad with filleted corners to create the effect of a ribbon that is weaved into the landscape. The architects used this method throughout the construction to conceal rigid forms. This links the concept of a continuous flow from the larger aesthetic to the smallest connection detail (Avoid Obvious Architects, 21 October 2020).

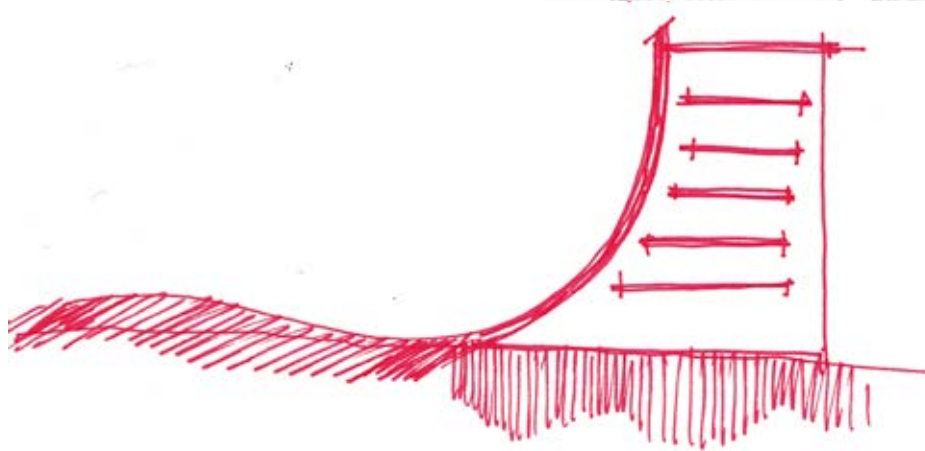


FIGURE 171. AOA diagram (Author, 2021)

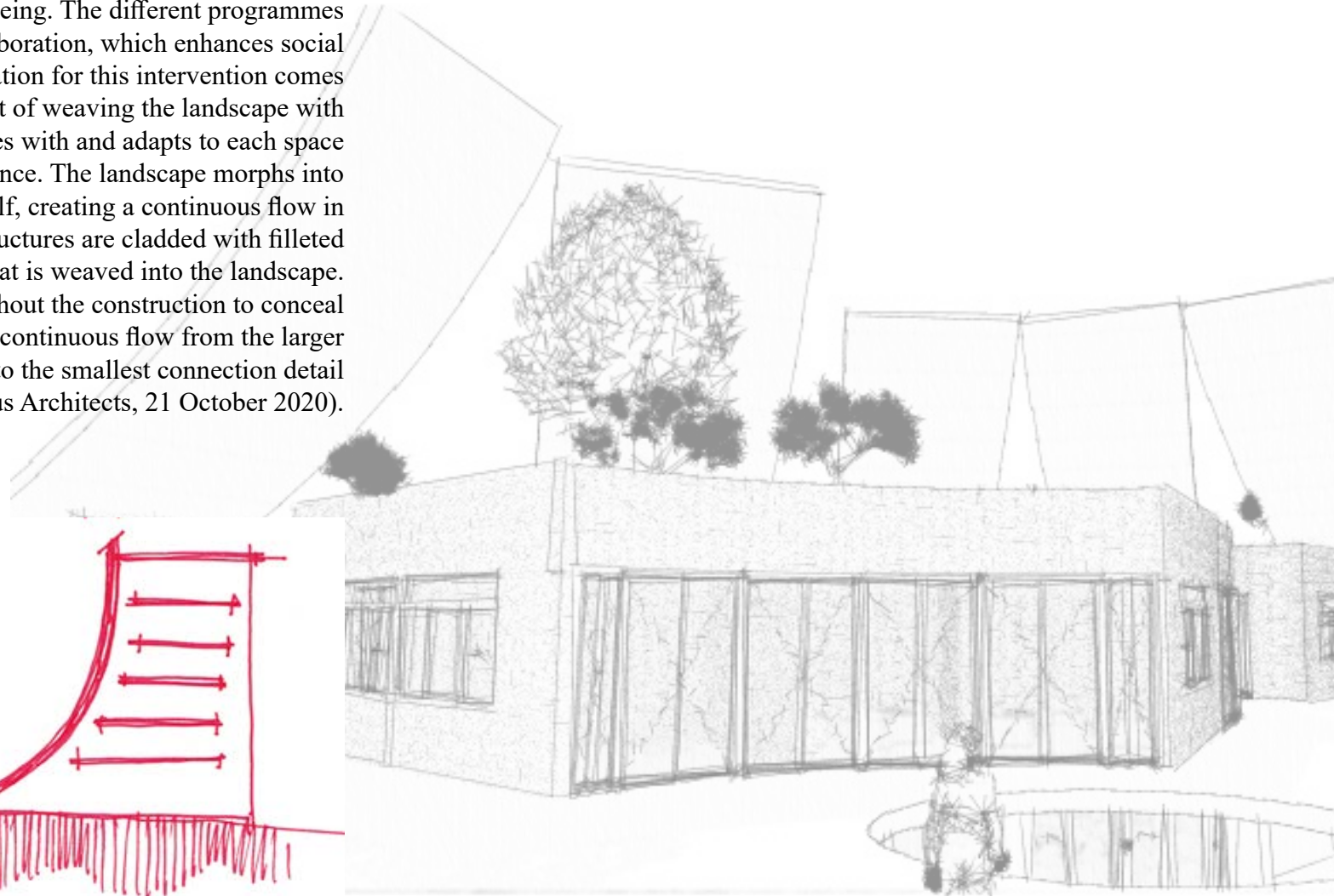


FIGURE 172. Sketch render of office explorations (Author, 2021)

Systems development

The systems on-site coincide with the Living Building Institute's approach of incorporating different systems, rather than merely the go-to considerations of energy and water.

The systems are also explored to ensure that the intervention qualifies for the Living Building Institute's petal certification.

This certification requires the building to achieve the following:

1. Ecology of place
2. Human-scaled living
3. Responsible water use
4. Energy and carbon reduction
5. Healthy interior environment
6. Responsible materials
7. Universal access
8. Inclusion
9. Beauty and biophilia
10. Education and inspiration

The building will also achieve to achieve all the imperatives listed under energy, which are:

- Energy and carbon reduction
- Net-positive carbon

(Living Building Institute, 24 August 2020)

I am exploring the main systems of air-quality regulation, air- and water flow, as well as solar, wind and bio-energy gathering.

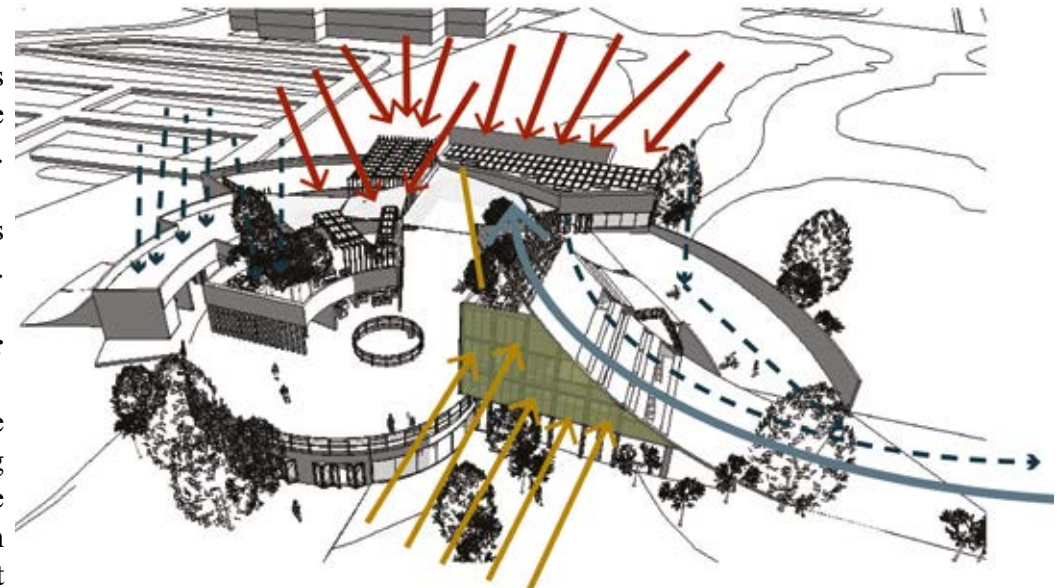


FIGURE 173. Diagram illustrating all systems (Author, 2021)



FIGURE 174. Existing systems into which proposed is inserted (Author, 2021)

Movement

The movement on-site is regulated through the placement of programmes and thoroughfares. The site is opened up on its east-to-west axis to ensure a visual connection between the residential community and urban environment.

This also creates a public walkthrough space that is safe from the street edge. The curved walls provide for a natural flow of movement and lead users throughout the site, ensuring that they do not feel like they are being regulated.

The roof ramps also facilitate skateboarding, parkour and any urban sport. This becomes a public function that enlarges the street edge for safety and ease of movement along Serene Street. All interior-exterior connections are through seamless sliding doors to ensure a continuous flow from inside to outside

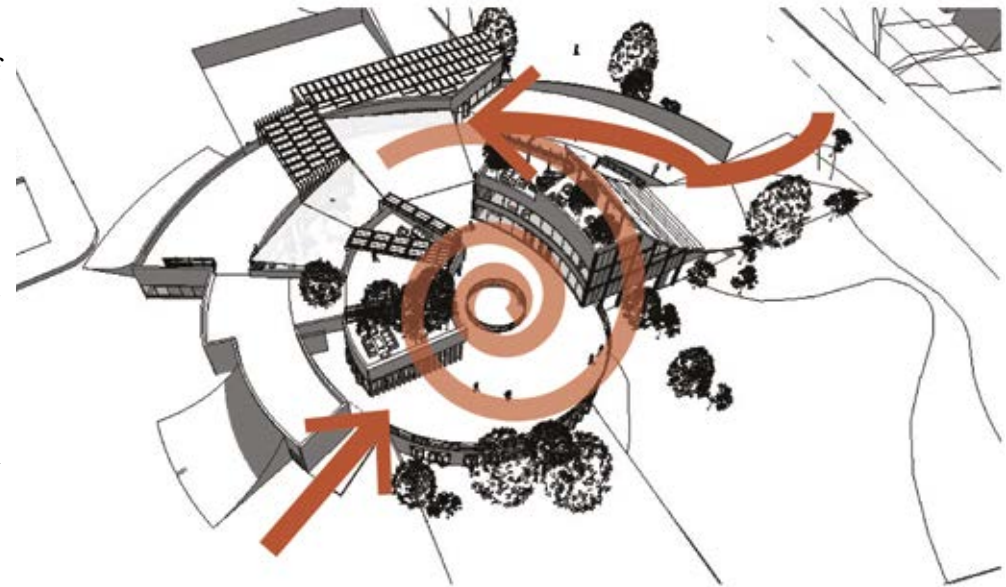


FIGURE 175. Movement diagram (Author, 2021)

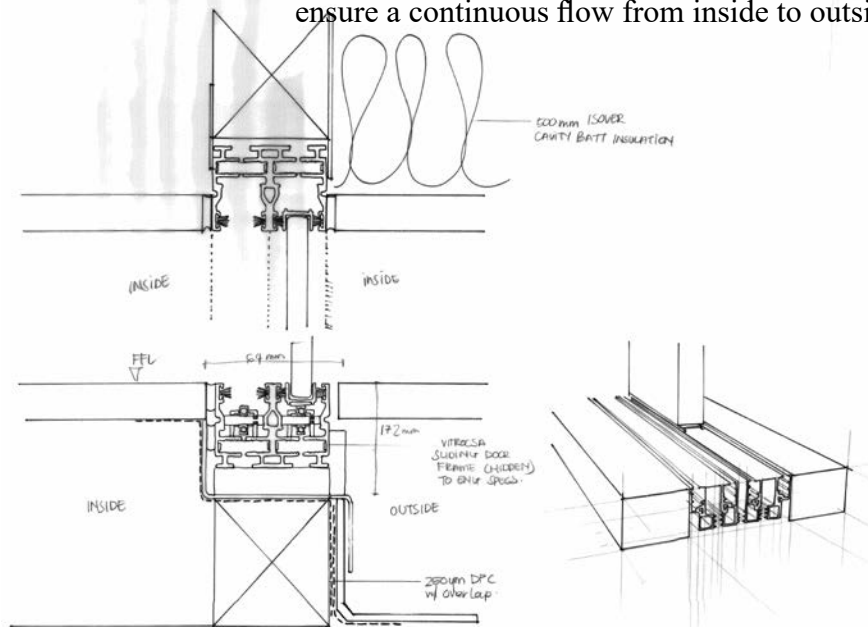


FIGURE 176. Seamless sliding door detail (Author, 2021)

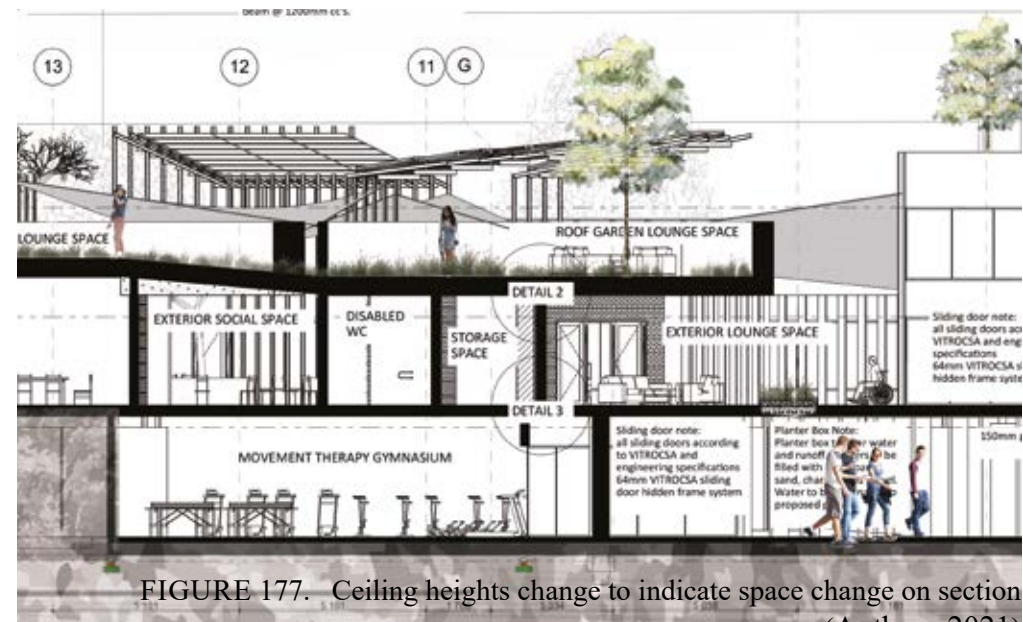


FIGURE 177. Ceiling heights change to indicate space change on section (Author, 2021)

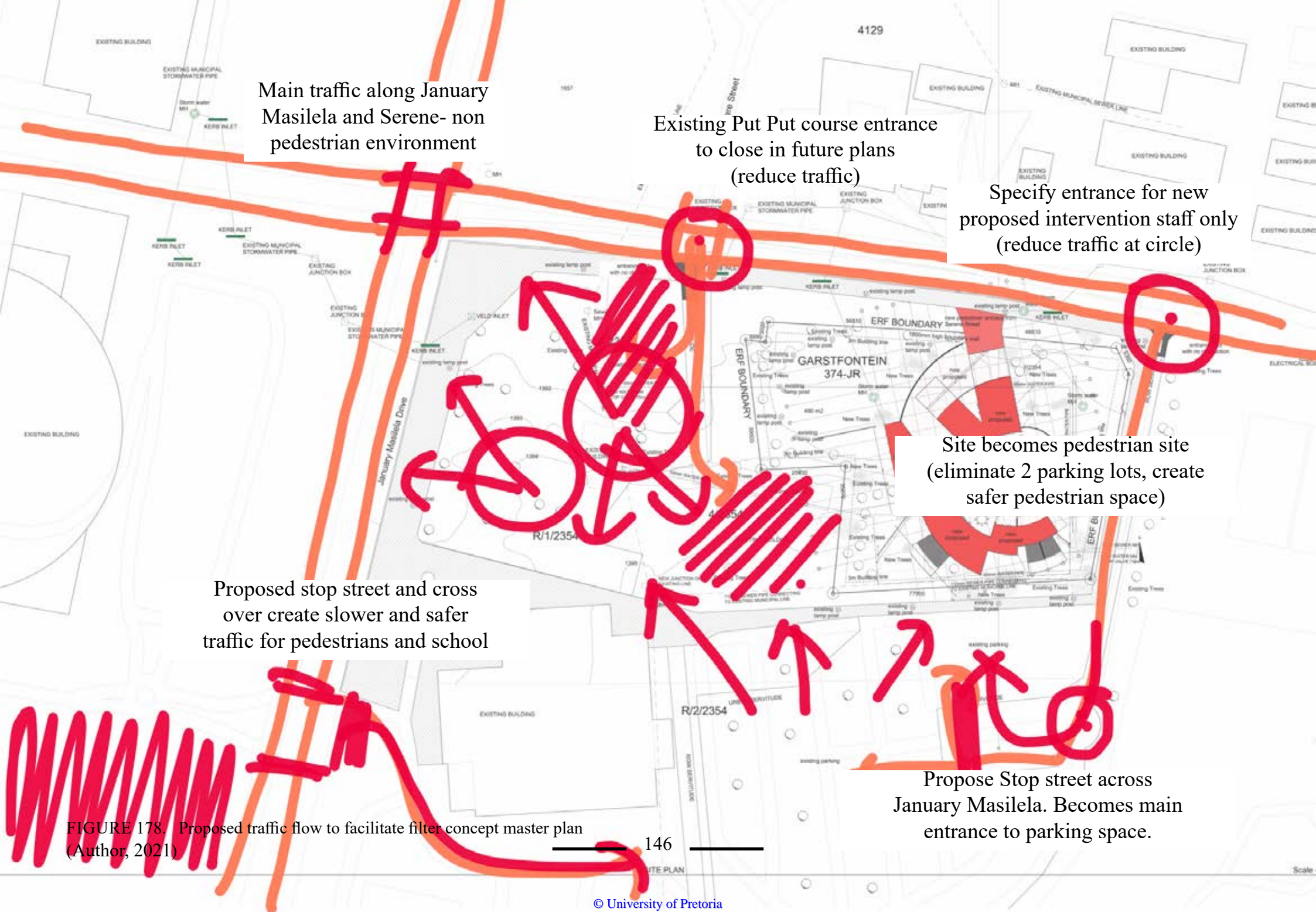


FIGURE 178. Proposed traffic flow to facilitate filter concept master plan (Author, 2021)



Main pedestrian movement along January Masilela and to Menlyn Maine

By changing entrances and traffic, safer space for pedestrians are created = increase pedestrian movement into East

Proposed stop street created easy and safe crossover for pedestrians leading them into East.

Public areas and resting spaces (green areas) draw pedestrians through site to Jimmy Aves Park

Site becomes pedestrian (removal of parking lots on site)

FIGURE 179. Proposed pedestrian flow to facilitate filter concept master plan (Author, 2021)

Air Temperature, Flow and Quality Regulation

The air-quality regulation is followed in accordance with the Living Building Institute's health and happiness petal, which aims for all interior environments to optimise people's psychological and physical health. These systems also increase energy production and decrease CO₂, which is in line with the energy and carbon reduction petal.

The curved roof forms and curved walls allow for vertical and horizontal airflow movement. The curved walls also allow for airflow through the intervention.

The curved roof also provides for optimal wind power generation. The curved concrete wall will direct all wind from the north-east, north and north-west upward towards the wind turbines.

In summer months the sudden temperature change caused by the concrete will result in the airflow to accelerate, increasing this effect.

The placement of the wind turbines at the top of the curved roofs also allow for wind generation from the south, south-east and south-western side.

This contributes to the net-positivity of the building.

Climate

The systems discussed ensure that the building responds to the climate and the site where it is situated. In summer months, the building uses heat to the benefit of the intervention and to provide the necessary functions.

The intervention counters heat through temperature regulation, and uses materials like concrete and brick to withstand harsh heat. Concrete is beneficial in winter when the ramps and concrete roofs heat the space. The roof uses wind to assist the building with airflow and temperature regulation (Weather Atlas, 15 May 2020).

The placement and orientation of the intervention ensure that natural light, which is important for creation spaces, comes mostly from the south and north, with horizontal concrete shading on the north and vertical concrete shading on the west.

Solar and biofuel panels attract sunlight mostly on the west and east for optimal energy production (Weather Atlas, 15 May 2020). All these considerations link to the ecology-of-place petal.

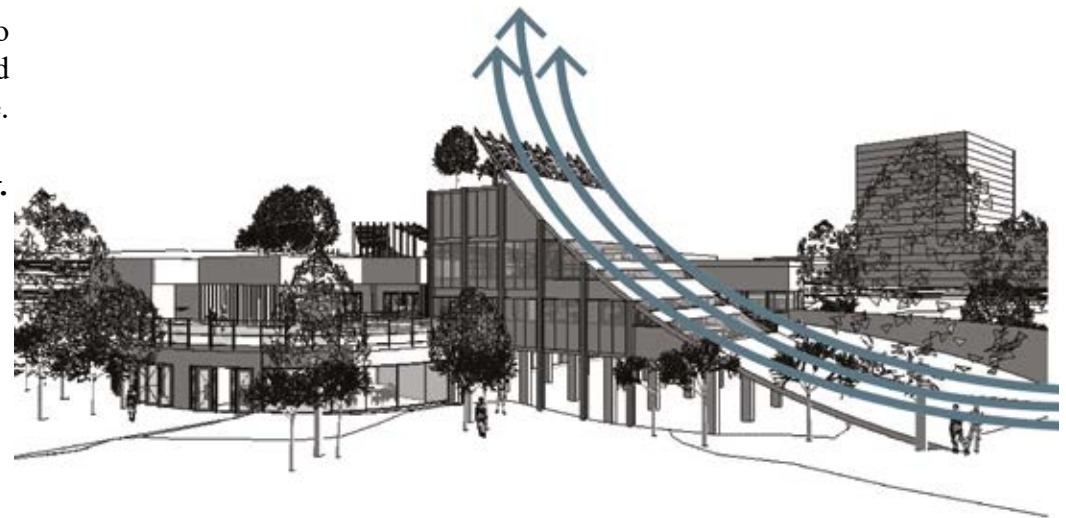


FIGURE 180. Diagram of upward windflow (Author, 2021)

Air Temperature, Flow and Quality Regulation

Vertical concrete shading is placed on the western and eastern facades to shade the spaces from the sun, but still allow for airflow and natural light.

The western and eastern outer shell of the building will filter air using bioreactor panels. These panels regulate air quality through the reduction of CO₂, and generate biofuel and bio-gasses that become usable energy.

These panels recycle their own CO₂, which is emitted through batteries, and, in so doing, create a constant air-filtration system. These panels furthermore contribute to climate control as they use sunlight, and prevent heat from entering the building.

Lastly, the intervention acts as a programmatic and urban-to-suburban scale filter, but it should also act as a filter from the exterior to the interior spaces.

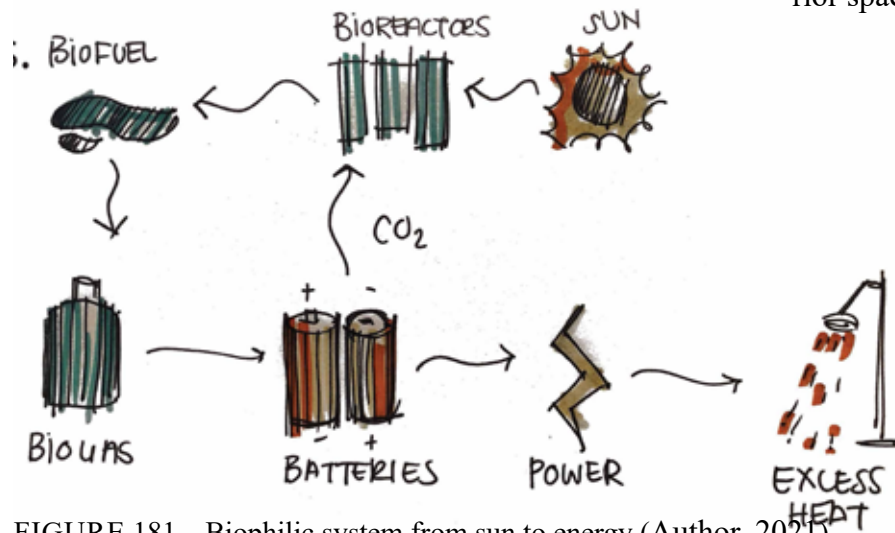


FIGURE 181. Biophilic system from sun to energy (Author, 2021)

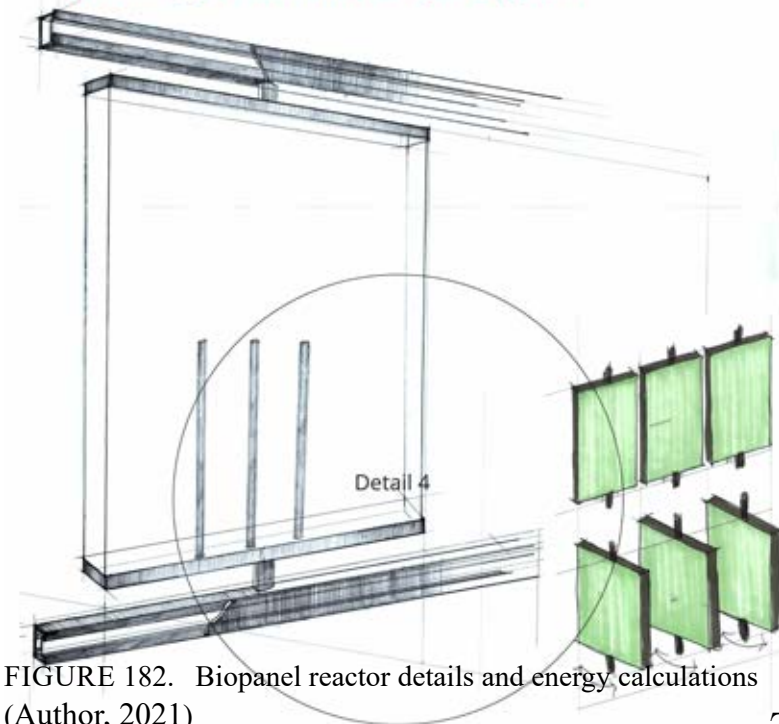


FIGURE 182. Biopanel reactor details and energy calculations (Author, 2021)

Appliances	Watts	Quantity	Total Watts	Year	Hours per day (use)	Hours per year (use)	Total per year (W/H)
Energy Saver Lamps / Globes	11	117	1287	365	4	1460	1879020
LED Downlights	9	50	450	365	4	1460	657000
Laptops	150	50	7500	365	10	3650	27375000
Phone Chargers	100	10	1000	365	2	730	730000
Kettle	1500	2	3000	365	2	730	2190000
Microwave	600	2	1200	365	2	730	876000
Fridge	80	2	160	365	24	8760	1401600
Modem	8	4	32	365	24	8760	280320
Radio	20	3	60	365	7	2555	153300
42" LCD Flat Screen Television	150	5	750	365	5	1825	1368750
Express Coffee Machine	1000	2	2000	365	2	730	1460000
Laser Printer	300	5	1500	365	3	1095	1642500
Oven	1500	1	1500	365	1	365	547500
					6,923076923	Watts/Hour per Year	40560990
						kW/H/year	40560,99
						kW/h/day needed	111,126
						kW/day	769,32

FIGURE 183. Appliances and Energy demand calculations (Author, 2021) 150

Bioreactor Size	Amount of Bioreactors	Area Used			TOTAL kWh/m2a	Heat 40%	CO2 Reduction
700 mm x 2500 mm x 90mm	129	225,75 m2			203,175	81,27	15,8
					Biomass 8-10%	CO2 Reduction	Biogas 80%
					20,317	6,77	16,25
							CO2 Reduction
							0,203

DATA PER BIOREACTOR		
Global Radiation JOHANNESBURG/PRETORIA	1800	kWh/m2a
50% Loss due to orientation, exposure and reflections	900	kWh/m2a
Heat 40%	360	kWh/m2a
CO2 Reduction	0,07	t/m2a
Biomass 8-10%	90	kWh/m2a
CO2 Reduction	0,03	t/m2a
Biogas 80%	72	kWh/m2a
CO2 Reduction	0,03	t/m2a

TOTAL kWh/m2a	Average Sun per day
203,175	6 hours per day
	1219,05 kW/per day

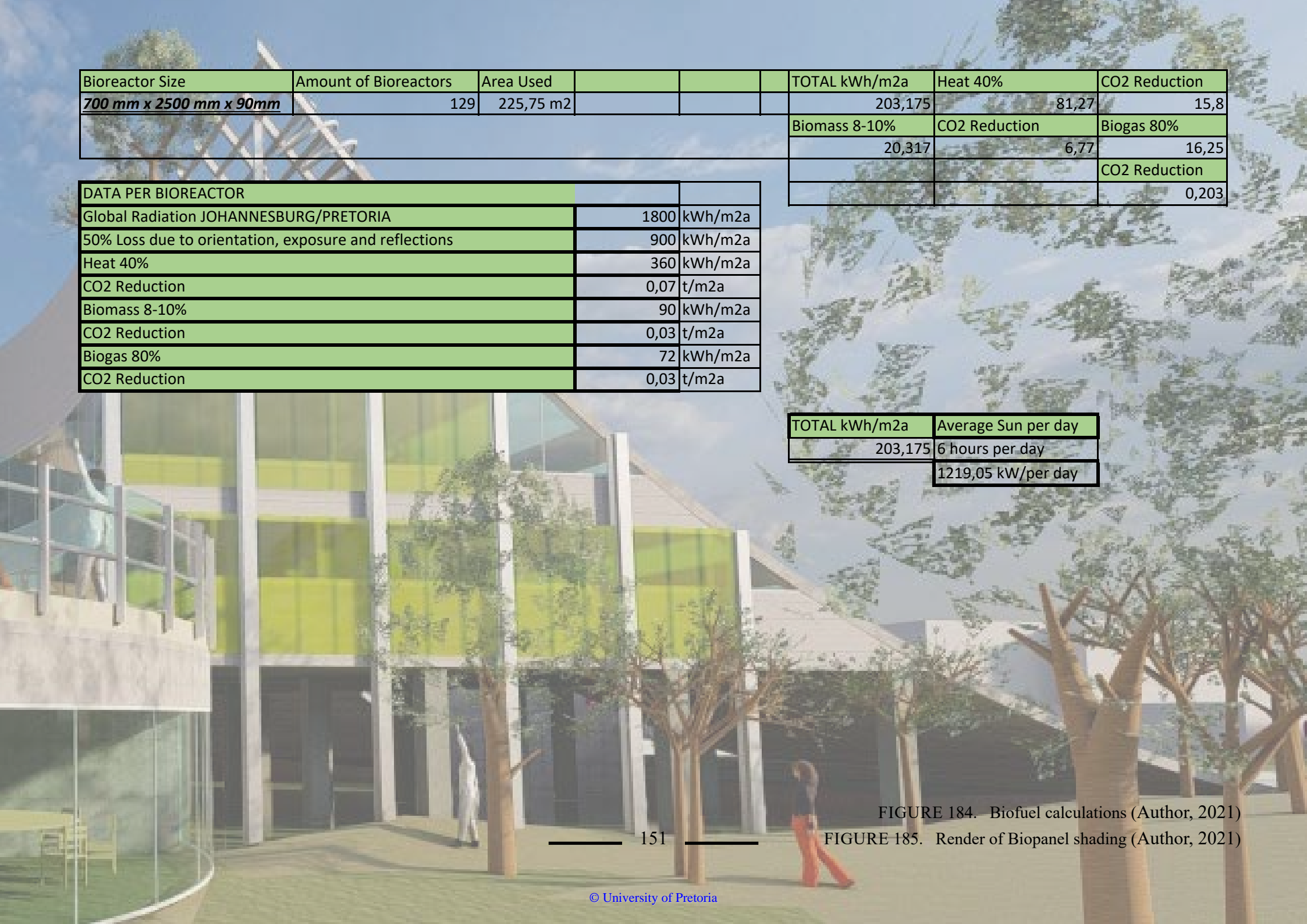


FIGURE 184. Biofuel calculations (Author, 2021)

FIGURE 185. Render of Biopanel shading (Author, 2021)

Amount of Panels =	120		
Panel size =	<i>1956 mm x 992 mm (1,94 m2)</i>		
Overall Daily Usage	Average Sun per day	Total Watts per Solar Panel	Solar Panel Production per Day
111,126 kW/h/day 769,325 kW/day	6 hours per day	350 W	2100 Watts per panel per day
West Facing Roof Space available	Total Watts per Solar Panel/day	Generated Power	
190 m2	2100 W	252000 Watts per day 252 kW/day	
2HP Water Pump needs	Panels for water Pump		
31500 Watts per day	15		
Available energy for building (solar panel)	TOTAL kWh/m2a	Average Sun per day	
220500 W per day	203,175	6 hours per day	
220,5 kW per day		1219,05 kW/per day	
		1439,55 kW/day	
		769,325 kW/day	
		670,225 kW/day	

FIGURE 186. Photovoltaic panel calculations (Author, 2021)

The photovoltaic solar panel energy and the biofuel and biogas provide a surplus energy for the retirement home across the street to reduce living costs.

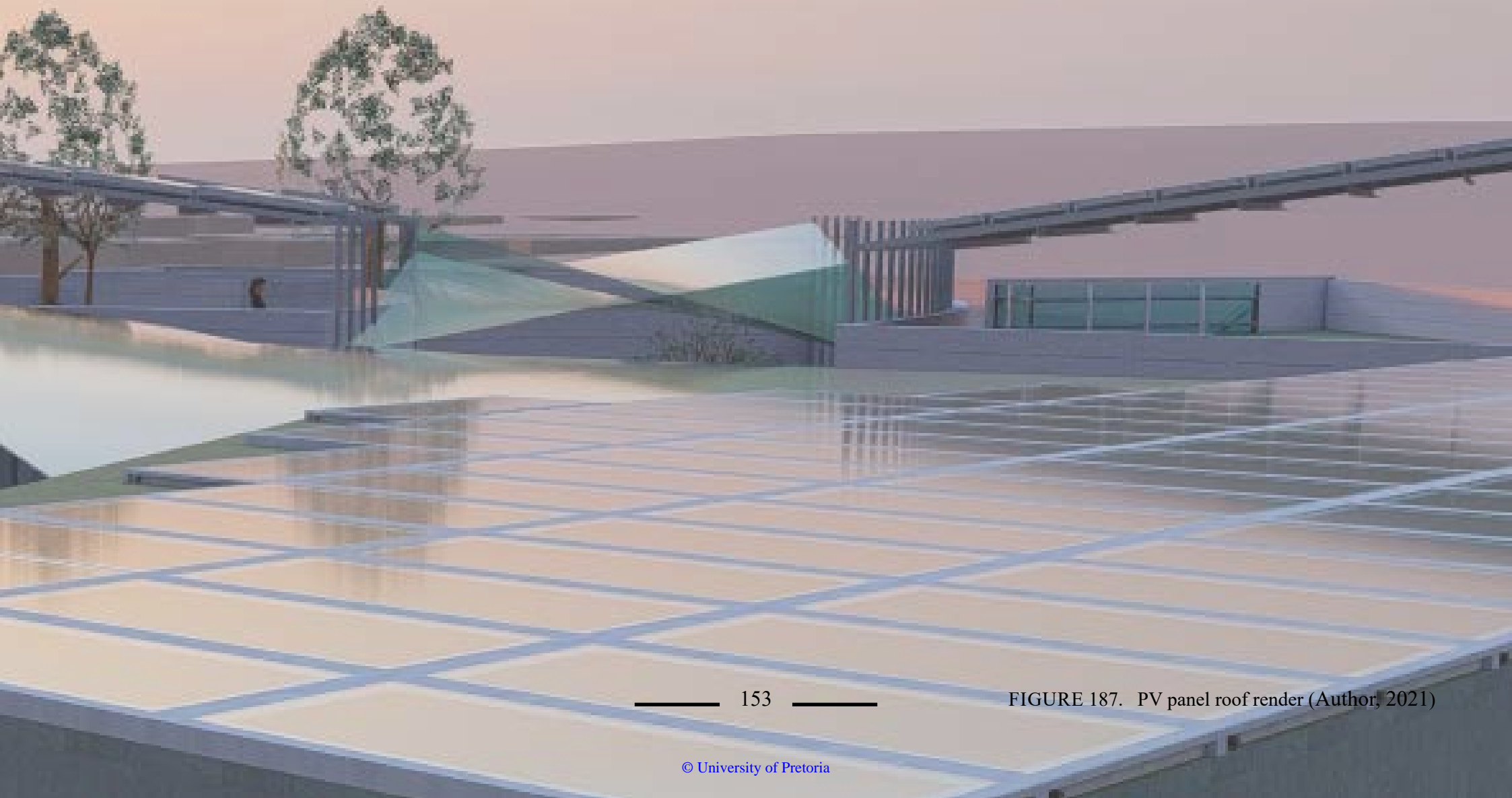


FIGURE 187. PV panel roof render (Author, 2021)

Water

This system is based on the water-responsibility petal. All services, bathrooms and the kitchen are placed at the highest point on-site.

All water on site and runoff is harvested and filtered through a series of filtration planters on the parking lots, the filtration ponds and the wetland. The pond and wetland is placed on the lower edges of the site to collect runoff and create a resting space on the street edge. The planter boxes are placed to collect water from gutters, parking lots, adjacent existing building roofs and the runoff from the green roofs to filter this once before entering the filtration pond. This water will then be filtered once again before entering the wetland. dual flush toilets are used, and activated pressure pumps to limit water wastage. Solar pumps will pump the filtered water back to the building.

The ponds and wetland require a slow moving pump to provide a continuous flow of water. The excess water will be stored in water reservoirs under the wetland and further tanks can be constructed under the Virgin Active parking lot if needed.

The pond is shaded to minimise evaporation. The pond furthermore increases security by creating a barrier between the street edge and the intervention, together with the elevated first floor.

The last function of the pond concerns therapy purposes. Private one-on-one therapy rooms are adjacent to the pond, which creates a sense of peace and tranquillity as water is the main source of life.

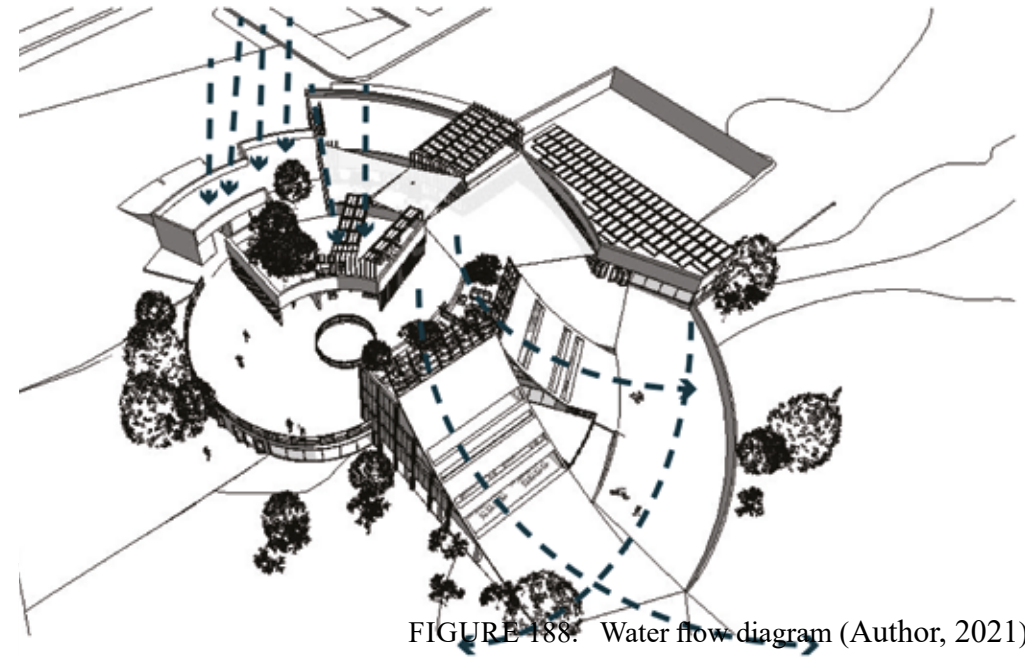


FIGURE 188. Water flow diagram (Author, 2021)

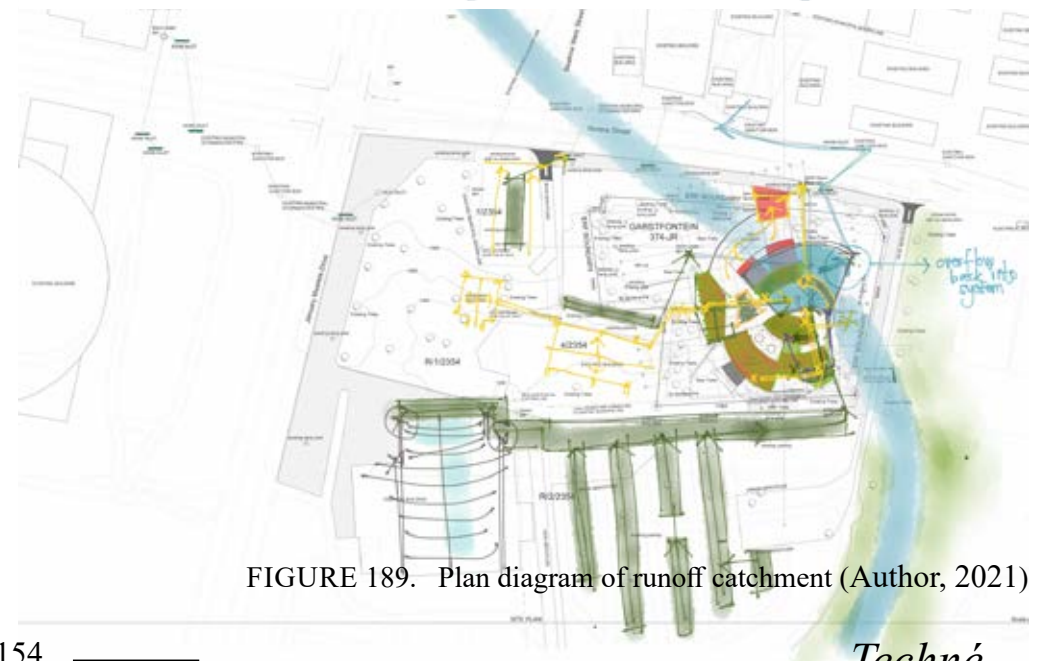


FIGURE 189. Plan diagram of runoff catchment (Author, 2021)

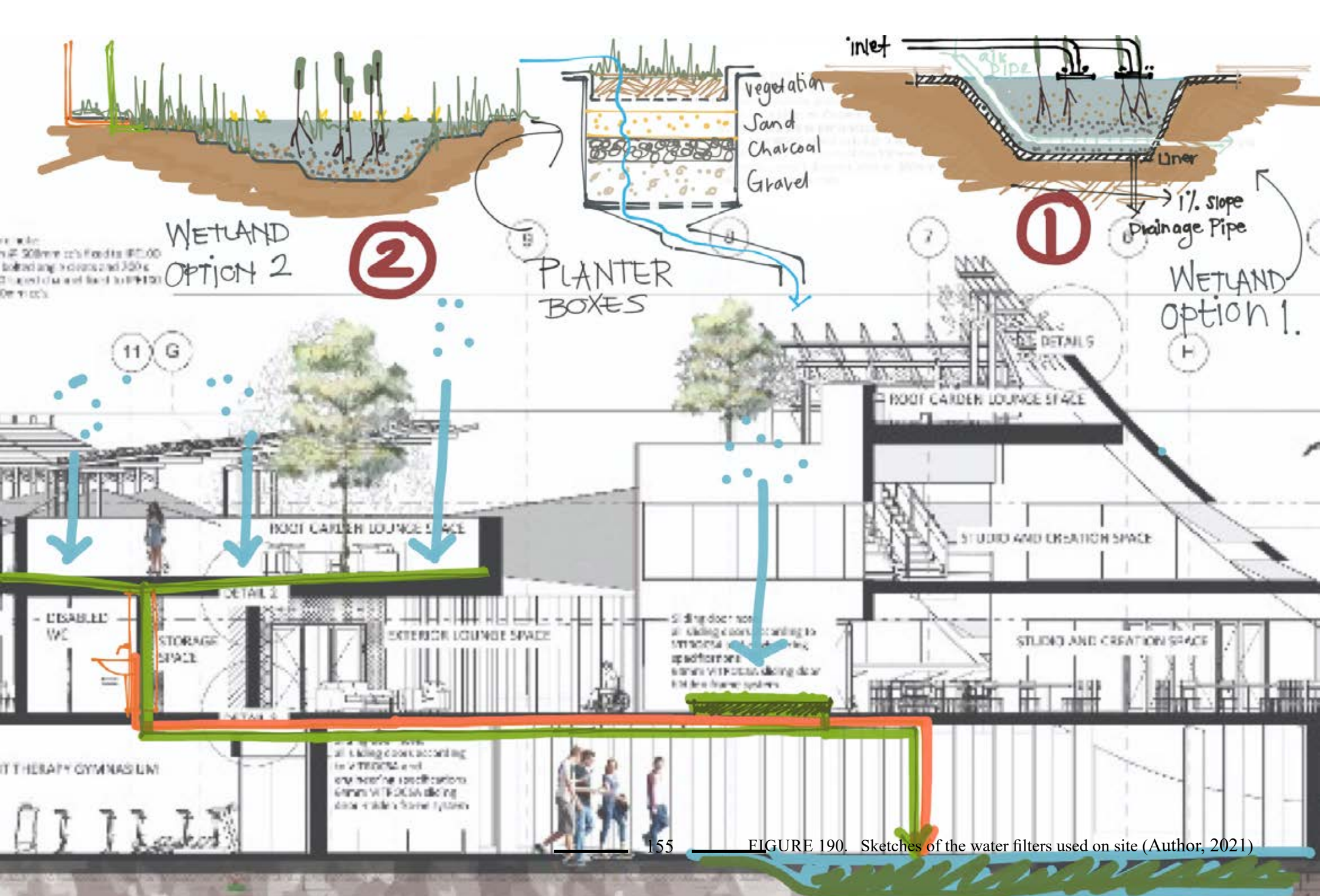
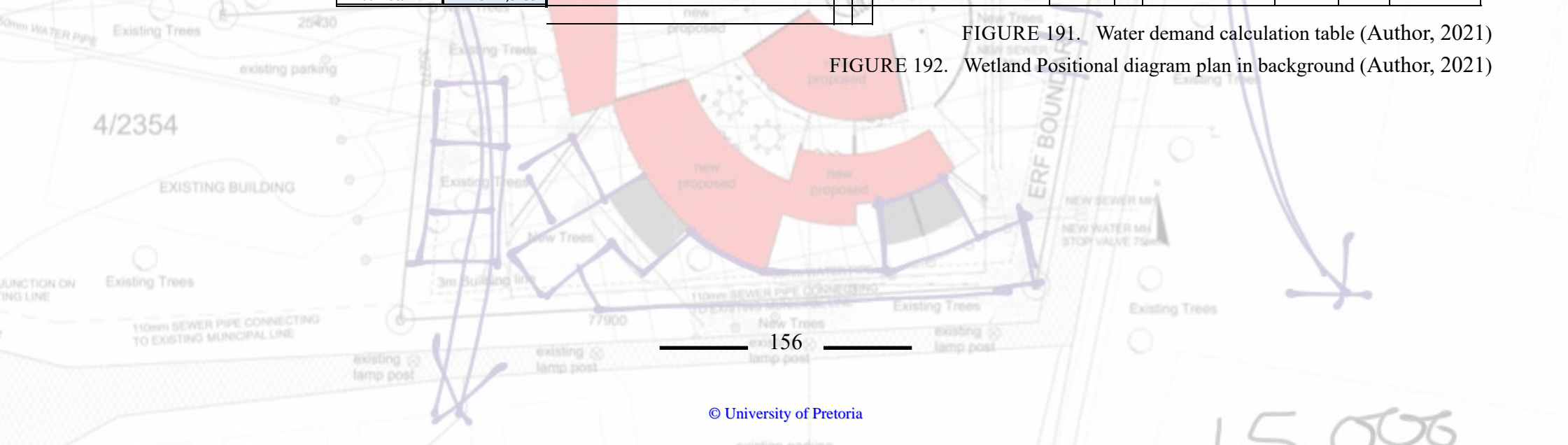


FIGURE 190. Sketches of the water filters used on site (Author, 2021)

Water Demand	Litres		average use	use per day		Catchment Area	m2	Runoff Coefficient	m2	C	C(weighted) (CxA)+(CxA).../ A+A...
W/C's	3	per flush	2x per day p.p	240	120 people per day at full capacity	Existing roofs + Parking		Existing roofs	4477,7	0,85	N/A
15	45			10800		Roofs	3555	New roofs	579,6	0,95	N/A
Urinals	2,2	per flush	2x per day p.p	240			235,7	Parking	10631	0,95	N/A
6	13,2			3168			687	Green roofs	662	0,43	N/A
Basins	2,1	per wash	2,5x per day p.p	300		Parking	1666	Paving	1422,2	0,95	N/A
20	42			12600			8965	Permeable Paving	616	0,75	N/A
Irrigation (m2)	2,4	per m2 per day	every 3rd day	0,33		New roofs and paving			18388,5		0,9
662	1588,8			524,304		Green Roofs	662				
Bio-Panels	157,5	per panel	1x per month	0,033		Concrete roofs	579,6				
129	20317,5			670,4775		Paving (Concrete)	1044				
Shower	47	per 5 minutes	2x a day	8			345,5				
4	188			376			32,7				
				28138,7815	Litres per day at full capacity	Permeable	165				
						Permeable	451				
Month 2019			l/p/d	Total Demand m3/month			18388,5				
January	31	28138,78		872302,18							
February	28	28138,78		787885,84							
March	31	28138,78		872302,18							
April	30	28138,78		844163,4							
May	31	28138,78		872302,18							
June	30	28138,78		844163,4							
July	31	28138,78		872302,18							
August	30	28138,78		844163,4							
September	31	28138,78		872302,18							
October	30	28138,78		844163,4							
November	31	28138,78		872302,18							
December	30	28138,78		844163,4							
			Annual Total	10242,51592							

FIGURE 191. Water demand calculation table (Author, 2021)

FIGURE 192. Wetland Positional diagram plan in background (Author, 2021)



Rainwater yield			Minimum Tank Size			Water Budget without Tank	Monthly Balance		
Month 2019	Avg Rainfall per month	Yield m2 (PxAxC)	Demand (m3)	Volume water in Tank	Volume water in Tank with 5% runoff loss	Demand (m3)	(Yield-Demand)	Yield m2 (PxAxC)- 5% loss	Monthly Balance (Yield-Demand)
January	0,12	1985,958	872,3	2905,7223	2630,991185	872,3	1113,658	1886,6601	1014,3601
February	0,095	1572,21675	787,88	3690,05905	3336,717098	787,88	784,33675	1493,605913	705,7259125
March	0,08	1323,972	872,3	4141,73105	3722,190498	872,3	451,672	1257,7734	385,4734
April	0,05	827,4825	844,16	4125,05355	3664,138873	844,16	-16,6775	786,108375	-58,051625
May	0,01	165,4965	872,3	3418,25005	2949,060548	872,3	-706,8035	157,221675	-715,078325
June	0,008	132,3972	844,16	2706,48725	2230,677888	844,16	-711,7628	125,77734	-718,38266
July	0,001	16,54965	872,3	1850,7369	1374,100055	872,3	-855,75035	15,7221675	-856,5778325
August	0,006	99,2979	844,16	1105,8748	624,27306	844,16	-744,8621	94,333005	-749,826995
September	0,02	330,993	872,3	564,5678	66,41641	872,3	-541,307	314,44335	-557,85665
October	0,08	1323,972	844,16	0	0	844,16	479,812	1257,7734	413,6134
November	0,11	1820,4615	872,3	948,16	857,13	872,3	948,1615	1729,438425	857,138425
December	0,102	1688,0643	844,16	1792,0643	1616,631085	844,16	843,9043	1603,661085	759,501085
	0,682	11286,8613	10242,48			10242,48		10722,51824	

Note: Tank starts on 0 in October before rainy season (Summer)

Runoff Coefficient	m2	C(weighted) (Cx(A)+(CxA).../A+A...
	18388,5	0,9

The Minimum tank size should be equal to the calculated maximum water in tank = 4141 m3 = 4 141 000 litres

The space on site can accommodate a wetland which filters the water as well as a 2 x water filtration ponds where the water will be stored primarily.

Wetland size = +- 31 x 25 x 500m = 387,5 m3

Water pond 1 = +- 12 x 16 x 450m = 86,4 m3

Water pond 2 = +- 10 x 11 x 450m = 49,5 m3

= 523,4 m3 = 525 000 litres (3616 000)

1 000 000 litre underground water reservoir underneath wetland (easy access from street)

2x 1000 000 and 773 000 litre underground reservoirs underneath Virgin Active Gym

Parking Lot

NOTE: EXCLUDING WATER COLLECTED FROM RAIN DIRECTLY INTO WETLAND AND PONDS EXCLUDES WATER RECYCLED FROM USE IN BUILDING ONLY INCLUDES RUNOFF CALCULATIONS

FIGURE 193. Water runoff and yield calculations (Author, 2021)

FIGURE 194. Wetland Positional diagram plan in background (Author, 2021)

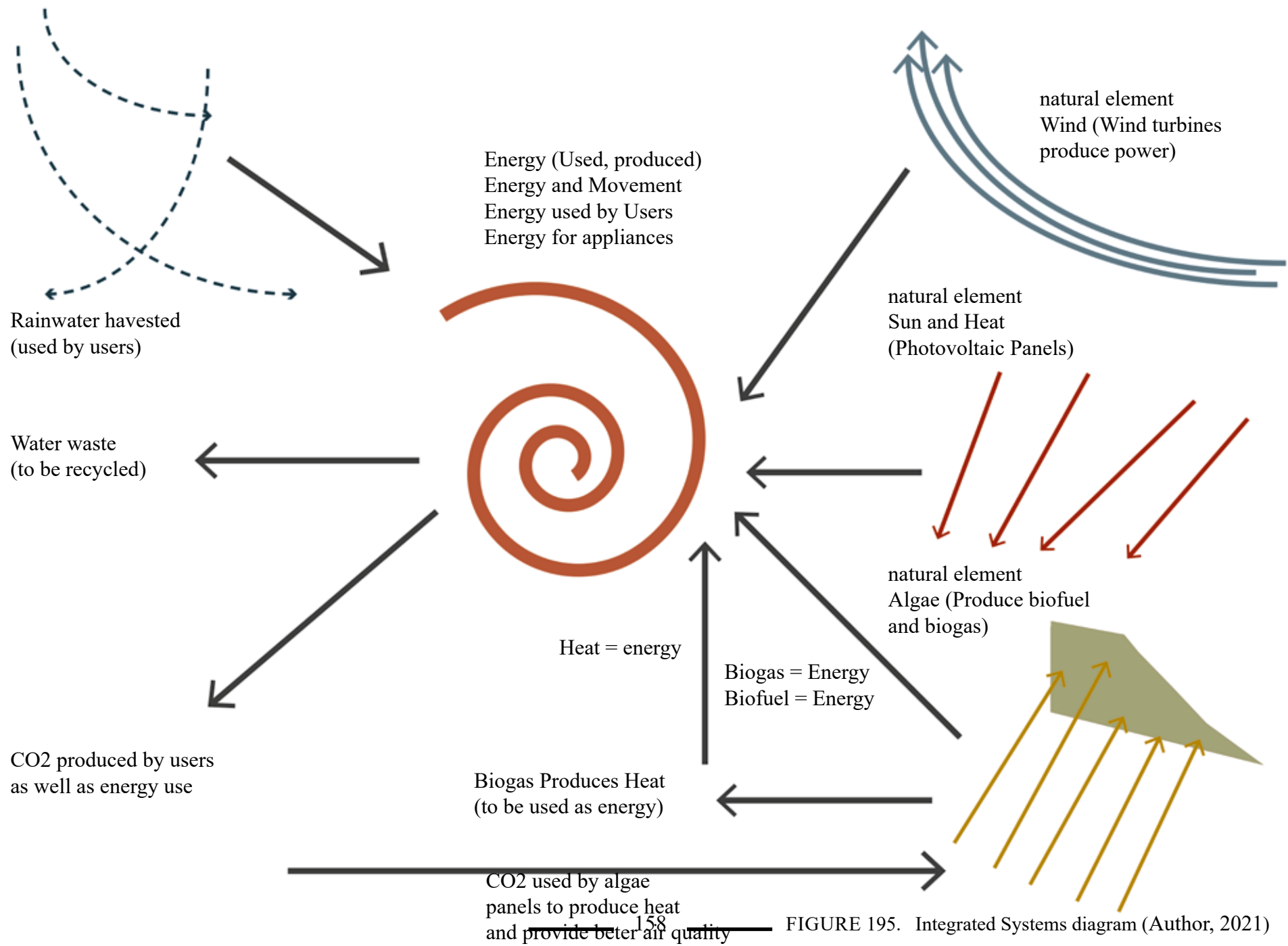


FIGURE 195. Integrated Systems diagram (Author, 2021)

FINAL DOCUMENTATION

- PLANS
- ELEVATIONS
- SECTIONS
- DETAILS
- MODEL



FIGURE 196. Render of proposed wetland (Author, 2021)



FIGURE 197. Site Plan NTS (Scale printed- 1:500) (Author, 2021)

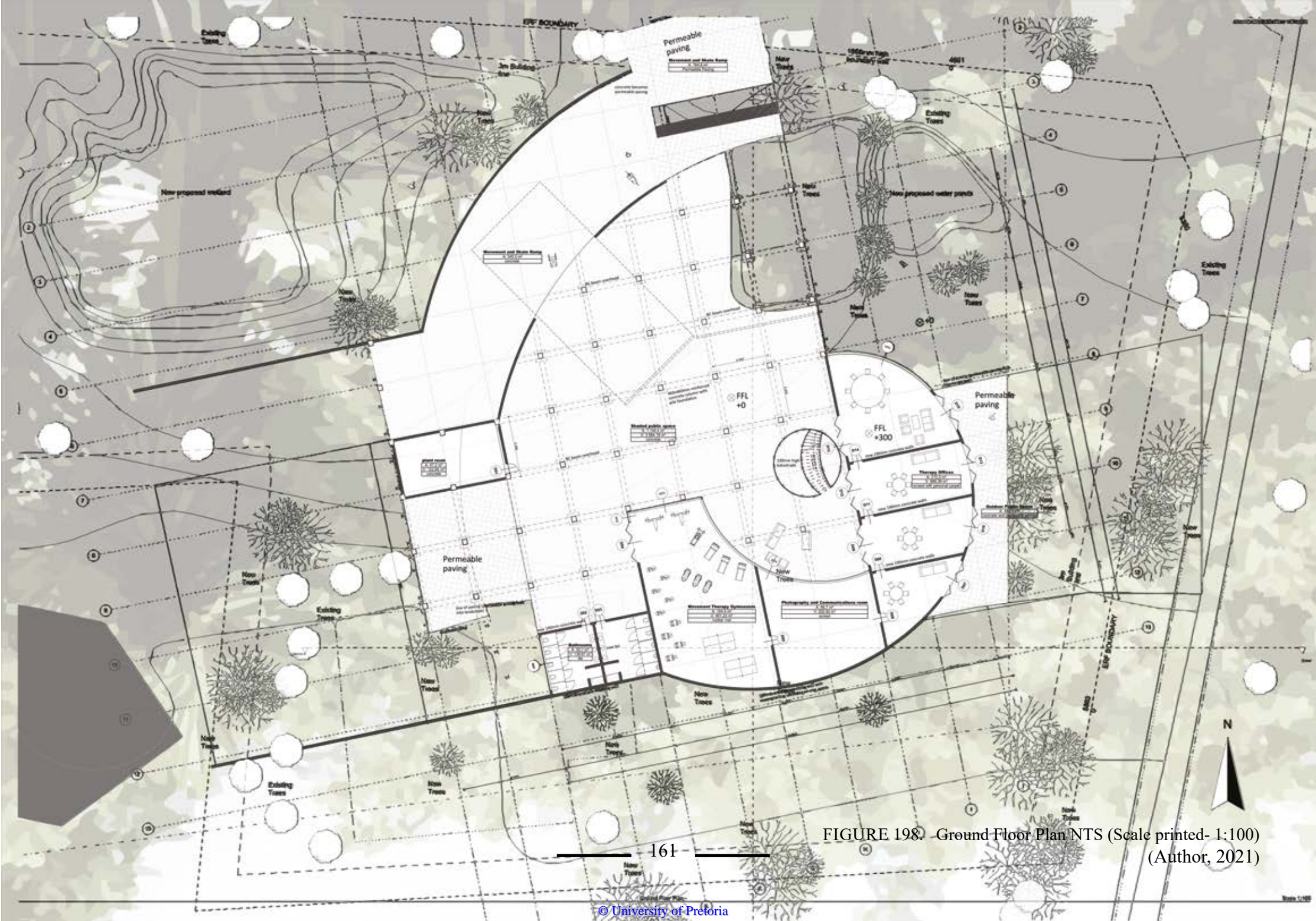


FIGURE 198. Ground Floor Plan NTS (Scale printed- 1:100)
(Author, 2021)

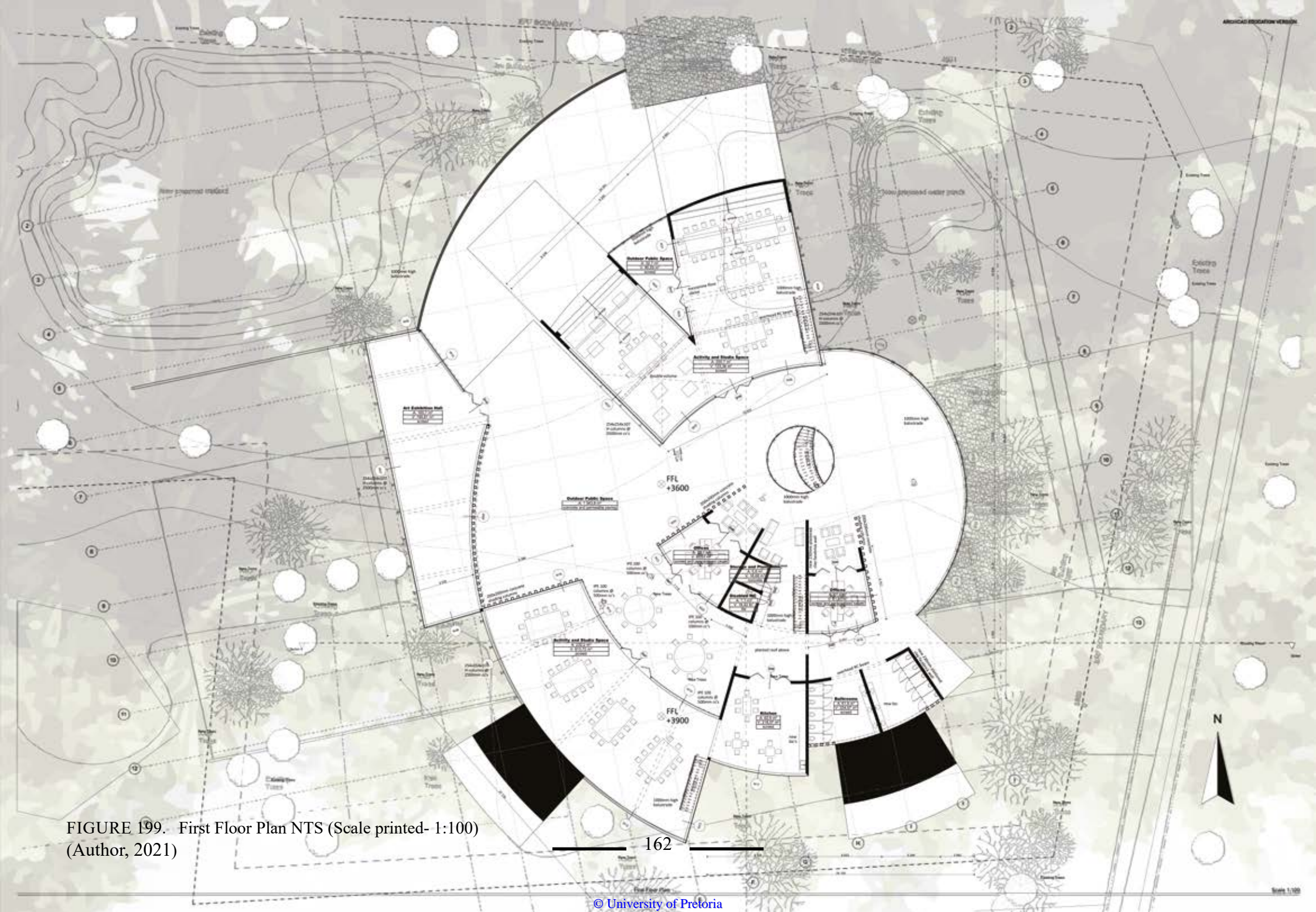


FIGURE 199. First Floor Plan NTS (Scale printed- 1:100)
 (Author, 2021)

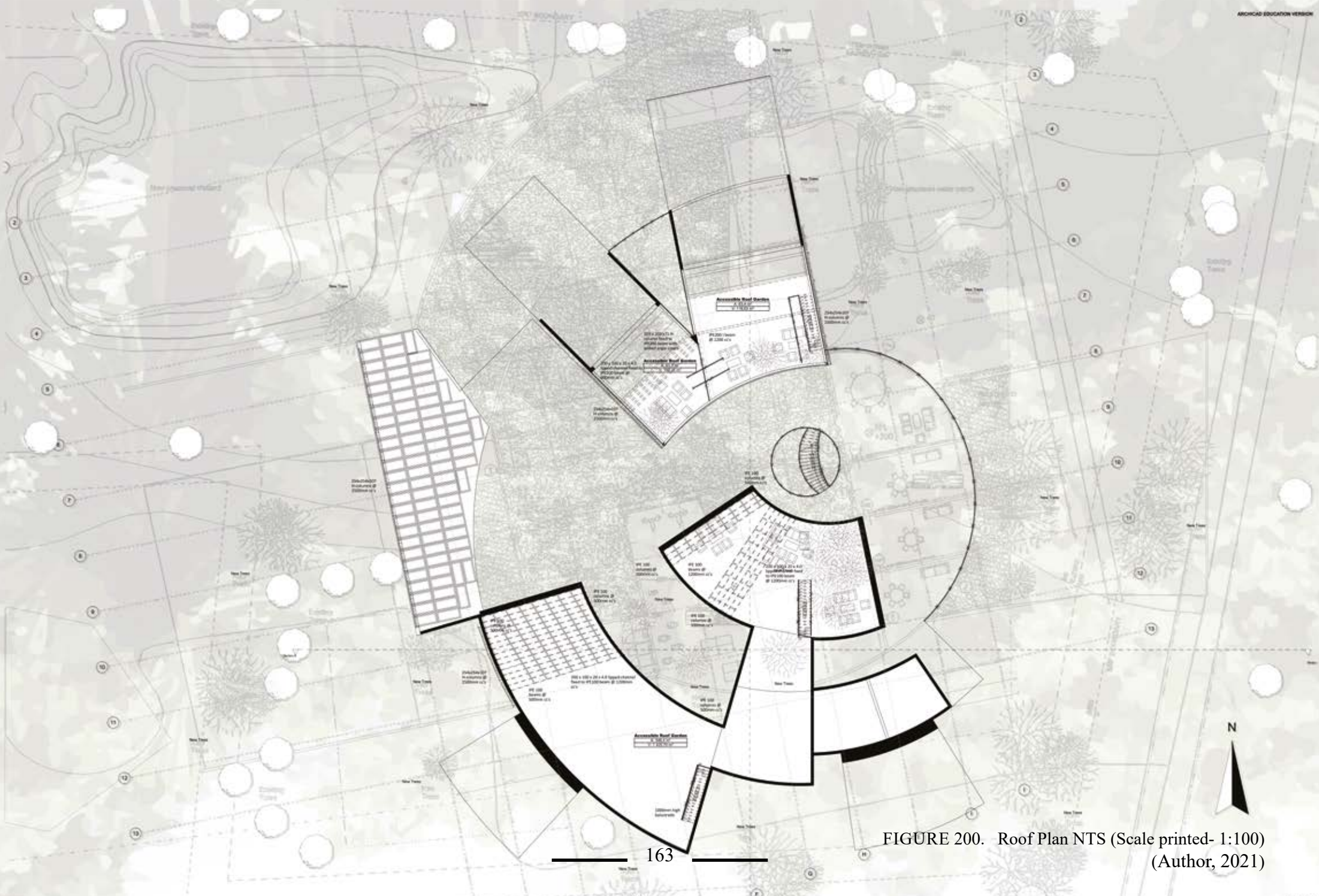
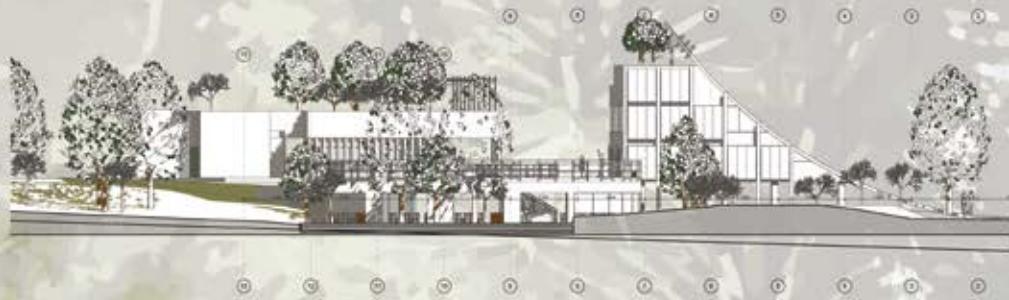
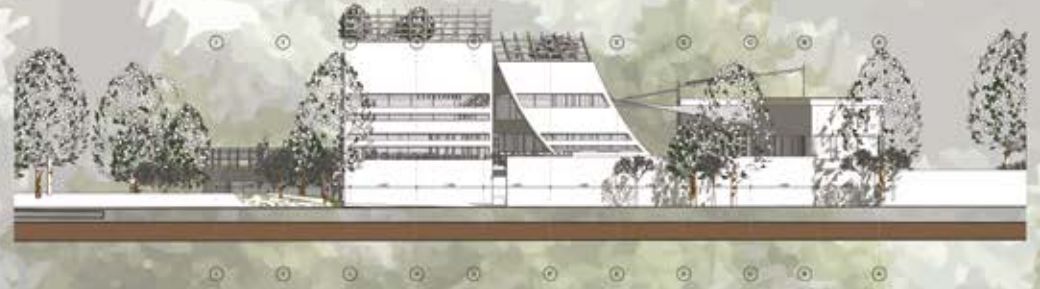


FIGURE 200. Roof Plan NTS (Scale printed- 1:100) (Author, 2021)



EAST elevation

Scale 1:200



NORTH Elevation

Scale 1:200



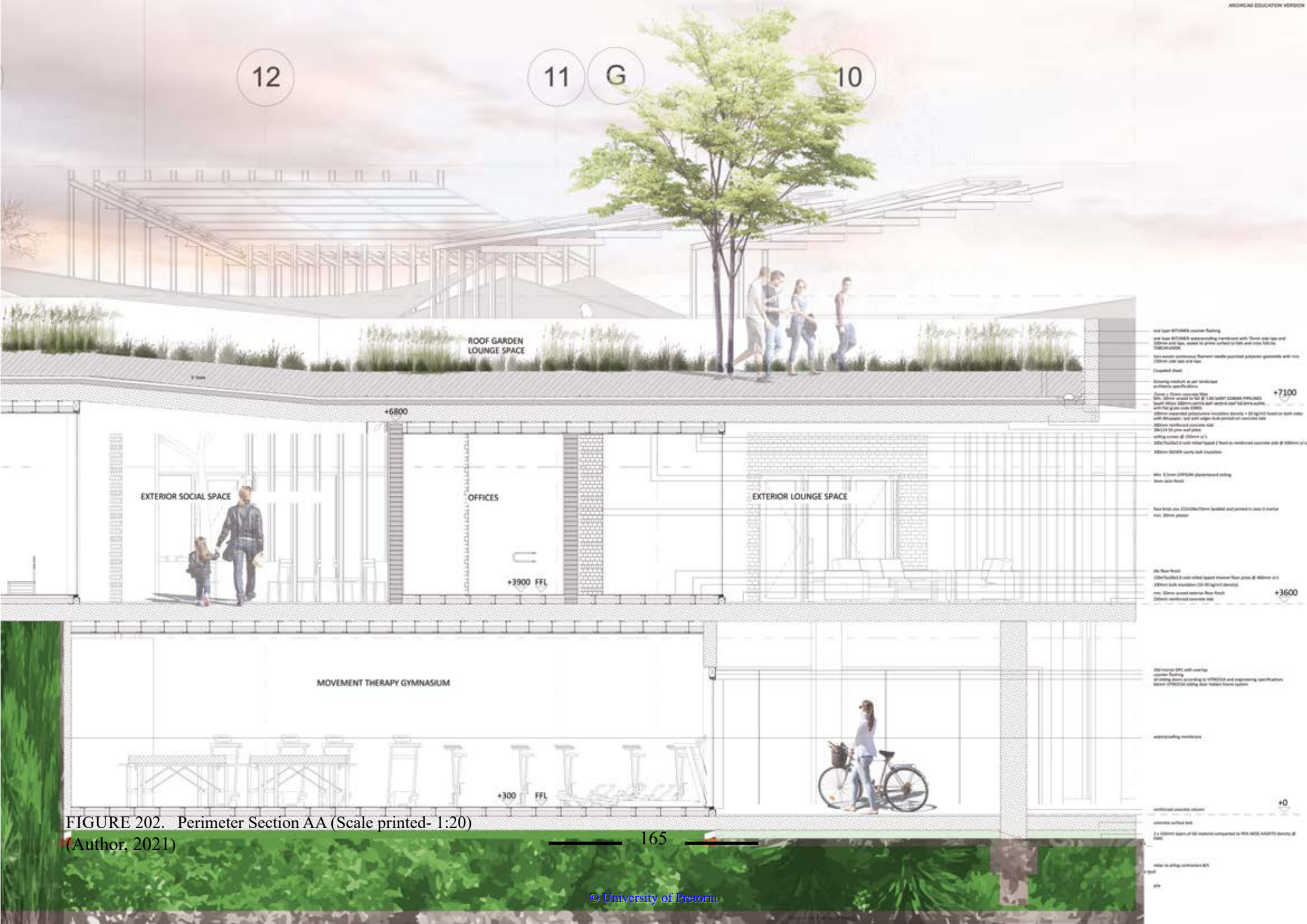
Scale 1:200



WEST Elevation

Scale 1:200

FIGURE 201. Elevations NTS (Scale printed- 1:200)
(Author, 2021)



12

11

G

10

ROOF GARDEN LOUNGE SPACE

EXTERIOR SOCIAL SPACE

OFFICES

EXTERIOR LOUNGE SPACE

MOVEMENT THERAPY GYMNASIUM

+3900 FFL

+300 FFL

+7100

+3600

+0

FIGURE 202. Perimeter Section AA (Scale printed- 1:20)
(Author, 2021)

FIGURE 203. Section AA (Scale printed- 1:100) (Author, 2021)

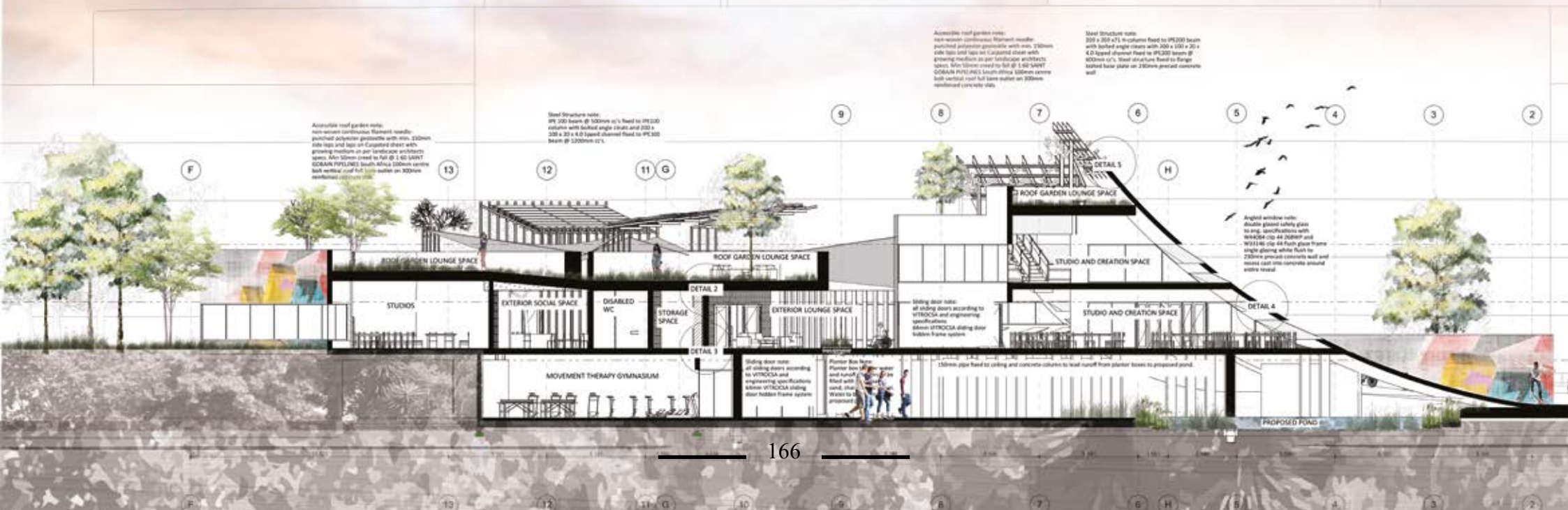
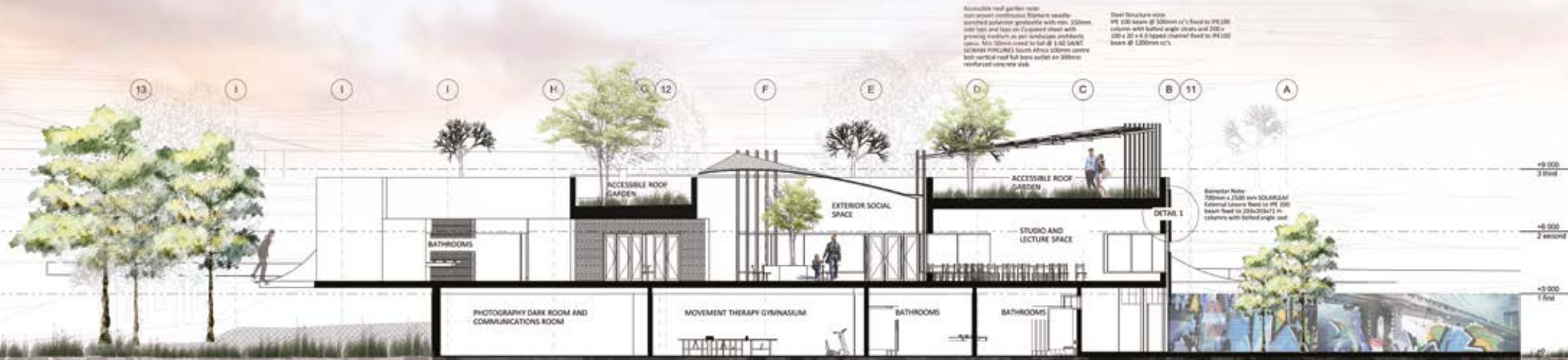
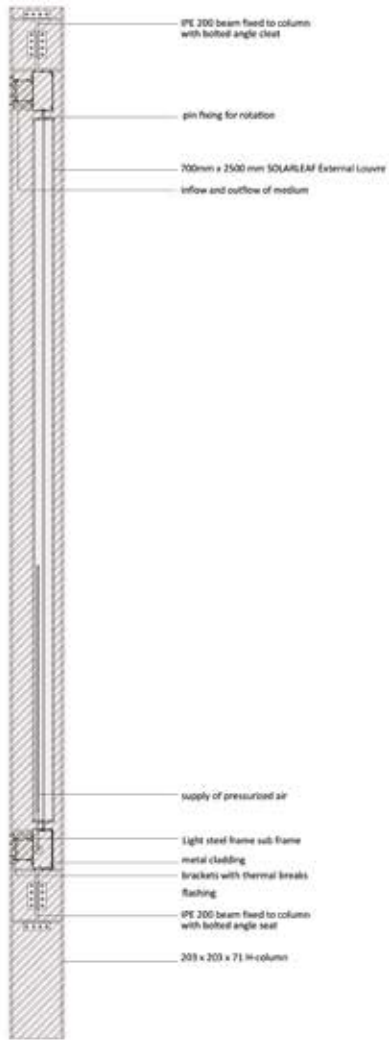


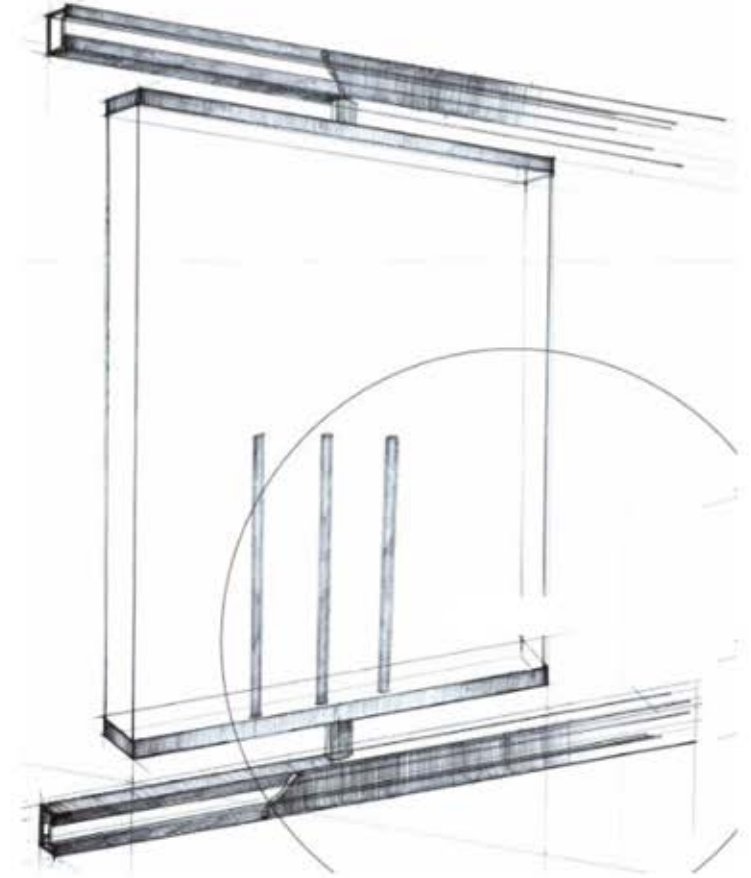
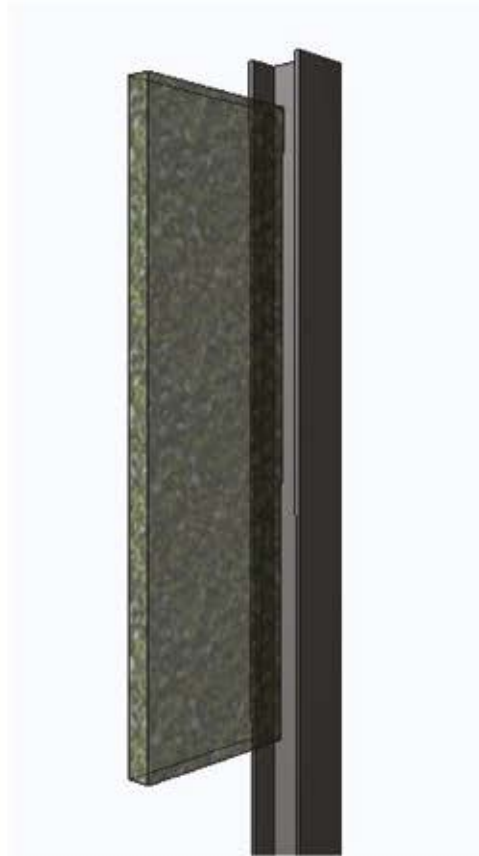
FIGURE 204. Section BB (Scale printed- 1:100) (Author, 2021)





Detail 1

1:10



Bioreactor panel detail 3D NTS

FIGURE 205. Biopanel Detail NTS (Scale printed- 1:10)
(Author, 2021)

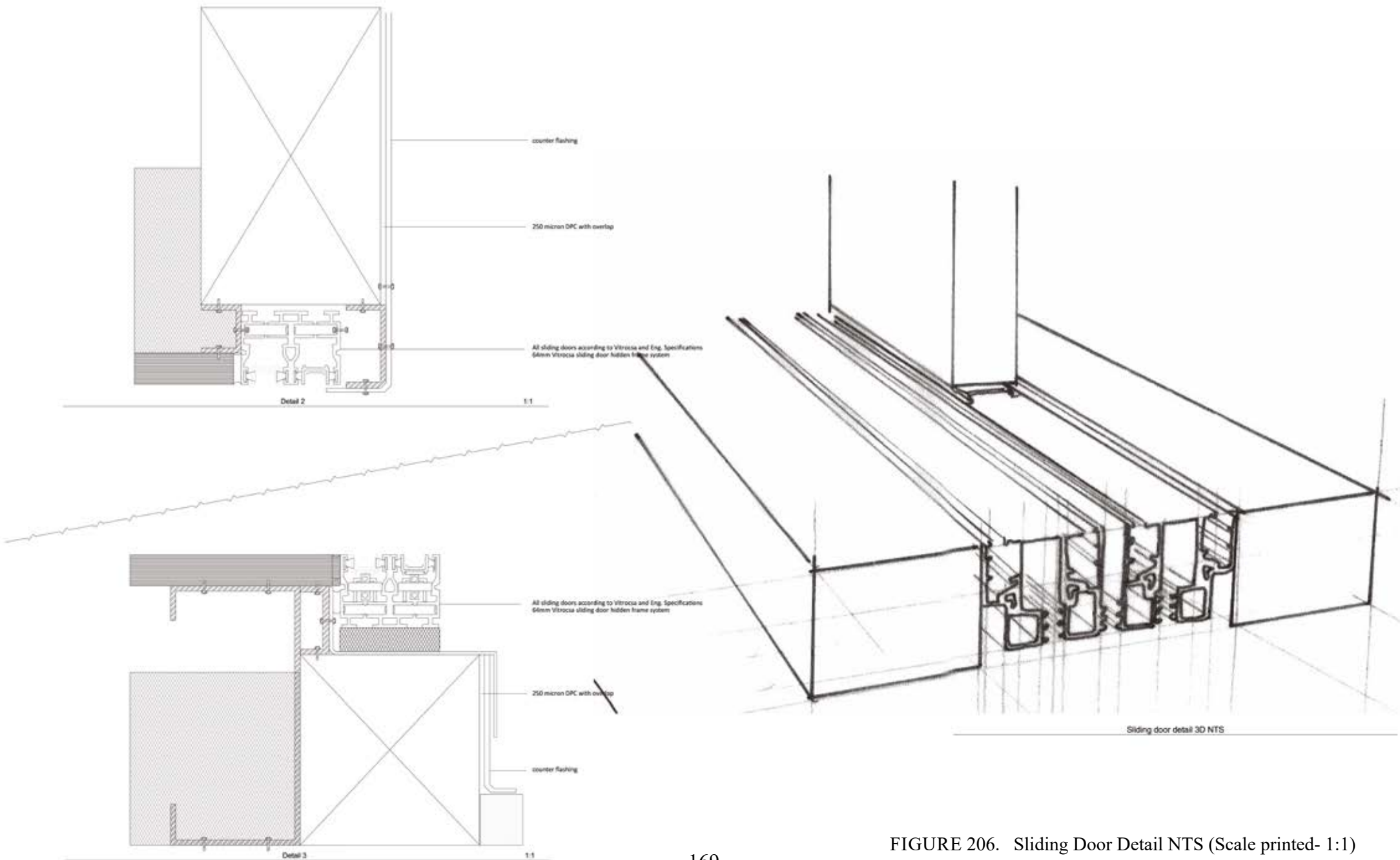
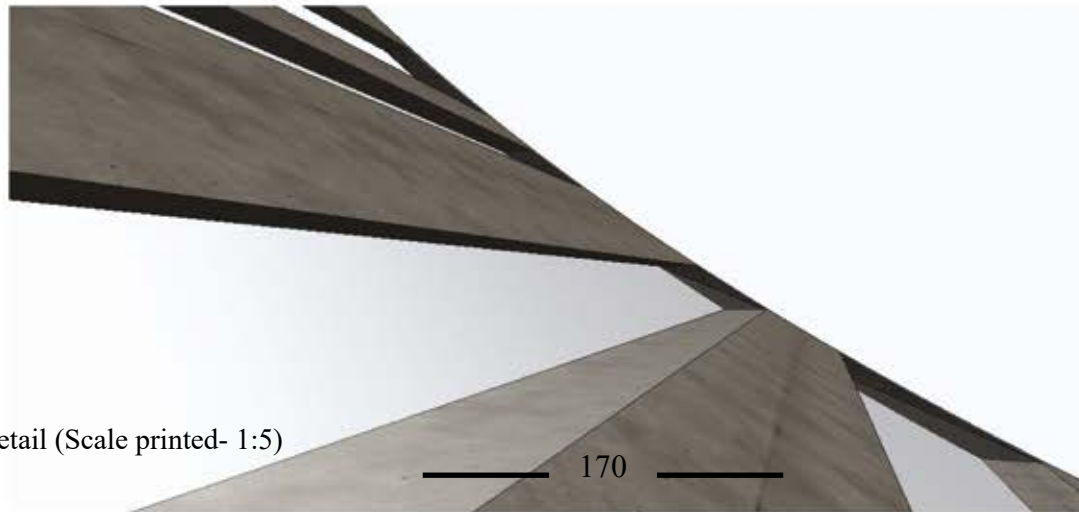
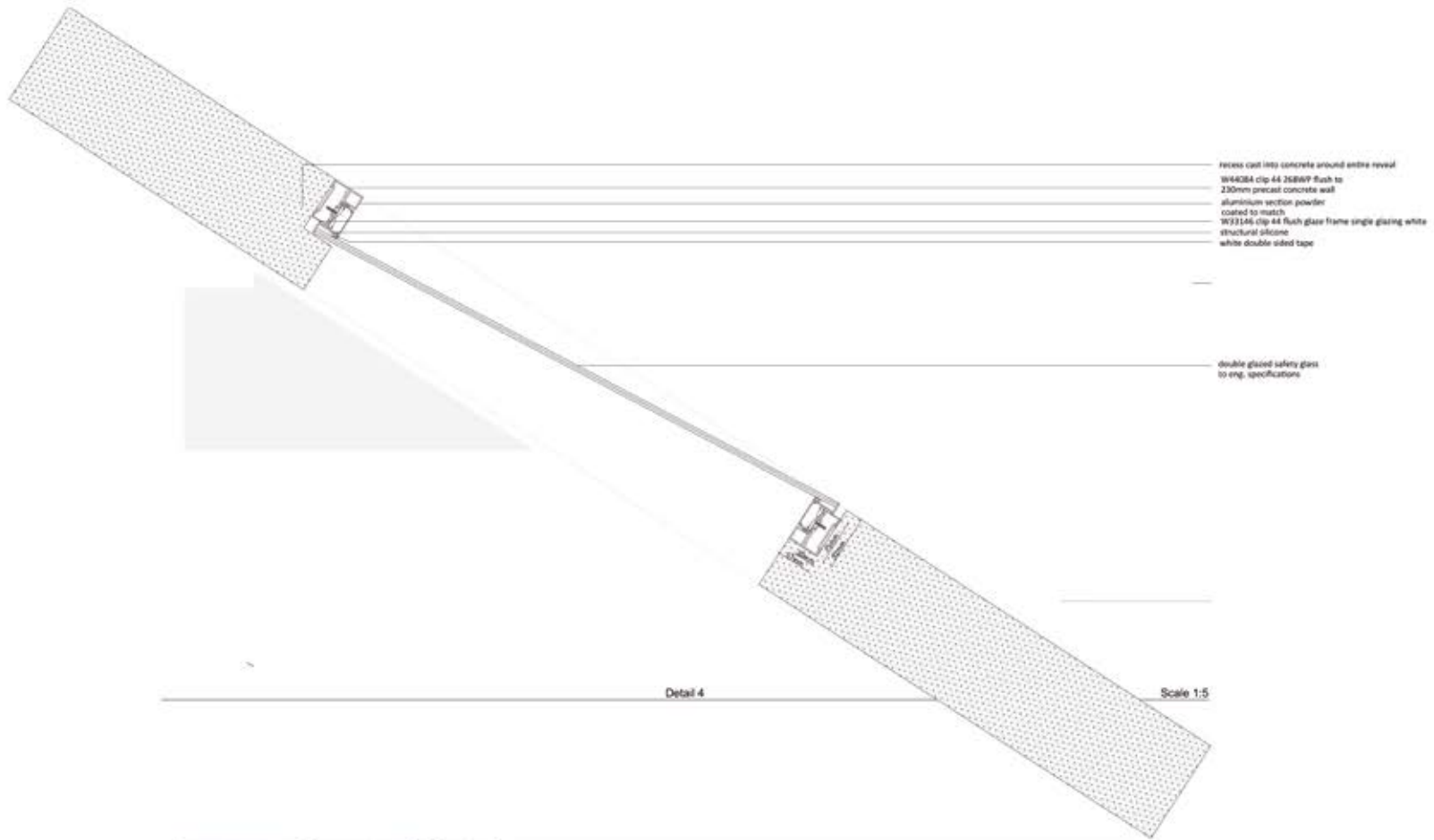


FIGURE 206. Sliding Door Detail NTS (Scale printed- 1:1)
(Author, 2021)



Concrete sloped window detail 3D NTS

FIGURE 207. Slanted window detail (Scale printed- 1:5)
(Author, 2021)

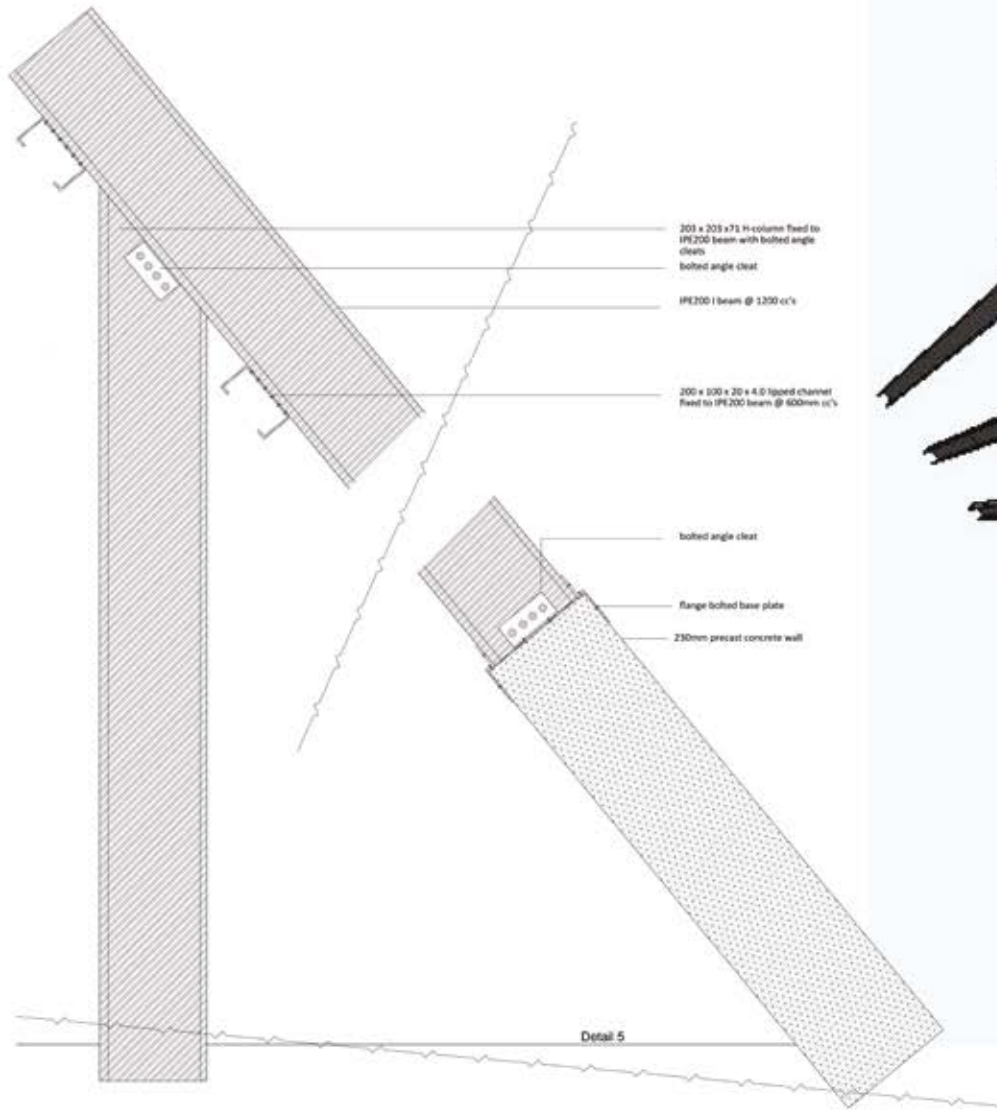
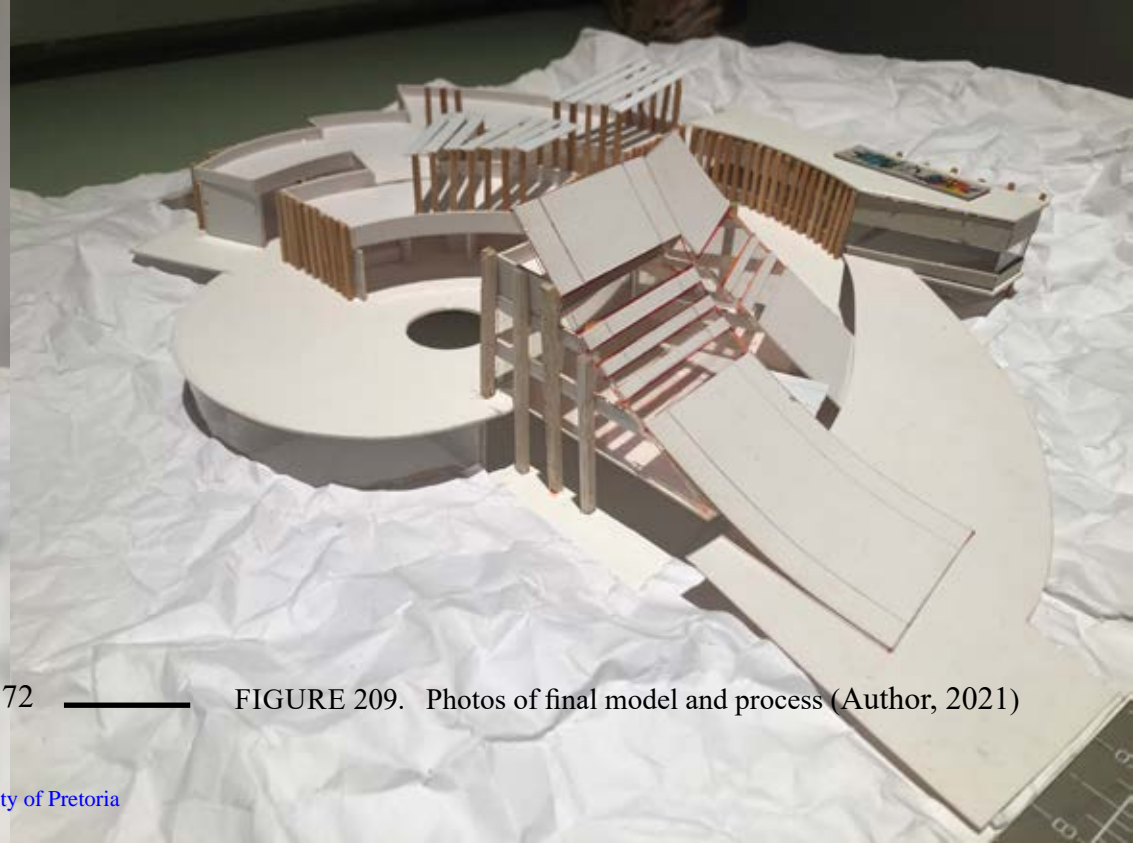
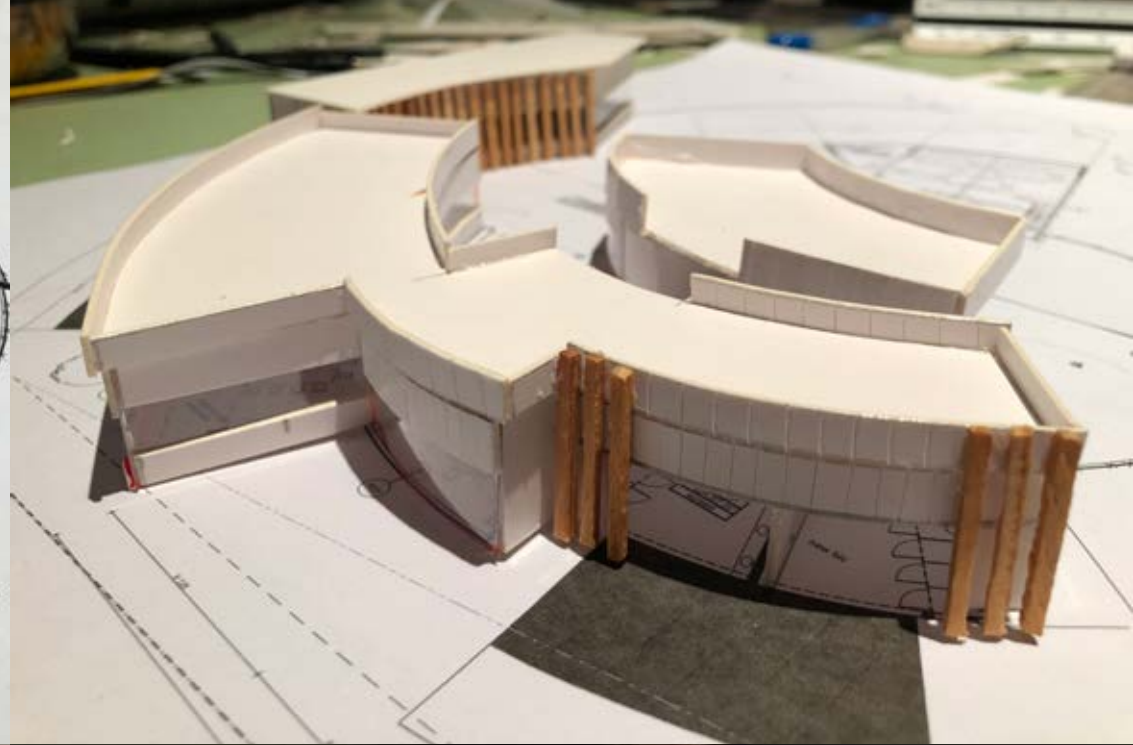
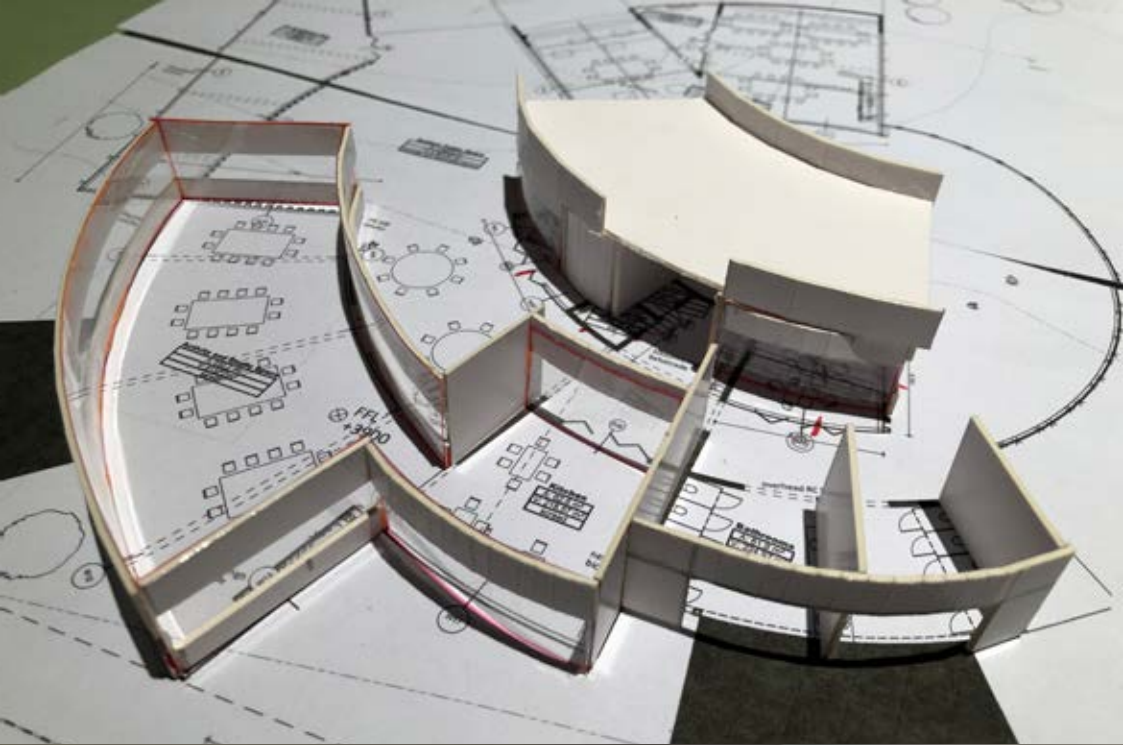


FIGURE 208. Steel Structure detail NTS (Scale printed- 1:5)
(Author, 2021)



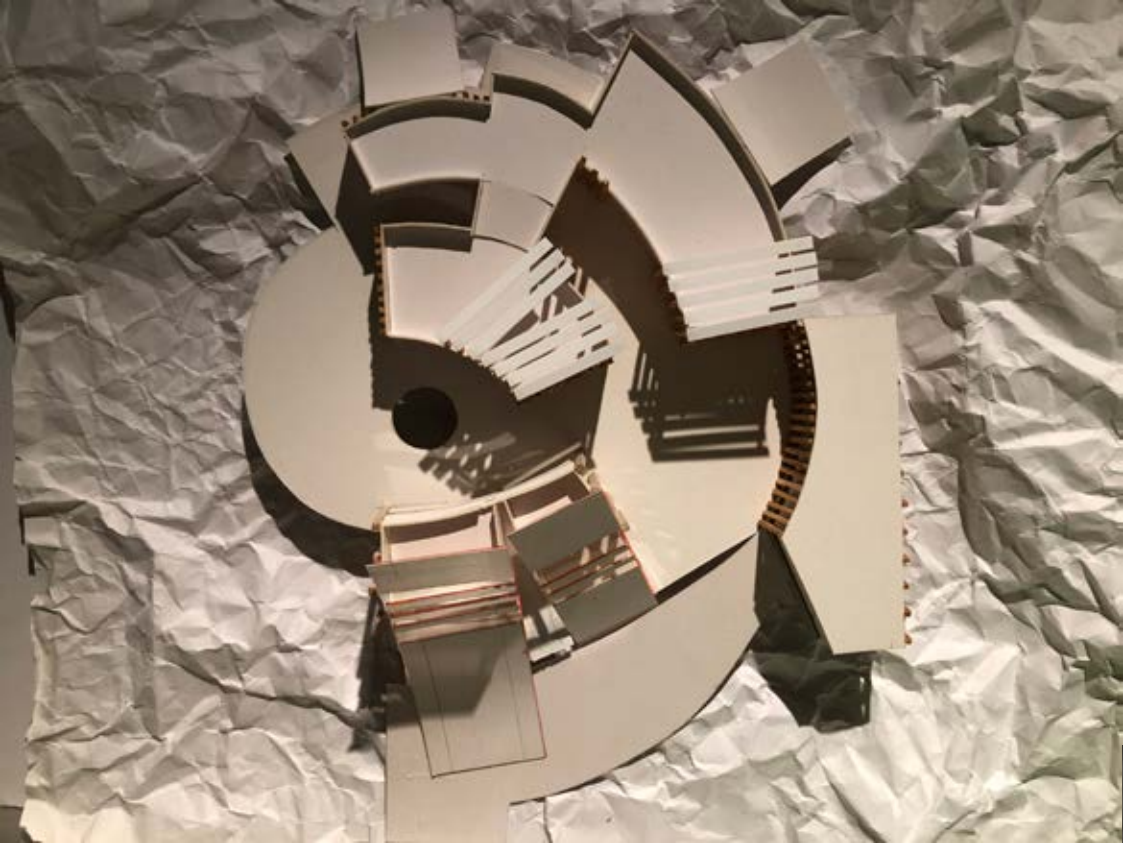


FIGURE 210. Photos of final model (Author, 2021)



FIGURE 211. Final Render of Proposed intervention public area
(Author, 2021)



FIGURE 212. Final Render of Proposed intervention from Jimmy Aves park (Author, 2021)

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Academic Article

The Building as Eco-Systemic Filter

Q1: How can eco-systemic development act as a filter, while supporting human wellbeing?

SQ1: How can architecture become the buffer between urban and suburban areas in Pretoria?

SQ2: How can architecture aid in ecosystem rehabilitation to regenerate urban and human well-being?

by Cosette-Mari Minnaar

Key words:

Biomimetic design, ecosystem services, human well-being, regenerate, social sustainability

Abstract:

The paper explores the possibility of the ‘transition’ zone becoming a ‘filter’ that surrounds the urban core which regulates and rehabilitates ecosystem services to support human well-being.

The main research question is how can eco-systemic development act as a filter, while supporting human wellbeing?

The two sub questions are 1) how can architecture become the buffer between urban and suburban areas in Pretoria, and 2) how can architecture aid in ecosystem rehabilitation to regenerate urban and human well-being? Through research it is evident that the zones around city centres, called ‘transition zones’, are commonly derelict and unsafe. Human well-being is under pressure as a result of the increasing degradation of ecosystem services due to human misuse and urban densification. As cities and their populations grow, urban cores expand which results in constant rezoning and the demolition and degradation of existing spaces. Basic human well-being is dependent on successful ecosystem services and biodiversity in urban environments. This study aims to identify, reintroduce and rehabilitate ecosystem services on the urban edge to facilitate the health and well-being of the surrounding community. The study addresses three main themes namely: i) urban zoning and development, ii) human well-being iii) ecosystem service rehabilitation and reintroduction. Through the use of case studies, literature reviews, historical analysis, questionnaires and interviews the research will be analysed and applied on the relevant study area to find the best possible solution.

Introduction

Human well-being and nature is closely linked, which in turn is continuously influenced by urban development. Sustainability has been at the forefront of global design to counter the sudden decline of resources and climatic change, but the gap between nature and human well-being is still widening. The continuing population growth demands quick and affordable development of space which often results in lacklustre sustainable interventions. These commonly consists of solar power harvesting, green roofs and grey water filtration, but this does not solve the overall impact that development has on nature. Organizations like the International Living Buildings Institute use a set of criteria by which the entire building process is judged to ensure that nature's and the user's health is taken into account (Living Building Institute, 24 August 2020).

As the population grows the urban and industrial areas grow simultaneously to support the increasing demand. As these areas continuously expand, the constant process of re-zoning influences the surrounding residential neighbourhoods. As inhabitants are forced to move further away from the city centre due to factors like pollution, safety and traffic, areas of neglect spread creating a distinct division between urban and suburban. This dividing zone is called the 'transitional zone', as one transitions from 'work' to 'live' (Preston, 1966:240).

The process of re-zoning often results in a decrease in open public areas as they provide space for development. When spaces are removed, habitats and biodiversity corridors reduce which impacts ecosystem services (Bolund & Hunhammar, 1999:299). Ecosystem services like noise control, air and water filtration as well as pollination is often controlled by green spaces in the city centre (De Groot et al, 2002). If these spaces are removed, these ecosystem services will be needed from outside the city boundaries (Bolund & Hunhammar, 1999:299). This affects the overall biodiversity and eco-system of the city. This is often the consequence of a lack of knowledge regarding ecosystem services and their importance. Ecosystem services also need ecosystem functions like habitats for insects to produce pollination, or soil control for optimal water filtration (De Groot et al, 2002:296). Developers repeatedly try to counter their impact through sustainable interventions but without basic ecosystem functions, these 'sustainable' interventions or 'services' will not operate successfully.

Ecosystem services also directly influence human well-being (Taylor & Hochuli, 2015:749). If the main reason for development is to provide ample space for the city's residents, the inhabitants' needs should be accounted for. This means that these ecosystem functions and services should be protected or in most cases rehabilitated.

Transition zones become the perfect location for the re-introduction of ecosystem services and biodiversity. Urban and industrial areas produce large amounts of pollution and other negative factors that influence the well-being of the city around it (Preston, 1966). To regulate the impact of the urban environment on the suburban areas, transition zones should become filters. If these spaces encircle urban cores, the overall city biodiversity would increase, resulting in a regulated and systemic environment. As an effect biodiversity corridors across cities are formed that provide ecosystem services to fully operate as they are intended to. This starts to solve human well-being issues as well as climate change and resource degradation.

This paper focusses on Tshwane, South Africa, which is a city with planned expansion and multiple urban hub development. This provides the opportunity to investigate the affects urban development has in a suburban and predominantly residential environment. These problems are considered in existing city centres and can therefore be anticipated and provided for, but they are not necessarily expected in sub-urban areas. The area which the paper will conduct on site research has been carefully chosen due to the importance of well-being for its users. The area is a predominantly older area consisting of old-age homes and low density residential. A new urban core has been developed which has resulted in the demolition of many homes and public spaces. This has resulted in the appearance of a transition zone that separates urban from suburban.

The main objective of this study is to ascertain whether architecture can become the regenerator for ecosystem and biodiversity degradation and in turn promote human well-being. Three main themes will be discussed and analysed to ensure that the end product covers all complexities in an ideal urban environment. Firstly the issues surrounding the theme of urban development and zoning will be investigated. This theme will mainly focus on the appropriation of space and how transitional zones develop. An historical analysis on South African spatial change, primarily in the chosen region, will be done to identify how South African cities develop in accordance with the Ernest Burgess (1966:237) concentric Circle model. Calculations developed by Murphy and Vance (1966:238) will also indicate the transitional zone and its specifics.

Secondly the theme of ecosystem services and biodiversity rehabilitation will be explored through case studies and a literature analysis. This will be supported by an investigation of their importance to everyday life. One must be able to identify their benefit to human use and how, in turn, human misuse affects the well-being of mankind. Research on biomimetic design and net positive design will also be consulted to identify the solution possibilities for man-made ecosystem services.

Literature review: Urban Development

The last theme is human well-being and its dependency on nature and ecosystem services. Case studies and research on the link between well-being and ecosystem services in urban areas will be consulted to understand the extent to which this connection stretches. Possible ways to assist this issue like circular economic systems will be researched.

All three themes are morphed into a solution for transitional zones that become filters in the city. The definition of a filter that best fits this context is a device that is used to remove impurities but also a layer which selectively absorbs specific components. The transitional zone should absorb impurities created in the urban core to regenerate and restore them before entering the surrounding environment.

This paper aims to develop the baseline for future developments to acknowledge their impact on ecosystem services. This paper facilitates the search for solutions that adds value to the environment and users to secure their future as well as increase biodiversity, social sustainability and human well-being.

A global issue that most cities face is the lack of sufficient amenities and housing for an ever growing population. To accommodate the population growth cities should be able to cater to everyone's needs by means of job and resource availability. South Africa has a long history with problematic city planning and this has had a lasting effect on human well-being. Historically cities were divided into racial specific areas where predominantly white areas surrounded the city centres and economic nodes (Williams, 2000:167). In the last few years citizens have moved into the city centres, frequently illegally, as they cannot afford travelling to and from work in addition to the expensive living costs of the suburban areas (Nosch, 1978:451). This resulted in sprawled amenities across the city as most residents live outside city boundaries. Developers have since tried to solve this issue with inserting new urban and business cores into the suburban city fabric which has led to many zoning difficulties.

According to research by Ernest Burgess (1966) most cities develop in concentric circles from the business centre outward. Every concentric circle represents a different zones and where its periphery is as seen in figure 1. By analysing American and European cities, Burgess (1966) found that most cities only develop in 3 directions as they approach a barrier element like a river, a main transportation route or educational facility. As cities grow and more business nodes develop throughout - these concentric circles of development start to overlap, creating issues at the intersections called transition zones (Preston, 1966:240). The zone focussed on in this paper is the transitional zone between urban and suburban.

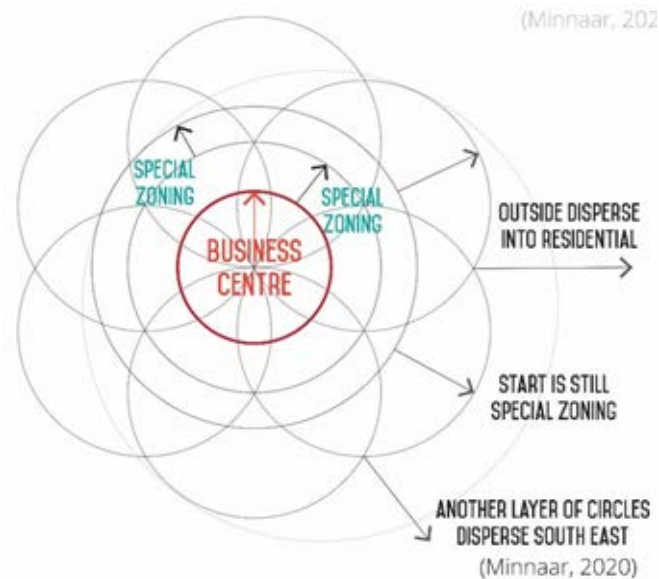


FIGURE 214. Concentric Circle diagram (Preston, 1966 & Author, 2020)

In the South African context many citizens have moved further away from the city business centre to escape traffic, pollution, crime and various other factors. The city simultaneously expanded resulting in multiple business districts across the region as seen in figure 2 (Myeza, 2013:99). This has led to the abandonment of some areas as sites were re-zoned in preparation for urban expansion. These zones, commonly encircling the business nodes, indicate the shift from urban to suburban and therefore become transitional zones.

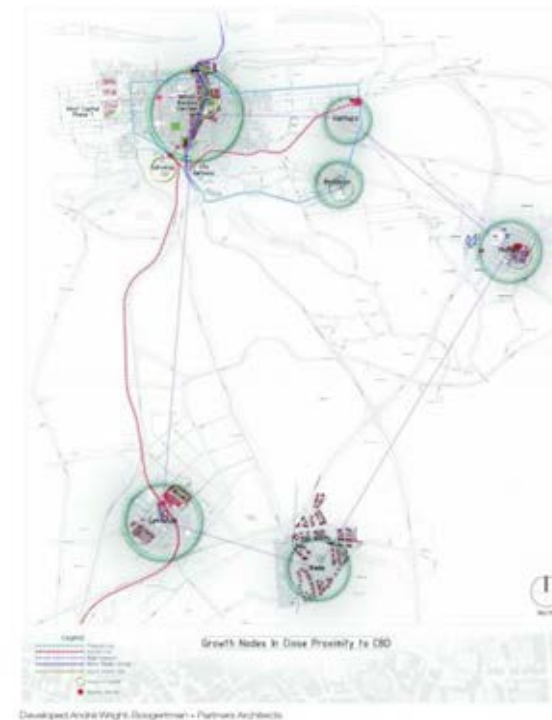


FIGURE 215. Nodes (Myeza, 2013)

Burgess (1966:237) states that the transitional zone is a zone of deterioration encircling urban areas and this is due to urban researchers not being able to develop a precise definition and understanding of this zone. This could be because every transitional zone is dependent on the context and country as well as the relevant problems found in that area. Even though the transitional zone is an anomaly, Richard Preston (1966:237) explores a number of commonalities between different transitional zones to aid in identifying them. Field observations by Richard Preston (1966:239) unveiled that these zones of transition commonly consists of public, wholesale, retail, office and transportation spaces. These zones expanded outward in a lateral direction and fade when they collided with large areas of homogenous land use- for example heavy industrial and residential. Residential communities were most apparent at the outer edge of these so called transitional zones (Preston, 1966:240). The biggest problem that these areas face is their increased vacancy. This is due to underdevelopment of the area, unattractive land for competitive development, and the obvious division between residential and city centre as well as land use proportions that indicate the unimportance of these plots (Preston, 1966:241).

These factors led to a conclusion- that there needs to be a specific set of rules regarding this peripheral zone. Urban planners should identify specific zoning requirements and uses for the zone as well as demarcated start and end point to minimize expansive and unnecessary development into residential areas (Preston, 1966).

Another issue with increased development is the re-zoning of open space (commonly public green spaces) that negatively influence the well-being of the public as many residents depend on these spaces as their only green space. According to the United Nations in 2050 80% of South Africa's population will be living in the urban environment (COGTA, 2014:12).

Open space thus becomes scarce as densification of city centres are the most feasible option. By developing the city centre, pollution rates increase due to bigger industrialized areas, increased traffic and a loss of green space (Bolund & Hunhammar, 1999:299). This affects environmental and human well-being, and simple sustainable measures are not sufficiently countering this ongoing cycle.

Therefore, transitional zones offer a place in the existing urban fabric where green spaces, well-being spaces and ecosystem rehabilitation can be reintroduced. These zones can provide a barrier between the urban and suburban areas that act as filters to regulate what enters the suburban area in terms of pollution, traffic and development. If ecosystem services are increased and negative influences regulated, the well-being of the city's inhabitants will be revived.

Human well-being

We often neglect the well-being of the city and its inhabitants and focus solely on densifying the city to have space for those inhabitants. There is also a lack of understanding of the massive scope which is human well-being and everything that contributes to the concept. Human well-being should be considered in its entirety including the mental, physical, social and spiritual aspects (Taylor & Hochuli, 2015:749). Taylor and Hochuli (2015:749) also argues that human well-being is predominantly reliant on three aspects especially in an urban setting, namely walkable, green and community spaces. These spaces act as social spaces where one interacts with others and nature whilst being active and escaping from every day constraints. These spaces ultimately act as mental, physical, social and spiritual well-being enhancers. Urban development also commonly neglects public in between work and live spaces. In-between zones become important when creating an easy transition between the urban and suburban areas. By considering what Taylor and Hochuli (2015:749) believe and comparing it with the average urban environment one can see that green, walkable and community spaces have often been neglected in the past, resulting in a decrease in human well-being.

This is where social sustainability becomes important. Social sustainability is the creation of successful and sustainable spaces that focus on the provision of human needs while simultaneously promoting well-being in spaces where they work and live (Woodcraft, 2017:135). These spaces should provide their users with needs that they do not necessarily receive in other environments and thus become break away spaces. This concept can be taken a step further where work and live spaces find harmony through social sustainability.

Other important considerations should be made where physical, mental and spiritual health should be included in the decision making of urban development- making well-being the main driver. To fully ensure that all aspects of human well-being is tended to, the development should be rooted in the well-being of nature.

Ecosystem Service degradation and Sustainability

On the authority of the Millennium Ecosystem Assessment (2005), 60 percent of the world's ecosystem services are degraded and unsustainably used (Haines-Young & Potschin, 2010:111). This means that the link between nature and mankind is, unfortunately, broken by mankind. This is primarily due to a lack of knowledge on the connection between ecosystems services and their impact on human well-being as well as exactly what ecosystem services are.

An ecosystem service is identified as the benefits humans gain from nature without paying any price. Haines-Young and Potschin (2010:111-113) separate ecosystem services into provisioning, regulating, cultural and supporting services (Haines-Young & Potschin, 2010:113). This downplays the importance of the entire process.

According to de Groot, Wilson and Boumans (2002:394) these resources should be split into functions and services. Ecosystem functions provide such services in terms of regulation, habitat, production and information functions. In turn services are produced generating value for ecological, socio-cultural and economic purposes (De Groot et al, 2002:394). Here one can add that these services provide value through provision, regulation, culture and support explaining the system as a whole, rather than the outcome like Haines-Young and Potschin (2010:113).

To further understand the importance of ecosystem functions and services one must be able to recognise them as well as their benefits in everyday life. In *Creating better cities: how biodiversity and ecosystem functioning enhance urban residents' wellbeing* the Taylor and Hochuli (2014:755) state that an ecosystem needs to be healthy and void of any pollution to provide an entire range of services like pollination, storm protection, noise regulation and food production (Taylor & Hochuli, 2014:755). De Groot, Wilson and Boumans (2002:394) classify these services according to the type of value they provide in their function, their process and components and finally the service. For example the production of food needs components like solar energy and rich soil that ultimately provides a continuous cycle of food, materials and fertilizer. This service also links to the production of medicinal products with an entirely new cycle (De Groot et al, 2002:396).

Ecosystem services often degrade due to the re-zoning of land. Previously green biodiverse spaces on the periphery of the city now become developed land, unfortunately leading to the decrease in services ultimately influencing human well-being. Ecosystem services should be provided in socially sustainable spaces as they are the main providers of human needs. Munzel, Meyer-Waarden and Galan (2018) takes this concept a step further by linking it to urban development, where more than half of the world's population is situated (Ledent 2003; Munzel, Meyer-Waarden and Galan, 2018). Urban plans should specifically include ecosystem services into their developments through non-natural methods like architecture. Architecture can be used to rehabilitate or reintroduce these services when they are demolished in the first place.

Unfortunately when mentioning sustainable design one commonly associate the word with solar power, energy and water saving. These interventions are indeed needed but the most important factor is often overlooked- the rehabilitation of the environment. The Living Buildings Institute expands on this notion by incorporating net-positivity and the concept of the building becoming an ecosystem (Living Building Institute, 24 August 2020). The important concept of net-positive is that a building or site produces more than what it requires. This results in a positive re-production that improves the system rather than just avoiding it with a net-zero approach (Cole, 2015).

Another model urban development should introduce is the Circular Economy Theory. This model aims at reducing the amount of waste produced in a normal business, industrial and economic cycle. Any waste produced should become a possible source in another cycle- eventually creating one large inclusive system in the urban environment (A Circular Economy is what we need to move towards, 7 September 2020).

A possible architectural solution to the above mentioned would be biomimetic architecture where the building itself produces ecosystem services. The building thus becomes a part of the environmental system rather than a negative imposition.

By defining bio-mimesis one finds that it is an architecture which imitates life (Croxford et al, 2017:695). More in-depth definitions define biomimetic as “the abstraction of good design from nature” (Bogatyrev et al, 2006:471-482) and “an emerging discipline that emulates nature’s designs and processes to create a healthier, more sustainable planet” (Benyus, 1998:392). Biomimetic architecture is therefore a possible way in which ecosystem services and functions can be replaced and rehabilitated by means of man-made structures. The biologist and leading researcher in the field, Janine Benyus, voices her concern for the way in which this concept has been executed in the past. Most previous attempts were unsuccessful due to the construction only mimicking natural form. Benyus (2008) explains that biomimetic design cannot function without mimicking the form, process and ecosystem in which these services function.

The Living Buildings Institute (2020) requires that the building, and its entire pre and post construction life, functions like a flower. They do not only demand elements of energy and water saving but also that the architectural product add to the environment through material use, movement, beauty, human health and happiness, place and equity. This approach involves both human and natural needs throughout the entire lifespan of the project (Living Building Institute, 24 August 2020). Another way to establish whether architecture can be the solution to rehabilitate ecosystem services is by doing multiple experiments. Bogatyrev et al (2006) use experiments to create a system with which Biomimetic architecture can be tested.

They use the core logic of causal attribution while using a secondary source of data – numerical data. This is for the purpose to provide explanations of certain phenomena in the field that are normally based on universal laws (Bogatyrev et al, 2006). Like most studies concerning biology and ecosystem services a scientific method is the correct way to collect relevant data, but this unfortunately results in a study void of any human link. This is a possible reason why most attempts to resolve the issues regarding nature degradation fail and lack relevance.

By using transitional zones as filters, socially sustainable spaces that reintroduces ecosystem services can be developed around urban cores.

This will result in urban environments acting as small ecosystems. This will enable cities to become large biodiverse ecosystems that link with each other, slowly solving the issues regarding well-being, climate and resources.

Ecosystem Service degradation and Sustainability

This paper is approached from an interpretivist standpoint to ensure that both the scientific and human sides of the argument is considered (Harris et al, 2015). To corroborate that both aspects are equally included in the research three methods of data collection is used.

Case studies and literature investigating the phenomenon of transition zones is consulted to fully understand why and how these zones develop. The information found through the case studies is applied and tested on the relevant areas of investigation. This is to ascertain whether the South African urban development system correlates with international development systems for example the Ernest Burgess (1966) concentric circle method (refer to figure 1).

The area was analysed according to the Murphy and Vance (1966) field mapping procedure to determine where the transition zone is located. This mathematical analysis was done concomitantly with Ernest Burgess' (1966) concentric circle analysis.

Firstly past and present maps regarding the change in open space, residential, urban and industrial zoning is considered (refer to figures 3 and 4). Maps from 1996 to 2010 and lastly 2019 is used and overlaid (Tshwane GIS, 13 March 2020).

This is to establish the amount and rate at which the area has grown in the last 24 years (refer to figure 3).

The development and loss of public open space is also considered to determine whether these spaces are used for densification in urban fabric. Other area maps regarding the change in densification of urban nodes in Pretoria is also analysed and considered to ensure that the possible solutions can support different urban environments across South Africa.

Secondly different business nodes in Gauteng is explored through the concentric circle model to establish how South African cities develop. These areas include Hatfield CBD, Pretoria Central CBD, Johannesburg CBD, Sandton CBD and the new Menlyn Maine development as seen in figures 6-10.

After analysing the development pattern of the area the mathematical analysis by Murphy and Vance (1966) is applied (see Appendix A). This is done by inspecting every block around the area and calculating the land use proportions, as well as the different patterns of zoning. This indicates which land use is the most prominent in the area and in turn indicates whether the area is becoming a transitional zone on an urban periphery (Preston, 1966).

Multiple case studies were compared to thoroughly understand the expanse of ecosystem services and functions, some of which are obvious and others obscure. This helps to identify all ecosystem services that are present in the area. It is apparent that human needs differ regionally and to ascertain what ecosystem services are most in demand, site investigations are essential. This is important for determining which ecosystem services should be reintroduced in an area and analysis which services are lacking.

Case studies investigating the connection between human well-being and ecosystem services were consulted to understand the importance of these services to the human user. Furthermore literature on social sustainability and spaces that enhance well-being was reviewed. These studies led to the understanding of possible solutions that reintroduce ecosystem services to revive human well-being.

To determine whether these interventions would be feasible in the area, a series of interactive posters were created to introduce a communal study. The interactive poster questionnaires were circulated in the immediate area (Menlyn Maine, Pretoria, South Africa) where questions about the site and its value was gathered. To include a range of participants the method of interactive collaboration was used. The survey was open for 2 weeks and 18 participants decided to interact. The participants were a mixture of skateboarders that have been using the facility for years, children, parents and passers-by. The study entailed the participant to answer using a green sticker. All questions were yes/no or comparative questions where the participant can place their sticker on their answer. Some questions included different categories of answers to cover a wide variety of information and opinions (see Appendix B and C).

Findings and discussion

According to the Tshwane 2055 Vision Gauteng will be experiencing major densification and development with 6 new business developments in Pretoria as seen in figure 2 (Myeza, 2013:99).

The issues commonly associated with urban environments will now prevail in suburban areas across the city. The Menlyn Maine development was purposefully chosen as the area was predominantly residential. The new development has since caused urban issues to arise that was not anticipated. Fortunately, these problems are still evolving which provides the opportunity for intervention and prevention.

Site maps from 1990 and 2018 is superimposed to identify the largest areas of change and densification. Maps indicating the industrial and urban development, figure 3, as well as the change in residential zoning, figure 4, is analysed. The maps show that as business zoning expands and appears across the area, residential slowly disperses and disappears. Industrial and business zoning also starts appearing throughout densely residential neighbourhoods forcing a divide in communities (Tshwane GIS, 13 March 2020).

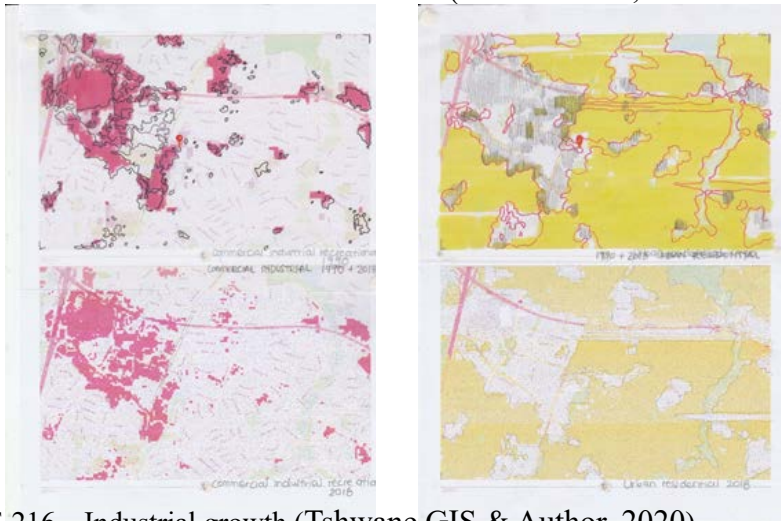


FIGURE 216. Industrial growth (Tshwane GIS & Author, 2020)

FIGURE 217. Residential growth (Tshwane GIS & Author, 2020)

In figure 3 the 1990 and 2018 maps are overlaid to identify areas that has since been completely demolished and rebuilt from residential into business, urban or industrial. This map indicates the pattern of development from the new Menlyn Maine business node outward into the residential neighbourhoods (Tshwane GIS, 13 March 2020).

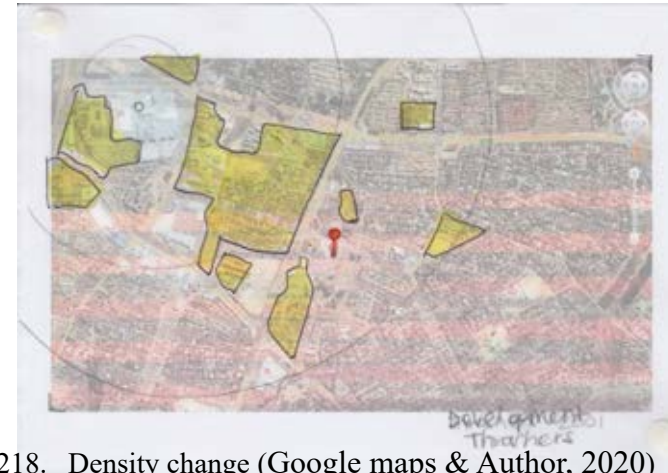


FIGURE 218. Density change (Google maps & Author, 2020)

In order to propose a solution of resilience and regeneration the future development of the area needs to be considered. To establish the future pattern of development the concentric circle method by Ernest Burgess is investigated (Preston, 1966).

This method was applied and adjusted to five existing city centres across Gauteng to ensure that a thorough investigation of South African city development patterns is done. These nodes include Menlyn Main, Pretoria CBD, Hatfield CBD, Johannesburg CDB and Sandton. The most interesting conclusion was that the majority of the nodes investigated developed in a three point direction rather than circularly outward. This is either due to heavy industrial areas or national roads that prevent development, or residential zones that were existing before the business node developed and grew in that city.

As can be seen in figure 6, the concentric circle development of the Pretoria inner city takes place towards the east which fades into the suburban and residential area. Educational facilities like the University of Pretoria prevents any further expansion to the south east. To the west any expansion is prevented by undeveloped land and a heavy industrial zone. There is a surge in densification between the Pretoria CBD and Hatfield area, which is fast becoming a new business node, where Residential 3, 4 and 5 is developing. This means that high rise residential is more in demand closer to the city centre.

Figure 7 shows the University of Pretoria and N4 highway preventing any development of Hatfield to the south east, and previously residential zoned areas are being rezoned for special and business interventions. Hatfield is slowly colliding with the inner city of Pretoria where the high rise residential units are densifying the city. The most prevalent concentric circles are expanding towards the north and north east.

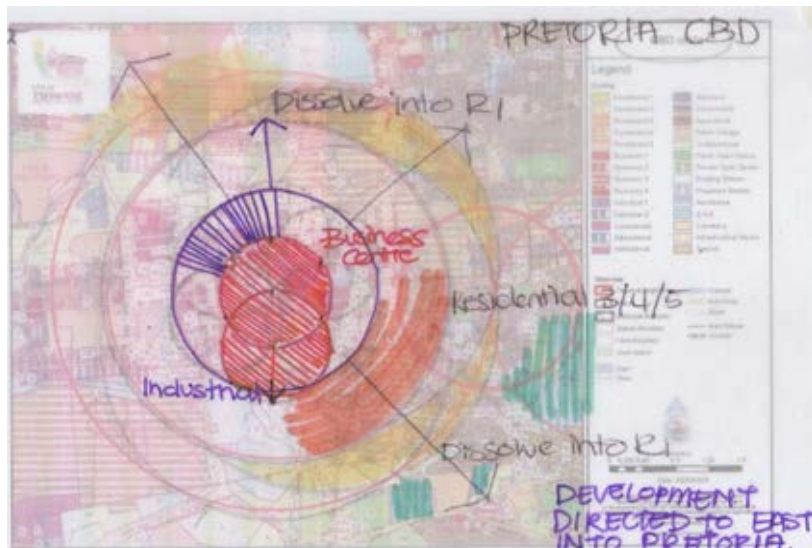


FIGURE 219. Pretoria CBD (Tshwane GIS & Author, 2020)

FIGURE 220. Hatfield (Tshwane GIS & Author, 2020)

An interesting phenomenon is seen in figure 8. Johannesburg's development take place in a linear fashion following the existing mining belt of the area. This also shows through the zone pattern which is the industrial belt surrounded by business which moves into low density residential. The only concentric circle development is seen to the south west of the city.

Sandton city is a perfect example of 3 direction development rather than perfect concentric circles illustrated in figure 9. The city centre expands towards the north and north east with mostly special and industrial amenities. These zones disperse into a highly residential focused area which surrounds the entire district. Through historical development analysis maps it is obvious that the business areas are slowly seeping into the residential communities.

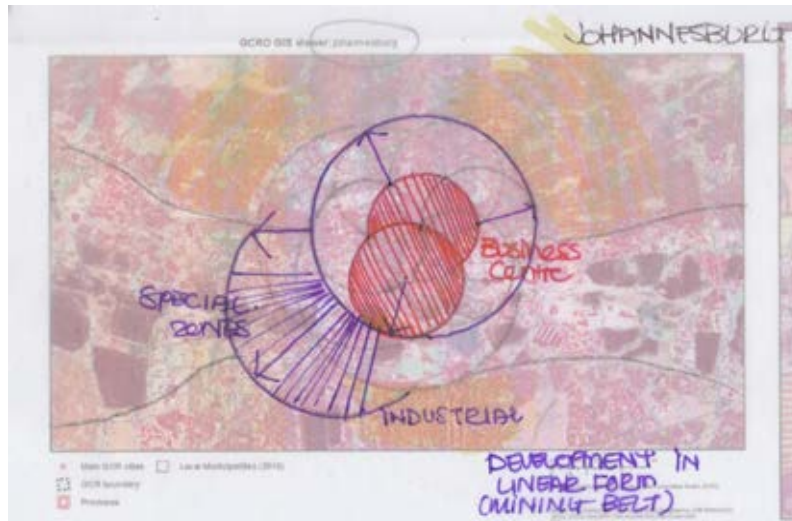


FIGURE 221. Johannesburg (Tshwane GIS & Author, 2020)

FIGURE 222. Sandton (Tshwane GIS & Author, 2020)

As seen in figure 10 below, the concentric circle model is most apparent in the Menlyn Maine area. The development slowly moves into the surrounding residential areas on the north, east and south of the business centre. To the west the national highway prevents development but it seems it has jumped the road and moved over to the other side.

The central circle is where the new business centre is situated. This moves into special zoning including retail and public throughout the second and third circles. When the third circle comes into contact with the residential areas it slowly disperses and becomes small singular special zones on the periphery of the residential zone.

This study supports the phenomenon of a transitional zone developing around the new Menlyn Maine development. Smaller businesses are spreading outward leading to open and vacant plots surrounding them.

As residents move further away from the urban environment, communities are affected, abandoned plots become derelict and the overall value of the area decreases. To determine to what extent the new development is influencing the existing zoning, and the zoning pattern, the Murphy and Vance (1966) mathematical method is used. This will indicate whether a transitional zone is developing.

The method of zone proportioning by Murphy and Vance was applied to the Menlyn Main area to calculate the zones most prevalent in the area and their positioning (Preston, 1966). Twenty three blocks in total were studied (see Appendix A) and the most common zones are Residential with 72.75%, Special with 21.56%, Business with 10%, Public open space with 5.21% and Educational with 3.9%. Figure 12 illustrates that the current zones move from clusters of business and special to mostly special moving into residential. Small business plots can be found further into the residential area but they are most commonly grouped together. The public open spaces and educational facilities are closer positioned to the residential areas except for one High School that was previously adjacent to residential plots but has since been surrounded with business and special.

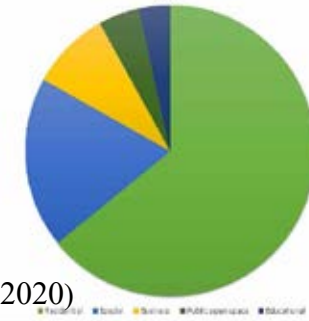


FIGURE 225. Zones (Author, 2020)



FIGURE 223. Menlyn Maine (Tshwane GIS & Author, 2020)



FIGURE 224. Menlyn Maine zoning (Tshwane GIS & Author, 2020)

According to the transitional zone research discussed in the literature review, transitional zones are highly public, retail and special zoning based and they originate from the urban centre and disperse into residential. The zoning proportions and patterns seen in the Menlyn area indicates that this transition zone is developing and expanding.

The new transition zone is accompanied by various issues from vacancy to safety issues and therefore needs to be anticipated.

The transition zone also indicates the future area of development as transition zones evolve into urban zones. Densification directly influences public space and green space as they pose opportunities for expansion.

One can see that there is only a small percentage of public open space left in the area at 5.21%. This is due to residential plots being demolished for high rise built up space eliminating small ecosystems (Bolund & Hunhammar, 1999:299). The existing green spaces and

biodiversity corridors are mapped across the Menlyn area to comprehend their larger purpose for the overall ecosystem in Pretoria.

Through the map in figure 13 it is apparent that the concentric circles result in a slow decrease in green space that disjoins the biodiversity corridor that stretches from North to South. It also acts as the midpoint ecosystem connection between the Faerie Glen Nature Reserve and the Pretoria Country Club golf course.

As seen in the literature review, ecosystem services are not mere processes in nature but are systems that produce specific products used by humans every day. These services also provide ecological, social, cultural and economic benefits as well as improve human well-being through providing consumable products, regulating ecosystems and supporting cultural and personal needs (De Groot et al, 2002:394).

All of the above services function in a cyclical system that connect and add to other systems for example the system of pollination connects to the system of medicinal plant production adding into edible plants and so on (Taylor & Hochuli, 2015:749). Other services like noise regulation can be achieved either through natural or man-made interventions but the origin of the service is found in nature.

A thorough site visit and analysis is done to identify whether the area's ecosystem services are degrading. The site visit indicates that certain aspects are completely degraded and derelict like sidewalks, noise regulating foliage, diversity in fauna and flora, as well as pollution. Due to the new business node, traffic and pollution has increased, affecting the adjacent public open spaces. Ecosystem service degradation has a direct correlation with human well-being decline, thus if a space experiences ecosystem loss the neighbourhood social sustainability will simultaneously diminish.

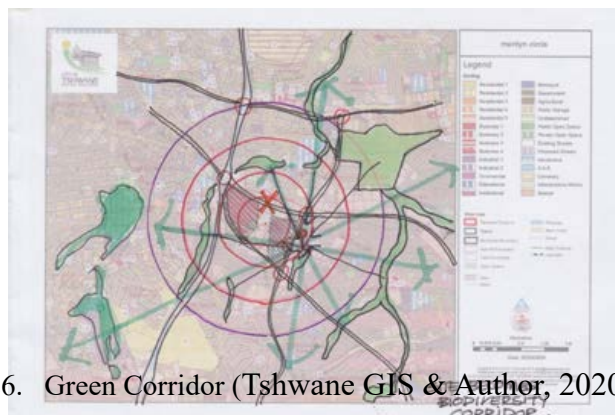


FIGURE 226. Green Corridor (Tshwane GIS & Author, 2020)



FIGURE 227. Degraded ecosystem services (Author, 2020)

Social sustainability ensures that spaces provide the necessary human needs to those using that space (Woodcraft, 2017:135). According to Taylor and Hochuli (2015:749), these spaces should have sufficient walkable, community and green open spaces to ensure that a variety of needs are tended to. When considering human needs and well-being one should ensure that all aspects be covered including mental, physical, social and spiritual well-being. This is done through systems that function in the image of ecosystems where all facets feed into each other and connect to create a larger overarching system.

Biomimetic Architecture aims at imitating ecosystems and services by means of man-made structures to facilitate and rehabilitate existing ecosystems (Benyus, 1998:392). This will lighten the load of human consumption resulting in a more sustainable use of resources.

The current problem with biomimetic design is the misinterpretation of its meaning (Benyus, 2008:40). By researching the requirements of the Living Buildings Institute it is also clear that most ‘green’ requirements are lacking and only cover the scope of energy saving. Unfortunately this is insufficient when trying to create a fully sustainably intervention that both cater to the needs of the environment and users connected to the space.

Biomimetic architecture and social sustainability is a must for urban development to ensure resilience. One intervention will not be sufficient to ensure urban resilience, thus this paper considers a zone in the urban environment to implement a possible solution- the transition zone. As seen in the literature review, the transition zone becomes the most attractive area to implement these biomimetic interventions. These zones will regulate unnecessary urban expansion and sprawl into residential communities and act as filter and regenerator for ecosystem services.

To ensure that the all needs are tended to correctly, interviews and field research was conducted (please see Appendix B). The interviewees granted permission to use the information obtained but required to stay anonymous as they were not comfortable in partaking. With permission the information gathered was that the new entertainment development and casino at Menlyn Main was a nuisance for the surrounding old age homes. The development also attracted unwanted traffic, noise and a large amount of people moving through the residential area. The interviewees mentioned positives such as the area’s increased safety at night due to the night time activities and some local businesses gained customers. Other amenities suffered due to their function becoming void in an urban environment like the existing skate park, gym and put-put course. For additional information interactive poster questionnaires were created to encourage participation in the data collection process that can be seen in Appendix C.

Thrashers Skate Park was used as the centre point of data collection as it was built in 1996 together with the residential area. The skate park has a dedicated community, some of which has been using the facilities in the area for over twenty years. Through seven interactive posters placed at the park, the following conclusions was made. 61.1% of users started using the facility in the past two years, 11.1% in the past five years, 5.5% in the last ten years, 11.1% in the last fifteen years and 11.2% over twenty years.

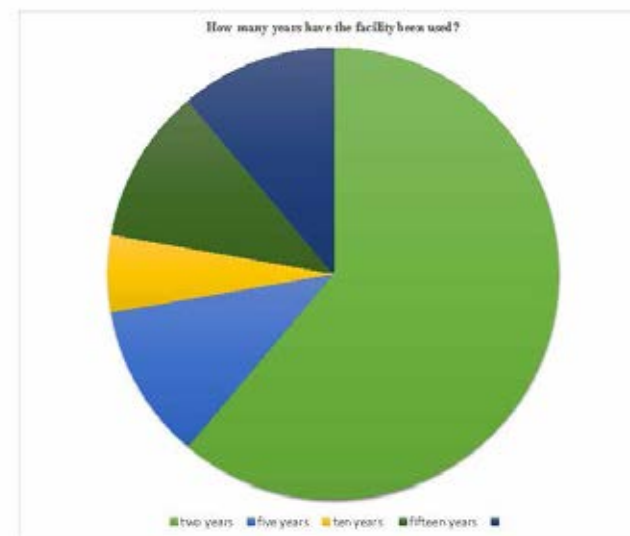


FIGURE 228. Years of use on site (Author, 2020)

72.2% of users connect the area with the words ‘home’ and ‘community’ where the remaining 27.8% associates it with ‘hobby’, ‘play’, ‘work’ and ‘relax’.

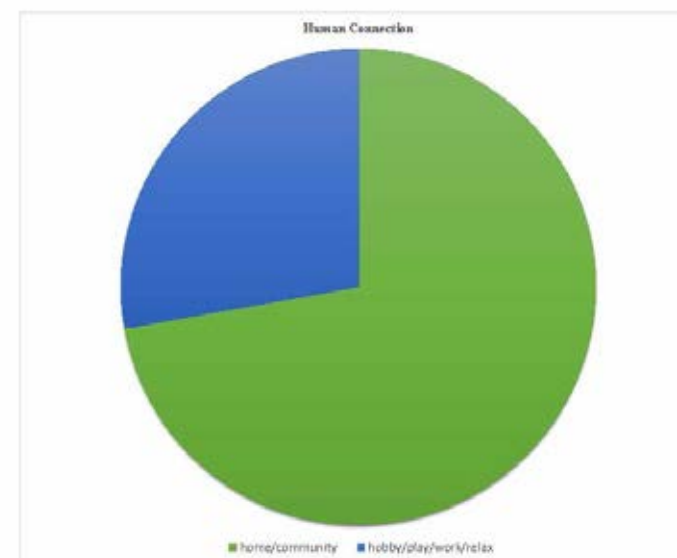
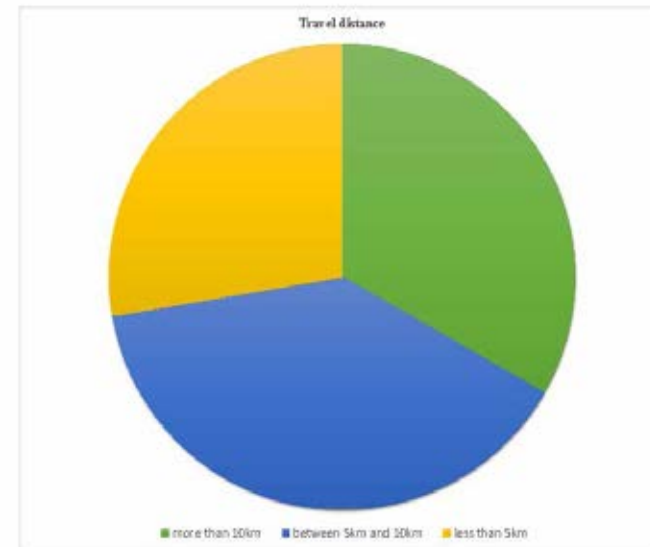


FIGURE 229. Human connection (Author, 2020)

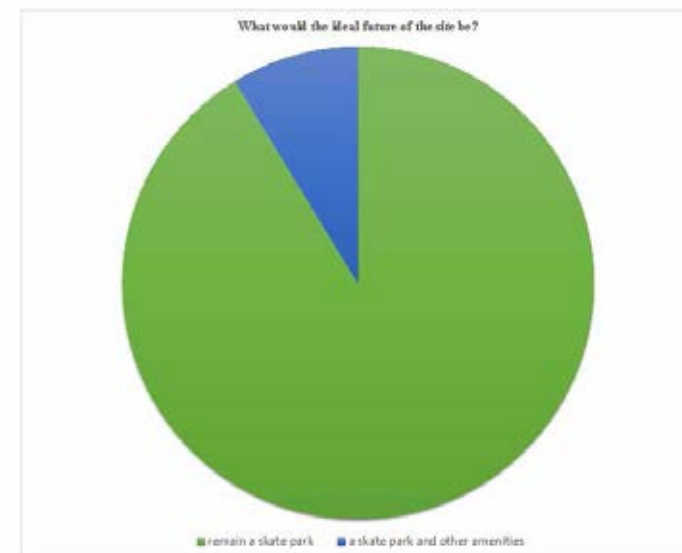
33.3% of the users travel more than ten kilometres to use the space whereas only 27.7% lives closer than five kilometres. This indicates that the area has a strong sense of community and that the existing spiritual and social well-being of the area needs to be protected.

FIGURE 230. Travel distance (Author, 2020)



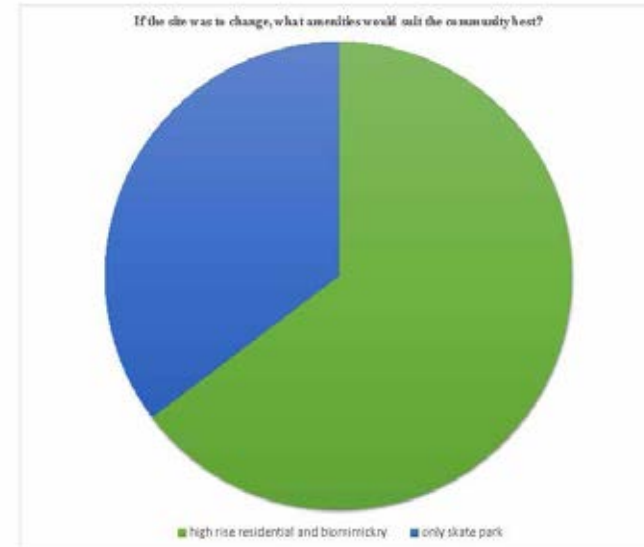
When asked whether the new Menlyn Maine development has had a positive influence on the area 88% of users said positive, as it created a safer environment. To establish whether the users preferred the area to densify more a comparative poster was created. Four pictures were given consisting of a skate park, a plaza, residential blocks and business blocks. When asked what the ideal future of the Skate Park and surrounds would be, 91.3% said it should remain a skate park.

FIGURE 231. Site preference (Author, 2020)



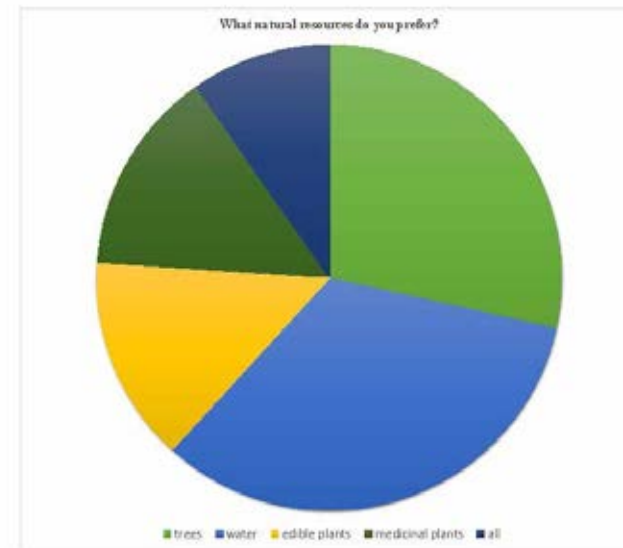
When the question was expanded to ask what amenities they would add, 64.7% said high rise residential units and biomimetic architecture. This shows that even though the existing functions are preferred, the area can still be developed to add value to the community and their needs.

FIGURE 232. Community amenities (Author, 2020)



The last question was what the users liked and preferred in terms of natural resources- to establish their ecosystem service needs. The options were trees and shading, water, edible plants and medicinal plants. 33.3% prefer water and 28.5% prefer trees. 28.5% said that they preferred edible and medicinal plants and only one participant preferred all options.

FIGURE 233. Resources (Author, 2020)



Through the site analysis it was obvious that the area lacked shaded spaces that provide rest and tranquillity to the inhabitants. This study concluded that the Menlyn Maine development positively influenced the area but that the frequent users preferred the existing amenities. The social sustainability has declined due to the development as the existing spaces are not considered, and was not considered during the development process. This has influenced the well-being of the neighbourhood as well as the overall biodiversity.

Conclusions

The researched discussed clearly shows a connection between urban development, ecosystem degradation and human well-being decline. It is evident that most cities develop through concentric circles and that this results in transition zones forming on the urban centre periphery. As cities expand to support their population growth, more city centres are established resulting in multiple transition zones. As considered this phenomenon might lead to a decline in human well-being coupled with other negative influences on the environment.

Multiple business node development also contain positive attributes. Business development has a positive impact on the overall economic value of a city as well as the employment numbers but the user well-being is just as important. If the urban environment enhances human well-being whilst enhancing economic well-being, the overall city system will function in a resilient manner. This is where the problem of isolated urban development arises. Urban developers often neglect human well-being and the surrounding zones and refrain from including both urban and suburban needs into the expansion.

Another factor to consider is the reintroduction of public and green spaces on the periphery of urban cores to regulate further densification. To prevent that these open spaces are developed in the future, they need to serve a specific purpose in the overall city system. They should provide amenities and facilities that can and should not be developed as they are an integral part of the city's well-being and value.

By developing these spaces, urban densification will be regulated and filtered before they reach suburban city zones. Urban development has the opportunity to add value to the city in multiple ways especially through social sustainability. Social sustainability focusses on the implementation of energy saving techniques and basic sustainable interventions as well as the rehabilitation and reintroduction of ecosystem services into public spaces. If these spaces are focussed on the urban periphery both the urban and suburban areas will have access to socially sustainable spaces and their benefits.

As identified in the research, the basis of human needs is set in ecosystem services. Ecosystem services require biodiversity, green space, and open space, and where this is not possible they should be imitated through man-made structures. These ecosystem services are essential to counter the negative influences of densification as they produce basic human needs- needs that are often removed by urban expansion. Human well-being is also dependant on basic needs, thus basic ecosystem services. Urban developers, designers and the public often misinterpret the meaning of ecosystem services and sustainability which results in sustainable interventions that are insufficient.

To ensure human well-being does not suffer further decline basic resources cannot merely be protected but their processes need to be rehabilitated. Not only should we rehabilitate ecosystems but we should reintroduce them by means of man-made structures and interventions to ensure future resilience and net-positivity, rather than net-zero. Most research found on Biomimetic Architecture does not include all aspects of the ecosystem but most often only mimic form. Therefore, the ecosystem in its entirety should be fully mimicked and properly understood.

The transition zone offers the best opportunity for the reintroduction of ecosystem services and socially sustainable spaces. These zones, placed on the periphery of city centres, should act as filter and regenerator by capturing the necessary and eliminating the unnecessary.

These spaces become buffer zones that regulate pollution, traffic and development influencing suburban areas. These spaces can also become community centre points for neighbourhood well-being.

In conclusion, to design and live sustainably is not enough, but to create socially sustainable resilient spaces might regenerate and rehabilitate both human and ecosystem well-being. Without human intervention these services will diminish. Our economic development is depleting our resources but, without resources our economy would be void. Therefore, we cannot view urban development as purely scientific or solely humane- it is a combination of both, working in unison.

(7171 incl. abstract)

Ethics documents

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	Minnaar
1.2 Student Initials	C.M.
1.3 Student Number	15040217
2. Details of the Research Project:	
2.1 Research title The Building as eco-social filter. (Working Title)	
2.2 Main objective(s) pertaining to field work The main objective of this study is to ascertain whether the site might, in the future, become a transitional zone between the densely developed business center (Menlyn Maine) and the existing low density residential area. Research shows that these transitional zones get stripped of purpose due to the new development often resulting in neglect and abandonment. The project aims at developing a model for transitional buildings that act as a zoning, social and ecosystem filter adding value to the existing functions and community.	
2.3 Research question(s) pertaining to field work How can architecture act as an eco-social filter zone? How can architecture become a buffer for eco and social problems?	
3. Data collection method:	
3.1 Will there be people involved in your research? <input type="checkbox"/> No, there will be no people involved in my research. <input checked="" type="checkbox"/> Yes, there will be people involved in my research but <i>only</i> as informants and <i>not</i> 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.) Users of the site mainly Skate boarders and those frequently experiencing the area/ community.	
3.3 If "Yes" to 3.1, how will you collect information from these people? <input checked="" type="checkbox"/> Primary data using Questionnaire <input checked="" type="checkbox"/> Primary data using Interviews <input type="checkbox"/> Other, please specify: Click or tap here to enter text.	
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? <input type="checkbox"/> No <input checked="" type="checkbox"/> 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? <input type="checkbox"/> Personal data such as gender, income, education level, health status. I have provided a motivation letter for asking these questions. <input checked="" type="checkbox"/> Opinions (e.g. ranking of factors, agreement to statements) that are not related to any company/organisation. <input checked="" type="checkbox"/> Company related information (e.g. financial performance, operational data). I have obtained permission letter(s). <input type="checkbox"/> Project related information. I have obtained permission letter(s). <input type="checkbox"/> 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).

3.7 If "Yes" to 3.6, what is the nature of the secondary data? Fully describe which data this would be and from where (source) do you obtain it?

The architectural plans of the existing building from the owners of the building.

I, Cosette-Mari Minnaar confirm that the above information is true.

Signature: 

Date: 3/3/2020

THE BUILDING AS ECO-SOCIAL FILTER: QUESTIONNAIRE

MPROF RESEARCH PROJECT
DEPARTMENT OF ARCHITECTURE
EBIT FACULTY
THE UNIVERSITY OF PRETORIA

1. Project information:
Title: The Building as Eco-social filter (Working Title)
2. Researcher details:
Cosette-Mari Minnaar
15040217
3. Research proposal outline:

The main objective of this study is to ascertain whether the site might, in the future, become a transitional zone between the densely developed business center (Menlyn Maine) and the existing low density residential area. Research shows that these transitional zones get stripped of purpose due to the new development often resulting in neglect and abandonment. The project aims at developing a model for transitional buildings that act as a zoning, social and ecosystem filter adding value to the existing functions and community.

1. On average how many people pass through the facility on a daily (week & weekend) basis and when events are held?
2. How long have you been using these facilities?
3. Do you feel a sense of **community** established around these facilities **and describe it in a sentence**?
4. Has the development of Menlyn Maine affected this site in a **NEGATIVE / POSITIVE** way? (Please indicate which)
5. In what way has the development affected the site? (Why negative/positive)
6. Do you experience an increase in foot traffic (more people) in the area since the development of Menlyn Maine?
7. If above answer is yes, is this **beneficial** for the site and residential area and in what way?
8. Do you experience a major shift from Menlyn Maine into the residential area?
9. If so, how would you **describe this shift**?

10. Do you think a **transitional space** (e.g. flats, community center, and public events space) would benefit this shift?
11. Would these facilities **benefit** from further densification (development) in terms of light retail/ community or public space/ residential?
12. If yes to the above, what added function would you recommend?
13. Are there enough recreational green spaces in the nearby area?
14. Do you think the area **suffers from a lack of natural services**? (e.g. air/water purification, edible plants/food production, noise reduction, storm water drainage)
15. Do you think a building can aid in these above mentioned natural services?
16. Please provide **2 natural functions** you would like to experience in this space?
17. If so, do you have a suggestion as to how a building can act as an ecosystem?
18. Please describe your ideal public space in **3 words**?
19. Please draw a quick sketch of how **YOU** view this space (**interpretive, emotional or realistic sketch**)?

APPENDIX B

Informed consent form [Form for research participant's permission]

1. Project information

1.1 Title of Research Project:

The Building as Eco-social Filter. (Working Title)

1.2 Research Field: Architectural Sustainability and Environmental Potential

1.3 Researchers details:

Cosette-Mari Minnaar 15040217 |, Department of Architecture, EBIT, University of Pretoria

1.4 Research Study Description:

In the Department of Architecture, the students of the Professional Master's Program annually engage in research activities related to specific areas in Gauteng (or area outside this region that has been well motivated). The students investigate specific architectural issues related to their chosen contexts, to enable them to respond to these conditions through a design proposal. These design projects, while resulting in real life recommendations, are neither implemented nor built.

The main objective of this study is to ascertain whether the site might, in the future, become a transitional zone between the densely developed business center (Menlyn Maine) and the existing low density residential area. Research shows that these transitional zones get stripped of purpose due to the new development often resulting in neglect and abandonment. The project aims at developing a model for transitional buildings that act as a zoning, social and ecosystem filter adding value to the existing functions and community.

The conversation will be recorded. Some of the results may be published and although participants will remain anonymous some of their words might be quoted in the publications.

2. Informed consent

- 2.1 I, _____ hereby voluntarily grant my permission for participation in the project as explained to me by the researcher.
- 2.2 The nature, objective, possible safety and health implications have been explained to me and I understand them.
- 2.3 I understand my right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for the purposes of publication.
- 2.4 Upon signature of this form, the participant will be provided with a copy.

I will remain anonymous my comments may be used without giving any specific geographic or personal references (name, address, ID, occupation, age, income etc.) that may accidentally imply my identity

- I give permission for the interview to be recorded: Y / N
- I give permission for notes to be taken: Y / N

Signed: _____ Date: 3/3/2020

Witness: _____ Date: 3/3/2020

Researcher: _____ Date: 3/3/2020

APPENDIX C

**Informed consent form
COMPANY/ENTITY APPROVAL**
MProf Research project [The Building as Eco-
social Filter]
Department of Architecture
EBIT Faculty
University of Pretoria.

1. Project Information:

1.1. Title of research project:
The Building as Eco-
social Filter
(Working Title)

1.2. Researcher's details:
Cosette-Mari Minnaar
15040217

1.3. Research Study Description:

The main objective of this study is to ascertain whether the site might, in the future, become a transitional zone between the densely developed business center (Menlyn Maine) and the existing low density residential area. Research shows that these transitional zones get stripped of purpose due to the new development often resulting in neglect and abandonment. The project aims at developing a model for transitional buildings that act as a zoning, social and ecosystem filter adding value to the existing functions and community.

The conversation will be recorded. Some of the results may be published and although participants will remain anonymous some of their words might be quoted in the publications.

2. I, Bianca Birrell, performing the role of Managing Director and representative for Menlyn Steak Park t/a Thrashers hereby voluntarily grant permission for employees of Thrashers to participate in the project as explained to me by Cosette-Mari.

3. The nature, objective, possible safety and health implications have been explained to me and I understand them.
4. I understand that employees of the company I represent have the right to choose whether to participate in the project and that the information furnished will be handled confidentially. I am aware that the results of the investigation may be used for academic purposes and / or publication.
5. I understand that the respondents representing the above stated company will remain anonymous their comments may be used without giving any geographic or personal references (name, address, ID, occupation, age, income etc.) that may accidentally imply our identity.

B 1

6. Upon signature of this form, you will be provided with a copy.
7. I, as representative of the above stated company, agrees that no specific data will be shared with the company. The company will have access to the final report.
8. This Informed consent form accompanies a letter from the above-mentioned company confirming permission to be granted. This letter is signed and states the company name (include the letterhead), date and role and identity of the person giving permission.

Signed: [Signature] Date: 3/3/2020
Witness: [Signature] Date: 3/3/2020
Researcher: [Signature] Date: 3/3/2020



PROFESSIONAL MASTERS PROGRAM AT THE DEPARTMENT OF ARCHITECTURE
ETHICS CHECKLIST ONE: PRIMARY DATA

If you answer **FALSE** or **NO** to any of the following statements/ questions, then you require **ethics clearance** at Faculty level: EBIT Ethics Clearance (full application).

1. Your research does not involve medical or animal research.	<input checked="" type="checkbox"/> TRUE	<input type="checkbox"/> FALSE
2. Your research does not involve healthcare in any form. <i>Note!</i> A project that is concerned with the design of facilities for any form of healthcare (formal and informal).	<input checked="" type="checkbox"/> TRUE	<input type="checkbox"/> FALSE
3. The research does not present potential impact on the environment. <i>In other words, is there potential for physical impact on the environment, e.g. building a physical prototype and monitor its impact on the environment.</i>	<input checked="" type="checkbox"/> TRUE	<input type="checkbox"/> FALSE
4. The research does not involve any of the following vulnerable peoples: <i>Children and/ or minors under the age of 18 / Homeless persons / Persons with Disabilities / Elderly persons / Persons who are migrants or refugees / Abused women.</i>	<input checked="" type="checkbox"/> TRUE	<input type="checkbox"/> FALSE
5. The research does not associate with any political or social issues that may have ethical concerns. <i>In other words, could your research place you in an ethically compromised position due to political or social issues that may be involved/ uncovered?</i>	<input checked="" type="checkbox"/> TRUE	<input type="checkbox"/> FALSE
6. You understand that a letter of permission is required should you be collecting information from a firm, organization or institution, from their archives, records or reports that are not publicly available . <i>Provide your letter of permission with this checklist for your supervisor to approve. Include it in an appendix to your dissertation a letter(s) of permission from this entity to carry out this study (See attached template).</i>	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
7. The research does not involve people as research subjects. <i>Research subjects are people that actively take part in the research, e.g. where biological measurements are made (e.g. heart rate) or where people take part in behavioral tasks (e.g. listening tasks) or using a prototype (e.g. kitchen utensil)</i>	<input checked="" type="checkbox"/> TRUE	<input type="checkbox"/> FALSE
8. If the research involves people as informants, you understand that informed consent must be obtained before any person is interviewed or takes part in a survey? <i>Informants are people of whom you require an opinion, e.g. people that are</i>	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO



Interviewed (incl. structured and semi-structured) or take part in a survey. Note! No vulnerable peoples (c.f. 4.) may be interviewed. Secondary data must be relied upon exclusively and the limitations thereof must be acknowledged in the methodology section. See Ethics Checklist Two: Secondary Data and/or Literature. Otherwise full ethics clearance must be sought. <i>Provide your questionnaire, survey questions or interview questions, along with your letter of informed consent (template provided) with this checklist for your supervisor to approve.</i> Note! You may not ask any personal details (gender, age, sexual orientation, HIV/ AIDS status, income, education level, health status, address, email address, etc.)	<input checked="" type="checkbox"/> TRUE	<input type="checkbox"/> FALSE
9. You will not be surveying or interviewing full-time UP students or UP personnel in this study.	<input checked="" type="checkbox"/> TRUE	<input type="checkbox"/> FALSE
10. You understand that while voice recording during interviews is permitted, no video recording is allowed. <i>The name of the respondent may not be recorded. The voice data must be refer to the respondent by numbers (e.g. respondent #1, #2, #3, etc). This is to prevent direct links between data files and respondents. You need to include a reference to voice recording in the informed consent form. You need to stipulate where you will store this data and how you will keep it secure. Question / statements 8: Interviews with informants apply.</i>	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
11. You understand that if any employees of a firm, organization or institution are to be questioned as informants, a company permission letter needs to first be signed. <i>Provide your company permission letter (template provided) with this checklist for your supervisor to approve. Include it in an appendix to your dissertation the letter(s) of permission from this entity to carry out this study.</i> <i>In the case of the Director / CEO / Owner being the only informant, then a company permission letter is not needed but a n additional condition needs to be stated in the informed consent form.</i>	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO

If you answered **FALSE** or **NO** to any of the statements/ questions, then ethics clearance from the EBIT ethics committee (full application) needs to be sought. Apply for ethics clearance for your research project, with assistance from your supervisor:

<http://www.up.ac.za/en/faculty-of-engineering-built-environment/article/15815/faculty-committee-for-research-ethics-integrity>

Student Signature:

Supervisor Signature:



ETHICS CHECKLIST TWO: SECONDARY DATA AND/ OR LITERATURE

This checklist is provided to prevent you from the potential ethical pitfalls in citing and application of secondary data and/or literature.

The questions serve to test whether you have sought secondary data and/ or literature according to the hierarchy of credibility:

<p>1. Have you sought literature according to hierarchy of credibility? Scale of credibility, (1) being the most credible and (5) being the least.</p> <p>(1) Peer-reviewed accredited publications (incl. monographs and peer-reviewed journals);</p> <p>(2) Unpublished Thesis / Dissertations (These two formats have undergone 'peer- review' in the sense that they have been examined by a panel of external examiners and thereafter passed University senate for conferral of the degree);</p> <p>(3) Official: government / company / institutional official websites, newspaper articles, published magazine / journal articles (not peer-reviewed);</p> <p>(4) Websites;</p> <p>(5) Other: social media (Twitter, YouTube, etc), blogs and wiki's.</p> <p>Note! Excludes chat-rooms, Facebook, Instagram or similar password controlled social media environments. You need to apply for ethics clearance and informed consent.</p>	<p>YES <input checked="" type="checkbox"/></p>	<p>NO <input type="checkbox"/></p>
<p>2. Are you citing peer-reviewed accredited publications?</p> <p>Either paraphrase in own words and reference (Author / Date) (e.g. Borden 2011: 21) OR quote "direct quote" using quotation marks and reference (Author / Date).</p>	<p>YES <input checked="" type="checkbox"/></p>	<p>NO <input type="checkbox"/></p>
<p>3. Are you citing from an unpublished thesis / dissertation?</p> <p>Prioritise the thesis / dissertation, which has explicit ethics clearance (find it in the methodology and appendix: signed ethics declaration, letter(s) of consent and interviews / surveys) over the thesis / dissertation, which does not.</p> <p>In either case you need to be descriptive in your citation, i.e. include a brief description of the nature of the study, method of data collection, ethics clearance (obtained or not) and purpose of the research.</p> <p>Thesis / dissertations older than 7 years will, in all likelihood, not have sought ethics clearance; this does not render the research redundant. However, as in (2), you need to be descriptive when citing the source.</p>	<p>YES <input checked="" type="checkbox"/></p>	<p>NO <input type="checkbox"/></p>



<p>4. Are you citing from an official website, newspaper or published magazine article (not peer-reviewed)?</p> <p>When citing, ensure that you are descriptive in your citation. State the nature and purpose of the source from which the data / literature was obtained.</p> <p>Examples:</p> <p>Official websites: Stats SA, or SA Government Gazette, or World Health Organisation (WHO), or Department of Basic Education;</p> <p>Newspapers: Pretoria News, Sunday Times, Mail & Guardian;</p> <p>Published magazines: Time, Frame, Domus, JA.</p>	<p>YES <input checked="" type="checkbox"/></p>	<p>NO <input type="checkbox"/></p>
<p>5. Are you citing from a website and/or non-password controlled social media, blog or wiki?</p> <p>You may decide to cite information from these sources as a substitute for conducting interviews / surveys, in an effort to avoid the need for ethics clearance.</p> <p>However, you are reminded to always first to search in accredited published literature, thereafter, should you have exhausted your search and can honestly not find the information in any accredited publication, then you may use data / literature from the sources described above. In this instance, it is critical that you are descriptive in your citation, i.e. include a brief description of the nature source (website / form of social media, the purpose it serves, e.g. a platform for disgruntled residents), the audience for whom it is intended, why it is in the public domain.</p> <p>Note! This source type includes design websites such as YouTube, Vox, ArchDaily, Dezeen, KNSTRCT and Yatzer.</p>	<p>YES <input checked="" type="checkbox"/></p>	<p>NO <input type="checkbox"/></p>

Rule of thumb!

If the data / literature is in the public domain you may cite it, **however**, always ensure that preference is given according to hierarchy of credibility.

As credibility decreases, **be descriptive in your citation** as to the nature of the source and intended audience. This is in an endeavor to ensure that you **do not misinterpret** the data/ literature, as well as, that your thesis (argument) and the data/ literature you use to support it **cannot be misconstrued** by others.

Student Signature:

Supervisor Signature:



Faculty of Engineering, Built Environment and Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en
Inligtingtegnologie / Lefapha la Boetšenere,
Tikologo ya Kago le Theknolotši ya Tshedimošo

Reference number: EBIT/53/2020

Ms C Karuseit
Department: Architecture
University of Pretoria
Pretoria
0083

Dear Ms C Karuseit

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 Dissertation in Architecture, Landscape and Interior Architecture" is approved under the strict conditions indicated below. If these conditions are not met, approval is withdrawn automatically.

Conditions for approval

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 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.

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

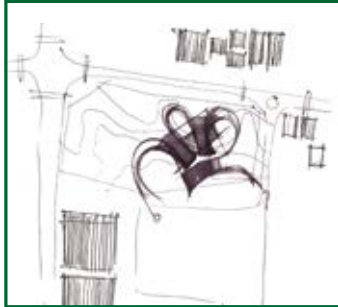
Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

ORIGINALITY REPORT

3%	3%	2%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.jisprm.org Internet Source	2%
2	moam.info Internet Source	<1%
3	isandla.org.za Internet Source	<1%
4	link.springer.com Internet Source	<1%
5	www.archdaily.com Internet Source	<1%
6	www.globalnature.org Internet Source	<1%
7	mafiadoc.com Internet Source	<1%
8	WWW.SOCR.CO.ZA Internet Source	<1%
9	Lucy Taylor, Dieter F. Hochuli. "Creating better cities: how biodiversity and ecosystem functioning enhance urban residents' wellbeing", Urban Ecosystems, 2014 Publication	<1%
10	architizer.com Internet Source	<1%
11	Vanesa Castán Broto, Linda K. Westman. "Ten years after Copenhagen: Reimagining climate change governance in urban areas", WIREs Climate Change, 2020 Publication	<1%



Location: Thrashers Skate Park, 241 Serene Street, Garsfontein, Pretoria 0081
25°47'19.50"S 28°17'03.57"E

The Building as Eco-Urban Filter

Transitional zones in the suburban context



Normative Position: I dream of a world where architecture serves the need of its users whilst adding value to the environment where it is situated. Architecture should mimic the simplistic beauty of nature, but encompass the complex functions that nature provides. Architecture should provide human needs much like nature does. The building should also provide for its own needs in terms of energy, water and air. The building, user and nature should function in harmony, complimenting and reinforcing each other to increase the well-being of all.

Context: The intervention is situated between a well-established suburban and residential area in Pretoria and a newly developed urban hub for Tshwane called Menlyn Maine. The intervention borders a public park and gymnasium and faces retirement facilities and religious institutions. The existing site consists of a skate park, a wrestling club and a put-put course, but most of these functions are becoming derelict and unused due to Menlyn Maine.

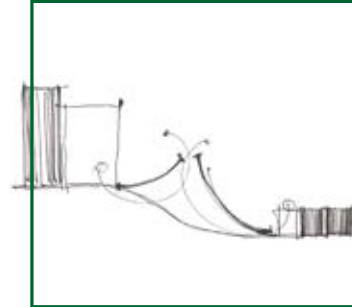
General Issue: The main focus of the study is the global issue of urban and eco degradation as a result of constant urban expansion.

Urban Issue: The urban, and commonly local, issues that stem from the global topics mentioned are problems regarding zoning, re-zoning and a lack of public open space in the denser urban areas of the city.

Architectural Issue: The main architectural issue found through the research done about transitional zoning problems in cities is that urban design does not always take both the urban and suburban areas into account. Architecture, specifically in this case, should be a system that can easily adapt to change. The architectural implementation should add value to its existing site as well as its ever changing environment.

Argument: The dissertation stems from the issue of the loss in green space due to multi-nodal urban expansion. By researching transitional zones and ecosystem service degradation, the solution of architecture becoming an ecosystem seemed most appropriate. Architecture should reconnect its users to the earth and sky. Architecture can also be used as a tool to educate its users about ecosystem services and well-being whilst enhancing their experience on site.

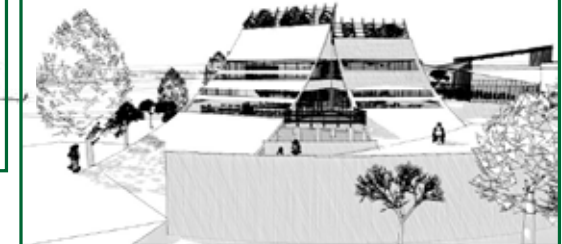
Intentions: Architecture should re-establish the connection between the natural and man-made through regenerating ecosystem services my means of man-made structures.



Location: Thrashers Skate Park, 241 Serene Street, Garsfontein, Pretoria 0081
25°47'19.50"S 28°17'03.57"E

The Building as Eco-Urban Filter

Transitional zones in the suburban context



Normative Position: I dream of an architecture that can rehabilitate ecosystem and natural services. Architectural structures should function and be assembled simply to enable easy construction and deconstruction. The structure should provide functions that mimic ecosystem services to enable the building to fully embody its place in nature. The materials should complement and add value to the context of the intervention.

Context: The intervention is placed in-between high rise urban and retail structures (Menlyn Maine) as well as low rise residential buildings. The residential structures consist predominantly of simple brick and mortar which contrasts with the concrete, glass and steel structures of the urban environment. The site is also linked to a public park that forms part of a larger biodiversity corridor as well as various other well-being facilities.

General Issue: The global issue is that of architectural development which is replacing natural services and functions.

Urban Issue: The urban issue that stem from the global issue is the lack of ecosystem services in denser urban environments.

Architectural Issue: The main architectural issue is that structures do not always account for the natural services that they replace. The materials often do not respond well to the environment or add value to the existing natural ecosystem on site.

Argument: The technical argument aim to solve the issue of ecosystem degradation. The technical concept of the building is to become an ecosystem in itself to reintroduce important natural functions on site. This will solve issues regarding re-zoning of cities as buildings will become well-being hubs together with their initial purpose.

Intentions: Architectural technology should aim to mimic and reintroduce natural systems, while using materials that complement the context and user of the intervention.

Structure: The structure links earth to building to sky and unfolds the landscape to reveal ecosystem services to the user. The structure reintroduces ecosystem services and operates as a natural system.

Services: The services aim to mimic ecosystem services by regulating air flow, air temperature and air quality as well as water quality. The building uses biophilic panels and solar panels to generate its own energy. The landscape also provides the opportunity for edible and medicinal plant growth.

Sustainability: The building aims to qualify for the Living Building's Institute Petal certification.

Materiality: The material use is based on the connection between earth, man and sky. The materials move from heavy stereotomic concrete to masonry construction that fade into a concrete shading and end in lightweight steel and glass.



